

# Understanding exercise behaviour during home-based cardiac rehabilitation: a theory of planned behaviour perspective<sup>1</sup>

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**Abstract:** Although home-based cardiac rehabilitation (CR) programs have been shown to produce significant increases in exercise capacity, obtaining patient adherence to these programs has been challenging. It is therefore critical to identify key theoretical determinants of exercise during home-based CR in order to inform the development of behavioural interventions that improve adherence. The present study examined the utility of the theory of planned behaviour (TPB) in explaining exercise behaviour during home-based CR. Seventy-six patients who were receiving 6 months of home-based CR completed a TPB questionnaire at the beginning and mid-point of the program and a physical activity scale at the mid-point and end of the program. Path analyses showed that attitude and perceived behavioural control significantly predicted intention for both time intervals (baseline to 3 months, and 3 months to 6 months), whereas subjective norm only predicted intention within the 1st 3 months. Intention significantly predicted implementation intention, which, in turn, significantly predicted exercise for both time intervals. Finally, several underlying accessible beliefs were significantly related to exercise for both time intervals. Therefore, results suggest that the TPB is a potentially useful framework for understanding exercise behaviour during home-based CR.

**Key words:** theory of planned behaviour, home-based cardiac rehabilitation, physical activity.

**Résumé :** Les programmes de réadaptation cardiaque (RC) à domicile augmentent considérablement la capacité à l'exercice; toutefois l'adhésion à ces programmes constitue un défi. Ainsi, il est essentiel d'identifier les déterminants théoriques clés de l'exercice durant la RC à domicile dans le but d'élaborer des interventions comportementales destinées à diminuer le problème d'adhésion. La présente étude a examiné l'utilité de la théorie du comportement planifié (TCP) pour expliquer le comportement lié à l'exercice durant la RC à domicile. Soixante-seize patients en RC à domicile ont rempli un questionnaire TCP au début et à mi-chemin (c.-à-d. trois mois) du programme, et une échelle d'évaluation de l'activité physique après trois et six mois (c.-à-d. à la fin du programme RC). Les analyses causales ont montré que les attitudes et le contrôle comportemental perçu ont constitué d'importants prédicteurs d'intention pour les deux intervalles de temps (c.-à-d. début à trois mois, trois mois à six mois), alors que la norme subjective a seulement prédit l'intention dans les trois premiers mois. L'intention a été un bon critère prédictif d'intention d'exécution, qui, à son tour, a été un important prédicteur d'exercice pour les deux intervalles de temps. Finalement, plusieurs croyances accessibles sous-jacentes ont été étroitement reliées à l'exercice pour les deux intervalles de temps. Ainsi, les résultats donnent à penser que la TCP est un cadre potentiellement utile pour expliquer le comportement lié à l'exercice durant la RC à domicile.

**Mots-clés :** théorie du comportement planifié, réadaptation cardiaque à domicile, activité physique.

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## Introduction

Coronary heart disease (CHD) is the leading cause of death for men and women living in Canada. In fact, 1 in 3 deaths are caused by the disease each year (Heart and Stroke Foundation of Canada 2002). One potential mechanism used to explain the high mortality rate associated with CHD patients is their lack of exercise capacity (that is, fitness). Indeed, recent evidence suggests that exercise capacity is the strongest predictor of mortality in patients with CHD in

comparison with other known cardiovascular risk factors (Myers et al. 2002). Fortunately, research in centre-based cardiac rehabilitation (CR) programs has consistently shown that patients experience significant increases in exercise capacity upon completion (Balady et al. 1996; Lavie and Milani 1997). Unfortunately, participation in centre-based CR programs has been reported to be as low as 15% (Ades et al. 1992; Jolly et al. 2003), which means that up to 85% of cardiac patients may not be receiving the type of CR needed to improve their exercise capacity. To reach a larger number of patients, there has therefore been a shift in rehabilitation toward implementing home-based CR programs, and while research has shown these programs to have similar exercise capacity benefits when compared with centre-based programs (Jolly et al. 2003; Marchionni et al. 2003; Arthur et al. 2002; Smith et al. 2004), home-based CR programs also suffer from poor exercise adherence (Cardiac Care Network of Ontario 2002; Jolly et al. 2003). A much-needed step is

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to identify key theoretical determinants of exercise during home-based CR that can be used to guide the development of future exercise interventions for these patients. Unless such determinants are identified, any intervention designed to increase patient adherence in this particular cardiac context will likely be futile.

