Compliance with a Medical Regimen for Asthma: a Test of the Health Belief Model

THE INCREASING IMPORTANCE of chronic conditions in the disease spectrum has engendered a greater emphasis on individual responsibility for health maintenance and care (*1*). This emphasis, in turn, has heightened the need to understand and to modify personal health behaviors such as adherence to prescribed medical regimens. Unfortunately, it is evident from the voluminous literature on patient cooperation with therapeutic advice that rates of compliance are disturbingly low (*2–4*). Although specific definitions or measures of compliance vary across investigations, reviewers (*5–8*) agree that at least one of every three patients who has been studied fails to follow the physician's recommendations. Especially dramatic and well documented are the low rates of adherence to instructions typically found in low-income populations attending clinics; noncompliance is frequently reported to be in excess of 60 percent (*9–12*), presenting a public health concern of considerable magnitude.

☐ *Dr. Becker and Dr. Rosenstock are professors, Department of Health Behavior and Health Education, School of Public Health, University of Michigan, Ann Arbor. Dr. Radius is assistant professor, Department of Health Services, School of Public Health, Harvard University, Boston. Dr. Drachman, Dr. Schuberth, and Dr. Teets are, respectively, associate professor, chief resident, and assistant professor, Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore.*

The research described in the paper was supported in part by grants HD 00061 and HD 00237 from the National Institute of Child Health and Human Development.

Tearsheet requests to Dr. Marshall H. Becker, Department of Health Behavior and Health Education, School of Public Health, University of Michigan, 1420 Washington Heights, Ann Arbor, Mich. 48109.

To date, research on patients' compliance has focused mainly upon health problems for which recommended regimens of considerable and consistent effectiveness (when followed) have been developed (for example, penicillin for otitis media and rheumatic fever or drug-diet-exercise regimens for hypertension). Less often studied, however, are conditions for which the prescribed ameliorative medications have a relatively lower probability of continuing success. In such instances, the patient's decision to adhere to the medical regimen must be made under circumstances of substantial uncertainty regarding the drug's efficacy.

Asthma is such a condition; theophylline (a drug which is commonly prescribed for asthma) by no means prevents or controls recurrent attacks with ideal frequency or probability (*13*). Even the most compliant patient can suffer further episodes because (*a*) the patient may encounter antigens in a quantity sufficient to overwhelm the effects of the medication, (*b*) of the incitant effect of an acute respiratory infection, (*c*) the dose prescribed may be inadequate (individual patients differ greatly in their absorption and metabolism of the drug), and (*d*) medication is only one aspect of a complex regimen that may include procedures difficult to achieve or questionable in efficacy, or both (for example, control of the patient's environment, breathing control, psychological counseling). Thus, our study of adherence to drug therapy for asthma attempts to contribute to knowledge of factors associated with compliance to health regimens by examining decisions made under conditions of greater uncertainty than is often the case.

In recent years, the health belief model (HBM), a theoretical framework for understanding individual health-related behaviors, has been the focus of considerable attention and research by behavioral scientists and health education specialists (*14–17*). According to the model, whether or not a person undertakes a recommended health action depends on

his or her perceptions of (*a*) the threat of illness, consisting of both the level of personal susceptibility to the particular illness or condition and degree of severity of the consequences (organic or social, or both) which might result from contracting the condition; (*b*) the health action's potential benefits or efficacy in preventing or reducing susceptibility or severity, or both; and (*c*) physical, psychological, financial, and other barriers or costs related to initiating or continuing the advocated behavior. In the model, a cue to action or stimulus must occur to trigger the appropriate behavior by making the person consciously aware of his feelings about the health threat; such cues can be internal (for example, perception of physical sensations) or external (for example, mass media campaigns, interpersonal interactions) (*18*). Although it is assumed that various sociodemographic and structural factors can influence the individual person's health beliefs and perceptions, these variables are viewed as linked only indirectly to compliance.

The original HBM, directed to preventive actions taken in the absence of compelling symptoms (that is, to a person's desire to avoid a specific disease threat), has been revised and expanded (*19*) to help explain compliance with medical regimens after illness has been diagnosed. The expanded model includes (*a*) general health motivations based on measures of health concerns, practices, and beliefs about prevention that are primarily nonspecific and stable across situations; (*b*) susceptibility to illnesses previously contracted, including the condition under study (often termed resusceptibility in the literature); (*c*) general faith in physicians and medical care; and (*d*) characteristics of the regimen which might impair compliance. This reformulated model is displayed in the chart.

