Physical Activity Levels & Correlates  
2 to 6 years Post-Rehabilitation  
in Cardiac Patients

by

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Graduate Department of Exercise Sciences  
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Abstract

Many patients do not maintain physical activity (PA) post cardiac rehabilitation (CR), however few studies examine a large enough sample over the long-term. Thus, a retrospective cross-sectional study was carried out to examine PA and its correlates 2-6 years post CR; 584 graduates completed a mailed survey (mean±SD age: 69.8±9.8 years, BMI: 27±5.0 kg/m², 80% male, 41.4±11.6 months since graduation, 36% response rate). PA was assessed using the Physical Activity Scale for the Elderly (PASE, mean±SD: 122.3±75.9). Seventy five percent of participants met Canadian PA guidelines. Greater PA was significantly associated with male sex, younger age, fear of falling, cholesterol control, self-controlled transportation, marital status, full-time work, rural location, higher VO₂max, more comorbid conditions, greater perceived health, PA enjoyment, quality of life (QOL), social support, income, and CR staff support. Age, PA enjoyment, QOL, work status, cholesterol control and CR staff were significant in a multivariate model (R²=0.22, F=18.7, p<0.001).
Acknowledgments

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1 Chapter 1
Introduction

1.1 Introduction

The lack of physical activity (PA) among patients with cardiovascular disease (CVD) is disconcerting, especially considering its importance in both the prevention and treatment of the leading cause of death and disability worldwide (1,2,3). Cardiac rehabilitation (CR) is a secondary preventative effort that encompasses PA and lifestyle counselling and has been shown to reduce mortality by approximately 25% from 6 to 18 months after CR (4). Lifestyle and risk factor management result in the regression of atherosclerosis and a reduction in cardiovascular events (5), yet most CR programs in North America are only 3 to 4 months in duration (5,6) due to resource constraints. This means that CR programs must help patients embrace life-long behavioural change in a potentially insufficient amount of time (7). The success of CR rests in part on the patient’s ability to maintain participation in regular PA and improved QOL for years to come.

Current recommendations suggest CAD patients accumulate at least 30 minutes of moderate intensity physical activity (PA) most days of the week (8,9). Several studies indicate that within a year after CR completion, BMI and cholesterol levels increase and that many patients fail to maintain adequate PA levels (5, 10-12). Failure to modify CVD risk factors is associated with disease progression and an increased incidence of mortality and morbidity. However, long term outcome data demonstrate improvements in morbidity and mortality among CR patients, suggesting many patients do maintain health behaviours post-CR (13,14). There are few studies in the literature examining PA levels more than 2 years post-CR and such evaluations are warranted for further understanding.

Only about 15-30% of eligible CVD patients are enrolled in CR and approximately 20% of those enrolled dropout (15,16). Thus, understanding the correlates and/or factors of continued PA among successful graduates is critical. Non-modifiable correlates will help identify vulnerable groups of patients and modifiable correlates will help develop and improve current services.
Currently, many factors are known to influence PA such as time, location, fear of injury and perceptions of its importance (13,17,18). While the majority of literature has focused on examining individual level factors from a few months to two years post-CR (4,19,20), newer research illustrates that factors outside of the individual also influence PA. Greater PA levels are associated with factors acting at the individual level including self-efficacy, perceived health status, reduced barriers and motivation. Demographic and clinical factors also act at the individual level. Factors at the community, society, institutional, policy, and service level include distance, access to PA, use of health services and the implementation of on-going support by programs (3,21-23). Many of these factors are modifiable but the extent to which they play a role and can be organized to explain PA is unknown among CR graduates.

To our knowledge, no original research has been done to examine PA and its related correlates (factors) across the individual, community and service levels simultaneously over the long term. Thus, this study will evaluate (1) whether or not CR graduates are maintaining recommended levels of PA and (2) factors related to PA at the individual, community and service level 2-6 years post-CR. This study aims to fill the gap in the literature identified by Petter and colleagues (3) and identify a number of potential new factors to explain PA: the use of health care services, the level of support of staff (health care and cardiac rehab), ethnicity, birthplace, rurality, fear of falling and the mode of transportation used to access PA.

1.2 Thesis Layout

This chapter is followed by a focused summary of current literature surrounding PA in CR graduates, factors/correlates (terminology used interchangeably) and possible behavioural models used to organize these factors. The rationale for this study is developed as well as a review of the measures used in the current study. Chapter 3 is a preliminary version of the manuscript to be submitted for publication, representing the study that is the focus of this thesis. Chapter 4 provides an extended discussion; limitations, directions for future research and overall conclusions. Finally, the appendices contain study documents and sample size justification.
2 Chapter 2
Review of Literature

Understanding life after CR is essential to assessing the impact of CR programs and the recovery of CR graduates. Overall, only a few studies in the literature examine CR graduates. Most studies look at PA or exercise up to 12 months post CR, in a few hundred patients and only assess patients with specific pathologies (i.e. CHD only). In addition, most of these studies do not assess, control for or include the multiple factors that can affect PA. Only a few studies have been carried out in North American populations. In this chapter, studies in the literature that have already examined PA and related factors post CR will be critiqued. Models to explain PA behavior will be introduced and considered for the organization of the multitude of factors discussed. The purpose and hypotheses of the proposed study will be stated followed by a review and outline of the measures to be included in the present study.

2.1 Cardiac Rehabilitation

CR is a PA intervention that can improve and maintain functional capacity, prolong an active lifestyle, improve many risk factors for CVD, and diminish immobility, social isolation, depression, osteoporosis, dependence, re-hospitalization and disability in the long-term (13, 35). PA also reduces the risk of falls and injuries from falls (114) and improves quality of life (66). In addition to PA, CR helps patients adopt healthier lifestyle choices such as smoking cessation, making healthier food choices, achieving an ideal weight, consuming alcohol in moderation, achieving a blood pressure (BP) level at or under 140/90 mm Hg, achieving a total cholesterol level at or below 5 mmol (17) and taking prescribed medications. Most CR programs in North America are 3-4 months long with patients attending 1 to 2 sessions per week (5, 6). Home based programs are also offered where patients receive counseling and instruction over the phone once a week (117) and may receive program information by email or mail. CR consists of a multidisciplinary lifestyle and behavioural approach to risk factor reduction including both exercise and educational components (118). Despite its numerous benefits, health behavior and PA attrition rates range up to 25% in the first 3 months, and up to 50% in the first 6 months following rehabilitation (7,115). These rates are similar to attrition.
rates from PA programs in the general population (116). The TEACH trial demonstrated that these rates are similar to non-CR patients whose PA levels begin to decline 2 months post hospitalization in CAD patients (66). At the same time, a worsening of risk factors such as body mass index (BMI) and cholesterol was noted in the years following CR (10, 12). Most studies examining PA and health behaviours follow CR graduates 1-2 years afterwards and little is known about behaviour long term.

2.2 Physical Activity in Cardiac Rehabilitation Graduates

Eight studies that examine PA levels at least 1 year after CR in cardiac patients will be discussed (11,20,35,37-40). Two additional studies examine predictors of exercise behaviour post CR but within a time frame of less than a year (19,36).

Jue and colleagues (11) framed their investigation of 253 CABG patients aged 60 and older in the Transtheoretical Model of Change (TMC – see Behavioural Models section) using a non-validated self-administered postal questionnaire. Results of the questionnaire mailed at two time points (4-6 months and 22-26 months post CABG in patients attending CR) indicated that 67% of subjects became long-term regular exercisers. Although the results of this study are useful, the stage of change that patients fell within in the TMC were assessed nominally as a yes/no to the following statements: “I currently do not exercise, I intend to exercise in the next 6 months, I currently exercise regularly and I have exercised regularly in the past 6 months”. Unfortunately, these items were not supplemented with necessary clarifications for the respondents; ‘regular’ exercise was not defined nor were examples of what is considered exercise provided. This would have been important to define in an elderly population who may not all follow a ‘planned exercise’ program; assessments of leisure-time PA are important in this population (43).

An Italian study (38) conducted among 143 CR inpatients post-surgery aged 65 and older examined adherence to exercise using the Paffenbarger Harvard Alumni Questionnaire (64) at baseline and one-year post surgery. Sixty five percent of elderly patients attending CR adhered to 1 hour/day on 5 days each week of light regular PA. This study reported PA using METs, recently cautioned for use in cardiac patients (38), and reports a small
sample size. One hundred and thirty two patients completing CR 12 months prior completed the 7-Day Physical Activity Recall Questionnaire and items concerning frequency and duration of exercise (37). This study corroborated that about 67% of patients reported current participation in vigorous exercise for an average of 171.4 minutes per week and 84% in moderate intensity exercise. Additionally, 75% of subjects were male and the average age of subjects was 63, the younger age and predominantly male cohort may explain the greater number of participants who currently exercise compared to the two studies above. Overall, these three studies indicate that for the proposed study we should expect at least 65% of responding patients to be regular exercisers. *The PA participation rate of these studies is high compared to what other studies cited below have reported* (10, 19, 37, 39, 65). Since CR is a multifactor program, research should include an analysis of health behaviour maintenance (nutrition, PA, smoking, risk factor management, etc.) and studies that have included a more in-depth look at PA level and related factors (QOL) will now be discussed.

A cross-sectional study using the 2003 Behavioural Risk Factor Surveillance System (n=1,374 MI patients) concluded that CR attendance is associated with healthy behaviours though maintenance diminished over time (39). The percentage of CR patients meeting national PA guidelines one year post CR was 25%. Surprisingly, CR was not associated with meeting PA guidelines or attaining a healthy BMI but was significantly associated with eating a healthier diet. The results of this study must also be taken with caution since whether or not patients met PA guidelines was self-reported on a non-validated 5 category PA variable.

Moore et al (19) examined predictors of exercise maintenance in 60 women using a heart rate wristwatch monitor, an objective measure more likely to yield an accurate PA level. Results revealed only 48% of the subjects were exercising adequately at 3 months and 25% did not exercise at all. This study was helpful in attempting to identify reasons for the PA levels observed by measuring age, BMI, cardiac functional status, co morbidity, muscle or joint pain, motivation, mood state, social support, self-efficacy, perceived benefits or barriers and prior exercise. Different predictors were found of the various dimensions of exercise maintenance. Predictors of exercise frequency were comorbidity
and instrumental social support (p<0.05). Instrumental social support was the only predictor of exercise persistence (p<0.05). Comorbidity was the only predictor of exercise intensity (p<0.001). The only predictor of the total amount of exercise was benefits or barriers (p<0.05). However, the low sample size may have led to inconclusive results with regard to other predictors examined. This study found a low level of adequate PA (48%) at 3 months post program. The low rate compared to other studies may reflect the discrepancy between direct and self-reported measures (44). A 6 month follow-up study reported an adherence rate of 82.6% among 109 MI patients in Japan who participated in a 5 month CR program (36). Although this rate is high, MI patients are more likely to adhere closer to the event, due to its severe nature and their immediate concern for their wellbeing.

A small randomized controlled trial (RCT) was conducted in Switzerland that looked at the effect of CR on PA and other outcomes 6 years post rehab in 50 heart failure patients (40). Likely because the sample size was small and the duration of CR was 1 month, there was no significant difference in the PA levels 6 years post CR between the exercise and control group. This finding would negate the benefit of CR and is further compounded by the lack of significance in the difference between pre and post CR VO₂ max scores among exercisers. The same lab conducted another study (20) also showing that post event PA levels are higher than pre-event, although actual rates were not provided.

The PIN (post infarct care) study examined cardiac risk factors, medication and recurrent clinical events after acute coronary disease in 2441 consecutive patients (78% men, mean age 65±10 years) across 18 inpatient rehabilitation centres in Germany from admission to CR to 12 months post CR (10). The majority of patients were admitted due to MI (56%) and CABG (38%). CR risk factors (smoking, BP, plasma cholesterol) improved during CR but deteriorated within 12 months. Over a third of patients reported experiencing a recurrent clinical event within one year of finishing rehab. A smaller study in Switzerland (20) assessed exercise capacity, blood lipids and PA patterns 2 years after CR in 78 patients post-MI or CABG and corroborated the results of the PIN study. A specific level of adherence was not obtained, but surprisingly, 2 years after CR, patients
expended 220% more kcals/week (p<0.001) during recreational activities than prior to their cardiac event (3127+1689 kcals/week post, 977+842 kcals/week prior), which suggests CR was beneficial in increasing PA among these patients. A Swedish study of 93 acute coronary patients over 65 (35) found PA, QOL and perceived health status were not significantly different between the exercise and control groups 3-6 years after an event. PA was measured using a self-reported 6 point scale. Limitations of the study, much like the other studies, include a small sample size and non-validated measure of PA.

A Canadian study worth mentioning is the TEACH trial with 782 CAD patients (66). Patients were prospectively examined at 0, 2, 6 and 12 months post hospitalization for a variety of predictors of exercise behaviour of interest (previous PA level, sex, age, education, diagnosis). One year post hospitalization leisure-time energy expenditure decreased as soon as 2 months after a CAD event when a trajectory of PA was made.

