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THE HEALTH BELIEF MODEL AND ADHERENCE WITH A COMMUNITY CENTER-BASED, SUPERVISED CORONARY HEART DISEASE EXERCISE PROGRAM

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ABSTRACT: Some investigators have concluded that health beliefs do not influence the maintenance of coronary heart disease (CHD) exercise adherence. However, the beliefs tested have not been specific to CHD nor exercise. In addition, much of the research has been atheoretical. We conducted a retrospective study to explore the possibile utility of the Health Belief Model (HBM) for explaining attendance at a supervised CHD exercise program, based in a community center. Two dimensions of the model, general health motivation and perceived severity of CHD, were associated with attendance in the theoretically predicted direction, while a third dimension, perceived benefits of exercise, was associated in a direction opposite that predicted by the model. The model as a whole accounted for 29% (adjusted R^2) of the variance. This study provides some initial evidence that health beliefs are associated with CHD exercise adherence.

INTRODUCTION

Despite recent declines, coronary heart disease (CHD) remains the leading cause of mortality among Americans, responsible for over 500,000 deaths annually.[1,2] Research indicates that exercise may be useful for the primary prevention of CHD.[3] Indeed, physical inactivity has been found to be an independent risk factor with a magnitude of effect almost equal to that of the better known CHD risk factors.[1] Evidence also suggests that exercise may be effective for the treatment of CHD, by controlling blood lipids and clotting factors,[4] as well as for rehabilitation post-myocardial infarction.[5,6] However, potential benefits can be realized only if exercise regimens are adhered to.[6,7,8] On average 50% of people enrolled in exercise programs drop out within the first six months.[5] In clinical settings, non-

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compliance has been found to range from 11% to 87%.[9] To identify factors affecting exercise maintenance that might be modifiable through health education intervention, we conducted a retrospective study of a community center-based, supervised CHD exercise program, employing the Health Belief Model (HBM) as our theoretical framework.

Several types of variables appear to be associated with CHD exercise adherence. Biophysiologic/health factors found to influence compliance negatively include high percent body fat,[10,11] high body weight,[12] low maximum oxygen intake,[11,13] smoking,[11,14] and CHD symptom level,[10] although the evidence for symptom level is inconsistent.[15] A psychological factor found to be associated with adherence is self-motivation, conceptualized as a personality trait.[16] Social environmental variables, such as social support,[11,17,18] and program characteristics, such as program location[19] and intensity of exercise,[20] also appear to be of some importance.

Curiously, while attitudes and beliefs have been associated with the decision to join CHD exercise programs, several studies indicate that they are not correlated with maintenance over time.[13,16,17,19] Based on this evidence several authors have concluded that attitudinal dimensions, and health beliefs in particular, are determinants of initial involvement but not continued participation in formal exercise programs for the primary and secondary prevention of CHD.[6,9] This conclusion, however, may be premature in light of two limitations that characterize this body of research. First, general health beliefs rather than beliefs specific to the regimen and/or disease condition, e.g., exercise and CHD, have been investigated.[13,16,21,22] Yet, several cognitive theorists of health behaviors have noted that to be predictive, attitudes must be on the same level of specificity as the behaviors they are intended to predict.[23,24]

A second limitation is that much of the research has been atheoretical.[25,26] Although such well developed theoretical models as the Health Belief Model, Fishbein and Ajzen's theory of reasoned action, the Triandis model, and Bandura's theory of self-efficacy have been employed to explain participation in various types of physical activity (e.g., exercise as a lifestyle behavior,[27,28] weightlifting,[29] an exercise regimen for sports related injuries,[30] a college physical education skills class[31]), few studies have tested the power of these models for explaining adherence to structured CHD exercise programs. Some investigators have argued that descriptive, atheoretical research was a necessary first step in understanding the compliance phenomenon in the context of formal CHD exercise programs.[32] It has been suggested, however, that at this time advancement in knowledge can be achieved only by testing hypotheses which have been either deduced from existing theoretical formulations or induced from data which have been accumulated on exercise adherence.[26]

