

**DEGREE AND SOCIO-ECOLOGICAL CORRELATES OF EXERCISE AT
COMPLETION OF SUPERVISED CARDIAC REHABILITATION IN HIGHLY-
ADHERENT PATIENTS**

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ABSTRACT

Purpose: The objectives of this thesis were to describe the quantity of physical activity (PA) in cardiac rehabilitation (CR) participants at the end of their program, and the correlates of PA, in a theoretically-informed manner.

Methods: A secondary analysis of baseline data from a randomized controlled trial was undertaken, cross-sectionally. Participants completed questionnaires which assessed socio-ecological constructs and PA at CR completion.

Results: 255 (40.0%) patients consented to participate. Participants engaged in a mean of 184.51 (SD=129.10) minutes of weekly moderate to vigorous-intensity PA, with 134 (62.9%) meeting the guideline-recommendation of 150 minutes. In the multivariate model, the socio-ecological correlates which were significantly related to meeting the PA target at CR completion were: greater functional status (OR=1.043, 95%CI=1.009-1.079), self-monitoring (OR=2.342, 95%CI=1.422-3.856) and living with someone who requires caregiving (OR=0.22, 95%CI=0.050-0.970).

Conclusion: CR programs should promote greater PA on non-CR days to ensure guideline attainment, and hence better health outcomes.

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INTRODUCTION

Cardiovascular disease (CVD) affects a large number of Canadians; there are 393,759 hospitalizations for CVD annually which accounts for 14.1% of all hospitalizations. It has been reported that there are more than 1 million Canadians currently living with the disease ¹. There is a myriad of risk factors, non-modifiable and modifiable, influencing the incidence and outcomes of CVD. Lifestyle behaviours such as smoking, physical inactivity and poor diet, which can lead to the development of dyslipidemia, hypertension, diabetes and obesity, are significant factors influencing the incidence and prognosis of CVD. Therefore, CVD requires appropriate long-term management and health behaviour modification to reduce or eliminate the occurrence of acute coronary events and other complications ¹.

Better CVD outcomes are dependent on cardio-metabolic fitness, mediated by appropriate health behavior ¹. Regular exercise is an important contributor to cardio-metabolic fitness in patients with CVD. Canadian guidelines recommend 30 to 60 minutes of moderate-to vigorous-intensity physical activity (MVPA) on most, preferably, all days of the week for patients with CVD. Better CVD outcomes are the result of the effects of exercise training on cardiovascular risk factors, vascular biology, and the atherosclerotic process itself ¹. There is a graded, positive relationship between both the volume of physical activity as well as the level of cardio-respiratory fitness and health status ^{2,3}.

Participation in cardiac rehabilitation (CR) is the recognized standard for supporting CVD patients in developing an exercising lifestyle ⁴. Participation in exercise-based CR decreases total and cardiac mortality by 20-26% ⁵. Exercise counseling and training is one of the

core elements of CR ¹. CR programs are successful in ensuring patients initiate regular exercise, and increase their exercise behaviour.

While participation in CR programs results in greater exercise behavior, surprisingly there are few studies that consider the attainment of physical activity (PA) recommendations in CR graduates and the theoretical aspects related to this exercise behavior. Thus, there is a major gap as this theoretically-informed knowledge can form a concrete foundation for interventions to be delivered within CR.

2. REVIEW OF LITERATURE

2.1 Defining CVD

CVD is defined as a group of conditions that affect the function and structure of the heart and blood vessels ⁶. Coronary Artery Disease (CAD) is one of the most common types of CVD and is characterized by a reduction in the diameter of the blood vessels supplying oxygenated blood to the heart. Its underpinning pathophysiology involves the accumulation of plaque within the lumen of the arteries supplying blood to the heart ¹. This build-up of fatty materials leads to plaque formation, known as atherosclerosis, and can occur in any artery of the vascular system. Often concomitant with such accumulation of arterial plaque, is the hardening of the endothelial walls of the arteries, leading to a reduction in elasticity of the vessels ¹. The diminished elasticity and reduced diameter of the coronary arteries hinder or entirely stop the flow of blood to the heart—a process required for continued operation and contraction of the cardiac muscles, which ultimately works to drive systemic and cardio-pulmonary blood circulation necessary for life ^{1,6}.

2.2 Burden of CVD

CVD is the single greatest cause of mortality in Canada and it has been reported to account for 32% of all deaths in 2004 ¹. It is important to note that CVD is not only a problem in the developed and affluent nations such as Canada, but also has become the leading cause of death in the developing world. It is proposed that between 1990 and 2020, there will be an increase of 120% and 137% in women and men respectively, with regards to the prevalence of CVD in the developing regions of the world ⁷.

A large number of Canadians, in particular older adults, live with CVD ¹. Individuals who are diagnosed with CVD tend to have a much lower health-related quality of life in comparison to individuals without the disease ⁸. Despite reductions in CVD mortality rates over the past several decades, it still remains as the leading cause of life expectancy loss in Canada.

CVD poses one of the highest economic burdens when compared to other diseases in Canada. The direct and indirect costs associated with CVD are 6.8 billion dollars and 11.6 billion dollars respectively in 1998 ⁸. The direct expenses associated with CVD include hospital care expenditure, drug expenditure, and physician costs. It is important to note that the diagnostic and corrective procedures associated with CVD are among the most costly elements of this epidemic. On the other hand, the indirect expenses include costs attributed to lost productivity due to short and long-term disability and premature mortality ¹.

2.3 Secondary Prevention of CVD

Patients with CVD are at a high risk of subsequent events. Therefore, appropriate long-term management is required to reduce or eliminate further complications through the adoption of secondary prevention ⁹. The Canadian Association of Cardiac Rehabilitation (CACR) defines

secondary prevention as “the sum total of all interventions, both physiological and behavioural, designed to favourably modify an individual’s lifestyle and enhance adherence and compliance with long-term behaviours compatible with minimizing disease progression”¹. Secondary prevention is comprised of pharmacological intervention, smoking cessation, eating a heart-healthy diet and PA^{10, 11}. Pharmacological therapies aim to reduce the hazard associated with the major modifiable risk factors of hypertension, dyslipidemia, diabetes and smoking. Beta-blockers, statins, angiotensin converting enzyme-inhibitors and antiplatelet/anticoagulant agents are among some of the common pharmacological agents with proven benefits in CVD patients^{10, 11}. Another important component of secondary prevention is smoking cessation. Smokers should be counselled in a non-judgmental manner to devise a plan for quitting smoking. This may include pharmacotherapy and/or referral to a smoking cessation program^{10, 11}. Finally, diet is an essential part of secondary prevention. A healthy balanced diet consists of a high intake of fresh fruits and vegetables, and consumption of low fat dairy products, dietary and soluble fibre, as well as whole grains and protein from plant sources which are low in saturated fat, cholesterol and sodium¹⁰.

Most centrally to this thesis, regular PA is arguably one of the chief contributors to secondary prevention in patients with CVD. In order to achieve health benefits, Canadian and American guidelines recommend that adults aged 18-64 accumulate at least 150 minutes of MVPA per week^{10, 11}. Improvements in cardio-metabolic fitness are the result of the effects of PA on the cardiovascular risk factors, vascular biology, and the atherosclerotic process itself¹. Some of the cardiovascular risk factor modifications associated with PA include management of systemic hypertension, better serum cholesterol levels, maintaining a healthy body weight and reducing the likelihood of developing type II diabetes. Moreover, PA has shown to reduce the

circulating levels of C-reactive protein which is a major contributor to atherosclerosis ^{1,12}. The level and type of PA can have significant effects on morbidity and mortality rates in patients with CVD. Benefits can also be achieved from leisure time PA such as recreational activity, walking, and moderate or heavy intensity gardening ^{1,2}. Cardiorespiratory fitness is another valuable prognostic tool which can be used among patients with CVD ². Cardiorespiratory fitness when measured in metabolic equivalent (MET) can be a strong predictor of the risk of mortality. It has been shown that every 1 MET increase in cardiorespiratory fitness corresponds to 12% improvement in survival rates among CVD patients ². Therefore it can be inferred that there is a graded, positive relationship between both the volume of PA and health status, and the level of cardiorespiratory fitness and health status ^{2,3}. Participation in CR is the recognized standard of supporting CVD patients in developing a physically active lifestyle ¹¹.

2.4 Cardiac Rehabilitation in Management of CVD

CACR has defined CR as the enhancement and maintenance of cardiovascular health through individualized programs designed to optimize physical, psychological, social, vocational, and emotional status ¹. This process includes the facilitation and delivery of secondary prevention through risk factor identification and modification in an effort to prevent progression and the recurrence of cardiac events.

CR programs are delivered by an inter-professional team including cardiologists or other physicians, nurses, exercise therapists or kinesiologists, psychologists or social workers, registered dietitians, and pharmacists ^{1,13}. In Canada, CR programs are typically offered for 5 months duration, starting a month or two post-discharge for a cardiac event or procedure ¹³. Patients come on site on average twice per week during this time for education and supervised

exercise. The individualized exercise prescription is based on the extensive intake assessment, which generally includes a graded, maximal exercise stress test.

The core components of CR include health behavior change and education, lifestyle risk factor management (which includes PA, diet and smoking cessation), psychosocial health, medical risk factor management, cardio-protective therapies, long-term management, along with audit and evaluation ¹⁴. Arguably, PA counseling and training is one of the key components of CR responsible for mortality reductions observed ¹². A systematic review and meta-analysis conducted by Taylor et al. ¹² investigated the effectiveness of exercise-based CR specifically compared with usual care in CAD patients. There were 48 randomized controlled trials with a total of 8940 patients included in this Cochrane review. The results showed that exercise-based CR was associated with reduced all-cause mortality and cardiac mortality. Moreover, there is a greater reduction in total cholesterol level, triglycerides, and systolic blood pressure as well as lower rates of self-reported smoking when compared to the usual care group. This review confirmed the notion that PA has direct benefits on the cardiovascular system as well as the indirect effect of lowering mortality rates through ameliorating risk factors for atherosclerotic disease ¹².

2.5 Physical Activity in Cardiac Rehabilitation

The high degree of physical inactivity in the general population is well established. However, surprisingly little is published regarding the actual volume of PA achieved in CR participants. It is also important to note that PA is recommended on most days of the week, while CR is generally offered on 2 days of the week in Canada. Thus, CVD patients are encouraged to engage in PA on non-CR days to achieve guideline recommendations ^{15, 16}, and to facilitate their

engagement in and maintenance of their exercising lifestyle in their home or community environments post-program.

Through a review of the literature assisted by an information scientist, publications reporting on the volume of PA in which participants engage during supervised CR sessions and outside of CR in relation to guideline recommendations were sought. For the purpose of study selection, articles citing the number of minutes of MVPA per week (goal of 150 minutes or at least 6500 and preferably 10000 steps/day) or kilocalories/week (kcal/wk) were considered. Specifically, 1000 kcal/week is equivalent to the guideline-recommended level of 150 minutes of MVPA per week. However, it has been suggested that energy expenditure of 1500 kcal/week or more is required in order to stop the progression of CVD, and moreover that the regression of CVD can be achieved through an energy expenditure of 2000 kcal/week^{15, 17, 18}. Seven studies assessing the volume of PA in relation to guideline recommendations at the end of CR were identified^{15, 16, 19, 20, 21, 22, 23}. These are outlined in chronological order below.

First, Savage et al.¹⁶ investigated the caloric expenditure in 112 CR participants; 87 of which were men and 25 were women. All patients attended three exercise sessions per week, with an average total aerobic exercise duration of 48 ± 6 minutes, which is consistent with the model of CR delivery in the United States. Each exercise session comprised aerobic exercise and resistance training with a total caloric expenditure of 270 ± 112 (mean \pm SD) kcal per session. Gross energy expenditure was estimated during 2 exercise sessions by calculating duration and heart rate for each exercise modality, and converting the VO_2 from the exit stress test to determine energy expenditure in calories. The mean energy expenditure at the 36th and final session was 282 ± 24 kcal (range 72-647). While patients did achieve significant increases in

VO_{2peak}, results showed that 73% did not expend the needed kilocalories per session to meet the minimum guideline-recommended levels of 1000 kcal/week. In multivariate analysis, session duration and exercise intensity were, among other variables, independent predictors of energy expenditure at the end of CR. PA outside of CR was not considered in this study.

Second, Ayabe et al.¹⁵ examined the PA patterns among 5 men and 24 women attending a CR program. The CR sessions were offered three times per week and each session was approximately an hour in duration. In order to assess PA levels, participants were required to wear a uniaxial accelerometer for 10 consecutive days. Results indicated a caloric expenditure of 1778 ± 877 kcal/week (mean \pm SD) among men and 1197 ± 622 kcal/week (mean \pm SD) among women. The amount of moderate and vigorous-intensity PA specifically was, respectively, 137 ± 116 , and 7 ± 14 minutes/week for men, and 100 ± 91 , and 4 ± 10 minutes/week for women (the difference between the sexes was not significant, when adjusted for differences in body weight). Participants in this study then on average met the guideline-recommended caloric expenditure. As expected, PA was significantly greater on CR than non-CR days. The authors also reported that less than half (43%) of the participants exceeded 1500 kcal expenditure per week suggested to stop the progression of CVD.

Reid et al.²⁰ prospectively examined the patterns of PA among CAD patients. The study comprised 782 patients, aged 20 to 85 years, who were hospitalized for CAD at cardiac centres in Ottawa and Kingston, Canada and were followed for a period of one year post-hospitalization. The dependent variable was leisure time activity energy expenditure which was measured using a telephone administered 7-day recall interview. Assessments at 6 months post-hospitalization were considered to correspond to the end of CR, in which 31% participated. Mean weekly

energy expenditure at moderate-intensity or greater at 6 months was 1897 ± 1270 for CR participants. This is well above the guideline recommendations. Patients who participated in CR had significantly greater energy expenditure than those who did not, however this association did not sustain adjustment.

In a study by Jones et al.²¹ the total amount of PA was explored among 25 men with a history of CAD who were participating in a CR program. The participants wore an accelerometer for seven consecutive days in order to capture their activity during and outside the CR sessions. They also used a log in order to record the duration, intensity and mode of exercise in which they engaged outside of the CR sessions. The dependent measure in this study was step counts. The participants attended CR for 3.0 ± 1.0 days/week (mean \pm SE), accumulated an average of $6,907 \pm 510$ steps/day and expended 466 ± 38 kcal/day during the 7-day assessment. Participants accumulated more steps on the days that they attended CR sessions versus non-CR days ($p < .05$). Approximately half (52%) of the participants expended the 10,000 steps/day guideline-recommended target on CR days, but only 8% satisfied this on the days that they did not attend CR. Fifteen (60%) participants also performed at least one bout of PA at home. These participants accumulated 2716 steps / day more than the CR-only participants ($p < .05$). Overall, this study demonstrates the importance of PA on non-CR days to ensure patients achieve the volume of PA to achieve health benefits.

