The Determinants of Physician Attitudes and Subjective Norms Toward Drug Information Sources: Modification and Test of the Theory of Reasoned Action[1]

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Purpose. To improve upon the theory of reasoned action and apply it to pharmaceutical research, we investigated the effects of relevant appraisals, attributes, and past behavior of physicians on the use of drug information sources. We also examined the moderating effects of practice characteristics.

Methods. A mail questionnaire asked HMO physicians to evaluate seven common sources of drug information on general appraisals (degree of usefulness and ease of use), specific attributes (availability, quality of information on harmful effects and on drug efficacy), and past behavior when searching for information on a new, simulated H_2 antagonist agent. Semantic differential scales were used to measure each appraisal, attribute and past behavior. Information was also collected on practice characteristics.

Results. Findings from 108/200 respondents indicated that appraisals and attributes were useful determinants of attitudes and subjective norms toward use. Degree of usefulness and quality of information on harmful effects were important predictors of attitudes toward use for several sources of information. Ease of use and degree of usefulness were important predictors of subjective norms toward use. In many cases, moderating effects of practice characteristics were in opposing directions. Past behavior had significant direct effects on attitudes toward the PDR.

Conclusions. The findings suggest ways to improve the usefulness of the theory of reasoned action as a model of decision-making. We also propose practical guidelines that can be used to improve the types of drug information sources used by physicians.

KEY WORDS: physician; attitudes; subjective norms; drug information sources; appraisals; attributes; decision-making; theory of reasoned action.

The theory of reasoned action is a well-tested cognitive model that is used by researchers interested in decision-making. It has been used to explain and predict a wide variety of decisions. Under the model, intention (i.e., decision-making) is determined by an individual's attitudes (i.e., positive or negative evaluations about an act) and subjective norms (the perception that those whose opinions are valued would approve or disapprove of performance of a behavior) (1). In equation form, the theory of reasoned action is often expressed through the following multiple regression representation:

$$I = \alpha_I + \beta_1 Aact + \beta_2 SN + e_I$$

where I is one's decision or intention to act in a particular way (e.g., to prescribe a particular drug), Aact is one's attitude toward acting in the particular way (e.g., one's preference toward prescribing the drug in question), SN is one's felt subjective norm (e.g., the degree to which one feels others whose opinions one respects believes that he or she should prescribe the drug), and α_I, β_i, and e_I are intercept, regression coefficient, and error terms, respectively.

Although the theory of reasoned action as presented in the above equation provides a basis for explaining and predicting decision-making (i.e., intentions), the direct antecedents to decisions—Aact and SN—are rather abstract, subjective responses of decision makers, and what researchers would like are more concrete determinants of intentions that can function as practical targets for education, persuasive communication, and managerial programs. The classic theory of reasoned action proposes the following antecedents of Aact and SN. Attitudes are a function of beliefs and evaluations about specific consequences of behavior. Subjective norms are a function of normative beliefs about specific referents (e.g., colleagues, supervisors, subordinates) and the motivation to comply with these referents. Corresponding beliefs and evaluations (and normative beliefs and the motivation to comply) are multiplied together and the products summed to yield a unidimensional construct that determines attitudes (and subjective norms). The rationale is a variant of expectancy-value theory, and the hypothesized relationships are typically tested through multiple regression analysis (1). The key relations are expressed by the following equations:

$$Aact = \alpha_2 + \beta_3 \Sigma b_i e_i + e_2$$

$$SN = \alpha_3 + \beta_4 \Sigma (nb)_j (mc)_j + e_3$$

where: b_i is the ith perceived consequence of acting, e_i is the evaluation of consequence i, $(nb)_j$ is the normative belief that referent j believes that one should act, $(mc)_j$ is one's motivation to comply with j's expectations, and the remaining symbols are as defined above.

