Factors Associated with Antibiotic Prescribing in a Managed Care Setting: An Exploratory Investigation

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Abstract

This multi-site, cross-sectional, observational study sought to identify attitudinal and social normative factors associated with prescribing of oral antibiotics to ambulatory patients in a managed care setting. Participants were twenty-five physicians specializing in internal medicine, family practice or pediatrics from five ambulatory care clinics within a large, fully integrated health care system in a major midwestern city. The main outcome measure was number of prescriptions per physician written in the fourth quarter of 1994 for each of seven selected antibiotics. Correlational and multiple regression analyses revealed that behavioral intentions were significantly associated ($p < .05$) with both attitudes and subjective norms. However, physicians' attitudes, subjective norms and intentions were not predictive of actual antibiotic prescribing behavior. Prescribing behavior may have been a function of patient-specific rather than general beliefs about antibiotics. Methodological limitations related to the sample size and the sparseness of the utilization data may also have prevented a significant effect of intentions on behavior from being detected. Alternatively, in managed care settings, it is hypothesized that prescribing behavior may have been influenced more by non-psychological factors, such as management systems, formularies and therapeutic substitution programs than they were by internal, psychological factors such as attitudes, subjective norms and intentions. Managed care is altering the role of the physician as an autonomous decision-maker. In response, models of prescribing must either incorporate variables such as perceived behavioral control to aid in the prediction of non-volitional behavior, model the decision making of non-physician managers, or forego psychological models in favor of structural- or system-level models of drug utilization.

Keywords: Antibiotic prescribing, managed care, theory of reasoned action, theory of planned behavior, physician autonomy

Current economic realities require health care providers and administrators to focus on cost-effectiveness and quality. The growth and development of managed care is clearly a response to these concerns (Gibaldi 1995). Another outgrowth of the current focus on cost and quality is the renewed emphasis on primary care (Starfield and Simpson 1993; Starfield 1994). Pharmacotherapy is the most common form of treatment in primary care settings, where drugs account for between 9 and 12% of health care costs (U.S. Bureau of the Census 1993; U.S. Department of Health and Human Services 1994). In light of these developments, recent research has attempted to understand precisely where and how prescription drug budgets are spent, focusing especially on outcomes associated with "therapeutically equivalent" drugs whose costs vary dramatically (Bootman, Townsend and McGhan 1991; Gibaldi 1995). Numerous strategies for influencing physician resource utilization choices have been, and continue to be, devised by managers and policy makers (Raisch 1990; Raisch 1990; Gibaldi 1995; Haaijer-Ruskamp and Denig 1996).

A substantial literature describes how physicians make prescribing decisions under fee-for-service medical practice (Stolley and Lasagna 1969; Maronde, Lee, McCarron and Seibert 1971; Worthen 1973; Harrell and Bennett 1974; Hemminiki 1975; Lilja 1976; Haayer 1982; Segal and Hepler 1982; Zelnio 1982; Epstein, Read and Winickoff 1984; Segal and Hepler 1985; Vance and Millington 1986; Carrin 1987; Mancuso and Rose 1987; Chinburapa and Larson 1988; Denig, Haaijer-Ruskamp and Zijsling 1988; Chinburapa, Larson, Brucks et al. 1993). Research in this area has had the stated goal of optimizing pharmacotherapy. Researchers have attempted to create a situation in which, for a given patient, the most effective, least expensive, easiest to use, safest drug is the drug most frequently selected (Haayer 1982; Vance and Millington 1986; Carrin 1987; Rucker 1988; Rucker and Schiff 1990). The optimization of pharmacotherapy has involved attempts to avoid contraindications, adverse drug reactions and interactions, therapeutic duplications, and unnecessary drug therapy (Hepler and Strand 1989).

While considerable research has described prescribing behavior in general, comparatively little work has been done in managed care settings (Gold, Nelson, Lake et al. 1995). Managed care presently encompasses over 50 million Americans, and growth estimates indicate that 60-70% of the population will be involved in managed care by 1998, especially if federal and state governments succeed in transferring Medicare and Medicaid enrollees to managed care (Lee and Etheredge 1989; Burns 1994; Gold, Nelson, Lake et al. 1995). Moreover, managed care has developed a variety of systems to control drug product selection to lower costs while assuring effectiveness. Prescription benefit management (PBM) is now the domain of multi-billion dollar firms which arrange, monitor, and intervene in pharmacotherapy of more than 100 million patients in the United States alone (Gibaldi 1995; Dedhiya and Salmon 1997, submitted). The effect of managerial decision making on physicians under managed care arrangements requires additional research (Gold, Nelson, Lake et al. 1995). The purpose of this project was to identify the attitudinal and social normative factors that influenced prescribing of oral solid antibiotics to ambulatory patients in a managed care setting.

Antibiotic Prescribing

Antibiotics are the second most common therapeutic category of drugs prescribed by American office-based physicians. Roughly 110 million prescriptions for antibiotics are written each year in ambulatory settings, accounting for about 12% of total ambulatory prescription volume (McCaig and Hughes 1995). Over-prescribing and inappropriate prescribing by physicians, and misuse of antibiotics by patients, have concerned researchers for the last two decades (Kunin 1978; Durbin, Lapidas and Goldmann 1981; Ray, Schaffner and Federspiel 1985; Kunin, Lipton, Tupasi et al. 1987; Levy, Burke and Wallace 1987). In addition, the development of multiple drug resistant strains of common bacteria continues to take a significant human and economic toll (Fish, Piscitelli and Danziger 1995; McCaig and Hughes 1995). Thus there are pressing medical and economic reasons to improve our understanding of antibiotic prescribing in managed care settings.

Theoretical Background

Factors that Influence Prescribing

Prescribing decisions are influenced by a wide array of factors. Raisch distinguishes between direct methods, indirect methods, and individual and practice factors that influence prescribing behavior (Raisch 1990; Raisch 1990). Direct methods include formularies, prescribing restrictions, required consultations and the like. Indirect methods include advertisements and visits by detail personnel, opinions of colleagues, scientific data from randomized, controlled clinical trials, and medical training. Individual and practice factors include demographics, case mix, organizational structure, and so on (Raisch 1990). Individual factors, practice factors, and indirect methods are thought to influence prescribing decisions by influencing the thought process of the physician (Raisch 1990). Direct methods, on the other hand, are thought to influence prescribing decisions without altering the internal processing done by physicians. Most published studies have attempted to model the internal processing of physicians as they make prescribing decisions, and most have used expectancy-value type models such as the theory of reasoned action (Harrell and Bennett 1974; Segal and Hepler 1982; Epstein, Read and Winickoff 1984; Segal and Hepler 1985; Gold, Nelson, Lake et al. 1995).

