The **ENCOURAGE** project:

ENhancing Primary Care **COU**nseling and **R**eferrals to Community-based Physical **A**ctivity Opportunities for Sustained Lifestyle Chan**GE**.

By

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Abstract

The lack of sufficient physical activity (PA) is estimated to affect 85% of Canadians. Therefore, this project seeks to support physical activity as a health intervention within primary care using innovative approaches to help people access community-based PA opportunities. With the use of novel approaches (i.e. integrating a Certified Exercise Physiologist into primary care, strategic PA counseling, enhancing healthcare information systems, creating partnerships between the clinic and existing community service providers, and developing inventories of community-based programming), we hypothesize that participants will increase their moderate to vigorous physical activity (MVPA) levels over ten months. One-hundred and nineteen patients were recruited from two primary care facilities in Winnipeg and followed for 10 months. The primary outcome of $MVPA_{10Mins}$ did not change from baseline to 10 months. However, light sporadic physical activity ($LPA_{Sporadic}$) increased by 14% by the 4th month and sustained increases up to month 10. Additionally, total sporadic physical activity ($TPA_{Sporadic}$) increased by 18% at four months and 21% at 6 months when compared to baseline values. Conversely, sedentary time increased by 10% amongst participants from baseline to 4 months and did not change by the conclusion of the study. Self-report data including self-efficacy for exercise, symptoms of depression, quality of life, and stage of change, all improved by the four month time point and improvements were sustained until the end of the study except self-efficacy for exercise where values returned to baseline by the 6th month. The ENCOURAGE intervention was not successful at increasing the primary outcome of $MVPA_{10Mins}$ over time. Furthermore, increases in sedentary time were identified amongst the study cohort. Notwithstanding, results from other secondary

outcomes (e.g. $LPA_{Sporadic}$, $TPA_{Sporadic}$, self-efficacy for exercise, mood, and quality of life) indicate that a multilevel intervention delivered within primary care may contribute to changes in light and total sporadic physical activity as well as self-reported parameters.

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Dedication

I would like to dedicate this thesis document to my children. You both are the reason that I strive to succeed. To my son Chase and to my daughter Paige, I wanted to show you that hard work and dedication do pay off and for both of you to follow your dreams wherever they may lead you. It has not always been easy but anything worth doing seldom is. Love you guys!

To my parents I would like to thank you for the support and encouragement over the years of which you have never lost faith in my potential.

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Chapter 1: Introduction

In Canada, several strategies to increase physical activity for the general population have been adopted. For example, public education initiatives identifying the benefits of physical activity [1, 2], implementation of high school physical education policies [3], taxation exemptions for physical activity participation for children and youth [4], and providing physical activity programming within local communities [5] have been utilized. However, 85% of Canadians still do not meet recommended physical activity guidelines and the risk for chronic disease due to physical inactivity remains high [6]. Therefore, new approaches are needed to address the issue of physical inactivity amongst this population. With this in mind, public health care facilities represent an opportunity for physicians and other health care professionals to interact and educate patients about healthy lifestyle choices including physical activity. Specifically in Manitoba, 79% of the population went to a physician at least one time within the 2010 calendar year [7]. The opportunity to promote physical activity, by utilizing the primary care environment to influence change, may be a viable approach and should be examined.

Purpose of research

This project seeks to influence various levels of the healthcare system to more fully support physical activity as a health intervention within the primary care environment by utilizing innovative strategies to better support patients to adopt a more physically active lifestyle. For example, some of the strategies that will be used include: teaching patients the skills they need in order to establish and maintain healthy lifestyles, developing a referral process that will provide primary healthcare providers the opportunity to refer patients to community based physical activity programming, utilizing healthcare information systems as a tool to enhance communication between healthcare providers and a Canadian Society for Exercise Physiology (CSEP) Certified Exercise Physiologist (CEP), developing inventories for local community physical activity opportunities, and establishing community partnerships to support primary care. In order to facilitate the physical activity promotion model a CSEP-CEP will be integrated into an existing Winnipeg Regional Health Authority (WRHA) primary health care team. In Canada, the CSEP-CEP credential is the highest level of certification available for an exercise specialist [8]. A CSEP-CEP's scope of practice (Appendix A) encompasses both healthy and clinical populations [8]. This approach recognizes that the collaborations between primary health care providers, exercise specialists, and community-based physical activity program providers are needed to help patients adopt and sustain a more physically active lifestyle [9]. Finally, this inter-professional collaborative approach may strengthen healthcare systems and improve patient health outcomes as indicated in the literature [10-12].

Defining terms

Physical activity

Physical activity is defined as body movements performed by skeletal muscles that enable expenditure of energy above basal levels [13]. Physical activity can be performed in several different contexts including occupational, leisure and daily activities. Physical activity can vary in intensities from light to vigorous [14]. A person that is classified as physically active means they have met a specific activity threshold. Based on the Canadian Physical Activity Guidelines (CPAG), this threshold is recommended to be 150 minutes of moderate to vigorous aerobic physical activity per week in bouts of ten minutes or longer [15]. The CPAG also suggest that individuals participate in resistance exercises to help strengthen major muscles of the body for a minimum of 2 days per week for added health benefits [15].

Physical inactivity

For a person to be classified as *physically inactive,* they must not meet the established physical activity guidelines [16, 17] of 150 minutes of moderate aerobic physical activity per week [15].

Sedentary behavior

The terms *sedentary* and *physically inactive* have often been used interchangeably within the fitness industry; however, the terms are different [17, 18]. Sedentary behavior encompasses activities that do not significantly increase a person's energy expenditure above the resting level (i.e. $\leq$ 1.5 metabolic equivalents or METs) [18, 19]. One MET is the amount of oxygen that a person uses to fuel working muscles for every kg of bodyweight every minute. By convention 1 MET = $3.5\ ml/O_2 \cdot kg^{-1} \cdot min^{-1}$ [20]. These activities would include resting, sitting, driving, lying down, watching television, and other forms of screen-based entertainment. The Canadian Health Measures survey provided data indicating that adults spend an average of 9.5 hours in sedentary activities which represent approximately 69% of their waking hours [21]. The current literature does not specifically discuss the duration of sedentary activities a person must engage in to be considered sedentary; however, research has indicated that excess sedentary activities (i.e. > 300 minutes/day) can contribute to a reduced life expectancy [22]. In fact, if a person reduced sedentary activities by 5 hours per day they would have a greater than 3 year increase in life expectancy [22] . Current literature discusses the behavior of an individual and how that behavior is classified as sedentary. For example, if a person was to engage in 60 minutes of MVPA during a 24 hour period and remain sedentary the other 23 hours, they would not be classified as sedentary, they would be considered physically active as they have met the CPAG [18]. However, these individuals would have displayed 23 hours of sedentary behaviour, so are they sedentary or physically active? Research has also identified that being active for only 60 minutes a day and being sedentary the remainder of the day does not improve health [23]. In fact, individuals who reduce their time being sedentary by 4 hours to perform light activity (i.e. leisurely walking) experience a greater degree of health related benefits [23]. Therefore, sedentary behavior is the participation in a distinct set of sedentary activities [19] during waking hours in which energy expenditure does not exceed 1.5 METS [24].

Primary care

Health Canada regards *primary care* as a subsystem embedded within the *primary health care system* [25]. Primary care is defined by Health Canada as *"*The element within primary health care that focuses on health care services, including health promotion, illness and injury prevention, and the diagnosis and treatment of illness and injury" [25]. The primary care workers can include but are not limited to family physicians, nurse practitioners, pharmacists, sociologists, mental health professionals, and dieticians. Primary care, as described by the National Research Council, is considered to be: "the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community" [26].

Exercise specialist

The Manitoba Kinesiologists Association defines a kinesiologist as a professional that promotes and provides best practices in prevention, assessment and intervention to enhance and maintain fitness, health and wellness, performance, and function, in the areas of sport, recreation, work, exercise, and activities of daily living [27]. Kinesiologists are *exercise specialists* who have successfully completed a four-year university degree that encompasses a specialized body of knowledge and skills related to physical activity [8]. These exercise specialists provide fitness assessments and evaluations, personalized prescription exercise, exercise supervision, behavioral counseling and healthy lifestyle education [28]. Exercise specialists are also able to refer patients to relevant community, public health and physical activity resources [29]. If the exercise specialist intends to prescribe physical activity as a health intervention, it is preferred that they certify as a CSEP-CEP. This is the only Canadian certification for kinesiologists, which includes a scope of practice enabling the exercise specialist to work with clinical populations [8]. Our research project specifically requires the expertise of a CSEP-CEP to facilitate our physical activity intervention model because they will be working within a clinical environment and prescribing physical activity to both apparently healthy and clinical populations. In Manitoba, CSEP-CEP's have not historically been incorporated into primary health care teams. In fact, the CSEP-CEP has not yet been officially recognized within the current healthcare system [30].

Interdisciplinary primary care teams

Interdisciplinary primary care teams are defined as partnerships between two or more health care providers who work together to achieve shared decision making according to patient centered objectives and ideals, while optimising the team's knowledge, skills, and perspectives, as well as practicing in a respectful environment and maintaining trust among all team members [31]. This interdisciplinary team may include, however, not limited to Physicians, nurses, nurse practitioners, and dieticians. This model of interdisciplinary health care delivery is believed to provide quality care through improved coordination, enhanced consultation, and improved referral processes attributed to the improved understanding and knowledge of available intervention options [32].

Chapter 2: Review of literature

The state of chronic disease

Chronic disease can be defined as a progressive non-communicable disease that has long lasting adverse effects [33]. Such diseases can include coronary heart disease, diabetes, asthma, hypertension, glaucoma and cancer. In fact, of the 57 million deaths reported globally, chronic disease is responsible for approximately 63%, or more than 36 million deaths [34]. Moreover, 31 million of those deaths are attributed to cardiovascular disease, diabetes, chronic respiratory disease, and cancer [34]. The World Health Organization expects a 15% global increase in deaths due to chronic disease from 2010 to 2020 [34].

In Canada, these same chronic disease issues are evident. For example, chronic disease conditions accounted for approximately 65% of the country's deaths in 2008 [35] and this number is predicted to increase over the next decade [33]. Cancer and cardiovascular disease are identified as the two leading chronic disease conditions in Canada and accounted for approximately 51% of total reported deaths in 2008 [35].

In 2010/2011, 417,000 Manitobans over the age of 20 received medical care for one or more chronic disease conditions such as cancer, asthma, coronary heart disease, stroke and diabetes [7]. This represents approximately 46% of the population in Manitoba. Based on Manitoba's vital statistics report, cardiovascular disease, diabetes and cancer accounted for almost 60% of the recorded causes of death in 2011 [36]. Furthermore, the 2003 Canadian Community Health Survey estimated that 760,000 residents in Manitoba have at least one risk factor for chronic disease, which represents approximately 63% of the population [37]. Importantly, 40% of all chronic disease conditions may be preventable by reducing the effect of known major risk factors such as physical inactivity [38].

The impact of physical inactivity

Physical inactivity is the fourth leading cause of death contributing to over 5.3 million deaths per year [33], and is recognized as a global health issue [33, 39, 40]. Moreover, physical inactivity is a major modifiable risk factor for over 17 chronic disease states [41]. In fact, Lee *et al.* [40] (2012) provided data indicating that 6% of coronary heart disease, 7% of type 2 diabetes, 10% of breast cancer, and 10% of colon cancer can be attributed directly to physical inactivity [40]. In addition to coronary heart disease; diabetes, colon and breast cancer; hypertension, stroke, and osteoporosis have also been directly attributed to physical inactivity [42, 43]. Astoundingly, it has been suggested that if a 25% reduction of the world's physical inactivity were to occur, over 1.3 million deaths per year could be averted [40].

The Canadian Fitness and Lifestyle Research Institute estimate that approximately 80% of Canadians believe physical activity has many health benefits [44]; however, according to the Canadian Health Measures Survey from 2009 only about 15% of Canadian adults accumulate 150 minutes of moderate to vigorous physical activity (MVPA) per week, as recommended by the CPAG [19, 45]. Moreover, only 5% of the population meets these guidelines on a regular basis (i.e. 150 minutes of physical activity weekly or 30 minutes a day 5 days per week) [19]. The economic burden of physical inactivity on the Canadian health care system is estimated at $6.8 billion dollars (i.e.

direct and indirect costs), which represents 3.7% of total health care dollars spent in 2009 [46].

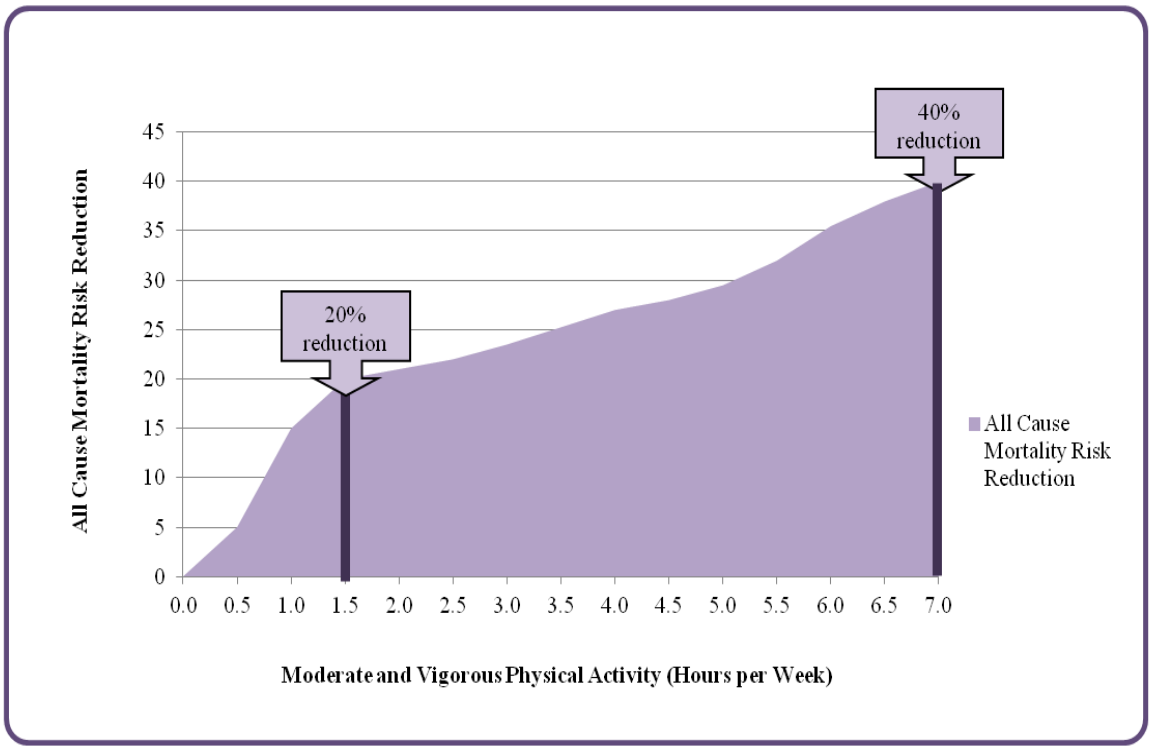
Current Canadian physical activity guidelines

The current Canadian physical activity guidelines (CPAG) [15] are evidence-based and provide suggested amounts of physical activity that will contribute to improve or maintain evidence-based health benefits [47]. The current guidelines describe the type and amount of physical activity that offer increased health benefits for the Canadian population which include children, youth, adults and older adults [45]. These guidelines reflect current literature and are in line with guidelines used in other countries (i.e. Australia, United States of America) [15, 48, 49]. The CPAG specifically calls to attention the duration and intensity of physical activity and are specific to children (5-11 years of age), youth (12-17 years of age), adults (18-64 years of age), and older adults (64 years of age and older). The ENCOURAGE project primarily focuses on adult and older adult populations, therefore, only these physical activity guidelines will be addressed in this section. The duration of physical activity that the CPAG recommends is 150 minutes of moderate to vigorous aerobic physical activity per week [15]. The intent of the guidelines is to encourage individuals to be active in bouts of 10 minutes or more to achieve evidence-based health benefits [45, 50, 51]. The intensity of physical activity is another important attribute addressed within the CPAG and the requirement to engage in moderate to vigorous intensity aerobic activity is encouraged in order to achieve health benefits [15, 43]. For example, Slordohl *et al.* [52] demonstrated that moderate and vigorous intensity physical activity improved cardiovascular fitness levels more than lower intensity physical activity [52]. The CPAG also suggest that exercises to strengthen major muscles of the body and strengthen bones should accompany the recommended aerobic activity to add further health benefits. For example, the literature indicates that exercises that strengthen muscles and bones can reduce the risk and reverse the process of osteoporosis [47]. Furthermore, high levels of musculoskeletal fitness are associated with positive health outcomes (i.e. functional independence, improved mobility, psychological well-being, and improvements in quality of life) compared to lower levels of musculoskeletal fitness [47, 53]. These guidelines represent the minimum amount of physical activity needed to gain measurable health benefits. Therefore, individuals are encouraged to engage in the described modes and intensity of physical activities for a longer period than the guidelines recommend optimizing health benefits [15].

Benefits of physical activity

Physical activity has considerable proven health benefits [47, 50]. In fact, it is estimated that an inactive person who becomes active can reduce the risk of heart attack by 35% to 55% [54]. Interestingly, coronary heart disease was the first chronic disease condition to be directly associated with physical activity [55]. Furthermore, inactive healthy men and women who increase their energy expenditure through physical activity by 1000 Kcal per week were found to have an all-cause mortality risk reduction up to 30% [50]. Health benefits may begin as early as the first 15 minutes of exercise [39]. In fact, Wen *et al.* [39, 56] investigated the minimum amount of physical activity needed to reduce the risk of all-cause mortality. They concluded that 15 minutes a day or 90 minutes per week of moderate intensity physical activity would reduce all-cause mortality by 14% for physically inactive individuals who become physically active [39, 56]. Moreover, a further 4% decrease occurs with every additional 15 minutes a day (up to 100 minutes a day) a person is physically active [39, 56]. Likewise, the Physical Activity Guidelines Advisory Committee report from 2008 indicates that 90 minutes of moderate and vigorous physical activity per week can reduce all-cause mortality by 20% when compared to individuals who do not engage in moderate or vigorous physical activity (Figure 1) [57]. A continued reduction in all-cause mortality of an additional 20% is evident with a further accumulation of 5.5 hours of physical activity per week [57].

Figure 1: The benefits of physical activity on all-cause mortality risk.



Adapted from the Physical Activity Guidelines Advisory Committee report from 2008 [57].

Cardiovascular disease, which is responsible for approximately 32% of deaths in Canada, is significantly impacted by physical activity [58]. In fact, physical activity can reduce the risk of cardiovascular disease by at least 33% and as high as 50% when compared to physically inactive individuals [51]. Stroke and hypertension are also influenced by increases in physical activity as represented by a 31% and 33% risk reduction, respectively [51].

The prevalence of type 2 diabetes in Canada has risen by almost 70% from 1998 to 2009, with an estimated 2.4 million Canadians living with the disease [59]. Physical activity is both an important preventative and treatment modality for type 2 diabetes [47]. In fact, a review of the evidence supporting Canada's physical activity guidelines stated that all of the studies referring to type 2 diabetes revealed an inverse relationship between the increasing levels of physical activity and the prevalence of type 2 diabetes at a population level [47]. Moreover, individuals with higher levels of physical activity (i.e. >2000 Kcals/week) had up to a 44% risk reduction of type 2 diabetes compared to their least active peers [47]. Persons living with type 2 diabetes can also benefit from physical activity. In fact, a person with type 2 diabetes that is moderately active has a 44% lower mortality rate than an inactive person living with diabetes [60].

Colon cancer and breast cancer have been closely associated with physical activity regarding risk reduction of disease [61]. In fact, physically active individuals have a 30-40% risk reduction of colon cancer compared with inactive peers and physically active women have a 20-60% risk reduction of breast cancer [47, 62]. Epidemiological studies have shown that moderate intensity activity has a higher degree of protective abilities compared with less intense physical activity [51, 63].

Chronic disease care model

The burden of global disease has shifted away from communicable diseases toward those of chronic conditions and health care systems have not evolved as quickly to meet this emerging demand [64]. In fact, the World Health Organization has reported that care is fragmented, focused on acute and emergent symptoms, and often provided without the patient's complete medical information [64].

Addressing chronic disease care needs require suitable infrastructure and healthcare support systems. The MacColl Institute for Healthcare Innovation [65] has proposed a comprehensive Chronic Care Model to address the growing concern of chronic disease management [66]. This conceptual model focuses on the development and utilization of interdisciplinary health care teams with a patient centered focus and provides a flexible yet comprehensive framework as a base for redesigning existing health systems to meet current health care demands [67]. In 2000, British Columbia adopted the Chronic Care Model and adapted the model to fit the expanding role of government and community within the Canadian healthcare system [66]. The recently developed model is named "The Expanded Chronic Care Model" (ECCM) [66, 68]. This model better integrated community based health promotion with primary care prevention efforts in order to address chronic disease concerns amongst the population [68]. Ontario, Saskatchewan and Alberta have since developed variations of the ECCM to effectively manage their own health care infrastructures [66].

Chronic care models offer systemic solutions to manage chronic disease issues ranging from current primary health care practices to population health promotion [68]. This involves many aspects of the health care system such as integrated information systems, research initiatives, patient self-management initiatives, health care funding, quality control, and policy development [69]. The constructs used in the original Chronic Care Model include health system-organization of health care, self-management support, delivery system design, decision support, clinical information systems, and community resources and policies [67, 70]. However, this model was difficult for healthcare teams to utilize as it focused on clinical based systems and operations without including design features to facilitate chronic disease education or prevention [68].

The ECCM as presented by Barr *et al.* [68] (Figure 2) focused on the addition of constructs to the previous model by Wagner *et al.* [70], to address population health promotion and prevention within Canadian communities. The ECCM consists of similar constructs to the previous model by Wagner *et al.* [70]; however, a more detailed community focus, consistent with the Ottawa Charter for Health Promotion, was proposed [71]. The constructs specific to this model include; self-management/develop personal skills, decision support, delivery system design/re-orient health services, information systems, build healthy public policy, create supportive environments, and strengthen community actions. Table 1 compares the concepts from the original Chronic Care Model developed by Wagner *et al.* [70] and the strategically adapted version developed by Barr *et al.*[68]. The development of the ENCOURAGE intervention has utilized many of the constructs presented within the Expanded Chronic Care Model [68].

Figure 2: The Expanded Chronic Care Model. This model was utilized to guide the development of the ENCOURAGE Project. Adapted from Barr *et al.* [68].

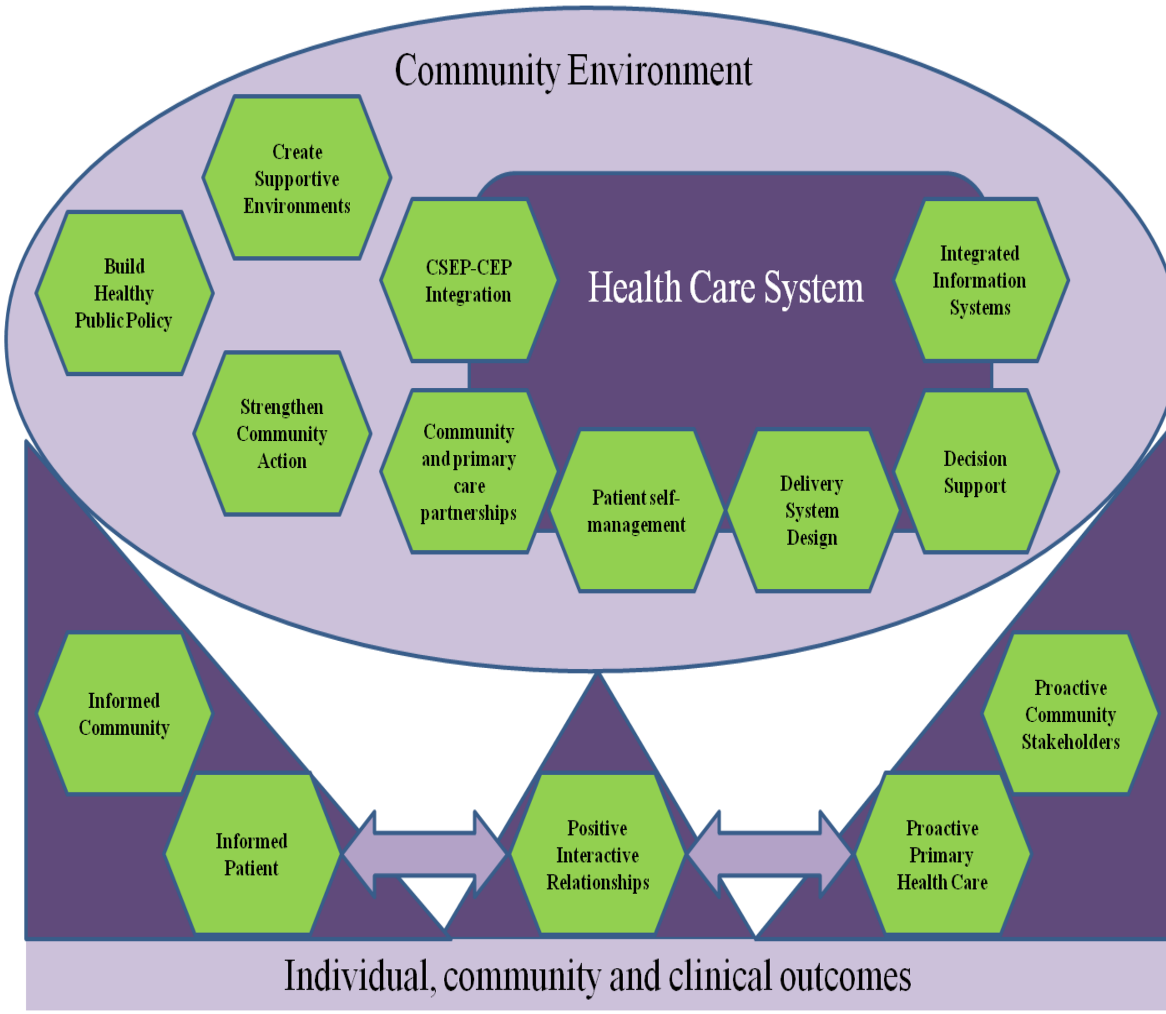


Table 1: ***Chronic Care Model Comparisons***

Major Concepts	Chronic Care Model (CCM)	Expanded Chronic Care Model (ECCM)
Self-management support	Patients have a central role in managing their own care	Patients have a central role in managing their own care
		Support patients with self-management skills to cope with disease
		Enhancing skills to develop personal health and wellness
Decision support	Using evidenced based guidelines to direct clinical practice	Using evidenced based guidelines to direct clinical practice
		Integrate community based strategies to stay healthy in addition to evidence based guideline directives
Delivery system design	Reliance on multi-disciplinary health care teams within clinics to support chronic care	Reliance on multi-disciplinary health care teams within clinics to support chronic care
		Expand the support of individuals and communities outside of the clinic environment
Information systems	Providing relevant and accurate patient data	Providing relevant and accurate patient data
		Include community data in addition to health care information
Community resources and policies	Developing community partnerships that support and meet patient needs	Developing community partnerships that support and meet patient needs
Build healthy public policy		Develop and implement population health policies
Create supportive environments		Generating safe and satisfying living and employment conditions
Strengthen community action		Enhance the health of communities through priority and goal setting initiatives

Innovative physical activity counseling in primary care

Several organizations such as the World Health Organization, United States Preventative Services Task Force, and the Canadian Task Force on Preventative Health Care support the improvement of the current healthcare system by encouraging people to become more physically active by supporting a variety of approaches to physical activity counseling in primary care [72-75]. Several counseling protocols used within the primary healthcare environment to help manage the health of individuals are discussed in the following subsections [76-78].

PACE Canada

Physician-Based Assessment and Counseling for Exercise (PACE) Canada, which was developed by the Canadian Fitness and Lifestyle Research Institute, provides a comprehensive guide to counseling designed to help primary health care providers assist their patients to adopt a more physically active lifestyle and to improve dietary behavior [78]. PACE Canada was adapted from the Unites States version taking into consideration the cultural and demographic differences that exist within Canada [78]. Research has supported the contribution of PACE to primary care counseling as it offers options for medical professionals within those environments to effectively counsel their patients [79, 80]. PACE Canada addresses multiple barriers that healthcare providers face (i.e. lack of time, lack of knowledge about counseling on physical activity, and inability to motivate patients to change behaviors), when counseling patients [81-84]. For example, PACE Canada has addressed the time it takes to counsel patients on physical activity. The current program requires only two to five minutes of providers' time to counsel their patient and focuses on familiar and safe moderate intensity physical activities [78]. Research has supported the two to five minute physician counseling session by facilitating increases in physical activity amongst their study participants [80, 85]. PACE also provides online education for medical professionals, counseling materials for patient distribution and other tools to support the medical professional in effective patient counseling [78]. PACE Canada is a suggested resource for healthcare providers within primary care, as indicated by the College of Family Physicians of Canada [78]. The PACE protocol has demonstrated that a positive relationship exists between physical activity counseling by physicians and changes in physical activity levels and therefore is a valid tool to use within primary care [85]. In fact, Calfas *et al* [85] demonstrated that a brief two to five minutes counseling session can improve time spent walking (increases of 37 minutes/week) amongst intervention participants when compared to control.

The 5 A's

The 5 A's are another technique adopted within the primary health care environment to help change health behaviors [76, 86, 87]. Used primarily to address health risk behavior, the 5 A's consist of the following counseling elements [87]:

1. *assess* the patient's level of behavior, beliefs and motivation;
2. *advise* the patient based upon personal health risks;
3. *assist* to anticipate barriers and develop a specific action plan;
4. *agree* to collaborate with patients to establish treatment goals and steps on how to achieve those goals; and
5. *arrange* follow-up support for the patient.

Although the use of the 5 A's has been effective in health risk behavior change [88-90] there are still a relatively low number of primary health care providers that are familiar with the strategies [86]. In fact, only 32% of 186 responding physicians in one study said they were generally familiar with the 5 A's protocol to counseling [86]. Still, as acknowledged by the American College of Sports Medicine, the US Preventive Services Task Force, and the Canadian Task Force on Preventive Care [91], the 5 A's behavior change technique is a valuable tool in the arsenal of the primary care physician [90]. The 5 A's is a validated and effective approach for physical activity counseling within primary care [90, 92].

The Transtheoretical Model

The Transtheoretical Model (TTM) of behavior change is well used within the healthcare environment based on its successes as a dynamic and comprehensive tool to help change health risk behaviors, specifically smoking cessation [93-96]. The TTM, developed by James Prochaska [94], has its roots in psychotherapy treating addictive behaviors. It is now offered as a tool used to help understand a person's readiness to start becoming physically active [95]. The premise behind the TTM indicates the self-modification of an existing behavior involves the movement through distinct stages of change [97]. The stage of change construct of the TTM identifies a particular stage that an individual is in and counsels to that stage. Each stage represents a willingness to participate in a certain behavior [94, 96]. The stages are as follows [77, 94]:

a. *Pre-contemplation* is the stage where the individual has no intention to change their behavior within the foreseeable future (6 months);

b. *Contemplation* is the stage where a person has recognized that they have a health problem and are thinking about change, however, have not committed to that behavior change;

c. *Preparation* is the stage when a person is about to take action to change a health behavior in which they are aware. This usually has a time line of one month or less;

d. *Action* is the stage where a person modifies their behavior or environment in order to overcome their negative behavior; and;

e. *Maintenance* is the stage where a person maintains the adopted behavior from the action stage and attempting to avoid relapse of the negative behavior.

These stages are dynamic, as movement through them is fluid and not necessarily in one continuous direction. Other constructs of the TTM have received some attention such as process of change, decision balance, and self-efficacy; however stage of change constructs have been the most widely adopted for attempting to change behavior [98]. Furthermore, a systematic review of the evidence suggests that stage-matched interventions appear to be effective in promoting physical activity behavior [98]. The TTM has been validated and supported for exercise behavior change [98].

The Green Prescription

Originating in New Zealand (1997) [99], the green prescription has provided physicians with a tool to alter physically inactive lifestyles of their patients. The green prescription is a written document, mimicking a pharmaceutical prescription, suggesting that the patient begin to accumulate specific amounts of physical activity based on nationally adopted physical activity guidelines [100]. Use of the green prescription indicates that the physician supports the importance of exercise and equates it with a form of medication in order to promote the health of the patient [101]. Physicians in these research studies have been very responsive to the green prescription process. In fact, many physicians believe it to be beneficial and achievable within general practice [102]. The green prescription; however, has not been implemented very often within primary care practice. In fact, a recent study looking at patient perceptions about physician led physical activity counseling stated they only received written exercise prescriptions 4% of the time [103]. Although several research studies have successfully utilized the green prescriptions for healthy and unhealthy populations within primary care [99-101, 104], there remains room to improve this process within the clinical setting.

Limitations of current counseling practices in primary care

Physical activity counseling practices in primary care have proven to be successful at changing patient health behaviors [105-108]. Despite the benefits of changing behaviors described in the literature, there are still barriers in place that limit physical activity counseling within primary care. Many of the barriers described by physicians include lack of time, more important health issues at hand, lack of knowledge of behavior change strategies and physical activity prescription, lack of success in changing patient behaviour, and the healthcare providers' personal health behaviors [83, 84, 109, 110]. As a result, physical activity counseling remains a low priority within the primary care environment [83]. The following sections will discuss some of these issues in more detail.

Limited time to counsel patients about physical activity and preventative strategies in general was cited as the most frequent barrier by physicians [83, 84, 111]. In fact, almost 50% of 96 respondents in one study reported that time was a limitation to counseling in primary care appointments [111]. Yarnall *et al.* [83] reported that the amount of time required for a primary care physician to provide recommended physical activity counseling was estimated to take approximately 4 minutes [83]. Furthermore, clinicians may only provide this service to selected patients depending on individual circumstances who display specific signs or symptoms. According to the United States Preventive Services Task Force, multiple services are to be offered by physicians in primary care [112]. Estimated appointment duration for non-acute primary care visits have increased from an average of approximately 18 minutes to approximately 20 minutes per visit [81]; however, so have the number of clinical items that are discussed at each visit [113-115]. In fact, physicians report discussing approximately 7 prevention items with patients at each visit in 2005, including cancer, diabetes and hypertension screening [81, 113]. This is compared to 5 items discussed during primary care visits in 1997 [113]. As a result, the amount of time spent on each clinical prevention item has been reduced by about 30 seconds [113]. This evidence certainly validates that lack of time is a barrier that limits physical activity counseling in primary care.

The need to attend to other health concerns was another barrier to physical activity counseling practices by health care providers. In fact, 47% of 96 responding health care providers in one survey stated this as a barrier [111]. Physical activity counseling in 2005, according to Abbo *et al.* [113], was approximately twelfth on a list of specific clinical issues that were addressed within primary care [113] even though it is considered a priority counseling item by the United States Preventative Services Task Force [112]. Medications, blood work, blood pressure and other diagnosis made up the majority of the top 11 clinical items addressed during visits with patients [113]. Even though physical activity counseling is considered a priority item [112] at a practice level, there seem to be more important and prioritized issues for physicians to attend to [82, 83, 113].

Inadequate knowledge in physical activity was also cited as another limitation that physicians have when counseling patients [109]. Bock *et al.* [116] surveyed 260 physicians about physical activity promotion and found that almost 30% of the responding physicians stated they had inadequate knowledge to appropriately counsel a patient about physical activity [116]. Furthermore, approximately 36% of those physicians felt they were ineffective in motivating their patients to increase their physical activity behavior [116]. Moreover, only 5% of 200 responding Canadian physicians considered themselves successful in changing patients' physical activity behavior [117]. This is important because if physicians feel that they have been successful at changing behaviors in patients they are more likely to initiate and continue to counsel patients about physical activity [108]. Bull *et al.* [118] indicated that 91% of 789 physicians felt they could provide basic physical activity counseling; however, only 45% of those physicians felt confident providing specific and more advanced knowledge on physical activity [118]. In a recent paper, Hnatiuk *et al.* [103] discuss the discrepancy between patient reported physical activity counseling and physician reported physical activity counseling attempts. Interestingly, physicians self-reported more counseling attempts than patients reported receiving. In fact, 86% of 48 responding physicians reported providing behavior change counseling to patients while only 58% of the 26 responding patients reported receiving behavior counseling from these same physicians [103]. Additionally, the provision of physical activity information and community resource referrals were only reported by physicians 51% of the time while only 18% of the patients reported receiving this information [103]. Therefore, it appears there is a disconnection between the types of physical activity support reported by physicians and the messages that patients report receiving.

