Automatic Referral to Cardiac Rehabilitation

Sherry L. Grace, PhD, Alexandra Evindar, MS,* Tabitha N. Kung, BSc,† Patricia E. Scholey, BN, RN,‡ and Donna E. Stewart, MD, FRCPC*†*

Objectives: Cardiac rehabilitation (CR) remains underused and inconsistently accessed, particularly for women and minorities. This study examined the factors associated with CR enrollment within the context of an automatic referral system through a retrospective chart review plus survey. Through the Behavioral Model of Health Services Utilization, it was postulated that enabling and perceived need factors, but not predisposing factors, would significantly predict patient enrollment.

Subjects: A random sample of all atherosclerotic heart disease (AHD) patients treated at a tertiary care center (Trillium Health Centre, Ontario, Canada) from April 2001 to May 2002 (n = 501) were mailed a survey using a modified Dillman method (71% response rate).

Measures: Predisposing measures consisted of sociodemographics such as age, sex, ethnocultural background, work status, level of education, and income. Enabling factors consisted of barriers and facilitators to CR attendance, exercise benefits and barriers (EBBS), and social support (MOS). Perceived need factors consisted of illness perceptions (IPQ) and body mass index.

Results: Of the 272 participants, 199 (73.2%) attended a CR assessment. Lower denial/minimization, fewer logistical barriers to CR (eg, distance, cost), and lower perceptions of AHD as cyclical or episodic reliably predicted CR enrollment among cardiac patients who were automatically referred.

Conclusion: Because none of the predisposing factors were significant in the final model, this suggests that factors associated with CR enrollment within the context of an automatic referral model relate to enabling factors and perceived need. A prospective controlled evaluation of automatic referral is warranted.

Key Words: referral, rehabilitation, cardiovascular disease

Atherosclerotic heart disease (AHD) is the leading cause of death and disability in the developed world.[1] Substantial health risks continue after coronary events and procedures,[2,3] and cardiac rehabilitation (CR) improves subsequent prognosis.[4] However, most research demonstrates low enrollment and inequality in access to CR,[5] specifically lower referral among women, minorities, and older patients compared with men, whites, and younger patients.[6–9] This occurs despite evidence demonstrating that these underreferred patients are at increased need as a result of greater morbidity and mortality after a coronary event[10,11] and that they do indeed benefit from CR.[12,13] The CR literature promotes automatic referral to increase enrollment and reduce disparities in access.[14,15] However, to the best of our knowledge, this type of referral has not been systematically defined, implemented, or evaluated in the peer-reviewed literature.

There are a combination of factors relating to patients,[7] physicians,[12,15] and the healthcare system itself[18] that lead to low CR referral overall and to disparities in referral and participation.[19] Andersen's expanded Behavioral Model of Health Services Utilization[20–22] proposes that utilization of health services is determined by a combination of these factors. In an automatic referral model within a single-payer healthcare system, patients are universally referred to a CR site closest to home, so that physician and health system factors that generally affect enrollment become less pertinent. Andersen conceptualizes patient factors as: 1) characteristics predisposing utilization, 2) characteristics enabling utilization, and (3) need (Fig. 1). Predisposing factors exist before the onset of illness and describe the inclination of individuals to use health services. The relevant predisposing factors shown in the literature to affect CR enrollment include sex, age, education level, ethnocultural background, comorbid conditions, history of regular exercise, depression, and anxiety.[6,8,23,24] Enabling factors are the barriers and facilitators to the use of health services, and include economic and environmental factors. The CR-enabling factors include social support, marital status, benefits and barriers of exercise, perceptions of control, and logistical factors such as proximity and time or work flexibility.[25,26] Need factors are the objective and subjective aspects of the decision to use health services, and include subjective health and perceived serious-