In conclusion, studies from Sweden, Switzerland, the United States, England, Japan and Italy have reported varying levels of PA among CR graduates; 48% at 3 months, 83% at 6 months, 25-84% at one-two years. Variations may be due to the differing measures of PA (pedometer, heart rate wristwatch, validated questionnaires, diaries, single PA questions – see Measures section). As well each study looked at patients with specific pathologies (heart failure, MI, CABG, etc.) with few studies looking at a broad range of CVDs.

2.3 Behaviour Change Models

Health psychology offers a number of models that seek to help us understand the factors that influence an individual’s adherence to a medical regime, such as secondary prevention of CHD. Leventhal and colleagues’ self-regulatory model (SRM) suggests that cognitive factors or “illness representations” influence a range of illness coping behaviours and outcomes among people experiencing illness or disease (67). Results from a recent study in CHD patients concluded that this approach did not prove helpful in predicting secondary preventative behaviour, accounting for about 2% of the variance in these behaviours (68). Another more widely known psychological model, the health
belief model (HBM) attempts to explain and predict health behaviours by focusing on the attitudes and beliefs of individuals. The HBM postulates that the likelihood of adopting a behaviour appropriate to the prevention or control of some disease depends upon the individual’s perception of a threat to personal health, and a conviction that the recommended action (i.e. PA maintenance) will reduce this threat (69). When recently tested in a CHD population, the model as a whole accounted for 29% of the variance in PA behaviour, although only 2 of the 3 dimensions tested in the study were associated with exercise adherence (70). In an effort to understand factors driving behaviour change, a few theories have tried to categorize PA at different behaviour change stages. The transtheoretical model (TTM; 71), multi-stage model (MSM; 72) and the health action process approach (HAPA; 73) are three such models. The basic idea is that individuals experience a shift of mindset when moving from the first stage (motivational) to the second stage (volitional). The stages generally progress in this order: planning, preparation, action, maintenance and relapse or dropout. Although researchers have tried to tailor interventions for rehab patients specific to their stage of change, results indicate that exercise behaviour and action plans but not intentions were affected and only in individuals in the intentional stage but intentions were not maintained (72). The Theory of Reasoned Action (74) and Theory of Planned Behaviour (75) state that individuals’ behaviour is determined by their intention and perceived control over the situation.

Social Cognitive Theory (SCT; 56) differs in that it proposes that behaviour change is affected by environmental influences, personal factors and attributes of the behaviour itself while proposing that self-efficacy (belief in a person’s ability) mediates behavioural change. This theory was the first to step outside of the individual in order to acknowledge factors that may affect health psychology. This paradigm shift is important because one of the main critiques of health behaviour theories is that they overlook environmental factors (76) and focus solely on intra and interpersonal factors.
Ecological approaches incorporate individual, socio-cultural and physical environmental influences on behaviour. The socio-ecological model encompasses several levels of influence on health behaviours; intrapersonal, interpersonal, group, institutional, community and public policy/service level factors (3). The proposed study will explore the use of a modified version of the model (Figure 2.0) organizing the variables on the individual (inter and intrapersonal), community and service level.
2.4 Factors (Correlates) Related to Physical Activity Levels

Understanding both modifiable and non-modifiable factors affecting PA is important. The identification of non-modifiable correlates of PA is important in targeting subgroups that are least active and at greatest risk of adverse health outcomes. Knowledge of modifiable correlates of PA can guide the development of interventions to change PA behavior. However, causation cannot be determined and the term correlate rather than predictor or determinant is preferred. In this section, correlates identified in a recent review (3) as well as from our own research will be reviewed.
Petter and colleagues (2008;3) searched the literature for original research studies around PA and its correlates in English speaking CHD patients over 18 years of age. Both subjective and objective measures of PA were included and studies were placed into four subgroups: (i) during institutional CR, (ii) during home-based CR, (iii) after CR and (iv) non-CR. They then determined whether or not a correlate was associated with PA by calculating the percentage of studies that supported an association. If more than 60% of studies found the expected association, the correlate was considered to be related to PA. One hundred and twenty one studies were included containing 25, 217 participants with mean ages of each study between 48 and 75 and the majority of studies having male participants.

Petter et al (3) identified in the post-CR context that perceived health status, self-efficacy, intention, control, previous PA, beliefs about benefits, sex, barriers, social support, action planning and ethnicity were significant correlates. None or only one study in the post-CR context examined employment, functional status, smoking, education level, marital status, location and income and thus they were not considered significant correlates. However, clearly more research is needed and other factors that exist at the individual, community and service level, at least, need to be suggested and studied.

In other studies, QOL has been studied as an outcome in cardiac patients and in 2 out of 3 studies we found it has been significantly associated with PA participation (5, 36, 48). Only one study we identified examined HR-QOL 5 years post-CR and found an overall low impact. However, none of these studies identified QOL as a correlate of PA, using a validated scale in the post-CR context.

A study in Lithuania comparing short (4 weeks) to long-term (6 months) CR, found that in conjunction with a reduction in sedentary lifestyle (31.3 vs 4.7%), long-term PA participation was associated with reductions in systolic blood pressure (151+/-9.2 vs. 135+/-9.7 mm Hg), diastolic blood pressure (92.3+/-6.5 vs. 75.4+/-3.8 mm Hg, body mass index (35.4+/-3.5 vs. 27.2+/-4.8 kg/m²), dyslipidemia (56.3 vs. 23.4%), and smoking (10.0 vs. 0%) (49). Thus, the management of other health behaviours exists as a result of managing PA due to the multi-disciplinary counseling received during CR.
A new psychological factor proposed by this study is the fear of falling. The risk of falling and sustaining a fall-related injury increases with the number of chronic health problems such that people with 5-7 illnesses have more than 2.5 times the risk of falling and 4.5 times the risk of fall-related injury than someone without (125). Cardiac patients may be at risk of falling due to their older age, comorbid conditions and because of having recently undergone a cardiac intervention (125). Previous falls and/or loss of balance, and the subsequent fear of falling, may contribute to real or self-imposed activity restriction and sedentary behaviour (122). Although the relationship is complex and falls analysis is warranted, only one study in the literature identified a relationship between fear of falling and PA in CHD patients (123). Forty percent of subjects reported a fear of falling and a fear of falling was significantly associated with not meeting minimum exercise guidelines. The same study found that 76% percent of older adults who reported a fear of falling modified their activity level secondary to this fear.

A systematic review on potential environmental factors affecting PA in adults revealed that the availability of home exercise equipment, neighbourhood layout and the accessibility of recreational facilities are potential correlates although no strong conclusion should be drawn and further research is needed (10). Although our study will not assess these factors, additional factors that have yet to be considered in the literature that will be examined in the proposed study include rurality and mode of transportation to PA. Rurality is important since patients residing in urban areas may have less access to community PA because of less availability of green space. On the other hand, perhaps urban-residing patients end up with higher PA levels because of additional resources that living in a city provides. This has yet to be determined in our population. Among non-diseased individuals, especially for women, those who live in rural areas are more likely to be sedentary, report less access to facilities and less likely to see others exercising in their neighbourhoods (126).

Ethnicity and birthplace are factors that may indirectly affect access to PA and PA motivation since language barriers and perceptions of PA may differ for people of different backgrounds. Among healthy adults living in the United States, racial/ethnic minorities generally engaged in less healthy exercise and dietary behaviors than whites
Toronto is one of the most multi-cultural cities in Canada so the examination of this correlate in our population is important. Lastly, the mode of transportation to PA will help us understand the primary modes of transportation used and what is convenient for patients.

Service or policy level factors were not identified in the literature (3). However, the proposed study would like to examine a few. Qualitative interviews conducted in CR patients revealed that patients had little subsequent contact with health services (23). Thus, looking at the number of visits to a health professional (physician and cardiologist) and the quality of these interactions is important. The level of support offered by the program and general practitioners through interventions may also be a contributing factor in sustaining PA behaviour. Petter et al (3) identified one study that found proxy efficacy (confidence in CR staff to assist in performing behaviours) to be not associated with PA at all, which we find to be surprising considering that another study found patients’ perception of personnel as attentive, receptive and personable was a significant predictor of dropout from CR (59).

2.5 Measures

2.5.1 Physical Activity

2.5.1.1 Physical Activity Measurements

Several methods are available for measuring PA, including accelerometers, heart rate monitors, direct and indirect calorimetry, activity diaries, and self-report questionnaires (31). Most often PA in CR graduates is assessed by self-report in standardized questionnaires mailed to patients’ homes. Objective examinations of post-CR PA level are far and few, with only two studies found using HR wristwatch monitors and pedometers in our population (19,36). PA and exercise levels have been reported in numerous ways; as an adherence rate (% adherence), categories (low, medium or high), metabolic equivalent (MET) hours/week, meeting or not meeting PA guidelines or in caloric expenditure (kcals/week). PA is defined as “any bodily movement produced by skeletal muscles that results in energy expenditure (78).” PA is comprised of activities of daily living (bathing,
feeding and grooming for example), sports and leisure and occupational activities. Thus, individuals who are more active will have greater energy expenditure.

Some PA assessment methods are adaptable for use with a variety of populations (self-report, activity monitors, pedometers, heart rate monitors, doubly labeled water, and indirect calorimetry) and others have been developed specifically for children (direct observation). Self-report techniques are the most common measure of PA because of low financial cost and low participant burden (43). The term self-report encompasses a variety of assessment methods: PA diaries, interviewer-administered questionnaires, self-administered questionnaires and reports by proxy. The limitations of self-report are well-documented; participants may misinterpret questions, experience difficulty recalling time or intensity of PA or may deliberately misrepresent information due to social desirability bias (43). Also, the instrument may not detect one or more dimensions of PA (frequency, intensity, type, duration).

Despite these limitations, recent reviews validate self-report measures in adolescent, adult and older adult populations using 3-day motion sensor counts, a 3-day PA diary and a global activity self-assessment (27). Currently, the PA questionnaire is the most practical and widely used approach for the assessment of PA in epidemiologic research (27). Typically, activity questionnaires require a recall of specific PA behaviour or a general appraisal of the level of PA of the subject. Recall can either be immediate, as in maintaining a detailed activity diary (79), or delayed, in which the subject is asked to recall PA over a specific time period ranging from several days to the past year (64, 80). Although the detailed diary provides a reasonably accurate assessment of PA, this procedure is burdensome for both participant and investigator and may also alter typical activity patterns. Therefore, the delayed recall technique is the most practical and commonly used approach. The PA questionnaire is also valued because it does not alter the behaviour of the individual being surveyed. In contrast, objective measurements of energy expenditure are not practical for most epidemiological studies (81). Questionnaires are also valued over telephone/interviews due to offering greater complexity and reliance on visual stimulus as well as being shorter and less of a burden on the researcher (82). For a comparison of these different methods see Table 1.
Table 1. Advantages and disadvantages of various PA assessment methods. Adapted from Welk, 2002 (43).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-report</td>
<td>Captures quantitative and qualitative information</td>
<td>Reliability and validity problems associated with recall of activity.</td>
</tr>
<tr>
<td></td>
<td>Inexpensive, allowing large sample size.</td>
<td>Potential content validity problems associated with misinterpretation of PA in different populations.</td>
</tr>
<tr>
<td></td>
<td>Usually low participant burden.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quick administration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Useful in lab and field settings.</td>
<td>Inaccurate assessments of some activities</td>
</tr>
<tr>
<td></td>
<td>Provides indicator of intensity, frequency and duration.</td>
<td>Cannot estimate energy expenditure.</td>
</tr>
<tr>
<td></td>
<td>Ease of data collection and analysis.</td>
<td>Cannot be sure placed properly on participants always.</td>
</tr>
<tr>
<td></td>
<td>Provides minute-by-minute information.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Allows for extended periods of recording (weeks)</td>
<td></td>
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<tr>
<td>Heart Rate Monitor</td>
<td>Physiological. Low participant burden.</td>
<td>Some discomfort.</td>
</tr>
<tr>
<td></td>
<td>Describes intensity, frequency and duration.</td>
<td>Useful for aerobic only.</td>
</tr>
<tr>
<td></td>
<td>Easy and quick for data collection and analysis.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Educational for participant.</td>
<td></td>
</tr>
<tr>
<td>Pedometers</td>
<td>Cheap, non-invasive.</td>
<td>Low accuracy when jogging or running. Walking only.</td>
</tr>
<tr>
<td></td>
<td>Easy to administer. Objective.</td>
<td>Potential for tampering.</td>
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<tr>
<td></td>
<td>Promote behavior change.</td>
<td></td>
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<tr>
<td>Direct observation</td>
<td>Excellent quantitative and qualitative.</td>
<td>Time-intensive training.</td>
</tr>
<tr>
<td></td>
<td>Software available to enhance data collection and recording.</td>
<td>Labor and time-intensive data collection, limiting sample size.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alters behavior.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited validity.</td>
</tr>
<tr>
<td>Indirect calorimetry and doubly labeled water</td>
<td>Precise. Ability to assess energy expenditure.</td>
<td>Invasive. Costly</td>
</tr>
</tbody>
</table>
2.5.1.2 Physical Activity Questionnaires

Important considerations in choosing an appropriate PA survey include: time frame, type of activity, reliability, validity and method of scoring. These considerations are discussed below. In addition, the length of the proposed questionnaire can be a factor influencing the number of participants recruited, thus influencing the power of the study (83). Shorter questionnaires are preferred.

