1994

Structural equation modeling of health belief model influences on exercise behavior among medical center employees

Charles Michael Cychosz

Iowa State University

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Structural equation modeling of health belief model influences on exercise behavior among medical center employees

Cychosz, Charles Michael, Ph.D.

Iowa State University, 1994
Structural equation modeling of health belief model influences on exercise behavior among medical center employees

by

Charles Michael Cychosz

A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of DOCTOR OF PHILOSOPHY

Department: Professional Studies in Education
Major: Education (Research and Evaluation)

Approved:

Signature was redacted for privacy.

In Charge of Major Work
Signature was redacted for privacy.

For the Department and Education Major
Signature was redacted for privacy.

For the Graduate College

Iowa State University
Ames, Iowa
1994
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INTRODUCTION

Background for the Study

The health of adults in today's society is a topic of growing concern. In spite of tremendous expenditures on health care, life expectancy and health status have begun to level off among American adults. This has resulted in a renewed emphasis on prevention and health promotion strategies because they offer the greatest potential contribution to improved health status. Regular aerobic exercise is one of the most promising preventive strategies employed in contemporary health promotion programs. Practitioners in medicine and health promotion continue to be very interested in developing a better understanding of adult decisions about exercise because of its potential for improving health.

Exercise and Health Promotion

Exercise is increasingly recognized for its important role in sustaining physical and mental health (King, Taylor, Haskell & DeBusk, 1989; Martin and Dubbert, 1982; Powell, Thompson, Caspersen & Kendrick, 1987). Beneficial or preventive effects have been cited for coronary heart disease (Haskell, 1984, Paffenbarger & Hale, 1975, Paffenbarger, Wing & Hyde 1978, Siscovick, 1982), diabetes (Richter & Schneider 1981) generalized immunological response (Simon, 1984), cancer (Sternfeld, 1992) hypertension (Gibbons, Blair, Cooper &
Smith, 1983; Roman, Cammuzzi, Villalon & Klenner, 1981) and osteoporosis (Aloia, 1981; Krolner, Toft, Nielsen & Tandewold, 1983). Physical exercise has also been associated with diminished stress reactivity (Crews & Landers, 1987) and diminished depression (Berger & Owen, 1983; Blumenthal, Williams, Needles & Wallace, 1982). As the medical cost of these diseases continues to grow, the public is increasingly being encouraged to engage in preventive activities such as exercise.

Public acceptability of exercise has grown considerably in recent years due, in part, to the promotion of its health benefits. In spite of this growing awareness, the level of participation in exercise behavior has remained relatively constant (Stephens, 1987; Stephens, Jacobs & White, 1985). People in the United States today have greater knowledge of health-related benefits associated with exercise and also indicate a greater interest in participating than in the past. However, this increase in public awareness and interest has not resulted in dramatic increases in regular exercise. Only 15-20% of the adult population exercise as vigorously as the American College of Sports Medicine recommends and fifty percent of those who start an exercise program drop out within a year (American College of Sports Medicine, 1978; Dishman, Sallis and Orenstein, 1985; Stephens, Jacobs & White 1987).
The failure of most adults to develop regular exercise patterns is an issue of growing importance due to a combination of the increasingly sedentary nature of work, a rapidly expanding older population, and the long incubation period of the chronic diseases associated with a sedentary lifestyle (Buskirk, 1990). The relative lack of success in bringing about widespread change in exercise behavior has, in recent years, focused attention on systematic approaches to behavior change. These approaches, often referred to collectively as health promotion, are increasingly being touted as desirable and necessary alternatives to medical interventions (Paffenbarger, Hyde & Wing, 1990; Shepard, 1990).

Health promotion programs are already in place or are being developed in many medium and large business settings across the country (Gibbs, Mulvaney, Henes & Reed, 1985). Exercise is often the central component in these programs. Careful economic analyses have reached varying conclusions about the cost-effectiveness of such programs in general (Warner, 1987; Warner, Wickizer, Wolfe, Schildroth & Samuelson, 1988) and the exercise component in particular (Keeler, Manning, Newhouse, Sloss & Wasserman, 1989). An important impediment to the achievement of cost-effective outcomes is failure to develop long-term adherence to changes in health behavior. Nonetheless, economic benefits continue
to be an important motivation for the development of fitness programs in the workplace (Herzlinger & Calkins, 1986). The growing public interest in exercise and the proliferation of workplace programs have generated additional demand for research-related insight into exercise adoption and participation.

**Predicting Exercise Behavior**

Health-related behavior has been explored by a number of researchers in the last 50 years. This research has generally focused on prediction of behavior using both internal and external influences. Internal influences include such things as motivation and expectations of success. External influences include rewards or incentives and significant life events or experiences.

**Internal Influences**

Much of the research on exercise behavior has emphasized cognitive models which examine the relations among internal influences and behavior patterns. This approach, typically attributed to Lewin, Dembo, Festinger & Sears (1944), is generally referred to as the value-expectancy approach to decision-making and the models are referred to as value-expectancy models. In this view, the attitude toward a behavior is a function of the value one assigns to the perceived consequences of the behavior. The value judgment is
then mediated both by the perceived probability of those consequences and subjective norms (one's perception of the extent others think one should engage in the behavior). For more complex behaviors, the extent to which one believes they have personal control of the behavior becomes an additional factor in the development of expectations. This has been described as behavioral (Ajzen, 1991) or volitional control (Ajzen & Madden, 1986).

The emphasis on expectations as an important component of motivation is common to most of the theoretical approaches to health behavior. Expectations regarding the benefits associated with the behavior are often distinguished from expectations regarding one's ability to behave in a given manner or perform certain tasks. For example, one value-expectancy model derives from Bandura's (1977) Social Learning Theory and includes both outcome expectations and efficacy expectations as explicit components. In a similar way, another value-expectancy model, the Health Belief Model (HBM; Becker, Maiman, Kirscht, Haefner, Drachman & Taylor, 1979), includes perceived benefits and perceived barriers as indicators of cognitive expectations about the value of a particular behavior. In either case, the person's expectations are seen as modifiable components of the cognitive processes underlying health related decisions. Thus, the expectations component of the model is typically the
basis for educational efforts or program activities intended to encourage the initiation or continuation of the health behavior.

In addition, Kasl and Cobb (1966a, 1966b) provided an important contribution to the value-expectancy models of health behavior when they differentiated between health behavior, illness behavior, and sick-role behavior. Health behavior was defined as the activities undertaken to prevent or detect disease in an asymptomatic state. Examples of health behavior include exercise, smoking control, dietary changes, or participation in disease screenings. Illness behavior was defined as activity directed toward determining whether one was ill as well as toward seeking treatment. Sick-role behavior was the cluster of activities one engages in while attempting to get well. Kasl and Cobb (1966a, 1966b) suggested that the motivational nature of these three roles were sufficiently different that they needed to be considered separately.

The examination of health behavior as a separate entity extended from their work and was included in ensuing efforts to develop theoretical models, most notably the Health Belief Model (Rosenstock, 1974). Indeed, Bandura (1977), Becker, Maiman, Kirscht, Haefner, Drachman and Taylor (1977), Kirscht (1983); Slenker, Price, Roberts and Jurs (1984) and others have argued that the principle of specificity should be
extended to the examination of specific health behaviors such as running, flossing, or self-examinations. In general, attitude-expectancy theorists agree that the most predictive models are conceptualized as specific to a given behavior rather than more broadly construed (Eagly, 1992).

While value-expectancy models are not the only approach to creating a theoretical model of exercise behavior, the advantage they offer is the ease with which logical interventions can be derived. For example, if one discovers that a certain set of behavioral consequences are particularly motivational, it is generally a straightforward matter to develop program strategies which address these consequences. This makes them intuitively attractive to researchers and practitioners alike.

**External Influences**

In contrast to these internal or cognitive processes, other researchers have examined the impact of external influences on behavior. In the most primitive sense, external influences are evident in the results of conditioning experiments on animals and later, on human subjects. Current perspectives (Eagly, 1992) on this issue suggest that external influences may be mediated by the aforementioned cognitive processes. Nonetheless, the presence of some of these external influences is perceived to have some impact on the process.
With respect to health behaviors, rewards and incentives are the most common external influences examined in the research (Dunbar, Marshall & Hovell 1979). Monetary rewards and other benefits of perceived personal value are often suggested as motivating or reinforcing components of programs (Dishman, 1990). As Winnit, King & Altman (1989) point out, however, the actual mechanism underlying the incentive effect is poorly understood but can be accommodated by most cognitive models of health behavior.

A second common external factor is specific experiences. Haefner, Kegeles, Kirscht & Rosenstock (1967) examined the applicability of the Health Belief Model in a national study of preventive health behavior and noted that changes in behavior are often triggered by a particular event or experience. They argue that the individual is predisposed to act in a particular way but does not necessarily do so until the triggering event occurs. For example, the experience of narrowly avoiding an automobile crash can be the event which triggers seat belt use. This stimulus may be internal (such as symptoms) or external (interpersonal interactions or media messages). In most cases of preventive health behavior, these triggering events are operationalized as some sort of short-term benefit or an experience that makes abstract information more relevant. In the Health Belief Model these triggering events are specifically identified as Cues to Action (Becker,
Thus, external influences such as rewards, incentives, and triggering events also have some influence on health behaviors. The Health Belief Model is one value-expectancy model which accommodates these external influences by specifically identifying Benefits and Cues to Action as components of the model.

Summary

Regular physical exercise contributes to one's physical and mental health. This contribution is increasingly important in American society with sedentary jobs, escalating health care costs, and an increasing proportion of older citizens. Nonetheless, persisting in an exercise program continues to be difficult for many adults.

Participation in an exercise program evolves from a variety of influences acting on an individual. Previous research has established that internal influences such as motivation and expectations combine with external influences such as individual experiences to ultimately influence the behavioral outcome. More recent research indicates that some cue may be necessary to actually trigger the behavior even when the propensity to act exists. Specific measures of attitudes or perceptions, often reflected in value expectancy models such as the Health Belief Model, are typically
developed as predictors of specific behaviors such as exercise. The Health Belief Model is a specific value-expectancy model which has been utilized as a framework for examining the effects of both internal and external influences on health behaviors. While the application of value-expectancy models to exercise prediction has shown promise, additional research is necessary to assess its effectiveness.

Statement of the Problem

This study is designed to investigate the utility of the Health Belief Model Inventory (HBMI) in explaining exercise behavior among adult employees of a large regional medical center. The study has two components.

The first component will consist of the examination of the factor structure of the revised Health Belief Model Inventory. Since this aspect of the study is essentially a follow-up of the initial psychometric work on this inventory, this will be treated as a confirmatory factor analysis (Bollen, 1989). In addition, this component of the study will explore whether Perceived Physical Ability is distinct from the other constructs in the revised Health Belief Model Inventory.

The second component of the study will test the strength of the relationships among the various components of the HBMI,
Perceived Physical Ability, and exercise behavior. Specifically, this aspect of the study will employ causal modeling techniques to develop and compare models of the relationship among the variables and their ability to predict exercise behavior.

The initial model will be derived from Rosenstock's (1974) conceptualization of the HBM components. In this situation, perceived benefits, perceived barriers, perceived susceptibility, social influences, and cues to action are used to predict exercise behavior. Subsequently, perceived physical ability is tested for its contribution to the model. Finally a fully recursive model with all predictors included will be examined among high intensity and low intensity exercisers in order to explore differences in motivational patterns.

Statement of Assumptions

The assumptions made in conducting this study are as follows:
1. The Health Belief Model Inventory (HBMI) and Perceived Physical Ability (PPA) subscale of the Physical Self Efficacy Scale (PSES) include all of the significant variables affecting compliance with exercise.
2. Self-report exercise information is indicative of individual's actual behavior.
3. The HBMI and PPA accurately measure the various constructs which influence exercise behavior.

Limitations of the Study

An important limitation of this study is the use of cross sectional data to explore a causal relationships. This limitation is particularly important because there is very little evidence to use in judging whether the factors which cause one to initiate exercise behavior are similar to the factors which sustain the behavior. The results must be interpreted in terms of predicting current behavior rather than future behavior.

A second limitation stems from the moderate response rate of those employees surveyed. With 45% of the subjects responding, it is likely that the sample is not entirely representative of the general medical center population. Unfortunately, no demographic profile of the workers was available to allow further examination of this issue. This sample was also more physically active than the general public. For this reason, results may not be representative of the general adult population.

A third limitation stems from the fact that this was a health-related work environment with an on-site health promotion facility. This may have contributed to the attitudes reported by subjects in this study. While it is not
unusual to have an emphasis on health issues in the workplace, it is also important to note that there are a number of worksite settings with much less health-related information available to employees. As a result of this, the attitudes of employees may be different in other setting and the findings of this study may not be applicable to other worksite environments.

Explanation of the Dissertation Format

This dissertation includes a general introduction and literature review, two papers for submission to scholarly journals, and additional analyses. A general summary is also included. References for all sections are included at the end.

The first paper, "Confirmatory Factor Analysis of a Health Belief Model Inventory with an Adult Worksite Population", examines the measurement characteristics of the Health Belief Model Inventory. It will be submitted to Health Education Quarterly.

The second paper, "Structural Equation Models of Exercise Compliance in an Adult Worksite Population", tests causal models derived from Health Belief Model theory. This paper will be submitted to the Research Quarterly in Exercise and Sport.
The Iowa State University Committee on the Use of Human Subjects in Research and the Iowa Methodist Hospital Committee on Human Subjects in Research reviewed this project and concluded that individuals were adequately informed of the risks and benefits involved with participation, the measures intended to protect their confidentiality, and the conditions on their participation.
REVIEW OF RELATED LITERATURE

The literature review will include sections on the Health Belief Model, self-efficacy, measures of exercise behavior, and structural equation modeling. Since the HBM is of substantive importance in both papers, it is reviewed first and in greatest detail. For the second paper, self-efficacy is added to the predictor variable set and exercise behavior is the outcome variable.

Health Belief Model Research

Historical Overview

The Health Belief Model was developed in the 1950's by Hochbaum, Kegeles, Leventhal, and Rosenstock, a group of social psychologists (Becker, Maiman, Kirscht, Haefner, Drachman & Taylor, 1979). It uses several sets of attitudes to predict the likelihood of a given health behavior. The exploration of attitudes as motivational phenomena relies heavily on value expectancy theory and cognitive traditions in social psychology.

