The Health Belief Model: A Decade Later

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Since the last comprehensive review in 1974, the Health Belief Model (HBM) has continued to be the focus of considerable theoretical and research attention. This article presents a critical review of 29 HBM-related investigations published during the period 1974–1984, tabulates the findings from 17 studies conducted prior to 1974, and provides a summary of the total 46 HBM studies (18 prospective, 28 retrospective). Twenty-four studies examined preventive-health behaviors (PHB), 19 explored sick-role behaviors (SRB), and three addressed clinic utilization. A "significance ratio" was constructed which divides the number of positive, statistically-significant findings for an HBM dimension by the total number of studies reporting significance levels for that dimension. Summary results provide substantial empirical support for the HBM, with findings from prospective studies at least as favorable as those obtained from retrospective research. "Perceived barriers" proved to be the most powerful of the HBM dimensions across the various study designs and behaviors. While both were important overall, "perceived susceptibility" was a stronger contributor to understanding PHB than SRB, while the reverse was true for "perceived benefits." "Perceived severity" produced the lowest overall significance ratios; however, while only weakly associated with PHB, this dimension was strongly related to SRB. On the basis of the evidence compiled, it is recommended that consideration of HBM dimensions be a part of health education programming. Suggestions are offered for further research.

INTRODUCTION

In 1974, *Health Education Monographs* devoted an entire issue to "The Health Belief Model and Personal Health Behavior."[1] This monograph summarized findings from research applying the Health Belief Model (HBM) as a conceptual formulation for understanding why individuals did or did not engage in a wide variety of health-related actions, and provided considerable support for the model.

During the decade that has elapsed since the monograph's publication, the HBM has continued to be a major organizing framework for explaining and predicting acceptance of health and medical care recommendations. The present article provides

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a critical review of HBM investigations conducted since 1974, and subsequently combines these results with earlier findings to permit an overall assessment of the model's performance to date.

Dimensions of the Model

The HBM was developed in the early 1950s by a group of social psychologists at the U.S. Public Health Service in an attempt to understand "the widespread failure of people to accept disease preventives or screening tests for the early detection of asymptomatic disease";[2] it was later applied to patients' responses to symptoms,[3] and to compliance with prescribed medical regimens.[4]

The basic components of the HBM are derived from a well-established body of psychological and behavioral theory whose various models hypothesize that behavior depends mainly upon two variables: (1) the value placed by an individual on a particular goal; and (2) the individual's estimate of the likelihood that a given action will achieve that goal.[5] When these variables were conceptualized in the context of health-related behavior, the correspondences were: (1) the desire to avoid illness (or if ill, to get well); and (2) the belief that a specific health action will prevent (or ameliorate) illness (i.e., the individual's estimate of the threat of illness, and of the likelihood of being able, through personal action, to reduce that threat).

Specifically, the HBM consists of the following dimensions.[6]

Perceived susceptibility.—Individuals vary widely in their feelings of personal vulnerability to a condition (in the case of medically-established illness, this dimension has been reformulated to include such questions as estimates of resusceptibility, belief in the diagnosis, and susceptibility to illness in general[7]). Thus, this dimension refers to one's subjective perception of the risk of contracting a condition.

Perceived severity.—Feelings concerning the seriousness of contracting an illness (or of leaving it untreated) also vary from person to person. This dimension includes evaluations of both medical/clinical consequences (e.g., death, disability, and pain) and possible social consequences (e.g., effects of the conditions on work, family life, and social relations).

Perceived benefits.—While acceptance of personal susceptibility to a condition also believed to be serious was held to produce a force leading to behavior, it did not define the particular course of action that was likely to be taken; this was hypothesized to depend upon beliefs regarding the effectiveness of the various actions available in reducing the disease threat. Thus, a "sufficiently-threatened" individual would not be expected to accept the recommended health action unless it was perceived as feasible and efficacious.

Perceived barriers.—The potential negative aspects of a particular health action may act as impediments to undertaking the recommended behavior. A kind of cost-benefit analysis is thought to occur wherein the individual weighs the action's effectiveness against perceptions that it may be expensive, dangerous (e.g., side effects, iatrogenic outcomes), unpleasant (e.g., painful, difficult, upsetting), inconvenient, time-consuming, and so forth.

Thus, as Rosenstock notes, "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."[8] However, it was also felt that some stimulus was necessary

to trigger the decision-making process. This so-called "cue to action" might be internal (i.e., symptoms) or external (e.g., mass media communications, interpersonal interactions, or reminder postcards from health care providers). Unfortunately, few HBM studies have attempted to assess the contribution of "cues" to predicting health actions. Finally, it was assumed that diverse demographic, sociopsychological, and structural variables might, in any given instance, affect the individual's perception and thus indirectly influence health-related behavior. The dimensions of the Health Belief Model are depicted in Figure 1.

Review Procedures

The following criteria were established for the present review: (1) only HBM-related investigations published between 1974 and 1984 were included; (2) the study had to contain at least one behavioral outcome measure; (3) only findings concerning the relationships of the four fundamental HBM dimensions to behaviors are reported; and (4) we chose to limit our literature survey to medical conditions (thus, no dental studies are reviewed), and to studies of the health beliefs and behaviors of adults (the corresponding literature for children has recently been examined[9]).

Results in Table 1 have been grouped under three headings: (1) preventive health behaviors (actions taken to avoid illness or injury); (2) sick-role behaviors (actions taken after diagnosis of a medical problem in order to restore good health or to prevent further disease progress); and (3) clinic-visits (clinic utilization for a variety of reasons). Within each medical category, studies are presented chronologically.

REVIEW OF STUDIES

Preventive Health Behaviors

Influenza

Obtaining vaccination against infectious diseases represents precisely the kind of preventive health behavior toward which the archetypical HBM was directed, and the expected outbreak of Swine influenza in 1976 presented a unique opportunity to assess the model. Overall, we have identified four investigations[10–13] published since 1974 that have applied the HBM in attempts to understand vaccination behavior; three of these studies concerned Swine Flu, and one dealt with influenza.

Aho[10] surveyed the health beliefs and Swine Flu inoculation status of 122 randomly-selected senior citizens (primarily black and Portuguese-American) who were active members in two senior centers. A 45-item interview schedule elicited respondents' beliefs along all of the major HBM dimensions.

Findings indicated that HBM variables were able to distinguish inoculation program participants from nonparticipants, and these relationships were statistically significant for "susceptibility," "efficacy," and "safety." However, interpretation of the "severity" dimension is more problematic. Two parts of the study interview gathered information concerning this dimension: a question about whether or not the respondent had ever

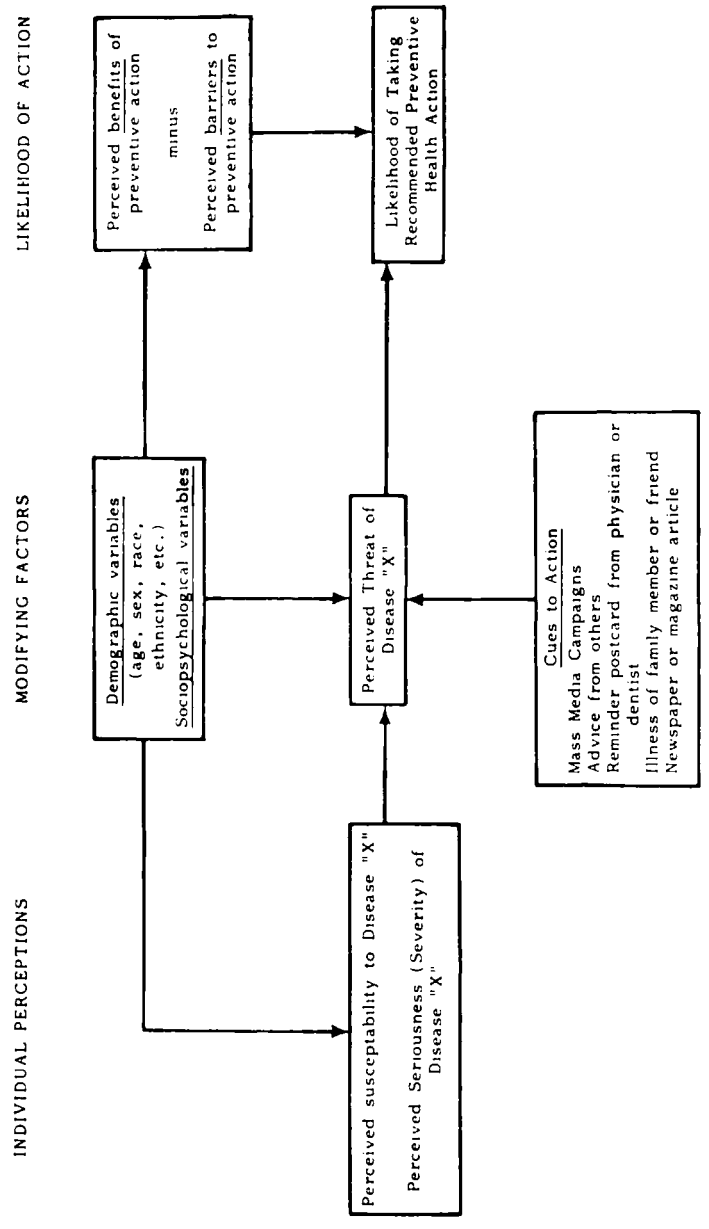

Figure 1. Basic Elements of the Health Belief Model. (Reproduced with permission of *Medical Care*.[51])

Table 1. Results of Health Belief Model Studies Published 1974–1984

Investigator(s)	Design	Health-Related Behavior	Results: Suscep Rel	Suscep Sig	Severity Rel	Severity Sig	Benefits Rel	Benefits Sig	Barriers Rel	Barriers Sig	Notes
			PREVENTIVE HEALTH BEHAVIORS								
Influenza Vaccination											
Aho[10]	*R*, Survey *S* = 122, M + F Age ≥ 60 Active members of 2 senior citizen centers	Swine Flue inoculation	+	yes	+/−	no	+	yes	+	yes	Also obtained information on intentions concerning future flu and other shots
Cummings et al.[11]	*P*, Survey *S* = 286, M + F Age (median) = 18–34 Random sample of adults in a single county	Swine Flu inoculation	+	yes	+	yes	+	yes	+	yes	Results indicate that physician's recommendation is also important
Rundall and Wheeler[12]	*R*, Survey *S* = 232, M + F Age ≥ 65 Random sample of senior citizens in a single county	Swine Flu inoculation	+	yes	+	no	+	yes	+	yes	Used logit analysis to examine variance explained by HBM

Table 1. Results of Health Belief Model Studies Published 1974–1984 (*Continued*)

Investigator(s)	Design	Health-Related Behavior	Results: Suscep Rel	Suscep Sig	Severity Rel	Severity Sig	Benefits Rel	Benefits Sig	Barriers Rel	Barriers Sig	Notes
Larson et al.[13]	*R*, Survey *S* = 232, M + F Age (mean) = 62 Family medical center patients at high risk of serious complications from influenza	Influenza inoculation	+	yes	+	yes	+	yes	+	yes	Included postcard reminder "cues"
Screening Behaviors											
Becker et al.[15]	*R*, Survey *S* = 868, M + F Age ≥ 18 Stratified random sample of an at-risk population encouraged to participate in Tay-Sachs screening program	Participation in Tay-Sachs disease screening program	+	yes	−	yes	+	NR	+	NR	Examined concordance of husband-wife health beliefs

Hallal[16]	*R*, Survey *S* = 207, F Age ≥ 18 Adult women participating in a variety of social, recreational, service and religious groups and employment settings	Practice of breast self-examination	+	yes	NM	—	+	yes	NM	—	Health locus of control and self concept were also examined
King[20]	*P*, Survey *S* = 102, M + F Age = 35–65 Adult patients of general practitioners	Attendance at HBP screening session	+	yes	NR	no	+	yes	+	yes	Total response rate of 68%
Risk-Factor Behaviors			"Behaviorally Consistent"								
Langlie[21]	*R*, Survey *S* = 383, M + F Age ≥ 18 Systematic random sample of adults in a single city	Preventive health behaviors: *Indirect risk PHB* (seat belt use, exercise, nutrition, medical, dental checkups, immunizations, miscellaneous screening exams)	−	yes	NM	—	+	yes	+	yes	Influence of social network variables on PHB also examined
		Direct risk PHB (driving, pedestrian and smoking behavior; personal hygiene)	−	yes	NM	—	+	yes	+	yes	