Substantial empirical evidence exists which supports the model's utility in explaining and predicting behavior directed to prevention, to obtaining diagnosis in the presence of symptoms, and to actual sickness (*20*), ranging from participation in screening (*21, 22*) and immunization programs (*23*) to compliance with short-term medication therapies (*24*). However, the HBM has rarely been employed with patients whose chronic conditions necessitated long-run personal health actions (*25*) or, as indicated, in connection with conditions requiring regimens of uncertain efficacy. In this paper, we report findings from research which tested the HBM's ability to explain mothers' differential adherence to a drug regimen prescribed for their asthmatic children.

Method

During the period October 1976 through February 1977, a total of 117 mothers of children previously diagnosed as asthmatic brought their children to the pediatric emergency facility of the Johns Hopkins Hospital for treatment of an asthma attack. These women were requested to cooperate in a study to learn more about the "problems mothers have in taking care of their children's health" and about "worries and problems in dealing with asthma." Prior screening assured that only mothers claiming to be responsible for the children's daily care were included in the study. Three subjects declined participation at the outset, and another three chose not to continue their involvement in the research. Consequently, 111 complete interviews were ultimately available for analysis.

Respondents ranged in age from 17 to 54 years (mean = 31 years), and all but 7 were black. The children's ages ranged between 9 months and 17 years (mean = 7.7 years).

The interview schedule, which required about 45 minutes to complete, dealt with the mother's general health motivations and attitudes and her views about various aspects of asthma and its consequences. Most questions were designed to provide measures of the HBM's dimensions.

Each mother was asked to recall her handling of the child's current asthma attack, including whether the most recently prescribed asthma medication had been administered. A covert evaluation of compliance was also made by drawing blood by finger stick and testing it for the presence of theophylline, a substance basic to all of the drugs prescribed for asthma by the cooperating physicians. Unfortunately, in the turmoil and strain of the emergency facility, participating physicians sometimes neglected to obtain a blood sample before treatment began. Consequently, such objective verification of compliance was ultimately available only for 80 (72 percent) of the 111 mothers. Their reports of medication administration were compared with laboratory findings for the 80 children; a correlation of 0.913 was obtained, arguing for the validity of the mother's statement as an additional indicator of compliance.

From these data, two measures of mothers' adherence were constructed. "Compliance 1" has three levels: absence of theophylline in the blood or mother's statement that she did not give the drug, or both; no test available, but mother states that she gave the drug; and presence of theophylline in the blood. "Compliance 2" has two levels: laboratory confirmation of the presence or absence of theophylline. Samples were positive for 53 children, a compliance rate of 66.3 percent for the 80 children for whom blood samples were obtained.

Results from these two measures of compliance are reported separately, permitting comparison of soft and hard measures for each variable of the HBM. It will be seen that, in general, where one measure is significantly correlated with an independent variable, the other measure is as well, and at the same level of significance. However, the softer measure ("Compliance 1") has the advantage of presenting data derived from a larger number of cases (that is, from all 111 mothers). Numbers in the tables that follow represent all respondents who answered each question.

Results

Associations obtained between each compliance measure and mothers' general health motivations are shown in table 1. First, subjects were asked how much they worried about their children's health. Although uniformly associated in the predicted direction with each compliance measure, the gammas in

Hypothesized model for explaining and predicting mothers' compliance with a medical regimen for their asthmatic children