While empirical research shows that attitudes and subjective norms frequently influence intentions (2), a number of problems can be pointed out with the representation of the determinants of attitudes and subjective norms under the theory of reasoned action. One limitation with the classic approach is conceptual and has implications for predicting decisions. By modeling the determinants of attitudes and subjective norms as the summation of expectancy-value products, the classic approach assumes that each product (i.e., $b_i e_i$ and $(nb)_j (mc)_j$) contributes equally and the net effect of antecedents can be represented as singular summaries. This prohibits one from discovering the relative contributions of beliefs and normative expectations and makes the approach less diagnostic than is desirable. Are there unique antecedents to attitudes and subjective norms that account for the etiology of decision-making (3)?

A second and related issue concerns the content of beliefs and normative expectations used in the classic approach. The usual elicitation procedure used to generate beliefs and normative expectations typically yields overly abstract or intangible

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determinants that relate poorly with the actual subjective experiences of decision-making. Can more concrete and tangible antecedents of attitudes and subjective norms be found to better explain decision-making?

Finally, use of product terms as predictors of attitudes and subjective norms poses methodological problems because self-reports are seldom ratio scaled, as required in tests of hypotheses for the models as they stand (3,4). This is especially a problem when sums of product terms are employed (5). Is it possible to specify antecedents that perform satisfactorily even when measures are only ordinally or intervally scaled?

One area in pharmaceutical research that is in need of a better model of decision-making based on more valid representations of attitudinal and normative factors is physicians' use of drug information sources. Research in this area has examined the types of drug information sources physicians use when searching for general drug information, information on new drug products, and differences in use based on practice characteristics (6–11). However, an important issue remains unaddressed: why do physicians choose one drug information source over another, and what are the decision-making processes that underlie this choice? In addition, there is some question regarding the appropriateness of the types of drug information sources used (12). It has been shown that attitudes, subjective norms, and past behavior can be used to predict physicians' intention to use drug information sources (13), but the specific antecedents to decision-making in this context are generally unknown. An understanding of the antecedents is needed to better influence the use of drug information.

A variety of appraisals and attributes may be antecedents to attitudes and subject norms. To the extent that these appraisals and attributes are concrete, understandable, and controllable, those interested in improving the utilization of drug information sources will have guidelines that can be developed to aid physicians in prescribing decisions. A set of appraisals that is relevant for physicians' use of drug information sources can be found in the literature describing the perceived characteristics of an innovation (14).

According to this literature, two characteristics which influence adoption—relative advantage and complexity—are particularly relevant to physicians' use of drug information sources. Relative advantage refers to the degree to which the benefits of an innovation supersede those of existing products (14). Specifically, the degree of "usefulness" of an information source can be seen as its relative advantage over other sources of drug information (15,16). Complexity represents the degree to which an innovation is perceived to be difficult to understand, learn, or implement (14). The less complex a source of drug information is to use, the increased likelihood of its adoption, *ceteris paribus*. This has been termed "ease of use" in the literature regarding the adoption of new technologies (15,16). Thus degree of *usefulness* and *ease of use* of drug information sources add theoretically to the understanding of physicians' use of these sources and provide a more concrete basis for prediction than the theory of reasoned action. Specifying other attributes of drug information sources may be informative as well.

The research of Chinburapa *et al.*, suggests that the quality of information on *adverse drug reactions* and on *drug efficacy* are attributes that will influence prescribing behavior (17). In addition, the *availability of the information* source is important. These attributes should positively influence physician attitudes, as well as physician colleagues' approval or disapproval of use of a source. Specifying the antecedents of attitudes and subjective norms allows for comparisons of the influence of each concrete belief and attribute on each source of drug information. In this way a set of appraisals can be developed that can be generalized to various types of drug information sources.

Our research is designed to link the abstract (i.e., Aact and SN) with the concrete (i.e., specific determinants of Aact and SN) by integrating concepts from the literature on the diffusion of innovations and the theory of reasoned action. We use this approach to determine if attitudes and subjective norms are functions of the degree of usefulness, ease of use, quality of information on harmful effects and on drug efficacy, and availability, and thus mediate the effects of controllable factors on decision-making. This approach allows us to bridge actual information sources and actual use with the thoughts, feelings, and judgments constituting decision-making. In addition, we investigated the moderating effects of several practice characteristics and past behavior. Previous discussion on the effects of practice characteristics have been descriptive in nature, thus not yielding much useful information (9–11). Figure 1 summarizes the key variables under study.