**Time Frame:** The activity questionnaire can either ask about usual activity or ask about activity done within the past week, month, year or lifetime. Surveys with shorter time frames have two advantages: the estimates are less vulnerable to recall bias and more practical to validate with objective tools (81). However, shorter time frames are less likely to reflect ‘usual’ behaviour as activity levels may vary with season, day of the week (125) or as a result of illness or time constraints. The proposed study will use a time-frame of recall of one week and since all participants will be sent the questionnaire at the same time (cross-sectional), seasonal variation is expected to be minimal.

**Type of activity:** PA may be estimated at work however, labour-intense occupations have declined in industrialized nations and assessments of leisure-time PA are better representations of PA in the population (43). In addition, the typical CR patient is over 60 (46). In older and diseased populations, activities around daily living (bathing, eating, etc.) may be more accurate than both occupational and leisure time PA, with the best survey tool assessing all facets of PA (81). The survey tool in the proposed study (PASE, 26) will assess occupational, leisure-time and daily PA.

**Reliability and Validity:** Reliability refers to consistency in measurement; generated by test-retest coefficients or correlation coefficients. Validity refers to accuracy in measurement and is assessed by comparison to direct or objective PA measures. Two hundred and ninety three studies were identified in a systematic review that examined the relationship between objective and direct measures of PA (84). Correlations between self-report and direct measures were generally low-to-moderate and ranged from -0.71 to 0.96. Self-report measures of physical activity were both higher and lower than directly measured levels of physical activity, which poses a problem for both reliance on self-
report measures and for attempts to correct for self-report - direct measure differences. Thus, no clear pattern emerged for the mean differences between self-report and direct measures of physical activity. Trends differed by measure of physical activity employed, level of physical activity measured, and the gender of participants. Measurement method may have a significant impact on the observed levels of physical activity. The validity of measures varies greatly depending on the questionnaire. However, not all PA surveys have been validated in cardiac populations (see below). A more thorough comparison between different surveys for our population of interest can be found in Table 2.
<table>
<thead>
<tr>
<th>Name</th>
<th>Authors</th>
<th>PA related outcomes</th>
<th>Reliability (Pearson correlation coefficients)</th>
<th>Validity (Pearson correlation coefficients)</th>
<th>Age</th>
<th>Time Frame</th>
<th>Problems</th>
<th>Measurement Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard Alumni / Paffenbarger</td>
<td>Paffenbarger et al.(^{64})</td>
<td>Leisure Time 33 items</td>
<td>0.72(^{102}) index, 0.78(^{103}) stairs, 0.63(^{103}) blocks, 0.75(^{103}) sports 0.42-0.73(^{104})</td>
<td>0.49(^{105}) Total 0.39(^{106}) total accelerometer 0.01-0.30(^{103})</td>
<td>males 35-74, females 42-77</td>
<td>-7 days -Past year</td>
<td>Not suitable for cardiac</td>
<td>Weekly caloric expenditure Kcal/week MET.minute/day</td>
</tr>
<tr>
<td>Health Insurance Plan of New York</td>
<td>Shapiro et al.(^{107})</td>
<td>10 items (occupation-6, leisure-4)</td>
<td>1 month test-retest 0.86(^{108})</td>
<td>0.19(^{105})</td>
<td>males &gt;30</td>
<td>Usual activity</td>
<td>Not widely accepted</td>
<td>Kcal/day</td>
</tr>
<tr>
<td>Baecke Questionnaire of Habitual PA</td>
<td>Baecke(^{87})</td>
<td>Total, work, sport (intensity*duration of top 4) and leisure (bike, walk, TV.) 16 items</td>
<td>0.93(^{103}) total, 0.78(^{103}) work, 0.90(^{103}) sports, 0.86(^{103}) leisure</td>
<td>0.38(^{105}) 0.21(^{106})</td>
<td>20-34 male/female</td>
<td>Usual, past year</td>
<td></td>
<td>Total (15 pt), Work (5 pt), Sport (METxmin/day), Leisure (5 pt)</td>
</tr>
<tr>
<td>Godin Leisure-Time Exercise Questionnaire</td>
<td>Godin &amp; Shephard(^{89})</td>
<td>Leisure, mild, moderate, strenuous activity and usual sweat 3 items</td>
<td>r=0.62 leisure, 0.24 light/, 0.36 moderate, 0.84 strenuous, 0.69 usual sweating (103)0.46-0.94(^{49})</td>
<td>0.24(^{49}) total, accelerometer 0.32(^{103})</td>
<td>7 days</td>
<td>Memory dependent</td>
<td></td>
<td>Times/week : activity, weighted times/week: leisure score, usual sweat 3 pt score.</td>
</tr>
<tr>
<td>Name</td>
<td>Authors</td>
<td>PA related outcomes</td>
<td>Reliability</td>
<td>Validity</td>
<td>Age</td>
<td>Time Frame</td>
<td>Problems</td>
<td>Measurement Scale</td>
</tr>
<tr>
<td>-------------------------------------------</td>
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</tr>
<tr>
<td>Physical Activity Scale for the Elderly</td>
<td>Washburn et al&lt;sup&gt;26&lt;/sup&gt;</td>
<td>Activity weight* frequency across work-related, leisure, and household activities 32 items</td>
<td>0.84&lt;sup&gt;100&lt;/sup&gt; 3- to 7-wk test-retest 0.68-0.84&lt;sup&gt;26&lt;/sup&gt;</td>
<td>0.28&lt;sup&gt;106&lt;/sup&gt; 0.59&lt;sup&gt;29&lt;/sup&gt; with ankle mini-log accelerometer 0.49&lt;sup&gt;30&lt;/sup&gt; VO&lt;sub&gt;2&lt;/sub&gt;max 0.33&lt;sup&gt;106&lt;/sup&gt;</td>
<td>65+</td>
<td>7 days</td>
<td>Floor effect observed in elderly</td>
<td>Total = (time spent in each activity (hour/week) or participation (yes/no) x PASE weight) summed for all activities.</td>
</tr>
<tr>
<td>CHAMPS – used to measure intervention success</td>
<td>DiPietro&lt;sup&gt;109&lt;/sup&gt;</td>
<td>Walking, sports, housework, gardening, aerobics, etc.</td>
<td>0.62-0.76&lt;sup&gt;29&lt;/sup&gt;</td>
<td>0.36-0.42&lt;sup&gt;29&lt;/sup&gt; with ankle mini-log</td>
<td></td>
<td></td>
<td>Typical week</td>
<td>Caloric expenditure per week Frequency of activity per week</td>
</tr>
<tr>
<td>Zutphen PA Questionnaire</td>
<td>Caspersen&lt;sup&gt;110&lt;/sup&gt;</td>
<td>Daily activities (gardening, walking, stairs), hobbies and sports.</td>
<td>Test-retest at 4 months 0.93&lt;sup&gt;110&lt;/sup&gt;</td>
<td>To doubly labeled water 0.61&lt;sup&gt;110&lt;/sup&gt;</td>
<td>Older males</td>
<td>no specified time period</td>
<td>kcal and total minutes/week spent in light, moderate, and heavy levels of PA</td>
<td></td>
</tr>
<tr>
<td>Modified Baecke Questionnaire for Older Adults</td>
<td>Voorrips et al&lt;sup&gt;111&lt;/sup&gt;</td>
<td>Household (chores, stairs), Sport, Leisure time (open-ended) Total activity 12 items</td>
<td>0.77-0.85&lt;sup&gt;112&lt;/sup&gt; 20 days apart test retest 0.89&lt;sup&gt;111&lt;/sup&gt;</td>
<td>0.72&lt;sup&gt;111&lt;/sup&gt; doubly labeled water 0.21 VO&lt;sub&gt;2&lt;/sub&gt;max 0.32&lt;sup&gt;29&lt;/sup&gt; Diary 0.44-0.56&lt;sup&gt;112&lt;/sup&gt;</td>
<td>63-80 m/f</td>
<td>Week/month/year varies by question</td>
<td>Intensity code unit-less based on energy costs.</td>
<td></td>
</tr>
</tbody>
</table>
Scoring: Questionnaires can measure the type (leisure, occupational, daily), frequency (average number of sessions per given time frame) and duration (average number of minutes per session) of PA across a week, month or year. Intensity is usually estimated. PA is either summed for a total time or scored using time weighted by activity intensity (81). Total time is obtained by multiplying frequency by duration. Energy expenditure is estimated by hours/week multiplied by intensity, expressed in METS. One MET represents the metabolic rate of an individual at rest (43) and is set at 3.5 ml of oxygen consumed per kg body mass per minute (113).

2.5.1.3 Physical Activity in Cardiac Populations

Patients in CR programs present with a range of conditions that vary in disease severity. These conditions include angina, acute myocardial infarction (MI), heart failure (HF) or events such as stenting, coronary artery bypass grafting (CABG), valve surgery and transplantation. Patients attending CR vary in age from 30-90. Evidence indicates that more elderly patients are attending CR and that average age is increasing (31). Thus, in order to gain an accurate PA assessment, there is a need to assess activities that are short in duration, occurring as part of a daily routine (e.g. transportation, dressing, chores) in order to be reflective of activity that are considered ‘physical’ for sicker patients. Recall of long periods may also be difficult for many CABG patients who may suffer memory problems after their surgery (85). Self-report measures of PA should limit time of recall to one week, which is the duration chosen for the proposed study, although little is known about memory loss after surgery over the long-term.

Le Grande and colleagues (31) undertook a comprehensive MEDLINE search to identify self-report PA instruments used in studies involving cardiac patients and identified the most frequently used: Stanford 7-Day Physical Activity Recall (86), Baecke Habitual Physical Activity Index (87,88), Godin Leisure-Time Exercise Questionnaire (89), Physical Activity Scale for the Elderly (PASE) (26,27) and the Paffenbarger Physical Activity Questionnaire(64). Authors concluded that for cardiac patients, surveys need to have a suitable time frame, be easy to complete, assess the full range of intensity, be validated in the elderly and be easy to administer and score. The PASE was listed as one of the preferred instruments to measure low-intensity PA, although it was noted that there is no perfect instrument. A comparison of these questionnaires, except the
Stanford 7-Day Recall since it is not for self-administered use, is found in Table 2. The PASE was selected as the instrument to assess PA in the proposed study due to the recommended time frame, ease of questions, accepted reliability and validity and suitability for CR graduates.

Briefly, this scale is an easily scored survey that has been designed specifically to assess PA in epidemiological studies of persons aged 65 years or older (26,27). Both magnitude and continuity of the activities are integrated by the PASE score combining information on leisure, household, and occupational activities. Total PASE scores are computed by multiplying the amount of time spent in each activity (hours per day over a 7-day period) by the respective weights (available for each activity reported) and summing over all activities. PASE score ranges from 0 to >250 in the overall population, whereas a score between 0 and 150 includes two third of older individuals (27). In a population of 87 males and females aged 65-89, 3 and 7 week test-retest reliability was 0.84 (29, see Table 2). Test-retest reliability, assessed over a 3–7 week interval, was 0.75 (95% CI = 0.69–0.80). Reliability for mail administration (r = 0.84) was higher than for telephone administration (r = 0.68). Construct validity was established by correlating PASE scores with health status and physiologic measures and varies between 0.28-0.68 (28-30). The highest validation of PASE scores was seen with ankle, waist and 6 minute walk-tests (r=0.59, 0.52, 0.68 respectively)(29). A modest, significant relationship was observed with an accelerometer (r=0.49) (30). PASE scores were also positively associated with doubly labeled water, daily total energy expenditure and VO\textsubscript{2}\text{max} scores (r=0.28, 0.36 and 0.33 respectively)(28). With regard to health measures, positive associations were found between PASE and grip strength, static balance and leg strength (r = 0.37, 0.33 and 0.25 respectively) and negatively correlated with resting heart rate, age, perceived health status and overall Sickness Impact Profile score (r = −0.13, −0.34, −0.34, −0.42 respectively)(26).

2.5.2 Quality of Life (QOL)

Health-related (HR) QOL may be assessed by a number of different instruments; Short Form (SF)-12 & SF-36 (90), quality of life index (QLI) & QLI for MI patients (91), EQ-5D (32), and MacNew (92), among others. The SF-12 and SF-36 are the most widely used to assess QOL but are not recommended for use in cardiac populations (93, 94). The MacNew is useful but lengthy
at 27 items or 3 pages. The EQ-5D is a simple item instrument measuring the patient’s perception of his or her global HRQOL that has been designed in Europe and validated in cardiac patients (32). The EQ-5D measures five domains including mobility, self-care, pain/discomfort, depression and usual activity. It also consists of a visual analog scale in the form of a thermometer which will not be used in the present study. It is highly valid (0.55-0.78), reliable (0.54-0.91) and responsive for assessing HRQOL. A caution of the EQ-5D index score ranging from 0 to 1 is that it is sensitive to different CVD severity levels such that a one minute increase in an exercise tolerance test was associated with a 0.019 increase in EQ-5D index (119).

