REVIEW

Drug-taking Compliance: A Review and Synthesis

By Dale B. Christensen

Patient compliance in taking prescribed drugs is still not well understood despite numerous studies. The state of knowledge through 1976 is reviewed, with some methodological criticisms of compliance studies, and patient, provider, disease, and drug factors associated with compliance are analyzed. Until recently the lack of a well-developed theory or model of compliance behavior was a major problem. Some compliance models based on the health belief model are discussed, and an alternative adaptation of the latter is developed.

The issue of patient compliance with medical therapy regimens in general, and particularly in taking prescribed drugs, has received considerable attention in the health literature. Low patient compliance rates have been found in numerous studies: reviews [1–3] have pointed out that 25 to 50 percent of patients do not comply with prescribed medical regimens. Such a range of noncompliance is noted among patients of all ages and with most disease states and socioeconomic backgrounds.

Public health concern about drug-taking compliance is timely and important. The age distribution of the U.S. population is gradually shifting, such that persons in the upper age brackets constitute a growing proportion of the population. Chronic illnesses are increasingly prevalent, and their control often involves long-term use of multiple drugs, reflected in increasingly high mean prescription-drug expenditures and use rates among the elderly [4,5].

The use of oral medications for chronic conditions has shifted the responsibility for control of the disease to the patient. Health practitioners all too often assume that drug therapy and other therapeutic regimens are automatically followed; too often, patient compliance is not adequately monitored. Further, when drugs are prescribed as an essential part of therapy, inadequate patient compliance interferes with maintenance or recovery of health. It is also uneconomic, in that medical resources expended in diagnosis and treatment are wasted and additional resources may be required.

Why do some patients fail to comply with therapy? Perhaps they are not well informed, or they do not regard the prescribed behavior as an essential and necessary part of getting well, or they do not wish or

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expect to get well; but none of these explanations is complete, and none is adequate to explain how or why patients arrive at these beliefs or behaviors. Better understanding is needed to help health practitioners respond to and modify such dysfunctional behavior.

Much of the research on patient compliance with instructions has focused on drug-taking compliance. The present article primarily emphasizes drug-taking behavior, but it also explores compliance with other forms of medical advice. Previous studies are examined as to methodology, findings, and proposed models of compliance behavior; a modified model of patient compliance behavior is presented.

Identifying the Noncompliant Patient

It would appear to be a simple matter to study drug noncompliers for characteristics that would readily identify them as needing more compliance-generating efforts, but identification of the potentially noncompliant person has proven to be unexpectedly difficult. Blackwell concluded that "the drug defaulter, just like the placebo reactor, is not a consistent or readily identified person. Whether or not a particular patient complies with the physician's instructions depends on a variety of factors that may change with time" [6]. At least two empirical studies support this assertion. Caron and Roth [7] demonstrated that physicians could not predict their patients' intake of antacids any more accurately than one could by chance. Even skilled psychiatrists were incorrect up to 20 percent of the time in predicting which of their chronically ill patients taking psychotherapeutic drugs would be noncompliant [8]. Generally, health professionals have been frustrated not only in their attempts to identify noncompliers, but also in their attempts to improve compliance.

Methodological Criticisms of Previous Studies

Most compliance studies have focused on identifying patient, drug, disease, or situational factors that may be related to compliance behavior [9]. Until relatively recently, there have been few attempts to develop or test models of compliance behavior, interrelationships among its variables, or other underlying factors that might better explain it. Very few studies have employed adequate control groups against which changed behavior of noncompliers could be measured. Hulka et al. [10], noting that few studies have used physician-patient pairs as units of analysis, suggested the study of physician-patient communication patterns in order to determine the extent to which noncompliance represents a lack of congruity between the instructions physicians intend to communicate and patients' understanding of those instructions.

