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PHYSICAL ACTIVITY AND SEDENTARY TIME AMONG KIDNEY TRANSPLANT RECIPIENTS: ASSOCIATIONS WITH HEALTH-RELATED QUALITY OF LIFE AND PSYCHOSOCIAL HEALTH

BY

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Abstract

Objective: The primary objective of this thesis was to determine associations of health-related quality of life (HRQoL) and psychosocial factors (i.e., self-esteem, depression, psychological growth) with objectively-assessed walking (i.e., pedometers), self-reported physical activity, and sedentary time among kidney transplant recipients.

Methods: Adults across Canada, living with a kidney transplant were recruited using research advertisements placed in kidney transplant-related media. Interested individuals were sent a survey package containing a health-related questionnaire, step pedometer, and a self-addressed business reply envelope

Results: A total of 32 kidney transplant recipients returned a completed survey, for a response rate of 82.1% (32 out of 39). The total average steps per day were 9751.8 steps (SD = 3685.1). Overall, 59% were achieving public health physical activity guidelines. The total average sitting time during the week was 11.6 hours per day while total average sitting time during the weekend was 8.9 hours per day. Compared to those not achieving at least 10,000 steps per day, those who were achieving at least 10,000 steps per day had a significantly higher physical component score for HRQoL (M_{diff} = 7.8, p = .018), and fewer depressive symptoms (M_{diff} = 3.7, p = .031). Similar patterns emerged for meeting physical activity guidelines and sitting time.

Conclusion: For kidney transplant recipients, greater participation in walking, overall physical activity, and lower engagement in sedentary activity, was associated with better HRQoL and fewer depressive symptoms.

Keywords: chronic kidney disease, end-stage-renal disease, kidney transplantation, walking, health-related quality of life, psychosocial health, sedentary behaviour

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CHAPTER I – Introduction

The compromised health-related quality of life (HRQoL) of patients with end-stage kidney disease is well documented (Fukuhara, Yamazaki, Hayashino, & Green, 2007; Hedayati, Bosworth, Briley, Sloane, Pieper, & Kimmel, et al., 2008). Kidney transplantation is considered the optimal choice of treatment for end-stage kidney disease in terms of survival, cost-effectiveness, and HRQoL (Kontodimopoulos & Niakas, 2008; Lee, Morgan, Conway, & Currie, 2005). Advancements in organ transplant procedures and immunosuppressive therapies have improved graft and patient survival in kidney transplant recipients (Hariharan, Johnson, Bresnahan, Taranto, McIntosh, & Stablein, 2000). As more individuals survive the disease and experience the effects of the disease and kidney transplantation, there is a need to explore HRQoL and psychosocial health among kidney transplant recipients.

Evidence suggests exercise may improve exercise capacity, muscle strength, and HRQoL among kidney disease patients (Kaysen, Larive, Painter, Craig, Lindsay, & Rocco, 2011; Mitrou, Grigoriou, Konstantopoulou, Theofilou, Giannaki, & Stefanidis, 2013). However, physical activity is not routinely assessed in the management of kidney disease. The limited literature regarding physical activity among those with kidney disease indicates physical activity levels are very low (Painter & Roshanravan, 2013; Tentori, Elder, Thumma, Pisoni, Bommer, & Fissell, et al., 2010). Kidney transplant recipients often have difficulties performing activities of daily living and occupational tasks and report a decreased HRQoL (Padilla, Krasnoff, Da Silva, Hsu, Frassetto, Johansen, & Painter, 2008). Following kidney transplantation, kidney transplant recipients are reported to slightly increase physical activity levels immediately following

transplantation, however, activity levels remain low and usually do not improve to pre-diagnosis levels, nor reach public health recommendations (Nielens, Lejeune, Lalaoui, Squifflet, Pirson, & Goffin, 2001; Painter, Hector, Ray, Lynes, Dibble, & Paul, 2002). Thus, it appears that most kidney transplant recipients may not be achieving the recommended levels of physical activity.

To date, most literature has been primarily focused on self-report measures of physical activity for health behaviour research (i.e., questionnaires, interviews, surveys, diaries, logs). However, more direct and objective assessments made with motion sensors have become an increasingly important tool in data collection (Bauman, Phongsavan, Schoeppe, & Owen, 2006). Despite not being able to capture intensity or pace, one simple objective instrument for measuring physical activity is a pedometer which is useful for investigating the total volume walked or walking behaviour (Tudor-Locke & Myers, 2001).

There is extensive evidence suggesting that walking may provide numerous physical and psychological health benefits. Walking has been shown to have a preventive effect on chronic diseases such as type 2 diabetes, cardiovascular disease, and other types of chronic diseases (Murtagh, Murphy, & Boone-Heinonen, 2010; Yates, Haffner, Schulte, Thomas, Huffman, & Bales et al., 2014). Additionally, walking has been demonstrated to reduce depression and anxiety, and even increase HRQoL (Kopp, Steinlechner, Ruedl, & Ledochowski, et al., 2012). Although the targeted step volume may vary from individual-to-individual, for ease and memory, public health campaigns often suggest individuals should aim to walk at least 10,000 steps per day (Moreau, Degarmo, Langley, McMahon, Howley, & Bassett, 2001; Tudor-Locke & Bassett, 2004).

Recent studies examining physical activity in concert with sedentary time have suggested sedentary behaviour has deleterious health consequences distinct from the beneficial effects of physical activity (Owen, Sparling, Healy, & Matthews, 2010; van der Ploeg, Chey, Korda, Banks, & Bauman, 2012). Sedentary behaviours are activities low in energy expenditure. They have been conceptualized as sitting or reclining and are in the energy-expenditure range of 1.0 to 1.5 metabolic equivalents (METs) (Owen, 2012). Sedentary behaviours are not to be confused with physical inactivity (i.e., performing insufficient amounts of moderate- to vigorous-intensity physical activity) (Sedentary Behavior Research Network, 2012). Sedentary behaviour can heighten the risk for end-stage kidney disease (Stengel, Tarver–Carr, Powe, Eberhardt, & Brancati, 2003) as well as other chronic diseases (Owen; Dunstan, Howard, Healy, & Owen, 2012). Emerging evidence also suggests individuals who spend large amounts of time sitting report poorer HRQoL and increased risk of depression than individuals who sit less (Vallance, Eurich, Lavallee, Marshall, & Johnson, 2011; Vallance, Winkler, Gardiner, Healy, Lynch, & Owen, 2011). To date, no studies have examined sedentary behaviours among kidney transplant recipients in Canada. This study will be the first to elicit sedentary time estimates from a sample of kidney transplant recipients in Canada.

The primary objective of this thesis is to determine associations of HRQoL and psychosocial factors (i.e., self-esteem, depression, psychological growth) with objectively-assessed walking (i.e., assessed via pedometers) among kidney transplant recipients. Secondary objectives are to determine associations of HRQoL and psychosocial factors with physical activity (meeting vs. not meeting physical activity guidelines), and sedentary time among individuals with kidney disease. We hypothesize

that 1) participants who achieve at least 10,000 steps per day will report higher HRQoL and more optimal psychosocial health outcomes compared to participants engaging in <10,000 steps per day, 2) participants who are achieving physical activity guidelines (≥ 150 minutes of moderate-vigorous physical activity per week) would report higher HRQoL and more optimal psychosocial health outcomes compared to participants not achieving guidelines, and 3) participants who report high amounts of daily sitting time will report poorer HRQoL and less optimal psychosocial health outcomes compared to participants reporting lower amounts of sitting.

CHAPTER II – Literature Review

Kidney Transplant Recipients as a Growing Demographic

Organ transplantation is often the only treatment of choice for end-stage organ failure. In Canada, the number of transplants has increased annually over the last five years (Canadian Institute for Health Information, 2015). In 2013, 2,432 organs were transplanted in Canada, up six percent over the previous year (Canadian Institute for Health Information). In the same year, approximately 28,000 Canadians were living with an organ transplant (i.e., kidney, liver, heart, lung, pancreas, small intestine), 4,433 patients were waiting for a transplant, and a total of 246 Canadians died waiting for an organ (Canadian Institute for Health Information).

Kidney transplantation is considered the optimal choice of treatment for end-stage kidney disease in terms of survival, cost effectiveness, and HRQoL (Kontodimopoulos & Niakas, 2008; Lee, Morgan, Conway, & Currie, 2005). In 2013, approximately 41,931 Canadians were being treated for end-stage kidney disease, a 35% increase since 2004 (Canadian Institute for Health Information, 2015). Of this group of individuals, an estimated 24,114 were treated with dialysis therapy and 17,817 were living with a kidney transplant (Canadian Institute for Health Information). In the same year, a total of 3,382 Canadians were waiting for a kidney transplant and 88 patients died waiting for a kidney (Canadian Institute for Health Information).

Advancements in organ transplant procedures and immunosuppressive therapies have improved graft and patient survival in kidney transplant recipients (Hariharan, Johnson, Bresnahan, Taranto, McIntosh, & Stablein, 2000). As a result of this considerable progress, improving HRQoL among this population has become an

important patient outcome (Greiner, Obermann, & Schulenburg, 2001). As more individuals survive the disease and experience the effects of the disease and kidney transplantation, exploring HRQoL and other psychosocial outcomes among kidney transplant recipients, and health behaviours associated with these outcomes, is necessary.

Functioning and Kidney Transplantation

The increasing prevalence of end-stage kidney disease is an important issue for health professionals, as health and policy strategies are developed to reduce the burden of kidney failure and maximize HRQoL and psychosocial health through prevention strategies, early detection and better management of the disease. In this way, the high risk for morbidity and premature mortality are reduced. Morbidity refers to the presence of more than one distinct health condition in an individual (Valderas, Starfield, Sibbald, Salisbury, & Roland, 2009). Premature mortality refers to deaths that occur among individuals younger than age 75 (Canadian Institute for Health Information, 2015). The World Health Organization reports lifestyle related diseases and kidney disorders in the top twenty leading causes of death (2004). While end-stage kidney disease can be caused by infection, especially in developing countries (Barsoum, 2006), lifestyle factors, including sedentary behaviour heighten the risk for end-stage kidney disease (Stengel, Tarver–Carr, Powe, Eberhardt, & Brancati, 2003). Additionally, individuals with end-stage kidney disease often suffer from multiple-related disorders (e.g., cardiovascular disease, diabetes, hypertension, infectious complications). As a result of their progressive deconditioning they experience substantial physical and psychosocial limitations (Herzog, Asinger, Berger, Charytan, Dıez, & Hart et al., 2011; Kosmadakis, Bevington, Smith, Clapp, Viana, & Bishop et al., 2010; Naqvi & Collins, 2006).

The treatment of end-stage kidney disease has evolved over time from a focus on mere survival to achieving optimal wellbeing and HRQoL (Rettig & Sadler, 1997). The aim of treatment is to improve the HRQoL among recipients by treating reversible causes, symptoms and complications, and preventing or slowing the progression of the disease (Schieppati, Pisoni, & Remuzzi, 2005). However, renal replacement therapy (i.e., kidney transplant, dialysis therapy) may often negatively affect the psychology, physiology and daily functioning of patients. That is, major challenges in graft failure, treatment decisions, and lifestyle changes, effects of treatment, disease progression, and possible death influence HRQoL outcomes from the time of initial diagnosis.

Psychological Symptoms

The prognosis of survival for end-stage organ failure is even poorer than many common malignant diseases and thus end-stage kidney disease patients may suffer from distressful psychological symptoms (Janssen, Spruit, Wouters, & Schols, 2008). Previous studies have shown that end-stage heart, lung, and kidney disease patients' HRQoL is equally or even more greatly affected by their disease in comparison to cancer patients (Gore, Brophy, & Greenstone, 2000; Riedinger, Dracup, & Brecht, 2002; Saini, Murtagh, Dupont, McKinnon, Hatfield, & Saunders, 2006).

Both end-stage kidney disease and transplantation are associated with depression, which may decrease adherence to treatment as well as influence survival (Devins, Beanlands, Mandin, & Paul, 1997; Dobbels, Skeans, Snyder, Tuomari, Maclean, & Kasiske, 2008). Moreover, the suicide rate in end-stage kidney patients was found to be 84 percent higher than the general population from 1995 to 2001 (Kurella, Kimmel, Young, & Chertow, 2005). While there are many advantages to kidney transplantation,

depressive symptoms are still present in approximately 25% of recipients, rates comparable to that of the hemodialysis population (Chilcot, Spencer, Maple, & Mamode, 2014). In a study by Karaminia, Tavallaii, Lorgard-Dezfuli-Nejad, Lankarani, Mirzaie, and Einollahi (2007), depressive symptoms did not seem to improve following kidney transplantation. Correlates of depressive symptoms among kidney transplant recipients include marital status, income, kidney function, history of affective illness, malnutrition, and inflammation (Akman, Özdemir, Sezer, Miçozkadioğlu, & Haberal, 2004; Chilcot, Spencer, Maple, & Mamode). Depression is also common in other organ transplant groups and risk factors include pre-transplant psychiatric history, poor social support, avoidance coping strategies for managing health problems, low self-esteem, and adverse effects of immunosuppressive medication (Dew, Roth, Schulberg, Simmons, Kormos, & Trzepacz, 1996).

Physical Symptoms

Patients with end-stage heart, lung, and kidney disease experience a gradual decrease in health status and daily functioning and may suffer from distressful physical symptoms (Murray, Kendall, Boyd, & Sheikh, 2005). A systematic review of observational studies of symptom prevalence in chronic organ failure provides limited understanding of daily symptom burden in patients with end-stage heart, lung, and kidney disease (Janssen, Spruit, Wouters, & Schols, 2008). Despite reporting on studies of various designs which were lacking a clear and commonly accepted definition of ‘end-stage’ and which varied with patient selection criteria and definition and measurement of symptoms, “daily symptom burden is likely to be high in end-stage chronic organ failure, irrespective of the underlying disease” (Janssen, Spruit, Wouters, & Schols, p.941). The

most frequently reported symptoms among end-stage heart, lung, and kidney patients were fatigue, shortness of breath, insomnia, and pain (Janssen, Spruit, Wouters, & Schols).

As kidney disease progresses, health and physical functioning decline, and lead to increased morbidity and premature death (DeOreo, 1997). The health of patients with end-stage kidney disease is impacted by uremic complications, malnutrition, inflammation, and cardiovascular and comorbid conditions which all contribute negatively to survival (Sietsema, Amato, Adler, & Brass, 2004). Regardless of the severity of kidney function, cardiovascular disease is the leading cause of death among kidney disease patients (Gullion, Keith, Nichols, & Smith, 2006; Sarnak, Levey, Schoolwerth, Coresh, Culleton, & Hamm, et al., 2003). It is also the leading cause of death among kidney transplant recipients and is estimated to be four to six times higher in kidney transplant recipients than in the general population (Aakhus, Dahl, & Wideroe, 2004; Oterdoom, de Vries, van Ree, Gansevoort, van Son, & van der Heide, et al., 2009).

Organ transplantation is, in general, associated with increased HRQoL (Dew, Switzer, Goycoolea, Allen, DiMartini, & Kormos, et al., 1997). The greatest improvements are said to be made in regards to physical dimensions and are observed typically during the first two post-operative years (Wright Pinson, Feurer, Payne, Wise, Shockley, & Speroff, 2000). Wright Pinson and colleagues (2000) compared mean preoperative and post-transplantation Karnofsky scores (i.e., physical functional status) showing significant improvement for all groups of patients following organ transplantation (all $p<0.001$). Lung, heart, and liver recipients demonstrated a large effect (1.2 ES) while kidney recipients demonstrated a moderate effect (0.6 ES) (Cohen, 1988;

Wright Pinson, Feurer, Payne, Wise, Shockley, & Speroff). Despite these improvements, organ transplant recipients continue to experience significant deficiencies in physical scales when compared to the general population (Wright Pinson, Feurer, Payne, Wise, Shockley, & Speroff). Though HRQoL following kidney transplantation is generally improved, serious post-transplant complications may result in reduced physical functioning.

Immunosuppressive Therapy

Important aspects of kidney transplant recipients' lives include the impact of side-effects from immunosuppressive drugs (De Geest & Moons, 2000). For men, some of the most distressing physical symptoms include impotence, back pain, reduced vision, muscular weakness, and stomach complaints whereas for women, muscle weakness, headaches, swollen gums, brittle skin, and increased hair growth are most distressing (De Geest & Moons). Factors influencing physical performance in kidney transplant recipients may differ from those influencing physical performance in end-stage kidney disease patients treated with hemodialysis therapy due to a reversal of the uremic state following successful kidney transplantation.

Recipients of a kidney transplant receive immunosuppressive therapy which is associated with increased morbidity and mortality, hypertension, diabetes mellitus, bone disease, cataracts, muscle atrophy and weakness, hyperlipidemia, infection, cancer, toxicity (particularly nephrotoxicity), anemia, obesity, skin disorders, hair growth, cardiovascular complications, and psychiatric and cognitive changes (e.g., depression, memory loss) (e.g., Boots, Christiaans, & van Hooff, 2004; Matas, Kandaswamy, Gillingham, McHugh, Ibrahim, & Kasiske, et al., 2005;). Given this information, it is

necessary to examine potential interventions that minimize negative symptom experiences and improve the HRQoL of kidney transplant recipients. Attempting to understand intervention strategies that improve HRQoL in kidney transplant recipients is necessary given the strong evidence suggesting that better HRQoL is associated with fewer debilitative physical and psychological symptoms (Ouzouni, Kouidi, Sioulis, Grekas, & Deligiannis, 2009).

Self-Management and Kidney Transplantation

The transplant literature has highlighted that receipt of a new kidney is accompanied with many new stressors and adaptive demands (Wainwright, Fallon, & Gould, 1999). These include following a strict post-transplant regimen as well as the side-effects of immunosuppressive drugs and the constant threat of organ rejection. Receiving an organ transplant is also associated with specific emotional and behavioural responses such as worry about the transplant, feelings of guilt towards the donor, disclosure of transplantation, medication adherence, and perceived responsibility to do well (Ziegelmann, Griva, Hankins, Harrison, Davenport, & Thompson, 2002).

