CARDIAC REHABILITATION BARRIERS AMONG UNDER-REPRESENTED GROUPS, AND THE ROLE OF TARGETED PROGRAM MODEL ALLOCATION

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Abstract

Purpose: Despite the well-established benefits of cardiac rehabilitation (CR) and greater need, under-represented populations are less likely to utilize CR compared to their counterparts. To date, there has been limited research to quantify CR barriers in these under-represented groups and there has been lack of research to assess whether barriers differ by program model. This dissertation examined CR utilization and barriers to CR use among rural and urban inhabitants, patients of low socioeconomic status (SES) and high SES, Chinese-Canadian and North American patients, and home-based versus site-based CR.

Method: Cardiac patients from hospitals across Ontario, Canada completed a survey which included the Cardiac Rehabilitation Barriers Scale among other variables for this cross-sectional study.

Results: Findings suggested that rural inhabitants attended significantly fewer CR sessions, and perceived greater CR barriers overall compared to urban inhabitants. These included distance, cost, and transportation problems. In addition, patients of lower SES were less likely to be referred, enroll, and participate in CR, and reported significantly greater barriers to CR compared to their high-SES counterparts. Greater barriers for low-SES patients included severe weather, distance, cost, and transportation problems. Moreover, Chinese-Canadian patients were significantly more likely to be referred to CR compared to North Americans, but there were no significant differences with regard to utilization. Chinese-Canadian patients reported significantly greater CR barriers compared to North Americans, specifically severe weather and transportation problems.

Also, appropriately, home-based CR participants reported greater barriers including distance when compared to site-based participants.

Conclusion: Broader application of proven strategies to promote greater CR enrolment and completion is needed, as well as development of tailored interventions to address the primary barriers identified for these vulnerable subpopulations of patients.

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Review of the Literature

Burden of Cardiovascular Diseases

Cardiovascular diseases (CVDs) are defined as diseases and injuries of the cardiovascular system: the heart, the blood vessels of the heart and the system of blood vessels (veins and arteries) throughout the body and within the brain.[1] CVDs are the leading cause of mortality worldwide with 17.3 million deaths each year.[2] In Canada, 29% of all deaths were due to CVDs.[3] In 2007, 1.3 million Canadians reported having heart disease.[1] CVDs cost the Canadian economy more than $22.2 billion annually in physician services, hospital costs, lost wages, and decreased productivity.[1]

The most common form of heart disease is coronary artery disease (CAD), which refers to blockage in the arteries leading to complications such as angina (chest pain due to lack of oxygen) or myocardial infarction (heart attack due to lack of oxygen). The main cause of CAD is atherosclerosis, which refers to build up of plaque (sticky, yellow substance made of fatty substances such as cholesterol) that narrows and clogs the arteries, which in turn slows the blood flow.[1] CAD and vascular problems such as hardening of the arteries account for most deaths due to CVD. Patients with these diagnoses in particular are likely to benefit from participation in cardiac rehabilitation (CR).

CR

CR is an outpatient, inter-professional, and individualized approach to secondary prevention.[4] The multidisciplinary CR team generally offers exercise training, education,

and counselling for both client and family regarding risk factors, lifestyle modifications, and coping with the disease.[5] There are three main CR program models: 1) co-ed site-based, 2) women-only, and 3) home-based.

After a patient receives referral for CR, he or she is generally scheduled for a clinical assessment, including exercise testing. Following this assessment, patients are prescribed a personalized program of exercise and education based on their needs and clinical status. Typically in Ontario, patients who are enrolled in either the co-ed or women-only site-based CR programs attend at least one supervised exercise class per week for a duration of four to six months, on average.[6] In general, each class consists of a warm-up, aerobic (e.g., walking) and resistance training (e.g., hand-held weights), an interactive education session, and peer-to-peer support. Patients are encouraged to exercise at home during most of the remainder of the week and record their progress using a diary. Educational lectures offer information on long-term lifestyle changes such as stress management, smoking cessation, and heart-healthy dietary habits. Where appropriate, one-on-one sessions are arranged with a psychologist, social worker and/or dietitian for example, depending on the mix of healthcare professionals at each program.

Evidence supports that home-based programs result in benefits similar to onsite co-ed CR programs with regard to morbidity, cardiac risk reduction, and health behaviour modifications,[7] and may even be more cost-effective.[8] Patients who are enrolled in the home-based CR program would try the prescribed exercise program once onsite and then continue the program at home for a duration of six months, on average. Participants send their weekly exercise logs to their supervisor. During a weekly telephone consultation,

the patient's supervisor would monitor his or her progress and provide any necessary feedback. A program workbook provides reading material to assist patients adopt long-term lifestyle modifications. Patients would have access to educational lectures through webcast and could arrange one-on-one sessions with a psychologist, social worker and/or dietitian by telephone or in-person.

Benefits of CR

A recent meta-analysis and systematic review of 47 studies that randomized 10,794 patients to exercise-based CR or usual care, a 13% reduction in all-cause mortality, 26% reduction in cardiovascular mortality, and 31% reduction in hospital admissions were reported in the treatment cohort.[9] Thus, many clinical practice guidelines promote CR as a standard part of the continuum of care.[4] Research also shows that physician-directed, exercise-based CR positively affects the pathophysiology of CAD and the extent of disability and level of quality of life, and reduces both morbidity and mortality.[10] Another review of the literature found that anxiety, stress, depression, social isolation, and quality of life all improve after CR.[11] Participation in CR benefits patients with various cardiac problems including those who have had acute myocardial infarction, have undergone coronary artery bypass graft (CABG) surgery, percutaneous coronary intervention, heart transplantation, heart valve surgery, and patients with heart failure.[10,12]

Under-Utilization of CR

Despite the well-established benefits of CR, it is greatly under-utilized. It is estimated that only approximately 20% to 30% of eligible patients participate in CR.[13,14] A review

of 15 studies from Europe, New Zealand, the United States, and Canada found that this low uptake is an international problem with rates of participation ranging from 13% to 60%, with patient, provider, and health care system factors contributing to the underutilization of CR.[15] An examination of CR referral and participation patterns among 906 patients from the coronary intensive care unit of 12 hospitals in Ontario revealed that only 30% of the patients were referred to CR programs by a physician, and 21.5% attended CR. Furthermore, among the patients who attended CR, only 62.5% reported attending most or all of the CR sessions.[16]

CR Barriers

Patient, provider, and health system-level barriers to CR utilization have been identified.[17] Prominent barriers include physician referral failure, variability by nature of cardiac condition or procedure and resultant perception of need, patient age, sex and socioeconomic status, as well as timing availability of CR sessions and geographic proximity.[17]

Many studies have examined factors related to low CR utilization. The barriers identified in the literature include lack of family or physician support, work conflicts, lack of transportation, distance to the facility, and cost of service. Most of these factors occur at the patient-level. CR participants are more likely to be younger, males, place a high importance on rehabilitation, feel that rehabilitation is necessary, and have attained a higher level of education.[18]

Provider-level barriers to CR have also been identified. In one Canadian study, 74% of patients did not attend CR because it was not recommended to them by a healthcare

provider.[16] Provider-level factors leading to non-referral include skepticism about the benefits of CR, not following clinical guidelines, and a lack of awareness of CR programs or sites.[19-21] Finally, there are barriers to CR at the health system-level. These factors include communication obstacles in the referral process and lack of funding for CR leading to long waiting lists and insufficient capacity.[17] Understanding correlates of long-term physical activity behaviour such as CR staff support and perceived health among CR graduates could help identify individuals at risk for non-adherence.[22]

Assessing CR Barriers

While many barriers to CR utilization have been identified in the literature, to date there have been limited means to assess these in a robust manner. Grace et al. have developed the Cardiac Rehabilitation Barriers Scale (CRBS) which assesses patients' perceptions of patient, provider, and health system-level barriers to CR utilization. The scale was developed following an extensive review of the literature, with feedback from cardiologists and CR staff. It has been administered to three cardiac cohorts. In the first cohort, researchers administered a 19-item version of the scale to 272 cardiac in-patients from two hospitals.[23] In the second cohort, investigators administered the same 19-item version of the scale to 1497 cardiac outpatients of 97 cardiologists.[24,25] The scale discriminated between those who attended CR and those who did not, thus illustrating the criterion validity of the scale.[24] Moreover, analyses revealed differences in CR barriers by sex[24] and age[25] as have been demonstrated in the literature,[15,26,27] thus showing the discriminant ability of the scale. In this study, participants were asked to list additional CR barriers in open-ended fashion. Based on these responses, some CRBS items were

revised. Items such as language barriers and motivation did not have adequate loadings to remain in the scale.

Shanmugasegaram et al. (2012)[28] sought to validate the multi-level Cardiac Rehabilitation Barriers Scale, applicable to both enrollees (participation barriers) and non-enrollees (enrolment barriers) alike. Factor analysis revealed four subscales, namely perceived need/health care factors, logistical factors, work/time conflicts, and comorbidities/functional status. All of the subscales had good internal consistency. CRBS scores were significantly related to enrolment status and degree of CR participation, such that the criterion validity of the CRBS was established. Finally, convergent validity was demonstrated, and three-week test-retest reliability was acceptable. Grace et al. have also developed and validated a Brazilian-Portuguese version of the CRBS (http://www.yorku.ca/sgrace/crbarriersscale.html).[29] Most recently, a Chinese translation of the CRBS was undertaken, but it has not yet been validated.

The availability of the CRBS may enable identification of key barriers for individual patients, in subgroups that are underrepresented in CR, and particular to certain models of health care organization. Ultimately, these barriers may be amenable to modification or intervention, thus potentially increasing CR utilization and facilitating optimal patient recovery and outcomes.

CR Barriers in Under-Represented Groups

Literature suggests that the rates of CR utilization among patients of older age, ethnocultural minorities, low SES, rural inhabitants, and females are consistently and significantly lower compared to their counterparts. Given that these under-represented

populations are at greater risk of suffering from CVD and its long-term consequences, it is necessary to identify and address their unique CR barriers to optimize patient recovery. To date, there has been limited research to quantify their barriers to explain their lower use and potentially to ameliorate utilization rates. Our group has undertaken examination of age and sex differences in CR barriers.[24,25] Thus, this dissertation will focus on barriers by rurality, SES, and Chinese-Canadian ethnocultural background. Second, it will examine whether home-based CR programs that were designed to overcome some of the barriers indeed achieve this goal.

Rurality

The term "rural" refers to the population living in towns and municipalities outside the commuting zone of larger urban centres (i.e., with a population of 10000 or more).[30] In 2001, 6.1 million (20.6%) Canadians were living in "rural and small town" areas.[31] Some researchers use municipal region (e.g., living within a certain metropolitan area) to determine rurality. Other researchers use the census data linking to patients' postal codes to determine rurality status. Our group has used the Cardiac Care Network of Ontario definition of living 30 minutes or greater from emergency care to determine rural living in a healthcare context.[32]

Evidence suggests that rural inhabitants generally have a constellation of factors that put them at greater need for CR. For instance, rural patients are more likely to be smokers, less physically active, and have lower education levels compared to their urban counterparts. Despite their greater need for CR, research suggests that rural inhabitants are less likely to undertake CR compared to their urban counterparts.[33,34] Research

suggests that barriers that are geographic in nature such as CR site location and distribution, distance, transportation access, parking costs, and patient driving status are significant barriers for patients from rural areas.[13,35-37] In addition, other barriers that may influence their CR attendance include quality of roads and harsh weather conditions.[38,39]

Suaya et al. (2007)[13] examined the relationship between geography and CR utilization using a sample of 267,427 outpatients who were either Medicare beneficiaries or over 65 years of age at the time of hospital discharge. They used patients' residence zip codes to determine distance to the closest CR site. They found that patients in the furthest quintile group, with a mean distance of 31.8 miles and ranging from 15 to 231 miles, were 71% less likely to utilize CR.

Research shows that distance and commute times to CR sites are negatively related to participation rates.[13] Brual et al. (2010)[40] examined the relationship between drive time and CR utilization in a sample of acute coronary syndrome (umbrella term used to refer to myocardial infarction and unstable angina) patients. The researchers found that distance/travel time to site-based CR was significantly related to CR referral and enrolment, but not degree of participation in CR. The researchers also found that patients were significantly less likely to be referred and to participate in site-based CR with drive times greater than 60 minutes in duration.

Leung et al. (2010)[41] reviewed the literature published in MEDLINE, CINAHL, and SCOPUS databases assessing the relationship between geographic indicators and CR utilization among coronary heart disease (CHD) patients. The researchers found that

overall, 52.9% of the identified studies reported a significant negative association between geographic indicators and CR utilization. Whether the geographic indicator was objective or subjective did not impact the overall conclusion that the majority of studies supported a significant negative relationship between geographic disadvantage and CR utilization. The authors also noted that the negative relationship was more consistent in studies from North America and Australia and less present in studies from the United Kingdom (UK). According to the authors, the weaker relationship present in the studies from the UK might be due to greater population density and availability of public transit.

Although previous research shows the nature of barriers that rural inhabitants experience, there is lack of data that compare barriers for rural and urban patients using a psychometrically-validated and comprehensive CR barriers scale. This study will quantitatively assess rural patients' barriers to referral, enrolment and participation in CR with a comparison group of urban outpatients.

Socioeconomic Status

Socioeconomic Status (SES) is defined as a hierarchical continuum on the basis of prestige, lifestyle, attitudes, and values, which can define a person's position in society.[42] SES can be assessed using objective and/or subjective indicators. Objective indicators of SES refer to income, education, and work status. Subjective SES is generally assessed via a Likert-type scale where participants are asked to indicate how they would rank their SES compared to others in the same country.

Literature suggests that low objective SES is associated with an increased risk of CHD[43-45] and with greater morbidity and mortality among CHD patients.[46-49] These may

be rooted in the high prevalence of risk factors in this population. A study among Canadian adults found that the prevalence of most CHD risk factors was inversely related to SES, particularly for smoking and overweight.[50] In addition, Canadians in the lowest income bracket were 1.3 times more likely to be physically inactive than those with the highest income.[51] Alter et al.[52] examined the relationship between income or education and cardiovascular risk factors, after adjustment for age, sex, ethnoracial factors, and geography among a cohort of 1635 patients younger than 65 years of age hospitalized with acute myocardial infarction. They found that the prevalence of diabetes, hypertension, smoking, and pre-existing heart disease were higher among poorer, less educated patients, as were the total number of cardiovascular risk factors. Hence, despite universal health care in Canada, significant disparities exist for those of low SES.

Findings from the above-mentioned studies show that patients of low SES have a greater need for CR. Despite this greater need, patients of low SES are less likely to utilize CR. For instance, Suaya et al. (2007)[13] found that patients living in zip codes with the highest median household income in the United States were 23% more likely to participate in CR than those living in zip codes with the lowest median income. Harlan et al. (1995)[53] assessed the major correlates of CR nonparticipation in a sample of 393 patients who underwent CABG. Despite a waiver of direct costs offered to patients who could not afford the program fees, multivariable analysis showed that higher education was an independent correlate of higher participation rate (college graduates were 71% more likely to participate than high school graduates).

Research shows that patients of low SES perceive greater CR barriers compared to their high SES counterparts, possibly due to fewer health benefits such as paid time off work to participate in preventive health programs, parking fees, and transportation issues. Although previous research shows the nature of barriers that patients of low SES perceive, there is lack of data that compare barriers for patients of low SES with their high SES counterparts using a psychometrically-validated and comprehensive CR barriers scale. The current study will compare barriers to enrolment and participation in CR for patients of low SES with high SES patients.

