INTEGRATED CARDIOVASCULAR DISEASE MANAGEMENT: HOW DO NON-CARDIAC AND POLYVASCULAR PATIENTS FARE?

TOMASZ PIOTR KOWAL

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Abstract

The incidence and prevalence of non-communicable disease is increasing. Preliminary evidence suggests that benefits of cardiovascular rehabilitation (CR) participation are observed in patients with stroke and diabetes (vascular diseases). The objectives were to compare outcomes of patients whose primary CR indication was cardiac (CD) versus vascular disease following initiation of CR.

Participants were recruited through a multi-site program evaluation at four CR programs. Consenting participants completed a survey pre-program and again 6 months later. Clinical data were extracted from patients' charts at both time points.

CD patients were significantly more likely to complete CR. CD patients who attended CR significantly improved their activity status, exercise behavior and nutrition. Vascular disease patients who attended CR significantly improved their physical activity.

This practical examination of integrated chronic disease management provides preliminary support for the benefits of CR for vascular disease patients, but attention to meeting their unique needs to ensure full participation may be needed.

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Introduction

Cardiovascular diseases (CVD) are among the leading causes of death and disability around the world, including in Canada[1]. CVDs are disorders that primary affect the heart and blood vessels, including in the brain and legs. Risk factors are common with various CVDs affecting different parts of the body[1]. Having multiple blood vessels affected increases the risk of adverse outcomes, and management is more complex[2–5].

Cardiac Rehabilitation (CR) is a multidisciplinary approach to secondary prevention that includes exercise training, education, and counselling for both client and family[6]. CR is a well-established secondary prevention program model that is increasingly being offered to patients with other vascular diseases. Preliminary research suggests it is safe and feasible for patients with various vascular diseases, and that they can derive similar benefit as cardiac patients[7–9]. Indeed, the recently-released Ontario Integrated Vascular Health Strategy recommends such integrated chronic disease management. Accordingly, the objective of this thesis is to compare the outcomes of patients whose primary CR indication is cardiac versus other or poly-vascular disease (PolyVD) following program participation at several programs in Ontario.

Review of Literature

CVD is defined as a group of disorders affecting the circulatory system including the function and structure of the heart and blood vessels[1,10,11]. Coronary artery disease (CAD) is defined as a progressive narrowing of the three main arteries (and their branches) that supply blood to the heart[12]. The narrowing and blockage of these arteries

deprives the myocardium of rich oxygenated blood that is required for proper function thus causing various symptoms, such as angina (chest paint) and/or dyspnea (a shortness of breath)[10,12]. Complete blockage deprives the myocardium of oxygenated blood causing damage or death of the myocardium tissue, which is referred to as myocardial infarction (heart attack)[1,10,11]. Cerebrovascular disease or stroke is defined as a disease of the blood vessels which are supplying the brain with oxygenated blood[1,10,13]. A ischemic stroke refers to a blockage caused by a built up of fatty deposits, whereas hemorrhagic stroke refers to a rupture of blood vessels within the brain causing the affected area of brain cells to die[10,13]. Peripheral vascular disease (PVD) is defined as a disease affecting the blood vessels supplying the extremities (arms and legs)[1,10]. Diabetes is defined as a chronic disease that occurs when the body does not manage insulin effectively[14,15]. This occurs when the pancreas does not produce sufficient insulin (Type 1 diabetes) or when the body does not use the insulin efficiently that has been produced (Type 2 diabetes), or gestational diabetes which occurs in women during pregnancy[14,15]. Renal disease (interchangeably used with Kidney disease) is defined as damage or loss of proper function to eliminate wastes and excess fluids from the body by the kidneys for a period of 3 months or longer[16,17]. PolyVD is defined as having disease in multiple arterial territories [3], and as such the co-existence of CVD, PVD and/or CAD[2,3,5].

Vascular Diseases

Globally, the incidence and prevalence of CVDs was estimated to be 17.3 million people in 2008, of which for 7.3 million people this was attributed to coronary heart

disease[1]. Stroke accounted for 6.2 million of all the CVD deaths[1], while stroke survivors account for 300,000 individuals living with disability currently in Canada and this number will keep rising[18]. Furthermore, 1.3 million deaths in 2008 were directly related to diabetes[1]. In Canada, 28.7% (68,342) of deaths in 2009 were due to CVD; of the 28.7% 121 deaths were due to renal disease, 14,105 were due to cerebrovascular disease, and 6,923 were due to diabetes mellitus[19]. However, due to advances in therapies, deaths due to CVD have declined by 25% over the past 10 years, resulting in many Canadians living with CVDs. As of 2008/09 in Canada, approximately 6.8% (2.4 million) individuals are living with diabetes and the prevalence is more than 200,000 individuals each year[20]. Individuals living with diabetes have a threefold increase of being hospitalized with CVD in comparison to individuals without diabetes, a twelvefold increase to be hospitalized with renal disease, and almost twentyfold increase to be hospitalized with lower limb amputations[20].

The prevalence of PolyVD ranges from 15.9-27.7%[5], which also indicates that there is increased risk of poor health outcomes in patients with polyVD. Patients with PolyVD are at 15-30% increased risk of experiencing adverse cardiovascular events in comparison to patients with monovascular disease[5]. In particular, there is a 5-fold increased risk of stroke for PolyVD patients in comparison to patients with acute coronary syndrome (ACS)[2]. These patients generally have more poorer outcomes both in-hospital and 6-months later in comparison to patients with monovascular disease[5].

Vascular diseases have a common etiology, such as atherosclerosis, smoking, diabetes mellitus, hypertension, hypercholesterolemia, obesity, family history, and renal

failure[2,5]. Consequently, chronic vascular diseases also have common risk factors. The World Health Organization (WHO) identifies high blood pressure, abnormal blood lipids, tobacco use, physical inactivity, obesity, unhealthy diet and diabetes mellitus as major risk factors for CVD and stroke[1,21]. Hazard increase when these risk factors co-occur (which is known as metabolic syndrome), as the risk of any one of CVD, stroke and diabetes becomes even greater[22,23]. Risk factors increase the risk of initial and recurrence of events, but this is of greater concern for individuals with polyvascular disease[2–5,24].

If these risk factors are not identified, reduced and controlled, patients have an increased risk of developing recurrent or more severe vascular disease. For example, patients with diabetes and renal disease who engage in regular exercise, and maintain a healthy diet lower their risk of heart disease and stroke[21,25–27]. In particular, PolyVD patients are at increased need for secondary prevention. However, there is little guidance on how to best manage these patients[28], and evidence suggests they are managed less aggressively[29]. A multi-faceted approach is necessary to mitigate the progression of disease, through education, lifestyle modification (i.e., healthy eating, exercise, smoking cessation), evidence-based medication prescription, titration and monitoring, blood glucose control, and psychosocial support[5,6]. These interventions are available in chronic disease management programs, such as CR.

Integrated Vascular Disease Management

The Canadian Association of Cardiac Rehabilitation (CACR) defines CR as "the enhancement and maintenance of cardiovascular health through individualized programs

designed to optimize physical, psychological, social, vocational and emotional status. This process includes the facilitation and delivery of secondary prevention through heart hazard identification and modification, in an effort to prevent disease progression and recurrence of cardiac events"[6]. Exercise is the core component of this multidisciplinary approach to secondary prevention, which also include health behaviour change and education, lifestyle risk factor management (physical activity and exercise, diet, and smoking), psychosocial health, medical risk factor management, cardioprotective therapies, long-term management, and audit and evaluation[30]. In Ontario, the average CR program is of 5 months duration, and supervised exercise sessions are offered to patients twice per week[31].

CR has been shown to significantly reduce cardiac risk, decrease the recurrence of cardiac events, and decrease mortality by 25%[6,32]. In the most recent Cochrane review, reduced hospital readmission rates were observed in the 6-12 months following CR when compared to patients not participating, and significantly reduced mortality was observed beyond 12 months post-CR[32]. Other benefits of CR include increased functional capacity, improved psychosocial well-being, greater rate of smoking cessation, improved blood lipid profile, and reduced hypertension[33–35]. These benefits of CR are substantiated amongst cardiac patients; it is unknown how many of these patients have other vascular diseases. However, given that approximately 15-30% cardiac patients have other vascular diseases[5], it is likely that polyVD patients similarly benefit from CR. This remains to be explicitly investigated, as does the outcome of patients with disease in non-cardiac vascular beds?

Indeed there is some preliminary research investigating the effects of CR for stroke patients, and much of this work comes from Ontario. The CR model of exercise-based secondary prevention may apply to stroke patients, as they are shown to benefit from fitness training as well[36]. Using this traditional CR model, the facilities and expertise in cardiovascular risk management through education and exercise can provide support for mild to moderate stroke survivors[7]. For instance, Prior et al. demonstrated that comprehensive CR is safe for patients post-TIA or mild non-disabling stroke[8]. Not only was it feasible for stroke patients to participate in CR, but it also resulted in significant improvements in VO_2peak, functional capacity and reduced depressive symptoms[7,9].

Additionally, guidelines on diabetes and cardiovascular disease from the European Society of Cardiology and the European Association for the Study of Diabetes emphasize the importance of regular physical exercise and the association of reduced CVD as well as, total mortality for those patients with diabetes who regularly exercise[37]. Furthermore, some preliminary findings suggest that patients with diabetes will benefit from CR with an aggressive program approach to risk factor management[38,39]. A traditional CR model can accommodate this unique patient population by improving functional capacity and management of fasting blood glucose, which is an important factor in improvement of VO_2peak[38,39].

Similar comprehensive outpatient disease management programs are not offered for stroke, diabetes, renal, and PVD patients. For instance, there are established inpatient rehabilitation facilities for stroke patients, but once they are discharged home, there are no disease management services offered. Moreover, there are many outpatient diabetes

education centers focused on nutrition and blood glucose control, but these do not address other risk factors or offer supervised exercise. Similarly, there are some outpatient dietary education offerings for renal patients, but we are not aware of any interprofessional programs with supervised exercise facilities. Given the commonalities in etiology and disease management, Ontario recently developed an Integrated Vascular Health Blueprint (http://www.opha.on.ca/Integrated%20Vascular%20Health%20Blueprint%20for%20Ontario_August%202012.pdf), in an attempt to breakdown artificial barriers that may lie between these vascular diseases and their associated organizations. Their goal is to create a systematic, comprehensive approach that: promotes and protects the vascular health of Ontarians; ensures equitable and effective vascular health diagnosis, treatment and recovery; improves the models of healthcare delivery to better prepare Ontario for the growing number of seniors and potential increases in vascular patients; and reduces avoidable vascular morbidity and mortality[40]. Certainly, integrated vascular disease management is a key area of opportunity to realize this vision, and this is recognized by the Ontario Stroke Network and Cardiac Care Network of Ontario. Indeed, 62.2% of CR programs in Ontario already offer their services for chronic disease management to patients with non-cardiac indications[31].

Objectives

The objectives of the study were to compare the outcomes of patients whose primary CR indication was cardiac (CD) versus other- or poly-vascular disease following initiation of an integrated vascular disease management program (CR). First, this thesis examined changes from pre- to post-CR in participants' risk factors (Body Mass Index (BMI), Waist Circumference (WC), Lipids, Blood pressure, HbA1c), functional status ($VO_{2\ Max}$, METs), psychosocial well-being (depressive symptoms, quality of life), and health behaviours (smoking status, nutrition habits, exercise, medication adherence) in CD vs vascular disease patients. It was hypothesized that significant improvements in all parameters would be observed in both CD and vascular disease patients.

Second, this thesis compared CR wait times, the type of CR program attended (on site vs home-based), exercise self-efficacy, barriers to CR, degree of CR participation and completion, and patient perceptions of their chronic disease care in CD vs vascular disease patients who initiated CR. It was hypothesized that there would be no significant differences in these parameters by indication.