Doubtlessly, one of the most robust theoretical models of health behaviors is the HBM. It has been used for explaining preventive, protective, illness, and sick role behaviors.[24,33,34] It has not, however, been extensively tested with regard to adherence to exercise programs for CHD.[32]

Since its initial formulation the HBM has undergone some modification.[35] In one frequently employed reformulation, Becker and colleagues have enlarged the model to include three broad beliefs: (1) general health motivation, (2) perception of the threat-value of a specific disease, and (3) perception of the effectiveness of a specific health behavior for reducing that threat.[36-39] The model assumes that beliefs work together to determine health actions. Accordingly, an individual who is positively motivated towards health and perceives a disease as threatening and a particular behavior as threat-reducing, is more likely to engage in that behavior than someone who lacks any one of these beliefs. The model further specifies both perception of threat and threat-reduction. A disease is likely to be perceived as threatening to the degree that the individual believes him/herself to be susceptible to it and believes the disease to be severe. Threat-reduction is viewed as perception of the capacity of a health behavior to bring about desired outcomes minus perception of costs (i.e., barriers) involved in carrying out that behavior.

A search of the literature uncovered five studies on the HBM and exercise adherence, two concerning CHD prevention and three CHD rehabilitation. Investigating adherence to an individualized exercise regimen for general fitness and CHD primary prevention among a sample of firefighters, Lindsay-Reid and Osborn[40] found perceived susceptibility and perceived benefits of personal health action to be inversely correlated with adherence, a direction opposite that predicted by the HBM. Morgan, Shephard, Finucane, Schimmelfing and Jazmaji[41] found that HBM items were unable to distinguish between "exercise-adopters" and "non-exercise-adopters" at a workplace employee fitness program. Tirrel and Hart,[42] studying a sample of patients who were prescribed individualized exercise regimens for rehabilitation after coronary artery bypass surgery, found the fewer the perceived barriers, the greater the adherence. Perceived susceptibility, however, was again associated in a direction opposite that predicted by the theory. Robertson and Keller,[43] investigating a similar group of patients, also found perceived barriers to be inversely related with exercise compliance. Lastly, Oldridge and Streiner[44] found, again contrary to what was expected, the greater the perceived susceptibility, the greater the likelihood of dropping out of a rehabilitation exercise program. Cues to action, another HBM dimension, was found to be predictive of dropout in a theoretically meaningful direction.

As others have pointed out,[45] most of these studies did not adequately test the HBM as a whole. Either important dimensions of the model were omitted[40,43] or they were defined in non-traditional ways.[40,42] Further, in two studies, only univariate analyses were conducted.[41,42]

The manner in which the dependent variable, exercise adherence, was measured in these studies is also problematic. Two studies[42,43] employed respondent self-reports, which as Perkins and Epstein[46] have noted, may not accurately reflect true behavior. In the study by Lindsay-Reid and Osborn,[40] the dependent measure appears to have been constructed by combining people who never started exercising with those who started but eventually discontinued. This means the measure confounds adoption with maintenance of an exercise program. As such, significant associations may be due to the influence of health beliefs on adoption rather on maintenance of exercise regimens. Finally, Morgan et al.[41] did not adequately define "exercise-adopters" and "non-exercise-adopters."

One additional noteworthy limitation of this body of research concerns its external validity. Most of these studies investigated the utility of the HBM for explaining adherence with an unsupervised exercise regimen, which was to be carried out either at home, or at a corporate or university-based exercise facility. The usefulness of the HBM for explaining adherence with supervised CHD exercise programs and/or exercise programs conducted in a different type of setting, such as a community center, remains unexplored.

