University of Alberta

Exercise Adherence in People with Heart Failure: Applying the Theory of Planned Behaviour

by

Leslie Wilson

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Abstract

Despite advances in heart failure (HF), mortality rates remain high and the affected population continues to grow. Improvement in symptomology, and quality of life is noted when exercise is included in the treatment plan. Despite this, exercise adherence is a challenge for people with HF. To understand the factors that drive exercise, this study examined the utility of the theory of planned behaviour (TPB).

Eighty-one participants completed a questionnaire at: baseline to establish demographic and TPB construct data; and, 3 months to assess exercise.

Hierarchical regression analyses determined that a) attitude, subjective norm and perceived behavioural control (PBC) accounted for 20% of the variance in exercise intention with PBC making the only significant contribution; b) intention explained 26% of the variance in exercise at baseline; and, c) intention was a significant contributor to exercise at 3 months.

The TPB may inform interventions for HF which may translate into an improved future for those affected.

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Table of Contents

List of Tables and Figures

Introduction

Heart failure (HF) is a syndrome characterized by the heart's weakened ability to pump blood throughout the body. It is often precipitated by prior cardiac diseases which have chronically overburdened the heart such as hypertension, myocardial infarction, arrhythmias and infection (Gosh & Gupta, 2002). Over time, the inadequate pumping of the heart muscle contributes to a myriad of negative effects which are unique to the HF population. These effects include, but are not exclusive to, the deterioration of skeletal muscle tissue, pulmonary and peripheral edema, decreased cognitive function, lowered functional capacity, endothelial dysfunction, shortness of breath and depression (Almeida & Flicker, 2001, Ventura-Clapier, Garnier & Veksler, 2003).

The prevalence of HF in Canada is over 500,000 and the incidence rate is 50,000 cases per year (Ross et al, 2006). In Alberta, 6268 new HF cases were reported from 1997-2000 (Lee et al., 2004). This burden of disease results in a substantial drain on health care resources and the chronic progressive nature of HF further adds to this burden through frequent hospital admissions and high annual mortality rates (Howlett, et al., 2003, Johansen, Strauss, Arnold, Moe & Lui, 2003, Kostuk, 2001). HF is associated with the second highest total number of hospital days and the third highest number of patients affected in comparison to other major disease states (Tsuyuki, Shibata, Nilsson, & Hervas-Malo, 2003).

Including regular exercise as part of the treatment plan for HF has shown a considerable improvement in symptomology, and quality of life (QoL) outcomes (Haykowsky, VonderMuhll, Ezekowitz & Armstrong, 2005; Oka, et al., 2000;

Willenheimer, et al., 2001). In addition, the benefits of exercise training have translated into reduced hospitalization rates (Davies et al., 2010, Eliaszadeh et al., 2001, O'Connor et al., 2009) and mortality (O'Connor et al., 2009, Piepoli, Davos, Francis, & Coats, 2004). As a result the Canadian Cardiovascular Society (Arnold et al., 2006), the European Society of Cardiology (Dickstein, et al., 2005), and the American Heart Association (Piña, et al., 2003) have each recognized the value of exercise in HF and have issued HF specific guidelines that include exercise as part of the recommended treatment. In summary, the Canadian guidelines promote inclusion of both aerobic and resistance training at a moderate intensity (60 to 80% of peak heart rate) for 30 to 45 minutes, 3 to 5 times per week for those with stable NYHA I to III HF (Arnold et al., 2006).

Despite the aforementioned benefits of exercise appreciated by people with HF, research on HF and exercise adherence is limited. Haykowsky et al. (2005), Willenheimer et al. (2001) and Smart, Haluska, Jeffreiss & Marwick (2005) have shown that HF patients significantly decrease their physical activity after being discharged from a formal exercise training program despite a return of symptoms and reduced QoL. Although these studies used small sample sizes (n=17, n=37 and n=30), their results generate an interesting question, why do people with HF decrease or stop their exercise regimen despite an initial acclimation, increased knowledge and experience of improved symptoms?

Dishman, (1988) and Robison & Rogers, (1994) support the need to address this question by noting that regardless of the patient demographic profile, exercise adherence is a major challenge. In their review of 21 studies including

healthy, middle and older aged adults, Martin & Sinden (2001) found the average rate of adherence to exercise programs was 63%. Exercise adherence in the cardiac rehabilitation setting has been noted to range from 47-81% (Conn, Taylor &Casey, 1992; Halm, Penque, Doll & Beahrs, 1999; Morrin, Black & Reid, 2000). Whereas van der wal et al noted that 80% of their sample of HF patients believed exercise to be important but only 39% reported regular exercise. Thus, the call to address HF and exercise adherence has been made by multiple authors (Barbour & Miller, 2007; Conraads & Beckers, 2010; O'Connor et al., 2009). Furthermore, Dishman (1994) and Baranowski, Anderson and Carmack (1998) agree there is a need for research to strengthen links between theory and exercise adherence. Behavioural studies, supported by complete and validated models, will help to identify the motivation or lack thereof underlying behaviour. This understanding will lend to a more robust foundation for the development of effective interventions (Baranowski et al, 1998). With respect to HF, a quantitative link between intention and behaviour may help to increase knowledge of the barriers to exercise and inform practical and viable interventions that promote the maintenance of regular exercise.

Behavioural Theory and Exercise Adherence

There are a host of models and frameworks that have been applied to explain exercise behaviour. Social cognitive theories including the Transtheoretical model (TTM; Diclemente & Prochaska, 1982), Health belief model (HBM; Becker, Haefner & Maiman, 1977, Rosenstock, 1974), Social cognitive theory (SCT; Bandura, 1977), Protection Motivation theory (PMT;

Rogers, 1983) and Theory of planned behaviour (TPB; Ajzen, 1988) have proven to be particularly useful to understand and identify determinants of exercise. The TTM views behaviour change as a dynamic process whereby individuals move through five stages of readiness to a level of maintaining the behaviour. The HBM proposes that three beliefs (heath motivation, perception of disease threat and perception of behaviour reducing threat) work together to produce behaviour change. As such, an individual who desires health, perceives a disease as threatening and believes a specific behaviour will reduce that disease threat is more likely to engage in that behaviour. The SCT posits that behavioural, cognitive and environmental factors interact to influence behaviour. By this definition behaviour will be adopted when an individual: develops behaviour goals, believes they have control over the behaviour, believes that the behaviour will produce positive results, and believes that the behaviour has more perceived facilitators than barriers. The PMT endeavours to explain behaviour change as a relation of threat and coping appraisal. By the theory's definition the threat and coping appraisals affect behaviour change via intention.

For the purposes of the proposed study, the TPB was used to examine the exercise adherence related beliefs of people living with HF. Figure 1 presents a schematic representation of the TPB. The TPB posits that one's intention to execute behaviour is the major determinant of that behaviour. Intention is driven by three theoretically independent constructs: (1) attitude, the person's overall favourable or unfavourable evaluations of performing the behaviour; (2) subjective norm (SN), a person's beliefs that significant others believe that he/she

should perform or not perform the behaviour; and (3) perceived behavioural control (PBC), the person's view of whether performing the behaviour will be easy or difficult. Overall, the TPB suggests that people will intend to perform a behaviour when they evaluate it positively, believe that significant others think they should perform it and that they perceive it to be under their control. The TPB further explains that underlying beliefs direct attitude, SN and PBC. Attitude is directed by behavioural beliefs, SN by normative beliefs and PBC by control beliefs. These salient underlying beliefs may vary depending on the population and context (Ajzen, 1991). Furthermore, according to a multiple component perspective, each construct may consist of several components. Specifically, attitude includes both affective and instrumental aspects, SN include injunctive and descriptive norms, and PBC may included components of perceived difficulty, perceived control and self-efficacy (Conner and Sparks, 2005).

In a recent review Hagger, Nikos & Stuart (2002) summarized 72 studies that have applied the TPB to physical activity in various populations. Overall, the TPB accounted for about 44.5% of the variance in exercise. Results demonstrated that intentions significantly predicted behaviour (B= .51, p < .01) and that attitude (B= .40, p < .01) and PBC (B= .33, p < .01) were the best independent predictors of intention while SN (B= .12, p < .01) had a small yet significant influence on intention.

