Is the Theory of Planned Behavior a Useful Framework for Understanding Exercise Adherence During Phase II Cardiac Rehabilitation?

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- **PURPOSE:** This study evaluated the theory of planned behavior (TPB) as a framework for understanding exercise adherence during phase II cardiac rehabilitation (CR).
- **METHODS:** A total of 215 patients completed a baseline questionnaire that included the TPB constructs and past exercise. Exercise adherence was measured via program attendance during phase II CR.
- **RESULTS:** Hierarchic regression analyses indicated that attitude, subjective norm, and perceived behavioral control (PBC) explained 30% of the variance in exercise intention, with attitude, subjective norm, and PBC each making significant unique contributions to intention. Furthermore, exercise intention explained 12% of the variance in exercise adherence. Finally, the behavioral, normative, and control beliefs provided novel information concerning why patients in phase II CR hold certain attitudes, subjective norms, PBC, and exercise intentions.
- **CONCLUSION:** Results of the present study provide evidence that the TPB is a useful framework for understanding exercise intentions and adherence during phase II CR.

KEY WORDS

exercise adherence

theory of planned behavior

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Recent evidence suggests that exercise capacity, compared with other known cardiovascular risk factors, is the strongest predictor of mortality in patients with cardiovascular disease .[1] Research in phase II cardiac rehabilitation (CR) consistently shows that patients experience significant increases in exercise capacity after completing a phase II CR program.[2-5] This increase in exercise capacity may be one of the factors contributing to the 20% reduction in mortality during the first 3 years after a cardiac event.[6] Despite these promising findings, however, adherence to such programs remains problematic.[7-9] In fact, previous research shows that dropout rates have ranged from 10% to 36%.[5,9,10] Furthermore, even when patients do not drop out of phase II CR, exercise adherence has ranged from 47% to 81%[7,8,11] and many patients' exercise adherence levels decline even further once they complete their program. More specifically, Moore et al[12] showed that only 30% of their sample were engaging in regular exercise 3 months after phase II CR, whereas Hellman[13] showed similar results (ie, 30% were regular exercisers) at 12 to 18 months after phase II CR. Together, these results suggest the importance of identifying key determinants of exercise during phase II CR as a stepping stone toward developing effective exercise interventions.

DETERMINANTS OF EXERCISE IN PHASE II CARDIAC REHABILITATION

The limited research on exercise determinants during phase II CR has typically focused on self-efficacy the-

ory.[14] More specifically, 2 studies found a significant relationship between self-efficacy and exercise adherence,[15,16] whereas 1 study found no relationship.[17] As Blanchard et al[18] noted, although self-efficacy provides a promising avenue of research to explain exercise adherence problems during phase II CR, the inconsistent results and the slight variance that self-efficacy accounted for in exercise adherence (ie, < 20%) as a single construct may suggest that alternative theories need to be examined to explain additional variance in the exercise adherence patterns. Given the fact that Emery[19] has reiterated the need to identify key social cognitive variables that can influence exercise adherence during phase II CR, Blanchard et al[18] proposed using Ajzen's[20] theory of planned behavior (TPB) because it had been frequently used in the healthy exercise population[21] and in cancer rehabilitation settings.[22,23]

The TPB proposes that a person's intention to perform a behavior is the major determinant of that behavior. Furthermore, a person's intention is determined by three theoretically independent variables: (1) a person's attitude, which is indicated by a positive or negative evaluation of performing the behavior; (2) subjective norm, which is the perceived social pressure that individuals may feel to perform or not perform the behavior; and (3) perceived behavioral control (PBC), which is the perceived ease or difficulty of performing the behavior and may have both direct and indirect effects on behavior. The TPB proposes that individuals will intend to perform a behavior when they evaluate it positively, believe that important others think they should perform it, and perceive it to be under their control.[20]

The TPB also suggests that attitude, subjective norm, and PBC are determined by underlying accessible beliefs.[20] Attitude is thought to be a function of behavioral beliefs. These beliefs refer to the perceived advantages and disadvantages of performing the behavior. Subjective norm is thought to be determined by normative beliefs. These beliefs reflect the individual's perceptions that specific individuals or groups, perceived to be important to that individual, think he or she should perform the behavior. Finally, PBC is thought to be a function of control beliefs. These beliefs focus on the individual's perceptions of both personal and environmental opportunities and resources available for performing the behavior.

