Adherence to Home Based Cardiac Rehabilitation

by

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A thesis submitted in conformity with the requirements for the degree of Master of Science
Graduate Department of Rehabilitation Science
University of Toronto

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Abstract

Cardiac rehabilitation (CR) is recommended for those living with heart disease, however adherence is suboptimal. The home program (HP) model of care is as clinically effective as traditional programs (TP), however little information exists about the HP’s effect on adherence. The objectives of this thesis were to 1) compare adherence of patients in a HP and TP model of CR. 2) To characterize self-regulatory self-efficacy (SR-SE) in a CR HP and 3) to explore the reasons for non-completion of a HP. Study 1 showed adherence to be similar between the TP and HP. Study 2 showed that SR-SE was high throughout the HP for completers, but dropped in those who did not complete the program. The HP is a good alternative for those unable to attend a TP; however those with low SR-SE may require further interventions to help them complete their program.
Acknowledgments

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"If I have the belief that I can do it, I shall surely acquire the capacity to do it even if I may not have it at the beginning" - Mahatma Gandhi

200
# Table of Contents

Acknowledgments .......................................................................................................................... iii

Table of Contents ........................................................................................................................ iv

List of Tables .................................................................................................................................. viii

List of Figures ............................................................................................................................... ix

List of Appendices .......................................................................................................................... x

Abbreviations ................................................................................................................................. xi

Chapter 1 Introduction .................................................................................................................... 1

Chapter 2 Literature Review .......................................................................................................... 3
  2.1 Cardiovascular Disease and Associated Risk Factors ............................................................. 3
  2.2 Cardiac Rehabilitation ............................................................................................................. 3
  2.3 Traditional Model of Cardiac Rehabilitation ......................................................................... 4
  2.4 Adherence to Traditional Cardiac Rehabilitation ................................................................ 4
  2.5 Differences in Adherence Studies .......................................................................................... 6
  2.6 The Need for Alternative Models of Care ............................................................................. 8
  2.7 Home Program Model of Cardiac Rehabilitation ................................................................ 9
  2.8 Effectiveness of Home Cardiac Rehabilitation ..................................................................... 10
  2.9 Adherence to Home Based Cardiac Rehabilitation ................................................................. 11
  2.10 Theoretical Mediating Variables and Adherence ................................................................. 13
  2.11 Self-Efficacy ......................................................................................................................... 19
  2.12 Summary ............................................................................................................................... 22

Chapter 3 Adherence to a cardiac rehabilitation home program model of care: a comparison to a well-established traditional on-site supervised program (Study #1) .................................................. 24
  3.1 Abstract .................................................................................................................................. 24
  3.2 Introduction ............................................................................................................................. 25
3.3 Materials and Methods ........................................................................................................26
  3.3.1 Sample ..........................................................................................................................26
  3.3.2 The Models of Care .......................................................................................................27
  3.3.3 Inclusion and Exclusion Criteria ..................................................................................29
  3.3.4 Measures .....................................................................................................................29
  3.3.5 Statistical Analyses .......................................................................................................30
3.4 Results ..................................................................................................................................30
  3.4.1 Demographics and Characteristics .............................................................................30
  3.4.2 Adherence ....................................................................................................................33
  3.4.4 Comparison of Change in Cardiovascular Fitness .......................................................34
3.5 Discussion ..........................................................................................................................34
3.6 Limitations ..........................................................................................................................37
3.7 Conclusion ..........................................................................................................................38

Chapter 4 Self-efficacy and Reasons for Non-completion in a Home Based Cardiac
  Rehabilitation Program – A prospective Pilot Study (Study #2) ........................................39
4.1 Abstract .............................................................................................................................39
4.2 Introduction .........................................................................................................................40
4.3 Methods .............................................................................................................................44
  4.3.1 Sample ..........................................................................................................................44
  4.3.2 The Home Program Model of Care ...........................................................................44
  4.3.3 Inclusion and Exclusion Criteria ................................................................................45
  4.3.4 Measures .....................................................................................................................45
     4.3.4.1 Questionnaires .......................................................................................................46
     4.3.4.2 Adherence .............................................................................................................50
     4.3.4.3 Reasons for Non-Completion .............................................................................50
     4.3.4.4 Demographics and Clinical Profile .....................................................................50
References ................................................................................................................................. 79
Appendices ................................................................................................................................ 92
Copyright Acknowledgements ...................................................................................................... 100
List of Tables

2.1 Examples of Varied Definitions for Adherence to Cardiac Rehabilitation Visits........7
2.2 Examples of Description of the Home Program Model of Care........................9
2.3 Differences in Modifiable Risk Factors between Home Based and Centred Based Models of Cardiac Rehabilitation in BRUM RCT.................................10
2.4 Inconsistent definitions of Adherence in RCTs Comparing Adherence in Traditional and Home Based Models of Cardiac Rehabilitation.................................12
3.1 Comparison of Model of Care Parameters between Traditional Program and Home Program..........................................................28
3.2 Primary Diagnoses of Patients at Entry in Traditional and Home Programs.........31
3.3 Comparison of baseline Profile between Traditional Program and Home Program......32
3.4 Comparison of Adherence to Cardiac Rehabilitation between Traditional Program and Home Program..........................................................33
4.1 Cronbach’s Alpha results for SR-SE-E and SR-SE-TC Questionnaires at each time point..............................................................52
4.2 Profile of all Study Participants – Completers and Non-Completers......................53
4.3 Profile of each Non-Completer.....................................................................54
4.4 Correlations between SR-SE-E and Physical Activity........................................58
4.5 Model that Predicts the Trajectory of monthly SR-SE-E scores..........................61
4.6 Model that Predicts the Trajectory of monthly SR-SE-TC scores..........................61
## List of Figures

<table>
<thead>
<tr>
<th>Number</th>
<th>Figure Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Significant theories in behaviour change with shared constructs</td>
<td>17</td>
</tr>
<tr>
<td>4.1</td>
<td>Timing of Questionnaires</td>
<td>46</td>
</tr>
<tr>
<td>4.2</td>
<td>Self-Regulatory Self-Efficacy for Exercise – Completers</td>
<td>55</td>
</tr>
<tr>
<td>4.3</td>
<td>Self-Regulatory Self-Efficacy for Telephone Consultations – Completers</td>
<td>56</td>
</tr>
<tr>
<td>4.4</td>
<td>Level of Physical Activity (IPAQ) for Completers</td>
<td>57</td>
</tr>
<tr>
<td>4.5</td>
<td>Self-Regulatory Self-Efficacy for Exercise – Non-Completers</td>
<td>59</td>
</tr>
<tr>
<td>4.6</td>
<td>Self-Regulatory Self-Efficacy for Telephone Consultations – Non Completers</td>
<td>60</td>
</tr>
<tr>
<td>4.7</td>
<td>Difference between the Slopes of Completers and Non-completers for SR-SE-E</td>
<td>62</td>
</tr>
<tr>
<td>4.8</td>
<td>Difference between the Slopes of Completers and Non-completers for SR-SE-TC</td>
<td>62</td>
</tr>
<tr>
<td>5.1</td>
<td>MOHLTC Chronic Disease Prevention and Management Framework</td>
<td>74</td>
</tr>
</tbody>
</table>
List of Appendices

Appendix A  Self-Regulatory-Efficacy for Scheduling and Planning for Self-Managed Exercise for Cardiac Rehabilitation……………………………………92
Appendix B  Self-Regulatory-Efficacy for Scheduling and Planning for Home Program Telephone Consultations……………………………………………………….94
Appendix C  International Physical Activity Questionnaire (IPAQ)…………………………96
Appendix D  The Newest Vital Sign Health Literacy Questionnaire…………………………98
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>Cardiac Rehabilitation</td>
</tr>
<tr>
<td>HL</td>
<td>Health Literacy</td>
</tr>
<tr>
<td>HP</td>
<td>Home Program</td>
</tr>
<tr>
<td>IPAQ</td>
<td>International Physical Activity Questionnaire</td>
</tr>
<tr>
<td>SE</td>
<td>Self-Efficacy</td>
</tr>
<tr>
<td>SR-SE</td>
<td>Self-Regulatory Self-Efficacy</td>
</tr>
<tr>
<td>SR-SE-E</td>
<td>Self-Regulatory Self-Efficacy for Exercise</td>
</tr>
<tr>
<td>SR-SE-TC</td>
<td>Self-Regulatory Self-Efficacy for Telephone Consultation</td>
</tr>
<tr>
<td>TP</td>
<td>Traditional Program</td>
</tr>
</tbody>
</table>
Canada has 1.3 million people living with cardiovascular disease (Public Health Agency of Canada, 2009), and its physical, psychological and social effects. Given the magnitude of the population living with this chronic disease as well as the number at risk for developing it, there is a need for effective and accessible programs that facilitate long-term lifestyle health behaviour changes that are necessary to help combat and reduce the impact of this disease. Research aimed at understanding the specific types of programs that enable individuals to adhere best to these lifestyle changes is of paramount importance.

Cardiac rehabilitation (CR) is one such program. These programs are structured, individualized services that prevent disease progression and future cardiac events by focusing on secondary prevention and identifying and reducing risk factors (Canadian Association of Cardiac Rehabilitation (CACR), 2009). These programs are a recommended standard of care as part of all cardiovascular services within the health care system (Arthur et al. 2010). Benefits of CR include a significant reduction in mortality (Alter, Oh & Chong, 2009), an increase in functional capacity (Beswick et al. 2005; Swabey, Suskin, Arthur and Ross, 2004; Taylor et al. 2004) and improved quality of life (Arthur, Smith, Kodis & McKelvie, 2002). Although these programs have been shown to offer great benefits, adherence is suboptimal with attendance rates to regularly scheduled on-site sessions as low as 30-35% (Ades, Meacham, Handy Nedde & Hanson, 1986) and drop-out rates as high as 40-55% (Martin et al. 2012; Oldridge & Jones, 1983). Groups most at risk for low adherence rates tend to be younger (Yohannes, Yalfani, Doherty & Bundy, 2007), obese, unmarried, smokers (Marzolini, Brooks & Oh, 2008), those reporting low physical activity, unemployed, unable to drive (Worcester, Murphy, Mee, Roberts & Goble, 2004), women, those who are depressed (Yohannes et al. 2007) and who have psychological distress (Worcester et al. 2004). Those who face practical barriers to participation including having a lack of transportation, live a far distance to a centre and those with work and time conflicts have greater drop-out rates (Jones, Jolly, Raftery, Lipp & Greenfield, 2007).
Alternative methods of service delivery for CR have been recommended to help address this problem including offering a home-based model (CACR, 2009). Randomized clinical trials have demonstrated similar clinical outcomes when home-based models have been compared to traditional onsite program models (Dalal, Zawada, Jolly, Moxham & Taylor, 2010). Adherence to this alternative approach however, has only been briefly examined and has shown to be similar to that of traditional onsite program adherence (Jones et al. 2007; Dalal et al. 2010). Home programs can address the practical reasons for non-adherence to traditional programs including lack of transportation, travel and work, yet adherence continues to be suboptimal. The exploration of intrapersonal factors may help to further explain adherence in a home program model of care.

This thesis will show, that although a home based model of care addresses the practical reasons for non-adherence to traditional models of CR, adherence continues to be suboptimal. Attention toward intrapersonal factors like self-efficacy may help to explain the reasons patients do not adhere to home-based cardiac rehabilitation health behaviours. We performed two studies where one established adherence in a home based model of care and the other examined an intrapersonal factor that could help to explain adherence in the home program model. Accordingly, study #1 compared adherence to CR and cardiovascular fitness between a traditional model and a home based model of care, and study #2 piloted the measurement of self-efficacy to characterize its trajectory through a home-based model of care, and explored the reasons for non-completion of a home program.
Chapter 2 Literature Review

2.1 Cardiovascular Disease and Associated Risk Factors

Cardiovascular disease, accounts for 29% of all deaths in Canada and is the leading cause of death for both men and women (Statistics Canada, 2008). With the decline in mortality rates from cardiovascular disease since the 1950’s, Canada now has 1.3 million Canadians living with this chronic disease (Public Health Agency of Canada, 2009) and its physical, psychological and social effects. Further, nine out of every ten Canadians have at least one modifiable risk factor for heart disease or stroke (Public Health Agency of Canada, 2009). Individuals who smoke, who do not engage in regular physical activity and those living with hypertension, diabetes mellitus, elevated cholesterol, obesity and stress, are at risk for developing cardiovascular disease. Further, those with established disease who continue to live with these risk factors, increase their chances of having a subsequent cardiac event. Ultimately, these individuals are likely to be living with a low functional capacity, poor quality of life and are living with depression, anxiety, chronic stress and social isolation (Rozanski, Blumenthal & Kaplan, 1999).

2.2 Cardiac Rehabilitation

Cardiac Rehabilitation is “…the enhancement and maintenance of cardiovascular health through individualized programs designed to optimize physical, psychological, social, vocational and emotional status. The process includes the facilitation and delivery of secondary prevention through risk factor identification and modification in an effort to prevent disease progression and recurrence of cardiac events (CACR, 2009)”. Cardiovascular secondary prevention programs are recommended to be part of the continuum of cardiovascular services within the health care system, which ultimately helps individuals living with heart disease make necessary changes to their lifestyle (Arthur et al. 2010). Programs include exercise assessments, exercise prescription and training. Nutrition and psychosocial services are offered in most programs and risk factor education and counseling are delivered to patients who attend these 3-12 month programs (CACR, 2009). The benefits of CR have been well documented showing a reduction in morbidity by up to 20-25% and improving functional capacity by 20% in patients completing
a program (Beswick et al. 2005; Swabey et al. 2004; Taylor et al. 2004). A 50% reduction in mortality has also been seen in patients who complete programs when compared with population matched controls (Alter et al. 2009). Further, a meta-analysis of 48 trials (n=8940) by Taylor et al. (2004), reviewed the effectiveness of exercise-based CR in patients with cardiovascular disease and reported that compared with usual care, CR was associated with a significant reduction in modifiable risk factors (hypertension, dyslipidemia, and smoking), and a reduction in all-cause and cardiac mortality (Taylor et al. 2004). Further, patients who participate in cardiac rehabilitation show greater improvements in risk factor modification, versus those who do not (Zwisler et al. 2008). Cardiac rehabilitation programs promote long-term lifestyle behaviour changes. Adherence to these programs and to the lifestyle changes it promotes are imperative for these benefits to be realized.

2.3 Traditional Model of Cardiac Rehabilitation

Traditional outpatient CR programs are well established and guidelines for the service have been outlined by both the Canadian Association of Cardiac Rehabilitation (CACR) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR). The core components of programs include patient assessment, risk stratification, health behaviour interventions, risk factor modification, psychosocial counselling, vocational counselling, exercise training, patient education and assessment and reassessment of performance measures (CACR, 2009; Balady et al. 2007). The program model includes case management with program lengths varying from 3 months to several years with 1-3 sessions per week (Brubaker et al. 1996; Cardiac Care Network of Ontario, 2002; Debusk et al. 1994). Sessions include onsite visits of exercise that are group based, counselling, education and assessment.

2.4 Adherence to Traditional Cardiac Rehabilitation

Adherence can be defined as “the extent to which a person’s behaviour (in terms of taking medications, following diets, or executing lifestyle changes) coincides with medical or health advice (Sackett & Haynes, 1976)”. Patients participating in a CR program face an exhausting
list of lifestyle changes recommended by their care team including, taking their medications regularly, following nutrition advice, participating regularly in their exercise prescription, practicing stress management techniques and attending several regularly scheduled CR visits. Behavioural adherence, including completion of CR and higher adherence to CR visits, has become an important quality indicator for CR, and recently, investigating adherence to program utilization has been linked to morbidity and mortality (Alter et al. 2009; Hammil, Curtis, Schulman & Whellan, 2010). Alter et al. (2009) found in their retrospective matched cohort study of 2042 patients, that participation in and completion of CR was associated with a 50% lower mortality rate (2.6 vs. 5.1%, P < 0.001) as compared with population-matched controls. Hammil et al. (2010) also linked attendance to CR to health benefits when they reviewed 30,161 patients who participated in a CR program and showed that those who attended 36 CR sessions had a 14% lower risk of death and a 12% lower risk of myocardial infarction than those who attended 24 sessions. Although the benefits of participating in CR have been clearly established, poor attendance and drop-out rates are factors for consideration.

A number of studies have investigated CR participation rates, predictors of adherence, groups who are more likely to drop-out as well as reasons for poor adherence. For those patients who are referred and attend traditional programs, attendance rates to regularly scheduled on-site sessions are as low as 30-35% (Ades et al. 1986, Hiatt, Zimmerman & Hoenshell-Nelson, 1990) and drop-out rates are reported to range from 30% to as high as 55% (Kerins, McKee & Bennett, 2011; Martin et al. 2012; Marzolini et al. 2008; Oldridge, 1983; Oldridge, 1988; Sanderson, Phillips, Gerald, DiLillo & Bittner, 2003; Taylor, Wilson & Sharp, 2011). Characteristics of patients who are more likely drop out of programs include patients who are: obese (Marzolini et al. 2008, Sanderson et al. 2003), those who have had either a myocardial infarction or percutaneous coronary intervention (Taylor et al. 2011), unmarried, smoke (Marzolini et al. 2008), report low physical activity, are unemployed, non-drivers (Worcester et al. 2004), those in a low socioeconomic group (Taylor et al. 2011), women (Sanderson et al. 2003; Yohannes et al. 2007), those who are depressed (Yohannes et al. 2007) and those who have psychological distress (Worcester et al. 2004). As well, some (Marzolini et al. 2008; Yohannes et al. 2007) but not all (Taylor et al. 2011) studies demonstrate younger participants having higher drop-out rates. Non-medical and more practical reasons for non-attendance
include lack of transportation, distance to centre, work, time conflicts (Jones et al. 2007) and family obligations (Marzolini et al. 2008).