Exercise Adherence in Cardiac Disease

To date there is a modest amount of information relating behavioural theory to exercise adherence in the cardiac population. Five studies using the SCT

have examined the issue of self-efficacy in relation to exercise adherence (Blanchard, Rodgers, Courneya, Daub & Knapik, 2002a; Bock et al., 1997; Ewart, Taylor, Reese, & DeBusk, 1983; Jeng & Braun, 1997; Maddison & Prapavessis, 2004). Although this may seem to be a promising direction of research, the studies report that efficacy accounts for less than 20% of the variance in exercise adherence. This small proportion of variance explained is likely due to the fact that self-efficacy is a single social cognitive variable which does not reflect variables such as social pressure, attitude, and control factors. Interestingly, Maddison & Prapavessis (2004) noted that the addition of intention in their study increased predictions of variance up to 59%.

In review of six studies, the HBM predicted 5-31% of the variance in exercise adherence with the most significant dimensions being cues to action, perceived barriers and perceived severity (Al-Ali and Haddad, 2004; Mirotznik, Feldman, & Stein 1995; Oldridge and Steiner, 1990; Petrie, Weinman,, Sharpe, & Buckley, 1996; Robertson and Keller, 1992; Tirrell & Hart, 1980). The wide variation in variance explained may be due to lack of clarity about which constructs are actually in the HBM, and how these constructs relate to one another. As a result, most investigators have developed their own unique approach to operationalizing each variable, which makes it problematic to compare findings across studies.

Two studies addressing the TTM and exercise adherence were reviewed. Kanning (2010), studied 108 coronary artery disease patients, and demonstrated that stimulus control, reinforcement management, self-liberation, and

consciousness raising were the only processes of change that predicted exercise adherence. Interestingly, Sneed & Paul (2003) found conflicting results in their examination of 250 patients with HF. Conclusions in this study reported that the TTM did not work well in assessing the stage of readiness for behaviour change.

Plotnikoff and Higginbotham (1998) examined the utility of the PMT in a sample of 151 cardiac patients during hospitalization and six months after their cardiac event. The full PMT model explained 32% of the variance in exercise adherence. Plotnikoff and Higginbotham (1998) also observed self-efficacy had the strongest influence on exercise.

In comparison to the other social cognitive models the TPB seems to be more widely utilized for understanding exercise in clinical settings such as in cancer rehabilitation (Andrykowski, Beacham, Schmidt, & Harper, 2006; Jones et al., 2007) and cardiac populations (Blanchard et al, 2002a; Blanchard et al, 2003; Godin, Valois, Jobin & Ross, 1991; Johnston, Johnston, Kinmonth & Manth, 2004). It is possible that constructs such as PBC may explain why patients are more or less likely to follow prescribed exercise regimens. As such, the TPB may provide useful direction for interventions in the area of HF.

In the following section, I review four studies using the TPB with cardiac populations (see Table 1). A cross sectional study by Godin et al. (1991) addressed a population of acute cardiac patients and found that attitude, SN, and PBC accounted for 24% of the variance in exercise intention. This study did not examine the relationship of intention to exercise adherence. Johnston et al. (2004) drew from similar populations yet measured only PBC and intention in relation to

exercise adherence. This work found that both PBC and intention correlated to exercise adherence, collectively explaining 9.6% of the variance. Johnston et al. (2004) further noted that PBC added significant independent predictive power 12 months after myocardial infarction (B= .22, p< .05). Johnston et al. (2004) admit limitations in their results due to their choice to address only two proximal factors in the TPB as opposed to the complete model. Lastly, Blanchard et al. (2002a) and Blanchard et al. (2003) addressed cardiac patients in the rehabilitation setting. Both studies found attitude, SN, and PBC to account for 38% and 30%, respectively of the variance in exercise intention. Furthermore, intention accounted for 23% and 20% of the variance in behaviour respectively.

This review of the literature highlights the potential value of the TPB in general cardiac populations and suggests its possible usefulness in understanding exercise adherence in HF. It should however be noted, that although valuable, this literature is not necessarily generalizable to the HF population. For instance, the palliative trajectory intrinsic to HF may wash out the effects of attitude and PBC that are seen in the general cardiac population. Due to the unique symptomology and treatment of people with HF, a careful examination of exercise intention in this specific population is warranted.

Research Objectives

This study proposes to examine the structural assumptions of the TPB and its applicability to exercise adherence in the HF population. The first objective is to examine the relationship between the TPB tenets and exercise at baseline. It is hypothesized that PBC and exercise intention will be significant independent

predictors of exercise behaviour. The second objective is to prospectively examine the relationship between PBC, intention and exercise adherence. It is hypothesized that PBC and exercise intention will be significant independent predictors of exercise adherence during HF treatment.

Method

Because there is currently no registry of HF patients in Alberta, it was difficult to draw a random sample of potential participants for this study. Thus participants were recruited from the Mazankowski Alberta Heart Institute Heart Function Clinic (Maz-HFC). Sampling involved a non-probabilistic, convenience approach. Since the objective of the study was to examine associations between beliefs and exercise among people living with HF, and not to establish prevalence, then the representativeness of the sample may be less of an issue.

Participants were surveyed at two time points: first at baseline to establish demographic, TPB construct data as well as exercise behaviour and; second at three months post baseline to establish exercise behaviour. This method is modeled after work by Karvinen et al. (2007a).

Eligible participants were those who: were referred by a physician; attended scheduled appointments at the Maz-HFC; and had a history of HF, New York Heart Association (NYHA) class I-III. Ineligible participants were those who: were classified as NYHA IV HF; had diagnosed cognitive impairment, did not speak or write proficient English; had not attended or completed grade 7 or its equivalent; or who failed to return the baseline or three month questionnaire. To determine how representative the sample is those who participated in the study

were compared with those who do not based on their demographic and medical variables.

The sample was projected in order to illicit appropriate statistical power for analysis and variance, and accounting for typical dropout rates noted in this population. As noted by Francis et al (2004) TPB studies using a multiple regression approach generally presume a moderate effect size. In their meta-analysis Hagger et al (2002) found medium to large effect size for all potential relationships in the TPB apart from SN – Behaviour ($r = 0.15$). According to Cohen (1992) this would translate to a sample of roughly 85 participants. Allowing for 70% response rates an attempt to recruit 122 participants was made to achieve the recommended sample size.

Measures

This study included measures of participant demographics and clinical data, behavioural, normative and control beliefs, intention, PBC, attitude, SN, outcome expectations and exercise behaviour. The participant's age, sex, height, weight, time since diagnosis, NYHA HF class, point in clinical care and other health related concerns (i.e., smoking status, diabetes, hypertension, etc.) were obtained from medical records. All remaining data was self-reported by each subject in the study questionnaire.

Protocol for the questionnaire design was guided by Ajzen & Fishbein (1980). As recommended by Ajzen (1988) each of the questions were developed using a seven-point likert scale and construct specific items were be mixed up throughout the document.

As recommended by Bland & Altman (1997) each of the constructs questions were averaged to obtain the construct score and Cronbach's coefficient alpha was utilized to confirm internal consistency of both the direct and indirect construct measures. To confirm the validity of the indirect measures bivariate correlations were calculated between direct and indirect measures of the same construct. A copy of the complete questionnaire can be found in Appendix B.

Six open-ended elicitation questions were incorporated into the questionnaire addressing behavioural (2 questions), normative (2 questions) and control (2 questions) beliefs. These items were: "What do you think are the benefits if you exercised regularly", "What do you think are the drawbacks if you exercised regularly", "What things make it easier for you to stick with your regular exercise", "What things make it harder for you to stick with your regular exercise", "Which people or groups of people that are important to you would approve of your regular exercise", and "Which people or groups of people that are important to you would disapprove of your regular exercise". Content analysis to assess whether beliefs most salient to the HF group are similar to those in other cardiac populations will be performed outside of this study.

Behavioural, normative and control beliefs were generated from consultation with Dr. Chris Blanchard, Dr. Kerry Courneya, the Maz-HFC staff and patients and review of Welsh, et al. (2010). Dr. Chris Blanchard has completed questionnaires in Cardiac rehabilitation settings and Dr. Kerry Courneya has completed questionnaires in the cancer domain.

Behavioural Beliefs. Behavioural beliefs were measured by seven items. Each belief was preceded by the statement "If you were to exercise regularly over the next month, do you think you would". The specific beliefs were: feel better, improve your well being, reduce the number of visits/calls to the Heart Function clinic, relieve stress, increase your energy level, live longer, and be able to do more during the day. Each measure was rated on a seven-point scale from one; strongly agree to seven; strongly disagree. Outcome evaluations were measured by two items. Each measure was rated on a seven-point scale from one; highly desirable to seven; highly undesirable. The items were: "Doing something to help my heart failure improve is" and "Going to the doctor or Heart function clinic less often for my heart failure is".