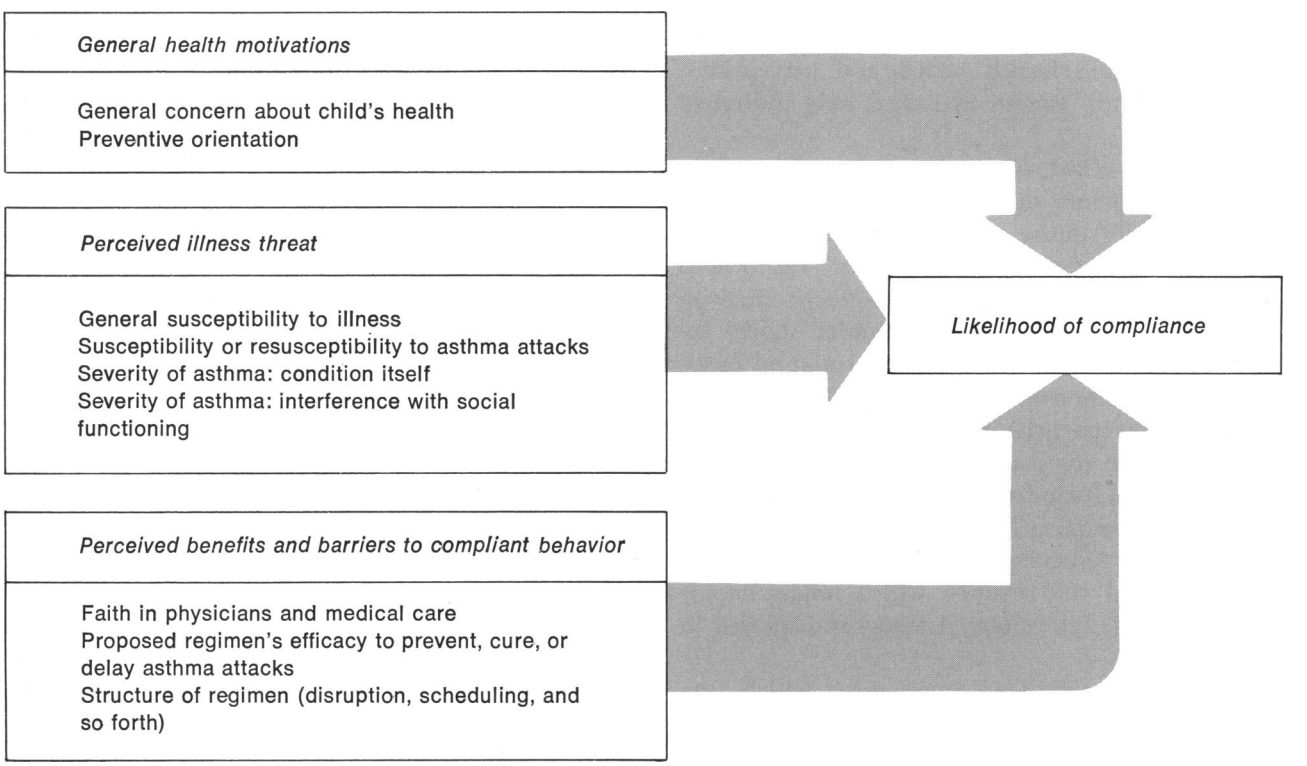

Table 1. Associations between mothers' general health motivations and compliance with a medication regimen for their asthmatic children

General health motivations	Compliance 1		Compliance 2	
	Gamma	Number	Gamma	Number
General concern about child's health:				
Worries about child(ren)'s health	0.197	109	0.190	79
Has greater concern for focal child than for her other children	[1] 0.430	83	[1] 0.527	62
Gives child vitamins	0.061	108	0.175	78
Possesses fever thermometer	[2] 0.291	108	[2] 0.419	78
Preventive orientation:				
Exerts control over situations	[2] 0.263	109	[2] 0.297	79
Does things as planned	[2] 0.280	109	[2] 0.364	79
One can prevent sickness	[2] 0.282	107	[2] 0.430	77
Ill health due to carelessness	0.042	105	0.193	76
Infectious diseases are preventable	[2] 0.255	106	[2] 0.423	78
Visits doctor when not ill	0.102	108	0.245	78
Gives asthma medicine when child feels well	[1] 0.384	105	[1] 0.467	76

[1] $P < 0.01$. [2] $P < 0.05$.

table 1 attain statistical significance only when the mother is asked to rate this concern for the focal child (that is, the patient) in comparison to that felt for her other children. In addition, while no significant relationship was obtained between medication adherence and giving the child vitamins, compliant mothers were more likely to own a fever thermometer, a covert indicator of general health concern in this largely indigent group.

Feelings of control over general and health-specific circumstances have received much attention in recent research on patient compliance (*16, 26, 27*). The findings concerning "preventive orientation" (table 1) indicate that mothers who appropriately administered the medication were significantly more likely to feel that they generally controlled situations and did things according to plan; further, although they neither blamed ill health on carelessness nor emphasized the value of preventive visits to physicians, they also felt most illnesses were preventable. However, the most direct question produced the highest correlations: those mothers who said that it was important to "give the asthma medicine even when the child feels well" were substantially more likely to have administered it as scheduled before the current attack.

Beliefs about their child's vulnerability to illness in general were also positively related to mothers' administration of the prescribed asthma medicine. As data in table 2 demonstrate, perceptions of the focal child as being in poor health and as susceptible to a constant set of health problems were particularly good predictors of variations in adherence. However, perceptual items relating the child's vulnerability to the specific illness were even more useful in predicting medication compliance. Among the respondents reporting that the asthmatic child experienced relatively more attacks, mothers were much more likely to be administering the drug. Similarly, administration of the asthma medicine was more likely if mothers perceived their child as being vulnerable to another attack of asthma within 1 month of the interview.

Associations obtained between each dependent variable and mothers' perceptions regarding the seriousness of an asthma condition are also presented in table 2. Although evaluations of asthma's severity relative to influenza did not predict compliance, assessment of asthma as more serious than measles and, in particular, pneumonia did co-vary with mothers' use of the regimen before the child was brought to the pediatric facility. Perceptions of the overall severity of the child's asthma in absolute terms, however, surpassed the predictive utility of all items contrasting asthma to other illnesses. Mothers who felt that their child had a serious asthma condition were substantially more likely to have been compliers.