Given the benefits that can be realized with full participation in a CR program, understanding the problem of poor adherence is necessary in order to implement evidence based interventions that can maximize participation.

2.5 Differences in Adherence Studies

Although great attention has been given to studies investigating adherence to CR, these studies vary in their definition of adherence. Specifically, the behavior being considered for adherence may include exercise (Arthur et al. 2002) or it may refer to attendance of rehabilitative visits (Gordon et al. 2002). Beswick et al. (2005) performed a systematic review to compare interventions that sought to improve adherence to CR and found 12 studies (7 randomized control trials and 5 non-randomized). These studies used different definitions of adherence including attendance to CR, self-report exercise, diet, cholesterol and fat intake (Beswick et al. 2005). Even when the behaviour for adherence being investigated in studies were consistent, like adherence to CR visits, definitions of these visits (including a lack of a definition) in the literature have varied (Table 2.1).
Table 2.1

Examples of Varied definitions for adherence to cardiac rehabilitation visits

<table>
<thead>
<tr>
<th>Reference</th>
<th>Definition described in study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yohannes et al. 2007</td>
<td>Drop-outs were those who dropped out after the first 2 weeks of cardiac rehabilitation participation, completers were those who attended all cardiac rehabilitation sessions and performed their final clinical assessment.</td>
</tr>
<tr>
<td>Higgins, Murphy, Goble, Le Grande, Elliott &amp; Worcester, 2008</td>
<td>Attendance to cardiac rehabilitation sessions.</td>
</tr>
<tr>
<td>Farley, Wade &amp; Bircmore, 2003</td>
<td>Attender vs non-attender to cardiac rehabilitation.  No further description available.</td>
</tr>
<tr>
<td>Sarrafaezdeegan, Rabiei, Shirani, Kabir, Mohammadifard &amp; Roohavza, 2007</td>
<td>Attendance to all cardiac rehabilitation visits was considered completion.</td>
</tr>
<tr>
<td>Sanderson et al. 2003</td>
<td>Completer vs non-completer. Completer was defined as attending all scheduled visits or achieving exercise and education goals.</td>
</tr>
</tbody>
</table>

Recently, Taylor et al. (2011) did a systematic review of the factors associated with adherence to CR and focused on 18 studies that included 8842 patients using completion and actual program attendance as outcome measures. Varying definitions of adherence were also noted including how many visits determined completion of program. Some studies showed results as a percentage of patients who completed CR, some, the mean number of attended sessions as a percentage, while others did not report a rate of attendance at all. The definition of adherence used in research must be precise, unambiguous and appropriate to both the research question and the research setting (Oldridge, 1983). Differences in the meaning of adherence make it difficult to compare across studies and hinders the understanding of the reasons for non-adherence (Bock, 2002). Due to these differences, recommendations for adherence investigations include being descriptive about their outcome measures, so that studies can in fact be compared (Taylor et al. 2011).
To better understand adherence across studies in the literature, further recommendations include being descriptive about programs. Program characteristics like length of program, services offered and fee for service may differ between studies. Transparent descriptions of programs are needed to fully understand why some patients adhere and others do not.

2.6 The Need for Alternative Models of Care

Given the problem of adherence to CR, creative interventions are needed to optimize CR utilization for those who face barriers for participation (Valencia, Savage & Ades, 2011). A Cochrane review completed in 2010 evaluated interventions in the literature that promoted patient adherence to cardiac rehabilitation (measured as attendance) and revealed five studies that had the objective of increasing adherence to CR (Davies, Beswick, Wise, Moxham, Ress & Ebrahim, 2010). Interventions evaluated included, written and oral commitment (no difference in adherence between intervention group (54%) and control group (42%) n=120) (Oldridge, 1983), letters based on the theory of planned behaviour directed to patients designed to increase attendance (n=87, adherence: intervention group 86%, control group 57% p<0.0025) (Wyer, Earll, Joseph, Harrison, Giles & Johnston, 2001), persuasive written and telephone communication (no difference in adherence between intervention group (64%) and control group (62%) n=94) (Daltroy, 1985), outpatient programming between a social worker and patient (n=94, adherence: intervention group 52%, control group 27%, p<0.005) (Hillebrand, Frodermann, Lehr & Wirth, 1995), and liaison between nurse in-hospital and general practice to encourage participation ( n=67, adherence: intervention 42%, control group 24%, p<0.001) (Jolly et al. 1999).

Another intervention that has been more recently investigated for its clinical effectiveness is the home program model of care. This model delivers CR differently and is one that responds to some of the common practical barriers to CR participation that patients have described in the literature.
2.7 Home Program Model of Cardiac Rehabilitation

Home-based CR has the potential to help combat issues of transportation, lack of service in rural areas, work and scheduling problems, ultimately making an impact on adherence. Best practice guidelines for CR have recommended this alternative strategy for service, with a goal to reach patients who are underserved (Arthur et al. 2004; CACR, 2009). As well, some evidence has suggested advantages for lower costs when compared with traditional onsite programs (TP) (Carlson, Johnson, Franklin & VanderLaan, 2000; Marchionni et al. 2003). Characteristics of some home program (HP) models described in the literature use minimal onsite clinic visits and instead rely on telephone follow-up or home visits by a case manager of whom some provide the core components of traditional CR (Carlson et al. 2000; Jones, Greenfield & Jolly, 2009; Kodis, Smith, Arthur, Daniels, Suskin & McKelvie, 2001; Marchionni et al. 2003). (See table 2.2). The optimal design of the HP model including elements of exercise, education, secondary prevention and duration and frequency of follow-up contacts has not been established.

Table 2.2

<table>
<thead>
<tr>
<th>Reference</th>
<th>Home Program Model Description</th>
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<tbody>
<tr>
<td>Jones et al. 2009</td>
<td>Utilized the “Heart Manual”, a self-help program for 6 weeks post MI, including education material, home-based exercise program and stress and relaxation management, including a relaxation tape. Also includes home visits and telephone contact by a Nurse.</td>
</tr>
<tr>
<td>Kodis et al. 2001</td>
<td>An Exercise Specialist provides 2-3 follow-up phone calls over a 6-month period.</td>
</tr>
<tr>
<td>Carlson et al. 2000</td>
<td>Three on-site ECG monitored sessions for 1 month followed by offsite exercise and educational support via telephone calls.</td>
</tr>
<tr>
<td>Marchionni et al. 2003</td>
<td>Onsite traditional cardiac rehabilitation for 4-8 weeks followed by exercise at home using a provided cycle ergometer and pulse monitor for 2 months including home visits by a Physical Therapist every fortnight.</td>
</tr>
</tbody>
</table>
2.8 Effectiveness of Home Cardiac Rehabilitation

The home based model of care is an innovative approach to help address poor adherence, and in recent years the focus has been to establish its clinical effectiveness. A systematic review and meta-analysis of 12 randomized controlled trials (RCT) (1938 participants) comparing centre based CR to home based CR showed similar clinical outcomes with respect to mortality, exercise capacity, modifiable risk factors, total cholesterol and quality of life (Dalal et al. 2010). The Birmingham rehabilitation uptake maximization study (BRUM) (Jolly et al. 2009) is one of the larger RCTs included in this review and had the greatest influence on the overall results in the review. The BRUM study analysed 525 patients and compared a HP using the Heart Manual (a self-directed educational manual) and a TP. Their primary outcome measures to determine the effectiveness of this alternative home based model included cholesterol, blood pressure, distance walked on an incremental shuttle walk test and depression. No significant differences were observed between the HP and TP at the end of 12 months (Table 2.3) (Jolly et al. 2009).

Table 2.3

Differences in modifiable risk factors between HP and TP models of cardiac rehabilitation in BRUM RCT (Jolly et al. 2009).

<table>
<thead>
<tr>
<th>Clinical Outcome</th>
<th>95% CI of mean difference</th>
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<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>1.94 (-1.1 to 5.0)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>0.42 (-1.25 to 2.1)</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>0.1 (-0.05 to 0.24)</td>
</tr>
<tr>
<td>Distance on incremental shuttle walk test (m)</td>
<td>-21.5 (-48.3 to 5.2)</td>
</tr>
<tr>
<td>HAD depression score</td>
<td>-0.35 (-0.95 to 0.25)</td>
</tr>
</tbody>
</table>
Further, in another RCT investigating elderly patients with coronary heart disease (>65 yrs), there was no significant difference found when exercise capacity was compared in 75 patients who were randomized to either a HP or TP showing a mean difference of peak V0₂ of 0.9 ml/kg/min (95% CI -0.7, 2.4) (Oerkild, Frederiksen, Hansen, Simonsen, Skovgaard & Prescott, 2011). Home based CR produces similar changes in outcomes as traditional CR, with respect to important CR clinical markers.

2.9 Adherence to Home Based Cardiac Rehabilitation

Despite the fact that recommendations have been made indicating that HPs could help combat the problem of poor uptake and adherence (CACR, 2009), few studies have clearly determined what impact a HP model has on adherence. A qualitative study by Jones et al. (2007) investigated patients who were enrolled in either a TP or HP model and revealed that reasons for non-completion were related to 1) participation in alternative exercises and activities, 2) patients experiencing other health problems, 3) personal reasons 4) program related reasons and 5) patients who had already made lifestyle changes (Jones et al. 2007). This study however did not adequately highlight the differences in reasons between the two models, leaving the reasons for non-completion in a HP unknown.

Although adherence has been reported in many randomized clinical trials comparing traditional to home-based models, none have included it as a primary outcome. Where adherence has been described, its definition and measurement is vague and have varied among studies. Some have reported adherence to exercise (either actual exercise or exercise class), while others have reported adherence to the rehabilitation program in the form of phone calls received or home visits received. (Refer to Table 2.4 with references).
Table 2.4

Varied definitions of adherence in RCTs comparing adherence in traditional and home based models of care

<table>
<thead>
<tr>
<th>Reference</th>
<th>Method/definition of adherence assessment by study</th>
</tr>
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<tbody>
<tr>
<td>Wu, Lin, Chen &amp; Tsai, 2006</td>
<td>Measured adherence to exercise</td>
</tr>
<tr>
<td>Carlson et al. 2000</td>
<td>Attendance to education classes and total actual exercise over follow-up</td>
</tr>
<tr>
<td>Miller, Haskell, Berra &amp; DeBusk, 1984</td>
<td>Ratio of exercise session completed vs prescribed</td>
</tr>
<tr>
<td>Marchionni et al. 2003</td>
<td>Number of exercise sessions completed</td>
</tr>
<tr>
<td>Arthur et al. 2002</td>
<td>Measured adherence to exercise sessions reported, level of activity</td>
</tr>
<tr>
<td>Gordon et al. 2002</td>
<td>Measured adherence to program by attendance to visits, telephone visits</td>
</tr>
<tr>
<td>Jolly et al. 2009</td>
<td>Measured adherence to exercise and to program by sessions attended or home contacts received</td>
</tr>
<tr>
<td>Debusk, Haskell, Miller, Berra &amp; Taylor, 1985</td>
<td>Measured adherence to exercise</td>
</tr>
<tr>
<td>Dalal et al. 2007</td>
<td>Measured adherence to exercise</td>
</tr>
</tbody>
</table>

Similar to the differences revealed in adherence studies in traditional CR, inconsistency of terminology and meaning of adherence makes it difficult to compare across studies and hinders the understanding of the reasons for non-adherence (Bock, 2002). Further, few studies that reported on adherence in HPs failed to provide statistical analyses on adherence (Dalal et al. 2010). In the meta-analyses of home based versus centre based cardiac rehabilitation, Dala et al. (2010) concluded that there was no difference seen in adherence between home based and centre based programs. This conclusion however, was based on the group’s interpretation of the data provided in the studies included, as no statistical analyses were provided by the RCTs themselves. More specifically, Dalal’s group looked at the study with the largest influence in
their meta-analysis (Jolly et al. 2009) and analysed the number of participants with outcome data at follow-up, deemed them completers, and found no difference between groups (RR 1.0 (0.97-1.04) heterogeneity $I^2 = 13\%$ (Dalal et al. 2010). This finding indicates that the HP can offer the same benefits that a TP can offer, however given the poor adherence rates reported in TPs (Kerins, McKee & Bennett, 2011; Martin et al. 2012; Marzolini et al. 2008; Oldridge, 1983; Oldridge, 1988; Sanderson, Phillips, Gerald, DiLillo & Bittner, 2003; Taylor, Wilson & Sharp, 2011), adherence in a HP may also be suboptimal. Home programs are offered in order to give patients who face barriers like distance to travel, transportation difficulties and work conflicts, a chance to participate in CR. If this alternative model of care does not show adherence to be superior to a TP after these practical barriers have been addressed, then there may in fact be other factors to investigate that could shed light on this adherence problem.

Although the meta-analyses by Dalal et al. (2010) attempted to provide the literature with a clearer understanding of adherence in the home based model of care, its impact still remains unclear. Knowing that behvavioural adherence to program participation is related to improvements in mortality and morbidity rates (Alter et al. 2009; Hammil et al. 2010), further investigation regarding completion and attendance rates to the home based CR program itself is still needed to determine the effect that home programs have on adherence. To gain a comprehensive understanding as to the reasons for non-adherence beyond the practical reasons described, attention toward interpersonal factors that affect adherence could be explored to better understand the intrinsic reasons that may play a role in HP CR participation.

### 2.10 Theoretical Mediating Variables and Adherence

The literature is well documented with the characteristics of who are likely to drop-out of CR programs (Marzolini et al. 2008; Sanderson et al. 2003; Taylor et al. 2011; Worcester 2004 Yohannes 2001). As well, it describes the practical factors that have been suggested to impact adherence to cardiac rehabilitation including geographical distance to a program, transportation and employment status (Jones et al. 2007). But what about the interpersonal factors that can affect adherence? Beyond the practical reasons that inform us of the barriers individuals may face, what intrinsic factors play a role in someone’s decision to complete their CR program?
The World Health Organization (WHO) has recently expressed in their definition of adherence, to include the concept of agreement between the individual and the health care provider, and is a more updated approach to looking at adherence as compared to the definition provided earlier by Sacket (1976). WHO states adherence to be “the extent to which a person’s behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider (World Health Organization, 2003)”. This definition of adherence forces us to recognize and explore how individuals make decisions about whether to adhere to a recommendation or not, and that these decisions may be more contingent on their beliefs.

Theory can help explain and help predict behaviour and guide interventions for health behaviour change (Glanz, Rimer & Biswannath, 2008). Theories that can be used in research to test and observe behaviour are the most suitable theories that can guide practitioners in their clinical practice. Common theories that fit these criteria and have been studied in the literature include; The Health Belief Model (Rosenstock, 1966), Social Cognitive Theory (Bandura, 1986), Self–efficacy Theory (Bandura, 1997), Health Action Process Model (Schwartzer, 2010) and the Theory of Planned Behaviour (Ajzen, 1991) (Figure 2.1). Shared constructs to these theories include having multiple levels of influence, (indicating that interventions may be suitable), they have an understanding that behaviour change is a process, and each emphasizes one or all of the concepts that explain behaviour including intention, motivation and action of the behaviour. (Glanz et al, 2008).

To help explain one’s intention, motivation and action of behaviour, these theories each focus on, and share specific constructs or mediating variables that have a specific definition within that theory. These mediating variables can predict behaviour and may have strong correlations to the desired health behaviour (Hansen and MacNeal, 1996; Baranowski et al. 1998). These variables can be categorized into 1) Modifying factors – like age, gender and socioeconomic status which can influence a person’s participation in a behaviour. 2) Beliefs – where feelings, attitudes, perceived barriers to the behaviour and perceived susceptibility to a disease, attitudes and normative beliefs can all influence one’s decision to participate in a behaviour. 3) The environment – highlighting that one’s community access to services and social norms play a role in one’s participation in behaviour. And 4) Self-efficacy – where one’s confidence in themselves to be successful in the behaviour are dependent on their emotions, accomplishments.
with the behaviour, their physiological state while doing the behaviour, the barriers they face and their self-regulatory skills and coping skills regarding the behaviour.