(*continued*)

Table 1. Results of Health Belief Model Studies Published 1974–1984 (*Continued*)

Investigator(s)	Design	Health-Related Behavior	Results: Suscep Rel	Suscep Sig	Severity Rel	Severity Sig	Benefits Rel	Benefits Sig	Barriers Rel	Barriers Sig	Notes
			"Behaviorally Inconsistent"								
Langlie[21] (continued)		*Indirect risk PHB* (as above)	−	no	NM	—	+	yes	+	no	
		Direct risk PHB (as above)	+	no	NM	—	+	yes	+	no	
Aho[22]	*R*,Survey *S* = 1046, M + F Age = X Random sample of persons living in Rhode Island	Smoking	NM	—	+	yes	NM	—	NM	—	Curvilinear relationship observed between "seriousness" and weight status
		Overweight/underweight	NM	—	+	yes	NM	—	NM	—	
		Regular physical activity	NM	—	NM	—	+	yes	NM	—	
Rundall and Wheeler[23]	*R*,Survey *S* = 781, M + F Age (mean) = 40 Multistage sample of adult residents of a single county in Michigan	MD visits for preventive care:									
		results by correlation	+	yes	−	no	+	no	+	yes	Income shown to affect utilization through health beliefs
		results by path analysis	+	yes	−	yes	+	yes	+	yes	

Tirrell and Hart[25]	*R*,Survey *S* = 30, M + F Age = 46–75 Postcoronary artery bypass patients	Compliance with individualized prescribed exercise regimen	−	no	+	no	+	no	+	yes	Knowledge found to operate as enabling factor
Beck[27]	*P*,Survey *S* = 272, M + F Age = 17–45 College students	Driving after drinking alcohol: getting caught by police	−	no	−	no	+	no	+	no	Attempts to contrast the utility of HBM and Fishbein model
		causing an accident	+	yes	−	no	+	yes	+	yes	
Weinberger et al.[28]	*R*,Survey *S* = 120, M + F Age ⩾ 18 Adult outpatients	Smoking behavior	+	yes	+	yes	NM	—	NM	—	Sample comprised of: 42 ex-smokers 33 moderate smokers 45 smokers (>10/day)
					SICK-ROLE BEHAVIORS						
Antihypertensive Regimen											
Inui, Yourtee, and Williamson[31]	*P*,Exp 2 groups: A = Physician tutorial B = No tutorial (placebo control) *SP* = 10 months *S* = 103, M + F Age = X Hypertensive outpatients	Compliance with antihypertensive regimen	+	yes	+	yes	+	yes	NM	—	62 physicians (29 exp, 33 control) 3–6 month patient follow-up Relationships reported in Table 1 refer to differences between patients of exp versus control physicians

(*continued*)

Table 1. Results of Health Belief Model Studies Published 1974–1984 (*Continued*)

Investigator(s)	Design	Health-Related Behavior	Results: Suscep Rel	Suscep Sig	Severity Rel	Severity Sig	Benefits Rel	Benefits Sig	Barriers Rel	Barriers Sig	Notes
Kirscht and Rosenstock[32]	*R*,Survey *S* = 132, M + F Age (median) = 50–59 Hypertensive adults	Compliance with antihypertensive regimen: medication (self report) pharmacy records diet (self report)	 + + +	 yes no no	 + + +	 no no no	 + + +	 yes no no	 + + +	 yes no yes	Ns substantially below 132 for the 3 compliance measures
Nelson et al.[33]	*R*,Survey *S* = 142, M + F Age (median) = 50–64 Hypertensive outpatients	Compliance with antihypertensive regimen: medication (self-report) appointment-keeping	 NM NR	 — no	 + NR	 yes no	 ? NR	 no no	 + NR	 yes no	Ss were patients under treatment for at least 2 years
Taylor et al.[34] Sackett et al.[35]	*P*,Survey *SP* = 12 months *S* = 128, M Age = X Hypertensive adults	Compliance with antihypertensive medication regimen: with pretreatment beliefs with post-treatment beliefs	 – NM	 no —	 + +	 no yes	 + +	 no no	 + +	 yes yes	Part of a randomized clinical trial for improving medication compliance
Diabetic Regimen Alogna[36]	*R*,Survey *S* = 50, M + F Age = X	Compliance with non-insulin dependent diabetic regimen:	NM	—	+	yes	NM	—	NM	—	Examined only 1 HBM dimension

	Noninsulin-dependent obese diabetic adult clinic patients	weight reduction and blood glucose control												
Cerkoney and Hart[37]	*R*,Survey *S* = 30, M + F Age = 18–73 (80% > 50) Insulin-dependent diabetic adults	Compliance with insulin-dependent diabetic regimen	+	no	+	yes	+	no	+	no	Cues to action were found to be significantly correlated with total compliance score			
Harris et al.[38]	*R*,Survey *S* = 50, M Age (mean) = 58 Adult-onset diabetics using outpatient clinics at a Veterans Administration Medical Center	Compliance with: 5 behavioral measures (medication, diet, urine testing, exercise, foot care)	+ (diet)	yes	NR	No	+ (exercise, diet)	yes	+ (medication)	yes	75% of subjects were receiving insulin			
		4 physiological measures (glycosylated hemoglobin, fasting plasma glucose, fasting triglycerides, urine glucose)	+ (hemoglobin, urine)	yes	+ (fasting glucose)	yes	+ (composite score)	yes	NR	no				
End-Stage Renal Disease Regimen														
Hartman and Becker[39]	*P*,Survey *S* = 50, M + F Age = 14–70 (mean = 44) Ambulatory hemodialysis patients at 3 clinics	Diet and medication regimen for end-stage renal disease: objective assessment (serum phosphorus and potassium levels, fluid weight gain)	−	yes (all)	+	yes (P, fluids)	+	yes (all)	+.	yes (all)	HBM variables also correlated well with blinded (to health beliefs) subjective overall compliance evaluation of each subject's record Patient self-reports were highly correlated with all objective compliance measures			

(*continued*)

Table 1. Results of Health Belief Model Studies Published 1974–1984 (*Continued*)

Investigator(s)	Design	Health-Related Behavior	Results: Suscep Rel	Suscep Sig	Severity Rel	Severity Sig	Benefits Rel	Benefits Sig	Barriers Rel	Barriers Sig	Notes
Cummings et al.[40]	*P*,Survey *S* = 116, M + F Age = 21–76 (mean = 55) Ambulatory hemodialysis patients at 2 clinics	Diet and medication regimen for end-stage renal disease: objective assessment (serum phosphorus and potassium levels, fluid weight gain)	−/+	no	+	no	+	yes (P)	+	yes (K, fluids)	Part of a larger, experimental study to evaluate compliance-enhancing strategies (Cummings et al., 1981)[41]
		patient self-report with diet, medication	+	**yes (K)**	+	**no**	+	**yes (all)**	+	**yes (all)**	
Mother's Compliance with Regimen for Child's Condition											
Becker, Drachman, and Kirscht[42]	*P*,Survey *S* = 116, F Age = 14–70 Mothers/grandmothers of children with otitis media at outpatient clinic	Compliance with medication regimen	+	yes	+	yes	+	yes	+	yes	HBM also used to predict knowledge about medication and date of follow-up visit
		Keeping follow-up appointment	+	yes	+	yes	+	no	+	yes	
		Overall clinic appointment keeping	+	yes	+	no	+	yes	+	yes	

Becker et al.[43]	*P*,Exp *SP* = 2 months *S* = 182, F Age = 17–62 (mean = 37) Mothers of obese children referred to clinic dietician	Compliance with: weight-loss diet for obese child	+	yes	+	yes	+	yes	+	yes	Used many measures of each HBM dimension
		clinic appointment keeping ratio	+	yes	+	yes	+/−	yes	+	yes	Scales tested for internal consistency and interbelief relationships (Maiman et al., 1977)[44]
Becker et al.[45]	*R*,Survey *S* = 111, F Age = 17–54 (mean = 31) Mothers of children receiving care in pediatric emergency room for asthma attack	Mother's compliance with prescribed medication regimen: presence of theophylline in blood and/or mother's self report	+	yes	+	yes	+/−	yes	+	yes	Included measures of preventive orientation emphasizing locus of control
		blood test only	+	yes	+	yes	−	yes	+	yes	
							+/−				

Physician Visit for Symptoms

			General Health Beliefs							
Berkanovic, Telesky, and Reeder[46]	*P*,Panel Survey *S* = 769, M + F Age (mean) = 43 Random probability sample of adult residents of Los Angeles county	Use of physician services for symptoms	+	yes	+	yes	+	yes	+	no	Also measured social network variables and tendency to delay seeking care
		Same as above	Symptom-Specific Beliefs							
			+	yes	+	yes	+	yes	+	yes	

(*continued*)

Table 1. Results of Health Belief Model Studies Published 1974–1984 *(Continued)*

Investigator(s)	Design	Health-Related Behavior	Results								Notes
			Suscep		Severity		Benefits		Barriers		
			Rel	Sig	Rel	Sig	Rel	Sig	Rel	Sig	
			CLINIC UTILIZATION								
Kirscht, Becker, and Eveland[47]	*R*, Survey *S* = 251, F Age = 15–55 (median = 27) Mothers of children receiving services from a comprehensive child care clinic at a large teaching hospital	Utilization of pediatric services: physician visits	+	yes	+	yes	+	yes	+	yes	Also obtained mothers' evaluation of physicians
		clinic use index	+	no	+	no	+	yes	+	no	
		scope of services utilized	+	no	+	no	+	no	+	no	
Becker et al.[48]	*P*, Survey *S* = 250, F Age = X Mothers of children obtaining ambulatory pediatric services at a large teaching hospital	Clinic utilization for:									These data were part of a larger study examining the effects of continuity of physician care
		preventive visits	−	yes	−	yes	+	yes	NM	—	
		acute visits	+	yes	+	yes	−	yes	NM	—	
		accident visits	−	no	+	no	−	yes	NM	—	
		clinic appointment-keeping	+	yes	NM	—	+	yes	+	yes	

			Retrospective									
Leavitt[49]	*R/P*, Survey *S* = (R) = 258, (P) = 210, M + F Age (mean) = 36 Random sample of nonmedical employees enrolled in a prepaid health program (HMO) for at least 12 months	HMO utilization for: illness-related services general services	+	yes	+	no	+	yes	NM	—		Sociodemographic variables of little importance in explaining variance in utilization
			+	yes	+	no	+	yes	NM	—		
			Prospective									
		illness-related services general services	+	yes	+	no	+	yes	NM	—		
			+	yes	+	no	+	yes	NM	—		

Rel = relationship; Sig = statistically significant; R = retrospective; P = prospective; Exp = experiment; SP = study period; S = number of subjects; M = males; F = females; X = unknown; NM = not measured; NR = not reported; ? = indeterminable.

had the flu, and an item asking how serious the Swine Flu would be for the respondent if he/she contracted it that year. Having previously experienced influenza symptoms had a positive (but nonsignificant) association with program participation, while more of those who received the shot felt it would "not be at all serious" if they contracted Swine Flu that year (this relationship was also not significant). It may be that inoculated individuals concluded that, if they were to get Swine Flu, their prior immunization would cause symptoms to be minimized.

Limits on internal and external validity include use of a retrospective design and a rather circumscribed sample of the population at risk.

Another study of Swine Flu inoculation-seeking behavior[11] employed random digit dialing procedures to sample households in Oakland County, Michigan. One respondent (18 years or older) was randomly selected from each household. The telephone survey was conducted one week before the launching of a mass inoculation campaign; follow-up surveys on random halves of the sample were carried out immediately after the campaign and two months later, respectively. There were 374 adults (response rate of 63%) in the initial survey, and 286 adults in the follow-up survey (88 subjects lost to follow-up). HBM variables were operationalized with multiple questionnaire items.