2.5.3 Social Support

Social support was assessed by another validated instrument; the Tangible, Informational and Emotional Social Support Survey (TIES, 33). Social support has also been assessed in cardiac patients using the Emotional Social Support Instrument (ESSI) and the Perceived Social support Scale (PSSS) both of which are shorter (120,121). The TIES is a 16-item survey designed to measure the types of social support that are necessary in CVD prevention and management. It is patient-derived, reliable, and valid when compared to the Medical Outcomes Study Social Support Survey (r = 0.82)(33).

2.5.4 Falls and Fear of Falling

In order to carry out falls analysis of an observational, cross-sectional nature, a self-reported questionnaire is used, depending on the population of interest. The Injury Module in the Canadian Community Health Survey (95) includes 17 items that may be administered by interview, of interest in falls analysis. It has been modified for self-administration, shortened and used in this study for analyzing falls among CR graduates. Items assessed include: did you fall (yes/no), how many times, have you been injured and what type of injury, location of injury, was medical attention or hospital admission received for the fall/injury, do you use mobility aids? There were also 3 investigator-generated questions related to PA and fear of falling. An analysis of falls and injuries will be discussed in another paper and not in this thesis. The only variable from this section that will be examined herein is the fear of falling assessed nominally as yes or no.
2.6 Summary

In conclusion, there is a gap in the literature with regard to describing current PA level and the correlates of PA behaviour post CR among cardiac patients over the long-term. The few studies that examined PA adherence evaluated patient behaviour for an average of 12 months after rehab, in a few hundred patients and focused on patients with specific pathologies (i.e. MI or CABG only). Most of the studies did not account for socio-ecological factors that have been shown to influence behaviour change and PA and only a minority of studies were conducted in a North American population. PA adherence levels varied from 25-84% one to two years after CR. The PASE(26) was identified as one of the recommended instruments in assessing PA behaviour in cardiac patients, assessing patients over a one-week time frame and will be used in the proposed cross-sectional study. A discussion of behaviour change models revealed that the socio-ecological model is worth examining. Behaviour is dynamic and occurs within a context and the SRM, HBM, TTM, MSM, HAPA and SCT only focus on psychological constructs between and within an individual. Therefore, the proposed study will contribute to enlightening researchers on potential relationships between individual, community and service level factors framed in a socio-ecologic model that may or may not predict PA levels in CR graduates over the long-term.

2.7 Purpose

To examine current PA level and the individual, community and service level factors influencing PA levels of CR graduates 2-6 years post rehabilitation at TRI.

2.8 Hypotheses

1. Current PA levels of CR graduates are expected to be moderate, with about 50% meeting current PA recommendations (moderate intensity, 30 minutes per day at least 5 days a week).

2. Greater PA is expected to be observed among young, Caucasian, married, healthy males of greater socioeconomic status who have increased QOL, social support and who live in urban areas. Greater PASE scores are expected for those who have access to their own transportation
and who receive greater support from CR and healthcare staff. We also expect greater PA levels among those who are more frequent in visiting a family doctor, cardiologist and who have greater control over other health behaviours.

3. A hierarchical/block regression will be performed with all factors significant at the bivariate level in order to determine factors to be entered step-wise in a model that will best explain PA levels. $R^2$ is expected to be 0.3 so that 30% of the variation in PA levels is explained by the model. A similar model examining adherence to PA among CHD patients reported 29% of the variance explained due to individual level factors during the CR program (70). Thus, inclusion of additional community and service level factors is expected to improve this value. Of all factors identified, the minimum expected to be significant at the multivariate level are age, gender, BMI, social support, QOL, marital status and income level.

3 Chapter 3
Manuscript for Publication

3.1 Title
Life After Cardiac Rehabilitation: Factors affecting physical activity (PA) 2-6 years later.
3.2 Abstract

It has been established that many patients do not maintain physical activity (PA) post cardiac rehabilitation (CR), however few studies have examined a large enough sample of patients over a long-term period. Thus, a retrospective cross-sectional study was carried out to examine PA and its multi-level correlates 2-6 years post CR; 584 patients (mean±SD age: 69.8±9.8 years, BMI: 27±5.0 kg/m², 80.3% male) consented to complete a survey via mail. PA was assessed using the Physical Activity Scale for the Elderly (PASE, mean±SD: 122.3±75.9). Seventy five percent of participants met Canadian guidelines of at least 30 minutes of moderate intensity PA most days of the week. PASE scores were significantly associated with sex, age, VO₂ max, fear of falling, comorbid conditions, perceived health, PA enjoyment, quality of life (QOL) cholesterol control, the mode of transportation used to access PA, social support, income, marital status, work status, residence location and CR staff support. Multivariate analysis identified age, PA enjoyment, QOL, work status, cholesterol control and CR staff support as significant correlates of greater PASE scores (p<0.001). In conclusion, ~3.5 years post CR, PA levels are high among graduates. Greater PA was associated with a number of modifiable multi-level correlates, including PA enjoyment. Interventions to improve PA in the long-term should target those who are single, elderly, women, those with lower fitness capacity, poor socioeconomic status and who exhibit a fear of falling.

3.3 Introduction

The lack of physical activity (PA) among patients with cardiovascular disease (CVD) is disconcerting, especially considering its importance in both the secondary prevention and treatment of the leading cause of death and disability worldwide (1-3). Cardiac rehabilitation (CR) is a secondary preventative program that encompasses PA and lifestyle counseling and has been shown to reduce mortality by approximately 25% from 6 to 18 months after CR (4). However, CR programs must help patients embrace life-long behavioural change in a potentially insufficient amount of time (7). The success of CR rests in part on the patient’s ability to maintain participation in regular PA for years to come.
Current recommendations suggest CAD patients accumulate at least 30 minutes of moderate intensity PA most days of the week (8,9). Several studies indicate that within a year after CR completion, body mass index (BMI) and cholesterol levels increase and that many patients fail to maintain adequate PA levels (5, 10-12). However, long-term outcome studies demonstrate improvements in morbidity and mortality among CR graduates, suggesting many patients do maintain health behaviours post-CR (13,14). There are few studies in the literature examining PA levels more than 2 years post-CR, thus it is unknown how long patients maintain PA at recommended levels.

In addition, understanding the correlates or factors associated with continued PA among the few patients who successfully complete CR, may help identify vulnerable groups of patients and modifiable correlates which could be used to inform improvement of current services.

Many factors are known to influence PA such as time, location, fear of injury and perceptions of its importance (13,17,18). While the majority of literature has focused on examining such individual level factors from a few months to two years post-CR (4,19,20), newer research illustrates that factors beyond the individual also influence PA. Researchers and psychologists frame their understanding of PA and other health behaviours in models that organize these correlates. For example, the socio-economic model posits that behaviour exists within a context of individual and social factors (56). Greater PA levels are associated with the following factors acting at the individual level: self-efficacy, perceived health status, reduced barriers and motivation. Demographic and clinical factors also act at the individual level. Factors at the community, society, institutional, policy, and service level factors include distance, access to PA, use of health services and the implementation of support by programs (3,21-23). Many of these factors are modifiable but the extent to which they play a role and can be organized to explain PA is unknown in CR graduates.

To our knowledge, no original research has been undertaken to examine post-CR PA maintenance and its related correlates (factors) across the individual, community and service level simultaneously over the long-term. Thus, this study will evaluate (1) the degree to which
CR graduates are maintaining recommended levels of PA and (2) factors related to PA at the individual, community and service level 2-6 years post-CR.

3.4 Methods

3.4.1 Participants

Two thousand five hundred and forty four English-speaking adults who graduated from TRI between 2005-2009 who previously consented to being contacted for future research were invited to participate. Patients attended either cardiac, risk factor, stroke or diabetes programs. Inclusion criterion for this study were completion of CR between 2005-2009 and current residence in Canada.

3.4.2 Procedure and Design

Approval was obtained from the University of Toronto and Toronto Rehabilitation Institute (TRI) Research Ethics Boards. The study was designed as a retrospective cross-sectional study.

The introductory letter, consent form and questionnaire were sent via surface mail to all those on the existing inventory of program graduates meeting inclusion criteria in January, 2011. Those who were non-responsive 1 month later were contacted a second time if a valid phone number or email address was available. Graduates were given 12 weeks to return the questionnaire. Clinical data collected at the time of graduation from CR were extracted from the program’s database for those who consented.

TRI’s CR program consisted of 6 months of weekly aerobic and resistance exercise and education sessions of approximately 90 minutes duration. In addition to the weekly supervised sessions program, participants were instructed to exercise at home or in the community an additional 3-4 times per week. This was followed by 6 months of monthly sessions, to support patient transition to self-regulation and management. TRI’s CR program is longer in duration that the majority of CR programs in North America (24). Patients undergo maximal VO\textsubscript{2} testing and ECG analysis before starting the program, 6 months into the program, and at graduation after 12 months. In order to be deemed a ‘graduate’ from CR, patients must attend at least 80% of
their weekly sessions and hand-in completed weekly exercise diaries. The average TRI program
completion rate is 80%. Further details on the program can be found in a previous publication
(25).

3.4.3 Measures

The questionnaire contained an investigator-developed package designed to assess health
behaviours, primarily PA, as well as correlates of PA. The questionnaire was designed using
recommendations in the literature to enhance response rate and reduce bias (82,83). The
dependent variable, PA, was assessed using the Physical Activity Scale for the Elderly (PASE).
The PASE was selected because of its accepted validity and reliability (ranging from 0.28-0.59
(28-30)) and suitability for CR graduates (26,27,31). Total PASE scores are computed by
multiplying the amount of time spent in each of leisure, household and/or occupational activities
(hours per day over a 7-day period) by the respective item weights (available for each activity
reported) and summing over all activities. PASE scores range from 0 to 360 in the overall
population, whereas two-thirds of individuals score between 0 and 150. A score of 0 indicated no
activity based on the items assessed. The mean score was 102.9±64.1 among 159 people sampled
from the general population (26). Item weights for the PASE were derived in 1993 from a 3-day
motion sensor count, activity diary (metabolic costs) and a global activity self-assessment (27).
Since then, Washburn et al. have continued to validate the tool among patients with chronic
medical conditions including CVD, and report a mean PASE score of 118.9±63.9 (27). A sample
week for a participant with a PASE score of 100 would include walking 3-4 times for less than
an hour each day, two hours of yoga, light housework, gardening and lawn work and
volunteering 3-4 hours once in a position requiring mostly sitting. A sample week for a
participant with a PASE score of 200 would include 1-2 hours of walking on 1-2 days, 1 day of
skating for less than an hour, 1-2 days of weight training for less than an hour, carrying out light
household chores, being a caregiver and 40 hours of work at a job requiring sitting and some
walking.

Variables collected included a variety of PA correlates at the individual, community and service
level (as framed within the socio-economic model) as well as socio-demographic information.
used to describe the sample. All variables were self-reported unless otherwise noted. The primary preferred location (home, park, gym, etc.) and mode of transportation for PA (i.e. car, taxi, public transportation, etc) were assessed by investigator-generated items. Perceived health and PA enjoyment were scored on an ordinal 5 point scale where 1 represented the lowest level. Fear of falling was assessed nominally as either yes or no.

QOL was assessed using the EQ-5D, a simple tool designed in Europe and validated in cardiac patients (32). The EQ-5D summary score index value ranges from 0 to 1 and was computed from the UK TTO dataset based on 5 dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Social Support was assessed using the Tangible, Informational and Emotional Social Support Survey (TIES, 33), a 16-item survey designed to measure the types of social support that are needed for health behaviour changes. The TIES computes a summary score based on 4 dimensions (tangible/practical, emotional, stress relief and tangible PA) ranging from 0 to a maximum of 32, with higher scores indicative of greater support.

Health behaviours, risk factors, and healthcare utilization were assessed using investigator-generated items. They included smoking history (i.e., packs per day, years smoked and/or quit date), number of visits to a family doctor and cardiologist within the past 6 months, comorbid and recurrent conditions since CR graduation, blood pressure and cholesterol control (yes, no or I don’t know), and percentage medication compliance over a 7 day period.

Socio-ecological factors assessed included rurality (i.e. urban, suburban or rural), birthplace, and ethnicity. Socio-demographic information including education was collected. VO$_2$max (maximal oxygen consumption in mL/kg/min), a measure of fitness capacity, was extracted from the program database for both intake and at graduation from CR. Fitness testing protocol is published elsewhere (25). Patients’ admitting diagnoses to the program and date of discharge from CR were extracted from the program database. Healthcare staff support of PA (yes/no) and CR staff support (based on the number of directives received: names of facilities, discussions around future plans for PA, etc.) was also collected.
3.4.4 Statistical Analysis

Questionnaire data were entered and analyzed in a statistical database (SPSS Statistics Version 19.0, August 2010, IBM Corporation). Data was cleaned using syntax and cross-checking of random entries with hard copies. Patterns of missing data were analyzed and found to be random and minimal (<5% of cases). All variables were checked for accuracy by mean and/or median and frequency distributions. All outlying cases were double-checked for data entry error and selection bias, and participants were called for clarification of discrepancies. PASE, QOL and TIES summary scores were treated as continuous data and analyzed parametrically, after normality was assessed. Alpha level was set at 0.05. Descriptive statistics including means, standard deviations, and percentages are summarized below. Bivariate analyses were performed using ANOVAs, Student’s t-tests and Pearson and Spearman correlations to identify correlates associated with PA levels. All tests were two-tailed.