Ethnocultural Background

Ethnicity is defined as the fact or state of belonging to a social group that has a common national or cultural tradition.[54] Research similarly shows that patients of non-white ethnocultural background have low levels of CR participation despite greater need. Limited research on barriers to enrolment and participation among non-white ethnocultural groups suggest that cultural and language barriers are among the most cited reasons for low CR utilization. Mochari et al. (2006)[55] examined whether barriers and referral to participation in CR differ by race or ethnicity in 304 women who were hospitalized for CHD. Ninety-two percent of the participants reported that physician referral was important to participation in CR, but only 22% reported physician instruction to attend. Whites were more likely than non-whites to report instruction to attend CR, whereas non-whites were more likely to report financial barriers compared to their counterparts.

A review of MEDLINE, CINAHL, PubMed, EMBASE, Google Scholar, and PsycINFO literature on CR under-utilization in South Asians showed that lack of physical exercise, language and communication preferences, religious and cultural needs, and program access are the main reasons for CR underutilization.[56] There is lack of research to understand specific barriers to patients from any one particular ethnocultural group. Given that the Chinese-Canadian population is projected to grow from 1.3 million in 2006 to approximately 3.0 million in 2031[30] and the Greater Toronto Area has one of the largest populations of individuals of Chinese ethnocultural background in the country, it is important to identify the barriers that are specific to this group as a start.

Barriers by CR Program Model

While the traditional model of CR care is a site-based program, home-based CR programs have been implemented to overcome geographic barriers related to distance and transportation, as well as time conflicts. However, there has been no investigation of whether home-based CR indeed is related to lower CR barriers such as these when compared to patients participating in site-based CR. This study will examine how barriers differ by program model.

Rationale

Given it is well-established the under-represented groups outlined above, namely rural inhabitants, those of low SES, and ethnic minorities benefit from CR, but are less likely to gain access, this study will quantify the CR barriers among these subgroups. Ultimately, these barriers may be amenable to modification or intervention, thus

potentially increasing CR utilization and facilitating optimal patient recovery and outcomes among under-represented groups.

Objectives

1. To examine degree of, and barriers to, CR enrolment and participation among rural versus urban cardiac outpatients.
2. To investigate barriers to enrolment and participation in CR for those of low versus high SES.
3. To examine barriers to enrolment and participation in home versus site-based CR, and the relation of these barriers to exercise behaviour.
4. To investigate barriers to enrolment and participation in CR for outpatients of Chinese-Canadian versus North American ethnocultural background.

First Research Manuscript Preface: Cardiac Rehabilitation Barriers by Rurality and Socioeconomic Status: A Cross-sectional Study

This study examined barriers to enrolment and participation in CR among rural versus urban patients and patients of low socioeconomic status (SES) versus high SES. Cardiac inpatients from 11 hospitals across Ontario were approached to participate in a larger study (see Appendix A for patient consent form, Appendix B for the case report form, and Appendix C for sociodemographic and medical history questionnaire). Participants completed a sociodemographic survey, which included the MacArthur Scale of Subjective Social Status Ladder (see Appendix D). One year later, they were mailed a survey which assessed CR utilization (see Appendix E) and included the Cardiac Rehabilitation Barriers Scale (see Appendix F). Appendix G presents the ethics approval for this study.

The results of this study are presented in the manuscript which follows. This manuscript has been published online in author format on the *International Journal for Equity in Health* website (http://www.equityhealthj.com/). It was accepted for publication on August 23, 2013.

Certificate of Authentication

Re: Cardiac Rehabilitation Barriers by Rurality and Socioeconomic Status: A Cross-sectional Study

I hereby confirm that the first author of this manuscript, Shamila Shanmugasegaram, was responsible in this study for data collection at one of the hospitals and for contributing to data entry and data cleaning. Shamila was also responsible for all data analyses and write-up of the manuscript. The co-authors are co-investigators on the larger grant who provided minor editorial feedback prior to manuscript submission.

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First Research Manuscript

Cardiac Rehabilitation Barriers by Rurality and Socioeconomic Status: A Cross-sectional Study

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Abstract

Introduction: Despite greater need, rural inhabitants and individuals of low socioeconomic status (SES) are less likely to undertake cardiac rehabilitation (CR). This study examined barriers to enrolment and participation in CR among these under-represented groups.

Method: Cardiac inpatients from 11 hospitals across Ontario were approached to participate in a larger study. Rurality was assessed by asking participants whether they lived within a 30-minute drive-time from the nearest hospital, with those >30 minutes considered "rural." Participants completed a sociodemographic survey, which included the MacArthur Scale of Subjective Social Status. One year later, they were mailed a survey which assessed CR utilization and included the Cardiac Rehabilitation Barriers Scale. In this cross-sectional study, CR utilization and barriers were compared by rurality and SES.

Results: Of the 1809 (80.4%) retained, there were 215 (11.9%) rural participants, and the mean subjective SES was 6.37±1.76/10. The mean CRBS score was 2.03±0.73/5. Rural inhabitants reported attending significantly fewer CR sessions ($p<.05$), and greater CR barriers overall compared to urban inhabitants ($p<.01$). Patients of lower subjective SES were significantly less likely to be referred, enroll, and participate in CR, and reported significantly greater barriers to CR compared to their high SES counterparts ($p<.01$). Prominent barriers for both groups included distance, cost, and transportation problems.

These relationships sustained adjustment, and a significant relationship between having undergone coronary artery bypass graft surgery and lower barriers was also identified.

Conclusions: The results confirm that rural inhabitants and patients of low SES experience greater barriers to CR utilization when compared to their urban, high SES counterparts. It is time to implement known strategies to overcome these barriers, to achieve equitable and greater use of CR.

Abstract word count=274

Keywords: cardiac rehabilitation, rural, socioeconomic status

Despite their greater need for CR, research suggests that rural inhabitants are less likely to undertake CR compared to their urban counterparts.[9] Suaya et al. (2007)[10] examined the relationship between geography and CR utilization in a sample of 267,427 outpatients who were either Medicare beneficiaries or over 65 years of age at the time of hospital discharge. They used patients' residence zip codes to determine distance to the closest CR site, and found that patients in the furthest quintile group, with a mean distance of 31.8 miles, were 71% less likely to utilize CR. Research suggests that barriers that are geographic in nature such as CR site location and distribution, distance, transportation access, parking costs, and patient driving status are significant barriers for patients from rural areas.[9-13] In addition, other barriers that may influence CR utilization among rural patients include quality of roads and harsh weather conditions.[14,15]

Socioeconomic Status

SES is defined as a hierarchical continuum on the basis of prestige, lifestyle, attitudes, and values, which can define a person's position in society.[16] There is literature to suggest that low SES is associated with greater morbidity and mortality among coronary heart disease patients.[17-20] Alter et al.[21] examined the relationship between objective SES indicators (i.e., income and education) and cardiovascular risk factors in Canada, among a fairly-representative cohort of 1635 hospitalized patients with acute myocardial infarction. They found that the prevalence of diabetes, hypertension, smoking, and pre-existing heart disease were higher among poorer, less-educated patients, as were the total

Introduction

Heart disease is one of the leading causes of mortality and morbidity worldwide.[1,2] Patients with heart disease benefit significantly from participation in comprehensive cardiac rehabilitation (CR) programs, and many clinical practice guidelines promote CR as a standard part of the continuum of care.[3] CR is an outpatient approach to the secondary prevention of heart disease, and it is composed of structured exercise, comprehensive education, and counseling. CR reduces mortality by 25% as well as hospital readmissions, interventional procedures and cardiac risk factors, and improves well-being among both men and women.[4,5] Despite the well-established benefits of CR, it is significantly under-utilized.[6] In particular, the rates of CR utilization among rural inhabitants and patients of low socioeconomic status (SES) are low. Given that these under-represented populations are at greater risk of suffering from heart disease and its long-term consequences, this represents another disturbing example of the treatment-risk paradox.[7]

Rurality

The term "rural" refers to the population living in towns and municipalities outside the commuting zone of larger urban centres (i.e., with a population of 10,000 or more).[8] Evidence suggests that rural inhabitants generally have a constellation of risk factors that put them at greater need for CR. For instance, rural patients are more likely to be smokers and less physically active, compared to their urban counterparts.

number of cardiovascular risk factors. This reiterates the need for CR in low SES patients.

Suaya et al. (2007) found that patients living in zip codes with the highest median household income were 23% more likely to participate in CR than those living in zip codes with the lowest median income. Research suggests that barriers to CR participation among patients of low SES include fewer health benefits such as paid time off from work for preventive health programs, program expense and insurance coverage, and transportation issues.[22]

Although the nature of barriers that rural inhabitants and patients of low SES experience have been described previously,[22] to date, there is lack of research that compares barriers among these vulnerable groups with their respective counterparts using a psychometrically-validated and comprehensive CR barriers scale. Moreover, much of the research in this area has stemmed from the United States where cost of CR is a formidable barrier for low SES patients. Ultimately, these barriers may be amenable to modification or intervention,[23,24] thus potentially increasing CR utilization and facilitating optimal patient recovery and outcomes among these under-represented groups. Accordingly, in the current study barriers to CR utilization among rural versus urban patients, as well as patients of low versus high SES were compared in Ontario, Canada where CR services are reimbursed through provincial health care. It was hypothesized that rural patients and those of low SES would report greater barriers to CR utilization.

Method

Design and Procedure

This is a secondary analysis of a larger study called Cardiac Rehabilitation care Continuity through Automatic Referral Evaluation (CRCARE),[25] comparing CR enrolment following different means of referral. Ethics approval was granted from all participating institutions.

In-patients from 11 hospitals in Ontario were recruited. After obtaining consent, clinical data were extracted from medical charts, and a self-report survey was provided to patients for completion. Among other variables, this survey assessed sociodemographic characteristics.

One year later, participants were mailed a follow-up survey assessing CR participation and barriers. CR services were provided through provincial health care at no cost to patients (although patients pay for transportation and / or parking at each visit). The cross-sectional analyses herein were based on this latter cohort of retained participants.

Participants

The inclusion criteria for the larger study were: confirmed acute coronary syndrome diagnosis, and patients who had undergone percutaneous coronary intervention or coronary artery bypass graft surgery, or had heart failure. The exclusion criteria for the larger study were: participation in CR within the past two years, and significant orthopedic, neuromuscular, visual, cognitive and/or any serious mental illness which would preclude CR participation. A total of 2635 stable cardiac inpatients were recruited.

Measures

Self-reported sociodemographic variables measured in the survey administered in-hospital included patient's marital status, ethnocultural background (response options were based on Statistics Canada), education level, family income, and work status. Patients were asked at the time of recruitment whether they lived within a 30-minute drive of a hospital, and were coded as rural if they responded "no."[26]

The MacArthur Scale of Subjective Social Status was administered in the baseline survey.[27] SES can be assessed using objective and/or subjective indicators. Objective indicators of SES refer to income, education, and work status. Often patients are not inclined to self-report their income on a survey. Moreover, patients with cardiac disease may be retired or on disability, which would negatively influence their income, rendering it a poor indicator of SES. Therefore, subjective indicators may offer a more valid approach to ascertaining SES. Subjective SES is generally assessed via a Likert-type scale, where participants are asked to indicate how they would rank their SES compared to others in the same country. On the MacArthur Scale of Subjective Social Status, participants were asked to demarcate their socioeconomic status on a 10-rung ladder compared to others in Canada. Scale scores ranged from 1 to 10, with higher scores indicating greater subjective socioeconomic status. A median split was computed, to categorize participants as high versus low subjective SES.

Sociodemographic data obtained from the medical chart included date of birth and sex. Clinical variables obtained from the chart included body mass index (kg/m^2),

diabetes mellitus, hypertension, dyslipidemia, smoking status, reason for cardiac admission, and comorbidities.

The one-year follow-up survey assessed self-reported CR utilization, through forced-choice response options for referral (yes/no), enrolment (yes/no), and participation (yes/no). Patients were also asked to estimate the percentage of prescribed CR sessions attended (0-100%).

The Cardiac Rehabilitation Barriers Scale (CRBS) assesses patients' perceptions of the degree to which patient, provider, and health system-level barriers affect their CR enrolment and participation.[28] Regardless of CR referral or enrolment, participants were asked to rate their level of agreement with the 21 statements. Items were rated on a 5-point Likert-type scale that ranged from 1 = *strongly disagree* to 5 = *strongly agree*. A mean score was computed, with higher scores indicating greater barriers to patient enrolment or participation in a CR program. The CRBS is demonstrated to be a valid and reliable measure.[28]

Statistical Analyses

SPSS Version 20.0 was used to analyze the data. First, *t*-tests and chi-square analyses were performed to assess differences in sociodemographic and in-hospital clinical characteristics between rural versus urban patients and those of high versus low SES. Second, chi-square tests were performed to test differences in CR referral, enrolment, and participation among these subgroups. *T*-tests were used to assess differences in percentage of prescribed CR sessions attended in each of the subgroups.

To test the objective of the study, a descriptive examination of CR barriers was first performed by subgroup. T-tests were then used to assess whether there were significant differences in total barriers, and for each barrier item by rurality and SES. A Bonferroni correction was applied to control against inflated error due to multiple comparisons for the latter tests, such that a p-value <.002 (.05/21) was considered statistically significant. Finally, a General Linear Model was run to assess whether rurality and SES (independent variables) were still related to total CRBS score (dependent variable), after adjusting for sociodemographic and clinical differences identified through the first tests outlined above.

Results

Respondent Characteristics

The sample for this study comprised 1809 participants (80.4% retention rate) who completed the one-year follow-up survey. Retained participants were significantly more likely to have some postsecondary education and earn family income ≥$50,000CAD annually, and less likely to live in rural areas than ineligible patients. Retained participants were also significantly more likely to be retired compared to patients who declined to participate.[25] Of these participants, 939 (51.9%) participated in CR, at one of 61 sites. The mean CRBS score was 2.03±0.73.

Table 1 displays the sociodemographic and clinical characteristics of the CR participants by rural versus urban residence, and low versus high SES. Rural patients were significantly less often to be male and have coronary artery bypass graft surgery

and/or percutaneous coronary intervention compared to urban patients. Patients of low SES were significantly less often male and married, and more often earned lower income annually compared to patients of high SES. In addition, they were more often smokers, and had diabetes and comorbidities.

Rurality

There were 215 (11.9%) participants considered rural of which 105 (54.7%) were of low SES. Rural patients were significantly more likely to be of low SES compared to urban patients ($p<.01$). The difference of two between the total sample (N=1809) and the sum of rural and urban participants included in the analyses (N=1807) is due to missing data. Two participants did not provide information regarding their rural/urban status. As shown in Table 2, there were no significant differences between rural and urban patients in terms of referral, enrolment, or participation in CR. However, rural inhabitants reported attending a significantly lower percentage of CR sessions compared to urban inhabitants.

As shown in Table 2, rural participants reported significantly greater total CR barriers than their urban counterparts ($t=3.51$, $p<.001$). Rural participants perceived some of their greatest barriers to CR as "I already exercise at home or in my community," "distance," and "cost." Rural participants rated the following barriers significantly greater than urbanites: "distance," "cost," "transportation problems," "severe weather," and "family responsibilities."

Socioeconomic Status

The mean subjective SES score was 6.37±1.76 (median=6.50). The sum of low SES and high SES participants (N=1631) is lower than the total sample (N=1809) because 178 participants did not complete the MacArthur Scale of Subjective Social Status. As shown in Table 2, patients of low subjective SES reported significantly lower referral (χ^2=7.90, p<.01), enrolment (χ^2=11.53, p<.01), and participation in CR (χ^2=5.33, p<.05) than those of high SES. There was no significant difference between patients of low versus high SES in terms of percentage of CR sessions attended.