Variations in the definition of noncompliance pose particular difficulties when attempts are made to generalize findings. Some investigators have included only errors of omission—the patient's failure to take a prescribed dose of the drug [11]; others have included errors of intent, dosage, and timing [12]; still others have added errors of commission—taking additional drugs not prescribed by the physician

[13]. Recently Hulka et al. [10,14] adopted two additional categories: scheduling misconceptions (incorrect patient knowledge of the dosage schedule) and scheduling noncompliance (correct knowledge but incorrect behavior).

Differences in measurement of noncompliance also pose difficulties in generalizing findings across studies. Compliance measures have been based on receipt of prescribed drug, patient interrogation, pill counts, and physiological measures, each of which carries some associated methodological difficulties.

Receipt of Drug. Often overlooked is the question of whether the patient received the drug. This patient-controlled action obviously occurs prior to subsequent compliance behavior. One survey has estimated that about 3 percent of all written prescriptions are not dispensed within 10 days; however, the percentage may vary considerably due to factors such as financial status and extent of prescription insurance coverage [15]. An assumption underlying use of this measure is that the physician intended the drug to be obtained and consumed promptly, but in fact he may have prescribed it on a discretionary or "as needed" basis.

Patient Interrogation. Patients often do not accurately report drug consumption patterns when queried, because of embarrassment, forgetfulness, or fear of recrimination. This tendency was clearly illustrated in a study by Bergman and Werner [16] of children receiving 10-day oral penicillin therapy for acute streptococcal infections. Although 83 percent of the parents claimed that all doses had been administered as prescribed, 56 percent of the children had discontinued taking the drug by the third day of therapy, 71 percent by the sixth day, and 82 percent by the ninth day. Gordis et al. [17] further illustrated the disparities, among children taking penicillin prophylactically, between reported compliance and urine tests for penicillin. Although responses of patients and their mothers indicated that 70 percent were compliant, only 33 percent to 42 percent had confirmatory levels of urine penicillin. In every case the tendency was for patients to overestimate compliance. The willingness of patients to admit to noncompliance has also been found to be related to the type and method of questioning employed [18].

Pill Counts. Counts of tablets or capsules remaining in containers have become the most commonly employed compliance measure. Although they are inexpensive, objective, and easy to implement, pill counts cannot be used with certainty. One study showed a 36-percent discrepancy rate between tablet counts and physiological measures used to determine consumption of antacids among ulcer patients [19]. An inherent assumption of pill counting is that missing doses were consumed by the patient. Although this is generally true, there are other possible reasons for the presence or absence of dosage units. Further, this measure does not establish that the appropriate number of doses was consumed each day, or at the appropriate time intervals during the day.

Physiological Measures. Stool markers, blood tests, and urine tests

have been employed. These measures provide objective and more reliable evidence, but they are costly and inconvenient.

An additional problem is that virtually every study has been cross-sectional rather than longitudinal. Mikeal and Sharpe [9] noted that, since the efficacy of most drug therapy depends on continuously exceeding some minimum blood level of the drug over some period, compliance should properly be viewed as a longitudinal process. It is inappropriate to make assumptions or conclusions about compliance over an entire time period on the basis of a single cross-sectional measure. Further, it is also inappropriate to regard compliance and noncompliance as mutually exclusive terms; they more accurately describe opposite ends of a continuum, with the extent of noncompliance as the most relevant measure. Finally, a single rate of compliance over a time period actually represents merely an average for that period; the variability in compliance during the period is also important.

Although one can point out general deficiencies in previous studies, the practical difficulties of conducting such investigations are considerable. Patients cannot be expected to submit to a blood test or urinalysis after each dose, and even if a group of willing subjects could be found and randomly sampled, difficulties would accrue in attempting to eliminate the "Hawthorne effect," or the extrinsic influence of the measurements on the subjects' behavior [20]. In most cases physiological measures are limited to the outpatient clinic setting, where they can be obtained for some other ostensible purpose [16]. Another difficulty is finding a setting for such studies in which compliance behavior can be extensively measured and in which there is also access to sufficient information on patients, physicians, diseases, and drugs to test predictive, analytic models. Sample size requirements and the associated economic and time costs are further deterrents to performing the rigorous, comprehensive studies needed.