PA was analyzed by calculating total continuous PASE scores for each participant. In order to indicate whether or not participants met current PA recommendations (at least 150 minutes of moderate intensity per week, 8), a two tailed, unpaired Student’s t-test was used to compare PASE scores to the estimated minimum PASE score needed to meet this guidelines after assessing walking, moderate, vigorous and planned exercise components.

Multivariate analysis was conducted to determine an appropriate model to explain PA behaviour and to identify important correlates. A hierarchical step-wise linear regression was performed with factors significant at the bivariate level in three blocks (individual, community and service). The model automatically assessed eligible factors at each step for entry or removal. Least significant factors were removed from the model, based on their level of association with the dependent variable at each step. The dependent variable was the PASE score. Thorough regression diagnostics were performed and the presence of multi-collinearity was assessed using Eigenvalues and condition indices.
3.5 Results

3.5.1 Recruitment and Participant Flow

There were 1,642 graduates meeting inclusion criteria. Five hundred and eighty four questionnaires were returned by CR patients, yielding a response rate of 35.6% (Figure 1).

3.5.2 Participant Characteristics

Characteristics of the participants in the sample are shown in Table 1. Participants’ ranged in age from 38 to 90 years old. Sixty six percent of participants were over 65 (n=386) whereas only 37% of all graduates from TRI between 1990-2011 are over 65. Over half of the sample was born in Canada (n=328, 57%). The main comorbid conditions reported were arthritis (n=186, 32%) and diabetes (n=163, 28%). The mean time since CR graduation was 41.4±11.6 months or ~3.5 years. The range was 1 to 6 years and median was 42 months.

The majority of participants also exhibited good psychosocial health and positive health behaviours. Participants reported an excellent QOL; the majority reported no problems on any of the listed dimensions (Table 3). The mean TIES score was 21.09±9.30. With respect to health behaviours, 93.2% (n= 544) and 89.4% (n=522) of participants reported having their blood pressure and cholesterol respectively under control. Eighty two percent (n=479) rated their health as at least good and 84% (n=490) rated enjoying PA at least somewhat. Sixty seven percent of participants (n=366) used a car and 22.5% (n=123) walked to access PA. The top three locations where participants engaged in PA were at home (41.4%, n=237), a public park (12.8%, n=74) and at the gym (12%, n=69).

Sixty seven percent of participants (n=391) report being asked by CR staff about how they plan to maintain PA post-CR, 38% (n=215) were asked where they plan to be active in the future and 24% (n=132) were given names and contacts for local community PA facilities. Twenty five percent (n=147) reported receiving no support about future PA plans. Only 17% of participants (n=91) reported having been suggested participation in community PA by a nurse or doctor. The mean number of visits to a cardiologist and family doctor was 0.78±0.71 and 2.73±2.61 respectively within the last six months.
3.5.3 Current Physical Activity Level

PASE scores ranged from 0 to 432. Means were slightly higher than the medians but measures of skewness and kurtosis fell within acceptable ranges of 0.925±0.101 and 0.748±0.202 respectively. Probability plots indicated that PASE scores were normally distributed. The average PASE score was 122.3±75.9. Seventy five percent of participants (n=437) met the current Canadian PA guidelines for older adults (34). Males (125.65±74.55) had significantly higher PASE scores than females (103.76±69.79, Table 2). This was not due to an age difference between the sexes. Finally, there was no significant association between the number of months since CR graduation and PASE scores (R=0.019, p=0.655).

3.5.4 Individual Level Factors

Twenty two factors were identified at the individual level (Table 2). Those who reported a fear of falling (23.6%, n=135) had significantly lower PASE scores than those who did not (96.0±62.7 vs 129.2±76.0). A one-way ANOVA revealed that those working full-time had significantly higher PASE scores than those working part-time, on disability or who were retired.

3.5.5 Community Level Factors

Three factors were identified at the community level (Table 4). Post-hoc analysis revealed that forms of transportation that were self-controlled (i.e. patient’s own car, taxi, bike) were associated with higher PASE scores than those controlled by others (i.e. someone else’s car, public transit). One-way ANOVA and Bonferroni post-hoc tests indicated that participants living in rural areas had significantly higher PASE scores than those who live in the city or suburbs.

3.5.6 Service Level Factors

Four factors were identified at the service level but only the level of support by CR staff was associated with increased PASE scores (Table 4). Those who reported receiving no CR support had significantly lower PASE scores compared to the overall cohort (t(146)=2.49, p<0.05).
3.5.7 Multivariate Model

A hierarchical step-wise linear regression was performed, with factors significantly related to the PASE at the bivariate level entered in three blocks (individual, community and service). All tolerances of the selected model were above 0.7 and variance inflation factors (VIFs) were below 2 indicating that there was no redundancy in the factors included. The model included age, PA enjoyment, QOL, work status, cholesterol control and CR staff support and accounted for 22% of the variance in PASE scores (F=18.7, p<0.001, Table 5). Correlations revealed that PA enjoyment was most strongly related to PA maintenance of all factors in the model. Older age, patient report of not having their cholesterol under control, and not working full-time were all negatively associated with PASE scores. CR staff support had a very low Eigenvalue and high condition index indicating the presence of multicollinearity with this factor.

3.6 Discussion

This study was the first to examine PA and its multi-level correlates in a large sample of CVD patients 2-6 years post-CR. An average of 3.5 years after CR completion, 75% of participants reported meeting current Canadian PA guidelines of 150 minutes of moderate intensity PA most days of the week (34). Increased QOL, and a greater enjoyment of PA were found to be significant and modifiable correlates of PA. Those with greater PA levels also had a strong control over other risk factors further suggesting the importance of perceptions and attitude in CVD and health management. Vulnerable groups identified included those who were unmarried, female, older, had a lower fitness capacity, a higher number of comorbidities and a fear of falling. Greater PA was associated with a number of modifiable multi-level correlates, including PA enjoyment.

Seventy five percent of participants met the current Canadian PA guidelines for older adults (34). To our knowledge, few other studies have reported higher percentages of PA participation (20,37). The majority of research reports diverse findings (11,20,35,36-41). For example, a cross-sectional study using the 2003 Behavioural Risk Factor Surveillance System (n=1,374 myocardial infarction patients) concluded that the maintenance of healthy behaviours diminished over time with 25% of CR patients meeting national PA guidelines one year post CR (39). PA
was similarly assessed via self-report by asking how many days/week respondents participated in moderate activity for 10 min/day or more. A small study of 132 patients completing CR 12 months prior completed the 7-Day Physical Activity Recall Questionnaire and items concerning frequency and duration of exercise (37). This study found that about 67% of patients reported current participation in vigorous exercise for an average of 171.4 minutes per week and 84% reported moderate intensity exercise. The variations in the reported number of patients meeting guidelines among these studies and others cited could be because of the measurement of PA used. Social desirability bias among self-reported PA leads to an exaggeration of PA levels compared to objective measures such as pedometers, and heart rate monitors (42, 43, 44). Discrepancies among these studies could also be due to the amount of time since CR graduation. However, our study detected no difference in PA levels based on time since graduation.

We examined over a comprehensive list of evidence-based factors related to PA in CR graduates at the individual, community and health service level. Our findings were consistent with the literature; greater PASE scores were associated with male gender, younger age, greater QOL, better perceived health status, higher VO_{2}\text{max}, better cholesterol control, greater social support, higher income, location, being married, and full-time work status (3,35,36,39,47-9). To our knowledge we were the first to identify a significant relationship in CR graduates between PA and enjoyment, number of comorbidities, a fear of falling, modes of transportation to PA and CR staff support.

There is an abundance of literature around PA enjoyment as a correlate of PA among adolescents (50,51). Our results indicate that enjoyment is one of the strongest factors influencing PA persisting into older age. One study showed that cardiac patients enjoyment in PA can be nurtured by participating in CR and that this enjoyment is mediated by weight loss (52). However, in the current study, CR graduation and its immediate benefits were many years ago suggesting a deeper, habitual, intrinsic root of PA enjoyment. It is important that further studies examine this factor because a lack of enjoyment in PA is stated as one of the reasons for withdrawal from CR programs and inactivity (53).
Overall, we found a greater importance of individual (inter and intrapersonal) factors. Other studies also found minimal evidence for few environmental correlates (21). MOVE

Limitations

Caution is warranted when interpreting our results. Self-selection and social-desirability bias may have been present in this pool of CR graduates who were eager to volunteer for research and who returned a questionnaire. Due to the cross-sectional nature of this study and the large sample size, we argue that our methods were appropriate for a first look at long-term factors affecting PA. A broad range of CVD patients were assessed and patients 2-6 years after rehab were surveyed on multi-level correlates for the first time. In addition, although many factors were examined, the list was not exhaustive (i.e. self-efficacy was not assessed). Participants were assessed from a single site with longer program duration than other programs.

Two-thirds of this self-selected sample of 584 CR graduates was over the age of 65 and the majority were highly educated, wealthy, retired, married males. The PASE was originally validated in use for adults over the age of 65 so it is unknown whether or not PA levels were elevated due to its use in younger adults. The sample exhibited excellent QOL and a strong control over their health behaviours. Over half (54%) of those who graduated between 2005 to 2009 (n=4,704) were sent the survey (TRI’s Year End Statistics). Our participants were likely more highly motivated, compliant and healthier than the average CR graduate although we were unable to compare any differences between responders and non-responders and between those who volunteered for research and those who did not. When compared to a previous sample of 5,922 CR patients at TRI, there were no differences in smoking status, marital status or the sex ratio of our respondents. Overall, our sample was less obese and had greater intake VO\textsubscript{2}\text{max} among both males and females but a higher proportion of diabetes (46).

Of the 2,544 potential eligible participants, our response rate was 36%. It is more difficult to contact patients many years after CR and those who respond are likely more highly motivated and health conscious (62). However, our ability to recruit more than 1/3 of those considered is
comparable to other studies (5, 62). Additionally, the generalizability of the study is limited to CR programs where services are paid for through healthcare coverage.

**Future Directions**

A prospective study looking at correlates of PA in this population is recommended in order to better identify the encouragement of PA and positive health behaviours. Institutional correlates should be examined including an examination of patients from multiple CR sites and types of CR programmes (home vs. hospital). Additional factors worth examining include patients’ perceptions of control, intentions, attitude and beliefs concerning the benefits of PA(3). A more diverse sample of graduates will shed light on cultural and socio-demographic differences in PA maintenance which is another limitation of the current study. Less reliance on self-report on a number of variables including medication compliance, blood pressure and cholesterol control is recommended.

Other researchers have provided evidence that individuals who attend CR are healthier, younger, more active, motivated and have greater social support and socioeconomic status than those who do not attend (63). We postulate that the same conclusions may be true of CR graduates compared to non-graduates and of graduates who exercise compared to those who no longer do. The characteristics of our sample won’t generalize to all cardiac patients, thus correlates identified may be different as well. However, the correlates of this compliant group give us an idea of ‘what works’.

In conclusion, 75% of participants surveyed were maintaining levels of PA recommended by Canadian guidelines 2-6 years later. Likely this is what leads to the significant reductions in mortality and morbidity reported in meta analyses and RCTs on CR (4). Age, PA enjoyment, quality of life, cholesterol control, work status and CR staff support were robust factors significantly related to greater PA at the multivariate level. PA enjoyment and other correlates identified are modifiable and are related to the management of other risk factors. Overall, individual level factors persisted as the strongest and most abundant in explaining PA levels in this population when compared to community and health service level factors. Future research is
necessary examining additional correlates in a prospective study with a more diverse sample of graduates.

3.7 Figures

Potential participants sent questionnaire (n=2,544)

<table>
<thead>
<tr>
<th>Excluded (n=902)</th>
<th>Ineligible Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-cardiac</td>
<td>n=690</td>
</tr>
<tr>
<td>Unable to contact</td>
<td>n=109</td>
</tr>
<tr>
<td>Deceased</td>
<td>n=37</td>
</tr>
<tr>
<td>In hospital or sick</td>
<td>n=37</td>
</tr>
<tr>
<td>Re-referred</td>
<td>n=11</td>
</tr>
<tr>
<td>Other</td>
<td>n=18</td>
</tr>
</tbody>
</table>

Eligible participants (n=1,642)

<table>
<thead>
<tr>
<th>Did not consent (n=1,058)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refused</td>
</tr>
<tr>
<td>Non-responsive</td>
</tr>
</tbody>
</table>

Participants included for analysis (n=584; 36% response rate)
3.7.1 Figure 1. Recruitment flow diagram.

