

# Illness Visualization and Therapeutic Adherence

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*In an attempt to identify a quick, inexpensive intervention for improving adherence to therapeutic plans for acute otitis media, a strategy supported by the health belief model was tested on 141 children and their caretakers. To augment education efforts, caretakers were shown the physical findings of acute otitis media in their child. Results of the intervention test show no effects on follow-up appointment-keeping behavior or on intermediate clinical outcome. The health belief model was not sustained by this test.*

Despite considerable investigative effort over the last 20 years, patient adherence (a term preferred to the previous *compliance*) to therapeutic programs remains as problematic as ever. A large body of literature has developed around the proposing and testing of theoretical determinants of adherence. Yet the results are often contradictory, and few strategies have been shown through rigorous study design<sup>1,2</sup> to have a consistent positive effect on adherence. Equally important to clinicians is that even fewer of these strategies are concise enough to be easily incorporated into a busy practice or clinic.

Acute otitis media is a common cause of childhood morbidity, which, if untreated or inadequately treated, can have serious sequelae when a bacterial infection is involved.<sup>3</sup> Clinical examination alone is not felt to be sufficient to differentiate bacterial from other causes of acute otitis media. As a result, most children with acute otitis media are treated with antibiotics, even though perhaps only one half indeed have a bacterial cause. Follow-up examination after treatment is also felt to be useful to identify those cases of antibiotic resistance leading to continued infection and to identify the common sequelae of serous otitis media with its effects on auditory acuity. In the case of acute otitis media, adherence to the therapeutic plan is important with regard to both medication use and follow-up examination. Several studies have documented that in both areas adherence is a problem.<sup>4-6</sup>

The study reported here was undertaken in an attempt to identify whether a simple educational intervention re-

quiring little time or resources from the provider could improve adherence to a treatment plan for acute otitis media. The intervention chosen, showing the abnormal tympanic membrane to the adult caretaker accompanying the child to the clinic, has theoretical support for its ability to improve adherence. The health belief model, or its more recent offspring, the health decision model, holds that the likelihood to adhere is directly related to the individual's perceived susceptibility to the disease (including a belief in the diagnosis) and the perceived severity of the condition. Both of these perceptions should be favorably influenced by visualization of the tympanic membrane as opposed to a simple statement of the diagnosis by the provider. Such a favorable influence on adherence should particularly be the case in the population studied, as will be explained. In essence, then, the following study tests a portion of the health belief model with an intervention easily incorporated into any practice setting. The outcomes examined were appointment keeping for a follow-up visit, and, indirectly, one measure of clinical outcome by noting further diagnoses of acute otitis media within four weeks.

## METHODS

The Crownpoint Service Unit is a facility of the US Public Health Service Indian Health Service. Through its clinics and hospital it provides health care to approximately 14,000 Navajos living in a 4,500 square mile area of northwest New Mexico. Services, including medications, are provided without charge to beneficiaries. Other health care providers are located 60 or more miles distant from Crownpoint; within the area served by this facility, however, there are essentially no other providers. Some patients do at times choose to go outside the area to seek

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health care, but the majority are seen at Crownpoint, and rarely is a patient who has been seen at Crownpoint for an acute illness subsequently followed up elsewhere.

From June 1, 1985, to August 1, 1986, all children younger than 7 years old seen in the Crownpoint clinics by the author and having a diagnosis of acute otitis media were tracked for adherence to follow-up appointment keeping. A diagnosis of acute otitis media was made on the basis of examination by pneumatic otoscopy showing abnormal coloration combined with two of the following characteristics of the tympanic membrane: decreased mobility, opacity, loss of bony landmarks, or bulging.

As the children were initially examined and the diagnosis of acute otitis media made, several statements were made to the parent or other caretaker present. First, the diagnosis and illness were explained. Next, the correct use of the antibiotic prescribed was reviewed. All caretakers were then told that a full course of antibiotic therapy was necessary, even should the child appear well before its completion, to eradicate the infection and prevent return of the illness. They were also told that a follow-up examination was essential to identify persistent infection, and that sometimes more antibiotic treatment was necessary at the time of the follow-up even though the child might appear well. The caretaker was asked whether the child could be brought back for examination in two weeks. A mutually agreed upon appointment was given to the caretaker, who was also told to bring the child in sooner if she or he did not improve.