As shown in Table 3, participants who rated themselves below the median on the subjective SES ladder reported significantly greater total CR barriers compared to those above (t=4.47, p<.001). Patients of low SES perceived some of their greatest barriers to CR as "I already exercise at home or in my community," "distance," "severe weather," and "cost." Barriers that were significantly greater for patients of low SES were "severe weather," "I find exercise tiring or painful," "distance," "cost," "I don't have the energy," "transportation problems," "it took too long to get referred and into the program," "many people with heart problems don't go to CR, and they are fine," "I am too old," "I think I was referred but the rehab program didn't contact me," and "I didn't know about CR" when compared to patients of high SES.

Finally, a univariate analysis of variance with multiple predictors (factors) was run to ascertain whether the association between rurality and SES with CR barriers remained. The model was adjusted for sociodemographic and clinical characteristics that were associated with the CRBS at the bivariate level. Income and education were not

included in the model as they would be confounded with subjective SES. As shown in Table 4, the interaction between rurality and subjective SES was not significant. The significant difference between CR barriers among rural versus urban [$F(1, 846)=4.61$, $p<.05$] and low SES versus high SES [$F(1, 846)=13.45$, $p<.001$] patients sustained adjustment.

Patients who had coronary artery bypass graft surgery also reported significantly lower CR barriers ($1.90\pm.74$ versus $2.12\pm.71$, $p<.001$) compared to those who did not undergo this type of surgery. Given this was a novel finding, post-hoc comparisons of CR barriers among patients who had bypass surgery versus those who did not was performed.

Participants who had bypass surgery rated the following barriers significantly lower than patients who had not: "I didn't know about CR" ($p<.001$), "I don't need CR" ($p<.001$), "I find exercise tiring or painful" ($p<.001$), "time constraints" ($p<.001$), "I don't have the energy" ($p<.001$), "My doctor didn't feel it was necessary" ($p<.001$), "Many people with heart problems don't go to CR and they are fine" ($p<.001$), "I can manage on my own" ($p<.001$), and "I prefer to take care of my health alone not in a group" ($p<.001$).

Discussion

Upon comprehensive assessment of CR barriers in this broad sample of cardiac outpatients, this study confirmed that rural inhabitants and patients of low SES experience significantly greater barriers to CR when compared to their more resourced counterparts. Analyses also demonstrated that bypass patients may experience fewer CR

barriers than patients who have other indications for CR. To our knowledge, this is a novel finding.

Given the burden of risk factors and poor outcomes demonstrated in rural cardiac patients and those of low SES, systematic identification and modification of barriers in these populations is warranted, to optimize their use of proven CR services. Interventions involving motivational communications delivered through letters, telephone calls, and home visits, as well as the use of liaison healthcare providers to support coordination of care, have all been shown to be effective in increasing uptake of CR.[29,30] Moreover, triage to structured and monitored home-based CR programs could enable rural inhabitants to overcome many of their identified barriers such as distance, and low SES patients to overcome many of their barriers such as transportation and cost (although this has not been tested). While these strategies have been known now for well over a decade, there has been a widespread failure to implement them. As pointed out by Valencia et al. in their recent review,[22] when noting that home-based CR has not been widely implemented, this may be due to CR funding models. Similarly, it is likely that resource constraints are to blame for the lack of broad implementation of other known strategies as well.

Most recently, interventions tailored to overcoming identified barriers and improving CR utilization in these *under-served* populations are being empirically tested. For instance, recognizing that healthcare providers should identify under-served populations prior to discharge from the hospital, Meillier et al.[23] have developed a system to screen inpatient's educational attainment as well as social support. They have tested the feasibility of their "social differentiation" approach, and go further to triage identified

patients to an augmented model of CR. Their preliminary results were promising, suggesting high rates of program adherence in both models of care.

The novel finding that bypass surgery patients may experience significantly fewer barriers to CR is consistent with previous research which has shown greater CR utilization in bypass, when compared to percutaneous coronary intervention patients, for instance.[31] Upon reflection on the items which differentiated between the bypass and non-bypass patient barriers, the issue seems to centre on lack of perceived need for CR. This appears to be the case for both patients and providers, although this contention warrants investigation prior to such interpretation. Indeed, from the patient's perspective, those receiving bypass surgery likely do have more severe disease than those undergoing percutaneous intervention. Moreover, there has been less research establishing the benefits of CR post-percutaneous coronary intervention when compared to bypass surgery, however CR is indicated in both instances. Motivational interviewing[24] could be helpful in addressing these non-logistical barriers identified by non-bypass patients, including perceptions that the norm is *not* to attend CR, and that they can manage their disease without the support of a CR program.

Limitations

There are several limitations to this study. First, recall bias may be at play as a result of the amount of time that would have elapsed between healthcare provider interactions where CR may have been discussed, and completion of the one-year follow-up survey when the CRBS was administered. Second, patient-report of CR utilization and perceived healthcare provider and health system-level CR barriers may be biased. Third,

generalizability of the findings are limited by some selection and retention biases in the sample, and to health care systems where CR services are not paid out-of-pocket by patients. Finally, due to the nature of the cross-sectional study design, causal conclusions cannot be drawn.

In conclusion, this study confirmed that rural inhabitants and patients of low SES experience greater barriers to CR compared to their more urban, high SES counterparts. The barriers more strongly-endorsed by rural patients and those of low SES appeared at the patient, provider and health system-levels. Indeed, as raised in the recent review paper by Valencia et al.,[22] remedying these access disparities will accordingly require a multi-level approach. It is time for broader application of proven strategies to promote greater CR enrolment, and to develop and test tailored interventions to address the primary barriers identified for these vulnerable subpopulations of patients.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

SS contributed to writing the paper, initiating the study, designing the study, and analyzing the data. PO contributed to writing the paper. RDR contributed to writing the paper. TM contributed to writing the paper. SLG (the guarantor) and contributed to writing the paper, initiating the study, and monitoring progress.

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Table 1. Sociodemographic and clinical characteristics of participants by rurality and SES

Mean ± SD / n (%)	Rural (n=215)	Urban (n=1592)	Low SES (n=726)	High SES (n=905)	Total (N=1807)
Sociodemographic Characteristics					
Age	65.0±10.5	65.4±10.4	64.9±10.7	65.5±10.1	65.4±10.4
Sex (% men)	147 (68.4)	1208 (75.9)*	524 (72.2)	719 (79.4)**	1357 (75.0)
Ethnicity (% white)	173 (85.2)	1271 (83.2)	580 (82.4)	762 (85.3)	1446 (83.4)
Marital status (% married)	169 (79.0)	1223 (77.6)	517 (72.2)	739 (82.3)***	1392 (77.8)
Education (% ≥ High school)	142 (69.3)	1170 (75.6)	467 (66.1)	731 (83.7)***	1312 (74.8)
Work status (% Retired)	110 (54.2)	793 (51.7)	371 (52.0)	465 (52.1)	905 (52.0)
Annual family income (% ≥$50,000CAD)	72 (44.4)	656 (50.7)	187 (30.9)	511 (66.5)***	730 (50.0)
Clinical Characteristics					
Body mass index	29.5±5.99	29.0±5.35	29.6±6.15*	28.8±4.90	29.0±5.40
Reason for Cardiac Admission					
Coronary artery bypass graft surgery	72 (33.5)	670 (42.4)*	286 (39.7)	385 (42.8)	743 (41.3)
Myocardial infarction	59 (27.4)	442 (28.0)	210 (29.2)	237 (26.3)	502 (28.0)
Percutaneous coronary intervention	59 (27.4)	543 (34.3)*	233 (32.3)	318 (35.3)	602 (33.5)
Heart failure	24 (11.2)	170 (10.7)	88 (12.2)	84 (9.3)	194 (10.8)
Valve (Repair)	5 (31.2)	36 (28.1)	19 (31.1)	13 (20.0)	41 (28.5)
Diabetes mellitus	68 (33.8)	449 (31.1)	235 (35.6)**	234 (28.3)	517 (31.5)
Family history of cardiovascular disease	105 (67.3)	749 (64.4)	344 (65.3)	428 (64.5)	854 (64.7)
Hypertension	139 (70.2)	1100 (74.6)	500 (74.4)	615 (73.4)	1239 (74.1)
Hypercholesterolemia	145 (81.5)	1139 (81.9)	513 (81.6)	657 (82.4)	1284 (81.9)
Smoker	13 (6.2)	98 (6.4)	55 (7.6)*	44 (4.9)	111 (6.4)
Comorbidities	132 (67.0)	982 (68.0)	469 (71.2)*	539 (65.6)	1114 (67.8)

*p<.05; **p<.01; ***p<.001

SD, standard deviation; SES, socioeconomic status; CAD, Canadian dollar

Table 2. Self-reported cardiac rehabilitation referral, enrollment, participation and barriers by rurality and socioeconomic status

	Rural (n=215; 11.9%)	Urban (n=1592; 88.0%)	Low SES (n=726; 40.1%)	High SES (n=905; 50.0%)
CR referral	131 (63.0)	1024 (65.1)	440 (61.4)	606 (68.1)**
CR enrollment	110 (53.1)	867 (56.7)	360 (51.6)	525 (60.2)**
CR participation	100 (47.6)	838 (54.0)	355 (50.3)	497 (56.1)*
% CR sessions completed†	76.2±31.5	83.6±26.6*	81.1±29.5	84.8±24.5
CRBS Total score†	2.24±0.73**	2.00±0.73	2.15±0.76***	1.94±0.68

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

†mean ± standard deviation

SES, socioeconomic status; CR, cardiac rehabilitation; CRBS, cardiac rehabilitation barriers scale

Table 3. Mean cardiac rehabilitation barrier scores (± standard deviation) by rurality and socioeconomic status

Barriers	Rural (n=215; 11.9%)	Urban (n=1592; 88.0%)	Low SES (n=726; 40.1%)	High SES (n=905; 50.0%)	Total (N=1809)
Travel	2.38±1.19	2.29±1.31	2.19±1.18	2.42±1.39	2.31±1.30
I already exercise at home or in my community	3.01±1.37	2.84±1.43	2.91±1.38	2.85±1.45	2.86±1.42
Work responsibilities	2.47±1.35	2.19±1.27	2.27±1.26	2.20±1.31	2.22±1.28
Time constraints	2.41±1.27	2.10±1.21	2.15±1.19	2.15±1.25	2.14±1.22
Severe weather	2.55±1.32*	2.16±1.29	2.38±1.34*	2.05±1.25	2.21±1.30
Other health problems prevent me from going	2.24±1.27	2.11±1.26	2.23±1.29	2.01±1.20	2.13±1.27
I find exercise tiring or painful	2.47±1.34	2.17±1.23	2.33±1.27*	2.08±1.20	2.20±1.25
Distance	2.91±1.49*	2.21±1.38	2.50±1.46*	2.13±1.35	2.30±1.42
Family responsibilities	2.31±1.13*	1.94±1.15	2.10±1.17	1.89±1.13	1.98±1.15
Cost	2.63±1.45*	2.11±1.30	2.38±1.37*	1.98±1.25	2.18±1.33
I don't have the energy	2.38±1.31	2.07±1.18	2.24±1.24*	1.97±1.13	2.11±1.20
Transportation problems	2.48±1.41*	1.96±1.67	2.24±1.26*	1.82±1.12	2.02±1.21
I prefer to take care of my health alone	2.37±1.24	2.11±1.21	2.22±1.19	2.08±1.22	2.14±1.21
It took too long to get referred and into the program	2.21±1.20	1.88±1.07	2.08±1.14*	1.77±0.99	1.92±1.09
I can manage on my own	2.15±1.08	2.03±1.13	2.11±1.12	1.99±1.10	2.05±1.12
I don't need CR	2.22±1.26	2.17±1.27	2.23±1.27	2.12±1.25	2.18±1.27
Many people with heart problems don't go to CR and they are fine	2.14±1.10	1.89±1.02	2.06±1.07*	1.82±0.99	1.92±1.03
My doctor didn't feel it was necessary	2.07±1.08	2.03±1.18	2.13±1.18	1.93±1.13	2.04±1.17
I am too old	1.85±0.96	1.72±0.94	1.86±0.98*	1.63±0.89	1.74±0.95
I think I was referred but the rehab program didn't contact me	2.01±1.14	1.80±1.05	1.97±1.11*	1.70±1.00	1.82±1.06
I didn't know about CR	2.36±1.40	2.13±1.40	2.33±1.44*	1.99±1.34	2.16±1.40

*$p<.002$ for rural versus urban or high versus low SES comparison.
SES, socioeconomic status; CR, cardiac rehabilitation

Table 4. General linear model assessing association with total cardiac rehabilitation barriers (N=854)

Variable	F	df	p
Sex	4.52	1	<.05
Marital Status	2.71	1	.10
CABG	17.11	1	<.001
Comorbidities	1.84	1	.18
Rural	4.61	1	<.05
Subjective SES	13.45	1	<.001
Rural*Subjective SES	2.86	1	.09
Error		846	

CABG, coronary artery bypass graft surgery; SES, socioeconomic status

Second Research Manuscript Preface: A comparison of barriers to use of home versus site-based cardiac rehabilitation

This study examines barriers to participation in CR by program type (site versus home-based), and the relation of these barriers to degree of program participation and exercise behaviour. A sample of 1809 cardiac patients from 11 hospitals across Ontario completed a sociodemographic survey in-hospital, and clinical data were extracted from charts (see Appendix A for the informed consent form, Appendix B for the case report form, and Appendix C for the sociodemographic and medical history questionnaire). They were mailed a follow-up survey one year later, which included the Cardiac Rehabilitation Barriers Scale (see Appendix F) and the Physical Activity Scale for the Elderly (see Appendix H). Participants were also asked whether they attended CR, the type of program model attended, and the percentage of prescribed sessions completed (see Appendix E). Appendix G presents the ethics approval for this study.

This manuscript has been published in the *Journal of Cardiopulmonary Rehabilitation and Prevention* (http://journals.lww.com/jcrjournal/pages/default.aspx). It was accepted on May 10, 2013.

Certificate of Authentication

Re: A comparison of barriers to use of home versus site-based cardiac rehabilitation

I hereby confirm that the first author of this manuscript, Shamila Shanmugasegaram, was responsible for data collection at one of the hospitals in this study, and for contributing to data entry and data cleaning. Shamila was also responsible for all data analyses and write-up of the manuscript. The co-authors are co-investigators on the larger grant who provided minor editorial feedback prior to manuscript submission.

Student Signature: Shamila Date: August 30th 2013

Shamila Shanmugasegaram, PhD (c)

Supervisor Signature: S Grace Date: Aug 30/13

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Second Research Manuscript

A comparison of barriers to use of home versus site-based cardiac rehabilitation

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Structured Abstract

Purpose: Despite the established benefits of cardiac rehabilitation (CR), it remains significantly underutilized. It is unknown whether patient barriers to enrolment and adherence are addressed by offering choice of program type. The purpose of this study was to examine barriers to participation in CR by program type (site versus home-based), and the relation of these barriers to degree of program participation and exercise behaviour.

Method: 1809 cardiac patients from 11 hospitals across Ontario completed a sociodemographic survey in-hospital, and clinical data were extracted from charts. They were mailed a follow-up survey one year later, which included the Cardiac Rehabilitation Barriers Scale and the Physical Activity Scale for the Elderly. Participants were also asked whether they attended CR, the type of program model attended, and the percentage of prescribed sessions completed.