Self-management is recognized as an important aspect of successful outcomes in healthcare (Linnell, 2005) and is shown to improve health function, decrease hospitalization, and enhance HRQoL (Lorig, Ritter, Stewart, Sobel, Brown, & Bandura, et al., 2001). Following kidney transplantation, recipients are at high risk for chronic rejection, infection, and graft failure and thus need to take responsibility for their own care (Pirsch, 2003). Additionally, health professionals indicate kidney transplant recipients need to participate in their care to a greater extent than other chronic disease patients in order to control for cardiovascular risk factors and preserve long-term graft

function (Curtin, Mapes, Schatell, & Burrows-Hudson, 2005). Increasing physical and psychosocial functioning through physical activity is one strategy for reducing the multiple pathophysiological and psychosocial issues in kidney transplantation and maximizing HRQoL.

Physical Activity

Psychosocial interventions are available for end-stage kidney disease patients and include pharmacotherapy, psychotherapy, and cognitive behavioural therapy (Finkelstein, Wuerth, & Finkelstein, 2009). However, these therapies are largely psychological in nature and are unlikely to address the physical and functional problems encountered by these patients (Kosmadakis, Bevington, Smith, Clapp, Viana, & Bishop et al., 2010). Research indicates that physical activity may be one therapeutic intervention that may complement existing medical therapies and address a variety of HRQoL outcomes relevant to end-stage kidney disease and kidney transplantation. Physical activity varies with type, intensity, and duration and involves increased energy expenditure with movement of the body which is produced by skeletal muscle contraction. Physical activity can be purposeful action to improve metabolic and physical functioning, and serve as leisure or recreation and activity related to daily living as well as occupation (Caspersen, Powell, & Christenson, 1985). Exercise, considered a subset of physical activity, is structured with the intent of developing physical fitness (i.e., enhance cardiovascular function, strength, flexibility) (Caspersen, Powell, & Christenson).

The American College of Sports Medicine recommends adults participate in at least 150 minutes of moderate-intensity, or 75 minutes of vigorous-intensity aerobic physical activity per week (American College of Sports Medicine (ACSM), 2009).

Adults are encouraged to increase moderate-intensity activity to 300 minutes or vigorous-intensity activity to 150 minutes per week to obtain additional benefits (ACSM). In addition, muscle-strengthening activities should be performed on two or more days of the week (ACSM). For chronic disease populations, it is recommended individuals be as physically active as their abilities and conditions allow (World Health Organization, 2010). The Kidney Disease Global Outcomes guidelines recommend at least 30 minutes of moderate-intensity physical activity five times per week for kidney disease patients (2012).

Further, the Kidney Disease Global Outcomes guidelines state immediately following kidney transplantation, kidney transplant recipients should begin a walking program consisting of 30 minutes of daily walking. Precisely how much walking (i.e., steps) confers benefit in this population is unknown. Tudor-Locke and Bassett (2004) proposed indices to classify walking behaviour in healthy adults: ‘sedentary lifestyle index’ (<5000 steps/day); ‘low active’ (5,000-7,499 steps/day); ‘somewhat active’ (7,500-9,999 steps/day); ‘active’ (≥10,000 steps/day); ‘highly active’ (>12,500 steps/day). A 10,000 steps per day recommendation has demonstrated health benefits in sedentary populations (Moreau, Degarmo, Langley, McMahon, Howley, & Bassett, 2001). Moreover, incremental change in terms of steps per day have demonstrated important health outcomes with approximately 2,500 steps per day over baseline (Sugiura, Sugiura, Kajima, Mirbod, Iwata, & Matsuoka, 2002; Tudor-Locke, Myers, Bell, Harris, & Rodger, 2002). To meet current physical activity guidelines, individuals are encouraged to walk a minimum of 3000 steps in 30 minutes on 5 days each week (Marshall, Levy, Tudor-Locke, Kolkhorst, Wooten, & Ji, et al., 2009).

Physical Activity Guidelines

Although physical activity is recognized as an important factor in managing kidney disease it is not commonly assessed in the management of kidney transplantation (Koufaki & Mercer, 2009). Despite the limited literature on the behaviour of physical activity following kidney transplantation, the literature proposes that physical activity is reduced in recipients. Evidence suggests that self-reported physical activity is low among individuals with end-stage kidney disease (Avesani, Trolonge, Deléaval, Baria, Mafra, & Faxen-Irving et al., 2012; Zamojska, Szklarek, Niewodniczy, & Nowicki, 2006) and remains that way even after kidney transplantation (Beddhu, Baird, Zitterkoph, Neilson, & Greene, 2009; van den Ham, Kooman, Schols, Nieman, Does, Franssen, & Akkermans, 2005). There is evidence demonstrating kidney transplant recipients slightly increase physical activity immediately after transplantation nevertheless it remains low and usually does not improve to pre-diagnosis levels, nor reach guideline recommendations (Nielens, Lejeune, Lalaoui, Squifflet, Pirson, & Goffin, 2001; Painter, Hector, Ray, Lynes, Dibble, & Paul, 2002). Thus, it is plausible that many kidney transplant recipients may not be taking a sufficient number of daily steps nor achieving physical activity guidelines.

Physical Activity in Kidney Transplant Recipients

An increasing number of studies have been published regarding the health effects of various physical activity interventions among adults with end-stage kidney disease and kidney transplant recipients. A systematic review of exercise intervention studies by Heiwe and Jacobson (2011) revealed 45 randomized controlled trials (RCT) examining the effects of exercise in adults with end-stage kidney disease. Intervention modalities

included supervised and unsupervised activities of high or low intensity such as cardiovascular training, mixed cardiovascular and resistance training, resistance-only training and yoga. Similar to research in healthy populations, these trials provide evidence that physical activity is effective in improving physical and psychological parameters such as physical fitness (aerobic capacity, walking capacity), cardiovascular dimensions (resting diastolic and systolic blood pressure and resting heart rate), some metabolic and nutritional parameters (albumin, pre-albumin, energy intake), and HRQoL.

Only three RCTs have examined exercise specifically in adults with a kidney transplant (Dimeo, Wencke, Krist, Westhoff, & Rothermund, 2007; Kouidi, Grekas, Dombros, Deligiannis, & Tourkantonis, 2002; Painter, Hector, Ray, Lynes, Paul, & Dodd, 2002). These trials suggest that exercise is associated with improved cardiovascular function, HRQoL (Dimeo, Wencke, Krist, Westhoff, & Rothermund), heart rate variability parameters (Kouidi, Grekas, Dombros, Deligiannis, & Tourkantonis), blood pressure, cholesterol, resting metabolic rate (METs), and total cardiovascular disease risk (Painter, Hector, Ray, Lynes, Paul, & Dodd).

There is evidence suggesting exercise could play an important role in preserving kidney function and lowering cardiovascular risk and death in kidney transplant recipients. Stump (2011) provides a review of physical activity in the prevention of chronic kidney disease and suggests that physical inactivity is a modifiable risk factor which may affect the development and course of chronic kidney disease and end-stage kidney disease. Epidemiological studies have suggested that engaging in vigorous physical activity may protect against kidney disease. Bharakhada, Yates, Davies,

Wilmot, Edwardson, and Henson et al. (2012) suggest that higher levels of physical activity and lower levels of sitting time are associated with a lower prevalence of chronic kidney disease independently of each other and other risk factors. Another study demonstrated that objectively assessed total physical activity (i.e., sum of light and moderate–vigorous minutes of physical activity) was positively associated with kidney function (individual without kidney disease) (Hawkins, Sevick, Richardson, Fried, Arena, & Kriska, 2011).

Romano and colleagues (2010) examined inflammatory responses to physical activity among kidney transplant recipients and revealed that activity training consisting of 40 minute sessions, three times a week, performed with the interval training technique significantly decreased the inflammation marker, Interleukin-6, from 2.8 ± 0.6 to 1.7 ± 0.5 pg/mL ($p < 0.01$). These changes may have clinical relevance given that inflammatory factors have been implicated in patient outcomes including cardiovascular disease and death (Dungey, Hull, Smith, Burton, & Bishop, 2013). Additionally, Surgit, Ersoz, Gursel, and Ersoz (2001) examined specific immune responses to activity in kidney transplant recipients and revealed that an 8-week aerobic activity program consisting of 45 minutes of supervised cycle exercise three times a week increased aerobic capacity by 11 percent ($p < .01$) and enhanced immune response ($p < .01$) without causing short term graft dysfunction. Although further research must confirm these conclusions, this preliminary evidence suggests that physical activity may play a crucial role in preserving kidney function and reducing a number of comorbidities including cardiovascular risk and death in kidney transplant recipients.

Besides the physiological benefits of physical activity, HRQoL and psychosocial health outcomes have also been reported to improve with increased activity. Studies (Lopes, Lantz, Morgenstern, Wang, Bieber, & Gillespie, 2014; Martins, Ramos, Guaraldo, Uezima, Martins, & Junior, 2011) indicate that end-stage kidney disease patients treated with other types of renal replacement therapy (e.g., hemodialysis) who met public health physical activity guidelines or exercised regularly, had less depressive symptoms and fewer psychological problems. Using self-report methods to assess aerobic activity, Lopes and colleagues reported physical activity to be positively associated with HRQoL and inversely related to depressive symptoms and mortality in a sample of 5,763 patients undergoing maintenance hemodialysis from 12 different countries. Comparably, Martins and company observed better cognitive function among active hemodialysis patients in comparison to inactive patients ($p < 0.05$). Among kidney transplant recipients, the psychosocial effects of physical activity have also been reported. The literature suggests that an appropriate dosing of physical training may be a useful, safe and non-pharmacologic contribution to kidney transplant treatment. For example, in one study (Romano, Simonella, Falleti, Bortolotti, Deiuri, & Antonutto, et al., 2010), eight kidney transplant recipients were evaluated before and after exercise training consisting of thirty 40-minute sessions, three times a week, performed with the interval training technique and showed significantly decreased anxiety and depressive symptoms ($p < 0.04$ and $p < 0.008$, respectively) and significantly increased HRQoL mean scores (SF-36) ($p < 0.001$).

Walking

Walking is an accessible and inexpensive way for kidney transplant recipients to engage in physical activity (e.g., low-impact, appropriate for all age-groups, done at one's own pace, no cost) (Eyler, Brownson, Bacak, & Housemann, 2003; Siegel, Brackbill, & Heath, 1995). There is extensive evidence suggesting that walking may provide numerous physical and psychological health benefits. There is an association between walking and a 19 to 30 percent reduction in mortality rate from all causes, depending on the amount and intensity of walking (Lee & Skerrett, 2001; Woodcock, Franco, Orsini, & Roberts, 2011). Walking has also been shown to have a preventive effect on chronic diseases such as type 2 diabetes, cardiovascular disease, and other types of diseases (Murtagh, Murphy, & Boone-Heinonen, 2010; Yates, Haffner, Schulte, Thomas, Huffman, & Bales et al., 2014). Additionally, walking has been demonstrated to reduce depression and anxiety, and even increase HRQoL (Hamiwka, Cantell, Crawford, & Clark, 2009; Kopp, Steinlechner, Ruedl, & Ledochowski, et al., 2012). Tudor-Locke, Craig, Thyfault, and Spence (2013) suggest the profile of individuals more likely to be taking less than 5,000 steps per day includes living with a chronic disease and (or) disability.

A study by Zamojska, Szklarek, Niewodniczy, and Nowicki (2006) reported results from an investigation into the walking behaviour of end-stage kidney disease patients over a period of two days. This study reported the mean steps per day (3,448, SD 1,178.5) of individuals treated with hemodialysis therapy (33 males, 27 females) aged 60 years ± 13. Moreover, a cross-sectional study enrolling 20 hemodialysis patients and 23 kidney transplant recipients from Brazil assessed physical activity in daily life by accelerometer (Carvalho, Reboredo, Gomes, Teixeira, Roberti, & Mendes, 2014). It was

reported that kidney transplant recipients were active a greater part of the day than hemodialysis patients. In particular, kidney transplant recipients had longer walking times (106 ± 53 vs 70 ± 27 minutes per day; p = .008). Kidney transplant recipients also took more steps per day (9,705 ± 4,902 vs 5,678 ± 2,178; p = .005). Study subjects may not be representative of the overall population of kidney transplant recipients as participants with several common comorbidities such as arrhythmia, hypertension, diabetes, angina, respiratory disease, infection, renal osteodystrophy, and neurologic or musculoskeletal disturbances were excluded from the study.

A previous study by Akber, Portale, and Johansen (2012), reported results from an investigation into pedometer-assessed physical activity in children and young adults with chronic kidney disease stage one to four (*n*=12), end-stage kidney disease treated with dialysis (*n*=7), and kidney transplantation (*n*=25). This study reported that participants walked 6,218 steps per day, considerably less than the recommended guideline for this young and unique population (Tudor-Locke & Bassett, 2004). It was reported that walking behaviour did not differ among participants in the chronic kidney disease, dialysis, and transplant groups. Females were significantly less active than males and there was an age-related gradient in steps per day showing fewer steps per day among older participants (i.e., 18 to 20 years of age). Additionally, average step count per day in a cohort of 20 children with a kidney transplant was 9,282 (SD = 4,666) (Hamiwka, Cantell, Crawford, & Clark, 2009). Currently, walking behaviour has not been investigated in adult kidney transplant recipients in Canada. Tracking daily steps among adult recipients of a kidney transplant is an important endeavour for understanding where this population stands in terms of total volume walked, as well as

the percentage of these individuals achieving recommended steps per day. The literature suggests that walking behaviour may increase following kidney transplantation however physical activity remains reduced (Nielens, Lejeune, Lalaoui, Squifflet, Pirson, & Goffin, 2001; Painter, Hector, Ray, Lynes, Dibble, & Paul, 2002). Thus many individuals may not achieve recommended guidelines and may also continue to be sedentary following kidney transplantation.

Sedentary Behaviour

Sedentary behaviours are activities low in energy expenditure. They have been conceptualized as sitting or reclining and are in the energy-expenditure range of 1.0 to 1.5 metabolic equivalents (METs) (Owen, 2012). Sedentary behaviours are not to be confused with physical inactivity (i.e., performing insufficient amounts of moderate- to vigorous-intensity physical activity) (Sedentary Behavior Research Network, 2012). Although some standing activities (standing quietly) require low energy expenditure (<1.5 METs), they are not considered sedentary behaviours as the individual is not in a seated posture. Moreover, sedentary behaviour does not include sleep, which has important restorative functions. Examples of sedentary behaviours include watching television or sitting at a computer.

In the general literature, sedentary time is the least well measured dimension compared to other domains of physical activity (Bauman, Phongsavan, Schoeppe, & Owen, 2006). Measuring time spent in sedentary pursuits independently of other domains of physical activity, particularly the amount of time individuals sit at work and watch television extends the literature on the role of sedentary behaviour as an independent indicator which may be related to chronic disease, obesity, and decreased HRQoL.

Studies with a primary focus on examining the relationship between sedentary behaviours and mental health outcomes are emerging. While this field is still in its infancy, findings from these studies demonstrate evidence of at least an association between sedentary behaviour and mental health. Independent of physical activity, these studies report positive associations between the measured sedentary behaviours and depressive symptoms.

Given the infancy of this body of research (sitting time and HRQoL), it is still unclear as to the role of sitting across HRQoL indices. Among kidney cancer survivors under the age of 60, negative associations between sitting time and physical and functional aspects of quality of life were reported (Trinh, Plotnikoff, Rhodes, North, & Courneya, 2013). Among older men, Vallance, Eurich, Marshall, Lavallee, and Johnson (2013) found no relationship between HRQoL and sitting time on weekdays. However, weekend sitting time was associated with HRQoL when comparing the lowest and highest quartiles. In their study population of older men (where 35% were still in the workforce), it was possible that some screen time was facilitative for health (e.g., rest, relaxation). Additionally, previous validation work with the sitting measure used in their study suggested the reliability estimates are generally lower for weekend sitting time across all domains (Marshall, Miller, Burton, & Brown, 2010).

Lifestyle factors, including sedentary behaviour heighten the risk for end-stage kidney disease (Stengel, Tarver–Carr, Powe, Eberhardt, & Brancati, 2003). Sedentary behaviour has deleterious health consequences that are distinct from the beneficial effects of physical activity (Owen, Sparling, Healy, & Matthews, 2010). Within public health research, measurement of adults' sedentary time has typically focused on television

viewing which may account for up to 50% of the leisure-time sedentary behaviour of adults (Sugiyama, Healy, Dunstan, Salmon, & Owen, 2008). Sedentary behaviour has been independently associated with chronic disease-related risk factors such as adiposity (Wijndaele, Healy, Dunstan, Barnett, Salmon, & Shaw, et al., 2010), insulin resistance and inflammation (Healy, Matthews, Dunstan, Winkler, Owen, 2011) in healthy adults. To date, there are no studies examining sedentary time estimates among kidney transplant recipients in Canada. This study will be the first study to elicit sedentary time estimates from a sample of kidney transplant recipients in Canada.

Health-Related Quality of Life

Combining subjective HRQoL assessment and objective clinical indicators has become a standard of practice for assessing the effects of illness on physical and psychosocial aspects of HRQoL and for evaluating the effectiveness and appropriateness of medical intervention (Enthoven, 2000). Subjective assessment takes into account individuals' perception of their health, such as physical and psychosocial functioning (Testa & Simonson, 1996). Objective clinical indicators determine the degree of health or functioning related to biological parameters or physical ability (e.g., walking behaviour). Altogether, subjective perceptions of health translate objective clinical indicators into the HRQoL (Testa & Simonson).

Kidney Transplantation and Quality of Life

More and more individuals are surviving end-stage organ failure and thus must live with the sequelae of both the disease and the effects of medical treatment perhaps for the rest of their lives. Kidney transplantation is thus a long term chronic condition with a possibly high impact on HRQoL (Cleemut & Dobbels, 2000). With advancements in

immunosuppressive therapy and other medical intervention, survival rates have improved and HRQoL has become an increasingly important outcome indicator in organ transplantation. While transplantation of an organ does not cure the recipient, it may improve HRQoL. Apart from the observable progress that results from organ transplantation, transplant recipients do not typically regain a HRQoL comparable to that of the general population (Dew, Switzer, Goycoolea, Allen, DiMartini, & Kormos, 1997; Wright Pinson, Feurer, Payne, Wise, Shockley, & Speroff, 2000).