In addition, at the time of the initial examination, in one half of the cases, the parent or other caretaker present was shown through the otoscope the tympanic membrane, and its pink or red color was pointed out; the normal color of a tympanic membrane was also explained. The basis for selection of which parents were shown the tympanic membrane was alternate registration in the clinic. Of note is that in the Navajo language (in which most patients over the age of 18 years are fluent) the words for red and raw or irritated are the same, so that the pink or red appearance of the tympanic membrane has particular significance in indicating infection to the parent. In virtually all cases the caretaker spontaneously interpreted the red tympanic membrane as indicating a painful, ill condition even before the normal appearance was explained to them. Treatment was by oral amoxicillin at 20 mg/kg/d or ampicillin at 50 mg/kg/d (the latter only in children able to take capsules). In cases of penicillin allergy or previous apparent treatment failure while on amoxicillin, cotrimoxazole or an erythromycin-sulfisoxazole combination was used at the manufacturers' recommended dosages. Patients who had purulent drainage from the ear canal, who were hospitalized for the otitis media or other illness, or who had subsequent intercurrent illness were dropped from the study because of anticipated biases introduced by these factors.

At a later point the charts of these patients were then reviewed to ascertain whether they were brought in for follow-up examination. Patients were considered to have followed up if they returned at their appointment time or within one week of the appointment, and if the chart indicated that the visit was a follow-up for the otitis. The charts were also examined for second diagnoses of acute otitis media within the four weeks following the initial illness to determine indirectly the clinical outcome of the initial intervention.

## RESULTS

During the period under study, 155 children were seen with a diagnosis of acute otitis media. Fourteen children were dropped from the study because of the presence of one of the factors listed above. Of the remaining 141 children, 74 received the intervention aimed at improving adherence, while 67 did not. The mean age of the subjects was 0.83 years, and of controls 0.90, a difference that was not significant (Mann-Whitney  $z = 0.167$ ,  $P = .867$ ). The mean distance to the clinic from the subjects' homes was 12.86 miles, and from the controls' homes was 13.36 miles, again a difference that was not significant ( $z = 0.803$ ,  $P = .422$ ). Of the subjects, 49 were treated with amoxicillin, three with ampicillin, and 15 with cotrimoxazole. Among the controls, 54 were treated with amoxicillin, one with ampicillin, 15 with cotrimoxazole, and four with erythromycin-sulfisoxazole.

Table 1 displays the appointment-keeping behavior of all children. Overall, 59 children (representing 41.8 percent of the total) returned for rechecks of treatment success. Among the subjects, 28 of 74 (37.8 percent) returned, while 31 of 67 (46.2 percent) of the controls did so. A comparison of these proportions using the chi-square method showed no statistically significant difference ( $\chi^2 = 0.7098$ ,  $P > .10$ ).

Second diagnoses of acute otitis media within the four weeks following the original diagnosis (but outside of the initial treatment period) are shown in Table 2. For the entire group, 24 of 141 (17.0 percent) had second diagnoses within four weeks. In the control group, 10 of 67 had second diagnoses (14.9 percent), and in the subject group, 14 of 74 (18.9 percent) did. Again, a chi-square analysis showed no significant difference ( $\chi^2 = 0.1646$ ,  $P > .10$ ).

## DISCUSSION

The intervention tested in this study was chosen because of its ease of incorporation into a busy practice setting with a minimum of additional resource utilization. Be-

**TABLE 1. APPOINTMENT KEEPING OF CHILDREN FOR FOLLOW-UP OF OTITIS MEDIA**

Study Group	Returned for Recheck No. (%)	Did Not Return No. (%)	Total
Caretaker shown tympanic membrane	28 (37.8)	46 (62.1)	74
Caretaker not shown tympanic membrane	31 (46.3)	36 (53.7)	67
Total	59 (41.8)	82 (58.1)	141

**TABLE 2. SECOND DIAGNOSES OF OTITIS MEDIA WITHIN FOUR WEEKS OF TREATMENT**

Study Group	Recurrence No. (%)	No Recurrence No. (%)	Total
Caretaker shown tympanic membrane	14 (18.9)	60 (81.1)	74
Caretaker not shown tympanic membrane	10 (14.9)	57 (85.1)	67
Total	24 (17.0)	117 (83.0)	141

cause of the increasingly limited resources in health care, it is felt that a major goal for development of strategies to augment adherence should be that they require as little additional time or resources to carry out as possible.

A single intervention was chosen to attempt to isolate its effects from those of additional time spent with the patient focused on the presenting complaint. In addition, theoretical support for the type of intervention chosen exists (the health decision model). Despite this theoretical support, no effects on appointment-keeping behavior or on initial clinical outcome could be shown.