This study sought to determine whether existing psychological models could predict prescribing behavior in a managed care setting. In particular, we focused on physicians' attitudes and subjective norms as predictors of prescribing behavior. Other variables, such as prior prescribing behavior, the influence of advertising and personal sales efforts by pharmaceutical companies, other pharmacy management initiatives, patient demand, etc. were not examined in the current project (Wennberg, Barnes and Zubkoff 1982; Chren and Landefeld 1994). The following section describes the psychological model we used to predict prescribing intentions and behavior.

The Theory of Reasoned Action

This investigation was designed to test a model of social behavior known as the Theory of Reasoned Action (TORA) (Harrell and Bennett 1974; Ajzen and Fishbein 1980; Segal and Hepler 1982; Segal and Hepler 1985). The model specifies relationships between beliefs, attitudes, behavioral intentions and behavior (see Figure 1).

Insert Figure 1 about here

Behavioral intention. According to TORA, a physician's intention to engage in a given behavior (BI_i) is a function of the physician's attitude toward the behavior (A_i) and the physician's subjective norm about the behavior (SN_i):

$$BI_i = w_1A_i + w_2SN_i \tag{1}$$

In addition to specifying the relationship between attitudes, subjective norms and behavioral intentions, TORA specifies the indirect determinants of both attitude and subjective norm.

Attitude. Attitude refers to a person's general evaluation of a behavior. The attitudinal component in TORA is a function of belief strength (b_i), the estimated likelihood that an outcome will occur given some action, and outcome evaluation (e_i), the positive or negative value associated with a given outcome:

$$A_i = \bullet\ b_i e_i \tag{2}$$

Subjective norm. Subjective norm refers to a physician's general perception that important others want one to do a given behavior. According to Ajzen and Fishbein, SN_i is a function of normative beliefs (NB_i), beliefs about whether specific others want one to do a certain action, and motivation to comply (MC_i), the desire to do what specific others want one to do (Ajzen and Fishbein 1980):

$$SN_i = \bullet\ NB_i MC_i \tag{3}$$

Behavior. TORA predicts that behavioral intentions will be highly correlated with actual behavior when three conditions hold: (a) the measures of intention and behavior correspond (in terms of their meaning, specificity, etc.), (b) the intention is stable during the time between measurement of intention and measurement of behavior, and (c) the behavior is under volitional control (Davidson and Jaccard 1979; O'Keefe 1990; Eagly and Chaiken 1993).

Previous studies have used patient-specific measures of both prescribing intention and prescribing behavior (Segal and Hepler 1982; Segal and Hepler 1985). When the measures of intention and behavior corresponded in this way, intentions successfully predicted prescribing behavior. When, however, a general measure of intention to predict a specific measure of behavior, the intention-behavior relationship was no longer significant (Segal and Hepler 1985).

This study sought to establish whether general measures of physician attitudes, subjective norms, and intentions (i.e., measures that did not specify diagnosis or other patient characteristics) could predict a general measure of prescribing behavior (i.e., overall quarterly prescribing of antibiotics). General measures of attitude and prescribing behavior are easier to collect than patient-specific measures, especially given the current state of most prescription drug information systems. If the general measures were successful at predicting prescribing behavior, TORA style measures could become part of ongoing drug utilization review processes. Such measures would suggest possible interventions by managed care executives, clinical pharmacy directors, and medical directors, and hence contribute to the rationalization of pharmaceutical care.

Hypotheses

Hypothesis 1: Attitude toward a given antibiotic will be significantly correlated with the sum of the products of belief strength and outcome evaluation (i.e., $A_i = \bullet\ b_i e_i$).

Hypothesis 2: Subjective norm about a given antibiotic will be significantly correlated with the sum of the product of normative belief and motivation to comply (i.e., $SN_i = \bullet\ NB_i MC_i$).

Hypothesis 3: Intention to prescribe a given antibiotic will be significantly associated with the weighted sum of attitude and subjective norm (i.e., $BI_i = w1A_i + w2SN_i$).

Hypothesis 4: Antibiotic prescribing behavior will be significantly correlated with stated intention to prescribe.

Method

To aid in development of the questionnaire, face-to-face interviews were conducted with a small number of physicians at the study sites to identify salient beliefs about antibiotic prescribing and to identify important others who influence prescribing decisions. Next, attitudinal, normative, and sociodemographic data were collected from physicians by way of a mailed questionnaire. Finally, prescribing data were compiled from the managed care organization's administrative database.

Setting

The setting for this research was a large, regional, fully integrated health care system in a midwestern metropolitan area. Five primary care sites were utilized to sample physicians who specialized in internal medicine, pediatrics, and family medicine. These clinics chiefly served enrollees from a managed care population of nearly 500,000 persons. Ongoing efforts at formulary development, clinical effectiveness improvement, and computerized clinical information systems affected the daily practice of these physicians.

Development of the Questionnaire

Two of the authors made site visits for face-to-face interviews with N = 5 physicians, four women and one man. Each physician responded to a series of open-ended questions about antibiotics and antibiotic prescribing and about other people in the managed care system who might influence prescribing decisions. Responses to these questions were noted in writing by the interviewers and were subsequently content analyzed. The number of mentions for each belief about antibiotic prescribing and each important other was tallied. The six most frequently mentioned beliefs about antibiotic prescribing and the six most frequently mentioned important others were included in the final questionnaire. The final questionnaire had 129 questions divided into five sections (copies of the questionnaire are available from the first author). The wording of individual items was based as closely as possible on the examples given by Fishbein and Ajzen (Ajzen and Fishbein 1980)

Outcome evaluation. Physicians evaluated the desirability of each of the six salient outcomes identified in the pilot-interviews. Desirability was measured on a seven point scale that ranged from extremely undesirable to extremely desirable (e.g., extremely, quite, slightly, neither, slightly, quite, extremely). Physicians were directed to evaluate each outcome <u>in general</u>, and to fill in any unspecified details by imagining a typical patient from their practice.

<u>Belief strength.</u> Physicians rated, for each antibiotic, the likelihood of occurrence of each outcome. A seven point response scale was used, anchored by extremely unlikely and extremely likely. For each drug, physicians also responded to a direct measure of prescribing intention (e.g., "When amoxicillin is one of several indicated alternatives, I intend to prescribe amoxicillin."), and a direct measure of attitude toward the drug (e.g., "Prescribing amoxicillin is"). The seven point response scale for the direct measure of attitude ranged from extremely harmful to extremely beneficial.

<u>Normative beliefs.</u> For each antibiotic, physicians rated the likelihood that six important others thought the drug should be prescribed. A direct measure of subjective norm toward each drug was also included (e.g., "When it is one of several indicated alternatives, most people who are important to me think I should prescribe amoxicillin"). The seven point response scale for this item ranged from extremely unlikely to extremely likely.