Manuscript Preface

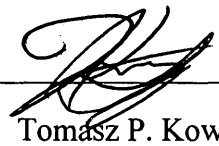
The thesis is prepared in manuscript format. The manuscript investigated: (1) CR utilization by clinical indication, (2) the sociodemographic and clinical characteristics of vascular disease patients who participate in CR versus those who do not, and (3) change in risk factors, functional capacity, psychosocial well-being and health behaviours from pre to post-program in cardiac vs vascular disease patients who participated in CR. The other objectives of the thesis are reported in the extended results and discussion section.

Participants were recruited through a multi-site program evaluation at four CR programs in the Greater Toronto Area. Participants clinical characteristics were extracted pre and post CR (Appendix C & D). Participants completed a self-report survey pre and post CR that includes sociodemographic characteristics (see Appendix E), functional capacity indicators (see Appendix F), assessment of exercise behaviour (see Appendix G), nutrition habits (see Appendix H), medication adherence (see Appendix I), smoking status (see Appendix J), mood (see Appendix K), and quality of life (see Appendix L). A modified Dillman[41] method was applied to optimize response rate, including a repeat email to non-responders (see Appendix U) and a telephone call (see Appendix V). The results of this study are presented in the manuscript which follows.

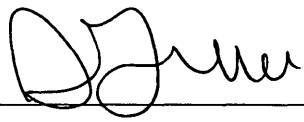
Certificate of Authentication

Re: Integrated Cardiovascular Disease Management: How do non-cardiac and Polyvascular patients fare?

I hereby confirm that the first author of this manuscript, Tomasz Kowal, was responsible for all of the cleaning of data, statistical analysis, and for the write-up of the first draft of the manuscript. As well, he was responsible for maintaining ethics approvals and communication with REBs at all participating sites, maintaining the study binders, communication with CR program sites (including provision of initial patient packages with ICFs and prepaid return envelopes), secure storage of informed consent forms (ICFs) and other source documents, managing the participant database in MS Excel, data entry into SPSS[42], administering the online surveys, extraction of clinical data onto CR intake and discharge forms for some patients, and non-resonder follow-up via phone and email according to a modified Dillman[41] method to optimize response rate. He has also been involved with training others to undertake these tasks, in accordance with the task delegation log. The co-authors are co-investigators or collaborators on the larger study who provided editorial feedback prior to submission.

Signature:  Date: Aug 22, 2013

Tomasz P. Kowal

Signature:  Date: Aug 22, 2013

Sherry L. Grace

Integrated Cardiovascular Rehabilitation: How do non-Cardiac and Polyvascular Disease Patients Fare?

TOMASZ P. KOWAL, CAROLINE CHESSEX, DOUGLAS S. LEE, WINSTON CHEUK & SHERRY L. GRACE, PHD

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Abstract

Introduction: The incidence and prevalence of non-communicable disease is increasing. Preliminary evidence suggests that benefits of cardiovascular rehabilitation (CR) participation are also observed in patients with stroke and diabetes (vascular diseases). This study compared: (1) CR utilization by clinical indication, (2) sociodemographic and clinical characteristics of vascular disease patients who participate in CR versus those who do not, and (3) change in risk factors, functional capacity, psychosocial well-being and health behaviours from pre to post-program in cardiac vs vascular disease patients who participated in CR.

Methods: As part of a multi-site study, new CR patients were approached and asked to complete a survey pre-program and again 6 months later. The surveys included the Duke Activity Status Index, Godin Leisure-Time Exercise Questionnaire, Morisky Medication Adherence Survey, and Patient Health Questionnaire. Clinical data including risk factors and exercise test results were extracted from patient's charts at both time points.

Results: Overall, 237 (84.0%) completed the pre-CR survey, and 201 (84.8%) completed the final survey. Cardiac patients (n=104, 68.9%) were significantly more likely to complete CR than vascular disease patients (n=37, 54.4%; p=0.039). Vascular disease patients who enrolled in CR engaged in more physical activity pre-program ($p<.05$). CD patients who attended CR achieved significant improvements in activity status, exercise behavior and nutrition by post-test ($p<.01$). Among vascular disease patients, there were trends toward lower depressive symptoms and greater exercise in those who participated in CR by post-test.

Conclusions: This practical examination of integrated chronic disease management provides preliminary support for the benefits of CR for other vascular patients.

Vascular diseases are defined as a group of disorders affecting the circulatory system as well as the function and structure of the heart, brain, and kidneys[1]. Accordingly, these diseases include stroke, peripheral artery disease, coronary artery disease, renal artery disease, and diabetes mellitus. Their incidence and prevalence is high, such that cardiovascular diseases for example are among the leading causes of morbidity and mortality[2]. Globally, the incidence and prevalence of cardiovascular disease was estimated to be 17.3 million people in 2008. With regard to mortality that same year, stroke accounted for 6.2 million deaths, with 1.3 million deaths directly related to diabetes[2].

Polyvascular disease (PolyVD) refers to disease in multiple arterial territories[3], such as the co-existence of coronary artery and renal disease[3–5]. The prevalence of PolyVD ranges from 15.9-27.7%[5] among those with monovascular disease. PolyVD patients are at 15-30% increased risk of experiencing adverse cardiovascular events in comparison to patients with monovascular disease[5]. Despite this increased need for secondary prevention, there is little guidance on how to best manage PolyVD patients[6], and evidence suggests they are managed less aggressively[7].

Vascular diseases have a common etiology, namely atherosclerosis[4,5]. Accordingly, they also have common risk factors such as hypertension, hypercholesterolemia, tobacco use, physical inactivity, obesity, and unhealthy diet[2,8]. A multi-faceted approach is necessary to mitigate the progression of vascular diseases, through education, lifestyle modification (i.e., healthy eating, exercise, smoking

cessation), evidence-based medication prescription, titration and monitoring, blood glucose control, and psychosocial support[5,9]. These interventions are available in chronic disease management programs, such as cardiovascular rehabilitation (CR). Indeed, CR has been shown to significantly reduce cardiac risk, decrease the recurrence of cardiac events, and decrease mortality by 25%[9,10]. Other benefits of CR include increased functional capacity, improved psychosocial well-being, greater smoking cessation, improved blood lipid profile, and reduced blood pressure[11–13].

While the benefits of CR are substantiated in the cardiac population, given that approximately 15-30% cardiac patients have other comorbid vascular diseases[5], it is likely that these other clinical indications are ameliorated through CR. Indeed, the CR model of exercise-based secondary prevention has been recently applied to stroke patients, as they are shown to benefit from fitness training as well[14]. For instance, Prior et al. demonstrated that comprehensive CR is safe for patients post-transient ischemic attack or mild non-disabling stroke[15]. Not only was it feasible for stroke patients to participate in CR, it also resulted in significant improvements in functional capacity and reduced depressive symptoms[16,17]. Moreover, emerging evidence supports the beneficial role of exercise training for renal patients[18]. Yet, comprehensive outpatient disease management programs similar to CR are not available for stroke, diabetes, renal, or PVD patients. For instance, there are established inpatient rehabilitation facilities for stroke patients, but once they are discharged home, there are often no disease management services offered. Moreover, there are many Diabetes Education centres focused on nutrition and blood glucose control, but these often do not address other vascular risk factors or offer

supervised exercise. Finally, recent data suggests that upwards of 10% of these patients end up attending two or more disease management programs[19].

As a result, there is an increasing trend for CR programs to provide service to patients with other vascular indications[20]. However there has been little study of the nature of these patients and hence how services may need to be tailored to meet their needs, nor has there been ample study on the outcomes achieved in vascular disease patients. Thus, the objectives of this study were to compare: (1) CR utilization by clinical indication, (2) the sociodemographic and clinical characteristics of vascular disease patients who participate in CR versus those who do not, and (3) change in vascular risk factors, functional capacity, psychosocial well-being and health behaviors from pre to post-program in CD versus vascular disease patients who participated in CR.

Methods

Design and Procedure

This research was observational, and prospective in design. Patients were assessed pre and post-CR program at each of 4 participating sites in the Greater Toronto Area of Ontario, Canada. Of these programs, 2 were academic.

At the first CR visit, all patients were approached to solicit informed consent. All patients completed an intake assessment as part of standard care. This included risk factor assessment, an exercise stress test, and blood work. The exercise stress tests were primarily undertaken on a treadmill (n=39; 97.5%), using a Bruce protocol (n=80; 97.6%)[21,22].

Consenting patients were emailed and asked to complete a survey administrated online using "SurveyMonkey"[23]. The survey assessed sociodemographic characteristics, functional capacity, exercise behavior, nutrition, medication adherence, smoking status, depressive symptoms, and quality of life.

The assessment protocol was repeated 6 months from the patient's CR intake date, which corresponded with the end of the CR programs. For patients who completed the program, this entailed a discharge assessment as part of standard care, similar to the intake assessment outlined above. Again, some of this available clinical data was extracted. A second self-report online survey was emailed to all participants. It assessed the same elements as above, in addition to participation in CR, and barriers to CR participation. To optimize response rate, a repeat email was sent to non-responders, and then they were phoned.

Participants

New patients were approached at first CR contact at the four programs described above. One of the programs served cardiac and stroke patients; two were integrated vascular programs where cardiac, stroke, diabetes, and renal patients were solicited to participate.

The inclusion criterion was that the patient was still deemed eligible to complete CR following their intake assessment. The exclusion criterion was lack of English-language proficiency.

Measures

To describe the sociodemographic characteristics of the participants, the following were assessed in the pre-CR survey: ethnic background, marital status, education level, and work status. Patient clinical characteristics extracted from CR charts included age, sex, referral and intake dates (to compute wait times), referral indication and diagnoses (to categorize patients as CD or vascular disease), risk factors, and exercise stress test results. Patients were also asked to self-report their smoking status.

There were seven psychometrically-validated scales administered in both surveys. These scales were chosen based on their reliability and validity when administered in cardiac samples. First, the Duke Activity Status Index (DASI)[24], is a 12-item self-report scale where patients are asked about activities of daily living. Higher scores denote greater functional capacity.

The Godin Leisure-Time Exercise Questionnaire (GLTEQ)[25] is a brief and reliable instrument to assess usual physical activity during a one-week period. Frequencies of strenuous, moderate, and light-intensity activities are assessed. Higher scores indicate greater exercise.

The Health Promoting Lifestyle Profile II (HPLP II)[26] Nutrition Subscale contains 6 statements that assess daily personal nutrition habits. Response options range from 1 to 4 (*never* to *routinely*), indicating the frequency that particular nutrition behavior is practiced. A mean was computed, with higher scores representing a healthier diet.

The Morisky Medication Adherence Scale (MMAS)[27] is a 4-item questionnaire. Response options are "Yes" I agree with the statement or "No" I do not. Responses are summed, and a total score of less than 4 indicates non-adherence.

The Patient Health Questionnaire (PHQ-8)[28] is a reliable and validated depressive symptom screening scale that inquires about the frequency of depressed mood in the last 2 weeks. Each item is scored on a Likert-type scale from 0 to 3 (*Not at all* to *nearly every day*). A total score was computed by summing responses, with higher scores indicating more severe depressive symptoms. Item 9 which assesses suicidal ideation, was excluded for ethical reasons. Total scores between 1-4 indicate *'Minimal depression'*, 5-9 *'Mild depression'*, 10-14 *'Moderate depression'*, 15-19 *'Moderately severe depression'*, and 20-27 *'Severe depression'*. A cut-off of $\geq$ 10 was applied to denote elevated depressive symptoms[29].

The EuroQol (EQ-5D)[30,31] is a reliable and validated 5-item quality of life scale. Respondents indicate their health status by choosing one of three response options (*no problem* to *extreme problem*) in each of 5 life dimensions. Responses are combined to compute a unique health state. The EQ also has a visual analogue scale item[30,31] where the respondents' were asked to self-rate their health on a vertical scale where the endpoints are labeled 'Worst imaginable health state' (0) and 'Best imaginable health state' (100).