Behavioural theories have been used in the literature to help explain these mediating variables. Beliefs have been examined by Blanchard (2008) using the Theory of Planned Behaviour and found that it was useful in understanding exercise adherence in a home-based model of care. The study showed that attitude and perceived behavioural control predicted both intention for exercise and exercise behaviour during a 6-month program. Al-Ali and Haddad (2004) examined both beliefs and modifying factors using the Health Belief Model to describe the health beliefs of Jordanian myocardial infarction patients related to exercise participation and to identify the association among health belief variables within the model. With respect to beliefs, they found a positive correlation between health motivation and exercise participation (r = .326, p<.01) showing that those concerned about their health were more likely to exercise. Further, they found a negative correlation between perceived barriers to exercise and actual exercise participation (r = -.210, p<0.05) indicating when faced with a barrier patients were less likely to engage in exercise. When modifying factors like age and socioeconomic status were evaluated in this model, the group found that the younger the patient, the more likely they were to engage in exercise and those earning greater than JD3000 ($42,000 US) per year were more likely to exercise regularly. Finally, self-efficacy has been examined to explain levels of physical activity in a home program using Bandura’s Social Cognitive Theory and through survey methodology it was found that barrier self-efficacy was a key predictor (B=0.21) of physical activity when using this theory (Blanchard et al. 2011).

A focused approach to evaluate one of these mediating variables is important to better understand adherence in CR. A common interpersonal mediating variable within the theories described above is self-efficacy. Whether it is evaluating intention, motivation or the action of behaviour, all of the theories include the concept of the belief or confidence in oneself to be capable of successfully performing a certain behaviour or reaching a goal even in the face of adversity (Bandura, 1997). This concept of self-efficacy can also be fostered, and as the theory posits, can be done through vicarious experience, by exploring past performance accomplishments, through social persuasion and awareness of physiological and emotional states (Bandura, 1996; O’Leary, 1985). The model of cardiac rehabilitation is an ideal environment to not only assess one’s self-efficacy, but has inherent traits that can also foster
self-efficacy. Programs include having: multiple visits where patients can learn and practice over time the necessary skills to take care of their health, inter-professional clinicians with coaching abilities to help patients problem solve through the barriers they may face, and counselling on and modeling of important CR behaviours like exercise. Targeted interventions have the potential to be implemented into CR programs to increase self-efficacy. However measurement of this important variable to determine its association with adherence is an important first step.
Figure 2.1 Significant theories in behaviour change with shared constructs or mediating variables: Multiple levels of influence, behaviour change is a process, emphasizes specific behavioural intrinsic factors. NOTE: common to all is self-efficacy. (Continued on next page)

HEALTH ACTION PROCESS APPROACH (SCHWARTZER, 2010)

THEORY OF PLANNED BEHAVIOUR (AJZEN, 1991)
Figure 2.1 (Continued) Significant theories in behaviour change with shared constructs or mediating variables: Multiple levels of influence, behaviour change is a process, emphasizes specific behavioural intrinsic factors. NOTE: common to all is self-efficacy.

Social Cognitive Theory (Bandura, 1986)

Health Belief Model (Rosenstock, 1966)

Self-Efficacy Theory (Bandura, 1997)
2.11 Self-Efficacy

Self-efficacy (SE) is an “individual’s judgment of their capacity to perform specific actions (Bandura, 1997)”. Their judgment is based on the belief about their ability to organize and execute a course of action even in the face of adversity (Bandura, 1997). Because efficacy beliefs influence participant’s choice of activity, effort expenditure and persistence in the face of adversity (Bandura, 1997), adherence to health behaviours associated with CR including exercise, attendance to visits, nutrition advice, quitting smoking etc. can be influenced by SE and is therefore an important mediator of CR outcomes. Efficacy expectations can be enhanced by four specific characteristics; performance attainments or mastery of skills, exposure to and sharing of vicarious experiences, verbal persuasion by professionals who are knowledgeable, and being aware of one’s physiological state during the desired behaviour (Bandura, 1996; O’Leary, 1985). CR as an intervention, naturally possess these characteristics and can therefore act as a vehicle to enhance SE. Self-efficacy (SE) has been investigated to help explain why some individuals adhere to particular behaviours in CR and others do not. A study by Carlson and colleagues (2001) measured SE in a modified cardiac rehabilitation program where the goal was to increase confidence in patients for independent exercise through the application of these four processes. The authors found these patients to have higher SE for independent exercise from baseline to 3 months (baseline: 3.69 ± 1.0, 3 month time point: 4.43 ±0.85, p<0.05) and that SE was the only predictor of exercise over 6 months (R 2 = .28 [adjusted R 2 = .22] P < .01) (Carlson, Norman, Feltz, Franklin, Johnson & Locke, 2001).

Two important behaviours associated with CR that has a positive and significant impact on functional capacity and mortality in CR, are exercise and attendance to scheduled CR visits (Alter et al. 2009; Hammil et al. 2010; Taylor et al. 2004). Understanding the relationship between SE and these behaviours is important in order to address adherence in CR. SE and exercise have been examined in the literature both as a determinant of adherence (ie. Does SE for a specific behaviour predict what a person’s adherence will be like) as well as an outcome (ie. Does SE for a specific behaviour change during CR). As a determinant, SE has been correlated well with the total number of exercise minutes performed (Moore, Dolansky, Ruland, Pashkow & Blackburn, 2003), has been shown to be a predictor of physical activity (Yates, Price-Fowlkes & Agrawal, 2003) and is positively related to CR attendance (Schuster & Waldron, 1991). As an outcome of adherence, SE has been shown to be enhanced with exercise.
and attendance to CR visits (Berkhuysen, Nieuwland, Buunk, Sanderman & Rispens, 1999; Bock, 1997; Gardner, McConnell, Klinger, Herman Hauck & Lauback, 2003; King, Humen, Smith, Phan & Flo, 2001). Measuring SE as a determinant of adherence may help identify those patients who would require interventions that can foster SE for a specific desired behaviour. Measuring it as an outcome, can help benchmark CR programs and help to determine whether patients have the necessary self-management skills to continue long-term with their health behaviour.

Self-efficacy has also been shown to be an important factor when examining exercise in the home program literature. Blanchard et al. (2011) explained levels of physical activity in HPs using three theoretical models 1) theory of planned behaviour 2) social cognitive theory and 3) protection motivation theory. The authors found using survey methodology that all three theories accounted for 28-34% of the variance in physical activity. Specifically, barrier SE was found to be a key predictor (B=0.21) of physical activity when analyzing social cognitive theory (Blanchard et al. 2011).

When analyzing SE, there are two aspects of this mediating variable to consider. Task SE refers to one’s belief that they can carry out a specific activity (e.g. performing a specific type of exercise). Self-regulatory self-efficacy (SR-SE) refers to the actions that must be done to ensure the specific activity occurs – the actions leading up to the task itself (ie. Scheduling the time to exercise, overcoming barriers to do it, etc.). Bandura suggested that in order for health habits to change, self-regulatory skills are required where “People have to learn to monitor their health behavior and the circumstances under which it occurs… (Bandura, 2004 pg 151).” These self-regulatory efficacy beliefs may in fact be more important to measure and understand than task self-efficacy when examining adherence and have been under-investigated in the literature (Woodgate & Brawley, 2008). In asymptomatic populations, self-regulatory efficacy has been shown to be a significant predictor of exercise adherence (DuCharme & Brawley, 1995). In the cardiac rehabilitation population, Woodgate and colleagues (2005) found that efficacy for scheduling exercise visits accounted for the majority of the variance in exercise attendance (model R2=.22, p<0.001) (Woodgate, Brawley & Weston, 2005).

In a HP, having high SE for exercise is important as the patient is performing their exercise without supervision. Further, having high SR-SE is also a key factor in this setting as the
patient is required to schedule and adhere to their telephone consultations with their Case Manager, which is the venue for most home based programs. They must also use self-regulatory skills to organize their time to complete tasks related to their home based program which may include completing their scheduled telephone consultations, completing education modules for the week on their own time, completing their prescribed exercise and keeping exercise diaries and emailing them to their case manager in a timely fashion. Self-regulatory self-efficacy then could help to understand adherence to behaviours in home based programs like exercise, completion of recurrent HP telephone consultations and full completion of the entire HP. Given the clinical importance of adherence to these behaviours, the appropriate measurement of SR-SE of patients in a home based program can inform future interventions that target appropriate patients who can benefit from enhanced SE.

Woodgate & Brawley (2008) have provided a review of SE in the CR population and have reflected on key measurement strategies of this factor. They indicate that the literature shows most studies have measured SE to determine its correlation between baseline and end-point of the study or, obtain one assessment during the study. The authors highlight two important areas to consider when measuring both task SE and SR-SE. 1) The initial measurement of SE should be made at least 2 weeks after individuals are exposed to an intervention/service. McAuley and Mihalko (1998) indicate that subjects need to gain experience with the behaviour and need time to fully understand their participation before accurately reflecting on their SE, as most subjects often overestimate their confidence if measured too early. 2) Intermediary assessments of SE during the intervention/service can tell you about the development of one’s efficacy beliefs over time which could affect adherence to the behaviour. Given these two important recommendations, serial measures of SE throughout a 6-month home-based model of CR would ensure the initial timing of SE was ideal, and could help to determine when interventions could be implemented to help foster this variable, depending on its association with adherence to CR.
2.12 Summary

Based on this literature review, CR is an evidence-based effective service for those living with heart disease. Attrition is high however in these programs, leaving a large population living without the benefits of CR. Alternative methods of service delivery is required in order to reach these patients, and the home based model of care is one that has proven to deliver similar outcomes when compared with traditional models. Adherence to this alternative model however has not yet been well-established nor have the reasons for non-completion of home-based models been determined.

This paper presents two studies that were completed in a real-world setting, where patients chose their CR model of care. The first had objectives that help to establish adherence to home-based CR. Its primary objective was to compare adherence to CR between individuals who chose to attend a TP or HP. The secondary objective was to compare changes in cardiovascular fitness of these two groups of patients. We hypothesized that adherence would be higher in the HP when compared to the TP and that changes in cardiovascular fitness would be similar between the two groups. The second pilot study encompassed objectives that looked at the trajectory of a theoretical mediating variable to help explain adherence in a home-based model of care. Its primary objectives were to 1) characterize self-regulatory self-efficacy for self-managed exercise for CR in a home based model of care and 2) characterize self-regulatory self-efficacy for home program telephone consultations with a case manager in a home based model of care. The secondary objectives were to 1) to explore the reasons for non-completion in a home based model of care and 2) explore self-regulatory SE in non-completers of a home based model of care. This study sought to pilot the serial measurement of SR-SE to determine its association with adherence and determine if interventions could be strategically placed to help foster SR-SE. We hypothesized in this study that completers of the HP would have high self-regulatory self-efficacy for self-managed exercise and for telephone consultations with a case manager and remain stable throughout the program. In non-completers, we proposed that self-regulatory self-efficacy would initially be high, and then decrease. We also hypothesized that reasons for non-completion of the HP would include lack of time, other medical issues and not being ready to participate.
Together, these studies will show that although a home based model of care addresses the practical reasons for non-adherence to traditional models of CR, adherence continues to be suboptimal. The exploration of self-regulatory self-efficacy may help to explain the reasons why patients do not adhere to home-based cardiac rehabilitation.

These studies address important outcomes for patients learning to self-manage their chronic disease. They establish adherence in a home based model of care by measuring it as a primary outcome, is precise in its definition of adherence, uses a transparent description of program models, and provides a feasible methodology for future investigations that can solidify the role of self-efficacy in a home based model of care.
Chapter 3 Adherence to a cardiac rehabilitation home program model of care: a comparison to a well-established traditional on-site supervised program (Study #1)

Published in Applied Physiology, Nutrition and Metabolism.

3.1 Abstract

Background: Despite the proven benefits of cardiac rehabilitation (CR), adherence to programs remains suboptimal. To improve adherence, alternative models of care, such as using home programs (HP), have been recommended. Little information exists, however, about its effect on adherence in real-world settings.

Objectives: This study’s primary objective was to compare adherence of patients in an HP and traditional on-site program (TP) model of CR. The secondary objective was to compare their clinical and demographic profiles and changes in cardiovascular fitness.

Methods: We implemented a retrospective review of 200 consecutively enrolled patients who chose either a TP or HP model. Profile data was collected at intake assessment. Adherence, defined as attendance to prescheduled contacts or on-site visits in each respective cohort, served as a primary outcome measure. Secondary outcomes included completion of program and cardiopulmonary fitness levels at 6 months.

Results: We found that the HP cohort had patients who were significantly younger, male (significantly more so than female), were more geographically removed from the on-site centre, were employed, and (or) had greater cardiopulmonary fitness at initiation. Similar mean attendance (p = 0.21) and completion rates (p = 0.22) were seen between models. Both groups attained similar gains in cardiovascular fitness (p = 0.79).
Conclusion: Analysis of adherence shows the HP to be a suitable option for patients who face barriers for TP-CR participation.

3.2 Introduction

Cardiac rehabilitation (CR) is recommended as a core intervention for patients living with heart disease (CACR, 2009; Balady et al. 2007). The benefits of CR have been well-documented in randomized control trials, indicating a reduction in total cholesterol, triglycerides, systolic blood pressure, and both cardiac mortality (Taylor et al. 2004) and total mortality (Clark, Hartling, Vandermeer & McAlister, 2005; Taylor et al. 2004). Further, improvements in functional capacity by 25% (Ades & Grunvald, 1990) have also been shown, as well as a 50% lower mortality rate as compared with population-matched controls for those patients who complete programs (Alter et al. 2009). Despite such outcome benefits, 80% of eligible patients are not participating in the service (Beswick et al. 2005) and adherence to programs is suboptimal, thus leaving this important service underutilized. A review of adherence predictors revealed that those who are less likely to participate in programs are women, those having to travel a long distance to participate, and those with family obligations (Jackson, Leclerc, Erskine & Linden, 2005). Of those who do participate in programs, 40%–50% drop out prematurely (Sanderson et al. 2003; Oldridge & Streiner 1990). Given the strong “dose–response” relationship between CR program adherence and survival (Hammill et al. 2010), recent attention has turned to developing strategies that have focused on enhancing participation and adherence to CR programs (CACR, 2009; Filip, McGillen & Mosca, 1999). One such strategy involves the implementation of home-based programs (HP). These programs have become an accepted alternative model of care (CACR, 2009) given that some evidence suggest advantages for lower costs when compared with traditional onsite programs (TP) (Carlson et al. 2000; Marchionni et al. 2003), and randomized clinical trials have demonstrated similar clinical outcomes between the 2 models of care (Arthur et al. 2002; Clark et al. 2010; DeBusk et al. 1985; Jolly et al. 2006, 2009; Marchionni et al. 2003; Neubeck, Redfern, Fernandez, Briffa, Bauman & Freedman, 2009; Taylor et al. 2007). Adherence, however, has been only briefly examined in this model (Jones et al. 2007). Moreover, few studies have explored the real-world impact of implementing a HP
within an already established, large, intensive, and comprehensive TP, in which patients themselves select their preferred delivery model of CR (DeBusk et al. 1985; Jolly, Taylor, Lip & Stevens, 2006, Jolly et al. 2009; Taylor et al. 2007; Gordon et al. 2002). Accordingly, the primary objective of this study was to compare adherence to CR between individuals who chose to attend a TP or HP. The secondary objective was to compare changes in cardiovascular fitness of these 2 groups of patients. The CR program used in the present study is a large TP that is committed to utilizing best practice guidelines. It is located in the urban, multicultural city of Toronto in Canada and is accessible by public transit. The program has provided services for over 30 years and has been used as a “best practice” benchmark for other programs in Canada and elsewhere. In 2007, the program introduced a voluntary HP as a pilot implementation study to evaluate whether patients who self-selected themselves to a HP adhered differently to those participating in a TP.

Home programs have been described differently in the literature with some having highly structured follow-up visits, education, and contact throughout the program, either through home visits or telephone calls (Jolly et al. 2009), while other less formalized programs may have minimal contact, no secondary prevention education, exercise only, or no structured follow-up (Kodis et al. 2001; Oerkild et al. 2011). Although home-based CR has been shown to provide improved clinical outcomes, the optimal design of its model, including elements of exercise, education, secondary prevention, and duration and frequency of follow-up contacts, has not yet been established. To comply with CR best practice guidelines and for a more precise comparison to the TP, the home-program in the present study had a highly structured mentored exercise and educational program design. Patients exercised independently at home and used regular telephone and Internet follow-up with a clinical case manager for exercise and educational counselling, and minimal onsite programming was utilized for clinical assessments.

3.3 Materials and Methods

3.3.1 Sample

A retrospective review was undertaken of a total of 200 men and women who were consecutively enrolled in either the TP or HP from April 2007 to May 2008 in a Canadian CR
program. Patients were informed of the HP at the time of their initial visit to the centre and were enrolled into that model of care based on their preference for program. Sample size (n = 100) in each program was determined based on the available cases in the HP since its inception in April 2007 to when the study began. Ethics approval was obtained from Toronto Rehab’s Research Ethics Board.

### 3.3.2 The Models of Care

The TP and HP shared similarities in certain elements of their models, including clinical assessments, education, exercise counselling, and exercise progression. A cardiopulmonary assessment, examination, and orientation session occurred at entry for both models. Patients in both programs received education on various topics associated with CR, including “how the heart works”, “how to deal with cardiac symptoms”, “exercise prescription and safety”, “risk factors for heart disease”, “heart healthy eating”, “stress management”, and “goal setting”. A review of symptoms, medications, goals, exercise, and risk factors occurred during each contact with their case manager in both programs. The TP and HP provided individualized exercise programming, which was based on their initial cardiopulmonary assessment. Exercise progression, for both aerobic and resistance training for frequency and intensity, occurred based on the patient’s goals, best practice guidelines (CACR, 2009), and a weekly review of the patient’s exercise diary and symptoms. Access to psychosocial and nutrition services were made available to patients through individual appointments.