Although the HRQoL of kidney transplant recipients is said to improve from before to after receipt of the transplant graft (Fujisawa, Ichikawa, Yoshiya, Isotani, Higuchi, & Nagano, 2000; Hathaway, Winsett, & Johnson, 1998), research has suggested that organ transplant patients can reach a plateau at one to two years post-transplant with subsequent predicted declines (Wright Pinson, Feurer, Payne, Wise, Shockley, & Speroff, 2000). Despite the lack of longitudinal data on kidney transplant outcomes, a cross-sectional study by Fructuoso, Castro, Oliveira, Prata, and Morgado (2011) evaluating the HRQoL of patients with end-stage kidney disease in various phases and under different treatment modalities reported that kidney transplant recipients did not achieve better results on several dimensions of HRQoL compared to patients treated with other types of renal replacement therapy (i.e. hemodialysis, peritoneal dialysis). In another study, Griva, Stygall, Ng, Davenport, Harrison, and Newman (2011) provided evidence that decline in HRQoL is not an inevitable consequence of long-term condition or advancing illness in the context of kidney transplantation.

The literature indicates HRQoL is influenced by various socio-demographic, psychosocial, and physiological factors as well as health behaviour. Socioeconomic

status, ethnicity, marital status, sex, and age are factors impacting HRQoL. Low socioeconomic status, immigrant status, and single or non-marital status are negatively related to HRQoL (Wee, Li, Cheung, Fong, & Thumboo, 2006). Gentile, Beauger, Speyer, Jouve, Dussol, & Jacquelinet et al. (2013) provided evidence that unemployment, lower education, living alone, and being older decreases HRQoL scores of adult kidney transplant recipients. Additionally, the impact of determinants may have dissimilar effects on HRQoL in different age groups. Although younger individuals demonstrate fewer issues in the physical rather than mental dimensions of HRQoL, older individuals demonstrate fewer issues in the mental rather than physical dimensions (Asakawa, Senthilselvan, Feeny, Johnson, & Rolfson, 2011).

Summary

The increasing prevalence of end-stage kidney disease and kidney transplantation in Canada as well as the deconditioning associated with the disease, transplantation, and other comorbidities call for a clearer understanding of physical activity behaviour (e.g., walking, sedentariness) among kidney transplant recipients (Canadian Institute for Health Information, 2015). Additionally, there is a need to promote regular physical activity with the aim to reduce cardiovascular risk factors, effects of subnormal kidney function, and physical deconditioning as well as preserve long-term graft function and improve HRQoL outcomes and psychosocial health.

There is an emerging body of research addressing physical activity as an effective approach for achieving optimal physical functioning and psychosocial health in kidney transplant recipients. Reducing periods of sedentary behaviour has also emerged as a potential target for improving health. Limited data is available on the physical activity (in

particular, walking behaviour) and sedentary behaviour of kidney transplant recipients and the associations between physical activity, sedentary behaviour, and HRQoL in this population.

Currently, walking behaviour has not been investigated in adult kidney transplant recipients in Canada. Tracking daily steps among adult recipients of a kidney transplant is an important endeavour for understanding where this population stands in terms of total volume walked, as well as the percentage of these individuals achieving recommended steps per day. Furthermore, there are no studies examining sedentary behaviour among individuals with a kidney transplant in Canada. This study will be the first to elicit sedentary time estimates from a sample of kidney transplant recipients in Canada. This study will serve to gain a better understanding of the associations of HRQoL and psychosocial factors (e.g., depressive symptoms) with walking and sedentary behaviour profiles.

Objective and Hypotheses

The primary objective of this thesis is to determine associations of HRQoL and psychosocial factors (i.e., self-esteem, depression, psychological growth) with objectively-assessed walking (i.e., pedometers), physical activity, and sedentary time among individuals with kidney disease. We hypothesized: a) participants who achieve at least 10,000 steps per day would report higher HRQoL and more optimal psychosocial health outcomes compared to participants engaging in <10,000 steps per day, b) participants who are achieving physical activity guidelines would report higher HRQoL and more optimal psychosocial health outcomes compared to participants not achieving guidelines, and c) participants who report high amounts of daily sitting time would report

poorer HRQoL and less optimal psychosocial health outcomes compared to participants reporting lower amounts of sitting.

This study will serve to advance the understanding of walking and sedentary behaviour and their associations with HRQoL in kidney transplant recipients. By understanding the outcomes associated with physical activity and sedentary behaviour among this population, this study may contribute to the discovery and development of ways to help kidney transplant recipients live active lifestyles.

Chapter III – METHODS

Participants and Procedures

Prior to any recruitment, ethical clearance to conduct this cross-sectional survey was granted by the Athabasca University Research Ethics Board (File No: 21489). Adults (18 years of age and older) across Canada were invited to participate in this study. To be included, prospective participants must have met the following criteria: (a) have received a successful/uncomplicated kidney transplant, (b) not currently be on dialysis therapy, (c) be free from orthopedic conditions that would preclude walking, (d) have the ability to read and understand English, and (e) reside in Canada. Participant recruitment commenced in November 2014 and was completed in June 2015.

Adults with a kidney transplant living in Canada were recruited using research advertisements placed in kidney transplant-related media (e.g., research notices on the Kidney Foundation of Canada website and electronic newsletter) and other social media (e.g., Twitter). Those interested in participating were invited to contact the researcher by email or telephone. After pre-screening by the researcher (i.e., confirming successful kidney transplantation, eligibility criteria), a survey package containing a detailed information letter, questionnaire, a Piezo SC-StepMX step pedometer (Stepscount, Deep River, Ontario), three-day step diary, and a self-addressed business reply envelope (i.e., postage paid) were sent to participants.

After resetting the pedometer to zero each morning, participants were instructed to wear the pedometer over their dominant leg for three days (Tudor-Locke, 2001) and record the value at the end of each day in the step diary that was provided. Participants

were asked to return the questionnaire and the three-day step diary in the envelope provided and to keep the pedometer for their own personal use.

Research participants were assigned a unique identification code (e.g., 001, 002, 003) to maintain anonymity during analyses. The participants' full contact information was stored in the study tracking file (i.e., Excel file) to which only the principal investigator (JR) had access. All data was entered into SPSS on a password-protected computer. All surveys were stored in a locked filing cabinet located in the principal investigator's clinic office.

Sample

A non-probability self-selected sampling method was used for the study given that participation was voluntary. In 2013, an estimated 17,817 were living with a kidney transplant in Canada (Canadian Institute for Health Information, 2015). The target sample size for this study was 100 participants. However, a total of 32 participants returned a completed survey.

Measures

All measures are located in Appendix B.

Demographic and clinical information. Sex, age, body mass index, marital status, education, annual household income, and employment status were assessed by self-report. Clinical information including physician prescription for physical activity, kidney donor source, time since kidney transplantation, and previous dialysis treatment, previous organ transplant, comorbidities (dichotomized as having at least one comorbidity), and lifestyle factors (e.g., smoking, alcohol consumption) were also assessed via self-reported.

Self-reported physical activity. Self-reported physical activity was assessed using the Godin Leisure-Time Exercise Questionnaire (GLTEQ) (Godin & Shephard, 1985). The GLTEQ contains three questions that assess the frequency of mild, moderate, and strenuous physical activity during free time in an average week over the past month. For each of the three intensity categories, examples of activities are given that are appropriate for each category. An independent evaluation of the GLTEQ found its reliability to compare favorably to nine other self-report measures of exercise based on various criteria, including test-retest scores, objective activity monitors, and fitness indices (Jacobs, Ainsworth, Hartman, & Leon, 1993).

Objective walking behaviour. Objective walking behaviour was assessed using the Piezo SC-StepMX (Stepscount, Deep River, Ontario) step pedometer. Step pedometers provide a practical and affordable low-tech option for objective and accurate monitoring of physical activity (i.e., steps taken). The SC-StepMX is a medical grade piezoelectric unit designed with leading edge technology and offers accuracy regardless of body size. After resetting the pedometer to zero each morning, participants were instructed to wear the pedometer over their dominant leg for three days (Tudor-Locke & Myers, 2001) and recorded the value at the end of each day (before bed) in the step diary that was provided. The SC-StepMX is a valid tool for the measurement of step counts in individuals of various ages and body types (Colley, Barnes, Leblanc, Borghese, Boyer, & Tremblay, 2013).

Sedentary behaviour. Sedentary time and time spent engaging in sedentary behaviour were determined using the SIT-Q (Lynch, Friedenreich, Khandwala, Liu, Nicholas, & Csizmadi, 2014). This questionnaire was developed as a comprehensive self-

report measure to assess adult sedentary behaviour across multiple domains (occupation, transportation, household and leisure-time), and weekday and weekend (Lynch, Friedenreich, Khandwala, Liu, Nicholas, & Csizmadi). It is divided into 7 sections: sleeping/napping, meals, transportation, work/study/volunteering, family care, light leisure/relaxing, and final open-ended questions allowing the participant to add in any additional activities that were not covered in the SIT-Q. The SIT-Q measures total time spent engaging in each domain of sedentary behaviour. This recently developed questionnaire has been assessed for test-retest reliability and validity (Lynch, Friedenreich, Khandwala, Liu, Nicholas, & Csizmadi). Intra-class correlation coefficient (ICC) and 95% confidence intervals were calculated for results of total sitting time (h/day) measured by two administrations of the SIT-Q, one month apart (ICC 0.65, 95%CI (0.49, 0.78)). Validity was assessed by comparing sitting time measured by the SIT-Q to estimates derived from Seven-Day Activity Diaries using postural and MET-based definitions of sedentary, resulting in Spearman's coefficients of 0.53 ($p<0.01$) and 0.52 ($p<0.01$) respectively (Lynch, Friedenreich, Khandwala, Liu, Nicholas, & Csizmadi).

Health-related quality of life. HRQoL was assessed using the RAND-12 (Ware, Kosinski, & Keller, 1996), which measures physical and mental dimensions of HRQoL taken from the RAND-36 Health Status Inventory (Maddigan, Feeny, & Johnson, 2004). The RAND-12 gives two scores; a mental health component scale (MHC) and a physical health component scale (PHC), each comprising of six items. Self-reported HRQoL was scored using the Ware, Kosinski, and Keller's (1995) *SF-12: How to Score the SF-12 Physical and Mental Health Summary Scales* and expressed as the physical (PCS) and

mental (MCS) component score which are scored using norm-based methods. That is, both scores are "transformed to have a mean of 50 and a standard deviation of 10 in the general U.S population… and all scores above and below 50 are above and below the average, respectively, in the general U.S population" (Ware, Kosinski, & Keller, p.21). Scoring the physical and mental component scores involved four steps: data cleaning and item recoding, creating indicator variable for item response choices, weighting and aggregation of indicator variables, and norm-based standardization of scale scores. First, data was screened for out of range values and reverse scoring of four items was completed so that a higher score indicated better health. Second, indicator variables were created for the item response choice categories. Third, indicator variables were weighted using regression coefficients from the general U.S population and were aggregated. Lastly, a constant (regression intercept) was added thus both PCS and MCS were standardized to have the same mean as SF-36 versions in the general U.S. population. Scores range from 0 to 100 and lower scores on the MHC and the PHC indicate greater disability (>50 = no disability; 40-50 = mild disability; 30-40 = moderate disability). A PHC score <42 suggests that perceived physical health problems are impeding life functioning, while a MHC score <38 likely indicates that an individual is experiencing psychological symptoms that might be impeding life functioning (Ware et al., 1996).

Self-esteem. Self-esteem was measured by the Rosenberg Self-Esteem Scale (RSES). The RSES consists of 10 items rating factors on a four-point Likert scale ranging from strongly agree to strongly disagree, with phrases such as "I am able to do things as well as most other people," or "Ultimately, I tend to feel like a failure" (Zhao, Kong, & Wang, 2013). The scale ranges from 0-30. Scores between 15 and 25 are within

normal range; scores below 15 suggest low self-esteem. This scale has been shown to have a high degree of reliability and validity (Zhao, Kong, & Wang).

Depressive symptoms. Depression was assessed using the Patient Health Questionnaire – 9 (PHQ-9) (Kroenke, Spitzer, & Williams, 2001). The PHQ-9 scores each of the nine DSM-IV criteria and item responses range from "0" (not at all) to "3" (nearly every day), providing a 0 to 27 severity score. Items are preceded by the statement "Over the last 2 weeks, how often have you been bothered by any of the following problems?" Scores of 5, 10, 15, and 20 indicate mild, moderate, moderately severe, and severe depression, respectively. The PHQ-9 is a brief, well-validated and reliable measure for detecting and monitoring severity of depression and has been widely used in populations with medical conditions including end-stage kidney disease patients (Drayer, Piraino, Reynolds, Houck, Mazumdar, & Bernardini, et al., 2006).

Psychological growth. Psychological growth was assessed using the Posttraumatic Growth Inventory (PTGI) (Tedeschi & Calhoun, 1996). This 21-item scale was designed to assess positive changes experienced after trauma (such as end-stage kidney disease diagnosis), and yields a total score and five subscale scores (i.e., relationships to others, new life possibilities, personal strength growth, spiritual change, appreciation of life). The PTGI has demonstrated a high degree of construct and criterion validity (Tedeschi & Calhoun, 1996).

Statistical Analysis

Data was entered into SPSS version 21. Descriptive statistics were used to examine the demographic, behavioural, and clinical characteristics of the sample. Objectively-assessed walking behaviour was coded as 0 (not meeting recommended daily

steps; < 10,000 steps per day) or 1 (meeting recommended daily steps; ≥ 10,000 steps per day). Self-reported physical activity (meeting physical activity guidelines) was coded as 0 (not meeting physical activity guidelines; < 150 minutes of moderate-vigorous physical activity per week) or 1 (meeting physical activity guidelines; ≥ 150 minutes of moderate-vigorous physical activity per week). For sedentary time, a median-split was employed to dichotomize those into a low sedentary time group (< 630 total min/day; < 487.5 total min/day; both coded as 0) and a high sedentary time group (≥ 630 total min/day; ≥ 487.5 total min/day; both coded as 1) for weekday and weekend, respectively.

Univariate and multivariate analysis of covariance (ANCOVA, MANCOVA) models were used to test for differences in HRQoL (i.e., PCS, MCS), and psychosocial health variables (self-esteem, depression, psychological growth) between walking (steps/day), self-reported weekly MVPA minutes, and weekday and weekend sitting time profiles. A correlation matrix was used to determine the degree to which the known independent variables were associated with the dependent variables (bivariate correlation = $p < .20$) and hence these were included as covariates in the multivariate models. Model 1 examined PCS and MCS (i.e., HRQoL) as the dependent variables. Covariates included age, sex, BMI, marital status, education, employment status, length of time on dialysis, times since kidney transplantation, kidney donor source, at least one comorbidity, and number of alcoholic beverages per week. Models 2, 3, and 4 examined psychosocial health variables as the dependent variables. For self-esteem, covariates included age, sex, MI, length of time on dialysis, dialysis therapy type, and physician prescription for physical activity. For depression, covariates included age, gender, BMI, length of time on dialysis, employment status, and kidney donor source. For psychological growth,

covariates included age, gender, BMI, marital status, kidney donor source, and at least one comorbidity. A significant MANCOVA was followed by univariate of analyses of variance (ANOVAs) for each specific HRQoL and psychosocial health outcome endpoint. Linear independent pairwise comparisons were analyzed (using Bonferroni corrections) to examine the magnitude of the differences in the mean scores of the dependent variable.

Chapter IV – Results

A total of 42 individuals contacted the study team to participate. After brief contact (via phone or email) with each potential participant to screen for inclusion criteria, 39 were deemed eligible. Potential participants who were excluded from this study had not yet received a kidney transplant (n = 1) and did not live in Canada (n = 2). A total of 32 participants returned a completed survey, for a response rate of 82% (32 out of 39). The sample contained 18 women (56.3%). The mean age of participants was 55 (SD = 9.7) years. The self-reported mean BMI was 26.4 (4.6) kg/m^2. Time since transplantation ranged from 0.32 to 360 months [(M = 75.7 84.6)]. For a detailed description of sample demographic and clinical characteristics see Table 1.

An overview of the descriptive statistics for physical activity (i.e., self-reported physical activity, objective steps), HRQoL, and psychosocial health outcomes (i.e., depression, self-esteem, psychological growth), and sitting time among kidney transplant recipients are displayed in Table 2. HRQoL mean scores (adjusted) across physical activity (self-report, daily steps) and sedentary time categories are displayed in Table 3, and the psychosocial health mean scores (adjusted) across physical activity (self-report, daily steps) and sedentary time categories are displayed in Table 4. The total average self-reported moderate-to-vigorous physical activity time per week was 246.6 (345.6), minutes or 4.1 hours per week. The total average steps per day was 9,751.8 steps (3685.1).

Table 2 indicates context-specific sitting time across both the weekday and weekend. The total average sitting time per day on a weekday was 693.1 minutes (SD = 256.6), or 11.6 hours per day. The total average sitting time per day on a weekend was

534.5 minutes (*SD* = 219.6), or 8.9 hours per day. For HRQoL, the RAND mean scores were as follows: PCS (*M* = 47, *SD* = 9.2) and mental component score (*M* = 50, *SD* = 9.9). These mean scores reflect a mild disability level.

The categories representing participants' activity levels are as follows: not meeting physical activity guidelines (< 150 minutes of moderate-to-vigorous physical activity per week) (*n* = 13); meeting physical activity guidelines (≥ 150 minutes of moderate-vigorous physical activity per week) (*n* = 19); not meeting recommended daily steps (< 10,000 steps per day) (*n* = 17); meeting recommended daily steps (≥ 10,000 steps per day) (*n* = 15); low sedentary time group on weekday (i.e., < 630 total min/day) (*n* = 14); high sedentary time group on weekday (i.e., ≥ 630 total min/day) (*n* = 18); low sedentary time group on weekend (i.e., < 487.5 total min/day) (*n* = 16); high sedentary time group on weekend (i.e., ≥ 487.5 total min/day) (*n* = 16).