Only 1 study has used the TPB during phase II CR. Blanchard et al[18] found that attitude, subjective norm, and PBC explained 38% of the variance in exercise intention, with attitude and PBC each making significant unique contributions to intention. Furthermore, exercise intention explained 23% of the variance in exercise adherence. Based on this study, it would appear that the TPB can be valuable in identifying key social cognitive constructs that will aid in the development of phase II CR interventions tailored to increase exercise adherence. However, because of the preliminary nature of the study, replication of the findings is warranted before any conclusions can be drawn with respect to the relevant determinants of exercise intentions and adherence. Furthermore, the Blanchard et al[18] study was limited by (1) a relatively small sample size (n = 81), (2) a 24% dropout rate, and (3) no assessment of the accessible beliefs (ie, behavioral, normative, and control) underlying attitudes, subjective norms, and PBC. It is important, therefore, that future studies in phase II CR attempt to (1) recruit larger samples to increase statistical power, and (2) limit study attrition to increase the generalizability of the findings. Inclusion of the underlying accessible beliefs in future studies is also particularly important as they will provide detailed information concerning which beliefs are most important for understanding exercise intentions and adherence during phase II CR. They will also help explain why patients in phase II CR hold certain attitudes, subjective norms, and perceptions of control for exercise during phase II CR.

PURPOSE OF THE PRESENT STUDY

The present study further examined the utility of the TPB in explaining exercise intentions and adherence during phase II CR by (1) recruiting a larger sample than in previous studies, (2) limiting study attrition, and (3) including an assessment of the underlying accessible beliefs. Based on the study by Blanchard,[18] it was hypothesized that attitude and PBC would be significant unique predictors of exercise intention and exercise intention would be a significant predictor of exercise adherence during phase II CR. Furthermore, it was hypothesized that the underlying behavioral, normative, and control beliefs would (1) provide a good explanation why patients in phase II CR hold certain attitudes, subjective norms, and perceptions of control for exercise and (2) shed light on the relevant beliefs related to exercise intention and adherence during phase II CR.

METHODS

The Glenrose phase II CR program (in Edmonton Alberta, Canada) follows the recommended guidelines for this phase of rehabilitation.[24] More specifically, the program combines medically supervised exercise with nutrition and behavior modification education to reduce risk factors associated with coronary artery disease. The program duration ranges from 4 to 8 weeks, depending on the severity of the patient's condition. Exercise sessions vary from 1 to 3 per week and last approximately 1 hour. Duration and frequency of the program are determined on the basis of each patient's cardiac con-

dition. Both can be altered on an ongoing basis, depending on the patient's response to the rehabilitation. The physician, other medical staff, and the exercise specialists determine the details of the exercise program. The program also includes weekly education classes on topics such as cardiac risk factors, sexual activity after coronary event, stress management, and nutrition planning. Once patients complete their phase II CR program, they move into phase III CR, where they participate in home-based or community-based exercise programs.

Sample

All patients entering the Glenrose rehabilitation program over a period of 5 months (ie, from July to November 2001) were eligible to participate in the study. The only exclusion criterion were patients who were assigned a 2-week program because of being from out of the city (n = 15). These patients were excluded because our previous research indicates that their exercise adherence rates are greater than 95%, which leaves little variability.

Several measures were used for data analysis. The next section describes the measures used to assess (1) exercise adherence during phase II CR, (2) prior exercise before starting phase II CR, (3) the TPB global (ie, attitude, subjective norm, PBC) constructs, and (4) the TPB belief-based (ie, behavioral, normative, and control) constructs.

Exercise Adherence During Rehabilitation

To obtain an objective measure of the patients' exercise adherence during their phase II CR, the following formula was used:

$$\frac{\text{number of exercise sessions attended}}{\text{number of exercise sessions prescribed at the start of rehabilitation}} \times 100$$

The percentage approach was necessary because patients' exercise sessions varied from one to three times per week and from 4 to 8 weeks, depending on the severity of their condition. A percentage score is standardized across patients. A patient's objective exercise attendance was verified by medical information recorded during each exercise session by the Glenrose staff. If a patient did not show up for a scheduled exercise session, that patient was marked absent for that day in the medical file. At the end of each patient's phase II CR, a staff member recorded the total number of sessions attended and prescribed. This format is similar to that used in previous studies.[16,18]

Past exercise was assessed by the leisure score index (LSI) of the Godin Leisure-Time Exercise Questionnaire.[25] The LSI measures the frequency of mild, moderate, and strenuous exercise performed for at least 15 minutes during free time in a typical week. The frequency of exercise at each intensity level is then multiplied by its metabolic equivalent (METS) and summed together to obtain an overall LSI score. The formula is as follows:

(3 METS × frequency of mild activity) +
(5 METS × frequency of moderate activity) +
(9 METS × frequency of strenuous activity)

An independent evaluation of this measure[26] found its reliability and validity to compare favorably to nine other self-report measures of exercise based on various criteria including test-retest scores ($r = 0.62$), objective activity monitors ($r = 0.32$), and fitness indices ($r = 0.56$). The LSI was used to assess past exercise behavior before starting rehabilitation (ie, from the time the patient was released from the hospital after a cardiac event to immediately before starting phase II CR).