Summarized Findings of Previous Studies

It is apparent that the noncompliant patient cannot be readily identified at the site of medical care. Nevertheless, previous studies provide some indication of factors that may contribute to a profile of the patient at risk of noncompliance. (Additional background information may be found in several earlier reviews [1–3,6,21–25].)

Nature of Drug and Duration of Treatment

Several studies [16,26,27] have shown compliance to be negatively associated with length of treatment. Sheer forgetfulness and tedium have been suggested as explanatory factors, but it remains unclear why some patients forget more than others. Compliance patterns have also been related to the nature of the drugs involved (and by implication, the life threat perceived in the disease) and the perceived importance of the drug to the patient's recovery. Compliance by patients taking digitalis, for example, did not diminish significantly with time, whereas consumption of iron by pregnant women and of *p*-aminosalicylic acid

by tubercular patients did diminish with time, as did administration of antibiotics to children by their mothers [26,28,29].

In the case of oral antibiotic therapy for acute illnesses, Parsons' sick-role theory [30] may be used to explain patient behavior. The sick role requires the patient to seek help and cooperate with the practitioner through compliant drug taking to return to normal health. However, an additional obligation is to relinquish the sick role as soon as possible and return to normal, socially productive roles. This obligation may motivate the patient to discontinue the medication as soon as symptoms subside, even though such action may be premature and ultimately detrimental. Drug taking may be interpreted by the patient in this circumstance as part of sick-role behavior, but not part of health behavior [9,31]. Drug overuse may become a problem among patients highly motivated to get well, who may take larger amounts per dose than intended, or among "malingerers" (patients who are reluctant to relinquish the sick role), who may continue to consume prescribed drugs beyond the intended therapy period.

Complexity of the Medication Regimen

Numerous studies [10,12,14,18,28,32] have shown that complexity of the medication regimen, as indicated by the number of concurrent medications to be consumed, daily dosage frequency, and the nature of the dosage forms employed, is negatively related to compliance. These findings suggest that complex regimens contribute to noncompliance because they are confusing and inconvenient.

Side Effects of Medications

Compliance tends to diminish as the incidence and severity of side effects increase [33,34]. The impact of side effects on compliance may be explained in terms of physical discomfort, increased skepticism about the value of the medication, and possibly skepticism about the physician's judgment on the part of patients who are not forewarned. There are some indications that unexpected side effects influence the perceived value of medications and thus contribute more to noncompliance than expected side effects [23]. This finding suggests that when patients are adequately informed by the practitioner, side effects may be interpreted as fulfillment of a therapeutic prediction and may thus reinforce compliance.

Patient Characteristics

Several studies [10,14,18,35] have attempted, unsuccessfully, to relate compliance patterns to patient characteristics. Lower class patients are generally regarded as more likely to be noncompliant, but findings are inconsistent. Higher socioeconomic status was found in one study [35] to be positively related to compliance among neurotic patients taking meprobamate, but other studies [10,14,18] found no such relation to social class or its components (income, occupation, and education).

Compliance behavior also does not generally correlate statistically with patient sex or age, although some studies have indicated that females are sometimes less compliant [34]. There is also evidence that

compliance is relatively good among children (due to parental administration of drugs), poor among adolescents, good during the middle years, and again relatively poor with advancing age [36]. However, factors other than age, such as multiple disease states and complex drug therapy, may better account for poor compliance among the elderly.

Family status of patients has been found to be related to compliance. Those living alone are more frequent noncompliers, suggesting that the spouse, companion, or associate assumes a role in ensuring that medications are taken as ordered [1].

Studies of patient personality traits have indicated some associations with drug-taking behavior. Among mental patients, those displaying hostility and aggression were poor compliers [37]. Among women, those characterized as immature, irresponsible, impulsive, and perhaps more prone to risk taking were generally poorer compliers in taking oral contraceptives [38].