Counseling practices tend to reflect a physician's own personal health habits [119]. Interestingly, Frank *et al.* [120] surveyed 3200 Canadian physicians in 2007/2008 and found that certain health characteristics predicted how a physician will counsel their patients. In fact, data indicate that physicians who were more interested in prevention of disease were more likely to counsel patients than those more interested in treatment [120]. The evidence indicates a strong relationship between the health habits of a physician and the way the physician counsels their patients within primary care [119-122]. As a result, by promoting and supporting physicians to become healthy, healthy habits of their patients may also be improved [120].

Exercise specialists in primary care

Several research studies have successfully utilized an exercise specialist within primary care as part of a physical activity intervention to increase the physical activity levels of patients [11, 12, 110, 123]. For example, a 2006 literature review by Tulloch *et al.* [110] examined physical activity intervention studies to determine if the provider influenced the effectiveness of the intervention for changing physical activity behavior. Physicians, combined health care providers, and exercise specialists were all represented in the literature review. Interestingly, the interventions considered in this paper that utilized exercise specialists had a 100% success rate for increasing physical activity behavior in their study participants over the short term (12-16 weeks). This is compared to 50% for physicians. Furthermore, long-term results remained significant for the exercise specialists as 71% of their patients maintained their physical activity behavior compared to the patients counseled by physicians whose behavior levels remained unchanged at 50% [110]. Moreover, combined health care groups (i.e. physician and one other health care provider) proved to be more beneficial than the physician alone, but neither group was as effective as the exercise specialist in increasing physical activity behavior. Based on this data, the use of an exercise specialist appears to better support changing health behaviors and the adoption of a more active lifestyle amongst patients attending a primary care center.

Halbert *et al.* [124] looked at the impact of an exercise specialist on physical activity accumulation and cardiovascular risk factors in a sedentary adult population 60 years of age and older. The results of the study demonstrated an increase in self-report physical activity for both the control and intervention group. In fact, the control group spent 60 minutes (i.e. 2 days per week x 30 minutes) walking and less than 15 minutes engaged in vigorous exercise compared to the intervention group who reported walking 90 minutes per week (i.e. 3 days per week x 30 minutes) and engaging in 40 minutes of vigorous physical activity [124]. This increase in self-reported physical activity was maintained over a twelve-month follow-up period. A greater increase of 33% was reported from the intervention group compared to the control group [124]. However, objective measures from a smaller sub-group (n=59) did not identify changes between intervention and control groups regarding increases in energy expenditure. This study also demonstrated that the participant's intention to exercise was greater within the intervention group in comparison to the control group. In fact, 68% of the intervention group increased their level of intention compared to 31% of the control group [124]. Based on the data represented in that study, the exercise specialist better supported patients as they increased their physical activity levels and their intention to exercise.

Hardcastle *et al.* [123] utilized an exercise specialist in a study looking at the effectiveness of a primary health care based counseling intervention on physical activity, diet, and coronary heart disease risk factors. The results indicate that the physical activity counseling group was more physically active compared to the control group in total physical activity accumulation. In fact, a 10% increase in self-report total physical activity was reported by the intervention group compared to a decrease of 6% for the control group [123]. Furthermore, the intervention participants who completed three or more sessions with the exercise specialist reported a 25% greater increase of total physical activity accumulation compared to individuals who completed two or less sessions with the exercise specialist [123]. This study further supports the literature in this area by indicating how exercise specialists in primary care can facilitate changes in physical activity behavior [124-126].

A comprehensive research study by Fortier *et al.* [12] incorporated a CSEP-CEP within the primary care environment. Their intervention encouraged physician referrals of patients to the CSEP-CEP for intensive physical activity counseling. Providing behavior counseling, physical activity prescription and education were the primary tasks of the CSEP-CEP as part of their scope of practice (Appendix A). These tasks were to be implemented over six sessions with each intense intervention participant [12]. Results indicate that self-reported physical activity accumulation increased by 47% during the study for the intensive intervention participants compared to a 13% increase amongst the brief counseling group at six and thirteen weeks [12]. This improvement was maintained up to 19 weeks; however, returned to baseline values by 25 weeks. Despite the positive results for the self-report physical activity, objectively measured (accelerometry) physical activity levels did not significantly change in either group from baseline to 25 weeks [12]. Even so, a sub-group analysis of 35 participants was conducted to assess specific physical and metabolic outcomes. Notably, the intense intervention group showed some anthropometric improvements for changes in fat mass and body fat percentage [12]. In fact, the intense intervention group reported a 2.2 % reduction in body fat percentage compared to an increase of 1.4% in the brief intervention group. Similarly, the total fat mass was reduced 1.8 % amongst the intense intervention group, as compared to a 1.3 % increase in fat mass with the brief intervention group [12]. More importantly, this was the first Canadian research study to utilize an interdisciplinary health care team approach that specifically utilized a strategy where physicians could refer patients to a CSEP-CEP [12].

Advancing the evidence

Many physical activity trials within primary care utilize physician-based intervention delivery with some success [105-108]. However, a collaborative approach with interdisciplinary health care teams has been suggested [110, 127]. Moreover, the addition of an exercise specialist onto these interdisciplinary teams has been identified as a potential strategy to help patients change their physical activity behavior [110]. Limitations have indicated that health care providers alone may not have the specialized knowledge or time to counsel patients effectively about physical activity within primary care [110, 128].

The studies described in the previous sections all support the use of inter-disciplinary healthcare teams within primary care. Furthermore, they provide evidence indicating that the knowledge and skill set of an exercise specialist can assist primary healthcare teams to better support the use of physical activity as a health intervention. With the concern of physical inactivity and chronic disease on the rise, it is necessary to pursue innovative strategies to get people moving more. Only one other Canadian study by Fortier *et al* [12] has integrated an exercise specialist into the primary care environment. Therefore, this thesis project will seek to build upon this literature by implementing innovative strategies to better support physical activity as a health intervention within primary care. Moreover, we will utilize the ECCM to help guide the development of novel linkages between primary care and community-based physical activity opportunities.

Therefore, we hypothesize that the ENCOURAGE intervention will increase the accumulation of moderate and vigorous physical activity in 10 minute bouts ($MVPA_{10Mins}$) over four months and will also support the maintenance of $MVPA_{10Mins}$ until the 10 month time point. Additionally, we expect that secondary objective parameters as well as self-report parameters will improve from baseline to 4 months. Furthermore, we would expect this improvement to be maintained until the end of the study.

Chapter 3: Methods

Research methodology

This research project utilized a quasi-experimental design. A quasi-experiment is an empirical study used to estimate the impact of an intervention on the study population [129]. The quasi-experimental research design shares many similarities with true experimental designs. However, the absence of participant randomization, comparison groups, as well as internal validity controls, will exclude cause and effect explanations of this research [130]. Our study specifically used a one-way repeated measure analysis to determine if changes occur in the dependent variable over predetermined time points [130]. In this quasi-experimental design, the assignment of participants was based on specific selection criteria. Although randomized control trials are considered the gold standard in establishing cause and effect [130], there are some situations where it may not be a feasible design. In our research project, the quasi-experimental design was a practical choice, as we were working in a clinical setting within primary care, which would be considered a real world environment [131]. Despite the reduced control of the quasi-experimental design, there are advantages. The greatest advantage of this design is its attention to external validity [132]. External validity reflects how results are generalized into real world settings [130].

Purpose

This project seeks to influence various levels of the healthcare system to more fully support physical activity as a health intervention within the primary care environment using innovative strategies to better support patients to adopt a more physically active lifestyle.

Hypothesis

We hypothesize that:

1. Participants will increase their moderate and vigorous physical activity performed in bouts of ten minutes or more ($MVPA_{10Mins}$) from baseline to four months.
2. Participants will maintain all improvements at six and ten months, as compared to baseline.
3. Participants will improve other objectively measured parameters (i.e. LPA_{10mins}, TPA_{10mins}, $MVPA_{Sporadic}$, $LPA_{Sporadic}$, $TPA_{Sporadic}$, $STEPS_{Light}$, $STEPS_{MVPA}$, and $STEPS_{Total}$) as well as self-reported parameters (i.e. SF-12, PHQ-9, SEE, and stage of change) from baseline to four months.
4. Participants will maintain all improvements at six and ten months, as compared to baseline.

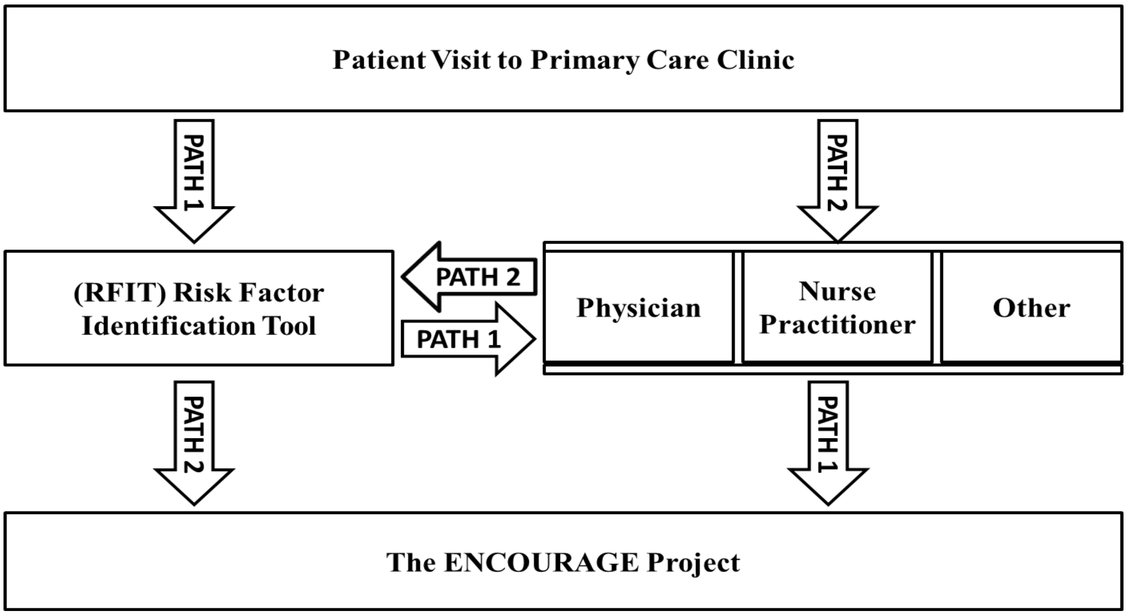
Participants

We screened 237 patients and proceeded to recruit 119 patients attending two primary care sites in Winnipeg in this phase of the ENCOURAGE project. We recruited both male and female patients in the age range of 25 to 75 years who are considered to be physically inactive (i.e. self-reporting they accumulate less than 150 minutes of total MVPA per week). Participants also indicated that they are ready to adopt a more physically active lifestyle. In fact, we accepted patients who identified that they were at least at the contemplative stage according to Prochaska's stage of change theory [94]. We excluded patients who have previously been diagnosed with chronic disease (i.e. cancer, ischemic heart disease, diabetes and osteoporosis) or other conditions (i.e. exercise-induced angina, cardiac arrhythmia) that would have limited their ability to complete the intervention. Patients who were eligible for this project were identified by a computerized Risk Factor Identification Tool (RFIT), which followed a specifically designed algorithm (Appendix B). Each assessment was personalized based on the patient's responses.

The RFIT is a comprehensive computer-based assessment tool designed to assess health risk behaviors, physical activity accumulation, and readiness to change [133]. Patients within the center waiting room completed this evidence-based assessment survey on a touch screen computer. Results were automatically returned to the patient upon completion of the computer survey. The patient then chose to present this information to their physician during their primary care appointment (path 1). In certain situations, the patient would visit their primary care giver before the RFIT is completed. When this occurred (path 2), the patient was required to complete the RFIT immediately after their appointment with results being handed to the health care provider in order to qualify for the research project (Figure 3). The responses provided by the participant are only temporarily stored in the computer memory for generating the summary report. Relevant information presented in this report can provide patients and physicians with information about the patient's risk for chronic disease. Once the report is printed and responses sent to the protected database, all information is eliminated from the local computer hard drive [29]. The RFIT tool has been previously validated for use in primary care as a tool used to collect and convey information about patients' health-related behaviors [133].

After being screened for eligibility and following a physician consultation, the patients who are eligible to participate were referred to the project CSEP-CEP by the primary health care staff. The CSEP-CEP then contacted each patient to ask if there was interest in participating in the research study. If the patient agreed, appointments were then booked with research staff to secure informed consent and entrance into the study.

Figure 3: Recruitment strategy. This flowchart highlights two paths for study participants. Path 1 begins with the RFIT evaluation followed by a health care provider consultation. Path 2 begins with a health care provider consultation followed by an RFIT evaluation. If patients meet selection criteria, they advance to the CSEP-CEP for the ENCOURAGE project. If they do not meet selection criteria, or choose not to participate in the study, they are directed to standard care.



Project sites

The ENCOURAGE project was implemented at two primary care center sites in Winnipeg. The specific sites were ACCESS Transcona and ACCESS River East. These centers were selected because previous collaborative primary care projects have been successful at these locations. Additionally, both Access centers utilized the same electronic medical record system. This did allow communication across both sites for primary care providers as well as the project CSEP-CEP. The site supervisors from each of these locations also expressed interest in becoming part of this research project. ACCESS Transcona is located in the east part of Winnipeg. The adult patient population in this center was approximately 4200 people. ACCESS River East is located in the north east part of Winnipeg. The adult patient population at this center was approximately 7500 people. Both ACCESS centers offer a wide range of programs including primary care, public health, community mental health, community development, home care and other services designed to meet the primary healthcare needs of the local community [134].

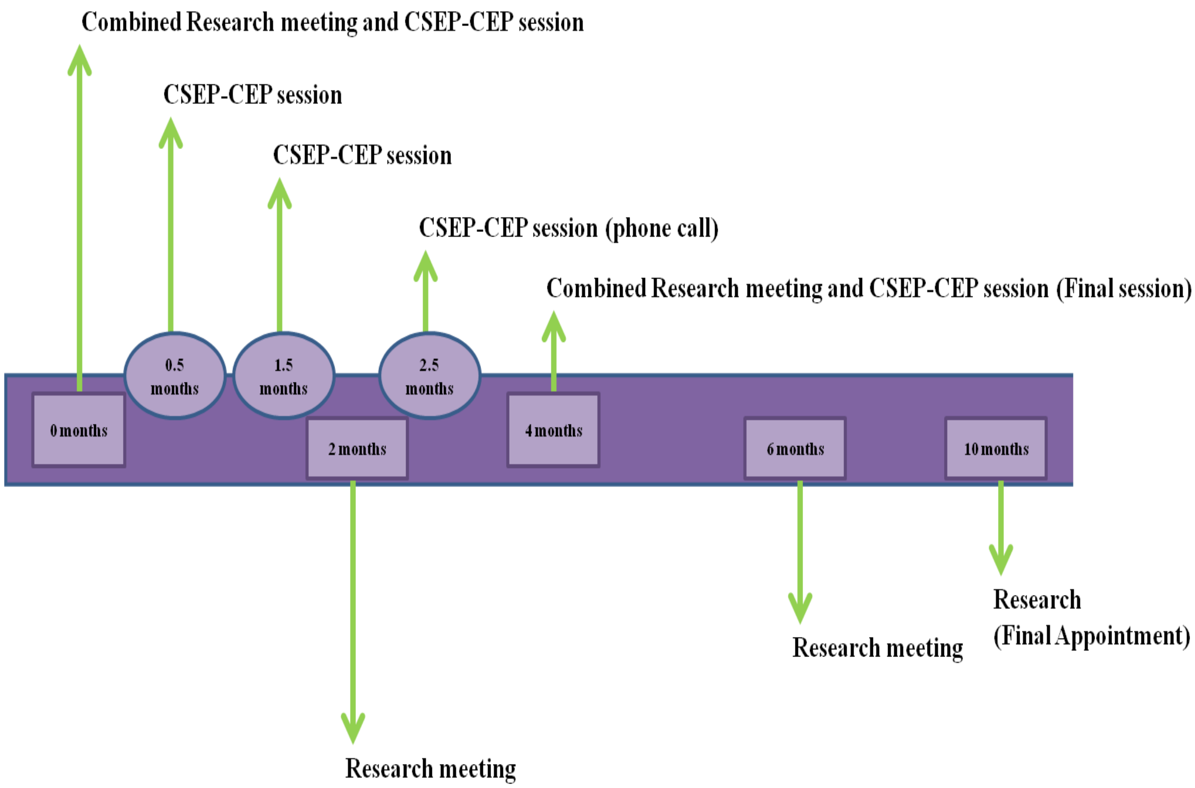
Ethics approval

This study has been approved by three ethics review panels namely the University of Manitoba Education/Nursing Research Ethics Board, the St. Boniface General Hospital Research Review Committee, and the Winnipeg Regional Health Authority Research Review Board.

Data collection

Collection of data took place over five meetings. Each meeting was conducted by one of the research staff and took approximately 30 minutes to complete. However, the initial baseline meetings lasted 60 minutes in order to provide enough time for patients to ask questions about the study and to collect informed consent. The research meetings consisted of completing a variety of questionnaires. Additionally, each patient was given an accelerometer to be worn for seven days. The research meetings took place prior to the intervention (baseline) and again at two, four, six and ten months (Figure 4). This research schedule enabled us to determine if the intervention contributed to a change in outcomes over time. Based on data collected in the Green Prescription study [99], we would expect patients to accumulate 11.3 ± 21.7 minutes (Mean $\pm$ SD) of daily MVPA upon entry into the study (i.e. 79.1 minutes of MVPA per week). Furthermore, we would expect the proposed intervention to increase daily MVPA by an average of 7.8 minutes per day (i.e. an increase of 54.6 minutes per week) above baseline [99]. Based on that information, we determined the sample size required to detect a moderate change in physical activity behavior. A power analysis indicates that with 50 participants we can detect a meaningful difference ($p \leq 0.05$) of approximately 55 minutes of MVPA per week with 80% power [30]. Data was collected from 119 participants. However, only participants who completed the study with three or more data points were included in the final analysis ($n = 56$). A valid accelerometer day is when accelerometer wear time is greater than 8 hours per day. Additionally, the accelerometer needed to be worn for at least 3 days to be considered valid data and used in the analysis [135].

Figure 4: ENCOURAGE project timeline. This timeline represents all research meetings and CSEP-CEP sessions that each participant will complete as outlined within the consent document for the ENCOURAGE project.



Intervention

All patients who volunteered to participate in the study were assigned to the ENCOURAGE intervention. In order to alter patient physical activity behaviors, the ENCOURAGE project was designed to influence multiple levels of the health care system, individuals, and the community. The ECCM (Figure 2) introduced by Barr *et al.* [68] reflects some of the processes that we specifically addressed in order to implement the ENCOURAGE project. Many aspects of this multi-level intervention took into consideration infrastructure and system level changes. A summary explaining some of the ENCOURAGE project approaches is provided within the following sections.

Adding an exercise specialist to the primary care team

The ENCOURAGE project CSEP-CEP is one aspect of the intervention model. The CSEP-CEP brought specialized skills and knowledge to primary care in a supportive role contributing to an interdisciplinary healthcare team (i.e. Physician, nurse practitioner, and dietician). The CSEP-CEP supported and educated the primary care team regarding the link between physical activity and patient care in order to enhance the health care providers' confidence and effectiveness when counseling patients about physical activity. To facilitate this integration process into primary care the CSEP-CEP actively participated in weekly staff meetings with health care providers to develop professional and inter-personal relationships. The CSEP-CEP also shared common office space with other health care professionals in order to help eliminate communication barriers and to further facilitate ongoing professional relationships. The CSEP-CEP's role within the center included the development of linkages between primary care and community-based physical activity providers to increase opportunities for participants to become physically active. Additionally, developing a patient-centered referral processes enabled participants to access community-based physical activity programs and other unstructured physical activity opportunities. This was another innovative function of this intervention facilitated by the project CSEP-CEP.

In order to influence patient physical activity behaviors the CSEP-CEP met with each patient on five occasions over a four-month period. Sessions occurred at baseline (0 months), 0.5 months, 1.5 months, 2.5 months and 4 months (Figure 4). The 2.5-month appointment was a phone call session; all others were face-to-face and lasted approximately 30 to 45 minutes. During each session, the CSEP-CEP provided the participants with the knowledge and skills they needed in order to adopt a more physically active lifestyle (Appendix C). The CSEP-CEP worked to enhance the prescription of physical activity as a health intervention on multiple levels. First, the CSEP-CEP supported and educated participants about the extensive health benefits of physical activity by using a one-on-one counseling approach to help improve the participants' physical activity behavior. Second, the CSEP-CEP provided participants with tailored and practical exercise prescriptions that consider the participants' physical activity interests while taking into consideration specific barriers that have prevented them from being more physically active in the past. Third, the CSEP-CEP taught participants the skills they need to create their own action plan, as they became more physically activity so they would have the skills necessary to sustain healthy physical activity behavior change over time. Finally, by providing the opportunity for participants to access support structures (i.e. group exercise sessions, one-on-one counseling sessions) the CSEP-CEP would be able to influence physical activity behavior change over time.

The CSEP-CEP's time was spent on specific job related functions within the clinics. During the ENCOURAGE project, the CSEP-CEP participated in meetings with clinic and non-clinic staff, interacted with study participants, engaged in meetings with community organizations, and performed many administrative duties (i.e. meeting preparation, developing patient notes, weekly reports, and physical activity inventory creation for the surrounding community). Expected time allocation for job-related functions of the CSEP-CEP, were based on the model created prior to project implementation. These duties are listed in Table 2. These values are listed as percentage of work day completed by the CSEP-CEP.

Table 2: ***Expected time allocation for job-related functions of the CSEP-CEP***

Job function	% of Workday
Interaction with Clinic staff	10
Interaction with Non-clinic staff	10
Interaction with Patients	40
Follow-up and Preparation for Patient Meetings	10
Specialty Program interaction	10
Administrative functions	20
Total	100%

This information is described as percentage of time spent out of 100%. (n = 49 weeks). Interactions with clinic staff include all health care providers and support staff. Interactions with non-clinic staff include Winnipeg *in motion*, City of Winnipeg and many other community partners. Interactions with patients include all study participants as well as other non-study patients. Follow-up and preparation included all material development for meetings and session plans for participants. Specialty program interactions include diabetes program delivery, exercise class delivery and other programs delivered throughout the study on and off site. Administrative functions cover all other areas not mentioned above such as patient session notes, weekly reports, and physical activity inventory development.

Integrated information systems

The ENCOURAGE project has leveraged the existing electronic medical record (EMR) system to better support communication about physical activity and patient care between health care providers at the centers. For example, an electronic referral system was established within the EMR using a process that is similar to the previously implemented system at the center for use by other health care providers. The EMR system also allows the CSEP-CEP to record patient notes and physical activity prescriptions into the EMR so other health care providers can access this information (Appendix D). This approach enables health care providers to read the physical activity prescription and to re-enforce the health behavior recommendation created by the CSEP-CEP.

Community and primary care partnerships

The CSEP-CEP extensively documented community based programming opportunities located within close proximity to the ACCESS centers. These inventories contained information of facility-based physical activities, nature-based physical activities, location, cost, and contact information for the organizations that are involved. This tool supported the increase and effectiveness of physical activity as a health intervention by providing accessible information to health care providers in order to help improve patient physical activity behavior. Notably, the ENCOURAGE project specifically designed and implemented a referral system where the CSEP-CEP referred ACCESS center patients to community-based physical activity programs. This referral system allowed for a tighter connection between primary care and established community-based physical activity service providers. Theoretically, this approach should help support patients to adopt a more physically active lifestyle.

Patient self-management

Self-management is generally described as the ability of a patient to make decisions about their current state of health and to make decisions about the steps needed to improve their health behaviors [136]. Providing education about physical activity and developing patient self-efficacy can create an environment where patients can start to make informed decisions about becoming more physically active in order to help prevent the development of chronic disease [136]. The project CSEP-CEP helped educate study participants about the health benefits of physical activity and taught them how to develop action plans to start and continue being physically active. For example, during scheduled counseling sessions with the CSEP-CEP the current activity levels of participants are assessed. Each person was then taught how to safely monitor the intensity and duration of their physical activity so they are conscious of their physical activity patterns. The participants are also trained on how to recognize physical activity opportunities within the community so they know how to access existing physical activity programs. Furthermore, patients were shown how to recognize potential barriers to physical activity and how to navigate through them in order to remain active. The participants are educated on how to create personal fitness goals and how to develop personal action plans to remain physically active through the provision of tools to track and record daily physical activity. Relapse of physical activity behavior is another issue that patients are counseled for. Occasionally, patients may discontinue their physical activity even though their intentions are to be active. Patients were taught how to recognize these situations and how to adjust goals and make minor alterations to existing patterns of behavior in order to regain their previous physical activity performance. This approach provides participants the tools to begin making informed decisions regarding health behaviors, specifically how physical activity can promote positive health outcomes.

Create supportive environments

Creating individual and social support structures is another important aspect of this intervention. For example, the project CSEP-CEP promoted the ENCOURAGE project within the community by informing local facilities and other stakeholders (i.e. City of Winnipeg, YMCA, Snap Fitness, etc.) of the purpose for the study. This approach can further reduce barriers for the participants by identifying the local facilities who are committed to welcoming the patient and helping them to integrate into this environment, potentially enhancing the patients' participation in physical activity. Group exercise classes were arranged for the study participants not only to provide technical skill development but also to provide the opportunity for developing personal relationships with other study participants. The intention is to facilitate a positive environment in order to support physical activity goals of the participants and to help with their adherence to exercise. Encouraging the use of the "buddy system" also contributes in supporting the study participants. This approach creates links between new participants and more experienced ones to help provide needed support, find others with common interests, and help facilitate changes in physical activity behavior. The project CSEP-CEP provided additional individual support for each patient as they were seeking to adopt a more physically active lifestyle.

Strengthen Community Action

Creating community connections is another important and innovative function of this intervention model. Establishing community support and developing a communication process between primary care and the community is necessary for promotion of health within the local population. One of the strategies developed to facilitate the relationship between the community and primary care was the creation of a "Community Connections" committee. This committee provided opportunities to establish partnerships between community leaders within the physical activity environment and primary care representatives. The main purpose of this group was to establish lines of communication and provide physical activity opportunities for primary care to support health interventions. These community partners currently provide programming within the local neighborhood for healthy populations; however, they currently are not part of an existing primary care referral process. In fact, our intention is to develop this referral process in coordination with primary care and our community partners to include multiple levels of physical activity opportunities appropriate for clinical populations. Specifically, the CSEP-CEP, with the help of these established community partners, developed an extensive document highlighting all community based physical activity opportunities that will be used to help facilitate the physical activity intervention. The city of Winnipeg, local community clubs, community groups, fitness facilities, and local schools offered their locations as resources for primary care to provide opportunities for participants to increase their physical activity. Therefore, these organizations are represented on the Community Connections Committee. Additionally, Winnipeg *in motion* did provide valuable tools, such as information and links to activities and acted as a resource for primary care.

Primary outcomes

The primary outcome for this study is a change in the total accumulation of MVPA performed in bouts of ten minutes or more ($MVPA_{10Mins}$), from baseline to four months assessed using accelerometry. Additional follow-up measures included six and ten month time points. The Actical accelerometer, which was used to objectively measure physical activity, is a small (2.8cm x 2.7cm x 1.0cm) electronic device that senses motion in three directions and is equipped with an internal processor that provides simultaneous step count data [137]. It detects low-frequency gravity-forces (0.5–3 Hz) common to human movement. These values, called counts, are summed over a specified interval, called an epoch [137, 138]. The cut points used in this project to identify physical activity intensities are consistent with those described by Colley *et al.* [19]. Specifically, the cut points used and summarized during 30-second epochs include sedentary activity cut points from 0 to 49.5, light activity cut points from 50 to 767.5, moderate cut points from 768 to 1981, and vigorous cut points are greater than 1981. A variety of parameters describing intensity and duration of activity are generated by the accelerometer (Appendix E). The accelerometer was worn for a period of seven days or more to directly measure the physical activity behavior of each patient at each data collection time point [139]. A valid accelerometer day is when accelerometer wear time is greater than 8 hours per day. Additionally, the accelerometer needed to be worn for at least 3 days to be considered valid data and used in the analysis [135]. This tool has been previously validated [19, 139, 140].

Secondary outcomes

Secondary outcome measures include additional accelerometer data parameters, changes in health behaviors, physical and mental functioning, quality of life, self-efficacy, symptoms of depression, and additional medical chart data. All secondary outcome measures were assessed at each of the research meetings.

Other additional accelerometer data parameters assessed include ten minute bouts of light (LPA_{10Mins}) and total physical activity (TPA_{10Mins}), ten minute bouts of sedentary time (SED_{10Mins}), sporadic MVPA ($MVPA_{Sporadic}$), sporadic light ($LPA_{Sporadic}$) and total physical activity ($TPA_{Sporadic}$), and sporadic sedentary activity ($SED_{Sporadic}$). We also assessed the accumulated step counts for MVPA ($STEPS_{MVPA}$). Other step counts (i.e. light and total steps) were not evaluated due to increased variability for low intensity step counts with the use of the Actical accelerometers [141].

Overall functioning and quality of life of the individual was assessed using the *SF-12v2 questionnaire* [142]. The SF-12v2 is based on the 36-item Short-Form Health Survey (SF-36) [142]. With its 12 questions, it is shorter and more straightforward to complete than the SF-36 [142]. It assesses health related quality of life using eight dimensions such as physical functioning, role physical limitations, bodily pain, general health, vitality, social functioning, role emotional limitations, and mental health. Responses were based on the patient's health over the previous four-week period. The patient responses were graded and scored by an online scoring system [143], with a higher score reflecting a better health related quality of life. Two separate component scores were returned, distinguishing between physical and mental health. The SF-12v2 has been previously validated in determining health related quality of life and overall functioning (Appendix G) [144, 145].

Physical activity self-efficacy, which is defined as a person's perception of how likely that they will successfully incorporate physical activity into their daily routine [146], was assessed using the *Self-Efficacy for Exercise (SEE) survey* [147]. The Self-Efficacy for Exercise (SEE) scale is a revised version of McAuley's self-efficacy barriers to exercise measure [147]. The self-efficacy for exercise scale focuses on self-efficacy expectations and how they relate to the ability of an individual to continue exercising in the face of perceived barriers [147]. Self-efficacy is defined by Bandura [146] as one's belief in their ability to succeed in specific situations [146]. This tool was used to measure the ability of an individual to become and stay physically active. This tool has previously been validated and has been shown to predict physical activity behaviour (Appendix H) [147].

Symptoms of depression were assessed by the *Patient Health Questionnaire-9* question form (PHQ-9). The PHQ-9 is a tool used to screen depression symptoms among individuals. This questionnaire provides patient feedback that is used for diagnosing major depression symptoms as well as selecting and managing potential treatments. The severity score that is derived from the survey returns a potential diagnostic feature which the attending physician can utilize to inform health care decisions. This tool has been previously validated for use in primary care (Appendix I) [148-150].

Patients were asked to complete the *Stages of Change Questionnaire* to determine if the intervention supports changes in attitude and motivation for increasing physical activity behavior [151, 152]. This questionnaire is based on the Transtheoretical model founded by James Prochaska [94]. This model, initially developed for smoking cessation then later adapted to physical activity behavior change, predicts that patients go through five stages of behavior change as they seek to change their physical activity behavior [94]. The stages consist of pre-contemplation, contemplation, preparation, action, and maintenance [94]. This tool has been previously validated for use with physical activity interventions (Appendix J) [153].

Ethical considerations

Informed consent

The informed consent process explained to the participant the nature of the research project, the procedures and expectations of participation, the risks and benefits, acknowledgement of the voluntary participation or withdrawal from the study, the level of confidentiality, risk and benefits of participation as well as the consent statement (Appendix K). The patients were provided an opportunity to discuss the study prior to volunteering to participate. The research staff was available to answer any questions that may arise from this process. Consent forms outlining the trial and all procedures involved and potential risks were given to potential participants. Informed consent was provided in writing from all participants prior to their enrollment in the study. The informed consent form was signed and dated by the participant and the research staff. The signed document was retained in the patient case folder and a copy was provided to the participant upon request.

Standard care

Standard care was available to all patients who do not participate in this research study. Standard care consists of medical and counseling services provided by health care providers at the center.

Risks

The literature suggests that the health benefits of physical activity exceed the potential injury risks of physical activity [154, 155]. In fact, the risk of death during exercise is estimated to range from one per 116,000 exercise hours, to one per 784,000 exercise hours amongst patients with established heart disease [154, 155]. These risks are further reduced by the fact that this project will recruit apparently healthy people who have not been diagnosed with a chronic disease condition. The risk associated with the participation in this study does not exceed the risks a person experiences on a daily basis while they are being physically active.

Benefits

The participants of this research study will benefit from the project as they were provided with specific knowledge and information regarding the amount and intensity of physical activity that they complete in their day-to-day life. This information is not currently available to patients that attend a primary care center. The health status of the participant may or may not be influenced by their participation in the study, as each patient in the study may differ with their participation in physical activity. The Winnipeg Regional Health Authority and the research team may benefit from this study by gaining novel information describing the effectiveness of the physical activity intervention within primary care. This information may then be utilized to direct the development of new programs.

Voluntary participation or withdrawal

The participation of each patient is voluntary. If a person decides not to participate in the study, they were provided the opportunity to ask for educational material about physical activity and other resources regarding physical activity programs within the City of Winnipeg. If a person chooses not to participate in the study, it did not compromise the current care that they are receiving at the primary care center. If a person does agree to participate, they were free to withdraw at any time with no impact to the standard care they are receiving at the primary care center.

Confidentiality

Information gathered as a part of the study may be published or presented in public forums. In accordance to the Personal Health Information Act of Manitoba (PHIA), participant names or any other features that would identify an individual will not be revealed in order to protect the identity of research participants. All participants were assigned a unique identification number for the purpose of this research study to ensure anonymity and confidentiality. Data files were only accessible to the principal investigator and his research staff, and did not contain the patient's name. All data was treated as confidential in accordance with the PHIA. In addition, all research staff have been appropriately trained to handle sensitive personal information in accordance with the PHIA training. Each researcher has signed a pledge of confidentiality before the study was implemented. All information that may reveal personal identifiers (such as name, address or telephone numbers) were removed prior to data analysis, again, in order to protect patient anonymity and confidentiality. Publications will present group results only and will not utilize specific examples of a single participant without removing identifiers prior to publication.

All records were kept in a secured area and only research team members had access to these records. Electronic data files were stored on a password-protected computer in a secure office located at the St. Boniface Research Center. During patient sessions with the project CSEP-CEP, information was recorded in the WRHA's electronic medical record system. This information will become a permanent addition to the patient's medical records. Study participants were asked to provide their consent to do so. This information will be protected as confidential in accordance to the PHIA. All other research data, which is not part of the electronic medical records system, will be kept for a maximum of seven years and then appropriately destroyed.

Statistical analysis

Data was evaluated using several statistical tests. Normality tests (i.e. Shapiro Wilk) were performed for study parameters. Parameters that were not normally distributed were transformed using the natural logarithm method. One way repeated measure ANOVA was employed for this data set to detect a significant change across time. The time points that were used for data collection are 0, 2, 4, 6, and 10 months. If the statistical analysis returns a significant value ($p \leq 0.05$) then we conducted a Newman–Keuls method post hoc analysis to identify where the significant differences between the means exist. Sub-group analyses were completed for several parameters (i.e. BMI, age, sex, site, season, and baseline physical activity) using a two-way ANOVA to detect significant changes across group and time. We conducted a Newman–Keuls method post hoc analysis if significance is detected to identify where the differences exist. T-tests were used for mean comparisons within the data to evaluate potential change of variables. We also used a Cochrane's Q statistical tests to analyze the categorical variables within our data set. Data was presented as mean ± SE or in frequency (%) amongst the group. Objective and self-report data parameters used in the statistical analysis of the ENCOURAGE study were coded with specific identifiers. All identifiers are displayed in Table 3. Only participants who completed the study were included in the statistical analysis.