The cognitive theories involve individual judgments and perceptions as predictors of behavior. In the value expectancy approach, decisions emanate from specific attitudes and perceptions rather than more general attitudes or dispositions. As noted earlier, the value expectancy tradition derives from the work of Lewin, Dembo, Festinger and
Sears (1944) in developing a general model for relating psychology to behavior. Lewin (1951) in particular has written extensively about general social psychological models which integrate both the individual and the context. The value expectancy perspective emphasizes the individual's perception of the value of a particular behavior or course of action (Lewin, 1951). Judgments about the relative value derive in part from the salience of the need which the behavior satisfies and in part from the effectiveness with which it satisfies that need. Phenomena which occur outside the individual are accommodated through the perceptions and judgments the individual makes regarding them. Eagly (1992) explains the rationale for including external influences in this manner when she states that more general attitudes often "come to mind" and may serve as context for a decision, however, it is the value expectancy models which best predict a particular course of action.

Although Lewin's early work was not directed specifically at explaining health-related behavior, the Health Belief Model derives from this social-psychological tradition and its success in relating specific attitudes with behavior. Initially, the Health Belief Model was an attempt to understand why people did not accept disease prevention and early detection practices (Rosenstock, 1974). It was subsequently adapted to situations involving patients'
responses to treatment and compliance with medical regimens (Becker, 1974; Kirscht, 1974) and also to sick-role behavior (Becker, Drachman & Kirscht, 1972).

Consistent with the value expectancy tradition (Lewin, Dembo, Festinger & Sears, 1944), the general model hypothesizes that behavior derives from the value placed on a particular goal and the individual's estimate of the likelihood of achieving the goal (Maiman & Becker, 1974). These general concepts were translated into the following HBM dimensions (Janz & Becker, 1984):

- **Perceived susceptibility**—subjective perceptions of the risk of contracting a condition.
- **Perceived severity**—medical/clinical and social consequences associated with a condition.
- **Perceived benefits**—beliefs regarding the feasibility and efficaciousness of a recommended health action.
- **Perceived barriers**—potential negative aspect of or impediments to undertaking the recommended behavior.

Rosenstock (1974) described the expected relationship of these components: "the combined levels of susceptibility and severity provided the energy or force to act and the perception of benefits (less barriers) provided a preferred path of action." (p. 332). This relationship is displayed in Figure 1. Thus, susceptibility and severity are general motivating components while benefits and barriers are
Figure 1. Original formulation of the health belief model.

associated with specific responses to a given situation.

Other researchers examining health behavior have identified very similar ideas about the components of these decisions. Turk, Rudy and Salovey (1984) used multidimensional scaling to explore the dimensionality of protective health behaviors. Their primary findings emphasized two dimensions, effort and effectiveness. Effort is similar to barriers in that both constructs emanate from perceptions about the amount of "force" necessary to act. Turk, Rudy and Salovey's (1984) construct of effectiveness is captured in the HBM relationship of susceptibility to the condition and benefits of a given action. Thus, the basic tenets of the Health Belief Model emerge even as these phenomena are explored from other analytical perspectives.

The relationship of the specific components of the Health Belief Model to health behavior has been examined by a number of researchers. Susceptibility, benefits, and barriers were generally found to contribute to the prediction of health behavior. The findings with respect to severity were mixed. The next section of the review will examine research on each of these components in more detail.

**Susceptibility**

Studies examining susceptibility have generally found a positive, significant relationship between perceived
susceptibility and preventive health behavior. These include swine flu inoculation among adults and senior citizens (Aho, 1979; Cummings, Jette & Brock, 1979; Rundall & Wheeler, 1979), influenza inoculation among patients at risk of flu-related complications (Larson, Olsen, Cole & Shortell 1979), and adult smokers (Weinberger, Greene & Mamlin, 1981). In all of these studies, perceived susceptibility significantly contributed to compliance with the recommended behavior.

One study of preventive health behavior reported a markedly different finding for susceptibility. Langlie (1977) used the Health Belief Model among a random sample of 383 adults to predict a cluster of preventive health behaviors in what were termed behaviorally consistent and behaviorally inconsistent groups. The consistent group was defined as having at least 8 of the 11 preventive health behavior (PHB) subscale scores above, below, or within one standard deviation of the mean for their gender. Behaviorally inconsistent subjects were those whose scores fell outside of these parameters. He found a negative relationship between susceptibility and preventive health behaviors in the consistent subjects and no relationship in the inconsistent group. This finding is rather unique among the HBM studies reported in the literature.

The reason for Langlie's different findings probably stems from the fact that his study attempts to aggregate both
preventive health behaviors and HBM constructs. This strategy deviates markedly from the general tendency to focus on the prediction of a single specific behavior. Because this study examined such a range of behaviors, the role of susceptibility as a motivating component for any specific behavior is not captured in the data. The best interpretation of these results would relate the findings to general attitudes rather than the prediction of specific health behavior. Thus, Langlie's study is not necessarily representative of the value expectancy traditions of the Health Belief Model because it attempts to aggregate behaviors.

Severity

Severity was examined in several studies and showed a less pronounced relationship with preventive health behavior. Researchers (Aho, 1979; Cummings, 1979; Jette & Brock, 1979; and Larson, Olson, Cole & Shortell, 1979) have found perceived severity to be a significant predictor of compliance with the medical recommendation of influenza inoculation. Rundall and Wheeler (1979) found insignificant impact on motivation for swine flu inoculation from their measure of severity among 232 adult subjects. Becker, Nathanson, Drachman and Kirscht (1977) examined health beliefs among 250 mothers and their children's clinic visits and found perceived severity to be a positive, significant predictor of appointment-keeping.
Severity seemed to be of greatest influence in situations associated with medical practice such as appointment-keeping or one-time actions such as obtaining inoculations. Even in these situations, however, it tended to have a less pronounced effect than the other components of the model.

**Benefits**

Benefits has generally been found to significantly predict health behavior (Aho, 1979; Becker, Nathanson, Drachman & Kirscht, 1977; Cummings, 1979; Jette & Brock, 1979; Rundall & Wheeler, 1979). The construct of "benefits" was originally operationalized in the HBM as a reduction in threat. For example, feeling that one is less likely to contract influenza or that the symptoms will be less severe as a result of the inoculation is the primary benefit measured in the influenza studies (Aho, 1979; Cummings, Jette & Brock, 1979; Rundall & Wheeler, 1979).

The concept of perceived benefits is generally broadened in contemporary research to include aesthetic and psychological benefits (Janz & Becker, 1984). This is particularly true in relation to behaviors which are on-going or more complex. For example, Simon and Das (1984) examined the relationship of HBM constructs and various sexually transmitted disease behaviors among 416 young adults. Their instrument included impact on family relations and peace of
mind in addition to more traditional questions regarding disease outcomes. Benefits was also the strongest predictor of preventive checkups in this population.

**Barriers**

Perceived barriers has been found to be significantly related to preventive health behaviors in the influenza and swine flu studies (Aho, 1979; Cummings, Jette & Brock, 1979; Rundall & Wheeler 1979), Langlie's (1977) behaviorally consistent group of preventive health behaviors, preventive sexually transmitted disease checkups (Simon & Das, 1984), and high blood pressure screening (King, 1982). In addition, a study of 30 post coronary artery bypass patients (Tirrell & Hart, 1980) found barriers to be the only HBM component predictive of compliance with an individualized prescribed exercise regimen. In most of these studies, barriers is the component which is most predictive of the preventive health behavior.

**Summary**

In a review of the Health Belief Model applied to health behavior, Janz and Becker (1984) summarized the findings of preventive health behavior studies conducted between 1974 and 1984, "Susceptibility, benefits, and barriers are consistently associated with outcomes, (indeed, barriers was significantly associated with behavior in all of the 13
studies reviewed" (p. 36). Susceptibility and benefits were approximately equivalent in their contribution while severity was significant in only about one-third of the studies reviewed. In addition, cues to action has been proposed as an important triggering mechanism for these behaviors. As noted earlier, these experiences are often something which increases the salience, relevance, or immediacy of a particular course of action. Janz and Becker (1984) note that few HBM studies have attempted to measure this component. They also noted that diverse demographic, sociopsychological and structural variables may affect perceptions and thus, indirectly influence health-related behavior. The summary of their review asserts that "while there are many other extant models of health related behavior, we know of none approaching the HBM in terms of research attention or research corroboration" (p. 41).

**Measuring HBM Components**

In spite of the extent to which the Health Belief Model has been utilized as the framework for investigating health behavior; Jette, Cummings, Brock, Phelps and Naessens (1981) are quite critical of the lack of attention given to the development of reliable and valid measures of HBM components. Specific criticisms include the lack of sound instruments, a tendency to use general rather than behavior-specific
indicators of the components, instruments which measure only a few of the components, differing interpretations of the components, and limited application in non-medical settings.

Slenker, Price, Roberts and Jurs (1984) responded to these recommendations in developing a HBM inventory focused specifically on fitness related behavior. They used an elicitation response procedure to develop the Health Belief Model Inventory (HBMI) in an adult worksite population. Prior to their work, the HBM had not been applied to exercise behavior outside of the clinical setting in any systematic manner. Their questionnaire had the characteristics shown in Table 1.

Using these HBMI factors and excluding locus of control, they were able to account for 56% of the variance in jogging behavior. Adding age and gender raised this to nearly 61%. Barriers accounted for the most variance in this analysis, followed by motivation, and benefits. The importance of barriers and benefits is consistent with the preventive health behavior research reviewed by Janz and Becker (1984). Variables representing susceptibility, support, locus of control, knowledge and education were not significant contributors to the prediction equation. Gender and age were significant because more males were joggers and joggers tended to be younger than non-joggers. The relatively high internal consistencies and the related success of this instrument in
Table 1. Characteristics of the Health Belief Model Inventory.

<table>
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<th>Component</th>
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</table>

* Change in $R^2$ excluding demographic variables. n=220

predicting jogging behavior suggested that it was worthy of further study. A modified version of Slenker, Price, Roberts and Jurs' instrument will be used in this study.

More recently, Rosenstock, Strecher and Becker (1988) recommended that the HBM be revised to include self-efficacy as a separate independent variable. Locus of control, in their view, is incorporated into other aspects of the model
and need not be measured as a separate construct. This change is consistent with the non-significant contribution of locus of control in Slenker, Price, Roberts and Jurs' (1984) study.

These recommendations are the basis for some of the revisions to the instrument for this study. Modifications to the HBM scales include the elimination of the scales for knowledge, locus of control, and severity, combining the complexity items with barriers and the support items with benefits, and rewording items in the susceptibility section. Additional revisions include an effort to improve the wording of selected questions, the addition of the Physical Self-Efficacy Scale (Ryckman, Robbins, Thornton & Cantrell, 1982) in place of the two motivations questions, and a more detailed assessment of physical activity. The latter two revisions will be discussed in the following sections.

Self-Efficacy

Bandura's (1977) Social Learning Theory and revised Social Cognitive Theory (1986) have provided a basis for the examination of an additional component of motivation—self-efficacy. Rosenstock, Strecher and Becker (1988) identify constructs within the Health Belief Model which are analogous to all of the components of Social Cognitive Theory except for self-efficacy. Perceived barriers, however, does have some similarity to self-efficacy, depending on how it is
operationalized. The addition of a specific self-efficacy component, however, is thought to be particularly important in domains like exercise where the behavior is more complex, time-consuming, and requires persistent behavior (Strecher, McEvoy, Becker, Rosenstock, 1986).

A measure of self-efficacy has been developed specifically with regard to physical activity (Ryckman, Robbins, Thornton & Cantrell, 1982). The Physical Self-Efficacy Scale (PSES), is a 22 item inventory with an overall scale score as a general measure of physical self-efficacy (alpha=.81), and two subscales: Perceived Physical Ability (PPA, alpha=.84) and Physical Self-Presentation Confidence (PSPC, alpha=.74). Ryckman, Robbins, Thornton and Cantrell (1982) report a coefficient of stability of .80 for the overall measure, .85 for the PPA subscale, and .69 for the PSPC subscale. They also report convergent validity values (r=.58 for the overall score, r=.43 for the PSPC and r=.52 for the PPA) with the Tennessee Physical Self-Concept subscale. Using hierarchical multiple regression to predict sports participation, significant variance was accounted for by PPA, PSES, and PSPC. They conclude that the overall scale and the two subscales have satisfactory psychometric properties and exceed the ability of related scales in predictive validity. This measure of self-efficacy will be included with the revised Health Belief Model Inventory to provide the primary
predictor variables under consideration. These predictor variables represent the HBM constructs of susceptibility, social influences, benefits, barriers, and cues to action, as well as physical self-efficacy. After examining the interrelationship of these constructs in study one, their ability to predict exercise behavior will be examined study two.

Measuring Exercise Behavior

The assessment of exercise behavior in large scale studies of adult populations has been the subject of some debate among epidemiologists (Froelicher & Oberman, 1972; Laporte, 1984; Laporte, Montoye & Casperson, 1985). Methods used to assess activity include calorimetry, job classification, behavioral observation, electronic monitoring, and a variety of survey and diary techniques (Laporte, Montoye & Casperson, 1985). Most researchers choose to employ survey methods in large scale epidemiological studies due to the practicality and specificity of the survey formats available (Washburn & Montoye, 1986). The focus of this study emphasizes participation. For that reason as well as the size of the sample, survey questions are preferable to clinical assessment of fitness status.

The validity of survey questions in the assessment of physical activity has been examined in several studies.
Boutcher (1990) suggests that the format of recall questions be adapted to the specific dimension of physical activity under study, particularly when exploring causal relationships. Williams, Klesges, Hanson and Eck (1989) found high test-retest reliability and convergent validity between the use of a daily log and a specific set of recall questions entitled the Stanford Activity Recall. Washburn, Janney and Juler (1990) examined the use of electronic monitoring in older adults and concluded that questionnaire data is preferred for most situations. Weiss, Slater, Green, Kennedy, Albright and Wun (1990) also explored the use of three, single-item, self-assessment questions as a measure of energy expenditure. While they concluded that this abbreviated format held promise as a proxy measure, they suggested that a longer, more precise format would be preferred. Baranowski, Dworkin, Cieslik, Hooks, Clearman, Ray, Dunn and Nader (1984) used a somewhat expanded format and found that examination of a selected period was reasonably representative of more general lifestyle patterns.