There is no research to date, either atheoretical or theoretical, that has specifically examined determinants of exercise during home-based CR. One dominant health-behaviour change theory that has excellent potential in doing so, however, is the theory of planned behaviour (TPB) (Ajzen 1991). The basic premise of the TPB (Fig. 1) is that the most proximal predictor of behaviour is intention, that is, a person's readiness to perform a behaviour. Behavioural intention is predicted by 3 major variables: attitude toward the behaviour (one's affective and instrumental evaluations of performing the behaviour), subjective norm (one's perceived social pressure to perform a behaviour), and perceived behavioural control (PBC) (the perceived ease or difficulty of performing the behaviour). Furthermore, each of these 3 variables reflects a set of underlying accessible beliefs. These are behavioural beliefs (the perceived advantages and disadvantages of performing a behaviour) in the case of attitude, normative beliefs (one's perceptions of the extent to which significant others want him or her to perform the behaviour) in the case of subjective norm, and control beliefs (the perceived barriers and facilitators of engaging in a behaviour) in the case of PBC.

To date, research in CHD patients outside the context of home-based CR has shown that the TPB explains up to 51% of the variance in intention. Attitude and PBC make significant and consistently unique contributions (Blanchard et al. 2002a, 2003; Godin et al. 1991), whereas the role of subjective norm remains inconsistent. Further, up to 23% of the variance in exercise behaviour has been accounted for by intention in centre-based CR patients (Blanchard et al. 2002a, 2003), whereas PBC was the lone predictor in patients who did not attend CR (Johnston et al. 2004). Finally, numerous behavioural, normative, and control beliefs have been found to be significantly associated with exercise during centre-based CR (Blanchard et al. 2003). Whether any of the aforementioned findings are relevant to a home-based CR context, however, remains unknown. Given that the TPB places a specific emphasis on context-specific determinants (that is, one cannot assume that findings outside of the home-based CR context may be generalized to this context) and that no determinants of exercise have been identified to date in the home-based CR context, it is vital that context-specific determinants be identified so that optimal exercise interventions can be designed for these particular CR patients.

Orbell and Sheeran (2000) have suggested the importance of integrating variables external to the TPB into this framework in order to increase its explanatory power with respect to exercise. One such variable that has begun to receive considerable attention is an implementation intention (Fig. 1), which translates intentions into specific plans, such as where, when, and how to perform exercise (Gollwitzer 1999). Importantly, support for the inclusion of this post-intentional construct comes from the centre-based CR context, where it was shown that implementation intentions

formulated at the end of CR were significantly related to exercise behaviour 2 weeks to 8 months after completing CR (Sniehotta et al. 2005a, 2005b, 2005c, 2006; Luszczynska 2006). These findings highlight the importance of examining the potential influence of implementation intentions within the home-based CR context, which has yet to be done.

The present study had 2 purposes. The 1st purpose was to determine whether the TPB explained significant variation in exercise intentions and behaviour from baseline to mid-program (0–3 months) and from mid-program to the end (3–6 months) in patients receiving home-based CR and whether implementation intentions added explanatory power to the TPB framework across the same 2 time intervals. It was hypothesized that attitude and PBC would significantly predict intention for both time intervals, whereas subjective norm would not. It was also hypothesized that intention and implementation intentions would significantly predict exercise for both time intervals. The 2nd purpose was to examine the relation between exercise and the behavioural, normative, and control beliefs for both time intervals. It was hypothesized that these beliefs would be significantly associated with exercise for both time intervals.