Furthermore, one psychometrically-validated scale was administrated only in the post-test survey. The Cardiac Rehabilitation Barriers Scale (CRBS)[32] is a 19-item scale which assesses multi-level barriers to CR applicable to enrollees and non-enrollees.

Responses were reported on a Likert scale from 1 (Strongly disagree) through to 5 (Strongly Agree). A mean score was computed to reflect total CR barriers, with greater scores reflecting greater perceived barriers.

Finally, investigator-generated items with forced-choice response options were included in the post-test survey to assess self-reported CR utilization. Specifically, CR enrolment (i.e., whether they completed an intake assessment; y/n), whether they participated in the program [y/n], program adherence (i.e., the percentage of prescribed CR sessions they attended), and whether they completed the program (graduated; y/n) were assessed.

Statistical Analyses

First, a frequency examination of clinical referral indication for CR was performed. This formed the basis for the independent variable of CD versus vascular disease created. The sociodemographic and clinical characteristics of participants were explored. These were compared by CR indication (i.e., CD vs. vascular disease), by performing Mann-Whitney U tests or chi-square analyses as applicable.

To test the first objective, chi-squared tests were performed to determine if there were significant differences between type of CR program attended and CR completion by CR indication. As well, Mann-Whitney U tests were performed to determine if there were significant differences between CR wait times, degree of CR participation and CR barriers by clinical indication.

To test the second objective, vascular disease patients were selected, and the pre-CR sociodemographic and clinical characteristics of those who participated in CR versus

those who did not were compared using chi-square or Mann-Whitney U tests, as appropriate. To test the third objective, a descriptive analysis of the outcomes under study was performed at pre and post-test, by clinical indication, among those who participated in CR. Mann-Whitney U and Wilcoxon signed rank tests were performed to ascertain whether there were significant changes from pre to post-test in the risk factors, functional outcomes, psychosocial indicators and health behavior variables, as appropriate. Given the large number of comparisons performed, a conservative p-value of $p<.01$ was applied to mitigate inflated error rates.

Results

Respondent Characteristics

A diagram of patient accrual and retention is shown in Figure 1. As shown, clinical data from the CR intake assessment was not available for 8 (2.8%) patients, as they did not enroll following their initial visit. For 82 (29.0%) patients there was no discharge assessment undertaken, due primarily to dropout (n=70, 90.9%), and also that some patients failed to remit blood work and attend their post-program stress test (n=61, 85.9%). Thus, there were 156 (79.2%) discharge assessments available in the charts for CD and 70 (82.4%) for vascular disease patients (p=0.50).

Of these patients, 85 (30.1%) were categorized as vascular disease. As shown in Table 1, other CR indications were most-commonly stroke and diabetes. Overall, 204 (73.4%) patients were considered to have monovascular disease (i.e., only one of cardiac, stroke or diabetes).

The sociodemographic characteristics of the sample are also shown in Table 1. CD patients were significantly more likely to be male than vascular disease patients. The pre-CR clinical characteristics of participants are displayed in Table 2. CD patients had significantly lower body mass index and glycated hemoglobin, as well as significantly greater functional capacity than vascular disease patients. They were also significantly more adherent to their medications than vascular disease patients. No other differences were observed.

CR Utilization

As per the first objective, CR utilization is shown in Table 3. Overall, 180 (72.3%) patients self-reported participating in the program after their initial visit, and this, as well as the degree of program participation among those enrolled, did not vary by indication. However, CD patients reported being significantly more likely to complete CR than their vascular disease counterparts. CR barriers did not differ by referral indication.

As per the second objective, there were no significant differences in the pre-CR sociodemographic, clinical or psychosocial characteristics of vascular disease patients who participated in CR versus those that did not (Table 4). However, vascular disease participants who attended CR engaged in significantly greater physical activity pre-program than those who did not attend.

Outcomes

Table 2 displays risk factors, functional status, psychosocial well-being, and health behaviors at pre- and post-test for both CD and vascular disease patients, and by

CR participation. To test objective 3, those who self-reported participation in CR were selected, and Wilcoxon Signed Rank tests were performed to investigate changes from pre to post-test assessment by CR indication (see †). Among CD patients, significant increases in functional capacity, exercise behavior and nutrition were observed. Among vascular disease patients, no significant differences were observed at the $p<.01$ level, however there were trends towards reductions in depressive symptoms ($p=.05$), and increases in physical activity ($p=.09$).

Discussion

Through this practical, multi-site study, the applicability of CR has been shown to be beneficial to patients with stroke and diabetes. Primary observations include the different presentation of vascular disease patients, the low rates of program completion (which are even lower among the vascular disease patients), but general trends towards improvements in psychological well-being and health behaviors.

Vascular disease patients may have somewhat different needs from CR programs, based on some notable differences in their clinical presentation at program entry. Vascular disease patients present with higher body mass index, greater HbA1c, lower functional capacity and lower medication adherence than traditional CR patients. This suggests that CR programs may need to consider whether their program equipment can sustain the greater weight of patients, and their blood pressure cuffs have sufficient circumference. Integration of the recent American Association of Cardiovascular and Pulmonary Rehabilitation guidelines for diabetes in CR programs would also be needed[33]. Moreover, given their lower functional capacity, choice of intake exercise

protocol and modality should be tailored accordingly. Finally, given the potentially higher number of medications required for patients with polyvascular disease, medication review and education would be particularly central, as would be integrating proven interventions to promote medication adherence[34]. Program access to a pharmacist would be ideal as patient disease complexity increases, so do the potential for drug interaction and side effects and therefore poly-pharmacy will play a crucial role I patient management.

The findings of the present study suggest that CD patients are significantly more likely to complete CR in comparison to their vascular disease counterparts. This is likely not explained by the barriers which were assessed, as no differences by indication were observed. There was only one significant difference in the characteristics of vascular disease patients who participated in the program after the initial visit, versus those who did not. This difference in history of exercise is comparable to the differences observed in cardiac samples[35]. Perhaps then, the differences in utilization are somewhat explained by the different characteristics upon presentation (as outlined above), and hence different needs of these patients. It is likely that proven strategies to promote adherence in CR, such as action (when, where, and how to act) and coping (how to deal with anticipated barriers) planning[36], could provide a needed boost to program adherence and completion rates for all participants, regardless of their indication.

Research and policy implications

The implications of the current study are limited by the nature of the study design. Randomized controlled trials are needed in vascular disease patients, particularly other

than stroke, to determine whether they indeed similarly benefit from CR, in terms of some of the proximate outcomes assessed herein, but also in terms of effects on morbidity and mortality. Indeed, a search of clinicaltrials.gov reveals that many such trials are currently underway, and some of which include cost analyses.

Limitations

First, the sample is one of convenience, such that CR program staff were trained to approach all new patients to solicit study participation. They did not record number approached, and therefore the response rate is unknown. Consequently, the generalizability of the findings is not known. Second, results are also potentially biased due to selection, such that findings may only be applicable to patients who are referred to CR. It is known that only approximately 30% of cardiac patients are referred to CR in Ontario[37], and this number would likely be much lower among vascular disease patients. Moreover, patients who enroll are often not those in greatest need of these services, for example higher functioning, English-speaking male patients of higher socioeconomic status patients are over-represented in CR[20]. Third, due to the low rates of CR completion, post-test clinical parameters were not available for most participants, which raises the potential of bias. Retention in the study to complete the post-test survey was fair however. Fourth, all vascular diseases being considered in this study may not have been recorded in CR charts. This may have led to some misclassification of CD and vascular disease patients which could contaminate findings. Chart extractors for the study were provided training to mitigate this threat, as well as a coding guide. Duplicate audit of some charts was undertaken to determine how much of a threat misclassification could

be to the findings, and was deemed to be low. Furthermore, patients with non-cardiac primary indications may ultimately have had underlying but undocumented cardiac disease, and therefore the categorization of cardiac versus other or polyvascular may be artificial or imprecise. Fifth, many of the outcomes are self-reported, which raises the possibility of expectation bias and socially-desirable responding. However, the measurement protocol is the same for the CD and vascular disease participants, so this should not have negatively impacted the between-group comparisons. Moreover, exercise stress test results were extracted, which is an objective and valid measure. Sixth, this is an observational study, and therefore causality cannot be inferred. Certainly, the results from this study suggest a randomized controlled trial may be warranted. Finally, generalizability is limited to healthcare systems where outpatient vascular rehabilitation services are offered at no cost to referred patients.

In conclusion, this practical examination of integrated chronic disease management provides some supporting evidence for the benefits of CR for other vascular patients, and accommodations in CR is warrant for these unique patient populations. While rates of program completion were low, results suggested vascular disease patients may achieve reductions in depressive symptoms and improvements in exercise behaviour following participation. In order to provide patient-centered, high-quality and cost-effective care for the growing number of people with vascular diseases globally, proven chronic disease management models such as CR could play an important role in ensuring an integrated outpatient journey.

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Figure 1: Study Flow Diagram

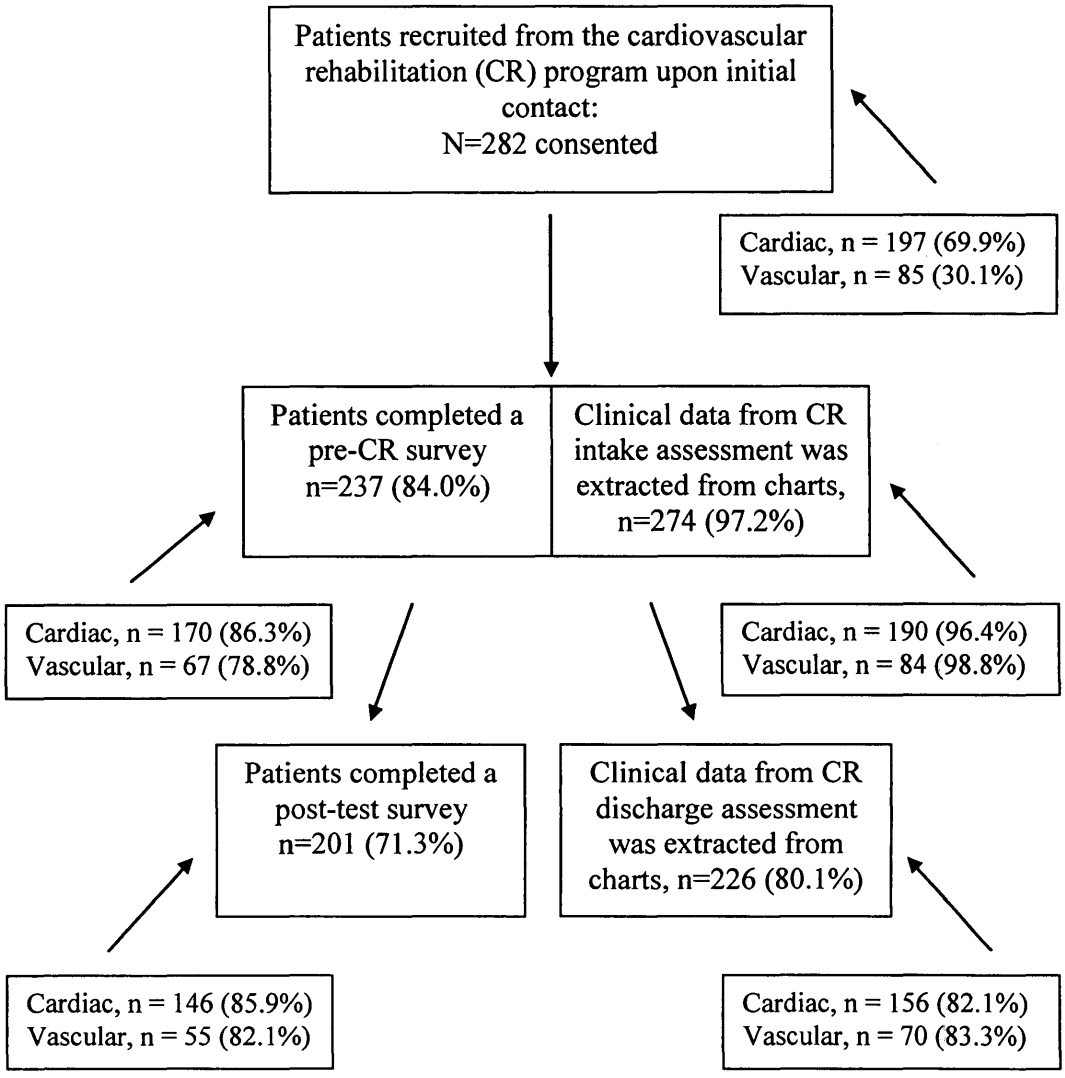

Table 1: Sociodemographic and Referral Indications of Cardiac versus Other or Polyvascular Disease Patients Pre-Program