Washburn, Adams and Haile (1987) examined two alternative strategies for capturing this survey data. They suggest that recall of frequency and duration are reasonably accurate and that intensity is best measured on a perceived exertion scale with "sweating" as the critical benchmark. Using these three items, Duncan and Stoolmiller (1993) found a reliability
coefficient of .67 and used this in structural equation modeling. These recommendations are consistent with those of Slater, Green, Vernon and Keith (1987), who cite the problems of single items questions and emphasize the value of specific questions identifying multiple facets of physical activity.

In this study a series of specific questions asked participants to recall minutes of exercise per week (frequency), level of exertion (intensity), and to recall the number of weeks they had been engaging in this pattern of activity. The format for these questions is a considerable extension of Slenker, Price, Roberts and Jurs’ (1984) questions, and consistent with the recommendations of several others (LaPorte, Montoye & Casperson, 1985; Washburn, Adams & Haile, 1987; Slater, Green, Vernon & Keith, 1987; and Washburn & Montoye, 1986).

Variables representing minutes per week of exercise and number of weeks of exercise were used to create the dependent variable under examination in study two. Duncan and Stoolmiller (1993) successfully used these components and level of exertion to establish a dependent variable in their structural equation modeling of exercise compliance. In this study however, motivation among high exertion and low exertion subjects will be compared.
Structural Equation Modeling

Structural equation modeling or covariance structure modeling has been used as a method for examining various theories about social psychological processes. In some settings the definition of structural equation modeling is limited to the simultaneous equation models of economics. In this discussion, however, the term will be used to more generally include models which allow latent variables, multiple indicators, and errors in the variables. This approach is often described as an extension of single equation regression techniques. Although the technique is adaptable to many types of situations, the applications discussed here will include testing a specified measurement model and comparing alternative models of the relationship among variables within cross-sectional data.

Before discussing the application of structural equation modeling, the notion of causality should be briefly elaborated. As Asher (1983) points out, the social science notion of causality virtually always involves some simplifying or clarifying assumptions. There are very few circumstances where a specific behavior or attitude is universally and unequivocally attributable to a cause. Asher (1983), in summarizing the work of various other authors, suggests that the scientific notion of causality requires three conditions.

The first condition is covariation between cause and
effect. This condition is not necessarily troublesome since traditional statistical methods generally describe the nature and extent of this relationship. Structural equation modeling techniques allow researchers to test explicit assumptions about covariation.

The second condition is temporal sequencing of cause and effect. This condition can be imposed on the data collection process or implied from the data. When the sequence is established in the data collection process, the condition of cause preceding effect is obviously met. There continues to be debate about the appropriateness of implying this relationship in cross-sectional data (Gollob & Reichardt, 1987). While cross-sectional studies clearly identify this as a constraint in discussions of causality, this general condition is often met by a series of studies which test the temporal sequence in a variety of ways.

The third assumption is that all causal factors have been identified. Given the universe of potential causes, this assumption is not always easy to accommodate. Repeated investigation can build a body of evidence suggesting that the important causal factors have been identified. There is no method, however, for ensuring that all possible causes have been examined. Therefore, interpretation of causality must clearly consider the potential of influential but unidentified variables. This is particularly true in the early stages of
model development and testing.

Thus, the nature of causality examined in this study is subject to several assumptions. These assumptions include the idea that observed covariation represents some relationship between the variables, that behaviors of interest are broadly distributed and covary in such a way that cross-sectional data can represent the relationship among variables, and that all causal factors have been identified. The use of structural equation modeling techniques and the interpretation of findings must be subject to these conditions.

There are five basic steps in developing causal models (Bollen & Long, 1993). While each stage may offer a variety of alternative techniques or procedures, the basic sequence of stages is quite consistent. The first step is model specification. In this step the initial relationships of the variables must be explicitly proposed. This is generally based on the underlying theory and previous research. A path diagram is usually the preferred method for initially representing the model. As a part of this step the equations for the model must be written and then translated into the various matrices.

The second step, identification, determines whether it is possible to find unique values for the parameters of the specified model. Bollen (1989) lists five identification rules which apply to either the model or the equations. Three
of these rules apply to the model including the t-rule, the Null S rule and the recursive rule. The two rules which apply to the equations are generally referred to as conditions. These are the order condition and the rank condition. The elaboration of each individual rule is not provided here since the process is developed in detail by others (Bollen, 1989; Asher, 1983).

The third step is estimation of model parameters. There are several estimation methods available including ordinary least squares, unweighted least squares, generalized least squares, two-stage and three stage least squares, maximum likelihood, and full information maximum likelihood. For social psychological models in the early stages of development, maximum likelihood estimates are generally employed (Bollen, 1989).

After estimating the parameters, the fit of the model is usually examined. In essence, the fit reflects the degree to which the proposed model is supported by the data. Because the fit indices are an area of contention within structural equation modeling, Bollen and Long (1993) suggest that:

1. Fit indices should be selected from several of the groups or families or indices which are available.
2. Indices which are independent of or only weakly related to sample size are preferred.
3. At least some of the indices selected should consider
the degrees of freedom in the model.

4. Indices which may have been used in previous structural equation work on the model should also be considered in order to allow substantive comparison across data sets.

The selection of fit indices is developed in greater detail by several contributors to Bollen and Long (1993). These authorities reach differing conclusions about the utility of specific indices; however, they do agree on the principles noted above. Consequently, selection of fit indices will be made using these criteria. Since the most appropriate indices are often indicated by characteristics of individual data sets, specific indices will be identified and computed in the data analysis process.

The final stage can be either respecification or comparison of alternative models. These changes typically involve incremental changes in the fit indices. Because of this, respecification and model comparison involve the same controversy as fit indices. Nonetheless, finding that multiple fit indices suggest a better fitting alternative can significantly strengthen the evidence in favor of a given model. In this way, causal modeling methods provide a systematic approach to the creation and testing of models relevant to the issue under study in this paper.

There really are few differences between the development
of the measurement model and the path model. The measurement model is a special case of the more general structural equation model. With the measurement model there are some modifications to the identification rules. Obviously the path model has a dependent variable specified. Within the path model, comparisons of alternative relationships among the predictor variables is often of interest. Other than that, however, the same systematic approach outlined in the previous section is followed.

In summary, structural equation modeling provides a systematic approach to the analysis of psychosocial models. In this case, the techniques will be used first to examine the measurement model developed to represent the Health Belief Model and second, to examine the extent to which the components of this model predict exercise behavior.
CONFIRMATORY FACTOR ANALYSIS OF A HEALTH BELIEF MODEL INVENTORY WITH AN ADULT WORKSITE POPULATION

Prepared for Health Education Quarterly

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ABSTRACT

This investigation examined the factor structure of a Health Belief Model (HBM) Inventory designed to assess motivation for participation in physical activity. Although the HBM has long been suggested as a framework for understanding decisions related to one's health, there has been only one previous research effort directed at empirical validation of the HBM constructs in relation to exercise behavior. Consequently, this study examined the factor structure of a revised, 53-item version of the Health Belief Model Inventory consisting of six factors. These six hypothesized factors represented five components of the health
belief model: Susceptibility (10 items), Benefits (11 items), Barriers (13 items), Social Influences (5 items), Cues to Action (4 items) along with a sixth construct, Perceived Physical Ability (10 items). Perceived Physical Ability is included as an indicator of Physical Self-Efficacy, a psychological construct recently recommended for inclusion in this model.

The inventory was administered to adult employees of a regional medical center. Of 1151 employees in the sample, five hundred eleven (45%) responded to a mailed questionnaire. Summary statistics confirm physical self-efficacy as a distinct construct in relation to the five HBM items. In the hypothesized model all factor loadings except two exceeded .45. Fit indices suggest a marginally good fit of the data to the hypothesized model. While generally supportive of the HBM framework, the findings suggest the need for further research on the application of the model as a whole and the Barriers construct in particular. Factor loadings of items in the Barriers construct were rather unstable suggesting that this component of the model consists of several subfactors.
Introduction

Exercise is increasingly recognized for its important role in sustaining physical and mental health (King, Taylor, Haskell & DeBusk, 1989; Martin and Dubbert, 1982; Powell, Thompson, Caspersen & Kendrick, 1987). Beneficial or preventive effects have been cited for coronary heart disease (Haskell, 1984, Paffenbarger & Hale, 1975, Paffenbarger, Hyde & Wing 1990, Siscovick, 1982), diabetes (Richter & Schneider, 1981), generalized immunological response (Simon, 1984), cancer (Sternfeld, 1992), hypertension (Gibbons, Blair, Cooper & Smith, 1983; Roman, Cammuzzi, Villalon & Klenner, 1981), and osteoporosis (Aloia, 1981; Krolner, Toft, Nielsin & Tandewold, 1983). Physical exercise has also been associated with diminished stress reactivity (Crews & Landers, 1987) and diminished depression (Berger & Owen, 1983; Blumenthal, Williams, Needles & Wallace, 1982). As the medical cost of these diseases continues to grow, the public is increasingly being encouraged to engage in preventive activities such as exercise.

Nonetheless, only 15-20% of the adult population exercise as vigorously as the American College of Sports Medicine recommends and 50% of those who start an exercise program drop out within a year (American College of Sports Medicine, 1978; Dishman, Sallis and Orenstein, 1985; Stephens, Jacobs & White, 1987). The failure of most adults to develop regular exercise
patterns is an issue of growing importance due to a combination of the sedentary nature of work, a rapidly expanding older population, and the long incubation period of chronic diseases (Buskirk, 1990). The relative lack of success in bringing about widespread change in exercise behavior has, in recent years, focused attention on systematic approaches to behavior change.

The Health Belief Model has emerged as one explanatory framework for this phenomena. The Health Belief Model was developed in the 1950's by a group of social psychologists (Becker, Maiman, Kirscht, Haefner, Drachman & Taylor, 1979). It uses several sets of attitudes to predict the likelihood of a given health behavior. Initially, the Health Belief Model was an attempt to understand why people did not accept disease prevention and early detection practices (Rosenstock, 1974). It was then adapted to situations involving patients' responses to treatment and compliance with medical regimens (Becker, 1979; Kirscht, 1983) and also to sick-role behavior (Becker, Drachman & Kirscht, 1972). Finally, the Health Belief Model has also been applied to situations involving preventive health behaviors (Langlie, 1977; Aho, 1979).

Consistent with the value expectancy tradition (Lewin, Dembo, Festinger & Sears, 1944), the general model hypothesizes that behavior derives from the value placed on a particular goal and the individual's estimate of the
likelihood of achieving the goal (Maiman & Becker, 1974). These general concepts were translated into the following HBM dimensions (Janz & Becker, 1984):

- **Perceived susceptibility**—subjective perceptions of the risk of contracting a condition.
- **Perceived severity**—medical/clinical and social consequences associated with a condition.
- **Perceived benefits**—beliefs regarding the feasibility and efficaciousness of a recommended health action.
- **Perceived barriers**—potential negative aspect of or impediments to undertaking the recommended behavior.

In addition, Haefner, Kegeles, Kirscht & Rosenstock (1967) examined the applicability of the Health Belief Model in a national study of preventive health behavior and noted that changes in behavior are often triggered by a particular event or experience. They argued that the individual is predisposed to act in a particular way but does not necessarily do so until the triggering event occurs. In most cases of preventive health behavior, these triggering events are operationalized as some sort of short-term benefit or an experience that makes abstract information more relevant. In the Health Belief Model, these triggering events are specifically identified as Cues to Action (Becker, Haefner, Kasl, Kirscht, Maiman & Rosenstock, 1977).

Thus, the Health Belief Model hypothesizes that
propensity to act results from individual perceptions about susceptibility to, and severity of, outcomes combined with perceptions of benefits of a given action and barriers to that action. Some cue(s) may be necessary to actually trigger the behavior even when the propensity to act exists.

In spite of the extent to which the Health Belief Model has been utilized as the framework for investigating health behavior, Jette, Cummings, Brock, Phelps and Naessens (1981) are quite critical of the lack of attention given to the development of reliable and valid measures of HBM components. Specific criticisms include the lack of sound instruments, a tendency to use general rather than behavior-specific indicators of the components, instruments which measure only a few of the components, differing interpretations of the components, and limited application in non-medical settings.

Slenker, Price, Roberts and Jurs (1984) responded to these concerns in developing a HBM inventory focused specifically on fitness related behavior. They used an elicitation response procedure to develop the Health Belief Model Inventory (HBMI) in an adult worksite population. The questionnaire had 10 scales. Five of these are theoretically indicated by the Health Belief Model. They found internal consistencies for the five HBM components to range from $\alpha=.80$ for Cues to Action to $\alpha=.91$ for Benefits. In addition, their findings confirmed that severity contributes little to the HBM
in this domain and social influences should be developed as an additional factor.

Bandura's (1977) Social Learning Theory and revised Social Cognitive Theory (1986) have provided a basis for the examination of an additional component of motivation--self-efficacy. Rosenstock, Strecher and Becker (1988) identify constructs within the Health Belief Model which are analogous to all of the components of Social Cognitive Theory except for self-efficacy. Perceived barriers, however, does have some similarity to self-efficacy, depending on how it is operationalized. The addition of a specific self-efficacy component, however, is thought to be particularly important in domains like exercise where the behavior is more complex, time-consuming, and requires persistent behavior (Strecher, Devellis, Becker & Rosenstock, 1986).

The first purpose of this study was to explore whether Perceived Physical Ability, as a measure of physical self-efficacy, is distinct from the other HBM constructs. The second purpose of this research was to replicate Slenker, Price, Roberts and Jurs' (1984) examination of the Health Belief Model Inventory factor structure including constructs of susceptibility, social influences, benefits, barriers, and cues to action. Confirmatory factor analysis methods are used to generate estimates of the goodness-of-fit for the hypothetical models.
Method

Subjects

The subjects of this study were employees of a major medical center. Instruments were mailed to all 351 employee members of the on-site health and fitness center as well as 800 randomly selected non-member employees. A postcard reminder and an employee newsletter article on the purpose of the study were used to encourage responses. In order to reassure respondents regarding the confidentiality of the data, no individual identifiers were included in the survey. Data were obtained from 511 (45%) of the 1151 employees in the initial mailing.

Ninety-six percent of the respondents were Caucasian and 79% were female. Subjects had a mean age of 35.7 years (SD=9.7) and 64% were married. Seventeen percent had no more than a high school education, 10% had trade school training, 25% some college, and 44% had at least a college degree. The remaining 4% had a highest level of schooling not accounted for in these categories. Thirty-five percent were members of the on-site fitness center.