Physical Activity, Sedentary Behaviour and Health Related Quality of Life

Pedometer steps

For HRQoL, the overall MANCOVA was significant when comparing those achieving at least 10,000 steps per day to those achieving less than 10,000 steps per day [Wilks' $\lambda = .735$, $F(2,20) = 3.597$, $p = .046$] (adjusted for BMI, sex, marital status, education, employment status, time since kidney transplantation, kidney transplant donor source, length of time of dialysis therapy, and at least one chronic disease). Univariate analysis was statistically significant for the physical component score of HRQoL ($p = .018$). Pairwise comparisons indicated that those who were achieving at least 10,000 steps per day had a significantly higher physical component score for HRQoL compared

to those who were not achieving 10,000 steps per day (M_{diff} = 7.8, p = .018). No significant differences were observed for the mental component score (p = .360).

For depressive symptoms, univariate analyses [F = 5.2, p = .031) indicated those achieving at least 10,000 steps per day reported significantly fewer depressive symptoms compared to those achieving less than 10,000 steps per day (M_{diff} = 3.7, p = .031) (controlled for age, BMI, sex, length of time of dialysis therapy, employment, and kidney transplant donor source).

Meeting Physical Activity Guidelines

For HRQoL, the overall MANCOVA was significant when comparing meeting and not meeting physical activity guidelines [Wilks' λ = .732, F(2,19) = 3.481, p = .05] (adjusted for BMI, sex, marital status, education, employment status, time since kidney transplantation in months, kidney transplant donor source, length of time of dialysis therapy, and at least one comorbidity). Univariate analysis was statistically significant for mental component score of HRQoL (p = .04). Pairwise comparisons indicated that those who were meeting physical activity guidelines (i.e., at least 150 minutes of moderate-to-vigorous physical activity per week) had a significantly higher mental component score for HRQoL compared to those who were not meeting physical activity guidelines (M_{diff} = 6.12, p = .040). There was no difference on physical component scores between those meeting physical activity guidelines and those who did not.

For depressive symptoms, univariate analyses [F = 7.9, p = .01) indicated those achieving physical activity guidelines reported significantly fewer depressive symptoms compared to those not achieving physical activity guidelines (M_{diff} = 4.1, p = .010)

(controlled for age, BMI, sex, length of time of dialysis therapy, employment, and kidney transplant donor source).

Sitting Time

For HRQoL, the overall MANCOVA was significant when comparing high and low weekend sitting times [Wilks' $\lambda = .713$, $F(2,18) = 3.620$, $p = .048$] (controlled for BMI, sex, marital status, education, employment, time since kidney transplantation, kidney transplant donor source, length of time of dialysis therapy, and at least one chronic condition). Univariate analysis was statistically significant for mental component score of HRQoL ($p = .037$). Pairwise comparisons indicated that those who had higher sitting times during the weekend had a poorer mental component score for HRQoL compared to those who had lower sitting times during the weekend ($Mdiff = 6.58$, $p = .037$). No differences in HRQoL between higher and lower sitting times on the weekday were found.

For depression, univariate analyses ($F = 6.206$, $p = .020$) indicated those with high sitting times on the weekend reported more depressive symptoms compared to those with low sitting times ($M_{diff} = 3.8$, $p < .020$) (controlled for age, BMI, sex, length of time of dialysis therapy, employment status, and kidney transplant donor source). Weekday sitting time was not associated with any HRQoL or psychosocial outcomes.

Psychological Growth and Self-Esteem

Pedometer steps, meeting physical activity guidelines, and weekday and weekend sitting were not significantly associated with psychological growth and self-esteem outcomes.

Chapter VI - Discussion

The primary objective of this thesis was to determine associations of HRQoL and psychosocial factors (i.e., self-esteem, depression, psychological growth) with objectively-assessed walking (i.e., pedometers), self-reported physical activity, and sedentary time among kidney transplant recipients. We hypothesized: a) participants who achieve at least 10,000 steps per day would report higher HRQoL and more optimal psychosocial health outcomes compared to participants engaging in <10,000 steps per day, b) participants who are achieving physical activity guidelines would report higher HRQoL and more optimal psychosocial health outcomes compared to participants not achieving guidelines, and c) participants who report high amounts of daily sitting time would report poorer HRQoL and less optimal psychosocial health outcomes compared to participants reporting lower amounts of sitting. We partially supported these hypotheses in that higher amounts of walking and self-reported physical activity, and less weekend sitting time were significantly associated with HRQoL and depressive symptoms. No associations with self-esteem and psychological growth were observed.

Overall, 47% of individuals were achieving 10,000 steps per day which is substantially higher than a previously published normative range suggesting special populations achieve between 3,500 to 5,500 steps per day (Tudor-Locke & Myers, 2001). The total average steps per day for participants in our study was 9,752 steps (SD = 3,685.1). Overall, our average step rate appears higher compared to the literature. This may be due to many physically active kidney transplant recipients being attracted to this type of research, as they may already be interested in exercise and regular walking habits. Most recently, a sample of 23 kidney transplant recipients in Brazil were reported to be

taking on average 9,705 (4,902) steps per day (Carvalho, Reboredo, Gomes, Teixeira, Roberti, & Mendes, 2014). This study found a significant difference in daily steps between kidney transplant recipients and kidney disease patients treated with hemodialysis *(p* = .005). Hemodialysis patients reported taking 5,678 (2,178) daily steps, significantly less daily steps than their kidney transplant counterparts. Additionally, average step count per day in a cohort of 20 children with a kidney transplant was 9,282 (4,666) (Hamiwka, Cantell, Crawford, & Clark, 2009).

The literature suggests kidney transplant recipients may be taking more daily steps relative to other chronic disease populations, including hemodialysis patients who are most similar in terms of disease state. Despite these preliminary findings and the relatively small sample size, the range of daily steps in our study suggests there is great variability in walking behaviour among kidney disease patients (minimum average daily steps per day = 2,484; maximum = 18,344). However, all of these studies included small sample sizes with significant sample heterogeneity (e.g., time since transplant). Larger, population-based, and homogeneous samples of kidney transplant recipients may yield more precise and accurate conclusions regarding walking prevalence in this population.

We confirmed our hypothesis that kidney transplant recipients achieving at least 10,000 steps per day would report better HRQoL and psychosocial health compared to those recipients not achieving 10,000 steps per day. To our knowledge, no studies have isolated walking from other modes of physical activity to explore associations between walking and HRQoL and psychosocial health outcomes among adult kidney transplant recipients. Data supporting an association between daily steps and HRQoL and psychosocial health is emerging. Among pediatric kidney transplant recipients, a

significant positive relationship between HRQoL and physical activity level as measured by total number of steps per day has been suggested (Hamiwka, Cantell, Crawford, & Clark, 2009). However, the extent to which physical activity alone contributes to overall HRQoL is unclear as lower HRQoL in kidney transplant recipients was more directly related to medical condition. Our study reported an association of walking with depressive symptoms and the physical component score of HRQoL. Comparably, other studies reporting total volume walked among kidney transplant recipients reported a relationship between daily steps and physical performance and functioning however these studies did not include assessment of emotional wellbeing or psychosocial health (Akber, Portale, & Johansen, 2012; Carvalho, Reboredo, Gomes, Teixeira, Roberti, & Mendes, 2014). Among other organ transplant groups, in particular liver transplant recipients, objectively-assessed physical activity has been linked to several indices of physical and emotional wellbeing including the physical and mental domains of HRQoL (van den Berg-Emons, Kazemier, van Ginneken, Nieuwenhuijsen, Tilanus, & Stam, 2006). Physical activity among kidney disease patients treated with other types of renal replacement therapy (e.g., hemodialysis) is known to have positive effects on psychosocial health and physical functioning (Kaltsatou et al., 2015; Kaysen et al., 2011; Mitrou et al., 2013) however few studies have isolated walking behaviour from other modes of physical activity to explore associations between walking and HRQoL. Our data coincides with the above-mentioned research and provides further support for the role of walking and overall physical activity in fostering physical functioning and psychosocial health. Our data extend this literature base by examining (specifically)

walking behaviour of adult kidney transplant recipients and linking this behavior to patient-reported health outcomes such as HRQoL and depressive symptoms.

A secondary objective of this study was to examine the association of HRQoL and psychosocial health outcomes with meeting public health physical activity guidelines. Our data indicated that specific categories representing participants' activity levels were associated with HRQoL and psychosocial health. In particular, participants who achieved public health physical activity guidelines (≥150 min/week of moderate-to-vigorous physical activity) reported significantly better HRQoL and significantly fewer depressive symptoms compared to those not achieving these guidelines. Our data are similar to other studies (Lopes, Lantz, Morgenstern, Wang, Bieber, & Gillespie, 2014; Martins, Ramos, Guaraldo, Uezima, Martins, & Junior, 2011) in that kidney disease patients (e.g., hemodialysis patients) who failed to meet public health physical activity guidelines or did not exercise regularly, had greater depressive symptoms and psychological problems. Using self-report methods of aerobic activity, Lopes and colleagues reported physical activity to be positively associated with HRQoL and inversely related to depressive symptoms and mortality in a sample of 5,763 patients undergoing maintenance hemodialysis from 12 different countries. Comparably, Martins and company observed better cognitive function among active hemodialysis patients in comparison to inactive patients ($p < 0.05$). Among kidney transplant recipients, the psychosocial effects of physical activity have also been reported. The literature suggests that an appropriate dosing of physical training may be a useful, safe and non-pharmacologic contribution to kidney transplant treatment. In one study (Romano, Simonella, Falleti, Bortolotti, Deiuri, & Antonutto, et al., 2010), eight kidney transplant

recipients were evaluated before and after exercise training consisting of thirty 40-minute sessions, three times a week, performed with the interval training technique and showed significantly decreased anxiety and depressive symptoms and significantly increased HRQoL mean scores.

Sedentary behaviour has deleterious health consequences that are distinct from the beneficial effects of physical activity (Owen, Sparling, Healy, & Matthews, 2010). However few studies have isolated sedentary time behaviour from physical activity to explore associations between sitting time and HRQoL and psychosocial health among kidney transplant recipients. We confirmed our hypothesis that those who report high amounts of daily sitting time would report poorer HRQoL and more optimal psychosocial health outcomes compared to participants reporting lower amounts of sitting. On average, participants spent 613.8 (*SD* = 203) minutes or 10.2 (*SD* = 3.4) hours in sedentary behaviour per day. Although on average participants reported a higher sitting time during a typical weekday rather than weekend day (693.1; *SD* = 256.6 vs. 534.5; *SD* = 219.6). This could be explained by other factors like increased socialization during the week and higher productivity in terms of work. One study, investigating sitting time among hemodialysis patients reported a median of 5 (3-8) hours of sitting per day (Johansen, Painter, Delgado, & Doyle, 2015). The authors of this study used a new physical activity questionnaire designed to capture activity in the lower end of the range, the Low Physical Activity Questionnaire (LoPAQ) to determine average time spent in sitting activities over one week. Time spent sitting among our sample of kidney transplant recipients seems much higher in comparison probably due to a more detailed

account of sitting time in various domains as collected by the SIT-Q which was used in our study.

We reported those who had higher sitting times during the weekend had a poorer mental component score for HRQoL compared to those who had lower sitting times during the weekend (M_{diff} = 6.6, p = .037). For depression, analyses indicated those with high sitting times on the weekend reported more depressive symptoms compared to those with low sitting times (M_{diff} = 3.8, p < .02). However, weekday sitting time was not associated with any HRQoL or psychosocial outcomes. High sedentary behaviour (i.e., sitting time) and physical inactivity (i.e., low levels of physical activity) have been observed among kidney disease patients, particularly hemodialysis patients (Anderton et al., 2015; Avesani et al., 2012). To date, only a few studies have explored sitting time among kidney disease patients, however limited data exists on the links with mental functioning and psychosocial health (Carvalho et al., 2014; Johansen, Painter, Delgado, & Doyle, 2015). Despite this, the literature does indicate kidney disease patients who failed to meet public health physical activity guidelines or did not exercise regularly, and had higher television viewing times had greater depressive symptoms (Mafra & Fouque, 2014; Sakraida & Weber, 2015). Our data coincides with the above-mentioned research and provides further support for the role of sedentary behaviour in compromising mental functioning and psychosocial health. Our data extend this literature base by examining sedentary behaviour of kidney transplant recipients.

Implications for Practice

HRQoL is becoming an increasingly important outcome indicator for kidney disease patients as it reflects their perception of their physical, mental, and social

wellbeing. For kidney transplant recipients in Canada, these outcomes can inform programming and clinical practice to address areas of HRQoL most affected by kidney disease, and its associated medical intervention and psychosocial effects.

In assessing HRQoL, the importance of listening to individual patient reports cannot be overstated as the impact that the change in therapy may have on patients' lives may not be captured by standardized HRQoL instruments. Additionally, the literature indicates discrepancies between kidney disease patients and their health care providers' assessment of problems and difficulties (Weisbord, Fried, Mor, Resnick, Unruh, & Palevsky, et al., 2007). Enhancing communication by viewing the patient as an expert in their own care is one method of addressing this issue. Additionally, appropriate objective assessments are also needed to evaluate the impact of disease on HRQoL and formulate clinical intervention strategies. Examples include, physiologic (e.g., oxygen uptake), clinical (e.g., inflammatory markers), psychological (e.g., depression), and functional (e.g., 6 minute walking test) measures.

The nephrology team is not only faced with the challenges of collecting pertinent information related to patients' perception of their wellbeing, the team must also incorporate their findings into the development of effective strategies to improve the compromised HRQoL. A comprehensive and systematic approach to addressing the compromised HRQoL is needed. Preliminary studies have shown that counseling, cognitive behavioural therapy, exercise therapy, treatment of anemia, depression, sleep disturbance, and changes in medical regimen have all resulted in improved HRQoL assessments. Supporting the caregiver of kidney patients may also improve outcomes for both the patient and caregiver (Tong, Sainsbury, & Craig, 2008). Evidently, the focus

needs to be on developing strategies to improve the compromised HRQoL of the patient with kidney disease. Encouraging patients to increase their level of physical activity and decrease periods of sedentary time are some examples of interventions that may increase survival and address the compromised HRQoL and psychosocial health among kidney transplant recipients (Beddhu, Wei, Marcus, Chonchol, & Greene, 2015).

Evidence from uncontrolled studies and from small randomized controlled trials shows that exercise training and structured exercise programs results in improved physical performance and functioning and HRQoL among patients with kidney disease (Ouzouni, Kouidi, Sioulis, Grekas, & Deligiannis, 2009; Painter, Moore, Carlson, Paul, Myll, & Phillips, 2002). Different modes of physical activity may be proposed to kidney patients, including aerobic exercise training, resistance training, and combined resistance and aerobic exercise (Howden, Fassett, Isbel, & Coombes, 2012; Johansen, 2007). The literature reveals kidney patients can positively respond physiologically to exercise training in a way similar to other patient populations. Engaging in physical activity post-transplant would be beneficial in counteracting the many factors which may contribute to deconditioning in this population including the side effects of immunosuppressive drugs (e.g., hypertension, hyperlipidemia, diabetes, muscle weakness, reduced bone density, weight gain). Resistance training may also benefit patients however very few studies have focused on resistance exercise training or included resistance training as part of a program (Rhee & Kalantar-Zadeh, 2014). Despite these findings, physical inactivity is not systematically addressed by nephrology teams and practical recommendations are few (Koufaki, Greenwood, Painter, & Mercer, 2015). One way to improve this is by making physical activity more of a priority in the clinical setting (e.g., staff education).

Based on our research outcomes, kidney transplant recipients should incorporate a walking program as part of an overall physical activity plan within an active (low sedentary) lifestyle. For chronic disease populations, it is recommended individuals be as physically active as their abilities and conditions allow (World Health Organization, 2010). The Kidney Disease Global outcomes guidelines (2012) recommend at least 30 minutes of moderate-intensity physical activity five times per week for kidney disease patients. Kidney transplant recipients are recommended to begin a walking program immediately following transplantation consisting of 30 minutes of daily walking. The majority of renal clinics across Canada promote these guidelines, and there are very few opportunities for kidney transplant recipients to access supervision and facilities to start engaging in these health behaviours. For this reason, walking is ideal. Renal clinics need to make a conscious effort to promote and provide these types of opportunities.

Proper medical screening before exercise participation is needed to assess for risks and provide proper recommendations for starting and progressing with a physical activity program. Furthermore, regular assessment of participation and responses to programs are lacking. Programs and physical activity recommendations must aim to safely induce favourable physiological adaptations while assessing for barriers to physical activity. Programs may need to be tailored to the unique needs of the individual and also must be designed to encourage compliance and be cost-effective.

Strengths and Limitations

This study has several strengths including being the first to examine associations between pedometer derived daily steps and HRQoL and psychosocial health outcomes within a sample of adults with a kidney transplant in Canada. It extends on previous

research by using objective assessments as opposed to self-report (Akber, Portale, and Johansen, 2012; Carvalho, Reboredo, Gomes, Teixeira, Roberti, & Mendes, 2014; Zamojska, Szklarek, Niewodniczy, and Nowicki, 2006). This study provided both objective and subjective measures of physical activity behaviour as well as subjective reports of HRQoL and psychosocial health. Combining subjective HRQoL assessment and objective clinical indicators has become a standard of practice for assessing the effects of illness on physical and psychosocial aspects of HRQoL and for evaluating the effectiveness and appropriateness of medical intervention (Enthoven, 2000). Altogether, subjective perceptions of health translate objective clinical indicators into the HRQoL experience (Testa & Simonson, 1996).

To our knowledge, this study is the first to examine associations between sedentary time estimates and HRQoL and psychosocial health outcomes within a sample of kidney transplant recipients. It extends on previous research (Johansen, Painter, Delgado, & Doyle, 2015) by using a comprehensive self-report measure to assess adult sedentary behaviour across multiple domains (occupation, transportation, household and leisure-time) (Lynch, Friedenreich, Khandwala, Liu, Nicholas, & Csizmadi). In the general literature, sedentary time is the least well measured dimension compared to other domains of physical activity (Bauman, Phongsavan, Schoeppe, & Owen, 2006). Measuring time spent in sedentary pursuits independently of other domains of physical activity, particularly the amount of time individuals sit at work and watch television extends the literature on the role of sedentary behaviour as an independent indicator which may be related to chronic disease, obesity, and decreased HRQoL. Measuring physical activity in this population is important for many reasons as it can inform health

promotion efforts in monitoring and understanding why some people are more active than others.