Characteristic	CD (n=196, 72.3%)	VD (n=83, 29.7%)	Total (N=279)
Sociodemographic			
Age† (mean years ± SD)	64.98 ± 10.68	66.58 ± 10.11	65.44 ± 10.50
Sex† (% Male)	143 (73.7%)	47 (59.5%)	190 (69.6%) *
Ethnicity (% North American)	67 (41.9%)	24 (38.1%)	91 (40.8%)
Marital Status (% married)	122 (76.7%)	49 (76.6%)	171 (76.7%)
Education (% Completed less than college / university)	89 (52.4%)	33 (50.0%)	122 (51.7%)
Work status (% currently retired)	82 (48.2%)	36 (54.5%)	118 (50.0%)
CR Referral			
Cardiac†	194 (99.0%)	62 (73.8%)	256 (92.1%)***
PCI	83 (43.5%)	25 (29.8%)	108 (39.3%)*
CAD	76 (39.8%)	23 (27.4%)	99 (36.0%)*
CABG	58 (30.4%)	18 (21.4%)	76 (27.6%)
MI	59 (30.9%)	15 (17.9%)	74 (26.9%)*
Arrhythmia	20 (10.5%)	9 (10.7%)	29 (10.5%)
HF	11 (5.8%)	5 (6.0%)	16 (5.8%)
Congenital	4 (2.1%)	1 (1.2%)	5 (1.8%)
Stroke†	-	22 (26.2%)	22 (8.0%)***
Diabetes†	-	16 (19.0%)	16 (5.8%)***
PVD		3 (3.6%)	3 (1.1%)**
Other† (e.g., Vascular Risk Factors, Renal)	-	26 (31.0%)	26 (9.5%)***

CD, Cardiac Disease; VD, polyVascular Disease; SD, standard deviation; PCI, Percutaneous Coronary Intervention; CAD, Coronary Artery Disease; CABG, Coronary Artery Bypass Graph; MI, Myocardial Infarction; HF, Heart Failure; PVD, Peripheral Vascular Disease.
*p<.05, **p<.01, ***p<.001
†chart report.

Table 2: Risk Factors, Functional Status, Psychosocial Well-being, and Health Behaviours at Pre and Post-Test among Cardiac versus Other or Polyvascular Disease Patients by CR Enrolment Status

Dependent Variable	Pre-CR			Post-CR						
	CD (n=197, 69.9%)	VD (n=85, 30.1%)	**Total Pre-CR (n=282,100%)**	CD (no CR, n=52, 26.8%)	CD (CR, n=142, 73.2%)	Total CD (n=194, 70.0%)	VD (no CR, n=30, 36.1%)	VD (CR, n=53, 63.9%)	Total VD (n=83, 30.0%)	**Total Post-CR (n=277, 100%)**
Risk Factors										
TC (mmol/L)	4.06 ± 1.16	4.18 ± 1.45	**4.02 ± 1.20**	-	3.61 ± 0.78	3.61 ± 0.78	-	3.63 ± 0.70	3.63 ± 0.70	**3.61 ± 0.77**
HDL (mmol/L)	1.15 ± 0.32	1.19 ± 0.40	**1.15 ± 0.38**	-	1.16 ± 0.33	1.16 ± 0.33	-	1.21 ± 0.45	1.21 ± 0.45	**1.19 ± 0.38**
LDL (mmol/L)	2.30 ± 0.92	2.21 ± 1.16	**2.25 ± 0.94**	-	1.92 ± 0.60	1.92 ± 0.60‖	-	1.83 ± 0.46	1.83 ± 0.46	**1.89 ± 0.58**
Triglycerides (mmol/L)	1.34 ± 0.87	1.63 ± 1.17	**1.33 ± 0.94**	-	1.17 ± 0.53	1.17 ± 0.53	-	1.30 ± 0.70	1.30 ± 0.70	**1.19 ± 0.58**
TC/HDL Ratio	3.74 ± 1.41	3.71 ± 1.52	**3.86 ± 1.68**	-	3.25 ± 0.85	3.25 ± 0.85‖	-	3.14 ± 0.89	3.14 ± 0.89‖	**3.18 ± 0.88**
BMI (kg/m^2)	28.39 ± 4.43	30.59 ± 6.04	**28.79 ± 4.50***	-	28.54 ± 4.35	28.54 ± 4.35	-	29.39 ± 5.32	29.39 ± 5.32	**28.67 ± 4.44**
WC (cm)	101.77 ± 9.93	105.28 ± 13.17	**102.16 ± 10.87**	-	100.16 ± 12.14	100.16 ± 12.14	-	103.63 ± 13.62	103.63 ± 13.62	**101.15 ± 11.60**
SBP (mmHg)	126.02 ± 18.45	127.49 ± 17.49	**126.53 ± 18.43**	-	120.31 ± 13.54	120.31 ± 13.54‖	-	120.72 ± 16.90	120.72 ± 16.90	**120.47 ± 14.56**
DBP (mmHg)	74.87 ± 11.23	74.16 ± 10.52	**74.86 ± 10.77**	-	69.07 ± 9.90	69.07 ± 9.90‖‖	-	66.15 ± 9.39	66.15 ± 9.39‖	**68.18 ± 9.86**
HbA1c (%)	5.89 ± 0.49	6.73 ± 1.08	**6.26 ± 0.95****	-	5.86 ± 0.35	5.86 ± 0.35	-	6.45 ± 0.84	6.45 ± 0.84*	**6.11 ± 0.50***
Functional Capacity										
METs	7.52 ± 3.10	6.30 ± 2.45	**7.39 ± 3.06***	-	9.14 ± 3.08	9.14 ± 3.08‖‖	-	7.49 ± 2.61	7.49 ± 2.61*	**8.84 ± 2.96***
VO_{2max}	26.32 ± 10.86	22.05 ± 8.59	**25.87 ± 10.69***	-	32.01 ± 10.77	32.01 ± 10.77‖‖	-	26.20 ± 9.13	26.20 ± 9.13*	**30.95 ± 10.37***
DASI§	39.25 ± 14.47	37.64 ± 14.53	**38.44 ± 14.53**	42.61 ± 14.29	46.10 ± 14.14††	45.56 ± 14.12‖‖	34.63 ± 14.89	36.50 ± 15.03	36.45 ± 15.04**	**43.43 ± 15.27****
Psychosocial Well-Being§										
Depressive Symptoms	3.60 ± 4.20	5.22 ± 5.48	**3.45 ± 4.02**	4.10 ± 4.69	2.71 ± 3.56	2.97 ± 3.82	6.24 ± 5.32	3.57 ± 4.29	4.44 ± 4.72	**3.39 ± 4.14**
Quality of Life	0.86 ± 0.14	0.86 ± 0.11	**0.86 ± 0.13**	0.90 ± 0.13‡	0.89 ± .014	0.89 ± 0.14‖	0.82 ± 0.15	0.85 ± 0.17	0.84 ± 0.16	**0.88 ± 0.15***
Quality of Life (visual scale)	77.55 ± 14.40	70.25 ± 17.81	**75.57 ± 17.05**	76.90 ± 12.19	82.34 ± 13.59	81.14 ± 13.32	73.83 ± 20.50	72.32 ± 18.82	72.91 ± 18.87	**80.41 ± 17.38**
Health Behaviours§										
Physical activity	18.60 ± 21.02	18.87 ± 21.46	**19.08 ± 21.14**	27.87 ± 39.86	29.04 ± 28.56†	29.59 ± 30.99‖‖	42.23 ± 63.06	21.67 ± 22.30	28.02 ± 39.27	**30.75 ± 33.63**
Nutrition	2.92 ± 0.53	3.05 ± 0.51	**3.00 ± 0.54**	2.71 ± 0.47	3.15 ± 0.48†	3.05 ± 0.51	3.00 ± 0.43	3.09 ± 0.60	3.07 ± 0.55	**3.07 ± 0.51**
Medication Adherence	3.68 ± 0.66	3.48 ± 0.77	**3.62 ± 0.70***	3.59 ± 0.73	3.66 ± 0.59	3.64 ± 0.62	3.65 ± 0.61	3.51 ± 0.77	3.55 ± 0.72	**3.60 ± 0.65**
Smoking (Current, %)	8 (4.8%)	1 (1.5%)	**9 (3.8%)**	2 (6.7%)	6 (5.3%)	8 (5.5%)	0 (0%)	1 (2.7%)	1 (1.8%)	**9 (4.5%)**

CR, Cardiovascular Rehabilitation; CD, Cardiac Disease; VD, Polyvascular Disease; SD, standard deviation; TC, Total Cholesterol; HDL, High Density Lipoprotein; LDL, Low Density Lipoprotein; BMI, Body Mass Index; WC, Waist Circumference; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; HbA1c, Glycated Haemoglobin; METs, Metabolic Equivalents Tasks; VO2max, Maximal Oxygen Consumption.

§assessed via self-report

*p<.01, **p<.001 for pre-CR CD vs VD, as well as post CD CR vs no CR and VD CR vs no CR

‖p<.01, ‖‖p<.001 for Wilcoxon Signed ranks test pre vs post-CR CD vs VD Total

†p<.01, ††p<.001 for Wilcoxon Signed ranks test CD CR, and VD CR pre compared to post-test;

‡p<.01, ‡‡p<.001 for Wilcoxon Signed ranks test CD no CR, and VD no CR pre to post-test

Table 3: CR Utilization and Barriers among Cardiac versus Other or Polyvascular Disease Patients

	CD (n=173, 69.5%)	VD (n=76, 30.5%)	Total (N=249)
CR Enrolment (%)	141 (97.9%)	48 (96.0%)	189 (97.4%)
CR Participation (%)	135 (97.1%)	45 (93.8%)	180 (96.3%)
CR Wait Times† (mean days ± SD)	38.66 ± 73.30	37.50 ± 32.26	38.31 ± 63.57
CR Program Model† (% supervised)	133 (85.8%)	62 (91.2%)	195 (87.4%)
% Sessions Attended† (mean ± SD)	68.82 ± 34.78	61.86 ± 32.61	66.65 ± 34.18
CR Completion† (%)	104 (68.9%)	37 (54.4%)	141 (64.4%)*
Total CR Barriers (mean ± SD)	1.64 ± 0.76	1.75 ± 0.79	1.67 ± 0.76

CR, Cardiovascular Rehabilitation; CD, Cardiac Disease; VD, Polyvascular Disease; SD, standard deviation;.

*p<.05, **p<.01, ***p<.001

†chart report.

Table 4. Pre-Test Characteristics of Vascular Disease Patients by CR Participation.