Instruments

Health Belief Model. The instruments used in this study included a revised Health Belief Model Inventory derived from Slenker, Price, Roberts, and Jurs (1984). Modifications to
the HBM scales include the elimination of the scales for knowledge, locus of control, and severity, combining the complexity items with barriers, and rewording items in the susceptibility section. The five revised HBM scales remaining in the inventory were Benefits, Barriers, Susceptibility, Social Influences, and Cues to Action.

In addition to the HBM components, the inventory included the Perceived Physical Ability subscale of the Physical Self-Efficacy Scale (Ryckman, Robbins, Thornton & Cantrell, 1982) and a detailed recall of physical activity. The latter two components will be discussed in the following sections.

Self-efficacy. A measure of self-efficacy has been developed specifically with regard to physical activity (Ryckman, Robbins, Thornton & Cantrell, 1982). The Physical Self-Efficacy Scale (PSES) is a 22 item inventory with an overall scale score as a general measure of physical self-efficacy ($\alpha=.81$), and two subscales: Perceived Physical Ability (PPA, $\alpha=.84$) and Physical Self-Presentation Confidence (PSPC, $\alpha=.74$). Ryckman, Robbins, Thornton and Cantrell (1982) report a coefficient of stability of .80 for the overall measure, .85 for the PPA subscale, and .69 for the PSPC subscale. They also report convergent validity values ($r=.58$ for the overall score, $r=.43$ for the PSPC and $r=.52$ for the PPA) with the Tennessee Physical Self-Concept subscale. Using hierarchical multiple regression to predict sports
participation, they found significant variance accounted for by the PPA, PSES, and PSPC. They conclude that the overall scale and the two subscales have satisfactory psychometric properties and exceed the ability of related scales in predictive validity.

Because the PPA subscale had higher reliability and related most directly to exercise behavior, it was used to measure self-efficacy in this study. This is consistent with Dishman's (1991) recommendation that general perceptions of physical ability might be better predictors of behavior than specific efficacy beliefs. It was included with the revised Health Belief Model Inventory to provide the primary predictor variables under consideration. The internal consistency (Cronbach, 1951) for each of the six independent variables is reported in Table 1. Alpha coefficients ranged from $\alpha=.76$ for barriers to $\alpha=.96$ for benefits.

Confirmatory factor analysis (CFA) was used to determine the extent to which the observed data fit the proposed model (Bollen, 1989). Specifically, PRELIS was used to create a polychoric correlation matrix which was then analyzed using the maximum likelihood method within LISREL 7.
Results

The internal consistency (Cronbach, 1951) for each of the six scales is reported in Table 1. Alpha coefficients ranged from .79 to .96. The overall alpha coefficient of .90 also reflected relatively high internal consistency among all 53 items. The correlation coefficients among the six scales are reported in Table 2. The values show Benefits to be intercorrelated with Social Influences ($r=.55$) and Cues to Action ($r=.68$). These correlations are not identified as a particular problem since the Health Belief Model does not necessarily imply that these are orthogonal subscales.

Perceived Physical Ability shows a modest negative correlation with Susceptibility ($r=-.35$), positive correlation with Barriers ($r=.31$). Thus, higher levels of ability are associated with lower levels of susceptibility to the consequences of inactivity and a greater sensitivity to barriers to exercise. Perceived Physical Ability is relatively uncorrelated with the other constructs in the model.

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Insert Table 1 about here

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Insert Table 2 about here
Confirmatory factor analysis was conducted to determine whether the hypothetical 6-factor structure adequately described these data. Results in Table 3 provides the summary statistics for the 6-factor structure using 53 items (full), a 6-factor structure using 50 items (reduced), and a nonsubstantive null model which assumes no underlying factor structure. The significant $\chi^2$ for the full model indicates a substantial departure from a perfect item-to-factor fit. Relatively good fitting models should have Goodness-of-Fit (GFI) and Adjusted Goodness-of-Fit (AGFI) values approaching 1 and $\chi^2$/df ratios of 5 or less (Bollen & Long, 1993). Root-Mean Square Residual values (RMR) also provide an indicator of fit with lesser residuals indicating improved fit. Inspection of these values for the full model provides further evidence of misspecification.

In order to try to isolate the areas of misspecification, items were evaluated according to the following criteria.

1. Items with the highest modification indices were considered for exclusion. Six items were identified as having total modification indices exceeding 100.

2. Items with standardized factor loadings of less than .50 were considered for exclusion. Only three items had loading
which failed to exceed .50.

3. Items with highly skewed response patterns were also considered for exclusion. Items were considered highly skewed if 50% or more of respondents fell into only two response categories.

Seven items met at least one of the criteria and were considered for exclusion. Five of the seven items considered for exclusion were associated with Barriers, one item with Susceptibility, and one item with Social Influences. Three items were selected for exclusion because they met at least two of the criteria. The remaining 50 items were analyzed according to the proposed 6 factor solution. As noted in Table 3, this improves the model specification although, the GFI, AGFI, and $\chi^2/df$ ratio suggest that this model still falls somewhat short of fully fitting the data.

Standardized item loadings for both the full and reduced model are shown in Table 4. The t-values for all items in the full model exceeded six. In the reduced model, the t-values for four items in the Barriers factor dropped to between four and six. While these are still judged to indicate non-zero loadings, this drop further suggests the instability of the Barriers factor.

Insert Table 4 about here
Discussion

Results in this study provide support for the recommendation that Perceived Physical Ability, as an indicator of self-efficacy, be included as a distinct component of the Health Belief Model, at least with respect to exercise behavior. The PPA items loaded on the PPA factor as hypothesized. Furthermore, the factor correlations did not suggest a high intercorrelation between PPA and other HBM factors.

The Health Belief Model items loaded on the hypothesized factors, although the goodness of fit indicators suggest that, as a whole, the model is only a mediocre fit to these data. Specific problems appear in several areas although the most noteworthy exist in the Barriers factor. As selected items were removed from this factor, the loading of some other items diminished. This suggests that the barriers construct is inadequately defined or is multidimensional. It may be that individual items in the barriers factor relate to stages in the adoption of behavior as described by Rogers (1983) or Prochaska and Diclemente (1985). If the stage of behavior change is the primary determinant of the salience of a particular barrier, then the unity of this construct is unlikely to be reflected in this analytical strategy. For instance, injuries or soreness are unlikely to become a salient barrier until one actually begins to engage in
physical activity. Work schedule and family responsibilities, however, do not necessarily depend on participation in order to be salient barriers. Thus, specific Barriers may affect some people and not others.

It is likely that the Barriers construct could be more effectively represented by several subfactors. In the study by Slenker, Price, Roberts and Jurs (1984), the items associated with complexity of the behavior were identified as a separate factor. In this study, they were combined with the other items in the Barriers factor and this probably contributed to some of the difficulty with this factor.

Another problem with the Barriers construct may be the frequent use of "could" in the wording of the questions. For example, "Lack of time could keep me from running or jogging" is likely to be a true statement for many people and a better measure might be the extent to which one feels it actually does so. This problem may also affect the responses to items in the Benefits construct.

Benefits is intercorrelated with Social Influences and Cues to Action. In spite of the intercorrelation, these factors seem justified by the strong standardized loadings. In this questionnaire, both Social Influences and Cues to Action are narrowly defined and measured. This likely strengthens their factor structure in comparison with other factors such as Benefits or Barriers which are more broadly
This analysis suggests only a modest fit of the hypothesized HBM structure to the data. One reason for this may be that the HBM components may vary in relevance and in psychometric importance as persons move through a behavior change process. Analysis of the HBM factors at various stages in the process of behavior change may reveal a sequence or structure not evident in cross-sectional analysis. The fit may also reflect the roots of the HBM as an approach to gaining insight or organizing influences on health behavior decisions. Because it originally served as a basis for conceptualizing health information campaigns, the HBM dimensions are rather broad domains of influence rather than specific cognitive or social processes. Rigorous predication of behavioral compliance has been a secondary goal in most uses of HBM Theory. Consequently, the HBM constructs may be too broadly organized and fail to reflect important underlying psychological processes. As a result, the HBMI may not result in the crisp psychometric characteristics of other scales which focus more specifically on one aspect of the behavior change process.

Further research is recommended in two areas. First, the HBM components and physical self-efficacy should be examined for their salience at various stages in the process of behavior change. Particular attention should be given to the
barriers construct since it is frequently a strong predictor of behavior but, at least in this study, appeared to be somewhat unstable. Second, additional attention should be given to theoretical integration of the Health Belief Model with other promising approaches to understanding compliance. For instance, while benefits of exercise appears to have relevance to one's decision about physical activity, the psychological process underlying that influence is likely to be more complicated than the simple additive relationship proposed by the Health Belief Model. Flay and Petrakis (1991) have provided some discussion of these issues with respect to drug use prevention.
Table 1. Summary Statistics for Health Belief Model Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th># items</th>
<th>mean</th>
<th>SD</th>
<th>alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susceptibility</td>
<td>10</td>
<td>3.82</td>
<td>1.19</td>
<td>.85</td>
</tr>
<tr>
<td>Benefits</td>
<td>11</td>
<td>4.62</td>
<td>1.70</td>
<td>.96</td>
</tr>
<tr>
<td>Barriers</td>
<td>13</td>
<td>4.09</td>
<td>1.15</td>
<td>.81</td>
</tr>
<tr>
<td>Social Influences</td>
<td>5</td>
<td>4.98</td>
<td>1.67</td>
<td>.90</td>
</tr>
<tr>
<td>Cues to action</td>
<td>4</td>
<td>4.47</td>
<td>2.01</td>
<td>.93</td>
</tr>
<tr>
<td>Perceived Phys. Ability</td>
<td>10</td>
<td>4.40</td>
<td>1.04</td>
<td>.79</td>
</tr>
</tbody>
</table>

(Item values ranges from 1 to 7.)
Table 2. Factor Correlation Coefficients

<table>
<thead>
<tr>
<th></th>
<th>SUSC</th>
<th>BENF</th>
<th>BARS</th>
<th>SOCI</th>
<th>CUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUSC</td>
<td></td>
<td>0.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BENF</td>
<td>0.09</td>
<td></td>
<td>0.31**</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>BARS</td>
<td>0.31**</td>
<td>0.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCI</td>
<td>-0.07</td>
<td>0.55**</td>
<td>-0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUES</td>
<td>0.03</td>
<td>0.68**</td>
<td>-0.01</td>
<td>0.49**</td>
<td></td>
</tr>
<tr>
<td>PPA</td>
<td>-0.35**</td>
<td>0.04</td>
<td>-0.32**</td>
<td>0.18**</td>
<td>0.05</td>
</tr>
</tbody>
</table>

* - Signif. < .05  ** - Signif. < .01  (2-tailed)

SUSC (Susceptibility)
BENF (Benefits)
BARS (Barriers)
SOCI (Social Influences)
CUES (Cues to Action)
PPA (Perceived Physical Ability Scale-Physical Self-Efficacy)
Table 3. Confirmatory factor analysis summary statistics.

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$(df)</th>
<th>$\chi^2$/df</th>
<th>RMR</th>
<th>GFI</th>
<th>AGFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null</td>
<td>25633.45(1378)</td>
<td>18.60</td>
<td>.283</td>
<td>.188</td>
<td>.156</td>
</tr>
<tr>
<td>Full</td>
<td>9407.89(1310)</td>
<td>7.18</td>
<td>.105</td>
<td>.592</td>
<td>.555</td>
</tr>
<tr>
<td>Reduced</td>
<td>7502.81(1160)</td>
<td>6.46</td>
<td>.087</td>
<td>.634</td>
<td>.598</td>
</tr>
</tbody>
</table>

Full-hypothesized 53 items, 6 factors
Reduced-50 items, 6 factors
Table 4. Standardized Factor Loadings for Full and Reduced Model