Intention was assessed by two items drawn from Blanchard et al.[18] For exercise intentions during phase II CR, the two items were (1) "I intend to attend my scheduled exercise classes during my rehabilitation program," rated on a 7-point scale from 1 (strongly disagree) to 7 (strongly agree) and (2) "My goal during my rehabilitation program is to attend...," rated on a 7-point scale from 1 (some scheduled exercise classes) through 4 (most scheduled exercise classes) through 7 (every scheduled exercise class). The two items were averaged to obtain an exercise intention score.

Perceived behavioral control (PBC) was measured by four items drawn from Ajzen and Madden,[27] which had been used by Blanchard et al[18] in phase II CR. The four items were (1) "How much control do you have over attending your scheduled exercise classes during your rehabilitation?" (1 = very little control to 7 = complete control). (2) "For me to attend my scheduled exercise classes during my rehabilitation will be..." (1 = extremely difficult to 7 = extremely easy). (3) "If I wanted to, I could easily attend my scheduled exercise classes during my rehabilitation" (1 = strongly disagree to 7 = strongly agree). (4) "Attending my scheduled exercise classes during my rehabilitation is completely up to me" (1 = strongly disagree to 7 = strongly agree). The four items were averaged to obtain a PBC score. Internal consistency for this scale was $\alpha = .85$.

Attitude was measured using six 7-point semantic differential adjective scales that tapped both instrumental (useless-useful, harmful-beneficial, bad-good) and affective (not enjoyable-enjoyable, unpleasant-pleasant, boring-fun) aspects of attitude.[18,28] The statement that preceded the adjectives was "For me to attend my scheduled exercise classes during my rehabilitation will be..." The scale used ranged from 1 to 7, with verbal descriptors on points 1 and 7 (extremely); 2 and 6 (quite); and 3 and 5 (slightly). The six items were averaged to obtain an attitude score. Internal consistency for this scale was $\alpha = .83$.

Subjective norm was measured by three items taken from Blanchard et al[18] rated on 7-point scales that ranged from 1 (strongly disagree) to 7 (strongly agree). The items were: (1) "Most people who are important to me think I should attend my scheduled exercise classes"; (2) "Most people who are important to me approve of my attending my scheduled exercise"; and (3) "Most people who are important to me would support me attending my scheduled exercise classes." The three items were averaged to obtain a subjective norm score. Internal consistency for this scale was $\alpha = .92$.

Behavioral beliefs were generated from consultation with the phase II CR staff and the patients. The specific beliefs were (1) get in shape, (2) strengthen your heart muscle, (3) feel more energetic, (4) feel more confident in doing everyday activities, (5) feel as good as you did before your cardiac event, (6) decrease your risk of having further heart problems, (7) incorporate exercise into your lifestyle, and (8) maintain your optimal weight. Behavioral beliefs were rated on 7-point scales from 1 (extremely unlikely) to 7 (extremely likely) and were preceded by the statement "If you were to attend your scheduled exercise sessions, you will likely..." Internal consistency for this scale was $\alpha = .87$.

Normative beliefs were also generated from consultation with the phase II CR staff and patients. Normative beliefs were rated on 7-point scales from 1 (strongly disagree) to 7 (strongly agree) and were preceded by the statement "How much do you agree or disagree that each of the following persons thinks you should attend your scheduled exercise sessions?" The specific normative beliefs were (1) spouse or partner (if applicable), (2) other family members, (3) friends, (4) family physician, (5) cardiologist, and (6) other individuals with heart disease. Internal consistency for this scale was $\alpha = .79$.

Control beliefs were taken from the Blanchard et al[16] study and rated on 7-point scales from 1 (not at all confident) through 4 (moderately confident) to 7 (extremely confident), and were preceded by the statement "How confident are you that you can attend your scheduled exercise sessions even if..." The specific control beliefs were (1) you fear you will have another cardiac incident, (2) you were experiencing back pain, (3) you were experiencing medication side effects, (4) the weather was bad, (5) you felt you had too much work to do, (6) you felt you didn't have time, (7) you had angina or chest pain earlier in the day, and (8) you had other health problems. Internal consistency for this scale was $\alpha = .93$.

Procedure

Before starting the study, ethical approval for research with human subjects was received from the University of Alberta Research Ethic's Board and the Glenrose Rehabilitation Hospital ethic's committee (human subjects). Once patients were referred to the Glenrose Rehabilitation program, they were sent a questionnaire package along with the information package that the Glenrose program staff typically sends out to its patients. The questionnaire package contained a cover letter to support the research, a cover letter explaining the details of the study and two informed consents (one for the patient and one for the researcher), and the questionnaire that included the TPB constructs (ie, attitudes, subjective norms, PBC, intention, underlying accessible beliefs), and past exercise behavior. If the patient agreed to participate, the cover letter asked that the patient complete the questionnaire and to contact the researchers about any questions or concerns. Patients were then asked to return the completed questionnaire and informed consent at their initial orientation meeting. Patients who returned their completed questionnaires at their orientation meeting were met by the researcher who then addressed any additional concerns they may have had. Once patients completed their phase II CR, they were debriefed. The debriefing entailed a conversation regarding the hypotheses of the study, answering any questions the patients had about the study, in general, or their own responses to the questionnaires, and confirming that the patients could get the results of the study at any time.