Table 3: ***Parameters for the ENCOURAGE study***

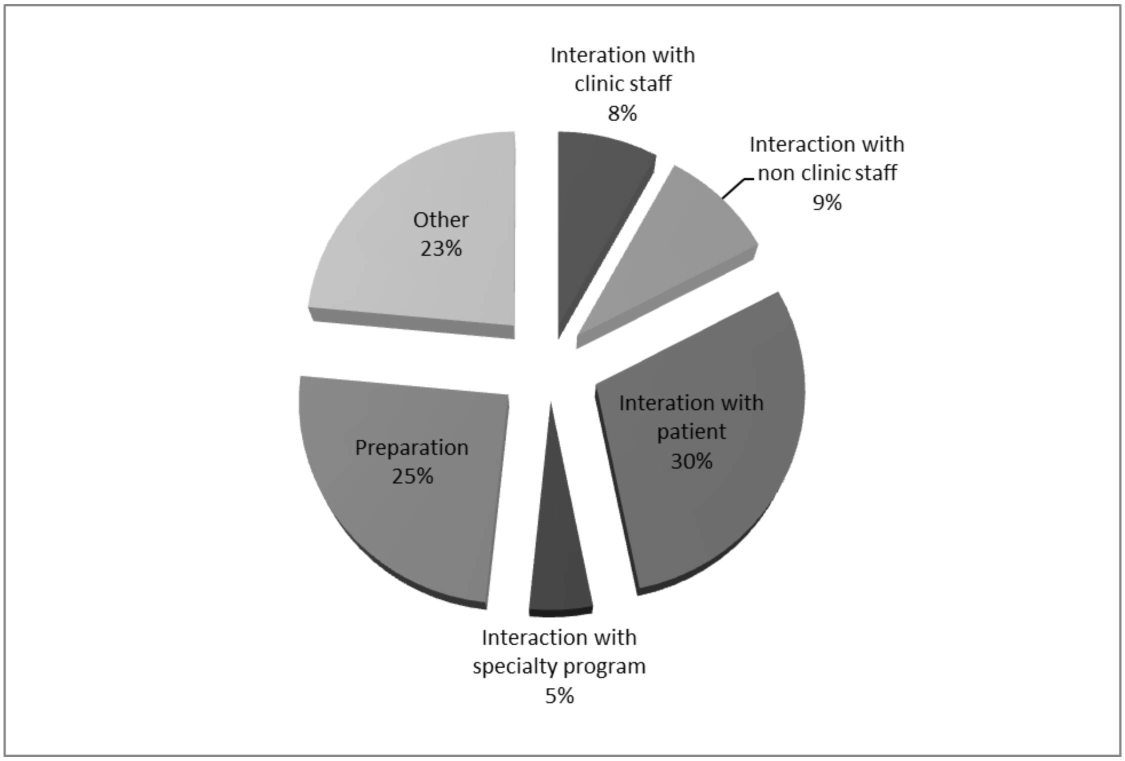
Abbreviated Parameter	Description of parameter
$MVPA_{10Mins}$	Moderate to vigorous physical activity in bouts of 10 minutes or more
$MVPA_{Sporadic}$	Moderate to vigorous physical activity in bouts less than 10 minutes
LPA_{10Mins}	Light physical activity in bouts of 10 minutes or more
$LPA_{Sporadic}$	Light physical activity in bouts less than 10 minutes
TPA_{10Mins}	Total physical activity (light, moderate and vigorous) in bouts of 10 minutes or more
$TPA_{Sporadic}$	Total physical activity (light, moderate and vigorous) in bouts less than 10 minutes
SED_{10Mins}	Sedentary activity in bouts of 10 minutes or more
$SED_{Sporadic}$	Sedentary activity in bouts less than 10 minutes
$STEPS_{MVPA}$	Step counts based on moderate and vigorous intensity
$PHQ\text{-}9_{Total}$	Patient health questionnaire total score
$PHQ\text{-}9_{Cat}$	Patient health questionnaire categorical score (symptoms or no symptoms of depression)
$SF\text{-}12_{Physical}$	Short form 12 health questionnaire physical dimension
$SF\text{-}12_{Mental}$	Short form 12 health questionnaire mental dimension
SEE	Self-efficacy for exercise questionnaire
$TPA_{TertMVPA}$	Total physical activity tertile based on moderate and vigorous PA at baseline
$MVPA_{TertMVPA}$	Moderate and vigorous PA tertile based on moderate and vigorous PA at baseline
$TPA_{TertTPA}$	Total physical activity tertile based on total PA at baseline
$MVPA_{TertTPA}$	Moderate and vigorous physical activity tertile based on total PA at baseline

Chapter 4: Results

The role of the CSEP-CEP within the ENCOURAGE intervention

The CSEP-CEP's role within the clinic was multifaceted (Figure 5). Approximately one third of the CSEP-CEP's time was spent with patients and a further 22% was spent interacting with clinic and non-clinic staff as well as specialty programming (i.e. diabetes and exercise classes). Interactions with clinic staff included all health care providers and support staff. Interactions with non-clinic staff included Winnipeg *in motion*, City of Winnipeg and other community partners. Interactions with specialty programs included diabetes program delivery, exercise class delivery and other programs delivered throughout the study on and off site. Preparation for meetings and program delivery required approximately 25% of the CSEP-CEPs day within the clinics. Follow-up and preparation included all material development for meetings and session plans for participants. The remaining time was spent on various administrative functions necessary for project implementation and delivery on a daily basis (i.e. patient session notes, daily and weekly reports and community physical activity inventories).

Figure 5: Time allocation chart: CSEP-CEP time spent in clinic performing job related functions associated with the ENCOURAGE study. Data described as percent of total time spent in clinic. (n = 49 weeks).



<u>Participant's characteristics</u>

One hundred and nineteen individuals were enrolled from 237 possible patients referred to the project coordinators from two community primary care locations. One hundred and eighteen patients were screened out from the original 237 potential participants for various reasons (i.e. did not meet study requirements, chose not to participate, did not show up for initial meeting with CSEP-CEP, was outside CSEP-CEP scope of practice) leaving 119 participants recruited for the study. Sixty-two participants elected to drop out of the study (Figure 6) leaving 57 participants who completed the study. The majority of the drop outs occurred after the baseline appointment, but before the 2 month appointment (n = 40). The remaining 22 participants withdrew over the remaining course of the study at various time points. Baseline characteristics for participants included in data analysis (*n* = 56) can be viewed in Table 4. The mean age of this study group was 51 ± 1 year with a range of 30 to 72 years. Females represented 70% of the study participants. Mean body mass index (BMI) for the study population was 35.2 ± 0.8 kg/m^2, which is classified as a class II obese population. BMI values for this population ranged between 27.8 kg/m^2 and 48.2 kg/m^2. The number of sessions that study participants (*n* = 56) completed with the CSEP-CEP averaged 4.6 ± 0.1. Fifty two participants completed three or more sessions with the CSEP-CEP representing 91% of the study population. Amongst 52 participants that attended three or more times, 48 of them attended all five meetings with the CSEP-CEP. All study participants had at least one risk factor for chronic disease [34, 156]. Specifically, 96% of the study population was not meeting the CPAG; 96% of the study participants were either overweight or obese; 71% of men were over the age of 45 and 36% of women were over 55 years of age. Furthermore, 88% of the study population had two of the aforementioned risk factors and 34% of the population had three risk factors for chronic disease (Table 4).

Figure 6: ***Participant flow chart for the ENCOURAGE project***

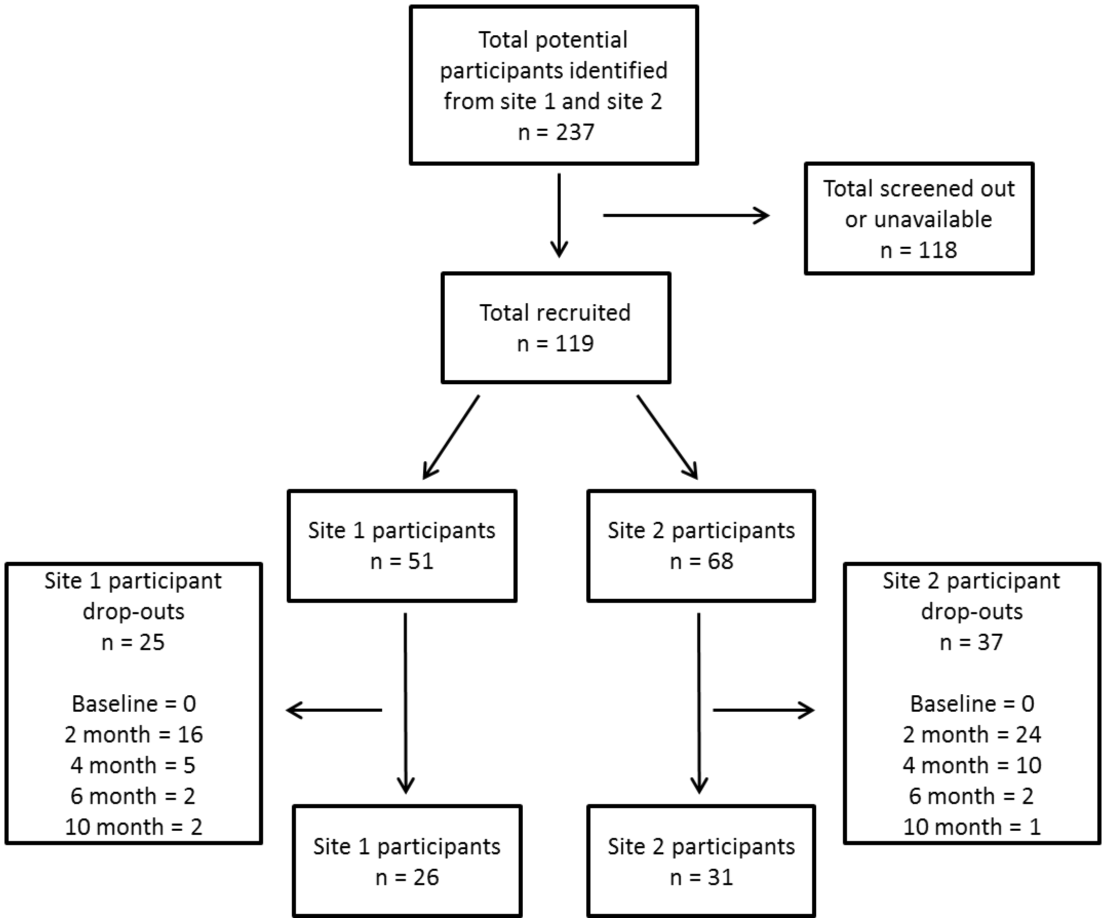


Table 4: ***Baseline participant characteristics, sessions attended, and risk factors.***

Parameter	Parameter description	Participants
Age		
	Years	51 ± 1
Sex		
	Male	17 (30%)
Anthropometric Measures		
	Weight (kg)	98.8 ± 2.6
	Height (m)	1.64 ± 0.03
	BMI (kg/m^2)	35.2 ± 0.8
Number of CSEP-CEP sessions attended (max of 5 sessions)		
	Mean sessions attended	4.6 ± 0.1
	≥ 3 sessions attended	52 (93%)
	All 5 sessions attended	48 (86%)
Chronic disease risk factors		
	Age (male ≥ 45)	12 (71%)
	Age (female ≥ 55)	14 (36%)
	BMI (≥25)	54 (96%)
	Insufficient Physical activity (< 150 MVPA mins/week)**	54 (96%)
Chronic disease risk factor summary for participants		
	Participant with 1 risk factor	56 (100%)
	Participants with 2 risk factors	49 (88%)
	Participants with 3 risk factors	19 (34%)

All patient data collected by research staff at both Access center locations (Transcona and River East). BMI, body mass index. Continuous data are reported as mean ± SE. Categorical data are reported as frequency (% of group) *n* = 56. Data for the listed parameters were collected at baseline research appointment by research. **based on accelerometer data.

Accelerometer physical activity

The primary outcome of the ENCOURAGE project was a change in MVPA in 10 minute bouts from baseline to four months. Additionally, these changes were to be maintained at the six and ten month time points. Physical activity parameters, as assessed by accelerometry, are displayed in Table 5. At baseline, participants completed a mean of 25 ± 6 minutes/week of $MVPA_{10mins}$. However, $MVPA_{10mins}$ did not change over the duration of the project ($p = 0.43$). In fact, average $MVPA_{10Mins}$ at ten months was only 23

± 9 minutes/week. Conversely, a main effect of time ($p<0.05$) was identified for the secondary outcome parameter LPA_{10mins} which significantly increased at 2 months when compared to baseline data (19 ± 4 minutes/week). In fact, participants accumulated 39 ± 11 minutes/week at 2 months, which represents a two-fold increase in LPA_{10mins}. However, by the tenth month LPA_{10mins} was significantly reduced by 48% (20 ± 5 minutes/week) when compared to 2 month data thus returning to baseline values. Other secondary outcome parameters (Table 5) collected in 10-minute bouts (i.e. TPA_{10mins} and SED_{10mins}) did not change over time.

It was important to assess accelerometer wear time and the number of valid days the accelerometer was worn for each of the data collection periods. Our approach required a minimum of 8 hours per day for a minimum of 3 days per data collection period to be considered as valid data for the purpose of this study. The participants wore the accelerometer, on average, 6 ± 2 days at baseline and 2 months; however, the number of days the accelerometers were worn was lower (5 ± 2 days) for the remaining 4, 6, and 10 month follow-up research appointments (Table 5). Wear time of the accelerometers by the participants was, on average, 12 ± 1 hour per day at baseline and remained constant until the end of the study (Table 5).

Table 5: ***Accelerometer data. Accelerometers were used to collect data on the intensity and quantity of physical activity performed by patients in the ENCOURAGE project.***

	Time points				
	Baseline	2 month	4 month	6 month	10 month
Accelerometer validity data					
Valid days worn (days)	6 ± 2	6 ± 2	5 ± 2 [ab]	5 ± 2 [bc]	5 ± 2 [bc]
Wear time (hours/day)	12 ± 1	12 ± 2	12 ± 2	12 ± 2	12 ± 2
Accelerometer 10 minute or longer bouts of activity					
$MVPA_{10mins}$ *(minutes/week)*	25 ± 6	25 ± 9	32 ± 9	36 ± 11	23 ± 9
LPA_{10mins} *(minutes/week)*	19 ± 4	39 ± 11 [a]	25 ± 4	30 ± 6	20 ± 5 [b]
TPA_{10mins} *(minutes/week)*	44 ± 8	65 ± 14	57 ± 11	67 ± 12	43 ± 10
SED_{10mins} *(hours/day)*	6.7 ± 0.2	6.5 ± 0.3	7.2 ± 0.3	6.8 ± 0.3	6.8 ± 0.3
Accelerometer sporadic bouts of activity (minutes/week)					
$MVPA_{Sporadic}$ *(minutes/week)*	144 ± 13	138 ± 15	153 ± 17	165 ± 25	144 ± 18
$LPA_{Sporadic}$ *(minutes/week)*	593 ± 27	621 ± 28	688 ± 29 [a]	728 ± 45 [a b]	685 ± 33 [a]
$TPA_{Sporadic}$ *(minutes/week)*	737 ± 34	759 ± 34	841 ± 35 [a]	893 ± 64 [a]	832 ± 42 [a]
$SED_{Sporadic}$ *(hours/day)*	8.4 ± 0.2	8.1 ± 0.3	9.3 ±0.4 [b]	9.3 ± 0.4 [a b]	9.3 ± 0.3 [a b]
Accelerometer Step data (steps/day)					
$STEPS_{MVPA}$	1898 ± 184	1784 ± 208	1799 ± 222	1731 ± 201	1630 ± 197
Meeting Canada's Physical Activity Guidelines (CPAG; ≥ 150 minutes of MVPA/ week)					
Meeting CPAG ($MVPA_{10mins}$)	2 (4%)	3 (5%)	3 (5%)	3 (5%)	4 (7%)

Data are reported as mean ± SE. *n*=56. $MVPA_{10mins}$, moderate to vigorous physical activity measured in 10 minute bouts; LPA_{10Mins}, light physical activity measured in 10 minute bouts; TPA_{10mins}, total physical activity (i.e. the sum of light, moderate and vigorous physical activity) measured in 10 minute bouts; SED_{10mins}, sedentary activity measured in 10 minute bouts. $MVPA_{Sporadic}$, moderate to vigorous physical activity measured in sporadic bouts; $LPA_{Sporadic}$, light physical activity measured in sporadic bouts; $TPA_{Sporadic}$, total physical activity (i.e. the sum of light, moderate and vigorous physical activity) measured in sporadic bouts; $SED_{Sporadic}$, sedentary time measured in sporadic bouts. $STEPS_{MVPA}$, steps measured in moderate to vigorous intensity Participants were categorized into groups either meeting or not meeting Canada's physical activity guidelines based on accumulating 150 minutes of moderate to vigorous intensity physical activity per week (i.e. percentage of participants meeting guidelines). [a] different from baseline; [b] different from 2 month. [c] different from 4 month ($p<0.05$)

Accelerometer data was also analyzed in sporadic bouts, which was defined as bouts lasting less than 10 minutes. The data for $MVPA_{Sporadic}$ did not change overtime. In fact,

$MVPA_{Sporadic}$ at baseline (144 ± 13 minutes/week) remained unchanged at two, four, six and ten months. However, differences were observed for $LPA_{Sporadic}$, $TPA_{Sporadic}$ and $SED_{Sporadic}$. A main effect of time ($p<0.05$) was observed for $LPA_{Sporadic}$ where increases were identified at four (688 ± 29 minutes/week), six (728 ± 45 minutes/week) and ten months (685 ± 33 minutes/week) when compared to baseline data (593 ± 27 minutes/week). Additionally, a significant ($p<0.05$) increase for $LPA_{Sporadic}$ was observed at six months when compared to 2 month data (621 ± 28 minutes/week). A main effect of time ($p<0.05$) was observed for $TPA_{Sporadic}$, where significant increases were observed at four (841 ± 35 minutes/week), six (893 ± 54 minutes/week), and ten (832 ± 42 minutes/week) months when compared to baseline data (737 ± 34 minutes/week). This level of change represented a ~18% increase above baseline levels. A main effect of time ($p<0.05$) was also observed for $SED_{Sporadic}$ where baseline (8.4 ± 0.2 hours/day) was less than 4 month data (9.3 ± 0.4 hours/day). Additionally, baseline (8.4 ± 0.2 hours/day) and two month data (8.1 ± 0.3 hours/day) was significantly less than six (9.3 ± 0.4 hours/day) and ten month (9.3 ± 0.3 hours/day) mean data. In fact, participants increased their $SED_{Sporadic}$ by ~11% at 4, 6, and 10 months when compared to baseline and two month data.

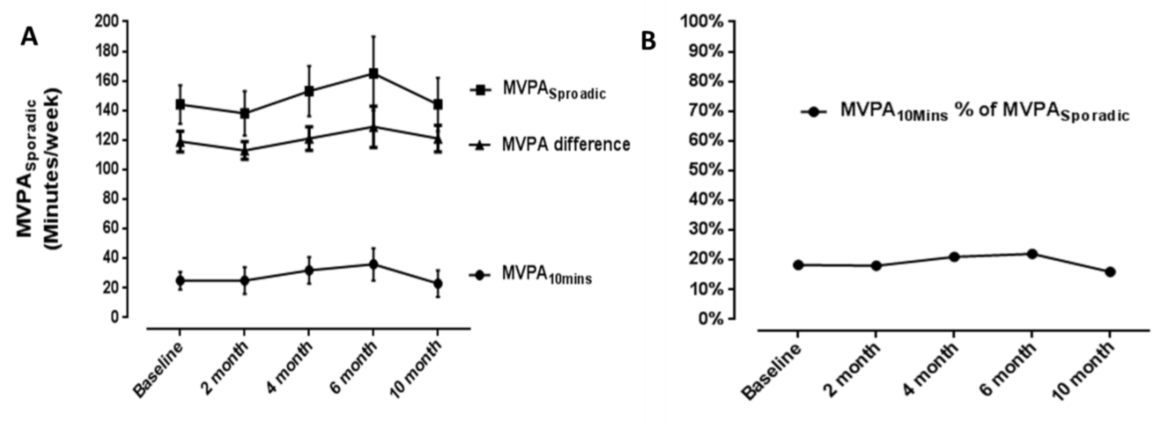
Step data, displayed in Table 5, was analyzed for $STEPS_{MVPA}$. At baseline, study participants accumulated an average of 1898 ± 184 step/day for $STEPS_{MVPA}$; however, this parameter did not change over time. Light intensity step count data was not analyzed because a recent publication did indicate that the Actical accelerometers, which were used in this study, do not accurately capture this type of data [141].

Participants were categorized as either meeting or not meeting the CPAG based on $MVPA_{10mins}$. Two participants (3% of the population) met the CPAG at baseline, as indicated in Table 5. By the second, fourth, and sixth month data collection periods, three participants (5% of the population) were classified as meeting the CPAG. The number of participants meeting the CPAG increased to four participants (7% of the population) by the 10th month.

MVPA accumulation

The accumulation of MVPA in 10 minutes bouts is considered optimal based on research in this area [47]. Our objective data indicates that the participants accumulated both $MVPA_{10Mins}$ and $MVPA_{Sporadic}$ both of which did not change over time. However, we wanted to see the percentage change of $MVPA_{10mins}$ that was accumulated by the participants when compared to $MVPA_{Sporadic}$ accumulation from baseline to 10 months. We took the amount of $MVPA_{10Mins}$ accumulated and divided into $MVPA_{Sporadic}$ accumulated by the participants to derive the percentage value (Figure 7). After the comparison, we did not observe a difference in the percentage accumulation of $MVPA_{10Mins}$ (Figure 7). Participants did not change the % accumulation of $MVPA_{10Mins}$ when compared to $MVPA_{Sporadic}$ over the 10-month study. In fact, at baseline participants accumulated 18% of $MVPA_{Sporadic}$ in $MVPA_{10Mins}$. However, by 10 months $MVPA_{10Mins}$ accumulation was ~16% of $MVPA_{Sporadic}$ accumulation.

Figure 7: Percent accumulation of $MVPA_{10Mins.}$ Values are mean ± standard error, n=56. **Panel A:** Difference between $MVPA_{Sporadic}$ and $MVPA_{10Mins}$. **Panel B:** The percentage of $MVPA_{10Mins}$ accumulated when compared to $MVPA_{Sporadic}$.



Sub-group analyses for accelerometer and participant characteristics

Given the range of participant characteristics in this study population, we performed sub-groups analyses based on BMI classifications (i.e. 4 sub-groups based on overweight, 25 to 29.9 kg/m^2; class I obese, 30 to 34.9 kg/m^2; class II obese, 35 to 39.9 kg/m^2; class III obese, >40 kg/m^2), age (i.e. 3 sub-groups based on young, 29 to 44 years; middle-age, 45 to 55 years; old, > 55 years), sex (i.e. 2 sub-groups based on male and female), site location (i.e. 2 sub-groups based on site 1 and site 2), seasonal shift (i.e. 4 sub-groups based on winter; spring; summer; and fall) and physical activity accumulation at baseline (i.e. 4 subgroups based on $MVPA_{TertTPA}$, $TPA_{TertTPA}$, $MVPA_{TertMVPA}$, and $TPA_{TertMVPA}$). All sub-group data have been displayed in tables located in Appendix L. Only significant results are described below and illustrated in Tables 6 and 7 and Figures 8 to 13.

Sub-group BMI

A sub-analysis based on BMI (overweight, $n = 12$; class I obese, $n = 17$; class II obese, $n = 14$; class III obese, $n = 13$) was conducted to see if different BMI categories responded to the intervention in a different way. No main effects of group were observed. However, BMI did have a main effect of time ($p \leq 0.05$) for $LPA_{Sporadic}$, which indicated a significant increase in total physical activity from baseline (593 ± 97 minutes/week) to 4, 6, and 10 month (Table 6). Furthermore, at six and ten months $LPA_{Sporadic}$ increased to 728 ± 44 minutes/week and 685 ± 33 minutes/week; respectively, reflecting a mean 11% increase when compared to two-month data (621 ± 28 minutes/week). Additionally, a main effect of time ($p \leq 0.05$) for $TPA_{Sporadic}$ was also indicated for BMI where 6 month data was significantly greater than baseline (737 ± 34 minutes/week) and 2 month data (759 ± 34 minutes/week). $SED_{Sporadic}$ also had a main effect of time ($p \leq 0.05$) where 4 and 6 month values are greater than baseline (8.4 ± 0.2 hours/day). Additionally, 4, 6, and 10 month data was greater than 2 month data (8.1 ± 0.3 hours/day) indicating a greater degree of sedentary behavior was being accumulated. There was no interaction indicated between BMI sub-groups for $TPA_{Sporadic}$.

Table 6: BMI sub-group analyses

Sub-Groups	Time points				
	Baseline	2 month	4 month	6 month	10 month
Sub-group based on BMI(kg/m^2)					
$LPA_{Sporadic}$ *(minutes/week)*	593 ± 27	621 ± 28	688 ± 29 [a]	728 ± 45 [a b]	685 ± 33 [a]
Overweight *(n=12)*	566 ± 47	585 ± 44	658 ± 59	699 ± 84	702 ± 80
Class I obese *(n=17)*	544 ± 49	629 ± 54	674 ± 58	751 ± 104	647 ± 70
Class II obese *(n=14)*	723 ± 59	726 ± 69	771 ± 51	803 ± 101	749 ± 51
Class III obese *(n=13)*	543 ± 44	530 ± 40	647 ± 62	644 ± 47	649 ± 66
$TPA_{Sporadic}$ *(minutes/week)*	737 ± 34	759 ± 34	841 ± 35 [a]	836 ± 49 [a]	820 ± 42 [a]
Overweight *(n=12)*	699 ± 50	709 ± 50	822 ± 73	861 ± 106	869 ± 107
Class I obese *(n=17)*	692 ± 67	754 ± 71	825 ± 74	975 ± 172	794 ± 88
Class II obese *(n=14)*	891 ± 77	900 ± 80	928 ± 59	945 ± 107	892 ± 61
Class III obese *(n=13)*	663 ± 49	659 ± 41	786 ± 70	759 ± 58	780 ± 75
$SED_{Sporadic}$ *(hours/day)*	8.4 ± 0.2	8.1 ± 0.3	9.3 ±0.4 [b]	9.3 ± 0.4 [a b]	9.3 ± 0.3 [a b]
Overweight *(n=12)*	7.6 ± 0.4	7.2 ± 0.4	8.2 ± 0.4	8.9 ± 0.8	9.1 ± 0.8
Class I obese *(n=17)*	8.2 ± 0.3	8.3 ± 0.5	9.2 ± 0.6	9.2 ± 0.9	8.6 ± 0.6
Class II obese *(n=14)*	9.0 ± 0.6	8.9 ± 0.6	10.0 ± 1.1	9.3 ± 0.9	9.6 ± 0.4
Class III obese *(n=13)*	8.6 ± 0.5	8.0 ± 0.5	9.8 ± 0.6	9.8 ± 0.5	9.9 ± 0.7

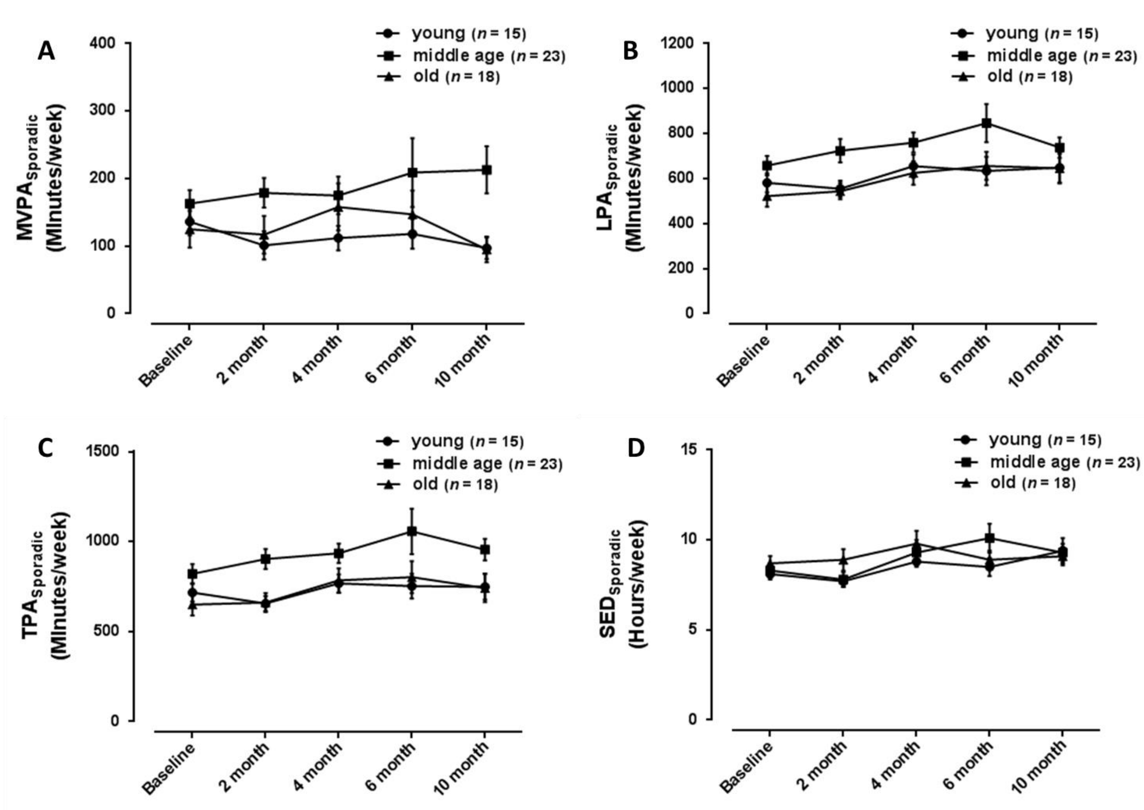
Data are reported as mean ± SE. (Total *n*=56). Two-way ANOVAs were used for sub-group analysis. BMI, body mass index. Overweight, 25 to 29.9kg/m^2; class I obese, 30 to 34.9kg/m^2; class II obese, 35 to 39.9 kg/m^2; class III obese, >40 kg/m^2. [a] different from baseline; [b] different from 2 month. ($p<0.05$)

Sub-group age

A sub-analysis based on age (young, *n = 15;* middle-aged, *n = 22*; old, *n = 19*) was conducted to see if different age categories responded differently to our intervention (Figure 8). A main effect of group ($p<0.05$) was identified for $MVPA_{Sporadic}$ which indicates the middle-aged group (mean 188 ± 31 minutes/week) accumulated more MVPA in sporadic bouts than the younger group (mean 113 ± 19 minutes/week). A main effect of group ($p<0.05$) was also identified for $LPA_{Sporadic}$ where the middle-aged group had a mean light physical activity (745 ± 54 minutes/week) which was greater than both the young (615 ± 52 minutes/week) and old (598 ± 52 minutes/week) groups. Additional group effects ($p<0.05$) were observed for $TPA_{Sporadic}$ between the young group, old group and the middle-aged group. Specifically, the middle-aged sub-group accumulated an average $TPA_{Sporadic}$ of 934 ± 70 minutes/week that was greater than the old sub-group's average of 727 ± 70 minutes/week, equivalent to a 28% difference between these two sub-groups. A significant difference was also observed when comparing the middle-aged group (934 ± 70 minutes/week) to the young group (728 ± 56 minutes/week) for $TPA_{Sporadic}$.

A main effect of time ($p<0.05$) was observed for $LPA_{Sporadic}$ where 4, 6, and 10 month data was significantly greater than baseline data (593 ± 27 minutes/week). Furthermore, 6 and 10 month data indicate an average increase of 17% in $LPA_{Sporadic}$ activity compared to 2 month data (621 ± 28 minutes/week). Additional main effect of time ($p<0.05$) was observed for $TPA_{Sporadic}$, where 10 month data (820 ± 42 minutes/week) was greater than baseline (737 ± 34 minutes/week) and 2 month data (759 ± 34 minutes/week). $SED_{Sporadic}$ also had a main effect of time ($p\leq0.05$) where 6 and 10 month values are greater than baseline (8.4 ± 0.2 hours/day). Additionally, 4, 6, and 10 month data was greater than 2 month data (8.1 ± 0.3 hours/day) indicating a greater degree of sedentary behavior was being accumulated. No interaction effect was detected for $TPA_{Sporadic}$.

Figure 8: Sub-group analysis for age (i.e. young, *n = 15;* middle-aged, *n = 22*; old, *n = 19*). Values are mean ± standard error; n=56. **Panel A:** $MVPA_{Sporadic}$ and age sub-group. Main effect of group ($p<0.05$) was observed where the middle-aged group > young groups. **Panel B:** $LPA_{Sporadic}$ and age sub-groups. A group effect was indicated ($p<0.05$) which identified the middle-aged group > young and old groups. Main effect of time was indicated ($p<0.05$) where baseline < 4, 6, and 10 months. 2 months < 6 and 10 months. **Panel C:** $TPA_{Sporadic}$ and age sub-groups. A group effect was indicated ($p<0.05$) which identified the middle-aged group > young and old group. A main effect of time was also indicated ($p<0.05$) where baseline and 2 months < 10 months. **Panel D:** $SED_{Sporadic}$ had a main effect of time ($p<0.05$) where baseline < 6 and 10 months. 2 months < 4, 6, and 10 months.

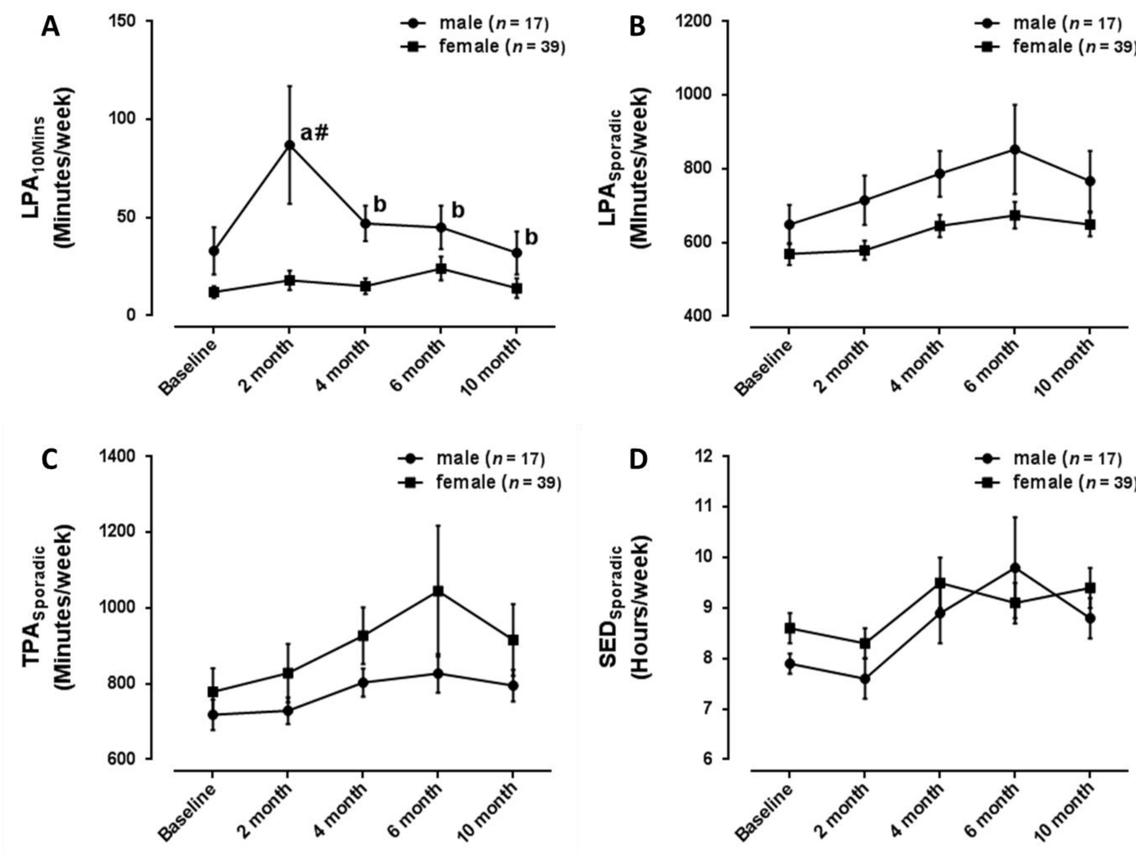


Sub-group sex

A sub-analysis based on sex (male, *n = 17*; female, *n = 39*) was conducted to see if the intervention influenced males and females differently. Significant results are displayed in Figure 9. At baseline for $LPA_{Sporadic}$ activity, males accumulated 649 ± 52 minutes/week and females accumulated 569 ± 30 minutes/week. At baseline for

$TPA_{Sporadic}$, males accumulated 779 ± 62 minutes/week and females accumulated 718 ± 40 minutes/week. Sex sub-groups for $LPA_{Sporadic}$ and $TPA_{Sporadic}$ were not different at baseline. An interaction of group and time ($p<0.05$) was observed for LPA_{10Mins}. Specifically, 2 month data (87 ± 30 minutes/week) was significantly higher when compared to 4, 6, and 10 month data for male group. Furthermore, the male group (87 ± 30 minutes/week) was significantly different that females (18 ± 5 minutes/week) at the 2 month time point (Figure 9). A main effect of group ($p<0.05$) was observed for $LPA_{Sporadic}$ where males (754 ± 77 minutes/week) accumulated more mean light physical activity then females (623 ± 31 minutes/week). A main effect of time was identified for TPA_{10Mins} where 10 month data (43 ± 10 minutes/week) was significantly lower than 2 month (65 ± 14 minutes/week) and 6 month (67 ± 12 minutes/week) values. A main effect of time ($p<0.05$) was observed for $LPA_{Sporadic}$ indicating that 4, 6, and 10 month data was greater than baseline data (593 ± 27 minutes/week). Additional differences were observed indicating an increase in $LPA_{Sporadic}$ activity for 6 month data (728 ± 45 minutes/week) when compared to 2 month data (621 ± 28 minutes/week). A main effect of time ($p<0.05$) was also observed for $TPA_{Sporadic}$ indicating that baseline (737 ± 34 minutes/week) data was significantly lower than 4, 6 and 10 month data. Furthermore, significant increases ($p<0.05$) were also observed at 6 months (836 ± 49 minutes/week) when compared to 2 months (759 ± 34 minutes/week) for $TPA_{Sporadic}$. $SED_{Sporadic}$ also had a main effect of time ($p\leq0.05$) where 4 6 and 10 month values are greater than baseline (8.4 ± 0.2 hours/day) and 2 month data (8.1 ± 0.3 hours/day). There was no interaction detected for sex sub-groups.