Similar difficulties in improving adherence are demonstrated throughout the literature. Sackett and Snow<sup>7</sup> have provided an extensive literature review regarding rates of adherence. They divided the literature into categories according to the type of adherence behavior studied (appointment keeping, medication usage, short-term vs long-term adherence, prevention vs cure) and came up with overall estimates of rates of adherence within each category. For instance, they found rates of appointment keeping to be in the range of 50 percent when the appointments are initiated by health professionals (except when the patient is a child, in which they tend to be closer to 75 percent) and in the range of 75 percent when appointments are initiated by the patient. Rates of adherence for a short course of medications for prevention were about 60 percent and for treatment were 75 to 80 percent. Longer courses of treatment regimens were adhered to at a rate of about 50 percent.

Since this review was published, other workers have reported similar findings. In studies using a variety of intensive intervention measures to influence adherence to short-course therapy or prevention, medication usage rates were increased 10 to 20 percent.<sup>4,5,8-11</sup> Follow-up appointment-keeping was either not affected or was raised 20 to 30 percent over controls. When looking at long-term adherence, Rosenstock<sup>12</sup> found reported rates of adherence to various aspects of diabetic care from 10 to 80 percent, with only 7 percent of patients fully compliant. A review of studies looking at adherence among patients with rheumatoid arthritis came to the conclusion that 50 percent of these patients fail to adhere no matter what the therapeutic intervention.<sup>13</sup> Many more studies have looked at adherence under different situations, but it should be clear from this small selection that adherence to a variety of health care approaches and interventions is much less than would be considered desirable.

From an individual patient perspective there appears to be little that can predict or explain likely adherence or nonadherence. Age, sex, level of education or income, intelligence, social class, occupation, marital status, race and ethnicity, religion, personality, general knowledge about health and illness, or pattern of adherence with other measures do not assist in making predictions about current adherence.<sup>9,12,14,15</sup> In the case of children, characteristics of the family do not aid in prediction.<sup>16</sup>

Beyond demographic considerations, though, there are some statements that can be made about the likelihood of adherence. A number of characteristics of the provider-patient communication process have been shown to influence adherence.<sup>17,18</sup> Briefly, a relationship characterized by mutual respect, mutual fulfillment of expectations, patient satisfaction and comprehension, and provider friendliness and supportive attitude is one that is more likely to lead to improved adherence. Clarity of instruction by the provider has an impact on adherence, but the amount of information provided does not have predictable effects.<sup>19</sup> Continuity of care<sup>16</sup> favorably influences adherence<sup>5,12</sup>; a long waiting time before an appointment date and at the time of the appointment negatively influence adherence.<sup>20</sup>

Characteristics of the proposed regimen obviously influence adherence also: complexity, duration, expense, convenience, and effect on lifestyle.<sup>19</sup> Side effects of the regimen have no clear influence on adherence,<sup>21</sup> although it has been shown<sup>11</sup> that a change in attitudes about side effects of influenza immunization is associated with an increased intention to get the immunization. Fear on the part of the patient has variable effects, depending on the level of anxiety produced and the patient's confidence that the cause of the fear can be dealt with.<sup>19</sup> In situations requiring long-term adherence, the frequency of outpatient visits and feedback regarding compliance influence adherence.<sup>19</sup> Time is another variable involved in adher-

ence considerations,<sup>22</sup> as is social support<sup>23-25</sup>—a sometimes vague term generally applied to all close relationships the patient has outside the health care setting. Disease or symptom severity or course has not been shown to correlate closely with adherence.<sup>20</sup> Blackwell<sup>26</sup> also states that medication dose frequency has not been shown to be clearly linked to adherence despite common assumptions otherwise.

Several theoretical frameworks have been developed to tie together these many observations. Perhaps the best known and so far most extensively tested is referred to as the health belief model.<sup>12,15,19,27,28</sup> This model views adherence as resulting from a large number of attitudes and beliefs. Other theories take a systems approach,<sup>29</sup> more of a behaviorist approach,<sup>30</sup> a cognitive-behavioral approach,<sup>31</sup> a social learning approach,<sup>32</sup> and an approach emphasizing communications.<sup>33</sup> It is beyond the scope of this article to outline these further, but the interested reader is referred to the sources noted.