Statistical Analysis

Means, standard deviations, and zero-order correlations among the TPB constructs were calculated for descriptive purposes. We tested the main hypotheses concerning the TPB using hierarchical regression analyses (HRA) with forced entry within each step. The order and content of the steps were based on previous research using the TPB in the exercise context and the tenets of the TPB. To determine the influence of the TPB constructs on exercise intention, we first regressed exercise intention onto attitude, subjective norm, and PBC on the first step and past exercise (ie, from the time the patient was released from the hospital after a cardiac event to immediately before starting phase II CR) onto the second step. As suggested by Ajzen,[20] past exercise was entered on the last step to determine the sufficiency of the TPB because exercise before starting phase II CR does not provide any insight into the development of strategies to increase exercise intentions to attend phase II CR. It does, however, need to be considered, because it can influence exercise intentions at the time phase II CR has commenced. To determine the influence of the TPB constructs on exercise adherence during phase II CR, the second HRA regressed exercise adherence onto intention (step 1), PBC (step 2), and past exercise (step 3). Next, to determine the influence of the underlying accessible beliefs on the global TPB constructs (ie, attitude, subjective

norm, and PBC), three HRA regressed each set of behavioral beliefs onto attitude, subjective norm, and PBC (step 1) followed by past exercise (step 2). For all regression analyses, we assessed multicollinearity by examining the condition index[29] and the variance inflation factor.[30] A condition index greater than 30 and a variance inflation factor greater than 10 suggest multicollinearity is problematic. Based on these criteria, multicollinearity was not a problem in our regressions. Finally, we calculated zero-order correlations between each individual underlying accessible belief and its respective global construct (ie, each behavioral belief was correlated to attitude, each normative belief was correlated to subjective norm, and each control belief was correlated to PBC), intention, and exercise adherence. This was done to shed light on which specific beliefs may be related to these constructs.

RESULTS

Sample Characteristics

Over the 5-month recruitment period, 390 patients were sent an initial questionnaire package. Of these 390 patients, 225 returned their questionnaires at their initial orientation meeting. This yielded a response rate of 58%. The most common reasons for refusal to participate were lack of interest (53%) and being non-English speaking (9%).

To determine the representativeness of the sample, those who agreed to participate in the study were compared with those who did not on numerous demographic (eg, marital status and education level) and medical variables (eg, number of comorbidities and type of cardiac event). Results showed differences on the number of comorbidities: $t\,(330) = -3.61$, $P < .01$, reason for admittance to phase II CR, $\chi^2\,(3 = 10.25$, $P < .05$, and education level, $\chi^2\,(2) = 22.13$, $P < .01$. More specifically, those who did not agree to participate had significantly more comorbidities ($\bar{X} = 1.96$), were more likely to be admitted to phase II CR as a result of a myocardial infarction (MI) (73%), and were more likely to have ≤ grade 9 level education (19.4%) compared with those who agreed to participate ($\bar{X}$ comorbidities = 1.49; 57.8% admitted for MI; 4.5% had ≤ grade 9 level education).

Throughout the study duration, 10 of the 225 patients dropped out, yielding a completion rate of 96%, which is a significant difference from the 76% dropout rate reported by Blanchard et al.[18] Six of these patients did not attend any exercise sessions, whereas 4 were discharged early. To further evaluate the representativeness of the findings, those who completed the study were compared with those who dropped out on the same demographic and medical variables examined above. The 2 groups were similar on all variables, except education level $\chi^2\,(2) = 23.5$, $P < .001$. More specifically, patients who completed the study were more likely to have completed post-secondary education (65.8%) compared with those who dropped out (33.3%).

The final sample consisted of 215 patients. Demographic and medical information can be found in Table 1. The mean age of the sample was 59.52 (SD = 10.09) with a mean percent body fat of 26.62 (SD = 5.74).

Main Analyses

Descriptive statistics and zero-order correlations among each of the main constructs of interest are presented in Table 2. Overall, patients' attitudes, subjective norms, PBC, and intentions were very positive during phase II CR.