<table>
<thead>
<tr>
<th>Item</th>
<th>Loadings (Full)</th>
<th>Loadings (Reduced)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Susceptibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>overweight</td>
<td>.487</td>
<td>.486</td>
</tr>
<tr>
<td>nervousness/stress</td>
<td>.544</td>
<td>.542</td>
</tr>
<tr>
<td>heart problems</td>
<td>.915</td>
<td>.916</td>
</tr>
<tr>
<td>blood pressure</td>
<td>.908</td>
<td>.909</td>
</tr>
<tr>
<td>lack energy</td>
<td>.629</td>
<td>.625</td>
</tr>
<tr>
<td>colds/flu</td>
<td>.455</td>
<td>.453</td>
</tr>
<tr>
<td>poor lung capacity</td>
<td>.572</td>
<td>.571</td>
</tr>
<tr>
<td>joint or muscle injury</td>
<td>.383</td>
<td>.382</td>
</tr>
<tr>
<td>cholesterol</td>
<td>.723</td>
<td>.723</td>
</tr>
<tr>
<td>back injuries</td>
<td>.453</td>
<td>.451</td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weight control</td>
<td>.810</td>
<td>.819</td>
</tr>
<tr>
<td>friendship and socializing</td>
<td>.649</td>
<td>.649</td>
</tr>
<tr>
<td>relax/relieve tension</td>
<td>.915</td>
<td>.915</td>
</tr>
<tr>
<td>sense of accomplishment</td>
<td>.933</td>
<td>.933</td>
</tr>
<tr>
<td>feel better</td>
<td>.966</td>
<td>.966</td>
</tr>
<tr>
<td>get in shape/stay fit</td>
<td>.951</td>
<td>.951</td>
</tr>
<tr>
<td>more energy</td>
<td>.954</td>
<td>.954</td>
</tr>
<tr>
<td>more patient</td>
<td>.759</td>
<td>.759</td>
</tr>
<tr>
<td>breathe better</td>
<td>.826</td>
<td>.826</td>
</tr>
<tr>
<td>tone muscles</td>
<td>.871</td>
<td>.871</td>
</tr>
<tr>
<td>lower cholesterol</td>
<td>.703</td>
<td>.703</td>
</tr>
<tr>
<td><strong>Barriers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lack of time</td>
<td>.593</td>
<td>---</td>
</tr>
<tr>
<td>injuries or soreness</td>
<td>.480</td>
<td>.354</td>
</tr>
<tr>
<td>work schedule</td>
<td>.588</td>
<td>.276</td>
</tr>
<tr>
<td>family responsibilities</td>
<td>.536</td>
<td>.278</td>
</tr>
<tr>
<td>unsuitable weather</td>
<td>.637</td>
<td>.373</td>
</tr>
<tr>
<td>lack of desire</td>
<td>.486</td>
<td>---</td>
</tr>
</tbody>
</table>
### Table 4. (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Loadings (Full)</th>
<th>Loadings (Reduced)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Barriers (continued)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lack of energy</td>
<td>.743</td>
<td>.479</td>
</tr>
<tr>
<td>prefer other activities</td>
<td>.455</td>
<td>---</td>
</tr>
<tr>
<td>bad knees, feet, ankles</td>
<td>.324</td>
<td>.301</td>
</tr>
<tr>
<td>confusing training techniques</td>
<td>.518</td>
<td>.793</td>
</tr>
<tr>
<td>lack of self-discipline</td>
<td>.589</td>
<td>.503</td>
</tr>
<tr>
<td>choice of shoes or equipment</td>
<td>.508</td>
<td>.834</td>
</tr>
<tr>
<td>avoiding injuries</td>
<td>.477</td>
<td>.818</td>
</tr>
<tr>
<td><strong>Social Influences</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>spouse or loved one</td>
<td>.828</td>
<td>.828</td>
</tr>
<tr>
<td>children</td>
<td>.750</td>
<td>.750</td>
</tr>
<tr>
<td>friends</td>
<td>.925</td>
<td>.925</td>
</tr>
<tr>
<td>physician</td>
<td>.868</td>
<td>.868</td>
</tr>
<tr>
<td>co-workers</td>
<td>.937</td>
<td>.937</td>
</tr>
<tr>
<td><strong>Cues to Action</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>desire to lose weight</td>
<td>.913</td>
<td>.912</td>
</tr>
<tr>
<td>desire to get in shape</td>
<td>.972</td>
<td>.972</td>
</tr>
<tr>
<td>desire to lower cholesterol</td>
<td>.868</td>
<td>.867</td>
</tr>
<tr>
<td>experiencing tension/stress</td>
<td>.850</td>
<td>.850</td>
</tr>
<tr>
<td><strong>Perceived Physical Ability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>excellent reflexes</td>
<td>.490</td>
<td>.492</td>
</tr>
<tr>
<td>not agile or graceful</td>
<td>.424</td>
<td>.424</td>
</tr>
<tr>
<td>rather strong</td>
<td>.551</td>
<td>.546</td>
</tr>
<tr>
<td>can't run fast</td>
<td>.516</td>
<td>.511</td>
</tr>
<tr>
<td>feel in control</td>
<td>.689</td>
<td>.702</td>
</tr>
<tr>
<td>poor muscle tone</td>
<td>.716</td>
<td>.712</td>
</tr>
<tr>
<td>little pride in sports ability</td>
<td>.557</td>
<td>.561</td>
</tr>
<tr>
<td>speed helped me</td>
<td>.470</td>
<td>.461</td>
</tr>
<tr>
<td>strong grip</td>
<td>.500</td>
<td>.507</td>
</tr>
<tr>
<td>do things others cannot</td>
<td>.618</td>
<td>.608</td>
</tr>
</tbody>
</table>
ABSTRACT

This investigation used structural equation modeling techniques to test the extent to which Health Belief Model components of benefits, barriers, cues to action, susceptibility, and social influences predict frequency and duration of exercise behavior. Perceived physical ability, as a measure of physical self-efficacy, was also examined for its contribution to the model. Finally, the model was also compared these motivational constructs among high and low exertion exercisers.

Data were collected from 511 subjects out of a sample of 1151 employees of a regional medical center. The
structural equation models of exercise behavior substantiated lower levels of susceptibility and higher levels of cues to action among more active individuals. Benefits, barriers, and social influences had non-significant relationships to exercise behavior in the full sample. Thus, the basic Health Belief Model was partially supported as a predictor of exercise behavior. Perceived physical ability was also positively related to exercise behavior.

When high and low exertion subjects were compared, the high exertion group showed a significant negative path from susceptibility and significant positive paths from cues to action and perceived physical ability. The low exertion group showed significant negative paths from susceptibility and social influences and a significant positive path from cues to action.

These findings support the inclusion of perceived physical ability as a self-efficacy construct in the Health Belief Model. In addition, results in this study suggest that exercise motivation may differ between high and low intensity exercisers.
Introduction

As the cost of medical care escalated during the 1970's and 1980's, attention turned to health promotion strategies as an important method for improving quality of life and reducing costs. Programs of physical activity have been a common component of health promotion efforts due to the wide range of associated benefits (King, Taylor, Haskell & DeBusk, 1989; Martin and Dubbert, 1982; Powell, Thompson, Caspersen & Kendrick, 1987). In spite of this attention, there has not been a dramatic increase in regular exercise by the general public. Only 15-20% of the adult population exercise as vigorously as the American College of Sports Medicine recommends and 50% percent of those who start an exercise program drop out within a year (American College of Sports Medicine, 1978; Dishman, Sallis and Orenstein, 1985; Stephens, Jacobs & White 1987). The consequences of this failure to develop regular exercise patterns are amplified by the increasingly sedentary nature of work, a rapidly expanding older population, and the long incubation period of the chronic diseases associated with a sedentary lifestyle (Buskirk, 1990). Thus, prediction of adherence to programs of physical exercise has become an important research issue.

The Health Belief Model

One approach to understanding compliance behavior, the
Health Belief Model (HBM; Rosenstock, 1974), has been a common theoretical framework utilized for the examination of preventive health behaviors and compliance with medical regimens. It was developed in the 1950's by Hochbaum, Kegeles, Leventhal, and Rosenstock, a group of social psychologists (Becker, Maiman, Kirscht, Haefner, Drachman & Taylor, 1979). The HBM uses several sets of attitudes to predict the likelihood of a given health behavior. Consistent with the value expectancy tradition (Lewin, Dembo, Festinger & Sears, 1944) from which this model is derived, it hypothesizes that behavior results from the value placed on a particular goal and the individual's estimate of the likelihood of achieving the goal (Maiman & Becker, 1974). This general concept was translated into the following HBM dimensions (Janz & Becker, 1984):

- **Perceived susceptibility**—subjective perceptions of the risk of contracting a condition.
- **Perceived severity**—medical/clinical and social consequences associated with a condition.
- **Perceived benefits**—beliefs regarding the feasibility and efficaciousness of a recommended health action.
- **Perceived barriers**—potential negative aspect of or impediments to undertaking the recommended behavior.

Rosenstock (1974) described the expected relationship of these components: "the combined levels of susceptibility and
severity provided the energy or force to act and the perception of benefits (less barriers) provided a preferred path of action" (p. 332). Thus, susceptibility and severity were thought to be general motivating components while benefits and barriers are associated with specific responses to a given situation.

In a review of the Health Belief Model applied to health behavior, Janz and Becker (1984) summarized the findings of preventive health behavior studies conducted between 1974 and 1984, "Susceptibility, benefits, and barriers are consistently associated with outcomes, (indeed, barriers was significantly associated with behavior in all of the 13 studies reviewed)" (p. 36). Susceptibility and benefits followed barriers closely in their contribution while severity was significant in only about one-third of the studies reviewed.

In addition, cues to action have been proposed as an important triggering mechanism for these behaviors. Cues to action are experiences or events which increase the salience, relevance, or immediacy of a particular course of action. Janz and Becker (1984) note that few HBM studies have attempted to measure this component. They also noted that diverse demographic, sociological, psychological and structural variables may affect perceptions and thus, indirectly influence health-related behavior. The summary of their review asserts that "While there are many other extant
models of health related behavior, we know of none approaching the HBM in terms of research attention or research corroboration" (p. 41).

In spite of the extent to which the Health Belief Model has been utilized as the framework for investigating health behavior, Jette, Cummings, Brock, Phelps and Naessens (1981) are quite critical of the lack of attention given to the development of reliable and valid measures of HBM components. Specific criticisms include the lack of sound instruments, a tendency to use general rather than behavior-specific indicators of the components, instruments which measure only a few of the components, differing interpretations of the components, and limited application in non-medical settings.

Slenker, Price, Roberts, and Jurs (1984) responded to these criticisms in developing a HBM inventory focused specifically on fitness related behavior. They used an elicitation response procedure to develop the Health Belief Model Inventory (HBMI) with an adult worksite population. Prior to their work, the HBM had not been applied to exercise behavior outside of the clinical setting in any systematic manner. Their questionnaire consisted of the following constructs: knowledge, susceptibility, severity, benefits, barriers, complexity, support, cues, motivation, and locus of control.

Using these HBMI factors and excluding locus of control,
they were able to account for 56% of the variance in exercise behavior (Slenker, Price, Roberts & Jurs, 1984). Adding age and gender raised this to nearly 61%. Barriers accounted for the most variance in this analysis, followed by motivation, and benefits. The importance of barriers and benefits is consistent with the preventive health behavior research reviewed by Janz and Becker (1984). Variables representing susceptibility, support, locus of control, knowledge and education were not significant contributors to the prediction equation. As in most other studies of preventive health behavior, severity was difficult to conceptualize and contributed only marginally to the prediction of behavior. Gender and age were significant with more males exercising and exercisers tending to be younger than non-exercisers. The relatively high internal consistencies and the success of this instrument in predicting exercise behavior suggested that it was worthy of further study. A modified version of Slenker, Price, Roberts, and Jurs' (1984) instrument was used in this study.

According to Rosenstock, Strecher and Becker (1988), locus of control is incorporated into other aspects of the model and need not be measured as a separate construct. This change is consistent with the finding of a non-significant contribution of locus of control by Slenker, Price, Roberts, and Jurs (1984) and others.
Rosenstock, Strecher and Becker (1988) also recommended that the HBM be revised to include self-efficacy as a separate independent variable. Bandura's (1977) Social Learning Theory and revised Social Cognitive Theory (1986) have provided a basis for the examination of self-efficacy as an additional component of motivation. In comparing these theoretical models, Rosenstock, Strecher and Becker (1988) identify constructs within the Health Belief Model which are analogous to all of the components of Social Cognitive Theory except for self-efficacy. The addition of a specific self-efficacy component is thought to be particularly important in domains like exercise where the behavior is more complex, time-consuming, and requires persistent behavior (Strecher, DeVellis, Becker & Rosenstock, 1986). This study examined the contribution of self-efficacy to the ability of the constructs in the Health Belief Model Inventory to predict exercise behavior.

Traditional fitness-focused models of behavior have usually combined frequency, intensity, and duration in definitions of exercise. As studies have probed the motivational influences on exercise, however, the discomfort associated with high exertion has been identified as a reason for dropping out (Morgan & Goldston, 1987) and avoiding some activities (Kasper, 1990; Sechrist, Walker & Pender, 1987). Dishman (1990) has suggested that high intensity exercise may
be more related to sport or achievement motivation than to health-related motives. He emphasized that these "exertional preferences" may be particularly important among "free-living" (i.e. not medically supervised) populations. Therefore, this study will compare the contribution of the motivational constructs among high exertion and low exertion subgroups.

Method

Subjects

The subjects of this study were employees of a major medical center. Instruments were mailed to all 351 employee members of the on-site health and fitness center as well as 800 randomly selected non-member employees. A postcard reminder and an employee newsletter article on the purpose of the study were used to encourage responses. In order to reassure respondents regarding the confidentiality of the data, no individual identifiers were included in the survey. Data were obtained from 511 (45%) of the 1151 employees in the initial mailing. Ninety-six percent of the respondents were Caucasian and 79% were female. Subjects had a mean age of 35.7 years (SD=9.7) and 64% were married. Seventeen percent had no more than a high school education, 10% had trade school training, 25% some college, and 44% had at least college degree. The remaining 4% had a highest level of schooling not accounted for in these categories. Thirty-five percent were
members of the on-site fitness center.

**Instruments**

*Health Belief Model.* The instruments used in this study included a revised Health Belief Model Inventory derived from Slenker, Price, Roberts, and Jurs (1984). Modifications to the HBM scales include the elimination of the scales for knowledge, locus of control, and severity, combining the complexity items with barriers, and rewording items in the susceptibility section. The five revised HBM scales remaining in the inventory were Benefits, Barriers, Susceptibility, Social Influences, and Cues to Action (See Cychosz & Anderson, previous chapter).

In addition to the HBM components, the inventory included the Perceived Physical Ability subscale of the Physical Self-Efficacy Scale (Ryckman, Robbins, Thornton & Cantrell, 1982) and a detailed recall of physical activity. The latter two components will be discussed in the following sections.

*Self-efficacy.* A measure of self-efficacy has been developed specifically with regard to physical activity (Ryckman, Robbins, Thornton & Cantrell, 1982). The Physical Self-Efficacy Scale (PSES) is a 22 item inventory with an overall scale score as a general measure of physical self-efficacy ($\alpha = .81$), and two subscales: Perceived Physical Ability (PPA, $\alpha = .84$) and Physical Self-Presentation
Confidence (PSPC, $\alpha=.74$). Ryckman, Robbins, Thornton and Cantrell (1982) report a coefficient of stability of .80 for the overall measure, .85 for the PPA subscale, and .69 for the PSPC subscale. They also report convergent validity values ($r=.58$ for the overall score, $r=.43$ for the PSPC and $r=.52$ for the PPA) with the Tennessee Physical Self-Concept subscale. Using hierarchical multiple regression to predict sports participation, they found significant variance accounted for by the PPA, PSES, and PSPC. They conclude that the overall scale and the two subscales have satisfactory psychometric properties and exceed the ability of related scales in predictive validity.

Because the PPA subscale had higher reliability and related most directly to exercise behavior, it was used to measure self-efficacy in this study. This is consistent with Dishman's (1991) recommendation that general perceptions of physical ability might be better predictors of behavior than specific efficacy beliefs. It was included with the revised Health Belief Model Inventory to provide the primary predictor variables under consideration. The internal consistency (Cronbach, 1951) for each of the six independent variables is reported in Table 1. Alpha coefficients ranged from $\alpha=.76$ for barriers to $\alpha=.96$ for benefits.
Measuring exercise behavior. In this study a series of specific questions asked participants to recall frequency, intensity, and duration of exercise as well as type of exercise. The format for these questions is a considerable extension of previous investigation of this inventory (Slenker, Price, Roberts, & Jurs, 1984), and is consistent with the recommendations of several others (LaPorte, Montoye & Casperson, 1985; Washburn, Adams & Haile, 1987; Slater, Green, Vernon & Keith, 1987; and Washburn & Montoye, 1986). Item means and variances for number of weeks of exercise, typical number of minutes per week of exercise, and level of exertion (1-low to 7-breathless, sweating) are reported in Table 1. Responses to questions regarding minutes per week and weeks of exercise were used to create the dependent variable under examination.