In reviewing the many factors shown or theorized to have an impact on adherence, it becomes evident that only some of them are under the control of the provider. Clearly, much of the patient-provider interaction can be modified by the provider in ways to improve adherence. Perhaps also the provider can adapt the health care system in ways shown to improve adherence. In some limited cases, a therapeutic regimen can be modified in a manner that could improve adherence, though in most situations the provider has less flexibility in this respect than might be hoped. A number of strategies aimed at giving the provider ways to improve adherence have been tested, but there are some major problems with many of them. First of all, many of the studies testing these strategies have not followed rigorous designs,<sup>7,13,20,34-36</sup> thereby limiting the findings. Second, as a general statement, single, isolated interventions have very little effect on adherence rates. On the other hand, those studies where multifaceted interventions have been shown to have effects have not adequately controlled for the potential bias of added time focused on the presenting complaint (attempts to control for added time spent with the patient have been made by spending time focused on topics other than the presenting complaint). Interpretation of these studies becomes an even greater problem because these multifaceted interventions do not as a rule go on to test each aspect of the intervention to identify whether any portion of the intervention has effects over and above the effects of focused time. Third, many of the multifaceted interventions require commitments of time or resources that may be difficult to justify in busy practice or clinic settings, particularly considering what are often limited benefits. Last, the studies often do not take the additional step of showing that an intervention has effects on ultimate clinical outcome of the morbidity being investigated. Though the value of this step has been debated,<sup>35</sup> the ultimate goal of

any intervention should be improved clinical outcome, or its use is hard to justify.

The current study was unable to demonstrate any improvement in adherence based on the intervention tested. One should search for potential biases that could have diluted a more positive effect though. The study design follows closely what has been recommended for studies of adherence<sup>1,34,36</sup> with the exception of alternative assignment to the study group rather than assignment by random number generation. It would seem unlikely that this difference could explain any lack of effect of the intervention. The sample size also makes unlikely a  $\beta$  error hiding a true effect of the intervention. Calculations show that using the control values as standards, the sample size used would have detected a 21 percent increase in follow-up resulting from the intervention with a power of 0.95.

The use of a four-week time standard for detecting treatment failures may have caused the inclusion of some recurrent cases rather than true treatment failures, but it would appear to be a useful measure of initial clinical outcome.

It is possible that there is some unique aspect of the population studied that acted to negate any effect of the intervention. Certainly the cultural differences in perceptions about health and illness, and the comparative economic disadvantage of the population (making transportation more difficult) both act to diminish follow-up appointment keeping. It has been shown that roads and distances involved in getting to health care in this area impact access.<sup>37</sup> In this study, mean distances to the clinic were similar in the control and study groups. In addition, for any of these factors to be a source of bias, one must postulate a disproportionate distribution of one of these factors among the study and control groups. Such a disproportionate influence seems improbable given the alternative assignment to study or control groups and the size of the groups. Likewise, for one to suppose that the particular population studied may limit the generalizability of the findings, one has to assume that the independent variable (visualization of the tympanic membrane) would have different effects on Navajos from those of the larger population (and from those predicted by the health belief model). As noted previously, the association of the word *red* with infection in the Navajo language should, if anything, augment the predicted effect.

The subjects were not blinded to the investigator as they were entered into the study, so potentially a bias could have been injected by the investigator as the intervention was conducted. This bias is certainly possible in any nonblinded study despite the best efforts of an investigator to prevent its happening. It is customarily thought that such a bias would act to augment a positive effect of an intervention (in the direction of the hypothesis), however, not to negate one. The absence of any positive effect in this study makes this potential source of bias unlikely.

Waiting time has been shown to affect appointment keeping.<sup>20</sup> The clinic at which this study was conducted does have a comparatively long waiting time, averaging two to three hours with seasonal, daily, and hourly variation. Again, however, one has to speculate that the alternate basis of subject assignment was inadequate to match for this factor to determine that waiting time was responsible for a lack of effect of the intervention.

## CONCLUSIONS

It seems most likely that the intervention tested was unable to improve adherence as measured by appointment keeping for follow-up and ultimate clinical outcome. Those aspects of the health belief model that gave theoretical support to the intervention have not been upheld by the study.

Two caveats should be mentioned. The first is that adherence is a concept involving multiple behaviors, all of which were not tested. More specifically, there was no direct measurement of medication usage; it is possible that the intervention had effects on medication usage even though it had none on follow-up appointment keeping. Since the true goal of the medication and its usage is measured by the clinical outcome, however, it is reasonable to use the outcome as an indirect measure of medication usage.