The TP and HP models differed in; their length and duration of contact patients had with their case managers during the program; the method of how patients received their care; how education and counselling were delivered, and; where the patient’s exercise took place. The TP was a 12-month program that required patients to attend 36 prescheduled group based visits (24 occurred within the first 6 months) to the centre, working with their case manager. During each prescheduled 90-min visit, education was delivered in lecture format in a group setting. Patients performed their prescribed exercise on-site during this once-per-week visit and received counselling as directed by their care plan. Patients were also encouraged to exercise on their own at home an additional 4 times per week, which was recorded on their exercise diary. Two follow-up cardiopulmonary assessments occurred at 6 and 12 months. The TP model allowed regularly weekly on-site visits for both education and exercise. The HP was a 6-month program.
requiring patients to complete 15 individually based, prescheduled telephone consultations with a case manager that took place over 6 months, once their onsite cardiopulmonary assessment and orientation took place. Telephone consultations were on average 15–20 min in length. During each telephone consultation, assessment and coaching by their case manager occurred as directed by their care plan. Review of the patient’s home exercise occurred based on an exercise diary that was emailed or faxed-in prior to the scheduled call. Education was delivered through lectures conducted by in-house clinicians, which were Webcasted via the Internet and was accompanied by a self-directed cardiac education workbook that was produced by the program. One follow-up cardiopulmonary assessment took place at the end of 6 months. This model allowed regular prescheduled telephone consultations for education and counselling with no regular on-site visits. (See Table 3.1 for comparison of model of care parameters between TP and HP.)

**Table 3.1**  
Comparison of Model of Care Parameters between Traditional Program and Home Program

<table>
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<tr>
<th>PARAMETER</th>
<th>TRADITIONAL PROGRAM</th>
<th>HOME PROGRAM</th>
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<tbody>
<tr>
<td>Assessment</td>
<td>Cardiopulmonary Assessment, Medical Exam and Orientation</td>
<td>Cardiopulmonary Assessment, Medical Exam and Orientation</td>
</tr>
<tr>
<td>Education</td>
<td>Group lectures, workbook, individual counseling</td>
<td>Workbook, Internet-based webcasts of program lectures, individual counseling</td>
</tr>
<tr>
<td>Group/Individual Program</td>
<td>Group and individual</td>
<td>Individual</td>
</tr>
<tr>
<td>Method of Contact</td>
<td>Pre-scheduled visits to centre</td>
<td>Pre-scheduled telephone consultations</td>
</tr>
<tr>
<td>Duration of Contact</td>
<td>24 visits of 90 minutes each, over 6-months</td>
<td>15 telephone consultations of 15-20 minutes over 6-months</td>
</tr>
<tr>
<td>Exercise</td>
<td>On-site and at home. Submission of exercise diary on each visit</td>
<td>At home. Submission of exercise diary each week via email/fax</td>
</tr>
<tr>
<td>Reassessment</td>
<td>Yes</td>
<td>Yes</td>
</tr>
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</table>
3.3.3 Inclusion and Exclusion Criteria

Data were extracted and analyzed from the CR program’s patient database and patient files by 1 investigator (K.S.). Once the initial collection of data was completed, it was repeated to ensure accuracy. Available cases between April 2007 and May 2008 were included that met the following criteria: completion of a cardiopulmonary assessment at intake and attendance to an orientation session, men and women, >18 years of age, diagnosis or history of established coronary artery disease, aortocoronary bypass surgery, percutaneous coronary intervention, myocardial infarction, cardiomyopathy, or congestive heart failure.

3.3.4 Measures

Data were collected at entry to the program to characterize patients’ profiles and included age, gender, employment status (defined as those working outside the home), marital status, and distance living from the program. Clinical data collected at entry for all patients as part of their cardiopulmonary assessment and at the time of their 6-month reassessment included weight (kg), waist circumference (cm), resting blood pressure, and measured oxygen uptake (VO₂) (mL·kg⁻¹·min⁻¹), which was determined by using gas analysis while patients were on either a cycle ergometer, with increases of 50–100 kilopond-metres, or on a treadmill using a modified Bruce protocol. Peak VO₂ (VO₂peak) vs. maximum VO₂ (VO₂ max) achieved was based on whether the patient satisfied the required number of criteria for VO₂ max (failure of heart rate to increase with further increases in exercise intensity, a plateau in oxygen uptake, a respiratory exchange ratio of 1.15, or a rating of perceived exertion of more than 17 (6–20 scale) (American College of Sports Medicine, 2001). Centre for Epidemiological Studies Depression (CES-D) score, which is a 20-item validated screening tool designed to measure depressive symptoms (Radloff, 1977) was also collected. A score >16 indicated further clinical assessment. Smoking status was also collected as well as current level of physical activity determined by self-report (attainment of <150 min of activity per week or ≥150 min of activity per week based on recommendations for minimum duration of aerobic activity per week required for health benefits (Haskell et al. 2007). Adherence was measured by both attendance rate and completion
of program, and was assessed at a common time point of 6 months for both programs. Attendance rate was determined by dividing the number of actual contacts by the number of scheduled contacts that were completed over a 6-month period for both programs. For the TP these contacts were based on weekly visits to the centre (maximum 24 contacts over 6 months). For the HP, it was based on completion of telephone consultations (maximum 15 contacts over 6 months). Completion of a program was not dependent on attendance rate, but was defined as patients who did not prematurely (before 6 months) withdraw from either program. Non-completion was defined as patients who dropped out of the program prematurely (before 6 months) because of a medical or nonmedical reason and was not dependent on attendance rate.

3.3.5 Statistical Analyses

The data analyses for this paper were generated using SAS software, version 9.2. (copyright 2008; SAS Institute Inc., Cary, N.C., USA). Differences in profiles of patients were compared using t tests; analysis of variance and $X^2$ were used where appropriate to compare adherence between the TP and HP. To identify change in cardiovascular fitness between programs, accounting for age and gender, analyses of covariance was conducted. A significance level of $\leq 0.05$ was used. Results are reported as means ± SD unless otherwise indicated.

3.4 Results

3.4.1 Demographics and Characteristics

Primary diagnoses of patients at entry in the TP and HP, which were similar ($p = 0.44$), are described in table 3.2. Baseline demographic and physiological measures are reported in Table 3.3. Patients in the HP were younger (HP: mean age, 60.4 ± 13 years; 95% confidence interval (CI), 57.8–63.0; and TP: mean age, 64.9 ± 11 years; 95% CI, 62.6–67.1 ($p = 0.01$)), had more males (86 vs. 73; $p = 0.02$), lived farther from the centre (HP: mean distance, 29.7 ± 48.6 km; 95% CI, 20.1–39.4 vs. TP: mean distance, 12.8 ± 11 km; 95% CI, 10.6–14.9 ($p = 0.02$)), had more workers (55 vs. 36; $p = 0.007$), and had a higher VO$_2$ (HP: mean VO$_2$, 21.4 ± 8.0 mL•kg$^{-1}$•min$^{-1}$).
\(1\text{•min}^{-1};\) 95% CI, 19.8–22.9 vs. TP: mean VO\(_2\), 17.6 ± 6.0 mL•kg\(^{-1}\text{•min}^{-1};\) 95% CI, 16.4–18.7 (p < 0.001)), than patients in the TP.

Table 3.2 Primary Diagnoses of Patients at Entry in Traditional Program and Home Program

<table>
<thead>
<tr>
<th>Primary Diagnosis at Entry of Program</th>
<th>Traditional Program (n=100)</th>
<th>Home Program (n=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angina</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>CABG*</td>
<td>25</td>
<td>32</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Ischaemic Heart Disease</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>PCI†</td>
<td>44</td>
<td>38</td>
</tr>
<tr>
<td>Valve Replacement</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

*C Coronary Artery Bypass Graft (CABG)  † Percutaneous Coronary Intervention (PCI)
### Table 3.3 Comparison of Baseline Profile between Traditional Program and Home Program

<table>
<thead>
<tr>
<th>Profile</th>
<th>Traditional Program</th>
<th>Home Program</th>
<th>p-Value (baseline)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline (n=100)</td>
<td>Baseline (n=100)</td>
<td></td>
</tr>
<tr>
<td><em>Age (y)</em></td>
<td>64.9±11(40-94)</td>
<td>60.4±13 (26-86)</td>
<td>0.01</td>
</tr>
<tr>
<td>Gender (M/F)</td>
<td>(73/27)</td>
<td>(86/14)</td>
<td>0.02</td>
</tr>
<tr>
<td><em>Distance living from centre (km)</em></td>
<td>12.8 ±11(0.8-93.2)</td>
<td>29.7±48.6(0.6-266.3)</td>
<td>0.001</td>
</tr>
<tr>
<td>Smoking (#) (non-smoker/smoker)</td>
<td>97/3</td>
<td>92/8</td>
<td>0.12</td>
</tr>
<tr>
<td>Marital Status</td>
<td>77/23</td>
<td>78/22</td>
<td>0.86</td>
</tr>
<tr>
<td>(married/unmarried)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity Level (#) (&lt;150min per week/&gt;150min per week)</td>
<td>34/66</td>
<td>43/55 (n=98)</td>
<td>0.15</td>
</tr>
<tr>
<td>Employment Status (#) (workers/non-workers)</td>
<td>36/64</td>
<td>55/45</td>
<td>0.007</td>
</tr>
<tr>
<td>*% Body Fat</td>
<td>29.4±9 (11-49)</td>
<td>27.1±(14-58)</td>
<td>0.06</td>
</tr>
<tr>
<td>*Weight (kg)</td>
<td>81.2±18 (46-149)</td>
<td>81.0±15(52-129)</td>
<td>0.93</td>
</tr>
<tr>
<td>*Waist (cm)</td>
<td>99.5±15(71-140)</td>
<td>96.8±12(55-133)</td>
<td>0.14</td>
</tr>
<tr>
<td>*Systolic BP (mmHg)</td>
<td>124.3±18(90-170)</td>
<td>121.9±19(78-168)</td>
<td>0.38</td>
</tr>
<tr>
<td>*Diastolic BP (mmHg)</td>
<td>73.5±10(50-110)</td>
<td>74.3±10(50-102)</td>
<td>0.67</td>
</tr>
<tr>
<td>*VO₂ (ml/kg/min)</td>
<td>17.6±6(8-42)</td>
<td>21.4±8(7-47)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>*Centre for Epidemiological Studies Depression</td>
<td>8.8±9(0-38)</td>
<td>8.3±8(0-37)</td>
<td>0.73</td>
</tr>
</tbody>
</table>

*Data is presented as Mean ±SD(min-max). †Significant difference between programs
p is significant at ≤0.05. h=n73 (27 patients did not complete the questionnaire, therefore scores were unavailable). †h=70 (30 patients did not complete the questionnaire, therefore scores were unavailable).
3.4.2 Adherence

There was no significant difference between programs when comparing the overall mean attendance rate to prescheduled telephone consultations in the HP and prescheduled visits in the TP (HP: 61.1% ± 36.3%, 95% CI 53.9–68.4; TP: 55.6% ± 3.5%, 95% CI 43.4–54.7; p = 0.21). There was also no significant difference between programs with respect to completion of program (HP: 72/100, TP: 64/100; p = 0.22) even when accounting for medical reasons for dropouts (HP 11/100, TP 4/100; p = 0.15) (Table 3.4). Although not statistically significant, an important clinical finding of 8% higher completion rate in the HP was seen as compared with the TP.

Table 3.4 Comparison of Adherence to CR between Traditional Program and Home Program

<table>
<thead>
<tr>
<th></th>
<th>Traditional Program</th>
<th>Home Program</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance (%)</td>
<td>55.61 ±30.5 (0-100)</td>
<td>61.1 ±36.3 (0-100)</td>
<td>0.21</td>
</tr>
<tr>
<td>Completion</td>
<td>64/100</td>
<td>72/100</td>
<td>0.22</td>
</tr>
<tr>
<td>Non Completion</td>
<td>36/100</td>
<td>28/100</td>
<td></td>
</tr>
<tr>
<td>Completion</td>
<td>64/100</td>
<td>72/100</td>
<td>0.15</td>
</tr>
<tr>
<td>Non-Completion-compliance</td>
<td>25/100</td>
<td>24/100</td>
<td></td>
</tr>
<tr>
<td>Non-Completion-medical</td>
<td>11/100</td>
<td>4/100</td>
<td></td>
</tr>
</tbody>
</table>

*Data is presented as Mean ±SD (min-max)

	1p is significant at ≤0.05

2Adherence: to pre-scheduled telephone contacts for HP and pre-scheduled visits for TP

3Non completion compliance: program withdrawal for any reason other than medical
3.4.4 Comparison of Change in Cardiovascular Fitness

Significant improvements were seen in cardiovascular fitness for both groups. The initial \( \text{VO}_2 \) for TP was 17.6 mL\( \text{kg}^{-1}\text{min}^{-1} \) and the 6-month \( \text{VO}_2 \) was 21.6 mL\( \text{kg}^{-1}\text{min}^{-1} \) (\( p < 0.001 \)). The initial \( \text{VO}_2 \) for HP was 21.4 mL\( \text{kg}^{-1}\text{min}^{-1} \) and the 6-month \( \text{VO}_2 \) was 27.6 mL\( \text{kg}^{-1}\text{min}^{-1} \) (\( p < 0.001 \)). No difference was seen in the change for cardiovascular fitness between programs (\( p = 0.79 \)).

3.5 Discussion

The present study compared the profiles, adherence, and change in cardiovascular fitness of patients in a traditional model of CR to a home-based model. Patients participating in the HP were found to be younger, fitter, resided in more geographically removed neighbourhoods, and had more participants that were employed. Similar positive changes in cardiovascular fitness were seen between models and are consistent with findings in other randomized controlled trials when compared with this important clinical outcome (calculated effect sizes of 0–0.19) (Arthur et al. 2002; Gordon et al. 2002; Kodis et al. 2001). Adherence was revealed to be similar between programs and although power was a limitation in this study, the results are clinically promising in favour of the HP. It confirms that there are potential adherence benefits that the HP can offer, especially for those who face barriers for TP participation.

Behavioural adherence has become an important quality indicator for CR and recently, investigating compliance to program utilization has been linked to important clinical markers. Completion of CR and higher adherence to CR visits has been related to a lower risk of mortality and future myocardial infarction (Alter et al. 2009; Hammill et al. 2010). Studies investigating adherence to CR, however, vary in their definition of adherence (Farley et al. 2003; Higgins et al. 2008; Marzolini et al. 2008; Sanderson et al. 2003; Sarrafzadegan et al. 2007; Worcester et al. 2004; Yohannes et al. 2007). These studies also differ in the behaviour being considered for adherence, which may include exercise (Arthur et al. 2002) or attendance to rehabilitative visits (Gordon et al. 2002). Inconsistency of terminology and meaning of adherence make it difficult to compare across studies and hinders the understanding of the reasons for non-adherence (Bock, 2002). A recent meta-analysis of randomized controlled trials
comparing home vs. centre CR highlighted the inconsistent definition and measurement of adherence among studies, as well as the varying results that showed similar compliance between models in some findings and higher compliance for the HP model in others (Dalal et al. 2010). We therefore defined adherence in this study as compliance to scheduled contacts (attendance rate) as well as completion of program and found inconsistencies in the literature when comparing our results. One study measured adherence to scheduled appointments for the TP and telephone calls for the HP and similarly found no differences between the comparison groups (Gordon et al. 2002). We noted a 61% mean attendance rate to scheduled telephone contacts in our HP, which is lower than figures from previous reports (86%–96%) (Jolly et al. 2009; Gordon et al. 2002). These HP models however, had a different number of scheduled contacts (4 vs. 15 in this study) (Jolly et al. 2009) and a shorter follow-up period (12 weeks vs. 6 months in this study) (Gordon et al. 2002). When completion rates were compared, our similar completion rate between the HP and TP was consistent with Dalal et al. (2007), but different from work done by Marchionni et al. (2003) when a higher drop-out rate was seen in the HP (Marchionni et al. 2003), as well as Carlson et al.’s (2000) study, which revealed a lower completion rate in the TP (Carlson et al. 2000). Design elements, such as length of program, education delivery, exercise, and number of and type of contact, may impact adherence, making it difficult to compare across studies if it is not consistent. Some limitations in trials comparing TPs with HPs have been argued to be unclear about the characteristics of their models of care, and recommendations have been made to be more comprehensive in the descriptions of programs to fully understand how their characteristics influence outcomes (Clark et al. 2010). Further examination is needed to fully understand the impact of the HP on adherence.