<u>Motivation to comply.</u> Physicians rated, on seven point scales, the likelihood that they would want to do what seven important others wanted them to do (e.g., "When it comes to antibiotic prescribing, I want to do what other physicians at the clinic think I should do").

<u>Demographics.</u> The final section asked physicians about their gender, age, degree, medical specialty, board certification, years of experience, medical school, practice site, percentage of female patients, distribution of patients by age, and rank-ordered preferences for different types of prescribing interventions.

Attitudes, Social Norms and Utilization

Participants

During the Summer of 1994, self-administered questionnaires were mailed to all of the family practice and/or internal medicine physicians, N = 39, from 5 separate primary care clinics in the study HMO. After two follow-up mailings, a total of N = 27 questionnaires were returned; two were discarded because they were substantially incomplete. The overall response rate was 69%. Physicians who participated in the pilot interviews were not excluded from the main study because we wanted to maximize the sample size and because we believed that the pilot interviews would have no substantial affect on responses to the main questionnaire. The pilot interviews consisted mainly of open-ended questions about antibiotic use. Pilot interviewees did not see the questionnaire instrument until the main study. Sociodemographic characteristics of the physicians are given in Table 1.

Insert Table 1 about here

Antibiotic prescribing data for the fourth quarter of 1994 were obtained for N = 19 of these physicians from the administrative database of the managed care system. Utilization data for 6 of the 25 physicians who completed the attitudinal questionnaire were not available, due to limitations in the administrative database at the participating health system. Analyses involving prescribing behavior were based on 19 cases, a response rate of roughly 49%.

Drugs Studied

Antibiotics, as a class of drugs, were of interest to the researchers and the managed care organization because they were commonly prescribed, because there was substantial variation in the cost of different antibiotics, and because there was substantial variability in the frequency of use of socalled first-, second-, and third-line antibiotics (Avorn, Harvey, Soumerai et al. 1987; McCaig and Hughes 1995). An attempt was made to select a set of antibiotics that included branded and generic, low and high cost, single and multi-source drugs that could be used to treat a wide range of conditions. The selected drugs had to be on the preferred drug list of the participating HMO. After applying these criteria, the following drugs were selected: amoxicillin, amoxicillin with clavulanate (Augmentin®, SmithKline Beecham), clarithromycin (Biaxin®, Abbott), cefaclor (Ceclor®, Lilly), cefuroxime (Ceftin®, Allen & Hanbury's), erythromycin, and sulfamethoxazole/trimethoprim. Medications were listed on the questionnaire using both trademark and generic names. Although the selected drugs differ somewhat in their indication, the clinician members of the research team deemed them to be sufficiently interchangeable for the purposes of the present study. Price information about various medications was available to prescribers in the form of a preferred drug list. Relative drug costs were indicated by dollar signs. Thus, amoxicillin, erythromycin, and sulfamethoxazole/trimethoprim received one dollar sign ($), clarithromycin received two ($$), amoxicillin with clavulanate received four ($$$$), cefaclor and cefuroxime received 5 each ($$$$$). Although the managed care organization was receiving discounts on some of the study drugs at the time of the study, prescribers were not directly aware of these discounts.

Analysis Plan

The first step was to compute basic descriptive statistics for physician responses (i.e., belief strength and outcome evaluation, normative beliefs and motivation to comply, attitude, subjective norm, and behavioral intention) for each antibiotic studied. The next step was to examine the zero-order correlation between direct (A_i) and indirect ($\bullet b_i e_i$) measures of attitude for each drug. Zero-order correlations between direct (SN_i) and indirect ($\bullet NB_i MC_i$)

measures of subjective norms were also examined for each drug. Next we formed a linear regression model for each drug, with direct measures of attitude and subjective norm as the independent variables and behavioral intention as the dependent variable. Regression coefficients were examined to determine the relative influence of attitudes and subjective norms on behavioral intentions. Zero-order correlations between the intention to prescribe (BI_i) and the actual prescribing were examined for each drug. An alpha level of .05 was used for all statistical tests.

Power. Many TORA studies have reported multiple correlation coefficients between .60 and .90 when predicting behavioral intention from attitudes and subjective norms (Sheppard, Hartwick and Warshaw 1988; O'Keefe 1990). With two-tailed alpha = .05, to detect a multiple R = .60 corresponding to an R^2 = .36, one could achieve power greater than .90 with only 20 subjects (Cohen 1988). Studies based on the Theory of Reasoned Action have typically reported correlations of .60 for the intention-behavior relationship (Sheppard, Hartwick and Warshaw 1988; O'Keefe 1990). With two-tailed alpha = .05, a sample size of 19 yielded power of .81 to detect r = .60. Thus, although the sample was small, it was larger than that used in some published studies of clinical decision making (Mancuso and Rose 1987), and, more importantly, tests had sufficient power to detect effects of the expected magnitude.

Results and Discussion

Belief Strength, Outcome Evaluation, Normative Belief, and Motivation to Comply

Table 2 shows the means and standard deviations for outcome evaluations associated with the six most frequently mentioned outcomes and strength of motivation to comply with the six most frequently mentioned important others. The salient outcomes and important others were quite similar to those identified in previous TORA prescribing studies (Segal and Hepler 1982; Segal and Hepler 1985).

Insert Table 2 about here

Table 3 shows descriptive statistics for strength of outcome beliefs and normative beliefs for each of the seven antibiotics studied.

Insert Table 3 about here

Direct and Indirect Measures of Attitude and Subjective Norms

Table 4 displays descriptive statistics for directly measured attitude, subjective norm, and behavioral intention for each drug studied. Correlations

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Insert Table 4 about here
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between direct and indirect measures of attitude and subjective norm respectively are given in Figure 2. Direct and indirect measures of attitude

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Insert Figure 2 about here
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were significantly correlated in the case of five out of the seven antibiotics investigated: amoxicillin with clavulanate, cefuroxime, amoxicillin, clarithromycin, erythromycin (see Figure 2A). In two cases, the correlations were positive but not statistically significant (sulfamethoxazole/trimethoprim and cefaclor). Direct and indirect measures of subjective norms were significantly correlated in the case of all seven antibiotics (Figure 2B). These results provided partial support for Hypothesis 1 and full support for Hypothesis 2. In the majority of cases, attitude toward prescribing a drug was determined jointly by the belief that a drug produced a given set of outcomes and the values placed on those outcomes. Similarly, subjective norms were determined jointly by beliefs about what others wanted one to prescribe and one's desire to comply with those specific others (Ajzen and Fishbein 1980).

Attitudes, Subjective Norms, and Behavioral Intentions

Zero order correlations between direct measures of attitude, social norm, and prescribing intention are given in Figure 2C and 2D respectively. For each of the seven drugs investigated, general attitude toward the drug was significantly correlated with intention to prescribe the drug (see Figure 2C). The general subjective norm about a drug was also significantly correlated ($p < .01$) with intention to prescribe the drug for all seven antibiotics (see Figure 2D).