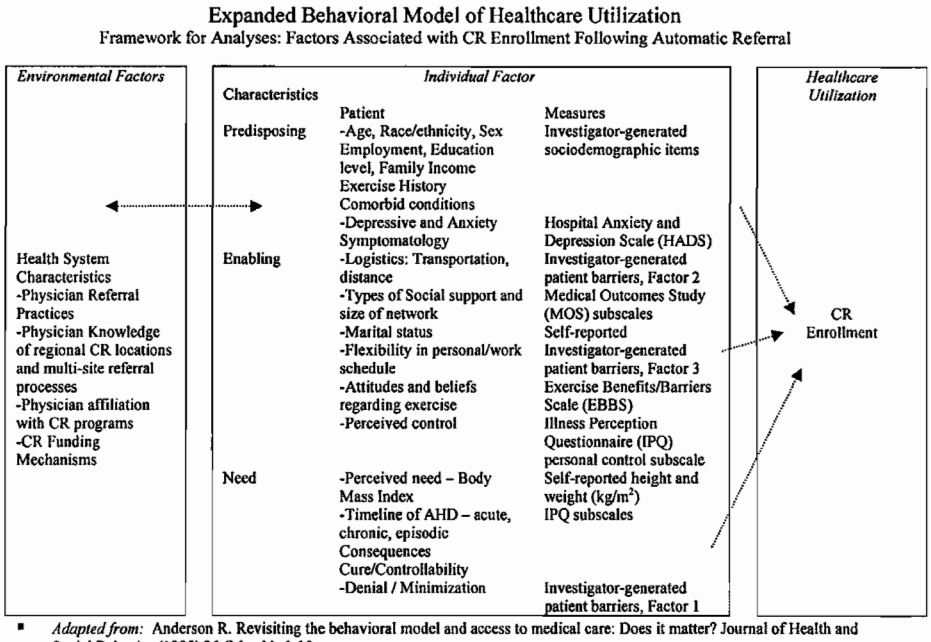

FIGURE 1. Expanded behavioral model of healthcare utilization framework for analyses: factors associated with cardiac rehabilitation enrollment after automatic referral.

ness and consequences of illness. Need factors in this instance consist of the patient's perceived need for CR, considering that all automatically referred cardiac patients are eligible for CR and are shown to benefit from such services (ie, all participants "need" CR based on professional judgment or clinical practice guidelines). Perceived need can be reflected through perceived seriousness of disease and other illness perceptions such as the time course (ie, acute/chronic or episodic) of the symptoms and disease, consequences, and the controllability of AHD.[27]

The following study evaluates predisposing, enabling and need factors affecting CR enrollment in a random sample of cardiac patients automatically referred to CR. It is postulated that enabling and need factors, but not predisposing factors, will significantly predict CR enrollment in eligible cardiac patients automatically referred to a CR site closest to their home.

METHODS

Participants

The Trillium Health Centre (THC) is a large, urban tertiary care facility in the Greater Toronto Area, Ontario, Canada. All cardiac patients who are eligible for CR based on CACR guidelines[16] are automatically referred to the THC Cardiac Wellness and Rehabilitation Centre and entered into their database. We obtained access to the database compiled between April 26, 2001, and May 15, 2002 (n = 1611). The database was screened to include AHD patients. This screening yielded a set of 1501 cases, from which a random sample was extracted to yield 501 patients for initial contact. Subsequently, 117 patients were deemed ineligible for the following reasons: deceased (n = 9), medically ineligible (n = 33), did not speak English (n = 12), or had moved and could not be located (n = 63). Of the 384 eligible patients who were successfully contacted, 272 (71%) patients consented to participate in the study.

Procedure and Design

The automatic referral model described here uses hospital electronic patient records to prompt the standard order for a CR referral for all eligible cardiac patients (based on American Association of Cardiovascular and Pulmonary Rehabilitation [ACVPR] and Canadian Association of Cardiovascular Rehabilitation [CACR] guidelines[16,17]). This discharge order is printed in the CR center and again screened for eligibility. An information package, including a personalized letter stating the name of the referring physician, a program brochure, a schedule of classes, and a request that the patient call to book an appointment, is mailed to the patient's home. Patients who live outside of the geographic area are also sent a similar package but provided with the contact information of the site closest to their home. This alternate site is also sent the patient's contact information.

This study constituted a cross-sectional comparative design. Ethics approval was obtained from both THC and

University Health Network. THC charts were abstracted for demographic and medical data.

A random sample of THC cardiac patients, as outlined previously, was sent a mailed survey. To increase the response rate of participants to the questionnaire, Dillman's Tailored Design Method[28] was implemented. Our 5 patient contacts were as follows: a prenotice letter sent 5 days before the questionnaire; a questionnaire mailing, including a cover letter and a consent form; a thank you/reminder postcard sent 11 days after the questionnaire; a replacement questionnaire sent to nonrespondents 4 weeks after the previous questionnaire mailing; and a final contact made by telephone. All mailings were personalized with the participant's name and address. Stamped return envelopes were provided.

Measures

The patient factors affecting CR enrollment were assessed with available psychometrically validated items as well as investigator-generated items. A summary of constructs is presented in Figure 1.

Predisposing Factors

Sociodemographic data included age, sex, racial/ethnic background, work status, level of education, and gross annual family income. Family income was incorporated as a predisposing rather than enabling factor because the universal healthcare system in Canada ensures that there are no costs incurred for CR participation. (The only exceptions could include costs for parking or transportation. Some CR programs are now charging a minimal fee, which can be waived in the case of financial need.)

Two "yes/no" response items were created to assess participants' past exercise habits ("Did you exercise to the point of getting short of breath on a regular basis [as an adult] before your cardiac event?") and comorbidities that might interfere with an exercise regimen ("Do you have any other medical conditions that would prevent you from exercising?").