Stevenson et al.¹⁹ conducted a study which assessed the changes in PA observed in CR participants from the point of entry to exit from the program. Participants started with a minimum of 15 consecutive minutes of PA per CR session at the time of entry, and gradually increased the duration of PA to a maximum of 40 minutes per session by program exit. A home

exercise program of 30 minutes of PA per day was also prescribed to the participants. PA was assessed using an accelerometer; participants were requested to wear the device for 7 consecutive days at the entry point and again at the completion of the 18-session CR program. Of the 49 participants, 34 (69.4%) completed the post-program accelerometer assessment, with the data from 22 (64.7%) participants having sufficient quality for analysis. At CR completion, participants were significantly below the recommended levels of 150 minutes of MVPA, with an average of 18.7 ± 2.5 (mean \pm SE) minutes of moderate-intensity PA per day (no participants recorded any vigorous-intensity PA). This corresponds to only approximately 131 minutes per week. Participants engaged in greater amounts of total and moderate-intensity PA on the days that they attended CR.

In one of the largest CR studies, Arthur et al.²² investigated women's levels of MVPA at the conclusion of a CR program, as well as 6 and 12 months following its completion. A total of 203 women were recruited from two CR sites in Ontario, Canada. The CR program sessions were ninety minutes in length and were held twice weekly over a 6-month period. The dependent variable was the attainment of guideline recommended levels of MVPA during CR, as assessed via the Godin Leisure-Time Exercise Questionnaire. A mean score of ≥ 24 units of PA/week was considered equivalent to the guideline-recommended levels of PA which is associated with health benefits. Women exercised a mean of 27 units/week at the end of CR.

Lastly, Blanchard et al.²³ assessed the steps-per-day trajectories of CR graduates. Two hundred and thirty-five patients from 8 CR programs (5 in New Brunswick and 3 in Nova Scotia, Canada) consented to participate in the study. The programs ranged in duration (6, 10, and 12 weeks), frequency of PA sessions (once versus twice/week), and location (community-based

versus hospital-based). The number of steps was measured using the Yamax DIGI-WALKER pedometer. Patients were asked to wear the pedometer during all waking hours of the day for 7 consecutive days and to record their step count in a logbook at the end of each day. Results indicated that patients averaged 6911 steps/day, however the average at CR exit specifically was not reported.

In summary, the evidence suggests that despite clinical practice recommendations and participation in CR, patients will increase the amount of PA in which they engage but may not always meet the guidelines for PA. These observational studies provide a summary of what happens in CR in the “real-world”, whereas often many of the randomized controlled trials of CR performed are likely capable of achieving guideline-recommended levels to achieve reductions in mortality and morbidity. Clearly more research is needed to examine the degree of PA achieved in multiple CR programs and to understand the factors that influence the degree of PA achieved. Thus, the purpose of this thesis is to assess the volume of PA at CR exit in and outside of the program, and to understand the clinical and theoretical correlates of degree of PA.

2.6 Socio-Ecological Model to Understand PA

Previous research has examined predictors of PA at the end or after CR²⁴, but few have done so in a theoretically-informed manner. The socio-ecological model was applied here to understand the correlates of PA in the CR setting²⁵. A socio-ecological perspective suggests that individuals vary in their behavior or characteristics in response to the changing resources in the social or physical environment²⁶.

As shown in Appendix A, the socio-ecological model has multiple levels of focus, with each being of equivalent significance^{27,28}. The model posits that there are individual (e.g.

knowledge, attitudes, and skills), social environmental (e.g., friends, family, and social networks) and physical environmental (e.g. home, neighbourhood and community characteristics; weather) factors that influence physical activity^{29,30}. These different levels of influence exert independent but also interdependent effects on PA.

2.6.1 Applying the Socio-ecological Model in the CR Setting

The socio-ecological correlates of PA in patients with CVD were examined in a narrative review conducted by Petter et al.³¹ This review included 121 peer-reviewed studies and was completed in 2008. Of the articles reviewed, 74 examined participants during a centre-based CR program, 27 have examined participants after CR completion, 18 have examined participants during a home-based CR program and 30 have examined individuals without the use of a CR program. The former group is applicable to the current thesis.

There were 23 correlates identified at the individual level, some of which were health status, self-regulatory self-efficacy, intention, control, previous PA, perceived benefits, task self-efficacy, barriers, sex, and action planning³¹. It was found that being male, a non-smoker, having a positive attitude and having fewer perceived barriers were associated with more PA in one or more CR contexts. In CR specifically, better overall health status (fewer comorbidities), higher level of self-regulation, higher previous PA levels, higher intentions to engage in PA, positive beliefs about the benefits of PA, and higher perceived behavioural control corresponded to increased PA levels. With regards to the former, it has been proposed that the existence of comorbid conditions such as chronic obstructive pulmonary disease, musculoskeletal conditions, cancer, and diabetes may create additional barriers to engaging in PA³². For example musculoskeletal conditions often cause pain during weight-bearing exercise and cancer treatment

is related to fatigue. It can be inferred that the consideration of comorbid conditions may lead to improvements in PA levels during and at the completion of CR ³³.

At the interpersonal level, 3 correlates were found: marital status, subjective norm and social support ³¹. Social support was the only correlate that was found to have a significant association with higher PA in CR. There were three correlates identified at the institutional level, one of which was exercise consultation. Patients who received exercise consultation were found to have a higher level of PA in comparison to those who did not. The time of the day was another correlate at the institutional level. It was demonstrated that individuals who participated in CR during the morning had higher PA levels. Finally, the last correlate at the institutional level was the location of the CR program. This did not correspond to an increased level of PA in CR.

Three community-level correlates were identified and assessed ³¹. Shorter distance to CR, and accessibility of CR site were the two correlates which were found to be positively related to the level of PA in CR. On the other hand, the time of the year (i.e., season) was not associated with PA in patients participating in CR. Finally, there were no policy-level correlates identified in this review.

To our knowledge, Petter et al. ³¹ is the most recent review conducted to date which documents the correlates of PA among CVD patients in CR from a socio-ecological perspective in order to address the different levels of influence on PA. Additionally, correlates at the policy level of the socio-ecological model have not yet been explored nor identified. There are myriad of potential policy level changes which could influence PA levels among CVD patients including funding for patients in obtaining gym memberships and/or home exercise equipment ³¹. Thus

this area of research within the socio-ecological framework is of great value and must be further investigated.

3. OBJECTIVES

The objectives of the study were to: (1) describe the degree of physical activity in highly-adherent CR participants at the end of their CR program, (2) understand the correlates of physical activity in CR graduates, in a theoretically-informed manner. Based on the socio-ecological model, the following constructs were considered at the individual level: racial/ethnic background, living arrangements, work status, education level, income level, depressive symptoms, functional status, health status, smoking status, PA self-regulation, PA intention and planning, task self-efficacy, and exercise benefits and barriers. Social support, subjective norm, marital status, and autonomy support were assessed at the interpersonal level; neighbourhood environment and home environment at the organizational level of the socio-ecological model, and lastly neighbourhood characteristics, mixed-land use, and season at the community level of the proposed socio-ecological model.

This study was one of the first studies to use a socio-ecological framework to assess the contributing factors underlying adherence to PA at the end of CR specifically. Moreover, novel insight was shed on the correlates of PA in a highly-adherent sample of patients who have completed CR. This provided information about other activities or environmental factors that may be modified in order to promote patients' attaining PA guidelines during and following CR, at this crucial patient transition. It also considered the complexity of patients with CVD who often suffer from multi-morbidity, and these morbidities can negatively influence PA ³⁴.

CANDIDATE'S ROLE

The candidate's main roles in this study were to: (1) communicate with the Research Ethics Board (REB) with regard to annual renewal and amendments, (2) maintain the study binder, (3) obtain informed consent and determine patient eligibility for the trial at the Toronto sites, (4) maintain a master tracking data sheet and a consolidated standards of reporting trials (CONSORT)³⁵ file, (5) chart abstraction with the Case Report Form (CRF), (6) some baseline data entry, (7) mail the accelerometers to participants with instructions and log at intake and 26 week assessments, (8) 26 week post-test data collection (surveys, clinical data, chart extraction where applicable), (9) follow-up with participants via telephone and email, (10) communicate any adverse events or out-of-range vital signs to the clinical investigator, (11) data cleaning and analysis for thesis, and (12) write up thesis findings for publication.

MANUSCRIPT

DEGREE AND SOCIO-ECOLOGICAL CORRELATES OF EXERCISE AT COMPLETION OF SUPERVISED CARDIAC REHABILITATION IN HIGHLY-ADHERENT PATIENTS

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ABSTRACT

Background: Patients with cardiovascular disease (CVD) are at a high risk of subsequent events. Therefore, appropriate long-term management is required to achieve secondary prevention. Regular physical activity (PA) is arguably one of the chief contributors to secondary prevention in patients with CVD which can be achieved through participation in cardiac rehabilitation (CR). The objectives of this study were to describe: (1) the degree of PA in CR participants at the end of their program, and (2) the correlates of their PA, in a theoretically-informed manner.

Methods: A secondary analysis of baseline data from a randomized controlled trial was undertaken, cross-sectionally. Highly-adherent supervised CR graduates were recruited from 2 programs. Participants completed a questionnaire which assessed constructs from the Socio-ecological model. A modified version of the Godin Leisure-Time Exercise Questionnaire was administered to ascertain the participants' PA at the end of CR. Clinical characteristics were obtained from medical charts.

Results: Two hundred and fifty-five (40.0%) patients consented to participate. Participants engaged in a mean of 184.51 (SD=129.10) minutes of moderate to vigorous-intensity PA per week, with 134 (62.9%) meeting the guideline-recommendation of 150 minutes. In the multivariate model, the socio-ecological correlates which were significantly related to meeting the PA target at CR completion were: greater functional status (OR=1.043, 95%CI=1.009-1.079), self-monitoring (OR=2.342, 95%CI=1.422-3.856) and living with someone who requires caregiving (OR=0.22, 95%CI=0.050-0.970).

Conclusion: Approximately two-thirds of CR program completers are achieving the PA guideline target. Attainment of PA targets were related to greater self-monitoring; a skill which is readily-teachable to CR participants. Patients with informal caregiving responsibilities engaged in significantly less PA. CR staff should explore respite services for such caregivers to ensure they can complete their course of CR and have time to be physically active outside of CR hours.

INTRODUCTION

Cardiovascular disease (CVD) is among the leading causes of mortality in North America. It has been reported that there are more than 1 million Canadians and an estimated 83.6 million Americans currently living with the disease^{1, 36}. Patients with CVD are at a high risk of subsequent events. Secondary and tertiary prevention are comprised of pharmacological intervention to reduce blood pressure and dyslipidemia, smoking cessation, eating a heart-healthy diet and physical activity (PA)^{10, 11}. In order to achieve cardiovascular benefits, clinical practice guidelines recommend that patients accumulate at least 150 minutes of moderate to vigorous-intensity physical activity (MVPA) per week^{10, 11}, preferably through exercising for 30 minutes a day most days of the week.

Cardiac Rehabilitation (CR) promotes cardiovascular health through the delivery of the above prevention strategies, coupled with education and counseling¹. Patients who participate in CR have 25% lower mortality than those who do not⁵. Arguably, exercise training is one the key components of CR responsible for these mortality reductions¹². However, CR is generally offered to patients 2 days a week in Canada¹, and patients may not accrue 75 minutes (i.e., to total 150 minutes of MVPA/week) of PA each session. Thus, patients must be encouraged to engage in PA on non-CR days to achieve guideline recommendations, and to facilitate their engagement in and maintenance of their exercising lifestyle in their home or community environments post-program.

Surprisingly little has been published regarding the volume of PA achieved during CR. While it may be expected that participants would meet or exceed targets by the end of the program as they have had the opportunity to increase their functional capacity and progress their

exercise prescriptions, many programs do not assess PA behavior on non-CR days. Whereas in randomized controlled trials of CR patients are more-closely supervised to ensure they achieve recommended PA levels, observational studies can inform what happens in “real-world” CR. In the 7 studies observing the volume of PA in relation to guideline recommendations at the end of CR in the literature^{15, 16, 19, 20, 21, 22, 23}, results demonstrated variability in achievement of the target. For instance, Ayabe et al.¹⁵ reported that 43% of participants met the guideline-recommended caloric expenditure each week, with PA significantly greater on CR than non-CR days. Similarly, Reid et al.²⁰, Blanchard et al.²³, and Arthur et al.²² observed that 46%, 45% and 22% (women only) respectively of the patients who participated in CR had energy expenditures above the guideline recommendations at CR completion. By the same token, Jones et al.²¹ and Stevenson et al.¹⁹ revealed that patients on average were not meeting the recommended level of 150 minutes of MVPA per week at CR completion.

Socio-Ecological Model

Previous research has examined determinants of PA at the end or after CR²⁴, but few have done so in a theoretically-informed manner. The socio-ecological model²⁶ is a relevant framework to understand the correlates of PA in the CR setting²⁵, particularly as patients are encouraged to exercise in and outside of CR. A socio-ecological perspective suggests that individuals vary in their behavior, such as PA, based on their social and physical environments. The model posits that there are individual (e.g. knowledge, attitudes, and skills), social environmental (e.g., friends, family, and social networks) and physical environmental (e.g. home, neighbourhood and community characteristics; weather) factors that influence PA^{29, 30}. These different levels of influence can exert independent but also interdependent effects on PA.

This model can enable identification of modifiable aspects of the patients' environment related to greater PA at the end of CR, a crucial patient transition point to other PA settings.

While participation in CR programs results in greater exercise behavior^{19, 21}, surprisingly there are few studies that consider the attainment of PA targets necessary to positively impact health outcomes in CR graduates, nor the theoretical aspects related to this PA. The purpose of this study was to: (1) describe the degree of PA in CR participants at the end of their CR program, and (2) understand the correlates of PA in CR graduates, in a theoretically-informed manner. Based on the socio-ecological model²⁶, correlates of PA in CR graduates may shed light on what leads to successful PA behavior.

METHODS

Design and Procedure

This study presents a secondary analysis of the baseline data from a randomized controlled trial entitled “ECologically OPTimizing exercise maintenance in men and women following Cardiac Rehabilitation” (ECO-PCR; clinicaltrials.gov identifier NCT01658683). It is a two-institution, parallel-group, superiority study evaluating the efficacy of an exercise facilitator intervention in improving long-term exercise maintenance in patients exiting CR compared to usual care. The design of this secondary analysis was cross-sectional. The study received research ethics approval from all participating institutions.

Study coordinators at each site attended the graduating and second last CR classes to solicit patient interest. Consenting participants were provided a self-report survey to complete, which assessed socio-demographic characteristics, PA, along with elements of the socio-ecological framework²⁶. Clinical data were extracted from CR charts.

Participants and Setting

Participants were recruited from 3 CR programs in Ontario, Canada (one institution offered programs at 2 sites). The supervised CR programs offered ranged in duration from 8 weeks to 6 months. Across all programs, participants underwent medical and coronary risk factor assessments, received individualized exercise prescriptions, and participated in supervised exercise sessions 2 times each week. Other services were available at each site on an as-needed basis (e.g. nutrition counseling, diabetes education, stress management, smoking cessation therapy, vocational and/or psychological counseling and social work). While there were some

differences in education timing and delivery format between programs, each program was based on the Canadian CR Guidelines ¹.

Patients were included in the study if they were currently participating in an on-site CR program of ≥ 8 -week duration, had attended $\geq 75\%$ of scheduled CR sessions (i.e., they would be graduating), had a documented diagnosis of coronary artery disease (CAD), were 18 years of age or older, and were able to walk unaided at 2 mph. Patients who had New York Heart Association class III or IV heart failure ³⁷, were pregnant, lactating or planning to become pregnant during the study period, were unable to read and understand English or French, or lived more than one-hour travel time from the study centers were excluded.