The primary limitations to this study are the small sample size, self-report measure of sedentary behaviour, and cross-sectional and correlational nature of the study. We recognize the cross-sectional design does not permit causative interpretation. The overall descriptive statistics for the HRQoL, self-esteem, depressive symptoms, and psychological growth variables suggest that our sample of kidney transplant recipients was generally very healthy. As a result, our study recruitment methods may have led to a response bias whereby generally healthy and interested in the study topic participated. Caution should be exercised in judging the representativeness of our sample to the larger population of kidney transplant recipients 18 years of age and older. Recall bias from the SIT-Q is also a potential limitation, even though the sedentary time was quite high. As well, the limitations of a short time period of wearing the pedometers and the fact it may have motivated participants to take more steps than usual for those days despite 3 days being the standard wear time. Finally, the causal order of physical activity, HRQoL, and psychosocial health cannot be determined from the cross-sectional data.

Despite offering a more direct, objective and physiological measure of physical activity (i.e., total volume walked), pedometers are the simplest form of objective instrument for capturing physical activity and do not assess intensity or pace and may not capture other types of physical activity like swimming and biking. More complex devices such as accelerometers can record the duration, frequency, and intensity of movement. It should also be noted that our physical activity prevalence estimate may be somewhat higher than the actual population prevalence rate as our study may have attracted a large

number of kidney transplant recipients interested in and likely to engage in physical activity to take part in this study.

Despite efforts to recruit a larger number of participants we were unable to achieve our target sample size of 100 participants. There were limitations to participant recruitment (e.g., difficulties recruiting directly from transplant clinics). Similar studies among organ transplant recipients have sample sizes ranging between eight and 25 participants (Akber, Portale, & Johansen, 2012; Carvalho, Reboredo, Gomes, Teixeira, Roberti, & Mendes, 2014; Langer, Gosselink, Pitta, Burtin, Verleden, & Dupont, 2009; van den Berg-Emons, Kazemier, van Ginneken, Nieuwenhuijsen, Tilanus, & Stam, 2006). More effective strategies for involving kidney transplant recipients in these types of physical activity studies need to be devised, tested, and implemented.

Future Directions

There is a growing body of research addressing walking as an effective strategy in assisting kidney disease patients with maintaining physical function, higher HRQoL, and preventing comorbid conditions associated with kidney disease. However, there are still knowledge gaps to be addressed. For example, a walking behaviour prevalence rate still needs to be established for kidney disease patients in Canada and specifically, for kidney transplant recipients, delineated from overall physical activity rates.

Clinical experts, nephrology teams and researchers can consult this study as a reference to contribute their knowledge base and guide development of programs. However, there are many other research studies that can still contribute to this knowledge base. Strategies need to be further explored for assisting kidney patients to reduce high sedentary lifestyles and to increase physically active lifestyles and daily steps. Our

research appeared to capture Canadian kidney transplant recipients who were keen about physical activity and walking, but missed many Canadians who are not physically active. Research needs to explore the reasons for this lack of engagement and explore how barriers can be removed so more Canadians can lead active lifestyles. This future research must also look at various sub-groups such as cultural groups and clinical groups to better understand any unique beliefs and barriers which impact a kidney recipients' level of activity.

Most physical activity studies in the kidney disease population have focused on dialysis patients while very few have focused on kidney transplant recipients. There is a need to explore kidney disease related dysfunction independent of age and comorbidity and physical inactivity. There has been virtually no exploration of the potential causes or mechanisms of poor physical functioning in kidney patients. Uremic toxins, vitamin D deficiency, chronic inflammation, hyperparathyroidism, metabolic acidosis, and anemia are among some of the possibilities that could be contributing to muscle wasting and altered neuromuscular function in hemodialysis patients although it is unknown whether this process is reversed in receipt of a new kidney. In particular, understanding the participants' functional limitations may serve to help researchers in further understanding the relationship between physical activity behaviour, quality of life, and psychosocial health.

Physical activity of kidney disease patients is not routinely recommended or assessed and effectiveness of these strategies are unknown. Improving monitoring of physical activity among kidney disease patients is needed. Further investigations to establish the frequency, intensity, duration and type of effective walking interventions

would be beneficial for providing further recommendations to health professionals. Longitudinal studies are needed to confirm the effect of physical activity on kidney patients (Greenwood, Koufaki, Mercer, MacLaughlin, Rush, & Lindup, et al., 2015). Strategies to enhance physical activity in these patients should be explored. Finally, given the less than optimal physical activity prevalence estimates provided in the literature, it is critical to develop, test, and implement population-based strategies that can potentially contribute to an increase in physical activity in this unique, diverse, and understudied population (Aucella, Valente, & Catizone, 2014).

The compromised HRQoL of kidney patients is well documented. This study has demonstrated an association between walking behaviour and self-reported physical activity with physical functioning and psychosocial health. Additionally, sedentary behaviour was associated with mental functioning and psychosocial health. Future research should seek to establish recommendations for the frequency, intensity, duration and type of effective walking interventions that would be beneficial for kidney disease patients, including kidney transplant recipients. Kidney transplant recipients should engage in regular physical activity and walking, and those working with kidney transplant recipients should also recommend they limit their time spent in sedentary pursuits.

References

Aakhus, S., Dahl, K., & Wideroe, T. (2004). Cardiovascular disease in stable renal transplant patients in Norway: Morbidity and mortality during a 5-yr follow-up. *Clinical Transplantation 18,* 596–604.

Akber, A., Portale, A., & Johansen, K. (2012). Pedometer-assessed physical activity in children and young adults with CKD. *Clinical Journal of the American Society of Nephrology, 7*(5), 720-726.

Akman, B., Özdemir, F., Sezer, S., Miçozkadioğlu, H., & Haberal, M. (2004). Depression levels before and after renal transplantation. *Transplantation proceedings 36*(1), 111-113.

American College of Sports Medicine (ACSM). (2009). American College of Sports Medicine position stand: Progression models in resistance training for healthy adults. *Medicine and Science in Sports and Exercise, 41*(3), 687–708.

Anderton, N., Giri, A., Wei, G., Marcus, R., Chen, X., Bjordahl, T., et al. (2015). Sedentary behaviour in individuals with diabetic chronic kidney disease and maintenance hemodialysis. *Journal of Renal Nutrition, 25*(4), 364-370.

Asakawa, K., Senthilselvan, A., Feeny, D., Johnson, J., & Rolfson, D. (2011). Trajectories of health-related quality of life differ by age among adults: Results from an eight-year longitudinal study. *Journal of Health Economics, 31*(1), 207-218.

Aucella, F., Valente, G., & Catizone, L. (2014). The Role of physical activity in the CKD setting. *Kidney & Blood Pressure Research, 39,* 97-106.

Avesani, M., Trolonge, S., Deléaval, P., Baria, F., Mafra, D., & Faxen-Irving, G. (2012).

Physical activity and energy expenditure in haemodialysis patients: an international survey. *Nephrology Dialysis Transplantation, 27*, 2430–2434.

Bauman, A., Phongsavan, P., Schoeppe, S., & Owen, N. (2006). Physical activity measurement--a primer for health promotion. *Promotion & Education, 13*(2), 92-103.

Barsoum, R. (2006). Chronic kidney disease in the developing world. *New England Journal of Medicine, 354*(10), 997-999.

Beddhu, S., Baird, B., Zitterkoph, J., Neilson, J., & Greene, T. (2009). Physical activity and mortality in chronic kidney disease (NHANES III). Clinical Journal of the American Society of Nephrology 4, 1901–1906.

Beddhu, S., Wei, G., Chonchol, M., & Greene, T. (2015). Light-intensity physical activities and mortality in the United States general population and CKD subpopulation. *Clinical Journal of the American Society of Nephrology, 10*(7), 1145-1153.

Bharakhada, N., Yates, T., Davies, M., Wilmot, E., Edwardson, C., & Henson, J. et al. (2012). Association of sitting time and physical activity with CKD: a cross-sectional study in family practices. *American Journal of Kidney Diseases, 60*(4), 583-590.

Boots, J., Christiaans, M., & van Hooff, J. (2004). Effect of immunosuppressive agents on long-term survival of renal transplant recipients: a focus on the cardiovascular risk. *Drugs, 64*(18), 2047-2073.

Canadian Institute for Health Information. (2015). Canadian organ replacement register

annual report: Treatment of end-stage organ failure in Canada, 2004 to 2013. Ottawa, On.

Carvalho, E., Reboredo, M., Gomes, E., Teixeira, D., Roberti, N., & Mendes, J. (2014). Physical activity in daily life assessed by an accelerometer in kidney transplant recipients and hemodialysis patients. *Transplant Proceedings, 46*(6), 1713-1717.

Caspersen, C., Powell, K., & Christenson, G. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports, 100*(2), 126–131.

Chilcot, J., Spencer, B., Maple, H., & Mamode, N. (2014). Depression and kidney transplantation. *Transplantation, 97*(7), 717-721.

Clarke, A., Young, H., Hull, K., Hudson, N., Burton, J., & Smith, A. (2015). Motivations and barriers to exercise in chronic kidney disease: a qualitative study. *Nephrology Dialysis Transplantation, 0,* 1-8.

Cleemput, I., & Dobbels, F. (2000). Measuring patient-reported outcomes in solid organ transplant recipients an overview of instruments developed to date. *Pharmacoeconomics, 25*(4), 269-286.

Cohen G. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum; 1988.

Colley, R., Barnes, J., Leblanc, A., Borghese, M., Boyer, C., & Tremblay, M. (2013). Validity of the SC-StepMX pedometer during treadmill walking and running. *Applied Physiology, Nutrition, and Metabolism, 38*(5), 520-524.

Curtin, R., Mapes, D., Schatell, D., & Burrows-Hudson, S. (2005). Self-management in patients with end stage renal disease: exploring domains and dimensions.

Nephrology Nursing Journal, 32(4), 389-395.

De Geest, S. & Moons, P. (2000). The patient's appraisal of side-effects: the blind spot in quality-of-life assessments in transplant recipients. *Nephrology Dialysis Transplantation, 15*, 457-459.

DeOreo, P. (1997). Hemodialysis patient-assessed functional health status predicts continued survival, hospitalization, and dialysis-attendance compliance. *American Journal of Kidney Diseases, 30*(2), 204–212.

Devins, G., Beanlands, H., Mandin, H., & Paul, L. (1997). Psychosocial impact of illness intrusiveness moderated by self-concept and age in end-stage renal disease. *Health Psychology, 16(*6), 529-538.

Dew, M., Roth, L., Schulberg, H., Simmons, R., Kormos, R., & Trzepacz, P. (1996). Prevalence and predictors of depression and anxiety-related disorders during the year after heart transplantation. *General Hospital Psychiatry, 18*(6 Suppl):48S-61S.

Dew, M., Switzer, G., Goycoolea, J., Allen, A., DiMartini, A., & Kormos, R., et al. (1997). Does transplantation produce quality of life benefits? A quantitative analysis of the literature. *Transplantation., 64*(9), 1261-1273.

Dimeo, F., Wencke, M., Krist, L.,Westhoff, T., & Rothermund, L. (2007). Effects of a stamina training programme over 8 weeks in patients after kidney transplantation. *Deutsche Zeitschrift fur Sportmedizin, 58*(7/8), 204.

Dobbels, F., Moons, P., Abraham, I., Larsen, C., Dupont, L., & De Geest, S. (2008).

Measuring symptom experience of side-effects of immunosuppressive drugs: the Modified Transplant Symptom Occurrence and Distress Scale. *Transplant International, 21*(8), 764-773.

Drayer, R., Piraino, B., Reynolds, C., Houck, P., Mazumdar, S., & Bernardini, J., et al. (2006). Characteristics of depression in hemodialysis patients: symptoms, quality of life and mortality risk. *General Hospital Psychiatry, 28(*4), 306-312.

Dungey, M., Hull, K., Smith, A., Burton, J., & Bishop, N. (2013). Inflammatory factors and exercise in chronic kidney disease. *International Journal of Endocrinology, 2013*, 1-12.

Dunstan, D., Howard, B., Healy, G., & Owen, N. (2012). Too much sitting--a health hazard. *Diabetes Research and Clinical Practice, 97*(3), 368-376.

Enthoven, A. (2000). In pursuit of an improving National Health Service. *Health Affairs, 19*(3), 102-119.

Eyler, A., Brownson, R., Bacak, S., & Housemann, R. (2003). The epidemiology of walking for physical activity in the United States. *Medicine Science in Sports and Exercise, 35*(9), 1529–1536.

Finkelstein, F., Wuerth, D., & Finkelstein, S. (2009). Health related quality of life and the CKD patient: challenges for the nephrology community. *Kidney International, 76*, 946-952.

Fructuoso, M., Castro, R., Oliveira, I., Prata, C., & Morgado, T. (2011). Quality of life in chronic kidney disease. *Nefrologia, 31*(1), 91-96.

Fujisawa, M., Ichikawa, Y., Yoshiya, K., Isotani, S., Higuchi, A., & Nagano, S. (2000).

Assessment of health-related quality of life in renal transplant and hemodialysis patients using the SF-36 health survey. *Urology, 56,* 201-206.

Fukuhara, S., Yamazaki, S., Hayashino, Y., & Green, J. (2007). Measuring health-related quality of life in patients with end-stage renal disease: why and how. *Nature Reviews Nephrology 3,* 352–353.

Gentile, S., Beauger, D., Speyer, E., Jouve, E., Dussol, B., & Jacquelinet, C., et al. (2013). Factors associated with health-related quality of life in renal transplant recipients: results of a national survey in France. *Health and Quality of Life Outcomes, 11*(88), 1-12.

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

Greenwood, S., Koufaki, P., Mercer, T., MacLaughlin, H., Rush, R., Lindup, H., et al. (2015). Effect of exercise training on estimated GFR, vascular health, and cardiorespiratory fitness in patients with CKD: a pilot randomized controlled trial. *American Journal of Kidney Diseases, 65*(3), 425-434.

Griva, K., Stygall, J., Ng, J., Davenport, A., Harrison, M., & Newman, S. (2011). Prospective changes in health-related quality of life and emotional outcomes in kidney transplantation over 6 years. *Journal of Transplantation,* 671571, 1-12.

Gullion, M., Keith, D., Nichols, G., & Smith D. (2006). Impact of comorbidities on mortality in managed care patients with CKD. *American Journal of Kidney Diseases, 48*(2), 212-220.

Hamiwka, L., Cantell, M., Crawford, S., & Clark, C. (2009). Physical activity and health related quality of life in children following kidney transplantation. *Pediatric*

Transplantation, 13(7), 861-867.

Hathaway, D., Winsett, R., Johnson, C., Tolley, E., Hartwig, M., & Milstead, J. et al. (1998). Post kidney transplant quality of life prediction models. *Clinical Transplantation, 12*(3), 168–174.

Hawkins, M., Sevick, M., Richardson, C., Fried, L., Arena, V., & Kriska, A. (2011). Association between physical activity and kidney function: National Health and Nutrition Examination Survey. *Medicine and Science in Sports and Exercise, 43*(8), 1457-1464.

Hedayati, S., Bosworth, H., Briley, L., Sloane, R., Pieper, C., & Kimmel, P., et al. (2008). Death or hospitalization of patients on chronic hemodialysis is associated with a physician-based diagnosis of depression. *Kidney International, 74*(7), 930-936.

Heiwe, S. & Jacobson, S. (2011). Exercise training for adults with chronic kidney disease. *Cochrane Database of Systematic Reviews, 10*, CD003236.

Herzog, C., Asinger, R., Berger, A., Charytan, D., Díez, J., & Hart, J., et al. (2011). A Clinical Update From Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney International, 80*(6), 572-586.

Howden, E., Fassett, R., Isbel, N., & Coombes, J. (2012). Exercise training in chronic kidney disease patients. *Sports Medicine, 42*(6), 473-488.

Jacobs, D., Ainsworth, B., Hartman, T., & Leon, A. (1993). A simultaneous evaluation of Ten commonly used physical activity questionnaires. *Medical and Science in Sports and Exercise, 25*(1), 81–91.

Janssen, D., Spruit, M., Wouters, E., & Schols, J. (2008). Daily symptom burden in end-

stage chronic organ failure: a systematic review. *Palliative Medicine, 22*(8), 938-948.

Johansen, K. (2007). Exercise in the end-stage renal disease population. *Journal of the Amercian Society of Nephrology, 18*(6), 1845-1854.

Johansen, K., Chertow, G., Ng, A., Mulligan, K., Carey S, & Schoenfeld, P. et al. (2000). Physical activity levels in patients on hemodialysis and healthy sedentary controls. *Kidney International, 57*(6), 2564-2570.

Johansen, K., Chertow, G., Kutner, N., Dalrymple, L., Grimes, B., & Kaysen, G. (2010). Low level of self-reported physical activity in ambulatory patients new to dialysis. *Kidney International, 78*(11), 1164-1170.

Johansen, K., Painter, P., Delgado, C., & Doyle, J. (2015). Characterization of physical activity and sitting time among patients on hemodialysis using a new physical activity instrument. *Journal of Renal Nutrition, 25*(1), 25-30.

Kaltsatou, A., Grigoriou, S., Karatzaferi, C., Giannaki, C., Stefanidis, I., & Sakkas, G. (2015). Cognitive function and exercise training for chronic renal disease patients: a literature review. *Journal of Bodywork & Movement Therapies, 19*, 509-515.

Karaminia, R., Tavallaii, S., Lorgard-Dezfuli-Nejad, M., Lankarani, M., Mirzaie, H., Einollahi, B., & Firoozan, A. (2007). Anxiety and depression: A comparison between renal transplant recipients and hemodialysis patients. *Transplantation proceedings, 39*(4), 1082-1084.

Kaysen, G., Larive, B., Painter, P., Craig, A., Lindsay, R., & Rocco, M., et al. (2011). Baseline] physical performance, health, and functioning of participants in the

Frequent Hemodialysis Network (FHN) trial. *American Journal of Kidney Diseases, 57*(1), 101-112.