Normative Beliefs. Normative beliefs were measured with two descriptive and seven injunctive items. The descriptive beliefs were rated on a seven-point scale from one; strongly agree to seven; strongly disagree. The items were: "If the people that are important to me had heart failure they would exercise" and "Most people with heart failure exercise". The injunctive beliefs were rated on a seven-point scale from one; extremely supportive to seven; extremely unsupportive. Each belief was preceded by the question "How supportive do you think each of the people below would be if you tried to exercise regularly over the next month". The specific beliefs were: spouse/partner (if applicable), other family members, best friend, cardiologist (heart failure doctor), heart function clinic staff and family doctor.

Control Beliefs. Control beliefs were measured by nine items. The beliefs were rated on a seven-point scale from one; always to seven; never. Each belief was preceded by the question "How much do the following things keep you from exercising". The specific beliefs were: I don't know how, side effects from your medication, bad weather, other health problems, angina, swelling, tiredness, lack of will power and no time.

Attitude. Attitude was measured by four items. As suggested by Azjen & Fishbein (1980) direct attitude questions were developed with a seven-point semantic adjective scale. Adjectives were related to the HF population and exercise adherence and incorporated both instrumental (bad-good, worthless-valuable) and affective (pleasant-unpleasant, boring-enjoyable) aspects. The statement that preceded the adjectives was "For me, exercising with heart failure is". The scale ranged from one to seven, with verbal descriptors at one and seven; extremely, two and six; quite and three and five; slightly. The third item (worthless-valuable) was dropped to improve internal consistency. Internal consistency for the resulting three item scale was 0.72.

SN. SN was measured by three items. Direct SN questions were developed so as to include injunctive quality (Ajzen, 1998). The seven-point likert scale ranged from one; strongly agree to seven; strongly disagree. The items were: "Most people that are important to me think that I should exercise regularly", "I am expected to exercise as part of my self care for heart failure" and "I feel that those I care about support me to exercise regularly". The three items were averaged to obtain a SN score. Internal consistency was 0.83.

Perceived Behavioural Control. PBC was measured by three items. Direct questions developed for PBC addressed the participant's perceived capability of performing the behaviour, the behaviours level of controllability and self efficacy (Ajzen & Madden, 1986). The seven-point likert scale for the first two questions ranged from 1; strongly agree to seven; strongly disagree. The seven-point likert scale for the last PBC question ranged from 1; extremely easy to seven; extremely hard. The items were: "I am confident that if I wanted to I could exercise regularly", "The decision to exercise regularly is completely up to me" and "For me to regular exercise is". The three items were averaged to obtain a SN score. Internal consistency was 0.71.

Intention. Lastly, three incomplete statements of generalized intention and one direct intention statement were included in the questionnaire. Intention questions were developed so that they were directly compatible with exercise adherence and accounted for target, action, context and time (Ajzen, 1998). The seven-point likert scale for the first two questions ranged from one; not at all to seven; every day. The seven-point likert scale for the third PBC question ranged from one; not at all to seven; very detailed plans and the scale for the last question ranged from one; extremely unmotivated to seven; extremely motivated. The items were: "In the next week, I want to exercise", "In the next week, I expect to exercise", "How motivated are you to do regular exercise in the next week" and "Do you have plans for when, where, and the kind of exercise you will do in the next week". The three items were averaged to obtain an intention score. Internal consistency was 0.81.

Exercise behaviour was assessed using the Leisure Score Index (LSI) of the Godin Leisure Time Exercise Questionnaire (GLTEQ) (Godin & Shepard, 1985). Jacobs, Ainsworth, Hartman & Leon (1993) independently evaluated this instrument and found that it was reliable and valid based on various criteria including activity monitors and fitness indices. The LSI contains three questions assessing the frequency of mild, moderate and strenuous exercise performed during free time for at least 15 minutes in duration in a typical week. Total LSI was calculated by the weighting each frequency by its estimated intensity of metabolic equivalents (METs) and summing for a total score as follows: (3 X mild) + (5 X moderate) + (9 X strenuous). Participants were asked to complete the GLTEQ at baseline and 3 months post baseline recalling their typical weekly exercise. The GLTEQ has been found to be brief, reliable, easily administered and possesses concurrent validity (Jacobs, Ainsworth, Hartman & Leon, 1993).

The two questionnaires (the TPB tenets and the GLTEQ) were combined into one, reviewed and revised by the Maz-HFC Research Coordinator to ensure language was appropriate for the sample group.

Procedure

Before starting the study the researcher met with the Medical Director and lead nurse from the Maz-HFC to review the research proposal. Alterations were made based on the impact to the program as well as the research aims of the program. Following agreement from the program, ethical approval for this study was sought from the Health Research Ethics Board.

The study used a prospective design wherein participants were asked to state their beliefs, attitudes, SNs, PBCs, outcome expectations, intentions to exercise and their exercise patterns. The researcher met each eligible participant prior to their scheduled program appointment and reviewed the study with them in a one to one setting. The researcher addressed questions and concerns, obtained informed consent from the participant, provided the self-administered questionnaire package and encouraged completion of the questionnaire before leaving the scheduled appointment or alternatively to return the questionnaire within one week. The questionnaire package included a personalized cover letter from the program supporting the research, an outline explaining the details of the research, a patient copy of the informed consent form, and a questionnaire assessing the TPB constructs and exercise patterns (see Appendix B). All participants completed their questionnaire prior to leaving their scheduled appointment. The survey method outlined included features that are known to increase response rates such as assurance of confidentiality, university sponsorship, coloured paper, and an average questionnaire completion time of less than 10 minutes (Ransdell, 1996). At three months all those participants completing the first questionnaire received a second package by mail including a questionnaire measuring exercise patterns and a stamped, self-addressed envelope (see Appendix C). For those participants not returning their packages a phone call reminder was given at three weeks followed by a postcard reminder at four weeks.

On completion of the study participants were debriefed through a telephone call from the researcher. The debriefing included an overview of the

study hypotheses, review of questions that the participants had, and confirmation that the participants may request results of the research for their interest.

Data Analysis

Two sets of analysis were completed, one for the cross sectional data and one for the prospective data. Both analyses followed the same process. To understand the relationships of the TPB tenets bivariate correlations were calculated for each individual belief (behavioural, normative and control), the direct constructs (attitude, SN and PBC), intention and exercise adherence using Pearson correlation coefficients. As suggested by Ajzen (1991), hierarchical regression analysis (HRA) was used to test the associations between: intention and the direct measures (HRA 1), past exercise, intention and PBC (HRA 2) and exercise adherence, intention and PBC (HRA 3). Distributions of all variables were examined for normality and the presence of outliers.

Results

Sample Characteristics

During the five-month recruitment period, 107 patients completed an initial questionnaire package and 81 completed the follow up mail out questionnaire. The second questionnaire yielded a response rate of 75%.

Table 2 presents the sample demographic and medical profiles. In summary, the mean age was 65.89 years, *SD* = 13.59, and 60.7% were male. Fifteen per cent of the sample exhibited a normal body mass index with 1.0%, 40.0% and 50.0% in the underweight, overweight and obese categories,

respectively. Medical information indicated that 20.8%, 54.7% and 24.5% of the sample was distributed into the NYHA classes I, II, and III respectively with the mean number of months since HF diagnosis of 62.45, *SD* = 60.97. Approximately 87% of the sample was measured during a follow up HF clinic visit and 12.1% of the total sample attended Cardiac Rehabilitation at some point in their medical care. The sample displayed multiple cardiac risk factors with 14.0% being current smokers, 48.6% exhibiting hypertension, 32.7% having diabetes mellitus and 56.1% exhibiting hyperlipidemia. Approximately 20% of the cohort was meeting physically activity guidelines at baseline with no apparent gender differences. However, a greater proportion of females (33.3%) than males (14.6%) were classified as being active at the 3-month follow-up, $\chi^2 = 3.98$ (1, N = 81), p = 0.05.

T-tests and Pearson Chi-squares were performed comparing those who completed the second GLTEQ and those who did not. Those who did not complete the second GLTEQ had a lower average age, mean = 61.3, *F* (105) = 0.01, *p* = 0.048, and were more likely to be in NYHA class 3 (30.8% vs. 22.5%), $\chi^2 = 6.28$ (2, N = 106), p = 0.04, than those who did complete the questionnaire.