Type and Severity of Illness

There are conflicting reports concerning the relation of illness characteristics to compliance. Studies of this nature are plagued by difficulties in controlling for patient types across various diseases. One study showed that mothers' perceptions of illness severity best explained their children's compliance in taking oral penicillin [29]. Studies of patients with chronic diseases generally show that patients tend to be less compliant when the drug is taken prophylactically, when the disease is asymptomatic, and when there are no immediate negative consequences of noncompliance [26,28]. The longer a patient has been well, the more he is apparently willing to gamble on remaining well. There is also evidence that patients tend to discriminate among medications, perhaps being motivated positively by therapeutic importance or negatively by unpalatability. In one study [39], cardiac patients tended to consume digoxin and diuretics more appropriately than they took a concurrently prescribed potassium supplement (which many find extremely unpleasant). In a study involving patients with congestive heart failure and diabetes, disease severity, as measured by duration and number of concurrent diseases, was not found to be related to the number of drug consumption errors [10,14]. However, among these patients compliance was significantly and consistently better for cardiac-related and diabetes-related drugs than for other drugs prescribed simultaneously.

Physician-Patient Relationship

Although the relationship between physician and patient is widely assumed to affect compliance, few studies have specifically examined the dynamics of the relationship or its effect on drug taking. Some aspects of the physician-patient communication process have been studied, and the findings are worthy of note.

Hulka et al. [10,14] examined physician-patient pairs to determine the extent to which noncompliance could be attributed to inadequate communications. The congruence of patients' knowledge about drug taking and information provided by their physicians was examined using

personal interviews. Patient misconceptions concerning dosage scheduling were found to be a significant reason for drug errors and a function of complexity of dosage schedules. Conversely, when patients were given more and better information about their drugs their compliance was significantly better. Davis and Eichhorn [40] reported that a formal relationship between physician and patient was more conducive to compliance than a friendly one; Charney et al. [29] found that a warm relationship of long standing between practitioner and patient was positively associated with compliance. In contrast, Berkowitz et al. found no relation between specific barriers to physician-patient communications and noncompliance [41].

Francis et al. [18] attempted to determine whether parental expectations and satisfaction were related to compliance among children with acute pediatric illnesses. Tape recordings of the medical visit, a chart review, a semistructured follow-up interview, and a tablet count one to two weeks later were the methods employed. The results, directly applicable only to initial physician encounters, indicated that the perceived seriousness of the illness prior to physician contact, the complexity of medical instructions, and the patients' economic and social family circumstances were associated with compliance more often than were events during the encounter. In addition, however, parental satisfaction with the initial medical visit, as measured by the extent of fulfillment of expectations, was also associated with better compliance. Diminished compliance was observed for children whose mothers had expected to, but did not, learn the cause and nature of the illness. This pattern apparently holds true only for certain expectations; when all parents with unmet expectations were grouped, diminished compliance was found but was not statistically significant. In general, friendliness, concern, and pleasant personality in physicians increased compliance less than negative physician characteristics, such as an actively unpleasant manner, decreased it.

It has been suggested that reciprocity in the physician-patient relationship may partially explain compliance behavior. According to this notion, when physicians fail to make the significance of the medication regimen clear or cause dissatisfaction in other ways, patients reciprocate by failing to comply. Studies of discharged hospital patients and of the treatment of ulcer patients have provided support for this explanation [42,43].

The attitude of the physician toward therapy, specifically his optimism about drug efficacy and his expression of the importance of the drug, has also been positively associated with better compliance [42]. Physicians who explained more to patients also have been found to obtain better compliance [27].

In a related study based on the reciprocal theory of patient behavior, Davis [44] focused on the relation between deviance from "prescribed institutional (normative) doctor-patient relationships" and failure to comply with physicians' advice. Davis used the Bales interaction process analysis technique to quantify the relative amount of communication activity in each of 12 categories of action during pri-

mary and follow-up visits for treatment of new patients. No relation was found between compliance behavior and any of the interaction factors analyzed in the first visit; however, communication processes differed substantially between the first and second visit, and several of the interaction factors correlated well with compliance behavior after the second visit. The highly correlated factors included "malintegrativeness" (negative socioemotional interaction), "active patient–permissive doctor," "informativeness," and "tension release." With the exception of the last, negative interaction factors (i.e., indicating conflict) were associated with noncompliance; positive factors were generally not associated with compliance.