The Hospital Anxiety and Depression Scale (HADS),[29] a reliable and well-validated scale,[30] was used to assess emotional distress. The HADS is a 14-item self-report questionnaire: anxiety and depression are each measured through 7 items rated on 4-point Likert-type scales. Total scores range from 0 to 21. For each subscale, a score below 8 is in the normal range, a score of 9 to 10 represents moderate expressions of anxiety or depression, and a score of 11 or greater represents severe expressions of the affective states.

Enabling Factors

Nineteen items relevant to patient facilitators and barriers to CR enrollment were generated based on the literature. Sample items included distance, time constraints, and having exercise equipment at home. Responses were made on a 5-point Likert-type scale from "strongly disagree" to "strongly agree." The Cronbach's alpha reliability was 0.94.

The Exercise Benefits/Barriers Scale (EBBS) was used to determine respondent's health beliefs concerning the benefits and barriers to participating in exercise.[31] The EBBS is a 43-item instrument that uses a 4-point Likert scale with responses ranging from 4 (strongly agree) to 1 (strongly disagree). Scores on the total instrument can range from 43 to 172 with a higher score indicating a more positive perception of exercise. The Cronbach's alpha reliability was 0.83 in the current sample. Mean benefit and barrier scores were computed.

The Social Support Scale developed in conjunction with the Medical Outcomes Study (MOS)[32] was used to measure respondents' levels of perceived social support. The instrument is self-administered through a 5-point Likert-type response scale from 1 "none of the time" to 5 "all of the time." Four subscales are derived from the scale, namely tangible support, emotional support, affectionate support, and positive social interactions. An additional item covers the structural (size of social network) aspect of support. Scores are calculated for each of the subscales, and a total social support score is also computed. The Cronbach's alpha reliability was 0.97 in the current sample.

The Illness Perception Questionnaire (IPQ-R)[33] was incorporated to assess cognitive representations of cardiovascular disease. The personal control subscale of the IPQ-R was incorporated as an enabling factor. All items were scored on a 5-point Likert-type scale, which ranges from strongly disagree to strongly agree. A mean subscale score was computed with higher scores denoting greater perceived control. Cronbach's alpha for the subscale was 0.76 in the current sample.

Need Factors

The IPQ-R consists of 9 subscales: the timeline (acute/chronic), timeline cyclical or episodic, consequences, and treatment cure/controllability subscales were included as need factors. All items are scored on a 5-point Likert-type scale, which ranges from strongly disagree to strongly agree. Mean subscale scores were computed with higher scores denoting greater endorsement of the given construct. Cronbach's alpha values for the subscales were 0.85, 0.89, 0.77, and 0.69 in the current sample, respectively.

Body mass index (BMI) was also included as a need factor to reflect the fact that overweight or obese cardiac patients are at increased risk of recurrent coronary events.[34] BMI was computed from self-reported height and weight (kg/m^2).

Dependent Variable: Cardiac Rehabilitation Enrollment

Participants were asked whether they attended a CR assessment (yes/no) (CR enrollment was verified with various

CR sites for all but 19 participants.). This is an intake appointment in which patients are accepted, registered, and enrolled for CR services. The purpose of the visit includes assessment of physical and psychosocial status, identification of CR goals, and collection of baseline data.

Statistical Analysis

SPSS 11.0.1 was used for the following analyses. After data cleaning and screening, a descriptive examination was performed. A principal components analysis was conducted to examine the factor structure of the patient barriers to CR participation items. In the interests of parsimony and the reduction of multicollinearity, a bivariate analysis of the predisposing, enabling, and need variables of interest was conducted to exclude variables from the final model based on empiric considerations: differences in CR enrollment were tested by Pearson's chi-squared and Student's t tests as appropriate. A hierarchical logistic regression analysis predicting CR enrollment was performed based on theoretical and empiric considerations. Significant predisposing variables were entered at step 1, followed by significant enabling and need variables at steps 2 and 3, respectively.

RESULTS

Respondent Characteristics

Study participants and nonparticipants did not differ by referral event (bypass grafting vs. any other event; chi-square [1] = 2.65, P = 0.10). However, study participants and nonparticipants did differ by sex (chi-square [1] = 4.75, P <0.05) and by CR enrollment (chi-square [1] = 64.83, P <0.001). Study participants were more likely to enroll in CR (60.7%) than ineligible or refusing patients (23.1%). Study participants were also more likely to be male (77.2%) than ineligibles or refusers (68.6%).

Sample characteristics are shown in Table 1. Participants completed the survey between 6.00 and 23.77 months after their referral event, with a mean of 15.14 months (standard deviation [SD], 3.57). The majority of the participants were revascularization patients. Of the 272 participants, 199 (73.2%) reported attending a CR assessment. Of these, 189 (69.7%) reported participating in CR after the assessment.