There was no difference in completion rates between models in our study, despite the fact that other studies identified that reduced travel time was a benefit for patients who prefer the HP and that practical concerns involving caregiving, transportation, and parking were reasons why patients chose the HP (Wingham, Dalal, Sweeney & Evans, 2006). Further analysis of intrinsic factors — such as patient’s self-efficacy (Woodgate & Brawley, 2008) and motivation (Russell and Bray, 2009), which can impact completion — may help to further understand adherence in the HP. Although the study statistically indicates that the HP offers just as good completion rates as the TP and is therefore a suitable option for CR participation, the study also shows a clinically significant result that cannot be ignored. The HP had an 8% higher completion rate
than the TP. This result shows promise that the HP can offer an alternative means for full CR participation for women and for those having to travel a distance to a CR program, which are 2 groups with low CR participation rates and who are at most risk for drop out from traditional CR (Ades, waldmann, Mccann & Weaver, 1992; Blackburn, Foody, Park, apperson-Hansen & Pashkow, 2000; Brual, Gravely-Witte, Suskin, Stewart, Macpherson & Grace, 2010). The HP model of care can address the barriers that these groups face and that deter them from participating, including work commitments, transportation (Grace et al. 2009), and living in rural areas where there are no CR services (Valencia et al. 2011). By offering patients a choice for their model of CR, the comparison revealed a unique profile of those participating in the HP. Patients were younger, fitter, lived a farther distance from the centre, and had more participants that were employed. These results fall in line with previous work that investigated patient preferences where employment and perceived time constraints were identified as reasons why patients opted for an HP over a TP model for their CR (Grace, McDonald, Fishman & Caruso, 2005). Similarly, Grace and colleagues included subjects who chose to participate in either a HP or TP in a study that examined patient preferences and showed that more patients were employed in the HP model (Grace et al. 2005). If given an initial option to choose their model of rehabilitation (home vs. center based), patients may be more motivated to participate and adhere (Brewin and Bradley, 1989). Guidelines for CR recommend alternative strategies for service with a goal to reach patients who are underserved (Arthur et al. 2004; CACR 2009). Valencia et al. (2011) also suggested in their recent review of population-specific barriers affecting CR access that creative interventions are needed to optimize CR utilization for those who face barriers for CR participation. The HP model is one such strategy, and in the present study’s real-world setting it was able to attract patients who were living in areas where CR services may not have existed. Patient choice also highlighted that those who were younger preferred the HP model. Given that this group has been shown to be a high-risk group for dropout from CR (Yohannes et al. 2007), a HP may have elements that are more appropriate for this group’s lifestyle, in which family and work commitments act as barriers that do not allow this group to adhere to a TP. The real-world findings in the present study can guide health care professionals toward developing, delivering, and recommending the most appropriate model of CR, depending on individual client need and preference. Choice, as part of model programming, can act as a strategy that enhances adherence.
Adherence in the HP showed a similar mean attendance to contacts and completion rate when compared with the TP. Although we are not completely convinced of the HP’s effect on adherence as the study lacked statistical power, the results are clinically promising and could have significant implications on population health and how CR services are delivered. Cardiac rehabilitation is a health service that is not only designed to promote and restore health, but is also designed to prevent disease. The service promotes self-care and coping strategies that individuals require when faced with the challenges that cardiovascular disease presents. Cardiac rehabilitation contributes toward a positive effect on these determinants of health that in turn, has a positive effect on population health. The less than 25% participation rate of eligible patients in the service (Arthur et al. 2004), however, is a barrier that prevents CR services from achieving a large positive effect on population health. If stronger results than what has been established in the present study, as pertaining to adherence in an HP, could be brought to fruition, then program administrators would have a stronger evidence-based case for implementing the model, especially when it has been shown to have a lower cost per patient when compared with the TP (Carlson et al. 2000; Marchionni et al. 2003). Moreover, access can be improved for patients who are at risk for dropout from programs, those in underserviced areas, and for those without transportation. More patients who face other barriers will also have a better opportunity to comply and complete their CR through this model, ultimately improving population health.

3.6 Limitations

Because of the retrospective, non-experimental design, the study is subject to threats of internal validity. The study was underpowered to effectively detect significant differences, patients were not randomly assigned to each model of care, and a selection bias may be present as patients chose their program model of participation. Women were not well represented in the study because of the retrospective study design that used consecutive enrollment. It does, however, reflect the poor participation rates of women in CR that have been reported elsewhere (Marzolini et al. 2008). Comparison of attendance between programs was based on visits for the TP and telephone consultations for the HP, and although not ideal, this comparison was unavoidable as these were the vehicles of delivery of care for each model. Other factors that
might have helped to explain the adherence results in this study were not considered for measurement or analysis, including factors like self-efficacy and motivation. Finally, the large comprehensive CR program utilized by the study may not be generalizable to smaller, less well-resourced programs.

3.7 Conclusion

The HP model is an accepted alternative model of care and has been shown to be as effective as a TP with respect to clinical outcomes. Programming efforts are futile, however, if patients are not adhering to programs. The present study has shown the HP to be a suitable option for patients who face barriers for TP CR participation. Further investigation is required, however, to solidify these promising results.
Chapter 4 Self-efficacy and Reasons for Non-completion in a Home Based Cardiac Rehabilitation Program – A prospective Pilot Study (Study #2)

4.1 Abstract

**Background:** The cardiac rehabilitation (CR) home program (HP), an accepted alternative model of care, provides similar clinical outcomes to the traditional on-site program at Toronto Rehab. Similar adherence outcomes have also been identified between the two models. The HP addresses the practical barriers to CR participation including transportation, distance to travel and scheduling, however, further investigation regarding adherence to the HP is required. Determining the reasons for non-completion of a HP as well as exploring the trajectory of a theoretical mediating variable like self-regulatory self-efficacy (SR-SE) through a HP, would give insight into why some patients adhere to a HP, and others do not.

**Objectives:** Primary: 1) to characterize SR-SE for self-managed exercise for CR in a home based model of care and 2) to characterize SR-SE for home program telephone consultations with a case manager in a home based model of care. Secondary: 1) to explore the reasons for non-completion in a home based model of care and 2) to explore SR-SE in non-completers of a home based model of care.

**Methods:** This pilot study had a prospective design with monthly serial measures of SR-SE for exercise and telephone consultations, and physical activity over a 6-month program. An interview with non-completers revealed reasons for drop-out.

**Results:** Fourteen patients were enrolled, 4 dropped out. Reason for non-completion was related to employment for one drop-out. SR-SE for exercise and telephone consultations for completers were high and remained stable throughout the program whereas SR-SE for non-
completers started high but dropped before discontinuation. Differences were seen in the trajectory of SR-SE over time between completers and non-completers for exercise ($B=21.57$, $p=<0.0001$) and for telephone consultations ($B=20.47$, $p=0.0002$). The four non-completers were male and obese.

**Conclusion:** Completers of the program had high SR-SE throughout whereas non-completers started with high SR-SE but this declined before dropping out of the program. This study shows important trends in non-completers of a home based model of care. Further research is needed to prove or disprove this pattern and inform the use of SR-SE as a risk index in CR.

### 4.2 Introduction

Cardiac Rehabilitation (CR) is recommended as a core intervention for patients living with heart disease (CACR, 2009). The benefits of CR have been well documented showing an improvement in functional capacity by 25% (Ades & Grunvald, 1990) and a 50% lower mortality rate as compared with population matched controls for those patients who complete programs (Alter et al. 2009). Despite these benefits, CR continues to be underutilized and adherence to programs is suboptimal. Approximately eighty percent of eligible patients are not participating in the service (Evans, Turner & Bethell, 2002) and of those who do participate, 30-55% dropout prematurely (Kerins et al. 2011; Martin et al. 2012; Marzolini et al. 2008; Oldridge 1983; Oldridge 1988; Sanderson 2003; Taylor et al. 2011). The CR home program (HP) is an accepted alternative model of care (CACR, 2009) that has been proven to provide similar clinical outcomes to traditional on-site programs (TP) (Arthur et al. 2002; Carlson et al. 2000; Dalal et al. 2010; Jolly et al. 2009; Marchionni et al. 2001) and has the potential to make a positive impact on adherence to CR. Models vary in design, but usually include a face-to-face assessment, followed by education and exercise occurring independently at home and may
include telephone/in home contacts with a health professional (Jones et al. 2009; Kodis et al. 2001; Scane, Alter, Oh & Brooks, 2012).

We showed in the previous chapter that there were no significant differences in adherence between traditional and home CR programs, showing potential that the HP model of care may be acceptable for patients who struggle to adhere to traditional models (Scane et al. 2012). Further investigation is warranted however, to determine the reasons for non-completion of a HP, when practical reasons like geographical distance, work and transportation which have been previously indicated as barriers for participation (Wingham et al. 2006; Grace et al. 2005), have been addressed by a HP model. Reasons for non-adherence in a HP have been only briefly examined in the literature. Jones et al concluded in a qualitative study that reasons for non-completion included participating in alternative exercises and activities, other health problems, personal reasons and CR program related changes (Jones et al. 2007). But what about the theoretical interpersonal factors that can affect adherence? Beyond the practical reasons that inform us of the barriers individuals may face, what intrinsic factors play a role in someone’s decision to complete their CR HP? Behavioural based theories can help explore these questions to explain and predict behaviour. They can also guide interventions that can foster health behaviours like adherence to home based CR (Glanz, Rimer & Biswannath, 2008).

Common theories in the study of health behaviour include; The Health Belief Model (Rosenstock, 1966), Social Cognitive Theory (Bandura, 1986), Self –efficacy Theory (Bandura, 1997), Health Action Process Approach (Schwartzer, 2010) and the Theory of Planned Behaviour (Ajzen, 1991). Shared constructs or mediating variables within these theories include having multiple levels of influence, (indicating that interventions may be suitable), they have an understanding that behaviour change is a process, and each emphasizes one or all of the concepts of intention, motivation and action of the behaviour. (Glanz et al, 2008). These mediating variables can predict behaviour and may have strong correlations to a desired health behaviour (Hansen and MacNeal, 1996; Baranowski et al. 1998). One mediating variable that can affect intention, motivation and the action of a behaviour that is common to these theories, is self-efficacy. Self-efficacy has been examined in the HP literature to explain levels of physical activity in a home program using Bandura’s Social Cognitive Theory. With survey methodology, it was found that barrier self-efficacy was a key predictor (B=0.21) of physical activity when using this theory (Blanchard et al. 2011).
Self-efficacy (SE) is an individual’s judgment of their capacity to perform specific actions. Their judgment is based on the belief about their ability to organize and execute a course of action even in the face of adversity (Bandura, 1997). Because efficacy beliefs influence participant’s choice of activity, effort expenditure and persistence in the face of adversity (Bandura, 1997), adherence to health behaviours associated with CR including exercise and attendance to visits, can be influenced by SE and is therefore an important mediator of CR outcomes. SE and exercise have been examined in the literature and was favourably identified as a determinant of adherence (Moore et al. 2003; Schuster & Waldron, 1991; Yates et al. 2003) and as an outcome of adherence (Berkuysen et al. 1999, Bock et al. 1997, Gardner et al. 2003, King et al. 1990). By measuring SE, we can identify patients who require interventions that foster it, and be able to determine whether patients at the end of a program, have the necessary self-management skills to continue their long-term health behaviours.

When analyzing SE, there are two aspects of this intrinsic factor to consider. Task SE refers to one’s belief that they can carry out a specific activity (e.g. performing a specific type of exercise). Self-regulatory self-efficacy (SR-SE) refers to the actions that must be done to ensure the specific activity occurs – the actions leading up to the task itself (ie. Scheduling the time to exercise, overcoming barriers to do it, etc.). Bandura suggested that in order for health habits to change, self-regulatory skills are required where “People have to learn to monitor their health behavior and the circumstances under which it occurs… (Bandura, 2004 pg 151).” These self-regulatory efficacy beliefs may in fact be more important to measure and understand than task self-efficacy when examining adherence and have been under-investigated in the literature (Woodgate & Brawley, 2008). In asymptomatic populations, self-regulatory efficacy has been shown to be a significant predictor of exercise adherence (DuCharme & Brawley, 1995). In the cardiac rehabilitation population, Woodgate and colleagues (2005) found that efficacy for scheduling exercise visits accounted for the majority of the variance in exercise attendance (model R2=.22, p<0.001) (Woodgate, Brawley & Weston, 2005). SR-SE pertains to the circumstances under which the behaviour occurs (Bandura, 2004) and having the SE to do self-regulatory skills required in a HP model of care, may in fact be more important than the SE required to do the behaviour itself (task SE).

In a HP, having high SE for exercise is important as the patient is performing their exercise without supervision. They must also use self-regulatory skills to organize their time to complete
tasks related to their home based program which may include completing their scheduled telephone consultations with their case manager, completing education modules for the week on their own time, completing their prescribed exercise and keeping exercise diaries and emailing them to their case manager in a timely fashion. Self-regulatory self-efficacy then could help to understand adherence to behaviours in home based programs like exercise, completion of recurrent HP telephone consultations and full completion of the entire HP. Given the clinical importance of adherence to these behaviours (Alter et al. 2009), the appropriate measurement of SR-SE of patients in a home based program can inform future interventions that target appropriate patients who can benefit from enhanced SE.

Patients in a HP also make decisions about their health based on their capacity to process and understand health information. Individuals, whose health literacy or capacity to make the appropriate decisions about their health is limited, are more likely to have a poorer health status (Williams, Baker, Parker & Nurss, 1998). Inadequate health literacy for patients in a HP could have a negative impact on their adherence to CR. Determining its association with adherence may contribute toward a better understanding of why some patients adhere to their program and other do not.

The purpose of this pilot study was to explore the potential of serially measuring a mediating variable like SR-SE over 6-months to explain adherence in a home based cardiac rehabilitation program and determine the reasons for non-completion in a HP. Accordingly, the primary objectives were, to 1) characterize SR-SE for self-managed exercise for CR in a home based model of care and 2) To characterize SR-SE for home program telephone consultations with a case manager in a home based model of care. The secondary objectives were to 1) To explore the reasons for non-completion in a home based model of care and 2) to explore SR-SE in non-completers of a home based model of care. We hypothesized in this study that completers of the HP would have high self-regulatory self-efficacy for self-managed exercise and for telephone consultations with a case manager and remain stable throughout the program. In non-completers, we proposed that self-regulatory self-efficacy would initially be high, and then decrease. We also hypothesized that reasons for non-completion of the HP would include lack of time, other medical issues and not being ready to participate.
Understanding the trajectory of SE through a HP as well as the reasons for non-completion will enable program administrators and clinicians to effectively tailor this alternative model to reflect the needs of patients, ultimately enhancing adherence to CR and the associated life-style behaviours.

4.3 Methods

4.3.1 Sample

A prospective cohort study with a total of 14 men and women who were enrolled in the home based model of cardiac rehabilitation in a Toronto based Cardiac Rehabilitation Program between May 2012 and September 2012 consented to participate in the study. Patients were informed of the HP at the time of their initial visit to the centre and were enrolled in the model of care based on their preference for program. Consent was then obtained for participation in the study. Ethics approval was obtained from both Toronto Rehab and University of Toronto’s Research Ethics Boards.

4.3.2 The Home Program Model of Care

The HP included a cardiopulmonary assessment, examination and orientation session that occurred at the start of the 6-month program. Over the next 6 months, patients then received education on various topics associated with CR including “how the heart works”, “how to deal with cardiac symptoms”, “exercise prescription and safety”, “risk factors for heart disease”, heart healthy eating”, “stress management” and “goal setting”. This education was provided through their telephone consultations with their Case Manager, their education workbook and webcasts. education lectures. A review of symptoms, medications, goals, exercise workbook and risk factors occurred during each contact with their Case Manager. Exercise progression for both aerobic and resistance training for frequency and intensity occurred based on the patient’s goals, best practice guidelines (CACR, 2009) and a weekly review of the patient’s exercise diary and symptoms. There were 15 individually based, pre-scheduled telephone consultations with a Case Manager that took place over the 6-months. Telephone consultations were on average 15-
20 minutes in length. During each telephone consultation, assessment and coaching by their Case Manager occurred as directed by their care plan. Review of the patient’s home exercise occurred based on the exercise diary that was emailed or faxed in prior to the scheduled call. Two follow-up cardiopulmonary assessments took place, one at 3 months and the final at the end of 6-months. This model allowed regular prescheduled telephone consultations for education and counseling with no regular on-site visits.

4.3.3 Inclusion and Exclusion Criteria

Eligible subjects included men and women, greater than 18 years of age with a diagnosis of coronary artery disease, aortocoronary bypass surgery, percutaneous coronary intervention, myocardial infarction, cardiomyopathy or congestive heart failure and who chose the HP model of care. Patients in Toronto Rehab’s Cardiac Rehabilitation program have the option to choose either an on-site traditional program or the HP.

4.3.4 Measures

Once enrolled, patients were asked to complete four questionnaires including the 1) Self-Regulatory Self-efficacy for Exercise (SR-SE-E), 2) Self-Regulatory Self-Efficacy for Telephone Consultations (SR-SE-TC) 3) International Physical Activity Questionnaire (IPAQ) and a 4) Health Literacy Questionnaire. Patients were also given 6 separate envelopes dated for the following 6 months containing 3 questionnaires that included SR-SE-E, SR-SE-TC and IPAQ. To ensure these serial measures were completed, they received an email/phone call to remind them to complete the forms and returned them via mail, in a self-addressed stamped envelope. Patients who did not complete the program consented at the start of the program to undergo an interview to determine the reasons for non-completion of the program. See Figure 4.1 for the schedule of questionnaires administered.
4.3.4.1 Questionnaires

Self-Regulatory Self-Efficacy

Two questionnaires were used to assess SR-SE and assessments were completed at each month of the 6 month program. One measured SE for self-managed exercise (“Self-regulatory-efficacy for scheduling and planning for self-managed exercise for cardiac rehabilitation”) and the other measured SE for completing their telephone consultation with their Case Manager (“Self-regulatory-efficacy for scheduling and planning for Cardiac Rehabilitation Home Program Telephone Consultations with Case Manager”). The SE questionnaire for exercise was taken from previous work (Brawley, Glazebrook, Spink & Jung, 2010; Rejeski et al. 2003; Woodgate et al. 2005; Woodgate, Brawley & Shields, 2007; Woodgate & Brawley, 2008; Woodgate & Brawley, 2008) and was adapted for the context for the second SE questionnaire which captured SE for completing telephone consultations.