The Davis study, although informative, did not fully test a reciprocal theory of behavior; other possible explanations for some of the findings were not eliminated. For example, the lack of physician-patient information flow implied by the highly correlated factors described above suggests that patients may also have been noncompliant because they were confused, apathetic, or not well informed. Another difficulty was that compliance was determined from physician and patient reports and medical chart review rather than from physiological or other objective measures.

Svarstad [45] viewed the physician-patient relationship as a process of instruction and motivation, and investigated potential relationships of these factors with patient drug taking. Interactions were systematically observed between physicians and low-income adult patients (primarily black and Puerto Rican) at an urban neighborhood health center. The research included observations of patients in the clinic reception area, follow-up home interviews, pill counts, and reviews of medical and pharmacy records. Physicians who gave explicit, consistent, written information to patients obtained greater patient understanding of medication use and greater compliance. Physicians exhibited four compliance-gaining strategies: friendliness, medical authority, justification of medication use, and emphasis on the need to continue taking the medication. The latter two were found most effective in assuring compliance.

Physicians showed no tendency to provide more or less instruction to different categories of patients, but feedback from patients facilitated effective communication and compliance. Patients did not always understand the physician's instructions, but only when they perceived the physician as friendly and receptive did patients actively provide feedback. Physician approachability diminished as work pressure increased: in this circumstance physicians discouraged further patient communication by portraying it as an interference with work yet to be done. During subsequent visits Svarstad found that extensive follow-up or monitoring activities by physicians facilitated their ability to discover patient complaints and previous noncompliance.

Toward a Model of Drug-taking Compliance

The major shortcoming of much of the research reviewed here is that factors associated with compliance behavior, although sometimes

predictive, are rarely explanatory. There are, however, some concepts and theories that have potential for explaining compliance behavior.

Role Theory and Noncompliance

It is often implicitly assumed that noncompliance is inherently abnormal, irrational, or pathological. This notion derives from societal norms and expectations applied to the sick role. According to Parsons [30], the sick person is obliged to "seek technically competent help . . . and to cooperate with [the physician] in the process of getting well." Given the physician's role as the expert, his instructions are assumed to be rational, appropriate, and obligatory. The patient is expected to be a passive and obedient follower of these instructions, since they are intended to be in his best interest. On this basis, noncompliant behavior is interpreted as deviant and inappropriate for the patient's well-being. As a result, studies tend to focus on determining what it is about patients that makes them behave in deviant (i.e., abnormal) ways.

Becker [46], Stimson [47], and others have noted that deviance is a label assigned by a particular social group on the basis of behavioral norms adopted by that group and is not an intrinsic quality of the labeled individual's act. Noncompliance can be considered abnormal, detrimental to health, or deviant from a medical perspective, but it is not necessarily deviant from the perspective of a patient's peer group. Zboroski's findings of ethnic differences in patient responses to pain [48], as well as the case studies of intercultural differences reported by Paul [49], illustrate the striking differences in health and illness behavior norms among social and ethnic groups. Suchman [50] further showed that ethnic exclusivity, friendship solidarity, and family orientation to tradition and authority are associated with low formal knowledge about disease, high skepticism toward medical care, and high dependency in illness.

Stimson [47] asserted that compliance behavior is best understood when patients are viewed as using medications in the setting of a drug-using culture. He emphasized the patient's role as an independent decision maker in drug use. The patient's perspective on his illness and on the appropriateness of recommended therapy are not necessarily static and may change as a result of his own experience or the experience and advice of significant others. The patient's perspective includes certain expectations about the care he seeks and provides a basis for evaluating the physician's actions and for making decisions about following instructions.