Kempeneers, G., Noakes, T., van Zyl-Smit, R., Myburgh, K., Lambert, M., & Adams, B., et al. (1990). Skeletal muscle limits the exercise tolerance of renal transplant recipients: effects of a graded exercise training program. *American Journal of Kidney Diseases, 16*(1), 57-65.

Kidney Disease Improving Global Outcomes (2012). Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Retrieved from http://kdigo.org/clinical_practice_guidelines/pdf/CKD/KDIGO_2012_CKD_GL.pdf on 30 July, 2014.

Kopp, M., Steinlechner, M., Ruedl, G., & Ledochowski, L., et al. (2012). Acute effects of brisk walking on affect and psychological well-being in individuals with type 2 diabetes. *Diabetes Research and Clinical Practice, 95*(1), 25–29.

Kosmadakis, G., Bevington, A., Smith, A., Clapp, E., Viana, J., & Bishop, N. et al. (2010). Physical exercise in patients with severe kidney disease. *Nephron Clinical Practice, 115*, c7-c16.

Koufaki, P., Greenwood, S., Painter, P., & Mercer, T. (2015). The BASES expert statement on exercise therapy for people with chronic kidney disease. *Journal of Sports Sciences, 33*(18), 1902-1907.

Koufaki, P., & Mercer, T. (2009) Assessment and monitoring of physical function for people with CKD. *Advances in Chronic Kidney Disease, 16*(6), 410-419.

Kouidi, E., Grekas, D., Dombros, N., Deligiannis, A., & Tourkantonis, A. (2002).

Exercise training after renal transplantation: cardiac autonomic effects [abstract M474]. ERA-EDTA Congress.

Kroenke K, Spitzer RL, Williams JB. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606-613.

Kurella M1, Kimmel PL, Young BS, Chertow GM. Suicide in the United States end-stage renal disease program. *Journal of the American Society of Nephrology, 16*(3), 774-781.

Langer, D., Gosselink, R., Pitta, F., Burtin, C., Verleden, G., & Dupont, L. (2009). Physical activity in daily life 1 year after lung transplantation. *Journal of Heart and Lung Transplantion, 28*(6), 572-578.

Lee, I., &. Skerrett, P. (2001). Physical activity and all-cause mortality: what is the dose-response relation? Medicine and Science in Sports and Exercise, 33, S459–S471.

Linnell, K. (2005). Chronic disease self-management: one successful program. *Nursing Economics, 23*(4), 189-191, 196-198.

Lopes, A., Lantz, B., Morgenstern, H., Wang, M., Bieber, B., & Gillespie, B. (2014). Associations of self-reported physical activity types and levels with quality of life, depression symptoms, and mortality in hemodialysis patients: the DOPPS. *Clinical Journal of the American Society of Nephrology, 9*(10), 1702-1712.

Lorig, K., Ritter, P., Stewart, A., Sobel, D., Brown, B., & Bandura, A., et al. (2001). Chronic disease self-management program: 2-year health status and health care utilization outcomes. *Medical Care, 39*(11), 1217-1223.

Lynch, B., Friedenreich, C., Khandwala, F., Liu, A., Nicholas, J., & Csizmadi, I. (2014).

Development and testing of a past year measure of sedentary behavior: the SIT-Q. *BMC Public Health, 14*, 899.

Maddigan, S., Feeny, D., & Johnson, J. (2004). Construct validity of the RAND-12 and Health Utilities Index Mark 2 and 3 in type 2 diabetes. *Quality of Life Research, 13*(2), 435-448.

Mafra, D., Deleaval, P., Teta, D., Cleaud, C., Arkouche, W., & Jolivot, A., et al. (2011). Influence of inflammation on total energy expenditure in hemodialysis patients. *Journal of Renal Nutrition, 21*(5), 387-393.

Mafra, D. & Fouque, D. (2014). Lower physical activity and depression are associated with hospitalization and shorter survival in CKD. Clinical Journal of the American Society of Nephrology, 9(10), 1669-1670.

Marshall, S., Levy, S., Tudor-Locke, C., Kolkhorst, F., Wooten, K., & Ji, M., et al. (2009). Translating physical activity recommendations into a pedometer-based step goal: 3000 steps in 30 minutes. American Journal of Preventive Medicine. 36(5), 410-415.

Marshall, A., Miller, Y., Burton, N., & Brown, W. (2010). Measuring total and domain-specific sitting: a study of reliability and validity. *Medicine and Science in Sports and Exercise, 42*(6), 1094-102.

Martins, C., Ramos, G., Guaraldo, S., Uezima, C., Martins, J., & Junior, E. (2011). Comparison of cognitive function between patients on chronic hemodialysis who carry out assisted physical activity and inactive ones. *The Jornal Brasileiro de Nefrologia, 33*(1), 14-16.

Matas, A., Kandaswamy, R., Gillingham, K., McHugh, L., Ibrahim, H., & Kasiske, B.

(2005). Prednisone-free maintenance immunosuppression- a 5 year experience. *American Journal of Transplantation, 5*, 2473-2478.

Miller, D., Squires, R., Gau, G., Ilstrup, D., Frohnert, P., & Sterioff, S. (1987). Graded exercise testing and training after renal transplantation: a preliminary study. *Mayo Clin Proc, 62*(9), 773-777.

Mitrou, G., Grigoriou, S., Konstantopoulou, E., Theofilou, P., Giannaki, C., & Stefanidis, I., et al. (2013). Exercise Training and Depression in ESRD: A Review. Seminars in Dialysis, 26(5), 604–613.

Moreau, K., Degarmo, R., Langley, J., McMahon, C., Howley, E., & Bassett, D., et al. (2001). Increasing daily walking lowers blood pressure in postmenopausal women. *Medicine and Science in Sports and Exercise, 33*(11), 1825-1831.

Murtagh, E., Murphy, M., & Boone-Heinonen, J. (2010). Walking – the first steps in cardiovascular disease prevention. *Current Opinion in Cardiology, 25*(5), 490-496.

Naqvi, S. & Collins, A. (2006). Infectious complications in chronic kidney disease. *Advances in Chronic Kidney Disease, 13*(3), 199-204.

Nielens, H., Lejeune, T., Lalaoui, A., Squifflet, J., Pirson, Y., & Goffin, E. (2001). Increase of physical activity level after successful renal transplantation : a 5 year follow-up study. *Nephrology Dialysis Transplantation, 16*, 134-140.

Oterdoom, L., de Vries, A., van Ree, R., Gansevoort, R., van Son, W., & van der Heide, J. et al. (2009). N-terminal pro-B-type natriuretic peptide and mortality in renal transplant recipients versus the general population. *Transplantation, 87*, 1562–1570.

Ouzouni, S., Kouidi, E., Sioulis, A., Grekas, D., & Deligiannis, A. (2009). Effects of intradialytic exercise training on health-related quality of life indices in haemodialysis patients. *Clinical Rehabilitation, 23*(1), 53-63.

Owen, N. (2012). Sedentary behavior: understanding and influencing adults' prolonged sitting time. *Preventive Medicine, 55*(6), 535-539.

Owen N, Sparling PB, Healy GN, Matthews CE. (2010). Sedentary Behavior: Emerging Evidence for a New Health Risk. *Mayo Clinic Proceedings, 85*(12), 1138-1141.

Padilla, J., Krasnoff, J., Da Silva, M., Hsu, C., Frassetto, L., & Johansen, K., et al. (2008). Physical functioning in patients with chronic kidney disease. *Journal of Nephrology, 21*(4), 550-559.

Painter, P., Hanson, P., Messer-Rehak, D., Zimmerman, & S., Glass, N. (1987). Exercise tolerance changes following renal transplantation. *American Journal of Kidney Diseases, 10*(6), 452-456.

Painter, P., Hector, L., Ray, K., Lynes, L., Dibble, S., & Paul, S. et al. (2002). A randomized trial of exercise training after renal transplantation. *Transplantation, 74*(1), 42–8.

Painter, P., Moore, G., Carlson, L., Paul, S., Myll, J., & Phillips, W., et al. (2002). Effects of exercise training plus normalization of hematocrit on exercise capacity and health-related quality of life. *American Journal of Kidney Diseases, 39*(2), 257-265.

Painter, P., & Roshanravan, B. (2013). The association of physical activity and physical function with clinical outcomes in adults with chronic kidney disease. *Current Opinion in Nephrology and Hypertension, 22*(6), 615-623.

Painter, P., Stewart, A., & Carey, S. (1999). Physical functioning: definitions, measurement, and expectations. *Advances in Renal Replacement Therapy, 6*(2), 110-123.

Pirsch J.D. (2003) Long-term complications of kidney transplantation. In Kidney Transplantation (Hricik D.E., ed.), Remedica Group, Lincolnshire, IL, pp. 97–115.

Rettig, R. & Sadler, J. (1997). Measuring and improving the health status of end stage renal disease patients. *Health Care Financing Review, 18*(4), 77-82.

Rhee, C., & Kalantar-Zadeh, K. (2014). Resistance exercise: an effective strategy to reverse muscle wasting in hemodialysis patients?

Robertson, R., Robertson, A., Jepsona, R., & Maxwell, M. (2012). Walking for depression or depressive symptoms: A systematic review and meta-analysis. *Mental Health and Physical Activity, 5*(1), 66–75.

Romano, G., Simonella, R., Falleti, E., Bortolotti, N., Deiuri, E., & Antonutto, G. et al. (2010). Physical training effects in renal transplant recipients. *Clinical Transplantation*, *24*, 510–514.

Sakraida, T., & Weber, M. (2015). The relationship between depressive symptoms and self-management behaviors in patients with T2DM and stage 3 CKD. *Perspectives in Psychiatric Care,* Article first published online: 11 JUN 2015 DOI: 10.1111/ppc.12128

Sanchez, Z., Cashion, A., Cowan, P., Jacob, S., Wicks, M., & Velasquez-Mieyer, P. (2007). Perceived barriers and facilitators to physical activity in kidney transplant recipients. *Progress in Transplantation, 17*(4), 324-331

Sarnak, M., Levey, A., Schoolwerth, A., Coresh, J., Culleton, B., & Hamm, L. et al. (2003). Kidney disease as a risk factor for development of cardiovascular disease: a statement from the American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention. *Hypertension, 42*(5), 1050-1065.

Schieppati, A, Pisoni, R, Remuzzi, G. (2005). Pathophysiology and Management of Chronic Kidney Disease. In: Primer on Kidney Diseases, Greenberg, A. (Ed), Elsevier Saunders, Philadelphia.

Sedentary Behaviour Research Network. (2012). Letter to the editor: standardized use of the terms "sedentary" and "sedentary behaviours". *Applied Physiology, Nutrition, and Metabolism, 37*(3), 540-542.

Siegel, P., Brackbill, R., & Heath, G. (1995). The epidemiology of walking for exercise: implications for promoting activity among sedentary groups. *American Journal of Public Health, 85*, 706–710.

Sietsema, K., Amato, A., Adler, S., & Brass, E. (2004). Exercise capacity as a predictor of survival among ambulatory patients with end-stage renal disease. *Kidney International, 64*, 719-724.

Stengel, B., Tarver-Carr, M., Powe, N., Eberhardt, M., & Brancati, F. (2003). Lifestyle factors, obesity and the risk of chronic kidney disease. *Epidemiology, 14*(4), 479-87.

Stump, C. (2011). Physical Activity in the Prevention of Chronic Kidney Disease. *Cardiorenal Medicine, 1*(3), 164-173.

Sugiura, H., Sugiura, H., Kajima, K., Mirbod, S., Iwata, H., & Matsuoka, T. (2002).

Effects of long-term moderate exercise and increase in number of daily steps on serum lipids in women: randomised controlled trial. *BMC Women's Health, 2*(1), 3.

Sugiyama, T., Healy, G., Dunstan, D., Salmon, J., & Owen, N. (2008). Is television viewing time a marker of a broader pattern of sedentary behavior? *Ann Behav Med, 35,* 245-250.

Surgit, O., Ersoz, G., Gursel, Y., & Ersoz, S. (2001). Effects of exercise training on specific immune parameters in transplant recipients. *Transplant Proceedings, 33*(7-8), 3298.

Tedeschi RG, Calhoun LG. (1996). The Posttraumatic Growth Inventory: Measuring the positive legacy of trauma. *Journal of Traumatic Stress 9*(3), 455-471.

Tentori, F., Elder, S., Thumma, J., Pisoni, R., Bommer, J., & Fissell, R., et al. (2010). Physical exercise among participants in the Dialysis Outcomes and Practice Patterns Study (DOPPS): correlates and associated outcomes. *Nephrology Dialysis and Transplantation, 25*(9), 3050-3062.

Testa, M., & Simonson, D. (1996). Assesment of quality-of-life outcomes. *New England Journal of Medicine, 334*(13), 835-840.

Tong, A., Sainsbury, P., & Craig, J. (2008). Support interventions for caregivers of people with chronic kidney disease: a systematic review. *Nephrology Dialysis and Transplantion, 23*(12):3960-3965.

Trinh, L., Plotnikoff, R.., Rhodes, R., North, S., & Courneya, K.. (2013). Associations between sitting time and Quality of Life in a population-based sample of kidney cancer survivors. *Mental Health and Physical Activity, 6* (1), 16–23.

Tudor-Locke C. & Bassett, D. (2004). How many steps/day are enough? Preliminary pedometer indices for public health. *Sports Medicine, 34*(1), 1-8.

Tudor-Locke, C., Bassett, D., Shipe, M., & McClain, J. (2011). Pedometry methods for assessing free-living adults. *Journal of Physical Activity & Health*, 8(3), 445-453.

Tudor-Locke, C., Bell, R., Myers, A., Harris, S., Lauzon, N., & Rodger, N. (2002). Pedometer-determined ambulatory activity in individuals with type 2 diabetes. *Diabetes Research and Clinical Practice, 55*(3), 191-199.

Tudor-Locke, C., Craig, C., Thyfault, J., Spence, J. (2013). A step-defined sedentary lifestyle index: <5000 steps/day. *Applied Physiology, Nutrition, and Metabolism, 38*(2), 100-114.

Tudor-Locke, C., Hatano, Y., Pangrazi, R., & Kang, M. (2008). Revisiting "how many steps is enough"? *Medicine & Science in Sports & Exercise, 40*(Suppl. 7), S537–S543.

Tudor-Locke, C., & Myers, A. (2001). Methodological considerations for researchers and practitioners using pedometers to measure physical (ambulatory) activity. *Research Quarterly for Exercise and Sport, 72(*1), 1-12.

Valderas, J., Starfield, B., Sibbald, B., Salisbury, C., Roland, M. (2009). Defining comorbidity: implications for understanding health and health services. *Annals of Family Medicine, 7*(4), 357-363.

Vallance, J., Eurich, D., Lavallee, C., & Johnson, S. (2011). Physical activity and health-related quality of life among older men: an examination of current physical activity recommendations. Preventive Medicine, 54(3-4), 234-236.

Vallance, J., Eurich, J., Marshall, A., Lavallee, C., & Johnson, S. (2013). Associations

between sitting time and health-related quality of life among older men. *Mental Health and Physical Activity, 6*(1), 49–54.

Vallance, J., Winkler, E., Gardiner, P., Healy, G., Lynch, B., & Owen, N. (2011). Associations of objectively-assessed physical activity and sedentary time with depression: NHANES (2005-2006). *Preventive Medicine, 53*(4-5), 284-288.

van den Berg-Emons, R., Kazemier, G., van Ginneken, B., Nieuwenhuijsen, C., Tilanus, H., & Stam, H. (2006). Fatigue, level of everyday physical activity and quality of life after liver transplantation. Journal of Rehabilitation Medicine, 38(2), 124-129.

van den Ham, E., Kooman, J., Schols, A., Nieman, F., Does, J., & Franssen, F., et al. (2005). Similarities in skeletal muscle strength and exercise capacity between renal transplant and hemodialysis patients. *American Journal of Transplantation, 5*(8), 1957-1965.

van den Ham, E., Kooman, J., Schols, A., Nieman, F., Does, J., & Akkermans, M., et al. (2007). The functional, metabolic, and anabolic responses to exercise training in renal transplant and hemodialysis patients. *Transplantation, 83*(8), 1059-1068.

van der Ploeg, H., Chey, T., Korda, R., Banks, E., & Bauman, A. (2012). Sitting time and all-cause mortality risk in 222 497 Australian adults. *Archives of Internal Medicine, 172*(6), 494-500.

Wainwright, S., Fallon, M., Gould, D. (1999). Psychosocial recovery from adult kidney transplantation: a psychosocial review. *Journal of Clinical Nursing, 8*, 233–245.

Ware, J., Kosinski, M., & Keller. S. (1995). SF-12: How to score the SF-12 Physical and

Mental Health Summary Scales. The Health Institute, New England Medical Center, Boston, Massachusetts.

Ware, J., Kosinski, M., & Keller, S. (1996). 12-Item Short-Form Health Survey: Construction of Scales and Preliminary Tests of Reliability and Validity. *Medical Care, 34*, 220-233.

Wee, H., Li, S., Cheung, Y., Fong, K., & Thumboo, J. (2006). The influence of ethnicity on health-related quality of life in diabetes mellitus: a population-based, multiethnic study. *Journal of Diabetes Complications 20*, 170–178.

Weisbord, S., Fried, L., Mor, M., Resnick, A., Unruh, M., & Palevsky, P., et al. (2007). Renal provider recognition of symptoms in patients on maintenance hemodialysis. Clinical journal of the American Society of Nephrology, 2(5), 960-967.

Wijndaele, K., Healy, G.N., Dunstan, D.W., Barnett, A.G., Salmon, J., Shaw, J.E., Zimmet, P.Z., & Owen, N. (2010). Increased cardiometabolic risk is associated with increased TV viewing time. *Med Sci Sports Exerc, 42*, 1511-1518.

Woodcock, J., Franco, O., Orsini, N., & Roberts, I. (2011). Non-vigorous physical activity and all-cause mortality: systematic review and metaanalysis of cohort studies. *International Journal of Epidemiology, 40*(1), 121–38.

World Health Organization. (2004). Global burden of disease: 2004 Update. Retrieved from www.who.int/helatinfo/statitics/global_burden_disease/en/indexhtml on 21 July, 2009.