To examine the combined effect of attitudes and subjective norms on prescribing intentions, seven separate linear regression models were fitted. No significant collinearity existed between the two independent variables (all tolerances were greater than .70; most were greater than .80). For each model, attitude was entered first, followed by subjective norm. Figure 2E shows that each of the seven models provided a statistically significant ($p < .01$) fit to the data, with multiple Rs ranging from .61 to .90 (R^2 from .37 to .81). Inspection of the standardized regression coefficients in Figure 2F and 2G reveals that social normative considerations tended to exert a stronger influence on prescribing intentions than did attitudinal considerations, though in this sample the difference was not statistically significant (results not shown).

Results were generally supportive of Hypothesis 3. As predicted by the Theory of Reasoned Action, behavioral intentions were strongly associated with attitudes and subjective norms toward the behavior. The results were somewhat unusual in that social norms, rather than attitudes, appeared to exert the strongest influence on intentions. Most TORA studies have found the opposite, that behavioral intentions are most strongly influenced by attitudes (O'Keefe 1990). We believe that the managed care setting may have succeeded in exerting normative influence on its staff physicians, so much so that physicians' prescribing intentions were more strongly influenced by what other people thought (subjective norms) than by their own beliefs and attitudes. This result suggests an hypothesis that ought to be investigated in subsequent research: In managed care settings, prescribing intentions will be more strongly influenced by subjective norms than by attitudes; the opposite will be true in fee-for-service (non managed care) settings.

Prescribing Intentions and Actual Utilization

Quarterly prescribing data for the seven studied antibiotics are given in Table 5. In subsequent analyses, actual prescribing behavior was represented as a proportion of the total number of prescriptions written by a given physician for all seven antibiotics combined.

Insert Table 5 about here

Correlation with intention to prescribe. For each antibiotic, zero-order correlations were computed between directly measured intention to prescribe and actual quarterly prescribing. The results are given in Figure 2H and 2I respectively. Prescribing intentions were not significantly correlated with actual prescribing behavior for any of the seven antibiotics studied. To check that null correlations were not due to deviations from a normality, proportions were transformed by the arcsine transformation and intention-behavior correlations were recomputed (Cohen and Cohen 1983). The magnitude of the correlation coefficients changed slightly after transformation, but there were still no significant correlations between intention and behavior (results not shown). Thus, bivariate analysis of the intention-behavior link did not support Hypothesis 4.

General Discussion

Limitations

Before beginning a general discussion of the study findings, it is important to be aware of the significant limitations of this exploratory investigation. The small sample was not representative of the population of physicians working at the HMO. Slightly fewer than half of the contacted physicians participated, and it was not possible to assess non-response bias. Thus, extreme caution must be used in generalizing these results beyond the physicians studied. Data on case mix (i.e., number of patients seen, diagnosis, medication history, etc.) were not available, and therefore it was not possible to control for case mix in analyses of the intention-behavior relationship. The data for antibiotic utilization were sparse, and this sparseness may have introduced substantial measurement error. Statistical power to detect small- to medium-sized effects was low, due to the small sample size and to a loss of power potentially caused by similarity of utilization patterns within clinics. (Analyses did not control for clustering within clinics.) Under these circumstances, inferences based on null findings must be seen as provisional and in need of additional support. Based only on the data reported above, there are several equally likely explanations for the null intention-behavior correlations.

Attitudes, Norms, Intentions, and Behavior

Attitudes, subjective norms, and prescribing intentions were related to one another in predictable ways, but actual prescribing of the seven selected antibiotics was not related to any of these psychological constructs. These results are unusual in that previous prescribing studies using TORA and related expectancy-value models have reported significant associations between prescribing behavior and stated intention to prescribe (Harrell and Bennett 1974; Segal and Hepler 1982; Epstein, Read and Winickoff 1984; Segal and Hepler 1985; Mancuso and Rose 1987; Denig, Haaijer-Ruskamp and Zijsling 1988). The central question raised by these results is thus “Why were intentions not related to behavior?” As stated previously, there are at least three circumstances under which the expected intention-behavior relationship is known to break down: (a) when measures of intention and behavior do not correspond, (b) when measures of intention and behavior are distant in time so that intentions may have changed, and (c) when the behavior is not under volitional control (Davidson and Jaccard 1979; O'Keefe 1990; Eagly and Chaiken 1993). In addition, social desirability biases and/or insufficient statistical power may have contributed to the present failure to detect a significant association between intention and behavior.

<u>Corresponding Measures of Intention and Behavior</u>

In this study, the measures of intention and behavior seemed to correspond well. The measure of intention was general, referring not to a specific patient but to a “typical patient” or “the majority of patients in the physician’s day-to-day practice.” The measure of behavior, number of prescriptions per physician per quarter, was correspondingly general. Thus we tentatively concluded that the break down of the intention-behavior relationship in this study was probably not due to lack of correspondence between measures of intention and behavior.

But perhaps a slight variant of the measurement correspondence explanation would be more plausible: Prescribing decisions are never made “in general.” They are always made clinically, with reference to a specific patient in specific circumstances. Therefore, a measure of prescribing behavior such as that used here (quarterly prescription volume) was really not general in the necessary sense. Rather, it is a cumulative measure of decisions made in specific circumstances. This explanation is consistent with physicians' claims that the art of medicine, in its particularity and customization, should not and could not ever be automated or governed by generic rules and protocols (Hampton 1983; Lee and Etheredge 1989; Nash, Shulkin, Owerbach and Owerbach 1992).

It should also be noted that, due to the sparseness of the utilization data (e.g., an average of only 22 total antibiotic prescriptions per physician), substantial error may have been introduced into the measurement of utilization. This measurement error could have violated the assumption of measurement equivalence and explained, in part, why intentions were not associated with behavior.

Delay between Measurement of Intention and Measurement of Behavior

It seems unlikely that excessive delay between measurement of attitudes and measurement of behavior was to blame for the null intention-behavior correlations found in this study. Attitudes were measured during the third quarter of 1994 and behavior was measured during the fourth quarter of 1994. We are not aware of any events that would have substantially altered physicians' attitudes during the time between measurement of attitudes and measurement of behavior. Future research should test this possibility by taking post-test measures of prescribers' intentions and comparing these to the pre-test measures.

Social Desirability and Statistical Power

There are two other possible alternative explanations for the negative findings reported here. First, the tendency for physicians to provide socially desirable responses to questions about antibiotic prescribing may have biased physicians' responses and thereby attenuated the expected intention-behavior correlations (Epstein, Read and Winickoff 1984). Social desirability biases may have influenced patterns of physician responses to questions about attitudes, social norms, and intentions. This tendency may have been more pronounced in a managed care setting that depends on its ability to influence behavior by exerting social-normative pressure on its physicians. If this were the case, it should not be surprising that biased reports of attitudes, norms, and intentions were not related to actual prescribing behavior. Second, the intention-behavior correlations may have been smaller than expected, and thus nearly impossible to detect given the sample size and low power to detect effect sizes smaller than $\underline{r} = .60$.