Baric [51] delineated several similarities and differences between persons in a sick role and healthy persons who become aware of a health threat for which some preventive action is indicated—the at-risk role. He suggested that persons are reluctant to accept the at-risk role and follow recommended preventive actions because the at-risk role, unlike the sick role, provides obligations but no rights, is not institutionalized, legitimized, or reinforced by the medical profession or by society, is continuous and involves behaviors for which payoffs are deferred and uncertain, and generally does not include disabling or uncomfortable

symptoms as cues to action. For these reasons it is substantially more difficult to induce persons to undertake health-maintenance measures than it is to induce them to undertake health-recovery measures. These suggestions imply that changing the person's behavior may require interaction with his social group and significant others, as well as with the person himself. Intervention may also require modification of individual or group reward or sanction systems.

The Health Belief Model

The health belief model appears to be the most applicable model for explaining medical compliance behavior. Initially developed by Rosenstock [52] to explain health behavior, the model also has potential for describing and explaining sick-role behavior. It is based on one's own perceptions of one's health rather than on objective measures or the judgment of health professionals.

In brief, this model postulates that health behavior is determined by: one's "readiness to act," based on one's perceptions of the seriousness of and one's susceptibility to a condition; the extent to which one believes the act will reduce the threat; and the existence of a cue or trigger to action. Given that a person is ready to act, he reviews and assesses alternative courses of action in terms of their likelihood of reducing the threat. In most cases the benefits of a proposed action must be weighed against its negative consequences, e.g., inconvenience, expense, unpleasantness, and pain. Weighing the advantages and disadvantages of alternative courses of action or deciding between action and inaction can be extremely anxiety-producing, perhaps resulting in dysfunctional conflict avoidance. The cue intensity required to trigger the health-preserving action is believed to be inversely proportional to the degree of readiness to act and directly proportional to the level of conflict among alternatives.

Rosenstock's reviews of medical care utilization behavior [52,53] identified empirical support for the relation of components of the model to health behavior, particularly to preventive health behavior. Most of the retrospective and prospective studies he reviewed tended to support the model. Retrospective studies, however, are generally criticized for the assumption that health beliefs assessed after a health-related action also existed prior to the action; beliefs and perceptions may change with or after action to reduce cognitive dissonance [53,54].

Kasl and Cobb employed the basic concepts of the health belief model as a framework for explaining health-related behavior [55,56]. Their extensive reviews [55,56] of the literature on health behavior (health-related behavior by persons experiencing symptoms) and sick-role behavior ("wellness-seeking" by persons viewing themselves as ill) found substantial support for the model. However, they presented their model without defined boundaries or limits for the variables. For example, there is a posited but undefined limit to the amount of threat to health that will produce optimal behavior. Beyond that point, e.g., with suspected cancer, it appears that an individual's psychological defenses may block optimal behavior. In the case of sick-role

behavior, which includes drug-taking compliance, Kasl and Cobb suggested that additional nonmedical behavioral determinants (e.g., the environment, interpersonal relationships, and personality) must be incorporated in the model. Taking sickness as a socially defined role, Kasl and Cobb indicated that the decision to adopt or abandon the sick role depends not only on the perceived threat of disease and perceived value of proposed actions, but also on psychological stress, the individual's motivation to get well, and the sick-role norms accepted by the patient. Sick-role norms are determined by a number of factors, among them the dimensions of the doctor-patient relationship, congruence with the patient's self-concept, reference group expectations, and commitment to other social roles.

Numerous alternative models of health behavior have been proposed, several of which are similar to the health belief model but which employ additional variables or other modifications [23,53,57–59]. For example, Antonovsky and Katz [59] deemphasized the concept of cues for action, postulated the desire to maintain health as a motivational factor, and suggested the concept of thresholds, rather than linear monotonic relationships, between variables such as susceptibility and health behavior.