To properly assess SE, the measurement has to be based specifically on the task, context, action and prospective time period for the investigation (Woodgate et al. 2005). Our serial measurements align well with recommendations regarding the timing of measuring SE made by
McCauley & Mihalko (1998), which indicates that the time point of initial measurement of SE is suggested to occur not only at baseline, but at least 2 weeks after the individual has gained some initial experience with the behaviour as they may over estimate their efficacy. Administering intermediary assessments of self-efficacy during a study can also tell you about the development of one’s efficacy beliefs over time which could give insight into the adherence of a behaviour (Woodgate & Brawley, 2008). We therefore chose our serial measures to occur at the start of the program and at each month of the 6-month CR HP.

**Self-Regulatory Self-Efficacy for Scheduling and Planning for Self-Managed Exercise for Cardiac Rehabilitation**

This questionnaire asks the participant to think about the present time in their life and circle the appropriate number on the scale (0-100%) following each statement. The statement leading up to each statement is “Over the next 4 weeks, I am confident that I can...”. There were 9 statements which covered themes that included; completing their prescribed exercise, planning their self-managed exercise to fit with daily activities, arranging their schedule to exercise no matter what, maintaining a plan to resume their exercise if several were missed, making up missed sessions, ensuring not more than 1 was missed, organizing time and responsibilities, developing plans to maintain goals of exercise and following through with the exercise even when it may be difficult. See appendix A for questionnaire.

**Self-Regulatory Self-Efficacy for Scheduling and Planning for Home Program Telephone Consultations**

This questionnaire asks the participant to think about the present time in their life and circle the appropriate number on the scale (0-100%) following each statement. The statement leading up to each statement is “Over the next 4 weeks, I am confident that I can...”. There were 7 statements that covered themes that included; completing their scheduled telephone consultation with their Case Manager, arranging their schedule to be available for the scheduled telephone consultation, contacting their Case Manager to re-schedule if a call is missed, making sure that not more than 1 consultation is missed, organizing their time and responsibilities around their weekly telephone consultations, developing plans to maintain their weekly telephone consultation and following through with their telephone consultation even though it may be difficult. See appendix B for questionnaire.
In clinical practice similar confidence scales have been used when chronic disease self-management techniques are employed to assess a patient’s confidence to engage in a behaviour (Bodenheimer, Lorig, Holman & Grumbach, 2002). Where patients rate their confidence at least 7/10 or 70/100, patients may be more likely to engage in the behaviour. Where levels are below a 7/10 or 70/100, clinicians are encouraged to counsel patients on enhancing their confidence level to increase their likelihood of engaging in the behaviour (Bodenheimer, Macgregor & Sharif, 2005).

**Physical Activity**

To measure physical activity, the International Physical Activity Questionnaire (IPAQ), which is a self-reported validated instrument to measure physical activity (Craig et al. 2003), was used. Assessment of physical activity was completed at each month of the 6 month program. This tool assessed physical activity levels (both frequency and duration) over a 7-day period within 4 different categories of vigorous, moderate, walking and sitting activities. IPAQ allows for the calculation of the level of physical activity as a continuous and categorical measure. The three categories of physical activity include high, moderate and low. The high, according to the IPAQ scoring protocol,

“...equates to approximately at least one hour per day or more, of at least moderate-intensity activity above the basal level of physical activity. Considering that basal activity may be considered to be equivalent to approximately 5000 steps per day, it is proposed that “high active” category be considered as those who move at least 12,500 steps per day, or the equivalent in moderate and vigorous activities. This represents at least an hour more moderate-intensity activity over and above the basal level of activity, or half an hour of vigorous-intensity activity over and above basal levels daily." (Sjostrom, Ainsworth, Bauman, Bull, Craig & Sallis, 2005)
The moderate category

“...is proposed that it is a level of activity equivalent to “half an hour of at least moderate-intensity PA on most days”, the former leisure time-based physical activity population health recommendation.” (Sjostrom et al. 2005)

The low category simply represents not meeting either the high or moderate categories for physical activity. Measurement of physical activity occurred initially and every month through the 6-month program. See appendix C for IPAQ.

**Health Literacy**

To assess general and quantitative health literacy (HL), we used the Newest Vital Sign that employs 6 questions to establish the patients’ understanding of a nutritional label on an ice cream container (Weiss et al. 2005). It was developed from a series of scenarios where patients were given health related information, which they read and answered questions about. Scenarios included instructions from a prescription headache medication, consent form for coronary angiography, heart failure self-care instructions, a nutritional label from an ice cream container and instructions for asthma medication. These scenarios were able to assess understanding of text and use of numbers, and are highly correlated with one another (Weiss et al. 2005). The test’s internal consistency and criterion validity were satisfactory (Cronbach $\alpha > 0.76$) and correlates with the Test of Functional Health Literacy in Adults (TOFHLA), an accepted and well-used health literacy assessment tool (Weiss et al. 2005). A raw and categorical score is applied when calculating the questionnaire. A raw score of 0-1 indicates a likelihood of limited HL. A score of 2-3 indicates a possibility of limited HL and a score of 4-6 indicates adequate health literacy (Weiss et al. 2005). See appendix D for questionnaire.
4.3.4.2 Adherence

Adherence was measured by completion of program. Patients who did not prematurely (before 6-months) withdraw from the program were deemed completers. Non-completion was defined as patients who dropped out of the program prematurely (before 6 months) because of a medical or nonmedical reason. Case Managers were instructed to notify the principal investigator (PI) when patients withdrew from the program, so that reasons for non-completion could be explored.

4.3.4.3 Reasons for Non-Completion

To describe the reasons for non-completion, a telephone interview was completed by the PI with patients who dropped out of the program. Interview questions were based on previous work that established a questionnaire for the barriers to traditional cardiac rehabilitation participation (Grace et al. 2009) as well as qualitative results from an investigation looking at the reasons for non-completion in a home based model of care (Jones et al. 2007).

4.3.4.4 Demographics and Clinical Profile

Demographic data were extracted from the patient’s file and included: age, gender, employment status, marital status and distance living from the centre.

Clinical data were also extracted from the patient file at the time of their initial assessment and included: Body Max Index (BMI), Centre for Epidemiological Studies Depression (CESD) score which is a 20-item validated screening tool designed to measure depressive symptoms (Radloff, 1977) (a score of >16 indicated further clinical assessment) and measured oxygen uptake (VO₂) (ml/kg/min). VO₂ was determined by gas analysis while patients were on either a cycle ergometer with increases of 50-100 kilopond-meters or on a treadmill using a modified Bruce protocol. Determination of peak VO₂ vs. maximum VO₂ achieved was based on whether the patient satisfied the required number of criteria for VO₂ max (failure of heart rate to increase with further increases in exercise intensity, a plateau in oxygen uptake, a respiratory
exchange ratio of 1.15, or a rating of perceived exertion of more than 17 (6-20 scale) (American College of sports Medicine, 2001).

4.3.5 Analyses

Statistical analyses were completed using SPSS 20 and SAS 9.0. Descriptive statistics were used to identify the profile of all study participants, completers and non-completers of the home based cardiac rehabilitation program. Cronbach’s alpha was calculated to determine content validity. Means and standard deviations were calculated for: SR-SE-E for completers from baseline to month 6; SR-SE-TC for completers from baseline to month 5. Repeated measures ANOVA was used to compare SR-SE-E and SR-SE-TC between months. Pearson correlation was used to identify the relationship between baseline SR-SE-SE and baseline level of physical activity for completers. It was also used to identify the relationship between SR-SE-E at month 6 with level of physical activity at month 6 for completers. Descriptive statistics were used to describe the profile and trajectory of SR-SE for non-completers. To determine if SR-SE-E and SR-SE-TC differed between completers and non-completers, a generalized linear model using PROC GEN MOD was used to test the interaction of time and completion of the HP.

4.4 Results

Fourteen patients consented to participation in the study. Ten patients completed the HP and 4 patients did not complete the program. One non completer was successfully contacted for an interview to explore the reasons for non-completion.
The internal consistency results for both SR-SE-E and SR-SE-TC indicated that the items were related to their scales and were content valid. See table 4.1 for results for each time point.

<table>
<thead>
<tr>
<th>Table 4.1 Cronbach’s Alpha results for SR-SE-E and SR-SE-TC Questionnaires at each time point</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SR-SE-E QUESTIONNAIRE</strong></td>
</tr>
<tr>
<td>Time Point</td>
</tr>
<tr>
<td>Initial</td>
</tr>
<tr>
<td>Month 1</td>
</tr>
<tr>
<td>Month 2</td>
</tr>
<tr>
<td>Month 3</td>
</tr>
<tr>
<td>Month 4</td>
</tr>
<tr>
<td>Month 5</td>
</tr>
<tr>
<td>Month 6</td>
</tr>
</tbody>
</table>

### 4.4.1 Demographic Profile

Profiles of all 14 study participants, (10 completers and 4 non-completers) can be found in Table 4.2. The reasons for choosing the HP were categorized into three categories 1) transportation, distance to travel to the centre and travel (work related/vacation), 2) work and 3) other. Employment status was categorized as either employed or unemployed and marital status was either married or unmarried. Nine patients were found to have adequate HL, while 5 patients had limited HL. Highlighted differences between completers and non-completers were that non-completers were all male with a mean age of 67.5 yrs. They lived closer to the CR program were not considered depressed and had a mean BMI of 39.4. Non-completers had a baseline mean SR-SE for exercise of 81.0% and a baseline mean SR-SE for telephone consultations of 92.8%, whereas completers had a baseline mean SR-SE for exercise of 76.0% and a baseline mean SR-SE for telephone consultations of 83.8%.
### Table 4.2  Profile of all Study Participants, Completers and Non-Completers

<table>
<thead>
<tr>
<th>PROFILE</th>
<th>ALL N=14</th>
<th>COMPLETERS N=10</th>
<th>NON-COMPLETERS N=4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>64.4 ±11.1</td>
<td>63.7 ±12.3</td>
<td>67.5 ±5.0</td>
</tr>
<tr>
<td>V02 (ml/kg/min)</td>
<td>17.6 ±4.8</td>
<td>17.9 ±5.5</td>
<td>16.8 ±1.9</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>30.7 ±9.6</td>
<td>27.3 ±7.7</td>
<td>39.4 ±8.7</td>
</tr>
<tr>
<td>CES-D depression</td>
<td>6.1 ±7.2</td>
<td>7.7 ±7.3</td>
<td>1.3 ±2.3</td>
</tr>
<tr>
<td>Distance living from centre (Km)</td>
<td>18.1±33.5</td>
<td>22.2 ±38.1</td>
<td>7.7 ±4.3</td>
</tr>
<tr>
<td>SR-SE for exercise baseline (%)</td>
<td>77.5 ±21.0</td>
<td>76.0 ±19.8</td>
<td>81.0 ±26.8</td>
</tr>
<tr>
<td>SR-SE for telephone consultations baseline (%)</td>
<td>86.4 ±15.8</td>
<td>83.8 ±17.7</td>
<td>92.8 ±8.0</td>
</tr>
<tr>
<td>Gender (Male/Female)</td>
<td>10/4</td>
<td>6/4</td>
<td>4/0</td>
</tr>
<tr>
<td>Marital Status (Married/Not Married)</td>
<td>8/6</td>
<td>6/4</td>
<td>2/2</td>
</tr>
<tr>
<td>Employment Status (Working/Not Working)</td>
<td>7/7</td>
<td>6/4</td>
<td>1/3</td>
</tr>
<tr>
<td>Health Literacy (HL)</td>
<td>2/3/9</td>
<td>1/2/7</td>
<td>1/1/2</td>
</tr>
<tr>
<td>- Likelihood of limited HL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Possibility of limited HL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Adequate HL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for HP</td>
<td>5/7/2</td>
<td>2/6/2</td>
<td>2/2/0</td>
</tr>
<tr>
<td>- Transportation, distance or travel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Work</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Activity (Baseline)</td>
<td>7/5/2</td>
<td>5/3/2</td>
<td>2/2/0</td>
</tr>
<tr>
<td>- Low</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Moderate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.4.1.1 Profile of each Non-Completer

The profile of each non-completer is described in Table 4.3. Non-completers were found to drop-out of the program between month 1 and month 3.

Table 4.3 Profile for each Non-Completer

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patient 001</th>
<th>Patient 010</th>
<th>Patient 011</th>
<th>Patient 014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>60</td>
<td>72</td>
<td>69</td>
<td>67</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Marital Status</td>
<td>Not Married</td>
<td>Married</td>
<td>Not Married</td>
<td>Married</td>
</tr>
<tr>
<td>Employment Status</td>
<td>Employed</td>
<td>Unemployed</td>
<td>Unemployed</td>
<td>Unemployed</td>
</tr>
<tr>
<td>Reason for HP</td>
<td>Work</td>
<td>Travel</td>
<td>Travel</td>
<td>Work</td>
</tr>
<tr>
<td>VO₂ ml/kg/min</td>
<td>17.5</td>
<td>18.2</td>
<td>14.0</td>
<td>17.4</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>51.7</td>
<td>36.6</td>
<td>31.3</td>
<td>38.1</td>
</tr>
<tr>
<td>CES-D depression</td>
<td>n/a</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Distance from CR (Km)</td>
<td>14</td>
<td>7.5</td>
<td>4.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Physical Activity at baseline</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Health Literacy</td>
<td>Adequate</td>
<td>Likelihood of limited</td>
<td>Possibility of limited</td>
<td>Adequate</td>
</tr>
<tr>
<td>Drop-out Month</td>
<td>At month 2</td>
<td>Before month 1</td>
<td>At month 3</td>
<td>At month 3</td>
</tr>
</tbody>
</table>
4.4.2 Self-Regulatory Self-Efficacy for Exercise for Completers

Mean SR-SE-E was calculated for each time point (initial: 76.0% ±19.7, month 1: 76.9% ±21.7, month 2: 77.9% ±20.1, month 3: 75.2% ±22.7, month 4: 68.2% ±26.5, month 5: 76.0 ±19.8 and month 6: 76.0% ±19.9) for completers. All time points indicated a greater than 70% self-efficacy score except month 4 where it dropped to 68.2%. This may be due to the change from weekly contacts with the Case Manager to monthly contacts. Repeated measures ANOVA indicated no significant difference between months for SR-SE for exercise (F(2.4, 19.3) = 1.324, p=0.29). Results are illustrated in Figure 4.2.

Figure 4.2  Self-Regulatory Self-Efficacy for Exercise – Completers N=10
4.4.3 Self-Regulatory Self-Efficacy for Telephone Consultations for Completers

Mean SR-SE-TC was calculated for each time points (initial: 83.7% ±17.7, month 1: 94.6% ±6.1, month 2: 83.3% ±14.6, month 3: 91.1% ±11.8, month 4: 87.0% ±10.0 and month 5: 89.7% ±11.0) for completers. All time points indicated a greater than 70% self-efficacy score. Repeated measures ANOVA indicated no significant difference between months for SR-SE for telephone consultations (F(1.52,9.16) = .788, p=.451). Results are illustrated in Figure 4.3.

Figure 4.3 Self-Regulatory Self-Efficacy for Telephone Consultations – Completers N=10
4.4.4 Physical Activity for Completers

The level of physical activity as measured by the IPAQ was determined for each time point. Patients were categorized into a low level of physical activity (not meeting the categories for high or moderate amounts), moderate level of physical activity (achieving 30 minutes of moderate intensity physical activity on most days of the week) and high level of physical activity (achieving the equivalent of 12,500 steps per day). Figure 4.4 illustrates the physical activity levels of completers from baseline to the end of the 6 month program.

**Figure 4.4 Level of Physical Activity (IPAQ) for Completers n=10**

![Graph showing physical activity levels](image)
4.4.5 Physical Activity Level and SR-SE for Exercise

Correlations between SR-SE for exercise and level of physical activity for completers at each time point during the program are displayed in Table 4.4. Results were limited by sample size and did not show significant correlations (all P values were >0.05), however the effect sizes displayed by correlation r, indicated small (initial and month 4), medium (months 1 and 3) and large (month 6) associations between SR-SE and level of physical activity.