Figure 9: Sub-group analysis for sex sub-groups (i.e. male, *n = 17*; female, *n = 39*). Values are mean ± standard error; n=56. **Panel A:** LPA_{10Mins} and sex sub-group. An interaction ($p<0.05$) was identified between time and group. Time effect identified baseline < 2 months for males and 2 month > 4, 6, and 10 data. There was a group effect indicating males at 2 month were different than females at 2 months. **Panel B:** $LPA_{Sporadic}$ and sex sub-group. A main effect of group was indicated ($p<0.05$) where females < males. A main effect of time was also indicated ($p<0.05$) where baseline < 4, 6, and 10 month data. Also, 2 month < 6 month. **Panel C:** A main effect of time for $TPA_{Sporadic}$ was indicated ($p<0.05$) where baseline < 4, 6, and 10 month data. Also, 2 month < 6 month. **Panel D:** A main effect of time was also indicated for $SED_{Sporadic}$ ($p<0.05$) where baseline and 2 months < 4, 6, and 10 month data. [a] different from baseline; [b] different from 2 month, [#] different from female.



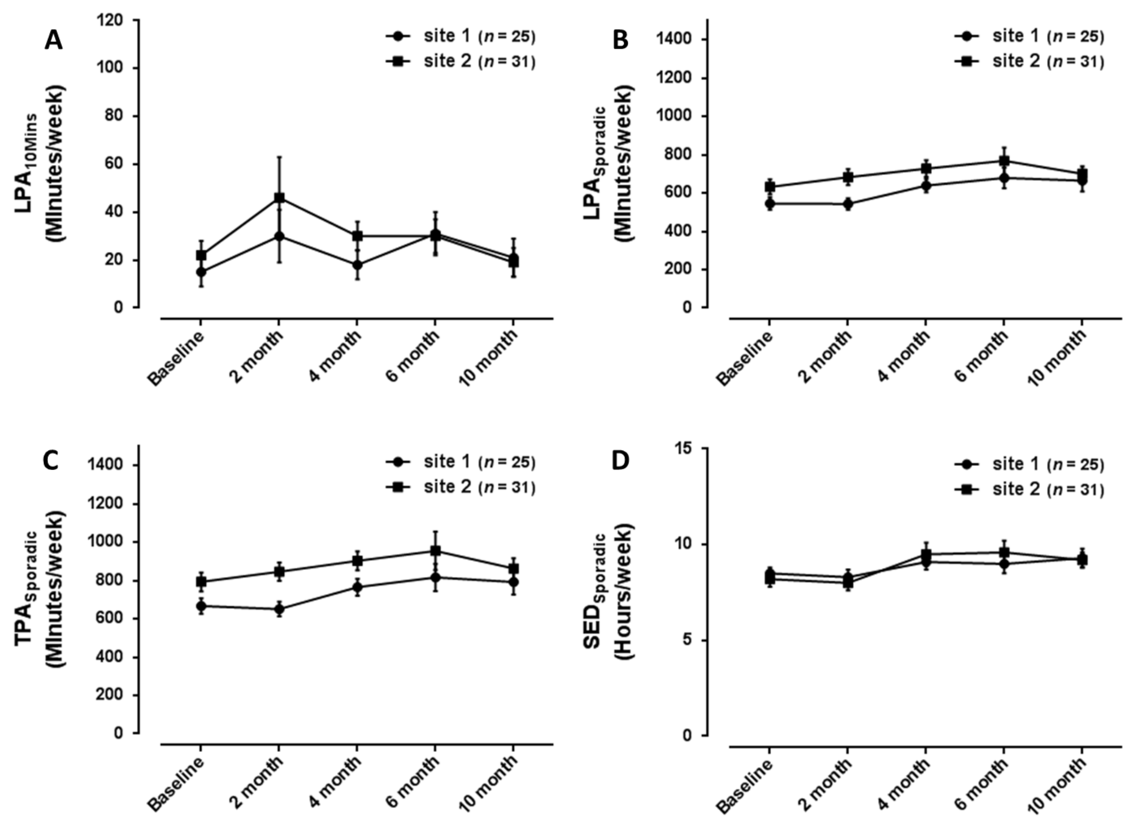
Sub-group site location

A sub-analysis based on site location of the study participants (i.e. site 1, *n = 25;* site 2, *n = 31*) was conducted to see if differences existed between the two sites where the intervention was tested (Figure 10). The site sub-groups for LPA_{10Mins}, $LPA_{Sporadic}$, and $TPA_{Sporadic}$ were not different at baseline. Site 1 participants accumulated 15 ± 6 minutes/week and site 2 participants accumulated 22 ± 6 minutes/week of LPA_{10Mins} at baseline. A main effect of time ($p<0.05$) was observed for LPA_{10Mins} where 2 month values (39 ± 11 minutes/week) were greater than baseline values (19 ± 4 minutes/week). Additionally, 10 month data (20 ± 5 minutes/week) was different than 2 month data (39 ± 11 minutes/week) identifying a decrease in light physical activity performed in 10 minute bouts.

Site 1 participants accumulated 545 ± 33 minutes/week and site 2 participants accumulated 632 ± 40 minutes/week of $LPA_{Sporadic}$ at baseline. Site 1 participants accumulated 667 ± 41 minutes/week and site 2 participants accumulated 793 ± 49 minutes/week of $TPA_{Sporadic}$ at baseline. A main effect of group ($p<0.05$) was indicated for $TPA_{Sporadic}$, where participants from site 2 (mean of 872 ± 60 minutes/week) were significantly more active for $TPA_{Sporadic}$ than participants from site 1 (mean of 738 ± 52 minutes/week). A main effect of time ($p<0.05$) was also observed for $LPA_{Sporadic}$ where 4, 6, and 10 month data was greater than baseline data (593 ± 27 minutes/week). Additional differences were observed indicating an increase in $LPA_{Sporadic}$ activity for 6 month data (728 ± 45 minutes/week) and 10 month data (685 ± 33 minutes/week) when compared to 2 month data (621 ± 28 minutes/week). $TPA_{Sporadic}$ had a main effect of time ($p<0.05$) where 6 month data (836 ± 49 minutes/week) was significantly greater than baseline (737

± 34 minutes/week) and 2 month values (759 ± 34 minutes/week). $SED_{Sporadic}$ also had a main effect of time ($p \leq 0.05$) where 4 and 6 month values are greater than baseline (8.4 ± 0.2 hours/day). Additionally, 4, 6, and 10 month data was greater than 2 month data (8.1 ± 0.3 hours/day) indicating a greater degree of sedentary behavior was being accumulated. There was no interaction identified between these two site sub-groups.

Figure 10: Sub-group analysis for site of intervention (i.e. site 1, *n = 25;* site 2, *n = 31*). Values are mean ± standard error; n=56. **Panel A:** A main effect of time ($p<0.05$) was indicated for LPA_{10Mins} where baseline < 2months. Also 2 months > 10 months. **Panel B:** A main effect of time ($p<0.05$) was indicated for $LPA_{Sporadic}$ where baseline < 4, 6, and 10 months. Additionally 2 months < 6 and 10 months. **Panel C:** A main effect of group was indicated ($p<0.05$) for $TPA_{Sporadic}$ where site 1 < site 2. A main effect of time ($p<0.05$) was indicated for $TPA_{Sporadic}$ where baseline and 2 months < 6 months. **Panel D:** A main effect of time ($p<0.05$) was indicated for $SED_{Sporadic}$ where baseline < 4 and 6 months, 2 months < 4, 6, and 10 months.



Sub-group seasonal shift

A sub-analysis based on seasonal shift (i.e. winter, *n = 10;* spring, *n = 22;* summer, *n = 10;* fall, *n = 14*) was conducted to see if there was a seasonal effect on the intervention results. Significant results are displayed in Table 7. At baseline for $LPA_{Sporadic}$, the winter sub-group accumulated 576 ± 62 minutes/week, the spring sub-group accumulated 572 ± 37 minutes/week, the summer sub-group accumulated 782 ± 69 minutes/week, and the fall group accrued 505 ± 40 minutes/week. Baseline values for $TPA_{Sporadic}$ included the winter sub-group who accumulated 727 ± 63 minutes/week, the spring sub-group who accumulated 720 ± 48 minutes/week, the summer sub-group with an accumulation of 952 ± 95 minutes/week, and the fall group who accrued 616 ± 54 minutes/week. There was no difference at baseline for parameters $LPA_{Sporadic}$ and $TPA_{Sporadic}$. A main effect of time ($p<0.05$) was observed for $LPA_{Sporadic}$ indicating that 4, 6, and 10 month data was greater than baseline data (593 ± 27 minutes/week). Additional differences were observed indicating an increase in $LPA_{Sporadic}$ activity at 6 months (728 ± 45 minutes/week) and 10 months (685 ± 33 minutes/week) when compared to 2 month data (621 ± 28 minutes/week). $TPA_{Sporadic}$ also had a main effect of time ($p<0.05$) where 6 month data (893 ± 64 minutes/week) was significantly greater than baseline (737 ± 34 minutes/week) and 2 month values (759 ± 34 minutes/week). $SED_{Sporadic}$ also had a main effect of time ($p\leq0.05$) where 4 and 6 month values are greater than baseline (8.4 ± 0.2 hours/day). Additionally, 4, 6, and 10 month data was greater than 2 month data (8.1 ± 0.3 hours/day). There were no group or interaction effects for seasonal sub-group data.

Table 7: Seasonal sub-group analyses

Sub-Groups	Time points				
	Baseline	2 month	4 month	6 month	10 month
Sub-group based on Seasonal Shift					
$LPA_{Sporadic}$ *(minutes/week)*	593 ± 27	621 ± 28	688 ± 29 [a]	728 ± 45 [a b]	685 ± 33 [a]
Winter *(n=10)*	576 ± 62	566 ± 52	725 ± 59	686 ± 96	695 ± 88
Spring *(n=22)*	572 ± 37	620 ± 41	683 ± 47	700 ± 80	636 ± 45
Summer *(n=10)*	782 ± 69	820 ± 80	752 ± 79	869 ± 124	709 ± 63
Fall *(n=14)*	505 ± 40	519 ± 37	625 ± 57	701 ± 70	737 ± 87
$TPA_{Sporadic}$ *(minutes/week)*	737 ± 34	759 ± 34	841 ± 35 [a]	836 ± 49 [a]	820 ± 42 [a]
Winter *(n=10)*	727 ± 63	708 ± 68	907 ± 66	826 ± 98	819 ± 91
Spring *(n=22)*	720 ± 48	783 ± 52	855 ± 60	898 ± 131	793 ± 69
Summer *(n=10)*	952 ± 95	969 ± 92	910 ± 88	1025 ± 128	901 ± 67
Fall *(n=14)*	616 ± 54	608 ± 42	722 ± 62	838 ± 106	851 ± 101
$SED_{Sporadic}$ *(hours/day)*	8.4 ± 0.2	8.1 ± 0.3	9.3 ±0.4 [b]	9.3 ± 0.4 [a b]	9.3 ± 0.3 [a b]
Winter *(n=10)*	8.2 ± 0.3	8.3 ± 0.3	9.3 ± 0.6	9.1 ± 0.7	9.1 ± 0.7
Spring *(n=22)*	8.0 ± 0.3	7.8 ± 0.4	9.1 ± 0.5	9.2 ± 0.7	9.4 ± 0.4
Summer *(n=10)*	8.8 ± 0.9	8.1 ± 0.8	9.6 ± 1.4	10.0 ± 1,2	8.9 ± 0.6
Fall *(n=14)*	8.8 ± 0.5	8.6 ± 0.7	9.4 ± 0.7	9.1 ± 0.7	9.5 ± 0.8

Data are reported as mean ± SE. (Total *n*=56). Two-way ANOVAs were used for sub-group analysis. SED, sedentary activity. TPA, total sporadic physical activity. [a] different from baseline; [b] different from 2 month. ($p<0.05$)

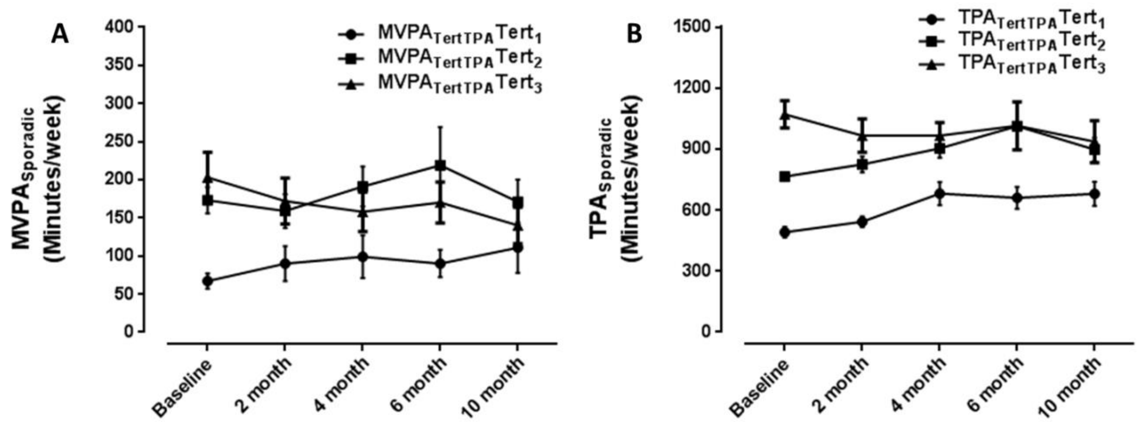
Sub-groups based on baseline physical activity levels

Tertile sub-groups were also analysed. Specifically, four objective data sub-groups (i.e. $MVPA_{TertTPA}$, $TPA_{TertTPA}$, $MVPA_{TertMVPA}$, and $TPA_{TertMVPA}$) were created and each sub-group was separated into three sections (i.e. $Tert_1$, $Tert_2$, $Tert_3$) based on the accumulation of either $TPA_{Sporadic}$ at baseline or $MVPA_{Sporadic}$ at baseline. Additionally, we created three self-report data sub-groups (i.e. SF-$12_{PhysicalTertMVPA}$, PHQ-$9_{TotalTertMVPA}$, and $SEE_{TertMVPA}$) for $MVPA_{Sporadic}$. The purpose of conducting these sub-group analyses was to explore whether there was a difference amongst the sub-groups in the way they responded to the ENCOURAGE intervention over time.

The accumulation of $TPA_{Sporadic}$ at baseline was used to compare the effect of three tertiles. $MVPA_{TertTPA}$ was separated into three tertiles (i.e. $MVPA_{TertTPA}Tert_1 \leq 644.2$, $MVPA_{TertTPA}Tert_2 > 644.2 \leq 878.2$, $MVPA_{TertTPA}Tert_3 > 878.2$). A group main effect ($p<0.05$) was observed (Figure 11). Specifically, $MVPA_{TertTPA}Tert_2$ (183 ± 29 minutes/week) and $MVPA_{TertTPA}Tert_3$ (169 ± 28 minutes/week) were greater than $MVPA_{TertTPA}Tert_1$ (91 ± 22 minutes/week).This identifies that a distinct separation of groups in the accumulation of total physical activity, based on $TPA_{Sporadic}$ existed between sub-groups. However, $MVPA_{TertTPA}$ tertiles did not change over time.

Likewise, when $TPA_{TertTPA}$ was separated into tertiles (i.e. $TPA_{TertTPA}Tert_1 \leq 644.2$, $TPA_{TertTPA}Tert_2 > 644.2 \leq 878.2$, $TPA_{TertTPA}Tert_3 > 878.2$) based on $TPA_{Sporadic}$ baseline activity, a significant change was observed (Figure 11). A main effect of group ($p<0.05$) was indicated where $TPA_{TertTPA}Tert_2$ (880 ± 55 minutes/week) and $TPA_{TertTPA}Tert_3$ (990 ± 87 minutes/week) were greater when compared to $TPA_{TertTPA}Tert_1$ (611 ± 44 minutes/week). A main effect of time was also observed where 6 month data (893 ± 64 minutes/week) was greater than both baseline (737 ± 34 minutes/week) and 2 month data (759 ± 34 minutes/week).

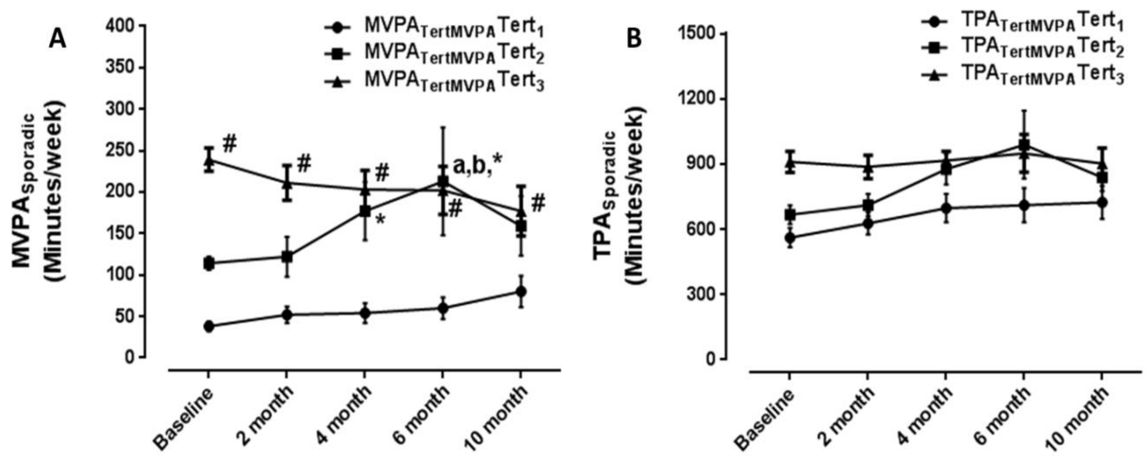
Figure 11: Sub-group analysis for $TPA_{Sproadic}$ tertile. Values are mean ± SE; n=56. (i.e. $Tert_1$, *n = 19;* $Tert_2$, *n = 25;* $Tert_3$, *n = 12*). **Panel A:** A main effect of group ($p<0.05$) was indicated for $MVPA_{TertTPA}$ where $Tert_1$ < $Tert_2$ and $Tert_3$. **Panel B:** A main effect of group ($p<0.05$) was indicated for $TPA_{TertTPA}$ where $Tert_1$ < $Tert_2$ and $Tert_3$. A main effect of time ($p<0.05$) was also indicated for $TPA_{TertTPA}$ where baseline < 6 months. Additionally 2 months < 6 months.



The accumulation of $MVPA_{Sporadic}$ at baseline was used to identify three sub-groups (i.e. $MVPA_{TertMVPA}Tert_1$ ≤76.1, $MVPA_{TertMVPA}Tert_2$ >76.2 ≤176.8, $MVPA_{TertMVPA}Tert_3$ >176.8). An interaction of group and time ($p<0.05$) was identified and illustrated in Figure 12. Specifically, 4 month (177 ± 68 minutes/week) and 6 month (213 ± 128 minutes/week) data for $MVPA_{TertMVPA}Tert_2$ was greater than $MVPA_{TertMVPA}Tert_1$ at the corresponding time point (i.e. 4 month (54 ± 12 minutes/week, 6 month (60 ± 13 minutes/week)). Furthermore, a time effect indicating that 6 month data (213 ± 65 minutes/week) is greater than baseline (114 ± 8 minutes/week) and 2 month data (122 ± 24 minutes/week) for $MVPA_{TertMVPA}Tert_2$ was also identified. Additionally, each time point in $MVPA_{TertMVPA}Tert_3$ (i.e. baseline (239 ± 14 minutes/week), 2 month (211 ± 21 minutes/week), 4 month (203 ± 23 minutes/week), 6 month (202 ± 29 minutes/week), and 10 months (177 ± 30 minutes/week)) was significantly different ($p<0.05$) than the comparable time point in $MVPA_{TertMVPA}Tert_1$ (i.e. baseline (38 ± 6 minutes/week), 2 month (52 ± 10 minutes/week), 4 month (54 ± 12 minutes/week), 6 month (60 ± 13 minutes/week), and 10 months (80 ± 19 minutes/week)).

$TPA_{TertMVPA}$ was also separated into tertiles (i.e. $TPA_{TertMVPA}Tert_1$ ≤76.1, $TPA_{TertMVPA}Tert_2$ >76.2 ≤ 176.8, $TPA_{TertMVPA}Tert_3$ >176.8) based on $MVPA_{Sporadic}$ baseline activity (Figure 12). A main effect of group (p<0.05) was identified where $TPA_{TertMVPA}Tert_2$ (816 ± 77 minutes/week) and $TPA_{TertMVPA}Tert_3$ (913 ± 61 minutes/week) were greater when compared to $TPA_{TertMVPA}Tert_1$ (664 ± 63 minutes/week). A main effect of time was also identified where 6 month data (893 ± 64 minutes/week) was greater than both baseline (737 ± 34 minutes/week) and 2 month data (759 ± 34 minutes/week).

Figure 12: Sub-group analysis for $MVPA_{Sproadic}$ tertile. Values are mean ± SE; n=56. (i.e. $Tert_1$, *n = 16;* $Tert_2$, *n = 17;* $Tert_3$, *n = 23*) **Panel A:** An interaction (p<0.05) was indicated for $MVPA_{TertMVPA}$. A group effect indicating $Tert_1 < Tert_2$ at 4 and 6 months, and $Tert_1 < Tert_3$ at baseline, 2, 4, 6 and 10 months. A time effect was observed indicating $Tert_2$ at 6 months > than $Tert_2$ at baseline and 2 months. **Panel B:** A main effect of group (p<0.05) was indicated for $TPA_{TertMVPA}$ where $Tert_1 < Tert_2$ and $Tert_3$. A main effect of time (p<0.05) was also indicated for $TPA_{TertMVPA}$ where baseline < 6 months. Additionally 2 months < 6 months. [a] different from baseline; [b] different from 2 month, [#] different from $Tert_1$; * different from $Tert_1$ at 4 and 6 months.



Survey data

PHQ-9 survey data was analyzed and displayed in Table 8. At baseline, the mean PHQ-9_{Total} score for participants was 9.0 ± 0.8. A main effect of time (p<0.05) was detected for PHQ-9_{Total}, where baseline data was higher as compared to 2, 4, 6 and 10 month scores. This change represents a 25% improvement in PHQ-9 scores at two months, as compared to baseline. Additionally, these improvements were maintained until the ten month time point. PHQ-9 survey data was categorized into symptoms of depression and displayed in Table 8. PHQ-9_{Cat} identified that 29 participants (48%) displayed symptoms of depression at baseline. A Cochrane's Q analysis was conducted for PHQ-9_{Cat}. A change was detected (p<0.05) indicating fewer participants reported depression symptoms at 2 month (15 participants), 4 month (15 participants), 6 month

(14 participants) and 10 month (12 participants) time points when compared to baseline self-report data (29 participants).

Table 8: Self-report data. Self-Reported symptoms of depression, quality of life and self-efficacy surveys were used to collect participant data. Additional surveys were used to collect stage of change data.

	Time points				
	Baseline	2 month	4 month	6 month	10 month
PHQ-9 score					
$PHQ\text{-}9_{Total}$	9.0 ± 0.8	6.8 ± 0.7 [a]	6.3 ± 0.8 [a]	6.6 ± 0.7 [a]	6.1 ± 0.8 [a]
Symptoms of depression					
$PHQ\text{-}9_{Cat}$	27 (48%)	15 (27%) [a]	15 (27%) [a]	14 (25%) [a]	12 (21%) [a]
Quality of Life/Health Perceptions					
$SF12_{Physical}$	38.0 ± 1.3	42.8 ± 1.3 [a]	41.8 ± 1.4 [a]	42.3 ± 1.5 [a]	44.2 ± 1.2 [a]
$SF12_{Mental}$	45.5 ± 1.5	46.2 ± 1.5	48.5 ± 1.5 [a]	48.5 ± 1.5 [a]	47.9 ± 1.6
Self-efficacy for exercise (range 1-10)					
SEE_{Total}	5.0 ± 0.3	5.6 ± 0.3	5.8 ± 0.3 [a]	5.4 ± 0.3	5.4 ± 0.2
Stage of change for exercise survey					
Action/Maintenance	7 (12%)	31 (55%) [a]	38 (68%) [a]	35 (62%) [a]	32 (57%) [a]

Continuous data are reported as mean ± SE. Categorical data are reported as frequency (%). *n*=56. $PHQ\text{-}9_{Total}$, patient health questionnaire-9 total score; $PHQ\text{-}9_{Cat}$, patient health questionnaire-9 categorical score; $SF12_{Physical}$, short form-12 for physical dimension; $SF12_{Mental}$, short form-12 for mental dimension; SEE_{Total}, self-efficacy for exercise total score; CPAG, Canadian physical activity guidelines. Action/Maintenance; the accumulation of action and maintenance stages of change. [a] different from baseline ($p<0.05$).

Quality of life data was analysed and is displayed in Table 8. Baseline scores for $SF12_{Physical}$ were calculated at 38 ± 1.3. A main effect of time ($p<0.0001$) was observed for $SF12_{Physical}$, where improvements were indicated at two, four, six and ten months in comparison to baseline data. Additionally, $SF12_{Mental}$ parameter was examined and baseline data was observed to be 45.5 ± 1.5. There was a main effect of time ($p<0.05$) detected for 4 and 6 month improvements for $SF12_{Mental}$ when compared to baseline.

Self-efficacy for exercise survey data was analyzed and can be viewed in Table 8. Baseline results for SEE_{Total} were 5.0 ± 0.3. A main effect of time ($p<0.05$) was detected for SEE_{Total}, where four month data was significantly improved when compared to baseline results. In fact, there was a 16% improvement at four months from baseline for SEE_{Total}.

Stage of change survey data, as displayed in Table 8, was grouped into 2 categories namely action/maintenance and no action (data not shown). At baseline the action/maintenance group consisted of 12% or 7 participants, leaving the remaining 88% of participants self-reporting no action. A Cochrane's Q analysis was conducted for stage of change categorical data. A change was detected ($p<0.05$) indicating a significant increase in the number of participants classified as action/maintenance over time when compared to baseline. Specifically the action/maintenance group increased to include 31 participants at 2 months, 38 participants at 4 months, 35 participants at 6 months, and 32 participants at 10 months compared to baseline self-reported data (7 participants).

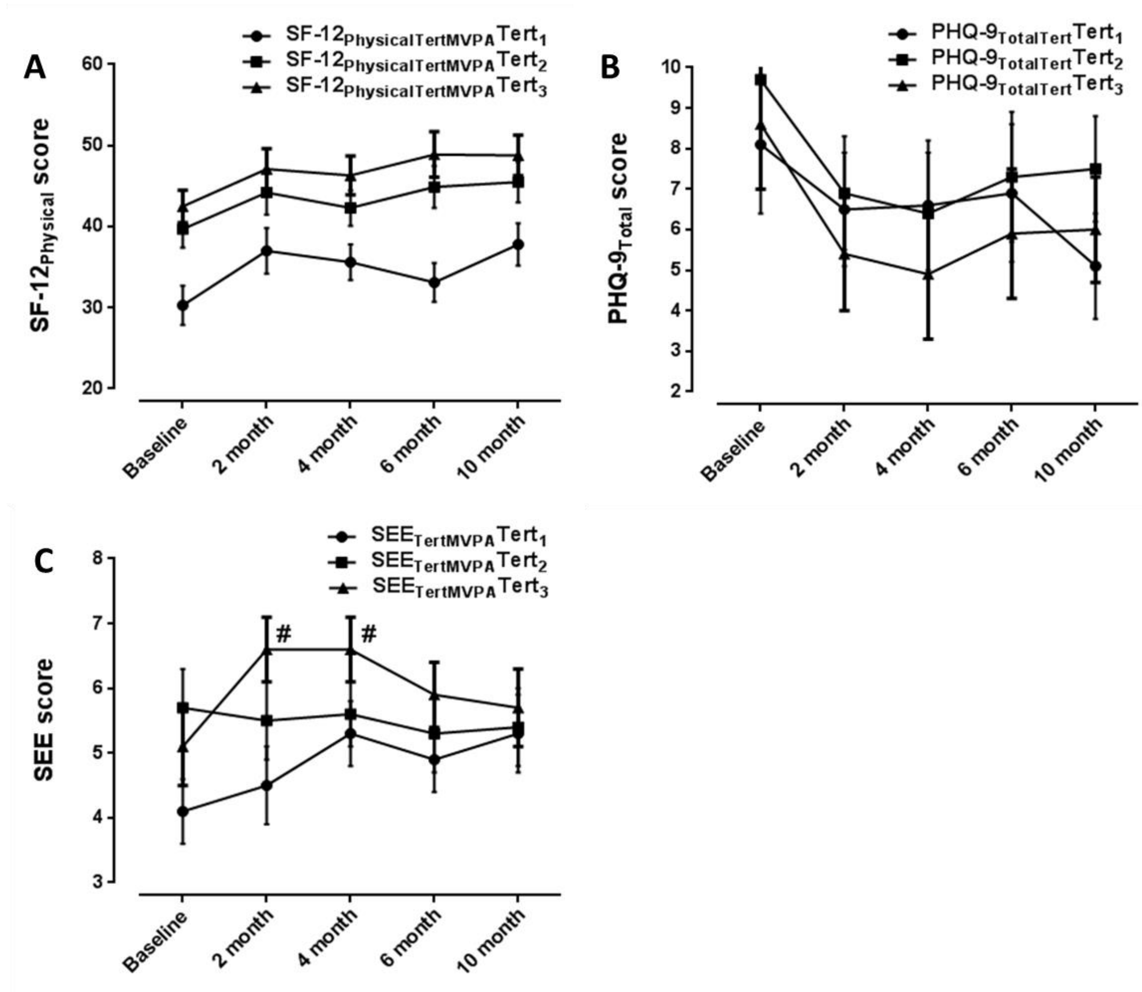
Sub-group analyses for accelerometer and self-report survey data

The accumulation of $MVPA_{Sporadic}$ at baseline was also used to compare the effect of three tertiles for self-report data parameters (i.e. $SF\text{-}12_{Physical}$, $PHQ\text{-}9_{Total}$, and SEE). First, $SF\text{-}12_{PhysicalTertMVPA}$, was separated into tertiles (i.e. $SF\text{-}12_{PhysicalTertMVPA}Tert_1 \leq 76.1$, $SF\text{-}12_{PhysicalTertMVPA}Tert_2 > 76.2 \leq 176.8$, $SF\text{-}12_{PhysicalTertMVPA}Tert_3 > 176.8$). A group effect and time effect ($p<0.05$) was identified and illustrated in Figure 13. Specifically, each time point in SF-$12_{PhysicalTertMVPA}Tert_2$ (i.e. baseline (39.7 ± 2.3), 2 month (44.2 ± 2.7), 4 month (42.3 ± 2.2), 6 month (44.9 ± 2.6), and 10 months (45.5 ± 2.5)) and in SF-$12_{PhysicalTertMVPA}Tert_3$ (i.e. baseline (42.5 ± 2.0), 2 month (47.1 ± 2.5), 4 month (46.3 ± 2.4), 6 month (48.9 ± 2.8), and 10 months (48.8 ± 2.5)) was different than the comparable time points in SF-$12_{PhysicalTertMVPA}Tert_1$ (i.e. baseline (30.3 ± 2.4), 2 month (37.0 ± 2.8), 4 month (35.6 ± 2.2), 6 month (33.1 ± 2.4), and 10 months (37.8 ± 2.6)). Furthermore, a main effect of time was observed indicating that 2, 4, 6, and 10 month data was greater than baseline for all tertiles (i.e. SF-$12_{PhysicalTertMVPA}Tert_1$, SF-$12_{PhysicalTertMVPA}Tert_2$, and SF-$12_{PhysicalTertMVPA}Tert_3$).

Second, PHQ-$9_{TotalTertMVPA}$, was separated into tertiles (i.e. PHQ-$9_{TotalTertMVPA}Tert_1 \leq 76.1$, PHQ-$9_{TotalTertMVPA}Tert_2 > 76.2 \leq 176.8$, PHQ-$9_{TotalTertMVPA}Tert_3 > 176.8$). A main effect of time ($p<0.05$) was identified and illustrated in Figure 13. Specifically, 2, 4, 6, and 10 month data for all three tertiles (i.e. PHQ-$9_{TotalTertMVPA}Tert_1$, PHQ-$9_{TotalTertMVPA}Tert_2$, and PHQ-$9_{TotalTertMVPA}Tert_3$) was less than baseline data for PHQ-$9_{TotalTertMVPA}Tert_1$ (8.1 ± 1.7), PHQ-$9_{TotalTertMVPA}Tert_2$ (9.7 ± 1.6) and PHQ-$9_{TotalTertMVPA}Tert_3$ (8.6 ± 1.6).

Third, $SEE_{TertMVPA}$, was separated into tertiles (i.e. $SEE_{TertMVPA}Tert_1 \leq 76.1$, $SEE_{TertMVPA}Tert_2 > 76.2 \leq 176.8$, $SEE_{MVPA}Tert_3 > 176.8$). An interaction ($p<0.05$) was identified and illustrated in Figure 13. Specifically, 2 month (6.6 ± 0.5) and 4 month (6.6 ± 0.5) time points for $SEE_{TertMVPA}Tert_3$ were greater than $SEE_{TertMVPA}Tert_3$ baseline data (5.1 ± 0.6).

Figure 13: Sub-group self-report analysis for $MVPA_{Sporadic}$ tertile. Values are mean ± SE; n=56. (i.e. $Tert_1$, *n = 16;* $Tert_2$, *n = 17;* $Tert_3$, *n = 23*). **Panel A:** A main effect of group ($p<0.05$) was indicated for $SF\text{-}12_{PhysicalTertMVPA}$ where $Tert_1$ < $Tert_2$ and $Tert_3$. A main effect of time ($p<0.05$) was also indicated for $SF\text{-}12_{PhysicalTertMVPA}$ where baseline < 2, 4, 6, and 10 months Panel **B:** A main effect of time ($p<0.05$) was indicated for $PHQ\text{-}9_{TotalTertMVPA}$ where baseline < 2, 4, 6, and 10 months. **Panel C:** An interaction ($p<0.05$) was observed for $SEE_{TertMVPA}$. Indicating that $Tert_3$ at 2 and 4 months > than $Tert_3$ at baseline. # different from baseline.



Chapter 5: Discussion

Overview

The primary purpose of this project was to influence various levels of the healthcare system to more fully support physical activity promotion as a health intervention within the primary care environment (i.e. as a strategy to enhance physical activity participation amongst patients attending the clinic). Specifically, by utilizing innovative strategies (i.e. patient and clinician education, the development of internal and external referral systems and the creation of support structures) the ENCOURAGE project intended to enable patients to adopt a more physically active lifestyle. Previous studies have attempted multilevel strategies focused on physical activity interventions within primary care [11, 12, 85, 123, 124]. To our knowledge only one other study by Fortier *et al.* [12], utilized similar processes used within the ENCOURAGE project. However, unlike Fortier *et al.* [12], the ENCOURAGE project was specifically built upon the ECCM model developed by Barr *et al.* [68]. This model was used to guide the development on the ENCOURAGE project in order to better integrate our intervention within primary care and the surrounding community on multiple levels.