Although these explanations cannot be rejected solely on the basis of the present study, analysis of the context of modern medical practice and of recent developments in social psychology led us to prefer a different explanation. Thus, of the known explanations for null intention-behavior correlations, the most intriguing alternative appears to be that antibiotic prescribing at the facility studied was, in some sense, not under physicians' volitional control.

Prescribing Behavior not Under Volitional Control

Deciding what drug to prescribe for a given patient is one of many clinical decisions physicians make daily. Such clinical decisions were once the exclusive domain of physicians, acting as autonomous agents of their patients. However, the corporate transformation of medicine and the rise of managed care in recent years have substantially eroded the autonomy of the physician (Hampton 1983; Lee and Etheredge 1989; Feinglass and Salmon 1994; Salmon, White and Feinglass 1994). The decisions of modern physicians are increasingly constrained by treatment protocols, formularies, and an ever-expanding arsenal of utilization management strategies. As Salmon and others have argued, increasing surveillance and management, motivated by a desire to contain costs, impose standards of care, and improve quality, have resulted in a “major assault on the doctor as the autonomous coordinator of care” (Salmon, White and Feinglass 1994). Moreover, as Lee and Etheredge note, “Physicians’ day-to-day clinical decision making——commonly referred to as clinical freedom——is increasingly subject to review and approval by “case managers” working for employers, insurance carriers, and government-financed and regulated professional review organisations” (Lee and Etheredge 1989).

For example, under managed care pharmacy, whether programs are run by a pharmacy benefit management firm, a third party administrator, or the HMO itself, formulary management and concurrent drug utilization review are now followed up by computerized prescribing profiles and recommended intervention protocols to control costs, improve quality, and constrain what management considers to be erratic physician behavior. Pharmacy benefit management firms, in particular, are very active in educating physicians and changing prescribing behaviors through incentives and academic detailing (Dedhiya and Salmon 1997, submitted)

For this study, we find the volitional control explanation to be a most intriguing possibility and the explanation most suggestive of future research questions. Specifically, if prescribing decisions are less and less under the volitional control of physicians, how are these decisions made? We would argue that, due to the erosion of physician autonomy that has accompanied the rise of corporatization and managed care, existing models of prescribing behavior may be somewhat outmoded (Haug 1976; McKinlay and Stoeckle 1990). Models such as TORA may no longer be useful in predicting physician prescribing behavior because it may no longer be accurate to model prescribing behavior as a process of volitional choice on the part of the physician (Davidson and

Jaccard 1979; Sheppard, Hartwick and Warshaw 1988; O'Keefe 1990; Eagly and Chaiken 1993). A revised version of TORA, known as the theory of planned behavior, may be better suited to modeling the non-volitional aspects of prescribing behavior.

The Theory of Planned Behavior

TORA's inability to predict non-volitional behavior prompted its creators to modify the theory. The modified theory, known as the theory of planned behavior, added an additional variable to the theory of reasoned action in an effort to capture non-volitional behavior. The variable was perceived behavioral control (Ajzen 1985; Ajzen and Madden 1986; Ajzen 1991; Madden, Ellen and Ajzen 1992; Eagly and Chaiken 1993). Perceived behavioral control refers to a person's belief that s/he has the ability, resources, and opportunity to perform a behavior (Madden, Ellen and Ajzen 1992). It is closely related to the idea of self-efficacy (Bandura 1989; Bandura 1991). As shown in Figure 3, perceived behavioral control is expected to have

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direct and indirect effects on behavior. When people feel able to perform a behavior (i.e., when there is high perceived behavioral control) they are more likely to form an intention to perform the behavior. Thus, perceived behavioral control exerts its indirect effects by altering the likelihood that an intention will be formed. Perceived behavioral control exerts direct effects on behavior when perceptions of control are accurate, for example, when the person actually possesses or lacks the ability, opportunity or resources to perform the behavior. Perceived behavioral control is itself determined by control beliefs (i.e., beliefs about obstacles, resources, impediments, and opportunities) and power of control factors (i.e., a weighting on each opportunity and resource). Figure 4 illustrates several common utilization management techniques that have the potential to influence control beliefs, perceived behavioral control, and the intention-behavior relationship.

Insert Figure 4 about here.

By incorporating perceived behavioral control, the theory of planned behavior has improved the accuracy of behavioral prediction in circumstances where the target behavior was non-volitional (Ajzen 1991). The theory of planned behavior is clearly preferable to the theory of reasoned action when predicting non-volitional or partially volitional behaviors (Ajzen 1991; Madden, Ellen and Ajzen 1992). Given the reliance on the theory of reasoned action in prior research on prescribing behavior, and considering the probability that volitional control over prescribing is reduced within managed care settings, we conclude that future managed care prescribing research ought to compare the theory of planned behavior to the theory of reasoned action. Specifically, the results of this exploratory study lead us to hypothesize that the theory of planned behavior will have greater predictive power in managed care settings than the theory of reasoned action (Madden, Ellen and Ajzen 1992).

Beyond the Individual Prescriber

In managed care settings, at least, we have speculated that it may no longer be valid to model prescribers as autonomous agents whose decisions are guided by individually held attitudes, norms, and intentions. The theory of planned behavior acknowledges external influences by including perceived behavioral control. Still, the theory of planned behavior is an individualistic, psychological model. It psychologizes external factors and encapsulates them in a measure of perceived behavioral control. But what about drug utilization phenomena that are not mediated by the psychological states of prescribers? What may be needed in such cases are structural or system-level models of utilization. These models would take as their unit of analysis the system of care rather than the individual prescriber. Changing the emphasis of prescribing models in this way allows one to acknowledge (among other influences) the influence of third party payors, pharmaceutical manufacturers, pharmaceutical benefit management companies, feedback systems, formularies, treatment protocols, disease state management and other financial incentives, profiling and other surveillance systems, and finally, with the growth of direct-to-consumer advertising, patient demands. Most of these are what Raisch calls direct methods of influence, methods that seek to alter prescribing behavior without attempting to change the internal decision-making process of individual physicians (Raisch 1990). Subsequent efforts to model drug utilization ought to bring to the foreground these direct methods of influence.

The widespread implementation of managed health care marks a historical point of inflection after which it appears that the utilization of drugs will be dominated more by management systems than by individual physician decision makers. Models that acknowledge this new reality may perform better than existing individualistic, psychological models at predicting and explaining the utilization of antibiotics as well as other classes of drugs.