Given these limitations, we agree with others who have called for additional research on the HBM and exercise adherence,[21,32] Such research appears all the more warranted in light of the fact that exercise researchers have offered different opinions about the potential usefulness of the HBM in this context.[21,32,47]

METHODS

The Coronary Detection and Intervention Center (CDIC), located at the 92nd Street YM-YWHA in New York City, provides a comprehensive program for the prevention, detection and treatment of coronary disease. Individuals may be referred to the CDIC by their physicians or may be self-referred. After medical screening, each client receives an individualized aerobic exercise regimen geared to meet his/her specific health and fitness needs. Participants join for a six month period and are expected to exercise for three half-hour sessions at the CDIC each week. As part of the routine operating procedures of the program, attendance records are kept on all participants.

We identified all CDIC clients who had completed the program (i.e., whose six month enrollment period had elapsed) during the year and a half immediately prior to the time we began data collection. Of these 83 individuals, we were able to interview 57 by telephone, a 69% response rate. Most nonrespondents could not be contacted; a few were contacted but declined to participate. Previously published studies on exercise adherence have utilized samples equivalent in size to ours or even smaller.[11,12] Further, a response rate of about 70% is not unusual for studies of this kind.[12,48] Indeed, rates as low as 56% have been reported.[49]

In Table 1 we present a profile of the sociodemographic as well as CHD risk and clinical characteristics of our sample. As can be seen the 57 subjects were predominantly middle-aged. The majority were male. Most were highly educated, i.e., a majority had graduated college and about a third had post-graduate degrees. Although data on race were not collected, CDIC clients tend to be White. In a study conducted previously only 15% of the CDIC program participants were non-White.[13] In spite of the fact that few subjects smoked, a majority of the sample were at risk of developing CHD, given their sedenatary occupations and their family history of heart attack. Indeed, about one third already had a heart attack. In addition, about a third reported that they had high blood pressure and a little less than one fifth indicated they had atherosclerosis. Regarding symptomotology, somewhat less than half of the sample indicated that they easily get short of breath after exertion and about one fourth said that they have chest pain on occassion.

A questionnaire to measure the dimensions of the HBM as they relate to coronary heart disease and exercise was developed specifically for the present research. This was accomplished by first adopting conventionally agreed upon definitions of the model's dimensions and then modifying questionnaire items other investigators have used in other contexts to operationalize those definitions.[36,39,50,51] Although this procedure yielded a lengthy list of appropriate items, we employed a smaller proportion of those items than originally intended. During the pretesting, the questionnaire was found to be too long for telephone interviewing.[52] Repetitive items included to increase reliability were consequently dropped.[53]

General health motivation was operationalized in terms of two measures. The first measure consisted of two items that assessed general concern with health (e.g., "How concerned are you about getting sick?"). The

TABLE 1

Sociodemographic, CHD Risk and Clinical Characteristics of the Sample

Age	56 (10.4)[a]
Gender	
Males	72[b]
Females	28
Educational Level	
Some High School and Below	2
High School Graduate	14
Some College	26
College Graduate	21
Some Graduate School	2
Graduate Degree	35
Smokes	
Yes	12
No	88
Sedentary Occupation	
Yes	63
No	37
Family History of Heart Attack or Stroke	
Yes	72
No	28
History of Heart Attack	
Yes	35
No	65
History of High Blood Pressure	
Yes	37
No	63
History of Atherosclerosis	
Yes	18
No	82
Easily Short of Breath after Exertion	
Yes	42
No	58
Chest Pain on Occasion	
Yes	25
No	75

[a]These numbers represent, respectively, the mean and standard deviation.
[b]These and all subsequent numbers represent percentages.