We hypothesized that the ENCOURAGE intervention would help study participants increase their MVPA performed in bouts of ten minutes or more (i.e. $MVPA_{10Mins}$) from baseline to 4 months. We also hypothesized that this change would be sustained at 6 and 10 months as compared to baseline data. Additionally, we posited that participants would improve other objectively measured parameters (i.e. LPA_{10mins}, TPA_{10mins}, $MVPA_{Sporadic}$, $LPA_{Sporadic}$, $TPA_{Sporadic}$, $STEPS_{Light}$, $STEPS_{MVPA}$, and $STEPS_{Total}$) as well as self-reported parameters (i.e. SF-12, PHQ-9, SEE, and stage of change) from baseline to 4 months.

Finally, we hypothesized that these improvements in both objective and self-reported parameters would be sustained at 6 and 10 months when compared to baseline data.

The data collected from the ENCOURAGE project failed to support the first and second hypotheses, as changes in $MVPA_{10mins}$ from baseline (25 ± 6 minutes/week) to 10 month follow-up (23 ± 9 minutes/week) was not detected amongst this cohort. The third and fourth hypotheses were partially supported. For example, we observed significant improvements ($p < 0.05$) for $LPA_{Sporadic}$ and $TPA_{Sporadic}$ over the duration of the ENCOURAGE project. In fact, 16% and 15% increase in $LPA_{Sporadic}$ and $TPA_{Sporadic}$, respectively, were detected following the 4 month intervention as compared to baseline. An improvement of 130 minutes/week was sustained at 6 months and a 90 minute/week improvement was maintained at 10 months for $LPA_{Sporadic}$ as compared to baseline data. Furthermore, a 160 minute/week and 100 minute/week increase was observed for $TPA_{Sporadic}$ at 6 and 10 months, respectively, as compared to baseline data. We calculated the number of participants who met the CPAG at 2, 4, 6, and 10 months as compared to baseline. By month 10 we observed a two-fold increase for the number of participants who met the CPAG, where an additional two participants were meeting CPAG compared to baseline (i.e. two participants met the CPAG at baseline). Self-reported data (i.e. PHQ-9_{Total}, PHQ-9_{Cat}, SF-$12_{Physiscal,}$ SF-12_{Mental}, SEE, and stage of change) all significantly ($p < 0.05$) improved at 4 months, when compared to baseline data. PHQ-9_{Total}, PHQ-9_{Cat} and SF-$12_{Physiscal}$ results were sustained at 6 and 10 months when compared to 4 month data. However, improvements in SEE and SF-12_{Mental} were not sustained at 10 months when compared to 4 month data. Additionally, we detected a change ($p < 0.05$) in the self-reported stage of change for study participants, where nine participants reported being in the *action* stage at baseline; whereas 41 participants reported being in the *action* stage at 4 months and 34 participants reported being in the *action* stage at 10 months. Although the primary outcome measure (i.e. $MVPA_{10Mins}$) did not change over time in the current study, secondary outcome measures from both objective data (i.e. LPA_{10Mins}, $LPA_{Sporadic}$, $TPA_{Sporadic}$) and self-report data ($PHQ\text{-}9_{Total}$, $SF\text{-}12_{Physical}$, SEE, Stage of Change) did improve over time. Thus, we interpret the collection of data as an indication that the ENCOURAGE approach supported patient health behavior change and enabled more patients to increase their light and total physical activity behavior over time.

The ENCOURAGE study participants

One hundred and nineteen patients were recruited into the ENCOURAGE study (Figure 6). Of these, 65 patients completed the 4 month intervention; however, only 57 remained with the project (56 participants were used in the data analysis, one was excluded due to missing three data points) until the 10 month follow-up was completed. Thus a total of 62 participants (52% of the study population) withdrew or were lost to follow-up (i.e. 40 withdrew before 2 months, nine withdrew before 4 months, seven withdrew before 6 months, and one withdrew before 10 months). Reasons for withdrawal were varied (i.e. health complication arose, life event altered commitment to study, could not afford the time to maintain commitment to study, received what they needed from the intervention); however, many of those who withdrew from the study did not provide a reason. Many individuals who opted not to participate in the project identified the inability to commit the time needed for the study. Based on the literature, attrition in physical activity interventions have been identified to range from 7% to 82% [157, 158], with an estimated mean ~ 45% of study participants who discontinue exercise interventions [157]. The length of these research studies varied from 8 weeks to 18 months [157, 158]. The ENCOURAGE project's drop-out rate was approximately 52% of the study population, thus falling within the higher range of attrition from exercise interventions. The literature does report that people who cite socio-economic barriers, such as lack of money or transportation, are more likely to change exercise behavior than individuals that report a lack of motivation or time as a barrier [159]. This could explain the high attrition rate in our study, as time was a factor in the decision for many individuals to either begin the study or remain a participant until the end of the study. The physical activity accumulation of the participants who withdrew from the research project was not different from the participants who remained in the study for $MVPA_{10Mins}$. However, physical activity accumulation was significantly ($p<0.05$) higher at baseline for the participants who withdrew from the study when compared to the group who remained in the study for $LPA_{Sporadic}$ and $TPA_{Sporadic}$. In fact, at baseline the dropout group accumulated 818 ± 60 minutes per week for $LPA_{Sporadic}$ and 992 ± 69 minutes per week for $TPA_{Sporadic}$. This group may have removed themselves from the study because they did not believe the intervention was advanced enough to meet their needs or that they had received enough support from the intervention so they no longer had a need for continued support. In some cases, participants verbalized this latter reason to the research coordinator or the CSEP-CEP prior to withdrawing from the study. No differences between age ($P<0.67$) or BMI ($P<0.72$) were observed amongst the dropout group and the study group.

How do the ENCOURAGE participants compare to the general population

Physical activity interventions have been delivered in primary care previously; however, most are delivered to apparently healthy populations [99, 124, 160]. The participants analyzed (n=56) in the ENCOURAGE study were at a greater risk for chronic disease than the general population was. In fact, the present study's participants resembled a population at elevated risk for chronic disease as the cohort surpassed Canadian norms in several areas. For instance, 96% of the study participants were identified as being physically inactive (i.e. they participated in less than 150 minutes of MVPA on a weekly basis) based on accelerometer data. In fact, the average $MVPA_{10mins}$ for ENCOURAGE participants was 25 ± 6 minutes per week at baseline. Colley *et al.* [19] reported that 85% of the Canadian population is considered physically inactive. Similarly, Fortier *et al.* [12] assessed their study participants and on average, they accumulated 17 minutes of $MVPA_{10mins}$ per week at baseline. Thus it appears the study populations in both the Fortier *et al.* [12] and the present study, were less active than the general Canadian population.

The ENCOURAGE participants were made up primarily of class II obese (BMI >30 kg/m^2) individuals. In fact, approximately 80% of the 56 participants analyzed in the study population had a BMI of > 30 kg/m^2. Specifically, the average BMI of this group was 35.2 kg/m^2. Canadian obesity rates are at approximately 18% [161] of the adult population. Thus, a greater proportion of the ENCOURAGE study cohort was obese as compared to the general population. Fortier *et al.* [12] study participants had similar obesity characteristics for their sample group, as the average BMI scores for their group was 31.2

kg/m^2. Thus, it appears that the primary care populations in the Fortier *et al.* [12] study and the current study were both more obese than the general population in Canada.

The age of the present study participants ranged from 25 years to 72 years of age with an average age of the study participants of 51 ± 1 year old. Fortier *et al.* [12] study participants were similar in comparison as the average age was 47 years of age for the intervention group. Age is a non-modifiable risk factor for chronic disease for both men and women. In fact, men over the age of 45 and women over 55 years of age are at an increased risk for chronic disease such as cardiovascular disease and hypertension [162].

All ENCOURAGE study participants were identified as having one risk factor for chronic disease. Furthermore, 88% of the study participants had at least two risk factors for chronic disease. This suggests that the participants in the ENCOURAGE study have a significantly higher risk for chronic disease than what is reported within the general population (i.e. ~65% have one risk factor for chronic disease) [37, 163, 164].

<u>The role of the ENCOURAGE CSEP-CEP within the interdisciplinary health care team</u>

The role of the ENCOURAGE study's CSEP-CEP was to bring specialized skills and knowledge to primary care in a supportive role, thus effectively contributing to an interdisciplinary healthcare team (i.e. physician, nurse practitioner, and dietician). The time the CSEP-CEP spent within the clinic was initially developed with approximately 50% of the job related functions working directly with patients (i.e. 40% patient interaction, 10% preparation and documentation) within the clinic (Table 2). After the completion of the study we evaluated the time spent on job related functions and compared it to our initial model. Patient interaction comprised of approximately 30% of the job-related functions of the CSEP-CEP with an additional 25% of his time preparing for patient meetings and documentation after (Figure 5). Interactions with clinic staff and non-clinic staff as well as other program interactions did not vary from the initial model. We did identify that the administrative responsibilities were more involved than originally anticipated based on our initial estimations. In fact, approximately 50% of the CSEP-CEP was spent on administrative functions. Other studies have identified the role of the CSEP-CEP during the project's intervention [11, 12, 110, 123]; however, with exception of Fortier *et al.* [12] job functions outside of patient interaction were not thoroughly discussed. To our knowledge, we are the only study to specifically identify and measure the job-related components that a CSEP-CEP is performing within primary health care. This novel information may contribute to refining the scope of practice of a CSEP-CEP to include functions specifically performed within the clinical environment. Additionally, this may provide guidance to future research regarding the job-related functions an exercise specialist may be expected to perform within the primary care environment

Despite the active role played by the project CSEP-CEP regarding physical activity counseling of participants, we did not observe a change in $MVPA_{10Mins}$ over the course of the study. Future research should examine the best practices for physical activity counseling and physical activity promotion within primary care so CSEP-CEPs and other health care providers have the tools required to implement evidence-based behavior change strategies amongst a physically inactive patient population.

Does current physical activity behavior affect future physical activity behavior?

The ENCOURAGE study data did not detect a significant change (p=0.43) of $MVPA_{10mins}$ from baseline (25 ± 6 minutes/week) to 4 months (32 ± 9 minutes/week) or sustained up to 10 months (23 ± 9 minutes/week). Therefore, the primary hypothesis was not supported. Fortier *et al.* [12] reported similar results identifying that objectively measured $MVPA_{10mins}$ did not change over the course of their physical activity counseling trial (i.e. baseline, 17 minutes/week of MVPA; 25-week data, 16 minutes/week of MVPA). Thus, it appears that the ENCOURAGE approach did not help patients to increase the amount of $MVPA_{10Min}$ they accumulate over the duration of the study.

Even though $MVPA_{10Min}$ was not significant, we were still interested in exploring other physical activity parameters. For example, no significant changes were observed for $MVPA_{Sporadic}$ (p=0.84) or TPA_{10Mins} (p=0.10). However, significant changes in $TPA_{Sporadic}$ were observed ($p<0.05$). In fact, our data indicated an increase in $TPA_{Sporadic}$ at 4 months (14%), at 6 months (21%), and at 10 months (14%) when compared to baseline data (737 ± 34 minutes/week). To further explore the relationship of these parameters we performed a secondary data analysis to separate our participants into tertiles based on the accumulation of physical activity (i.e. $MVPA_{Sporadic}$ and $TPA_{Sporadic}$) at baseline to determine if the tertiles differentially responded to the ENCOURAGE approach. Notably, the tertiles that were separated based on baseline $MVPA_{Sporadic}$ (i.e. $MVPA_{TertMVPA}Tert_1$ ≤76.1 minutes of $MVPA_{10Min}$ per week, $MVPA_{TertMVPA}Tert_2$ > 76.2 and ≤ 176.8 minutes of $MVPA_{10Min}$ per week, $MVPA_{TertMVPA}Tert_3$ > 176.8 minutes of $MVPA_{10Min}$ per week) returned some interesting results (Figure 12). Specifically, a significant group difference was observed between the three baseline $MVPA_{Sporadic}$ tertiles:

The group of participants that were least active at baseline (i.e. $MVPA_{TertMVPA}Tert_1$; n=16), did not change their activity $MVPA_{Sporadic}$ over the 10 month intervention. This group is at the highest risk for the negative health effects of physical inactivity. Thus, future interventions should be designed to address the barriers and facilitators that support the adoption of a more physically active lifestyle for this highest risk group. Interestingly, a study by Leijon *et al.* [165] looked at characteristics of individuals who did not adhere to physical activity referrals and why. They indicated that individuals in their study who accumulated low levels of physical activity at baseline (0-2 days per week) were less likely to adhere to physical activity referrals. Another reason why the $MVPA_{TertMVPA}Tert_1$ group may not have changed could have been influenced by the physical ability or physical literacy of the individual. Physical literacy can be defined as the confidence and physical competence to perform a variety of purposeful physical activities in many diverse environments throughout the individual's life [166]. Research has suggested that participation in physical activities may be related to the physical literacy of the individual [167]. Although we did not test for this parameter in the present study, it does stimulate an interesting question: "*Does the person's ability to engage in different movement patterns influence their ability to increase their physical activity accumulation over time?*" Research in this area may provide insight to inform the behavior differences amongst groups of individuals in regards to physical activity behavior and the impact of physical literacy over the lifespan.

The group of participants that were somewhat active at baseline (i.e. $MVPA_{TertMVPA}Tert_2$; n=17) increased their $MVPA_{Sporadic}$ by 63 minutes/week and by 99 minutes/week at 4 and 6 months, respectively, as compared to baseline (114 minutes/week). This outcome is notable because it supports the notion that the ENCOURAGE intervention enabled a sub-group of participants to increase their $MVPA_{Sporadic}$. In the attempt to try to understand, why $MVPA_{TertMVPA}Tert_2$ was able to change their physical activity over time compared to $MVPA_{TertMVPA}Tert_1$ we evaluated the stage of change for $MVPA_{TertMVPA}Tert_1$ and $MVPA_{TertMVPA}Tert_2$ participants at baseline, 2, 4, 6 and 10 months. There was no difference at baseline between $MVPA_{TertMVPA}Tert_1$ and $MVPA_{TertMVPA}Tert_2$.for stage of change. Furthermore, self-report data identified that participants in both groups reported a similar stage of change from *no action* to *action* from baseline to 10 months (Table 8). Further research may be needed to uncover why stage of change did not differ between $MVPA_{TertMVPA}Tert_1$ and $MVPA_{TertMVPA}Tert_2$ but $MVPA_{Sporadic}$ changed in $MVPA_{TertMVPA}Tert_2$ but not $MVPA_{TertMVPA}Tert_1$.

The group of participants that were most active at baseline (i.e. $MVPA_{TertMVPA}Tert_3$; n=23) did not change their $MVPA_{Sporadic}$ activity over the 10 month intervention. It is possible that the ENCOURAGE intervention did not adequately meet the needs of this more active group. In an effort to understand this data, we evaluated self-efficacy for each of the tertiles. $MVPA_{TertMVPA}Tert_1$ and $MVPA_{TertMVPA}Tert_2$ did not show any changes relating to self-efficacy; however, we did observe an interaction for $MVPA_{TertMVPA}Tert_3$ identifying that 2 month and 4 month SEE scores (Figure 13) were greater when compared to baseline scores. However, we did not see a change in physical activity accumulation for $MVPA_{TertMVPA}Tert_3$. Self-efficacy has a strong relationship regarding the amount of effort and the duration of effort a person would demonstrate while performing physical activity [168]. Therefore, we assumed that changes in physical activity would have reflected the changes in SEE scores. However, this was not the case. Perhaps the changes in self-efficacy were not sufficient to elicit a greater change amongst an already active group of participants. Further research is needed to identify how to get these individuals to move more for greater health benefits. However, it must be acknowledged that this sub-group of participants was already the most active sub-group of the cohort at baseline.

To our knowledge, the current study is the first to identify different responses and behaviors amongst sub-groups of the larger cohort based on baseline MVPA accumulation. This observation may inform the development of future physical activity promotion interventions more specifically tailored to the sub-groups with specific baseline characteristics and physical activity behavior.

Patients increased their light activity performed in 10 minute bouts as well as their total and light sporadic activity performed in bouts less than 10 minutes

The ENCOURAGE intervention stimulated changes in light physical activity (LPA_{10Mins}) within the study cohort. In fact, our data indicated a significant two-fold increase ($p<0.05$) by the 2 month time point. It is noteworthy to reiterate that the ENCOURAGE intervention lasted four months and included five CSEP-CEP physical activity counseling sessions three sessions were completed by month 2. LPA_{10Mins} returned to baseline by the 4th month and did not change for the remainder of the assessment periods. Thus, it is possible that the counseling sessions with the CSEP-CEP will have provided the motivation needed for individuals to incorporate longer bouts of physical activity into their daily lives, albeit at low physical activity intensities, as defined by Colley *et al.* [19]. The decline in LPA_{10Mins} accumulation by the fourth month may have occurred due to the tapering of support from the CSEP-CEP that occurred between in month 3 and 4 of the intervention (i.e. only one in person meeting a one phone conversation occurred over the final 60-day period of the 4-month intervention).

Changes in light physical activity in sporadic bouts ($LPA_{Sporadic}$) were also identified within this cohort. In fact, our data indicated a 16% and 22% increase ($p<0.05$) in $LPA_{Sporadic}$ at 4 and 6 months, respectively. Improvements were maintained at 10 months, where a 16% increase was observed when compared to baseline data (593 ± 27 minutes/week). Increasing LPA is considered beneficial as reported by Bailey *et al.* [169]. In fact, a significant reduction of 16% for postprandial plasma glucose was observed when short bouts of LPA interrupted long periods of sitting. Our population spent a significant amount of time in sedentary behavior. Specifically, at baseline the ENCOURAGE population spent over 8 hours sitting or performing other sedentary activities. This makes the increase in $LPA_{Sporadic}$ an important addition to their day. A recent study of Japanese adults indicates that risk of metabolic syndrome is reduced, in addition to waist circumference, with increases of light intensity physical activity [170]. Specifically, increases in $LPA_{Sporadic}$ of 15% were associated with 45% fewer participants reporting metabolic syndrome and 31% fewer participants reporting increased waist circumferences, when compared to groups that were least active [170]. A research study by Blair *et al.* [171] looked into the decline in functional capacity in long-term cancer survivors and identified the importance of performing $LPA_{Sporadic}$. In fact, participants who performed $LPA_{Sporadic}$ were able to attenuate their functional decline, when compared to the control group. Greater improvements were seen in those patients who added anywhere from 14% to 16% $MVPA_{Sporadic}$ into their total physical activity accumulation per week [171]. However, $LPA_{Sporadic}$ was easier for this population to perform which suggests strategies that enhance $LPA_{Sporadic}$ may be a viable approach for beginning to improve an individual's health status. Although there is a growing body of evidence that $LPA_{Sporadic}$ is beneficial, it is well established that the benefits of physical activity are optimized when $MVPA_{Sporadic}$ is increased along with an increased $LPA_{Sporadic}$.

Many of the research articles [170-172] described in the previous section refer to both light and moderate to vigorous physical activity and the benefits they provide. The combination of these intensities is considered total physical activity (TPA). We chose to examine TPA in order to highlight the benefits of total physical activity accumulation amongst our study group. Changes in total physical activity completed in sporadic bouts ($TPA_{Sporadic}$) were identified within the current study's cohort. In fact, our data indicated a significant 14% increase ($p<0.05$) in $TPA_{Sporadic}$ at 4 months with additional increases of 21% at 6 months and 14% at 10 months, when compared to baseline data (737 ± 34 minutes/week). Although we attempted to compare our data to the Fortier *et al.* [12] study, we were unable to because Fortier *et al.* [12] did not identify intensities other than MVPA accumulated in 10-minute bouts amongst their sample population. A study by Calfas *et al.* [85] observed changes in total physical activity amongst a cohort of 212 individuals. These changes identified by Calfas *et al.* [85] included self-reported physical activity as well as objective physical activity for a small sub-group (n=56) as measured by accelerometers. This study assessed the value of physician counseling in primary care for previously sedentary individuals. Calfas *et al.* [85] identified a ~ 30% increase in total physical activity within the sub-group of the study [85] . Additionally, the self-reported physical activity results identified increases of physical activity by as much as 100% for the intervention group. Furthermore, the study participants improved their adoption of physical activity. In fact, the intervention group identified over 50% of their participants as becoming physically active on a regular basis. Interestingly, the ENCOURAGE project identified similar results with approximately 57% of the participants self-reporting regular physical activity by the end of the study. The Calfas *et al.* [85] study was of short duration (6 weeks) and therefore exercise adherence over the medium to long term (i.e. 6-10 months) was not reported. In contrast, the current study identified longer-term adherence for objective physical activity parameters over a 10-month period, as increases in $TPA_{Sporadic}$ and $LPA_{Sporadic}$ were maintained over time. Thus, our data suggest that we need to further examine LPA and TPA as outcome measures for cohorts that are recruited from primary care settings. As individuals start to become more physically active, particularly those who have been previously sedentary of physically inactive, they may find it easier to accumulate physical activity behavior at a lower intensity. Future research needs to focus on facilitating intensity progressions from light-to-moderate and moderate-to-vigorous in order to promote health benefits as a strategy to establish and support long-term physical activity behavior change.

The importance of sporadic physical activity

The CPAG suggest that individuals accumulate 150 minutes of MVPA in 10-minute bouts over the course of one week [15]. Sessions of 30 minutes in length in each of five days are encouraged in order to accumulate this time. Even so, shorter bouts (i.e. 10 minute) performed in three or more intervals over the course of the day are considered as effective as a 30-minute continuous session in regards to health benefits [173, 174]. The emphasis on both long (i.e. ≥30 minutes) and short bouts (i.e. ≥ 10 minutes) of physical activity for improving health have previously been described in the literature [43, 51, 173, 174].

Participants in the ENCOURAGE study by the end of the 4 month intervention spent 93% of the time being physically active in sporadic bouts with the remaining 7% in bouted physical activity (i.e. > 10 minutes). A growing body of evidence indicates that sporadic activity is associated with improved health outcomes. Thus, the observed improvements in sporadic activity in ENCOURAGE may contribute to improved health. The investigation of sporadic (i.e. < 10 minutes) bouts may be important as it contributes significantly to an individual's total accumulation of physical activity during the week and may play an important role in the derived health benefits associated with physical activity. Holman *et al.* [175] conducted a cross sectional study and observed that participants spent ~80% of their physical activity in sporadic bouts (i.e. < 10 minutes). Holman *et al.* [175] also reported improvements of cardiorespiratory fitness amongst their cohort. Macfarlane *et al.* [176] reported that their participants spent over 70% of their total physical activity in sporadic bouts (i.e. < 10 minutes) and compared them to an exercise group that performed activity in bouts longer than 15 minutes. Notably, Macfarlane *et al.* [176] reported similar improvements in aerobic fitness amongst both groups.

The current study evaluated several intensities of physical activity in sporadic bouts namely, $LPA_{Sporadic}$, $MVPA_{Sporadic}$, and $TPA_{Sporadic}$. Even though our primary outcome of $MVPA_{10Mins}$ did not change over time the fact that participants were still engaging in $MVPA_{Sporadic}$ may be clinically relevant. It is worth noting that participants performed approximately 19 % of their total MVPA in bouts that were longer than 10 minutes in duration (i.e. $MVPA_{10Mins}$). Improvements in $LPA_{Sporadic}$ and $TPA_{Sporadic}$, over time, indicated that participants were becoming more physically active during the ENCOURAGE intervention. A study conducted by McGuire *et al.* (2011) [177] investigated the health benefit, as assessed by cardiorespiratory fitness, associated with incidental (i.e. sporadic) physical activity (IPA) [177]. They reported improvements in cardiorespiratory fitness when their study cohort engaged in sporadic bouts of light and moderate physical activity. Specifically, correlations indicated that IPA had a positive relationship with improvements in cardiorespiratory fitness for intensity (r^2=0.53, p<0.01) when controlled for gender and BMI. Additionally, greater improvements in cardiorespiratory fitness were observed for participants who engaged in $MVPA_{Sporadic}$, as indicated by a significant correlation (r^2=0.60, p<0.001) [177]. Furthermore, greater intensity did play a role in increased benefits; however, only 6 % of the total accumulated physical activity per day was in MVPA leaving 94% reported as sporadic light physical activity. These results are similar to the ENCOURAGE project as the study participants spent approximately 82% of their total sporadic physical activity in light sporadic bouts, while accumulating the remaining 18% in sporadic bouts of MVPA by the end of the 4 month intervention. Even though we did not investigate physiological changes amongst the study participants, we can infer that similar health benefits may have occurred within our population based on these results.

The ENCOURAGE participants were divided into tertiles based on $MVPA_{Sporadic}$ accumulation at baseline for conducting secondary data analyses. An interaction effect was observed for some parameters, which indicates that the sub-groups responded differently over time. Specifically, $MVPA_{TertMVPA}Tert_2$ (n=17) was identified as having the greatest change on $MVPA_{Sporadic}$ activity (Figure 12). Even though $MVPA_{TertMVPA}Tert_2$ did not represent the entire study population it is important to note that this particular group did see significant ($p<0.05$) increases in $MVPA_{Sporadic}$ over time. In a study by Clarke *et al.* [178], $MVPA_{Sporadic}$ was identified as beneficial in reducing the risk for metabolic syndrome in adults. In fact, for every MET hour increase in $MVPA_{Sporadic}$ per week the risk reduction for metabolic syndrome improved by 10% [178]. The ENCOURAGE $MVPA_{TertMVPA}Tert_2$ group observed increases of 63 minutes (~3 MET hours) for $MVPA_{Sporadic}$ at 4 months and 99 minutes (~5 MET hours) at 6 months; therefore, based on the results from Clarke *et al.* [178] risk for chronic disease (i.e. metabolic syndrome) for the current study population may be reduced by as much as 50%. Furthermore, Clarke *et al.* [178] suggested, based on their study results, that performing total MVPA is important but how its accumulated (i.e. sporadic or bouted) may not be. Glazer *et al.* [179] looked at cardiovascular risk and other chronic disease risk parameters (i.e. BMI, waist circumference, triglycerides, HDL, and obesity) of individuals performing $MVPA_{10Mins}$ and $MVPA_{Sporadic}$. Glazer *et al.* [179] compared both MVPA intensities to identify if one was significantly different from the other in relation to realized health benefits. The evidence identified that the study population engaged in 9

± 13 minutes per day (56 minutes/week) of $MVPA_{10Mins}$ and 19 ± 14 minutes per day (133 minutes/week) of $MVPA_{Sporadic}$. Interestingly, when compared to total physical activity accumulation, the Glazer *et al.* [179] study group accumulated approximately 12% of their total physical activity accumulation in sporadic bouts of MVPA. The parameters (i.e. cardiovascular risk, BMI, waist circumference, triglycerides, HDL, and obesity) measured in the Glazer *et al.* [179] study all changed significantly ($p < 0.05$) for both $MVPA_{10Mins}$ and $MVPA_{Sporadic}$; thus, $MVPA_{Sporadic}$ appears to be as effective as $MVPA_{10Mins}$ in improving health related parameters. The accumulation of $MVPA_{Sporadic}$ reported in the Glazer *et al.* [179] study was similar to the current study. In fact, participants in the ENCOUARGE study accumulated approximately 18% of their total physical activity in sporadic bouts of MVPA, which may provide health benefits based on the data reported by Glazer *et al.* [179].

Research by Macfarlane *et al.* [176] looked at the impact of sporadic physical activity (i.e. bouts < 10 minutes), as compared to bouts that were longer than 10 minutes, on changes in aerobic fitness. Two groups were compared in that study, where the light moderate physical activity group (LIFE) spent 70% of their daily activity time in bouts of less than 10 minutes and the remaining 30% of their physical activity accumulation was in bouts of greater than 10 minutes. In contrast, the exercise group (EPM) spent over 85% of their activity time in bouts greater than 30 minutes. Even though the bouts of the LIFE group were shorter (average 6 ± 2 minutes per bout) and did not accumulate the same amount of activity over the course of the day, the impact on aerobic fitness was just as significant. In fact, a 5% to 7% increase in aerobic fitness was identified amongst the LIFE group [176] as well as the EPM group, respectively. Thus, sporadic activity enhances physical fitness. The ENCOURAGE participants also accumulated sporadic physical activity and, therefore, it is likely that they also experienced health related benefits similar to those described by MacFarlane *et al.* [176]. Future research should continue to examine the clinical outcomes for physical activity promotion interventions, such as the ENCOURAGE study, in primary care settings.

Research has indicated the benefits for individuals engaging in sporadic bouts of physical activity [169, 176, 177, 179, 180]. Since the results of the ENCOURAGE study are significant for both $LPA_{Sporadic}$ and $TPA_{Sporadic}$ the impact of this data should be recognized. Although it is important to accumulate longer bouts (i.e. > 10 minutes) of physical activity, there is value in accumulating physical activity in sporadic bouts over the course of the day. This approach may help increase the adoption of physical activity behavior by individuals who are physically inactive or sedentary [181]. Continued research in this area is needed to identify novel approaches to support individuals who are seeking to increase their physical activity behavior for improved health benefits.

The ENCOURAGE intervention's effect on mood

In the present study, we were not able to directly attribute the observed reduction in depressive symptoms with the ENCOURAGE intervention per se, as we do not have a control comparison group. Nonetheless, the current study did show a reduction of depression symptoms as assessed by the PHQ-9 at 4 months, which was maintained throughout the 10-month study. Although we cannot identify cause and effect, the increases in $LPA_{Sporadic}$ and $TPA_{Sporadic}$ observed in the current study may have contributed to changes in mood amongst this group. For example, Horne *et al.* [182] previously observed that a high proportion of physically inactive individuals reported symptoms of depression in their study (i.e. 51%), which is similar to the proportion of participants who reported symptoms of depression in the ENCOURAGE cohort (i.e. 48%). Moreover, Horne *et al.* [182] identified that increases in physical activity, as assessed by accelerometry, were associated with decreases in self–reported symptoms of depression as assessed by PHQ-9 (i.e. $r = -0.21$, $p<0.05$) amongst their cohort that underwent cardiac surgery. Horne *et al.* [182] also reported that physical inactivity was an independent risk factor for future development of depressive symptoms. In fact, they observed a two-fold increased risk for depression in physically inactive patients. This information is relevant to the current study because more than half of the ENCOURAGE study population reported symptoms of depression at baseline in addition to 96% of the participants being classified as physically inactive.

A growing body of evidence indicates that mild to moderately severe depression symptoms can be improved through the participation in bouts of physical activity [183, 184]. The ENCOURAGE participants self-reported a 32% improvement in depression scores, as assessed by the PHQ-9, at 10 months (6.1 ± 0.8) when compared to baseline data (9.0 ± 0.8). Additionally PHQ-9_{Cat} scores were able to show categorical changes of depression symptoms during this same time-period (Table 8). Depression is a major risk factor for cardiac events and reduced mortality [185] and is estimated to become one of the top three contributing factors to the burden of chronic disease by the year 2020 [186]. Continued research is necessary to further explore the relationships between physical activity and its impact on depression.

Sedentary behavior has also been linked to depression. In the present study, the participants accumulated an average of ~9 hours per day of sedentary behavior over the course of the project. Additionally, 48% of the ENCOURAGE population reported symptoms of depression at baseline. Notably, approximately 8% to 12% of the general population reports symptoms of depression [187], however this number can increase to as much as 70% as a person experiences negative health outcomes (i.e. chronic disease) [188]. A review completed in 2011 by Teychenne *et al.* [189], identified that the majority of studies they evaluated (7 of 11) had positive associations between increased levels of sedentary behavior and increased symptoms of depression. One of the studies reviewed, by Teychenne *et al.* [189], specifically reported that increases in mental disorders (i.e. depression and anxiety) were associated with an average sedentary behavior of 7 hours per day or more. This is an important observation as the participants in the current study have significantly exceeded this threshold (Table 4). Based on the results from Teychenne *et al.* [189] our cohort would be at a high risk for depression due to increased sedentary behavior. This data is contrary to our results, as $PHQ\text{-}9_{Total}$ and $PHQ\text{-}9_{Cat}$ improved by the end of the 4-month time point. These results were maintained until the end of the study. However, sedentary behavior remained elevated amongst the current study's cohort. Even though the ENCOURAGE cohort reduced the symptoms of depression from 48% to 21% by the end of the 10 month study, symptoms of depression still remain elevated as compared to the general population [187, 188]. Further research should explore the impact that sedentary behavior has on the symptoms of depression and how physical activity affects this relationship.

Another risk factor for depression is obesity and research has demonstrated this relationship [190]. In fact, as a person increases their obesity category from class 1 to class 2 or class 3, self-reported depressive symptoms are increased [190]. Furthermore, obese women are at an even greater risk for depression [190]. This is an important risk factor as 70% of the ENCOURAGE study population was female and of that, 77% of these women are obese. We did not examine whether BMI changed over the duration of the intervention; therefore, we cannot determine if the reduction in depressive symptoms reported in the ENCOURAGE cohort occurred because of changes in BMI. However, the initial BMI data of this group (mean of 35.2 kg/m^2) supported the research identifying the potential reasons why 48% of individuals were reporting higher symptoms of depression at baseline. Increased risk for depression is associated with individuals who are obese and are considered sedentary as indicated by Vallence *et al.* [186]. Furthermore, increased sedentary time coupled with elevated BMI increases the risk for cardiovascular disease and increased mortality [185, 186].

The ENCOURAGE intervention effects quality of life of participants

Quality of life refers to the ways in which health, illness, and medical treatment influence an individual's perception of functioning and well-being [191]. Mental and physical quality of life was assessed during the ENCOURAGE study by utilizing the SF-12 survey. The data indicate that $SF\text{-}12_{Physical}$ and $SF\text{-}12_{Mental}$ did improve over time (Table 8). These results differ from those presented by Fortier *et al.* [12] as they did not report changes in quality of life (i.e. physical and mental dimensions) amongst their study population. Halbert *et al.* [124] reported similar results to the current study identifying significant improvements in physical functioning amongst their intervention group. However, the SF-12_{Mental} parameter in the Halbert *et al.* [124] study did not change.

Physical activity participation may have contributed to the improvement of quality of life amongst this group. Another explanation for the improvements in quality of life may be influenced by the time that each participant spent receiving physical activity counseling with the project's CSEP-CEP. Physical activity counseling interventions have been shown to improve quality of life measures amongst its participants. For example, Uysal and Özcan [192] reported that physical activity counseling and training programs delivered to individuals with chronic disease were able to elicit an improvement in physical and mental quality of life parameters. A different study by Elley *et al.* [160] was successful at improving quality of life, as assessed by SF-36 questionnaires, for primary care patients by counseling on physical activity and providing opportunities for follow up meetings for additional support. Specifically, health care providers administered initial counselling then patients were referred to community based exercise professionals. Follow-up phone calls were made to the referred patient by the exercise professionals to help direct initial goals developed during their counseling session with the healthcare provider [160]. In addition to improvements in quality of life, Elley *et al.* [160] was able to identify leisure time physical activity increases. In fact, improvements of 68 minutes per week for men and 20 minutes per week for women were identified [160]. Given the literature [124, 160, 192] and the outcomes of the ENCOURAGE project, it appears that behavioral counseling may be an important addition to primary care's attempt to improve quality of life indicators and physical activity behavior amongst patients.