Table 1 • DEMOGRAPHIC AND MEDICAL CHARACTERISTICS OF THE SAMPLE

	Sample	
Demographic Variable	n	(%)
Marital status		
Married/common law	168	(77.8)
Divorced/separated	13	(6.0)
Single/widowed	23	(10.6)
Missing	12	(5.6)
Education level		
Grade 9 or less	9	(4.2)
High school	59	(27.3)
Post-secondary	131	(60.6)
Missing	17	(17.9)
Employment status		
Retired/homemaker	93	(43.1)
Employed	95	(44.0)
Unemployed	11	(5.1)
Missing	17	(7.9)
Admitting diagnosis		
Myocardial infarction	118	(54.6)
Bypass surgery	39	(18.1)
Angioplasty/angiogram	43	(19.9)
Missing	16	(7.5)
Health-related problems*		
Arthritis	84	(38.9)
Asthma	27	(12.5)
High blood pressure	107	(49.5)
Diabetes	31	(14.4)
Stomach problems	33	(15.3)
Gallbladder problems	23	(10.6)
Thyroid problems	16	(7.4)
Smoking status		
Currently smoke	23	(10.6)
Do not currently smoke	182	(84.3)
Missing	11	(5.1)

*The percentages of health-related problems are not cumulative.

Table 2 • DESCRIPTIVES AND ZERO-ORDER CORRELATIONS AMONG THE THEORY OF PLANNED BEHAVIOR CONSTRUCTS AND EXERCISE EDHERENCE DURING PHASE II CARDIAC REHABILITATION

TPB Constructs	2	3	4	5	6	7	8	9	Mean	SD
1. Attendance	.35*	0.18†	0.24*	0.19†	0.06	0.13‡	0.01	0.08	88.86	14.07
2. Intention		0.37*	0.45*	0.39*	0.28*	0.27*	0.24*	0.05	6.58	0.69
3. Attitude			0.41*	0.34*	0.43*	0.27*	0.21*	0.14‡	5.93	0.68
4. Subjective norm				0.26*	0.29*	0.49*	0.24*	0.02	6.76	0.51
5. Perceived control					0.22*	0.23*	0.26*	0.06	5.99	1.01
6. Behavioral beliefs						0.34*	0.23*	0.15‡	6.11	0.74
7. Normative beliefs							0.10	0.07	6.52	0.58
8. Control beliefs								0.09	5.41	1.39
9. Past exercise (metabolic equivalents)								—	20.13	14.76

*$P < .001$.
†$P < .01$.
‡$P < .05$.

Regarding the first HRA pertaining to exercise intention, the results showed that attitude, subjective norm, and PBC explained 30% of the variance in exercise intention with attitude ($\beta = .16$, $P < .05$), subjective norm ($\beta = .32$, $P < .001$), and PBC ($\beta = .24$, $P < .001$) making significant unique contributions to intention. Past exercise did not add significant unique variance in exercise intention. Table 3 provides a summary of this analysis.

In the second HRA pertaining to exercise adherence during phase II CR, the results showed that intention ($\beta = .35$, $P < .001$) explained 12% of the variance in exercise adherence, whereas PBC and past exercise did not add significant unique variance in exercise adherence. Table 3 provides a summary of this analysis.

In the final HRA pertaining to the underlying accessible beliefs, it was shown that these accessible beliefs explained 21% of the variance [$F(3,211) = 19.53$, $P < .001$] in attitude, with no additional variance explained by past exercise. Behavioral ($\beta = .35$, $P < .001$) and normative ($\beta = .15$, $P < .05$) beliefs made significant unique contributions. For subjective norm, the underlying accessible beliefs explained 29% of the variance [$F(3,211) = 28.14$, $P < .001$] with no additional variance explained by past exercise. Control ($\beta = .17$, $P < .01$) and normative ($\beta = .44$, $P < .001$) beliefs made significant unique contributions. Finally, for PBC, the underlying accessible beliefs explained 12% of the variance [$F(3,211) = 9.59$, $P < .001$] with no additional variance explained by past exercise. Control ($\beta = .22$, $P < .001$) and normative ($\beta = .17$, $P < .05$) beliefs made significant unique contributions. Table 4 provides a summary of these analyses. Also, see Figure 1 for a summary of the standardized betas from all regression analyses.

Finally, the zero-order correlations (Table 5) showed that behavioral beliefs were significantly related to attitude ($r = .43$, $P < .001$) and intention ($r = .28$, $P < .001$), but not exercise adherence ($r = .06$, ns), with the most important belief being "confidence in doing everyday activities." Normative beliefs were significantly correlated to subjective norm ($r = .49$, $P < .001$), intention ($r = .28$, $P < .001$), and exercise adherence ($r = .13$, $P < .05$) with "spouse or partner," "other family members," and "friends" being the most important beliefs. Finally, control beliefs were significantly correlated to PBC ($r = .26$, $P <$

Table 3 • HIERARCHICAL REGRESSIONS OF EXERCISE INTENTION AND ADHERENCE ON THE THEORY OF PLANNED BEHAVIOR DURING PHASE II CARDIAC REHABILITATION

Steps/Predictors	R^2	R^2_{change}	F_{change}	*df*	β^1	β^2	β^3
Intention							
1. Attitude					.16*	.16*	N/A
Subjective norm					.32†	.33†	N/A
Perceived control	.30	.00	30.14†	3211	.24†	.24†	N/A
2. Past exercise	.30	.00	.04	1210	—	.01	N/A
Exercise Adherence							
1. Intention	.120	.00	28.92†	1213	.35†	.32†	.32†
2. PBC	.123	.003	.80	1212	—	.06	.06
3. Past exercise	.126	.003	.83	1211	—	—	.06

*$P < .05$.
†$P < .001$.
β^1, standardized regression coefficients for equation 1; β^2, standardized regression coefficients for equation 2; β^3, standardized regression coefficients for equation 3; N/A, not applicable; PBC, perceived behavioral control.