To further indicate their perceptions of the seriousness of the problem, mothers were asked to respond to items dealing with the degree of pain, discomfort, harm, and power which they perceived as attributable to their child's asthmatic condition. Again, as shown in table 2, each of these items was positively associated with mothers' use of the recommended regimen, and most at a statistically signifi-

cant level. Taking exception to the statement that "asthma is not a problem if the child is well," compliers agreed that asthma is of such seriousness that it affects their child's general health. Further, the compliant mother was more likely to feel that both the asthma and the use of prescribed medication would endure throughout the child's life.

As predicted by the health belief model, the perceived threat of illness may also be represented in the degree to which a health condition disturbs normal social functioning. The last set of correlations in table 2 reveals that mothers who reported that the child's asthma interfered with their personal activities were more probable compliers; additional associations show that items indicating the extent to which asthma was perceived as disruptive of the focal child's activities are equally useful explanatory measures (for example, compliant mothers were more likely to view asthma as a source of embarrassment to their child). The most substantial association, however, was that obtained when relating compliance to the extent that asthma interfered in the child's schooling. When perceiving relatively greater asthma-caused obstruction to the focal child's education, mothers were substantially more likely to have intervened in the child's attack by administering the required drug treatment. Finally, mothers who believe that their own ill health would have serious consequences for their families were more likely to be compliers (table 2).

To this point, then, the results presented offer reasonably direct and substantial support for the relationships hypothesized by the HBM to exist between measures of general health motivations, susceptibility, and severity, and mothers' adherence to the prescribed medication regimen.

An interesting pattern emerges from the associations obtained between compliance and measures of mothers' faith in physicians and medical care. Contrary to expectations, those who adhered to physicians' recommendations by administering the prescribed medication more often expressed skepticism in evaluating clinicians' abilities, and they also more often reported dissatisfaction in their interactions

Table 2. Associations between mothers' perceived illness threat and two measures of compliance with a medication regimen for asthmatic children

Illness.threat	*Compliance 1*		*Compliance 2*	
	Gamma	*Number*	*Gamma*	*Number*
General susceptibility to illness:				
Child has poor health in general	[1] 0.363	110	[1] 0.387	80
Child has poorer health than other children	0.201	109	0.163	79
Child contracts same illnesses repeatedly.	[2] 0.352	109	[2] 0.431	79
Child contracts things going around	0.132	109	0.173	79
Susceptibility to asthma:				
Times per year child sick with asthma	[2] 0.489	108	[2] 0.627	79
Child likely to have asthma attack this month	[2] 0.372	106	[2] 0.489	78
Severity of asthma condition:				
Seriousness of child's condition	[2] 0.550	109	[2] 0.733	80
Asthma more serious than pnuemonia	[1] 0.344	106	[1] 0.275	78
Asthma more serious than measles	0.168	107	0.187	77
Asthma more serious than influenza	0.063	106	0.067	76
Asthma is painful	0.136	109	0.103	80
Asthma is uncomfortable	[1] 0.228	110	[1] 0.365	80
Asthma is harmful	[1] 0.340	109	[1] 0.497	79
Asthma is powerful	[1] 0.214	106	[1] 0.285	78
Asthma is not a problem if child is well	[2] −0.372	107	[2] −0.503	78
Asthma affects child's health	[1] 0.156	108	[1] 0.141	79
Asthma will last for child's life	[2] 0.503	103	[2] 0.517	75
Child will take asthma medicine for rest of life	[1] 0.651	95	[1] 0.772	69
Severity of asthma—social interference:				
Interference with mother's activities	[1] 0.136	110	[1] 0.393	80
Interference to child's schooling	[1] 0.306	74	[1] 0.345	55
Asthma as cause of embarrassment	[1] 0.247	108	[1] 0.172	79
Severity of mother's illness: personal sickness bad for family	[1] 0.260	106	[1] 0.364	77

[1] $P < 0.05$. [2] $P < 0.01$.

Table 3. Associations between perceived benefits of compliant behavior and two measures of compliance with a medication regimen for asthmatic children

Perceived benefits	Compliance 1		Compliance 2	
	Gamma	Number	Gamma	Number
Faith in doctors and medical care:				
Never doubts what doctors say	[1] −0.261	108	[1] −0.265	78
Doctors disinterested in patients	[1] −0.156	108	[1] −0.231	78
Doctors spend sufficient time with patients	[1] −0.214	108	[1] −0.288	78
Doctors know best in treating health problems	−0.133	108	−0.053	78
Physicians know a great deal about asthma	[1] −0.237	105	[1] −0.185	77
Does not use own judgment in deciding to follow physicians' advice	−0.032	108	0.179	78
Feels better when heeding doctors' advice	0.179	107	[1] 0.307	77
Does not wait until own efforts fail before taking child to doctor	[2] 0.438	106	[2] 0.674	78
Children do not recover from sickness by waiting	[2] 0.288	107	[2] 0.294	77
Proposed regimen's efficacy:				
Medicine can help but not cure asthma	[1] 0.374	103	[1] 0.529	74
Asthma medicine is likely to prevent an attack if given	0.120	107	0.199	77
Asthma medicine is likely to prevent an attack regularly and on time	0.180	111	0.251	80