Improvements in self-efficacy for exercise were observed

Self-efficacy is an important factor in health behavior change. Perceived self-efficacy affects the choice of activities, the contextual settings, how much effort is put forth performing an activity, and how long they will persist in the face of barriers and negative experiences [168]. Stronger perceived self-efficacy for exercise (SEE) is associated with more active and successful coping efforts of the individual [168]. The ENCOURAGE project specifically measure SEE using the previously validated (SEE) survey [193]. The data indicated that self-efficacy improved by the fourth month of the intervention as compared to baseline (Table 8). Research by Halbert *et al.* [124] assessed the self-efficacy of their study group and observed significant improvements. Moreover, increases in the intention to exercise relating to the improvements of self-efficacy were also observed. In fact, a 45% difference between the intervention and control group existed indicating that more individuals increased their exercise intention within the intervention group (56%) at 12 months, as compared to the control group (38%). The current study measured stages of change amongst the participants and categorized them into two groups (i.e. *no action* and *action*). The reason for this was to show the intention of participants to move from one stage to the next or in this case *no action* to *action*. These stages of change results can be related to Halbert's intention to exercise results and both can be associated with improvements in SEE [194, 195]. The current study reported improvements in the stage of change categories. In fact, by the end of the 4 month intervention 68% of the participants were considered in the *action* category, whereas only 12% of the population was considered to be in the *action* category at baseline. Like SEE, stage of change results did not continue to improve after the completion of the intervention at 4 months. With the

SEE results and the stage of change results showing an increase by four months we can speculate that the ENCOURAGE intervention may be effective at improving SEE and for moving participants from *no action* to *action* stages. Notably, after the 4 month intervention, participants no longer had contact with the CSEP-CEP. This may have contributed to the reduction of SEE scores as well as the attenuation of the stage of change categorical data at 6 and 10 months. With the decreases in SEE and the attenuated number of participants in the *action* group by the 6 month time point, continued patient support may be required to sustain improved health outcomes. Follow-up sessions (i.e. booster sessions) have been identified and used within research to support the maintenance of improved health outcomes of the patients [196]. These sessions may take different forms including telephone sessions or face-to-face sessions both of which are aimed at supporting newly learned health behaviors [196]. Future research needs to explore long-term interventions (i.e. 12 month intervention) in order to provide increased support for patients in order to sustain improved health behavior.

The impact of the ENCOURAGE project on sedentary behavior

The Canadian Health Measures survey provided data indicating that adults spend an average of 9.5 hours in sedentary activities which represent approximately 69% of their waking hours [21]. The ENCOURAGE study cohort spent an average of 8.4 hours per day at baseline and increased their sedentary behavior to as much as 9.3 hours per day. Sedentary behavior has been identified as a risk factor for several chronic diseases. Specifically, the risk for cardiovascular disease, diabetes, obesity and all-cause mortality are all increased when unhealthy sedentary behavior remains elevated (i.e. > 6 hours per day) [22, 197-202]. A review article authored by Dunstan *et al.* [203] evaluated the research surrounding the accumulation of sedentary behavior (e.g. sitting or watching TV). They identified several linkages between poor health outcomes (i.e. all-cause mortality, diabetes and cardiovascular disease) and sedentary behavior. Interestingly, they reported that individuals who were physically active for 7 hours per week but still watched 7 hours or more of TV per day had a 50% increased risk of dying compared to individuals who were physically active for 7 hours per week and only watched 1 hour of TV per day [203]. Dunstan *et al.* [203] indicated based on their data, that increases in physical activity should accompany decreases of sedentary behavior for better health outcomes. A study by Henson *et al.* [204] observed associations between sedentary behavior (i.e. >10 hours per day) and markers of cardio-metabolic health (i.e. waist circumference, 2 hour fasting glucose, BMI, and HDL level). Henson *et al.* [204] reported positive associations between sedentary time and increases in BMI, waist circumference and 2 hour fasting glucose. Negative associations between sedentary time and HDL levels were also observed. Furthermore, Henson *et al.* reported that breaking up sedentary behavior with several short bouts of physical activity improved markers of cardio-metabolic health [204]. Interestingly, we observed increases in $SED_{Sporadic}$ at the same time points we observed increases in $TPA_{Sporadic}$ as well as $LPA_{Sporadic}$. This does not seem intuitive as we would expect a decrease in sedentary behavior when observing increases in physical activity accumulation. Other research has uncovered a potential reason why this may occur. For example, acute changes in exercise behavior may inadvertently increase sedentary behavior amongst these individuals through specific mechanisms [205, 206] such as non-exercise physical thermogenesis (NEAT), which is defined as non-exercise related physical activity that is performed over the course of the day [206]. Specifically, research has suggested that NEAT may decrease as exercise increases [206]. This may explain why we observed increases in sedentary behaviour amongst the present study's population after significant increases in physical activity were identified. Similarly, a study by Hawkins *et al.* [172] also observed changes in sedentary behavior amongst their study group. Specifically, eight minute per day increases in MVPA and LPA were observed at the same time as 12 minute per day increases of sedentary behavior by month 12 of their study. However, Hawkins *et al.* [172] did not provide a reason to explain why they observed increases in sedentary behavior. Thus, more research in this area may be warranted.

Even though the ENCOURAGE population improved $LPA_{Sporadic}$ and $TPA_{Sporadic}$, the need to address the impact of increased sedentary behavior on the study population is important. Interventions to reduce sedentary behavior while also increasing physical activity accumulation amongst patients may be needed to optimally improve health outcomes amongst a primary care cohort. Future research should address this need.

Cost of the ENCOURAGE intervention

Previous research has demonstrated that interventions that support physical activity counseling and promotion within health care have been financially viable [207-210]. The initial grant for this project of $80,000 was received from the Heart and Stroke foundation of Manitoba in 2011. The direct cost of implementing this project in primary care was approximately $70,000 dollars to support approximately 1848 hours of project related work. The net difference of $10,000 was applied to offset indirect costs related to the project. The $70,000 includes wages and all other direct expenses (i.e. office supplies, exercise equipment, transportation costs, meeting costs, outside consultant fees). Figure 5 identifies the approximate breakdown of the time spent by the CSEP-CEP during the intervention. The ENCOURAGE project's overall cost to deliver the intervention was estimated at $37.88 per hour. Further calculations reveal that the direct cost per participant (*n=119*), with an average of 3.4 meetings with the CSEP-CEP during the intervention (range = 1 to 5 meetings), comes to approximately $94.00 per participant for a 4 month physical activity counseling intervention. This amount takes into account the preparation that the CSEP-CEP needed to do prior to and the time spent documenting each patient session. Each 40-45 minute physical activity counseling session was calculated to cost approximately $28 per appointment, based on direct costs only. Hogg *et al.* [210] published a report identifying that the cost for implementing a physical activity counselor in primary health care in 2012 was upwards of $275.00 per participant based on the study by Fortier *et al.* [12]. This could be broken down further to a cost of $46.00 per physical activity counseling session. Thus the cost of the ENCOURAGE intervention was similar to that described for Fortier *et al.* [12] physical activity counseling trial [210]. The physically activity counseling performed by the CSEP-CEP during the ENCOURAGE study was on a 1:1 ratio with participants. The potential of group sessions could reduce costs even more and research has identified the benefits of group counseling in regards to improvements in physical activity accumulation and other physical parameters. In fact, a study by Bouchard *et al.* [11] reported improvements in physical capacity amongst their participants who participated in group physical activity counseling sessions with a CSEP-

CEP when compared to other health care providers. Even though a direct relationship was not determined between group sessions and the changes in physical capacity, group sessions may have contributed to these additional improvements [11]. Another study by Roessler *et al.* [211] reported improvements in physiological measures (i.e. BMI, waist circumference) for women participating in group counseling and exercise classes. Future research should continue to explore different intervention modalities in order to reduce health care costs while helping to improve physical activity accumulation by patients in primary care thus contributing to their improved health outcomes.

The Winnipeg Regional Health Authority identified that the average costs per visit for health care providers (i.e. Physicians, Nurse practitioners) is about $38.75 per visit [212]; however, costs may vary depending on the nature of the appointment, length of visit and whether it is in a fee for service environment. Access center physicians, on average, spend about 15 minutes per patient and nurse practitioners spend approximately 30 minutes per patient (Access center scheduling records, 2013). The CSEP-CEP spent, on average, 45 minutes with each patient in the study at a cost of $28 per appointment. Thus, the cost of physical activity counseling seems to be lower when delivered by a CSEP-CEP, as compared to other health care providers (i.e. Physicians, Nurse practitioners) in primary care and may be more effective [110]. It is possible that by having a CSEP-CEP available to support patients, other health care providers would have more time to spend on other health care priorities for their patients. A cost analysis performed by Dalziel *et al.* [207] analyzed the cost-effectiveness of physical activity interventions in primary care. Dalziel *et al.* [207] reported that physician referral interventions (i.e. green prescription) with the support of exercise specialists represent the most cost-effective approach to help patients in primary to become more physically active. Future research needs to continue to explore the benefits of multi-disciplinary health care teams that include exercise specialists in order to provide lower cost strategies to help improve the health of primary care populations.

Potential healthcare savings based on individuals meeting the CPAG

An economic analysis supported by the Primary Prevention Syndicate of Manitoba in 2013 [213] identified potential long-term health care costs of certain chronic disease risk factors. The economic burden on the Manitoban health care system may significantly increase by as much as $3.6 billion (cumulative) by 2031 if risk factors for chronic disease are not reduced [213]. Three major risk factors were identified by the report as contributing to the greatest increased health risk (i.e. smoking, physical inactivity, and obesity). Reducing these specific risk factors by as little as 1% per year may significantly reduce the economic burden of chronic diseases on the health care system by as much as $329 million dollars per year by 2031. The same report identified three potential interventions to address chronic disease risk factor reduction. Of these three interventions, physical activity was identified as an effective tool for reducing the population risk for chronic disease. Even though $MVPA_{10mins}$ was not shown to have significantly changed over time in the current study, it is important to examine clinically relevant changes in the number of patients meeting the CPAG since a change in this parameter may influence potential health care expenditures. The accelerometer data reported in this study indicate an increase in participants meeting CPAG from baseline to 10 months. Specifically, at baseline only two participants (4% of the population) were meeting CPAG compared to four participants (7% of the population) at 10 months. Thus, we observed a 3% reduction in the proportion of participants that were not meeting CPAG over the duration of the study from baseline (i.e. where 96% of the population was classified as physically inactive at baseline) to 10 months (i.e. where 93% of the population was classified as physically inactive). This reduction, if applied to primary care as a whole, could amount to significant healthcare savings over the long term. Thus, the implementation of a physical activity promotion program within primary care based on the ENCOURAGE approach may be a financially viable solution to slowing the growth of health care expenditures in Manitoba. However, before such a claim can be made with confidence, there is a need to conduct definitive clinical trials and long term implementation [214] or effectiveness trials [215-218] to assess the broader public health impact of the ENCOURAGE approach.

Limitations

A limitation of this research project is the use of the quasi-experimental design. The internal validity of a quasi-experimental study is low, as the element of control within the design has been eliminated. Additionally, the strength of cause and effect is reduced due to the inability to compare the intervention group to a control group. Without the specific control of parameters and the comparison factor it is difficult to identify the true reason why certain improvements existed [130].

Drop-out rate in physical activity interventions can range from 7% to 82% making it difficult to translate knowledge gained throughout research studies [157, 158]. The

ENCOURAGE study had a 52% drop-out rate which influenced the interpretation of the results and raises potential questions why so many patients made the decision to drop out of the project. The time demand on the participants within the study may have contributed to the increased drop-out rate, potentially affecting results of the study. Each participant was responsible for attending eight total meetings over 10 months (i.e. a total of 6.5 hours over the 10 month protocol) to meet with the CSEP-CEP and/or research team. This time commitment can be a barrier and may be financially difficult for some participants. No reimbursement was given to participants in the current study; therefore, the incentive to participate may have been low. Additionally, participant meetings were restricted by operating hours of the clinics for primary care appointments (i.e. Monday through Friday, 8:30 am to 4:30 pm and no weekend appointment times). However, the clinics were open until 9 pm through the week for various usages; however, no health care providers were available. We utilized these extended hours to meet with several patients who were unable to attend regular clinic hours.

Another limitation in this project was that we did not use the intention to treat analysis. This analysis takes into consideration all participants regardless of whether they dropped out of the project or not [130]. This approach guards against the potential biases that may exist, based on why participants dropped out of the study, and is considered to reflect clinical situations where patients may be non-compliant within specific treatment groups [130]. The current project only analyzed the participants who completed the intervention and follow-up appointments. This may have created a participant bias situation where assumptions could be drawn that only participants who were progressing remained in the study. On the other hand, by utilizing an intention to treat analysis we may have underestimated the effect of the intervention and minimized the changes that were observed amongst the participants who did not drop out.

Health care providers practice of referring patients to the ENCOURAGE study may have provided another limiting factor. The selection criteria used for the ENCOURAGE study consisted of age limits between 25-75 years and physical activity limits less than 150 minutes/week of $MVPA_{10Mins}$. Additionally, participants needed to be free from established chronic disease. However, health care providers referred not only inactive patients but also patients with a variety of other health issues. For example, the 4 main reasons for referrals to the ENCOURAGE study for all 237 patients were: 1) hypertension and dyslipidemia made up about 25% of the referrals; 2) obese patients made up approximately 20% of the referrals. Interestingly, the ENCOURAGE population was comprised of over 80% obese patients, yet only 20% of the referrals were made because of this reason; 3) patients with diagnosed mental health issues (i.e. depression and anxiety) comprised of 16% of the referrals; and 4) chronic back and joint pain referrals comprised of approximately 12% of the population. Other reasons such as diabetes management, cardiac issues, weight management, and sleep apnea made up approximately 30% of the remaining referrals to the ENCOURAGE study. Assumptions about the primary care population being a reflection of general populations may be misleading. Accumulation of physical activity may have been difficult for this group therefore limiting their ability to meet the primary outcome of the study, namely $MVPA_{10Mins}$.

The primary outcome of this study was a change in MVPA performed in bouts of ten minutes or more (i.e. $MVPA_{10Mins}$). The expectation, based on our initial rationale, that the recruited population would be able to accumulate $MVPA_{10min}$ may have been inappropriate given that this population was not only inactive, but also overweight, sedentary and older. Given the growing body of research demonstrating the benefits of sporadic bouts of physical activity, it may have been wiser to identify the primary outcome as a change in $MVPA_{Sporadic}$ for this particular population.

Accelerometer use may have also been a limitation to our study. Specifically, actual use, compliance, placement, and hardware issues causing malfunctions (i.e. battery failure, water damage) and may have played a role in potential issues regarding the objective physical activity data collection. These accelerometer issues affected at least five data points amongst the participants. We also acknowledge that the accelerometers may not have captured all forms of physical activity. For example, several of the study participants engaged in physical activity on a cycle ergometer or engaged in swimming activities of which accelerometers may not have accurately accounted intensity and duration of these modes of exercise. This may have affected the capture of physical activity accumulation in some individuals; thereby, influencing the overall results of the objectively measured physical activity parameters.

Another limiting factor was the way the accelerometer data was analyzed. The study participants were habitually inactive (25 ± 6 minutes/week of $MVPA_{10mins}$) and were obese (>30 kg/m^2). This group was less active than the national average [19]. Additionally, this group was sedentary for approximately nine hours a day, which is similar to national averages [19]. Furthermore, our cohort was also heavier than the national average, as indicated by BMI [161]. With this in mind, the cut points used for accelerometer data analysis may have misrepresented this cohort. Colley *et al.* [219] assessed data and evaluated accelerometer cut-points for use in general adult and apparently healthy populations. The cut points used in the current study were based on this research. However, the ENCOURAGE participants did not represent the general population. Therefore, it may be more appropriate to use different cut-points to evaluate their physical activity intensity and accumulation. Recent research has identified the need for appropriate accelerometer cut-points for use in specific populations. For example, a study by Loprinzi *et al.* [220] identified that the cut-points used to evaluate physical activity intensity do influence the number of minutes that individuals accumulate at different intensities. Specifically, Loprinzi *et al.* [220] did a comparative analysis using approximately 17 different accelerometer cut-point models, for children (5) and adults (12), based on previous research. MVPA data was utilized from the NHANES study for this comparison. They concluded that there was a wide variation within the data for adults as well as children derived cut-points, potentially affecting the estimation and prevalence of meeting physical activity guidelines. Watson *et al.* [221] agree that there is a need to develop appropriate cut-points for demographic subgroups. We did not go back and reassess our data based on the recommendation of either Loprinzi *et al.* [220] or Watson *et al.* [221] because of the amount of work to do so. Nonetheless, we acknowledge there may be value in doing so. Advancing research in this area is vital to the appropriate physical activity evaluation of Canadians.

Another limitation of this study was the lack of data reporting health outcomes for the ENCOURAGE participants. We did not gather physiological data (i.e. LDL, HDL, waist circumference, triglycerides, or blood pressure) from our participants over the course of the study. Therefore, we were not able to identify whether the physical activity behavior change that was observed amongst this cohort had an effect on the health outcomes of the study population.

Conclusion

The data collected in the ENCOURAGE project failed to support our first and second hypotheses, as $MVPA_{10mins}$ did not change from baseline to 4 or 10 months. It is not clear why the intervention was not successful in achieving the primary outcomes. Potential reasons for this may include: 1) inadequate delivery of the physical activity counseling intervention to participants based on their baseline characteristics and initial physical activity needs; 2) the physical abilities or characteristics of the study population may have limited their physical activity accumulation at moderate and vigorous bouts as this cohort was more inactive and heavier than the normal population; 3) provision of too few counseling sessions within the first few weeks to contribute to adequate health behavior change; and 4) lack of support over the long term to ensure adherence to physical activity behavior change. Future research needs to address these possibilities amongst primary care populations in order to help change physical activity behavior performed at moderate-to-vigorous intensities in bouts longer than 10 minutes.

The third and fourth hypotheses were partially supported. Specifically, we observed improvements in objectively measured secondary outcomes (i.e. $LPA_{Sporadic}$, and $TPA_{Sporadic}$) at 4 months and were maintained until 10-month time point of the study. Additionally, self-report parameters (i.e. PHQ-9_{Total}, PHQ-9_{Cat}, SF-$12_{Physical}$, SF-12_{Mental}, SEE, and stage of change) were also improved at 4 months when compared to baseline.

However, only PHQ-9_{Total}, PHQ-9_{Cat}, and SF-$12_{Physiscal}$ maintained this improvement until the 10 months. Based on these secondary data, we suggest that the ENCOURAGE approach supported patient health behavior change. This change in behavior enabled more patients to increase their light and total sporadic physical activity accumulation over time. Notwithstanding the increases in $LPA_{Sporadic}$ and $TPA_{Sporadic}$ accumulation observed over time amongst the participants, it should be noted that sedentary behaviour also increased over time. However, it is not clear why increases in both sporadic activity and sedentary behaviour occurred. Hawkins *et al.* [172] have previously reported a similar phenomenon. Further research is needed to determine whether this is a common issue amongst populations similar to those of the ENCOURAGE cohort and if it is, there is a need to determine how this phenomenon can be addressed.

Many of the changes that were implemented within the primary care environment may benefit future work in this area. Firstly, the project's utilization of the electronic medical record system may further improve communication amongst interdisciplinary health care teams (e.g. including a CSEP-CEP) to further improve patient care. Secondly, the development of inventories for community-based physical activity opportunities may help improve patient's level of physical activity by establishing a referral process from primary care to the community. Lastly, the creation of community groups to help support physical activity as a health intervention within primary care may enable future relationships amongst primary care and community organizations to reduce barriers for patients to become more physically active.

Even though the hypothesized primary outcomes were not successful, the secondary outcomes identified in this study may inform future interventions. For example, the

ENCOURAGE study has demonstrated that it is feasible to implement a physical activity counseling program based on the ECCM in a primary care setting. Moreover, this study provides the first data indicating that such an intervention can enable more primary care patients to increase their light and total sporadic physical activity accumulation over time. Given the patient characteristics of the sample population, it may be worthwhile to explore the value of using light or total sporadic physical activity as a primary outcome in future research as a first step for detecting changes in physical activity behavior amongst a primary care population. Future research should continue to investigate the benefits of collaborative approaches in primary care amongst health care providers and community certified exercise professionals in order to help improve the health of individuals. Finally, there is a need for randomized controlled clinical trials or effectiveness trials [215-218] to assess the broader public health impact of the ENCOURAGE approach.

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List of Appendices

Appendix A: CSEP-CEP Scope of Practice

CSEP-CEP Scope of Practice [8]

A CSEP Certified Exercise Physiologist® is sanctioned by CSEP to:

- Administer appropriate assessment protocols (both submaximal and maximal) for the evaluation of physical fitness to individuals who have been screened, signed an informed consent form and/or who have been cleared for unrestricted or restricted activity by a licensed health care professional.
- Provide physical activity clearance following further queries to positive responses to questions 4, 5 and/or 7 on the PAR-Q. For example, an individual could be cleared for physical activity/exercise by a CSEP-CEP if:
    - (i) in question 4 it was determined that the dizziness was associated with over breathing during heavy exercise or sudden postural changes;
      (ii) in question 5 it was determined that the joint problem was an old knee, ankle,
      shoulder or other old joint constraint; and,
      (iii) in question 7 it was determined that the individual had a "cold" or relative contraindication such as, but not limited to, controlled diabetes or stable medicated blood pressure.
- Provide physical activity clearance to clients who are screened out by PAR-Q questions 1 and/or In these instances, until additional information is gathered, the CSEP-CEP can recommend tailored, low intensity, progressive physical activity (such as walking).
- Seek medical clearance for clients of any age who are screened out by PAR-Q questions 2 and/or 3 which deal with potential heart problems before providing physical activity recommendations.
- Provide physical activity clearance and recommend tailored, progressive physical activity for clients over age 69 who do not respond positively to PAR-Q questions 2 and/or 3 which deal with potential heart problems.
- Provide physical activity clearance to clients over age 69 and recommend tailored, progressive physical activity.

- Provide physical activity clearance to youths under age 15 who have consent of their parent or guardian.
- Interpret the results of an individual´s fitness assessment to determine the individual´s health-related fitness level and/or performance-related (function, work or sport) fitness level.
- Use the outcomes from objective assessments to guide decisions regarding physical activity/exercise: prescription, demonstration, supervision and monitoring, fitness and healthy lifestyle counseling and act as a personal trainer.
- Suggest healthy dietary practices in concert with physical activity/exercise programs for healthy weight management.
- Suggest dietary practices for health-related nutrition and performance-related nutrition.
- Use a heart rhythm tracing to observe heart response during a fitness assessment and a structured exercise session.
- Evaluate and treat both asymptomatic and symptomatic populations with medical conditions, functional limitations and disabilities, through the application of exercise and physical activity, for the purpose of improving health and function.
- Perform evaluations, prescribe conditioning exercise, and provide exercise supervision, health education and outcome evaluation.
- Work with apparently healthy asymptomatic and symptomatic populations such as older adults, children and youth, and obstetric populations, and to society as a whole, in health enhancement and the prevention of impairment and disability.
- Provide appropriate exercise therapy to clients including, but not limited to, those with musculoskeletal, cardiorespiratory, and metabolic conditions.
- Accept referrals from licensed health care professionals trained to diagnose and treat musculoskeletal conditions and/or medical conditions.

A CSEP-CEP is NOT sanctioned by CSEP to:

- Administer assessment protocols and prescribe exercise and/or therapy to acutely injured and diseased individuals who are not within the boundaries of the above scope of practice.
- Diagnose pathology based on any assessment performed.

Appendix B: Risk Factor Identification Tool

Risk Factor Identification Tool – Assessment Content

The following list of questions provides an outline of the general content of the RFIT assessment. However, not all of these questions are asked and they do not follow the linear process in which they are presented. Rather, a unique algorithm produces a series of questions according to previous responses provided by each individual participant.

Screen 1 - This is a Risk Factor Identification Tool

This computer program will ask you questions about your health behaviors. A report will then be printed for you to keep for your information.

The care you receive from your doctor will not be affected if you choose not to use this program or decide to quit the program.

This is a touch screen. Press the "Next" button to find out more about RFIT

Screen 2-Consent

Your answers may be helpful to study different patient behaviors and how they affect health and wellness. Once you've answered the questions on this computer, the information is coded for privacy and may be sent to a protected research database. It may also be linked to other research databases for future studies. Your personal information such as your name or health number will not be part of the research database.

You can also continue with the survey without storing your information.

Will you allow your responses to be sent to the research database?

Yes

No

Screen 3: Instructions

We're ready to begin…

Your responses [will / will not] be stored in the research database.

Here is how you use the program:

- Each question can be answered by touching the screen.
- Once you have answered a question, press the "Next" button.
- By pressing the "Back" button you can go to the previous screen.
- To stop or exit the program at any time, press the "Quit" button.

To begin the program, please press the "Next" button now…

1. Personal Health Information Number
2. Name
3. Date of Birth
4. Sex
5. Height
6. Weight
7. Self-rated health present and one year ago
8. In the past 12 months, how many times have you consulted or visited a physician outside of this clinic?
9. Do you regularly take any medications (prescription or over-the-counter) that have not been prescribed by a physician at this clinic?
10. Do you see a dental professional regularly (i.e. Yearly or more often)?

SMOKING

11. Check the answer that best describes you at the present time:
    - I have never smoked
    - I used to smoke but quit more than 10 years ago
    - I used to smoke but quit more than 1 year ago
    - I have quit smoking within the last year
    - I have cut back on the amount I smoke
    - I smoke regularly (i.e. daily, weekly, monthly or as a social smoker)
12. What strategy(s) did you use to quit smoking? (Select all that apply)
13. Assessment for readiness for change

DIET

14. How difficult would it be for you to stop smoking?
15. Do you currently have a healthy diet?
16. In a typical day, how many servings of fruit and vegetables would you eat?
17. In a typical day, how many servings of grain products would you eat?
18. In a typical day, how many servings of milk or alternates would you have?
19. Are you lactose intolerant?
20. In a typical day, how many servings of meat or alternates would you eat?
21. Are you a vegetarian?
22. How often do you choose whole grain bread, crackers and/or high fiber cereal?
23. In the past 7 days, how often did you eat breakfast (approx. within 1 hour of rising)?
24. Which of the following best describes how you feel about your present weight?
25. Assessment of readiness for change
26. How confident are you that you could make some changes to your daily diet?

ALCOHOL USE/ABUSE

27. In a typical week, how many alcoholic drinks do you consume?
28. In a typical week, how many alcoholic drinks do you consume on one occasion?
29. Please select all the statements that describe you:
    - I’ve felt guilty or bad after drinking
    - I’ve needed a drink first thing in the morning to get going
    - It is time to cut down or stop drinking
    - I get annoyed when someone criticizes how much I drink

None of the above

30. Assessment of readiness for change

PHYSICAL ACTIVITY

31. From the following list of physical activities, select the activities you do during your typical or usual week. (Choose as many as you like)
    - Basketball or Volleyball
    - Squash or Racquetball
    - Soccer, Football, Rugby or Lacrosse
    - Hockey
    - Skiing or Snowboarding
    - Running
    - Skating or Rollerblading
    - Martial Arts
    - Boxing or Wrestling
    - Swimming
    - None of these
32. Your selected activity ______________ (from previous question)
    a. What is the TOTAL number of times per week you do this activity?
    b. What is the TOTAL number of minutes per week you spend doing this activity?
33. Select the activities you do during your typical or usual week. (Choose as many as you like)
    - Household chores
    - Baseball or cricket
    - Dance or Aerobics
    - Bowling
    - Weightlifting or Circuit Training
    - Tennis or Badminton
    - Gardening/Lawn Care or Shoveling Snow
    - Cycling
    - Walking (for exercise)
    - Golf
    - Curling
    - Other activities
    - None of these activities
34. The activities you selected (from previous question) are listed below on the left hand side of the screen. When you are doing these activities, how hard are you breathing?
    - Heavy (I can barely talk)
    - Moderate (I can maintain a conversation)
    - Light (I can speak easily)
35. Heavy breathing activities selected (from previous question)
    c. What is the TOTAL number of times per week you do these activities?
    d. What is the TOTAL number of minutes per week you spend doing these activities?

36. Moderate breathing activities selected
    e. What is the TOTAL number of times per week you do these activities?
    f. What is the TOTAL number of minutes per week you spend doing these activities?
37. Assessment of readiness for change
38. How difficult would it be for you to increase your physical activity level?
39. Does your physical health or pain limit your work or activities?
40. Does your activity level change according to the seasons?
41. When riding a bicycle outdoors, how often do you wear a bicycle helmet?
42. Do you wear sunscreen with an SPF of 15 or greater when you are in the sunshine?
43. How often do you wear a hat to protect against sun exposure?
44. Are you presently employed?
45. Think about your workplace and any physical, chemical or other potential causes for injury. Are you able to identify any potential hazards?
46. How often do you protect yourself against potential hazards at your workplace?

The following questions are for patients over the age of 60.

47. Since last being seen by this doctor have you had a fall with an injury that caused you to limit your regular activities for at least one day or to go see a doctor?
48. Since last being seen by this doctor, have you been involved in more than 1 car crash or collision?
49. Which of the following statements are true for you?

I have taken someone else's medication to help treat my ailment
I sometimes miss a dose of my medication
I sometimes take more or less of my medication depending on how I feel
None of these statements apply to me

Questionnaire COMPLETE

Final Screen a-

Thank you for completing this questionnaire

Researchers are currently investigating ways of improving care for patients and addressing physical activity needs. You may be an eligible participant for a related study.

May we contact you with more information?

Yes
No

Final Screen b –

Using the keypad, please provide a phone number where research staff may call you to provide further information:

Appendix C: Counseling Session Guidelines for CSEP-CEP

Table 1 Counseling Session Guidelines for CSEP-CEP

# Months	Type of meeting	Purpose	Suggested tools
Baseline 0 months (1st session with the CSEP-CEP)	In person (60 min) **Focus on relationship and gathering information**	**Stages of change Values life and how exercise fits in Benefits of exercise Education about PA recommendations Barriers Activity preferences Short-term and long-term goals (SMART) Information about the resources in the community How to use the pedometer and the log sheet Action plan (first-step planner or self-contract) for the first 2 weeks**	Stages of changes questionnaire, Decision balance sheet, Goal setting worksheet, Choosing alternatives for action, Activity Inventory, Self-efficacy questionnaire, Pedometer, Daily activity log and pedometer resource sheet, First-step planner and, Self-contract, Dose Response
0.5 Months (2nd session with the CSEP-CEP)	In person (30 min) **Focus on social support**	**Review the previous goal Positive feed-back (compare to baseline) Involvement in existing community programs Rewards & Motivation Social support Pedometer counts Action plan (first-step planner or self-contract)for the next 4 weeks**	Relapse planner Social support cues?
1.5 Months (3rd session with the CSEP-CEP)	In person (30 min) **Focus on progress and observed changes**	**Review the previous goal Positive feed-back (compare to baseline) Review the progress done so far Restating the values Involvement in existing community programs Pedometer counts Action plan (focus on 1 goal) for the next 4 weeks**	Relapse planner
2.5 Months (4th session with the CSEP-CEP)	Phone call (20 min) **Focus on enjoying exercise**	**Review the previous goal Positive feed-back (compare to baseline) Assess barriers and motivation Involvement in existing community programs Pedometer counts Action plan (focus on 1 goal) for the next 6 weeks**	Relapse planner
4 Months (5th session with the CSEP-CEP)	In person (45 min) **Focus on seeing them as an exerciser**	**Review the progress done through the program Positive feed-back (compare to baseline) Review the previous goal and establish a establish long-term goal What to do if they lose motivation? Tips to stay active Pedometer counts Setup a long-term challenge Apply what they have learn with the take home sheet**	Relapse planner Take home sheet

Appendix D: EMR Counseling Session Documents (1-5)

ENCOURAGE - Session # 1: Relationship Building & Gathering Information

Client Name: <PATFIRSTNAME> <PATLASTNAME>

Date: <CURRENTDATE>

Time: <CURRENTTIME>

1) Completed Personal Data Sheet –

(Link to Participant Baseline-EMR)

2) Confirm Stage of Change: {□ Precontemplation| □ Contemplation| □ Preparation| □ Action| □ Maintenance| □ Relapse} [ ]

3) Values Interview: Identify values, beliefs, attitudes, life goals: {□ Family| □ Health| □ Longevity| □ Enjoyment| □ Role Model| □ Improve Quality of Life| □ Improve Social Relationships| □ Other: }

Choose 1 important value and try to get client to link to exercise: [ ]

Link to values tool – copy & paste

4) Discuss Benefits of Physical Activity:

How do you think physical activity can help you? {□ Improved Health and Well-Being| □ Weight Loss| □ Weight Maintenance| □ Reduced Risk of Disease| □ Manage Stress| □ Improved Mental Health| □ Improved Sleep| □ Improved Fitness| □ Feel Better| □ Look Better| □ Energy| □ Self-Confidence| □ Fun| □ Sleep Better| □ Social Interaction| □ Live Longer|□ Improved Quality of Life| □ Self Efficacy| □ Self-Esteem| □ Psychological Well-Being| □ Perceived Quality of Life| □ Other: }

5) Review benefits not mentioned:

[ ] Review Dose Response Relationship - Triglycerides, Blood Pressure, Body

Composition, Cholesterol (HDL): [ ] Review Physical Activity Guidelines: [ ]

6) Identify Physical Activity History: {□ Past month| □ Past 6 months| □ 6 months - 1 year| □ 1 - 5 years ago| □ 5 - 10 years| □ 10 years plus| □ Never| □ Other: }

7) Physical Activity Inventory & Preference: {□ Programs| □ Walking| □ Group Activities| □ Free Activities| □ Home-Based Activities| □ Outdoor Recreation| □ Facility-Based Activities| □ Team Sports| □ Individual Sports| □ Other: }

8) Barriers: what will prevent or limit you from becoming more active? {□ Time| □ Cost| □ Environment| □ Previous Negative Experience| □ Lack of Energy| □ Lack of Knowledge| □ Lack of Motivation| □ Lack of Skills| □ Uncomfortable in Physical Activity Settings| □ Fear of Injury| □ Self-Image| □ Lack of Facilities| □ Safety| □ Lack of Child Care| □ Lack of Social Support| □ Lack of Transportation| □ Low Priority| □ Self-Efficacy| □ Fear of Making Condition Worse| □ Other: }

9) Community Connections: {□ Local facility| □ City Programming| □ Walking Club| □ Sports| □ Other: }

10) Introduction to pedometer & activity logs: [ ]

Have you ever used a pedometer before? [Yes|No]

Educate on use and activity levels: [□ Under 5000 (Sedentary)| □ 5000-7499 (Low active)| □ 7500-10000 (somewhat active)| □ 10000-12500 (active)| □ Over 12500 (highly active)]

11) Create an Action Plan and set SMART (Specific, Realistic, Measurable, Attainable, Timely) goals: {□ Facility Tour| □ Find a Workout Partner| □ Reduce Barriers| □ Walking| □ Buy Equipment| □ Try a New Activity| □ Increase Steps| □ Increase Time| □ Increase Intensity| □ Other: }

12) Follow-up via: {□ Phone| □ Email| □ Appointment}

Follow-up plan: {□ Next Appt Date: <APPTDATEEMPTY>| □ Referral| □ Other: }

13) Tools used: [Stage of Change| Goal Setting Worksheet| Values Interview| Decision Balance Sheet| Activity Inventory| Information Handouts| Choosing Alternatives for Action| Pedometer Tool| Motivation List| First Step Planner| Activity Log| Relapse Planner| Self Contract| Dose Response]

14) Additional Resources Provided: [ ]

15) NOTES: [ ]

16) Completed Charting [□]

ENCOURAGE - Session # 2: Social Support

Client Name: <PATFIRSTNAME> <PATLASTNAME>

Date: <CURRENTDATE>

Time: <CURRENTTIME>

(Add "Referral-Pad-TopOnly-Nov21-EMR" attachment to the EMR as a task.)

(Place macro "Participant-Baseline-EMR" on the top of each charting page.)

1 Review of last 2 weeks: How did things go? [ ] Focus on positive changes: What went well? How did you feel? [ ]

Did you complete your action plan? [Yes|No] [ ]

2 Barriers: What prevented or limited you from becoming more active / reaching your goals?

{□ Time| □ Cost| □ Environment| □ Previous Negative Experience| □ Lack of Energy| □ Lack of Knowledge| □ Lack of Motivation| □ Lack of Skills| □ Uncomfortable in Physical Activity Settings| □ Fear of Injury| □ Self-Image| □ Lack of Facilities| □ Safety| □ Lack of Child Care| □ Lack of Social Support| □ Lack of Transportation| □ Low Priority| □ Self-Efficacy| □ Fear of Making Condition Worse| □ Other: }

3 Overcoming Barriers & Planning for Relapse: How can we move forward? [ ]

What steps can we take to overcome and minimize those barriers? {□ Create a Support System| □ Joining a Class| □ Setting Goals| □ Family Activity Options| □ Subsidy| □ No/Low Cost Opportunities| □ Scheduling| □ Increase Knowledge/Awareness| □ Other: }

4 Sources of Motivation & Rewards:

{☐ Feel Better| ☐ Look Better| ☐ Energy| ☐ Self-Confidence| ☐ Weigh Management| ☐ Improved Health| ☐ Fun| ☐ Manages Stress| ☐ Improved Fitness| ☐ Special Event| ☐ Sleep Better| ☐ Social Interaction| ☐ Live Longer| ☐ Improved Quality of Life| ☐ Decrease Risk of Disease| ☐ Physician Referral| ☐ Other: }

5 Social Support: What kinds of support do you have available to you?

{☐ Workplace| ☐ Family| ☐ Friends| ☐ Community| ☐ Other: }

Which ones do you utilize?