Measures

The socio-demographic characteristics of participants were obtained through self-report questionnaires. The following elements were assessed: age, ethnic background, living arrangements, marital status, number of children, education level, and income level. The clinical characteristics of participants which included the primary indication for CR, risk factors (i.e., diabetes, obesity, hyperlipidemia, and hypertension), and disease severity indicators were obtained from CR records. The socio-ecological correlates of PA were assessed as outlined below, and as shown in Figure 1.

Individual Level

Correlates at the individual level included many of the socio-demographic and clinical characteristics outlined above. For instance, participants' racial/ethnic background, employment status, education, income, smoking status and ethnicity were assessed through forced-choice

response options in the self-report survey. Other correlates at the individual level were the participants' clinical characteristics, which were extracted from the CR charts.

Other individual-level correlates were assessed through psychometrically-validated scales. This included depressive symptoms, functional status, barrier self-efficacy, PA intention and planning, PA self-regulation, task self-efficacy, and exercise benefits and barriers. The Patient Health Questionnaire-2 (PHQ-2)³⁸ was administered to assess depressive symptoms over the past two weeks. For each item the response option ranged from 0 "not at all" to 3 "nearly every day". PHQ-2 total scores ranged from 0 to 6, with higher scores indicating greater depressive symptoms³⁸.

Functional status was assessed using the Duke Activity Status Index (DASI)³⁹ which is a self-administered questionnaire that correlates highly with patients' peak oxygen uptake. There were 12 items, with a yes/no response option for each. These items related to personal care, ambulation, sexual function and recreational activities. Higher scores on this scale denoted greater functional capacity³⁹.

The barrier self-efficacy construct was measured using a modified version of the 13-item scale developed by Plotnikoff et al.⁴⁰ This scale evaluated one's confidence to engage in 30 or more minutes of MVPA/day on at least 5 days a week against 14 potential hindrances. Each item was scored between 0 and 100%, with each percentage having an allocation ranging from "not at all confident" to "extremely confident". There was also a response option of 'not applicable' for each barrier. The mean of the items were calculated to provide a total score.

Blanchard's 2-item PA intention scale⁴¹ was administered. Each item was scored from 1 and 5 on a scale from "strongly disagree" to "strongly agree". The mean of the items was calculated, with higher scores denoting greater intentions. PA planning was measured using a 4-

item action planning scale also developed by Blanchard et al.⁴¹ Each item was again scored from 1 to 5 on a scale from “strongly disagree to strongly agree”. The mean of the items was computed.

PA self-regulation was measured using the 12-item PA Self-Regulation scale (PASR-12)⁴². The items assessed self-monitoring, goal setting, eliciting social support, reinforcement, time management, and relapse prevention, with two questions pertaining to each. Each item was scored on a 5-point Likert scale with response options ranging from “never” to “very often”. The PA self-regulation score was calculated by summing the two items pertaining to each element, resulting in 6 sub-scale scores.

Task self-efficacy was measured using Blanchard’s 7-item scale⁴³. This scale assessed one’s confidence to continue to participate in at least 30 minutes of regular MVPA. Each item was scored from 10-100% corresponding to the range from “not at all confident” to “completely confident”. The mean of all items was computed to provide a total score.

Beliefs about the benefits of, and barriers to, exercise were measured using the 43-item Exercise Benefits/Barriers scale (EBBS)⁴⁴. Participants were asked to rate the degree to which they agree with each of the items by choosing one of the 4 response options ranging between “strongly agree” to “strongly disagree”. The mean of the 14 barrier sub-scale items was calculated, with higher scores indicative of more barriers. The mean of the 29 benefit sub-scale items was calculated, with higher scores indicative of more benefits. The direction of the barrier items was reversed, and total mean score was also computed.

Interpersonal Level

The interpersonal-level correlates assessed were living arrangements, marital status, social support, subjective norm, and autonomy support. First, living status and marital status were self-reported in the survey as outlined earlier. Next, social support from family, friends and other CAD patients or peers was measured using Sallis et al.'s 13-item scale⁴⁵. Ten of the items in the scale related to encouragement, 2 of the items related to rewards while 1 item related to punishment. Each item was scored from 1-5, ranging from "none" to "very often". A score of 8 corresponded to the option of "does not apply," and was considered missing. The sum of scores was calculated separately for encouragement, rewards and punishment by family, friends and others.

The subjective norm construct was assessed by Blanchard's 3-item scale⁴⁶. This scale reflected one's beliefs about the perception of family and friends regarding the importance of regular PA. Each item was scored from 1 to 5, ranging from "strongly disagree" to "strongly agree". The mean of all three items was computed.

Lastly, autonomy support from healthcare providers was measured using the 6-item Health Care Climate Questionnaire (HCCQ)⁴⁷. Each item was scored from 1 to 7 ranging from "not at all true" to "very true". Higher mean scores represented a higher level of autonomy support⁴⁷.

Organizational Level

The correlates at the organization level included participant's home exercise equipment availability and neighborhood environment. Perceived home environment was measured using a modified version of Sallis' Perceived Environment Related to Physical Activity scale⁴⁸. This

survey assessed the types of PA equipment participants owned and whether they would use during the next week, with a yes/no response option.

Places to engage in PA was measured using a modified version of the Physical Activity Neighborhood Environment Scale (PANES)⁴⁹ and the Perceived Environment Related to Physical Activity⁴⁸. This scale evaluated the availability and use of facilities. Each item was assessed with a “Yes” or “No” response. A descriptive frequency analysis was conducted to calculate the availability and use of each place to do PA.

Community-Level

The perception of neighborhood characteristics was another socio-ecological construct under investigation in this study. It was measured using a subscale of the Neighbourhood Environment Walkability Scale (NEWS) developed by Saelens et al.⁵⁰ There were 9 items on this scale, with subscales for neighborhood aesthetics, perceived neighbourhood crime rate, and street connectivity. Each item was scored from 1 to 4, ranging from “strongly disagree” to “strongly agree”. Applicable responses were averaged to ascertain subscale scores.

Another correlate investigated at the community-level was season. A variable was created to denote whether participants completed their survey in the months of December, January, and February in comparison to other months of the year. Lastly, mixed-land use was assessed. Participants were asked to report the type of neighborhood in which they reside as residential, mixed commercial residential or mainly commercial. There were no measures of public policy-level constructs in this study.

Dependent Variable

A modified and validated version⁵¹ of the Godin Leisure-Time Exercise Questionnaire⁵² was administered to ascertain the average weekly MVPA of the participants. Participants were asked, “How many days in a typical week in the past six months did you do moderate (e.g., fast walking, easy bicycling, easy swimming, dancing) PA for at least 10 minutes at a time?” and, “On the days when you did moderate PA, how many minutes on average did you spend per day doing this activity?”. The same two questions assessed the frequency and duration of vigorous-intensity (e.g., running, jogging) activities. To calculate the total MVPA score, the frequency of moderate-intensity PA was multiplied with the duration of moderate-intensity PA, which resulted in the total minutes per week of moderate-intensity PA. The same equation was applied in order to calculate the total number of minutes participants engage in vigorous-intensity PA. The total minutes of moderate and vigorous PA per week was then summed. Additionally, in order to determine the proportion of people meeting the recommended guidelines of 150 minutes of MVPA per week^{10, 11} a dichotomous variable was computed (i.e. $<$ or \geq 150 minutes).

Statistical Analysis

All analyses were performed using SPSS version 21.0⁵³. To test the first objective, the mean Godin score was described. To assess the second objective, Pearson’s correlations, Analysis of Variance or Student’s t-tests were computed between the revised Godin score of number of minutes of MVPA/week and each of the socio-ecological correlates. Variables which were significantly related to MVPA were then entered by blocks (to correspond to model level) into a stepwise logistic regression analysis using a backward conditional selection procedure, with PA target as the dependent variable.

RESULTS

A total of 1374 patients were approached, of which 740 patients (54%) were deemed ineligible. Of the ineligible patients, 80 patients were from the sites in Toronto while 660 patients were from Ottawa. In Toronto, patients were considered ineligible for the following reasons: 43 (53.8%) patients did not have a documented CAD diagnosis, 20 (25%) patients did not read or understand English or French, 6 (7.5%) patients had attended less than 75% of the CR classes, 5 (6.3%) patients were planning to leave the province or region in the next 12 months, 5 (6.3%) patients could not walk 2 mph, and 1 (1.3%) patient had a New York Heart Association class III or IV ³⁷. Two hundred and fifty-five (40.0%) of the 634 eligible participants consented to participate. The socio-demographic and clinical characteristics of participants are described in Table 1.

With respect to objective one, participants engaged in a mean of 184.51 ± 129.10 minutes of MVPA per week (median = 175). With respect to the recommended guidelines, 134 participants (62.9%) were engaging in at least 150 minutes of MVPA per week.

Socio-Ecological Correlates of PA

The socio-ecological constructs are reported in Tables 1 and 2. Mean scores for the psychometrically-validated scales are shown in Table 2. Table 3 displays the correlations between the continuous socio-ecological correlates.

Associations with PA at CR exit are presented in Table 2. At the individual-level, there were positive, significant associations of PA with being male, having fewer depressive symptoms, higher functional status, the presence of fewer comorbidities, engaging in greater self-monitoring, greater reinforcement, better time management, higher relapse prevention,

higher PA intentions, higher PA planning, higher barrier self-efficacy, greater exercise benefits, and fewer exercise barriers. At the interpersonal level, not living with someone who requires caregiving and perceiving a positive health care climate were significantly and positively associated with the participants' PA at CR completion.

Figures 1 and 2 display the organizational-level constructs. As shown in Figure 1, regarding the home environment, the availability of weight training equipment, having a dog, skis and skates were significantly associated with greater PA. There were trends for having aerobic workout videos, a swimming pool, and an outdoor bicycle. As shown in Figure 2, regarding the neighbourhood environment, having access to a swimming pool and schools' recreation program were significantly related to greater PA at the end of CR. There were trends for having access to a golf course, and beaches, lakes, rivers or creeks. Lastly, at the community-level, perceived crime was the only variable found to be significantly correlated, in a negative direction, to the participants' PA at the end of CR. There was a trend for aesthetics.

The results of the stepwise logistic regression are reported in Table 4. One variable which was significantly related to PA was excluded from the model (Table 3). The presence of Osteoporosis was excluded, as there were too few cases. Association between the socio-ecological correlates were examined for potential multi-collinearity and none was observed (i.e., variance inflation factors all below 2). Functional status, self-monitoring and living with someone who requires caregiving were each significantly related to meeting the PA target at CR completion.

DISCUSSION

In this sample of CR graduates from academic programs, approximately two-thirds were meeting PA guidelines at CR completion. With regard to the socio-ecological correlates of meeting the PA guideline at CR exit, patients with greater functional status, and engaging in greater self-monitoring and not having to provide caregiving were significantly associated with greater PA. The likelihood that patients met the PA guideline was over two times greater in patients who engaged in greater self-monitoring. The likelihood that patients met the PA guideline was over 78% lower in patients who had caregiving responsibilities. While the association with functional status is likely due to reverse causation, self-monitoring skills are highly teachable and represent an important area of focus for CR providers.

Despite clinical practice recommendations and participation in CR, patients may not always meet the guideline recommendations for PA by program completion. Our findings are consistent with the handful of other studies in this area^{15, 16, 19, 20, 21, 22, 23}. Future research is needed to investigate the initial exercise prescription of patients, how they are progressed through the program, and whether patients have legitimate clinical contraindications to engaging in guideline-recommended levels of PA. Given it is known that many patients dropout of CR and that PA decays post-CR, these results, while concerning, are in line with the broader rates of inactivity reported in the adult population.

This study provides support for the socio-ecological model as a framework in understanding the correlates of PA in a CR setting. Previous research has examined correlates of PA at the end or after CR²⁴, but few have done so in a theoretically-informed manner. This study was the first to apply the socio-ecological framework to assess the contributing factors

underlying adherence to PA at the end of CR specifically. Within the individual level of the model, many associations observed were consistent with what has been reported in previous research³¹. The association identified for self-monitoring, is an example of this. In a study by Izawa et al,⁵⁴ it was found that the use of self-monitoring approach during supervised CR effectively increased exercise maintenance at CR completion. Similarly, in a study by Carels et al,⁵⁵ using a self-monitoring approach increased the participants' cardiorespiratory fitness, increased weekly exercise and increased kilocalorie expenditure from leisure time PA.

Additionally, other populations have exhibited a similar finding. Burke et al.⁵⁶ conducted a review of literature on three components of self-monitoring in behavioural weight loss studies: diet, exercise and self-weighing. The study revealed that self-monitors of exercise had greater weight loss, fewer barriers with exercise and exercised more often. This finding is encouraging as this strategy is easily implementable by healthcare practitioners in the CR setting. For example, staff members could encourage participants to complete a daily exercise diary describing their exercise type and duration. Patients can use paper-and-pencil, or an internet-based diary to record daily PA. Indeed, there are software and structured internet programs that are designed for self-monitoring which have been established as effective in research⁵⁶. This modality can potentially lessen the burden of self-monitoring and consequently enhance PA adherence among participants.

Our finding that patients caring for a loved one engage in less PA has been demonstrated in other populations. In a review by Ross et al,⁵⁷ it was shown that cancer caregivers have the tendency to sacrifice their need of proper nutrition, PA and rest for the patient's healthcare needs, which consequently lead to deterioration in their own health. While evidence on the effects of caregiving on caregiver health behavior is equivocal, there is much evidence

documenting deleterious mental health outcomes⁵⁸. Given the informal caregivers in this program were at least taking their own condition seriously and participating in CR, it is imperative to remind them to pace themselves and prioritize their own health. In light of the time constraints that caregivers may be facing, healthcare providers should secure respite support to liberate patient's time to engage in more PA, in order to ensure their own cardiac condition is optimally managed.

Caution is warranted when interpreting these results. An important limitation of this study is the reliance on self-report with respect to the primary outcome variable, which poses the risk of patients over-reporting their PA. Self-report of PA is subject to bias and error⁵⁹. The second main limitation of this study is related to design. In cross-sectional studies such as this, it is not possible to infer a cause-and-effect relationship between correlates and PA. For example, it is likely that the association observed between functional capacity and self-reported MVPA is bi-directional. Third, the objectives of this secondary study were not pre-specified. This can lead to under-powered tests of associations. Fourth, there were no constructs measured at the public policy level of the socio-ecological model. Therefore there may be other unmeasured factors, which affect PA in this population. The final limitations relate to generalizability. The findings may not be generalizable to settings outside of Ontario, where CR services are not reimbursed through the health care system. Finally, the generalizability of the findings will be limited to those who gain access to CR and complete the program, which represents only approximately 20% of cardiac outpatients²⁰.

In conclusion, approximately two-thirds of CR graduates meet guideline-recommended levels of 150 minutes of MVPA per week. Attainment of PA targets were related to greater self-

monitoring; a skill which is readily-teachable to CR participants. Patients with informal caregiving responsibilities engaged in significantly less PA. CR staff should explore respite services for such caregivers to ensure they can complete their course of CR and have time to be physically active outside of CR hours

EXTENDED RESULTS AND DISCUSSION

Extended Results

The SPSS software was used to explore the distribution of the dependent variable, MVPA. Sixteen cases were identified as outliers, considering they had a z-score outside of the appropriate range. The outlier MVPA values were as follows: 3600, 2700, 1440, 1350, 1140, 960, 950, 910, 840, 840, 750, 720, 660, 630, 630, and 620. Due to the implausible nature of these values, the corresponding participants' surveys were checked to confirm the validity of the data entry. The participants were also contacted in order to ascertain the accuracy of their responses. Considering that the outliers could not be corrected, it was decided that they should be eliminated from the analysis as they do not represent valid population data points. It is important to note, outliers can lead to inflated error rates and reduce the power of statistical tests. They can also decrease normality, and bias or influence estimates that may be of great importance.