[1] $P < 0.05$. [2] $P < 0.01$.

with physicians (table 3). It was the compliant mother who more frequently doubted what the physician told her; moreover, compliers were more probable adherents of the beliefs that physicians do not "know best in treating health problems" and that they do not "know a great deal about asthma." On the other hand, despite such negative evaluations of physicians (who were also thought to spend insufficient time with patients and to be uninterested in them), mothers who administered the medication nonetheless reported that they themselves feel better when heeding physicians' advice.

The most substantial and statistically significant positive associations between mothers' faith in medicine and drug administration were obtained when measures were invoked that dealt with mothers' responsivenesss to children's health problems. Respondents concurring with the item, "Children do not recover from sickness by waiting," were more likely to have given their asthmatic child the required medication. Greater reliance upon medical expertise is also reflected in the finding that compliant mothers were more likely to seek physicians' advice before ending any efforts which they might attempt to improve the asthmatic child's condition.

Data in table 3 show that (*a*) compliant mothers exhibit greater skepticism and, yet, more dependency concerning physicians, (*b*) sufficient distrust in the medication's efficacy exists so that beliefs about the preventability of an asthmatic attack by medication did not distinguish compliers from noncompliers, and (*c*) adherent mothers were significantly more likely to understand that the prescribed medication "can help but not cure asthma."

Findings related to the HBM's "perceived benefits" dimension thus describe the complex situation confronted by the compliant mothers of asthmatic children. They hold 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."

Concerning the last category of the HBM, "perceived barriers," one finds from the results shown in table 4 that mothers' reports of four obstacles to their administering the prescribed drug (regimen's disruption of normal activities, relative inaccessibility of places to fill or refill prescriptions, child's complaints about the taste of the medication, and problems with the schedule for administering the medication) are all associated with compliance failures. Only the item relating to the medication's cost fails to reach statistical significance in its associations with nonadherence, perhaps because of the availability of reimbursement mechanisms; even for the cost item, however, the correlations are in the predicted direction. These data thus appear to suggest a straightforward and considerable relationship between mothers' perceptions of various "negative" aspects of the medica-

tion regimen and the likelihood of their failure to administer it.

Certain demographic and condition-related variables not enumerated in the HBM were also examined in this study because of their prominence in the compliance literature, albeit generally without predictive success (*28*). Results relating these items to mothers' administration of the prescribed therapy are displayed in table 5.

Only two demographic variables were significantly associated with adherence: mother's marital status and the extent of her formal education. The positive influence of marital status (ordered in the analysis as follows: married, widowed, divorced, separated, never married) perhaps derives from the many ways in which a spouse may effect the regimen compliance of other family members (*29*) (for example, reminding or encouraging the mother to administer medication, engaging in environmental control, providing supportive evaluation of the need for care, and so forth). Education may increase mothers' sophistication concerning the realities of their child's condition and available treatment. Finally, none of the remaining predisposing factors (including mothers' perceptions of the seriousness of the present attack, both alone and in comparison to previous episodes) was impressively related to compliance.

Discussion

The results of the study provide additional support for a particular psychosocial approach to understanding health-related behaviors. Moreover, this research extends the utility of the health belief model to explain and predict differential adherence to a therapy of uneven efficaciousness when it is prescribed for a chronic condition such as asthma. Significant associations were found between each of the major HBM components and the two study measures of medication compliance.

It is notable that, despite the fewer cases for the Compliance 2 measure, associations between the various independent variables and the more objective or "hard" indicator of the dependent variable (Compliance 2) achieve, by and large, higher values than those obtained with the more subjective or "soft" measure (Compliance 1). Levels of statistical significance, however, are comparable across both outcomes. Self-reported measures necessarily include biases introduced by respondents' inaccurate recollection of, or reticence to disclose, personal behaviors. Thus, while an impressive degree of intercorrelation maintains between both constructions of the dependent variable, inclusion of mothers' personally reported compliance unavoidably effects a slight depression in the predictive capacity of Compliance 1.

Of the HBM's dimensions, the overwhelming majority—general concern about child's health (including overall preventive orientation), views of the child's vulnerability to illness in general and to asthma specifically, the perceived intrinsic severity of asthma and the social interferences it creates, as well as perceptions of the regimen's efficaciousness and barriers to its use—operate in the predicted direction. Even the nonhealth-focused indicators of the "preventive orientation" component of the model offered support for the argument that mothers who claimed that they exert control over situations and that they do things according to plan are significantly more likely to administer the prescribed medication. The health-related items in this orientation, "belief that illnesses are preventable" and "giving medicine even when child is well," also predicted compliance.