Results: Overall, 939 (51.9%) patients participated in CR, with 96 (10.3%) participating in a home-based program. Home-based participants reported significantly greater CR barriers compared to site-based participants ($p<.001$), including distance. Mean barrier scores were significantly and negatively related to session completion and physical activity among site-based (ps<.05), but not home-based CR participants ($p>.05$).

Conclusion: The barriers to CR are significantly different among patients attending site versus home-based program, suggesting appropriate use of alternative models of care. Patient preferences should be considered when allocating patients to program models.

Once in CR, programs should work towards identifying and tackling barriers among site-based participants.

Abstract word count=231

Condensed Abstract

This cross-sectional study examined barriers to participation in cardiac rehabilitation (CR) in patients attending home versus site-based programs. Home-based CR participants reported significantly greater barriers to CR utilization compared to site-based CR participants, particularly distance. Results suggest that program model allocation is being appropriately undertaken to promote CR use.

Condensed abstract word count= 49

Introduction

The global prevalence of cardiovascular diseases is reaching epidemic proportions.[1] Research shows that exercise-based cardiac rehabilitation (CR) reduces the likelihood of cardiac-related mortality and improves quality of life.[2] Despite the significant benefits of CR, it is greatly under-utilized. It is estimated that only approximately 20% to 30% of eligible patients participate in CR.[3,4]

To address many of the CR barriers such as lack of transportation access and distance to program facilities, home-based CR programs have been developed. Home-based CR programs offer the same core CR components as site-based programs,[5,6] but communication occurs through telephone or internet contact, education occurs through provision of written materials, and exercise is undertaken in the patient community environment. Home-based and site-based programs do not differ in terms of mortality rates, cardiac events, exercise capacity, smoking cessation, or health-related quality of life.[7]

Patients reporting greater barriers to CR use are significantly less likely to enrol, and are more likely to dropout, ultimately not achieving the health benefits of CR.[8] Yet, many patient barriers to CR could be addressed by appropriate allocation to site or home-based programs, although this has yet to be investigated. Thus, the objectives of this study were to: (1) describe and compare barriers to participation, and (2) investigate whether these barriers are related to (a) program adherence (percentage of site or phone CR sessions attended) and (b) exercise behaviour, among patients participating in site versus home-based CR programs.

Method

This is a secondary analysis of a larger study[9] for which cardiac inpatients from 11 hospitals in Ontario, Canada were recruited. CR services were provided through provincial health care at no cost to patients (although patients pay for transportation and / or parking at each visit). Ethics approval was granted from all participating institutions. After obtaining consent, clinical data were extracted from medical charts, and a self-report survey was provided to patients for completion. Among other variables, this survey assessed sociodemographic characteristics.

One year later, participants were mailed a follow-up survey assessing physical activity, CR barriers, and CR use. The cross-sectional analyses herein were based on this latter cohort of retained participants who reported attending CR.

Participants

A total of 2635 (61.8% response rate) stable cardiac inpatients were recruited. The inclusion criteria for the larger study were: confirmed acute coronary syndrome diagnosis, and patients who had undergone percutaneous coronary intervention or coronary artery bypass graft surgery, or had heart failure. The exclusion criteria for the larger study were: participation in CR within the past two years, and significant orthopedic, neuromuscular, visual, cognitive and/or any serious mental illness which would preclude CR participation.

Overall, there were 1809 (80.4%) participants retained in the study who completed the one year follow-up survey. There were some significant differences in the

characteristics of participants retained versus lost-to-follow-up that are reported elsewhere.[9]

Measures

Self-reported sociodemographic variables measured in the initial survey through forced-choice response options included patient marital status and ethnocultural background (response options were based on Statistics Canada). Patients were asked at the time of recruitment whether they lived within a 30-minute drive of a hospital, and were coded as rural if they responded "no." The MacArthur Scale of Subjective Social Status was also administered.[10] Participants were asked to demarcate their socioeconomic status on a 10-rung ladder compared to others in Canada. Scale scores ranged from 1 to 10, with higher scores indicating greater subjective socioeconomic status. Sociodemographic data obtained from the medical chart included date of birth and sex.

Participants were also administered the Duke Activity Status Index in the initial survey.[11] This scale correlates highly with peak oxygen uptake and functional capacity.[11] Clinical variables obtained from the chart included diabetes mellitus, hypertension, and comorbidities.

The one year follow-up survey assessed self-reported CR utilization, through forced-choice response options for participation (yes/no), as well as a patient estimate of percentage of prescribed CR sessions attended. CR program type was assessed by asking participants to report whether they attended a home-based or site-based CR program. The following two psychometrically-validated scales were also administered.

The Physical Activity Scale for the Elderly (PASE) is a valid and reliable 10-item brief questionnaire which measures the level of physical activity in individuals aged 65 years or older. The respondent is asked how many days per week, and how much time was spent in each activity over the past week, graded in four categories.[12]

The Cardiac Rehabilitation Barriers Scale (CRBS) is a valid and reliable measure which assesses patient perceptions of patient, provider, and health system-level barriers to CR enrolment and participation.[8] Participants were asked to rate their level of agreement on each of the 21 statements. Items were rated on a 5-point Likert-type scale that ranged from 1=*strongly disagree* to 5=*strongly agree*. A mean score is computed, and higher scores indicate greater barriers to patient participation in a CR program.

Statistical Analyses

SPSS Version 20.0 was used to analyze the data. Student's *t*-tests and χ^2 analyses were performed as appropriate to compare sociodemographic and clinical characteristics between those who attended home versus site-based CR. To test the first objective, *t*-tests were performed to compare CR barriers between patients reporting participation in home versus site-based CR. Given that multiple tests were being performed to test each individual barrier, a Bonferroni correction of $p<.002$ (.05/21) was applied. To test the second objective, Pearson's correlation was used to assess the associations between total CR barriers with physical activity and with percentage of CR sessions attended, overall and among those who attended home versus site-based CR. Where significant, an examination of the relation to each barrier was undertaken.

Results

Of the 1809 participants, 939 (51.9%) reported enrolling in CR and comprised the sample for this study. Of these, 821 (88.2%) reported attending a site-based CR program and 96 (10.3%) reported attending a home-based CR program. Fourteen (1.5%) patients reported attending a hybrid program that consisted of both site-based and home-based CR, and these patients were excluded from the sample to avoid contamination of the data. Eight (0.9%) patients failed to report the type of program that they attended. Table 1 displays the sociodemographic and clinical characteristics of the CR participants by home versus site-based program use. There were no significant differences in these characteristics between participants enrolled in either program model.

CR Barriers

Table 2 displays the CR barriers in descending order. The highest endorsed barrier among site-based participants was travel, and among home-based participants was already exercising at home or in one's community. Home-based CR participants reported significantly greater barriers overall compared to site-based CR participants. More specifically, home-based CR participants rated the following two barriers significantly higher than site-based CR participants: distance and already exercising in the home or community. The nature of these barriers is such that they are addressed by provision of home-based programs.

CR Barriers in Relation to Program Adherence and Physical Activity

The mean percentage of site CR sessions attended for site-based participants was 83.2±26.5%, and of phone sessions for home-based participants was 82.7±30.6%

(p>.05). The percentage of sessions attended was significantly and negatively related to barriers among site-based participants (r=-0.36, p<.001), but not among home-based participants (r=-.15, p>.05). All of the items were significantly and negatively related to percentage of sessions attended for site-based CR participants (PS<.001) except for "severe weather" (r=-.13, p<.01) and "travel" (r=-.05, p>.05).

The PASE scores suggest that overall, 280 (29.8%) CR participants were meeting physical activity guidelines of 150 minutes of moderate-to-vigorous physical activity per week at one year post-hospitalization. The mean physical activity score was 139.0±88.2 for site-based CR participants, and 165.1±93.7 for home-based participants (p<.05). The total CRBS score was significantly and negatively related to physical activity for site-based (r=-0.11, p<.05), but not home-based CR participants (r=-.12, p>.05). The following items were significantly and negatively related to physical activity for site-based CR participants: "I find exercise tiring or painful" (p<.01) and "I don't have the energy" (p<.01).

Discussion

Although CR barriers were generally low, patients who attended home-based CR programs reported significantly greater barriers to CR utilization compared to those who attended site-based CR. Also, the nature of these barriers such as distance, suggest patients are being appropriately allocated to program model. The finding that program adherence rates were high overall, and the lack of significant difference in program adherence between home and site-based CR, further suggest that patients were highly engaged in CR. Overall, this indicates that programs are using a patient-centered

approach to program model allocation, and that this approach may serve to promote CR program adherence.

However, only approximately 10% of patients participated in home-based CR, and these participants were engaging in significantly more exercise one year post-hospitalization than their site-based counterparts. Many of the CR barriers were significantly related to lower program adherence and exercise behaviour among participants who had attended site-based programs. Indeed, this could be due to lack of integration of the patient exercise routine into the home and community environment. However, the associations between mean total barriers and physical activity for home-based and site-based CR were weak. The lack of significant difference for home-based participants could be due to insufficient power. The findings have important implications in terms of home-based service capacity, and promotion of program adherence and exercise maintenance following site-based programs.

Program Model Allocation and CR Barriers

The results of this study suggest that patient perceptions of their CR barriers are taken into consideration when allocating patients to CR program models. Although several indicators of disease severity were not related to CR model allocation, distance to the program as perceived by patients and having an established routine for exercise in one's home or community setting were taken into consideration. Similar to our findings, an earlier study reported no significant differences between program models in terms of the sociodemographic characteristics of participants.[13] However, contrary to the current findings, they found that patients attending a site-based CR program had lower functional

status compared to their home-based counterparts, suggesting that higher acuity patients were being appropriately allocated to a supervised program.[13] It is worrisome that such differences were not observed in the current sample.

In a randomized controlled trial with four arms (randomization to home or site-based CR or patient preference to home or site-based CR), researchers compared the clinical effectiveness of home-based versus site-based CR after myocardial infarction. First, they found that choice of a model did not significantly affect clinical outcomes.[14] This again highlights the value of considering patient preference in program model allocation. Second, adherence to home-based CR was comparable between the randomized (73%) and preference arms (75%). This suggests that if patients were to be allocated to a home-based program based on low disease severity for instance, it would less likely have a negative impact on their program adherence.

Limitations

Caution is warranted when interpreting these results due to several study limitations. First, the generalizability of the findings is limited by sample selection and retention bias. Second, due to the nature of the cross-sectional study design, causal conclusions cannot be drawn. Third, there was a relatively small sample of home-based CR participants when compared to the site-based sample. The lack of significant relationships between the CRBS and program adherence, as well as exercise behaviour among the home-based CR participants could be due to lack of power. Finally, there are some measurement limitations. CR barriers were assessed one year post-hospitalization, and therefore patient reports could have been affected by recall bias. We did not ascertain

CR program model allocation, reasons for CR program model allocation, or degree of patient participation directly from CR programs. Moreover, degree of program adherence reported by participants may be inflated due to socially-desirable responding. However, this influence would be minimal as literature shows that self-reported and site-verified rates of program participation are highly concordant.[15] In addition, there may be some measurement error related to the appropriateness of some of the CRBS items and hence their interpretation by home when compared to site-based CR participants. Lastly, we failed to ask participants to report the number of CR sessions prescribed. It is likely that home-based participants would have significantly fewer sessions than site-based participants, which may have led to errors in our comparison of program adherence by model. This should be tested more comprehensively in future research.

Conclusions

In summary, home-based CR participants reported greater CR barriers when compared to site-based CR participants. The nature of these barriers can be overcome through home-based CR provision, suggesting they are being appropriately allocated to this alternative model of care. In addition, several barriers and perceptions among site-based CR participants, notably lack of energy, were related to lower program participation and exercise. Given there are several established interventions to promote program adherence and post-program exercise behaviour, perhaps these should be targeted to patients reporting these specific barriers.

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Table 1. Sociodemographic and clinical characteristics of participants by CR program model

	Site-based (n=821; 88.2%) M±SD / n (%)	Home-based (n=96; 10.3%) M±SD / n (%)	Total (N=939[a]) M±SD / n (%)
Sociodemographic Variables			
Age, y	64.3±9.76	63.1±10.2	64.1±9.9
Sex, male	646 (78.7)	72 (75.0)	718 (78.3)
Ethnicity, white	664 (83.5)	78 (84.8)	742 (83.7)
Marital status, married	677 (83.1)	78 (81.2)	755 (82.9)
Education, ≥high school	647 (80.9)	76 (82.6)	723 (81.1)
Work status, retired	385 (48.4)	46 (50.0)	431 (48.5)
Annual family income (≥$50,000CAD)	393 (59.5)	49 (61.3)	442 (59.7)
MacArthur Scale of Subjective Social Status[**]	6.50±1.70	6.46±1.83	6.50±1.70
Rural (yes)[***]	124 (15.1)	22 (22.9)	146 (15.9)
Clinical Variables			
Primary reason for cardiac admission			
Coronary artery bypass graft surgery	417 (50.9)	57 (59.4)	474 (51.8)
Myocardial infarction	281 (34.4)	34 (35.4)	315 (34.5)
Percutaneous coronary intervention	226 (27.6)	23 (24.0)	249 (27.2)
Heart failure	76 (9.3)	6 (6.2)	82 (9.0)
Valve (repair)	20 (25.6)	0 (0)	20 (24.4)
Risk factors			
Body mass index	29.0±5.26	28.8±4.42	29.0±5.13
Diabetes mellitus	220 (29.1)	27 (29.3)	247 (29.2)
Family history of cardiovascular disease	405 (64.0)	56 (70.0)	461 (64.7)
Hypertension	546 (72.0)	63 (69.2)	609 (71.7)
Hypercholesterolemia	583 (81.1)	76 (87.4)	659 (81.8)

Current smoking	44 (5.5)	1 (1.1)	45 (5.1)
Other			
Physical Activity Scale for the Elderly***	139.0±88.2	165.1±93.7	142.2±89.8
Duke Activity Status Index****	27.1±17.1	28.6±18.7	27.2±17.2
Comorbidities	484 (65.5)	60 (67.4)	544 (65.7)

[a]All participants who reported enrolling in CR are shown here.

*Scale scores ranged from 1 to 10, with higher scores indicating greater subjective socioeconomic status.

**Patients were asked at the time of recruitment whether they lived within a 30-minute drive of a hospital, and were coded as rural if they responded "no."

***The Physical Activity Scale for the Elderly is a valid and reliable 10-item brief questionnaire which measures the level of physical activity in individuals aged 65 years or older. The respondent is asked how many days per week, and how much time was spent in each activity over the past week, graded in four categories.

****The Duke Activity Status Index measures a patient's functional capacity. It can be used to get an estimate of a patient's peak oxygen uptake.