Table 4.4  Correlations Between SR-SE-E and Physical Activity Level

<table>
<thead>
<tr>
<th>TIME POINT IN HOME PROGRAM</th>
<th>r</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>.21</td>
<td>.28</td>
</tr>
<tr>
<td>Month 1</td>
<td>-.39</td>
<td>.15</td>
</tr>
<tr>
<td>Month 2</td>
<td>.07</td>
<td>.42</td>
</tr>
<tr>
<td>Month 3</td>
<td>.32</td>
<td>.18</td>
</tr>
<tr>
<td>Month 4</td>
<td>.20</td>
<td>.28</td>
</tr>
<tr>
<td>Month 5</td>
<td>.04</td>
<td>.45</td>
</tr>
<tr>
<td>Month 6</td>
<td>.48</td>
<td>.08</td>
</tr>
</tbody>
</table>
4.4.6 Self-Regulatory Self-Efficacy for Exercise for Non-Completers

SR-SE-E was captured for the non-completers before they dropped out for patients 001, 010, 011 and 014. Initially, it was high (greater than 70%) except for patient 014 and then immediately dropped below 70% in subsequent measurements. See Figure 4.5.

Figure 4.5  Self-Regulatory Self-Efficacy for Exercise for each Non-completer

Time Point in Home Program
4.4.7 Self-Regulatory Self-Efficacy for Telephone Consultations for Non-Completers

SR-SE-TC was captured for the non-completers before they dropped out, for patients 001, 010, 011 and 014. Initially it was high (greater than 70%) and then immediately dropped below 70% in subsequent measurements. See Figure 4.6.

Figure 4.6 Self-Regulatory Self-Efficacy for Telephone Consultations for each Non-completer
4.4.8 Difference in Trajectory of SR-SE Scores over time between Completers and Non-completers

Generalized linear model was used to determine if there was a difference in the trajectory in SR-SE over time between completers and non-completers. The dependent variable was SR-SE for both models and independent variables included; time (month), completer (vs. non completer) and the interaction between these two variables. A model was determined for both SR-SE-E and for SR-SE-TC. (See Table 4.5 for SR-SE-E and Table 4.6 for SR-SE-TC). A significant interaction was found between time and completion of program for SR-SE-E (p<0.001) and for SR-SE-TC (p=0.0002). (See Figures 4.7 and 4.8). This indicates that for each month, the progressive decline in SR-SE scores for exercise and for telephone consultations falls less precipitously among completers than among non-completers. The results did not change after adjusting for the month at which patients dropped-out.

Table 4.5 Model that predicts the trajectory of monthly SR-SE-E scores

<table>
<thead>
<tr>
<th>Variables in the Model</th>
<th>Parameter Coefficient (B)</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (each month)</td>
<td>-21.65 (SE 3.05)</td>
<td>-21.6 to -15.7</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Completion vs. Non-completion of HP</td>
<td>-5.26 (SE 11.56)</td>
<td>-27.9 to 17.4</td>
<td>0.65</td>
</tr>
<tr>
<td>Interaction between time (month) and Completion</td>
<td>21.57 (SE 3.14)</td>
<td>15.4 to 27.7</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Table 4.6 Model that predicts the trajectory of monthly SR-SE-TC scores

<table>
<thead>
<tr>
<th>Variables in the Model</th>
<th>Parameter Coefficient (B)</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (each month)</td>
<td>-19.5 (SE 5.5)</td>
<td>-30.3 to -8.7</td>
<td>0.0004</td>
</tr>
<tr>
<td>Completion vs. Non-completion of HP</td>
<td>5.65 (SE 5.57)</td>
<td>-7.77 to 19.1</td>
<td>0.41</td>
</tr>
<tr>
<td>Interaction between time (month) and Completion</td>
<td>20.47 (SE -31.4)</td>
<td>9.6 to 31.4</td>
<td>0.0002</td>
</tr>
</tbody>
</table>
Figure 4.7  Difference between the slopes of completers and non-completers for SR-SE-E.  (p <0.001)

Initial  Month 1  Month 2  Month 3  Month 4  Month 5  Month 6
Completers: N=10; Non-Completers: Initial - N=4, Month 1 – N=3, Month 2 – N=2, Month 3 – N=2

Figure 4.8  Difference between the slopes of completers and non-completers for SR-SE-TC.  (p = 0.0002)

Initial  Month 1  Month 2  Month 3  Month 4  Month 5
Completers: N=10; Non-Completers: Initial - N=4, Month 1 – N=3, Month 2 – N=2, Month 3 – N=2
4.4.9 Reasons for Non-Completion of Program

One non-completer (patient 001) was successfully contacted to undergo an interview to determine the reasons for non-completion. The patient answered questions related to barriers to cardiac rehabilitation participation as described by Grace et al (2009) as well as questions related to the components of the home program (e.g. telephone consultations). Work and work scheduling impacted this patient’s participation in the cardiac rehab home program the most. He indicated that he received unexpected shifts for work and had an unsupportive work environment. Other themes highlighted by the patient in the interview included 1) lack of family support. The patient described his family as unsupportive and that he had no spouse for support. 2) Exercise environment. Patient had a membership to a gym facility but felt it was too busy and had too many children. 3) Telephone consultations with Case Manager. Patient was unable to schedule times due to work conflicts and was often not available for the calls. 4) Activities of daily living. The patient felt overwhelmed with all of his responsibilities and could only focus on doing his activities of daily living, which were in itself a challenge.

Three out of the four non-completers were unsuccessfully contacted for an interview to discuss their reasons for non-completion, therefore they were unknown.

4.5 Discussion

The present pilot study has focused on SE beliefs, an emerging important clinical outcome that can affect behaviour changes related to cardiac rehabilitation (Berkhuysen et al. 1999). It sought to characterize self-regulatory self-efficacy for exercise and telephone consultations during a 6-month home based program, and determine the reasons for non-completion in a home based cardiac rehabilitation program. The study found SR-SE-E and SR-SE-TC to be high for completers and serial measures of SR-SE for completers did not change over the 6 month CR HP. For non-completers, their SR-SE-E and SR-SE-TC were initially high, but then dropped significantly before dropping out of the program. The study also found, that over time completers showed a significantly different trajectory of their SR-SE when compared to non-completers. This confirms our hypotheses regarding the characterization of SR-SE for both exercise and telephone consultations. Non-completers were found to be male and obese.
The reason for non-completion (for one subject), based on a review of barriers to CR, was significantly impacted by employment. This reason for non-completion was not included in our hypothesis and was surprising given that employment has been a reason for choosing the HP (Jones et al. 2007).

4.5.1 Self-Regulatory Skills in a Cardiac Rehabilitation HP

In a home-based program, individualized exercise prescriptions are usually taught by the CR team and patients perform the exercise independently, without supervision (Brual et al. 2010) and thus having high SR-SE for exercise is an important characteristic. In the present study, the HP required patients to also use self-regulatory skills to organize their time to complete tasks related to their home based program which included completing their scheduled telephone consultations with their case manager, completing their prescribed exercise and keeping exercise diaries and emailing them to their case manager in a timely fashion. Bandura suggested that in order for health habits to change, self-regulatory skills are required where “People have to learn to monitor their health behavior and the circumstances under which it occurs… (Bandura, 2004 pg 151).”

4.5.2 Serial Measures of SR-SE

Serial measures of SE have been identified to be of value as it may differ along an individual’s journey of initiating, adopting and maintaining exercise behaviours (Brawley & Rodgers, 1993; Ducharme & Brawley, 1995). Our study was unique in that it was able to track SR-SE for exercise and for telephone consultations more frequently at each month through the 6 month program. Its trajectory was interesting for both completers and non-completers. For completers in the program, these measures stayed high above 70%, a key level for clinicians to be aware of when using chronic disease self-management techniques, and is a level linked to producing greater health outcomes (Bodenheimer et al. 2005). For our non-completers, although their SR-SE started out high, within the first few weeks it dropped. SR-SE could be used to help forecast who might drop-out of a home program, given that our study showed a significant difference in the trajectory of SR-SE over time between completers and non-completers. Similarly,
Ducharme & Brawley (1993) did serial measures of scheduling SE (like SR-SE) at week 1, week 9 and week 16 of a 16 week prospective study to determine if SE predicted exercise intention and actual exercise attendance. Scheduling SE mean was 81.4% (n=63) at week 1 and 73.4 % (n=38) at week 9. SE at week 9 predicted exercise attendance for the last 2 months of the 16 week program ($R^2$ change = .16 p<.02). Although consistent serial measures of SE may not be realistic to measure in clinical practice, its measurement, as shown in our study as well as in Ducharme’s study, has been able to highlight that there are time points in a CR program that may be important for its assessment. This will help to identify where clinical interventions to enhance adherence can make the largest impact on clinical practice. Further research is necessary to solidify these time points.

4.5.3 Reasons for Non-Completion of a Cardiac Rehabilitation HP

A recent qualitative review of the influences for attendance to CR indicated that personal barriers to attendance like financial and work constraints had a large impact on participation in CR. In fact, patients indicated that by participating in the CR program resulted in large financial and work ramifications (Clark et al. 2012). Similarly in our study, one of the non-completers highlighted in their interview that the pressures, expectations and environment of his employment ultimately led him toward having to drop out of the program as he was unable to cope with managing both his health and work life. Interestingly, this patient’s SR-SE for both exercise and telephone consultations were shown to drop significantly after his first month on the program. Awareness that the confidence in his self-regulatory skills were low because of his work while still connected with the program provides the opportunity for clinicians to implement interventions that can enhance SR-SE skills pertaining to work, so patients can continue to participate in programs.
4.5.4 Profile of Non-Completers

The present study revealed that non-completers were all male, lived close to the CR program (7.7 km away) and were obese (BMI = 39.4) as defined by the World Health Organization as having a body mass index of >30 (World Health Organization (WHO), 2013). Other studies of traditional CR programs have shown that those who are obese are more likely to drop out (Marzolini et al. 2008, Sanderson et al. 2003). As well, patients in the HP in our study did not have a long distance to travel (mean 18 km) and in fact the non-completers lived closer. This observation is consistent with findings from a study determining the clinical and geographical factors related to the use of hospital vs home based cardiac rehabilitation. Reasons for patients enrolled in a CR home program in that study were found not to be related to geographical distance (Brual, Gravely, Suskin, Stewart & Grace, 2012). Dis-similar from the literature is that women are usually more likely to drop out from CR programs (Sanderson et al. 2003; Yohannes et al. 2007,) while in the present study, all non-completers were male. The small sample size and nature of this pilot study may be the reason for this finding.

4.5.5 Health Literacy

Health literacy (HL) was important to measure in the present study because it is considered a skill that promotes self-management, effective communication and adherence to medical recommendations (Nutbeam, 2008). The literature has established a link between level of HL and adherence to various medical recommendations. A study determining the effect of HL on drug adherence showed that those with adequate HL had better adherence to taking cardiovascular medications than those who had inadequate HL (69.4% and 54.2% respectively, p=0.001) (Noureldin, Plake, Morrow, Tul wu & Murray, 2012). In our study, 30% of completers of the HP were found to have limited HL and 70% adequate HL. Non-completers on the other hand, had 50% with limited HL and 50% with adequate HL. Further investigation is needed to confirm the trend that those with poor HL in a CR HP may be at higher risk for drop-out than those with adequate HL.
4.5.6 Clinical Implications

A unique finding in the present study was the powerful drop in SR-SE for both exercise and for telephone consultations after the first month of the program in non-completers. It started high, above 70% and subsequently dropped to well below 70% prior to them dropping out. Clearly, the results seen for SR-SE in non-completers, indicates that these patients lack the necessary self-regulatory skills to manage their health. As Bandura has suggested, in order for health habits to change, self-regulatory skills are required where “People have to learn to monitor their health behavior and the circumstances under which it occurs… (Bandura, 2004 pg 151).”

Recently, the Health Canada Council published a report on an updated approach to dealing with the chronic diseases Canadians face today. Their focus was on providing Canadians self-management support, including “…education, coaching, and other interventions to help them gain the confidence, knowledge, skills, and motivation to manage the physical, social, and emotional impacts of their disease (Health Canada Council, 2012 pg 4).” Those who possess high self-efficacy for self-management skills have better health outcomes (Marks, Allegrante & Lorig, 2005) because they are able to organize, control and cope better with what they have to manage with their disease like exercise, depression and pain (Marks et al. 2005). By identifying patients who lack the confidence to self-manage (e.g. have low SR-SE), clinicians and programs can create and implement specific interventions aimed at enhancing their confidence.

The trajectory of the SR-SE of the non-completers in this study not only showed that their SR-SE dropped after the first month, but that these patients continued to stay connected with the program for a short while before dropping out. The opportunity for implementing interventions to enhance efficacy would be ideal during this time period so that patients are able to continue with their rehabilitation, and experience the decreased mortality benefits associated with completing CR (Alter el al. 2009). A further and more striking finding that has important clinical implications was the difference in the slope of SR-SE over time between completers and non-completers. The more precipitous fall in SR-SE seen in non-completers tells us that this mediating variable may be able to forecast who may drop-out of CR so that the above mentioned interventions that foster SR-SE can be used. To confirm this, further research is needed.


4.6 Limitations

The present study had several limitations. Its pilot study nature limited our sample size, preventing more detailed statistical analyses to confirm suggested trends. In particular, our determination of the difference in the trajectory of the serial measures of SR-SE between completers and non-completers need to be solidified. We were unable to contact three out of the four non-completers for their interview resulting in a narrowed view of the reasons for non-completion. A potential Hawthorne effect may exist in the serial measures of self-regulatory self-efficacy and level of physical activity as patients knew these outcomes were measured month to month.

4.7 Conclusion

The present pilot study sought to characterize the trajectory of SR-SE in a home based cardiac rehabilitation program within a real-world setting, and determine the reasons patients do not complete programs. Completers of the program had high SE throughout where as non-completers started with high SE but declined before dropping out of the program. Exploration of the reasons for non-completion revealed that employment factors impacted participation the most. This study has highlighted important trends in non-completers of a home based model of care that could help to forecast drop-outs and inform targeted interventions to enhance adherence.
Chapter 5  General Discussion

Building on previous research regarding home based cardiac rehabilitation (Clark et al. 2010), the present thesis has presented interesting data regarding adherence and the use of SE to help understand adherence in a home based model of care. This thesis has contributed to the literature on adherence in a home based model of care by; measuring adherence in a real-world setting where patients self-selected themselves to participate in a home based program based on their own determination of the barriers they face that would interfere with on-site traditional based CR; using adherence as a primary outcome; being clear and consistent in the definition and measurement of adherence; being transparent in the description of the program model with respect to length of program, what occurred on patient visits and telephone consultations, assessments, education and counseling provided; and piloting the serial measurement of a mediating variable like SR-SE to determine how and when interventions can be implemented for its enhancement in order to make an impact on adherence.

The results of study 1 and 2 have shown that within a real-world setting, although a home based model of care addresses the practical reasons for non-adherence to traditional models of CR, adherence continues to be suboptimal. Attention to self-regulatory self-efficacy (SR-SE) is suggested to identify those at risk for drop-out so that targeted interventions can be put in place to enhance this factor and make a positive impact on adherence to CR.

In study 1, when compared to patients in the TP, patients in the HP were more likely to be employed, fitter, younger and living a distance from CR. The findings in this study contradicted our hypothesis that adherence would be higher in the HP and was found to be similar when compared to an established traditional onsite model of care and was suboptimal. Given the recent evidence concerning the link between adherence and mortality (Alter et al. 2009; Hammil et al. 2010; Martin et al. 2012), analyses on this important clinical outcome in the home program was timely and necessary as it was lacking in the literature.

In study 2, we demonstrated the feasibility of using theoretical mediating variable like SR-SE as a primary outcome to help understand adherence in the HP. The serial measurement and resultant characterization of its trajectory confirmed our hypothesis and was interesting. Patients who completed the program showed their SR-SE to be high and stable throughout the
program. Particularly striking, was the rapid decline in SR-SE in patients who eventually dropped out of the program and was shown to be significantly different than the trajectory of SR-SE in completers. The reason revealed for non-completion of the HP was not expected, and was found to be related to employment. While we observed an important trend in this outcome, further investigation is necessary to solidify this trend.

There is potential to make a large impact on adherence in patients who are initially engaged in CR and then disengage or drop-out. They enter the program with strong beliefs and conviction about their participation in CR. Understanding the importance and having the conviction to engage in a behaviour like CR, is one of the initial steps in adopting a new behaviour (Schwartzer, 2010; Glanz, Rimer & Biswanath, 2008). For that behaviour to be successful, an individual then needs to possess the necessary confidence and SR-SE skills to support it (Schwartzer, 2010). For patients who are initially engaged in a CR HP and then drop out, likely lack the SR-SE skills and are unable to cope with the demands of the new behaviour as depicted in Patient 001’s interview in study 2. This group is different from patients who never become engaged with CR and have the most potential for making improvements in their heart health. Focused attention on drop-outs in a HP is necessary to better understand this group, so that we can begin to implement appropriate and timely targeted interventions to build SE and enhance adherence.