MVPA was compared between sites of recruitment using Analysis of Variance (ANOVA) to ascertain potential differences. The results indicated that there were no significant site differences in the attainment of guideline recommended levels of MVPA at CR completion ($F = 0.728, p = 0.484$).

Extended Discussion

Parallel with previous research, there were no socio-ecological correlates assessed in this study at the public policy level of the model. The correlates at this level may be best identified using a qualitative approach. For example, by investigating the policies that are currently in practice, as well as interviewing patients, CR program administrators, as well as municipal and provincial government officials could provide insight as to what is required to improve PA

among CVD patients³¹. In light of the fact that policy change is likely to translate to population level change, this area of pursuit deserves significant consideration. There are many promising public policy level changes that could influence PA in CVD patients. Some examples include funding for CVD patients who cannot otherwise afford it to gain access to gym memberships or home exercise equipment. In addition, CR programs can be reformatted in order to include training for CR staff members to understand the different correlates which can aid in enhancing PA in this population.

The current investigation raises some directions for future research. First, future studies should attempt to analyze the initial exercise prescription for participants at the beginning of CR and how they have progressed throughout the course of the program. For instance, assessing the number of times the exercise prescription has been modified and at what time interval, may shed some light on the extent of the participants' PA improvement. This could also help in understanding the suitability of MVPA at CR completion.

Second, given the socio-ecological model considers the levels as interdependent, analysis to consider this interdependence should be undertaken. For example, multi-level models could be tested. Specifically, a two-level random effects model could be run where level one corresponded to patient-level variables and level two to broader ecological level variables. Moreover, structural equation modeling could be used to explore mediators and moderators of MVPA.

PA at CR completion was measured via a self-report survey. The result of this study would have been more robust if MVPA measurements were obtained directly by using accelerometers. Objective measures are not susceptible to socially-desirable responding,

however, there are other biases^{59, 60, 61}. For instance, when participants know their activity is being tracked, they may tend to engage in more PA⁶². It can be speculated that levels of MVPA would be over-estimated with either assessment method. Consequently, the nature of correlates identified in this study at each level of the model may not necessarily be affected.

The ECO-PCR trial has recently received renewal funding from the Heart and Stroke Foundation. Therefore recruitment will continue to secure a larger sample of female participants to assess sex differences in PA at CR completion as well as in the socio-ecological correlates. Participants' PA is not only going to be measured via a self-report survey but also through the use of accelerometers in order to yield more robust data. The investigators will re-examine the 2 objectives of this thesis when baseline data collection is complete, and potentially submit the findings for publication at that time.

In conclusion, secondary analysis of the post-CR data from the ECO-PCR trial has revealed that not all patients attain the guideline-recommended levels of PA. This study identified the key correlates of PA at CR completion. As the later assessments are completed for the trial, the investigators will be able to test whether these, or other, correlates are key determinants to PA maintenance over the year post-program.

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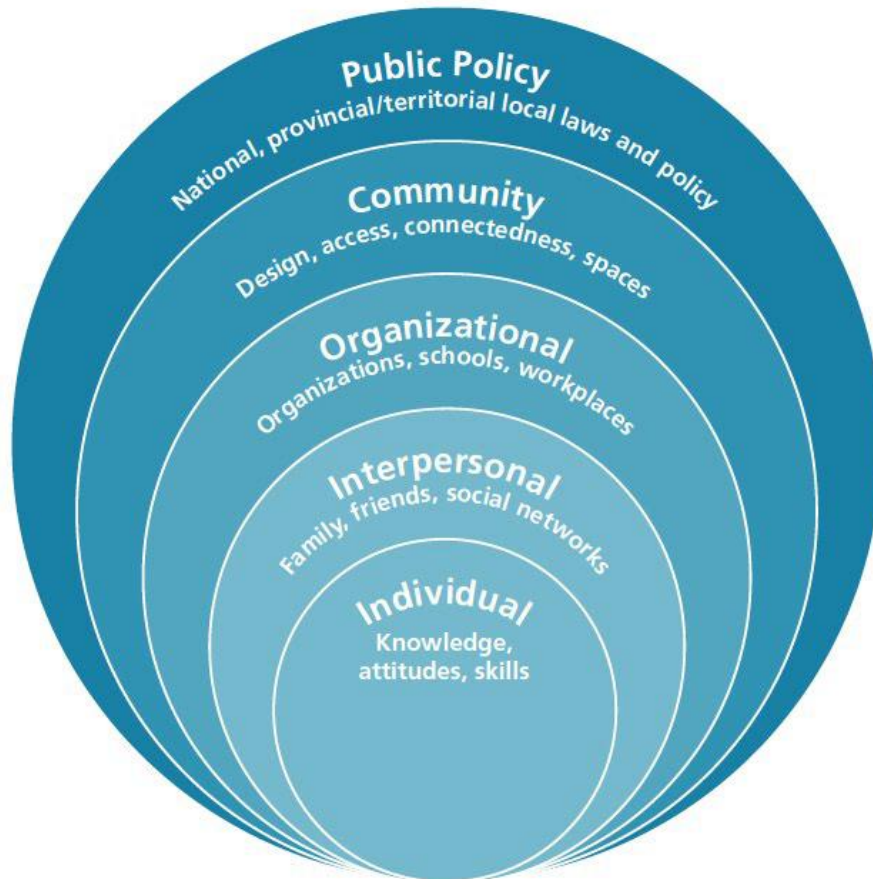
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APPENDICES

Appendix A: Socio-ecological Model



A Social-Ecological Model for Physical Activity - Adapted from Heise, L., Ellsberg, M., & Gottemoeller, M. (1999)

Appendix B: Proposed Socio-ecological Constructs by Level

Socio-ecological Model Level	Proposed Constructs To Be Assessed (*)
Individual (Knowledge, Attitudes, Skills)	Sex (Appendix D, page 1), Racial/Ethnic Background (A*), Work Status (A), Education Level (A), Income Level (A), Depressive Symptoms (A), Functional Status (B), Health Status: Comorbidities (C), Smoking Status (C), PA Self-regulation (L), PA Intention and Planning (J), Task Self-efficacy (O), Barrier Self-efficacy (F), Exercise Benefits and Barriers (Q), BMI (Appendix D, page 3)
Interpersonal (Family, friends, Social Networks)	Social Support: Participation, Rewards, and Punishment (K), Subjective Norm (N), Living Arrangements (A), Marital Status (A), Autonomy Support: Health Care Climate (P),
Organizational (Organization, Schools, Workplaces)	Neighbourhood Environment: Places to do PA (H), Home Environment: Home PA Equipment (I)
Community (Design, Access, Connectedness, Spaces)	Neighbourhood Characteristics: Aesthetics, Crime Rate, and Street Connectivity (G), Mixed-Land Use (G, item 10), Season (Appendix D, page 1)

BMI (body mass index), PA (physical activity)

*Denotes section of survey where construct is assessed.

Appendix C: Informed Consent Form

ECO-PCR



CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Study Title: Ecologically Optimizing Exercise Maintenance in Men and Women Following Cardiac Rehabilitation: A Randomized Controlled Trial of Efficacy with Economics

Principal Investigators: Dr. Robert Reid, PhD MBA (Ottawa)
Sherry L. Grace, PhD (Toronto)

Sponsor Heart and Stroke Foundation of Ontario

Introduction

You are being asked to take part in a research study. Please read this explanation about the study and its risks and benefits before you decide if you would like to take part. You should take as much time as you need to make your decision. You should ask the study doctor or study staff to explain anything that you do not understand and make sure that all of your questions have been answered before signing this consent form. Before you make your decision, feel free to talk about this study with anyone you wish. Participation in this study is voluntary.

Background and Purpose

Physical activity is an important contributor to fitness for patients with heart disease. Canadian guidelines recommend 30-60 minutes of moderate to vigorous physical activity most, preferably, all days of the week.

Participation in an outpatient cardiac rehabilitation program is the usual first step toward developing an exercising lifestyle after a heart problem is diagnosed. About 70-85% of people report achieving recommended guidelines for physical activity during the time they are participating in cardiac rehab. Unfortunately, these levels of physical activity are often not maintained after participation in the program ends.

You have been asked to take part in this research study because you have completed at least 75% of a supervised cardiac rehabilitation program at the University Health Network (Toronto Western Hospital or Toronto Rehabilitation Institute).

Version 3, December 13, 2012
ECO-PCR ICF

Page 1 of 6

We have developed a new intervention to promote the continuation of exercise following cardiac rehab. It incorporates an exercise “facilitator” to transition patients from structured, supervised exercise to home walking or approved community-based exercise programs (also known as Heart Wise Exercise Programs).

This research study will examine whether the facilitator intervention is related to more exercise maintenance over the year following cardiac rehab, which elements of the process affected your exercise, your clinical profile, and the cost of in the intervention, including whether patients are less likely to use the healthcare system.

About 286 people from Ottawa and Toronto will be in the study. About 100 people will come from the University Health Network (Toronto Western Hospital and the Toronto Rehabilitation Institute cardiac rehab programs).

Study Design

This study is a 1-year study that that will compare an intervention group (exercise facilitator) with a control group (usual care). Whether you assigned to the intervention or the control group will be decided randomly (by chance) like flipping a coin or rolling dice. The number of people getting study intervention will be 143 and the number of people in the control group will be 143.

Study Procedures

Questionnaires

You will be asked to complete three (3) survey questionnaires: one at the beginning of the study, one at 26 weeks (6 months) and finally one at 52 weeks (1 year). The questionnaires will ask you about your demographics (age, gender, education), lifestyle (exercise behaviours, cardiac risk factors, medications), as well as questions about your health and emotional well-being. Completion of the questionnaires will require approximately 45 minutes of your time.

Intervention Group

Participants in the intervention group will receive five small group counselling teleconferences, be invited to multiple community exercise program demonstrations, and three personal telephone calls from a trained exercise facilitator over a 50-week (almost 1 year) intervention period.

- Small group teleconferences will take place in study weeks: 3, 13, 26, 39 and 52. These sessions are 60 minutes long.
- Personal (individual phone calls) will take place in study weeks: 20, 34 and 45. These sessions are 15-30 minutes long.
- A random sub-sample of these calls would be audio taped with your permission so we can audit the consistency of the session content the facilitator is providing.
- The above activities will actively explore and review your exercise behaviours and barriers.

Usual Care Group

The usual care group will receive the usual exercise advice provided to patients exiting cardiac rehabilitation at the study centers. Patients in both programs are provided with an updated exercise prescription and a home-based walking program prior to program completion and exercise maintenance strategies are reviewed with program exercise staff. There is no further patient contact after program completion at either program.

Follow up

Participants in both groups will have their follow-up continue through to 52 weeks (1 year later).

- Results from your exit assessments will be collected from your cardiac rehab charts.
- Measures will be taken at 26 weeks (6 months) and 52 weeks (1 year) after randomization.
 - You will be asked to come on site for these assessments, and complete a survey measuring your thoughts and feelings about exercise. It will take approximately 45 minutes to complete.
 - In order to measure your health, we would also like to test your blood pressure and measure your waist.
 - You will be asked wear an accelerometer device to measure your physical activity for 9 days. You will be provided with a pre-paid addressed envelope to return the accelerometer.
- A randomly-chosen subsample of patients will be asked to do a physician-supervised, symptom-limited cardiopulmonary test at the 1-year final assessment only. Cardiac rehab graduates from the Toronto Rehabilitation Institute program are asked to do this as a standard part of the program, so if this information is available we would simply want to get the results.

As part of the study, we will review your medical records to obtain information about your diagnosis and your medical history, including the nature of your cardiac problem, heart history and medications. We will also collect the information obtained as part of your rehab program, which includes test results, blood pressure and waist measurements, cholesterol levels, as well as your participation level and dates of attendance.

Economic Measures

Finally, we would also like permission to link your information gathered from this program with a provincial database to determine your health care use and health outcomes over time. This would not require any paperwork on your behalf.

Reminders

While you are in this study you should continue with everything your family doctor or cardiac specialist has recommended. You will still receive your usual care from your family doctor and cardiac specialist. You do not have to stop or change anything.

Potential Risks and Benefits

It is very unlikely that participation in this research study will result in any side effects. The Cardiopulmonary stress test will require you to walk (starting at a low level with the speed and grade slowly increasing throughout the test) on a treadmill with electrodes on your chest in order to see how the heart works during exercise. It will help us measure your heart minimal and maximal exercise capacity. This test is based on your own efforts and you can stop at any time throughout the procedure. There will be a full medical staff supervising the stress test.

You will be revealing personal information about yourself; however this information will remain private.

When you provide a blood sample, pain from the needle stick and bruising may occur.

Benefits to Being in the Study

You may receive direct benefit from being in this study by receiving further support to maintain exercise. Your participation will also help us improve the care of future cardiac patients following cardiac rehab participation.

Voluntary Participation

Your participation in this study is voluntary. You may decide not to be in this study, or to be in the study now, and then change your mind later. You may leave the study at any time without affecting your care. You may refuse to answer any question you do not want to answer.

We will give you new information that is learned during the study that might affect your decision to stay in the study.

Confidentiality

If you agree to join this study, the study doctor and his/her study team will look at your personal health information and collect only the information they need for the study. Personal health information is any information that could be used to identify you and includes your:

- name
- address
- email address
- OHIP number
- new or existing medical records (including types, dates and results of medical tests or procedures)

The information that is collected for the study will be kept in a locked and secure area by the study doctor for 10 years. Only the study team or the people or groups listed below will be allowed to look at your records. Your participation in this study also may be recorded in your medical record at this hospital.

The following people may come to the hospital to look at the study records and at your personal health information to check that the information collected for the study is correct and to make sure the study followed proper laws and guidelines:

- Representatives of the study organizing committee.
- University Health Network Research Ethics Board.

All information collected during this study, including your personal health information, will be kept confidential and will not be shared with anyone outside the study unless required by law. Any information about you that is sent out of the hospital will have a code and will not show your name or address, or any information that directly identifies you. You will not be named in any reports, publications, or presentations that may come from this study.

If you decide to leave the study, the information about you that was collected before you left the study will still be used. No new information will be collected without your permission.

In Case You Are Harmed in the Study

If you become ill, injured or harmed as a result of taking part in this study, you will receive care. The reasonable costs of such care will be covered for any injury, illness or harm that is directly a result of being in this study. In no way does signing this consent form waive your legal rights nor does it relieve the investigators, sponsors or involved institutions from their legal and professional responsibilities. You do not give up any of your legal rights by signing this consent form.

Expenses Associated with Participating in the Study

You will not have to pay for any of the procedures (i.e. blood draws, stress test) involved with this study. You will be reimbursed for your parking costs for your 3 on-site visits to complete study assessments (initial, 26 weeks and 52 weeks). You will not be paid for participation in this study.

Questions About the Study

If you have any questions, concerns or would like to speak to the study team for any reason, please call: Sherry Grace, PhD at 416-340-4800 x. 6455# or the Study Coordinator at 416-736-2100 x20575.