Table 2. Mean Cardiac Rehabilitation Barriers Scale scores by program model

Barriers	Site-based (n=821; 88.2%) M±SD	Home-based (n=96; 10.3%) M±SD	Total[b] (N=917) M±SD
Travel	2.44±1.45	2.32±1.37	2.41±1.44
I already exercise at home or in my community	2.25±1.36	3.07±1.56	2.34±1.40[a]
Work responsibilities	2.18±1.37	2.28±1.34	2.17±1.36
Severe weather	2.03±1.32	2.54±1.48	2.10±1.34
Time constraints	2.03±1.28	2.14±1.25	2.04±1.27
Other health problems prevent me from going	1.95±1.29	1.94±1.09	1.95±1.27
Distance	1.85±1.21	2.81±1.59	1.95±1.29[a]
I find exercise tiring or painful	1.89±1.18	2.01±1.14	1.91±1.18
Cost	1.81±1.17	2.56±1.46	1.89±1.23[a]
I don't have the energy	1.80±1.11	2.13±1.13	1.84±1.12
Family responsibilities	1.82±1.14	1.97±1.08	1.83±1.13
Transportation problems	1.72±1.08	2.39±1.47	1.78±1.13[a]
I prefer to take care of my health alone	1.67±.98	1.97±1.13	1.70±1.00
It took too long to get referred and into the program	1.60±.96	1.92±1.14	1.64±.99
I can manage on my own	1.58±.89	1.71±.86	1.59±.89
I don't need CR	1.58±.97	1.75±1.03	1.59±.97
Many people with heart problems don't go to CR and they are fine	1.53±.81	1.70±.95	1.55±.82
My doctor didn't feel it was necessary	1.48±.84	1.72±.91	1.50±.84
I am too old	1.47±.79	1.72±.89	1.49±.79
I think I was referred but the rehab program didn't contact me	1.47±.84	1.68±.96	1.49±.85
I didn't know about CR	1.44±.85	1.72±1.05	1.47±.87
Total	1.72±.65	2.05±.70	1.75±.66[a]

[a] $p<.002$ (differences in barriers between site-based and home-based CR participants).
[b] Total number of participants who reported attending 1 type of program model.

Exploratory Analysis

A comparison of cardiac rehabilitation barriers in North American and Chinese-Canadian outpatients

Abstract

Introduction: Limited research suggests that visible minority groups are less likely to utilize cardiac rehabilitation (CR). The objectives of this study were to: (1) compare CR utilization among outpatients of Chinese-Canadian versus North American ethnocultural background, (2) assess sociodemographic, cultural, and clinical correlates of CR utilization in Chinese-Canadian patients, and (3) compare barriers to enrolment and participation in CR between the two groups.

Method: Participants for this cross-sectional study consisted of cardiac patients from one hospital and two outpatient clinics of a Chinese-Canadian cardiologist in Ontario, Canada. All three sites used a standard (usual) referral to CR at the discretion of a healthcare provider. Participants completed a survey, which assessed ethnocultural background, CR utilization, and CR barriers using the Cardiac Rehabilitation Barriers Scale (CRBS).

Results: Chinese-Canadian patients (n=56) were significantly more likely to be referred to CR compared to North Americans (n=23; 45.1% versus n=43; 28.9%, $p<.05$). There were no significant differences with regard to utilization (ps>.05). Chinese-Canadian patients reported significantly greater CR barriers compared to North Americans (2.69±0.65 versus 2.27±0.63, $p<.01$), specifically with regard to: "severe weather," and

"transportation problems." Chinese-Canadian patients who enrolled in CR had significantly higher body mass index (28.8±0.87 versus 24.7±2.67, $p<.05$) than those who did not, but no other cultural or sociodemographic differences were observed.

Conclusions: The greater referral of Chinese-Canadian patients may be the result of a Hawthorne effect. However, Chinese-Canadians perceived greater barriers to CR use. These findings highlight the need to address barriers to CR among this growing visible minority group in Canada, through delivery of culturally-tailored programs.

Abstract word count=257

Keywords: cardiac rehabilitation, ethnic group, barriers

Introduction

Non-communicable diseases are the leading cause of mortality globally, accounting for approximately 36 million deaths annually.[1] Cardiovascular diseases (CVDs) are the greatest contributor to this burden of mortality, with 17.3 million deaths each year.[1] In Canada, CVDs are one of the leading causes of mortality, accounting for 29% of all deaths.[2] In China, CVDs are the leading cause of death for both men and women.[3] Moreover, the Chinese population is the second largest visible minority group in Canada, and is projected to grow from 1.3 million in 2006 to approximately 3.0 million in 2031.[4] The stresses of acculturation and exposure to obesogenic environments in the developed world may have further negative effects on the cardiovascular health of Chinese-Canadians. Thus, access to secondary prevention programs such as cardiac rehabilitation (CR) may be particularly important for this population.

CR is an outpatient disease management program, which through interprofessional healthcare delivery, offers an individualized approach to secondary prevention.[5] The programs offer medical assessment, exercise training, education, and counseling for both client and family regarding risk factors, lifestyle modifications, cardioprotective therapies, and coping with the disease.[6] Research shows that CR reduces mortality by 25% and improves functional capacity, among other benefits.[7] Despite this evidence, CR is greatly under-utilized, with only approximately 20% to 30% of eligible patients participating.[8,9]

The limited research on CR utilization and ethnicity, defined as the fact or state of belonging to a social group that has a common national or cultural tradition[10] shows that

patients of non-white ethnocultural background have even lower levels of CR participation, often despite greater need.[11] For instance, a Canadian study showed that CR attendance rates were lower in Chinese (18%) and South Asians (21%) compared with Europeans (31%).[12]

The mainly qualitative research on reasons for under-utilization in patients of non-white ethnocultural background suggest that cultural and language barriers are primarily to blame.[13] There is also some preliminary research on CR in China,[14] however these services are not widely available there.

This was the first study to our knowledge which aimed to comprehensively assess multi-level barriers to CR use among immigrant Chinese-Canadians. The objectives of this study were to: (1) compare CR utilization among outpatients of Chinese-Canadian versus North American ethnocultural background, (2) sociodemographic, cultural, and clinical correlates of CR utilization in Chinese-Canadian patients, and (3) barriers to enrolment and participation in CR between the two groups.

Method

Design and Procedure

This sub-study was cross-sectional in design. Ethics approval was granted from all participating institutions.

As part of a larger study comparing CR enrolment following different means of referral, 2635 (61.8% response rate) cardiac in-patients from 11 hospitals in Ontario, Canada were recruited.[15] Of these, 154 patients (1 Chinese-Canadian and 153 North Americans) from a hospital which used standard (usual) referral to CR at the discretion of

a healthcare provider were included in this sub-study. CR services were provided through provincial health care at no cost to patients.

After obtaining consent, clinical data were extracted from medical charts, and a self-report survey was provided to patients for completion. Among other variables, this survey assessed sociodemographic characteristics such as ethnocultural background. One year later, participants were mailed a follow-up survey assessing CR utilization and CR barriers.

Similarly, 55 cardiac outpatients of Chinese-Canadian ethnocultural background were recruited from two clinics in the Greater Toronto Area of Ontario, Canada. One clinic was situated in an academic health sciences centre, and the other in a Chinese community setting, with health services provided by a cardiologist of Chinese ethnocultural background. This cardiologist identified patients of Chinese ethnocultural background by their surname and this was further verified by a self-report question on ethnocultural background in the survey. The patients were asked to complete a slightly revised version of the one-year follow-up survey administered in the larger study as described above. Patients were approached in-person at the clinic in a private area to complete the survey, or alternatively clinic staff contacted the patients via phone and mailed the survey to interested individuals.

The participants in the sub-study had the option of completing the survey in either English or traditional Chinese character. For the Chinese version of the survey, an adapted World Health Organization process for translation and adaptation of the psychometrically-validated English version was undertaken including forward translation

by professionals, as well as review and cultural adaptation by bilingual experts. The same clinical variables as above were extracted from participants' medical charts.

Participants

Participants consisted of cardiac patients self-reporting to be of Chinese or North American ethnocultural background. The inclusion criteria for the larger study were the following: confirmed acute coronary syndrome diagnosis, and patients who had undergone percutaneous coronary intervention or coronary artery bypass graft surgery, or had heart failure.

The exclusion criteria for the larger study were the following: participation in CR within the past two years, and significant orthopedic, neuromuscular, visual, cognitive or serious mental illness which would preclude CR participation. Exclusion criterion for this sub-study was receiving acute care on a cardiac unit or at an outpatient clinic with a pre-specified CR referral strategy. There were two wards where recruitment was undertaken for the larger study where no CR referral strategy was in place.

Measures

Self-reported sociodemographic variables measured through forced-choice response options included patient's ethnocultural background, family income, and work status. The former was the main independent variable, and consisted of 19 response options based on Statistics Canada assessment. Participants were selected where they indicated their ethnocultural background as North American (i.e., Canadian, American) or East Asian (i.e., Chinese). The MacArthur Scale of Subjective Social Status was also administered. Participants were asked to demarcate their socioeconomic status on a 10-

rung ladder compared to others in Canada.[16] Scale scores ranged from 1 to 10, with higher scores indicating greater subjective socioeconomic status.

The survey administered at the two outpatient clinics also included cultural assessment. First, participants were asked to rate their level of proficiency (read, write, speak, and understand) in English and/or Mandarin/Cantonese on a scale from 1 = *not at all* to 5 = *very well.* A mean score was computed for each language. They were also asked how many years they lived in Canada, their primary language of communication at home, perceived fluency in English, whether they received any heart health information in a Chinese language, and ever used an interpreter during a healthcare visit. They were also asked to indicate whether they would attend CR if offered in English (yes/no).

The Multigroup Ethnic Identity Measure (MEIM)[17] was also included in the survey given to participants from the two outpatient clinics. The MEIM consists of 14 items that assess three aspects of ethnic identity: 1) positive ethnic attitudes and sense of belonging (five items), 2) ethnic identity achievement including exploration and resolution of identity issues (seven items), and 3) ethnic behaviours or practices (two items), which include involvement in social activities with members of one's group and participation in cultural traditions. In addition to the MEIM, six questions were included in the current survey to assess other-group orientation. Total ethnicity score consisted of the mean of 14 items (11 items from the MEIM and three from the additional questions). Items were rated on a 4-point Likert-type scale that ranged from 1= *strongly disagree* to 4 = *strongly agree.* Scores were derived by reversing negatively worded items, summing across items, followed by calculation of the mean. Higher scores indicate greater ethnic

identity. When responses were missing for items, scores were calculated based on non-missing items.

Clinical variables obtained from the medical chart included risk factors, disease severity indicators, and comorbidities. Participants were administered the Duke Activity Status Index in the survey.[18] This scale correlates highly with peak oxygen consumption and functional capacity.[18]

The survey assessed self-reported CR utilization, through forced-choice response options for referral (yes/no), enrolment (yes/no), participation (yes/no), as well as a patient's estimate of percentage of prescribed CR sessions attended. They were asked to indicate the type of healthcare provider who referred them to CR, the perception of the strength of their healthcare provider's endorsement of CR on a scale from 1 = *not at all strongly* to 5 = *very strongly*, and the place from which they were referred to CR. CR program type was assessed by asking participants to report whether they attended a home-based or site-based CR program.

The Cardiac Rehabilitation Barriers Scale (CRBS) is a valid and reliable measure which assesses patients' perceptions of patient, provider, and health system-level barriers to CR enrolment and degree of participation.[19] Regardless of CR referral or enrolment, participants were asked to rate their level of agreement with each of the 21 statements (see Appendix I for Chinese Version of the CRBS). Items were rated on a 5-point Likert-type scale that ranged from 1 = *strongly disagree* to 5 = *strongly agree*. A mean score is computed, and higher scores indicate greater barriers to patient enrolment or participation in a CR program.

Statistical Analyses

SPSS Version 20.0 was used to undertake all analyses.[20] To test the first objective, Student's *t*-tests and chi-square analyses were performed to describe and compare the sociodemographic and clinical characteristics of the Chinese-Canadian and North American patients. Chi-square analyses were performed to compare rates of CR referral, enrolment, and participation by ethnocultural background. *T*-tests were used to assess differences in percentage of prescribed CR sessions attended by ethnocultural group.

To test the second objective, only Chinese-Canadian patients were selected, and sociodemographic, cultural, and clinical characteristics among CR enrollees and CR non-enrollees were compared using chi-square or t-tests, as appropriate.

To test the final objective, t-tests were performed to assess differences in individual CR barriers between the ethnocultural groups. Given that multiple tests were being performed, a Bonferroni correction of $p<.002$ (.05/21) was applied.

Results

Respondent Characteristics

For the larger study, 1809 participants (80.4% retention rate) completed the one-year follow-up survey. There were some significant differences in the characteristics of participants retained versus those lost to follow-up that are reported elsewhere.[15] Of the retained participants, 154 (8.51%) were not treated on a unit with a pre-specified CR referral strategy. Of these, 1 (0.65%) was of Chinese-Canadian ethnocultural background and 153 (99.4%) were of North American ethnocultural background.

Fifty-five Chinese-Canadian patients were recruited through the outpatient clinics. Of these, 49 (89.1%) patients completed the survey in traditional Chinese character. Thus, a total of 56 Chinese-Canadian patients were included in the analyses herein.

Table 1 shows the sociodemographic and clinical characteristics of patients by ethnocultural background. Chinese-Canadian patients were significantly more likely to be older, earn high income, and report a lower score on the subjective SES compared to North Americans. Chinese-Canadian patients were more likely to have lower functional status (Duke Activity Status Index) and body mass index compared to their North American counterparts. Chinese-Canadian patients were more likely to have undergone coronary artery bypass graft surgery, myocardial infarction, but less likely to have undergone percutaneous coronary intervention compared to North Americans. Moreover, Chinese-Canadian patients were less likely to have a family history of cardiovascular disease, hypercholesterolemia, and to be a current or former smoker compared to their counterparts.

As shown in Table 2, Chinese-Canadian patients reported living in Canada for approximately 22 years, on average. They reported being more fluent in Chinese than English, and had fairly high scores on ethnic identity. Almost all patients communicated in a non-English language at home. Approximately 50% reported receiving heart health information in Chinese, and 43% reported using an interpreter during a healthcare visit. Eighty-one percent of Chinese-Canadian patients reported that they would attend CR if it was offered in Chinese.

CR Utilization

With regard to objective 1, Table 1 also displays rates of CR referral, enrolment, participation, and percentage of CR sessions completed in Chinese-Canadian and North American patients. As shown, Chinese-Canadian patients had significantly greater CR referral compared to North Americans. There were no significant differences between the groups with regard to CR enrolment, participation, and degree of CR participation.

Descriptive analyses of only the Chinese-Canadian sample showed that of the 14 (31.8%) patients who enrolled in CR, half were referred by their family doctor (n=6, 50.0%), with others reporting being referred by their cardiologist (n=5, 41.7%) or another healthcare provider (n=1, 8.3%). The mean perceived endorsement of CR by their healthcare provider was 3.42±0.90/5. Seven (63.6%) patients were referred to CR from a physician's office, 2 (18.2%) from an inpatient unit, and 2 (18.2%) from a cardiac diagnosis/intervention unit. Eight (80.0%) patients participated in a site-based CR program. None of the patients reported a reason why they were not referred to CR. The rate of CR enrolment for Chinese-Canadians was 22.9%, and the rate of program adherence was 88.1%.

With regard to objective 2, there were almost no significant differences in the sociodemographic, cultural, and clinical characteristics of the Chinese-Canadians who enrolled in CR versus those who did not. The only difference was in body mass index, suggesting that Chinese-Canadian CR enrollees had a higher body mass index compared to non-enrollees. However, this was only reported for 16 patients, and thus caution is warranted in interpreting this finding.

CR Barriers

With regard to objective 3, as demonstrated in Table 1, Chinese-Canadian patients reported significantly greater total CR barriers than North American patients. As shown in Table 3, Chinese-Canadian patients endorsed the following barriers significantly greater than North American patients: "severe weather," and "transportation problems."

Overall, 2 (6.67%) Chinese-Canadian patients reported ancillary barriers to enrolling in CR in open-ended fashion in the space provided. Those who participated in CR reported "do own exercise" and "joint problem" as barriers. Those who did not participate in CR reported "do it later attitude," "haven't completely assessed that I have heart problems," and "I was not referred" as barriers.