An abundance of evidence in the adherence literature has highlighted those groups who are at highest risk of dropping out of traditional CR. Of importance are those who are obese (Marzolini et al. 2008; Sanderson et al. 2003; Wittmer, Volpatti, Piazzalonga & Hoffmann, 2012), women (Sanderson et al. 2003; Yohannes et al. 2007,), those who are depressed (Yohannes, 2007), and those who have psychological distress (Worcester et al. 2004) and poor quality of life (Wittmer et al. 2012). Further, those who are employed and lack transportation and live a distance from a CR program, tend to be non-completers of programs (Jones et al. 2007; Wittmer et al. 2012; Worcester et al. 2004). In study 1, we showed a profile of patients in the HP who were part of these at risk for drop-out populations. They were workers and lived a far distance from the program. Unique to this study was its real-world setting. Patients self-selected themselves to participate in the HP, showing that these at high risk for dropout groups were able to identify their own limitations and take advantage of the HP. Similarly, Jones and colleagues (2007) examined the reasons for drop-out from home based CR and also found that
work and time constraints were reasons why patients preferred participating in the HP. The subjects in study 2 who chose to participate in the HP due to a practical reason like employment were shown to possess high SR-SE skills and successfully completed their CR HP. Conversely the study also revealed that a reason for non-completion of the HP was due to employment, the exact barrier that the HP model can address. We also observed a trend; non completers were obese and experienced a drop in SR-SE for exercise and HP telephone consultations after starting the HP. Although these patients self-selected themselves to participate in a model of care that addresses their practical barriers to TP participation, they were unable to complete their CR HP. Why is it that one patient who chooses the HP for a practical reason like employment, adopts their CR behaviours with ease and completes their program, while another, who chooses it for the same reason, struggles to adopt the behaviours and eventually drops-out of their program?

Behaviour theory can help to understand this phenomenon of how individuals decide to engage in CR, and what it takes to ensure the behaviours associated with CR are maintained. Theories like the Theory of Planned Behaviour, the Health Action Process Approach and Social Cognitive Theory posit that in order to change behaviour and to adhere to that behaviour, it takes high intention and conviction (Glanz et al. 2008; Schwartzer, 2010; Bandura, 1991). In order to support that behaviour, there is a need for confidence and self-efficacy skills (Schwartzer, 2010). Schwartzer, (2010) a proponent of the Health Action Process Approach indicates that for the behaviour to take shape, detailed plans and self-management strategies are required to map it out, and that confidence and self-regulatory, coping and maintenance self-efficacy skills are necessary to be successful. Once the behaviour has been initiated, it is very vulnerable and must be protected from competing priorities or other behaviours. Factors that protect the behaviour include strong self-regulatory skills for the behaviour. An interesting premise to this theory is that:

“When an action is being performed, self-efficacy determines the amount of effort invested and the perseverance. People with self-doubts are more inclined to anticipate failure scenarios, worry about possible performance deficiencies, and abort their attempts prematurely. People with an optimistic sense of self-efficacy, however, visualize success scenarios that guide the action and let them persevere in face of obstacles. When running into unforeseen difficulties they quickly recover (Schwarzer, 2010).”
These theoretical concepts help to explain what was seen in our study. We saw a strong intention for participation in the HP when patients self-selected themselves for the HP. Once engaged in the program, completers showed through their high SR-SE scores, that they could support their intended CR behaviours. They were able to organize their lives to adhere to their regular telephone consultations with their case manager and prepare themselves accordingly to ensure their frequency and minutes of exercise occurred each week. Whereas non-completers who had low scores, could not. Non-completers like Patient 001 did not have the skills and confidence to formulate an effective plan to continue with both his exercise and scheduled calls with his case manager while working, even though his conviction was strong. Regardless of the model of care, patients who are at high risk for drop-out may lack the self-management skills and SR-SE skills to exercise and complete their CR program. The serial measures of SR-SE conducted in study 2 allowed us to identify these patients before they dropped out of the program. SR-SE could be used to help forecast who will drop out of a CR HP. Identification of these patients early in their program is vital so that targeted theory based interventions for those who lack SR-SE, can be implemented to ensure they maintain and stay engaged with the behaviours associated with CR.

The HP model in the present thesis utilized a case managed approach for delivering CR where a case manager worked with a patient through their program and developed a therapeutic relationship over 6 months. Clinicians engaged in this therapeutic relationship have the opportunity to implement targeted interventions to enhance SR-SE by supporting patients in mastering the skills that are necessary to manage their disease. Self-efficacy theory tells us that this can be done through vicarious experiences, using verbal persuasion and encouraging patients to be mindful of their physiological state while engaging in the desired behaviour (O’Leary, 1985 & Bandura 1996).

A recent review completed by Ferrier, Blanchard, Vallis & Giacomantonio (2011) examined which behavioural change techniques and interventions used by clinicians, were most effective in increasing physical activity in patients during and after CR. Goal setting and action planning, relapse planning and prevention, and self-monitoring techniques were found to be effective (Ferrier et al. 2011). The most effective interventions that have been shown to increase physical activity in patients during and after CR are those that combine both behavioural interventions like those described above, as well as cognitive interventions that foster self-efficacy, barrier
management and problem solving (Chase, 2011). All of these techniques can enhance SR-SE for a particular behaviour and are an integral part of chronic disease self-management programs (Health Council of Canada, 2012). These programs allow individuals to succeed in adopting new behaviours related to their health, and in the case of the present thesis, include exercise and staying engaged with their CR program.

In order for interventions like the ones described above to succeed, clinicians require the appropriate training to deliver such programs. “Choices and Changes” by the Institute for Health Care Communication is a workshop that provides clinicians with literature, theory and training in techniques to use with patients that empower them to self-manage their chronic disease (Institute for Health Care Communication (IHCC), 2013). Given the positive link between adherence to CR and mortality, as well as the functional capacity benefits seen in those completing CR, interventions like the ones described above need to be tailored directly toward those patients who have high intention for attending CR and for exercise, but show signs of poor self-efficacy and self-management skills. The HP model has the potential to include strategies and support to enhance SR-SE and other important self-management strategies that can keep patients engaged in their CR behaviours. Having well trained clinicians using evidence based approaches to enhance adherence to these behaviours can build strong research methodology to further evaluate this approach.

Supports and interventions, as described above, that are designed to keep patients engaged in CR, align well with the Chronic Disease Prevention and Management Framework that Ontario has adopted in the recent years. It is a systematic approach intended to affect population health and addresses chronic disease management differently from the traditional acute care approach where care tends to be reactive. Instead, it requires ongoing, planned pro-active care that includes the individual living with the disease to interact with their health care team, and learn and manage their own health (Ministry of Health and Long Term Care, 2007) (See Figure 5.1).

This approach depends on productive interactions and relationships between the patient, the clinical practice team and the community in which they live, so that learning of the appropriate self-management skills, including building SE, coping and planning skills, can be fostered. Patients who become disengaged in these relationships and interactions lose out on the benefits of this approach and instead are more likely to loop back into the acute care model for treatment.
The success of CR programs within this Chronic Disease Prevention and Management Framework depends on its efforts of keeping patients engaged.

Figure 5.1

5.1 Limitations

The two studies presented in this thesis add to the body of knowledge regarding adherence to home based CR. There were however limitations in both studies. There was an inadequate sample size in both studies to solidify the trends and results presented. Further, there was a poor representation of women. Women have been shown to have specific needs in CR (Grace, Racco, Chessex, Rivera & Oh, 2010) and require special attention when learning about the factors that affect their adherence.
Pilot study 2 sought to engage with those who dropped-out of the home program to discuss their reasons and experience. A poor response rate from the drop outs occurred in the study, leaving the reasons described in the study based on only one interview.

5.2 Future Directions

The results from the two studies described in the present thesis not only provides knowledge to the literature regarding adherence to home based cardiac rehabilitation, but also raises more questions that need to be addressed by future studies. Further, although the studies presented in this thesis have separately shed light on adherence to the HP model of care, a larger study with adequate power is required to help solidify the results. The synthesis of both studies together, has led to a more interesting realization that requires greater analyses. In order to learn more about adherence to the behaviours associated with CR in a HP and to make an impact on adherence, future research efforts need to focus on drop-outs and those at risk for drop-out, with the goal of keeping patients engaged in their CR program. In particular, investigating patients who have low SR-SE and have been identified as high risk for drop-out is paramount. Of importance is the utilization of an appropriate behaviour change theory that can guide research, and develop targeted theoretical interventions that is most appropriate for enhancing self-management and SR-SE skills within CR and test its impact on adherence.

Solidifying the results seen in the present thesis

To confirm the similar adherence pattern between the TP and HP seen in study 1, a larger study with adequate power is required to replicate the findings. This would also be the case for study 2 which would confirm the trends observed. Further, an adequate sample size would allow for a comparison of the trajectory of SR-SE between completers and non-completers. Finally, this larger study could provide the opportunity for an alternative methodology to collect and determine the reasons for non-completion of the HP program, from patients themselves.

Serial measurement and trajectory of SR-SE

A striking observation found in study 2 was the trajectory of SR-SE in patients through the HP and the difference seen between completers and non-completers. As described above
confirming this difference is of paramount importance. Determining how it compares to the trajectory of SR-SE within a traditional onsite program would also be interesting.

Specificity of adherence behaviours

As identified in the present thesis, the definition and specificity of adherence is vital in research to not only replicate findings, but to ensure that findings can be compared across studies so that results can be formulated into practice guidelines. Future studies could use completion of program as one definition of adherence as well as adherence to exercise as another. Due to the varying lengths of CR programs and varying intensity of contacts with patients, using completion would be most ideal given the mortality benefits seen in those who complete programs (Alter et al. 2009). In clinical practice, each program that follows best practice guidelines maps their CR services appropriately within the length of their given program. Therefore patients completing a program, regardless of length, would receive comprehensive services that will best equip them to manage their disease. Given the functional capacity improvements and mortality benefits seen with habitual exercise (Myers, 2003), using adherence to exercise as another definition of adherence, provides the rationale to continue evaluating this behaviour.

Utilization of Behaviour Change Theory

The present thesis has introduced the concept of evaluating SR-SE to better understand adherence in home based CR. To further evaluate this important theoretical mediating variable, a behaviour change theory to better guide assessment of intention, motivation and action of the behaviours of interest would provide a much more sound methodology for research. Work by Blanchard et al (2011) who has implemented theory based research to better understand exercise behaviour in both traditional and home based CR, could help to guide this approach. Further, using the most appropriate theory can also help guide interventions that would help foster SR-SE to determine its impact on adherence to CR.
**Interventions to enhance SR-SE for those at risk for drop-out**

As described earlier, study 2 showed a marked decline in SR-SE in those who dropped out of the HP while they were still engaged in the program. By piloting the use of this measure, the study shed light on the importance of focusing on those who are at risk for drop-out. Continuing to serially measure this factor in future studies would allow theory based interventions that foster SR-SE to be implemented as these scores begin to decline.

**Future research design**

To incorporate the above mentioned areas into a focused future study, the design parameters could include a randomized control study, stratified by gender and age, comparing a home based and traditional onsite cardiac rehabilitation program. Outcome measures to compare between models could include; 1) Adherence to CR (specific to both program completion and exercise); 2) SR-SE for exercise; 3) Trajectory of SR-SE for exercise in completers and non-completers within each model of care; 4) The change in SR-SE for exercise after a theory based intervention has been implemented to increase SR-SE in those who are forecasted to drop-out of the program and; 5) Change in cardiovascular fitness. The randomized control trial into either a HP or TP would be the central design for this study. However, to capture how the study would work in a real-world setting where patients would be offered a choice between models based on their identification of barriers and preference, patients who decline randomization could be invited to participate in the study based on choice of program.

**Implications of this future direction:**

If an association can be determined between SR-SE and adherence to both CR and exercise, then this mediating variable could become a recommended outcome to measure in both a traditional and home based model of CR. Further, once appropriate theoretical based interventions to foster SR-SE can be developed and researched; guidelines for clinical practice in CR can be confirmed.
5.3 Conclusion

This thesis has established adherence patterns in a home based model of care, and has turned attention toward utilizing SR-SE to help explain the reasons why patients in a HP model do not complete their program. We have shed light on an interesting phenomena; the CR home program is an established strategy designed to overcome practical barriers to TP participation. The strategy is only successful however, when patients have both the intention to fully participate, as well as the self-regulatory and self-management skills required to carry through the behaviours we know will decrease mortality and improve quality of life. Those who do not have the SR-SE and self-management skills need to be identified and supported before dropping out, so that they stay engaged with the program to foster these skills from expert clinicians.
References


Appendices

Appendix A
Self-Regulatory-Efficacy for Scheduling and Planning for Self-Managed Exercise for Cardiac Rehabilitation

The following is a list of behaviours associated with participating in your personal exercise prescription from cardiac rehabilitation each week for the next 4 weeks. Please consider each specific behaviour as it applies to you at the present time.

Please indicate how confident you are that you can complete each of the following behaviours regularly over the next 4 weeks by circling the appropriate number using the scale below.

Think about the present time in your life and circle the appropriate number on the scale following each statement

Over the next 4 weeks, I am confident that I can …

1. Complete my prescribed exercise sessions for each week for the next 4 weeks no matter what.

2. Each week, plan my self-managed exercise sessions so they fit with my daily activities.

3. Arrange my schedule to exercise regularly each week as prescribed no matter what over the next 4 weeks.
4. Maintain a definite plan to resume my weekly self-managed exercise if I should miss several prescribed exercise sessions during the next 4 weeks.

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5. Make up times when I miss my planned exercise sessions.

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6. Make sure that I do not miss more than one week of exercise due to other obligations during the next 4 weeks.

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7. Organize time and responsibilities around each of my weekly self-managed exercise sessions during the next 4 weeks no matter what.

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8. Develop plans to maintain my goals for the frequency and minutes of my weekly exercise, for the next 4 weeks.

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</tr>
</tbody>
</table>

9. Follow through with my goals for frequency and minutes of weekly exercise, for the next 4 weeks, even though it may be difficult at times.

<table>
<thead>
<tr>
<th>%</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all confident</td>
<td>somewhat confident</td>
<td>completely confident</td>
<td></td>
<td></td>
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</table>
Appendix B

Self-Regulatory-Efficacy for Scheduling and Planning for Home Program Telephone Consultations

The following is a list of behaviours associated with participating in your Cardiac Rehab Home program each week for the next 4 weeks. Please consider each specific behaviour as it applies to you at the present time in your life.

Please indicate how confident you are that you can complete each of the following behaviours regularly over the next 4 weeks by circling the appropriate number using the scale below.

Think about the present time in your life and circle the appropriate number on the scale following each statement

Over the next 4 weeks, I am confident that I can …

1. Complete all of my scheduled telephone consultations with my Case Manager each week for the next 4 weeks no matter what

2. Arrange my schedule to be available for each of my scheduled telephone consultations with my Case Manager each week.

3. Contact my Case Manager to re-schedule a telephone consultation when I miss any of my planned consultations.
4. Make sure that I do not miss more than 1 telephone consultation due to other obligations during the next 4 weeks.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
not at all confident somewhat confident completely confident

5. Organize time and responsibilities around each of my weekly telephone consultations during the next 4 weeks no matter what.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
not at all confident somewhat confident completely confident

6. Develop plans to maintain my schedule of weekly telephone consultations with my Case Manager for the next 4 weeks.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
not at all confident somewhat confident completely confident

7. Follow through with my goal of weekly telephone consultations with my case manager for the next 4 weeks even though it may be difficult at times.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
not at all confident somewhat confident completely confident
Appendix C

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ days per week

☐ No vigorous physical activities  ➔  Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐ Don’t know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ days per week

☐ No moderate physical activities  ➔  Skip to question 5

4. How much time did you usually spend doing moderate physical activities on one of those days?
Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

   ____ days per week

   [ ] No walking → Skip to question 7

6. How much time did you usually spend walking on one of those days?

   ____ hours per day
   ____ minutes per day

   [ ] Don’t know/Not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day?

   ____ hours per day
   ____ minutes per day

   [ ] Don’t know/Not sure
Appendix D

ASSESSMENT OF HEALTH LITERACY
THE NEWEST VITAL SIGN – ENGLISH (WEISS ET AL, 2005)

The following information is on the back of a container of a pint of ice cream

Review the information and then answer the questions on the following page

---

Nutrition Facts

<table>
<thead>
<tr>
<th>Serving Size</th>
<th>½ cup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving per container</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount per serving</th>
<th>Calories 250</th>
<th>Fat Cal 120</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>%DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat 13 g</td>
</tr>
<tr>
<td>Sat Fat 9 g</td>
</tr>
<tr>
<td>Cholesterol 28mg</td>
</tr>
<tr>
<td>Sodium 55 mg</td>
</tr>
<tr>
<td>Total Carbohydrate 30 g</td>
</tr>
<tr>
<td>Dietary Fiber 2 g</td>
</tr>
<tr>
<td>Sugars 23 g</td>
</tr>
<tr>
<td>Protein 4 g</td>
</tr>
</tbody>
</table>

* Percent Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Refer to the information on the previous page when answering the following questions

Questions
1. If you eat the entire container, how many calories will you eat?

__________________

2. If you are allowed to eat 60 g of carbohydrates as a snack, how much ice cream could you have?

__________________

3. Your doctor advises you to reduce the amount of saturated fat in your diet. You usually have 42 g of saturated fat each day, which includes 1 serving of ice cream. If you stop eating ice cream, how many grams of saturated fat would you be consuming each day?

__________________

4. If you usually eat 2500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving?

__________________

5. Pretend that you are allergic to the following substances: Penicillin, peanuts, latex gloves, and bee stings
Is it safe for you to eat this ice cream?

__________________

6. If you said no to question #5, Why not?

__________________
Copyright Acknowledgements

Study 1 (Chapter #3)


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