Patient Barriers to Cardiac Rehabilitation Enrollment Above and Beyond Referral Failure

A descriptive examination of the 19 investigator-generated barriers to CR enrollment was performed. The 5 items with the highest mean score in descending order were: "I already exercise at home" (mean, 2.51; SD, 1.29), "I already exercise in my community" (mean, 2.24; SD, 1.18), "I am confident I can manage my heart problem on my own" (mean, 2.09; SD, 1.04), "distance" (mean, 2.04; SD, 1.28), and "Many people with heart problems don't go to cardiac rehab and they are fine" (mean, 2.01; SD, 1.04).

A principal components analysis of patient barriers with varimax rotation was conducted. On examination of the scree plot and rotated component matrix, a 3-factor solution resulted with eigenvalues greater than 1. Table 2 presents the factor loadings from the resulting solution. The first factor, with an eigenvalue of 9.74 and explaining 51.28% of the variance in scores, appears to reflect denial or minimization of heart disease. The second factor, with an eigenvalue of 1.43 and explaining 7.56% of the variance in scores, appears to reflect logistics such as travel and cost. The third factor, with an eigenvalue of 1.20 and explaining 6.33% of the variance in scores, appears to reflect time and work conflicts. Factor scores were saved as variables to be entered into subsequent analyses. The first factor of denial/minimization was deemed a need factor, because it reflects the opposite to perceived seriousness of AHD. The remaining 2 factors of logistics and time/work conflicts were deemed to be enabling factors.

Predicting Cardiac Rehabilitation Enrollment

Bivariate analyses of predisposing, enabling, and need variables based on CR enrollment were conducted (see Table 3). Because both the exercise barriers and benefits variables were significant, yet these variables were highly correlated (r = −77, P <0.001), exercise benefits was chosen to include in the model based on the greater t value when compared with barriers.

A hierarchical logistic regression analysis predicting CR enrollment was conducted, with significant variables from the bivariate predisposing, enabling, and need analyses entered at each of 3 steps, respectively. Analysis was conducted using SPSS LOGISTIC REGRESSION. A test of the full model with all predictors against a constant-only model was statistically reliable (chi square [9, N = 195] = 66.49, P <0.001), indicating that the predictors, as a set, reliably distinguished between those who enrolled in CR and those who did not. Each step of the model did reach statistical significance (step 1 chi square [2] = 13.31, P = 0.001; step 2 chi square [4] = 24.68, P <0.001; step 3 chi square [3] = 28.50, P <0.001). In the final model (see Table 4), 43.2% of the variance in CR enrollment was accounted for by this set of predictors. Prediction success was 80.5%. According to the Wald criterion, lower denial/minimization, fewer logistic barriers to CR (eg, distance, cost), and lower perceptions of AHD as cyclical or episodic reliably predicted CR enrollment among cardiac patients who were automatically referred. There was a trend whereby participants who perceived greater benefits of exercise were more likely to enroll in CR. Therefore, the enabling factor of logistics and the need factors of denial/minimization and episodic perception of

TABLE 1. Descriptive Characteristics of the Study Sample (n=272)*

Characteristic	N (%)	Mean (SD)
Referral Event		
Coronary Artery Bypass Graft (CABG)	175 (64.3)	
Angioplasty	49 (18.0)	
Myocardial Infarct	31 (11.4)	
Coronary Artery Disease	17 (6.3)	
Gender		
Male	210 (77.2)	
Female	62 (22.8)	
Ethnocultural Background†		
White	224 (84.2)	
Other	48 (17.8)	
Marital status		
Married	205 (76.8)	
Widowed	38 (14.2)	
Separated/Divorced	11 (4.1)	
Single/Never married	9 (3.4)	
Current daily activity		
Retired	144 (53.7)	
Employed (full-time or part-time)	86 (32.1)	
Other	38 (14.1)	
Education		
Less than grade 9	38 (14.2)	
High School	95 (34.9)	
Post-secondary	135 (49.6)	
Family income		
Over $40 000CAD‡	129 (57.8)	
Under $40 000	94 (42.2)	
Regular history of exercise to the point of shortness of breath		
Yes	64 (24.3)	
No	199 (75.7)	
Comorbid condition affecting exercise§		
Yes	92 (34.7)	
No	173 (65.3)	
Age		64.92 (10.38)
Body Mass Index		27.54 (4.89)

*Some frequencies may not add up to the total due to missing data. 2.

†Ethnocultural backgrounds other than white included South Asian, Filipino, and Japanese. Participants who were born in another country had been in Canada for a mean of 35.53 y (SD=15.83).