3.8 Tables

3.8.1 Table 1. Participant characteristics (n=584).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>mean±SD / % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sociodemographic</strong></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>69.8±9.8 years</td>
</tr>
<tr>
<td>Sex % (N) male</td>
<td>80.3 (469)</td>
</tr>
<tr>
<td>Residence location % (N)</td>
<td></td>
</tr>
<tr>
<td>City/Urban</td>
<td>81.4 (469)</td>
</tr>
<tr>
<td>Rural</td>
<td>3.3 (19)</td>
</tr>
<tr>
<td>Suburbs</td>
<td>15.3 (88)</td>
</tr>
<tr>
<td>Work status % (N)</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>56.9 (328)</td>
</tr>
<tr>
<td>Full-time</td>
<td>24 (138)</td>
</tr>
<tr>
<td>Education % (N) &gt; high school</td>
<td>11.2 (64)</td>
</tr>
<tr>
<td>Marital Status % (N) married</td>
<td>78.9 (453)</td>
</tr>
<tr>
<td>Annual income &gt;$100,000 % (N)</td>
<td>28.3 (140)</td>
</tr>
<tr>
<td>Ethnicity % (N)</td>
<td></td>
</tr>
<tr>
<td>North American</td>
<td>52.3 (301)</td>
</tr>
<tr>
<td>European</td>
<td>28.6 (165)</td>
</tr>
<tr>
<td>South Asian</td>
<td>4.5 (26)</td>
</tr>
<tr>
<td><strong>Clinical</strong></td>
<td></td>
</tr>
<tr>
<td>Bypass grafting % (N)</td>
<td>31.8 (174)</td>
</tr>
<tr>
<td>Factor</td>
<td>Bivariate Test Value(s)</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Sex</td>
<td>t(132.2)=2.97</td>
</tr>
<tr>
<td>Age</td>
<td>r=0.32</td>
</tr>
<tr>
<td>BMI</td>
<td>r=0.000</td>
</tr>
<tr>
<td>Smoking</td>
<td>F=1.52</td>
</tr>
<tr>
<td>Education</td>
<td>F=0.98</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>F=1.18</td>
</tr>
<tr>
<td>VO2max Intake</td>
<td>r=0.23</td>
</tr>
<tr>
<td>VO2max Graduation</td>
<td>r=0.27</td>
</tr>
<tr>
<td>VO2max Change</td>
<td>r=0.19</td>
</tr>
<tr>
<td>Number of comorbidities</td>
<td>r=0.20</td>
</tr>
<tr>
<td>Number of recurrent events</td>
<td>r=0.063</td>
</tr>
<tr>
<td>Perceived health</td>
<td>ρ=0.23</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>ρ=0.251</td>
</tr>
<tr>
<td>Quality of life</td>
<td>r= 0.227</td>
</tr>
<tr>
<td>Blood pressure control</td>
<td>F=0.89</td>
</tr>
<tr>
<td>Cholesterol control</td>
<td>F=5.04</td>
</tr>
</tbody>
</table>

3.8.2 Table 2. Bivariate relationships between individual level factors and PASE physical activity scores.
<table>
<thead>
<tr>
<th>Dimension</th>
<th>None % (N)</th>
<th>Some % (N)</th>
<th>Major % (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility</td>
<td>76 (438)</td>
<td>24 (137)</td>
<td>0.2 (1)</td>
</tr>
<tr>
<td>Self-care</td>
<td>96 (553)</td>
<td>4 (24)</td>
<td>0.2 (1)</td>
</tr>
<tr>
<td>Usual activities</td>
<td>84 (488)</td>
<td>14 (82)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>Pain/discomfort</td>
<td>50 (290)</td>
<td>46 (266)</td>
<td>3 (19)</td>
</tr>
<tr>
<td>Anxiety/depression</td>
<td>70 (404)</td>
<td>28 (162)</td>
<td>1 (7)</td>
</tr>
<tr>
<td>Mean summary index value</td>
<td></td>
<td>0.82 ± 0.21</td>
<td></td>
</tr>
</tbody>
</table>

3.8.3 Table 3. Quality of life among 584 cardiac participants as assessed by the EQ-5D.
### 3.8.4 Table 4. Summary of the relationship between community and service level factors and physical activity scores.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Bivariate Test Value(s)</th>
<th>Significance (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Community Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA Location</td>
<td>F=1.46</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mode of transportation</td>
<td>F=3.18</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Residence location</td>
<td>F=5.707</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td><strong>Service Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac rehab staff support</td>
<td>F=4.89</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Health care staff support</td>
<td>T=0.215</td>
<td>n.s.</td>
</tr>
<tr>
<td>Number of visits to a family doctor</td>
<td>R=0.062</td>
<td>n.s.</td>
</tr>
<tr>
<td>Number of visits to a cardiologist</td>
<td>R=0.066</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
### 3.8.5 Table 5. Hierarchical step-wise three block regression model results for physical activity scores and significant factors.

<table>
<thead>
<tr>
<th>Model</th>
<th>β</th>
<th>Standard Error</th>
<th>R</th>
<th>R square</th>
<th>Standard Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant), work status</td>
<td>158</td>
<td>32.7</td>
<td>0.307</td>
<td>0.094</td>
<td>71.9</td>
</tr>
<tr>
<td>(Constant), age, physical activity enjoyment</td>
<td>-1.39</td>
<td>0.398</td>
<td>0.385</td>
<td>0.148</td>
<td>69.7</td>
</tr>
<tr>
<td>(Constant), age, physical activity enjoyment, quality of life</td>
<td>13.2</td>
<td>3.10</td>
<td>0.416</td>
<td>0.173</td>
<td>68.9</td>
</tr>
<tr>
<td>(Constant), age, physical activity enjoyment, quality of life, cholesterol control</td>
<td>51.1</td>
<td>18.1</td>
<td>0.432</td>
<td>0.187</td>
<td>68.4</td>
</tr>
<tr>
<td>(Constant), age, physical activity enjoyment, quality of life, cholesterol control, work status</td>
<td>-13.5</td>
<td>6.31</td>
<td>0.457</td>
<td>0.209</td>
<td>67.5</td>
</tr>
<tr>
<td>(Constant), age, physical activity enjoyment, quality of life</td>
<td>-5.89</td>
<td>1.74</td>
<td>0.471</td>
<td>0.222</td>
<td>67.1</td>
</tr>
</tbody>
</table>
4 Chapter 4
Extended Discussion

4.1 Limitations

4.1.1 Physical Activity Scale for the Elderly

Washburn et al (1993) noted important considerations for the administration of the PASE (26). The mail version of the PASE produced significantly higher activity scores (17.8 points on average) compared with telephone administration. Socio-demographic differences were shown to account for 38% of the variation in PASE scores; higher among younger, employed, men which consisted of the majority of our sample. PASE scores also exhibit seasonal variations with a reported correlation of 0.83; higher levels of PA are reported during the summer. Our questionnaire was mailed in the early months of 2011 and participants were given 12 weeks to return the questionnaire. Therefore, there may have been a slight seasonal variation between our respondents. As with all self-reported, questionnaire-based measures, objective measures are shown to be superior in validity; pedometer-derived step counts were more valid than the PASE in an older sample of adults (42). However, due to the magnitude and cross-sectional nature of the study, the PASE was cost-effective and helpful in providing a first-look at this population. In addition, activity weights used to calculate total PASE score were based partly on METs activity lists available in 1993, the majority of which have been updated since (113).
4.1.2 Model

The selection of factors to be included in the current study was based on the socio-economic model and a gap identified in the literature by a review of PA correlates (3). Although theories can be helpful in organizing correlates of PA adherence, there are too many theories with overlapping constructs in the literature (76). Our model explained 22% of the variation in PASE scores 2-6 years after CR which is lower than we hypothesized but when compared to the HBM accounting for 29% of the variance in PA adherence during CR (70), our model fared pretty well.

4.1.3 Sample

As noted in Chapter 3, the sample available for this study consisted of self-selected volunteers of a high socio-economic status. These patients were the ones who had the time and well-being to participate in research and were still healthy many years post-CR. They were mostly white, married, males. There was no control group in this study. An appropriate control could have been a group of volunteers with similar socio-demographic characteristics (i.e. living close to TRI) with CVD who did not attend CR. We were also unable to make a comparison between those who responded and who did not. We do not know how this group may be different from a larger sample of TRI patients. However, a previous study of 5,922 cardiac patients was undertaken by TRI staff and their characteristics are in Table 3 (46).

Table 3. Characteristics of 5,922 cardiac rehabilitation patients from the Toronto Rehabilitation Institute (Marzolini, 2008).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Cardiac (N=5922)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex % (N) male</td>
<td>81.6 (4833)</td>
</tr>
<tr>
<td>Obesity BMI &gt; 30 % (N)</td>
<td>32 (349) female; 27.3 (1319) male</td>
</tr>
<tr>
<td>Marital Status % (N) married</td>
<td>79.5 (4710)</td>
</tr>
<tr>
<td>Smoking % (N) current</td>
<td>4 (239)</td>
</tr>
<tr>
<td>VO2max (ml/kg/min) at intake</td>
<td>13.6±3.7 female; 18.6±5.2 male</td>
</tr>
</tbody>
</table>
It is also important to note that the sample to which the questionnaire was sent did not consist of only cardiac patients. However, there were no significant differences between cardiac and non-cardiac respondents in our sample (Table 4).

Table 4. Characteristics of non-cardiac participants from the present study.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Non-Cardiac (N=119)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>66.7±9.9 years</td>
</tr>
<tr>
<td>Sex % (N) male</td>
<td>43.5 (50)</td>
</tr>
<tr>
<td>Residence location % (N)</td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>82.3 (93)</td>
</tr>
<tr>
<td>Rural</td>
<td>1.8 (2)</td>
</tr>
<tr>
<td>Suburbs</td>
<td>15.9 (18)</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>29.4±6.3</td>
</tr>
<tr>
<td>Work status % (N)</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>54.1 (60)</td>
</tr>
<tr>
<td>Full-time</td>
<td>22.5 (25)</td>
</tr>
<tr>
<td>Education % (N) &gt; high school</td>
<td>6.2 (7)</td>
</tr>
<tr>
<td>Marital Status % (N) married</td>
<td>66.1 (74)</td>
</tr>
<tr>
<td>Smoking % (N) current</td>
<td>3.6 (4)</td>
</tr>
<tr>
<td>VO2max (ml/kg/min)</td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>18.4±5.8</td>
</tr>
<tr>
<td>Graduation</td>
<td>20.9±6.5</td>
</tr>
<tr>
<td>Change</td>
<td>2.5±3.6</td>
</tr>
</tbody>
</table>
4.2 Overall Conclusions and Implications

The main findings of this study were that 2-6 years post-CR the majority of participants were highly active and that individual level factors including PA enjoyment is important in PA maintenance. The management of PA goes hand-in-hand with other health behaviours. This study also allowed the identification of groups that should be targeted for further intervention: older, non-married, women with a low fitness capacity, high number of comorbidities and a fear of falling.

Our first study hypothesis was incorrect; moderate levels of PA were not observed, rather they were quite high with 75% of participants meeting current guidelines. My second hypotheses of correlates that would be significant at the bivariate level was correct for sex, age, smoking, education, QOL, fear of falling, income, marital status, social support, PA location, blood pressure control, transportation, rurality, medication compliance, VO2max, recurring events, admitting diagnosis and CR staff support. BMI, ethnicity, birthplace, health care level support and the number of visits to a family doctor and cardiologist were not significant whereas I expected them to be. Perhaps this is due to the low variation in BMI, ethnicity and birthplace of the sample. I underestimated the significance of perceived health, PA enjoyment, cholesterol control, comorbidities and work status, the majority of which were identified for inclusion in the multiple regression.

There are many unanswered questions stemming from this study. If only 22% of the variation in PASE scores comes from the myriad of factors examined, we are obviously missing something very important. Where does the other 78% come from? The quantification of any behavior should be taken with caution so perhaps the use of a model itself is limited. Other unanswered questions include the differences among those who were maintaining PA and those who were not because the current study only identified characteristic and not necessarily behavioural differences. How can a sense of PA enjoyment be incorporated into CR programs and what is the role of QOL: causation is reversible. If other factors were included would this help or inhibit the current model?
When asked whether they found certain components of CR beneficial, 96% said yes to exercise, 67.1% said yes to heart education, 54.5% said yes to diet and 32% said yes to social support. T-tests were performed and the only component found to be significantly associated with PASE scores was education. Those who said they did not find heart education beneficial had significantly lower PASE scores than those who did (yes=126.9±75.4, no=110.7±70.0, p<0.05). In another study patients tended to talk about the exercise component of CR and only mention the education component when prompted (23) suggesting a subtle role of education. Both education and reinforcement through exercise are important in CR programs. Thus, education of modifiable correlates of PA herein identified is an avenue for the improvement of PA in cardiac groups with lower PA levels.

4.3 Directions for Future Research

Self-efficacy had the most reliably observed relationship with PA compared to other psychosocial constructs (3), but it was not assessed in the current study. There is some evidence that it is more important in initiating rather than maintaining PA (97). However, it would have been important in helping us understand the confidence of participants (98). White (99) found that self-efficacy moderates the relationship between QOL and PA.