In order to determine whether the model is affected by "exertional preferences", the population was split into two groups. Those reporting average exercise intensity of at least "energetic but able to talk, often sweat" were labeled high exertion (n=325). Those whose average activity level ranged up to "energetic but able to talk conversationally, rarely sweat" were labeled low exertion subjects (n=186). While this method lacks the precision of clinical measures of
intensity, it does attempt to accommodate individual exertional perceptions. In addition, the "sweating" indicator is often judged to be a perceptual anchor of perceived exertion scales (Borg, 1973). Duncan and Stoolmiller (1993) successfully used these two components plus intensity of exercise to establish a dependent variable in their structural equation modeling of exercise behavior.

Thus, this study examined the relationship of the HBM components of Benefits, Barriers, Susceptibility, Cues to Action, Social Influences as well as Perceived Physical Ability (as an indicator of physical self-efficacy) with exercise behavior as indicated by minutes per week and weeks of exercise behavior.

**Structural Equation Modeling**

Structural equation modeling or covariance structure modeling has been used as a method for examining various theories about social psychological processes. Structural equation modeling allows latent variables, multiple indicators, and errors in the variables to be specified and tested within a common model.

The nature of causality examined in this study is subject to several assumptions. These assumptions include the idea that observed covariation represents some relationship between the variables, that behaviors of interest are broadly
distributed and covary in such a way that cross-sectional data can represent the relationship among variables, and that all causal factors have been identified. The use of structural equation modeling techniques and the interpretation of findings must be subject to these conditions.

For social psychological models in the early stages of development, maximum likelihood estimates are generally employed (Bollen, 1989). After estimating the parameters, the fit of the model is usually examined. In essence, the fit reflects the degree to which the proposed model is supported by the data.

The modeling approach used here is an adaptation of the multiple indicators, multiple causes (MIMIC) approach described by Jöreskog and Sörbom (1989). In this case, the indicators are minutes per week of exercise and number of weeks of exercise. The causes are taken to be the HBM constructs of Susceptibility, Benefits, Barriers, Social Influences, and Cues to Action as well as Perceived Physical Ability. This analysis explores the extent of their effect on the indicators of exercise behavior.

Prelis (SPSS, 1990) was used to create a covariance matrix among the observed variables in the study. Lisrel 7 was then used to create a standardized covariance matrix among the six latent constructs and the two observed indicators. This matrix was then analyzed using Lisrel 7 to identify the
path coefficients and fit indices for the models of interest. The same procedures were used for the comparison of the high exertion and low exertion subgroups.

Thus, structural equation modeling provides a systematic approach to the analysis of psychosocial models. In this case, it will be used to develop a preliminary framework for the interrelationship among the major constructs of the Health Belief Model applied to exercise behavior.

Proposed Models

In this study, the models of substantive interest are developed sequentially since there has been little structural equation modeling of the HBM components and no previous effort to model the HBM components as they influence exercise behavior. Figure 1 shows the basic components of the model to be tested.

The null model provides a basis for evaluating improvements in fit indices among the substantive models. The first substantive model examines the contribution of paths from the five HBM variables in the model. The next model adds the path for PPA in order to examine whether PPA contributes to the fit of the model. A reduced model including only the significant paths is also reported. The full model including the HBM components and PPA is then compared among high exertion and low exertion subgroups in this sample.
Results

The correlation coefficients among the eight variables in the study are reported in Table 2. The values show Benefits to be intercorrelated with Social Influences ($r=.56$) and Cues to Action ($r=.66$). Similarly, Social Influences is correlated with Cues to Action ($r=.49$). These correlations are not identified as a particular problem since the Health Belief Model does not necessarily imply that these are orthogonal subscales. Perceived Physical Ability displays moderate negative correlations with Susceptibility ($r=-.35$) and Barriers ($r=-.34$) and is relatively uncorrelated with the other constructs in the model.

Analysis of the HBM model (see Figure 2) revealed significant paths for perceived Susceptibility ($\beta_{11}=-.259$) and Cues to Action ($\beta_{15}=.145$). Thus, higher perceived Susceptibility is associated with lower activity levels. Higher values for Cues to Action are associated with higher
levels of activity. The Chi-square value of 15.30 (6 df), while still significant \( p = .018 \), compares favorably with the null model \( \chi^2(11) = 82.84, p = .001 \) (see Table 3). The Goodness of Fit Index (GFI) improves from .963 to .993 and the Root Mean Square Residual (RMR) also improves from .090 in the null model to .024 in the HBM model. The Squared Multiple Correlation for exercise behavior was .21.

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Insert Table 3 about here

---

The path coefficients for the indicators reflect the standardized value (1.0) for weeks and a very similar coefficient for minutes per week (.869). Thus, the HBM components represent an improvement over the null model but falls somewhat short of what may be termed a good fit to these data. Benefits, Barriers, and Social Influences contribute little to the prediction of exercise.

---

Insert Figure 2 about here

---

Analysis of the model with HBM components and PPA (HBM+PPA) reveals significant paths for Susceptibility \( ( \beta_{11} = - .224 ) \) and Cues to Action \( ( \beta_{15} = .139 ) \) (see Figure 3). The path
for PPA ($\beta_{16} = 0.092$) was also significant in this model. The nonsignificant Chi-square ($\chi^2(5) = 10.49, p = 0.062$), reveals an improved fit of the model (see Table 3). Improvements in the GFI to .995 and the RMR to .017 also suggest an improved fit. The SMC for exercise behavior is .23. PPA appears to improve the fit of the model resulting in a nonsignificant $\chi^2$ and relatively good fit indices. The improvement in the SMC for exercise behavior, although slight, argues in favor of this model's fit to the data.

---

In order to test whether the paths for Benefits, Barriers, and Social Influences could be deleted from the model, a reduced model having only Susceptibility, Cues to Action, and PPA was examined (see Figure 4). Path coefficients remain relatively stable. The change in Chi-square between the full model (HBM+PPA) and the reduced model was examined to assess the fit. The change in Chi-square from $\chi^2(5) = 10.49$ to $\chi^2(8) = 12.99$ was $\chi^2(3) = 2.50$. The probability associated with this value was approximately $p = 0.50$. This nonsignificant change in Chi-square supports the reduced model as the most parsimonious representation of the relationships examined in this data set. This is further supported by the
small changes in GFI, RMR and SMC values for the reduced model. The Adjusted Goodness of Fit Index, which adjusts for degrees of freedom in the model relative to the number of variables, also supports this as the best fitting model.

Insert Figure 4 about here

Level of exertion

Correlation coefficients for the high and low exertion groups are reported in Table 4. Results for the high exertion group show correlations which are quite similar to the full sample reported in Table 2.

Results for the low exertion group display similar correlations among the constructs except that Social Influences and Cues to Action are correlated \((r=.54)\) for the lower exertion group. Somewhat different coefficients emerge for the relationships between the constructs and both minutes and weeks of exercise in the low exertion group. Most notably, weeks is negatively correlated with Benefits \((r=-.21)\) and Social Influences \((r=-.20)\). The correlation between Cues to Action and minutes drops from \(r=.23\) in the full sample to \(r=.01\) in the low exertion group.
Analysis of the full model (HBM+PPA) for high exertion subjects revealed significant paths for Susceptibility ($\beta_{11} = -.173$), Cues to Action ($\beta_{15} = .151$), and PPA ($\beta_{16} = .126$) (see Figure 5). Although the coefficients change slightly, the significant paths remain the same in this group as in the full sample. The fit indices reveal a somewhat poorer fit with ($\chi^2(5) = 12.65, p = .027$). Nonetheless the SMC for exercise behavior was .23.

Analysis of the full model (HBM+PPA) among low exertion subjects, however, revealed significant paths for Susceptibility ($\beta_{11} = -.171$), Social Influences ($\beta_{14} = -.166$), and Cues to Action ($\beta_{15} = .103$) (see Figure 6). The path from PPA to exercise behavior was nonsignificant in this group. Fit indices included ($\chi^2(5) = 8.95, p = .111$) and a GFI = .988 suggesting a relatively good fit although the SMC for exercise behavior dropped to .12.
These findings suggest that Susceptibility and Cues to Action are significant contributors to exercise behavior for both high and low exertion subjects. PPA appears to contribute to exercise behavior in high exertion subjects while Social Influences emerge as a contributor for low exertion subjects. The negative coefficient for Social Influences is an unexpected, although not illogical finding. It suggests that active, low exertion subjects report lower levels of social influences than the less active, low exertion subjects.

Discussion

The ability of the HBM components to predict exercise activity in this sample fell short of Slenker, Price, Roberts and Jurs (1984) who explained over 50% of the variance in exercise behavior. The sample examined in this study represented a broad range of activity levels including inactive, moderately active, and very active individuals. In contrast, the original study (Slenker, Price, Roberts & Jurs, 1984) of this instrument involved only inactive and highly active individuals and this may have served to maximize the
differences among groups. It is likely that the sample examined in the present study is more representative of the attitudes one would encounter among employees in a workplace environment or among adults in general.

Although the model showed less association with exercise behavior in this sample than in Slenker, Price, Roberts and Jurs' (1984), the variance explained in this study is consistent with the findings of Courneya and McAuley (1993) and Lindsay-Reid and Osborn (1980), while exceeding the variance explained by others (Godin, Valois & LePage, 1993; Kristiansen & Eiser, 1986; Tappe, Duda & Ehrnwald, 1989).

Among the models examined, Cues to Action was consistently associated with the prediction of behavior. These findings validate the observation by Janz and Becker (1984) that Cues to Action are often necessary to activate health behavior.

Susceptibility was negatively related to exercise behavior across all models. Higher levels of susceptibility were reported among those who exercised the least. The most logical explanation of this extends from the fact that this is a cross-sectional study and perceptions of susceptibility are affected by the behavior. Those who engage in exercise perceive lower susceptibility to the consequences of inactivity while those who are less active perceive themselves to be susceptible. While these findings support the theory
that susceptibility is a motivating force in exercise behavior, the question of whether susceptibility acts as a motivating force for the initiation of exercise cannot be resolved by these data.

The recommendation that physical self-efficacy be included in the HBM (Rosenstock, Strecher & Becker, 1988) is supported by the findings of this study. Perceived physical ability, as a measure of PSE, contributed to an improved fit of the model and was particularly important among high exertion subjects. The nonsignificant contribution in low exertions subjects suggest that PPA and the efficacy expectations it represents are not important determinants of physical activity among low intensity exercisers. This finding is important because it suggests that people may engage in low intensity physical activity without developing improved perceptions of their physical ability.

Health promotion efforts may find that increasing levels of participation among adults requires much closer attention to the type of activity and individual exertional preferences rather than efforts to help people adapt to high intensity exercise regimens. This view is supported by research indicating that the health benefits resulting from low intensity exercise have been previously underestimated (Paffenbarger, Hyde & Wing, 1990).

Among the low exertion exercisers, the negative
association of social influences with exercise behavior was unexpected. The perception of higher levels of approval for exercise by spouse, physician, family, and co-workers suggest that the low exertion group feel some pressure, or at least some support, to engage in the behavior.

This was in contrast with the high exertion group where social influences showed no effect. It is possible that among high intensity exercisers other, more internal motives become more important than approval of the behavior by others. Dishman (1990) along with Masters, Ogles, and Jolton (1993) have advanced these arguments in more detailed explorations of the motivation for high intensity activity. It may also be that higher intensity exercisers begin to experience conflict between exercise and other commitments in their lives. As a result, they may perceive lower or more varied levels of approval for their exercise activity.

The benefits of exercise behavior has received enough attention in recent years that the social desirability of exercise is likely to have influenced the responses to the items in this questionnaire. This is most likely to be evident in the Benefits scale where the consequences of exercising are noted and in the Social Influences scale where the perceived social approval of others is reported. In addition, an element of social desirability is also likely to be represented by the whole questionnaire since this is a
medical environment and the nature of the investigation was readily apparent in the line of questioning.

Summary

The results of this study substantiate the contribution of the HBM constructs of Susceptibility and Cues to Action to the prediction of exercise behavior. PPA also contributed to the prediction of exercise, particularly among high exertion exercisers.

The motivational constructs examined in this study accounted for only 22% of the variance in exercise behavior. While this is consistent with other studies of adult exercise, it suggests that HBM motives play a limited role in exercise behavior. Motives and influences outside this domain should be explored for their influence on this behavior.

Low exertion exercisers displayed a somewhat different pattern of motivational influences from those affecting high exertion exercisers. Future study of motivation for exercise among adults should distinguish high and low exertion exercisers and further develop the concept of exertional preferences.

Further research is suggested in several areas:

1. Studies involving health-related exercise behavior should consider the potential exertional preferences as part of an individual's beliefs rather than simply as a dimension of exercise behavior. In addition to the level of exertion,
there are other characteristics of activity which may affect motivation. These characteristics may involve interaction with other people, the type of movements required or even preferences for clothing or exercise environments. While these have previously been studied as potential barriers, some consideration should be given to the potential that these are non-modifiable preferences. The non-modifiable preferences may dictate boundaries within which the individual's exercise behavior must occur.

2. Longitudinal designs should be employed to more definitively identify the appropriate causal ordering of Susceptibility and Social Influences.

3. More attention should be directed to identifying stages of change (Prochaska & Diclemente, 1985; Rogers, 1983) including the constructs and relationships which are relevant to stage transitions. Since this study addressed the prediction of participation in physical activity, it does not necessarily delineate which components influence people to initiate the behavior.

4. Additional efforts to test structural equations representing the HBM should consider employing indicators of behavioral intention to assist in the elaboration of the attitude/behavior relationship. For example, Godin, Valois, and LePage (1993) found strong attitude/intention associations and weak intention/behavior associations in their study of
exercise intentions. The use of behavioral intention may be particularly important in relation to repetitive activities such as exercise since they require considerable commitment and persistence. Intentions may serve as an improved indicator of attitudes and allow more careful attention to the factors which interfere with a person's ability to act on their intentions.
Table 1. Summary statistics for constructs in the study

<table>
<thead>
<tr>
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<th># items</th>
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Physical Activity

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<th>exertion</th>
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Table 2. Factor correlation coefficients for variables in the study, corrected for measurement error.