## Materials and methods

### Home-based CR program

Participants were recruited from the University of Ottawa Heart Institute home-based CR program. This is a 6-month comprehensive program that includes a risk-factor assessment (0, 3, and 6 months), cardiopulmonary stress test (0 and 6 months), physician assessment, personalized action plan for risk reduction, individualized exercise prescription, and ongoing face-to-face, telephone, and (or) e-mail contact with the patients. A strength of this program is its representativeness of the general cardiac population. Characteristics of the patients in the home-based program are as follows: (i) female, 23%, (ii) mean age, 61 years, (iii) cardiac events: myocardial infarction, 45%; coronary artery bypass graft, 40%; percutaneous coronary intervention, 45%, (iv) married, 78%, and (v) one or more years of college, 51%.

### Participants

Patients were eligible if they (i) had ascertained heart disease, (ii) could ambulate independently, (iii) were over the age of 18, (iv) provided informed consent, and (v) were able to read and write English. Patients were excluded if they (i) had a positive graded exercise test (defined by a drop in systolic blood pressure  $\geq 20$  mmHg, uncontrolled atrial or ventricular dysrhythmias, or horizontal or down-sloping ST segment displacement  $\geq 0.1$  mV at 80 s after the J point), or (ii) were unable to participate due to physical limitations.

### Procedure

The study was approved by the ethics boards of the University of Ottawa and the University of Ottawa Heart Institute. The home-based-CR staff was asked to inform cardiac patients about the current study at the initial rehabilitation orientation meeting. Patients who were interested in the study were asked to speak to the research coordinator. At

that time, the patients were given an information letter and an informed consent form, and the study was explained to them in more detail. If they were interested in participating, they signed the informed consent and took a questionnaire home with them that included the TPB questions in addition to demographic and medical questions. They were asked to complete the questionnaire and take it back to their initial session (on-site) with the CR home-based mentor assigned to them for the 6-month program. To obtain the 3- and 6-month follow-up data, the same questionnaire plus an exercise instrument was mailed to the patients 2 weeks before their regularly scheduled follow-up assessments at the hospital with their mentor. At this time the research coordinator met the patients to obtain their questionnaires and to reimburse them for their parking expenses (\$13).

## Measures

### Exercise

The Godin Leisure-Time Exercise Questionnaire (LSI) (Godin and Shepard 1985) was used to measure the patients' level of exercise. The LSI contains 3 questions, which assesses the frequency of mild, moderate, and strenuous exercise performed for a duration of at least 10 min during leisure time in a typical week. Patients were asked to consider a typical week in the past 3 months. A total LSI score was calculated by adding the frequency of exercise within the mild, moderate, and strenuous categories, measured on an open-ended scale. An independent evaluation of this measure found that its reliability and validity compared favourably with 9 other self-reported measures of exercise that were based on various criteria, including test-retest scores, objective activity monitors, and fitness indices (Jacobs et al. 1993). Additionally, the LSI has been used frequently in the cardiac population as a measure of exercise behaviour (Blanchard et al. 2002a; 2006).

### Global constructs of the theory of planned behaviour

All items were measured by using the same scale from 1 (strongly disagree) to 5 (strongly agree). Questions 1 to 4 (Blanchard et al. 2002a, 2003) and question 5 (Rhodes et al. 2006) were based on previously validated items in centre-based CR patients and slightly modified for the current study.

- (1) To measure attitude, patients were asked, "During the next three months, for me to participate in exercise during my home-based CR program on a weekly basis will be (a) extremely fun, (b) extremely bad, (c) extremely boring, (d) extremely beneficial." The "extremely bad" and "boring" responses were reverse-scored before aggregating the instrument to ensure higher scores represented a more favourable attitude. Internal reliability for the instrument in the current sample was measured by Cronbach's alphas and found to be good at baseline ( $\alpha = 0.70$ ) and 3 months ( $\alpha = 0.69$ ).
- (2) Subjective norm was measured by responses to the question, "During my home-based CR program during the next three months, most people important to me will (a) definitely think I should exercise on a weekly basis, (b) definitely want me to exercise on a weekly basis."