Characteristic	CR (n=51, 63.0%)	No CR (n=30, 37.0%)	Total (N=81)
Sociodemographic§			
Age (mean years ± SD)	66.67 ± 10.64	66.53 ± 9.66	**66.58 ± 10.11**
Sex (% Male)	32 (65.3%)	14 (48.3%)	**46 (59.0%)**
Ethnicity (% North American)	19 (47.5%)	4 (18.2%)	**23 (37.1%)**
Marital Status (% married)	29 (72.5%)	19 (82.6%)	**48 (76.2%)**
Education (% Completed college/university or higher)	22 (53.7%)	10 (43.5%)	**32 (50.0%)**
Work status (% currently retired)	22 (53.7%)	13 (56.5%)	**35 (54.7%)**
Risk Factors			
TC (mmol/L)	4.14 ± 1.45	4.24 ± 1.48	**4.18 ± 1.45**
HDL (mmol/L)	1.25 ± 0.43	1.10 ± 0.33	**1.19 ± 0.40**
LDL (mmol/L)	2.08 ± 1.04	2.38 ± 1.31	**2.21 ± 1.16**
Triglycerides (mmol/L)	1.63 ± 1.26	1.62 ± 1.04	**1.63 ± 1.17**
TC/HDL Ratio	3.55 ± 1.59	3.92 ± 1.41	**3.71 ± 1.52**
BMI (kg/m^2)	29.20 ± 4.78	32.74 ± 7.20	**30.59 ± 6.04**
WC (cm)	103.43 ± 11.56	107.97 ± 15.18	**105.28 ± 13.17**
SBP (mmHg)	127.84 ± 18.67	127.55 ± 15.47	**127.49 ± 17.49**
DBP (mmHg)	73.42 ± 10.88	75.52 ± 10.09	**74.16 ± 10.52**
HbA1c (%)	6.61 ± 0.95	6.88 ± 1.24	**6.73 ± 1.08**
Functional Capacity			
METs	6.38 ± 2.53	6.13 ± 2.41	**6.30 ± 2.45**
VO_{2max} (ml/kg/min)	22.33 ± 8.85	21.46 ± 8.44	**22.05 ± 8.59**
DASI§	39.37 ± 13.87	32.84 ± 14.85	**37.64 ± 14.53**
Psychosocial Well-Being§			
Depressive Symptoms	5.37 ± 5.87	4.96 ± 5.09	**5.22 ± 5.48**
Quality of Life	0.86 ± 0.12	0.84 ± 0.08	**0.86 ± 0.11**
Quality of Life (visual scale)	67.42 ± 20.85	76.83 ± 12.34	**70.25 ± 17.81**
Health Behaviours§			
Physical activity	22.90 ± 23.01	12.10 ± 18.05	**18.87 ± 21.46***
Nutrition	3.01 ± 0.55	3.11 ± 0.45	**3.05 ± 0.51**
Medication Adherence	3.54 ± 0.81	3.38 ± 0.71	**3.48 ± 0.77**
Smoking (Current, %)	1 (2.4%)	0 (0.0%)	**1 (1.6%)**

CR, Cardiovascular Rehabilitation; VD, Polyvascular Disease; SD, standard deviation; TC, Total Cholesterol; HDL, High Density Lipoprotein; LDL, Low Density Lipoprotein; BMI, Body Mass Index; WC, Waist Circumference; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; HbA1c, Glycated Haemoglobin; METs, Metabolic Equivalents Tasks; VO_{2max}, Maximal Oxygen Consumption.

§assessed via self-report

*$p<.05$.

Extended Results

Other Objectives

As per the first objective of the thesis, to test whether the relationships observed sustained adjustment, general linear models were computed for the outcomes for which a difference by time was observed in the manuscript (including the trends). A propensity score was computed to adjust for differences in characteristics of CD and vascular disease participants, except for those which were not assessed in all participants (i.e., glycated hemoglobin not applicable to participants without diabetes). The models were adjusted for degree of CR participation, propensity score and pre-CR value. Observed power for the full models ranged from 0.72-1.00, but the power for degree of CR participation (ranging from 0.05-0.16) and for indication (ranging from 0.06-0.20 except for the activity status model which was 0.76) was very low in all models.

As shown in Table 5, all models were significant. With regard to activity status, higher scores at post-test were significantly associated with higher scores at pre-test, and CD indication. This again suggests that vascular disease patients are more complex, and may have unique needs. With regard to depressive symptoms, physical activity and nutrition, scores were significantly associated with pre-test symptoms only. It cannot be determined whether indication or CR participation are significantly related to these outcomes due to insufficient power. Further research is needed.

As per the second objective of the thesis, self-reported confidence with exercise[43] (see Appendix P) and perception of chronic disease care[44] (see Appendix Q) was compared among CD versus other or vascular disease patients post-CR (see Table 6).

Mann-Whitney *U*-tests were performed, and no significant differences were observed in either instance (p=0.32 and p=0.93, respectively).

In summary, overall many of the hypotheses proposed were not supported. With regard to objective one of the thesis, significant improvements in all outcomes were not observed among CR participants. This could be explained by lack of power, or insufficient intensity of the CR programs. With regard to the second objective, we hypothesized that no differences in CR utilization and other similar parameters would be observed by indication. This was mostly supported, except CD patients were significantly more likely to complete CR than vascular disease patients. This could potentially be explained by their greater complexity, and that the programs are designed with the needs of CD patients.

Missing Data

Some data were missing for several reasons. First, because research participation is voluntary, patients always had the option not to complete items that made them feel uncomfortable. For example, activity status (question 12) was notably missing for 11(3.8%) participants. Second, the self-report surveys have gone through several amendments, and therefore all variables were not administered to all patients. For example, the quality of life and depressive moods were not assessed in all patients until 6 months after the program evaluation began. Finally, clinical chart reporting varied across the CR programs, and therefore clinical characteristics were sometimes missing. Fourth, some patients were lost-to-follow-up (i.e., nonresponse). Some patients did not complete

the follow-up survey (n=81, 28.7%). Patients who did not complete the CR program did not have a clinical discharge assessment (n=56, 19.9%).

To minimize missing data, repeated contacts to patients was built into the study protocol. For the purposes of this thesis, missing clinical data was not imputed. We attempted to undertake robust non-parametric statistical approaches. Listwise deletion was used, and therefore in some instances the sample being analyzed was smaller than the total sample size.

Statistical Assumptions

Non-parametric test were applied throughout the thesis, as homogeneity of variance between the CD and vascular disease patients could not be assumed due to unequal sample sizes. Kolmogorov-Smirnov statistic was calculated to determine if the sample were normally distributed, and activity status (D_n=0.125, p<0.001), physical activity (D_n=0.187, p<0.001), nutrition (D_n=0.0.75, p=0.002) and depressive moods (D_n=0.191, p<0.001) were all not normally distributed.

Finally, Cronbach's alpha was calculated to test the internal reliability of the psychometrically-validated scales by CR indication and time point (Table 7). As shown, Cronbach's alpha was considered acceptable for all scales except for the nutrition subscale. This could be due to the small number of items in the subscale (i.e., 6). Thus, caution should be warranted in drawing conclusions in relation to the nutrition behavior of participants in the study.

Extended Discussion

It is reported that 10% of CD patients in Ontario are accessing multiple chronic disease management programs[45]. There also appears to be a lack of communication between CR and various chronic disease management programs patients are receiving care[45]. Moreover, 62.2% of CR programs across Ontario already offer services to patients without CD as a primary referral indication[31]. There is clearly a need for greater 'cross-talk" between ambulatory programs in the province.

The Ontario Vascular Health Coalition formed in 2010, through collaboration of the Heart and Stroke Foundation of Ontario, the Ontario Stroke Network and the Cardiac Care Network of Ontario. They developed a Blueprint for "an integrated, patient-centered, accessible continuum of high quality vascular health services and resources that facilitates and fosters improved vascular health, reduced incidence of vascular disease and reduced consequences of vascular-related diseases for all Ontarians" (http://www.opha.on.ca/Integrated%20Vascular%20Health%20Blueprint%20for%20Ontario_August%202012.pdf). Dr. Sherry Grace serves as chair of their knowledge management work group for the Coalition, and will present these preliminary findings to the steering committee to inform the development of integrated chronic disease management programs in the province.

In conclusion, this thesis has provided information on the profile of vascular disease patients who are being treated in CR programs. While definitive conclusions cannot be drawn from this observational study, results suggest that CD patients are achieving some of the benefits of CR, and vascular disease patients may as well.

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Table 5: General Linear Models Assessing Differences Between Cardiac vs Polyvascular Disease Patient Outcomes at Post-Test*

Outcome	*F*	*P*	η_p^2
Functional Status			
DASI—Model	48.889	<0.001	0.640
Propensity Score	7.667	0.007	
Indication	7.157	0.009	
Pre-test DASI	101.177	<0.001	
Degree of CR Participation	0.377	0.540	
Psychosocial Well-Being			
Depressive Symptoms—Model	26.987	<0.001	0.422
Propensity Score	0.359	0.550	
Indication	1.254	0.266	
Pre-test PHQ	89.406	<0.001	
Degree of CR Participation	0.831	0.363	
Health Behaviors			
Physical Activity—Model	2.615	0.038	0.073
Propensity Score	0.412	0.552	
Indication	0.502	0.480	
Pre-test Godin	7.497	0.007	
Degree of CR Participation	0.000	0.994	
Nutrition—Model	14.061	<0.001	0.284
Propensity Score	1.735	0.190	
Indication	0.086	0.769	
Pre-test HPLP-II	44.818	<0.001	
Degree of CR Participation	0.953	0.331	

DASI, Duke Activity Status Index; CR, Cardiovascular Rehabilitation; PHQ, Patient Health Questionnaire; HPLP, Health Promoting Lifestyle Profile II.

*models adjust for degree of CR participation, sex, as well as pre-CR BMI, VO_2 max, and depressive symptoms through a propensity score.

Table 6: Self-Reported Confidence with Exercise and Perception of Chronic Disease Care among Cardiac versus Other or Polyvascular Disease Patients

	CD (n=127, 74.3%)	VD (n=44, 25.7%)	Total (N=171)
CESEI (mean ± SD)	3.90 ± 0.87	3.73 ± 0.63	3.90 ± 0.83
PACIC (mean ± SD)	2.70 ± 1.10	2.76 ± 1.28	2.75 ± 1.15

CD, Cardiac Disease; VD, Polyvascular Disease; SD, standard deviation; CESEI, Cardiac Exercise Self-Efficacy Instrument; PACIC, Patient Assessment of Chronic Illness Care.