Correlations between each individual belief and its respective global construct (i.e., attitude, SN, PBC), intention, exercise at baseline and exercise at three months are presented in Table 3. Each individual belief was significantly correlated with its global construct with the exception of outcome evaluation ‘going to the doctor or Heart function clinic less often for my heart failure is’, normative belief ‘Heart function clinic staff’, and control beliefs ‘bad weather’,

'angina' and 'no time'. 'Being able to do more during the day' emerged as the most important underlying behavioural belief, $r = 0.42$. 'If the people that are important to me had heart failure they would exercise' emerged as the most important normative belief, $r = 0.61$ and 'other health problems' emerged as the most important control belief, $r = 0.44$. None of the beliefs correlated with all four dependant variables.

Main Analyses

Descriptive statistics and Pearson correlations among each of the direct TPB constructs, exercise at baseline and exercise at three months are presented in Table 4. Each of the TPB constructs were positively and significantly correlated with intention. Intention had the strongest correlations with attitude, $r = 0.43$, and perceived behavioural control $r = 0.48$.

Baseline exercise exhibited strong correlations with intention, $r = 0.44$ but a weaker correlation was seen between exercise at three months and intention, $r = 0.29$. Exercise at three months showed a significant but low correlation with exercise at baseline, $r = 0.25$.

The main hypotheses concerning the TPB were tested using three separate HRA's with forced entry within each block of variables. Each of these HRA's were adjusted for age, gender, months since diagnosis, attendance to CR and NYHA class within the analysis. In the first regression analysis, exercise intention was regressed onto one block of variables; attitude, SN and perceived behavioural control. In the second HRA, exercise at baseline was regressed on intention (step 1) and perceived behavioural control (step 2) to determine if any additional

variance was explained. In the last HRA exercise at three months was regressed on intention and exercise at baseline (step 1), and perceived behavioural control (step 2) to determine if any additional variance was explained.

The first regression analysis addressing intention and the direct TPB measures showed that PBC, $B = 0.38$, $F\ (8, 88) = 4.00$, $p = 0.002$, was the only significant contributor to intention (see Table 5). Overall, the model accounted for 20% of the variance in exercise intention.

Table 6 presents the prediction of exercise at baseline and exercise at three months. The second HRA indicated that exercise intention, $B = 0.46$, $F\ (7, 91) = 5.67$, $p < 0.0001$, along with the demographic variables explained 26% of the variance in exercise at baseline. No significant contribution of PBC was noted on the second step. The last regression analysis showed similar results with intention, $B = 0.291$, $F\ (8, 66) = 1.86$, $p = 0.02$) being a significant contributor to exercise at three months. PBC did not make significant unique contributions to exercise at three months.

Discussion

This study investigated the utility of the TPB in understanding exercise intention and exercise adherence during HF treatment. Overall, the results confirm structural assumptions within the model and support applicability for use in the treatment of HF. The first and second research objectives were partially confirmed as results showed intention was the only significant predictor of

exercise behaviour and exercise adherence. PBC did not display a significant independent role as hypothesized.

Cross sectional findings showed that the TPB explained 20% of the variance for intention and 26% of the variance for exercise behaviour. These results compare with existing cross-sectional TPB studies. In the general population (Armitage &Connor, 2001; Hagger et al., 2002) and clinical populations (Blanchard, Courneya, Rodgers, & Murnaghan, 2002, Godin et al, 1991, Jones, 2007, Karvinen et al., 2007b) the model explains approximately 23-50% of the variance for exercise intention and 20-36% for exercise behaviour. Possible explanations for the slightly smaller variance on intention may be related to the unique disease pathology inherent to HF. For instance, Conner and Sparks (2005) note that some studies have found a direct unmediated effect of common background variables on intention and behaviour i.e., emotion (anxiety, depression, apathy), cognitive decline, and socioeconomic factors. Ajzen and Fishbein (2005) state that individuals may find it challenging to correctly predict the strong emotions that drive their real life behaviour. An emotion variable may be attenuated in those people with HF due to the high prevalence of depressive symptoms present in up to 85% (Lane, Chong & Yip, 2005) and clinical depression in 21.5% (Rutledge et al, 2006). Since depression is associated with decreased adherence in treatment regimens and includes symptoms of loss of interest in people (DiMatteo, Lepper and Croghan, 2000)3 it is conceivable there would be an effect on each of the TPB constructs. Future research should incorporate measures of anxiety and depression to rule out potential interference.

Within the current study exercise intention explained 8.6% of the variance in exercise adherence with no significant influence from PBC. This is consistent with previous research in general populations (Hagger et al., 2002), other cardiac populations (Blanchard et al., 2003, Blanchard et al., 2002a), as well as diabetes populations (Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2010) which demonstrated a range in variance explained from 8-23% with no PBC influence . It should be noted however that both Blanchard et al. (2003) and Blanchard et al. (2002a) accounted for higher levels of variance at 20% and 23% respectively.

The smaller amount of variance predicted in this study as compared to Blanchard's work (2002a, 2003) may be attributed to unique qualities within the HF population combined with differences in methodology and program type. An examination of Blanchard et al.'s (2003) general cardiac sample and the present study sample highlights several differences. The current study included a sample with a higher mean age, 65.89 as compared to 59.52 (Blanchard et al., 2003), more than double the incidence of Diabetes Mellitus, and a significantly higher proportion of women.

Blanchard and colleagues (2002a) incorporated formalized exercise at a hospital based Cardiac Rehabilitation (CR) program. Participants were administered a survey after their initial orientation session and asked to return it at their first scheduled exercise session. Between the orientation and first exercise session each participant would have participated in an exercise tolerance test along with an individual explanation of their exercise limits with a Physician, Nurse or Exercise Specialist. Given that the CR program in this study used a

family-centred model one could also assume that spouses or significant support persons may have been present for this orientation. Thus, knowing this level of detail about exercise and having clear concepts of normative support, participants may have formed stronger intentions to exercise compared with participants in the current study. Furthermore, Ajzen & Sexton (1999) noted that beliefs activated when completing a questionnaire are different from the ones accessible at the point of performing the behaviour. The methods in Blanchard et al. (2002a) may therefore have altered predictions of variance within the TPB by having participants complete the questionnaire and behaviour in close temporal proximity.

Another important consideration between Blanchard et al., (2002a), Blanchard et al., (2003) and the present study is the difference in program type. Schuster (1991) noted that patients who enrolled in hospital based CR had higher exercise adherence rates than those in home based programs. Both Willenheimer et al. (2001) and Haykowsky et al. (2005) showed similar findings specific to the HF population. This suggests that patients completing hospital based programs are more motivated to exercise. A formalized hospital program may alter the strength of relationships between the TPB constructs. Within the current study 12.10% of the sample attended CR for a formalized HF exercise program. Although no significant differences were noted between those with CR and no CR this portion of the sample was small (n=13) and time elapsed since attending the program was not explicitly defined, i.e., those participants with CR may have attended before, during, or after implementation of the initial questionnaire.

Future research is needed to compare the TPB model between home- and hospital-based programming in people with HF.

An interesting finding in the present study was that PBC was the sole construct to predict intention to exercise. Although this finding is inconsistent with much of the cardiac literature where most of the TPB constructs tend to be predictors of intention (Blanchard et al, 2002a; Blanchard et al, 2003; Godin et al, 1991; Johnston et al, 2004), it does present potential for informing interventions to improve exercise adherence. Future study should be considered to explore this relationship.

The sample characteristics of the current study are reasonably consistent with a large RCT and a meta-analysis within the HF population. In comparison with HF-Action (O'Connor et al., 2009), a RCT that assessed the efficacy of exercise in 2331 HF patients and ExTraMATCH (Piepoli et al., 2004), a meta-analysis exploring similar endpoints in 801 HF patients our study presented with a higher percentage of women, slightly older mean age, and lower severity of disease (NYHA class). It should however be mentioned that the present study excluded NYHA class IV patients whereas both HF-ACTION and ExTraMATCH included this group. Although ExTraMATCH did not report on risk factors the present study does compare with the prevalence of diabetes and hypertension reported in HF-ACTION.

Finally, though gender was not a significant predictor of exercise in the linear regressions in the current study, the proportion of patients considered to be sufficiently active varied over time by gender (see Table 2). Specifically, when

gender cutoffs were applied for physical activity (women = 35 METs, men = 38 METs; Bengoechea, Spence, & McGannon, 2005), a greater proportion of females were active at three months. Although this shows an interesting pattern, caution should be given as the cut offs defined by Bengoechea et al. (2005) have not been validated in clinical or older populations. Future research addressing this potential gender difference is warranted especially considering that the literature on older women with HF reports they have a greater disability, are less likely to be referred to and attend cardiac rehabilitation than men (Haykowsky et al., 2005).