Internal reliability for the instrument was good at baseline ( $\alpha = 0.95$ ) and 3 months ( $\alpha = 0.94$ ).

- (3) Perceived behavioural control was measured via 4 items. Patients were asked, "If I wanted to during my home-based CR over the next three months (a) I am completely confident I could exercise on a weekly basis, (b) I am in complete control of exercising on a weekly basis, (c) it would be extremely easy for me to exercise on a weekly basis, (d) it is completely up to me if I exercise on a weekly basis." Internal reliability for the instrument was good at baseline ( $\alpha = 0.84$ ) and 3 months ( $\alpha = 0.88$ ).
- (4) Intention was measured via answers to the question, "During my home-based CR for the next three months, I definitely (a) intend to exercise on a weekly basis, (b) plan to exercise on a weekly basis." Internal reliability for the instrument was good at baseline ( $\alpha = 0.94$ ) and 3 months ( $\alpha = 0.95$ ).
- (5) Implementation intention was measured via "During my home-based CR for the next three months, I have made plans concerning (a) when I am going to participate in exercise, (b) where I'm going to participate in exercise, (c) what kinds of exercise activities I am going to participate in, (d) how I am going to get to a place to exercise." Internal reliability for the instrument was good at baseline ( $\alpha = 0.87$ ) and 3 months ( $\alpha = 0.94$ ).

### Belief constructs of the theory of planned behaviour

Table 2 presents the complete list of the 8 behavioural, 6 normative, and 8 control belief constructs that were measured by the following questions.

- (1) Behavioural beliefs were measured by questions taken from the Blanchard et al. (2003) study in centre-based CR patients. Patients were asked, "During the next three months of my home-based CR, if I participate in exercise on a weekly basis, it will definitely (a) get me in shape, (b) strengthen my heart..." (Table 2). Responses were rated on a scale from 1 (strongly disagree) to 5 (strongly agree).
- (2) Questions concerning normative beliefs were also taken from the Blanchard et al. (2003) study and answers were rated on a scale from 1 (strongly disagree) to 5 (strongly agree). Here, patients were asked, "During the next three months, the following people will definitely think I should exercise on a weekly basis during my home-based CR, (a) spouse/partner, (b) other family members..." (Table 2).
- (3) Control beliefs were rated on a scale from 0 (not at all confident) to 100 (completely confident) based on questions taken from the Blanchard et al. (2002b) study in CR patients. Patients were asked, "How confident are you that you will continue to exercise on a weekly basis during your home-based CR program for the next three months even if (a) you fear you will have another cardiac event, (b) you fear you will have back pain..." (Table 2).

### Data analysis

Means, standard deviations, and zero-order correlations among the TPB constructs were calculated from baseline to 3 months and from 3 months to 6 months. Next, paired-

**Table 1.** Means, standard deviations, and zero-order correlation among the TPB constructs at baseline and subsequent exercise behaviour at 3 months and among constructs at 3 months and behaviour at 6 months of patients in home-based cardiac rehabilitation,  $n = 76$ .