Additional factors that should be considered for future studies include perceptions of control as this could be an underlying theme between our factors and whether or not PA and other health behaviors were maintained when linked to perceived health status and PA enjoyment. Additionally, cognitive and physical functioning are factors that influence health behaviours and HR-QOL. A recent American study found that the neighbourhood is a source of cognitive reserve (41). The role of natural and built environments in PA is a growing area of study; factors that need more examination include traffic, noise, trash, lighting, public transportation, convenient facilities, scenery, safety and availability of sidewalks (97).

The current study evaluated residence location and found highest levels of PA in rural, city (urban) and then suburban residents. Intuitively, urban residents are closer to PA centres and have greater potential for walking because of the close proximity of services. Rural communities
are often thought of as disadvantaged with less services available to support older residents. However, they are also viewed as idyllic, close-knit and supportive through the care of family, friends and neighbours (100). More research in this area is warranted in cardiac populations.

We also found that participants with control over transportation to PA had higher PASE scores than those who did not. This may be explained through aging. With impaired health, often, patients’ licenses are revoked. There is a loss of autonomy and for some it may be daunting to join a group to take transit and schedule bus trips. This loss of control may be a barrier to PA in the elderly (101).

Barriers to community PA were assessed in the questionnaire (Appendix B, Section C) based on the CRBS (77). CRBS scores were not related to PASE scores and were excluded from this thesis since the scale was originally designed to assess barriers to CR participation. It seems our sample was able to successfully overcome these barriers. However, 25% of participants do not currently meet guidelines. Thus, barriers faced in maintaining PA may be different from those faced in CR and PA participation. This is a direction for future research.

In conclusion, a further examination of socio-economic and environmental factors in a more socio-demographically and culturally diverse group of participants is warranted. Administering the questionnaire to a control group of CVD patients living in Toronto who did not attend CR would allow for further understanding of the role of education, PA counseling and health behavior management. Self-efficacy, control and cognitive function should be considered in a prospective study examining CR graduates in a multi-site study.
5 Chapter 5

References


82. Dillman DA, Christian LM. Survey Mode as a Source of Instability in Responses across Surveys. Field Methods February 2005 vol. 17 no. 1 30-52


96. Noar S, Zimmerman RS. Health behavior theory and cumulative knowledge regarding health behaviours: are we moving in the right direction? Health Education Research. 2005;20(3);275-290.


6 Chapter 6

Appendices

6.1 Appendix A: Consent Form

Life After Cardiac Rehab: An Evaluation of Lifestyle, Injury and Care

Consent to Participate in Research

Investigators:

<table>
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<tr>
<th>Name</th>
<th>Institution</th>
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<tbody>
<tr>
<td>Shazareen Khan</td>
<td>Toronto Rehabilitation Institute</td>
</tr>
<tr>
<td>(Principal Investigator and Study Coordinator)</td>
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<tr>
<td>Dr. Paul Oh</td>
<td>Toronto Rehabilitation Institute</td>
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<tr>
<td>Dr. David Alter</td>
<td>University of Toronto</td>
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<tr>
<td>Susan Marzolini</td>
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<td>Dr. Scott Thomas</td>
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You are being asked to take part in a research study. Before agreeing to participate, please read this information carefully and ask any questions you wish. Please phone 416 597 3422 ext. 5261 to ask the study coordinator to explain anything you don't understand and make sure all your questions have been answered to your satisfaction before signing this document.

**Purpose:** You have been asked to participate in a study evaluating the benefits and maintenance of healthy behaviour after rehabilitation in heart patients. The primary purpose of this study is to look at the lifestyle of patients a few years after rehabilitation, whereas, the secondary purpose is to compare these outcomes with sociodemographic and program information.

**Procedure:** You have been asked to participate in this study because you graduated from cardiac rehab at Toronto Rehabilitation Institute and at that time, you agreed to being contacted for participation in future research. If you agree, we would like your permission to extract some study-relevant medical information from your chart, including the nature of the heart event, your other conditions, risk factors, assessment information, and program attendance. This information is needed so that we can describe the participants who make up our study sample.

You are also being asked to complete a survey and provide it to the study coordinator in the envelope provided. This information is necessary to understand all the factors affecting your current lifestyle.
☐ I do not wish to share information from my medical chart but will agree to fill out the questionnaire.

Confidentiality: All information obtained during the study will be held in strict confidence. No names or identifying information will be used in any publication or presentations. Your surveys and other study results will have only an identifying number on them. Your surveys and other study results will be stored in a locked filing cabinet, and no one except the investigators and study coordinators will see your answers and/or study results. They will not have access to your name information, just your survey responses and research ID number for the purposes of exploring our research questions. The questionnaire data will be securely stored in a locked filing cabinet, as required, for 7 years after the study ends, after which time it will be shredded and disposed of in a confidential manner.

The researcher’s privacy policies are in accordance with PHIPA legislation.

Access Rights: You have the right to ask the study investigator about the data being collected on you for the study and about the purpose of this data. You also have the right to ask the study investigator to let you see your personal information and to have any necessary corrections made to it.

Participation: Your participation is VOLUNTARY and you may withdraw from the study at any time or refuse to answer any questions. Your participation will not affect the care you receive from your healthcare providers. Your doctors do not know whether or not you decide to participate by filling out this survey. You will not be compensated for your participation in this study.
Risks: You will be revealing personal information about yourself; however this information will remain confidential.

Benefits: Your participation will help us improve the care of cardiac patients.

Questions:

If you have any questions about the study, please call Shazareen Khan (Study Coordinator) at 416-597-3422 ext. 5261. Participants who have concerns or questions about their involvement in the study or rights as a research subject, may call Dr. Gaétan Tardif, Chair of the Toronto Rehab Research Ethics Board, 416-597-3422, ext 3730. This person is not involved with the research project in any way, and calling them will not affect your participation in the study.

Consent:

I consent to take part in the study with the understanding that I may withdraw at any time. I voluntarily consent to participate in this study. By signing this consent I understand that I will not be waiving any of my legal rights. The study has been fully explained to me and all of my questions have been answered. I will be given a copy of this signed and dated consent form.

_____________________  ____________________  ________________
Please print your name  Your signature  Date

________________        ____________________   ____________________
I agree to be contacted for possible participation in future studies with the understanding that I may refuse or withdraw at any time.

6.2 Appendix B: Questionnaire

Participant ID #: ____________

Life After Rehab

An Evaluation of Lifestyle, Injury and Care
Instructions for completing the survey questions appear at the beginning of each section.

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

**SECTION A: PHYSICAL ACTIVITY**

**Instructions:** For each question or subquestion, circle the one answer that best describes you.

1. Over the past 7 days, how often did you participate in sitting activities such as reading, watching TV or doing handcrafts?


↓ (1-2 Days) (3-4 Days) (5-7 Days)

Go to Q.#2

1a. What were these activities?

_____________________________________________________________________

1b. On average, how many hours per day did you engage in these sitting activities?

[1] Less than 1 hour  [2] 1 but less than 2 hours


2. Over the past 7 days, how often did you take a walk outside your home or yard for any reason? For example, for fun or exercise, walking to work, walking the dog etc.?


↓ (1-2 Days) (3-4 Days) (5-7 Days)

Go to Q.#3
2a. On average, how many hours per day did you spend walking?

[1] Less than 1 hour  
[2] 1 but less than 2 hours  
[3] 2-4 Hours  
[4] More than 4 hours

3. Over the past 7 days, how often did you engage in light sport or recreational activities, such as bowling, golf with a cart, shuffleboard, fishing from a boat or pier or other similar activities?

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Go to Q.#4

3a. What were these activities?

_______________________________________________________________

3b. On average, how many hours per day did you engage in these light sport or recreational activities?

[1] Less than 1 hour  
[2] 1 but less than 2 hours  
[3] 2-4 Hours  
[4] More than 4 hours

4. Over the past 7 days, how often did you engage in moderate sport and recreational activities such as aerobic classes, doubles tennis, ballroom dancing, hunting, ice skating, golf without a cart, softball or other similar activities?

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<td>(5-7 Days)</td>
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Go to Q.#5

4a. What were these activities?

_______________________________________________________________

4b. On average, how many hours per day did you engage in these moderate sport and recreational activities?

[1] Less than 1 hour  
[2] 1 but less than 2 hours  
[3] 2-4 Hours  
[4] More than 4 hours
5. Over the past 7 days, how often did you engage in strenuous sport and recreational activities such as jogging, swimming, cycling, singles tennis, skiing (downhill or cross-country) or other similar activities?

↓ (1-2 Days) (3-4 Days) (5-7 Days)

Go to Q.#6

5a. What were these activities?
_______________________________________________________________

5b. On average, how many hours per day did you engage in these strenuous sport and recreational activities?

[1] Less than 1 hour [2] 1 but less than 2 hours

6. Over the past 7 days, how often did you do any exercise specifically to increase muscle strength and endurance, such as lifting weights, pushups, sit-ups etc.?

↓ (1-2 Days) (3-4 Days) (5-7 Days)

Go to Q.#7

6a. What were these activities?
_______________________________________________________________

6b. On average, how many hours per day did you engage in exercises to increase muscle strength and endurance?

[1] Less than 1 hour [2] 1 but less than 2 hours
7. During the past 7 days, have you done any light housework, such as dusting, cooking, ironing, making beds, carrying out the garbage, washing dishes or (describe) _________________?


8. During the past 7 days, have you done any heavy housework or chores, such as scrubbing floors, washing windows, cleaning gutters, carrying wood or (describe) _________________?


9. During the past 7 days, did you engage in any of the following activities?

Please answer Yes or No for each item.

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<td>a.</td>
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<td>Home repairs like painting, wallpapering, electrical work, etc.</td>
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<td>b.</td>
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<td>Lawn work or yard care, including snow or leaf removal, wood chopping, etc.</td>
<td>1</td>
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<td>c.</td>
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<td>2</td>
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<td></td>
<td>Outdoor gardening</td>
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<td>d.</td>
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<td>Caring for another person, such as children, dependent spouse, or another adult</td>
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10. During the past 7 days, did you work for pay or as a volunteer?


10a. How many hours per week did you work for pay and/or as a volunteer? ________________ hours
10b. Which of the following categories best describes, on average, the amount of physical activity required on your job and/or volunteer work?

[1] Mainly sitting with slight arm movements. [Examples: office worker, watchmaker, seated assembly line worker, bus driver, etc.]

[2] Sitting or standing with some walking. [Examples: cashier, general office worker, light tool and machinery worker.]

[3] Walking, with some handling of materials generally weighing less than 50 pounds. [Examples: mailman, waiter/waitress, construction worker, heavy tool and machinery worker.]

[4] Walking and heavy manual work often requiring handling of materials weighing over 50 pounds. [Examples: lumberjack, stone mason, farm or general laborer.]

11. **Where** is the primary location that you participate or prefer to participate in physical activity? *Check ONE.*

- In your home or building
- Public park or space in your community
- Private gym
- Community recreation or leisure centre
- Mall
- YMCA or other charitable organization
- University or local school
- Cultural, religious or spiritual centre
- Hospital or medical health clinic

12. Which of the statements below BEST describes your motivation for being physically active? *Check ONE.*

- My physician says that physical activity is necessary for my health and wellbeing.
- I understand that physical activity is necessary for my health and wellbeing.
- My friends or loved ones encourage me to be physically active for my health and wellbeing.
- My involvement in physical activity is not related to my health and wellbeing but because of other reasons (athletic, social).
- My involvement in physical activity is not my choice.
- I am not physically active.

13. Rate on a scale of 1 to 5, how much you enjoy physical activity (1=very little, 5=very much): ______
14. What is the most commonly used method you use to travel to physical activity programs or facilities in your community? Check □ ONE.

□ Car (I drive) □ Taxi □ Walking □ Wheel Trans (accessible transit)
□ Car (friend/family drives) □ Bike □ Public transit □ Other : __________________
□ None, the program(s) is/are located in my place of residence

SECTION B: FALLS ASSESSMENT

This section is about falls (including slipping, close falls, etc.) which may have happened after you graduated from rehab and were serious enough to limit your normal activities.

1. Have you had a fall since graduating from rehab? □ YES □ NO (If no, skip to Question 8)

2. How many times have you fallen since graduating from rehab? ______________

3. What type of injury if any resulted from any of your falls? Check □ all that apply.

□ Multiple injuries □ Cut, puncture, animal bite (open wound)
□ Broken or fractured bones □ Scrape, bruise, blister
□ Concussion or other brain injury □ Injury to internal organs
□ Dislocation □ Other – Specify: __________
□ Sprain or strain □ None

4. Where did the fall(s) happen? Check □ all that apply.

□ In a home or its surrounding area
□ Residential institution
□ Other institution (e.g., church, hospital, theatre, civic building)
□ Street, highway, sidewalk
□ Commercial area (e.g., store, restaurant, office building, transport terminal)
□ Other – Specify: __________

5. Did any of the falls happen during physical activity or exercise? □ YES □ NO

6. Did you receive medical attention for any falls within 48 hours? □ YES □ NO

7. Were you admitted to a hospital overnight for any of the falls? □ YES □ NO

8. Do you use any mobility aids?
   Yes → please specify: □ Cane □ Walker □ Wheelchair □ Mobility scooter
   □ Other: ____________________
   No

9. Do you ever experience a fear of falling?
   □ YES → please specify: When? _____________________________
   □ NO

11. Does a fear of falling prevent you from engaging in activities?
   □ YES → please specify: Which activities? _____________________
   □ NO

SECTION C: FACTORS AFFECTING COMMUNITY PHYSICAL ACTIVITY

The following questions ask about some of the factors influencing your participation in community physical activity programs. Please answer all of the questions on this page regardless of whether you participate or do not participate. Check off one box per line.