Each of the four major HBM dimensions produced a statistically-significant correlation with vaccination behavior. It should be added that the investigators also obtained subjects' reports regarding their intention to obtain inoculation, and included this variable in a path analysis; they note that "the path model shows that these [HBM] variables are important in that they influence an individual's behavioral intention, and in this manner, indirectly affect inoculation behavior."

Study limitations include substantial nonresponse and drop-out from follow-up rates, and the combining of outcome data at two different points in time.

A third test of the HBM in the context of Swine Flu vaccination was conducted by Rundall and Wheeler,[12] who surveyed a random sample of 500 senior citizens in Tompkins County, New York (response rate = 58%). Respondents were asked whether or not they had received the vaccine; a single item was employed to assess each HBM component.

The investigators obtained positive correlations between the HBM items and subjects' inoculation status, statistically significant except for "severity." In addition, results from logit analysis revealed that the HBM accounted for 34% of the variance in outcome. The authors state that their findings "indicate strong support for the model . . ." and conclude that "the model can yield very useful results in terms of understanding the variables influencing a person's readiness to undertake recommended preventive medical care . . .".

Study limitations include the potential for bias introduced by a relatively low response rate, and a retrospective design which renders causal assertion problematic (e.g., in attempting to account for the absence of statistical significance of the correlation between "severity" and vaccine use, the authors argue that perceptions of severity may have been attenuated for inoculated individuals who came to believe that, if they were to contract Swine Flu, ". . . the effects of the disease will not be as severe because of the protection provided by the vaccine").

Larson et al.[13] applied the HBM in the context of receipt of influenza vaccine by persons thought to be at high risk for serious complications from influenza infection (individuals over 65 years old and patients with such chronic problems as diabetes, and heart, bronchopulmonary, and renal disease). Following a flu epidemic, self-

administered questionnaires assessing health beliefs and vaccination status were completed by 241 patients (response rate = 75%) and 232 were ultimately available for analysis.

All of the HBM dimensions were significantly correlated with vaccination behavior leading the investigators to conclude that "this study has demonstrated that health beliefs regarding susceptibility, severity, and efficacy are important factors in utilization of influenza vaccine."

In this study, 144 of the subjects also received a reminder postcard; these patients were found to have twice the inoculation rate of those not receiving the card. Since comparison of the card and no-card groups yielded no differences in health beliefs, the authors reasoned that the postcard acted as a "cue to action."

Interpretation of findings is restricted by use of subjects at a single site and by the study's retrospective design. It should be noted that the senior investigator (Larson) went on to conduct a prospective trial of postcard "cues" which included an "HBM card" as part of the experiment; that study found the HBM postcard to be more effective than either no postcard or a neutral postcard in obtaining higher rates of influenza vaccination.[14]

Screening Behaviors

Only one investigation appears to have employed the HBM in the context of genetic screening. Becker et al.[15] examined the ability of health beliefs to distinguish participants from nonparticipants in a screening program for Tay-Sachs disease (TSD). Approximately 7 weeks prior to program initiation, an identified Jewish population in the Baltimore-Washington area was exposed to an educational campaign concerning TSD and the availability of testing. Every person screened completed a questionnaire which obtained sociodemographic and health belief data. First, a sample of 500 *participants* was drawn (after stratification on marital status and couple participation). Second, by subtracting participants from lists of those invited for screening, a sampling frame of nonparticipants was constructed, and a similar stratified random sample of 500 persons was selected. The same questionnaire was mailed to these individuals, and 412 were returned (response rate = 82%). Forty-four were eliminated because the respondents reported having been tested previously for TSD: thus, data were ultimately available for 368 *nonparticipants*.

The unique nature of the health condition under examination required nontraditional measures of the HBM dimensions. "Perceived susceptibility" was measured by the person's estimate of the likelihood that he could carry the Tay-Sachs gene and transmit it to his progeny; "perceived severity" was interpreted as the individual's views of the potential impact of learning that he (and/or his spouse) was a carrier, especially as regards future family planning. Finally, the definition of "benefits and barriers" was in terms of a personal evaluation of how much good it would do the potential carrier to be screened for the trait and the potential psychosocial costs of knowing his carrier status. This included his feelings about abortion and any indication of knowledge about amniocentesis.

Findings revealed that significantly more participants than nonparticipants felt they were susceptible to being carriers of the Tay-Sachs gene. The association of "perceived severity" and participation was also significant, but negative. While a low or moderate

estimation of severity appears necessary to motivate participation, the perception that being a carrier would be highly disruptive of future family planning had an inhibiting effect on participation. The investigators also examined extent of agreement between husbands' and wives' health beliefs, and found that consideration of the combined "susceptibility" and "severity" beliefs of married or engaged couples increased precision in the identification of likely screening participants. While the findings regarding "benefits" and "barriers" were in the predicted direction, no information on statistical significance is provided for these analyses (the authors suggest that these HBM dimensions are mediated both by knowledge that amniocentesis could determine whether or not a fetus had TSD, and by willingness to undergo abortion if a diseased child was detected).

The retrospective design precludes causal conclusions, and generalizability is restricted because of the unique sociodemographic characteristics of the subjects.

Hallal[16] employed two dimensions of the HBM in a study which attempted to distinguish practicers from nonpracticers of breast self-examination (BSE). Participants were 207 women "purposively" sampled from a variety of non-health care settings (i.e., social, recreational, service, and religious groups and employment settings). The investigation focused on "perceived susceptibility" and "perceived benefits"; these beliefs were assessed using an instrument developed for this purpose by Stillman.[17] A self-administered questionnaire obtained both beliefs and reports on the practice of BSE. Compliance was dichotomized as "indicated they practiced BSE" versus "never practiced BSE."

Results revealed positive, significant correlations between the subscale scores for "susceptibility" and "benefits" and the practice of BSE, with the correlation for "benefits" about twice that obtained for "susceptibility." Together, these beliefs accounted for 10% of the explained variance in practice.

The "purposive" nature of the sample and retrospective design limit interpretation and generalizability of these findings. An additional difficulty is created by the dichotomization of the dependent variable so that women were classified as "practicers" regardless of frequency of performance of BSE (the author notes that such frequency ranged from less than once a year to more than once a month).

Two other studies[18,19] have included HBM variables in retrospective surveys seeking correlates of BSE knowledge and behavior. However, the fact that one focused solely on BSE-related *knowledge* and the other did not provide direct comparisons of examiners and nonexaminers precluded the listing of these investigations' findings in Table 1. Manfredi and her colleagues[18] found that, in a sample of 696 black inner-city women, belief in the efficacy of early disease detection (i.e., "benefits") was "the strongest correlate of the ability to perform BSE," and that "independent effects of fear as reflected in perceived threat and feelings of personal susceptibility were also apparent." Finally, comparing examiners with nonexaminers in a population of 158 women seeking care for a breast concern (e.g., lump, pain), Kelly[19] learned that practicers had two major reasons for both initiating and maintaining BSE: "an awareness that it is desirable to detect breast cancer early" (i.e., "benefits"), and "an awareness that they themselves could get breast cancer" (i.e., "susceptibility"). She also found another major reason for not performing BSE was agreement with the statement "self-examination is too frightening" (i.e., "barriers"). It is interesting to note that, across three BSE studies involving very disparate populations and points in time, perceived

susceptibility and perceived efficacy were consistently associated with BSE knowledge and practice.

Only one study appears to have focused on the HBM as a predictor of participation in a high blood pressure (HBP) *screening* program. Using a prospective survey design, King[20] mailed questionnaires to 160 randomly-selected patients at a Health Centre in England who, approximately four days earlier, had received a letter from their GP "advising them to attend a screening for raised blood pressure." Ultimately, HBM data were available for 73 attenders and 29 nonattenders. The investigator wished to examine the predictive value of a larger hypothetical model representing a synthesis of the HBM and attribution theory (specifically, the general and specific causal attributions which the subjects gave to the illness). Here, attributions are viewed as antecedents of the HBM variables.

Zero-order correlations yielded significant associations between attendance and both perceived susceptibility to HBP and perceived benefits of screening. In addition, discriminant function analysis revealed "costs/barriers to screening" to be a significant predictor of attendance. Finally, although "perceived severity of HBP" did not directly predict participation, it was found to be significantly related to the study's measure of "behavioral intention," which, in turn, was an excellent predictor of attendance. The larger model proposed by King was further supported by the finding that several attribution variables were also significantly and directly related to attendance.

Perhaps foremost among this study's limitations is the potential confounding affect of the GPs letter inviting participation in the screening program (e.g., it limits the subjects, may have accounted for the relatively high attendance, and may even have had a subtle effect on subjects' health beliefs). On the other hand, this letter may have introduced a conservative bias by enlisting the participation of patients whose health beliefs alone would otherwise have been insufficient to motivate attendance. Other methodological limitations include a relatively small sample of "noncompliers" and the fact that the main analyses did not control for the potentially confounding effects of previous HBP screening.

Risk-Factor Behaviors

In attempting to examine degree of consistency among an individual's preventive health behaviors (PHBs), Langlie[21] also assessed the ability of the HBM to account for variation in these behaviors. A questionnaire was sent to a systematic random sample of the adult population of Rockford, Illinois; telephone and personal follow-up was conducted to attain a response rate of 62% ($n = 383$). "Perceived vulnerability" was operationalized by asking respondents to estimate how likely they were, during the next year, to experience each of a list of untoward health events (e.g.: be in a car accident; get cancer; get an electrical shock; get polio; feel nervous). "Perceived benefits" was the respondent's extent of agreement with statements about the potential benefits of various PHBs (e.g.: eating fruit daily; dental checkups; daily exercise; sharing drinking cups; immunizations). Finally, "perceived barriers/costs" was measured by asking respondents how difficult it would be to engage in each of 12 different PHBs (e.g.: wear seat belts; exercise; obtain immunizations; get checkups). The remaining HBM dimension, "perceived severity," was not measured in this study. PHB

was measured by 11 additive scales: driving behavior; pedestrian behavior; smoking behavior; personal hygiene; seat belt use; medical checkups; dental care; immunizations; screening exams; exercise behaviors; and nutrition-related behaviors. Using factor analysis, Langlie divided these behaviors into two scales: "Direct Risk" PHB (DR) and "Indirect Risk" PHB (IR) (see listing in Table 1). Respondents were also classified as "behaviorally consistent" if a minimum of 8 of the 11 subscale scores were either above the mean for his/her sex, or below the mean, or within one standard deviation of the mean, or "behaviorally inconsistent" if their scores were about equally distributed above and below the mean, or if the respondent was missing more than one subscale score.

For "behaviorally consistent" subjects, Langlie notes that "the hypothesized zero-order relationships [for the HBM variables] are generally supported by our data; the major exception is that *low* rather than high levels of perceived vulnerability are associated with appropriate PHB." This significant but negative association may be due to the retrospective nature of the study, wherein individuals who had already undertaken appropriate PHBs were being asked to estimate the likelihood that they would soon incur the negative health event that the particular PHB was designed to protect against (e.g., respondents who had been immunized against polio were being asked how likely it was that they could get polio in the next year). Both "benefits" and "barriers" were significantly and positively related to DR and IR PHBs.

For "behaviorally inconsistent" respondents, the trend was essentially the same; however, only "perceived benefits" was significantly correlated with the dependent variables. Langlie summarizes her findings relevant to the HBM by stating that "The data support the hypothesis that the greater the number of appropriate social-psychological characteristics possessed the more likely the individual is to engage in PHB. This relationship is more pronounced among consistents than among inconsistents and for Indirect than for Direct Risk PHB. Possession of a particular constellation of attributes is more important than quantity per se, however. Regardless of their scores on the other scales, 85% of those persons who score above the mean on the Perceived Benefits, Perceived Barriers, and Attitudes Scales ($n = 73$) have above average Indirect Risk PHB compared to only 19% of those who score low on all three of these scales ($n = 42$)."