If you have any questions about your rights as a research participant or have concerns about this study, call the Chair of the University Health Network Research Ethics Board (REB) at 416-581-7849 or please call the Toronto Rehab Research Ethics Board Office at (416) 597-3422 x 3081. The REB is a group of people who oversee the ethical conduct of research studies. These people are not part of the study team. Everything that you discuss will be kept confidential.

Consent

This study has been explained to me and any questions I had have been answered. I know that I may leave the study at any time. I agree to take part in this study.

Print Study Participant's Name Signature Date

(You will be given a signed copy of this consent form)

My signature means that I have explained the study to the participant named above. I have answered all questions.

Print Name of Person Signature Date
Obtaining Consent

Appendix: D Case Report Form

PARTICIPANT ID: _____

ECO-PCR Case Report Form (CRF)

ELIGIBILITY

Date: _____ (dd/mm/yy)

Participant Age: _____

Gender: Male Female

INCLUSION CRITERIA

- Patient is currently participating in an on-site CR program of \geq 8-week duration
- Patient has attended \geq 75% of scheduled CR sessions
- Patient has a documented diagnosis of CAD
- Patient is 18 years of age or older
- Patient is able and willing to provide informed consent

EXCLUSION CRITERIA

- NYHA class III or IV heart failure
- Unable to read or understand English or French
- Planning to leave the province or region in the next 12 months
- Pregnant, lactating or planning to become pregnant during the study period

Patient Decline to Participate:

- No Yes -Reason, if willing:

PI / Investigator confirm patient eligible:

- Eligible Ineligible, Reason:

P.I. Signature

Date

Stop here if patient is ineligible or declined.

CRF Completed By: _____

CRF Entered By: _____

Date: _____

Date: _____

ECO-PCR Case Report Form (CRF)

1) Reason for CR enrollment (*check all that apply*):

- PCI
- CABG Surgery
- Angina / ACS / CAD
- MI
- Valve surgery

Index Cardiac Condition

<p>2) <input type="checkbox"/> PCI Date: _____</p> <p>Procedure Vessels(s):</p> <p><input type="checkbox"/> Primary <input type="checkbox"/> LM</p> <p><input type="checkbox"/> Non-Primary <input type="checkbox"/> RCA</p> <p><input type="checkbox"/> Unknown <input type="checkbox"/> LAD</p> <p style="text-align: center;">(circle: prox/med/dist)</p> <p><input type="checkbox"/> Circ</p> <p><input type="checkbox"/> Ramus</p> <p>3) <input type="checkbox"/> MI Date: _____</p> <p>Location(s): Type:</p> <p><input type="checkbox"/> Anterior <input type="checkbox"/> STEMI</p> <p><input type="checkbox"/> Inferior <input type="checkbox"/> NSTEMI</p> <p><input type="checkbox"/> Lateral <input type="checkbox"/> Q-Wave</p> <p><input type="checkbox"/> Posterior <input type="checkbox"/> BBB</p> <p><input type="checkbox"/> Septal <input type="checkbox"/> NONQ-Wave</p> <p><input type="checkbox"/> Rt Ventricular <input type="checkbox"/> Unstable Angina</p> <p>4) <input type="checkbox"/> CABG Date: _____</p> <p>Vessel(s):</p> <p><input type="checkbox"/> LM</p> <p><input type="checkbox"/> RCA</p> <p><input type="checkbox"/> LAD (circle: prox / med / dist)</p> <p><input type="checkbox"/> Circ</p> <p><input type="checkbox"/> Ramus</p> <p>5) <input type="checkbox"/> Valve Date: _____</p> <p>Surgery: Valve(s):</p> <p><input type="checkbox"/> Repair <input type="checkbox"/> Aortic</p> <p><input type="checkbox"/> Replace <input type="checkbox"/> Tricuspid</p> <p style="margin-left: 150px;"><input type="checkbox"/> Bicuspid</p> <p style="margin-left: 150px;"><input type="checkbox"/> Pulmonary</p>	<p>6) <input type="checkbox"/> ACS Confirmation Date: _____</p> <p><input type="checkbox"/> ECG <input type="checkbox"/> Angiogram <input type="checkbox"/> Enzymes <input type="checkbox"/> Symptoms</p> <p>7) Other cardiac cond(s) Date: _____</p> <p><input type="checkbox"/> Aneurysm <input type="checkbox"/> Arrhythmia</p> <p><input type="checkbox"/> Infection <input type="checkbox"/> Congenital HD</p> <p><input type="checkbox"/> Heart Failure <input type="checkbox"/> Cardiomyopathy</p> <p style="text-align: right;"><input type="checkbox"/> Other: _____</p> <p>8) Previous cardiac diagnosis, if applicable:</p> <p><input type="checkbox"/> CAD <input type="checkbox"/> Infection</p> <p><input type="checkbox"/> CHF <input type="checkbox"/> Valve condition</p> <p><input type="checkbox"/> Arrhythmia <input type="checkbox"/> Cardiomyopathy</p> <p><input type="checkbox"/> Congenital HD <input type="checkbox"/> Other: _____</p> <p><input type="checkbox"/> ACS/MI <input type="checkbox"/> None</p>
--	---

PARTICIPANT ID: _____

Cardiac Rehab Program Information, Risk Factors and Other Clinical Data:

<p>9) CR Admission Date: _____ (dd/mm/yy)</p> <p>10) CR Discharge Date: _____ (dd/mm/yy)</p> <p>11) CR Program Completed:</p> <p><input type="checkbox"/> UHN (TWH) <input type="checkbox"/> TRI <input type="checkbox"/> OHI</p> <p>12) Percentage of CR completed (% of prescribed sessions): _____</p> <p>13) Risk Factors (VALUES AT CR DISCHARGE): Y N</p> <p><input type="checkbox"/> <input type="checkbox"/> Diabetes: <input type="checkbox"/> Type I <input type="checkbox"/> Type II HbA1c%: _____ Date assessed: _____</p> <p><input type="checkbox"/> <input type="checkbox"/> Obesity (BMI>30) Height (cm): _____ Weight(kg): _____ BMI (kg/m²): _____ Waist circ (cm): _____ Date assessed: _____</p> <p><input type="checkbox"/> <input type="checkbox"/> Hypertension BP: syst: _____ / diast: _____ Date assessed: _____</p> <p><input type="checkbox"/> <input type="checkbox"/> Dyslipidemia Total Cholesterol: _____ HDL: _____ LDL: _____ Triglycerides: _____ Date assessed: _____</p> <p>CR Intake GXT results: 14) Complete: yes <u>or</u> no Date assessed: _____</p> <p>If yes.. 15) GXT Mode (Intake): <input type="checkbox"/> Treadmill <input type="checkbox"/> Cycle Ergometer</p> <p>16) Protocol (Intake): <input type="checkbox"/> Modified Bruce <input type="checkbox"/> other: _____</p>	<p>GXT Results (Intake): 17) peak METS: _____ 18) peak VO₂: _____ 19) peak HR: _____</p> <p>20) Intake GXT comments: <div style="border: 1px solid black; height: 50px; width: 100%;"></div></p> <p>21) Symptom-limited (Intake)? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>22) CR Intake Heart rate: _____ Date assessed: _____</p> <p>CR Discharge GXT results: 23) Complete: yes <u>or</u> no Date assessed: _____</p> <p>24) GXT Mode (Discharge): <input type="checkbox"/> Treadmill <input type="checkbox"/> Cycle Ergometer</p> <p>25) Protocol (Discharge): <input type="checkbox"/> Modified Bruce <input type="checkbox"/> other: _____</p> <p>GXT Results (Discharge): 26) peak METS: _____ 27) peak VO₂: _____ 28) peak HR: _____</p> <p>29) Discharge GXT comments: <div style="border: 1px solid black; height: 50px; width: 100%;"></div></p> <p>30) Symptom-limited (Discharge)? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>31) CR Discharge Heart rate: _____ Date assessed: _____</p>
---	---

32) Comorbid Conditions:

- Cancer
- Hyperthyroid
- Liver Disease
- PAD/PVD
- Depression
- Renal Disease
- MSK / Joint Replacement, specify: _____
- Other: _____

33) CCS Angina Class: N/A

- 0 1 2 3 4 Not assessed

34) NYHA Functional Class: N/A

- 1 2 3 4 Not assessed

35) LV Function:

- Nuclear Echo Angiogram
- LVEF %: _____
- Narrative: _____

- Normal Mild Moderate Severe
- Date assessed: _____

36) Complications during CR program:

- | | |
|---|--|
| <input type="checkbox"/> Arrhythmia | <input type="checkbox"/> Cardiac Arrest |
| <input type="checkbox"/> Recurrent Angina / ischemia | <input type="checkbox"/> Pericarditis |
| <input type="checkbox"/> Repeat cardiac procedure
Specify: _____ | <input type="checkbox"/> Pneumonia |
| <input type="checkbox"/> Cardiogenic shock | <input type="checkbox"/> Acute Renal Fail |
| <input type="checkbox"/> Cerebrovascular Accident | <input type="checkbox"/> DV Thrombosis |
| <input type="checkbox"/> Hospital readmittance
Specify: _____ | <input type="checkbox"/> MI |
| | <input type="checkbox"/> Heart Failure |
| | <input type="checkbox"/> Cardioversion |
| | <input type="checkbox"/> Cardiac Tamponade |
| | <input type="checkbox"/> Other
Specify: _____ |

PARTICIPANT ID: _____

Current Medications (*check all*):

Medication	Name	Dose
<input type="checkbox"/> 37) ACE Inhibitors		
<input type="checkbox"/> 38) Anti-coagulants		
<input type="checkbox"/> 39) ASA		
<input type="checkbox"/> 40) Ca ²⁺ antagonists		
<input type="checkbox"/> 41) Statin		
<input type="checkbox"/> 42) LL – fibrate		
<input type="checkbox"/> 43) LL – nicotinic acid		
<input type="checkbox"/> 44) LL – resin drugs		
<input type="checkbox"/> 45) Diuretics		
<input type="checkbox"/> 46) Clopidogrel or ticlopidine		
<input type="checkbox"/> 47) Other anti-platelet		
<input type="checkbox"/> 48) Nicotine Replacement		
<input type="checkbox"/> 49) Anti-arrhythmic		
<input type="checkbox"/> 50) Anti-platelets		
<input type="checkbox"/> 51) Beta-blockers		

PARTICIPANT ID: _____

Medication	Name	Dose
<input type="checkbox"/> 52) Digoxin		
<input type="checkbox"/> 53) Nitrates (not PRN)		
<input type="checkbox"/> 54) ARBs		
<input type="checkbox"/> 55) Anti-depressant		
<input type="checkbox"/> 56) Coumadin		
<input type="checkbox"/> 57) Heparin		
<input type="checkbox"/> 58) HRT		
<input type="checkbox"/> 59) Insulin		
<input type="checkbox"/> 60) Oral hypoglycemic		
<input type="checkbox"/> 61) Other: _____		

ECO-PCR Case Report Form (CRF)

PARTICIPANT CONTACT INFORMATION
(separate this page)

First Name: _____

Last Name: _____

Salutation (circle one): Ms. Mrs. Mr. Dr.

Health Card Number: _____

Randomized to: Navigator Intervention Usual Care
 GXT No GXT

Telephone:

Home #: _____

Work #: _____

Cell #: _____

Preferred time(s) to be called: Morning: _____ Afternoon: _____ Evening: _____

Permission to leave phone message for call back: yes or no

Address:

If patient works rather than lives close to the CR programs, record office postal code: _____

E-mail address: _____

Alternate Contact Information (if willing):

Name: _____ Relationship: _____

Telephone #: _____

Accelerometer Number: _____

Date Received by Participant: _____

Appendix E: Baseline Survey



UNIVERSITY OF OTTAWA
HEART INSTITUTE
INSTITUT DE CARDIOLOGIE
DE L'UNIVERSITÉ D'OTTAWA



ECO-PCR Study Initial Survey



Instructions for completing the survey questions appear at the beginning of each section.

Please seal your completed questionnaire in the envelope provided, and return it to the study coordinator.

DATE COMPLETED:(dd/mm/yyyy)_____ Participant #_____

ECO-PCR Initial Pt Survey
Version 3, August 15, 2012
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GENERAL INSTRUCTIONS

We need your help to make our study a success. Your candid answers to the items in this survey are very important to us. The survey will take approximately 30 minutes to complete.

REMEMBER...

- ♥ We want to know what **you** think.
- ♥ There are no right or wrong answers.
- ♥ Everything you tell us will be kept strictly confidential.

AND PLEASE

- ♥ Provide only one answer for each item.

The following questionnaire will ask you questions about participating in physical activity

IMPORTANT

- ♥ **Moderate intensity** refers to activities that are not exhausting, but lead to light perspiration (e.g., bicycling at a regular pace, easy swimming, dancing, fast walking)
- ♥ **Vigorous intensity** refers to activities that cause your heart to beat rapidly and lead to heavy sweating (e.g., aerobics, fast bicycling, running, jogging)
- ♥ **PHYSICAL ACTIVITY TARGET: accumulate ≥ 30 minutes of moderate-to-vigorous physical activity on ≥ 5 days of the week.**

Please answer the following questions about physical activity with this in mind.

If, at any time, you have questions as you complete this questionnaire, or regarding your participation in this study, please call:

Golnoush Taherzadeh, MSc Candidate
Phone: 416.736.2100 x 20575
Email: gtaherza@uhnresearch.ca

SECTION A: ABOUT YOU

Instructions: The information within this section is needed to help understand the characteristics of the people participating in this study. For this reason, it is very important information. **Be assured that it will remain confidential.**

1. What do you consider to be your racial/ethnic background? Please check one (1) of the following boxes:

- Aboriginal (includes Inuit, Métis peoples of Canada, First Nations)
- Arab (includes Egyptian, Kuwait, Libyan)
- West Asian (includes Afghan, Assyrian and Iranian)
- Black (includes African, Nigerian, Somali)
- Chinese
- Filipino
- Japanese
- Korean
- Latin American (includes Chilean, Costa Rican, Mexican)
- South Asian (includes Bengladeshi, Punjabi, Sri Lankan)
- South East Asian (includes Vietnamese, Cambodian, Malaysian)
- White (Caucasian)
- Other (**specify:** _____)
- Multiple cultural backgrounds (**specify** _____)

2. Who do you live with?

- Family (spouse, children, etc.)
- Alone
- Other
(specify: _____)

3. How many people live in your house hold? _____

4. Do you live with someone who requires caregiving (e.g., ill spouse, grandchildren)?

- Yes
- No

5. Which option best matches your work status?

- Employed Full-time (that is 35 or more hours per week)
- Employed Part-time (that is less than 35 hours per week)
- Self-employed (primary occupation)
- Unemployed, but looking for work
- Student
- Retired
- Not in the paid workforce (homemaker, unemployed, not looking for work)

6. What is your marital status?

- Single
- Married or equivalent (i.e., common law, same sex)
- Separated or equivalent
- Widowed

7. What is the highest level of education you have completed?

- Less than high school (no certificates, diplomas or degrees)
- High school graduation certificate
- Trades certificate
- College certificate or diploma: a certificate from a community college, CEGEP, school of nursing, theological college or private college
- University: a certificate below the bachelor's level, bachelor's degree, certificate above the bachelor level, master's degree, earned doctorate or a professional degree in medicine, dentistry, veterinary medicine or optometry

8. How much did you earn before taxes and other deductions, during the past 12 months?

- Less than \$5,000
- \$5,000 through \$11,999
- \$12,000 through \$15,999
- \$16,000 through \$24,999
- \$25,000 through \$34,999
- \$35,000 through \$49,999
- \$50,000 through \$74,999
- \$75,000 through \$99,999
- \$100,000 and greater

9. Did you engage in physical activity to the point of getting short of breath on a regular basis (as an adult) prior to your vascular event?