Table 4 • HIERARCHICAL REGRESSIONS OF THE THEORY OF PLANNED BEHAVIOR GLOBAL CONSTRUCTS ON THE UNDERLYING ACCESSIBLE BELIEFS DURING PHASE II CARDIAC REHABILITATION

Steps/Predictors	R^2	R^2_{change}	F_{change}	*df*	β^1	β^2
Attitude						
1. Control beliefs					.11	.11
Normative beliefs					.14*	.15*
Behavioral beliefs	.21	.21	19.53†	3211	.36†	.35†
2. Past exercise	.22	.01	1.90	1210	—	.08
Subjective norm						
1. Control beliefs					.17‡	.17‡
Normative beliefs					.43†	.44†
Behavioral beliefs	.29	.29	28.14†	3211	.11	.11
2. Past exercise	.29	.00	0.07	1210	—	.02
Perceived behavioral control						
1. Control beliefs					.22†	.22†
Normative beliefs					.17*	.17*
Behavioral beliefs	.12	.12	9.59†	3211	.11	.11
2. Past exercise	.12	.00	0.23	1210	—	.03

*$P < .05$.
†$P < .001$.
‡$P < .01$.
β^1, standardized regression coefficients for equation 1; β^2, standardized regression coefficients for equation 2.

.001) and intention ($r = .24$, $P < .01$), but not exercise adherence ($r = -.01$, ns), with the most important beliefs being "too much work" and "other health problems."

DISCUSSION

The results of the present study provide further support that the TPB is a useful framework for understanding exercise adherence during phase II CR. One important finding of the present study was that intention was the sole determinant of exercise adherence, which is consistent with previous research in phase II CR.[18] However, the amount of variance that intention accounted for in exercise adherence in the present (ie, 12%) study was less than that of the Blanchard et al[18] study (23%). One possible explanation for this finding is that the Blanchard et al[18] study gave patients the TPB questionnaire after their initial orientation meeting and were asked to return it to their first scheduled exercise

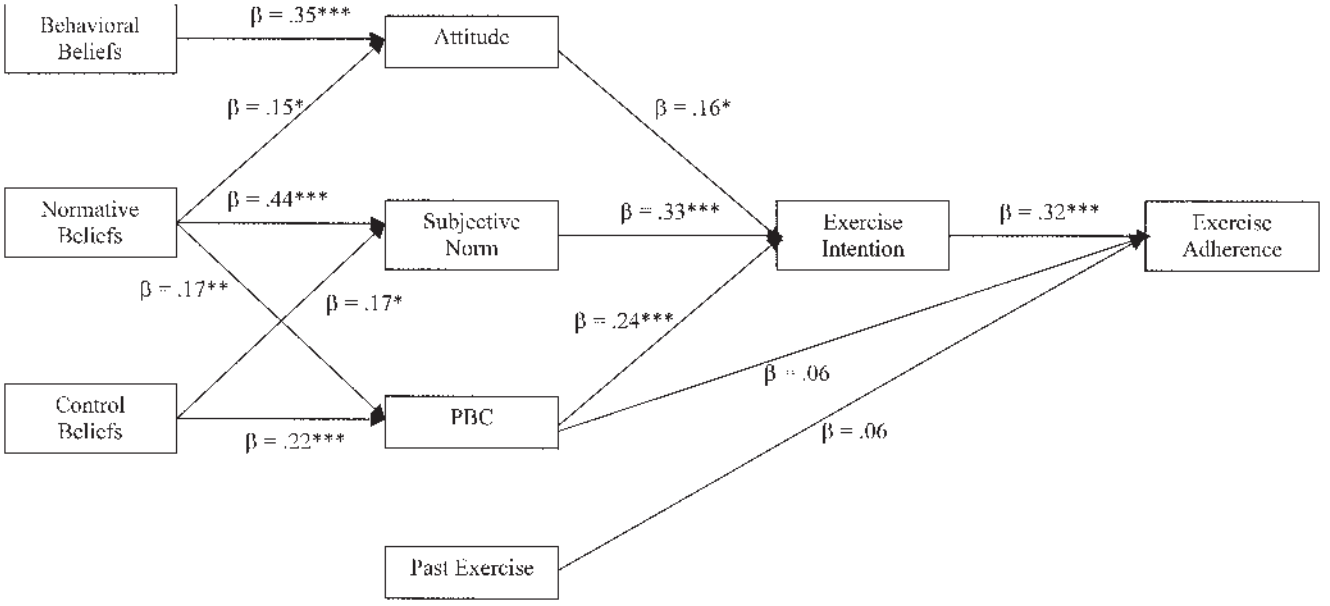

Figure 1. Summary of the standardized betas from the theory of planned behavior hierarchical regression analyses. *P < .05; **P < .01; ***P < .001. PBC, perceived behavioral control.