|                                | Correlation     |                               |           |                          |                    | Patient response <sup>a</sup> |      |
|--------------------------------|-----------------|-------------------------------|-----------|--------------------------|--------------------|-------------------------------|------|
|                                | Subjective norm | Perceived behavioural control | Intention | Implementation intention | Exercise behaviour | Mean                          | SD   |
| <b>Baseline to 3 months</b>    |                 |                               |           |                          |                    |                               |      |
| TPB construct at baseline      |                 |                               |           |                          |                    |                               |      |
| Attitude                       | 0.36***         | 0.55***                       | 0.58***   | 0.49***                  | 0.09               | 4.11                          | 0.63 |
| Subjective norm                | —               | 0.48***                       | 0.52***   | 0.22                     | −0.27*             | 4.36                          | 0.90 |
| Perceived behavioural control  |                 | —                             | 0.64***   | 0.54***                  | 0.14               | 4.25                          | 0.67 |
| Intention                      |                 |                               | —         | 0.48***                  | 0.10               | 4.57                          | 0.55 |
| Implementation intention       |                 |                               |           | —                        | 0.23*              | 15.59                         | 3.65 |
| Exercise behaviour at 3 months |                 |                               |           |                          | —                  | 5.45                          | 3.71 |
| <b>3 months to 6 months</b>    |                 |                               |           |                          |                    |                               |      |
| TPB construct at 3 months      |                 |                               |           |                          |                    |                               |      |
| Attitude                       | 0.23*           | 0.50***                       | 0.53***   | 0.43***                  | 0.41***            | 4.24                          | 0.62 |
| Subjective norm                | —               | 0.27*                         | 0.29*     | 0.21                     | 0.15               | 4.51                          | 0.79 |
| Perceived behavioural control  |                 | —                             | 0.71***   | 0.74***                  | 0.40***            | 4.40                          | 0.74 |
| Intention                      |                 |                               | —         | 0.71***                  | 0.31***            | 4.65                          | 0.64 |
| Implementation intention       |                 |                               |           | —                        | 0.39***            | 16.92                         | 3.47 |
| Exercise behaviour at 6 months |                 |                               |           |                          | —                  | 4.64                          | 3.59 |

**Note:** TPB, theory of planned behaviour. Significant at \*,  $p < 0.05$ ; \*\*\*,  $p < 0.001$ .

<sup>a</sup>TPB constructs were measured by patient agreement with favourable statements on a scale of 1 (strongly disagree) to 5 (strongly agree). Exercise behaviour (frequency) was measured by the Godin Leisure-Time Exercise Questionnaire (LSI) on an open-ended scale. Implementation intention scales ranged from 1 to 5 and were added to form a final measure to 20.

sample  $t$  tests were conducted to determine the potential change in the TPB global constructs (Bonferroni correction set to  $p < 0.01$ ), which was followed by path analyses using maximum likelihood procedures in LISREL 8.8 to test the tenets of the global TPB and the role of implementation intentions within the TPB (purpose 1 of the study). For latent concept specification (that is, attitude, subjective norm, PBC, intention, implementation intention, and exercise), the loading for each concept's indicator was fixed to 1.0 and the indicator's error was fixed to 0%. The first path analysis tested the baseline to 3-month time interval, whereas the second analysis tested the 3- to 6-month time interval. Next, to identify the key beliefs associated with exercise (purpose 2), the baseline beliefs were correlated with 3-month exercise, and the 3-month beliefs were correlated with 6-month exercise.

## Results

A total of 103 patients were eligible to participate in the study. Of these, 14 patients did not approach the research coordinator after the study was introduced, 3 were not interested, 3 did not want to complete the questionnaire, 3 were too busy, and 4 were non-English speaking, which left 76 patients who agreed to participate in the study. The average age of the 76 study participants was 62.6 (SD, 11.0) years, they went to school for approximately 13.8 (SD, 3.1) years, and their body mass index (BMI) was 29.24 (SD, 4.85). The majority of participants were also male (76%), married (80%), white (93%), retired (57%), and had an income less than \$60 000 (60%).