‡Equivalent to ∼ $28,500 USD

§Comorbid medical conditions which could impede exercise included orthopedic conditions (ie, lower limb, hip; n=28, 10.3%), arthritis (n=29, 7.4%), asthma (n=11, 4.0%) and diabetes (n=9, 3.3%).

AHD symptoms were significantly predictive of CR enrollment.

DISCUSSION

Automatic referral involves the use of electronic health records to flag eligible cardiac patients and refer them to CR at a site closest to home. Through the lens of the behavioral model of health services utilization,[20] we tested predisposing, enabling, and need factors affecting CR enrollment. We demonstrate that logistics and specific illness perceptions are the significant predictors of CR enrollment where referral to CR is universal. These factors accounted for over 43% of the

TABLE 2. Principal Components Analysis Rotated Component Matrix for Patient Barriers to CR

Item	Loadings		
	Factor 1	**Factor2**	**Factor3**
My heart condition is not that serious	0.78	0.17	0.26
I don't need cardiac rehab	0.71	0.32	0.24
It won't improve my health	0.70	0.36	0.26
I am confident I can manage it on my own	0.69	0.16	0.23
I didn't know about cardiac rehab	0.61	0.38	0.15
My doctor doesn't encourage me to attend	0.60	0.34	0.18
Many people with heart problems don't go to cardiac rehab, and they are fine	0.58	0.39	0.27
I already exercise at home	0.55	0.22	0.18
I already exercise in my community	0.53	0.22	0.15
Illness of a close relative	0.48	0.43	0.22
It was not offered in my first language	0.48	0.27	0.40
I am visually impaired	0.44	0.18	0.32
Other health problems prevent me from going	0.38	0.37	0.27
Transportation problems	0.28	0.86	0.22
Distance	0.22	0.84	0.18
Cost	0.40	0.74	0.18
Family Responsibilities	0.45	0.56	0.36
Work Responsibilities	0.29	0.17	0.84
Time constraints	0.30	0.31	0.80

variance in CR enrollment. Therefore, within the context of automatic referral, enabling factors and perceived need play a role in CR enrollment, but predisposing factors such as sex, age, comorbidity, work status, education, and family income do not. This supports our hypothesis that universal access to CR would rule out predisposing factors in the prediction of CR enrollment. Previous research has demonstrated that women, older cardiac patients, and ethnic minorities are less likely to be referred to and participate in CR.[6] Our findings suggest that within the context of the automatic referral model, enrollment could be less dependent on factors that exist before the onset of AHD, which are irrelevant to CR eligibility and more dependent on enabling and need factors.

The automatic referral context enabled an examination of factors leading to CR enrollment among patients in the absence of referral failure. Illness perceptions have been shown to be important factors in help-seeking, health behavior, and healthcare utilization more generally.[35] Our results show that participants who deny or minimize the seriousness of their AHD are less likely to enroll in CR. Moreover, participants who perceive their cardiac symptoms as episodic appear to be more likely to enroll in CR, perhaps in the hopes that CR will allow them to gain some control over their symptoms such as chest pain. This suggests that cardiac patients should be questioned regarding their perceptions of AHD, and that frank discussions with a healthcare provider regarding the seriousness of AHD (ie, rates of recurrence), symptom management, and the benefits of CR could ensure that a greater percentage of patients complete their referral.[36, 37]

Although patients were automatically referred to a CR site closest to home, logistic barriers remained paramount. For instance, items that loaded highly on this factor were transportation and distance to a CR site. Another study using Andersen's conceptual model found that distance was a significant factor affecting CR participation in a rural cardiac sample.[19] As a tertiary care center, THC patients arrive from a wide geographic area; cardiac patients from this sample were referred to 22 different CR sites closer to home. Canada is a vast country with a widely dispersed population, and it would be an inefficient use of health resources to offer CR in all areas. Recently, the Ontario provincial government funded an innovative and unprecedented pilot study to examine regional variation in supply and demand for CR services.[38] This study offers preliminary siting criteria to attempt to offer CR services based on population density. Although it is not feasible to offer proximate CR services for every cardiac patient, home-based programs are also showing promise.[39–41]

Although there was a trend that perceptions of exercise benefits were predictive of CR enrollment, social support and

TABLE 3. Frequency and Percentage of Categorical, Mean and Standard Deviation of Continuous Predisposing, Enabling and Need Factors Affecting Self-Reported CR Enrollment Following Automatic Referral to CR, n=272