*p<.05, **p<.01, ***p<.001

Table 7: Internal Reliability of Psychometrically-Validated Scales Scored on Likert Scales (Cronbach's α), by sample and time

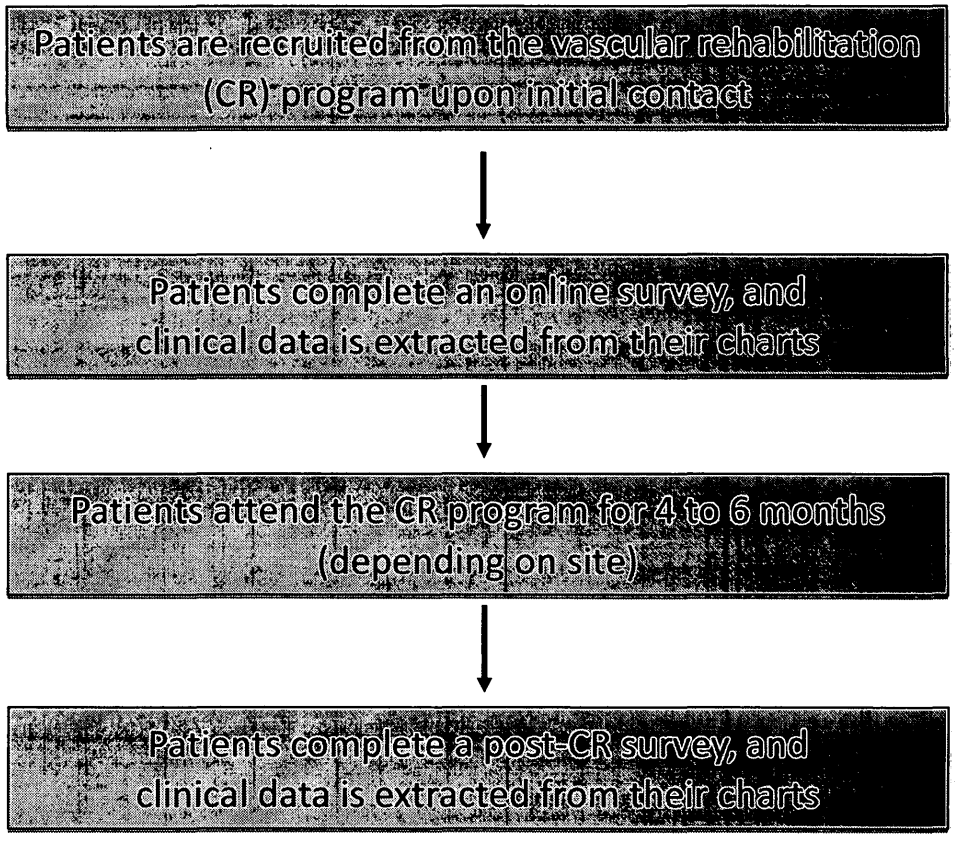
Scale	Pre-test CD	Post-test CD	Pre-test VD	Post-test VD
PHQ-8	0.862	0.852	0.865	0.836
HPLP-II Nutrition Subscale	0.637	0.614	0.553	0.676
CESEI*	-	0.919	-	0.905
PACIC*	-	0.957	-	0.966
CRBS*	-	0.912	-	0.914

CD, Cardiac Disease; VD, Polyvascular Disease; PHQ-8, Patient Health Questionnaire-8; HPLP, Health Promoting Lifestyle Profile II; CESEI, Cardiac Exercise Self-Efficacy Instrument; PACIC, Patient Assessment of Chronic Illness Care; CRBS, Cardiac Rehabilitation Barriers Scale.

*Only administered at post-test.

Appendices

Appendix A: Study Design



Appendix B: Informed Consent Form (York University)

YORK
UNIVERSITÉ
UNIVERSITY

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Study Name: Cardiovascular Rehabilitation – Chronic Disease Management Program Evaluation and Cost-Effectiveness Analysis

Researchers:

Sherry L. Grace, PhD (Principal Investigator)	**York University and University Health Network**
Caroline Chessex, MD (Co-Principal Investigator)	**University Health Network**
Judy Murray, RN	**York Central Hospital, District Stroke Centre**
Paul Oh, MD	**University Health Network, Toronto Rehabilitation Institute**
Tomasz Kowal, BA (MSc Student)	**York University**
Yongyao Tan, MSc, CCRP (Research Associate)	**University Health Network**
Roni Jamnik, PhD	**York University**
Michelle Bedard and Cassandra Collins (MFSc Students)	**York University**

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

You have already agreed to participate in the York University Cardiovascular Rehabilitation (CR) Program. In this research study, we would like to include your information collected in this program for research purposes. We would like to use this information to learn how we can better meet the needs of our clients and to improve the services we provide. We would like to better understand how your quality of life, heart risk factors, knowledge, and health behaviors change following participation in CR. We are also interested in studying the cost-effectiveness of the services we provide to you.

What You Will Be Asked to Do in the Research: As part of our program, you will be asked to complete 4 surveys online: one at the beginning of the cardiovascular rehab program, one 6 months, 12 months and 24 months later. The surveys include questions about your exercise and nutrition habits, medication adherence, quality of life, and mood. These questions help us understand how you are managing your health condition. We also plan to develop a survey 5 years from now. Your completion of all surveys is voluntary. You can provide your email address at the end of this form to receive an email link to the survey.

If you consent to participate in this study, your survey responses would be used for research purposes. We would also like to extract clinical information from your charts (e.g., disease history, other health problems, risk factors, exercise stress test results, cholesterol levels, your medications). Finally, we would also like your permission to link your information gathered from this program with a provincial database to determine your health care use and health outcomes over time. This would not require any paperwork on your behalf.

Potential Benefits and Risks: You may or may not receive any direct benefit from being in this study. Information learned from this study may help other people with your condition in the future.

There are no additional risks to you if you take part in this study. Being in this study may make you feel uncomfortable. You may refuse to answer questions if there is any discomfort.

As a general reminder, email may not always be a secure method of communication. For this study, email is being used for general communication purposes only, and will not be used to collect/provide personal health information. If you take part in this study, please be reminded that personal information will be collected in a de-identified manner through the online survey.

Voluntary Participation: Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence the treatment you may be receiving, nature of the ongoing relationship you may have with the researchers or study staff, nature of your relationship with York University either now, or in the future.

Withdrawal from the Study: You can stop participating in the study at any time, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, York University, or any other group associated with this project. In the event you withdraw from the study, all associated data collected will be immediately destroyed wherever possible.

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

- name,
- email address
- address,
- OHIP number, new or existing medical records, that includes types, dates and results of medical tests or procedures.

The information that is collected for the study will be kept in a locked and secure area by the study doctor for 10 years. Only the study team or the people or groups listed below will be allowed to look at your records.

Representatives of the York University's Ethics Review Board may look at the study records and at your personal health information to check that the information collected for the study is correct and to make sure the study followed proper laws and guidelines.

We are collaborating with some other programs in the province, to study how self-management education varies in different programs. Therefore, parts of the information you provide in your survey may be securely and anonymously shared with the research investigators from this larger study.

Please note that any information that you provide for this study in the online survey, even though de-identified, when transferred to the U.S, is subject to U.S. laws, and in particular, to the U.S. Patriot Act. The US Patriot Act allows authorities access to the records of study participants in the event of auditing by authorities.

All information collected during this study, including your personal health information, will be kept confidential and will not be shared with anyone outside the study unless required by law. You will not be named in any reports, publications, or presentations that may come from this study.

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

Questions About the Research? If you have questions about the research in general or about your role in the study, please feel free to contact the study coordinator, Tomasz Kowal, at tom56@yorku.ca or (416) 736-2100 ext 20575. This research has been reviewed and approved by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Sr. Manager & Policy Advisor for the Office of Research Ethics, 5th Floor, York Research Tower, York University (telephone 416-736-5914 or e-mail ore@yorku.ca).

Legal Rights and Signatures:

I_____, consent to participate in **Cardiovascular Rehabilitation – Chronic Disease Management Program Evaluation and Cost-Effectiveness Analysis** conducted by Dr. Sherry Grace. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Print Study Participant's Full Name	Signature	Date

Person Obtaining Consent	Signature	Date

Please provide your email address to complete your surveys online:

Appendix C: Intake Case Report Form

Study ID#: _____

1. Age ☐ yrs
2. Sex ☐ Male ☐ Female
3. Date Referral Received ☐ dd ☐ mmm ☐ yyyy
4. Date of Intake Appointment ☐ dd ☐ mmm ☐ yyyy
5. Expected date of graduation ☐ dd ☐ mmm ☐ yyyy
6. Referral Indication (check all that apply)
   - ☐ Cardiac
     - ☐ PCI
     - ☐ CABG Surgery and/or Valve surgery
     - ☐ Stable Angina / CAD
     - ☐ MI
     - ☐ HF
     - ☐ Congenital
     - ☐ Arrhythmia
   - ☐ Stroke / TIA
   - ☐ Diabetes
   - ☐ Renal
   - ☐ PVD
   - ☐ Arthritis Clinic
   - ☐ Other, please specify _____
7. Risk Factors

Yes	No	Factor	Details			
☐	☐	Diabetes	Type	☐ Type I	☐ Type II	
			HbA1c%			
			Date assessed			
				dd	mmm	yyyy
☐	☐	Obesity (BMI>30)	BMI (kg/m2)			
			Waist circ (cm)			
			Date assessed			
				dd	mmm	yyyy
☐	☐	Hypertension	Blood Pressure (BP)			
				systolic		diastolic
			Date assessed			
				dd	mmm	yyyy
☐	☐	Dyslipidemia	Total Cholesterol			
			HDL			
			LDL			
			Triglycerides			
			Date assessed			
				dd	mmm	yyyy

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8. Heart rate _____
   Date assessed | | | | (dd mmm yyyy)

9. Waist circumference _____ cm

10. Intake Exercise Stress Test
    Peak METs _____
    Peak VO2 _____

11. Comments re: GXT – symptom-limited?

12. Current Medications (check all that apply):

☐ ACE Inhibitors	☐ Anti-platelets
☐ Anti-coagulants	☐ Beta-blockers
☐ ASA	☐ Digoxin
☐ Ca2+ antagonists	☐ Nitrates (not PRN)
☐ Statin	☐ ARBs
☐ LL – fibrate	☐ Anti-depressant
☐ LL – nicotinic acid	☐ Coumadin
☐ LL – resin drugs	☐ Heparin
☐ Diuretics	☐ HRT
☐ Clopidogrel or ticlopidine	☐ Insulin
☐ Other anti-platelet	☐ Oral hypoglycemic
☐ Nicotine Replacement	☐ Anti-inflammatory
☐ Anti-arrhythmic	☐ Other _____

13. Family Physician _____

    Phone #: _____

[redacted]

Study ID#: _____

1. Patient's First Name:

2. Patient's Last Name:

3. Preferred Salutation:

- ☐ Ms.
- ☐ Mrs.
- ☐ Mr.
- ☐ Dr.

4. Patient's Telephone Number:

(Area code)

5. Patient's Address:

Street Address			
City			
Province	ON	Postal Code	

6. Patient's email address: _____

7. Alternate Contact Information (*if willing*):

Name	
Relationship	
Telephone	

8. OHIP number: _____

Appendix D: Discharge Case Report Form

Study ID#: _____

1. Program elements utilized (check all that apply):
   - ☐ Education session(s)
   - ☐ On-site exercise
   - ☐ Home-based exercise program
   - ☐ Dietitian consult
   - ☐ Smoking cessation referral or consult
   - ☐ Pharmacy consult
   - ☐ Diabetes education referral or consult
   - ☐ Stress management, or psychosocial referral / consult

2. Number of Sessions prescribed: _____

3. Number of sessions completed: _____ or information not available in chart

4. Any untoward events detected during exercise sessions:
   - ☐ Yes, please specify: _____
   - ☐ No
   - ☐ Not documented in chart

5. Did the patient complete the program? Yes No
   If yes: Date of graduation: | | | | (dd mmm yyyy)
   If no, reason indicated in chart?
   - ☐ No
   - ☐ Yes, please specify whether: clinical not clinical

6. Risk Factors

Yes	No	Factor	Details			
☐	☐	Diabetes	Type	☐ Type I	☐ Type II	
			HbA1c%			
			Date assessed			
				dd	mmm	yyyy
☐	☐	Obesity (BMI>30)	BMI (kg/m2)			
			Waist circ (cm)			
			Date assessed			
				dd	mmm	yyyy
☐	☐	Hypertension	Blood Pressure (BP)			
				systolic		diastolic
			Date assessed			
				dd	mmm	yyyy
☐	☐	Dyslipidemia	Total Cholesterol			
			HDL			
			LDL			
			Triglycerides			
			Date assessed			
				dd	mmm	yyyy

Study ID#: _____

7. Heart rate
   Date assessed [ ][ ][ ] dd mmm yyyy

8. Discharge Exercise Stress Test
   a. Completed: No Yes, date: [ ][ ][ ] dd mmm yyyy
   b. Peak METs: _____
   c. Peak VO2: _____

9. Comments re: GXT – symptom-limited?

10. Chart indication discharge report mailed to other healthcare provider(s) involved in patient care?
   - ☐ Yes
   - ☐ No