World Health Organization. (2010). Global Recommendations on Physical Activity for Health. Retrieved from

http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf on 12 August, 2012.

Wright Pinson, C., Feurer, I., Payne, J., Wise, P., Shockley, S., & Speroff, T. (2000). Health-related quality of life after different types of solid organ transplantation. *Annals of Surgery, 232*(4), 597–607.

Yates, T., Haffner, S., Schulte, P., Thomas, L., Huffman, K., & Bales, C., et al. (2014). Association between change in daily ambulatory activity and cardiovascular events in people with impaired glucose tolerance (NAVIGATOR trial): a cohort analysis. *Lancet, 383*(9922), 1059-1066.

Zamojska, S., Szklarek, M., Niewodniczy, M., & Nowicki, M. (2006). Correlates of habitual physical activity in chronic haemodialysis patients. *Nephrology Dialysis Transplantation, 21*, 1323–1327.

Zhai, L., Zhang, Y., & Zhang, D. (2015). Sedentary behaviour and the risk of depression: a meta-analysis. *British Journal of Sports Medicine, 49*(11), 705-709.

Zhao, J., Kong, F., Wang, Y. (2013). The role of social support and self-esteem in the relationship between shyness and loneliness. *Personality and Individual Differences, 54*(5), 577–581.

Ziegelmann, J., Griva, K., Hankins, M., Harrison, M., Davenport, A., & Thompson, D., et al. (2002). The Transplant Effects Questionnaire (TxEQ): The development of a questionnaire for assessing the multidimensional outcome of organ transplantation – example of end stage renal disease (ESRD). *British Journal of Health Psychology, 7*(4), 393-408.

Table 1

Participant Demographic and Clinical Characteristics

Characteristic	*n*	%
Sex		
Male	14	43.8
Female	18	56.3
Marital status		
Never married	1	3.1
Married	25	78.1
Common Law	3	9.4
Separated	1	3.1
Divorced	2	6.3
Education		
Some high school	3	9.4
Completed high school	2	6.3
Some university/college	6	18.8
Completed university/college	16	50.0
Some graduate school	3	9.4
Completed graduate school	2	6.3
Income		
20-39,999	3	9.4
40-59,999	5	15.6
60-79,999	6	18.8
80-99,999	5	15.6
>100,000	13	40.6
Work status		
Disability	5	15.6
Retired	13	40.6
Part-time	2	6.3
Full-time	10	31.3
Homemaker	1	3.1
Temporarily unemployed	1	3.1
Smoker		
Yes	1	3.1
No	31	96.9
Background		
White	31	96.9
Aboriginal	1	3.1
Dialysis therapy		
None	8	25.0
Hemodialysis	13	40.6
Peritoneal	8	25.0
Hemodialysis and peritoneal	3	9.4

Transplant source		
Deceased donor kidney	8	25.0
Living donor kidney	24	75.0
Previous kidney transplant		
Yes	2	6.3
No	30	93.8
Previous organ transplant other than kidney		
Yes	5	15.6
No	27	84.4
Angina		
Yes	2	6.3
No	30	93.8
Stroke		
Yes	1	3.1
No	31	96.9
Diabetes		
Yes	6	18.8
No	26	81.3
High blood pressure		
Yes	30	93.8
No	2	6.3
Cholesterol		
Yes	23	71.9
No	9	28.1
Cancer		
Yes	6	18.8
No	26	81.3
Other		
Yes	5	15.6
No	27	84.4
Physical activity prescription		
Yes	5	15.6
No	27	84.4

Table 2

Descriptive statistics for physical activity, psychosocial health outcomes, and sitting time among kidney transplant recipients

Variable	Mean (SD)
Self-report physical activity (minutes per week)	
Light	167.7 (314)
Moderate	225.2 (345.6)
Vigorous	21.4 (56.2)
Moderate-Vigorous	246.6 (345.6)
Total leisure activity score	34 (22.4)
Daily steps (average steps per day)	9,751.8 (3,685.13)
Health outcomes (total score)	
PCS	47 (9.2)
MCS	50 (9.9)
Self-esteem	22.8 (6.8)
Depression	4.8 (4.3)
Psychological growth	61.7 (19.9)
Sitting time (minutes per day)	
Minutes spent sitting while travelling - weekday	50.3 (36.8)
Minutes spent sitting while travelling - weekend	49.1 (28)
Minutes spent sitting while working, volunteering, studying	247.5 (238.4)
Minutes spent caring for child and/or elderly family Member – weekday	10.5 (27.7)
Minutes spent caring for child and/or elderly family Member – weekend	15.9 (40.3)
Minutes spent sitting watching television – weekday	176.3 (97.5)
Minutes spent sitting watching television – weekend	203 (121.5)
Minutes spent sitting while using a computer at home –	95.2 (95.5)

weekday	
Minutes spent sitting while using a computer at home – weekend	113.4 (110.4)
Minutes spent sitting during leisure time - weekday	113.4 (55.9)
Minutes spent sitting during leisure time - weekend	153.1 (77)
Total sitting time – weekday	693.1 (256.6)
Total sitting time – weekend	534.5 (219.6)

Data are presented as the mean (M), standard deviation (SD).

Table 3

HRQoL (adjusted) mean scores across physical activity and sedentary time

	HRQoL			
	PCS	*F*	MCS	*F*
MVPA (N=32) [Wilks' λ = .732, F(2,19) = 3.481, p = .05]				
<150 min/week (N=13)	44.31(2.27)	2.16,	46.40(2.04)*	4.82,
≥150 min/week (N=19)	48.89(1.83)	*p*=.156	52.53(1.64)*	*p*=.040
Average daily steps (N=32) [Wilks' λ = .735, F(2,20) = 3.597, p = .046]				
<10,000 steps/day (N=17)	43.38(1.87)*	6.52,	48.62(1.97)	.877,
≥10,000 steps/day (N=15)	51.16(2.02)*	*p*=.018	51.65(2.14)	*p*=.360
Sedentary time – weekday (N=32) [Wilks' λ= .947, *F*(2,18) = .503, *p* = .613]				
<630.00 min/day (N=14)	48.80(2.25)	.948,	50.64(2.19)	.117,
≥630.00 min/day (N=18)	45.65(1.94)	*p*=.343	49.57(1.89)	*p*=.736
Sedentary time – weekend (N=32) [Wilks' λ= .713, *F*(2,18) = 3.620, *p* = .048]				
<487.50 min/day (N=16)	49.85(2.08)	3.02,	53.33(1.89)*	4.96,
≥487.50 min/day (N=16)	44.21(2.08)	*p*=.097	46.75(1.89)*	*p*=.037

MVPA = moderate-vigorous physical activity; HRQoL = health-related quality of life; PCS = physical component score; MCS = mental component score

Data are presented as the mean and standard error.

* denotes statistically significant group comparison.

HRQoL models adjusted for BMI, sex, marital status, education, employment status, time since kidney transplantation, kidney transplant donor source, length of time of dialysis therapy, and at least one chronic disease

Table 4

Psychosocial health (adjusted) mean scores across physical activity and sedentary time

	Psychosocial Health					
	Self-esteem	*F*	Depression	*F*	Post Growth	*F*
MVPA (N=32)						
<150 min/week (N=13)	22.33(1.97)	.106, *p*=.747	7.21(1.08)*	7.90, *p*=.010	64.72(4.03)	.897, *p*=.353
≥150 min/week (N=19)	23.19(1.60)		3.12(.877)*		59.61(3.28)	
Average daily steps (N=32)						
<10,000 steps/day (N=17)	22.32(1.73)	.175, *p*=.680	6.51(1.02)*	5.22, *p*=.031	63.76(3.62)	.607, *p*=.443
≥10,000 steps/day (N=15)	23.44(1.86)		2.82(1.09)*		59.34(3.89)	
Sedentary time – weekday (N=32)						
<630.00 min/day (N=14)	21.85(1.91)	.432, *p*=.517	3.48(1.16)	2.06, *p*=.164	64.62(3.95)	.894, *p*=.354
≥630.00 min/day (N=18)	23.62(1.66)		5.80(1.01)		59.41(3.43)	
Sedentary time – weekend (N=32)						
<487.50 min/day (N=16)	24.43(1.73)	1.51, *p*=.231	2.90(1.01)*	6.21, *p*=.020	65.05(3.58)	1.62, *p*=.215
≥487.50 min/day (N=16)	21.25(1.73)		6.67(1.01)*		58.32(3.58)	

MVPA = moderate-vigorous physical activity; PG = psychological growth
Data are presented as the mean and standard error.
* denotes statistically significant group comparison.
Self-esteem models adjusted for age, body mass index, gender, length of dialysis therapy, dialysis therapy type, and prescription for physical activity; Depression models adjusted for age, body mass index, gender, length of dialysis therapy, employment status, and kidney donor source; Psychological growth models adjusted for age, body mass index, gender, marital status, kidney donor source, and chronic disease

Appendix A

Athabasca University Research Ethics Approval

June 10, 2014

Ms. Josee Raymond
Faculty of Health Disciplines
Athabasca University
File No: 21489
Expiry Date: June 9, 2015

Dear Ms. Josee Raymond,

Thank you for your recent resubmission to the Athabasca University Research Ethics Board (AUREB), addressing the clarifications and revisions as requested for your research entitled, 'Physical activity among adult recipients of a functioning kidney transplant in Ontario: Prevalence and associations with transplant effects, side effects of immunosuppressive drugs, and other patient-reported outcomes'.

Your application has been **approved** and this memorandum constitutes a *Certification of Ethics Approval*. You may begin the research immediately.

This REB approval, dated June 10, 2015, is valid for one year less a day.

Throughout the duration of this REB approval, all requests for modifications, renewals and serious adverse event reports are submitted via the Research Portal.

To continue your proposed research beyond June 9, 2015, you must submit a Renewal Form before May 15, 2015.

If your research ends before June 9, 2015, please submit a Final Report Form to close out REB approval monitoring efforts.

At any time, you can login to the Research Portal to monitor the workflow status of your application.

If you encounter any issues when working in the Research Portal, please contact the system administrator at research_portal@athabascau.ca.

Sincerely,

Sherri Melrose

Chair, Centre for Nursing and Health Studies Departmental Research Ethics Board
Research Ethics Board
May 20, 2015

Ms. Josee Raymond
Faculty of Health Disciplines
Athabasca University
File No: 21489
Approval Date: June 01, 2014
New Renewal Date: May 19, 2016

Dear Ms. Josee Raymond,

Your Renewal Form has been received by the AU REB Office.

Athabasca University's Research Ethics Board (REB) has approved your request to renew the certification of ethics approval for a further year for your project entitled "Physical activity among adult recipients of a functioning kidney transplant in Ontario: Prevalence and associations with transplant effects, side effects of immunosuppressive drugs, and other patient-reported outcomes".

As you progress with the research, all requests for changes or modifications, ethics approval renewals and serious adverse event reports must be reported to the Athabasca University Research Ethics Board via the Research Portal.

To continue your proposed research beyond May 19, 2016, you must apply for renewal by completing and submitting an Ethics Renewal Request form before May 10, 2016. Failure to apply for annual renewal before the expiry date of the current certification of ethics approval may result in the discontinuation of the ethics approval and formal closure of the REB ethics file. Reactivation of the project will normally require a new Application for Ethical Approval and internal and external funding administrators in the Office of Research Services will be advised that ethical approval has expired and the REB file closed.

When your research is concluded, you must submit a Project Completion (Final) Report to close out REB approval monitoring efforts. Failure to submit the required final report may mean that a future application for ethical approval will not be reviewed by the Research Ethics Board until such time as the outstanding reporting has been submitted.

If you encounter any issue with the Research Portal's online submission process, please contact the system administrator via research_portal@athabascau.ca.

If you have any questions about the REB review & approval process, please contact the AUREB Office at (780) 675-6718 or rebsec@athabascau.ca.

Sincerely,

Office of Research Ethics

Appendix B
Survey Questions

Physical activity and health study

Centre for Nursing and Health Studies,

Athabasca University

Ms. Josée Raymond & Dr. Jeff Vallance

Thank-you for agreeing to participate in this study! In this survey, we are going to ask you a series of questions about yourself. 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 minutes to complete. All responses are completely confidential and will never be used in any way that could link them to you. It is important to complete all questions. Please remember that you will never be individually identified in any reports or presentations.

After completing your **survey**, please place it (along with your completed **Step Log Sheet** and signed **Participant Consent Form**) back in the stamped addressed envelope provided.

By completing this survey and returning it to us, you are indicating your voluntary participation and consent to be in this study. Many thanks in advance for participating in our study. We hope you find it informative.

For further information or if you have any questions about completing the questionnaire, please contact Ms. Josée Raymond at 249-878-0088, jz_raymond@laurentian.ca or Dr. Jeff Vallance at 403-977-4338, jeffv@athabascau.ca.

- *These next questions are about the usual amount of time over the <u>past 12 months</u> that you spent sitting or lying down.*

- *The amount of time you spent sitting or lying down may have varied over the past 12 months. Do your best to estimate your <u>usual</u> pattern over the past 12 months.*

- *If you did not participate in a particular sitting task, please write "0" in the time response field.*

- *For each of the sitting tasks only count the time where this was your <u>main focus</u>. For example, if you spent one hour sitting on the sofa reading a book while you had a CD on in the background, count this time as one hour reading (do not also 'double count' as one hour listening to music).*

SECTION 1 – SLEEPING AND NAPPING

Sleeping and napping are an important part of your daily routine.

If you do shift work or you have variable sleeping patterns, please try to estimate the average number of hours in your sleep period, whether this is during the night or day.

SLEEPING

Think about how many hours you usually slept each night over the past 12 months.

Please record how long you usually slept on weekdays and weekends. This may include time you spent lying quietly while waiting to fall asleep, or after awakening.

1. How long did you usually sleep per night? *(include time spent lying quietly while waiting to fall asleep, or after awakening)*	___hr ___min *(weekday)*	___hr ___min *(weekend)*

NAPPING

A nap is a brief sleep, often during the day. A nap can be taken in a chair as well as in a bed.

Did you take a nap each day, on either weekdays or weekends, over the past 12 months?

➔ If no, please write "0" in the response section, below.

2. How long did you usually nap per day? *(do not include occasional naps)*	___hr ___min *(weekday)*	___hr ___min *(weekend)*

SECTION 2 - MEALS

Eating is a task we don't often think about, but it can take up quite a bit of time each day.

Please think about the amount of time you usually spent sitting for meals over the past 12 months:

- do report times when your main focus was eating, including eating out
- do report the amount of time you spent between sitting down and being finished with a meal (leaving the table)
- do not include time spent preparing food
- do not include times you were eating while doing other things, like snacking while watching TV (you will be asked about this later).

3. How long did you usually spend sitting for meals per day?	___hr ___min *(weekday)*	___hr ___min *(weekend)*

SECTION 3 – TRANSPORTATION

This section refers to the time you spent sitting during transportation (travelling in a car, bus, train, etc.) in the past 12 months:

- do report time spent as either a driver or a passenger
- do report time spent commuting to and from work
- do not report time spent sitting during transportation as part of your job

4. How long did you usually spend sitting during transport per day?	___hr ___min *(weekday)*	___hr ___min *(weekend)*

SECTION 4 – WORK, STUDY AND VOLUNTEERING

"Work" refers to your occupation or your job - all tasks done to earn money or make a living. You may work full-time or part-time; you may work for a company or be self-employed.

"Study" refers to formal educational activities related to school, technical college or university.

"Volunteering" refers to work that you do for no pay, such as helping at a hospital, church or sports club.

Please complete one response section for <u>each type</u> of work, study or volunteering you did in the past 12 months:

there is space to record up to four different types of work, study or volunteering you may have done <u>over the past 12 months</u>

- <u>do</u> include the usual amount of time that you spent sitting down as part of your work, study or volunteering
- <u>do not</u> record holiday time here, even if it is paid vacation.

➔ If you <u>did not</u> do any work, study or volunteering in the past 12 months, please skip to **Section 5** on page 11.

Choose type of "job": ☐ work ☐ study ☐ volunteering

Please name Job #1: _____

5a. How many weeks in the past 12 months did you do Job # 1? ___ weeks

6a. How many days per week did you do Job # 1? ___ days

7a. How much time per day did you spend sitting for Job # 1? ___hr ___min

(include driving and travelling while doing this job; do not include time commuting to and from this job)

Think about the total time you spent sitting during Job # 1. We are interested in how often you stood up and moved around to "break up" the time you spent sitting. For example, you might have taken short walks to get a drink of water, to collect a document from the printer or to talk to someone else in the office.

8a. How often did you "break up" the time you spent sitting in Job # 1?

☐ *(less than hourly)* ☐ *(hourly)* ☐ *(half hourly)* ☐ *(every 10 mins)* ☐ *(every 5 mins)*

OR ☐ I did not sit for more than 30 minutes in a day

➔ Did you have any other work, study or volunteering "jobs" in the past 12 months? If so, continue on the next page.

➔ If you did not have any other jobs, please skip to **Section 5** on page 11.

Choose type of "job": ☐ work ☐ study ☐ volunteering

Please name Job #2: _____

5b. How many weeks in the past 12 months did you do Job # 2? ___ weeks

6b. How many days per week did you do Job # 2? ___ days

Think about the total time you spent sitting during Job # 2.

8b. How often did you "break up" the time you spent sitting in Job # 2?

☐ ☐ ☐ ☐ ☐

(less than hourly) *(hourly)* *(half hourly)* *(every 10 mins)* *(every 5 mins)*

➔ Did you have any other work, study or volunteering "jobs" in the past 12 months? If so, continue on the next page.

➔ If you did not have any other jobs, please skip to **Section 5** on page 11.

Choose type of "job": ☐ work ☐ study ☐ volunteering

Please name Job #3 _____

5c. How many weeks in the past 12 months did you do Job # 3? ___ weeks

6c. How many days per week did you do Job # 3?
___ days

7c. How much time per day did you spend

Think about the total time you spent sitting during Job # 3.

8c. How often did you "break up" the time you spent sitting in Job # 3?

☐ ☐ ☐ ☐ ☐

(less than hourly) *(hourly)* *(half hourly)* *(every 10 mins)* *(every 5 mins)*

➔ Did you have any other work, study or volunteering "jobs" in the past 12 months? If so, continue on the next page.