There are a number of limitations that should be acknowledged when interpreting the findings of this study. The first limitation is that self-report assessment of exercise behaviour was used to measure exercise adherence. The vulnerability to self-presentation bias inherent to this type of assessment is well documented (Armitage, 2001). Self-report limitations may also be accentuated in the HF population due to the common symptom of cognitive impairment. Future research should utilize direct measures of exercise expenditure (i.e., accelerometers, heart rate monitors, pedometers).

A second limitation is the potential selection bias of the sample. Analysis of the group completing the second GLTEQ and the group not completing the second GLTEQ showed significant differences in severity of HF and age. We can postulate that those who did not complete the second GLTEQ may have been less motivated to exercise and therefore chose not to participate. This information

would potentially alter the strength of association between intention and exercise adherence.

A third limitation of the study was the lack of assessment of the TPB constructs at 3 months. Blanchard (2002a) noted that TPB behaved differently over time. It would therefore be interesting to see if administration of the TPB questionnaire was temporally relevant.

A fourth limitation centers on the knowledge that the single cohort longitudinal design is prone to pre-test threats. A threat to internal validity occurs when those individuals taking a pre-test (GLTEQ at baseline) may improve at time two (GLTEQ at three months) simply because they have been previously exposed to the test. Spence, Burgess, Rodgers and Murray (2009), however did not note this phenomena in their study addressing pre-testing on intentions and behaviour in a walking intervention. The study sampled 63 female university students and used a four group Solomon design. Analysis did not elicit pre-test sensitization in either the intervention or non-intervention groups.

Lastly, several clinical factors may have influenced findings. The recommended device therapy and/or pharmacological management of people with HF may illicit a number of symptoms which would very likely be reflected in the measurement of the TPB tenets. The Canadian Cardiovascular Society consensus suggests that automatic implanted cardiac defibrillators, cardiac resynchronization therapy and a host of medications (diuretics, angiotensin-converting enzyme (ACE) inhibitors, beta blockers, and Digoxin) should be included as part of a comprehensive HF treatment plan (Arnold et al, 2006). Unfortunately the

symptoms common to these therapies include, but are not exclusive to, weakness, dizziness, lightheadedness, syncope, upset stomach, vomiting, constipation, frequent urination, headache, loss of energy, altered sleeping habits, sensitivity to heat or cold and swelling (Arnold et al, 2006, REACT Medication Information, n.d.). It is fair to assume that feelings of weakness or an upset stomach would alter a patient's PBC. Similarly, a witnessed syncopal episode may negatively affect a family member's view of exercise and concomitantly effect the patient's SN measurement. Changes in clinical factors were unfortunately not monitored within this study. This area warrants future investigation.

Implications/Conclusion

In spite of all the advances in the treatment of HF the mortality rate remains high and the affected population continues to grow (Lee et al., 2004; Ross et al., 2006). Effective interventions for this population are required to alleviate the current and future strain on our health care system. Exercise appears to be one key pathway for reducing symptoms, improving QoL, decreasing access to medical care and reducing mortality for HF patients.

Although evidence for the TPB's utility in HF is preliminary, potential clinical implications exist based on the present findings. Specifically, the results suggest that health care providers should work closely with their HF patients to identify and discuss control beliefs and to promote implementation intentions. By doing so, they can create persuasive communications targeting behaviours and

develop strategies with patients to overcome barriers; both of which may increase exercise adherence.

Ajzen (1971) notes, the greater the relative weight of a given TPB construct, the more likely it is that changing that construct will influence intentions and behavior. Since the present study highlighted PBC as the only significant independent predictor of intention it is logical to focus on the control beliefs related to this variable. Behavioural interventions should therefore address readily accessible personal control beliefs identified by the participants within the elicitation study as well as those used within this studies' questionnaire. As noted in Table 3 the control beliefs 'I don't know how', 'side effects from your medication', 'other health problems', 'swelling', 'tiredness' and 'lack of will power' were significantly and negatively correlated with PBC and intention. The measurement of these specific beliefs, lends insight into the underlying cognitive foundation of those people with HF at a given point in time (Ajzen, n.d.). This material provides health teams with relevant topic areas for patient – clinician discussions or the development of educational materials. Ajzen (n.d.) also noted it may be easier to augment behavior change by introducing information designed to lead to the formation of new beliefs. For this, he suggests reviewing not only the modal beliefs in the population of interest, but also beliefs mentioned by only a small number of respondents within the elicitation study. For example, the elicitation study may note 'having an exercise partner' or 'ensuring time for rest afterwards' is important to improve feelings of control. Since most people with

HF do not link this outcome and exercise behavior, it could be a valuable target for intervention (Ajzen, n.d.).

Interventions targeting control beliefs may be successful in producing positive changes to behavioral control and intentions but the intervention will still be ineffective, if individuals are unable to carry out their newly formed intentions (Ajzen, n.d.). Sheeran (2002) furthermore notes that although intentions are good predictors of behaviour, merely half of those people with positive intentions successfully translate their intention into action. For this reason, it is important to incorporate methods of practice that strengthen the link from intention to behavior. One of the most effective tools to decrease the disparity is implementation intentions (Gollwitzer, 1999). Implementation intentions are if-then plans that identify when, where, and how an individual plans to implement their desired behavior (Gollwitzer, 1999). They link good opportunities to act with the behavioural activity that is effective in attaining their goal. Implementation intentions take the form of personal action plans. Journaling both their successful and unsuccessful exercise attempts provides an opportunity for patients and healthcare providers to work together to problem solve, address barriers and renegotiate goals. Patients may concurrently be encouraged to make note of the gains and losses related to the behaviour as an evaluation tool.

Sniehotta, Scholz, & Schwarzer (2005) and Luszczynska (2006) found that formulation of implementation intention plans successfully promoted physical activity in CR settings. In her study of 114 patients post first uncomplicated myocardial infarction Luszczynska (2006), found those patients

that were randomly assigned to the implementation intention intervention group maintained the same number of exercise sessions at eight months post CR. In contrast the control group performed significantly fewer sessions. The intervention group 1) received information detailing what an implementation intention planning strategy was, 2) formed their own individual planning strategy, 3) received one to one coaching from a healthcare provider encouraging exact times, which exercises were performed at which exact times, days of week and specific circumstances for their strategy and, 4) were complimented on successful implementations. By adopting practices to encourage and promote the use of implementation intention regulation tools, health care providers may positively enhance exercise adherence in those who suffer from HF.

In summary, the TPB is a useful framework for understanding exercise intention and exercise adherence during HF treatment. For people with HF, PBC is a strong independent determinant of exercise intention and intention is similarly a strong independent determinant of exercise.

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Table 1

A Review of the Literature Using the Theory of Planned Behaviour to Predict Exercise Adherence in Cardiac Populations

Author	Year	Patient Population	Mean Age	N	Design	Country	Findings
Blanchard et al.	2002	Patients in cardiac rehabilitation	59.59[a] SD = 11.49	81 57 male	Prospective	Canada	During CR attitude, SN and PBC explained 38% of the variance in exercise intention. Intention explained 23% of the variance in exercise adherence. Post rehabilitation follow up attitude, SN and PBC explained 51% of the variance in exercise intention. Intention explained 23% of the variance in exercise adherence.
Blanchard et al.	2003	Patients in cardiac rehabilitation	59.52 SD = 10.09	215[b]	Prospective	Canada	Attitude, SN and PBC explained 30% of the variance in exercise intention. Intention explained 20% of the variance in exercise

							behavior. Exercise intention explained 12% of the variance in exercise adherence.
Godin et al.	1991	Acute cardiac patients	52.8 SD = 8.1	161 137 male	Cross-sectional	Canada	Attitude, SN and PBC explained 24% of the variance in exercise intention.
Johnston et al.	2004	Acute cardiac patients	63.4 SD = 10.0	597 358 male	Prospective	England	PBC and intention explained 9.6% of the variance in exercise adherence. Neither attitude nor SN were addressed in this study.

Note. CR = cardiac rehabilitation, SN = subjective norm, PBC = perceived behavioural control.