Besides its retrospective design, this investigation contains a number of important conceptual and methodologic difficulties. (1) Many of the PHBs were operationalized in unusual ways; for example, "exercise" referred to "number of blocks walked yesterday, chooses to walk to third floor rather than use elevator"; "nutrition" measured intake of vitamins A and C and protein (rather than asking about caloric or fat intake); "personal hygiene" included such items as "avoids coughing people" and "doesn't pick pimples". (2) Inspection of the factor analysis reveals that among the "behaviorally consistent," smoking does not fit particularly well in the dimension labeled Direct Risk—and in a similar manner, a low-loading "exercise" is included in the Indirect Risk PHB group. Indeed, the analyses seem to show three (rather than two) dimensions of PHB. (3) There was relatively little variation in DR PHB as measured in this research (most of the respondents were found to have high scores on this dimension). (4) There appears to be no conceptual justification for the arbitrary labels "Direct" and "Indirect" PHB.

In August, 1976 and January, 1977, Aho[22] used random digit dialing to conduct telephone interviews of 1,046 persons residing in Rhode Island (combined sample

response rate = 77%). The 24-item interview focused on the behaviors "cigarette smoking," "being overweight/underweight," and "regular participation in physical activity." For the first two behaviors, Aho asked about "perceived seriousness," while for the last behavior, the subject was asked about "perceived efficacy."

Analyses were performed separately for two age categories: subjects aged 65 and over, and those under age 65. For both age categories, a statistically-significant relationship was obtained between "seriousness" and smoking, and between "seriousness" and being overweight/underweight. With regard to physical activity, the "efficacy" variable was significant only for those under age 65 (the author attributes this lack of significance to the fact that some senior citizens are unable to perform regular physical activity because of their health status).

Use of this study to evaluate the HBM is limited by its retrospective design and by its focus on only two HBM dimensions (and only one dimension was examined for each preventive health behavior).

Rundall and Wheeler[23] included HBM components among the independent variables they employed to examine use of preventive services (defined as number of physician visits for preventive care). The data came from a household survey of adult residents of Washtenaw County, Michigan; of the 854 interviews completed (response rate = 69%), 781 were used for these analyses. A single question was employed to assess each HBM dimension: for "susceptibility"—"How likely do you think it is that you could get [each of four diseases: heart disease, stroke, high blood pressure, lung cancer] in the next five years?"; for "severity"—"How much of an effect do you think [each disease] would make on a person's life?"; for "efficacy"—"How much do you think a doctor, a dentist, or some other health professional can do to prevent [each disease]?"; and, for "barriers"—each respondent was asked whether or not he/she had a "usual source of medical care." The dependent variable was derived from responses to the question "About how often do you visit a physician for a checkup even though you may be feeling well?"

Of the four HBM dimensions, two ("susceptibility" and "barriers") were significantly correlated with obtaining preventive medical checkups. Because the investigators were also interested in determining the possible direct and indirect effects of sociodemographic characteristics and perceived health status on utilization, a path analysis was performed. All of the HBM variables were found to have statistically-significant direct paths to use; in addition, income was shown to have significant indirect effects on use through both "susceptibility" and "barriers." (These findings are consistent with those obtained by Dutton.[24])

Constraints on data interpretation include a retrospective design and the use of only one question to measure each HBM dimension. It should also be noted that, while "age" had a negligible direct effect on use, it had a very substantial path to "susceptibility," suggesting that the "susceptibility" question (with its five-year time frame) was most meaningful to relatively older respondents.

Tirrell and Hart[25] administered the Standardized Compliance Questionnaire[26] to 30 patients who, six to eighteen months previously had undergone coronary artery bypass operations, and who had subsequently been given individualized exercise regimens. Nineteen questions addressed subjects' health beliefs. Compliance was assessed by patients' self-reports with regard to walking, a training "heart walk," and pulse monitoring in other activities. A composite compliance score was also calculated.

Only "perceived barriers" was significantly related to exercise compliance. While

the correlations for "perceived efficacy" were substantial, they failed to reach statistical significance (perhaps because of the small number of subjects studied). An unusual finding was the tendency toward a negative association between "susceptibility" and adherence. The authors note that "many of the patients in this survey gave an unusual response to the questions in this section. For example, many agreed with the statement, 'If you wait long enough, you will get over most any illness,' because 'you'd die and then you'd no longer be ill.' "

Study limitations include: (1) a retrospective design; (2) a very small convenience sample; (3) self-reported assessments six to eighteen months after regimen prescription; and (4) nontraditional operationalization of some HBM components (e.g., "susceptibility" refers to general illness rather than to the untoward sequelae of noncompliance). The authors note that the subjects' "unusual" responses raise questions about patient interpretation of the health belief items.

In an unusual application of HBM variables, Beck[27] examined possible relationships of attitudes and beliefs to drinking/driving behavior in a group of college students. Of 443 undergraduates in health education classes who had agreed to participate in a repeated survey, 272 (61%) completed questionnaires concerning their drinking and driving attitudes and practices. A second questionnaire was administered six weeks later. The HBM items were constructed with regard to two possible outcomes of drinking and driving that might be of concern to college students: "getting caught by the police," and "causing an accident while driving under the influence of alcohol." The behavioral outcome measure asked the respondent how often during the previous six weeks he/she had driven a car "while you were drunk or when you have known you've had too much to drink" (coded dichotomously).

The manner in which the author reports the findings makes it difficult to examine clearly the relationships obtained between HBM dimensions and actual drinking and driving behavior. The HBM variables were found to be correlated (in the predicted direction) with concerns about getting caught by the police (significance levels not reported). A similar outcome was obtained between beliefs and "causing an accident," except that, opposite to prediction, susceptibility to causing an accident while driving under the influence of alochol was positively related to doing so. The authors speculate that "the students may have adjusted their feelings of susceptibility in accordance with their previous and likely to be continued, drinking and driving behavior."

A number of study features render interpretation of these findings problematic. Perhaps most important is the unique and nontraditional manner in which belief dimensions were operationalized. For example, perceived "effectiveness" (i.e., benefits/barriers) usually denotes an individual's assessment of the value of undertaking the recommended health action (which in this instance would be *not* driving while intoxicated). However, this investigator measured this dimension in terms of how effective the student thought he/she would be "at avoiding being caught by the police" and "at avoiding being in an automobile accident" while driving after drinking. Moreover, an additional attitude item (. . . "for men, driving while under the influence of alcohol is: . . . " followed by response scales of good-bad, awful-nice, harmful-beneficial, and wise-foolish) turned out to be the strongest predictor of actual behavior. While Beck employs this item to represent "attitude toward the act" in a model developed by Fishbein, it clearly could be interpreted as representing a substantial portion of the HBM. Additional difficulties include dichotomization of the dependent variables (so that possible relationships between health beliefs and *frequency* of inappropriate be-

havior cannot be assessed), use of a rather *sui generis* population of college undergraduates (thus limiting generalization of the findings), and the fact that only 107 of the original 272 participants completed the follow-up questionnaire (from which the measure of actual behavior was obtained).

To see if beliefs might be useful in discriminating different levels of smoking behavior, Weinberger and his associates[28] interviewed 120 patients receiving care at the outpatient department of a municipal teaching hospital. Subjects were categorized as "ex-smokers," "moderate smokers" (presently smoking 10 or fewer cigarettes per day), and "smokers." With regard to health beliefs, respondents were asked about the reasons people should quit smoking, about the potential for negative outcomes of smoking on their own health, and about the likelihood that they would, in fact, experience such smoking-related health problems.

Using multiple discriminant analysis, the investigators found ex-smokers significantly more likely to view smoking as a serious health problem and to feel personally susceptible to its potential adverse effects. Moderate smokers also perceive smoking as a serious threat to health, but did not see themselves as susceptible to smoking-related health problems. Their two discriminant functions were able to correctly classify (i.e., with regard to category of current smoking status) 66% of the study participants. The authors conclude both that "certain attitudes can discriminate between groups of current smokers, as well as smokers from ex-smokers," and that "in order to quit, it is not sufficient for persons to believe smoking is a serious health problem; they also must see themselves as personally susceptible to any adverse effects."

Among this study's important limitations are: (1) its retrospective design; (2) restricted generalizability based on the sociodemographic characteristics of the sample (typical respondent described as "a 58-year-old black female who has smoked for 29 years"); and (3) the fact that only two of the HBM dimensions were evaluated.

Croog and Richards[29] examined data on 205 postmyocardial infarction males over a period of eight years (patients' wives were followed for one year) in order to examine the possible influences of sociodemographic, personality and attitudinal variables on smoking behavior. Although repeated reference is made in the article to "existing theoretical frameworks," to the HBM, and to such variables as "threat," "susceptibility," and "belief in the efficacy of preventive action," dimensions of the HBM appear never to have been operationalized (at least, not in any traditional fashion). For example, although the study concerns smoking behavior, "susceptibility" was assessed by asking the patient how often during the past month he had experienced various symptoms which might be associated with heart disease. At the end of their discussion, the authors state that "the conclusions of this study cannot be interpreted as testing the utility of health belief models."

Finally, one study[30] used as its dependent variable the degree to which wives felt that they could play a role in helping their husbands avoid heart attacks; termed "preventive health orientation," this variable was trichotomized as "very much," "some," and "a little or not at all." Because there is no behavioral outcome assessed, this study is not included in Table 1. Area probability sampling techniques were used to select as survey subjects 199 wives living in Lebanon County, Pennsylvania; Aho used data from 187 of these subjects for his analyses.

Findings from this retrospective survey indicated that wives' HBM scores (husband's susceptibility to heart attack; chances that a person with heart disease could lead a normal life; and belief that treatment for heart disease was effective) were related to

their "preventive health orientation" (belief that they could help to prevent heart attacks in their husbands). In addition, preventive health orientation was also related to whether or not these wives had ever suggested any health-related behaviors to their husbands.

Sick-Role Behaviors

Antihypertensive Regimens

In hope of enhancing patient compliance with antihypertensive therapy, Inui and his colleagues[31] developed a tutorial aimed at physicians treating hypertensive patients at a General Medical Clinic of a large teaching hospital. Sixty-two clinic physicians were assigned to control or experimental groups by day of clinic attendance. Observations of physicians' and patients' characteristics, attitudes and behaviors were made before and after the experimental intervention. The physician tutorial emphasized strategies for increasing regimen adherence "based on the 'Health Belief Model'. . . . stressing the relation of patient ideas bearing on the seriousness of his disorder, his susceptibility to its complications, and the efficacy of his therapy to compliant behavior." The tutorial also included feedback on compliance levels of patients seen during the previous two months. Physicians in the control group received a "placebo" in the form of a written communication declaring the existence of an investigation that involved their clinic patients, including chart review and patient interviews (however, the fact that hypertensive patients would be the focus of study was not mentioned).

Results showed the intervention to have the following effects: (1) tutored physicians spent substantially more time than their control counterparts on patient education; (2) patients of tutored physicians were more knowledgeable about hypertension, and about their drug and diet regimens—and with specific regard to the HBM, more likely to appreciate the "dangerousness" of hypertension, personal susceptibility to untoward sequelae, the benefits of drug therapy, and the possible negative outcomes of discontinuing that therapy; and (3) experimental group patients were significantly more compliant than were the controls with regard to taking their medication, and were much more likely to have their blood pressures under control during the three to six months following the intervention (69% versus 36%, respectively). This study provides one of the few instances in which an intervention strategy explicitly employing the HBM was evaluated. The authors conclude that "the 'HBM' for relating patient ideas to behavior was a useful didatic construct for teaching physicians to approach compliance problems among their patients with hypertension. . . . It suggests a need for continuing reinforming and reinforcement of appropriate patient beliefs."

The complex nature of this study creates at least two problems in the interpretation of the findings. First, it is impossible to assess the degree to which the effectiveness of the tutorial was enhanced by the inclusion of actual data on the adherence levels of the physicians' own patients. Second, the investigators do not provide correlational analyses between patients' health beliefs and compliance behaviors; one must infer such relationships from the significant differences obtained between experimental and control group patients.

In the exploratory phase of a three-year investigation to explain and improve compliance to antihypertensive medical regimens, Kirscht and Rosenstock[32] focused on

HBM dimensions in their interviews with 132 patients under treatment by private physicians. There were three measures of adherence: (1) self-reported use of prescribed medications (both generally and on the day before the interview); (2) self-reported ability to follow dietary recommendations; and (3) measures derived from medical and pharmacy records (concerning filling/refilling of prescriptions). Most patients had been diagnosed more than five years earlier, and almost half were taking three or more medications. Also, 44% were on diet regimens (mainly for salt reduction), and 37% were on weight-loss programs. Only one patient in five had a regimen that included weight loss, dietary change, and medication.