second measure also consisted of two items that assessed whether subjects' engaged in special health practices (e.g., "Do you buy special foods to improve or protect your health?"). Perceived susceptibility was measured in terms of four items that concerned beliefs about the likelihood of developing various forms of CHD and of getting sick in general (e.g., "Taking all possible factors into consideration, what do you think your chances are of getting a heart attack?"). Perceived severity was operationalized in terms of three items regarding being worried about having a heart condition as well as regarding beliefs about its seriousness and disabling effect on normal activities (e.g., "If you had coronary heart disease, how much do you think it would interfere with your normal activities?"). Perceived benefits was measured by four items regarding beliefs about the extent to which CHD can be controlled and about the effectiveness of exercise for preventing CHD (e.g., "How helpful do you think an exercise program is in preventing CHD?"). Perceived costs was operationalized in terms of three items concerning: the time, effort, and fees associated with exercising; the potential health problems that may result from exercising; and the degree to which exercising interferes with normal acitivities (e.g., "How much do you feel that having to exercise regularly interferes with your normal activities?"). All of these operationalizations are consistent with measures of the HBM employed in previous research.[36,39,50,51]

Most questionnaire items were followed by a Likert-type answer option that was scaled to range from 0 to 1. Multiple-item indices were constructed by summing and then dividing by the number of answered items. Generally, the higher the index score, i.e., the closer to 1, the greater the concern with health, the greater the perceived severity of CHD, etc.

As can be seen in Table 2, the internal consistency reliability of our measures, assessed using Cronbach's alpha, ranged from .44 to .73. Several studies evaluating the psychometric properties of various operationalizations of the dimensions of the HBM have reported equivalent reliability coefficients.[54,55] Our coefficients, however, are lower than those reported by Maiman and associates who used items quite similar to ours.[51] Curiously, the items that we employed for perceived costs were found to be weakly correlated, indicating that they tapped distinct dimensions of the construct. Given that these items could not legitimately be combined into a composite score, we decided to treat them as separate indicators.

Adherence, the study's dependent variable, was defined in terms of the number of exercise sessions attended. Attendance is a conventionally accepted measure of adherence within the exercise literature. Indeed, it has been the most common index of exercise adherence.[46,56] Attendance data were abstracted from the exercise logs kept on file at the CDIC.

RESULTS

Means and standard deviations for the HBM independent variables and also for our adherence measure are presented in Table 2. Using .5, the midpoint of each measure's potential range, as a cutpoint, these data indicate that on average the sample of CDIC clients perceived CHD as severe, perceived exercise as beneficial, were concerned with health and engaged in special health practices. In contrast, they tended not to see themselves as susceptible to CHD nor see exercise as presenting barriers in terms of cost, health problems, or interference with normal activities. With regard to exercise adherence, subjects attended an average of 31 sessions over the six months of the CDIC program. The minimum and maximum number of sessions attended were, respectively, 1 and 69.

Also in Table 2 we report the zero-order correlations between the HBM independent variables and our exercise adherence measure. As indicated, three of the variables, special health practices, perceived severity of CHD, and perceived costs measured in terms of exercising's capacity to cause health problems, exhibited statistically significant but modest associations with attendance when unadjusted for the other HBM variables. Two of the three variables were in the theoretically predicted direction, one, perceived costs, was not.

To determine the explanatory power of the HBM as a whole as well as the unique contribution made by each component of the model, multiple linear regression was used. Specifically, number of exercise sessions attended was regressed on all of the HBM variables simultaneously. The results of the analysis are presented in Table 3. The model as a whole accounted for 29% (adjusted R^2) of the variance in exercise attendance ($F(8,46) = 3.719$, $p = .002$). Further, three HBM dimensions were found to be significant: special health practices, perceived severity of CHD, and perceived benefits of exercise. The former two variables were associated with attendance in the expected direction, the third variable, perceived benefits, in a direction opposite that predicted by the model.