Discussion

In this small sample of Chinese-Canadian cardiac patients, we demonstrated significantly higher CR referral rates compared to North Americans. There were no significant differences with regard to utilization. Chinese-Canadian patients reported significantly greater CR barriers compared to North Americans, specifically severe weather and transportation problems. The difference in referral rate result should be interpreted with great caution as almost the entire Chinese-Canadian sample was recruited from a cardiologist's practice. Also, a Hawthorne effect might be at play due to lack of blinding. In addition, this association was not adjusted for the myriad of differences in sociodemographic and clinical differences between the Chinese-Canadian and North American samples. However, most patients reported being referred by their family doctor, not cardiologist. At the least, this finding suggests that it is possible to achieve

rates of CR referral and use in this ethnocultural minority group that are comparable to North Americans, including a high degree of program adherence in attendees. Moreover, these findings point to the potential major differences in the clinical presentation of Chinese-Canadian cardiac patients as well as in their sociodemographic profile; differences which should be taken into consideration at CR programs to ensure they are meeting the needs of these patients.

Surprisingly, their CR utilization did not appear to be related to any sociodemographic characteristics besides their ethnocultural background, or to any cultural factors such as years in Canada or language proficiency. However, again this could be due to the small sample size, such that there is insufficient power to detect differences. However, Chinese-Canadians did report significantly greater barriers to CR use than their North American counterparts. In particular, they were more likely to perceive that transportation problems mitigated their ability to attend, and also perceived that the weather imposed a barrier to attending. Transportation problems are often noted by cardiac outpatients with lower SES,[21] which could explain this issue. It could also be related to the fact that their English proficiency is limited, leading to challenges reading public transportation signs and directions. It is unknown why Chinese-Canadians would perceive weather to be a greater barrier than North Americans. In discussion with our Chinese-Canadian co-investigators, it was suggested that there is a greater dislike of precipitation and snow in the Chinese culture than here in North America. Future research would be needed to confirm this hypothesis.

There has only been one previous study on CR use in Chinese patients to our knowledge, but ours is still the first among Chinese immigrants. A prospective study from Hong Kong assessed CR use in a sample of patients diagnosed with acute coronary syndrome.[14] Unfortunately, only education session attendance was recorded as the authors noted that patients were more likely to attend at least the education session which was offered prior to the exercise session. The authors observed that patients were less likely to stay for the exercise session due to reasons such as time and lack of energy to do both sessions on the same day. Of the 145 (79.7% retention rate) patients who provided data during the six-month follow-up, results showed that 25% attended at least one CR session and of these, only 7.5% completed the seven-week CR program. The rate of CR enrolment was fairly similar to the rate observed in our study for Chinese-Canadians. However, the rate of program adherence seems much lower than what was observed in North America and in our study of Chinese in Canada. These differences are likely due to cultural and health system differences (e.g., differences in programs), and warrant future study.

In general, it is recommended to have 10 times as many participants as variables to perform factor analysis.[22] In addition, a sample size of 100 is considered poor for factor analysis, whereas a sample size of 300 is regarded as good.[23] Given that only 49 Chinese-Canadian participants completed the Chinese version of the CRBS, we did not meet the sample size requirement of at least 210 participants to perform factor analysis and validate this scale. The CRBS has been translated and validated in Brazilian-

Portuguese, and comparison in barriers between Canadians and Brazilian-Portuguese has been undertaken. A group is currently working on a Spanish version.[24,25]

Clinical and Policy Implications

Given their modifiable nature, several strategies could help Chinese-Canadian patients overcome their identified CR barriers. For those patients who avoid CR due to "severe weather", they could be informed of, and referred to, home-based CR programs. Home-based CR programs have been found to be as effective in reducing risk factors and recurrent cardiac events as site-based CR programs. Patients could be supported to exercise using equipment in their own homes, or to identify community centres with automated external defibrillators which are closer to home. For those patients who report "transportation problems" as a barrier, they could again be referred to home-based programs.

The majority of Chinese-Canadian respondents reported that they would be more willing to attend CR if it was offered in their Chinese language. Indeed, culturally-tailored CR programs are being developed in Canada. For example, at the CareFirst Health Promotion & Chronic Disease Management Centre in Ontario, Canada, a six-month CR program has been developed which offers bilingual and culturally-relevant programming in both English and Chinese languages. Similarly, a culturally-tailored CR program for the South Asian community is available in British Columbia, Canada. Research is needed to assess whether offering these ethnoculturally-tailored programs can achieve greater CR utilization, and ultimately improved health outcomes in minority patients. The only study to our knowledge on a culturally-tailored CR program is from

Hawaii.[26] Researchers proposed developing a CR program based on hula (a Native Hawaiian dance form). Patient and cultural consultations provided information on the benefits of hula, whereas clinical and scientific consultations provided guidelines for exercise prescription and patient monitoring. Interventions were formed based on these consultations. Specifically, Kumu hula with 30 or more years of teaching experience engaged as instructor and at least one nurse during class. Kumu hula modifies movements to accommodate limited range of motion in beginning weeks. All classes include warming up movement, conditioning (dancing), and cooling down. Participants use heart monitors and Borg scale for self-assessment. The class fosters social support through group sharing and learning. All participants receive educational material about heart health.

Limitations

There are several limitations to this study. As outlined above, the main limitation is related to a potential Hawthorne effect, such that patients at the outpatient clinics were treated by a single cardiologist who was not blind to study objectives. Second, there were many differences in the sociodemographic and clinical characteristics of the North American and Chinese-Canadian samples which may have biased the findings in relation to differences in CR utilization. Third, we had an insufficient sample size to psychometrically-validate the CRBS in traditional Chinese character. Therefore the comparison between Chinese-Canadian and North American patients may be fraught with error. Fourth, recall bias may be at play as a result of the amount of time that would have elapsed between healthcare provider interactions where CR may have been discussed,

and completion of the survey when the CRBS was administered. Fifth, while we attempted to fully consider differences between the Chinese-Canadian and North American samples, unmeasured factors may explain our findings. Sixth, due to the nature of the cross-sectional study design, causal conclusions cannot be drawn. Seventh, we were likely under-powered to observe true differences. Future research is needed to confirm these findings in a larger sample of Chinese-Canadian patients.

In conclusion, the findings from this study show that Chinese-Canadian patients were significantly more likely to be referred to CR compared to North Americans potentially due to a Hawthorne effect, but there were no significant differences with regard to utilization. Chinese-Canadian patients reported significantly greater CR barriers compared to North Americans, specifically severe weather and transportation problems. Also, the results suggest that Chinese-Canadian patients present with different clinical characteristics and sociodemographic profile compared to their North American counterparts. They are highly interested in participating in culturally-tailored CR programs. CR barriers such as weather conditions and transportation problems could be addressed through referral to alternative CR models.

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Table 1. Sociodemographic and clinical characteristics of participants, and self-reported CR utilization and barriers by ethnocultural background

Mean ± SD / n (%)	Chinese-Canadian (n=56)	North American (n=153)	Total (N=209)
Sociodemographic Characteristics			
Age	69.3±9.42	63.3±10.85	64.6±10.8**
Sex (% men)	35 (81.4)	104 (68.0)	139 (70.9)
Work status (% Full or part-time)	32 (57.1)	65 (42.5)	97 (46.4)
Annual family income (% ≥$50,000CAD)	14 (30.4)	71 (52.6)	85 (47.0)*
Subjective SES /10	4.21±2.03	6.51±1.85	5.94±2.13***
Clinical Characteristics			
Cardiac indication			
Coronary artery bypass graft surgery	6 (15.0)	4 (2.6)	10 (5.2)**
Myocardial infarction	7 (17.1)	8 (5.2)	15 (7.7)*
Percutaneous coronary intervention	12 (29.3)	143 (93.5)	155 (79.9)***
Heart failure	3 (7.3)	10 (6.5)	13 (6.7)
Body mass index	25.3±2.82	29.5±5.26	29.0±5.21***
DASI	35.8±15.5	41.5±16.1	40.0±16.1*
Diabetes mellitus	12 (30.8)	39 (28.3)	51 (28.8)
Family history of cardiovascular disease	6 (16.7)	58 (66.7)	64 (52.0)***
Hypertension	31 (79.5)	107 (76.4)	138 (77.1)
Hypercholesterolemia	30 (73.2)	126 (89.4)	156 (85.7)*
Smoker	19 (37.3)	105 (70.0)	124 (61.7)***
Comorbidities	24 (61.5)	96 (66.7)	120 (65.6)
CR Utilization			
CR referral	23 (45.1)	43 (28.9)	66 (33.0)*
CR enrollment	14 (31.8)	38 (26.2)	52 (27.5)
CR participation	13 (27.1)	33 (22.0)	46 (23.2)
% CR sessions completed	88.13±16.24	88.93±20.47	88.76±19.43
CRBS Total score	2.69±0.65	2.27±0.63	2.39±0.66**

*$p<.05$; **$p<.01$;***$p<.001$ for usual referral Chinese-Canadian versus North American sample.

SD, standard deviation; CAD, Canadian dollar; SES, Socioeconomic status; DASI, Duke Activity Status Index; CR, cardiac rehabilitation

Table 2. Sociodemographic, cultural, and clinical correlates of CR enrolment in Chinese-Canadian patients

Mean ± SD / n (%)	Chinese-Canadian CR enrollees (n=14; 31.8%)	Chinese-Canadian CR non-enrollees (n=30; 68.2%)	Total (N=44)
Sociodemographic Characteristics			
Age, years	67.30±9.19	69.16±9.53	69.33±9.42
Sex (% men)	8 (80.0)	20 (80.0)	28 (80.0)
Work status (% Full or part-time)	7 (50.0)	19 (63.3)	26 (59.1)
Annual family income (% ≥$50,000CAD)	5 (41.7)	7 (25.9)	12 (30.8)
Cultural Characteristics†			
Years lived in Canada	28.91±14.35	20.03±10.30	21.76±12.22
Primary language spoken at home (% English)	1 (12.5)	0 (0.0)	1 (2.7)
Perceived fluency in English/5	3.73±1.19	3.97±1.13	3.98±1.12
Proficiency in English (reading, writing, speaking, understanding)/20	10.92±4.54	10.52±5.18	9.80±4.83
Proficiency in a Chinese language (reading, writing, speaking, understanding)/20	17.96±1.48	17.52±2.65	17.11±2.98
Ethnic identity	3.10±0.47	3.07±0.40	3.09±0.52
Received any heart health information in a Chinese language (% yes)	7 (63.6)	14 (46.7)	21 (51.2)
Ever used an interpreter during a healthcare visit (% yes)	6 (50.0)	12 (40.0)	18 (42.9)
Willing to attend CR if offered in a Chinese language (% yes)	11 (91.7)	22 (75.9)	33 (80.5)
Clinical Characteristics			
Cardiac indication			
Coronary artery bypass graft surgery	0 (0.0)	5 (20.8)	5 (15.6)
Myocardial infarction	2 (25.0)	5 (20.0)	7 (21.2)
Percutaneous coronary intervention	3 (37.5)	6 (24.0)	9 (27.3)
Heart failure	0 (0.0)	2 (8.0)	2 (6.1)

Body mass index	28.8±0.87	24.7±2.67	25.3±2.82*
Diabetes mellitus	4 (50.0)	7 (30.4)	11 (35.5)
Family history of cardiovascular disease	2 (25.0)	4 (18.2)	6 (20.0)
Hypertension	7 (87.5)	17 (73.9)	24 (77.4)
Hypercholesterolemia	8 (100)	18 (72.0)	26 (78.1)
Smoker	5 (38.5)	11 (36.7)	16 (37.2)
Comorbidities	4 (57.1)	16 (66.7)	20 (64.5)
DASI	42.02±14.50	31.74±14.26	35.77±15.50

SD, standard deviation; CAD, Canadian dollar; DASI, Duke Activity Status Index

†Data reported only for n=55 patients recruited from the two outpatient clinics.

*$p<.01$

Table 3. Mean cardiac rehabilitation barrier scores (± standard deviation) by ethnocultural background

Barriers	Chinese-Canadian (n=56)	North American (n=153)	Total (N=209)
I already exercise at home or in my community	3.43±1.17	3.14±1.20	3.21±1.20
I didn't know about CR	3.61±1.20	2.92±1.48	3.10±1.44
Travel	2.57±1.14	2.34±1.07	2.41±1.10
Work responsibilities	2.53±1.19	2.35±1.10	2.40±1.12
Distance	2.94±1.39	2.19±1.17	2.41±1.28
I find exercise tiring or painful	2.92±1.20	2.35±1.13	2.50±1.17
Time constraints	2.81±1.26	2.87±1.21	2.48±1.13
I don't need CR	2.81±1.26	2.87±1.21	2.86±1.22
Severe weather	3.11±1.39	2.30±1.07	2.52±1.22*
Cost	2.76±1.21	2.14±1.12	2.32±1.17
I prefer to take care of my health alone	2.13±1.01	2.50±1.07	2.41±1.07
I don't have the energy	2.68±1.32	2.29±1.07	2.39±1.14
My doctor didn't feel it was necessary	2.47±1.13	2.76±1.11	2.69±1.12
Other health problems prevent me from going	2.36±1.13	2.25±1.16	2.27±1.15
I can manage on my own	2.35±1.15	2.35±0.94	2.35±0.99
Family responsibilities	2.56±1.21	2.16±1.12	2.28±1.15
Transportation problems	2.86±1.33	2.10±1.12	2.32±1.23†
Many people with heart problems don't go to CR and they are fine	2.50±1.11	2.26±0.95	2.32±0.99
It took too long to get referred and into the program	2.66±1.00	2.07±0.98	2.21±1.01
I think I was referred but the rehab program didn't contact me	2.66±1.24	2.06±1.07	2.22±1.14
I am too old	2.44±1.27	1.92±0.87	2.06±1.01

CR, cardiac rehabilitation.

*A Bonferroni correction of $p<.002$ was applied given the large number of comparisons between the usual referral Chinese-Canadian and North American sample.

†trend. $p=.024$

Extended Discussion

Studies that have been published since initiating this dissertation several years ago continue to show low rates of CR utilization ranging from 20% to 30%.[14,57] Clearly, we must continue to identify, and then rectify the multi-level barriers leading to such low rates of utilization. In this extended discussion, the following areas will be considered: implications from the findings for the measurement of CR barriers, a review of tested interventions to remedy the barriers, and directions for future research.

Measurement Implications

Mean total and subscale reliability of the CRBS was tested with Cronbach's alpha. As shown in Table 1, the mean total and subscales of the CRBS (perceived need/health care, logistical factors, work/time conflicts, and comorbidities/functional status) had moderate internal consistency in almost all of these underrepresented populations, ranging from α=.64-.92.[58]

When asked to report any other barriers to CR utilization in an open-ended fashion, participants reported "very boring routine," "participants in the class are not at similar level," "program did not meet personal needs," "crowded classes," and "felt no one cared." Other barriers in the Chinese-Canadian sample were reported in the exploratory analysis section above. The authors of the CRBS will now consider whether to add these additional items to the scale.

The 21 CRBS items were analyzed using maximum likelihood factor analysis with oblique rotation. Factor loadings were interpreted, and items with loadings lower

than 0.40 were considered for deletion. The item "It took too long to get referred and into the program" had a weak loading (0.34) in the cohorts used to compare barriers between urban versus rural patients and those of low SES versus high SES. In the sample used to compare barriers between home-based and site-based CR participants, all items performed well. When the reliability of the CRBS was tested with Cronbach's alpha, the values in the Alpha if Item Deleted column indicated that all items had similar correlations and thus, it was determined deletion of the item from the current version of the CRBS is unwarranted.