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<th>BARS</th>
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<th>PPA</th>
<th>Minutes</th>
<th>Weeks</th>
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<td>.07</td>
<td>.14</td>
<td>.13</td>
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(n=511)

SUSC (Susceptibility)
BENF (Benefits)
BARS (Barriers)
SOCI (Social Influences)
CUES (Cues to Action)
PPA (Perceived Physical Ability Scale-Physical Self-Efficacy)
Minutes-minutes per week of exercise.
Weeks-reported weeks of regular exercise.
Table 3. Summary statistics for structural equation models.

<table>
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<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>RMR</th>
<th>GFI</th>
<th>AGFI</th>
<th>SMC-$\eta$</th>
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<td>.995</td>
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<tr>
<td>Reduced</td>
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<td>.021</td>
<td>.994</td>
<td>.972</td>
<td>.22</td>
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</table>

**HBM+PPA by exertion level**

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<th>Level</th>
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<th>$p$</th>
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<th>GFI</th>
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<th>SMC-$\eta$</th>
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</thead>
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<td>High</td>
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<td>.12</td>
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</table>

Full sample, n=511  
High exertion, n=325  
Low exertion, n=186  
$\eta$=exercise behavior
Table 4. Factor correlation coefficients for variables among high and low exertion groups

<table>
<thead>
<tr>
<th></th>
<th>SUSC</th>
<th>BENF</th>
<th>BARS</th>
<th>SOCI</th>
<th>CUES</th>
<th>PPA</th>
<th>Minutes</th>
<th>Weeks</th>
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<td>PPA</td>
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<tr>
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<td>-.06</td>
<td>-.10</td>
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<td>.05</td>
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<td>Weeks</td>
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<td>-.21</td>
<td>-.18</td>
<td>-.20</td>
<td>-.10</td>
<td>.04</td>
<td></td>
<td>.54</td>
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</table>

Note: High exertion subjects (n=325) above diagonal and low exertion subjects (n=186) below diagonal.

SUSC(Susceptibility)  
BENF(Benefits)  
BARS(Barriers)  
SOCI(Social Influences)  
CUES(Cues to Action)  
PPA(Perceived Physical Ability Scale-Physical Self-Efficacy)  
Minutes-minutes per week of exercise.  
Weeks-reported weeks of regular exercise.
Figure 1. Model to be tested.
Motivational Constructs

- Susceptibility
- Benefits
- Barriers
- Social Influences
- Cues to Action
- Perceived Physical Ability

Indicators

- Minutes per week
- Weeks

Note: Correlations among motivational constructs omitted for clarity (see Table 2).

Figure 2. Path diagram for Health Belief Model components (n=511). (*p<.05).
Motivational Constructs

- Susceptibility
- Benefits
- Barriers
- Social Influences
- Cues to Action
- Perceived Physical Ability

Indicators

- Minutes per week
- Weeks

Note: Correlations among motivational constructs omitted for clarity (see Table 2).

Figure 3. Path model for all variables—Health Belief Model and Perceived Physical Ability (HBM+PPA) (n=511) (*p<.05).
Note: Correlations among motivational constructs omitted for clarity (see Table 2).

Figure 4. Reduced path model of exercise motivation (n=511) (*p<.05).
Motivational Constructs

Susceptibility

Benefits

Barriers

Social Influences

Cues to Action

Perceived Physical Ability

Exercise Behavior

Indicators

Minutes per week

Weeks

Note: Correlations among motivational constructs omitted for clarity (see Table 4).

Figure 5. Full path model (HBM+PPA) for high exertion subjects (n=325) (*p<.05).
Motivational Constructs

- Susceptibility
- Benefits
- Barriers
- Social Influences
- Cues to Action
- Perceived Physical Ability

Indicators

- Exercise Behavior
  - $R^2 = .12$
  - Minutes per week: $.711^*$
  - Weeks: $.741^*$

Note: Correlations among motivational constructs omitted for clarity (see Table 4).

Figure 6. Full path model (HBM+PPA) for low exertion subjects (n=186). (*p<.05).
ADDITIONAL ANALYSIS

Introduction

One additional theoretical model of the relationship among the constructs in this study was also examined using structural equation modeling techniques. Although the model ultimately proved unsatisfactory, the results are reported here since there has been little structural equation modeling of the HBM components and no previous effort to model the HBM components as they influence exercise behavior.

For this analysis, exercise behavior was represented by three individual questions reporting minutes per week of exercise, number of weeks (up to 99), and level of exertion. These three variables were combined to form the composite exercise behavior. The estimated correlation matrix among the latent factors is shown in Table 2. These estimates of the relationships among the constructs were generated using a confirmatory factor analysis strategy in Lisrel 7.

Correlation coefficients estimated under these conditions depart substantially from those in the previous chapter. The relationship of exercise behavior to the other six constructs of interest in this study--Susceptibility, Benefits, Barriers, Cues to Action, Social Influences, and Perceived Physical Ability--was then examined using this matrix as the estimated correlation matrix among the factors.

The model of relationships between the five factors
Table 2. Estimated Factor Correlation Coefficients

<table>
<thead>
<tr>
<th></th>
<th>SUSC</th>
<th>BENF</th>
<th>BARS</th>
<th>SOCI</th>
<th>CUES</th>
<th>PPA</th>
</tr>
</thead>
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<td>SUSC</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BENF</td>
<td>.06</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARS</td>
<td>.53</td>
<td>.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOCI</td>
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<td>.68</td>
<td>-.03</td>
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<td>CUES</td>
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<td>.53</td>
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</table>

SUSC (Susceptibility)
BENF (Benefits)
BARS (Barriers)
SOCI (Social Influences)
CUES (Cues to Action)
PPA (Perceived Physical Ability Scale-Physical Self-Efficacy)

comprising the HBM is proposed based on Rosenstock (1974) who posited that Benefits, minus the influence of Barriers, is the determinant of the mode of behavior. Although it is not explicitly stated as such, this implies that Benefits and Barriers may play a mediating role for the other variables in the model. The model in Figure 2 shows this relationship
among basic components of the HBM and Perceived Physical Ability. Because several psychological models propose that Benefits and Barriers influence behavioral outcomes (Turk, Rudy & Salovey, 1984), they are included as basic components of the model. In addition, Janz and Becker (1984) suggest that Cues to Action are important triggering mechanisms for behavior and their role in the prediction of behavior is clearly identified. This basic relationship is represented by paths labeled 1a, 1b, and 1c in Figure 2. Paths 1d and 1e are included in all models.

Since Rosenstock (1974) describes Susceptibility as "the force to act", it is added to Benefits, Barriers, and Cues to Action as the predictors in Model 2a and 3a. The principal research question in Model 2a is whether the "force to act" (Susceptibility) is manifested through perceptions regarding Benefits (Paths 2a.1 in Figure 2) and Barriers (Path 2a.2). Model 3a examines if this is more directly related to Exercise Behavior (Path 3a).

Social Influences are often regarded as an aspect of benefits in HBM research but Slenker, Price, Roberts, and Jurs' (1984) finding that Social Influences accounted for variability independent of Benefits, suggests that Social Influences may have a broader role. It may act on Benefits, Barriers, or directly on exercise behavior. Thus, the third substantive research question is whether Social Influences
Figure 2. Model of mediating effects.
acts on Benefits (Path 2b.1 in Figure 2) and Barriers (Path 2b.2). Model 3b examines the effect directly on Exercise Behavior (Path 3b).

Perceived Physical Ability is examined in a similar manner in Model 2c. At this stage, the research question is whether PPA predisposes one to perceptions regarding Benefits (Path 2c.1 in Figure 2) and Barriers (Path 2c.2). Model 3c tests the effect of PPA directly on exercise behavior (Path 3c).

Thus, Models 2a, 2b, and 2c test the contribution of the predictor variables to the mediating variables in addition to the relationships established in Model 1. Models 3a, 3b, and 3c add the paths directly to exercise behavior from each of the three predictor variables.

Model 4 includes all paths from the predictor variables (Susceptibility, Social Influences, and PPA) to the mediating variables (Benefits and Barriers) and the paths from Model 1.

Finally, the fully recursive path model (see Model 5) with all paths for the predictors is examined. The purpose of testing this model is to identify all path loadings and explore areas which may potentially improve the overall fit of the model.
Results

Results in Table 3 show the path coefficients for the models under consideration. In addition, data in Table 4 provide summary statistics for the models examined in this section.

Table 4. Fit Indices for mediating effects models.

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<tr>
<th>Model</th>
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<td>5</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
<td>.719</td>
</tr>
</tbody>
</table>

Note: All models included unidentified parameters. The solution failed to converge for Model 4 after 51 iterations.
Table 3. Path coefficients for mediating effects models

<table>
<thead>
<tr>
<th>Model</th>
<th>Paths</th>
<th>CUES(γ1)</th>
<th>SUSC(γ2)</th>
<th>SOC(γ3)</th>
<th>PPA(γ4)</th>
<th>Ex.(β3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β1</td>
<td>β2</td>
<td>β3</td>
<td>β1</td>
<td>β2</td>
<td>β3</td>
</tr>
<tr>
<td>1</td>
<td>-.777</td>
<td>-.032</td>
<td>.765</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td>-.778</td>
<td>-.039</td>
<td>.727</td>
<td>.070</td>
<td>.534</td>
<td></td>
</tr>
<tr>
<td>2b</td>
<td>-.578</td>
<td>-.092</td>
<td>1.636</td>
<td>.302</td>
<td>.091</td>
<td></td>
</tr>
<tr>
<td>2c</td>
<td>-.792</td>
<td>.030</td>
<td>.772</td>
<td></td>
<td>-.147</td>
<td>.591</td>
</tr>
<tr>
<td>3a</td>
<td>-.778</td>
<td>-.039</td>
<td>1.472</td>
<td>.070</td>
<td>.534</td>
<td>-.869</td>
</tr>
<tr>
<td>3b</td>
<td>.578</td>
<td>-.092</td>
<td>-.236</td>
<td>.302</td>
<td>.091</td>
<td>1.036</td>
</tr>
<tr>
<td>3c</td>
<td>-.792</td>
<td>.030</td>
<td>.695</td>
<td></td>
<td>-.147</td>
<td>.591</td>
</tr>
<tr>
<td>4</td>
<td>-.892</td>
<td>-2.208</td>
<td>.103</td>
<td>.105</td>
<td>.187</td>
<td>-.141</td>
</tr>
<tr>
<td>5</td>
<td>-.645</td>
<td>.255</td>
<td>1.118</td>
<td>.209</td>
<td>.247</td>
<td>-.465</td>
</tr>
</tbody>
</table>

β1 = benefits
β2 = barriers
β3 = exercise behavior
Although the most important research questions are addressed by examining the specific paths in each model, the overall fit of these models must be examined in order to judge whether any of the models result in satisfactory fit. Initial indicators of poor fit included unidentified parameters for all models and several out-of-range values. Parameter estimates fell out of range for 10 values (see Table 5). All of the parameters should be between -1.0 and 1.0. The ten out-of-range values represent an inability to develop reasonable parameter estimates and provide evidence of a very poor fit of the model to the data.

Table 5. Out-of-range parameter estimates for mediating effects model.

<table>
<thead>
<tr>
<th>Model</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a</td>
<td>(β32=-1.114)</td>
</tr>
<tr>
<td>2b</td>
<td>(γ31=1.636) (β31=1.904)</td>
</tr>
<tr>
<td>3a</td>
<td>(γ31=1.472) (β31=1.622)</td>
</tr>
<tr>
<td>3b</td>
<td>(γ33=1.036) (β31=-1.402)</td>
</tr>
<tr>
<td>4</td>
<td>(β32=-2.806) (β31=-1.113)</td>
</tr>
<tr>
<td>5</td>
<td>(γ31=1.118)</td>
</tr>
</tbody>
</table>
Further examination of fit indices (see Table 4) included inspection of $\chi^2$ values. The $\chi^2$ values for all models were relatively high ranging from Model 1 ($\chi^2(7)=742.95$) to Model 4 ($\chi^2(1)=122.47$). Since Models 5 is a fully recursive model, the summary statistics only reflect that all paths are entered. These are all highly significant $\chi^2$ values further indicating a very poor fit.

Although Model 4 had a reasonably high Goodness-of-Fit Index (GFI) value, the values for the models generally indicate very poor fit. This is further supported by the low and occasionally even negative Adjusted Goodness of Fit Index values. Taken as a whole, these results indicate that the mediating effects model is inappropriate for these data.

Discussion

The conceptualization of the Health Belief Model was originally stated in very general terms. As researchers have sought empirical verification of the model, these general statements have occasionally been interpreted in different ways. The model tested in this section represents one possible latent path model of Rosenstock's (1974) description. By stating that benefits and barriers determine the mode of action, he implied that they acted to mediate the effects of the other motivational variables in the model. This model,
however, is not substantiated by the data in this study.

There are several possible reasons that this mediating effect is not apparent. First, this analysis is based on cross-sectional data and as such, does not unequivocally resolve the direction or sequence of causal relationships. A longitudinal analysis of these variables among a sample large enough to capture several hundred adults who initiate exercise behavior might capture a mediating effect not seen in this study.

Second, physical activity is a complex behavior requiring persistent attention. As such, it differs markedly from the immunization compliance and appointment-keeping behavior which the HBM initially sought to explain. While it has been adapted to preventive health behavior of many kinds, the model may serve to capture the elements affecting a single decision better than the elements leading to persistent patterns of behavior. This argument has been alluded to by Kelly, Zyzanski and Alemagno (1991) who found beliefs (similar to susceptibility and benefits in this study) to be motivational but behavioral outcomes to be equally affected by efficacy beliefs. This parallels the findings of a significant contribution for PPA among high exertion subjects in previous findings of this study.

Finally, the subjects in this study represent relatively active adults working in a medical setting. Elements of the
work culture may have an impact on how subjects viewed benefits. The promotion of preventive activities and the emphasis on the value of exercise in the health-oriented environment may have resulted in diminished variability in the benefits construct. Because this may be unique to this particular setting, it is possible that a non-medical, adult population might display the mediating effect for benefits and barriers.
GENERAL SUMMARY

Previous research has substantiated a general role for the Health Belief Model as a predictor of health behavior. Application of this model to physical activity, however, has been quite limited. Previous investigations have identified a need for improved definition and measurement of HBM constructs. In addition, limited research has addressed the interrelationship among HBM factors related to exercise behavior.