[a] all patients >70 years of age were excluded from this study, [b] gender not reported

Table 2

Demographic and Medical Profile of the Study Participants

	Sample			
Variable	n	%	Mean	SD
Age	107	100.00	65.89	13.59
Gender				
Male	65	60.70		
Female	42	39.30		
BMI				
Underweight[a]	1	0.90		
Normal[b]	16	15.00		
Overweight[c]	40	37.40		
Obese[d]	50	46.70		
NYHA Class				
I[e]	22	20.80		
II[f]	58	54.70		
III[g]	26	24.50		
Months Since HF Diagnosis	106	99.00	62.45	60.97
Point in Clinical Care				
First time to HF Clinic	14	13.10		
Follow Up visit to HF Clinic	93	86.90		

Attended CR		
Yes	13	12.10
No	94	87.90
Cardiac Risk Factors		
Smoking Status		
Yes	15	14.00
No	92	86.00
Hypertension		
Yes	52	48.60
No	55	51.40
Diabetes Mellitus		
Yes	35	32.70
No	72	67.30
Hyperlipidemia		
Yes	60	56.10
No	47	43.90
Physically Active[h]		
Exercise1[i]		
Male	65	20.0
Female	42	19.5
Exercise2[j]		
Male	65	14.6
Female	42	33.3

Note. BMI = body mass index; NYHA = New York Heart Association functional classification; HF = heart failure; CR = cardiac rehabilitation.

[a]underweight = < 18.499; [b]normal weight = 18.5 – 24.99; [c]overweight = 25 – 29.99; [d]overweight = >30 (Douketis, Paradis, Keller, & Martineau, 2005)

[e]I = No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, or dyspnea (shortness of breath); [f]II = Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, palpitation, or dyspnea; [g]III = Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, palpitation, or dyspnea. (http://www.abouthf.org/questions_stages.htm)

[h]Physically active = females ≥35, males ≥38 (Bengoechea, Spence, & McGannon, 2005); [i]Exercise1 = Godin Leisure Score Index measured at baseline; [j]Exercise2 = Godin Leisure Score Index measured three months from baseline.

Table 3

Pearson Correlations of Behavioural, Normative and Control Beliefs with Global Indicator, Intention, and Exercise

Subscale	Global	Intention	Exercise1[a]	Exercise2[b]
Behavioural Beliefs				
1. 'Feel better'	0.33**	0.16	0.04	0.08
2. 'Improve your well being'	0.25*	0.06	0.01	0.18
3. 'Reduce the number of visits/calls to the Heart Function clinic'	0.38**	0.20*	0.03	0.01
4. 'Relieve stress'	0.40**	0.14	- 0.05	0.13
5. 'Increase your energy level'	0.34**	0.14	0.04	0.15
6. 'Live longer'	0.32**	0.24*	0.18	0.16
7. 'Be able to do more during the day'	0.42**	0.19	0.10	0.12
Outcome Evaluation				
1. 'Doing something to help my heart failure improve is'	0.22*	0.00	- 0.07	0.10
2. 'Going to the doctor or	0.18	0.02	0.02	0.12

Heart function clinic less often for my heart failure is’				
Normative Beliefs – Descriptive				
1. ‘If the people that are important to me had heart failure they would exercise’	0.61**	0.14	- 0.11	0.04
2. ‘Most people with heart failure exercise’	0.30**	0.02	- 0.10	0.15
Normative Beliefs - Injunctive				
1. ‘Spouse/partner (if applicable)’	0.22*	0.06	0.12	0.09
2. ‘Other family members’	0.46**	- 0.04	0.02	0.15
3. ‘Best friend’	0.39**	- 0.03	0.10	0.20
4. ‘Cardiologist (heart failure doctor)’	0.22*	- 0.13	0.02	0.13
5. ‘Heart function clinic staff’	0.19	- 0.13	0.01	0.12
6. ‘Family doctor’	0.45**	- 0.20	0.06	0.18

Control Beliefs				
1. ‘I don’t know how’	- 0.31**	- 0.34**	- 0.20	- 0.10
2. ‘Side effects from your medication’	- 0.33**	- 0.25*	- 0.20	- 0.08
3. ‘Bad weather’	- 0.19	- 0.26*	- 0.12	- 0.16
4. ‘Other health problems’	- 0.44**	- 0.42**	- 0.26**	- 0.21
5. ‘Angina’	- 0.19	0.06	- 0.06	0.05
6. ‘Swelling’	- 0.32**	- 0.23*	- 0.31**	- 0.04
7. ‘Tiredness’	- 0.41**	- 0.38**	- 0.16	- 0.05
8. ‘Lack of will power’	- 0.29**	- 0.45**	- 0.14	- 0.18
9. ‘No time’	- 0.03	- 0.07	0.00	- 0.04

Note. Global indicators were attitude for behavioural beliefs and outcome evaluations, SN for normative beliefs and perceived behavioural control for control beliefs.

[a]Exercise1 = Godin Leisure Score Index measured at baseline; [b]Exercise2 = Godin Leisure Score Index measured three months from baseline.

**p <0.01, *p < 0.05.

Table 4

Descriptives and Pearson Correlations among the Theory of Planned Behaviour Constructs and Exercise in Heart Failure Patients (N = 107)

Subscale	2	3	4	5	6	M	SD
8. Intention	0.43**	0.27**	0.48**	0.44**	0.29**	4.68	1.39
9. Attitude		0.45**	0.56**	0.16	0.04	5.37	1.00
10. SN			0.42**	0.11	0.09	6.35	0.82
11. PBC				0.29**	0.90	5.36	1.23
12. Exercise1[a]					0.25**	22.13	22.41
13. Exercise2[b]						26.35	27.86

Note. PBC = perceived behavioural control.

[a]Exercise1 = Godin Leisure Score Index measured at baseline; [b]Exercise2 = Godin Leisure Score Index measured three months from baseline.

**$p < 0.001$.

Table 5

Prediction of Intention in Heart Failure Patients Using Hierarchical Regression Analysis (N = 107)

Predictors	r^2 (adjusted)	r^2 change	F change	*B*	*p*
Prediction of					
Intention					0.131
1. Attitude				0.19	0.627
SN				0.05	0.002
PBC	0.20	0.08	0.18	0.38	

Note. Adjusted for age, gender, months since diagnosis, attendance to cardiac rehabilitation and New York Heart Association class.

PBC = perceived behavioural control.

r^2 = coefficient of determination; F = F ratio; B = standardized regression coefficient.

Table 6

Prediction of Exercise in Heart Failure Patients Using Hierarchical Regression Analysis (N = 107)

Predictors	r^2 (adjusted)	r^2 change	F change	*B*	*p*
Prediction of Exercise1[a]					
1. Intention	0.26		6.65	0.46	0.000
2. Intention				0.44	0.000
PBC	0.25	0.001	0.09	0.03	0.765
Prediction of Exercise2[b]					
1. Intention				0.29	0.023
Exercise1[a]	0.86		2.0	0.05	0.746
2. Intention				0.35	0.015
Exercise1[a]				0.06	0.691
PBC	0.09	0.01	0.91	-0.13	0.343

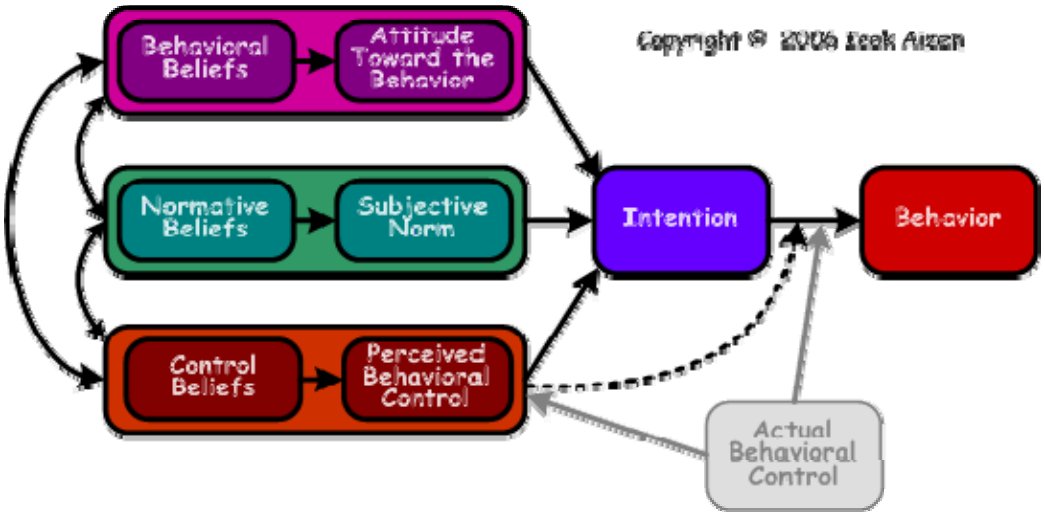
Note. Adjusted for age, gender, months since diagnosis, attendance to cardiac rehabilitation and New York Heart Association class.

[a]Exercise1 = Godin Leisure Score Index measured at baseline; [b]Exercise2 = Godin Leisure Score Index measured three months from baseline.