Findings provided general support for the HBM across all three adherence measures, with some results attaining statistical significance and others yielding trends in the predicted direction. The authors conclude that ". . . each of several belief measures helps to explain current levels of adherence. . . . the perceived severity of, and susceptibility to, the consequences of hypertension, the perceived efficacy of intervention, and, to some extent, the perceived costs of following advice." These preliminary results formed the basis of interventions to increase adherence in this population.

The article does not provide detailed information regarding the criteria employed for determining compliance (e.g.: How were self-reports of general and prior-day medication compliance combined?; How were assessments of dietary restrictions and/or weight loss aspects of the regimen combined into a "self-reported diet" measure?; How *much* nonadherence constituted "noncompliance" for medication and/or diet regimens?). Also, although 132 patients were interviewed, compliance assessments were available for substantially smaller numbers of subjects ($N = 117$ for medication self-reports, 81 for pharmacy records, and 60 for diet self-report); these relatively small numbers undoubtedly affected the likelihood of the result trends being statistically significant. Finally, the cross-sectional nature of the survey precludes the making of causal interpretations from the findings.

Another retrospective survey examining possible relationships between HBM variables and compliance with the medication and appointment-keeping aspect of an antihypertensive regimen was conducted by Nelson et al.[33] A systematic random sample of patients within randomly-sampled clinic sessions yielded 185 subjects meeting the study's selection criteria. Ultimately, 142 interviews were completed (response rate = 77%). To assess medication adherence, subjects were asked how many of their prescribed doses they had missed during the previous 28 days. "Compliers" were defined as those who said they had *never* missed a dose; all others were labeled "noncompliers." Appointment-keeping information was obtained from medical records for a 12-month period, and subsequently dichotomized into "high" or "low" (kept 80% or more of scheduled appointments, or kept less than 80%, respectively).

Bivariate analyses showed that "perceived severity of own hypertension" and "perceived side effects from own hypertension medications" were significantly associated with medication-taking. The investigators also treated the variable "medication prescribed for another chronic condition" as a "cue to action"—and this variable was also significantly correlated with medication compliance. Finally, although "perceived benefits" was not significantly related to either medication or appointment-keeping behavior, Nelson et al. did find a significant association between "perceived efficacy of the regimen" and BP *control*. The authors conclude: "The finding that patient attitudes towards hypertension and its treatment are important determinants of compliance suggests that emphasis in patient education on the potential threat posed by hypertension

and on the effectiveness of treatment in reducing this threat may motivate compliant behavior."

Serious measurement/analytic difficulties in this study derive from the manner in which the key dependent and independent variables were operationalized. For example, a subject was categorized as noncompliant if he/she reported missing even a *single* dose during a 28-day period (thus, such patients were grouped with those who reported missing *all* their doses; the mean number of doses missed was nine). Moreover, the investigators do not distinguish between a missed dose on a multiple-medication regimen (for hypertension) and a missed dose where only a single medication is being taken. Similarly, an arbitrary cut-point of 80% was selected for determining appointment-keeping compliance. It is not clear why these dichotomies were created when a variety of statistical techniques could have been employed to capture more of the richness of these data. The investigators have also substantially altered the basic HBM. For example, perceived susceptibility is not measured. A new variable, "priority of health in life" has been added to what the authors term the "core perceptions" of the model. Side effects are viewed as "modifying factors" instead of as "barriers" (the traditional conceptualization). "Perceived benefits" is not even described in the investigators' list of their 18 HBM variables. As a result, "perceived severity" is the only HBM dimension treated in the usual way.

As part of a larger, randomized trial to improve medication compliance in a group of 230 Canadian steelworkers with hypertension, Taylor[34] and colleagues[35] assessed the health beliefs of 128 subjects along HBM dimensions prior to diagnosis and at six and twelve months posttreatment. Determination of medication compliance status was made at six and twelve months after treatment initiation, and was expressed as the percentage of prescribed medication taken (based on pill counts and self-report). "Perceived susceptibility" was directed at the possibility of *developing* hypertension (since it was ascertained *before* diagnosis); it was not examined postdiagnosis. In addition to the usual "seriousness" variable, the investigators also assessed "social dependency," the individual's "perception of the dependency implications of illness." "Barriers" examined beliefs about the drug's safety.

Findings indicated that the pretreatment beliefs were poorly correlated with compliance; "drug safety" was significantly related to adherence at six months. However, "social dependency" produced strong correlations at both six and twleve months. Health beliefs measured during treatment *were* generally significantly correlated with compliance (the exception being "benefits"). The authors interpret these results as supporting a view that "health beliefs, instead of preceding and determining compliance behaviors, develop along with compliance behavior as a result of experience with treatment gained by patients in the early weeks or months of therapy."

Several major features of the study design compromise its ability to provide a valid assessment of health beliefs as predictors of compliance. First, pretreatment HBM beliefs were obtained prior to the diagnosis of hypertension; since the diagnosis itself is very likely to influence these beliefs, it seems inappropriate to use prediagnostic attitudes to explain postdiagnostic behaviors—and furthermore, it may be the diagnosis, rather than early experience with the regimen, that explains why postdiagnosis beliefs are significantly correlated with compliance. Second, this survey was a subset of an intervention study which attempted to evaluate several compliance-enhancing strategies (an educational program versus no program, and physician follow-up at work versus

private physician). Since exposure to these interventions might be expected to influence health beliefs and/or medication behavior, one would assume that anticipated relationships between prediagnostic beliefs and compliance would be confounded by these influences.

An additional problem is posed by the fact that the investigators do not, in their publications, provide critical information necessary to assess the internal and external validity of their findings. For example, no data are offered concerning the sociodemographic (e.g., age, income, education, ethnic background) characteristics of the steelworkers studied—and the fact that the educational booklet was provided "in English, Italian, or Croatian" suggests strong potential ethnic-group effects on beliefs and behavior. Also, the representativeness of the 128 men who were ultimately surveyed is rendered problematic because, of the 245 workers eligible for the study, 230 agreed to participate, only 153 began treatment, and physicians discontinued treatment on an additional 25 men before the trial was completed (the investigators do not provide data comparing participants and nonparticipants).

Diabetic Regimen

In examining compliance with a diet regimen for diabetes mellitus, Alogna[36] focused on a single HBM dimension: perception of severity of the disease. Fifty obese non-insulin-dependent diabetic adults attending the Diabetic Clinic of a major hospital were selected for study, and were classified as compliant or noncompliant according to a set of criteria involving prior weight loss and blood glucose control. "Severity" was assessed with a "perception of severity of disease index" from a "standardized compliance questionnaire" developed by Sackett and Haynes.[26]

Results demonstrated a significant difference on "perceived severity:" compliant subjects viewed their illness as more serious than did the noncompliant subjects. The authors note that "even though the individuals in the compliant group did not have more diabetes-related complications than non-compliant subjects, they perceived their diabetes as more severe. It may be that these patients are more realistic about the consequences of the disease and therefore are motivated to take action to control their diabetes."

Because this was a retrospective survey conducted with a small nonrandom group of patients at a single clinic, generalizability is limited. Furthermore, the dichotomized nature of the dependent variable makes it impossible to evaluate the role that perceived severity might play in explaining different *degrees* of regimen adherence.

Cerkoney and Hart[37] interviewed 30 insulin-dependent diabetics six to twelve months after these patients had attended diabetic education classes at a community hospital. Health beliefs were assessed with questions taken from the Standardized Compliance Questionnaire;[26] three items were used to measure each dimension of the HBM. Direct observation and self-report were employed to gauge degree of adherence to the regimen in the areas of insulin administration, urine testing, diet, hypoglycemia management, and foot care. A "total compliance score" was constructed across these measures, with items assessed by direct observation receiving double point values.

Results obtained using the total compliance score produced positive associations for each of the HBM components, and the correlation for "perceived severity" attained

statistical significance. In addition, the investigators had also calculated a "total HBM score" across all HBM measures—and the correlation between that score and the total compliance score was .50 (significant at $p < .01$).

Limitations on generalizability of these findings include the use of a small, nonrandom group of subjects, the retrospective nature of the study, and arbitrary doubling of the compliance scores obtained by direct investigator observation. An unusual feature of this research was the use of a highly detailed multidimensional compliance score whose 61 items (across five regimen areas) included many aspects of the patient's regimen-related knowledge and behavior.

Perhaps the most comprehensive exploration of the role of HBM variables in diabetes-regimen compliance was conducted by Harris and co-workers,[38] who studied 50 men with type II diabetes mellitus, recruited from the outpatient clinics of a Veterans Administration Medical Center. Each subject was interviewed by a nurse who obtained recall information in five areas of behavior: medication use; dietary compliance; urine testing; exercise; and foot care. Four physiological measures derived from blood and urine samples were also obtained. Both behavioral and physiological measures were rated on 4-point scales. Subjects' health beliefs were obtained with a protocol adapted from one used by Hartman and Becker;[39] these items were also converted to 4-point response scales.

Significant correlations were obtained between: "susceptibility" and dietary compliance; "benefits" and exercise; and "barriers" and medication use. For the physiological measures, significant associations occurred between: "susceptibility" and both hemoglobin and urine glucose; "severity" and fasting glucose; and "benefits" and a composite score calculated across the four measures.

Study limitations include a retrospective design, a focus on a small, nonrandom sample of subjects (all veterans) and use of a composite score whose weighting scheme is not explained. Also, the study's operationalization of "cues to action" appears to contain an item ("more extreme sweating [necessary] to seek medical help") that would more traditionally be viewed as a measure of "severity" (this item was strongly correlated with medication use).

End-Stage Renal Disease Regimen

Hartman and Becker[39] examined the ability of the HBM to predict dialysis patients' compliance with instructions concerning taking a phosphorus-binding medication, minimizing dietary potassium, and limiting fluid intake (to control weight gain between dialysis treatments). The study group of 50 subjects included all hemodialysis clients at one clinic and convenience samples at two additional clinics. Laboratory data were obtained for all patients with regard to serum phosphorus and potassium levels and interdialysis weight gain. For each adherence measure, six observations were used for each subject—three before and three after the interview. Compliance was defined as whether, across the six observations, "the patient was within the compliant range (as defined by the medical staff) more or less often than not" (equivalent instances of compliance and noncompliance were assigned an intermediate category). Thus, all subjects were placed into categories of high, medium, or low adherence. Attitudinal data were gathered by personal interview while the patient was undergoing treatment.

Statistically-significant correlations were obtained between the HBM dimensions

and all of the objective compliance measures (with the exception of the positive but nonsignificant association between "severity" and potassium level). However, the relationship between "susceptibility" and the objective data is *negative* (i.e., patients found to be following the regimen were less likely than their noncompliant counterparts to feel vulnerable to a list of specific noncompliance sequelae). The authors argue that "while presently compliant patients may initially have felt very vulnerable to future health problems, they believe . . . their adherence to the prescribed therapy will successfully protect them from the untoward consequences of poorly controlled disease, i.e., that their actions make them less susceptible to sequelae usually associated with non-compliance."

Problematic aspects of the investigation include the small sample size, the question of representativeness of the convenience samples obtained in two of the three clinics, and the fact that each compliance measure was composed of data that were half retrospective and half prospective. A further concern is the use of a "compliance range" defined by the medical staff (as opposed to actual compliance scores) to place subjects into the three adherence categories (thus reducing the richness of the data).

In subsequent research on adherence to diet and medication for end-stage renal disease, Cummings and associates[40] (as part of a larger investigation[41]) studied 116 clients at two outpatient hemodialysis clinics. Compliance involved taking phosphate-binding medicine, following dietary restrictions on potassium intake, and limiting ingestion of fluids; these behaviors were assessed by both chart review and patient self-report. Health beliefs were obtained by interview during dialysis treatments. Serum phosphorus levels were an average of four observations, three preinterview and one postinterview. Six measures of serum potassium level were obtained, three before and three after the interview. Fluid weight gains between dialysis sessions were all obtained after the interview.