Table 5 • ZERO-ORDER CORRELATIONS OF THE UNDERLYING ACCESSIBLE BELIEFS WITH THEIR RESPECTIVE GLOBAL CONSTRUCTS (ATTITUDE, SUBJECTIVE NORM, PERCEIVED BEHAVIORAL CONTROL), EXERCISE INTENTION, AND ADHERENCE DURING PHASE II CARDIAC REHABILITATION

Beliefs	Global	Intention	Exercise Adherence
Behavioral beliefs	.43*	.28*	.06
1. "Get in shape"	.35*	.20*	.08
2. "Strengthen you heart muscle"	.28*	.16†	−.04
3. "Feel more energetic"	.38*	.19†	.03
4. "More confidence in doing everyday activities"	.39*	.33*	.15†
5. "Feel as good as before your cardiac event"	.20†	.16†	.03
6. "Decreased risk of further heart problems"	.27*	.15‡	−.03
7. "Incorporate exercise into your lifestyle"	.33*	.27*	.09
8. "Maintain your optimal weight"	.35*	.16‡	.04
Normative beliefs	.49*	.24*	.13‡
1. "Spouse/partner"	.48*	.28*	.11‡
2. "Other family members"	.48*	.22†	.16†
3. "Friends"	.43*	.28*	.08
4. "Family physician"	.35*	.19†	.10
5. "Cardiologist"	.29*	.08	.09
6. "Other individuals with heart disease"	.16‡	.16‡	.04
Control beliefs	.26*	.24†	−.01
1. "Fear of another cardiac incident"	.27*	.14‡	−.02
2. "Back pain"	.25*	.19†	−.01
3. "Medication side effects"	.23*	.20†	−.01
4. "Bad weather"	.19*	.25*	.04
5. "Too much work to do"	.22*	.27*	.04
6. "No time"	.18†	.26*	.05
7. "Angina/chest pain earlier in the day"	.15‡	.10	−.06
8. "Other health problems"	.23*	.16‡	−.05

*$P < .001$.
†$P < .01$.
‡$P < .05$.

session. In the present study, however, patients were mailed their questionnaire approximately 3 to 5 weeks before their orientation meeting and were asked to return the survey to that meeting. Given that the patients in the Blanchard et al[18] study had more detail concerning their exercise program during their phase II CR program (as a result of the orientation meeting) and were closer in proximity to starting their phase II CR compared with those in the present study, this may have resulted in the Blanchard et al[18] patients being more motivated and their intention scores being more accurate. The fact that the patients knew their exact exercise schedule after their orientation meeting may have improved their accuracy judgments on the intention scales compared with patients in the present study who only knew they would be exercising approximately 3 times a week once they started their phase II CR. An alternative explanation is that the different dropout rates between the Blanchard et al[18] study and the present study may have contributed to a selection bias that potentially influenced the strength of the association between intention and exercise. Whatever reason why intention explained less variance in exercise adherence in the present study, both studies suggest that intention is an important social cognitive determinant of exercise adherence during phase II CR.

A second important finding in the present study was that attitude and PBC determined intention to exercise, which is consistent with previous research in phase II CR[18] and the general exercise literature.[21] However, subjective norm also had a significant influence on exercise intention, which is inconsistent with previous research in the phase II CR[18] and the general exercise literature.[21] Subjective norm, however, was significantly correlated ($r = .39$, $P < .001$) with exercise adherence in the Blanchard et al[18] study, it just did not emerge as a significant predictor when combined with attitude and PBC. Therefore, it appears that subjective norm may be an important determinant of exercise that needs to be focused on during phase II CR. Nonetheless, replication of the present study's findings are needed before any firm conclusions can be drawn.

Analysis of the underlying accessible beliefs provided additional detailed information on which beliefs

were (1) most important for understanding attitude, subjective norm, and PBC, and (2) related to intention and exercise adherence. The behavioral beliefs related well to attitude and intention, however, only one behavioral belief was related to exercise adherence during phase II CR. In terms of explaining attitude *and* intention, the most important behavioral beliefs were "more confidence in doing everyday activities," "feel more energetic," and "get in shape." The only behavioral belief that correlated with behavior was "more confidence in doing everyday activities." As this belief was significantly correlated with attitude and intention as well, it would appear that it is a key belief that should be targeted when designing exercise interventions. However, future research needs to identify other relevant behavioral beliefs that may provide a more complete understanding of exercise adherence during phase II CR.