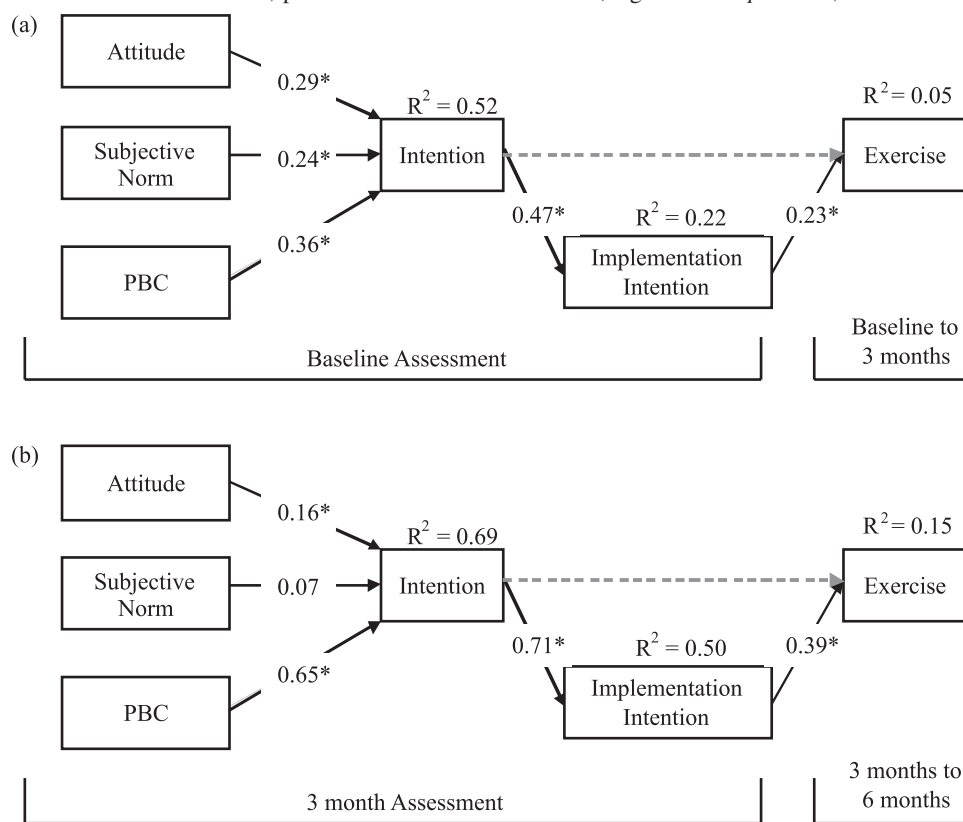
The mean, standard deviation, and zero-order correlation

among exercise and the TPB global constructs are presented in Table 1. As shown, the means for attitude, subjective norm, PBC, and intention were all above 4 on the 5-point scale throughout the entire 6-month home-based CR program, indicating patients agreed or strongly agreed with the favourable statements measuring these variables. Additionally, the paired-sample  $t$  tests showed that all the TPB variables were stable, with the exception of implementation intentions, which significantly increased from baseline to 3 months  $t_{74} = -3.12$ . Based on Cohen's criteria for the magnitude of correlations (Cohen 1992), the majority of the correlations between exercise and TPB constructs were also in the moderate ( $\geq 0.3$ ) to large ( $\geq 0.5$ ) range.

In terms of the path analyses, Figs. 1a and 1b show that the TPB accounted for 52% of the variance in intention at baseline and for 69% at 3 months. Closer inspection revealed that attitude and PBC significantly predicted intention in both time intervals; however, subjective norm only predicted intention within the 1st 3 months of home-based CR. Intention significantly predicted implementation intention, which, in turn, significantly predicted exercise for both time intervals and accounted for 5% (baseline to 3-month time interval) to 15% (3- to 6-month time interval) of the variance in exercise. Finally, examination of the modification indices suggested that freeing the path from perceived behavioural control to exercise and (or) intention to exercise would not improve model fit for either time interval, thus also suggesting the importance of implementation intentions in explaining exercise behaviour for this particular CR population.

In terms of the belief-level analyses, 8 of the 22 baseline

**Fig. 1.** (a) Theory of planned behaviour constructs at baseline predicting exercise at 3 months; (b) theory of planned behaviour constructs at 3 months predicting exercise at 6 months. PBC, perceived behavioural control. \*, significant at  $p < 0.05$ ,  $n = 76$ .



beliefs were significantly correlated to 3-month exercise. As can be seen from Table 2, these 8 beliefs were all normative and control beliefs. On the other hand, 12 of the 22 beliefs at 3 months that were significantly correlated to 6-month exercise were predominantly behavioural and control beliefs.