With regard to objective compliance measures, correlations with HBM variables were generally in the predicted direction, and attained statistical significance for the relationships between "benefits" and phosphorus-level control, and between "barriers" and both potassium-level control and control of interdialysis weight gain. For patient self-report, the associations were all in the predicted direction, with significant correlations between "susceptibility" and dietary potassium regulation, and between phosphorus/potassium/fluid compliance and both "benefits" and "barriers."

In interpreting these findings, it is important to note that: (1) there was considerable disparity in the degree to which the objective compliance measures contained a prospective component, from the relatively retrospective loading in serum phosphorus levels to the entirely prospective assessment of fluid-weight gain; (2) self-report measures were found to be more consistent predictors of compliance than were assessments obtained from medical records; and (3) the study group was not a random sample, but rather, consisted of all eligible clients willing to participate.

Mother's Compliance with Regimen for Child's Condition

In one of the earliest attempts to apply the HBM to sick-role behavior, Becker et al.[42] surveyed a random sample of 116 mothers whose children were being treated for otitis media (middle-ear infection) in the ambulatory pediatric clinic of a large teaching hospital. Mothers' health beliefs were obtained by interview at the time of the clinic

visit. The study's primary focus was mothers' compliance with the oral antibiotic regimen prescribed for their children. Also examined was appointment-keeping behavior, both with regard to the scheduled follow-up appointment for that illness episode and in terms of overall appointment-keeping at that clinic (operationalized as the ratio of appointments kept to appointments made during a 12-month period). Medication adherence was determined from antibiotic assay of urine specimens obtained from the child at unannounced home visits five days after the start of treatment.

Either at a general level or at a level dealing with the specific illness studied, variables from each major HBM category were found to be related to compliance. Across the three outcome measures, there were only two instances where the correlations with HBM dimensions failed to achieve statistical significance: the relationship between "perceived benefits" and keeping the follow-up appointment, and that between "perceived severity" and the appointment-keeping ratio.

Study limitations include: (1) the HBM dimension "perceived barriers" was operationalized by a general (as opposed to a medication-specific) approach, wherein mothers were asked to report how easy or difficult it was for them "to get through the day" and "to take care of their children"; thus, barriers to following the specific regimen were not directly assessed; (2) difficulties in obtaining urine specimens (e.g., erroneous addresses, problems in obtaining samples from infants, persons not at home) resulted in the collection and testing of samples from only 59 of the 116 children); therefore, analyses involving *medication* compliance were based on a group of mothers whose average personal and attitudinal characteristics may have been different from those of the larger group of which they were a part (and on whom the other compliance measures were based); and (3) generalizability of the findings is somewhat restricted by the fact that the subjects were almost all low income, nonwhite mothers/grandmothers obtaining free medical care and medication at a single ambulatory care facility.

Within the context of a prospective experimental design, Becker et al.[43] evaluated the HBM's ability to predict mothers' adherence to a diet prescribed for their obese children. Over a two-year period, 182 mothers were interviewed concerning their health beliefs and motives. The questionnaire included multiple-item scales to assess each HBM dimension (tested for internal consistency and interbelief relationships[44]) and was administered prior to the mothers' receiving instruction and a weight-reduction plan from the dietician. Data on the primary dependent variables, child's weight change, were obtained by the dietitian at four follow-up visits spaced two weeks apart. In addition, a general compliance measure, long-term clinic appointment-keeping (excluding dietitian visits), was calculated for each child by dividing appointments kept by appointments made during a 12-month period.

Each of the HBM core components was found to be a statistically significant predictor of compliance with the diet regimen. There was, however, some diminution in the strength of these correlations over the study period. The authors suggest that health beliefs may be most important at the beginning of the regimen, but, with time, experience with the diet, and weight change outcomes, other variables may become important as well. Similar findings were obtained between the HBM dimensions and long-term appointment-keeping, with the exception of a significant but negative association with the degree to which the mother felt that information from the dietitian was helpful (i.e., better overall appointment compliers perceived the diet information as less necessary).

This research also tested the efficacy of two levels of fear-arousing communications in enhancing regimen compliance. Subjects were randomly assigned to one of three groups: receipt of a "high fear" message and booklet concerning obesity; receipt of a "low fear" message and booklet with similar (but less threatening) information; and receipt of usual care (the control group). Because the fear-arousal interventions were also found to be significantly associated with weight loss (high fear > low fear > control), analyses were performed to explore the influence of the study intervention on health beliefs; these analyses demonstrated that, when the effects of the intervention were controlled, the HBM variables continued to significantly predict weight change.

An important consideration bearing upon evaluation of the study's results is the investigators' decision to employ weight change to represent dietary compliance, since other factors (e.g., illness, exercise) could also have resulted in weight loss (no self-reports of adherence were obtained). Generalizability is hampered by use of a non-random sample of low-income mothers at a single clinic.

The noncompliance phenomenon has not often been examined in situations where the prescribed medication is of relatively uncertain efficacy. Asthma exemplifies such a condition; the usually prescribed theophylline-based medication does not *assure* nonrecurrence of attacks, since acute respiratory infection, environmental antigens, and other aspects of the complex regimen create circumstances which may overwhelm the drug's effects. Becker et al.[45] assessed the HBM as a possible explanatory rubric for mothers' differential compliance with the medication regimen intended to prevent further attacks in their asthmatic children.

Interviews were conducted with 111 mothers from a low-income clinic population who had brought their children to a pediatric emergency facility for treatment of acute asthma episodes. Each mother was questioned along HBM dimensions and was also asked to recall her handling of the child's current asthma attack, including whether or not the previously prescribed medication had been given. A covert evaluation of compliance was also made by testing a blood sample for the drug's presence (available for 80 of the 111 mothers). When self-reports were compared with laboratory findings, a correlation of .91 was obtained, arguing for the validity of the mother's statement as a compliance indicator. Two measures of adherence were constructed. The first measure employed the following trichotimization: negative blood test or negative self-report; no test available but positive self-report; and positive blood test. The second measure simply dichotomized the laboratory report (i.e., drug either present or absent).

Positive and statistically-significant correlations were obtained between both compliance measures and "susceptibility," "severity," and "barriers." Findings for the "benefits" component present a more complicated pattern. Contrary to expectation, mothers who were better compliers more often expressed skepticism along the study dimension "faith in doctors and medical care"; they were also more likely to agree that the medication "can help but not cure asthma." The investigators interpret the skepticism-compliance findings as an appropriate, rational response to the complex situation presented by medication treatment for asthma, suggesting that the compliant mothers correctly perceive that "physicians do not know a great deal about asthma, and the medicine they prescribe won't cure the condition—but, the medicine does help to prevent at least some attacks, and, overall, I feel better when heeding my doctor's instructions."

In addition to the limits on causal interpretation imposed by the retrospective design

and the fact that one compliance measure was available for only 80 subjects, generalizability of the findings is restricted by the study's focus on low-income clients of a single emergency facility.

Physician Visit for Symptoms

The largest prospective examination of the HBM's ability to predict utilization of services is reported by Berkanovic et al.,[46] who based their analyses on panel data available from the Los Angeles Health Survey (a three-stage random probability sample of households in Los Angeles County). In the 1976 sample 1,883 potential adult respondents were selected, and 1,210 were ultimately successfully interviewed (response rate = 64%). During a three-month period, demographic and health data were gathered during the initial personal interviews, with telephone follow-up interviews conducted every six weeks thereafter for approximately one year. During the study period, symptoms were reported by 769 respondents, and information was obtained on use of physician services for symptoms. A total of 1,679 "most important" symptom episodes were noted with individual respondents reporting from one to seventeen symptoms. The investigators weighted the data inversely by the number of symptoms reported by the respondent, thus maintaining both the individual as the unit of analyses and the link between health beliefs and symptom response.

HBM dimensions were operationalized at both general and symptom-specific levels. At the general orientation level, "susceptibility" used six items regarding personal vulnerability to illness and belief in the efficacy of preventive health behavior; "severity" employed five items concerning how seriously the respondent views his/her illnesses; "benefits" was based on three items regarding belief in the efficacy of curative medical care; and "barriers" included accessibility (six items on satisfaction with availability of services) and costs (two items involving concern about the cost of medical services). Data on symptom-specific health beliefs were obtained from responses to five questions: "How serious did you think this condition was?; How important did you think a doctor would have considered this condition?; How likely did you think it was that this problem would occur again?; When you realized you had this problem, how much good did you think a doctor could have done?; At that time, how easy would it have been for you to go to the doctor?"

Results revealed that, with the exception of the correlation between general-level "barriers" and use, all of the HBM predictors were found to be significantly associated with the use of physician services for symptoms. Among the general-level beliefs, the highest correlation was produced with "susceptibility"; at the symptom-specific level, very strong correlations were obtained with perceived efficacy of care for the symptom ($r = .69$) and with perceived seriousness of the symptom ($r = .56$). Using hierarchical multiple regression analysis, the investigators found that, after controlling for all other variables, social network measures and personal beliefs specific to the symptom accounted for 42% of the variance in the dependent variable (in this analysis, the beta for each HBM variable was statistically significant). However, the authors offer two cautionary notes: (1) all of the HBM variables were intercorrelated, creating a problem of multicollinearity that makes it difficult to apportion the variance these dimensions share in common; and (2) because specific belief data were obtained after

the care-seeking decisions were made, causal interpretation for the symptom-specific items remains speculative.

Additional study limitations include a definition of "susceptibility" which incorporated the dimension of "belief in the efficacy of preventive health behavior" (this may have contributed to the multicollinearity problem), and the decision to combine the respondent's estimates of "perceived seriousness" with the relevant "perceived importance estimates of the physician" within a single index of "perceived seriousness of the symptom."

Clinic Utilization

Kirscht and his colleagues[47] conducted lengthy interviews with a sample of 251 low-income mothers bringing their children to a pediatric clinic in response to symptoms of illness. The interview included items designed to tap mothers' health beliefs (along HBM dimensions) and perceptions of the clinic and medical care. "Susceptibility" and "severity" were combined in the analyses to form a "threat of illness" index. Dependent variables of interest included: physician visits (number of times the child was taken to a physician in the past year); clinic use index (number of times the child was taken to the study clinic in the past year and number of different clinics utilized); and scope of services utilized (extent to which all children in the family were registered at clinic, appointment-keeping for the child, and use of telephone for medical advice and problems). Some measures were based entirely on medical record audits, while others were derived from information provided by the mother.

All of the HBM dimensions were significantly related to physician utilization; however, the only health belief variable which produced a significant correlation with the index of clinic use was "efficacy," and none of the beliefs attained statistical significance in their relationship with scope of services utilized. Further analyses revealed that when illness episodes are partialled out, the correlations of both "threat of illness" and "efficacy" with clinic utilization reach statistical significance. The investigators also found that controlling for mothers' personal problems also elevated associations between health beliefs and clinic utilization behavior to significant levels. The authors conclude that "Beliefs about threat of illness and efficacy of medical care are consistently related to use of services, especially with illness taken into account" and that "with personal problems taken out, the new threat measure showed a positive relationship to the scope of service measure."

Restrictions on data interpretation include the retrospective study design and a single-site sample of only low-income mothers whose children were displaying symptoms of illness. Also, the creation of a "threat" index prevents determination of the individual contributions to behavior of "susceptibility" and "severity."

In a prospective study of possible relationships between mothers' health beliefs and utilization of pediatric services for their children, Becker et al.[48] interviewed a random sample of 250 mothers of children enrolled in the Children and Youth Program of a major teaching hospital. Utilization data were obtained for a standard 3-1/2-year period subsequent to the interview with regard to numbers of visits for: well-child (preventive) care; acute-illness; and accidents. In addition, a measure of appointment behavior was

created for each child by dividing the number of appointments kept by the number of appointments made during the study period. HBM dimensions were assessed as follows: "susceptibility," by extent of agreement with the statement "my child gets sick easily" and (in the case of appointment keeping) by agreement with the physician's diagnosis; "severity," by extent of agreement with the statement "I worry a lot about my child's health"; "benefits," via a number of items examining the mother's preventive orientation (e.g., extent of agreement with such statements as "most children's illnesses can be prevented" and "if you wait long enough children will get over most any illness"). "Barriers" was measured only in relation to keeping clinic appointments (e.g., extent of agreement with statements such as "clinic appointment times are convenient for me").