11. Medications at Discharge (check all that apply):
   - ☐ ACE Inhibitors
   - ☐ Anti-coagulants
   - ☐ ASA
   - ☐ Ca2+ antagonists
   - ☐ Statin
   - ☐ LL – fibrate
   - ☐ LL – nicotinic acid
   - ☐ LL – resin drugs
   - ☐ Diuretics
   - ☐ Clopidogrel or ticlopidine
   - ☐ Other anti-platelet
   - ☐ Nicotine Replacement
   - ☐ Anti-arrhythmic
   - ☐ Anti-platelets
   - ☐ Beta-blockers
   - ☐ Digoxin
   - ☐ Nitrates (not PRN)
   - ☐ ARBs
   - ☐ Anti-depressant
   - ☐ Coumadin
   - ☐ Heparin
   - ☐ HRT
   - ☐ Insulin
   - ☐ Oral hypoglycemic
   - ☐ Anti-inflammatory
   - ☐ Other: _____
   - ☐ Not reported in chart

Appendix E: Initial Survey Demographics

ID#: ___

SECTION A: YOUR SOCIO-DEMOGRAPHIC CHARACTERISTICS

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

   - ☐ North American (e.g., Canadian, American)
   - ☐ French (not French-Canadian)
   - ☐ British Isles (e.g., British, Scottish, Irish)
   - ☐ Western European (e.g., Austrian, Belgian, German, Swiss)
   - ☐ Northern European (e.g., Danish, Finnish)
   - ☐ Eastern European (e.g., Hungarian, Ukrainian, Polish, Czech)
   - ☐ Southern European (e.g., Greek, Italian, Spanish)
   - ☐ Jewish
   - ☐ African
   - ☐ Arab
   - ☐ West Asian (e.g., Afghan, Armenian, Iranian)
   - ☐ South Asian (e.g., East Indian, Punjabi, Pakistani)
   - ☐ East or South East Asian (e.g., Chinese, Filipino, Japanese, Vietnamese, Thai, Laotian)
   - ☐ Oceania (e.g., Australian, New Zealander, Pacific Islanders)
   - ☐ Caribbean
   - ☐ Latin, Central, or South American
   - ☐ Aboriginal (e.g., Métis, Inuit)
   - ☐ Other (specify: _____)

   - ☐ Multiple cultural backgrounds (specify: _____)

2. Please rate how comfortable you are speaking, reading and writing in English:
   - ☐ Not comfortable
   - ☐ I can get by, but am more comfortable using a language other than English
   - ☐ Fairly comfortable
   - ☐ Very comfortable communicating in English

3. What is your marital status:
   - ☐ Married/common-law
   - ☐ Separated/divorced
   - ☐ Single
   - ☐ Widow

4. What is the highest level of education you have completed?
   - ☐ 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

ID#: ____

5. Which option best matches your current work status?
   - ☐ full-time work
   - ☐ part-time work
   - ☐ full-time caregiver or homemaker (inside your home)
   - ☐ unemployed
   - ☐ receiving disability
   - ☐ retired
   - ☐ other: _____

6. Which option best matches your desired work status?
   - ☐ full-time work
   - ☐ part-time work
   - ☐ full-time caregiver or homemaker (inside your home)
   - ☐ unemployed
   - ☐ receiving disability
   - ☐ retired
   - ☐ other: _____

7. What is today's date?
   Day:
   Month:
   Year:

Appendix F: The Duke Activity Status Index

ID#: ___

SECTION B: USUAL ACTIVITIES

Instructions: The following questions have to do with your current activity status. Please circle (Yes) or (No) in response to each question.

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

Appendix G: Godin Leisure Time Exercise Questionnaire

ID#: ____

SECTION C: EXERCISE

1. During a typical 7-Day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number).

	Times per week
a) **STRENUOUS EXERCISE** (HEART BEATS RAPIDLY) (Examples: running, jogging, hard long distance bicycling, cross country skiing, vigorous swimming)	_____
b) **MODERATE EXERCISE** (NOT EXHAUSTING) (Examples: fast walking, easy bicycling, easy swimming, dancing)	_____
c) **MILD EXERCISE** (MINIMAL EFFORT) (Examples: yoga, bowling, golf, easy walking)	_____

2. During a typical 7-Day period (a week), in your leisure time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

OFTEN	SOMETIMES	NEVER/RARELY
1. ☐	2. ☐	3. ☐

Appendix H: Health Promoting Lifestyle Profile II– Nutrition Subscale

ID#: ___

SECTION D: NUTRITION

Instructions: This questionnaire contains statements about your present personal nutrition habits. Please respond to each item as accurately as possible, and try not to skip any item. Indicate the frequency with which you engage in each behavior by circling:

N for never, S for sometimes, O for often, or R for routinely

	Never	Sometimes	Often	Routinely
1. Eat 6-11 servings of bread, cereal, rice and pasta each day.	N	S	O	R
2. Eat 2-4 servings of fruit each day.	N	S	O	R
3. Eat 3-5 servings of vegetables each day.	N	S	O	R
4. Eat 2-3 servings of milk, yogurt or cheese each day.	N	S	O	R
5. Eat only 2-3 servings from the meat, poultry, fish, dried beans, eggs, and nuts group each day.	N	S	O	R
6. Eat breakfast.	N	S	O	R

Appendix I: Morisky's Medication Adherence Scale

ID#: ____

SECTION E: PILL TAKING

Instructions: The following questions have to do with your prescribed medication. Please circle (Yes) or (No) in response to each question.

1. Do you ever forget to take your medication?	Yes	No
2. Are you careless at times about taking your medication?	Yes	No
3. When you feel better do you sometimes stop taking your medication?	Yes	No
4. Sometimes if you feel worse when you take your medicine, do you stop taking it?	Yes	No

Appendix J: Smoking Assessment

ID#: ___

SECTION F: SMOKING STATUS

1. Please describe your smoking status (please check ONE box):
   - ☐ I have never smoked (skip to Section G)

   - ☐ I currently smoke
     a. How many cigarettes per day on average? _____ cigarettes per day
     b. For how many years have you smoked? _____ years
     c. Do you find it difficult not to smoke in situations where you would normally do so?
        ☐ Yes ☐ No
     d. Have you tried to stop smoking but found you could not?
        ☐ Yes ☐ No

   - ☐ I quit smoking
     e. When did you quit? Month _____ year_____
     f. How many cigarettes per day did you smoke on average? _____ cigarettes per day
     g. For how many years did you smoke? _____ years

Appendix K: The Patient Health Questionnaire-8

ID#: ____

SECTION G: YOUR MOOD

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless.	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy.	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down.	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

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

*From the Primary Care Evaluation of Mental Disorders Patient Health Questionnaire (PRIME-MD PHQ). The PHQ was developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues. For research information, contact Dr. Spitzer at rls5@columbia.edu. PRIME-MD® is a trademark of Pfizer Inc. Copyright© 1999 Pfizer Inc. All rights reserved. Reproduced with permission.

Appendix L: The EuroQol-5D Quality of Life Scale

ID#: ____

SECTION H: QUALITY OF LIFE

For each group below, please choose one statement that best describes the state of your general health today. Please check the box (☑) that matches your answer.

A. Mobility
- ☐ I have no problems walking about
- ☐ I have some problems walking about
- ☐ I am confined to bed

B. Self-Care
- ☐ I have no problems with washing or dressing myself
- ☐ I have some problems with washing or dressing myself
- ☐ I am unable to wash or dress myself

C. 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

D. Pain and Discomfort
- ☐ I have no pain or discomfort
- ☐ I have moderate pain or discomfort
- ☐ I have extreme pain or discomfort

E. Anxiety and Depression
- ☐ I am not anxious or depressed
- ☐ I am moderately anxious or depressed
- ☐ I am extremely anxious or depressed

ID#: ____

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

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

Your own health state today

Appendix M: Godin Leisure Time Exercise Questionnaire & Exercise Location

ID#:___

SECTION B: EXERCISE

1. During a typical 7-Day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number).

	Times per week
a) **STRENUOUS EXERCISE** (HEART BEATS RAPIDLY) (Examples: running, jogging, hard long distance bicycling, cross country skiing, vigorous swimming)	_____
b) **MODERATE EXERCISE** (NOT EXHAUSTING) (Examples: fast walking, easy bicycling, easy swimming, dancing)	_____
c) **MILD EXERCISE** (MINIMAL EFFORT) (Examples: yoga, bowling, golf, easy walking)	_____

2. During a typical 7-Day period (a week), in your leisure time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

OFTEN	SOMETIMES	NEVER/RARELY
1. ❑	2. ❑	3. ❑

3. Where did you exercise in the last 4 months (please check one)?

- ❑ At home or in my community ONLY
  - ↳ ❑ I participated in home-based cardiac rehabilitation
- ❑ At supervised cardiac rehabilitation ONLY
- ❑ At home or in my community AND at supervised cardiac rehabilitation
- ❑ At another cardiovascular rehabilitation program. Where? _____
- ❑ I didn't exercise anywhere

Appendix N: Exercise Plans Post CR

ID#:____

SECTION C: EXERCISE AFTER CARDIAC REHAB

1. **Where do you intend to exercise now that your cardiac rehab program is over (please check ☑ all that apply)?**
   - ☐ **At home**
   - ☐ **In my community (example: local gym or community centre)**
   - ☐ **Other, please specify: _____**
   - ☐ **I don't plan to exercise**

2. **If you plan to exercise at home only, have you planned what kind of exercise you are going to do?**
   - ☐ **Yes, please specify: _____**
   - ☐ **No**
   - ☐ **Not applicable**

3. **If you previously have not exercised in a community facility, do you intend to join now that you have finished cardiovascular rehab?**
   - ☐ **Yes**
   - ☐ **No**
   - ☐ **Not applicable**

Appendix O: Health Care Utilization

ID#:___

SECTION I: USING MEDICAL CARE

Instructions:
We would like to know about the health professionals you saw during the last 4 months BECAUSE OF YOUR CARDIOVASCULAR HEALTH. It will be easier to answer if you refer to a calendar or appointment list on which you record your appointments. If you did not keep a record, try to remember if any appointments were on or near special days, such as your birthday, or the day of a social event. Please answer the questions below by entering the number of times in the past 4 months that you have:

	Number of times
1. Seen your family doctor	_____
2. Seen a specialist	_____
3. Gone to the Emergency Department	_____
4. Been admitted to the hospital	_____

5. Have you experienced any of the following heart problems or procedures in the last 4 months? (Please check ☑ all that apply):

- ☐ Heart Attack
- ☐ Angina
- ☐ Angioplasty (stent)
- ☐ Bypass Surgery
- ☐ Valve Surgery
- ☐ Heart Failure
- ☐ Heart transplant
- ☐ Pacemaker or implantable cardioverter defibrillator
- ☐ Stroke
- ☐ Peripheral Vascular Disease
- ☐ Ablation
- ☐ Left ventricular assist device
- ☐ Other, please specify: _____
- ☐ None of the above

6. Have you experienced any of the following diagnostic tests in the last 4 months? (Please check ☑ all that apply):
   - ☐ X-Ray
   - ☐ Electrocardiogram (ECG)
   - ☐ Blood test
   - ☐ Urine test
   - ☐ CT Scan
   - ☐ Echocardiogram
   - ☐ Stress Test
   - ☐ Other, please specify: _____
   - ☐ None of the above

7. How much <u>of your own money</u>, in total, did you pay for these health care visits (eg., transportation, parking, food, lodging), including the money paid by anyone who accompanied you?
   - ☐ None OR enter amount: $_____

8. How much time was associated with these health care visits (include travel, waiting, etc.)?

   _____hours in total

9. How much <u>of your own money</u>, in total, did you pay for your <u>cardiac rehab</u> visits (eg., transportation, parking, food), including the money paid by anyone who accompanied you?
   - ☐ None OR enter amount: $_____

10. How much time was associated with these <u>cardiac rehab</u> visits (include travel, waiting, etc.)?

    _____hours in total

11. In the last 4 months, who <u>USUALLY</u> accompanied you on the visits to cardiac rehab?
    Check (√) all that apply.
    - ☐ Nobody, I usually went by myself
    - ☐ Partner
    - ☐ Son, daughter, or grandchild
    - ☐ Sister, brother, friend, or neighbour
    - ☐ Volunteer
    - ☐ Paid homemaker or caregiver
    - ☐ Other, please specify_____

    11b. This person's age is: _____years.