Summary and Conclusion

Attitudes and subjective norms with respect to seven selected antibiotics were significantly related to stated prescribing intentions. However, actual antibiotic prescribing, as measured by the proportion of prescriptions written by 19 primary care physicians over a three month period, was not significantly related to physicians’ general attitudes, subjective norms, or stated prescribing intentions. Several competing explanations of the negative results were considered. The data from this study did not conclusively favor any single explanation. Nevertheless, we felt it was useful to step beyond our empirical results in order to expand the model for understanding and interpreting physician prescribing behavior. Recent developments in the organization and financing of medical care and in social psychology suggested that future models of physician prescribing ought to address the non-volitional nature of prescribing under managed care. One could heed this suggestion either by including measures of perceived behavioral control (or self-efficacy) in psychological models of prescribing, by modeling the decision making of non-physician managers, or by developing non-individualistic, system-level models of drug utilization that better reflect the realities of managed care pharmacy.

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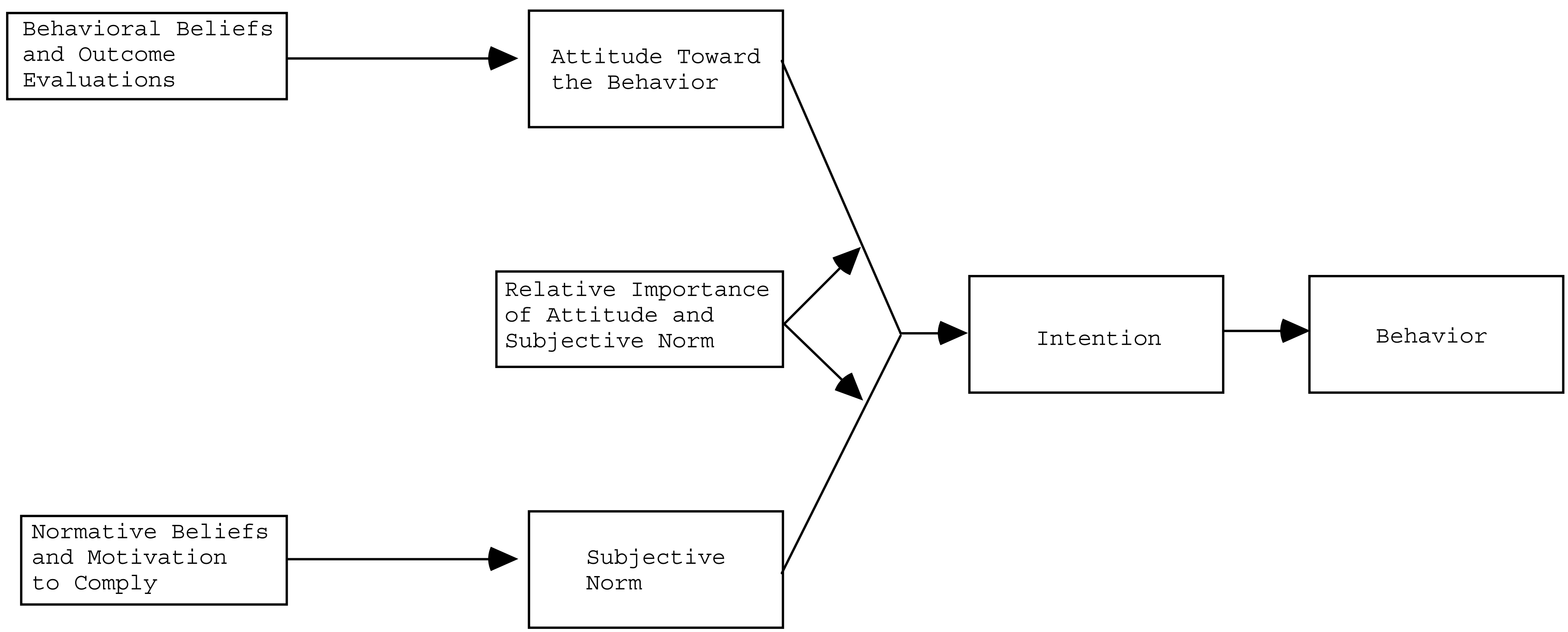

Figure 1. Relations among beliefs, attitude, subjective norm, intention, and behavior in the theory of reasoned action (cf. Ajzen & Fishbein, 1980).

Table 1

Physician Demographic Characteristics

Characteristic	N (%)
Age—M(SD)	41.56 (7.84)
Range	28-63
Sex	
Men	11 (44)
Women	14 (56)
Experience (Yrs.)—M(SD)	11.44 (8.01)
Range	2-36
Practice Site	
Clinic A	9 (36)
Clinic B	4 (16)
Clinic C	5 (20)
Clinic D	2 (8)
Clinic E	4 (16)
Missing	1 (4)
Medical School	
School A	9 (36)
School B	3 (12)
School C	3 (12)
Other	10 (40)
Specialty	
Int. Med.	12 (48)
Family Practice	9 (36)
Int. Med./Peds.	3 (12)
Emergency	1 (4)

Table 2

Descriptive Statistics for Evaluations of Salient Outcomes and Motivation to Comply with Important Others (N = 25).

Topic	Item	M	SD	Min	Max
SALIENT OUTCOME BELIEFS					
	Cures the underlying infectious disease	2.96	.20	2	3
	Makes it difficult for patients to follow the treatment regimen	-2.48	.59	-3	-1
	Cost-effective for the medical group	2.36	.76	0	3
	Inexpensive to the patient	2.16	1.11	-2	3
	Does not lead to stomach cramps, nausea, vomiting or diarrhea	2.36	.64	1	3
	Quickly lessens uncomfortable or painful symptoms	2.68	.48	2	3
IMPORTANT OTHERS					
	Physicians	.44	1.58	-3	2
	Patients	-.44	1.56	-3	2
	Pharmacist	.72	1.21	-3	2
	Medical director	.48	1.39	-3	2
	Medical group prescriber guidelines	1.40	1.22	-2	3
	Insurance plan's preferred drug list	.72	1.24	-3	3

Note. Response options for each item ranged from -3 (e.g., extremely undesirable, extremely unlikely) to 3 (e.g., extremely desirable, extremely likely