Results demonstrated that mothers who viewed their children as relatively more vulnerable to illness *less* frequently took their children to the clinic for preventive care but made *more* visits for acute illness (the former finding "may reflect mothers' faith in the protection putatively bestowed by regular preventive visits"). Similarly, "perceived severity" was negatively associated with well child visits but positively related to visits for acute illness. However, this pattern is reversed for "benefits:" mothers with a preventive orientation were significantly more likely to bring the child for preventive services and significantly less likely to make visits related to acute illness episodes. The only significant correlation with accident-related visits was produced by "benefits"; mothers whose children made more accident visits were more likely to agree with the statements "I usually just let things happen" and "If you wait long enough children will get over most any illness." Finally, "susceptibility," "benefits," and "barriers" were straightforward, significant predictors of mothers' clinic appointment-keeping behavior. The authors conclude that their data "lend support for the hypothesis, that knowledge of an individual's health beliefs is useful in attempting to predict future utilization," and that "utilization of preventive services and of services for acute care represent quite different behavioral dimensions; that is, they are responses that stem from the same health attitudes and beliefs but to dissimilar circumstances, and in very different ways."

Generalization is restricted by the use of subjects from a single clinic, all of whom were of low socioeconomic status. Furthermore, "preventive orientation" represents a nontraditional proxy for "benefits," and "barriers" was assessed only in relation to clinic appointment-keeping.

Leavitt[49] assessed the HBM's ability to account for health services utilization in a health maintenance organization (HMO) organized as a private not-for-profit prepaid medical plan for employees of a large urban medical center. The study was conducted over a 30-month period.

Information on health beliefs was gathered by self-administered questionnaires mailed to a random sample of nonmedical employees who had been enrolled in the HMO for at least 12 months. Of 323 employees agreeing to participate, 258 (80%) returned useable questionnaires, and utilization data were obtained on these respondents for a 12-month period prior to the survey (the retrospective aspect of the study). After a six-month interval was allowed to elapse, utilization data were again collected for an additional 12 months on the 210 respondents still enrolled in the prepaid program (the study's prospective aspect). Within each data-gathering period, utilization was categorized either as "illness-related" (patient-initiated visits to physicians associated with

reports of symptoms or illness) or as "general" (all other visits—e.g.: follow-up visits, periodic health evaluations, routine screening procedures, immunizations).

To measure "susceptibility," Leavitt obtained respondents' perceptions of personal vulnerability to illness in the next 12 months, based on their estimates of the likelihood that they would experience each of 25 commonly identified symptoms (e.g.: blood in urine; shortness of breath; sore throat). Two measures of "severity" were derived using the same symptom list; one asked the respondent to judge the need for medical attention for each symptom, and the other asked whether, if no medical action was taken, each symptom would "go away," "stay the same," or "become worse." There were also two measures of "benefits." The first measure asked the respondent to rate the amount of benefit that might be obtained from bringing each symptom to the attention of a physician. The second efficacy measure asked respondents about things they could do to keep healthy; specifically, the respondent rated the amount of benefit that might be derived from each behavior on a list of 11 commonly identified preventive health activities (e.g.: early treatment; checkups; diet; exercise). "Barriers" were not assessed in this investigation.

It is interesting to note that findings for the three HBM dimensions studied were consistent across type of utilization (i.e., general versus illness-related) and across type of data (i.e., retrospective versus prospective). "Vulnerability" and the preventive health dimension of "efficacy" were always significantly associated with utilization; "severity" also produced positive (but nonsignificant) relationships with behavior. The author concludes that "the most salient of the HBM attitudes for predicting use of ambulatory services in advance appears to be vulnerability, followed by beliefs of benefits associated with preventive health behavior" and states that the study results ". . . strongly suggest that this model may be usefully applied to both symptomatic health behavior as well as the broader range of ambulatory health activity."

Generalizability of this study's conclusions is restricted by the selection, at a single site, of predominantly female employees of a large medical center with assured access to prepaid health services ("Generalization of these results to delivery service systems in which access is not guaranteed and to different patient populations remains to be established").

Another study examining HBM dimensions in the context of ambulatory care was conducted by Becker et al.[50] as part of a field experiment to evaluate the putative benefits of continuity of physician care. After stratification on family size and prior clinic experience, all patient families of a large pediatric outpatient facility providing free comprehensive health care services were randomly assigned to either a "conventional" clinic (wherein the patient is seen by the first available physician) or a "continuity" clinic (wherein the patient would wait to see his/her assigned pediatrician on each return visit). These study conditions were maintained for a period of one year. All physicians, ancillary staff, and a random sample of 125 mothers from each clinic were surveyed during the last three months of the study period. Health-related attitudes and beliefs of mothers were obtained by an hour-long interview.

Findings revealed that mothers experiencing continuity of pediatrician care for their children reported significantly more "desirable" HBM-related beliefs, and were significantly more likely to report engaging in health-protective activities. In addition, the investigators found mothers in the continuity clinic to be significantly more likely to discuss behavior problems their children were experiencing and to keep follow-up

appointments. However, while this study found that a continuous doctor-patient relationship influences both health beliefs and health-related behaviors, the paper does not report on possible relationships *between* these beliefs and behaviors (for this reason, this study's findings are not reported in Table 1).

DISCUSSION

HBM Studies 1974–1984

Table 2 provides a numerical summary of the findings reported in Table 1. It is apparent from these data that research published during the past decade provides substantial support for the usefulness of the HBM as a framework for understanding individuals' health-related decision-making.

To facilitate discussion, we have created a "significance ratio" wherein the number of positive and statistically significant findings for an HBM dimension are divided by the total number of studies which reported significance levels for that dimension. Examination of this ratio across the 29 investigations reviewed reveals that the best results are obtained by the "barriers" dimension (91%) followed (in descending order) by "benefits" (81%), "susceptibility" (77%), and "severity" (59%). This ordering among the dimensions holds for both prospective and retrospective studies. An early concern about HBM findings appearing before 1974 was that they were derived predominantly from research employing retrospective designs; thus, one often could not be confident that the positive correlations obtained indicated that these beliefs were the cause (and not the effect) of the behavior in question. However, it is apparent from Table 2 that the predictive results yielded by the 12 prospective studies produce higher significance ratios for each dimension category than those obtained by investigations with retrospective designs.

In the three instances where significant results were obtained in a direction opposite to that predicted by the HBM, two were found in retrospective studies (where the issue of time order may account for the results); in the prospective instance, the authors argued that this unanticipated outcome was due to regimen-compliant patients reporting (logically) that they were less likely to be susceptible to the untoward consequences associated with not following instructions.

Turning to the results for preventive health behavior, we find that "susceptibility," "benefits," and "barriers" are consistently associated with outcomes (indeed, "barriers" was significantly associated with behavior in *all* of the 13 studies reviewed). "Susceptibility" and "benefits" yielded equivalent levels of effectiveness. However, "severity" is seen as making a relatively poor showing, producing significant results in only about one-third of the studies. We would speculate that these findings for "perceived severity" may be due in part to difficulties that study respondents have in conceptualizing this dimension: (1) when they are asymptomatic; (2) for health threats that are usually thought to be long term; and (3) concerning medical conditions with which they have had little or no personal experience. Also, in some cases (e.g., cancer), most subjects tend to view the condition as very serious; thus, there is little variability in the "severity" measure, and the item does not distinguish compliers from noncompliers (i.e., yields nonsignificant results).

Only three of the 13 PHB studies were prospective; this may reflect problems that investigators encounter in trying to find relevant populations for study (i.e., it is relatively easier to examine prospectively individuals just diagnosed as ill and asked to begin a therapeutic regimen—sick-role behavior). However, given the paucity of prospective PHB-HBM research, it is worth noting that (with the exception of "severity"), the significance ratios for the prospective findings are 100%.

In the case of sick-role behavior (SRB), "perceived severity" takes on greater importance, producing the second highest significance ratio (lending support to the argument that this HBM dimension is more meaningful to individuals diagnosed as ill and/or experiencing symptoms). In general, all of the HBM dimensions appear to contribute to an understanding of SRB—and, as was the case with PHB, the highest significance ratio is produced by "perceived barriers." The fact that "susceptibility" does not do quite as well with SRB as it did with PHB may result from difficulties in attempting to operationalize the concept of vulnerability in instances where diagnosis of illness has already been made.

For HBM-SRB research, we found more prospective than retrospective investigations. Similar to the results for PHB, the prospective SRB significance ratios tend (with the exception of "susceptibility") to run above those obtained in the retrospective studies. For the prospective SRB studies, the most powerful HBM dimension was "perceived barriers" (significance ratio = 100%).

The three HBM studies related to clinic utilization cannot be summarized easily. These studies covered a wide range of PHB, SRB, and overall appointment-keeping behavior. In general, perceptions of "benefits" produced the strongest findings, followed by "susceptibility," "barriers," and "severity." However, examining the results in greater detail (see Table 1), one finds that: (1) HBM dimensions are most productive in relation to visits to providers for treatment of illness; and (2) "severity" is important as a predictor of acute visits. (Because of the limited number of clinic utilization studies reviewed, Table 2 does not summarize these findings by type of study design.)

HBM Studies Prior to 1974

Results of HBM-PHB and HBM-SRB investigations published prior to 1974 were summarized in a 1977 supplement to *Medical Care*.[51] Table 3 compiles these data in a manner similar to Table 2. Because only six of the seventeen pre-1974 studies were prospective, the data in Table 3 are not subclassified by type of study design.

Examination of the significance-ratio orderings among the HBM dimensions reveals that the highest ratio (91%) is produced by "susceptibility" (the comparable figure in the post-1974 data was 77%); it may be that this strong showing by "susceptibility" results from the fact that most of the early HBM work examined preventive health behaviors. "Severity" and "barriers" yield identical significance ratios (80%); however, only seven of the seventeen pre-1974 studies measured the "barriers" dimension, and an additional two did not assess their measure's statistical significance. "Benefits" produced the relatively lowest significance ratio (73%).

The overall dimensions ordering remains essentially unchanged when one examines the findings of PHB research. However, although most of the six early HBM-SRB investigations failed to assess (or report the significance for) all of the major model

Table 2. Summary of Findings From Health Belief Model Studies Published 1974–1984

Number of HBM Studies 1974–1984	Findings	Susceptibility	Severity	Benefits	Barriers
29 Total	Significant	20	16	21	21
	Nonsignificant	4	10	5	2
	Significant but opposite to HBM prediction	2	1	—	—
	Significance not reported	—	—	1	1
	Dimension not measured	3	2	2	5
	Significance ratio:*	20/26(77%)	16/27(59%)	21/26(81%)	21/23(91%)
12 Prospective (Summary)	Significant	10	8	11	10
	Nonsignificant	1	4	1	—
	Significant but opposite to HBM prediction	1	—	—	—
	Significance not reported	—	—	—	—
	Dimension not measured	—	—	—	2
	Significance ratio:	10/12(83%)	8/12(67%)	11/12(92%)	10/10(100%)
17 Retrospective (Summary)	Significant	10	8	10	11
	Nonsignificant	3	6	4	2
	Significant but opposite to HBM prediction	1	1	—	—
	Significance not reported	—	—	1	1
	Dimension not measured	3	2	2	3
	Significance ratio:	10/14(71%)	8/15(53%)	10/14(71%)	11/13(85%)
	PREVENTIVE HEALTH BEHAVIORS				
13 Total	Significant	10	4	9	10
	Nonsignificant	1	6	2	—
	Significant but opposite to HBM prediction	1	1	—	—
	Significance not reported	—	—	1	1
	Dimension not measured	1	2	1	2
	Significance ratio:	10/12(83%)	4/11(36%)	9/11(82%)	10/10(100%)
3 Prospective (Summary)	Significant	3	1	3	3
	Nonsignificant	—	2	—	—
	Significant but opposite to HBM prediction	—	—	—	—
	Significance not reported	—	—	—	—
	Dimension not measured	—	—	—	—
	Significance ratio:	3/3(100%)	1/3(33%)	3/3(100%)	3/3(100%)