    11c. This person is: ☐ Male OR ☐ Female

Appendix P: The Cardiac Exercise Self-Efficacy Instrument

ID#:____

SECTION C: CONFIDENCE WITH EXERCISE

How much confidence do you have about doing each of the behaviors listed below? These are not questions about what you are *supposed to do*. They are questions about what you think you *can do*. Circle the letters that show your beliefs.

A Quite a Lot — B — C — D — E Very Little

CONFIDENCE

How much confidence do you have...

Lots ← → Little

A	B	C	D	E	1) "Warming up" before exercise.
A	B	C	D	E	2) Exercising without getting chest pain.
A	B	C	D	E	3) Knowing when I have exercised too much and need to stop.
A	B	C	D	E	4) Exercising when it is inconvenient.
A	B	C	D	E	5) Knowing what my heart rate should be before & after exercise.
A	B	C	D	E	6) "Cooling down" after exercise.
A	B	C	D	E	7) Fitting exercise into a busy day.
A	B	C	D	E	8) Enduring strenuous exercise.
A	B	C	D	E	9) Knowing what exercise is healthy for me.
A	B	C	D	E	10) Knowing when I can increase my exercise level.
A	B	C	D	E	11) Enduring moderate exercise.
A	B	C	D	E	12) Taking my heart rate before and after exercise.
A	B	C	D	E	13) Resuming my pre-hospital level of activity.
A	B	C	D	E	14) Enduring light exercise.
A	B	C	D	E	15) Exercising for at least 30 minutes five days each week.
A	B	C	D	E	16) Exercising at home by myself.

Appendix Q: Patient Assessment of Chronic Illness Care

ID#:___

SECTION J: PERCEPTIONS OF YOUR CARE

Staying healthy can be difficult when you have a chronic condition. We would like to learn about the type of help with your condition you get from your health care team. This might include your regular doctor, his or her nurse, or physician's assistant who treats your illness. Your answers will be kept confidential and will not be shared with your physician or clinic.

Over the past 4 months, when I received care for my heart condition, I was:

	None of the time	A Little of the Time	Some of the Time	Most of the Time	Always
B1. Asked for my ideas when we made a treatment plan	☐1	☐2	☐3	☐4	☐5
B2. Given choices about treatment to think about	☐1	☐2	☐3	☐4	☐5
B3. Asked to talk about any problems with my medicines or their effects	☐1	☐2	☐3	☐4	☐5
B4. Given a written list of things I should do to improve my health	☐1	☐2	☐3	☐4	☐5
B5. Satisfied that my care was well organized	☐1	☐2	☐3	☐4	☐5
B6. Shown how what I did to take care of myself influenced my condition	☐1	☐2	☐3	☐4	☐5
B7. Asked to talk about my goals in caring for my condition	☐1	☐2	☐3	☐4	☐5
B8. Helped to set specific goals to improve my eating or exercise	☐1	☐2	☐3	☐4	☐5
B9. Given a copy of my treatment plan	☐1	☐2	☐3	☐4	☐5
B10. Encouraged to go to a specific group or class to help me cope with my chronic condition	☐1	☐2	☐3	☐4	☐5
B11. Asked questions, either directly or on a survey, about my health habits	☐1	☐2	☐3	☐4	☐5

ID#:____

Over the past 4 months, when I received care for my heart condition, I was:

	None of the time	A Little of the Time	Some of the Time	Most of the Time	Always
B12. Sure that my doctor or nurse thought about my values, beliefs, and traditions when they recommended treatments to me.	☐1	☐2	☐3	☐4	☐5
B13. Helped to make a treatment plan that I could carry out in my daily life.	☐1	☐2	☐3	☐4	☐5
B14. Helped to plan ahead so I could take care of my condition even in hard times.	☐1	☐2	☐3	☐4	☐5
B15. Asked how my chronic condition affects my life.	☐1	☐2	☐3	☐4	☐5
B16. Contacted after a visit to see how things were going.	☐1	☐2	☐3	☐4	☐5
B17. Encouraged to attend programs in the community that could help me.	☐1	☐2	☐3	☐4	☐5
B18. Referred to a dietitian, health educator, or counselor.	☐1	☐2	☐3	☐4	☐5
B19. Told how my visits with other types of doctors, like an eye doctor or other specialist, helped my treatment.	☐1	☐2	☐3	☐4	☐5
B20. Asked how my visits with other doctors were going.	☐1	☐2	☐3	☐4	☐5

Appendix R: Work Status

ID#:___

SECTION K: WORK STATUS

1. Which option best matches your current work status?
   - ☐ full-time work
   - ☐ part-time work
   - ☐ full-time caregiver or homemaker (inside your home)
   - ☐ unemployed
   - ☐ receiving disability
   - ☐ retired
   - ☐ other: _____

2. Which option best matches your desired work status?
   - ☐ full-time work
   - ☐ part-time work
   - ☐ full-time caregiver or homemaker (inside your home)
   - ☐ unemployed
   - ☐ receiving disability
   - ☐ retired
   - ☐ other: _____

3. During the past 4 months, did you have any difficulty working at your paid employment because of your cardiovascular health or its treatment?
   - ☐ I was unemployed or retired during the last 4 months
   - ☐ NO, no difficulty working because of my health
   - ☐ YES, I had difficulty working

   3b. If yes, what was the total time you had difficulty working: _____days and/or _____ hours

   3c. By approximately what percent was your working capacity reduced during this time? _____%

4. Did you need help to do your unpaid work (eg., household chores, caregiving, running errands) in the last 4 months?
   - ☐ Yes
   - ☐ No

   4b. If yes, what was the total amount of time that other people did chores for you in the last 4 months, without pay from you:

   ☐ None OR _____days and/or _____hours

   4c. If yes, what was the total amount of your own money you paid people to do chores for you in the last 4 months:

   ☐ None OR $_____

Appendix S: Assessment of CR Participation

ID#:____

SECTION M: CARDIOVASCULAR REHABILITATION PARTICIPATION

Instructions: Cardiovascular rehabilitation (CR) is an outpatient program of structured exercise and education to maximize your recovery. Please check the appropriate box in response to each question. If your checked answer has an arrow leading to another box, answer the questions in the attached box. Please print any written answers clearly.

1. Did you attend a cardiovascular rehabilitation assessment (intake appointment)?

☐ Yes → (If Yes) 1.Where? _____
2. How many minutes did you take you to travel there one-way? _____ mins

☐ No → (If No) Why not?

2. Did you participate in cardiovascular rehabilitation?

☐ Yes → (If Yes) 1. What type of program did you attend? (please ☑ one answer)
- ☐ Women-only hospital-based
- ☐ Men and women hospital-based
- ☐ Home-based

2. Approximately how many weeks passed between being discharged from hospital, and starting the cardiovascular rehab program? _____ wks

3. Did you consider this to be an acceptable or unacceptable length of time to wait?
- ☐ acceptable
- ☐ unacceptable

Why?

4. Approximately what percentage of vascular rehabilitation sessions did you complete on the phone or at the hospital?
_____ % of sessions completed

☐ No → (If No) Why not? Please be as specific as you can.

Appendix T: Cardiac Rehabilitation Barriers Scale

ID#:____

SECTION N: CARDIOVASCULAR REHABILITATION BARRIERS

The following questions ask about some of the factors influencing your attendance at cardiac rehabilitation sessions. Please answer all of the questions on this page regardless of whether you attended or did not attend a cardiac rehabilitation program.

I did not attend a cardiac rehabilitation program, or if I did attend, I missed some sessions because:	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1. ...of distance (e.g., not located in your area, too far to travel)	☐	☐	☐	☐	☐
2. ...of cost (e.g., parking, gas)	☐	☐	☐	☐	☐
3. ...of transportation problems (e.g., access to car, public transportation)	☐	☐	☐	☐	☐
4. ...of family responsibilities (e.g., caregiving)	☐	☐	☐	☐	☐
5. ...I didn't know about rehab (e.g., doctor didn't tell me about it)	☐	☐	☐	☐	☐
6. ...I don't need rehab (e.g., feel well, heart problem treated, not serious)	☐	☐	☐	☐	☐
7. ...I already exercise at home, or in my community	☐	☐	☐	☐	☐
8. ...severe weather	☐	☐	☐	☐	☐
9. ...I find exercise tiring or painful	☐	☐	☐	☐	☐
10. ...travel (e.g., holidays, business, cottage)	☐	☐	☐	☐	☐
11. ...of time constraints (e.g., too busy, inconvenient class time)	☐	☐	☐	☐	☐
12. ...of work responsibilities	☐	☐	☐	☐	☐
13. ...I don't have the energy	☐	☐	☐	☐	☐
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 I was referred, but the rehab program didn't contact me	☐	☐	☐	☐	☐
20. ...it took too long to get referred and into the program	☐	☐	☐	☐	☐
21. ...I prefer to take care of my health alone, not in a group	☐	☐	☐	☐	☐

22. Other reason (s) for not attending a cardiovascular rehabilitation program:

_____

Shanmugasegaram, S., Gagliese, L., Oh, P., Stewart, D.E., Bristor, S., Chan, V., & Grace, S.L. Psychometric validation of the Cardiac Rehabilitation Barriers Scale.

Appendix U: Survey Non-responder Cover Letter

«Date_of_Discharge_Survey_Replacement»

«Salutation» «First_Name» «Last_Name»
«Street_Address»
«City» «Province» «Postal_Code»

RE: Chronic Disease Management Evaluation Mailed Follow-Up Survey

Dear «Salutation» «Last_Name»:

About four weeks ago I sent a survey to you that asked how you are managing your health. To the best of our knowledge, it's not yet been returned.

The comments of people who have already responded include a wide variety of answers regarding their experiences staying active and eating well along with potential barriers that may have hindered their adherence. We think the information collected from these surveys are going to be very useful to improve secondary prevention programs for patients with chronic conditions.

We are writing again because of the importance that your survey has for helping to get accurate results and feedback. It's only by hearing from nearly everyone from the program that we can be sure that the results are truly representative.

A comment on our survey procedures: a survey identification number is printed on the survey so that we can check your name off of the mailing list when it is returned. The list of names is later destroyed so that individual names can never be connected to the results in any way. Protecting the confidentiality of people's answers is very important to us.

We hope that you will fill out and return the survey soon, but if for any reason you prefer not to answer it, please let us know by returning a note or blank survey in the enclosed stamped envelope.

If you have any questions about the survey or its purpose, please feel free to contact our study coordinator, at (416) 736-2100 ext. 20575.

Sincerely,

D. Grace

Dr. Sherry L. Grace
University Health Network, York University and York Central Hospital

CR-CDM Prog Eval V3. Nov 9, 2011.
Page 1 of 1

Appendix V: Survey Non-responder Telephone Script

Telephone Contact Script for Non-Responders to the Chronic Disease Management Program Evaluation 6 and 12-Month Follow-up Survey

Research Assistant (RA): "Hello my name is [enter name]. I am the study coordinator for our research evaluating the chronic disease management program evaluation. During the last few weeks we have sent you mailings about our program follow-up survey. It includes questions that will help us improve the quality of services. We have not yet received a completed survey from you, so I'm calling to see if you have any questions?"

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

Research Assistant (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: Go through questionnaire, Record responses

If P says "No" – RA: **"Would you like to receive a replacement survey 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 of our mailing list, and this will be the last contact we make with you."**

Thank participant and hang up.