This investigation had two purposes. First, the study was designed to confirm the factor structure of the Health Belief Model Inventory (HBMI) among employees of a medical center. Second, a structural equation model using HBMI components to predict exercise behavior was developed and tested. Items for the Health Belief Model Inventory (HBMI) were developed from the major elements of the HBM--benefits, barriers, social influences, susceptibility, and cues to action. Many of the specific items were originally developed by Slenker, Price, Roberts and Jurs (1984). Perceived physical ability (Ryckman, Robbins, Thornton & Cantrell, 1982) was added as a measure of physical self-efficacy.

Data were obtained from 511 (45%) of the 1151 employees in the initial mailing. Analysis of the data included: 1) confirmatory factor analysis of the proposed model including benefits, barriers, susceptibility, social
influences, cues to action, and perceived physical ability. 2) structural equation modeling of the relationship between these factors and exercise behavior.

Confirmatory factor analysis of the HBMI revealed relatively stable factor structure for Benefits, Susceptibility, Social Influences, Cues to Action, and Perceived Physical Ability. Barriers was somewhat less unidimensional and, although the goodness of fit was improved by trimming some items, it continued to be the poorest fitting factor in the model. Results of the confirmatory factor analysis indicate the model represents only a mediocre fit to the data.

The structural equation models of exercise behavior substantiate the role of Susceptibility, Cues to Action, and Perceived Physical Ability in determining 22% of the variance in exercise behavior. Susceptibility was negatively associated with exercise behavior while Cues to Action and Perceived Physical Ability were positively associated. Benefits, Barriers, and Social Influences were nonsignificant in their contributions to the model.

When high exertion subjects were compared with low exertion subjects, some differences emerged. The high exertion group displayed negative path coefficients for Susceptibility and positive coefficients for Cues to Action and Perceived Physical Ability. The low exertion group
displayed negative path coefficients for Susceptibility and Social Influences and a positive coefficient for Cues to Action. Results of this study substantiate the addition of Perceived Physical Ability as a component of the model, at least among high exertion subjects. This model's overall ability to predict exercise behavior was substantially less than that achieved in a previous application of the HBMI instrument used in this study.

Finally, the potential for benefits and barriers to mediate the effects of the other constructs was examined. The model parameters and fit indices indicated an extremely poor fit to this type of model. Thus, there was no evidence of Benefits or Barriers playing a mediating role in this application of the Health Belief Model.

Recommendations for Further Study

Further research is recommended in several areas. First, effort should continue to be directed to improvement in measurement of the various constructs involved in the Health Belief Model. Particular attention should be given to the barriers construct since it is frequently cited as a strong predictor of behavior but, at least in this study, appeared to be somewhat unstable. Second, additional attention should be given to theoretical integration of the Health Belief Model with other promising approaches to understanding compliance.
For instance, while Perceived Physical Ability was associated with high intensity exercise in this study, the Health Belief Model does not specifically delineate a role for the psychological process associated with self-efficacy or predict its impact on behavior. In order to clarify this, the HBM components and physical self-efficacy should be examined for their salience at various stages and stage transitions in the process of behavior change (Prochaska & DiClemente, 1985; Rogers, 1983). Flay and Petraitis (1991) have provided some discussion of these issues with respect to drug use prevention.

Further insights could also be derived from a longitudinal study examining adherence to physical activity. This design should be employed to more definitively identify appropriate causal ordering. A longitudinal design would also allow development of a prediction model for those who make changes in their pattern of physical activity since change may involve issues apart from maintenance of the behavior.

Exercise has frequently been studied from a physiological tradition emphasizing frequency, intensity, and duration of activity. This study substantiates Dishman's (1990) recommendation that "exertional preferences" be considered as part of the motivational milieu affecting exercise. Future studies should consider exertional preferences as part of the motivational context rather than simply as one dimension of
the behavioral variable.

Finally, additional efforts to test structural equations representing the HBM should consider employing indicators of behavioral intention to assist in the elaboration of the attitude/behavior relationship.
LITERATURE CITED


King, J. B. (1982). The impact of patients' perceptions of high blood pressure on attendance at screening. *Social Science in Medicine, 16*, 1079-1091.


This dissertation represents the culmination of an effort which has been supported and encouraged by many people. Dr. Dean Anderson of the Department of Health and Human Performance has been an important source of encouragement and support for my academic endeavors. I would also like to thank Dr. Mary Huba, Dr. Tony Netusil, Dr. Richard Warren, and Dr. William Miller of the Research and Evaluation section for their teaching and their support of the students in the section. In addition, I would like to thank Dr. Fred Lorenz for both his teaching and advice.

My family has also supported this effort in countless ways. I would like to recognize their patience, understanding, and encouragement. Their cooperation was an essential part of this enterprise.

Finally, I would like to extend my appreciation to the administration and staff of Iowa Methodist Medical Center. Their support of this project was essential.
APPENDIX A.

CORRESPONDENCE
May 4, 1989

Dear Iowa Methodist employee:

Last week a questionnaire regarding your health lifestyle and exercise involvement was mailed to you. Your name was drawn in a random sampling of IMMC employees.

If you have already completed and returned the questionnaire to Iowa State University, please accept our thanks. If not, please do so today. Because it has been sent to only a small, but representative sample of employees, it is extremely important that yours also be included in the study if the results are to accurately represent employees at IMMC.

If by some chance you did not receive the questionnaire, or it got misplaced, please call (515) 283-6073 and we will get one into the mail today.

Thank you for your assistance.

Sincerely,

Charles Cychosz  Dean Anderson  Sherry Stewart
Health Studies  Physical Education  IMMC Director
APPENDIX B.

INSTRUMENTS
Iowa State University & IMMC Health and Fitness Centre
Survey of Employee Health Lifestyle
A. Do you exercise vigorously on a regular basis at least three times per week for at least 20-30 minutes.
   Yes ______ No ______
   How many weeks have you been doing this? ______

B. If yes, what types of exercise are involved.
   _____ walking
   _____ running or jogging
   _____ lifting
   _____ swimming
   _____ sports
   _____ other: ______________________

C. Are you enrolled in a formal exercise program?
   _____ No ______ Yes ______ Is it the IMMC Health & Fitness Centre? ______

D. If you exercise regularly, please indicate the percentage of time you exercise alone and with others.
   _____ % alone _____ % with others _____ Does not apply

E. Please estimate your average exercise pattern for the last thirty days.
   An average of _____ exercise sessions per week
   An average of _____ minutes per session of workout time

F. Please check off the level of exertion which best describes your average exercise session:
   breathless, sweating
   _____ breathing heavily, sweating
   _____ energetic but able to talk, often sweat
   _____ energetic but able to talk conversationally, rarely sweat
   _____ rarely or never sweat
   _____ not much different from other parts of my daily routine
   _____ other

G. Do you have a regular exercise partner?
   _____ Yes ______ No ______ How many?
   Who is it? ______ Spouse _____ Co-worker(s) _____ Other friend(s)

H. Please estimate your present height ______
   weight ______

I. Date of birth _____/____/____

J. Sex ______ M ______ F ______

K. Married Single Divorced Other

L. Your highest level of education:
   Elementary School 1 2 3 4 5 6 7 8
   High School 1 2 3 4
   College 1 2 3 4 5 6 or more
   Trade School ______________________

Spouse's highest level of education:
   Elementary School 1 2 3 4 5 6 7 8
   High School 1 2 3 4
   College 1 2 3 4 5 6 or more
   Trade School ______________________
M. # of children _____ Ages ________

N. Do you have any medical problems which keep you from exercising?

   No   Yes: __________________________________________

O. Present occupation ____________________________________

P. Race/Ethnicity (Circle one)
   a) White, not of Hispanic Origin. Persons having origins in any of the original peoples of Europe.
   b) African-American. Persons having origins in any of the Black racial groups of Africa.
   c) Asian or Pacific Islander. Persons having origins in any of the original peoples of the Far East, Southeast Asia, Indian Subcontinent, or the Pacific Islands.
   d) Middle Easterner or North African.
   e) American Indian or Alaska Native. Persons having origins in any of the original peoples of North America.
   f) Hispanic. Persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race.

Q. How much do you smoke?
   Not at all
   ___ Cigarettes per week
   ___ Cigars per week
   ___ Pipes per week

R. Please estimate percentage of your co-workers who engage in regular exercise.
   (Circle one) 0 25 50 75 100

S. In comparison to your co-workers, do you exercise
   considerably less
   somewhat less
   same
   somewhat more
   considerably more

T. Please identify the:
   Interscholastic sports you participated in during high school ___________________

   __________________________________________

   Interscholastic sports you participated in during college ________________________

   __________________________________________
Directions: Please make a check mark (✓) in the space which best describes your personal opinion. For each item indicate on a scale from (1) likely to (7) unlikely, how you feel. Please answer them all and do not make more than one mark per item.

<table>
<thead>
<tr>
<th></th>
<th>Likely</th>
<th>Unlikely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Considering my life-style, I might be prone to overweight.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Considering my life-style, I might experience nervousness or stress problems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Considering my life-style, I might develop heart or coronary problems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Considering my life-style, I might develop high blood pressure or cardiovascular problems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Considering my life-style, I might often lack energy.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Considering my life-style, I might get frequent colds or flu.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Considering my life-style, I might be prone to poor lung capacity or shallow breathing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Considering my life-style, I might develop serious joint or muscle injuries.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Running or jogging could benefit me by helping to control my weight.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Running or jogging could benefit me by providing friendship and socializing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Running or jogging could benefit me by relaxing me and relieving tension.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Running or jogging could benefit me by giving me a sense of accomplishment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Running or jogging could benefit me by making me feel better.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Running or jogging could benefit me by helping me get in shape and stay fit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Running and jogging could benefit me by giving me more energy.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
18. Running or jogging could benefit me by helping me to be more patient and understanding.

19. Running or jogging could benefit me by increasing my lung capacity and helping me breathe better.

20. Running or jogging could benefit me by toning my muscles.

21. Running or jogging could benefit me by lowering my cholesterol.

22. Lack of time could keep me from running and jogging.

23. Injuries or soreness could keep me from running and jogging.

24. My work schedule could keep me from running or jogging.

25. Family responsibilities and/or children could keep me from running or jogging.

26. Unsuitable weather could keep me from running or jogging.

27. Lack of desire or interest could keep me from running or jogging.

28. Lack of energy could keep me from running or jogging.

29. A preference to do other things with my time could keep me from running or jogging.

30. Bad knees, feet, ankles, or back could keep me from running or jogging.

31. The use of training techniques could be confusing to me.

32. Lack of self-discipline could keep me from running or jogging.

33. The choice of running shoes or other equipment could be confusing to me.

34. Knowing how to avoid injuries could be confusing to me.

35. My spouse or loved one would approve of my running or jogging.

36. My children would approve of my running or jogging.
37. My friends would approve of my running or jogging.

38. My physician would approve of my running or jogging.

39. My co-workers would approve of my running or jogging.

40. A desire to lose weight would make me want to run or jog.

41. A desire to get in shape would make me want to run or jog.

42. A desire to lower my cholesterol level would make me want to run or jog.

43. Experiencing some tension or stress would make me want to run or jog.

44. Running or jogging is an effective way to improve or maintain health.

45. I have excellent reflexes.

46. I am not agile and graceful.

47. I am rarely embarrassed by my voice.

48. My physique is rather strong.

49. Sometimes I don't hold up well under stress.

50. I can't run fast.

51. I have physical defects that sometimes bother me.

52. I don't feel in control when I take tests involving physical dexterity.

53. I am never intimidated by the thought of a sexual encounter.

54. People think negative things about me because of my posture.

55. I am not hesitant about disagreeing with people bigger than me.

56. I have poor muscle tone.
57. I take little pride in my ability in sports.

58. Athletic people usually do not receive more attention than me.

59. I am sometimes envious of those better looking than myself.

60. Sometimes my laugh embarrasses me.

61. I am not concerned with the impression my physique makes on others.

62. Sometimes I feel uncomfortable shaking hands because my hands are clammy.

63. My speed has helped me out of some tight spots.

64. I find that I am not accident prone.

65. I have a strong grip.

66. Because of my agility, I have been able to do things which many others could not do.

67. If I take care of myself, I can avoid illness.

68. Whenever I get sick it is because of something I've done or not done.

69. Good health is largely a matter of good fortune.

70. No matter what I do, if I am going to get sick I will get sick.

71. Most people do not realize the extent to which their illnesses are controlled by accidental happenings.

72. I can only do what my doctor tells me to do.

73. There are so many strange diseases around that you can never know how or when you might pick one up.
74. When I feel ill, I know it is because I have not been getting the proper exercise or eating right.

75. People who never get sick are just plain lucky.

76. People's ill health results from their own carelessness.

77. I am directly responsible for my health.

78. Physical exercise is a central factor to my self concept.

79. When I describe myself to other people, I usually include my involvement in physical exercise.

80. The IMMC Health and Fitness programs are restricted to upper-level management.

81. The IMMC Health and Fitness Centre is open at hours when I can participate.

82. The IMMC Health and Fitness Centre is in a place where I have easy access.

83. The IMMC Health and Fitness programs offer a variety of activities that I am interested in.

84. The IMMC Health and Fitness Centre offers me the opportunity to interact with people outside my department.

85. A health and fitness center is one type of benefit that shows me that my employer is committed to the welfare of its employees.

86. Having an on-site health and fitness center would not affect my decision to work for or stay with a particular organization.
87. Participating in an on-site health and fitness center would help me to:

<table>
<thead>
<tr>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

- Stay on a regular fitness program.
- Be more productive at work.
- Think more clearly about work-related problems.
- Concentrate better on work tasks.
- Enjoy my work more.
- Relate better to my co-workers.

88. Do you believe you are capable of persisting in a 12-week program of exercise?

- No
- Yes

If yes, how confident are you? (Circle one)

Not at all confident 1 2 3 4 5 6 7 8 9 10 Very confident

What factors are most influential in your decision whether or not to exercise?

Please use this space for any other comments.

Thank you very much for your help. Look for the results in future issues of SCOPE.
Iowa State University
Care of IMMC Mailroom