Only variables in the class "faith in doctors and medical care" were found to behave differently than as hypothesized by the HBM. Contrary to expectations, the findings reported in table 3 revealed that compliant mothers were relatively less likely to have high regard for the physician's knowledge and inter-

Table 4. Associations between measures of perceived barriers and two measures of compliance with a medication regimen for asthmatic children

Perceived barriers	Compliance 1		Compliance 2	
	Gamma	Number	Gamma	Number
Disruption to activities	[1] −0.405	111	[1] −0.500	80
Inaccessibility of stores	[1] −0.321	110	[1] −0.469	80
Taste	[1] −0.154	111	[1] −0.208	80
Cost	−0.102	107	−0.203	77
Administration schedule	[1] −0.220	110	[1] −0.343	79

[1] $P < 0.05$.

Table 5. Associations between demographic and predisposing variables and two measures of compliance with a medication regimen for asthmatic children

Demographic and predisposing variables	Compliance 1		Compliance 2	
	Gamma	Number	Gamma	Number
Demographic variables pertaining to mother:				
Age	0.123	108	0.211	78
Educational attainment	[1] 0.321	108	[1] 0.414	78
Marital status	[2] 0.265	108	[2] 0.422	78
Employment status	0.104	108	0.123	78
Personal health status	0.081	108	0.117	78
Demographic variables pertaining to child:				
Age	0.025	111	0.044	80
Sex	−0.165	111	−0.243	80
Predisposing variables:				
Other family members have asthma	−0.149	110	−0.190	80
Residence of other family asthmatics	−0.124	77	−0.217	55
Age of other family asthmatics	−0.070	77	−0.051	55
Seriousness of present attack	−0.029	110	−0.042	80
Seriousness of present attack relative to previous attacks	0.077	109	0.047	79

[1] $P < 0.05$. [2] $P < 0.01$.

est. In retrospect, this outcome should not be too surprising in light of (*a*) the limited efficacy of the regimen and (*b*) in spite of compliant mothers' administration of the drug, the prescribed treatment nonetheless failed to prevent an asthmatic attack, thereby prompting mothers' visits to the emergency room.

At least two possible explanations for these seemingly contradictory findings may be suggested. First, administering the medicine does not always prevent attacks (note the nonsignificant correlations in table 3 between mothers' belief that the "asthma medicine is likely to prevent an attack," even "if given regularly and on time" and compliance with the drug regimen). Mothers' responses to many of the "perceived benefits" items may therefore reflect attempts to reconcile conflicting feelings and actions. The previously compliant mother—whose child has nonetheless suffered an asthmatic attack—may be realizing a desire to criticize medicine and physicians for having failed to prevent the attack (previously noncompliant mothers would presumably have less reason to respond similarly).

Moreover, it must be remembered that the interviews upon which the study is based were obtained under conditions of stress, perhaps masking the somewhat different feelings that would have emerged had the setting been less stressful or unrelated to this medical problem, or both. The cross-sectional nature of the survey design precluded an empirical demonstration of the time order among the variables. Thus, interpretation of these findings must be tempered by recognition that beliefs about physicians and medical care, which are hypothesized to precede and influence compliance, were in fact measured after the mother had followed or failed to follow medical advice, and after the effects of her compliance had been tested.

However, it is generally believed that subjective perceptions of the potential benefits of medical care are derived from a variety of other beliefs and experiences and, for that reason, are relatively enduring across medical settings. Thus, a second interpretation of the findings may be advanced which is not dependent upon an hypothesized need for compliant mothers to reduce conflicting feelings. In this second approach, which is more in accord with the data in table 3, as well as more consistent with other findings in the compliance literature, compliers are seen as relatively more realistic and knowledgeable about the value of medical intervention, understanding both the limitations and the worth of the physician's involvement. In keeping with this view, mothers' adherence to the prescribed regimen may be interpreted as the outcome of their implicit probability assessments regarding the efficacy of treatment.

On a more general level, the belief dimensions incorporated by the HBM are held to be relatively fundamental and largely impervious to the particular health condition or setting under study. This view is reinforced by (*a*) demonstration that these beliefs may be invoked in explanations of individuals' actions relative to chronic conditions, (*b*) the absence

of any systematic correlation between sociodemographic variables (for example, age of mother or child, sex of child, mother's employment status) and compliance, and (*c*) perhaps most important, the lack of any significant relationship between medication administration and mothers' perceptions of the seriousness of the present attack.