Table 3

Strength of Outcome Beliefs and Normative Beliefs for Seven Study Antibiotics

Item	AMX	AWC	CLA	CFA	CFU	ERY	SLF
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Outcome Beliefs							
Cures the underlying infectious disease	2.04	2.12	2.28	2.12	2.24	1.96	2.20
	(.54)	(.78)	(.61)	(.60)	(.60)	(.73)	(.65)
Makes it difficult for patients to follow the treatment regimen	.92	.92	1.80	1.28	1.88	.52	1.68
	(1.93)	(1.73)	(1.26)	(1.46)	(1.09)	(1.61)	(1.38)
Cost-effective for the medical group	1.80	-.44	-.56	-.52	-1.20	.36	1.72
	(1.98	(2.20)	(2.29)	(2.02)	(2.16)	(2.16)	(1.81)
Inexpensive to the patient	1.36	-.40	-.96	-.96	-1.04	.08	1.52
	(2.10	(2.16)	(2.23)	(2.09)	(2.13)	(2.20)	(1.81)
Does not lead to stomach cramps, nausea, vomiting or diarrhea	-.16	-.32	.20	.20	.48	-.76	.12
	(2.17)	(1.84)	(1.58)	(1.78)	(1.96)	(1.64)	(1.90)
Quickly lessens uncomfortable or painful symptoms	1.76	1.40	1.56	1.64	1.76	1.04	1.48
	(1.05	(1.15)	(1.16)	(1.22)	(.97)	(1.21)	(1.19)
Normative Beliefs							
Physicians	1.64	-.24	.24	-1.00	-.40	.20	1.28
	(1.75)	(2.11)	(2.03)	(2.18)	(2.10)	(2.38)	(1.88)
Patients	.96	.00	.16	-.36	-.08	-.48	.60
	(1.57	(1.96)	(1.82)	(1.73)	(1.80)	(2.00)	(1.35)
Pharmacist	1.44	-.68	-.24	-1.04	-.48	-.16	.96
	(1.89)	(2.29)	(2.20)	(2.09)	(2.14)	(2.29)	(1.90)
Medical director	1.64	-.52	-.24	-1.12	-.56	-.16	1.12
	(1.75	(2.31)	(2.26)	(2.09)	(2.18)	(2.32)	(1.92)
Medical group guidelines	1.76	-.44	-.20	-1.00	-.72	.33	1.28
	(1.76)	(2.36)	(2.35)	(2.18)	(2.26)	(2.43)	(1.97)
Insurer's preferred drug list	1.68	-.40	-.28	-.96	-.76	.16	1.32
	(1.75)	(2.35)	(2.37)	(2.19)	(2.24)	(2.48)	(2.08)

Note. Response options for each item ranged from -3 (e.g., extremely unlikely) to 3 (e.g., extremely likely). Amx=amoxicillin, awc=amoxicillin with clavulanate, cla=clarithromycin, cfa=cefaclor, cfu=cefuroxime, ery=erythromycin, slf=sulfamethoxazole/trimethoprim.

Table 4

Attitude, Subjective Norm, and Intention to Prescribe for Seven Study Antibiotics

Measure	AMX M (SD)	AWC M (SD)	CLA M (SD)	CFA M (SD)	CFU M (SD)	ERY M (SD)	SLF M (SD)
Attitude	2.00	1.60	1.80	1.48	1.44	1.52	2.16
	(1.41)	(1.12)	(1.08)	(1.12)	(1.39)	(1.00)	(.94)
Subjective Norm	1.64	-.64	-.16	-1.04	-.44	-.16	1.20
	(1.68	(2.14)	(2.25)	(2.03)	(2.12)	(2.27)	(1.94)
Behavioral Intention	2.12	-.32	.32	-.52	-.32	.04	1.88
	(1.27)	(2.39)	(2.08)	(2.10)	(2.15)	(2.17)	(1.48)

Note. Response options for each item ranged from -3 (e.g., extremely unlikely, extremely harmful) to 3 (e.g., extremely likely, extremely beneficial). Amx=amoxicillin, awc=amoxicillin with clavulanate, cla=clarithromycin, cfa=cefaclor, cfu=cefuroxime, ery=erythromycin, slf=sulfamethoxazole/trimethoprim.

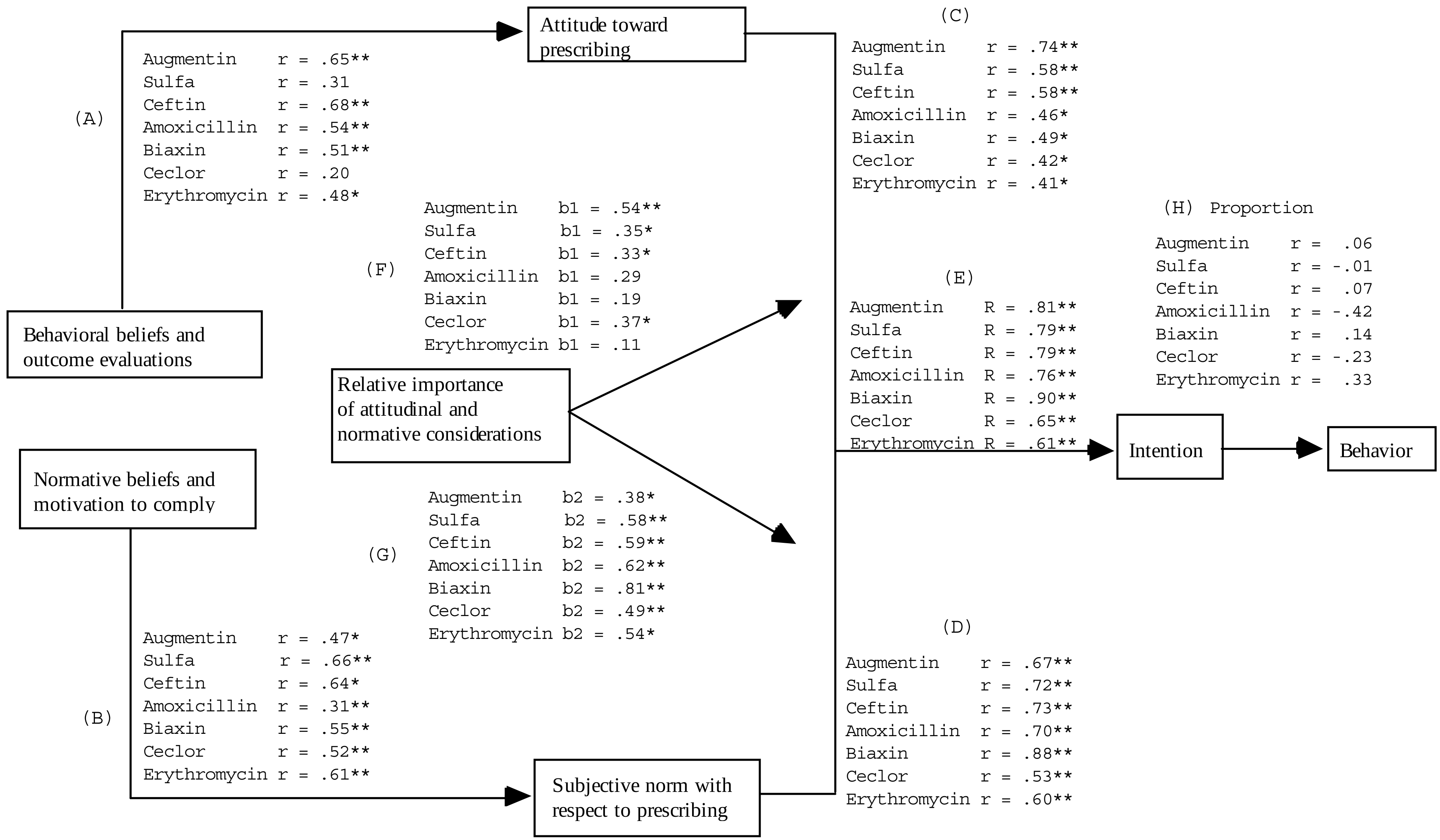

Figure 2. Relationships among beliefs, attitudes, subjective norms, intentions, and behavior with respect to prescribing of seven selected antibiotics (* p < .05, ** p < .01).