PBC = perceived behavioural control.

r^2 = coefficient of determination; F = F ratio; B = standardized regression coefficient.

Figure 1. Schematic Representation of the Theory of Planned Behaviour.



From Ajzen, I. (1998 September). Constructing a TpB questionnaire: Conceptual and methodological considerations. Retrieved March 24, 2007, from http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf

Appendix

Appendix A

Research Outline, Informed Consent Form, and Combined TPB and Exercise Questionnaire

Exercise adherence in heart failure: Applying the theory of planned behaviour

Principal Investigator: Dr. John C. Spence

Sub-Investigators: Leslie Wilson, Dr. Kerry S. Courneya, and Dr. Justin Ezekowitz

Background: The treatment of heart failure has improved over the last several years but there are still many ways to get better. Research has shown us that including exercise into the care plan for people with heart failure helps people to live longer and spend less time in the hospital. Even with this knowledge people with heart failure still struggle to exercise regularly. This study is looking at factors that may help us understand why people choose to exercise.

Purpose: As you already know exercise is an important part of your health. Unfortunately we don't know very much about helping people with heart failure to include regular exercise in their lives. The purpose of this study is to look at factors that may affect your exercise behaviour. We are interested in studying the things you think and do that help you to include exercise in your day. We are also interested in how sure you are about exercise and how you overcome those things that stop you from exercising.

Procedures: We ask you to complete 2 surveys for this study. The first survey will take the longest, about 15-20 minutes. In this survey we will ask you some information about your health, your past exercise habits and what you think about exercise.

The second survey will be mailed to you after 3 months. This survey will only take 5 minutes to complete and will ask you about your exercise during the 3 months since we first met. This will help us to see if your exercise has changed at all over a few months. We will phone you and send a reminder postcard 2 weeks after you receive this second survey.

To save time the Heart Function clinic will provide the following information about you from your health record: age, sex, height, weight, body mass index, time since diagnosis, New York Heart Association (NYHA) Heart Function class and other health related concerns (i.e., smoking status, diabetes, hypertension, etc.). This information will help us to compare similarities and differences across groups of people.

Possible Benefits: Taking part in this study may help you to understand yourself better in relation to your exercise routine. The results of this study will also help us to give better advice to future heart failure patients about how they may keep a steady exercise routine.

Possible Risks: There are no known physical risks involved when you take part in this study. When completing the surveys some of the questions may make you feel uneasy. You may skip these questions or talk with Leslie or the research assistant if needed. It is important to grasp that there are no right or wrong answers to the questions. It is most important to tell us how you feel. Any information you give us will be used to improve care in the Heart Function clinic and develop future studies.

Confidentiality: Personal health records relating to this study will be kept confidential. Any research data collected about you during this study will not identify you by name, only by your initials and a coded number. Your name will not be disclosed outside the research clinic. Any report published as a result of this study will not identify you by name.

For this study, the study doctor may need to access your personal health records for health information such as past medical history and test results. He/she may also need to contact your family physician and your other health care providers to obtain additional medical information. The health information collected as part of this study will be kept confidential unless release is required by law, and will be used only for the purpose of the research study. By signing the consent form you give permission to the study staff to access any personally identifiable health information which is under the custody of other health care professionals as deemed necessary for the conduct of the research.

To ensure your privacy, your name and any other information that identifies you will be removed, coded and stored in a locked office to which only the research team has access. The information will be stored by Dr. J.C. Spence in the Sedentary Living Laboratory, VanVliet Centre at the University of Alberta for five years.

Voluntary Participation: You are free to withdraw from the research study at any time, and your continuing medical care will not be affected in any way. If the study is not undertaken or if it is discontinued at any time, the quality of your medical care will not be affected. If any knowledge gained from this or any other study becomes available which could influence your decision to continue in the study, you will be promptly informed.

Contact Names and Telephone Numbers:

If you have concerns about your rights as a study participant, you may contact the Patient Relations Office of Alberta Health Services, at (780)342-8080. This office has no affiliation with the study investigators.

Please contact any of the individuals identified below if you have any questions or concerns:

Leslie Wilson, Study Coordinator (780) 735-8238

Dr. John Spence, Principal Investigator (780)492-1379

Consent Form

Part 1 (to be completed by the Principal Investigator):

Title of Project: Exercise adherence in heart failure: Applying the theory of planned behaviour

Principal Investigator: Dr. John C. Spence

Co-Investigators: Leslie Wilson, Dr. Kerry Courneya, Dr. Justin Ezekowitz

Contact Names: Leslie Wilson Phone Number: (780) 735-8238

Dr. John Spence Phone Number: (780) 492-1379

Part 2 (to be completed by the research subject):

	Yes	No
Do you understand that you have been asked to be in a research study?	☐	☐
Have you read and received a copy of the attached Information Sheet?	☐	☐
Do you understand the benefits and risks involved in taking part in this research study?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Do you understand that you are free to withdraw from the study at any time, without having to give a reason and without affecting your future medical care?	☐	☐
Has the issue of confidentiality been explained to you?	☐	☐
Do you understand who will have access to your records, including personally identifiable health information?	☐	☐
Do you want the investigator(s) to inform your family doctor that you are participating in this research study? If so, give his/her name _____	☐	☐

Who explained this study to you? _____

Title of Project: Exercise adherence in heart failure: Applying the theory of planned behaviour

I agree to take part in this study: YES ☐ NO ☐

Signature of Research Subject _____

(Printed Name) _____

Date:_____

Signature of Witness _____

I believe that the person signing this form understands what is involved in the study and voluntarily agrees to participate.

Signature of Investigator or Designee _____ Date _____

THE INFORMATION SHEET MUST BE ATTACHED TO THIS CONSENT FORM AND A COPY GIVEN TO THE RESEARCH SUBJECT

Heart Failure and Exercise Behaviour Study: Opinion Survey

Some people with heart failure choose to exercise regularly and others do not. This survey is part of a research thesis that will try to identify some of the reasons why people with heart failure exercise or don't exercise. We are interested in your point of view on exercising with heart failure. Please read each question carefully and answer it as best you can. There are no wrong answers.

Please enter the date, and your name in the underlined spaces below. Your name is needed for the follow up survey. You will receive this in 3 months by mail. All surveys are completely confidential. Your health care provider will not see your survey. Once the data has been collected all of your personal information will be removed. Your participation in this survey and the answers you give will in no way affect the care you receive in the Heart Function clinic.

Thank you for helping us to learn more about people with heart failure. We hope this study will improve the care people with heart failure receive.

Name: _____ **Date Completed: _____**

Past Exercise

The following questions ask about your usual weekly exercise. Please answer the questions even if you do not think you are an active person. Only tell us about exercise that you have done in your free time (outside of work).

1. During your free time in a normal week how many times do you do the following types of exercise for more than 15 minutes?

a) **Challenging exercise** (your heart beats quickly)
Examples of hard exercise = jogging, running, hockey, soccer, elliptical trainer, cross country skiing, fast cycling, fast swimming, basketball, stair climbing _____

b) **Medium exercise** (not tiring but your heart beats faster than normal)
Examples of medium exercise = fast walking, badminton, easy cycling, easy swimming, dancing, volleyball _____

c) **Light Exercise** (minimal effort)
Examples of light exercise = yoga, archery, gardening, fishing, golf, snowmobiling, easy walking, bowling _____

For the rest of the questions we ask you to focus on regular exercise. We define regular exercise as any medium intensity exercise that is done 3-5 days per week for 30-45 minutes each day.

2.

a) What do you think are the benefits if you exercised regularly?

———————————————————————

———————————————————————

———————————————————————

b) What do you think are the drawbacks if you exercised regularly?

———————————————————————

———————————————————————

———————————————————————

c) What things make it easier for you to stick with your regular exercise?

———————————————————————

———————————————————————

———————————————————————

d) What things make it harder for you to stick with your regular exercise?

———————————————————————

———————————————————————

———————————————————————

e) Which people or groups of people that are important to you would approve of your regular exercise?

———————————————————————

———————————————————————

———————————————————————

f) Which people or groups of people that are important to you would disapprove of your regular exercise?

———————————————————————

———————————————————————

———————————————————————

Please answer the following questions based on your feelings and experiences. Circle only one number that best expresses how you feel.