Becker and his various coworkers [23,58,60,61] have suggested that a sick person's readiness to undertake recommended health behaviors is determined by interpersonal motivations, the perceived threat of illness and the value of reducing the threat, and the perceived probability that the prescribed behavior will reduce the threat. The model proposed by Becker and Maiman [23] includes motivating factors based not only on negative aspects of health (e.g., disease seriousness), but also on positive aspects such as general awareness about health and willingness to seek and follow medical advice. The likelihood of compliance is presented as a function of the perceived benefits (as indicated by the surrogate measures of belief in the physician and his ability) and the perceived efficacy of the prescribed treatment. Modifying or enabling factors include various dimensions of the physician-patient relationship, structural aspects such as cost, complexity, and the need to change behavior, and various demographic and personality characteristics of the patient. In the case of sick-role behavior, the concept of perceived susceptibility to illness was modified to reflect the fact that some illness has already been diagnosed. Perceived susceptibility was assessed by estimating the patient's belief in the accuracy of the diagnosis, his perception of the likelihood of illness recurrence, and his feelings of vulnerability to other diseases [58].

Comprehensive reviews of the compliance literature by Becker and Maiman and by Becker [23,58] found substantial evidence in support of the proposed model in explaining sick-role behavior as well as health and illness behavior. Among three studies involving prophylactic penicillin consumption for rheumatic fever, two demonstrated an association between perceptions of the likelihood of disease recurrence and compliance behavior [58]. A prospective study by Becker et al. [60,61] similarly found a positive correlation between perceptions of

illness recurrence and compliance behavior among mothers of children with otitis media.

An association between perceived severity of an illness (i.e., social or organic repercussions) and compliance behavior has been found consistently in studies by Becker et al. [60,61], Francis et al. [18], Heinzelman [62], Gordis et al. [63], and Charney et al. [29]. Apparently, however, this association is not consistent for all types of health actions or for all levels of severity [23]. For example, preventive health actions for illnesses of both very high and very low severity are quite difficult to motivate. Low levels of perceived severity apparently provide insufficient motivation, whereas very high levels are inhibiting, presumably because of fears associated with the disease. In the case of drug-taking compliance, on the other hand, Becker and Maiman [23] found that high levels of perceived severity generally have a positive rather than an inhibitory effect on compliance. They also suggest that the presence of physical symptoms produces greater perceived severity, which motivates the patient toward greater drug-taking compliance, at least as long as the symptoms persist.

Several studies [18,60–62,64,65] have offered substantial empirical support for the premise that compliance by persons who are ill is positively associated with perceived benefits of following recommended health procedures and negatively associated with perceived costs or barriers to following these procedures. These studies also offer partial support for several of the modifying and enabling factors proposed in the Becker model. Although most studies have examined individual model components and compliance behavior, a few [54,60–62] have found support for the predictive ability of multiple components. Thus there appears to be strong and consistent support for the health belief model, and research directed at testing and modifying it continues, particularly in the area of chronic diseases such as hypertension [66].

A Modified Compliance Behavior Model

The accumulating evidence in support of the health belief model suggests that it is particularly relevant for explaining drug-taking compliance behavior. However, some inadequacies still exist: for example, the dynamics of the physician-patient relationship are not adequately addressed, nor are the processes through which patients' perceptions (and their subsequent behaviors) are formulated.

I propose a modification of the health belief model that views drug-taking compliance as a response by the patient to a sequence of testing and illness-redefinition stages during the course of an illness. The model adopts the perspective of the patient who constantly reassesses the decision to comply (and the extent of compliance) with prescribed instructions as he seeks medical help and proceeds through convalescence. Since the model focuses on drug-taking compliance, it is assumed that the patient contacts a physician and receives prescribed drugs. It is further assumed that the prescribed therapy is appropriate and essential to recovery or maintenance of health.