## Discussion

The present study attempted to determine whether the TPB explained significant variation in exercise intentions and behaviour during home-based CR from baseline to 3 months and from 3 months to 6 months. Importantly, attitude and PBC had moderate to large effects on intention to exercise for both time intervals, which is consistent with previous research in centre-based CR (Blanchard et al. 2002a, 2003) and reiterates the importance of targeting these variables in future exercise interventions for these patients. More interesting, however, is the fact that subjective norm significantly predicted intention within the 1st 3 months of home-based CR, but had no effect on intentions to exercise for the 2nd 3 months. This temporal finding suggests that it may be important to target perceived social pressure to engage in exercise only in the early stages of a home-based CR program and that other variables, such as attitude and PBC, play a more important role in the later stages. The current results provide the first evidence that the TPB satisfactorily explains exercise intentions during home-based CR. Given the preliminary nature of this finding to the home-based CR context, replication of these initial results is warranted.

An interesting finding of the current study was that while intention significantly predicted implementation intention at baseline and 3 months, implementation was the sole predictor of exercise behaviour at 3 and 6 months. In other words, intention did not predict behaviour. Thus, the current results emphasize the importance for patients who are attending home-based CR to first develop the intention (that is, the motivation) to engage in exercise. Yet, in order for them to translate this motivation into action, it is necessary for them to develop an action plan that specifies when, where, and how to engage in exercise (Gollwitzer 1999) during their home-based CR. This action plan is particularly necessary in the mid- to late phases of the program when implementation intentions are increased and have their strongest effect on exercise. Such action planning has been shown to be effective in maintaining exercise levels 2 weeks to eight months after completing centre-based CR (Sniehotta et al. 2005a, 2005b, 2005c, 2006; Luszczynska 2006;). Whether such an intervention would be effective in home-based CR remains to be seen; however, on the basis of the current findings, it is an area that requires further investigation.

Another purpose of the present study was to identify key underlying accessible beliefs that were significantly correlated with 3- and 6-month exercise behaviour. Identifying such beliefs is essential as the TPB proposes that it is important to change the beliefs that ultimately guide the performance of the behaviour (Ajzen 1991). Interestingly, none of the baseline behavioural beliefs were significantly related to 3-month exercise, whereas certain 3-month behavioural beliefs (namely, get in shape, strengthen heart, confidence in

**Table 2.** Zero-order correlation of the baseline underlying accessible beliefs with 3-month exercise and of the 3-month underlying accessible beliefs with 6-month exercise of patients in home-based cardiac rehabilitation.

| Belief <sup>a</sup>                          | Correlation with exercise |          |
|----------------------------------------------|---------------------------|----------|
|                                              | 3 months                  | 6 months |
| <b>Behavioral</b>                            |                           |          |
| Get in shape                                 | 0.06                      | 0.24*    |
| Strengthen heart muscle                      | 0.04                      | 0.28*    |
| Feel more energetic                          | 0.14                      | 0.34**   |
| More confidence in doing everyday activities | 0.13                      | 0.14     |
| Feel as good as before cardiac event         | 0.12                      | 0.13     |
| Decreased risk of further heart problems     | 0.08                      | 0.16     |
| Incorporate exercise into lifestyle          | 0.13                      | 0.14     |
| Maintain optimal weight                      | 0.13                      | 0.29*    |
| <b>Normative</b>                             |                           |          |
| Spouse/partner                               | 0.08                      | 0.02     |
| Other family members                         | 0.34**                    | 0.10     |
| Friends                                      | 0.02                      | 0.12     |
| Family physician                             | 0.25*                     | 0.13     |
| Cardiologist                                 | 0.21*                     | 0.15     |
| Other individuals with heart disease         | 0.01                      | 0.05     |
| <b>Control<sup>b</sup></b>                   |                           |          |
| Fear of another cardiac incident             | 0.14                      | 0.25*    |
| Back pain                                    | 0.24*                     | 0.35**   |
| Medication side effects                      | 0.26*                     | 0.31**   |
| Bad weather                                  | 0.27*                     | 0.33**   |
| Too much work to do                          | 0.34**                    | 0.32**   |
| No time                                      | 0.27*                     | 0.33**   |
| Angina/chest pain earlier in the day         | 0.01                      | 0.22*    |
| Other health problems                        | 0.09                      | 0.21*    |