{☐ Workplace| ☐ Family| ☐ Friends| ☐ Community| ☐ Other: }

Would you like to seek / create additional social support networks? [Yes|No] [ ]

6 Community Connections:

What resources do you know are available to you in your community?

{☐ Facilities| ☐ Programs| ☐ Clubs| ☐ Sports| ☐ Other: }

Refer to community connections / resources [ ]

7 Pedometer Counts and Activity Log check:

Using a Pedometer? [Yes|No]

Average Daily Steps:

{☐ Under 5000 (Sedentary)| ☐ 5000-7499 (Low active)| ☐ 7500-10000| ☐

(Somewhat active)| ☐ 10000-12500 (active)| ☐ Over 12500 (highly active)}

[ ]

8 Create an Action Plan and set SMART (Specific, Realistic, Measurable,

Attainable, Timely) goals:

{□ Facility Tour| □ Find a Workout Partner| □ Reduce Barriers| □ Walking| □ Buy Equipment| □ Try a New Activity| □ Increase Steps| □ Increase Time| □ Increase Intensity| □ Other: }

9 Follow-up via:

{□ Phone| □ Email| □ Appointment}

Follow-up plan:

{□ Next Appt Date: <APPTDATEEMPTY>| □ Referral| □ Other: }

10 Tools used:

[Stage of Change| Goal Setting Worksheet| Information Handouts| Decision Balance Sheet| Activity Inventory| Choosing Alternatives for Action| Pedometer Tool| Motivation List| First Step Planner | Activity Log| Relapse Planner| Self Contract| Dose Response]

11 Additional Resources Provided: [ ]

12 NOTES: [ ]

13 Completed Charting [□]

ENCOURAGE - Session # 3: Progress and Change

Client Name: <PATFIRSTNAME> <PATLASTNAME>

Date: <CURRENTDATE>

Time: <CURRENTTIME>

(Add "Referral-Pad-TopOnly-Nov21-EMR" attachment to the EMR as a task.)

(Add macro "Participant-Baseline-EMR" to the top of each charting page.)

1 Review of last 4 weeks: How did things go? [ ]

Focus on positive changes: What went well? How did you feel? [ ]

Did you complete your action plan? [Yes|No] [ ]

2 Barriers: What prevented or limited you from becoming more active / reaching your goals?

{□ Time| □ Cost| □Environment| □ Previous Negative Experience| □ Lack of Energy| □ Lack of Knowledge| □ Lack of Motivation| □ Lack of Skills| □ Uncomfortable in Physical Activity Settings| □ Fear of Injury| □ Self-Image| □ Lack of Facilities| □ Safety| □ Lack of Child Care| □ Lack of Social Support| □ Lack of Transportation| □ Low Priority| □ Self-Efficacy| □ Fear of Making Condition Worse| □ Other: }

3 Overcoming Barriers & Planning for Relapse: How can we move forward? [ ]

What steps can we take to overcome and minimize those barriers?

{□ Create a Support System| □ Joining a Class| □ Setting Goals| □ Family Activity Options| □ Subsidy| □ No/Low Cost Opportunities| □ Scheduling| □ Increase Knowledge/Awareness| □ Other: }

4 Re-focus on the positive progress they have made and reflect back onto values interview from meeting #1: [ ]

5 Social Support: What sources of support have you utilized?

{□Family| □ Friends| □ Co-Workers| □ Community| □ Other: }

What sources of support have been helpful? Which have been a hindrance? What needs to change?

{□Family| □ Friends| □ Co-Workers| □ Community| □ Other: }

6 Community Connections:

Have you connected with any of your community resources? [Yes|No]

Which ones? - pull list from community resources.

{□ Facilities| □ Programs| □ Clubs| □ Sports| □ Other: }

Refer to community connections / resources [ ]

7 Pedometer Counts and Activity Log Check:

{□ Under 5000 (Sedentary)| □ 5000-7499 (Low active)| □ 7500-10000| □

(somewhat active)| □ 10000-12500 (active)| □ Over 12500 (highly active)*}

[ ]

8 Create an Action Plan for Next 4 Weeks:

{□ Facility Tour| □ Find a Workout Partner| □ Reduce Barriers| □ Walking| □ Buy Equipment| □ Try a New Activity| □ Increase Steps| □ Increase Time| □ Increase Intensity| □ Other: }

9 Follow-up via: {□ Phone| □ Email| □Appointment}

Follow-up plan: {Next Appt Date: <APPTDATEEMPTY>| □Referral| □Other: }

10 Tools used:

[Stage of Change| Goal Setting Worksheet| Information Handouts| Decision Balance Sheet| Activity Inventory| Choosing Alternatives for Action| Pedometer Tool| Motivation List| First Step Planner | Activity Log| Relapse Planner| Self Contract| Dose Response]

11 Additional Resources Provided: [ ]

12 NOTES: [ ]

13 Completed Charting [□]

ENCOURAGE - Session # 4: Enjoyment

Client Name: <PATLASTNAME> <PATFIRSTNAME>

Date: <CURRENTDATE>

Time: <CURRENTTIME>

(Add "Referral-Pad-TopOnly-Nov21-EMR" attachment to the EMR as a task.)

(Place macro "Participant-Baseline-EMR" at the top of each charting page.)

1 Review of last 4 weeks: How did things go? [ ]

Focus on positive changes: What went well? How did you feel? [ ]

Did you complete your action plan? [Yes|No] [ ]

2 Barriers: What prevented or limited you from becoming more active / reaching your goals?

{□ Time| □ Cost| □Environment| □ Previous Negative Experience| □ Lack of Energy| □ Lack of Knowledge| □ Lack of Motivation| □ Lack of Skills| □ Uncomfortable in Physical Activity Settings| □ Fear of Injury| □ Self-Image| □ Lack of Facilities| □ Safety| □ Lack of Child Care| □ Lack of Social Support| □ Lack of Transportation| □ Low Priority| □ Self-Efficacy| □ Fear of Making Condition Worse| □ Other: }

3 Overcoming Barriers & Planning for Relapse: How can we move forward? [ ]

What steps can we take to overcome and minimize those barriers?

{□ Create a Support System| □ Joining a Class| □ Setting Goals| □ Family Activity Options| □ Subsidy| □ No/Low Cost Opportunities| □ Scheduling| □ Increase Knowledge/Awareness| □ Other: }

4 Sources of Motivation & Rewards:{□ Feel Better| □ Look Better| □ Energy| □ Self-Confidence| □ Weight Management| □ Improved Health| □ Fun| □ Manages Stress| □ Improved Fitness| □ Special Event| □ Sleep Better| □ Social Interaction| □ Live Longer| □ Improved Quality of Life| □ Decrease Risk of Disease| □ Physician Referral| □ Other: }

5 Re-focus on the positive progress they have made and reflect back on values interview from meeting #1: [ ]

6 Social Supports and Community Connections: [ ]

7 Pedometer Counts and Activity Log Check:

{□ Under 5000 (Sedentary)| □ 5000-7499 (Low active)| □ 7500-10000| □ (somewhat active)| □ 10000-12500 (active)| □ Over 12500 (highly active)*}

8 Create an Action Plan for Next 6 Weeks:

{□ Facility Tour| □ Find a Workout Partner| □ Reduce Barriers| □ Walking| □ Buy Equipment| □ Try a New Activity| □ Increase Steps| □ Increase Time| □ Increase Intensity| □ Other: }

9 Follow-up via: {□ Phone| □ Email| □Appointment}

Follow-up plan: {Next Appt Date: <APPTDATEEMPTY>| □Referral| □Other: }

10 Tools used:[Stage of Change| Goal Setting Worksheet| Information Handouts| Decision Balance Sheet| Activity Inventory| Choosing Alternatives for Action| Pedometer Tool| Motivation List| First Step Planner | Activity Log| Relapse Planner| Self Contract| Dose Response]

11 Additional Resources Provided: [ ]

12 NOTES: [ ]

13 Completed Charting [□]

ENCOURAGE - Session # 5: Self-Identity and Moving Forward

Client Name: <PATFIRSTNAME> <PATLASTNAME>

Date: <CURRENTDATE>

Time: <CURRENTTIME>

(Add "Referral-Pad-TopOnly-Nov21-EMR" attachment to the EMR as a task.)

(Place macro "Participant-Baseline-EMR" at the top of each charting page.)

1 Review of last 6 weeks: How did things go? [ ] Focus on positive changes: What went well? How did you feel? [ ] Did you complete your action plan? [Yes|No] [ ]

2 Barriers: What prevented or limited you from becoming more active / reaching your goals?

{□ Time| □ Cost| □Environment| □ Previous Negative Experience| □ Lack of Energy| □ Lack of Knowledge| □ Lack of Motivation| □ Lack of Skills| □ Uncomfortable in Physical Activity Settings| □ Fear of Injury| □ Self-Image| □ Lack of Facilities| □ Safety| □ Lack of Child Care| □ Lack of Social Support| □ Lack of Transportation| □ Low Priority| □ Self-Efficacy| □ Fear of Making Condition Worse| □ Other: }

3 Overcoming Barriers & Planning for Relapse:

How can we move forward? [ ]

What steps can we take to overcome and minimize those barriers?

{□ Create a Support System| □ Joining a Class| □ Setting Goals| □ Family Activity Options| □ Subsidy| □ No/Low Cost Opportunities| □ Scheduling| □ Increase Knowledge/Awareness| □ Other: }

4 Sources of Motivation & Rewards:

{□ Feel Better| □ Look Better| □ Energy| □ Self-Confidence| □ Weight Management| □ Improved Health| □ Fun| □ Manages Stress| □ Improved Fitness| □ Special Event| □ Sleep Better| □ Social Interaction| □ Live Longer| □ Improved Quality of Life| □ Decrease Risk of Disease| □ Physician Referral| □ Other: }

Re-do values assessment and focus on positive progress they have made in the last 16 weeks:

Have their values, beliefs, attitudes, self-identity changed? [Yes|No]

Review of previous goals - have any been reached?

{□ Family| □ Health| □ Longevity| □ Enjoyment| □ Role Model| □ Improve

Quality of Life| □ Improve Social Relationships| □ Other: }

6 Social Support and Community Connections- moving forward: [ ]

7 Pedometer Counts and Activity Log Check:

{□ Under 5000 (Sedentary)| □ 5000-7499 (Low active)| □ 7500-10000| □

(somewhat active)| □ 10000-12500 (active)| □ Over 12500 (highly active)*}

[ ]

8 Create an Action Plan for and set new SMART (Specific, Realistic, Measurable, Attainable, Timely) goals to move forward:

{□ Facility Tour| □ Find a Workout Partner| □ Reduce Barriers| □ Walking| □ Buy Equipment| □ Try a New Activity| □ Increase Steps| □ Increase Time| □ Increase Intensity| □ Other: }

9 Review and customize take-home sheet:[ ]

10 Tools used:

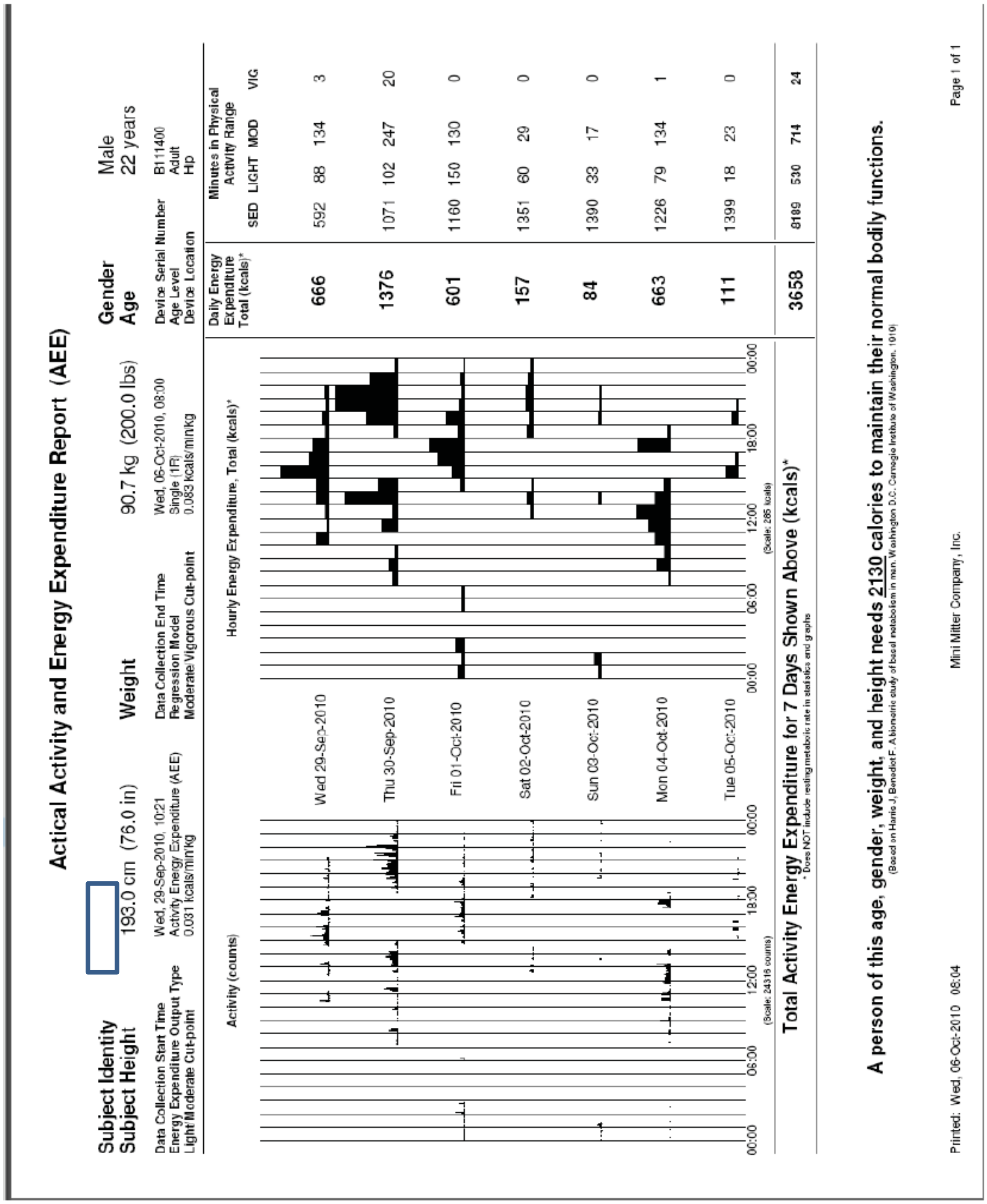
[Stage of Change| Goal Setting Worksheet| Information Handouts| Decision Balance Sheet| Activity Inventory| Choosing Alternatives for Action| Pedometer Tool| Motivation List| First Step Planner | Activity Log| Relapse Planner| Self Contract| Dose Response]

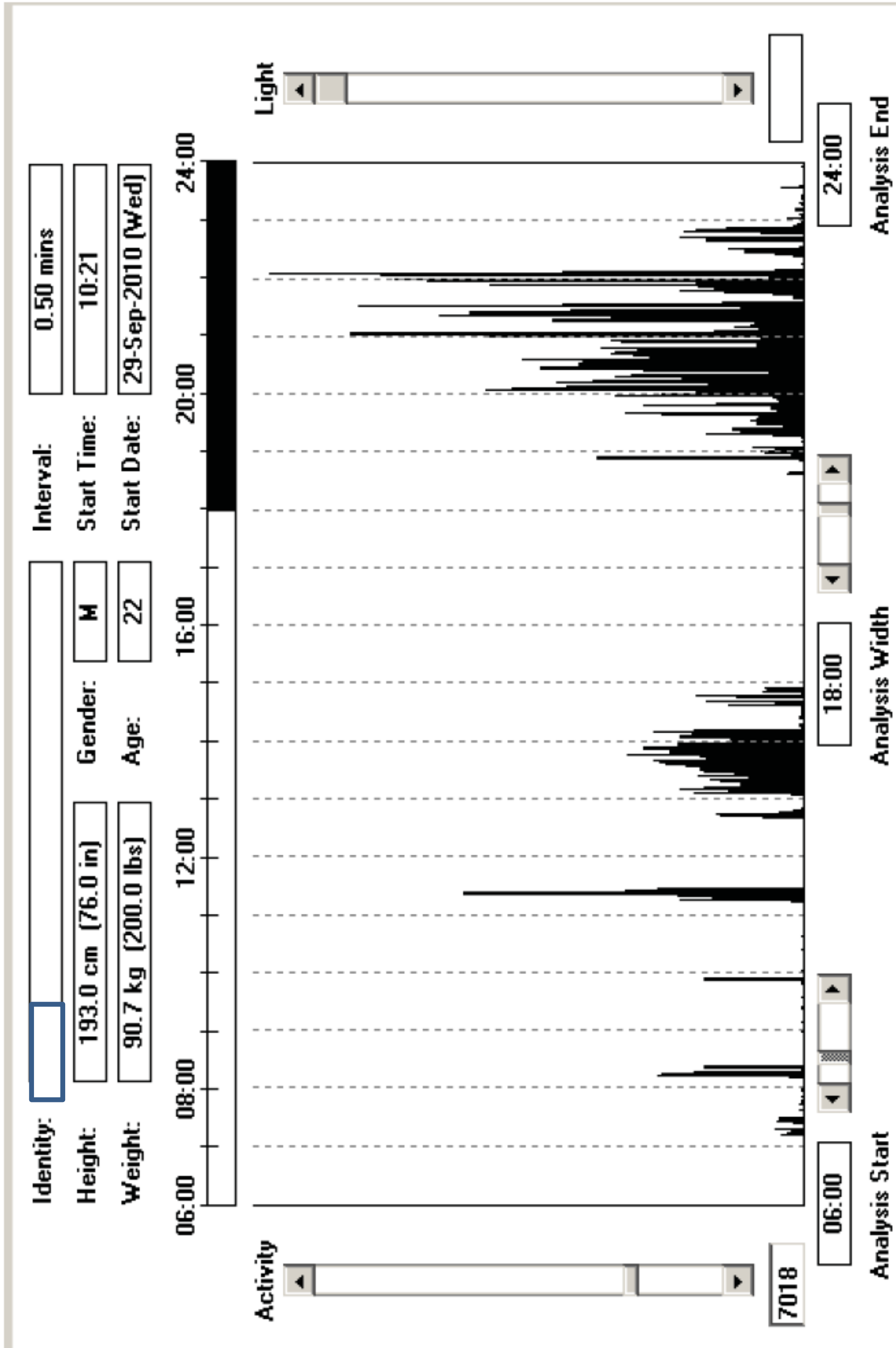
11 Additional Resources Provided:[ ]

12 NOTES:[ ]

13 Completed Charting [□]

Appendix E: Accelerometer Data Reports




Identity:
Height: 193.0 cm (76.0 in)
Weight: 90.7 kg (200.0 lbs)
Gender: M
Age: 22
Interval: 0.50 mins
Start Time: 10:21
Start Date: 29-Sep-2010 (Wed)
06:00
08:00
12:00
16:00
20:00
24:00
Activity
Light
7018
06:00
Analysis Start
18:00
Analysis Width
24:00
Analysis End

Appendix F: RFIT Patient Print Out (selection criteria met)

ENCOURAGE STUDY

PHYSICIAN REPORT

Risk Factor Identification Tool

*Based on responses provided

Completed On
01-Oct-2012

NAME:
AGE: 65

BACKGROUND INFORMATION

BMI: 31
Health: is reported as Fair and About the same than 1 year ago
OTHER consults: 2-5 in past 12 months
OTHER Rx or OTC med: No
Dental: Regular

SMOKING

Status: Ex-smoker

ALCOHOL

CAGE:
Change status:

PHYSICAL ACTIVITY

Duration: UNMET @ 0
Limits: No
Change status: Action
Level of difficulty: Manageable

DIET/NUTRITION

Self assessed Weight: Overweight
Daily nutrition report:
Fruit and Veg – 1-4
Grain – 1-3
Whole grain – Sometimes
Milk – Less than 2
Meat/alternates – Less than 2
Breakfast – Sometimes
Change status: Action

CURRENT SAFETY CONCERNS

Bike helmet
Sun Protection

Appendix F (selection criteria not met)

ENCOURAGE STUDY

PHYSICIAN REPORT

Risk Factor Identification Tool

*Based on responses provided

Completed On
01-Oct-2012

NAME:
AGE: 58

BACKGROUND INFORMATION

BMI: 31
Health: is reported as Fair and About the same than 1 year ago
OTHER consults: 2-5 in past 12 months
OTHER Rx or OTC med: Yes
Dental: Not Regular

SMOKING

Status: Ex-smoker

ALCOHOL

CAGE:
Change status:

PHYSICAL ACTIVITY

Duration: MET @ 150
Limits: No
Change status: Contemplative
Level of difficulty: Manageable

DIET/NUTRITION

Self assessed Weight: Overweight
Daily nutrition report:

- Fruit and Veg – 1-4
- Grain – 1-3
- Whole grain – Sometimes
- Milk – More than 3
- Meat/alternates – More than 3
- Breakfast – Rarely

Change status: Contemplative
Level of confidence for change: Somewhat confident

CURRENT SAFETY CONCERNS

Bike helmet
Sun Protection
Occupational hazards

Appendix F (patient healthy information feedback form)

Recommendations for your Health

*Based on responses provided

01-Oct-2012

All of the following behaviors affect your health. By working toward the goals listed here, you are making an important decision to maintain or even improve your health – and that includes preventing heart disease and certain cancers! Your physician can help you find a way that works for you.

PHYSICAL ACTIVITY

Every 10 minutes that you spend doing an activity that causes an increase in breathing is good for you. And it is not just doing sports – think about walking briskly, raking leaves, or dancing. Aim for a total of 150 minutes of physical activity each week.

DIET/NUTRITION

Your diet:		Suggested daily diet:
Fruit and Vegetables	1-4	7
Grain Products	1-3	7
Milk and Alternatives	< 2	3
Meat and Alternatives	< 2	3

Do you know what a serving size is? See Canada's Food Guide for all the information you need to make good choices.

Whole grains

Try to make at least half of your grain products whole grain each day.

SMOKING

Keep up the good work!
Every day you remain a non-smoker you are reducing your health risks.

ALCOHOL

DENTAL

Well done! A professional visit along with daily cleaning is important for maintaining or improving your oral health.

SAFETY

WEARING A BICYCLE HELMET RARELY OR NOT AT ALL

Wearing a helmet has been shown to save lives and may prevent a "minor" head injury which can cause serious long-term health problems.

ALWAYS PROTECTING YOURSELF FROM WORKPLACE INJURY

Well done! You are making an important decision to protect your right to be healthy and pain free – not just for work but for all your activities.

NOT ALWAYS PROTECTING YOURSELF FROM SUN EXPOSURE

Avoiding the sun at mid-day, using sunscreen and/or protective clothing are all important steps to preventing sunburns and skin cancer

Appendix G: SF-12v2 Questionnaire

ENCOURAGE

SF-12v2™ Health Survey Standard Version

This survey asks for your views about your health. This information will help you keep track of how you feel and how well you are able to do your usual activities. ***Thank you for completing this survey!***

For each of the following questions, please check the circle that best describes your answer.

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

Excellent	Very good	Good	Fair	Poor
☐	☐	☐	☐	☐

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

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. <u>Moderate activities,</u> such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐	☐	☐
b. Climbing <u>several</u> flights of stairs	☐	☐	☐

3. During the <u>past 4 weeks,</u> how much of the time 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>

	All of the time	Most of the time	Some of the time	A little of the time	No, not limited at all
a. <u>Accomplished less</u> than you would like	☐	☐	☐	☐	☐
b. Climbing <u>several</u> flights of stairs	☐	☐	☐	☐	☐

PROMOTING ACTIVE LIFESTYLES

ENCOURAGE

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

	All of the time	Most of the time	Some of the time	A little of the time	No, not limited at all
a. Accomplished less than you would like	☐	☐	☐	☐	☐
b. Did work or activities less carefully than usual	☐	☐	☐	☐	☐

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

Not at all	A little bit	Moderately	Quite a bit	Extremely
☐	☐	☐	☐	☐

6. 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…

	All of the time	Most of the time	Some of the time	A little of the time	No, not limited at all
a. Have you felt calm and peaceful?	☐	☐	☐	☐	☐
b. Did you have a lot of energy?	☐	☐	☐	☐	☐
c. Have you felt downhearted and depressed?	☐	☐	☐	☐	☐

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

All of the time	Most of the time	Some of the time	A little of the time	None of the time
☐	☐	☐	☐	☐

PROMOTING ACTIVE LIFESTYLES

Appendix H: Self Efficacy for Exercise Questionnaire (SEE)

ENCOURAGE

Self-Efficacy Survey

How confident are you right now that you could exercise three times per week for 20 minutes if:

1. **The weather was bothering you?**
   0 1 2 3 4 5 6 7 8 9 10
2. **You were bored by the program or activity?**
   0 1 2 3 4 5 6 7 8 9 10
3. **You felt pain when exercising?**
   0 1 2 3 4 5 6 7 8 9 10
4. **You had to exercise alone?**
   0 1 2 3 4 5 6 7 8 9 10
5. **You did not enjoy it?**
   0 1 2 3 4 5 6 7 8 9 10
6. **You were too busy with other activities?**
   0 1 2 3 4 5 6 7 8 9 10
7. **You felt tired?**
   0 1 2 3 4 5 6 7 8 9 10
8. **You felt stressed?**
   0 1 2 3 4 5 6 7 8 9 10
9. **You felt depressed?**
   0 1 2 3 4 5 6 7 8 9 10

PROMOTING ACTIVE LIFESTYLES

Appendix I: Patient Health Questionnaire-9 (PHQ-9)

ENCOURAGE

Patient Health Questionnaire-9

1. Over the last 2 weeks, how often have you been bothered by the following problems?

	Not at all (0)	Several days (1)	More than half the days (2)	Nearly every day (3)
a. Little interest or pleasure in doing things	☐	☐	☐	☐
b. Feeling down, depressed, or hopeless.	☐	☐	☐	☐
c. Trouble falling/staying asleep, sleeping too much	☐	☐	☐	☐
d. Feeling tired or having little energy	☐	☐	☐	☐
e. Poor appetite or overeating.	☐	☐	☐	☐
f. Feeling bad about yourself, or that you are a failure, or have let yourself of your family down.	☐	☐	☐	☐
g. Trouble concentrating on things, such as reading the newspaper or watching TV.	☐	☐	☐	☐
h. Moving or speaking so slowly that others could have noticed. Or the opposite; being so fidgety or restless that you have been moving around more than usual	☐	☐	☐	☐
i. Thoughts that you would be better off dead or of hurting yourself in some way.	☐	☐	☐	☐

PROMOTING ACTIVE LIFESTYLES

ENCOURAGE

2. If you checked off any problem on this questionnaire so far, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

☐ Not difficult at all ☐ Somewhat difficult ☐ Very difficult ☐ Extremely difficult

TOTAL SCORE ___________

PROMOTING ACTIVE LIFESTYLES

Appendix J: Stage of Change Questionnaires

ENCOURAGE

Transtheoretical Model of Change Questionnaire

1. **Have you made any lifestyle changes (exercise/watch diet etc.) to help manage your condition/symptoms (self-manage)?**

☐ Yes (go to question 2) ☐ No (go to question 3)

2. **How long ago have you made those changes?**

☐ Less than 6 months ☐ More than 6 months

3. **When do you feel that you will be ready to make these changes?**

☐ In more than 6 months

☐ In less than 6 months

☐ In 1 month

☐ Never

If never, why not ___________________________________

PROMOTING ACTIVE LIFESTYLES

ENCOURAGE

Stages of Change Questionnaire

Which sentence represents your current status:

☐ I exercise regularly and have done so for longer than 6 months.

☐ I exercise regularly but have done so for less than 6 months.

☐ I currently exercise but not regularly.

☐ I currently do not exercise but I have been thinking about starting exercise in the next 6 months.

☐ I currently don't exercise and I do not intend to start in the next 6 months.

☐ I have done physical activity regularly in the past but I am not doing so currently.

Appendix K: Consent Document for the ENCOURAGE project

UNIVERSITY OF MANITOBA | Hôpital St-Boniface Hospital

The ENCOURAGE project: Enhancing primary care counseling and referrals to community-based physical activity opportunities for sustained lifestyle change.

Principal Investigator: Todd Duhamel, PhD

Faculty of Kinesiology and Recreation Management, University of Manitoba & Institute of Cardiovascular Sciences St.Boniface General Hospital Research Centre

Co-investigators:

- Alan Katz and Jon McGavock,
  - Faculty of Medicine, University of Manitoba
- Jeanette Edwards, Sande Harlos, Debra Vanance, Ingrid Botting, Colleen Metge, Jan Schmalenberg, Deanna Bettridge and Amy Tibbs
  - Winnipeg Regional Health Authority
- Sue Boreski,
  - Reh-Fit Centre
- Karen Beck
  - City of Winnipeg
- Danielle Bouchard, Shaelyn Strachan, David Kent, Eric Garcia, Scott Kehler, Nicole Dunn
  - Faculty of Kinesiology and Recreation Management, University of Manitoba & Institute of Cardiovascular Sciences St. Boniface General Hospital Research Centre.

You are being asked to participate in a research study. Please take your time to review this consent form and discuss any questions you may have with the study staff. You may take your time to make your decision about participating in this study and you may discuss it with your friends, family or (if applicable) your doctor before you make your decision. This consent form may contain words that you do not understand. Please ask the study staff to explain any words or information that you do not clearly understand.

Purpose of Study: It is generally well accepted that physical activity has a large role in the prevention of chronic disease. However, traditional primary care services in Canada do not provide people with the support that they require to adopt and sustain a more physically active lifestyle.

The purpose of this research study is to improve the prescription of physical activity as a health intervention by adding an exercise specialist (which is also called a kinesiologist) to the primary health care team and to determine if this addition helps people to become more physically active. The role of the kinesiologist will be to:

1. educate people about the broad health benefits of physical activity;
2. provide people with advice about how to exercise by doing activities that are fun; and,
3. develop a referral process that will enable health care providers to refer people to local community-based physical activity programs or self-directed physical activity opportunities.

Study procedures

If you choose to participate in the study, you will be asked to meet with a kinesiologist on at least 4 occasions for approximately 30-60 minutes each time. During each of these meetings, the kinesiologist will ask you about your current physical activity levels and about the types of activities that you enjoy. They will also work with you to develop a plan to help you become more physically active. The kinesiologist will take notes during each meeting using standardized clinical assessment forms. These notes will be added to your permanent clinical record so other medical staff at the clinic can provide you with appropriate care. Your decision to participate or not participate in the study will not alter the standard of care you receive at the clinic.

If you do choose to participate in the study, you will also be asked to attend a meeting with the research team on five different occasions for approximately 30 minutes each time. The five meetings will be held at the clinic at a mutually agreeable time and will occur:

1. prior to meeting with the kinesiologist;
2. 2 months after you started the program;
3. 4 months after you started the program;
4. 6 months after you started the program; and

5. 10 months after you started the program.

This schedule will enable the research team to determine if the kinesiologist was able to help you become more physically active.

During each of the five meetings, you will be asked:

1. To complete a series of surveys to characterize:
    a. your perception about how likely it is you will successfully incorporate physical activity into your daily routine;
    b. your attitude and motivation for increasing your physical activity levels;
    c. your health risk behaviours and readiness to change;
    d. your general mood status;
    e. your ideas about physical activity; and,
    f. your cardiovascular disease risk; and
    g. your quality of life;

2. To wear an accelerometer for a period of 7 days. An accelerometer is a small device that is about the size of a watch (4 cm x 4 cm) and is worn on a belt. This device measures the amount and intensity of physical activity that you complete on a daily basis. Given the small size and placement of the accelerometer at belt level, you will be able to participate in your normal daily routine without alteration. It is important to note that the accelerometer will only measure the amount of physical activity that you accumulate and does not store personal information. Therefore, your privacy will not be adversely affected by wearing the unit. If you agree to wear an accelerometer, the unit will be given to you by research staff at each of the five meetings and you will be asked to return the unit to the clinic 7-days later.

Additional data for this project will be collected by reviewing your medical records at the clinic. Research staff will review the information contained in these standard forms in order to evaluate the effectiveness of the project for changing your overall health status. Your medical record may include information such as:

1. height and weight
2. heart rate or EKG tracings,
3. blood analyses;
4. hospital and health care admissions;

5. medications and current treatments; and,
6. demographic data including patient diagnosis and age.

The collection of this information is standard practice for all clients attending the clinic. All data will be treated as confidential in accordance with the Personal Health Information Act of Manitoba. Any information that may reveal personal identifiers (such as name, address or telephone numbers) will be removed prior to data analysis in order to protect patient anonymity and confidentiality.

Risks

With respect to safety, there is a large amount of evidence demonstrating that the benefits of physical activity exceed the injury-related risks of physical activity. In fact, the risk associated with this project do not exceed the risks a person experiences on a daily basis while they are physically active (e.g. while you run and play or exercise).

You are free to withdraw from participation in the study at any time upon request. Withdrawal from the research study will not alter the standard of care you receive from the clinic. Your participation in the study may also be discontinued upon the advice of the clinic medical staff for your safety.

Benefits

A benefit to participating in this study is that you will gain specific and detailed information regarding the amount and intensity of physical activity that you complete in your daily life at various times over a 10 month period. This information is not currently available to patients at the clinic. Although this information may help you to adopt a more physically active lifestyle, your health status may not be influenced by your participation in the study.

The clinic may benefit from this study by gaining new information describing the effectiveness of the project. This new information may be used to guide the development of future program initiatives at the clinic.

Confidentiality

Information gathered in this research study may be published or presented in a program evaluation report to inform the Winnipeg Regional Health Authority and its stakeholders about the outcomes of the study. However, your name and other identifying information will not be used or revealed. Medical records that contain your identity will be treated as confidential in accordance with the Personal Health Information Act of Manitoba. All

Participant Initials:__________

study documents related to you will bear only your assigned patient code. All records will be kept in a locked secure area and only those persons identified as researchers will have access to these records. If any of your medical/research records need to be copied, information that may reveal personal identifiers will be removed. No information revealing any personal information such as your name, address or telephone number will leave the clinic nor will it be used for unauthorized purposes. Despite efforts to keep your personal information confidential, absolute confidentiality cannot be guaranteed. Your personal information may be disclosed if required by law. The University of Manitoba Education and Nursing Research Ethics Board, the St. Boniface General Hospital and the Winnipeg Regional Health Authority may review research-related records for quality assurance purposes. After the completion of the study, research data will be kept for a maximum of 7 years and then destroyed". However, the clinical assessment forms (there are 5 in total) completed by the Kinesiologist will be added to your permanent clinical record as a way to enable the medical staff to provide you with appropriate care. This information will be protected as confidential in accordance with the Personal Health Information Act of Manitoba."

Feedback

Participants in the study will be provided an opportunity to request specific feedback about their individual results as well as the overall results of the study. If you would like to receive feedback, please provide your contact information on the "Feedback Request Form" at the end of this consent form package.

Costs

All research-related procedures, which will be performed as part of this study, are provided at no cost to you.

Payment for participation

No compensation will be provided for participating in this study.

Alternatives

Instead of being in this study, you may request educational material about physical activity programs available in the City of Winnipeg.

Voluntary Participation/Withdrawal From the Study

Your decision to take part in this study is voluntary. You may refuse to participate or you may withdraw from the study at any time. Your decision not to participate or to withdraw from the study will not affect your other medical care at this site. If medical staff determine that it is in your best interest to withdraw you from the study, the medical staff will inform the research team and will remove you from the study without your consent.

We will tell you about any new information that may affect your health, welfare, or willingness to stay in this study.

Medical Care for Injury Related to the Study

In the case of injury or illness resulting from this study, necessary medical treatment will be available at no additional cost to you. If the research team becomes aware of a condition that may affect your health, the research team will share this information with the clinic medical staff in order to enable the medical staff to provide you with appropriate care. You are not waiving any of your legal rights by signing this consent form nor releasing the investigator(s) from their legal and professional responsibilities.

Questions

You are free to ask any questions that you may have about your treatment and your rights as a research participant. If any questions come up during or after the study or if you have a research-related injury, contact Dr. Todd Duhamel by phone at [redacted] For questions about your rights as a research participant, you may contact the University of Manitoba Education and Nursing Research Ethics Board at [redacted].