- Yes
- No

10. Please circle one number in each row below:

Over the past 2 weeks, how often have you been bothered by any of the following problems?¹	Not At All	Several Days	More Than Half the Days	Nearly Every Day
a. Little interest or pleasure in doing things	0	1	2	3
b. Feeling down, depressed or hopeless	0	1	2	3

¹ Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care*. 2003 Nov;41(11):1284-92.

SECTION B: USUAL ACTIVITIES

Instructions: The following questions have to do with your current activity status.²

Please circle Yes or No in response to each question.

1.	Can you take care of yourself, that is, eating, dressing, bathing or using the toilet?	Yes	No
2.	Can you walk indoors, such as around your house?	Yes	No
3.	Can you walk a block or two on level ground?	Yes	No
4.	Can you climb a flight of stairs or walk up a hill?	Yes	No
5.	Can you run a short distance?	Yes	No
6.	Can you do light work around the house like dusting or washing dishes?	Yes	No
7.	Can you do moderate work around the house like vacuuming, sweeping floors, or carrying in the groceries?	Yes	No
8.	Can you do heavy work around the house like scrubbing floors, or lifting or moving heavy furniture?	Yes	No
9.	Can you do yard work like raking leaves, weeding or pushing a power mower?	Yes	No
10.	Can you have sexual relations?	Yes	No
11.	Can you participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?	Yes	No
12.	Can you participate in strenuous sports like swimming, singles tennis, football, basketball or skiing?	Yes	No

² Hlatky, M.A., Boineau, R.E., Higginbotham, M.B., Lee, K.L., Mark, D.B., Califf, R.M., Frederick, R.C., Pryor, D.B. A Brief Self-Administered Questionnaire to Determine Functional Capacity (The Duke Activity Status Index). *The American Journal of Cardiology*. 1989; 64(Sept. 15): 651-654

SECTION C: YOUR MEDICAL HISTORY

OTHER HEALTH CONDITIONS

9. Do you have any of the following conditions? Please check all the conditions that apply to you.

- Chronic Obstructive Pulmonary Disease (COPD)
- Asthma
- Arthritis
- Cancer
- Chronic Renal Failure (kidney)
- Liver problems/disease
- Osteoporosis
- Anxiety or Depression
- Diabetes
- Sleep Apnea
- Chronic pain or injury to any of the following:
 - Back
 - Hip
 - Knee (s)
 - Foot
 - Joint repair or replacement (such as hips, knees)
- Other health problems: Please Specify: _____

RISK FACTORS

10. a. At the present time, do you smoke cigarettes? Every day Occasionally Not at all

b. (If 'No' go to 11). Have you ever smoked cigarettes daily? Yes No

c. (If 'Yes' go to 10 b.). When did you stop smoking? _____ (month and year)

11. Do you have a history of heart disease in your family (direct blood relative: parents, siblings, and children)?

- Yes
- No

SECTION D: TAKING YOUR MEDICATIONS

©Morisky Medication Adherence Scale (MMAS-4).³⁴

You indicated that you are taking medication for your heart. Individuals have identified several issues regarding their medication-taking behaviour and we are interested in your experiences. There is no right or wrong answer. Please answer each question based on your personal experience with your heart medication.

(Please check one box on each line)

	No	Yes
1. Do you ever forget to take your heart medicine?	<input type="checkbox"/>	<input type="checkbox"/>
2. Do you ever have problems remembering to take your heart medication?	<input type="checkbox"/>	<input type="checkbox"/>
3. When you feel better, do you sometimes stop taking your heart medicine?	<input type="checkbox"/>	<input type="checkbox"/>
4. Sometimes if you feel worse when you take your heart medicine, do you stop taking it?	<input type="checkbox"/>	<input type="checkbox"/>

5. How often do you have difficulty remembering to take all your medications?

- (Please circle the correct number)**
- Never/Rarely.....**4**
 - Once in a while.....**3**
 - Sometimes.....**2**
 - Usually.....**1**
 - All the time.....**0**

³ Morisky DE, Green LW, Levine DM. Concurrent and Predictive Validity of a Self-Reported Measure of Medication Adherence and Long-Term Predictive Validity of Blood Pressure Control. *Medical Care* 1986.

⁴ Morisky DE, Malotte CK, Choi P, et al. A Patient Education Program to Improve Adherence Rate with Antituberculosis Drug Regimens. *Health Education Quarterly* 1990; 17:253-268

SECTION E: YOUR QUALITY OF LIFE

Instructions: By placing a check-mark in one box in each group below, please indicate which statements best describe your own state of health today.

1. Mobility

- I have no problems in walking about
- I have some problems in walking about
- I am confined to bed

2. Self-Care

- I have no problems with self-care
- I have some problems washing or dressing myself
- I am unable to wash or dress myself

3. Usual Activities (e.g. work, study, housework, family or leisure activities)

- I have no problems with performing my usual activities
- I have some problems with performing my usual activities
- I am unable to perform my usual activities

4. Pain/Discomfort

- I have no pain or discomfort
- I have moderate pain or discomfort
- I have extreme pain or discomfort

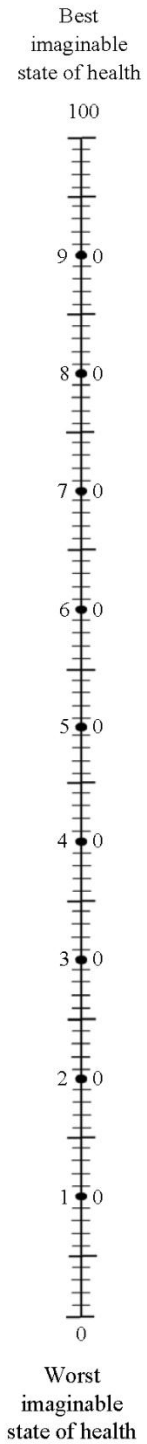
5. Anxiety/Depression

- I am not anxious or depressed
- I am moderately anxious or depressed
- I am extremely anxious or depressed

To help people say how good or bad their state of health is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked 100 and the worst state you can imagine is marked 0.

We would like you to indicate on this scale how good or bad your own health is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your state of health is today.

YOUR HEALTH TODAY =



SECTION F: YOUR CONFIDENCE TO DO PHYSICAL ACTIVITY

Using the 0% to 100% scale below, please circle how confident you are that you will accumulate 30 or more minutes of moderate to vigorous physical activity per day on at least 5 days⁵, EVEN IF...

	Not at all Confident		Moderately Confident				Extremely Confident				Not Applicable (N/A)	
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
1. you fear you will have another cardiac event	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
2. you are experiencing back pain	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
3. you are experiencing medication side effects	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
4. the weather is bad	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
5. you feel you have too much work to do	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
6. you feel you do not have time	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
7. you had angina / chest pain earlier in the day	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
8. you have other health problems	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
9. it is too expensive	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
10. you have to do physical activity alone	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
11. you do not enjoy it	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
12. you feel tired	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
13. you feel anxious or stressed	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A
14. you feel depressed	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	N/A

⁵ Plotnikoff RC, Lippke S, Trinh L, Courneya KS, Birkett N, Sigal RJ. Protection motivation theory and the prediction of physical activity among adults with type 1 or type 2 diabetes in a large population sample. *Br J Health Psychol.* 15(Pt 3):643-661.

SECTION G: NEIGHBOURHOOD CHARACTERISTICS

Instructions: For the next series of questions, we would like to know about what you think about your current neighbourhood (that is, where your room, apartment, or house is located- the area in which you currently reside/live).

Please circle the number for each question (i.e. from 1= strongly disagree to 4 = strongly agree) that best applies to your neighbourhood during the next week.⁶

	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
1. There are trees along the streets in my neighborhood.	1	2	3	4
2. There are many interesting things to look at while walking in my neighborhood.	1	2	3	4
3. There are many attractive natural sights in my neighborhood (such as landscaping, views).	1	2	3	4
4. There are attractive buildings / homes in my neighborhood.	1	2	3	4
5. There is a high crime rate in my neighborhood.	1	2	3	4
6. The crime rate in my neighborhood makes it unsafe to do physical activity outside DURING THE DAY.	1	2	3	4
7. The crime rate in my neighborhood makes it unsafe to do physical activity outside AT NIGHT .	1	2	3	4
8. The distance between intersections in my neighborhood is usually short (100 yards or less; the length of a football field)	1	2	3	4
9. There are many alternative routes for getting from place to place in my neighborhood (I don't have to go the same way every time).	1	2	3	4

10. Is your neighborhood (Please check one

1. Residential 2. Mixed commercial and residential 3. Mainly commercial

⁶ Sallis JF, Kerr J, Carlson JA, Norman GJ, Saelens BE, Durant N, Ainsworth BE. Evaluating a brief self-report measure of neighborhood environments for physical activity research and surveillance: Physical Activity Neighborhood Environment Scale (PANES). *J Phys Act Health.* 7(4):533-540.

SECTION H: PLACES TO DO PHYSICAL ACTIVITY

Instructions: Please indicate if each place is present in your community. If **you live** in an **urban community**, please consider places that are **within a 15 minute walk** of your house. If **you live** in a **rural community**, please consider places that are **within a 15 minute drive** of your house. Please check a box beside each place that is present in your community and whether or not you will use it within the next week.⁷

Places to do physical activity	Is it available?		Will/would you use it?	
	Yes	No	Yes	No
1. Fitness clubs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Schools offering recreation programs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Community recreation centres	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Arenas (skating, hockey)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Jogging / walking paths	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Bicycle lanes / paths	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Swimming pools	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Racquet clubs / courts (tennis)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Indoor shopping malls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Golf courses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Beaches, lake, river, or creek	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Public parks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Playing fields (soccer, football, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

⁷ Sallis JF, Kerr J, Carlson JA, Norman GJ, Saelens BE, Durant N, Ainsworth BE. Evaluating a brief self-report measure of neighborhood environments for physical activity research and surveillance: Physical Activity Neighborhood Environment Scale (PANES). *J Phys Act Health.* 7(4):533-540.

SECTION I: HOME PHYSICAL ACTIVITY EQUIPMENT

Instructions: What **physical activity equipment**, if any, do you (or will you) own **during the next week?** (Please consider only equipment that is in working condition and safe for you to use, and answer the "will/would you use it?" column even if you have answered that you do NOT have the equipment.)⁸

Home Environment	Do / will you own it?		Will/would you use it?	
	Yes	No	Yes	No
Treadmill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stationary bicycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Outdoor bicycle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skis (downhill, cross country, water)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skates (ice, roller)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weight training equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Running, walking shoes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Swimming pool	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Toning devices (exercise balls, dynabands)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aerobic work-out video or audiotapes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dog	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

⁸ Sallis JF, Kerr J, Carlson JA, NormanGJ, Saelens BE, Durant N, Ainsworth BE. Evaluating a brief self-report measure of neighborhood environments for physical activity research and surveillance: Physical Activity Neighborhood Environment Scale (PANES). *J Phys Act Health.* 7(4):533-540.

SECTION J: INTENTIONS AND PLANNING FOR PHYSICAL ACTIVITY

Instructions: Please circle one number in each row.

After my Cardiac Rehabilitation Program, in a typical week during the next 6 months ...	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>
(1) I <u>definitely intend</u> to engage in regular physical activity.	1	2	3	4	5
(2) I <u>definitely plan to</u> engage in regular physical activity.	1	2	3	4	5

After my Cardiac Rehabilitation Program, in a typical week during the next 6 months ...	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>
(3) I have made plans concerning “when” I am going to engage in regular physical activity.	1	2	3	4	5
(4) I have made plans concerning “where” I am going to engage in regular physical activity.	1	2	3	4	5
(5) I have made plans concerning “what” kinds of physical activities I am going to engage in.	1	2	3	4	5
(6) I have made plans concerning “how” I am going to get to a place to engage in regular physical activity.	1	2	3	4	5

SECTION K: SOCIAL SUPPORT

Instructions:

Below is a list of things people might do or say to someone who is trying to get regular physical activity. If you are not trying to get regular physical activity, then some of the questions may not apply to you, but please read and give an answer to every question. ⁹

Please rate each question three times: (1) Under family, rate how often anyone living in your household has said or done what is described during the past week. Under (2) "friends" and (3) "other CHD patients or peers", rate how often your family, friends, and other peers with cardiac heart disease (CHD) have said or done what is described during the past week.

Please write one number from the following rating scale in each space:

None	Rarely	A few times	Often	Very often	Does not apply
1	2	3	4	5	8

During the past week, my family (or members of my household), friends and peers with CHD:

	(1) Family	(2) Friends	(3) Other CHD Patients or Peers
1. Engaged in physical activity with me			
2. Offered to engage in physical activity with me			
3. Gave me helpful reminders to engage in physical activity ("Are you going to take part in physical activity tonight?")			
4. Gave me encouragement to stick with my physical activity program			
5. Changed their schedule so we could engage in physical activity together			
6. Discussed physical activity with me			
7. Complained about the time I spend engaging in physical activity			
8. Criticized me or made fun of me for engaging in physical activity			
9. Gave me rewards for engaging in physical activity (bought me something or gave me something I like)			
10. Planned for physical activity on recreational outings			
11. Helped plan activities around my physical activity			
12. Asked me for ideas on how <i>they</i> can get more physical activity			
13. Talked about how much they like to engage in physical activity			

⁹ Sallis, J.F., Grossman, R.M., Pinski, R.B., Patterson, T.L., and Nader, P.R. (1987). *The development of scales to measure social support for diet and exercise behaviors. Preventive Medicine, 16, 825-836.*

SECTION L: SELF-REGULATION

Instructions: Please indicate how often you used each self-regulation strategy in the past week. ¹⁰

	Never	Rarely	Sometimes	Often	Very Often
1. I mentally kept track of my physical activity	1	2	3	4	5
2. I mentally noted specific things that helped me be active	1	2	3	4	5
3. I set short term goals for how often I am active	1	2	3	4	5
4. I set physical activity goals that focused on my health	1	2	3	4	5
5. I asked someone for physical activity advice or demo	1	2	3	4	5
6. I asked a physical activity expert or health professional for physical activity advice or demo	1	2	3	4	5
7. After physical activity I focused on how good it felt	1	2	3	4	5
8. I reminded myself of physical activity health benefits	1	2	3	4	5
9. I mentally scheduled specific times for physical activity	1	2	3	4	5
10. I rearranged my schedule to ensure I had time for physical activity	1	2	3	4	5
11. I purposefully planned ways to do physical activity when on trips away from home	1	2	3	4	5
12. I purposefully planned ways to do physical activity in bad weather	1	2	3	4	5

¹⁰ Umstatt MR, Moti R, Wilcox S, Saunders R, Watford M. Measuring physical activity self-regulation strategies in older adults. *J Phys Act Health.* 2009;6 Suppl 1:S105-112.