Characteristics	Attender	Non-Attender	Test Statistic[†]
Predisposing Characteristics			
Sex (% Female)	39 (19.7%)	20 (28.2%)	2.19
Education (%<high school)	92 (46.7%)	39 (57.4%)	2.30
Family Income (%<$40000)	61 (36.5%)	33 (58.9%)	8.63**
Ethnic Background (%non-White)	32 (16.4%)	9 (13.2%)	0.39
Work Status (%Full-time)	16 (31.0%)	18 (26.5%)	0.49
Exercise History (%no)	142 (74.7%)	55 (78.6%)	0.41
Comorbid Condition (%yes)	64 (33.0%)	27 (39.7%)	1.00
Age	64.47 (10.31)	66.00 (10.57)	−0.95
Depressive Symptomatology	3.36 (3.36)	4.61 (4.28)	−2.23*
Anxiety	5.13 (3.85)	6.04 (4.48)	−1.63
Enabling Characteristics			
Marital Status (%unmarried)	41 (20.8%)	19 (28.4%)	1.62
Exercise Barriers	1.92 (0.44)	2.22 (0.40)	−4.92***
Exercise Benefits	3.09 (0.33)	2.85 (0.33)	5.28***
Tangible Support	4.15 (0.87)	3.88 (1.08)	1.85
Affectionate Support	5.82 (2.89)	6.22 (4.95)	−0.82
Emotional/Informational Support	4.13 (0.87)	3.87 (1.08)	1.85
Positive Social Interaction	4.19 (0.85)	3.90 (1.04)	2.12*
Total Support	4.57 (1.14)	4.47 (1.68)	1.94
Personal Control	23.70 (3.21)	22.22 (3.70)	3.18**
F2[††]- Logistics	−0.23 (0.72)	0.66 (1.14)	−5.53***
F3[††]–Time/Work Flexibility	−0.06 (0.87)	0.16 (1.03)	−1.50
Need Characteristics			
Body Mass Index	27.31 (4.95)	28.34 (4.67)	−1.42
Timeline–Acute/Chronic	21.56 (4.95)	21.26 (4.63)	−.002
Timeline–Episodic	9.55 (3.55)	10.90 (3.82)	−2.66**
Consequences	17.70 (4.53)	19.27 (4.43)	−2.50*
Cure/Controllability	18.76 (2.96)	18.06 (2.93)	1.70
F1[††]–Denial/Minimization	−0.24 (0.80)	0.54 (1.00)	−5.94***

[†]Pearson's χ^2 and t-tests for categorical and continuous variables respectively. Where the assumption of homogeneity of variance is not met, the t value for equal variances not assumed is presented.

[††]These variables are factor scores computed based on the patient barriers principal components analysis.

*$P < 0.05$

**$P < 0.01$

***$P < 0.001$

emotional distress did not play a role as has been previously shown in the literature.[25,42] Generally, support or encouragement by a physician plays a large role in CR attendance.[12,43] The automatic referral process has ensured all patients get access to CR regardless of inconsistencies in physician referral practices. Moreover, previous research has shown that participants who are emotionally distressed could be less likely to engage in certain physician-endorsed health behaviors.[44] The universal nature of automatic referral could assist even emotionally distressed patients in gaining access to CR. This is notable considering the negative effects of comorbid depression and AHD,[45] and the findings that CR can improve psychologic well-being.[46]

The limitations of this study include the retrospective design, sample bias, and measurement issues. More CR participants and males responded to our mailed survey than CR nonparticipants and females, so that the resulting factors associated with CR enrollment might not be generalizeable to

TABLE 4. Hierarchical Logistic Regression Predicting CR Enrollment, Full Model

Variable	B	Wald	p	OR	95% C.I.
Family Income	0.21	0.23	0.63	1.23	0.53–2.88
Depressive Symptomatology	0.03	0.27	0.60	1.03	0.92–1.16
Exercise Benefits	−1.33	2.87	0.09	0.26	0.06–1.23
Positive Social Interaction	−.25	1.11	0.29	0.78	0.49–1.24
F2–Logistics	1.05	18.11	<.001	2.84	1.76–4.60
Personal Control	.015	0.05	0.83	1.02	0.88–1.17
F1–Denial/Minimization	1.21	22.91	<0.001	3.36	2.05–5.52
Timeline-Episodic	−0.17	4.35	0.04	0.85	0.73–.99
Consequences	.07	1.34	0.25	1.07	0.96–1.19

Note: B refers to beta weight, Wald is the test statistic, p represents the significance value, OR is the acronym for odds ratio, and the final column presents the confidence intervals.

all AHD patients. Another limitation relates to the measurement of need factors and the dependent variable. Other potential perceived need factors that were not assessed in the model included diabetes status, smoking status, or cholesterol level for example. Moreover, CR enrollment does not necessarily imply full CR participation and attainment of clinical gains. Future research is needed to prospectively examine automatic referral versus usual referral. Different models of automatic referral should be empirically tested against one another. Innovations in health informatics will advance these efforts.[47,48]

In conclusion, this is the first study to empirically examine factors associated with CR enrollment within the context of automatic referral. By conceptualizing CR enrollment through the behavioral model of healthcare utilization, we found that enabling and need factors were significantly predictive of referral completion. Because none of the sociodemographic predisposing factors were statistically predictive in the multivariate model, results suggest enrollment could be less dependent on premorbid factors unrelated to CR eligibility within the automatic referral context. Further efforts to promote CR enrollment based on need are vital, considering that often those patients less likely to be referred are those with worse cardiac prognoses.