Research on the compliance of asthma patients is complicated by the uncertain efficacy of the prescribed regimen (*13*). Most investigators of patients' adherence behaviors have studied practices or regimens held by most medical experts to be highly effective (for example, many types of immunizations, correct oral hygiene practices, antibiotics for bacterial infections). Receiving far less scrutiny, however, are the sociobehavioral influences on patients' adherence to regimens which are correctly perceived to be of uncertain value; two examples are weight reduction per se or the use of propranolol to prevent myocardial infarction. Yet, many personal health practices with the potential for preventing chronic disease are in this gray area of uncertain effectiveness (*30*).

Thus, if we are to improve our knowledge, and consequently our capability to intervene in health behaviors to increase adherence to medical regimens in the absence of symptoms, we must devote greater attention to the factors influencing compliance with treatments that are not always effective. Future projects might therefore focus on a range of conditions with prescribed therapies of varying efficacy. Such studies would allow measurement of an increased range of individual perceptions regarding the value of the regimen and would also permit more precise tests of the ability of that HBM dimension to explain behavior. In so doing, we would also enhance our ability to develop proper health education goals by providing a more precise identification of the extent to which people believe particular treatments to be effective in controlling particular conditions.

The group of mothers of asthmatic children included in this study provided an opportunity to examine what occurs when compliance does not control disease, as well as a test of the hypotheses posed by the compliance-adapted HBM. The results show that no profound changes in health beliefs derive from the medication's failure, except perhaps for an increased skepticism about physicians and medical care. The health beliefs supporting compliance do not seem to be diminished. An interesting task for future research would be an assessment of whether such occasional failures in therapy may ultimately result in an increased reliance upon the particular medication as a kind of "desperation" reaction. Some evidence for this hypothesis is provided by the correlations in table 2 showing that mothers whose children were more frequently sick with asthma were nonetheless more likely to comply with the regimen.

A final observation of some interest derives from the data linking respondents' compliance with their skepticism about medical care in general. These seemingly negative results are not without some comfort. It is our contention that the thoughtful student of public health should not strive to produce a patient who invariably follows the physician's advice. Rather, he or she should encourage people to recognize both the strengths and limitations of medical knowledge and technology and to consider those factors in their response to professional advice. As demonstrated in this research, such tempered appreciation of the medical care system may be of value in achieving the desired end of patients' compliance with instructions about medications.

References

1. Gerson, E. M., and Strauss, A. L.: Time for living: Problems in chronic illness care. Soc Pol 6: 12–18, November-December 1975.
2. Fox, W.: Self-administration of medications: A review of published work and study of problems. Bull Int Union Tuberc 32: 307–331, July 1962.
3. Marston, M.: Compliance with medical regimens: A review of the literature. Nurs Res 19: 312–323, July-August 1970.
4. Mitchell, J. H.: Compliance with medical regimens: An annotated bibliography. Health Educ Monogr 2: 75–87, spring 1974.
5. Blackwell, B.: Drug therapy: Patient compliance. N Engl J Med 289: 249–252, Aug. 2, 1973.
6. Stimson, G. V.: Obeying doctor's orders: A view from the other side. Soc Sci Med 8: 97–104, February 1974.
7. Sackett, D. L.: The magnitude of compliance and noncompliance. *In* Compliance with therapeutic regimens, edited by D. L. Sackett and R. B. Haynes. Johns Hopkins University Press, Baltimore, 1976, pp. 9–25.
8. Podell, R. N.: Physician's guide to compliance in hypertension. Merck, Sharp and Dohme, West Point, Pa., 1975.
9. Becker, M. H., Drachman, R. H., and Kirscht, J. P.: A new approach to explaining sick-role behavior in low-income populations. Am J Public Health 64: 205–216, March 1974.
10. Bergman, A. B., and Werner, R. J.: Failure of children to receive penicillin by mouth. N Engl J Med 268: 1334–1338, June 13, 1963.
11. Gordis, L., Markowitz, M., and Lilienfeld, A. M.: The inaccuracy in using interviews to estimate patient reliability in taking medications at home. Med Care 7: 49–54, January-February 1969.
12. Vincent, P.: Factors influencing patient noncompliance: A theoretical approach. Nurs Res 20: 509–516, November-December 1971.
13. Howard, C. A.: Effect of oral theophylline on bronchospasm. J Asthma Res 8: 111–114, March 1971.
14. Becker, M. H., Drachman, R. H., and Kirscht, J. P.: Moti-