SECTION M: PHYSICAL ACTIVITY

Instructions: Please recall your **average/typical** weekly physical activity during the past 6 months and write your responses to the questions (i.e. 1 to 6) in the spaces provided. If you did not participate in any activity(s), please put a zero (0) in the "days" **AND** the "minutes per day" spaces.

(1) How many days in a typical week out of the past 3 months did you do **MILD** (e.g., easy walking, yoga, archery, fishing, bowling, horseshoes, golf) **physical activity** for at least 10 minutes at a time? _____ days

(2) On the days when you did **MILD physical activity** (for at least 10 minutes at a time), how much total time on average did you spend per day doing these mild **physical activities**? _____ minutes per day

(3) How many days in a typical week out of the past 3 months did you do **MODERATE** (e.g., fast walking, tennis, easy bicycling, easy swimming, dancing) **physical activity** for at least 10 minutes at a time? _____ days

(4) On the days when you did **MODERATE physical activity** (for at least 10 minutes at a time), how much total time on average did you spend per day doing these moderate **physical activities**? _____ minutes per day

(5) How many days in a typical week out of the past 3 months did you do **VIGOROUS** (e.g., running, jogging, squash, cross country skiing, vigorous swimming, vigorous bicycling, vigorous aerobic classes) **physical activity** for at least 10 minutes at a time? _____ days

(6) On the days when you did **VIGOROUS physical activity** (for at least 10 minutes at a time), how much total time on average did you spend per day doing these vigorous **physical activity**? _____ minutes per day

SECTION N: IMPORTANT OTHERS

Instructions: These questions ask you about what you think important people in your life would think about you engaging in physical activity after completing cardiac rehabilitation on a weekly basis during the next six (6) months. Please circle a number for EACH question using the scale provided.

After my Cardiac Rehabilitation Program, in a typical week during the next 6 months ...	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>
(1) most people <u>important to me</u> will <u>definitely think I should be</u> participating in regular physical activity.	1	2	3	4	5
(2) most people <u>important to me</u> will <u>definitely want me to engage</u> in regular physical activity.	1	2	3	4	5
(3) most people <u>important to me</u> will <u>definitely themselves engage</u> in regular physical activity.	1	2	3	4	5

SECTION O: YOUR CONFIDENCE

Instructions: All of the items listed below are designed to **assess your confidence** to continue participating in at least 30 minutes of moderate-to-vigorous regular physical activity. Please circle the percentage (%) that best represents your response for EACH question using the scale provided. **Please answer each question on lines 1-7.**

During a typical week over the next 6 months, how confident are you that you will definitely accumulate at least 30 minutes of moderate-to-vigorous physical activity		Not at all Confident (%)		Moderately Confident (%)		Completely Confident (%)						
1. 1 day out of the next 7	→	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2. 2 days out of the next 7	→	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
3. 3 days out of the next 7	→	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
4. 4 days out of the next 7	→	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
5. 5 days out of the next 7	→	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
6. 6 days out of the next 7	→	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
7. 7 days out of the next 7	→	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	

SECTION P: HEALTH CARE

This questionnaire contains items that are related to your visits with a health-care practitioner (or group of practitioners) in which your physical activity was discussed in any way. Health-care practitioners (doctors, nurses, counsellors, etc.) have different styles in dealing with patients, and we would like to know very specifically about your experience of your provider(s) in any encounters when your physical activity was discussed. Your responses will be kept confidential, so none of your practitioners will know about your responses. Please be honest and candid. In some cases, you may have met with only your physician; in other cases you may have discussed your physical activity with several people. If you have met only with your physician, please respond with respect to him or her; if you have met with several practitioners concerning this issue, please answer in terms of your experience of all these practitioners together.¹¹

1 2 3 4 5 6 7
 Not true at Somewhat Very true
 all true

	Not at all true		Somewhat true			Very True	
1. I feel that my health-care practitioners have provided me with choices and options about exercising regularly (including not exercising regularly)	1	2	3	4	5	6	7
2. I feel my health-care providers understand how I see things with respect to my exercising regularly	1	2	3	4	5	6	7
3. My health-care providers convey confidence in my ability to make changes regarding my exercising regularly	1	2	3	4	5	6	7
4. My health care practitioners listen to how I would like to do things regarding my physical activity	1	2	3	4	5	6	7
5. My health-care practitioners encourage me to ask questions about my exercising	1	2	3	4	5	6	7
6. My health-care practitioners try to understand how I see my exercising before suggesting any changes	1	2	3	4	5	6	7

¹¹ Williams GC, Ryan RM, Deci EL. Health-Care, Self Determination Theory Questionnaire Packet. Available at: http://www.psych.rochester.edu/SDT/measures/hc_description.php. Accessed August 31, 2010, 2010.

SECTION Q: BENEFITS AND BARRIERS

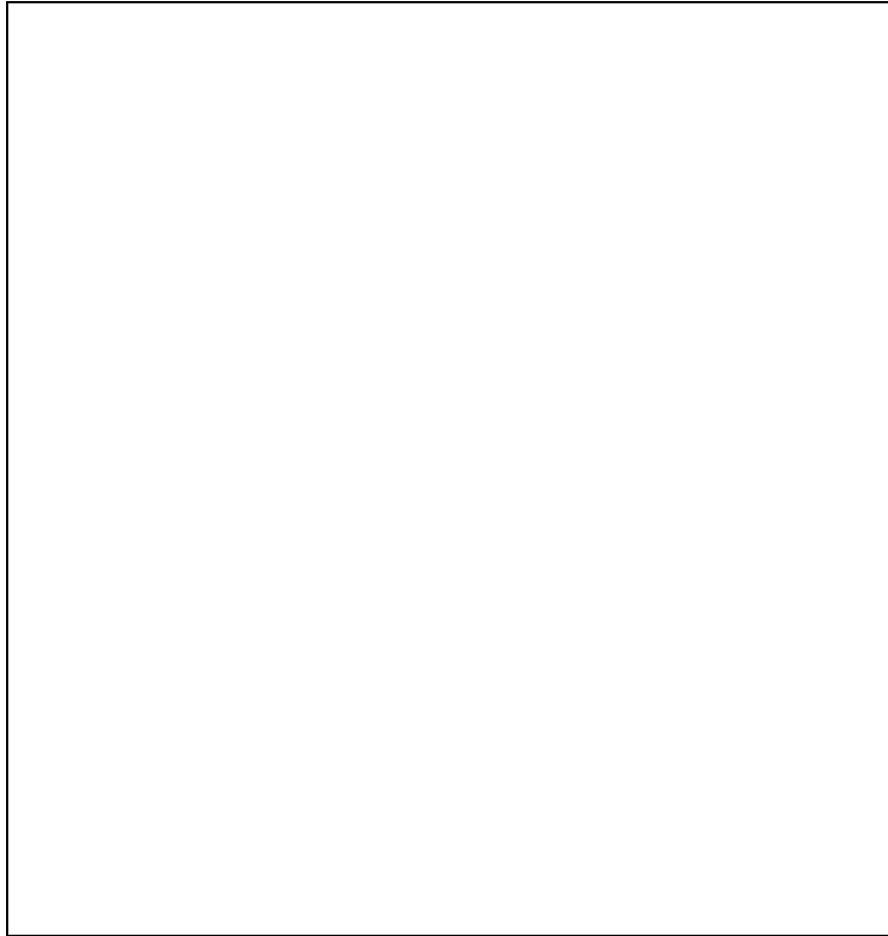
Instructions: Below are statements that relate to ideas about physical activity. Please indicate the degree to which you agree or disagree with the statements by circling SA for strongly agree, A for agree, D for disagree, or SD for strongly disagree.

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. I enjoy physical activity	SA	A	D	SD
2. Physical activity decreases feelings of stress and tension for me	SA	A	D	SD
3. Physical activity improves my mental health.	SA	A	D	SD
4. Physical activity takes too much of my time	SA	A	D	SD
5. I will prevent heart attacks by engaging in physical activity	SA	A	D	SD
6. Physical activity tires me	SA	A	D	SD
7. Physical activity increases my muscle strength	SA	A	D	SD
8. Physical activity gives me a sense of personal accomplishment	SA	A	D	SD
9. Places for me to engage in physical activity are too far away	SA	A	D	SD
10. Physical activity makes me feel relaxed	SA	A	D	SD
11. Physical activity lets me have contact with friends and persons I enjoy	SA	A	D	SD
12. I am too embarrassed to engage in physical activity	SA	A	D	SD
13. Physical activity will keep me from having high blood pressure	SA	A	D	SD
14. It costs too much to engage in physical activity	SA	A	D	SD
15. Physical activity increases my level of physical fitness	SA	A	D	SD
16. Physical activity facilities do not have convenient schedules for me	SA	A	D	SD
17. My muscle tone is improved with physical activity	SA	A	D	SD
18. Physical activity improves functioning of my cardiovascular system	SA	A	D	SD
19. I am fatigued by physical activity	SA	A	D	SD
20. I have improved feelings of well being from physical activity	SA	A	D	SD
21. My spouse (or significant other) does not encourage physical activity	SA	A	D	SD
22. Physical activity increases my stamina	SA	A	D	SD
23. Physical activity improves my flexibility	SA	A	D	SD
24. Physical activity takes too much time from family relationships	SA	A	D	SD
25. My disposition is improved with physical activity	SA	A	D	SD
26. Physical activity helps me sleep better at night	SA	A	D	SD
27. I will live longer if I engage in physical activity	SA	A	D	SD

	Strongly Agree	Agree	Disagree	Strongly Disagree
28. I think people in physical activity clothes look funny	SA	A	D	SD
29. Physical activity helps me decrease fatigue	SA	A	D	SD
30. Physical activity is a good way for me to meet people	SA	A	D	SD
31. My physical endurance is improved by physical activity	SA	A	D	SD
32. Physical activity improves my self-concept	SA	A	D	SD
33. My family members do not encourage me to engage in physical activity	SA	A	D	SD
34. Physical activity increases my mental alertness	SA	A	D	SD
35. Physical activity allows me to carry out normal activities without becoming tired	SA	A	D	SD
36. Physical activity improves the quality of my work	SA	A	D	SD
37. Physical activity takes too much time from my family responsibilities	SA	A	D	SD
38. Physical activity is good entertainment for me	SA	A	D	SD
39. Physical activity increases my acceptance by others	SA	A	D	SD
40. Physical activity is hard work for me	SA	A	D	SD
41. Physical activity improves overall body functioning for me	SA	A	D	SD
42. There are too few places for me to engage in physical activity	SA	A	D	SD
43. Physical activity improves the way my body looks¹²	SA	A	D	SD

¹² Sechrist KR, Walker SN, Pender NJ. Development and psychometric evaluation of the exercise benefits/barriers scale. *Res Nurs Health*. 1987;10(6):357-365.

Thank you for taking the time to complete this questionnaire. Your assistance in providing this information is very much appreciated. If there is anything else you would like to tell us about this survey, or about your experiences with cardiac disease and/or recovery, please do so in the space provided below.

A large, empty rectangular box with a thin black border, intended for the respondent to provide additional comments or information related to the survey.

Please return your completed questionnaire in the envelope provided by the study coordinator

Appendix F: Non-Responder Cover Letter

Date:

Participant Name
Address

RE: ECO-PCR Study: Exercise Maintenance in Men and Women Post-Cardiac Rehabilitation

Dear Salutation –Participant Name,

I am writing to remind you of the study you consented to participate in 6/12 months ago at the end of your cardiac rehabilitation program which is looking at exercise after cardiac rehabilitation in patients with coronary artery disease (CAD). As part of your participation in our research study we request that you complete the enclosed survey. We very much appreciate the time and effort you have put into helping us with this study and hope that you will be willing to complete this questionnaire.

This survey, like the previous one, requests information about your physical activity, quality of life, risk factors and health care costs. Enclosed is a pre-addressed and stamped envelope in which you can return the completed survey.

If you have any questions regarding the survey or the study please feel free to contact the study coordinator, at (416) 736-2100 ext 20575 or xxx@uhnresearch.ca.

We want to stress that your participation in this study is completely voluntary, and will not impact the care or services you or your family receive. Please know that your help would be greatly appreciated and any information you could give us would further aid us in improving the quality of life for patients after cardiac rehabilitation, such as yourself.

Thank you for your consideration.

Sincerely,



Dr. Sherry Grace
ECO-PCR Study Investigator
York University & University Health Network



ECO-PCR
Non-Responder Cover Letter
V1; September 27, 2013

TABLES

Table 1: Socio-demographic and Clinical Characteristics of Participants at CR Exit, N=255.

Characteristics	
<i>Socio-demographic</i>	n (%) / mean ± SD
Age	63.4 ± 9.37
Sex (% Male)	205 (80.4 %)
Racial/Ethnic Background (% White/Caucasian)	194 (87.0 %)
Living Arrangements (% with Family)	171 (76.3 %)
Living with Someone Who Requires Caregiving	17 (7.6%)
Employment Status (% Retired)	107 (47.8 %)
Marital Status (% Married/Equivalent)	166 (74.8 %)
Highest Education (% University)	115 (51.6 %)
Income Level (≥ \$50,000 CAD/year)	119 (56.9 %)
<i>Clinical</i>	
Referral Indication (% PCI)	161 (63.1%)
Duke Activity Status Index	47.37 ± 11.48
<i>Risk Factors</i> (% yes)	
History of Physical Inactivity	82 (36.9 %)
Smoking History	119 (60.7 %)
Current Smoking	3 (1.3 %)
Body Mass Index	28.16 ± 4.83
Hypertension	114 (45.1 %)
Dyslipidemia	126 (49.8 %)
<i>Comorbidities</i> (% yes)	
Musculoskeletal or joint issues	79 (31%)
Arthritis	53 (23.8%)
Diabetes	43 (19.4%)
Asthma	21 (9.5%)
Cancer	16 (7.2%)
Osteoporosis	10 (4.5%)
Chronic Obstructive Pulmonary Disease	8 (3.6%)

PCI=Percutaneous Coronary Intervention; CR=Cardiac Rehabilitation; SD=Standard Deviation.