ACKNOWLEDGMENTS

The authors thank the CIHR Institute of Gender and Health for a postdoctoral fellowship to S. Grace which supported this study. The authors also acknowledge Bonnie Sanderson, PhD, RN, for permitting their adaptation of her conceptual CR utilization schema shown in Figure 1.

REFERENCES

1. Organization for Economic Cooperation and Development. *International Mortality Data*. 2001.
2. Law MR, Watt HC, Wald NJ. The underlying risk of death after myocardial infarction in the absence of treatment. *Arch Intern Med*. 2002;162:2405–2410.
3. Kannel WB, Sorlie P, McNamara PM. Prognosis after initial myocardial infarction: the Framingham study. *Am J Cardiol*. 1979;44:53–59.
4. Jolliffe JA, Rees K, Taylor RS, et al. Exercise-based rehabilitation for coronary heart disease. *Cochrane Database Syst Rev*. 2001;4.
5. Tod AM, Lacey EA, McNeill F. 'I'm still waiting': barriers to accessing cardiac rehabilitation services. *J Adv Nurs*. 2002;40:421–431.
6. Thomas RJ, Miller NH, Lamendola C, et al. National survey on gender differences in cardiac rehabilitation programs. Patient characteristics and enrollment patterns. *J Cardiopulm Rehabil*. 1996;16:402–412.
7. Grace SL, Abbey SE, Shnek ZM, et al. Cardiac rehabilitation II: referral and participation. *Gen Hosp Psychiatry*. 2002;24:127–134.
8. Lieberman L, Meana M, Stewart D. Cardiac rehabilitation: gender differences in factors influencing participation. *J Womens Health*. 1998; 7:717–723.
9. Blackburn GG, Foody JM, Sprecher DL, et al. Cardiac rehabilitation participation patterns in a large, tertiary care center: evidence for selection bias. *J Cardiopulm Rehabil*. 2000;20:189–195.
10. Mosca L, Manson JE, Sutherland SE, et al. Cardiovascular disease in women: a statement for healthcare professionals from the American Heart Association. Writing Group. *Circulation*. 1997;96:2468–2482.
11. Vaccarino V, Krumholz HM, Yarzebski J, et al. Sex differences in 2-year mortality after hospital discharge for myocardial infarction. *Ann Intern Med*. 2001;134:173–181.
12. Ades PA, Waldmann ML, Polk DM, et al. Referral patterns and exercise response in the rehabilitation of female coronary patients aged greater than or equal to 62 years. *Am J Cardiol*. 1992;69:1422–1425.
13. Harlan WR III, Sandler SA, Lee KL, et al. Importance of baseline functional and socioeconomic factors for participation in cardiac rehabilitation. *Am J Cardiol*. 1995;76:36–39.
14. King KM, Teo KK. Cardiac rehabilitation referral and attendance: not one and the same. *Rehabil Nurs*. 1998;23:246–251.
15. Daly J, Sindone AP, Thompson DR, et al. Barriers to participation in and adherence to cardiac rehabilitation programs: a critical literature review. *Prog Cardiovasc Nurs*. 2002;17:8–17.
16. *Canadian Guidelines for Cardiac Rehabilitation and Cardiovascular Disease Prevention*, 1st ed. Winnipeg: Canadian Association of Cardiac Rehabilitation; 1999.
17. American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR). *Guidelines for Cardiac Rehabilitation and Secondary Prevention Programs*, 3rd ed. Windsor, Ontario: Human Kinetics; 1999.
18. Jolly K, Bradley F, Sharp S, et al. Randomised controlled trial of follow up care in general practice of patients with myocardial infarction and angina: final results of the Southampton heart integrated care project (SHIP). The SHIP Collaborative Group. *BMJ*. 1999;318:706–711.
19. Johnson JE, Weinert C, Richardson JK. Rural residents' use of cardiac