vations as predictors of health behavior. Health Serv Rep 87: 852–862, November 1972.
15. Rosenstock, I. M.: Why people use health services. Milbank Mem Fund Q 44: 94–127, July 1966 (pt. 2).
16. Simonds, S. K.: Emerging challenges in health education. Int J Health Educ 19 (supp): 1–19, October-December 1976.
17. Aho, W. R.: Relationship of wives' preventive health orientation to their beliefs about heart disease in husbands. Public Health Rep 92: 65–71, January-February 1977.
18. Rosenstock, I. M.: Historical origins of the health belief model. Health Educ Monogr 2: 328–335, winter 1974.
19. Becker, M. H., and Maiman, L. A.: Sociobehavioral determinants of compliance with health and medical care recommendations. Med Care 13: 10–24, January 1975.
20. Becker, M. H., editor: The health belief model and personal health behavior. Health Educ Monogr 2: 324–473, winter 1974.
21. Hochbaum, G. M.: Public participation in medical screening programs: A socio-psychological study. PHS Publication No. 572. U.S. Government Printing Office, Washington, D.C., 1958.
22. Becker, M. H., Kaback, M. M., Rosenstock, I. M., and Ruth, M. V.: Some influences on public participation in a genetic screening program. J Community Health 1: 3–14, fall 1975.
23. Leventhal, H., Rosenstock, I. M., Hochbaum, G. M., and Carriger, B. K.: Epidemic impact on the general population in two cities. Ch. 3. *In* The impact of Asian influenza on community life: A study in five cities. PHS Publication No. 766. U.S. Government Printing Office, Washington, D.C., 1960, pp. 53–77.
24. Becker, M. H., Drachman, R. H., and Kirscht, J. P.: Predicting mothers' compliance with pediatric medical regimens. J Pediatr 81: 843–854, October 1972.
25. Kasl, S. V.: The health belief model and behavior related to chronic illness. Health Educ Monogr 2: 433–454, winter 1974.
26. MacDonald, A. P., Jr., and Hall, J.: Internal-external locus of control and perception of disability. J Consult Clin Psychol 36: 338–343, June 1971.
27. Fishbein, G. M.: Perceptual modes and asthmatic symptoms: An application of Witkin's hypothesis. J Consult Psychol 27: 54–58, February 1963.
28. Haynes, R. B.: A critical review of the "determinants" of patient compliance with therapeutic regimens. *In* Compliance with therapeutic regimens, edited by D. L. Sackett and R. B. Haynes. Johns Hopkins University Press, Baltimore, 1976, pp. 26–39.
29. Becker, M. H., and Green, L. W.: A family approach to compliance with medical treatment: A selective review of the literature. Int J Health Educ 18: 173–182, July-September 1975.
30. Belloc, N. B.: Relationship of health practices and mortality. Prev Med 2: 67–81 (1973).

SYNOPSIS

BECKER, MARSHALL H. (School of Public Health, University of Michigan), RADIUS, SUSAN M., ROSENSTOCK, IRWIN M., DRACHMAN, ROBERT H., SCHUBERTH, KENNETH C., and TEETS, KATHERINE C.: *Compliance with a medical regimen for asthma: a test of the health belief model. Public Health Reports, Vol. 93, May–June 1978, pp. 268–277.*

Increased empirical attention is presently being directed to the study of personal health behaviors and, in particular, to psychosocial factors impinging upon individuals' acceptance and following of therapeutic advice. Research has, however, typically focused upon treatments of reasonably constant and considerable effectiveness, avoiding disease states in which patients are advised to adhere to regimens of only uncertain efficaciousness. Asthma is such a condition; taking the theophylline-based medication as directed does not preclude the possibility of recurrent attacks. Accordingly, in this paper findings are presented from research which attempted to test the ability of a particular decision-making framework, the health belief model (HBM), to explain mothers' differential compliance with a drug regimen prescribed for their asthmatic children.

Interviews were completed with 111 mothers from a low-income, clinic population, who brought their children to a pediatric emergency facility for treatment of acute asthma episodes. Based on the HBM's sociobehavioral dimensions, the interview included questions about the mother's general health motivations and attitudes, as well as about her view regarding the child's asthma condition and its ramifications. Two measures of compliance were employed: (a) laboratory verification of the drug's presence or absence in the patient's blood and (b) a construction combining objectively determined and self-reported information if laboratory documentation was unavailable.

Significant associations were obtained between the majority of HBM components and the measures of compliance. Mothers' perceptions of threat of illness (particularly the child's susceptibility to illness and the seriousness of such conditions, whether asthma-related or not) and of difficulties associated with administration of the medication were substantial predictors of adherence. An unexpected finding, that adherent mothers are both more skeptical of, yet more dependent upon, physicians and medical care is explained in terms of hypotheses specific to the condition studied. Of those variables suggested by relevant literature (but unspecified in the HBM), only mothers' marital status and level of formal education maintained significant associations with compliance. These results offer additional support for the HBM approach to understanding health-related behaviors. On the basis of the findings, it is also suggested that there are no profound changes in health beliefs when compliance "fails."