The second caveat is that other interventions have been shown to improve adherence with treatment plans for otitis media,<sup>4,10</sup> including some with comparatively little additional utilization of resources. From an ethical standpoint, though, one has to question whether any additional resources should be used in an attempt to improve adherence until such time as an intervention has been shown to significantly improve clinical outcome. To date, this key link is missing. Some investigators have implied adherence by itself is a sufficient endpoint, and their lack of demonstrated effects on ultimate clinical outcome have been minimized. In fact, clinical outcome has been said to be an inadequate measure of adherence because of comparable outcomes between adherent and nonadherent patients. This viewpoint seems to be a case of placing the cart before the horse, when in reality the true goal of all efforts should be improved clinical outcome. Equal outcomes among adherent and nonadherent patients should lead one to question the treatment regimen rather than disregard the goal of improved clinical outcome.

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## Commentary

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In the last ten to 15 years there has been a great number of studies on adherence because, as the above article points out, patient adherence continues to be a problem in the provision of health care. Many of the interventions designed to improve adherence either have not been based on theory or have been quite intensive and complex. Williams should be commended for devising an intervention to improve adherence with treatment for otitis media that is both theoretically grounded and easily incorporated by the physician into a clinical approach. The intervention was based upon two components of the health belief model: perceived susceptibility and severity. It was expected that the intervention, consisting of visualization of the tympanic membrane, should increase caregivers' perceptions of the child's susceptibility to the disease and severity of the disease. Thus, intervention patients were expected to elicit better adherence than control patients because the health belief model postulates that heightened perceptions of susceptibility and severity are associated with better adherence.

The intervention was not found to be effective in improving adherence. Williams does an excellent job of considering and ruling out possible confounding factors that may have negated the effect of the intervention, including lack of randomization, unique characteristics of the patients, and lack of blinding in the study.

There are at least two possible explanations for the lack

of an intervention effect: (1) the intervention was not effective in changing caregivers' perceptions of susceptibility and severity, or (2) the intervention may have changed perceptions of susceptibility and severity, but these perceptions are unimportant relative to other factors in determining adherence behavior. The first explanation would be fairly easy to assess by conducting the study again and measuring perceptions of susceptibility and severity in both control and intervention caregivers. I feel that the second explanation is more important and warrants further discussion.

Williams' intervention was based on two components of the health belief model. The health belief model, however, does include such other factors as perceptions of barriers to the action and efficacy of the action.<sup>1</sup> According to the model, these factors must also be considered in trying to understand adherence behaviors. Unfortunately the health belief model is not completely clear about how these factors are to be measured or how the model components interact to determine behavior.<sup>2-4</sup> In addition, studies that have tested the health belief model have found only modest support for it in explaining patient adherence, with support for each of the model components being quite inconsistent.<sup>3</sup>

Despite the above concerns, the health belief model has made an important contribution to the study of patient adherence. Prior to the health belief model, most studies

met with little success when they focused on trying to identify relatively stable characteristics such as patient demographics or disease and regimen characteristics as predictors of adherence.<sup>5</sup> In contrast, the health belief model emphasizes patient perceptions and motivations as the primary determinants of health behavior. This approach is appealing both because it makes intuitive sense and because it suggests that interventions to change adherence could be developed, as patient perceptions can be changed while demographic characteristics cannot. Most applications of the health belief model, however, have emphasized the susceptibility and severity components of the model and have assumed that those components are quite important in all health-related adherence behaviors. This assumption is a major problem with the model. Other perceptions may be far more important than perceptions about severity and susceptibility in affecting many health behaviors. In addition, the perceptions or beliefs that are most important will vary for different behaviors, populations, or settings. I will illustrate this using the above study as an example.

Williams looked at two behaviors: adherence with taking medication and adherence with keeping a follow-up appointment. It is quite possible that perceptions of susceptibility and severity were quite important in determining the likelihood that the caregiver would begin the medication regimen. It is also possible that the most important factor affecting perceptions of susceptibility and severity was the child being symptomatic, and the intervention may have only served to confirm these perceptions. After the child was no longer symptomatic, the perceptions of susceptibility and severity may have decreased to equal levels in both the intervention and control groups. Thus perceptions that the child was well may have outweighed susceptibility and severity perceptions in determining the likelihood of completing the medication regimen.