**Note:** Significant at \*,  $p < 0.05$ ; \*\*,  $p < 0.01$ ;  $n = 76$ .

<sup>a</sup>Beliefs were measured by patient agreement with favourable statements on a scale of 1 (strongly disagree) to 5 (strongly agree).

<sup>b</sup>Control beliefs were patient confidence that exercise would continue despite the barriers listed.

doing everyday activities, and maintain weight) were significantly related to 6-month exercise. This finding may not be surprising, however, as Blanchard et al. (2003) showed that only 1 of the 8 behavioural beliefs (confidence in doing everyday activities) in the current study was significantly related to exercise during a 3-month centre-based CR program. Taken together, these findings may suggest that behavioural beliefs are not relevant when patients start their centre- or home-based CR because they have not had the chance to experience any exercise benefits since being hospitalized for their heart condition. However, once the patients engage in exercise for a given period of time (for example, 3 months), the exercise-related benefits they experience during this time may play a more important role in motivating them to exercise (for example, over the next 3 months). Whatever the case, the results of the present study suggest that behavioural beliefs should be targeted in a behavioural intervention at the mid-point of a home-based CR program, but perhaps not the beginning.

In terms of the normative beliefs, it appears that perceived social pressure from family members, family physicians, and cardiologists could be key intervention targets at the beginning of a home-based CR program, whereas none of the nor-

mative beliefs were important in the later stage of the program (that is, 3 to 6 months). Given that subjective norm was also a nonsignificant predictor of intention in the last half of the program, this lends credence to the fact that perceived social pressure from important people in the patients' lives may have little effect on their exercise intentions and behaviour. However, this does not negate the fact that other more "direct" measures of social support (for example, encouragement to exercise from the home-based CR staff members) may play a significant role in influencing their exercise intentions and behaviour. Future studies should explore this issue before concluding that a social component may not be needed in the latter stages of a home-based CR program.

Numerous control beliefs were significantly related to 3- and 6-month exercise, which is inconsistent with the Blanchard et al. (2003) centre-based CR study that found none of the control beliefs were significantly related to exercise adherence. In that study, however, the patients completed the control beliefs scale before knowing their exercise prescription, whereas in the current study, all patients were informed of the exercise guidelines for CHD patients at their intake session before beginning their

home-based CR program. As a result, patients in the current study may have had more accurate assessments of their control beliefs (DuCharme and Brawley 1995). At any rate, the current findings suggest that it will be important for home-based CR staff members to help patients build their confidence to overcome exercise barriers at the beginning and mid-point of the rehabilitation program to help them adhere to their exercise prescriptions.

One limitation of the present study is the small number of women. Future studies should incorporate equal numbers of men and women to allow for comparisons to be made when examining the TPB. Indeed, Blanchard et al. (2002*b*) showed that the effect of certain control beliefs on exercise behaviour during centre-based CR varied by sex. A second limitation was the use of self-reported exercise, which may have lead to an over- or under-estimation of exercise. Future studies should attempt to correct for this by using pedometers or accelerometers to obtain objective exercise data. Finally, the present study was designed to explain exercise intentions and behaviour only during home-based CR. Whether the TPB can explain exercise intentions and behaviour in patients after they complete their home-based CR program will be important to delineate.

Despite these limitations, the present study showed that the TPB was a promising theoretical framework with which to explain exercise intentions and behaviour during home-based CR. Numerous underlying accessible beliefs were also identified that could be potentially useful for targeting in a TPB-based exercise intervention for patients with CHD. Replication of the current findings is warranted with objective exercise measures and longer-term follow-up assessments.

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