We conducted several checks on our final regression results. First, we conducted a residual analysis to determine if our data fit the underlying assumptions of linear regression. Second, the residual analysis also provided information on whether there were any outliers in our data set that could have unduly influenced our findings. The analysis indicated that our data were appropriate for linear regression. In addition, none of our cases were found to be outliers, defined in terms of having a standardized re-

TABLE 2

The Health Belief Model and Exercise Adherence Variables: Alpha Values, Descriptive Statistics, and Zero-Order Correlations

Variables	*Alpha Values*	*Means*	*Standard Deviations*	*Correlation with Attendance*
General Health Motivation				
General Health Concern	.58	.55	.24	.06
Special Health Practices	.44	.58	.38	.39*
Perceived Susceptibility to CHD	.51	.33	.15	−.14
Perceived Severity of CHD	.71	.79	.21	.38*
Perceived Benefits of Exercise	.73	.63	.19	−.07
Perceived Costs of Exercise				
Time, Effort, Fee Costs		.19	.20	−.12
Health Problems		.23	.19	.35*
Interference with Activities		.36	.26	−.15
Attendance		31	20	

*$p < .05$.

TABLE 3

The Linear Regression of Number of Exercise Sessions Attended on the Dimensions of the Health Belief Model

Health Beliefs	*B*	*Beta*
General Health Motivation		
General Health Concern	−1.104	−.013
Special Health Practices	17.542**	.338
Perceived Susceptibility to CHD	−25.389	−.187
Perceived Severity of CHD	28.401*	.298
Perceived Benefits of Exercise	−28.673*	−.272
Perceived Costs of Exercise		
Time, Effort, Fee Costs	−18.268	−.183
Health Problems	22.916	.215
Interference with Activities	−3.702	−.049
Intercept	24.921	

*$p < .05$.
**$p < .01$.

sidual score of 3 or greater.[57] Indeed, the largest standardized residual was 1.8.

We also explored the possibility that the associations between the dimensions of the HBM and attendance could have been spurious due to uncontrolled extraneous variables. Given that fitness status and CHD symptom level have been found to be associated with exercise adherence[10-15] and that they may conceivably also be related to health beliefs, we reasoned that fitness/CHD symptom level might have confounded our results. We were able to construct a fitness/CHD symptom level measure from four items in our questionnaire. Specifically, the items assessed whether the respondent had a sedenatary occupation, smoked, suffered chest pains or shortness of breath. The zero-order correlation between this variable and attendance was -.03, suggesting that the variable could not have confounded our results. Indeed, when we reran the regression, controlling for fitness/CHD symptom level, the initial relationships between the HBM variables and attendance remained unchanged (data not shown). We also reran the regression controlling for age, gender, and educational level. Again, the results of the analysis remained unchanged (data not shown).

One additional analysis was considered. It will be recalled that 35% of our sample had had a myocardial infarction (MI). This meant that some of our subjects were exercising as a preventive behavior and others as a sick-role behavior. The question arose whether health beliefs and attendance were associated similarly across subjects exhibiting these two types of health behaviors. To explore this we calculated the zero-order correlations between health beliefs and attendance separately for the non-MI and MI subjects (Table 4). For most of the variables the differences in coefficients between the two groups, expressed in terms of the amount of explained variance,[58] did not exceed 9%. Such differences have been categorized by Cohen[58] as small effects. Only for perceived severity was the difference in explained variance of moderate size. Given the number of subjects in our non-MI (N=37) and MI (N=20) groups, the statistical power, or put otherwise, probability of finding such differences significant at the .05 alpha level, ranged between .00 and .39. (Table 4), substantially less than the conventionally accepted minimum level of .80. Power analysis conducted directly on the regression coefficients for the crossproduct terms betweenhealth beliefs and non-MI/MI status confirmed that our study lacked adequate power to test for these interactions. At the very least, we can state, however, that if differences exist in the associations of health beliefs with attendance between those exercising for preventive versus sick-role reasons, those differences for the most part appear to be small.