10 Retrospective (Summary)	Significant	7	3	6	7
	Nonsignificant	1	4	2	—
	Significant but opposite to HBM prediction	1	1	—	—
	Significance not reported	—	—	1	1
	Dimension not measured	1	2	1	2
	Significance ratio:	7/9(78%)	3/8(38%)	6/8(75%)	7/7(100%)
	SICK-ROLE BEHAVIORS				
13 Total	Significant	8	11	9	10
	Nonsignificant	2	2	3	1
	Significant but opposite to HBM prediction	1	—	—	—
	Significance not reported	—	—	—	—
	Dimension not measured	2	—	1	2
	Significance ratio:	8/11(73%)	11/13(85%)	9/12(75%)	10/11(91%)
7 Prospective (Summary)	Significant	5	6	6	6
	Nonsignificant	1	1	1	—
	Significant but opposite to HBM prediction	1	—	—	—
	Significance not reported	—	—	—	—
	Dimension not measured	—	—	—	1
	Significance ratio:	5/7(71%)	6/7(86%)	6/7(86%)	6/6(100%)
6 Retrospective (Summary)	Significant	3	5	3	4
	Nonsignificant	1	1	2	1
	Significant but opposite to HBM prediction	—	—	—	—
	Significance not reported	—	—	—	—
	Dimension not measured	2	—	1	1
	Significance ratio:	3/4(75%)	5/6(83%)	3/5(60%)	4/5(80%)
	CLINIC UTILIZATION				
3 Total	Significant	2	1	3	1
	Nonsignificant	1	2	—	1
	Significant but opposite to HBM prediciton	—	—	—	—
	Significance not reported	—	—	—	—
	Dimension not measured	—	—	—	1
	Significance ratio:	2/3(67%)	1/3(33%)	3/3(100%)	1/2(50%)

*Ratio of positive statistically significant findings to all studies reporting significance levels for that dimension.

Table 3. Summary of HBM Studies Published Prior to 1974

Number of HBM Studies Prior to 1974	Findings	Susceptibility	Severity	Benefits	Barriers
17 Total	Significant	10	8	8	4
	Nonsignificant	1	2	3	1
	Significant but opposite to HBM prediction	—	—	—	—
	Significance not reported	3	3	3	2
	Dimension not measured	3	4	3	10
	Significance ratio:*	10/11(91%)	8/10(80%)	8/11(73%)	4/5(80%)
	PREVENTIVE HEALTH BEHAVIORS				
11 Total	Significant	8	5	5	3
	Nonsignificant	1	2	3	1
	Significant but opposite to HBM prediction	—	—	—	—
	Significance not reported	2	2	2	1
	Dimension not measured	—	2	1	6
	Significance ratio:	8/9(89%)	5/7(71%)	5/8(62%)	3/4(75%)
	SICK-ROLE BEHAVIORS				
6 Total	Significant	2	3	3	1
	Nonsignificant	—	—	—	—
	Significant but opposite to HBM prediction	—	—	—	—
	Significance not reported	1	1	1	1
	Dimension not measured	3	2	2	4
	Significance ratio:	2/2(100%)	3/3(100%)	3/3(100%)	1/1(100%)

*Ratio of positive statistically significant findings to all studies reporting significance levels for that dimension.

dimensions, significant findings were obtained in every instance where the dimension was measured and significance was reported.

Summary of All HBM Studies

Table 4 permits an overall evaluation of the Health Belief Model by combining the pre- and post-1974 findings (i.e., Tables 2 and 3). In the preponderance of cases, each HBM dimension was found to be significantly associated with the health-related behaviors under study; the significance-ratio orderings (in descending order) are "barriers" (89%), "susceptibility" (81%), "benefits" (78%), and "severity" (65%).

Of the 46 studies reviewed, 18 are prospective and 28 are retrospective. As noted previously, the significance ratios for the prospective findings are at levels at or above those obtained from retrospective research, and the orderings of the significance ratios for the HBM dimensions are the same regardless of study design. It is particularly noteworthy that, in the case of the prospective studies, all of the 11 studies examining "perceived barriers" obtained positive and statistically-significant results—and that the poorest outcomes are yielded by the "perceived severity" dimension.

Slightly more than one-half (24) of the studies focused on PHB. While "barriers" was most productive, "susceptibility" was a close second. Most dramatic is the finding that only 50% of the PHB studies reporting significance levels for "severity" had obtained positive, significant results. It was suggested earlier that "perceived severity" may be a concept of relatively-low relevance in the area of PHB, but of greatest salience to individuals with diagnosed illness. The results in Table 4 from HBM-SRB research appear to support this contention: the significance ratio for "severity" (88%) is second highest among the four dimensions. Here, "susceptibility" yields the lowest significance ratio (first place is still held by "barriers"). Again, the relatively-poorer results produced by "susceptibility" in the instance of SRB may be due to difficulties in operationalizing this dimension of the model for cases where a diagnosis of illness has been established.

CONCLUSION

This article has summarized results from 46 studies of the Health Belief Model, 29 (63%) of which were published since 1974, and 18 (39%) of which were prospective in design. Overall, these investigations provide very substantial empirical evidence supporting HBM dimensions as important contributors to the explanation and prediction of individuals' health-related behaviors. Moreover, it is especially encouraging that findings from studies with *prospective* designs produced significance ratios as good or better than those derived from retrospective surveys. While there are many other extant models of health-related behavior,[52] we know of none approaching the HBM in terms of research attention or research corroboration. This support is particularly remarkable given the wide diversity of populations and settings studied, health conditions and health-related actions examined, and the multiplicity of different approaches and tools used to assess health beliefs and behavioral outcomes.

Prior to 1974, it appeared that "perceived susceptibility" was the most powerful dimension of the HBM; however, few of these studies had attempted to measure

Table 4. Summary of Findings From All HBM Studies

Number of HBM Studies	Findings	Susceptibility	Severity	Benefits	Barriers
46 Total	Significant	30	24	29	25
	Nonsignificant	5	12	8	3
	Significant but opposite to HBM prediction	2	1	—	—
	Significance not reported	3	3	4	3
	Dimension not measured	6	6	5	15
	Significance ratio:*	30/37(81%)	24/37(65%)	29/37(78%)	25/28(89%)
18 Prospective (Summary)	Significant	14	11	13	11
	Nonsignificant	2	6	3	—
	Significant but opposite to HBM prediction	1	—	—	—
	Significance not reported	—	—	—	—
	Dimension not measured	1	1	2	7
	Significance ratio:	14/17(82%)	11/17(65%)	13/16(81%)	11/11(100%)
28 Retrospective (Summary)	Significant	16	13	16	14
	Nonsignificant	3	6	5	3
	Significant but opposite to HBM prediction	1	1	—	—
	Significance not reported	3	3	4	3
	Dimension not measured	5	5	3	8
	Significance ratio:	16/20(80%)	13/20(65%)	16/21(76%)	14/17(82%)

	PREVENTIVE HEALTH BEHAVIORS				
24 Total	Significant	18	9	14	13
	Nonsignificant	2	8	5	1
	Significant but opposite to HBM prediction	1	1	—	—
	Significance not reported	2	2	3	2
	Dimension not measured	1	4	2	8
	Significance ratio:	18/21(86%)	9/18(50%)	14/19(74%)	13/14(93%)
	SICK-ROLE BEHAVIORS				
19 Total	Significant	10	14	12	11
	Nonsignificant	2	2	3	1
	Significant but opposite to HBM prediction	1	—	—	—
	Significance not reported	1	1	1	1
	Dimension not measured	5	2	3	6
	Significance ratio:	10/13(77%)	14/16(88%)	12/15(80%)	11/12(92%)
	CLINIC UTILIZATION				
3 Total	Significant	2	1	3	1
	Nonsignificant	1	2	—	1
	Significant but opposite to HBM prediction	—	—	—	—
	Significance not reported	—	—	—	—
	Dimension not measured	—	—	—	1
	Significance ratio:	2/3(67%)	1/3(33%)	3/3(100%)	1/2(50%)

*Ratio of positive statistically significant findings to all studies reporting significance levels for that dimension.

"perceived barriers." In the post-1974 research, "barriers" consistently yielded the highest significance ratios, regardless of study design, for both PHB and SRB—and this overall finding persists when all HBM studies are summarized. In general, "susceptibility" appears somewhat more important in PHB than in SRB, and the reverse is observed for "benefits." However, the most notable difference among the HBM dimensions is the relatively lower power of "perceived severity" *with the major exception of its importance to understanding SRB*. In the 1974–1984 research, the significance ratio for "severity" in PHB studies was only 36%; in SRB studies, the figure is 85%.

Despite the impressive body of findings linking HBM dimensions to health actions, it is important to remember that the HBM is a *psychosocial* model; as such, it is limited to accounting for as much of the variance in individuals' health-related behaviors as can be explained by their attitudes and beliefs. It is clear that other forces influence health actions as well; for example: (1) some behaviors (e.g., cigarette smoking; tooth-brushing) have a substantial habitual component obviating any ongoing psychosocial decision-making process; (2) many health-related behaviors are undertaken for what are ostensibly *nonhealth* reasons (e.g., dieting to appear more attractive; stopping smoking or jogging to attain social approval); and (3) where economic and/or environmental factors prevent the individual from undertaking a preferred course of action (e.g., a worker in a hazardous environment; a resident in a city with high levels of air pollution). Furthermore, the model is predicated on the premise that "health" is a highly valued concern or goal for most individuals, and also that "cues to action" are widely prevalent; where these conditions are not satisfied, the model is not likely to be useful in, or relevant to, explaining behavior. However, these concerns excepted, it is evident from this review that health education programs should attend to the attitude and belief dimensions of the HBM in addition to other likely influences on health-related behaviors.

Recent research has demonstrated the importance of variables which, although they fit conceptually within the HBM framework, were not developed or examined in that context. For example, in addition to more traditional HBM elements (i.e., "the person's beliefs that the behavior leads to certain outcomes and his evaluation of these outcomes"), a behavioral model developed by Ajzen and Fishbein[53] also emphasizes the importance of considering "the person's beliefs that specific individuals or groups think he should or should not perform the behavior." This normative (or "social approval") variable may be viewed as a logical refinement of the "benefits" or "barriers" dimensions of the HBM. In other words, the prospect of undertaking a socially-approved behavior (e.g., jogging) would be seen as a benefit, while having to perform a socially disapproved action (e.g., a young unmarried woman obtaining contraceptive advice/method) might be viewed as a barrier. Similarly, a person who wants to quit smoking might be inhibited by fear of experiencing the social disapproval of his/her prosmoking coworkers.

Another example comes from work begun by Bandura on the concept of "self-efficacy," which he defined as "the conviction that one can successfully execute the behavior required to produce the outcomes."[54] There is evidence in the smoking literature that the strength of a person's belief in his/her ability to undertake and/or maintain cessation is related to behavior.[55] This variable may similarly be viewed as a particular aspect of "perceived barriers"; i.e., a smoker who has repeatedly tried to quit and failed would be likely to develop feelings of low self-efficacy in this area,

and would therefore interpret his previous failures as a barrier to undertaking further attempts at cessation. (It is noteworthy that both the "social approval" and "self-efficacy" examples fall within the "barriers" category, which we have found to be the most powerful dimension of the HBM.)

Given the numerous survey-research findings on the HBM now available, it is unlikely that additional work of this type will yield important new information. However, there is a paucity of *experimental*-design research evaluating the efficacy of different interventions in modifying HBM dimensions to achieve desired health behaviors. While the HBM specifies relevant attitude and belief dimensions, it does not dictate any particular intervention strategy for altering those elements. A few available investigations[14,31,43,56] have generated promising results; hopefully, these studies and the supportive survey findings will stimulate further experimental research.

Finally, there exists a need to refine and standardize tools used to measure HBM components. For the most part, every investigator has developed a unique approach to operationalizing each variable (it is a testament to the robustness of the model that the dimensions remain predictive despite these different measures). The variability which now exits renders interpretation of results and comparison of findings across studies problematic. Thus, although some attention has been devoted to HBM-related scale development and evaluation,[44,57,58] this critical issue deserves considerable further research.

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