Table 2: Socio-ecological Constructs, by Level, and Association with Moderate and Vigorous-Intensity Physical Activity at Cardiac Rehabilitation Exit

Socio-ecological Constructs	Minutes MVPA / Week Mean \pm SD[†]	Test of Association r (p) / t
<i>Individual Level</i>		
Sex		t=2.12 (0.04)
Male	194.70 \pm 135.85	
Female	147.98 \pm 93.85	
Racial/Ethnic Background		t= 1.46 (0.14)
White/Caucasian	178.64 \pm 129.06	
Other	219.80 \pm 129.28	
Work Status		t= -0.35 (0.73)
Retired/Equivalent	186.96 \pm 131.79	
Other	180.48 \pm 126.80	
Education Attainment		t= -1.74 (0.08)
University	199.50 \pm 132.28	
Other	167.48 \pm 124.47	
Annual Income		t= -1.31 (0.20)
\$0-49,999 CAD	170.58 \pm 130.11	
\geq \$50,000 CAD	195.69 \pm 128.56	
Depressive Symptoms[†]	0.56 \pm 1.12	r= -0.20 (0.004)
Functional Status[†]	47.27 \pm 11.48	r= 0.26 (0.001)
Comorbidities		t= 0.28 (0.78)
Yes	182.56 \pm 135.51	
No	187.81 \pm 118.25	
Smoking Status		t= -0.55 (0.59)
Never	174.83 \pm 117.06	
Former	185.82 \pm 138.64	
PA Self-Regulation[†]		
Self-Monitoring	3.95 \pm 0.83	r= 0.32 (<0.001)
Goal Setting	3.99 \pm 1.61	r= 0.09 (0.18)
Eliciting Social Support	2.31 \pm 1.09	r= 0.02 (0.80)
Reinforcement	3.79 \pm 0.93	r= 0.24 (0.001)
Time Management	3.78 \pm 0.93	r= 0.27 (<0.001)
Relapse Prevention	3.17 \pm 1.07	r= 0.21 (0.003)
PA Intention[†]	4.76 \pm 0.49	r= 0.17 (0.02)
PA Planning[†]	4.49 \pm 0.72	r= 0.15 (0.04)
Task Self-Efficacy[†]	8.39 \pm 10.90	r= 0.20 (0.79)
Barrier Self-Efficacy[†]	7.11 \pm 2.45	r= 0.19 (0.005)

Exercise Benefits†	95.84 ± 11.97	r= 0.30 (<0.001)
Exercise Barriers†	24.15 ± 5.53	r= -0.23 (0.001)
Body Mass Index	-	r= -0.08 (0.24)
<i>Interpersonal Level</i>		
Living Status		t= -1.66 (0.09)
With Family	192.34 ± 127.29	
Alone	156.43 ± 132.83	
Number of People in the Household†	2.25 ± 1.10	r= 0.06 (0.37)
Living with Someone Who Requires Caregiving	0.8 ± 0.27	t= 2.38 (0.02)
Yes	106.07 ± 88.28	
No	190.46 ± 130.19	
Marital Status		t= -1.72 (0.09)
Married/Equivalent	193.29 ± 124.85	
Other	155.90 ± 141.74	
Subjective Norm†	4.35 ± 0.64	r= 0.06 (0.44)
Social Support†		
Family Participation	23.43 ± 10.93	r= 0.08 (0.25)
Friend Participation	18.92 ± 8.99	r= 0.06 (0.42)
Other Participation	13.17 ± 15.27	r= -.06 (0.39)
Family Rewards	1.47 ± 1.13	r= 0.10 (0.17)
Friend Rewards	1.12 ± 0.65	r= -0.03 (0.69)
Other Rewards	1.09 ± 0.71	r= -0.12 (0.12)
Family Punishment	2.23 ± 1.28	r= -0.07 (0.36)
Friend Punishment	2.14 ± 1.25	r= -0.14 (0.06)
Other Punishment	2.17 ± 1.50	r= -0.03 (0.71)
Autonomy Support†		
Health Care Climate	5.3 ± 1.60	r= 0.15 (0.04)
<i>Organizational Level (see figures)</i>		
<i>Community Level</i>		
Neighborhood Characteristics†		
Aesthetics	3.47 ± 0.59	r= 0.14 (0.06)
Crime Rate	1.20 ± 0.38	r= -0.15 (0.04)
Street Connectivity	3.02 ± 0.78	r= -0.05 (0.45)
Mixed Land-Use		t= 0.94 (0.35)
Residential	178.97 ± 122.04	
Mixed Commercial and Residential	199.17 ± 149.41	
Season		t= -1.16 (0.25)
Winter	164.75 ± 133.11	

All Other Seasons	187.55 ± 120.17	
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†for continuous variables which are not described in Table 1, the mean scores and standard deviations are reported.

PA=physical activity; MVPA=moderate to vigorous-intensity physical activity

Table 3: Pearson’s Correlations between the Continuous Socio-ecological Correlates of Physical Activity under Investigation

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.Depressive Symptoms	1																													
2.Functional Capacity	-.19**	1																												
3.Self-Monitoring	-.11	.07	1																											
4.Goat Setting	-.07	-.07	.41**	1																										
5.Eliciting Social Support	.07	-.00	.12	.13*	1																									
6.Reinforcement	-.06	.12	.48**	.29**	.35**	1																								
7.Time Management	-.09	.05	.61**	.39**	.19**	.43**	1																							
8.Relapse Prevention	-.13	.11	.55**	.29**	.32**	.41**	.54**	1																						
9.PA Intention	-.08	.21**	.27**	.19**	.05	.11	.16*	.22**	1																					
10.PA Planning	-.14*	.09	.39**	.16*	.09	.18**	.35**	.34**	.55**	1																				
11.Task Self-Efficacy	-.04	.11	.026	.02	.13	.06	.07	.12	-.05	.013	1																			
12.Barrier Self-Efficacy	-.15*	.10	.27**	.12	.07	.13	.20**	.26**	.25**	.27**	.06	1																		
13.Exercise Barriers	.09	.02	.04	.04	-.05	-.09	.01	.01	.03	-.00	.07	-.17*	1																	
14.Exercis	-.21	.39	.25	.19	.44	.35	.33	.25	.34	.0	.18	.0	1																	

e Benefits	.21 **	**	**	**	**	**	**	**	**	**	2	**	7																												
15.Body Mass Index	.02	-.00	-.16*	-.04	-.09	-.12	-.15*	-.16*	-.05	-.09	.10	-.17*	-.07	-.03	1																										
16.Number of People in the Household	.10	.05	-.11	-.08	-.04	-.02	-.06	-.02	-.05	-.03	-.03	-.04	-.08	-.04	1																										
17.Subjective Norm	-.17 **	.02	-.16*	.09	-.02	.07	-.14*	.10	-.19 **	-.21 **	-.00	-.27 **	.07	-.16*	.12	-.01																									
18.Family Participation	-.03	.08	.05	-.02	-.12	.12	.06	.02	.05	.05	-.07	.06	-.06	.08	.08	.11	.10	1																							
19.Friend Participation	-.09	.14	.13	.03 3	.22 **	.18*	.11	.12	.09	.01	-.04	-.01	-.05	.12	-.02	-.04	.17*	.34 **	1																						
20.Other Participation	-.07	-.03	.01	-.05	.04	.05	-.03	-.01	.02	.06	.01	-.14*	-.02	-.03	-.03	-.02	-.13	.11	.63 **	1																					
21.Family Rewards	-.11	.05	-.16*	.08	.06	.20 **	.19 **	.15*	.07	.09	-.01	.09	-.03	-.18 **	-.02	-.04	.14*	.40 **	.40 **	.26 **	1																				
22.Friend Rewards	-.05	.09	.03	.03	.04	.10	.04	.07	.03	.17*	-.02	-.02	-.14*	.12	-.04	-.28 **	.23 **	.61 **	.72 **	.56 **	1																				
23.Other Rewards	-.03	.05	.05	.03	.03	.07	.07	.02	-.04	-.04	-.03	-.01	-.05	.10	-.02	-.26 **	.30 **	.62 **	.85 **	.60 **	.88 **	1																			
24.Family Punishment	.03	.00	-.03	-.03	-.02	-.00	-.01	-.10	-.09	-.07	-.05	-.08	-.01	-.05	-.08	-.11	.28 **	.20 **	.20 **	.29 **	.20 **	.49 **	1																		
25.Friend Punishment	-.02	.04	-.00	.01	.02	.08	.02	-.03	-.02	-.04	-.03	-.00	-.03	.12	-.04	-.13	.19 **	.59 **	.76 **	.51 **	.76 **	.91 **	.43 **	1																	
26.Other Punishment	-.04	.01	.02	.01	-.06	.04	.03	.05	.05	.04	-.03	-.01	-.00	-.07	-.01	-.14	.27 **	.54 **	.77 **	.50 **	.72 **	.89 **	.51 **	.88 **	1																
27.Health Care Climate	-.13	.01	.22 **	.15*	.10	.16*	.29 **	.28 **	.12	.19 **	-.03	.12	-.02	.26 **	-.01	-.15*	.12 0\	.08	.07	.05	.07	-.00	-.08	-.03	-.03	1															
28.Aesthetics	-.21 **	.14	.19 **	.11	.03	.18 **	.19 **	.22 **	.01	.19 **	-.03	.15*	-.11	.25 **	-.07	-.19 **	.08	.02	-.12	.07	.05	.03	.01	.03	.05	.09	1														
29.Crime Rate	.13*	-.14	-.12	-.05	-.06	.10	.06	.05	.07	.03	.13	-.08	-.03	-.18 **	-.02	-.08	-.16*	.11	.05	.12	.08	.06	.07	.06	.07	.07	.07	.06	.07	.06	.07	.06	.07	.06	.07	.06	.07	.06	.07	.06	

30.Street Connecti ty	- .03	.10	- .00	.03	.10	.00	.00	.09	.07	.06	.0 3	.13	- .0 0	.13	- .0 1	.0 7	.01	- .01	.07	.08	.09	.16 *	.11	.01	.07	.0 8	.1 2	.22 **	.1 1	1
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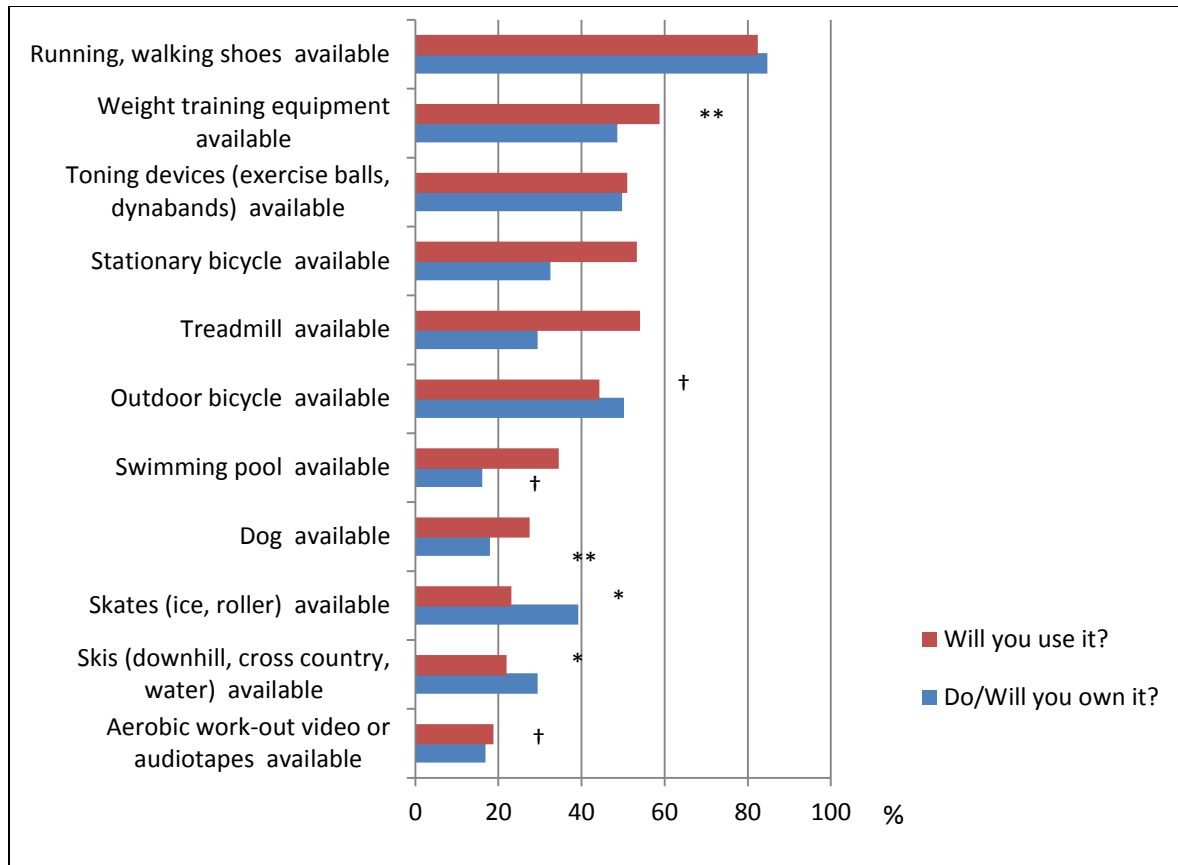
Table 4: Stepwise Logistic Regression Analysis of the Socio-ecological Correlates of Physical Activity

Independent Variables	β	p	OR	95% C.I.	
Functional Status	0.043	0.014	1.043	1.009	1.079
Self-Monitoring	0.851	0.001	2.342	1.422	3.856
Living with Someone Who Requires Caregiving	1.520	0.045	0.220	0.050	0.970

OR=Odds Ratio; C.I.=Confidence Interval

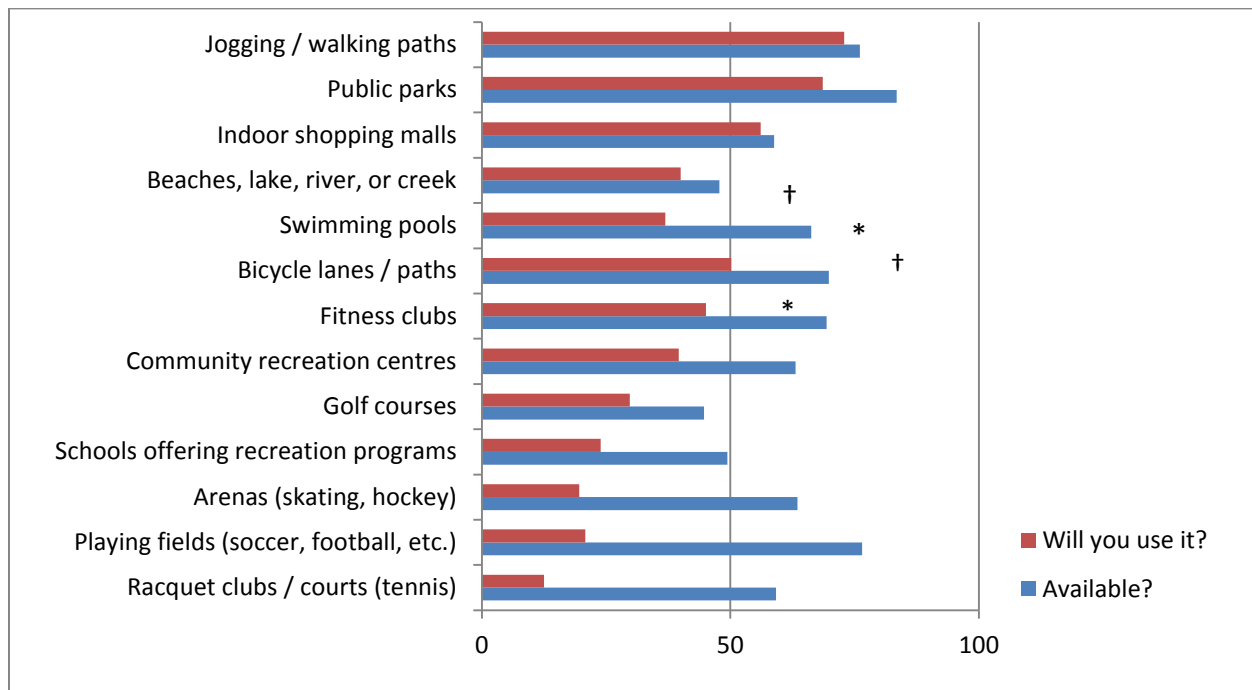
FIGURES

Figure 1: Socio-ecological Correlates of Physical Activity at the Organizational Level: Home Environment



*p<0.05, **p<0.01, † Trend

Figure 2: Socio-ecological Correlates of Physical Activity at the Organizational Level: Neighbourhood Environment



*p<0.05, † Trend