TABLE 4

Zero-Order Correlations Between Dimensions of the Health Belief Model and Number of Exercise Sessions Attended for Subjects with and Without Myocardial Infarction

	Correlation Coefficients			
Health Beliefs	*Non-MI*	*MI*	$r^2_{group\,1} - r^2_{group\,2}$	*Power Range*
General Health Motivation				
General Health Concern	.31	.43	8.90%	.06-.10
Special Health Practices	−.01	.20	3.99%	.10-.18
Perceived Susceptibility to CHD	−.12	−.004	1.43%	.06-.10
Perceived Severity of CHD	.27	.55	23.0%	.18-.27
Perceived Benefits of Exercise	.12	−.32	8.80%	.27-.39
Perceived Costs of Exercise				
Time, Effort, Fee Costs	−.31	.11	8.40%	.27-.39
Health Problems	.34	.41	5.25%	.00-.06
Interference with Activities	−.14	.02	1.92%	.06-.10

DISCUSSION

In contrast to much of the published literature on the HBM and CHD exercise adherence, the present study tested the model in its entirety. That is to say, it operationalized all of the major dimensions of the model, using standardized definitions, as well as employed a multivariate analysis to determine the explanatory power of the model as a whole as well as of its individual components. In addition, in our study adherence was measured through archival-type data, as opposed to subjective self-reports. Also noteworthy, we investigated the model in the context of a community center-based, supervised CHD exercise program. To our knowledge this has not been done previously.

As hypothesized, we found evidence that attitudes were associated with exercise adherence, and, for the most part, in theoretically meaningful ways. Specifically, both general health motivation, measured in terms of special health practices, and perceived severity of CHD were positively correlated with the number of sessions attended. Although suggestive of a possible causal role of attitudes in CHD exercise maintenance, our results must be considered preliminary for several reasons.

It will be recalled that we employed a retrospective design. Subjects were questioned on their health beliefs only after their six month enrollment period had elapsed. As such, the associations we uncovered may exist because adherence impacted on beliefs. Such a dynamic might explain the inverse relationship between perceived benefits of exercise and attendance. That is, people who exercise on a routine basis might come to the conclusion that they cannot prevent or control heart disease. It is also possible that subjects modified their health beliefs to reduce cognitive dissonance.[59-62] For instance, subjects who initially perceived CHD as severe but failed to exercise might have altered their beliefs to render them more consistent with their behavior.

Somewhat surprisingly, the questionnaire items we had developed, based on other investigators' operationalizations of the dimensions of the HBM, yielded measures with at best modest reliabilities. As a consequence, our measures may have underestimated the magnitude of the associations between the HBM dimensions and exercise adherence.

Exercise adherence was measured in terms of number of sessions attended. Attendance has an apparent objectivity and face validity as a measure of adherence.[46] It, however, also contains certain limitations. Specifically, it provides no indication of whether an exercise regimen was carried out with the frequency, intensity, and duration necessary to achieve program objectives. It is also possible that people may have attended the same absolute number of sessions but in quite different patterns. It may be that health beliefs are differentially associated with distinct patterns of attendance. Unfortunately, given our sample size, we were unable to test for this possibility.

Lastly, our results may have been somewhat affected by selection processess. Our sampling frame of exercise partipants was limited to clients of the CDIC. Although exercise adherence studies, indeed compliance studies in general, usually restrict their investigations to only one program or clinical setting, it must be acknowledged that doing so may impact on both the internal as well as external validity of study findings. Also quite typical, not all potential participants were successfully recruited into our study. Specifically, 31% of the clients were either unreachable or refused to participate. This too may have affected our findings.

In light of the above, our results must be interpreted with caution. Although not allowing for causal inference regarding the influence of health attitudes on exercise adherence, our findings do raise some question about the belief that health attitudes only affect exercise initiation. In addition, our findings provide justification for conducting a prospective study on the HBM and CHD exercise adherence. Should such a study confirm that health beliefs are predictive of compliance, it would be warranted then to develop and evaluate educational strategies, using the HBM as a guiding theoretical framework, for enhancing CHD exercise adherence.

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