The magnitude of effects suggests that the CRBS does not demonstrate clinical significance. The practical significance of the CRBS was tested by investigating whether there were any significant differences at the subscale level between rural versus urban patients and patients of low SES versus high SES after applying a Bonferroni correction of $p<.002$ (.05/21). The results showed that rural and urban patients significantly differed on the logistical factors subscale ($p<.001$), and patients of low SES and high SES significantly differed on perceived need/health care factors ($p<.001$), logistical factors ($p<.001$), and comorbidities/functional status ($p<.001$) subscales. These findings suggest that interventions should target the particular subscales for rural patients and patients of low SES in order to help increase CR utilization for these vulnerable populations.

Previous research shows significant differences in total CR barriers by referral strategy. Specifically, there are differences in barriers between systematic and liaison (i.e., discussion at the bedside) strategies (1.92±0.72 vs 2.07±0.80; $p<.05$), and between systematic and usual referral (1.92±0.72 vs 2.22±.69; $p<.001$). Patients who had usual

referral reported the following barriers significantly greater compared to systematic referral: "I didn't know about CR" ($p<.001$), "I don't need CR" ($p<.001$), and "my doctor didn't feel it was necessary" ($p<.001$).[59]

Interventions That Could Remedy CR Barriers

Evidence shows that CR reduces health care costs through reduced hospital readmissions.[9] Thus, it is important to overcome barriers in order to increase utilization, particularly among the under-represented populations. It is now time to start implementing strategies that could address CR barriers. Table 2 displays the CR barriers and suggests some interventions to overcome these barriers, and whether or not they have been tested.

The effectiveness of interventions to increase CR access has been demonstrated. These interventions could likely mitigate four of the, albeit not as commonly-endorsed, CR barriers, namely: "I didn't know about CR," "I think I was referred but the rehab program didn't contact me," "My doctor didn't feel it was necessary," and "It took too long to get referred and into the program." A review of the literature showed that a combination of systematic referral (i.e., electronic health records or discharge order set) and liaison (discussions with healthcare providers about CR) method results in significantly higher rates of CR enrolment than usual referral.[60] Although the above approach has not been investigated through a randomized controlled trial, some other strategies have been tested. Motivational communications delivered through letters, telephone calls, and home visits, as well as the use of liaison healthcare providers to support coordination of outpatient care, significantly increase uptake of CR.[61,62] A

theoretically-worded invitation letter and leaflet based on the Theory of Planned Behavior and the Common Sense Model of Illness could be an inexpensive intervention to improve attendance at CR.[63]

Triage to structured and monitored home-based CR programs could mitigate up to 11 barriers, namely: "travel," "I already exercise at home or in my community," "work responsibilities," "severe weather," "time constraints," "distance," "cost," "family responsibilities," "transportation problems," "I prefer to take care of my health alone," and "I can manage on my own." The flexibility of home-based programs offers patients greater opportunity to incorporate program components into their daily lives and environments. In a randomized controlled trial with four arms (randomization to home or site-based CR or patient preference to home or site-based CR), researchers compared adherence rates between the choices.[64] The results showed that adherence to home-based CR was comparable between the randomized (73%) and preference arms (75%), and was higher than in the site-based allocation arm. While the reasons for patients' choice of the home program were not provided, this suggests that if patients were allocated to a home-based program to overcome barriers such as distance, transportation, cost, and severe weather, they would likely achieve the benefits of CR participation.

With regard to the barriers of "other health problems prevent me from going," "I find exercising tiring or painful," "I don't have the energy," and "I am too old," patients and referring healthcare providers should be informed that exercise prescriptions are individually-tailored in CR. For example, where patients have comorbid diabetes, they are taught to assess their blood glucose before and after exercise, and a sugary drink and

safety protocols are in place at all programs. For patients with comorbid musculoskeletal problems, weight-bearing exercise is recommended, non-weight bearing machines (e.g., NuStep) are offered, and it may be suggested to patients to take a pain reliever half an hour before they start their classes. The extent to which conveying this information would overcome enrolment barriers warrant testing, in addition to the degree to which it would mitigate program adherence failures.

The final two barriers could be considered ones of perception, namely "I don't need CR," and "Many people with heart problems don't go to CR and they are fine." Conveying to patients that in addition to exercise, CR programs include other beneficial components such as education and counseling that could assist in their recovery process could help patients prioritize CR in their schedules. They could also be informed about the benefits of CR participation with regard to morbidity, mortality, health behaviour change, and quality of life. A candid discussion about patterns of decline in exercise behaviour that can be prevented through CR may be helpful. Research suggests that uptake may be improved by addressing issues of motivation and perceived relevance of rehabilitation to future well-being, comorbidities, site and time of sessions, transport and arrangement of care for dependents.[63] One small study has tested an intervention to impact myocardial infarction patients' illness perceptions.[65] Unfortunately, there was no significant effect on CR use however.

There has been a Cochrane review of interventions to promote CR adherence among participants.[66] While these have not addressed CR barriers specifically, the findings are nevertheless cogent. There were seven trials identified for inclusion. Unfortunately, only

one of the studies was successful in increasing adherence.[67] In this study, researchers assessed two brief planning interventions designed to encourage cardiac patients to engage in regular physical exercise following discharge from rehabilitation. The participants were randomly assigned to one of two intervention groups or a standard care control group. One intervention group focused on action planning alone, whereas the other intervention group focused on a combination of action planning and coping planning. The interventions comprised action plans on (a) when, where, and how to act, and (b) coping plans on how to deal with anticipated barriers. Although there was no significant difference in adherence between the "action planning" and control groups (n=149, 44% versus 42%), those in the "combined planning" group were significantly more adherent than both the "action planning" (n=130, 71% versus 44%, $p<.01$) and control groups (n=143, 71% versus 42%, $p<.001$).

Evidence suggests "patient navigation" could improve CR uptake, through facilitating patient transition across the continuum of cardiac care. Recently, a randomized controlled trial where patients were assigned to either a patient navigation or usual care groups was undertaken. Patient navigation involved individuals helping patients traverse the inpatient to outpatient cardiac care system, with a particular focus on enrolling in a local CR program. The findings showed a 3-fold increase in patient enrolment in a CR program for the patient navigation group compared to the usual care group.[68]

It is necessary to use a multi-level approach to address CR barriers comprehensively. According to the socio-ecological model, intrapersonal, interpersonal, institutional, community, and policy will have independent and interactive effects when influencing a

behaviour change as exercise adherence.[69] At the intrapersonal level, patient-level barriers such as "I don't need CR" could be addressed. At the interpersonal level, social support through family, friends, other patients, and healthcare providers could assist in helping reduce barriers. At the institutional level, home-based, internet-based, culturally-tailored CR programs, as well as implementation of automatic referral to CR could help increase CR use. At the community level, barriers such as distance to facility could be overcome through provision of community-based CR programs. Finally, at the policy level, governments could subsidize transportation costs for patients of low SES and provide CR staff with behaviour change training to use in their practice.

Future Research

Future research should examine why the known strategies such as systematic referral have not been broadly implemented (i.e., resource constraints), and how they could be scaled up. Perhaps we can look to implementation science research to ensure broader implementation of referral strategies and program model stratification (including perhaps culturally-tailored programs) to overcome the primary CR barriers.[70,71] Moreover, the postulated interventions need to be tested.

One particular intervention which has yet to be explored, but applicable across many barriers, is motivational interviewing. Motivational interviewing refers to a client-centred, directive therapeutic style to enhance readiness for change by helping clients explore and resolve ambivalence.[72] Previous research has demonstrated that motivational interviewing has resulted in greater rates of health service use than usual care.[73] In addition, a meta-analysis of motivational interviewing versus brief advice or usual care

resulted in a modest but significant increase in smoking cessation.[74] Moreover, research shows that motivational interviewing increases the type and level of physical activity in patients, including those with chronic heart failure.[75] Motivational interviewing might then be particularly appropriate to address patient-level CR barriers.

In a potential future randomized controlled trial, an intervention group of cardiac inpatients and / or new CR enrollees could complete the CRBS. Patients would be randomized to receive motivational interviewing or to usual care. Motivational interviewing could include discussions about identified barriers. Patients could be encouraged to discuss broader healthcare provider and health system-level barriers with their providers. Post-test data collection would include repeat administration of the CRBS. Paired t-tests could be performed to investigate whether any significant changes in barriers were achieved over time within the motivational and usual care groups. Independent samples t-tests could be performed to assess differences between the groups at different time points. Data on CR program model allocation, number of prescribed CR sessions, and degree of patient participation in these sessions could be collected directly from CR programs, as well as from patients to serve as the dependent variables. This will allow researchers to examine the effect of motivational interviewing on reducing barriers and ultimately program adherence.

In conclusion, the overall results suggest that patient preferences should be considered when allocating patients to program models, and there is a need to identify and address barriers to CR among rural patients, patients of low SES, and perhaps of Chinese ethnocultural background both prior to CR referral and once patients are

enrolled. Remedying these access disparities will accordingly require a multi-level approach. For patients, in-person consultations with a healthcare provider before hospital discharge could include discussions about the benefits of CR, structure of CR, and information on CR program locations. Patients could also be provided written material reviewing the content of the discussion and reminder follow-up phone calls to patients could improve CR uptake. Physicians should also be given opportunities to increase their awareness of CR through seminars.[76]

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Table 1. Cardiac Rehabilitation Barriers Scale Subscale and Mean Total Internal Reliability (Cronbach's α), by sample

Sample	Health Care	Logistical	Work/Time	Comorbidities	Total
Home-based	0.87	0.86	0.78	0.80	0.92
Site-based	0.89	0.86	0.64	0.79	0.92
Total Subsample	0.89	0.87	0.65	0.79	0.92
Rural	0.89	0.82	0.71	0.82	0.91
Urban	0.89	0.88	0.71	0.83	0.93
Total Subsample	0.89	0.87	0.71	0.83	0.92
Low SES	0.89	0.87	0.76	0.85	0.93
High SES	0.89	0.86	0.68	0.82	0.92
Total Subsample	0.89	0.87	0.71	0.83	0.92

Table 2. Cardiac rehabilitation barriers, in descending order, with potential interventions

Barriers	Potential Interventions	Tested & Supported (yes/no)	RCT (yes/no/ underway)
Travel	Home-based CR	No	No
I already exercise at home or in my community	Home-based CR; motivational interviewing; follow-up with patients	No	No
Work responsibilities	Home-based CR; evening/weekend site-based CR	No	No
Severe weather	Home-based CR	No	No
Time constraints	Home-based CR; evening/weekend site-based CR	No	No
Other health problems prevent me from going	Motivational interviewing (emphasize individualized exercise prescriptions); follow-up with patients	No	No
Distance	Home-based CR	No	No
I find exercise tiring or painful	Motivational interviewing (emphasize individualized exercise prescriptions); follow-up with patients	No	No
Cost	Home-based CR	No	No
I don't have the energy	Motivational interviewing (emphasize individualized exercise prescriptions); follow-up with patients	No	No
Family responsibilities	Home-based CR	No	No
Transportation problems	Home-based CR	No	No
I prefer to take care of my health alone	Home-based CR; motivational interviewing; follow-up with patients	No	No
It took too long to get referred and into the program	Automatic referral; motivational interviewing; follow-up with patients	No	No
I can manage on my own	Home-based CR; motivational interviewing; follow-up with patients	No	No
I don't need CR	Motivational interviewing; theoretically-worded invitation letter and leaflet based on the Theory of Planned Behavior and the	Yes	Yes

	Common Sense Model of Illness; follow-up with patients		
Many people with heart problems don't go to CR and they are fine	Motivational interviewing (emphasize individualized exercise prescriptions); follow-up with patients	No	No
My doctor didn't feel it was necessary	Automatic referral; motivational interviewing (emphasize individualized exercise prescriptions); theoretically-worded invitation letter and leaflet based on the Theory of Planned Behavior and the Common Sense Model of Illness; follow-up with patients	Yes	Yes
I am too old	Motivational interviewing (emphasize individualized exercise prescriptions); follow-up with patients	No	No
I think I was referred but the rehab program didn't contact me	Automatic referral; motivational interviewing; follow-up with patients	No	No
I didn't know about CR	Automatic referral; motivational interviewing; theoretically-worded invitation letter and leaflet based on the Theory of Planned Behavior and the Common Sense Model of Illness; follow-up with patients	Yes	Yes

Appendices

Appendix A: Informed Consent Form

Health Care for Heart Patients

PATIENT CONSENT FORM

Investigators:

Jane Winstanley, RN **(Co-Principal Investigator)**	York Central Hospital
Sherry L. Grace, PhD **(Co-Principal Investigator)** (416) 340-4800 x.6455	York University and University Health Network (UHN)
Shamila Shanmugasegaram, BSc **(Coordinator)**	
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Sonia Anand, MD, PhD	McMaster University
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Karen Williamson, RN, MScN, PhD(c)	University of Windsor
Paula Harvey, BMBS, PhD	UHN
Steve Bunker, PhD	National Heart Foundation of Australia

Sponsor: Canadian Institutes of Health Research (CIHR) and Heart and Stroke Foundation of Canada

You are being asked to take part in a research study. Before agreeing to participate, please read this information carefully and ask any questions you wish.

Purpose: You have been asked to participate in a study evaluating secondary prevention services for heart patients.

Procedure: You have been identified to participate in this study because you are receiving cardiac care at one of our 10 study hospitals. If you agree, we would like your permission to extract some study-relevant medical information from your chart. You are also being asked to complete a survey, which may take approximately 60 minutes to complete, and provide it to the study coordinator in the envelope provided. The study coordinator will also ask to measure around your waist with a cotton measuring tape if you are willing. You will not have any further visits with the study coordinator. You will also be mailed a brief survey in 1 year, which may take approximately 60 minutes to complete. Completion of that survey is also voluntary. If you record on your questionnaire that you have attended cardiac rehabilitation, we would like to contact the program to ask them about your participation. The length of participation in this study is approximately 1 year. We would also like to anonymously link your information with a provincial database to determine your health care use and health outcomes in three years. This will not require any paperwork on your behalf.

Finally, we would like your permission to contact you by mail or telephone to inquire about your interest in participating in an interview about your thoughts and feelings regarding future cardiac health services you may or may not receive. Again, participation in such an interview would be voluntary and confidential.

Confidentiality: All information obtained during the study will be held in strict confidence. No names or identifying information will be used in any publication or presentations. Your surveys and other study results will have only an identifying number on them. Your surveys and other study results will be stored in a locked filing cabinet, and no one except the principal investigators and study coordinators will see your answers and/or study results.

Participation: Your participation is VOLUNTARY and you may withdraw from the study at any time or refuse to answer questions that make you feel uncomfortable. Your participation will not affect the care you receive from your health care providers. Your doctors do not know whether you have been chosen as a study participant, or whether or not you decide to participate by filling out this survey. You will not be compensated for your participation in this study.

Risks: You will be revealing personal information about yourself; however this information will remain confidential.

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

Future Contact: Can we mail you the one-year follow up survey: ☐ YES ☐ NO
Can we contact you by mail or telephone to see if you would be interesting in participating in an interview: ☐ YES ☐ NO

Questions
If you have any questions about the study, please call Shamila Shanmugasegaram (Study Coordinator) at (416) 736-2100 x. 20575 or email sshan@yorku.ca. If you have any questions about your rights as a research participant, please call the Chair of the Research Ethics Board, available through the York Central Hospital switchboard at (905) 883-1212. These people are not involved with the research project in any way, and calling them will not affect your participation in the study.