I do not participate in community physical activity or if I do, I miss some days because:

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1. …of distance (e.g., not located in your area, too far to travel)  

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2. …of cost

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3. …of transportation problems (e.g., access to car, public transportation)

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4. …of family responsibilities (e.g., caregiving)

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5. …I didn’t know they were available

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6. …I don’t need to exercise

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I do not participate in community physical activity or if I do, I miss some days because:

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7. …I already exercise at home

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8. …severe weather

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9. …I find exercise tiring or painful

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10. …travel (e.g., holidays, business, cottage)

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11. …of time constraints (e.g., too busy, inconvenient class times)

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12. …of work responsibilities

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13. …I don’t have the energy

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14. …other health problems prevent me from going (specify:__________)
15. …I am too old

16. …my doctor did not feel it was necessary

17. … many people with health problems don’t go, and they are fine

18. … I can manage my health problem on my own

19. … I think someone told me about a program, but I didn’t get enough information to sign up

I do not participate in community physical activity or if I do, I miss some days because:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

20. …parking was inconvenient

21. …I prefer to take care of my health alone, not in a group

22. Other reason(s) for not participating in community physical activity (example cultural differences):

SECTION D: SOCIAL SUPPORT

Instructions: Please read the following questions and circle the number that most closely describes your current situation.

HOW OFTEN WOULD THERE BE…

<table>
<thead>
<tr>
<th>All or</th>
<th>Some of</th>
<th>None of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most of</td>
<td>the time</td>
<td>the time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Someone to encourage you to follow a healthy diet?  
   All or Most of Some of None of the time the time the time the time

2. Someone available to help you to prepare healthy meals? 
   2  1  0

3. Someone to encourage you to take your medications? 
   2  1  0

4. Someone available to help you get access to your medications (getting your prescriptions filled)? 
   2  1  0

5. Someone available to actually take you to go with you to the hospital/doctor when you are sick? 
   2  1  0

6. Someone to encourage you to exercise? 
   2  1  0

7. Someone who could participate in exercise with you? 
   2  1  0

8. Someone to encourage you to quit smoking? 
   2  1  0

9. Someone who could discuss your condition or health concerns with your doctor? 
   2  1  0

10. Someone who you can talk to about important things in your life? 
    2  1  0

11. Someone who could visit you or check up on you while you are in the hospital or at home? 
    2  1  0

12. Someone who makes you laugh? 
    2  1  0

13. Someone you can go out with just for fun (go to the...
movies)?  
14. Someone who could make sure you get enough rest and relaxation?  
15. Someone to encourage you, tell you “things will be okay,” or reassure you?  
16. Someone (other than your doctor) you could turn to for general advice regarding your health (eating, dieting, exercise, medications)?

**SECTION E: QUALITY OF LIFE**

By placing a tick in one box in each group below, please indicate which statements best describe your own health state today.

**Mobility**

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

**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

**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
**Pain/Discomfort**

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

**Anxiety/Depression**

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

**SECTION F: YOUR HEALTH BEHAVIOURS**

1. In general, would you say your health is... *Circle one.*

   Excellent  ----------- Very Good  ------------------ Good  ------------------ Fair  ------------------ Poor

2. What is your smoking history? *Check one.*

   - [ ] I have never smoked
   - [ ] I currently smoke
   - [ ] I quit smoking

3. Instructions: Please answer the questions below by entering in the number of times IN THE LAST 6 MONTHS that you have seen:

   a) Your family doctor …… [ ] times.
   b) A heart specialist …… [ ] times (if applicable)

4. Please select any health problems that you **CURRENTLY** experience: *Check [ ] all that apply.*

   | [ ] Breathing/ Lung Disease | [ ] Diabetes | [ ] Cancer | [ ] Depression or anxiety |
5. **AFTER GRADUATING from rehab**, have you experienced any of the following cardiac events? *Check □ all that apply.*

<table>
<thead>
<tr>
<th>□</th>
<th>Heart Attack</th>
<th>□</th>
<th>Angina</th>
<th>□</th>
<th>Angioplasty (stent)</th>
<th>□</th>
<th>Bypass surgery</th>
<th>□</th>
<th>Peripheral vascular disease (diseased arteries not in heart / brain, i.e. in legs or pelvis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>Heart transplant</td>
<td>□</td>
<td>Heart failure</td>
<td>□</td>
<td>Valve surgery</td>
<td>□</td>
<td>Stroke</td>
<td>□</td>
<td>Arrhythmia or irregular heart beat</td>
</tr>
<tr>
<td>□</td>
<td>Pacemaker</td>
<td>□</td>
<td>Other:</td>
<td>□</td>
<td>None of the above</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Is your **blood pressure** under control at present (i.e., it is below cut-off values, possibly from medications to lower your blood pressure)  

   □ Yes  
   □ No  
   □ I don’t know
7. Is your cholesterol under control at present (i.e., it is below cut-off values, possibly from medications to lower your blood pressure)

☐ Yes
☐ No
☐ I don’t know

8. What percentage of the time would you say you take your pills as prescribed by your doctors? (0% would be not taking your pills as prescribed at any time due to forgetting or choosing not to take your pills, ranging to 100% which would be taking your pills as prescribed all the time): ____________ %

SECTION G: REHAB EVALUATION

1. Which of the following, if any, components of the rehab program at Toronto Rehab were the most beneficial to you? Check ☐ all that apply.

☐ Exercise  ☐ Diet  ☐ Heart Education  ☐ Social Support  ☐ None

2. Did a staff member from the rehabilitation program discuss with you your plans to exercise after you graduated either in a group or individually? Check ☐ all that apply.

☐ Yes, I was asked about how I plan to maintain exercise in my life
☐ Yes, I was asked where I plan to exercise
☐ Yes, I was provided with names and contact information for local community exercise facilities
☐ No, I did not discuss how to maintain my exercise program after rehab

3. Has a doctor or nurse ever suggested you participate in a physical activity program in your community to help you manage your health condition (e.g., community recreation centre)?

☐ Yes ☐ please specify which one (s) ________________________________
☐ No

4. Have you heard of the following programs for patients who have completed cardiac rehabilitation:

a) “Heart Health for Life”  ☐ YES ☐ NO

b) “Heart Wise Exercise”  ☐ YES ☐ NO
5. Rate your level of participation, if any, in a community based physical activity or health management program after completing rehab, Check ONE.

- Never
- Hardly ever
- Some of the time
- Most of the time
- All of the time

6. Rate how beneficial each of the following would be in helping you continue to manage your health problem after cardiac rehab (1=not helpful at all, 5=extremely helpful). Please circle the number corresponding to your response.

   a) Attending a few more rehab sessions 1 2 3 4 5
   b) Face-to-face meetings with rehab staff when I need it 1 2 3 4 5
   c) Internet contact with rehab staff when I need it 1 2 3 4 5
   d) Internet contact with other program graduates 1 2 3 4 5
   e) Other: ____________________________________

SECTION H: ALL ABOUT YOU

1. Please indicate your sex: MALE FEMALE

2. Please indicate your birth month and year: (month) / 19(year)

3. What do you consider to be your racial/ethnic background? Check one.

   - North American (Canadian, American)
   - Hispanic
   - European
   - Aboriginal (Métis, Inuit, First Nations)
   - Middle Eastern
   - South Asian
   - East or South East Asian (Chinese, Filipino, Japanese, Vietnamese, Thai, Laotian)
   - Black
   - Other (specify: ________________________________)

4. a. What is your height? feet and inches cm
   b. What is your weight? pounds kgs

5. What is your marital status: Check one.

   - Married/common-law
   - Separated/divorced
6. What is the highest level of education you have completed? *Check one.*

- [ ] less than grade 9
- [ ] less than high school
- [ ] completed high school
- [ ] some college or university courses
- [ ] completed college or university degree
- [ ] Graduate School/Professional Program

7. What is your approximate household income from all sources? *Check one.*

- [ ] Less than $5000
- [ ] $5,000 – $9,999
- [ ] $10,000 – $19,999
- [ ] $20,000 – $29,999
- [ ] $30,000 – $39,999
- [ ] $40,000 – $49,999
- [ ] $50,000 – $59,999
- [ ] $60,000 – $69,999
- [ ] $70,000 – $79,999
- [ ] $80,000 – $89,999
- [ ] $90,000 – $99,999
- [ ] $100,000 or more

8. Which option best matches your work status? *Check one.*

- [ ] full-time work
- [ ] part-time work
- [ ] full-time caregiver or homemaker (inside your home)
- [ ] unemployed
- [ ] receiving disability
- [ ] retired
- [ ] other: ______________________

9. Where is your home located? *Check one.*

- [ ] In a city
- [ ] In a rural community
- [ ] In a Suburban area
10. In what country were you born? *Check one.*

- [ ] Canada
- [ ] Other (specify) ___________________________

11. Today’s date: __________ / __________ / __________

Day       Month       Year

Thank you for taking the time to complete this questionnaire. Please return your completed questionnaire to:

Shazareen Khan,
Toronto Rehabilitation Institute
347 Rumsey Road
Toronto, ON
M4G 1R7

Any additional comments may be written in the space below.
6.3 Appendix C: Patient Letter

Month Day, Year

Dear Mr./Mrs. __________________:

This letter is in regards to a study called Life After Cardiac Rehab that is being conducted through Toronto Rehabilitation Institute’s Alumni Program.

You are being asked to participate in this study because you graduated from TRI’s cardiac rehab program between 2005-2009 and at the time of your graduation, you consented to being contacted for consideration for future research.

The goal of our study is to learn more about the lifestyle of patients a few years after graduating from rehab, and to learn more about your habits and recovery from heart disease. The study will help us improve the system for future heart patients. The study consists of completing one questionnaire now and we will also ask for your permission to extract some of your clinical information from Toronto Rehab’s database.

In this package, you will find a copy of our survey questionnaire, two identical consent forms, and one return envelope with our address and postage. Once you have completed the questionnaire, please place it in the return envelope and mail it back to me along with
one signed copy of the consent form; the other copy of the consent form is for you to keep as a personal reference.

If you have any further questions or concerns, please feel free to contact me at 416 597 3422 x 5261 or khan.shazareen@torontorehab.on.ca. We appreciate your time and contribution to this area of research and wish you all the best!

Sincerely,

Shazareen Khan, Study Coordinator

6.4 Appendix D: Telephone Script for Non-Responders

Research Assistant (RA): “Hello my name is Shazareen Khan. I am calling from Toronto Rehab Institute. During your participation at the cardiac rehab program, one of our staff approached you about participating in future research. At that time, you gave consent. We mailed you a questionnaire a few weeks ago with a consent form. We have not yet received the survey from you, and so I’m calling to see if you have any questions about the study?

Answer any questions and emphasize importance of obtaining answers from all participants (P) to ensure representative results.

RA: “Would it be all right if we completed the survey now over the phone? Anything you say will be kept confidential.”

If P says “Yes” -- RA: Obtain consent. Go through questionnaire, Record responses

If P says “No” – RA: “Would you like to receive a replacement questionnaire by mail or is there a time when I could call back?”

Record alternate time and call back or resend questionnaire.
If P says they don’t wish to complete survey at all: RA: “Thank you for your time. We will take your name off and this will be the last contact we make with you. Is there a particular reason you do not wish to participate?”

Record reason if given, thank participant and hang up.

6.5 Appendix E: Sample Size Justification

2,544 CR graduates at TRI previously consented to being contacted for participation in future research. Due to the observational nature of the study and the low response rate expected in mail-out surveys in an older cardiac population, all eligible patients will be sent a questionnaire. Therefore, the sample will be smaller than the 2,544 patients but we expect a 30% response rate which is typical in epidemiological studies so approximately 763 surveys will be returned. In addition, the questionnaire is minimally invasive and any questions deemed sensitive may be skipped by participants. The only inconvenience to patients is the time it will take to complete the questionnaire, but attempts have been made to keep writing at a minimal. Multiple regression analyses to determine predictors of physical activity level: A review of statistical literature on the sample size needed to perform multiple regression reveals that at least 5 cases per independent variable should be included. However, many authors agree that having at least 10 to 20 times as many observations as one has variables will produce a model that has greater stability and a greater likelihood of replication if the study were to be done again. Therefore,
because we are proposing that 31 independent variables will explain the variance of the dependent variable (physical activity level), 620 observations will be optimal (15 observations x 31 independent variables). Thus, our expected sample size of 763 is adequate for statistical purposes. Similar studies report significant findings with sample sizes between 150-2441 (10-11, 37, 49, 102). Thus, we expect a sample size that falls within this range as well.