The initial medical encounter is seen as a testing and learning

process as well as a curative one. The patient brings to the encounter certain attitudes, beliefs, and assumptions about his ailment, along with his estimates of the likelihood that the practitioner will be able to effect a cure. These attitudes and beliefs are based on such background factors as prior medical-care experience, level of education, and peer group norms. During the initial encounter, and to a lesser extent in subsequent encounters, the patient forms an opinion about the credibility of the practitioner and his ability to cure or mitigate the disorder. The physician provides an objective assessment of the patient's disease and its seriousness and offers a treatment plan with indications of its utility in curing the disease (benefits) and the specific actions required—costs to the patient in terms of expense, time and effort involved, and expected physiological discomfort. Some of this information about the therapeutic plan may in fact be provided by another practitioner, e.g., a nurse or the pharmacist who dispenses the prescribed drug. The patient who is not adequately informed about the purpose of the therapy and the actions required of him is especially likely to be noncompliant, either because of confusion or disappointment in the physician.

In light of the new information provided by the practitioner (physician, nurse, or pharmacist), the patient reassesses his health and the need for action. This reassessment is based on the extent of agreement or congruence between the medical opinion received, the patient's prior perceptions concerning the seriousness of the condition, and the costs and benefits of the various actions to be taken. When the patient and practitioner differ, the resolution will depend on the patient's assessment of the practitioner—his friendliness, trustworthiness, believability, and ability to help in this particular circumstance. Language and other sociocultural differences between physician and patient enter into this assessment. When differences are great, the practitioner's ability to relate will be a major factor in a positive assessment. When the patient makes a positive assessment of the practitioner his perceptual differences are more likely to be redefined in accord with the practitioner's definitions, at least provisionally. If the patient is dissatisfied and does not comply with prescribed therapy, he recycles through the symptom-experience and practitioner-contact stages if symptoms persist.

Initial compliance behavior stems directly from the patient's reassessment of the seriousness of his condition and the benefits and costs of alternative actions. The patient is most likely to follow the prescribed treatment regimen when there is general congruence with his previous perceptions and expectations. When incongruence or disagreement is resolved and redefined in accord with the physician's view, the patient will tend to comply, but on a much more tentative basis; when redefinition is away from the physician's perception, the patient will not comply.

Patient experiences during the regimen-testing stage will serve as cues to future compliance behavior. Common cues are drug side effects (especially unexpected ones), various costs or inconveniences

incurred, partial or complete relief of symptoms while taking the drug, and symptom recurrence or worsening when the drug is not taken. Cues may trigger noncompliance because they substantially alter the perceived benefit/cost ratio of the treatment alternative or because they lead to disillusionment with the practitioner and rejection of his advice. Cues will be particularly important for patients who have complied on a trial basis. These experiences are the results of the trial; they will be less salient to patients who at first make a firm commitment to comply: the cues may be ignored the first time they occur, but if they become longer in duration, more frequent, or more severe, they may trigger noncompliance even in a committed patient.

Recurrence of symptoms when the drug is not taken becomes particularly important as the patient begins to reassess the benefits and costs of continuing therapy and his chances of recovery. A new trial is initiated when the patient (intentionally or unintentionally) misses a dose and assesses the outcome. An immediate recurrence of symptoms will serve as an immediate and positive reinforcement to continuing compliance, whereas absence or delay of recurrence will encourage further noncompliant testing.

A major distinction of the above model is the explicit recognition of compliance behavior as a dynamic process in which change occurs as a result of new information and experience gained by the patient. The model needs to be further developed and defined, but it should be useful as a basic framework for developing intervention strategies to improve compliance.

Discussion

Models are useful only to the extent that they can be used to explain or predict compliance behavior and suggest strategies for improving it. Most suggested strategies for improving compliance call primarily for iteration of instructions for taking drugs. Further systematic investigation of alternatives based on proposed models is needed, so the familiar call for further research must be made. Most research to date has been directed at identifying or reaffirming the relationship of compliance behavior to single specific factors in proposed models. Refinements of the basic health belief model, including the one proposed here, continue to be suggested, but empirical verification of the validity of the model and its applicability to various patient groups and disease conditions is needed.

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