Normative beliefs related well to subjective norm, intention, and exercise adherence. Three specific individuals or groups perceived to be important by the phase II CR patients in influencing subjective norm and exercise intention were "spouse or partner," "other family members," and "friends." Furthermore, spouse or partner and other family members were also significantly related to exercise adherence. Given that both of these normative beliefs were significantly related to subjective norm, intention, and exercise adherence, they would appear to be important beliefs on which to focus when designing exercise interventions tailored to phase II CR. However, as with the behavioral beliefs, future research needs to identify other relevant normative beliefs as well as replicate the present study's findings before any firm conclusions can be drawn.

Control beliefs performed well in terms of explaining PBC and intention. The most important control beliefs were "bad weather," "too much work to do," and "other health problems." The more confident patients were that they could exercise despite these barriers, the higher their perceptions of control and exercise intention. None of the control beliefs, however, correlated with exercise adherence during phase II CR, which is inconsistent with previous research.[16] In that study, however, patients were approached to complete the control beliefs' scale (or a barrier efficacy scale, in that case) after starting their actual exercise sessions during their phase II CR. As a result, these patients had been exercising in the program for at least a week and were familiar with the barriers that would be relevant to them. Patients in the present study, however, did not have this luxury, which may have resulted in inaccurate assessments (ie, over or under estimating their confidence to overcome the barriers) of the control beliefs.[31] Nonetheless, the inconsistency in findings between the two studies emphasizes the importance of the "timing" of assessing the control beliefs before starting phase II CR, particularly because both studies had similar exercise adherence rates.

Although the evidence is preliminary from a TPB standpoint, potential clinical implications exist for the present study's findings. More specifically, the findings suggest that phase II CR staff should obtain information about their patients' attitudes, subjective norms, and PBC about exercise at program entry. In doing so, they can target the specific TPB constructs to increase their patients' exercise adherence during their phase II CR. In terms of PBC, phase II CR staff could target specific control beliefs that their patients may have. For example, important control beliefs that emerged from the present study's results were barriers to exercise (eg, bad weather, too much work). In this case, the phase II CR staff could help their patients develop strategies to overcome these barriers, which will then have a positive influence on their PBC and exercise intentions. In terms of subjective norms, the present study's results suggest the importance of phase II CR staff speaking with spouses or partners, other family members, and friends to encourage the patients to exercise during their phase II CR. Finally, attitudes could be influenced by attempting to modify the phase II CR patients' behavioral beliefs. For example, the present study's results suggest that important behavioral beliefs for patients in phase II CR are that exercise will help them be more confident in doing everyday activities, feel more energetic, and get in shape. Therefore, phase II CR staff may need to be particularly aware of these benefits of exercise for their patients and be able to communicate these benefits effectively to them.

Despite the important information gained from this study, some limitations need to be considered when interpreting the findings. 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.[16,19] A second limitation is the potential selection biases in the sample. We cannot assume that the findings of the 58% of patients who participated in the CR study generalize to the 42% who did not agree to participate. Furthermore, it is not clear whether the results of the present study would be relevant to a home-based phase II CR program. In fact, Schuster et al[9] showed that patients who enrolled in hospital-based phase II CR had higher exercise adherence rates compared with home-based programs. This suggests that patients attending hospital-based programs are more motivated to exercise. Therefore, it would be interesting to see if the TPB could explain the exercise adherence differences between the two program types. A third limitation is that there was no assessment of exercise behavior before a patient's cardiac event. Although exercise behavior was assessed from the time of a patient's cardiac event to immediately starting phase II

CR, this assessment does not provide a complete picture of the exercise history of the patients in the present study. A final limitation is the one time assessment of the TPB constructs. Blanchard et al[18] found that the TPB behaved differently during phase II CR compared with following completion of phase II CR. Furthermore, Blanchard et al[16] found control beliefs to be related to exercise adherence, whereas the present study did not, which may result from the difference in timing of assessments. In any case, these findings may suggest that multiple assessments of the TPB constructs during phase II CR may increase the utility of the underlying accessible beliefs in explaining exercise adherence during phase II CR.

Despite these limitations, the present study overcame previous limitations (ie, by using a larger sample and maintaining a higher completion rate) and found that attitudes, subjective norm, and PBC made significant unique contributions to exercise intentions during phase II CR, whereas exercise intentions explained significant variance in exercise adherence. Furthermore, the present study provided novel results to phase II CR concerning the underlying accessible beliefs relevant to this patient population. However, further research is needed that includes similar numbers of men and women, multiple assessments of the TPB constructs, and extension into home-based programs. Nevertheless, the current study suggests that the TPB is a promising theory for understanding exercise adherence during phase II CR.

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