This research has been approved by the Education/Nursing Research Ethics Board. The University of Manitoba Research Ethics Board(s) and representative of the University of Manitoba Research Quality Management / Assurance office may also require access to your research records for safety and quality assurance purposes. If you have any concerns or complaints about this project you may contact the Human Ethics Secretariat at [redacted] or e-mail [redacted] A copy of this consent form has been given to you to keep for your records and reference.

Do not sign this consent form unless you have had a chance to ask questions and have received satisfactory answers to all of your questions.

Statement of Consent

I have read this consent form. I have had the opportunity to discuss this research study with Dr. Todd Duhamel and/or his study staff. I have had my questions answered by them in language I understand. The risks and benefits have been explained to me. I believe that I have not been unduly influenced by any study team member to participate in the research study by any statement or implied statements. Any relationship (such as employee, student or family member) I may have with the study team has not affected my decision to participate. I understand that I will be given a copy of this consent form after signing it. I understand that my participation in this clinical trial is voluntary and that I may choose to withdraw at any time. I freely agree to participate in this research study.

I understand that information regarding my personal identity will be kept confidential, but that confidentiality is not guaranteed. I authorize the inspection of my research study documents by the University of Manitoba Education and Nursing Research Ethics Board, the St. Boniface General Hospital or the Winnipeg Regional Health Authority in the event that an audit is conducted.

By signing this consent form, I have not waived any of the legal rights that I have as a participant in a research study.

Participant signature_________________________________ Date ____________________
(day/month/year)

Participant printed name: ______________________________

Time:______________AM/PM

Research Staff

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has knowingly given their consent

Printed Name: ________________________________ *Date* ____________________
(day/month/year)

Signature: ____________________________________ *Time:*____________*AM/PM*

Role in the study: ___________ *Relationship to study team members:*__________

Feedback Request Form

I would like to receive (check the box that applies):
_______ a specific feedback report detailing my individual results
_______ a summary report of the overall study findings.
_______ both reports.

Participant signature______________________________ Date __________________
(day/month/year)

Participant printed name: ___________________________
Time:_____________AM/PM

Please send me a copy of these reports by:

_____ email to the following email account:

____

_____ post mail to the following address
Address: ____
City: ____
Postal code: _______________________________________

Appendix L: Sub group non-significant data for the ENCOURAGE project

BMI sub-group analyses

Sub-Groups	Time points				
	Baseline	2 month	4 month	6 month	10 month
Sub-group based on BMI(kg/m^{2})					
$MVPA_{10mins}$ *(minutes/week)*	25 ± 6	25 ± 9	32 ± 9	36 ± 11	23 ± 9
Overweight *(n=12)*	21 ± 11	14 ± 6	28 ± 10	36 ± 20	23 ± 15
Class I obese *(n=17)*	45 ± 15	24 ± 12	35 ± 14	67 ± 32	28 ± 16
Class II obese *(n=14)*	19 ± 11	34 ± 28	35 ± 30	9 ± 7	5 ± 2
Class III obese *(n=13)*	10 ± 6	26 ± 19	29 ± 15	25 ± 11	35 ± 29
LPA_{10mins} *(minutes/week)*	19 ± 4	39 ± 11 [a]	25 ± 4	30 ± 6	20 ± 5 [b]
Overweight *(n=12)*	9 ± 4	29 ± 16	26 ± 9	28 ± 9	9 ± 6
Class I obese *(n=17)*	11 ± 4	59 ± 29	27 ± 9	31 ± 10	22 ± 8
Class II obese *(n=14)*	42 ± 15	43 ± 19	34 ± 8	41 ± 13	39 ± 14
Class III obese *(n=13)*	11 ± 3	18 ± 5	11 ± 6	21 ± 11	6 ± 2
TPA_{10mins} *(minutes/week)*	44 ± 8	65 ± 14	57 ± 11	67 ± 12	43 ± 10
Overweight *(n=12)*	30 ± 14	43 ± 19	53 ± 17	64 ± 25	33 ± 15
Class I obese *(n=17)*	56 ± 15	84 ± 30	62 ± 17	97 ± 32	50 ± 16
Class II obese *(n=14)*	61 ± 19	77 ± 34	69 ± 32	50 ± 14	45 ± 15
Class III obese *(n=13)*	21 ± 8	47 ± 19	39 ± 14	46 ± 14	41 ± 30
SED_{10mins} *(hours/day)*	6.7 ± 0.2	6.5 ± 0.3	7.2 ± 0.3	6.8 ± 0.3	6.8 ± 0.3
Overweight *(n=12)*	5.9 ± 0.4	5.5 ± 0.4	6.2 ± 0.3	6.7 ± 0.6	6.7 ± 0.5
Class I obese *(n=17)*	6.6 ± 0.3	6.5 ± 0.5	6.9 ± 0.6	6.8 ± 0.6	6.6 ± 0.6
Class II obese *(n=14)*	7.2 ± 0.5	7.1 ± 0.5	7.9 ± 1.0	7.1 ± 0.8	7.4 ± 0.3
Class III obese *(n=13)*	7.1 ± 0.4	6.6 ± 0.4	7.7 ± 0.5	7.6 ± 0.3	6.8 ± 0.7
$MVPA_{Sporadic}$ *(minutes/week)*	144 ± 13	138 ± 15	153 ± 17	165 ± 25	144 ± 18
Overweight *(n=12)*	134 ± 23	124 ± 27	164 ± 37	162 ± 43	162 ± 54
Class I obese *(n=17)*	148 ± 27	126 ± 25	151 ± 29	223 ± 71	147 ± 27
Class II obese *(n=14)*	168 ± 31	174 ± 33	158 ± 35	142 ± 22	143 ± 22
Class III obese *(n=13)*	121 ± 21	129 ± 32	139 ± 38	115 ± 23	124 ± 44
$LPA_{Sporadic}$ *(minutes/week)*	593 ± 27	621 ± 28	688 ± 29 [a]	728 ± 45 [a b]	685 ± 33 [a]
Overweight *(n=12)*	566 ± 47	585 ± 44	658 ± 59	699 ± 84	702 ± 80
Class I obese *(n=17)*	544 ± 49	629 ± 54	674 ± 58	751 ± 104	647 ± 70
Class II obese *(n=14)*	723 ± 59	726 ± 69	771 ± 51	803 ± 101	749 ± 51
Class III obese *(n=13)*	543 ± 44	530 ± 40	647 ± 62	644 ± 47	649 ± 66
$TPA_{Sporadic}$ *(minutes/week)*	737 ± 34	759 ± 34	841 ± 35 [a]	836 ± 49 [a]	820 ± 42 [a]
Overweight *(n=12)*	699 ± 50	709 ± 50	822 ± 73	861 ± 106	869 ± 107
Class I obese *(n=17)*	692 ± 67	754 ± 71	825 ± 74	975 ± 172	794 ± 88
Class II obese *(n=14)*	891 ± 77	900 ± 80	928 ± 59	945 ± 107	892 ± 61
Class III obese *(n=13)*	663 ± 49	659 ± 41	786 ± 70	759 ± 58	780 ± 75
$SED_{Sporadic}$ *(hours/day)*	8.4 ± 0.2	8.1 ± 0.3	9.3 ±0.4 [b]	9.3 ± 0.4 [a b]	9.3 ± 0.3 [a b]
Overweight *(n=12)*	7.6 ± 0.4	7.2 ± 0.4	8.2 ± 0.4	8.9 ± 0.8	9.1 ± 0.8

Class I obese *(n=17)*	8.2 ± 0.3	8.3 ± 0.5	9.2 ± 0.6	9.2 ± 0.9	8.6 ± 0.6
Class II obese *(n=14)*	9.0 ± 0.6	8.9 ± 0.6	10.0 ± 1.1	9.3 ± 0.9	9.6 ± 0.4
Class III obese *(n=13)*	8.6 ± 0.5	8.0 ± 0.5	9.8 ± 0.6	9.8 ± 0.5	9.9 ± 0.7

Data are reported as mean ± SE. (Total *n*=56). Two-way ANOVAs were used for sub-group analysis. BMI, body mass index. Overweight, 25 to 29.9kg/m^2; class I obese, 30 to 34.9kg/m^2; class II obese, 35 to 39.9 kg/m^2; class III obese, >40 kg/m^2. [a] different from baseline, [a] different from 2 month. ($p<0.05$)

Sex sub-group analyses

Sub-Groups	Baseline	2 month	4 month	6 month	10 month
Sub-group based on Sex					
$MVPA_{10mins}$ *(minutes/week)*	25 ± 6	25 ± 9	32 ± 9	36 ± 11	23 ± 9
Female *(n=39)*	25 ± 7	31 ± 12	35 ± 13	32 ± 13	28 ± 12
Male *(n=17)*	26 ± 12	12 ± 6	23 ± 10	44 ± 23	12 ± 6
LPA_{10mins} *(minutes/week)*	19 ± 4	39 ± 11 [a]	25 ± 4	30 ± 6	20 ± 5 [b]
Female *(n=39)*	12 ± 3	18 ± 5	15 ± 4	24 ± 6	14 ± 5
Male *(n=17)*	33 ± 12	87 ± 30 [#]	47 ± 9	45 ± 11	32 ± 11
TPA_{10mins} *(minutes/week)*	44 ± 8	65 ± 14	57 ± 11	67 ± 12	43 ± 10
Female *(n=39)*	37± 8	49 ± 13	50 ± 13	57 ± 14	42 ± 13
Male *(n=17)*	60 ± 16	100 ± 32	71 ± 16	89 ± 25	45± 12
SED_{10mins} *(hours/day)*	6.7 ± 0.2	6.5 ± 0.3	7.2 ± 0.3	6.8 ± 0.3	6.8 ± 0.3
Female *(n=39)*	6.9 ± 0.3	6.6 ± 0.3	7.3 ± 0.4	6.7 ± 0.3	6.9 ± 0.4
Male *(n=17)*	6.2 ± 0.3	6.2 ± 0.4	6.9 ± 0.6	7.6 ± 0.7	6.7 ± 0.4
$MVPA_{Sporadic}$ *(minutes/week)*	144 ± 13	138 ± 15	153 ± 17	165 ± 25	144 ± 18
Female *(n=39)*	150 ± 16	149 ± 18	158 ± 21	153 ± 20	144 ± 23
Male *(n=17)*	130 ± 24	113 ± 22	140 ± 28	192 ± 68	144 ± 28
$LPA_{Sporadic}$ *(minutes/week)*	593 ± 27	621 ± 28	688 ± 29 [a]	728 ± 45 [a b]	685 ± 33 [a]
Female *(n=39)*	569 ± 30	579 ± 26	645 ± 30	674 ± 36	649 ± 32
Male *(n=17)*	649 ± 53	715 ± 67	787 ± 62	853 ± 121	767 ± 82
$TPA_{Sporadic}$ *(minutes/week)*	737 ± 34	759 ± 34	841 ± 35 [a]	836 ± 49 [a]	820 ± 42 [a]
Female *(n=39)*	718 ± 40	729 ± 35	803 ± 37	827 ± 51	795 ± 42
Male *(n=17)*	779 ± 62	828 ± 77	927 ± 75	1045 ± 173	916 ± 95
$SED_{Sporadic}$ *(hours/day)*	8.4 ± 0.2	8.1 ± 0.3	9.3 ±0.4 [b]	9.3 ± 0.4 [a b]	9.3 ± 0.3 [a b]
Female *(n=39)*	8.6 ± 0.3	8.3 ± 0.3	9.5 ± 0.5	9.1 ± 0.4	9.4 ± 0.4
Male *(n=17)*	7.9 ± 0.2	7.6 ± 0.4	8.9 ± 0.6	9.8 ± 1.0	8.8 ± 0.4

Data are reported as mean ± SE. (Total *n*=56). Two-way ANOVAs were used for sub-group analysis. [#] different from group at time point, [a] different from baseline, [a] different from 2 month. ($p<0.05$)

Site sub-group analyses

Sub-Groups	Time points				
	Baseline	2 month	4 month	6 month	10 month
Sub-group based on Site					
$MVPA_{10mins}$ *(minutes/week)*	25 ± 6	25 ± 9	32 ± 9	36 ± 11	23 ± 9
Site 1 *(n=25)*	34 ± 11	22 ± 9	27 ± 10	37 ± 18	26 ± 11
Site 2 *(n=31)*	18 ± 6	28 ± 15	36 ± 15	35 ± 15	21 ± 13
LPA_{10mins} *(minutes/week)*	19 ± 4	39 ± 11 [a]	25 ± 4	30 ± 6	20 ± 5 [b]
Site 1 *(n=25)*	15 ± 6	30 ± 11	18 ± 6	31 ± 9	21 ± 8
Site 2 *(n=31)*	22 ± 6	46 ± 17	30 ± 6	30 ± 7	19 ± 6
TPA_{10mins} *(minutes/week)*	44 ± 8	65 ± 14	57 ± 11	67 ± 12	43 ± 10
Site 1 *(n=25)*	49 ± 13	52 ± 15	45 ± 13	68 ± 20	46 ± 12
Site 2 *(n=31)*	40 ± 9	75 ± 21	66 ± 16	65 ± 16	40 ± 14
SED_{10mins} *(hours/day)*	6.7 ± 0.2	6.5 ± 0.3	7.2 ± 0.3	6.8 ± 0.3	6.8 ± 0.3
Site 1 *(n=25)*	6.9 ± 0.3	6.7 ± 0.3	6.9 ± 0.4	6.7 ± 0.4	7.3 ± 0.4
Site 2 *(n=31)*	6.5 ± 0.3	6.3 ± 0.4	7.4 ± 0.6	7.2 ± 0.4	6.5 ± 0.4
$MVPA_{Sporadic}$ *(minutes/week)*	144 ± 13	138 ± 15	153 ± 17	165 ± 25	144 ± 18
Site 1 *(n=25)*	122 ± 19	108 ± 18	126 ± 23	137 ± 26	121 ± 21
Site 2 *(n=31)*	161 ± 18	163 ± 21	175 ± 24	187 ± 39	162 ± 28
$LPA_{Sporadic}$ *(minutes/week)*	593 ± 27	621 ± 28	688 ± 29 [a]	728 ± 45 [a b]	685 ± 33 [a]
Site 1 *(n=25)*	545 ± 33	543 ± 30	639 ± 35	679 ± 54	665 ± 57
Site 2 *(n=31)*	632 ± 39	683 ± 42	728 ± 43	768 ± 69	701 ± 40
$TPA_{Sporadic}$ *(minutes/week)*	737 ± 34	759 ± 34	841 ± 35 [a]	836 ± 49 [a]	820 ± 42 [a]
Site 1 *(n=25)*	667 ± 41	651 ± 38	765 ± 44	816 ± 71	792 ± 65
Site 2 *(n=31)*	793 ± 49	846 ± 48	903 ± 50	955 ± 100	863 ± 54
$SED_{Sporadic}$ *(hours/day)*	8.4 ± 0.2	8.1 ± 0.3	9.3 ±0.4 [b]	9.3 ± 0.4 [a b]	9.3 ± 0.3 [a b]
Site 1 *(n=25)*	8.5 ± 0.3	8.3 ± 0.4	9.1 ± 0.4	9.0 ± 0.5	9.3 ± 0.5
Site 2 *(n=31)*	8.2 ± 0.4	8.0 ± 0.4	9.5 ± 0.6	9.6 ± 0.6	9.2 ± 0.4

Data are reported as mean ± SE. (Total *n*=56). Two-way ANOVAs were used for sub-group analysis. Site 1, Access River East; site 2, Access Transcona. [a] different from baseline, [a] different from 2 month. ($p<0.05$)

Age sub-group analyses

Sub-Groups	Time points				
	Baseline	2 month	4 month	6 month	10 month
Sub-group based on Age					
$MVPA_{10mins}$ *(minutes/week)*	25 ± 6	25 ± 9	32 ± 9	36 ± 11	23 ± 9
Young *(n=15)*	17 ± 8	8 ± 3	11 ± 7	16 ± 12	3 ± 2
Middle-age *(n=23)*	17 ± 6	27 ± 11	26 ± 9	36 ± 18	39 ± 19
Old *(n=18)*	43 ± 16	38 ± 24	56 ± 25	53 ± 24	19 ± 12
LPA_{10mins} *(minutes/week)*	19 ± 4	39 ± 11 [a]	25 ± 4	30 ± 6	20 ± 5 [b]
Young *(n=15)*	13 ± 4	30 ± 12	19 ± 7	18 ± 6	11 ± 4
Middle-age *(n=23)*	30 ± 10	60 ± 22	36 ± 7	43 ± 11	20 ± 8
Old *(n=18)*	8 ±3	21 ± 12	15 ± 7	25 ± 8	27 ± 10
TPA_{10mins} *(minutes/week)*	44 ± 8	65 ± 14	57 ± 11	67 ± 12	43 ± 10
Young *(n=15)*	30 ± 9	39 ± 14	29 ± 11	34 ± 12	15 ± 5
Middle-age *(n=23)*	47 ± 11	86 ± 24	63 ± 10	79 ± 21	59 ± 20
Old *(n=18)*	51 ± 17	59 ± 26	71 ± 29	78 ± 25	46 ± 14
SED_{10mins} *(hours/day)*	6.7 ± 0.2	6.5 ± 0.3	7.2 ± 0.3	6.8 ± 0.3	6.8 ± 0.3
Young *(n=15)*	6.3 ± 0.3	6.2 ± 0.2	6.7 ± 0.3	6.6 ± 0.5	6.5 ± 0.6
Middle-age *(n=23)*	6.7 ± 0.4	6.0 ± 0.4	7.0 ± 0.7	7.5 ± 0.5	6.9 ± 0.4
Old *(n=18)*	7.0 ± 0.4	7.3 ± 0.5	7.8 ± 0.6	6.8 ± 0.4	7.1 ± 0.6
$MVPA_{Sporadic}$ *(minutes/week)*	144 ± 13	138 ± 15	153 ± 17	165 ± 25	144 ± 18
Young *(n=15)*	136 ± 20	101 ± 21	112 ± 18	118 ± 22	97 ± 16
Middle-age *(n=23)*	163 ± 20	179 ± 22	175 ± 28	209 ± 51	213 ± 35
Old *(n=18)*	125 ± 27	117 ± 28	158 ± 35	147 ± 35	95 ± 19
$LPA_{Sporadic}$ *(minutes/week)*	593 ± 27	621 ± 28	688 ± 29 [a]	728 ± 45 [a b]	685 ± 33 [a]
Young *(n=15)*	581 ± 42	555 ± 36	655 ± 51	634 ± 63	649 ± 70
Middle-age *(n=23)*	658 ± 43	724 ± 52	760 ± 44	847 ± 85	738 ± 45
Old *(n=18)*	522 ± 47	544 ± 36	625 ± 52	656 ± 62	646 ± 64
$TPA_{Sporadic}$ *(minutes/week)*	737 ± 34	759 ± 34	841 ± 35 [a]	836 ± 49 [a]	820 ± 42 [a]
Young *(n=15)*	717 ± 50	656 ± 41	767 ± 50	752 ± 69	749 ± 71
Middle-age *(n=23)*	820 ± 55	903 ± 55	935 ± 54	1056 ± 126	955 ± 60
Old *(n=18)*	650 ± 61	661 ± 53	784 ± 67	802 ± 89	742 ± 78
$SED_{Sporadic}$ *(hours/day)*	8.4 ± 0.2	8.1 ± 0.3	9.3 ±0.4 [b]	9.3 ± 0.4 [a b]	9.3 ± 0.3 [a b]
Young *(n=15)*	8.1 ± 0.3	7.7 ± 0.3	8.8 ± 0.3	8.5 ± 0.5	9.4 ± 0.7
Middle-age *(n=23)*	8.3 ± 0.4	7.8 ± 0.4	9.3 ± 0.7	10.1 ± 0.8	9.3 ± 0.5
Old *(n=18)*	8.7 ± 0.4	8.9 ± 0.6	9.8 ± 0.7	8.9 ± 0.5	9.1 ± 0.5

Data are reported as mean ± SE. (Total *n*=56). Two-way ANOVAs were used for sub-group analysis. Young, 29 to 44 years; middle-age, 45 to 55 years; old, >55 years. [a] different from baseline, [a] different from 2 month. ($p<0.05$)

Seasonal sub-group analyses

Sub-Groups	Time points				
	Baseline	2 month	4 month	6 month	10 month
Sub-group based on Seasonal Shift					
$MVPA_{10mins}$ *(minutes/week)*	25 ± 6	25 ± 9	32 ± 9	36 ± 11	23 ± 9
Winter *(n=10)*	38 ± 18	50 ± 39	61 ± 42	29 ± 18	10 ± 8
Spring *(n=22)*	19 ± 7	23 ± 12	28 ± 9	43 ± 19	31 ± 19
Summer *(n=10)*	14 ± 7	12 ± 6	23 ± 9	13 ± 10	22 ± 18
Fall *(n=14)*	34 ± 18	21 ± 14	24 ± 16	47 ± 31	20 ± 14
LPA_{10mins} *(minutes/week)*	19 ± 4	39 ± 11 [a]	25 ± 4	30 ± 6	20 ± 5 [b]
Winter *(n=10)*	11 ± 6	16 ± 7	31 ± 9	22 ± 10	29 ± 15
Spring *(n=22)*	20 ± 6	53 ± 23	22 ± 6	31 ± 10	15 ± 7
Summer *(n=10)*	38 ± 19	44 ± 22	34 ± 12	46 ± 16	20 ± 11
Fall *(n=14)*	7 ±3	31 ± 15	17 ± 10	26 ± 8	21 ± 8
TPA_{10mins} *(minutes/week)*	44 ± 8	65 ± 14	57 ± 11	67 ± 12	43 ± 10
Winter *(n=10)*	49 ± 19	66 ± 41	93 ± 44	50 ± 19	40 ± 16
Spring *(n=22)*	39 ± 10	76 ± 26	50 ± 11	73 ± 21	46 ± 20
Summer *(n=10)*	53 ± 19	56 ± 23	58 ± 12	59 ± 17	43 ± 19
Fall *(n=14)*	41 ± 18	53 ± 19	40 ± 22	72 ± 32	40 ± 15
SED_{10mins} *(hours/day)*	6.7 ± 0.2	6.5 ± 0.3	7.2 ± 0.3	6.8 ± 0.3	6.8 ± 0.3
Winter *(n=10)*	6.4 ± 0.4	6.6 ± 0.3	7.0 ± 0.5	6.9 ± 0.5	7.1 ± 0.6
Spring *(n=22)*	6.5 ± 0.3	6.2 ± 0.4	7.1 ± 0.5	7.2 ± 0.4	7.3 ± 0.4
Summer *(n=10)*	6.8 ± 0.6	6.1 ± 0.7	7.5 ± 1.3	7.5 ± 1.0	6.6 ± 0.5
Fall *(n=14)*	7.2 ± 0.5	7.1 ± 0.7	7.2 ± 0.7	6.6 ± 0.5	6.2 ± 0.8
$MVPA_{Sporadic}$ *(minutes/week)*	144 ± 13	138 ± 15	153 ± 17	165 ± 25	144 ± 18
Winter *(n=10)*	151 ± 31	142 ± 43	183 ± 58	138 ± 33	125 ± 32
Spring *(n=22)*	149 ± 17	163 ± 26	172 ± 27	198 ± 54	157 ± 38
Summer *(n=10)*	170 ± 37	148 ± 25	158 ± 27	156 ± 26	191 ± 27
Fall *(n=14)*	111 ± 30	90 ± 18	98 ± 23	137 ± 42	103 ± 25
$LPA_{Sporadic}$ *(minutes/week)*	593 ± 27	621 ± 28	688 ± 29 [a]	728 ± 45 [a b]	685 ± 33 [a]
Winter *(n=10)*	576 ± 62	566 ± 52	725 ± 59	686 ± 96	695 ± 88
Spring *(n=22)*	572 ± 37	620 ± 41	683 ± 47	700 ± 80	636 ± 45
Summer *(n=10)*	782 ± 69	820 ± 80	752 ± 79	869 ± 124	709 ± 63
Fall *(n=14)*	505 ± 40	519 ± 37	625 ± 57	701 ± 70	737 ± 87
$TPA_{Sporadic}$ *(minutes/week)*	737 ± 34	759 ± 34	841 ± 35 [a]	836 ± 49 [a]	820 ± 42 [a]
Winter *(n=10)*	727 ± 63	708 ± 68	907 ± 66	826 ± 98	819 ± 91
Spring *(n=22)*	720 ± 48	783 ± 52	855 ± 60	898 ± 131	793 ± 69
Summer *(n=10)*	952 ± 95	969 ± 92	910 ± 88	1025 ± 128	901 ± 67
Fall *(n=14)*	616 ± 54	608 ± 42	722 ± 62	838 ± 106	851 ± 101
$SED_{Sporadic}$ *(hours/day)*	8.4 ± 0.2	8.1 ± 0.3	9.3 ±0.4 [b]	9.3 ± 0.4 [a b]	9.3 ± 0.3 [a b]
Winter *(n=10)*	8.2 ± 0.3	8.3 ± 0.3	9.3 ± 0.6	9.1 ± 0.7	9.1 ± 0.7
Spring *(n=22)*	8.0 ± 0.3	7.8 ± 0.4	9.1 ± 0.5	9.2 ± 0.7	9.4 ± 0.4
Summer *(n=10)*	8.8 ± 0.9	8.1 ± 0.8	9.6 ± 1.4	10.0 ± 1,2	8.9 ± 0.6
Fall *(n=14)*	8.8 ± 0.5	8.6 ± 0.7	9.4 ± 0.7	9.1 ± 0.7	9.5 ± 0.8

Data are reported as mean ± SE. (Total *n*=56). Two-way ANOVAs were used for sub-group analysis. [a] different from baseline, [a] different from 2 month. ($p<0.05$)

Appendix M: Correlation data for the ENCOURAGE project

Table: ***Pearson correlations for objectively measured data and self-report surveydata.***

Pearson Correlations		
Parameters	Pearson r	p – value
PHQ-9		
$MVPA_{10Mins}$ (minutes per week)	-0.06	0.29
$MVPA_{Sporadic}$ (minutes per week)	-0.10	0.10
LPA_{10Mins} (minutes per week)	-0.04	0.54
$LPA_{Sporadic}$ (minutes per week)	-0.001	0.96
TPA_{116s} (minutes per week)	-0.03	0.62
$TPA_{Sporadic}$ (minutes per week)	-0.04	0.48
$STEPS_{MVPA}$ (steps/day)	-0.12	0.04
SED_{10Mins} (hours/day)	-0.014	0.81
$SED_{Sporadic}$ (hours/day)	0.07	0.26
SF-12 Physical		
$MVPA_{10Mins}$ (minutes per week)	0.16	0.006
$MVPA_{Sporadic}$ (minutes per week)	0.25	0.0001
LPA_{10Mins} (minutes per week)	0.09	0.13
$LPA_{Sporadic}$ (minutes per week)	-0.04	0.45
TPA_{10Mins} (minutes per week)	0.19	0.002
$TPA_{Sporadic}$ (minutes per week)	0.07	0.25
$STEPS_{MVPA}$ (steps/day)	0.28	0.0001
SED_{10Mins} (hours/day)	-0.28	0.0001
$SED_{Sporadic}$ (hours/day)	-0.27	0.0001
SF-12 Mental		
$MVPA_{10Mins}$ (minutes per week)	0.05	0.38
$MVPA_{Sporadic}$ (minutes per week)	0.06	0.32
LPA_{10Mins} (minutes per week)	0.01	0.88
$LPA_{Sporadic}$ (minutes per week)	0.09	0.12
TPA_{10Mins} (minutes per week)	0.05	0.42
$TPA_{Sporadic}$ (minutes per week)	0.09	0.10
$STEPS_{MVPA}$ (steps/day)	0.04	0.51
SED_{10Mins} (hours/day)	0.14	0.02
$SED_{Sporadic}$ (hours/day)	0.09	0.10
Self-efficacy for exercise (SEE)		
$MVPA_{10Mins}$ (minutes per week)	0.25	0.0001
$MVPA_{Sporadic}$ (minutes per week)	0.21	0.0005
LPA_{10Mins} (minutes per week)	0.04	0.49
$LPA_{Sporadic}$ (minutes per week)	-0.09	0.10
TPA_{10Mins} (minutes per week)	0.23	0.0001
$TPA_{Sporadic}$ (minutes per week)	0.009	0.88
$STEPS_{MVPA}$ (steps/day)	0.3	0.0001
SED_{10Mins} (hours/day)	-0.19	0.001
$SED_{Sporadic}$ (hours/day)	-0.24	0.0001

Figure: Pearson correlations between SF-12 data and Physical activity /Step count data. *Correlations contain pooled data from all time points.* **Panel A:** TPA_{10Mins} and SF-$12_{Physical}$ scores ($r = 0.19$; $p<0.05$). **Panel B:** $MVPA_{10Minsc}$ and SF-$12_{Physical}$ scores ($r = 0.16$; $p<0.05$). **Panel C:** $MVPA_{Sporadic}$ and SF-$12_{Physical}$ scores ($r = 0.25$; $p<0.05$). **Panel D:** $STEPS_{MVPA}$ and SF-$12_{Physical}$ scores ($r = 0.28$; $p<0.05$).

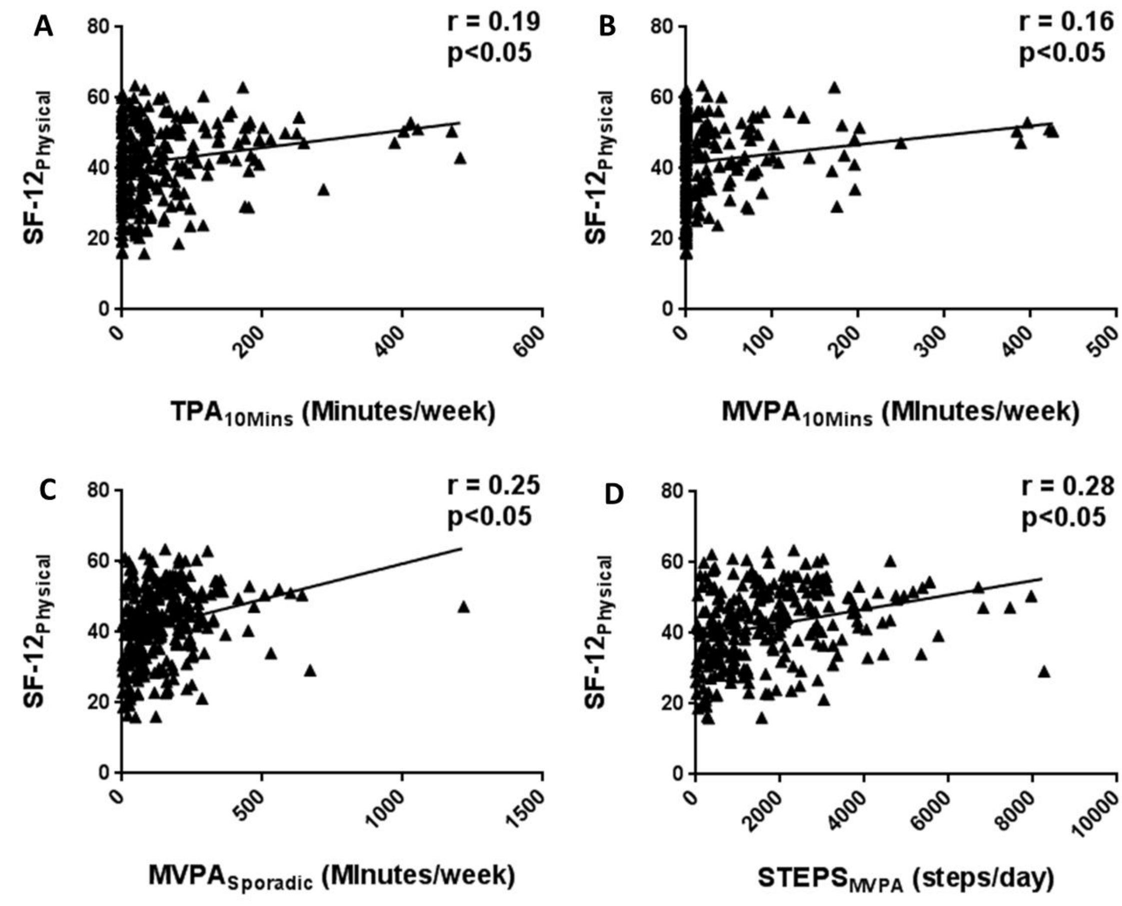


Figure: Pearson correlations between SF-12 data and sedentary activity data. *Correlations contain pooled data from all time points.* **Panel A:** SED_{10Mins} and SF-$12_{Physical}$ scores ($r = -0.28$; $p<0.05$). **Panel B:** $SED_{Sporadic}$ and SF-$12_{Physical}$ scores ($r = -0.27$; $p<0.05$).

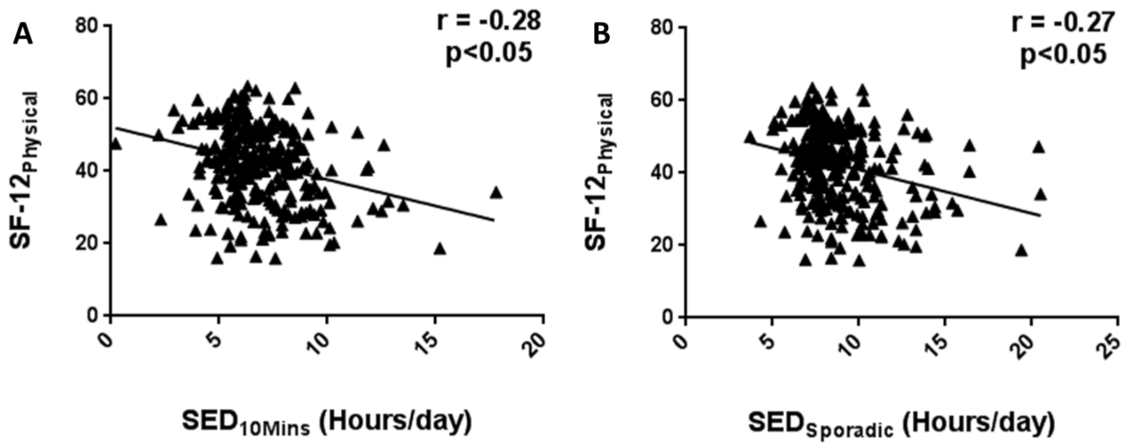


Figure: Pearson correlations between SEE data and sedentary activity data. *Correlations contain pooled data from all time points.* **Panel A:** SED_{10Mins} and SEE scores ($r = -0.19$; $p<0.05$). **Panel B:** $SED_{Sporadic}$ and SEE scores ($r = -0.24$; $p<0.05$).

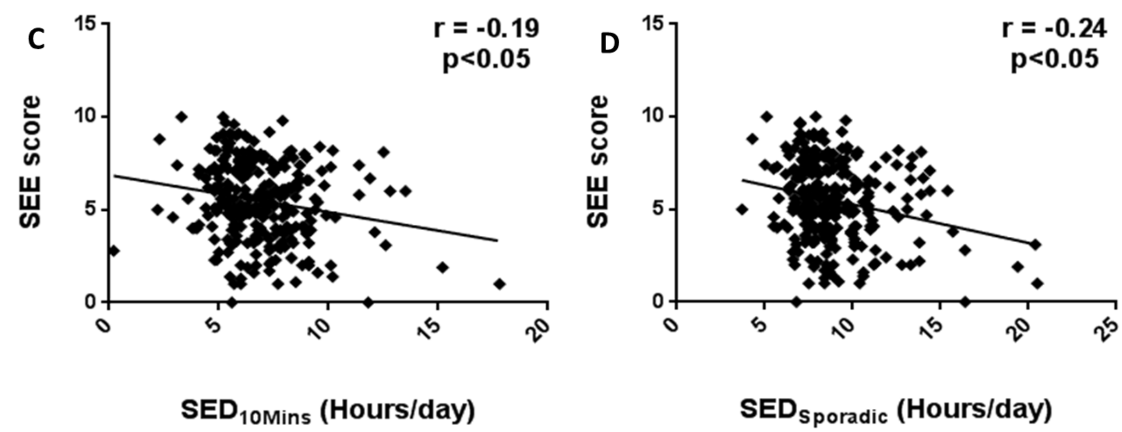


Figure: Pearson correlations between SEE data and Physical activity /Step count data. *Correlations contain pooled data from all time points.* **Panel A:** $MVPA_{10Mins}$ and SEE scores (r = 0.25; p<0.05). **Panel B:** TPA_{10Mins} and SEE scores (r = 0.23; p<0.05). **Panel C:** $MVPA_{Sporadic}$ and SEE scores (r = 0.21; p<0.05). **Panel D:** $STEPS_{MVPA}$ and SEE scores (r = 0.30; p<0.05).