Consent:
I consent to take part in the study with the understanding that I may withdraw at any time. I voluntarily consent to participate in this study. The study has been fully explained to me and all of my questions have been answered. I will be given a copy of this signed and dated consent form.

Please print your name	Your Signature	Date

Signature of Person Obtaining Consent	Date

Signature of (Co-)Investigator	Date

Appendix B: Case Report Form

Recruitment Data Sheet/Chart Extraction Form

1. Site ID #: _____

2. Today's Date | | | | Day M Year

3. Cardiac Condition and/or Procedure:
- ☐ Unstable angina
- ☐ CHF
- ☐ MI
- ☐ PCI
- ☐ CABG (# of vessels_____)
- ☐ Other: _____
- ☐ ACS confirmation: _____

4. Date of Index ACS: | | | | Day M Year

5. Gender: ☐ Male ☐ Female

6. Date of Birth | | | | Day M Year

7. Marital Status:
- ☐ Married/common-law
- ☐ Separated/divorced
- ☐ Single
- ☐ Widow/Widower

8. Do you live more than 30 minutes drive from the hospital?
- ☐ Yes
- ☐ No

9. 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

10. What do you consider to be your racial/ethnic background?

_____

11. Patient Ineligible for Study:
☐ Yes ☐ No

If Yes, please specify:

- ☐ Orthopedic, neuromuscular, vision, cognitive or psychiatric condition which precludes CR eligibility; specify: _____
- ☐ Does not speak/read English/SAsian language
- ☐ Previous attendance at cardiac rehab
- ☐ Other: _____

12. Patient Refused to participate:
☐ Yes ☐ No

If Yes, please specify:

- ☐ Not interested
- ☐ "Don't feel well enough"
- ☐ Other: _____

13. Study ID # assigned to patient: | |

Stop here if patient is ineligible or refused.

14. Patient's First Name: | |

15. Patient's Last Name: | |

16. Preferred Salutation:
- ☐ Mr.
- ☐ Ms.
- ☐ Mrs.
- ☐ Dr.

17. Patient's Telephone: | | | | | | | | | | |
(Area code)

18. Patient's Address:

Street Address			
City			
Province		Postal Code	

19. Alternate Contact Information:

Name	
Relationship	
Telephone	

20. Current Cardiac Medications *(check all that apply)*:

- ☐ ACE Inhibitors
- ☐ Anti-coagulants
- ☐ ASA
- ☐ Ca^{2+} antagonists
- ☐ Lipid Lowering
- ☐ Antiarrhythmic
- ☐ Anti-platelets
- ☐ Beta-blockers
- ☐ Digoxin
- ☐ Nitrates
- ☐ Other: _____

21. CCS Class:

□ 1 □ 2 □ 3 □ 4

22. NYHA Class:

□ 1 □ 2 □ 3 □ 4

23. Comorbid Conditions?

☐ Yes ☐ No

If Yes, please specify:

24. Risk Factors:

Y N

- ○ ○ Diabetes: ☐ Type I ☐ Type II
- ○ ○ Obesity
  - BMI (kg/m^2): _____
  - Waist-to-hip ratio: _____
  - Waist circumference: _____
- ○ ○ Family History of CVD
- ○ ○ Hypertension
  - BP systolic: _____
  - BP diastolic: _____
- ○ ○ Smoking History
  - ❑ current
  - ❑ past → quit date _____; pack years
  - ❑ never
- ○ ○ Dyslipidemia

Total Cholesterol: _____

HDL: _____

LDL: _____

Triglycerides: _____

Appendix C: Sociodemographic and Medical History Questionnaire

SECTION I: DEMOGRAPHICS

1. What do you consider to be your racial/ethnic background? Please also 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, Ukranian, 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: **Please specify**:_____)
   - ❑ 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. Who do you live with?
   - ❑ With family (spouse, children, etc.)
   - ❑ Alone
   - ❑ Other (specify:_____)

3. What is your gross annual family income?
   - ❑ $19, 999 or less
   - ❑ $20, 000 - $29, 999
   - ❑ $30, 000 - $39, 999
   - ❑ $40, 000 - $49, 999
   - ❑ $50, 000 - $59, 999
   - ❑ $60, 000 - $69, 999
   - ❑ $70,000 or greater

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

5. Please provide your job title, and a description of your work:

_____

6. a. What is your height? _____ feet and _____ inches **or** _____ cm

   b. What is your weight? _____ pounds **or** _____ kgs

7. How many minutes does it take you to drive to the hospital closest to your home, one way?

   _____ minutes

8. What is your smoking history?
   - ❑ I have never smoked
   - ❑ I currently smoke
     - How many cigarettes per day on average? _____ smokes per day
     - For how many years have you smoked? _____ years
   - ❑ I quit smoking
     - Quit date: _____
     - How many cigarettes per day did you smoke on average? _____ smokes per day
     - For how many years did you smoke? _____ years

9. Do you have a history of heart disease in your family?
   - ❑ Yes
   - ❑ No

10. Do you have high blood pressure?
    - ❑ Yes
    - ❑ No

11. Do you have high cholesterol?
    - ❑ Yes
    - ❑ No

12. Did you exercise to the point of getting short of breath on a regular basis (as an adult) prior to your cardiac event?
    - ❑ Yes
    - ❑ No

Appendix D: MacArthur Scale of Subjective Social Status Ladder

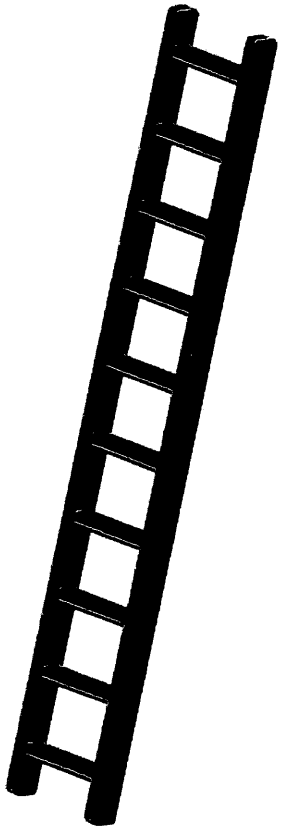
SECTION M: SOCIAL STATUS

Think of this ladder as representing where people stand in Canada.

At the **top** of the ladder are the people who are the best off – those who have the most money, the most education, and the most respected jobs. At the **bottom** are the people who are the worst off – who have the least money, least education, and the least respected jobs or no job. The higher up you are on this ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom.

Where would you place yourself on this ladder?

Please place a large "X" on the rung where you think you stand at this time in your life, relative to other people in Canada.



Appendix E: Cardiac Rehabilitation Utilization

SECTION A: CARDIAC PROGRAM

Instructions: The following questions ask about your outpatient treatment after having your heart problem. Cardiac rehabilitation is an outpatient program of structured activity and education to maximize your recovery. For example, you might go to a hospital outpatient program to exercise 1-3 times per week for 6 months or so.

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.

1. Were you referred to a cardiac rehabilitation program? (A referral requires that a health care provider completed a form and sent it to a cardiac rehab program so you can enroll)

☐ **Yes** ⟶

(If YES) 1. What cardiac rehabilitation site were you referred to?

_____

2. What type of health care provider referred you? (please check ☑ 1 box)
- ☐ Family doctor
- ☐ Nurse
- ☐ Cardiologist
- ☐ Cardiac Surgeon
- ☐ Internist
- ☐ Other (specify): _____

3. How strongly did your provider endorse cardiac rehab?

Not at all strongly	Somewhat strongly	Neutral	Strongly	Very Strongly
☐	☐	☐	☐	☐

4. Where were you referred from? (please check ☑ 1 box)
- ☐ Inpatient Unit at hospital
- ☐ Physician's office
- ☐ Cardiac Diagnostics/Intervention
- ☐ Other (specify): _____

☐ **No** ⟶

(If No) Did your health care provider give you a reason why you were not referred?
- ☐ Yes: Reason? _____
- ☐ No

2. Did you attend a cardiac rehabilitation assessment?

☐ **Yes**

☐ **No** ⟶

(If No) Why not?

3. Have you participated in cardiac rehabilitation?

❑ **Yes** ⟶

(If Yes) 1. How many minutes does it take to travel from your home to the cardiac rehab site one-way? _____ minutes

2. Was your cardiac rehab program hospital/clinic based, or was it a structured and monitored home-based program? (please ☑ your answer).

☐ Hospital-based ☐ Home-based

3. Which components of cardiac rehab did you attend (please check ☑ all that apply)

☐ Education ☐ Exercise

4. Approximately what percentage of cardiac rehabilitation sessions did you attend?

_____ % of sessions attended

5. If you missed some cardiac rehabilitation sessions, what has been the main reason for your absence?

_____
_____
_____

❑ **No** ⟶

(If No) Why not?

Appendix F: Cardiac Rehabilitation Barriers Scale (English Version)

SECTION B: CARDIAC PROGRAM 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 cardiac rehab (e.g., doctor didn't tell me about it)	☐	☐	☐	☐	☐
6. ...I don't need cardiac 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 heart problems don't go, and they are fine	☐	☐	☐	☐	☐
18. ... I can manage my heart 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 cardiac rehabilitation program:

_____

Appendix G: Ethics Approval

YORK
UNIVERSITÉ
UNIVERSITY

RENEWAL

OFFICE OF
RESEARCH
ETHICS (ORE)

5th Floor,
York Research Tower,
4700 Keele St.
Toronto ON
Canada M3J 1P3
Tel 416 736 5914
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Memo

Certificate #:	**2011 - 044**
Renewal Approved:	**01/31/12**
Approval Period:	**02/22/12-02/22/13**

To: Professor Sherry Grace, Faculty of Health, sgrace@yorku.ca

From: Alison M. Collins-Mrakas, Sr. Manager and Policy Advisor, Research Ethics
(on behalf of Wade Cook, Chair, Human Participants Review Committee)

Date: **February 22nd, 2012**

Re: **Ethics Approval**

Health Care for Heart Patients

With respect to your research project entitled, "Health Care for Heart Patients" the committee notes that, as there are no substantive changes to either the methodology employed or the risks to participants or any other aspect of the research project, a renewal of ethics approval re the above project is granted.

Should you have any questions, please feel free to contact me at: 416-736-5914 or via email at: acollins@yorku.ca.

Yours sincerely,

Alison M. Collins-Mrakas M.Sc., LLM
Sr. Manager and Policy Advisor,
Office of Research Ethics

Appendix H: Physical Activity Scale for the Elderly

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

LEISURE TIME ACTIVITY

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

[0] Never ↓ Go to Q.#2 | [1] Seldom (1-2 Days) | [2] Sometimes (3-4 Days) | [3] Often (5-7 Days)

1a. What were these activities? _____

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

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

[3] 2-4 Hours [4] More than 4 hours

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

[0] Never ↓ Go to Q.#3 | [1] Seldom (1-2 Days) | [2] Sometimes (3-4 Days) | [3] Often (5-7 Days)

2a. On average, how many hours per day did you spend walking?

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

[3] 2-4 Hours [4] More than 4 hours

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

[0] Never ↓ Go to Q.#4 | [1] Seldom (1-2 Days) | [2] Sometimes (3-4 Days) | [3] Often (5-7 Days)

↓

3a. What were these activities? _____

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

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

[3] 2-4 Hours [4] More than 4 hours

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

[0] Never ↓ Go to Q.#5 [1] Seldom (1-2 Days) [2] Sometimes (3-4 Days) [3] Often (5-7 Days)

4a. What were these activities? _____

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

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

[3] 2-4 Hours [4] More than 4 hours

5. Over the past 7 days, how often did you engage in strenuous sport and recreational activities such as jogging, swimming, cycling, singles tennis, skiing (downhill or cross-country) or other similar activities?

[0] Never ↓ (1-2 Days) Go to Q.#6 [1] Seldom (3-4 Days) [2] Sometimes (5-7 Days) [3] Often

5a. What were these activities? _____

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

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

[3] 2-4 Hours [4] More than 4 hours

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

[0] Never ↓ Go to Q.#7 [1] Seldom (1-2 Days) [2] Sometimes (3-4 Days) [3] Often (5-7 Days)

6a. What were these activities? _____

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

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

[3] 2-4 Hours [4] More than 4 hours

7. During the past 7 days, have you done any light housework, such as dusting, cooking, ironing, making beds, carrying out the garbage, washing dishes or (describe) _____ ?

[1] No [2] Yes

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

[1] No [2] Yes

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

Please answer Yes or No for each item.

	No	Yes
a. Home repairs like painting, wallpapering, electrical work, etc.	1	2
b. Lawn work or yard care, including snow or leaf removal, wood chopping, etc.	1	2
c. Outdoor gardening	1	2
d. Caring for another person, such as children, dependent spouse, or another adult	1	2

10. During the past 7 days, did you work for pay or as a volunteer?

[1] No [2] Yes

↓

10a. How many hours per week did you work for pay and/or as a volunteer? _____ hours

10b. Which of the following categories best describes, on average, the amount of physical acitivity required on your job and/or volunteer work?

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

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

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

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

Appendix I: Cardiac Rehabilitation Barriers Scale (Chinese Version)

第二部份：心臟計劃的障礙

以下問題問及一些影響你出席心臟復康計劃活動的因素。無論你有**沒有**參加心臟復康計劃，請你回答本頁內所有問題。

我沒有參加心臟復康計劃，或者我有參加，但我有幾次缺席，因為：	十分不同意	不同意	沒有同意也沒有不同意	同意	十分同意
1. …距離（例如：地點不在我的本區，路途太遠）	☐	☐	☐	☐	☐
2. …費用（例如：泊車，汽油）	☐	☐	☐	☐	☐
3. …交通問題（例如：汽車和公共交通的使用）	☐	☐	☐	☐	☐
4. …在家中的責任（例如：照顧家人）	☐	☐	☐	☐	☐
5. …我不知道要參加心臟復康計劃（例如：醫生沒有告訴我要參加心臟復康計劃）	☐	☐	☐	☐	☐
6. …我不需要心臟復康計劃（例如：我感覺舒適，心臟病已經得到治療，病情不嚴重）	☐	☐	☐	☐	☐
7. …我已經有在家或在我的社區運動鍛練。	☐	☐	☐	☐	☐
8. …天氣惡劣	☐	☐	☐	☐	☐
9. …做運動我感覺疲倦或痛楚	☐	☐	☐	☐	☐
10. …需要出門（例如：渡假、公幹、渡假屋）	☐	☐	☐	☐	☐
11. …時間限制（例如：太忙、活動時間不方便）	☐	☐	☐	☐	☐
12. …要工作	☐	☐	☐	☐	☐
13. …我沒有精力	☐	☐	☐	☐	☐
14. …其他健康問題妨礙我參加（請說明：_____）	☐	☐	☐	☐	☐
15. …我年紀太老	☐	☐	☐	☐	☐
16. …我的醫生覺得沒有需要	☐	☐	☐	☐	☐
17. … 有很多人有心臟病都沒有參加，而他們也好好的。	☐	☐	☐	☐	☐
18. … 我自己能夠處理我的心臟問題	☐	☐	☐	☐	☐
19. … 我覺得我有被推薦，但復康計劃沒有與我接觸	☐	☐	☐	☐	☐
20. …得到推薦和參加計劃需要太長時間	☐	☐	☐	☐	☐
21. …我寧可獨自照顧自己的健康，也不願意參加小組活動	☐	☐	☐	☐	☐

22. 其他不參加心臟復康計劃的原因：

_____