➔ If you did not have any other jobs, please skip to **Section 5** on the next page.

SECTION 5 – CHILDCARE AND ELDER CARE

This section refers to the time you spent sitting while taking care of your children, grandchildren or elderly family members.

Were you involved in childcare or elder care each day, on either weekdays or weekends, over the past 12 months?

➔ If no, please write "0" in the response section, below.

Please record the usual amount of time you spent sitting during childcare or elder care over the past 12 months.

9. How long did you usually spend sitting or lying down while caring for your child per day? *(examples: nursing baby, helping child with homework)*	___hr ___min *(weekday)*	___hr ___min *(weekend)*
10. How long did you usually spend sitting down while caring for an elderly family member per day?	___hr ___min *(weekday)*	___hr ___min *(weekend)*

SECTION 6 – LIGHT LEISURE AND RELAXING

This section refers to things done for enjoyment, during your own time.

Please record the usual amount of time you spent sitting or lying down in these pursuits over the past 12 months.

SCREEN TIME

Think about the total time you spent watching TV or using a computer during your leisure-time. We are interested in how often you stood up and moved around to "break up" the time you spent sitting or lying down. For example, you might have got up to get a cup of coffee during a commercial break.

11. How long did you usually spend watching TV (dvds/videos) or playing video games per day?

	___hr ___min	___hr ___min
	(weekday)	*(weekend)*

12. How long did you use a computer for leisure or for additional work on your own time per day?

	___hr ___min	___hr ___min
	(weekday)	*(weekend)*

13. How often did you "break up" the time you spent watching TV or using a computer during your leisure-time?

☐ *(less than hourly)* ☐ *(hourly)* ☐ *(half hourly)* ☐ *(every 10 mins)* ☐ *(every 5 mins)*

14. How often did you eat snack-foods (e.g. chips, sweets) while watching TV during your leisure-time?

☐ *(always)* ☐ *(usually)* ☐ *(sometimes)* ☐ *(rarely)* ☐ *(never)*

OTHER LEISURE PURSUITS

15. How long did you usually spend reading while sitting or lying down per day?	___hr ___min *(weekday)*	___hr ___min *(weekend)*
16. How long did you usually spend in other leisure pursuits while sitting down per day?	___hr ___min *(weekday)*	___hr ___min *(weekend)*

Some examples:

listening to music	*talking to friends*	*sewing/knitting*
doing crosswords/puzzles	*doing crafts*	*attending a sporting event*
woodworking	*playing cards*	*praying/meditating*
writing letter	*sitting outdoors*	*watching a movie at the cinema*

SECTION 7 – FINAL QUESTIONS

Were you involved in other <u>daily</u> pursuits done sitting or lying down that were not covered in this questionnaire, on either weekdays or weekends, over the past 12 months?

➔ If no, please continue to question 17.

Please record the <u>usual</u> amount of time you spent sitting or lying down in other pursuits not covered in this questionnaire.

Other pursuits:

……..	___hr ___min	___hr ___min
	(weekday)	*(weekend)*
……..	___hr ___min	___hr ___min
	(weekday)	*(weekend)*
……..	___hr ___min	___hr ___min
	(weekday)	*(weekend)*

This next questionnaire asks about your perceptions of your life. Please indicate the extent to which you have experienced each of the statements by <u>circling the appropriate number</u> using the following scales provided.

In general, would you say your health is:

1 Excellent
2 Very Good
3 Good
4 Fair
5 Poor

The following items are about **<u>activities you might do during a typical day</u>**. Does your health now limit you in these activities? If so, how much:

Moderate activities such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?

1 Yes, limited a lot
2 Yes, limited a little
3 No, not limited at all

Climbing several flights of stairs?

1 Yet, limited a lot
2 Yes, limited a little
3 No, not limited at all

During the **<u>past 4 weeks</u>**, have you had any of the following problems with your work or other regular daily activities **<u>as a result of your physical health</u>**?

Accomplished less than you would like?

1 Yes
2 No

Were limited in the kind of work or other activities?

1 Yes
2 No

During the **past 4 weeks**, 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)?

Accomplished less than you would like?

1 Yes
2 No

Didn't do work or other activities as carefully as usual?

1 Yes
2 No

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

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

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

Have you felt calm and peaceful?

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

Did you have a lot of energy?

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

Have you felt downhearted and blue?

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

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

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

The following questions concern the general perceptions that you currently have about yourself. Please circle the number that best reflects your current view of yourself using the following scale as a guide for your responses.

1	2	3	4
strongly disagree	disagree	agree	strongly agree

1. On the whole I am satisfied with myself.	1	2	3	4
2. At times I think that I am no good at all.	1	2	3	4
3. I feel that I have a number of good qualities.	1	2	3	4
4. I am able to do things as well as most other people.	1	2	3	4
5. I feel I do not have much to be proud of.	1	2	3	4
6. I certainly feel useless at times.	1	2	3	4
7. I feel that I am a person of worth, at least on an equal plane with others.	1	2	3	4
8. I wish I could have more respect for myself.	1	2	3	4
9. All in all, I am inclined to feel that I am a failure.	1	2	3	4
10. I take a positive attitude toward myself.	1	2	3	4

Over the ***last 2 weeks***, how often have you been bothered by any of the following problems?

1. Little interest or pleasure in doing things **(check one)**

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

2. Feeling down, depressed, or hopeless **(check one)**

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

3. Trouble falling or staying asleep, or sleeping too much **(check one)**

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

4. Feeling tired of having little energy **(check one)**

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

5. Poor appetite or overeating **(check one)**

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

6. Feeling bad about yourself – or that you are a failure or have let yourself or your family down **(check one)**

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

7. Trouble concentrating on things, such as reading the newspaper or watching television **(check one)**

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

8. Moving or speaking so slowly that other people could have noticed. Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual

(check one)

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

9. Thoughts that you would be better off dead, or thoughts of hurting yourself **(check one)**

Not at all (0 day) _____

Several days (e.g., 1-7 days) _____

More than half the days (e.g., 8-12 days) _____

Nearly every day (e.g., 13-14 days) _____

Indicate for each of the statements below the degree to which this change occurred in your life *as a result of your experience with renal disease*, using the following scale.

To what degree did you experience this change?

	Not at all	**A very small degree**	**A small degree**	**A moderate degree**	**A great degree**	**A very great degree**
1. My priorities about what is important in life	1	2	3	4	5	6
2. An appreciation for the value of my own life	1	2	3	4	5	6
3. I developed new interests	1	2	3	4	5	6
4. A feeling of self-reliance	1	2	3	4	5	6
5. A better understanding of spiritual matters	1	2	3	4	5	6
6. Knowing that I can count on people in times of trouble	1	2	3	4	5	6
7. I established a new path for my life	1	2	3	4	5	6
8. A sense of closeness with others	1	2	3	4	5	6
9. A willingness to express my emotions	1	2	3	4	5	6
10. Knowing I can handle difficulties	1	2	3	4	5	6
11. I'm able to do better things with my life	1	2	3	4	5	6
12. Being able to accept the way things work out	1	2	3	4	5	6

	Not at all	A very small degree	A small degree	A moderate degree	A great degree	A very great degree
13. Appreciating each day	1	2	3	4	5	6
14. New opportunities are available which wouldn't have been otherwise	1	2	3	4	5	6
15. Having compassion for others	1	2	3	4	5	6
16. Putting effort into my relationships	1	2	3	4	5	6
17. I'm more likely to try to change things which need changing	1	2	3	4	5	6
18. I have a stronger religious faith	1	2	3	4	5	6
19. I discovered that I'm stronger than I thought I was	1	2	3	4	5	6
20. I learned a great deal about how wonderful people are	1	2	3	4	5	6
21. I accept needing others	1	2	3	4	5	6

This part of the questionnaire is needed to help understand the characteristics of the people participating in the study. For this reason, it is very important information. All information is held in strict confidence.

1. Marital Status:

Never Married _____ Married _____ Common law _____ Separated _____

Widowed _____ Divorced _____

2. Education (please check highest level attained):

Some high school _____ Completed high school _____

Some university/college _____ Completed university/college _____

Some graduate school _____ Completed graduate school _____
(e.g., master's degree or PhD)

3. Annual family income:

< 20,000 _____ 20-39,999 _____ 40-59,999 _____

60-79,999 _____ 80-99,999 _____ >100,000 _____

4. Including you, how many people live at your house? _____ (number of people)

5. Employment status:

Disability _____ Retired _____ Part-time _____

Full-time _____ Homemaker _____ Temporarily _____
Unemployed

6. Please weigh yourself and measure your height without shoes and report it here:

Height: _____ Weight: _____

7. Did you receive dialysis treatment?

no_____ yes_____

8. If you received dialysis treatment, what was the length of time of dialysis treatment (i.e., number of months and/or years)?

_____ months / years (please circle)

9. If you received dialysis treatment, what was the type of dialysis treatment?

Peritoneal dialysis _____ Hemodialysis _____

10. Date of successful kidney transplantation (YYYY-MM-DD): _____

11. Describe the kidney transplant donor source (check one):

Deceased donor kidney _____ Living donor kidney _____

12. Have you had a previous unsuccessful kidney transplantation? no_____ yes_____

13. Have you had an organ transplant other than a kidney transplant?

no_____ yes_____

If yes, what type of organ transplant was it? _____

If yes, what is the date of this organ transplant? (YYYY-MM-DD): _____

14. Has a doctor or nurse ever told you that you have had the following?
Please check all that apply.

a. Angina ____no ____yes
b. Heart attack ____no ____yes
c. Stroke ____no ____yes
d. Diabetes ____no ____yes
e. High blood pressure ____no ____yes
f. High blood cholesterol____no ____yes
g. Cancer ____no ____yes
h. Other_____

15. Are you currently on any medications? If so, please specify below:

_____

_____

16. Has a physician ever given you a prescription for physical activity or exercise (i.e., told you specifically what exercise to do)?

no _____ yes _____

17. What is your age? _____

18. Do you smoke? no_____ yes_____

19. How many alcoholic beverages do you on average consume per week? _____

20. What best describes your background?

_____	White	_____	Southeast Asian
_____	Aboriginal (First Nations, Metis, Inuit)	_____	Arab
_____	South Asian (e.g., East Indian, Pakistani, Sri Lankan)	_____	West Asian (Afghan, Iranian)
_____	Black	_____	Japanese
_____	Filipino	_____	Korean
_____	Latin American	_____	Chinese

Is there anything else you would like to tell us? On this final page, please feel free to make any comments below about the study itself, or physical activity. All comments are extremely helpful to us.

Please place this completed survey, completed Step Log Sheet and signed Participant Consent Form in the enclosed postage paid envelope and place in your nearest post box. Thank you for your time!

Appendix C

Information Letter

Physical Activity and Health Survey for Adult Recipients of a Kidney Transplant Living in Ontario

Information Letter

This information letter is designed to give you an idea of what our research study is about. Please read this form carefully to make sure you are aware of all the information it provides. You can keep this form for your records. Participation in this study is entirely voluntary.

My name is Josée Raymond and I am currently a Master of Health Studies student in the Faculty of Health Disciplines at Athabasca University. As part of my Master Thesis requirements, I am conducting a research study. I have a keen interest in kidney transplant recipients' health and wellbeing. In particular, I am interested in how walking behavior (e.g., daily steps taken) is related to the health of adults with a functioning kidney transplant. My supervisor for this research study is Dr. Jeff Vallance, a physical activity researcher in the Faculty of Health Disciplines at Athabasca University.

Why is this study being done?

We know that being active is good for people's health and wellbeing. But we don't know much about the physical activity and walking activity habits of adult recipients of a kidney transplant. We are interested in finding out a little bit about your general health and then seeing what your current physical activities are, including the amount of daily steps taken over a three day period. The purpose of our study is to further understand how physical activity and walking behavior can affect your health. The information gathered in this research study will be used to directly benefit and improve the health of kidney transplant recipients.

How do I participate in the study?

We ask that you please complete the enclosed survey. This survey will ask you about the current physical activities you do, including how much time you spend being sedentary (e.g., sitting, driving), as well as your current quality of life and how you feel about yourself.

What if I am not a very active person?

Absolutely yes, we would still like you to participate in this study if you think that you are not a very active person. For the study to be successful, we need information from a

wide range of activity levels: from those who think they are inactive, all the way to kidney transplant recipients who are active every day.

What am I being asked to do?

We would like to ask you to complete the tasks below:

- Complete the enclosed survey as soon as possible (within the next day or two). The survey should take you 30 to 45 minutes to complete.

- When you have finished the survey, return the finished survey in the self-addressed business reply envelope that is enclosed for you, and mail the envelope back to us. You do not have to pay for postage. We have done that for you already.

- It is very important that you don't change your normal physical activity and any walking behavior during this study. We want to know what it is that you normally do. Doing more physical activity than normal will not improve the results of this study. We will actually get more helpful information if you keep doing the activities that you normally do and don't change anything. Once you have completed the survey you are free to change any physical activity habits at that time if you choose.

How long will I be involved in the study?

Your involvement in the study is only to complete the survey and return it to our research team as per the above instructions. However, you have the right to refuse to participate and to withdraw from the study at no consequence to you. At your request, the data you provide will be removed and destroyed.

Do I have to travel somewhere to be in this study?

No, you do not need to travel anywhere to be in this study. This study is a home-based physical activity study. That means that this study can be done in the comfort of your own home. We just want you to continue with what activities are normal for you.

Are there any risks to participating?

There is a very small risk to being in this study. There is a small chance that some questions in the survey may make some people feel uncomfortable (e.g., questions about emotions). If this is the case for you, feel free to skip that question. Given that we are not asking you to do more physical activity and that we are just asking you to complete a survey, there is no physical risk.

Who sees your information?

Please do not put your name on this survey. All information will be held confidential, except when legislation or a professional code of conduct requires it to be reported. Even then your name will not be reported. Each survey has only an ID number on it, so you do not need to put your name on it. No one will see the data except the researcher XX, her supervisor in the Faculty of Health Disciplines, Dr. Jeff Vallance, and the research coordinator, ********. There is no way other people (e.g., other participants) will see your information. The data we collect will be kept in a locked filing cabinet. Five years after publication (in research journals), all of the data will be destroyed. If you are interested, you are welcome to receive a final report of the study results. Just contact the researcher.

Do I need to sign something?

No, you don't need to sign anything. By doing this survey and returning it to us, you are lending your voluntary participation and consent to be in this study.

If you have any questions about the survey, please contact XX at XXX-XXX-XXXX or e-mail at XX. XX is conducting this study as part of her Master's Thesis requirements. You may also contact Josée Raymond's supervisor, Dr. Jeff Vallance at 403-488-7182. If you would like to speak to someone not involved with this survey, please contact the Research Ethics Officer, Athabasca University Research Ethics Board Secretary at 1-800-788-9041, ext. 6718, if you have any questions or concerns. The Research Ethics Officer has no direct involvement with this project.

Thank you for being in our study. It is only through helping with these research projects that we can increase our knowledge of physical activity, walking behavior, and health across Ontario for kidney transplant recipients.

Yours in health,

Josée Raymond, RN BScN

Master in Health Studies Student, Athabasca University

Jeff Vallance, PhD

Associate Professor, Athabasca University

Alberta Innovates – Health Solutions Population Health Investigator

Appendix D

Reminder Letter to Participants

Month xx, 2015

Hello Mr./ Mrs./ Ms.,

Thank you so much for helping us with the Physical Activity and Health Survey for Adult Recipients of a Kidney Transplant Living in Ontario. The response to our study has been overwhelming as over xxx individuals contacted us to participate in the study. Indeed, folks from Ontario have stepped up to the plate and shown an interest in health-related initiatives in our region. Thank you so much.

We are still waiting to receive the survey from a few people. I am sending this letter as a friendly reminder to please return the survey at your earliest convenience. The more responses we get from participants the better we can understand the factors that affect physical activity, quality of life, and health of adults living with a functioning kidney transplant. If you have lost your survey, let me know and another package can be sent out to you.

If you have since decided not to complete the survey, and not participate in the study, that is okay as well. We thank you for taking an interest in the study.

After we have analyzed all the data, as summary of the study results as well as a physical activity resource for strategies for staying active will be sent to all participants.

If you have any questions, please don't hesitate to contact us at the number and/or e-mail address listed below. I have spoken with many of you over the phone and e-mail and have very much enjoyed those interactions.

Yours in health,

Josée Raymond, RN BScN

Master in Health Studies Student, Athabasca University

Appendix E

Step Log Sheet

How to use your pedometer

Thank you for participating in this study! To complete the study, we would like you to wear a step pedometer for 3 days. **Begin tracking your steps the first day after receiving the pedometer in the mail.** For this assessment, it is important that you don't change your regular physical activity level**. Just do what is normal for you.** Follow these steps every day for the next three (3) days.

Step 1

Open the pedometer cover. Press the button to reset the step count to zero (0).

Step 2

Now you need to put the pedometer on your belt. The best place to put your pedometer is to clip it to your waistband or belt, midway between your navel and your hip, in line with your knee. The pedometer must remain upright to record correctly. It cannot be tilted forward, backward or side-to-side. It will not record properly when open, so keep the pedometer closed - unless you are checking your steps. See Figure 1 below to see where to place the pedometer.

Figure 1: Where to place your pedometer.

Step 3

Wear the pedometer all day, except when taking a shower, bathing, or swimming. It is small and light so you should not even notice it is there.

Step 4

When you are ready to go to bed, remove the pedometer and open the cover. The number displayed on the screen is the number of steps you took for that day (see Figure 2). Record this number onto the pedometer log sheet for the appropriate day. Then hit the yellow 'Reset' button so you start fresh at '0' steps the next morning. If you forget to wear the pedometer for the entire day, leave the pedometer log sheet blank for that day.

Figure 2: Display showing the number of steps taken.

Step Log Sheet

Use this form to record the number of steps you take each day.

Before you go to bed each night, open your pedometer and write down the number you see on your pedometer screen onto this log sheet. Record the daily total in the 'Total Steps' column. Then reset your pedometer for the next day by pressing the 'RESET' button. **Make sure you record your steps for 3 days**.

This is where you find your daily step total

Day	Total Steps
1	
2	
3	