Another factor that could be important in determining adherence is the caregiver's belief about likelihood of a relapse if the regimen was not completed. This belief was most likely to be equivalent in both control and intervention groups, however, since it was a focus of the education provided to all patients. It seems unlikely that the visualization intervention would further increase caregivers' beliefs about likelihood of a relapse.

Clearly, other beliefs, such as perception that the child was well after symptoms disappeared, may be important and may greatly outweigh or negate perceptions about severity and susceptibility in affecting adherence with completing the medication. Other perceptions that may also be important are beliefs that the child likes or dislikes the medication, beliefs about difficulty in administering the medication, and inconvenience of remembering to administer the medication.

The belief that the child was well after symptoms disappeared, along with its likely impact in reducing perceptions of susceptibility and severity, may also have been quite important in affecting adherence with follow-up appointment keeping. In addition, it is clear that in this particular setting travel time to the clinic and waiting time at the clinic may be quite long. These factors along with the perception that the child is well may greatly outweigh perceptions of susceptibility and severity in affecting follow-up appointment adherence. Of course, in another setting or another population these perceptions about inconvenience may not be particularly important, and perceptions about susceptibility and severity may be the most important factors affecting adherence.

Clearly, to understand adherence behavior in any particular situation, it is important to consider other patient beliefs or perceptions besides those about susceptibility and severity. The health belief model is not clear about how to incorporate these perceptions into the prediction of adherence behavior. There are other models, based upon expectancy-value theory, that are more flexible and comprehensive in their inclusion of perceptions that affect behavior and that are more explicit in specifying how these perceptions are integrated to determine behavior. One such model, the theory of reasoned action, has been applied successfully to the prediction and understanding of a wide variety of behaviors including health behaviors such as use of contraception, Papanicolaou smears, influenza vaccination, and mammography.<sup>4,6,7</sup> This model addresses how a person's beliefs or perceptions are integrated to form his or her attitude toward a behavior and thereby affect the likelihood of performing that behavior.

The theory of reasoned action considers "attitude toward the behavior" to be the most important determinant of a particular adherence behavior. Attitude toward the behavior is determined by the individual's beliefs about the behavior, weighted by the values placed on those beliefs. Thus, if a person believes that the behavior will result in or involve mostly positively valued outcomes, he or she will have a positive attitude toward that behavior. Conversely, if the person believes that the behavior will result in mostly negatively valued outcomes, he or she will have a negative attitude toward the behavior. The model does not assume specific beliefs or perceptions that are important in determining all adherence behaviors; instead, it assumes that different beliefs may be important in different situations. The application of the model typically requires separate identification and measurement of beliefs for each study of adherence behavior. Thus, perceptions about susceptibility and severity may or may not be found to be important determinants of the adherence behavior being studied.

The theory of reasoned action is clearly more flexible and comprehensive than the health belief model in treat-

ing patient perceptions or beliefs as determinants of adherence. But how does one use the theory of reasoned action to develop interventions to improve adherence? The health belief model, with its emphasis on susceptibility and severity, implies some very obvious and immediate directions for interventions by focusing on changing patient perceptions of susceptibility and severity. But if these perceptions are unimportant relative to other beliefs in affecting that particular behavior, the intervention will obviously be ineffective. In contrast, the theory of reasoned action does not provide an immediate focus for an intervention. The use of this method requires that the investigator do some extra work before developing interventions. In using this method, a set of potential beliefs that may be important determinants of the behavior must first be identified. This identification is usually done with interviews of a small sample from the target population. Next, those beliefs must be measured in another sample. Finally, the specific beliefs that best discriminate between patients who are and patients who are not adherent to the particular behavior being studied are identified empirically. Interventions can then be developed to target those beliefs for change in order to change behavior. This method requires much more work in developing interventions but has much greater likelihood of success.

In summary, interventions to improve adherence should be theoretically based. Williams did an excellent job of developing and testing an intervention based upon the health belief model, yet that intervention was not found to be effective in improving adherence. These findings can be explained if other competing beliefs are considered that may have outweighed or negated the impact of perceived susceptibility and severity in affecting adherence. The health belief model is not clear about how to identify these competing beliefs or how to integrate them into the prediction of behavior. The theory of rea-

soned action is more comprehensive than the health belief model because it does not focus specifically on susceptibility and severity, but considers all possible beliefs about an action as potentially important determinants of that action. This model is quite clear in defining how those beliefs are integrated to affect behavior, and it provides a method for identifying the most important beliefs that affect the behavior of interest so that interventions can then be developed to target those key beliefs.

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