3. During my heart failure care so far I have been asked to exercise by someone in my health care team:

1	2
No	Yes

---

4. In the next week, I want to exercise:

1	2	3	4	5	6	7
Not at all		Once in a while		Every other day		Every day

---

5. In the next week, I expect to exercise:

1	2	3	4	5	6	7
Not at all		Once in a while		Every other day		Every day

---

6. How motivated are you to do regular exercise in the next week:

1	2	3	4	5	6	7
Extremely unmotivated	Quite unmotivated	Slightly unmotivated		Slightly motivated	Quite motivated	Extremely motivated

---

7. Do you have plans for when, where, and the kind of exercise you will do in the next week?

1	2	3	4	5	6	7
Not at all		Some general ideas		Some specific ideas		Very detailed plans

The following questions ask you to rate how you feel about doing regular exercise. Circle only one number that best expresses how you feel for each opposite feeling.

8. For me, exercising with heart failure is:

a.	1 Extremely good	2 Quite good	3 Slightly good	4	5 Slightly bad	6 Quite bad	7 Extremely bad
b.	1 Extremely pleasant	2 Quite pleasant	3 Slightly pleasant	4	5 Slightly unpleasant	6 Quite unpleasant	7 Extremely unpleasant
c.	1 Extremely worthless	2 Quite worthless	3 Slightly worthless	4	5 Slightly valuable	6 Quite valuable	7 Extremely valuable
d.	1 Extremely enjoyable	2 Quite enjoyable	3 Slightly enjoyable	4	5 Slightly boring	6 Quite boring	7 Extremely boring

Please use the following scale for your answers to the next 7 questions:

1 Strongly agree	2 Moderately agree	3 Slightly agree	4	5 Slightly disagree	6 Moderately disagree	7 Strongly disagree

9. If you were to exercise regularly over the next month, do you think you would . . .

a. feel better	1	2	3	4	5	6	7
b. improve your well being	1	2	3	4	5	6	7
c. reduce the number of visits/calls to the Heart Function clinic	1	2	3	4	5	6	7
d. relieve stress	1	2	3	4	5	6	7
e. increase your energy level	1	2	3	4	5	6	7
f. live longer	1	2	3	4	5	6	7
g. be able to do more during the day	1	2	3	4	5	6	7

10. Doing something to help my heart failure improve is:

1	2	3	4	5	6	7
Highly desirable		Somewhat desirable		Somewhat undesirable		Highly undesirable

11. Going to the doctor or Heart function clinic less often for my heart failure is:

1	2	3	4	5	6	7
Highly desirable		Somewhat desirable		Somewhat undesirable		Highly undesirable

The following questions ask you to think about how the people who are important to you feel about your exercise. Please circle the only one number that best expresses this.

12. Most people that are important to me think that I should exercise regularly:

1	2	3	4	5	6	7
Strongly agree	Moderately agree	Slightly agree		Slightly disagree	Moderately disagree	Strongly disagree

13. I am expected to exercise as part of my self care for heart failure:

1	2	3	4	5	6	7
Strongly agree	Moderately agree	Slightly agree		Slightly disagree	Moderately disagree	Strongly disagree

14. I feel that those I care about support me to exercise regularly:

1	2	3	4	5	6	7
Strongly agree	Moderately agree	Slightly agree		Slightly disagree	Moderately disagree	Strongly disagree

---

15. If the people that are important to me had heart failure they would exercise:

1	2	3	4	5	6	7
Strongly agree	Moderately agree	Slightly agree		Slightly disagree	Moderately disagree	Strongly disagree

---

16. Most people with heart failure exercise:

1	2	3	4	5	6	7
Strongly agree	Moderately agree	Slightly agree		Slightly disagree	Moderately disagree	Strongly disagree

---

Please use the following scale for your answers to the next 6 questions. Please circle only one number that best expresses how you feel.

1 Extremely supportive	2 Quite supportive	3 Slightly supportive	4	5 Slightly unsupportive	6 Quite unsupportive	7 Extremely unsupportive

17. How supportive do you think each of the people below would be if you tried to exercise regularly over the next month?							
a. spouse/partner (if applicable)	1	2	3	4	5	6	7
b. other family members	1	2	3	4	5	6	7
c. best friend	1	2	3	4	5	6	7
d. cardiologist (heart failure doctor)	1	2	3	4	5	6	7
e. heart function clinic staff	1	2	3	4	5	6	7
f. family doctor	1	2	3	4	5	6	7

The following questions relate to your regular exercise. We define regular exercise as any medium intensity exercise that is done 3-5 days per week for 30-45 minutes each day. Please circle only one number that best expresses how you feel.

18. I am confident that if I wanted to I could exercise regularly:

1	2	3	4	5	6	7
Strongly agree	Moderately agree	Slightly agree		Slightly disagree	Moderately disagree	Strongly disagree

19. For me to regular exercise is:

1	2	3	4	5	6	7
Extremely easy			Moderately easy			Extremely hard

20. The decision to exercise regularly is completely up to me:

1	2	3	4	5	6	7
Strongly agree	Moderately agree	Slightly agree		Slightly disagree	Moderately disagree	Strongly disagree

Please use the following scale for your answers to the next 9 questions. Please circle only one number that best expresses how you feel.

1 Always	2 Almost always	3	4 Sometimes	5	6 Almost never	7 Never

21. How much do the following things keep you from exercising?							
a. I don't know how	1	2	3	4	5	6	7
b. Side effects from your medication	1	2	3	4	5	6	7
c. Bad weather	1	2	3	4	5	6	7
d. Other health problems	1	2	3	4	5	6	7
e. Angina	1	2	3	4	5	6	7
f. Swelling	1	2	3	4	5	6	7
g. Tiredness	1	2	3	4	5	6	7
h. Lack of willpower	1	2	3	4	5	6	7
i. No time	1	2	3	4	5	6	7

22. Are any of the questions difficult to answer? Which ones?

_____

_____

23. Is the survey too long?

_____

24. Do the questions feel repetitive? Which ones do you think are repeats?

_____

_____

_____

Anything else you would like to tell us? On this page please make any comments you would like about the survey, your health, exercise or anything else you think may be helpful for us to know. All comments are welcome.

You are done! Thank you for taking the time.

Appendix B
Personalized Cover Letter and Exercise Questionnaire

Heart Failure and Exercise Behaviour Study

Dear <insert name>,

Three months ago you agreed to join a study looking at heart failure and exercise. Thank you for completing the first survey when you were visiting the clinic. I am now sending you the second and last survey to complete. It will take only 5 minutes to finish. When you are done please place it in the stamped return envelope and mail it.

Please note as we talked about before, taking part in this study is up to you. Whether you choose to take part or not does not affect your care in the Heart Function clinic in any way. You may choose to withdraw from the study at any time without consequences. Please contact Leslie if you wish to leave the study or if you have any questions about this second survey.

Thank you once again for helping us to improve heart failure care.

Yours in the pursuit of health,

Leslie Wilson, BSC. KIN
Masters Student, Centre for Health Promotion
University of Alberta
Phone: (780) 407-7425
Fax: (780)407-6018
E-mail: leslie.wilson@albertahealthservices.ca

Heart Failure and Exercise Behaviour Study:

Final Survey

Some people with heart failure choose to exercise regularly and others do not. This survey is part of a research thesis that will try to identify some of the reasons why people with heart failure exercise or don't exercise. We are interested in your point of view on exercising with heart failure. Please read each question carefully and answer it as best you can. There are no wrong answers.

Please enter the date in the underlined spaces below. All surveys are completely confidential. Your health care provider will not see your survey. Once the data has been collected all of your personal information will be removed. Your participation in this survey and the answers you give will in no way affect the care you receive in the Heart Function clinic.

Thank you for helping us to learn more about people with heart failure. We hope this study will improve the care people with heart failure receive.

ID #: _____

Date Received in the mail: _____ **Date Completed: _____**

Past Exercise
The following questions ask about your usual weekly exercise. Please answer the questions even if you do not think you are an active person. Only tell us about exercise that you have done in your free time (outside of work).

1. During your free time in a normal week how many times do you do the following types of exercise for more than 15 minutes?

a) **Challenging exercise** (your heart beats quickly)
Examples of hard exercise = jogging, running, hockey, soccer, elliptical trainer, cross country skiing, fast cycling, fast swimming, basketball, stair climbing

_____

b) **Medium exercise** (not tiring but your heart beats faster than normal)
Examples of medium exercise = fast walking, badminton, easy cycling, easy swimming, dancing, volleyball

_____

c) **Light Exercise** (minimal effort)
Examples of light exercise = yoga, archery, gardening, fishing, golf, snowmobiling, easy walking, bowling

_____

Anything else you would like to tell us? On this page please make any comments you would like about the survey, your health, exercise or anything else you think may be helpful for us to know. All comments are welcome.

You are done! Please place the survey in the stamped envelope and mail it to us as soon as you get the chance. Thank you for taking the time.