Table 5

Quarterly Prescribing Volume for Seven Selected Antibiotics

	Frequency				Proportion			
Antibiotic	M	SD	Min	Max	M	SD	Min	Max
Amoxicillin	1.79	2.57	0	9	.09	.13	0	.50
Amx/Clv	1.89	2.71	0	10	.07	.10	0	.33
Clarithromycin	3.58	3.78	0	13	.15	.14	0	.43
Cefaclor	.37	.60	0	2	.09	.25	0	1.00
Cefuroxime	.58	1.30	0	5	.03	.07	0	.27
Erythromycin	2.00	2.29	0	7	.10	.11	0	.40
Smz/Tmp	12.11	10.15	0	39	.47	.26	0	.90
Total	22.32	14.49	1	55	-	-	-	-

Note. Smz/Tmp=sulfamethoxazole with trimethoprim; Amx/Clv=amoxicillin with clavulanate.

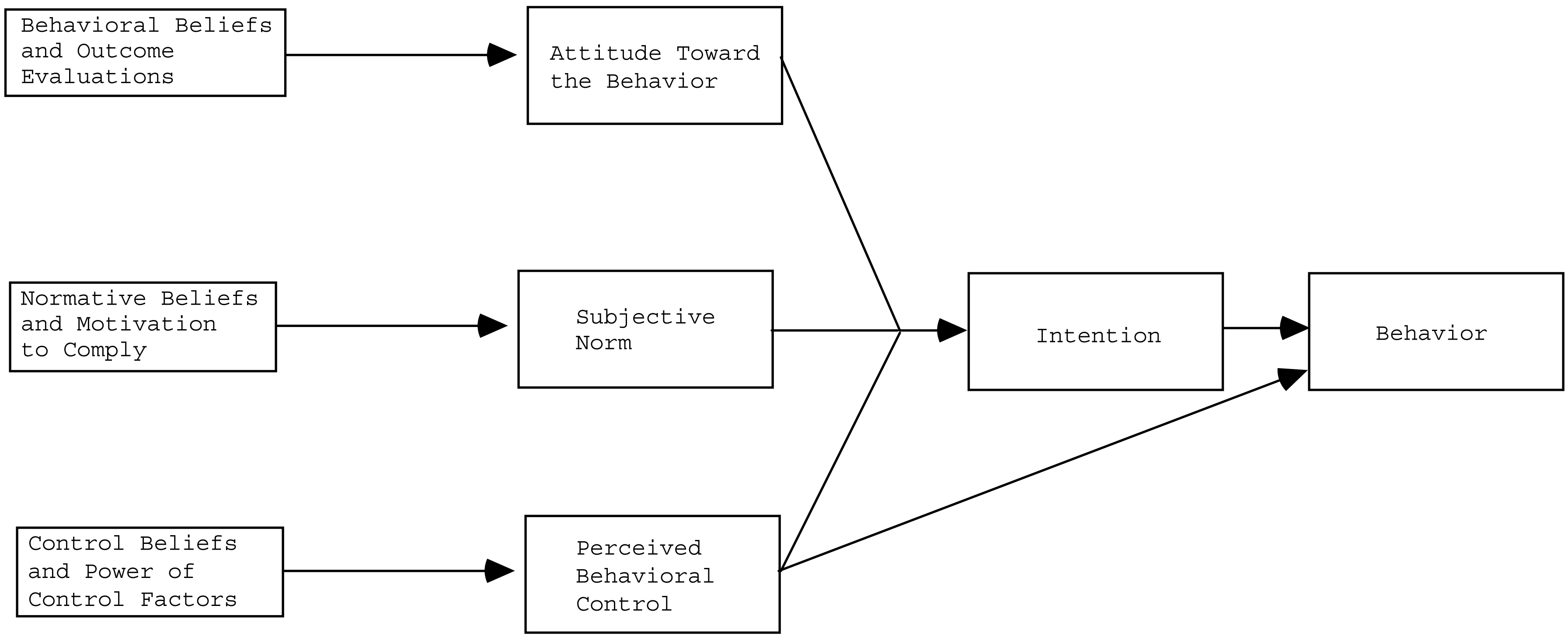

Figure 3. Relations among belief, attitude, subjective norm, perceived behavioral control, intention, and behavior in the theory of planned behavior (cf. Ajzen, 1991).

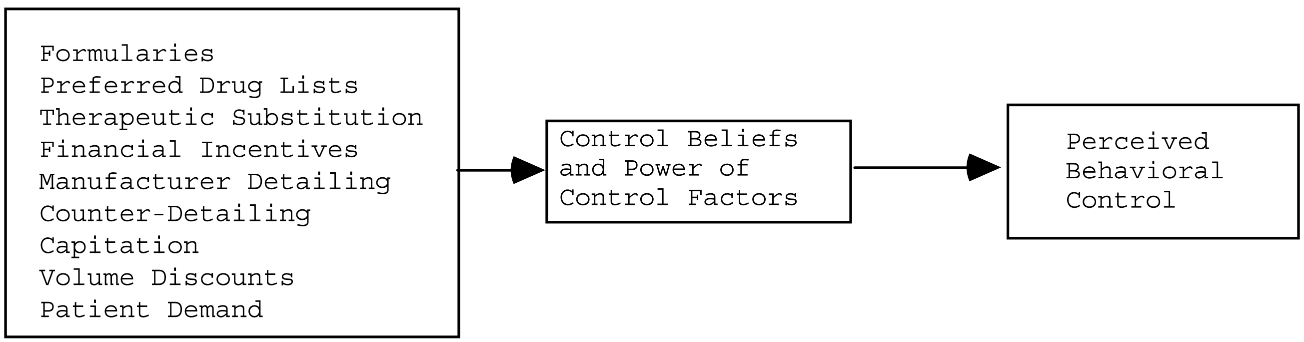

Figure 4. Factors that potentially affect physicians' control beliefs and perceived behavioral control.