rehabilitation programs. *Public Health Nurs.* 1998;15:288–296.
20. Aday LA, Awe WC. Health services utilization models. In: Gochman DS, ed. *Handbook of Health Behavior Research 1: Personal and Social Determinants.* New York: Plenum Press; 1997:153–172.
21. Andersen RM, Davidson PL. Ethnicity, aging, and oral health outcomes: a conceptual framework. *Adv Dent Res.* 1997;11:203–209.
22. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav.* 1995;36:1–10.
23. Ashton KCR, Saccucci MS. A follow-up of ethnic and gender differences in cardiac rehabilitation. *Rehabilitation Nursing.* 1996;21:187–191.
24. Conn VS, Taylor SG, Abele PB. Myocardial infarction survivors: age and gender differences in physical health, psychosocial state and regimen adherence. *J Adv Nurs.* 1991;16:1026–1034.
25. Dracup K. The role of social support in recovery and compliance. In: Shumaker SA, Czajkowski SM, eds. *Social Support and Cardiovascular Disease.* New York: Plenum Press; 1994:333–353.
26. Moore SM, Kramer FM. Women's and men's preferences for cardiac rehabilitation program features. *J Cardiopulm Rehabil.* 1996;16:163–168.
27. Cooper A, Lloyd G, Weinman J, et al. Why patients do not attend cardiac rehabilitation: role of intentions and illness beliefs. *Heart.* 1999;82:234–236.
28. Dillman DA. *Mail and Internet Surveys: The Tailored Design Method,* 2nd ed. Toronto: John Wiley & Sons; 2000.
29. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand.* 1983;67:361–370.
30. Bjelland I, Dahl AA, Haug TT, et al. The validity of the Hospital Anxiety and Depression Scale. An updated literature review. *J Psychosom Res.* 2002;52:69–77.
31. Sechrist KR, Walker SN, Pender NJ. Development and psychometric evaluation of the exercise benefits/barriers scale. *Res Nurs Health.* 1987;10:357–365.
32. Sherbourne CD, Stewart AL. The MOS social support survey. *Soc Sci Med.* 1991;32:705–714.
33. Moss-Morris R, Weinman J, Petrie KJ, et al. The revised illness perception questionnaire (IPQ-R). *Psychology & Health.* 2002;17:1–16.
34. Rea TD, Heckbert SR, Kaplan RC, et al. Body mass index and the risk of recurrent coronary events following acute myocardial infarction. *Am J Cardiol.* 2001;88:467–472.
35. Horne R, James D, Petrie K, et al. Patients' interpretation of symptoms as a cause of delay in reaching hospital during acute myocardial infarction. *Heart.* 2000;83:388–393.
36. Wiles R, Kinmonth A. Patients' understandings of heart attack: implications for prevention of recurrence. *Patient Educ Couns.* 2001;44:161–169.
37. Murray PJ. Rehabilitation information and health beliefs in the post-coronary patient: do we meet their information needs? *J Adv Nurs.* 1989;14:686–693.
38. Cardiac Care Network of Ontario. *The Ontario Cardiac Rehabilitation Pilot Project: Report and Recommendation.* Toronto: Cardiac Care Network of Ontario; 2002.
39. Kodis J, Smith KM, Arthur HM, et al. Changes in exercise capacity and lipids after clinic versus home-based aerobic training in coronary artery bypass graft surgery patients. *J Cardiopulm Rehabil.* 2001;21:31–36.
40. Brubaker PH, Rejeski WJ, Smith MJ, et al. A home-based maintenance exercise program after center-based cardiac rehabilitation: effects on blood lipids, body composition, and functional capacity. *J Cardiopulm Rehabil.* 2000;20:50–56.
41. Johnson NA, Heller RF. Prediction of patient nonadherence with home-based exercise for cardiac rehabilitation: the role of perceived barriers and perceived benefits. *Prev Med.* 1998;27:56–64.
42. Barber K, Stommel M, Kroll J, et al. Cardiac rehabilitation for community-based patients with myocardial infarction: factors predicting discharge recommendation and participation. *J Clin Epidemiol.* 2001;54:1025–1030.
43. Suskin N, Witherspoon G, Pellizzari J, et al. Physician endorsement improves cardiac rehabilitation participation, & feasibility of user fees. *Can J Cardiol.* 2000;16:208F.
44. Carney RM, Freedland KE, Eisen SA, et al. Major depression and medication adherence in elderly patients with coronary artery disease. *Health Psychol.* 1995;14:88–90.
45. Frasure-Smith N, Lesperance F, Talajic M. Depression following myocardial infarction. Impact on 6-month survival. *JAMA.* 1993;270:1819–1825.
46. Linden W, Stossel C, Maurice J. Psychosocial interventions for patients with coronary artery disease: a meta-analysis. *Arch Intern Med.* 1996;156:745–752.
47. Barhoumy G, Bitter M. Automating referral process with interactive voice response. *Health Manag Technol.* 1999;20:18, 20–21.
48. Crosswhite R, Beckham SH, Gray P, et al. Using a multidisciplinary automated discharge summary process to improve information management across the system. *Am J Manag Care.* 1997;3:473–479.