OBJECTIVES

Specifically, the objectives of this study were to 1) investigate the effects of key appraisals (degree of usefulness and ease of use), specific attributes (quality of information on harmful effects and on drug efficacy, and availability), and past behavior on physicians' attitudes and subjective norms toward the use of various sources of drug information; and 2) determine if selected practice characteristics (number of patients seen daily,

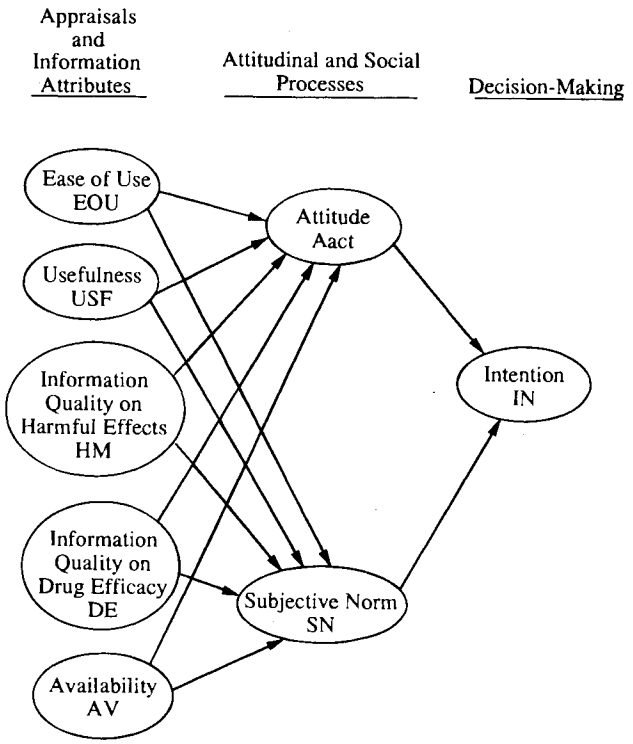

Fig. 1. Diagram of proposed effects.

number of other physicians at the primary practice site, and number of patients started on a similar drug during the past month) moderate the effects of appraisals, attributes and past behavior on attitudes and subjective norms toward use of various sources of drug information (see Figure 1 for specification of the primary relationships). This study represents part of a larger project that examines physicians' use of drug information sources (13,18).

METHODS

The context that we used to determine our objectives was physicians' use of drug information sources when searching for information on a new drug. Physicians were asked to respond to a short scenario which described a fictitious, new H_2 antagonist ("Tionidine") that had recently been released on the market. By describing a new drug from a well known class of medications, we focused physicians' attention on a specific drug information task thereby reducing extraneous variance that may confound our results. Previous research has frequently confounded physician specialty and drug therapy with information usage.

Physicians were asked to provide information regarding seven commonly used drug information sources: the Physicians Desk Reference(PDR); medical textbooks; medical journals/newsletters; pharmaceutical manufacturers' literature; pharmaceutical manufacturers' representatives; other physicians; and pharmacists. On seven-point semantic differential scales (extremely not useful/extremely useful, extremely easy to use/extremely difficult to use, positive/negative feelings, approve/disapprove, and frequently/infrequently), physicians responded to questions asking how useful the drug information source was to them (degree of usefulness), how easy it was to use (ease of use), their feelings toward use (attitudes), colleagues' perceived approval/disapproval of use (subjective norms), and frequency of use during the past month (past behavior).

Physicians were also asked to rate the quality of information from each source on harmful effects (contraindications, drug-drug interactions and adverse reactions) and on drug efficacy, and the availability of each drug information source on five-point semantic differential scales (very high quality/very low quality and highly available/highly unavailable, respectively). An appendix is provided on the measures of degree of usefulness, ease of use, quality of information on harmful effects and drug efficacy, and availability (See Appendix A). The measures of attitude, subjective norm, and past behavior have been reported elsewhere (13). Physicians indicated how many patients they cared for daily, how many patients they started on H_2 antagonists during the past month, and the number of other physicians located at their primary place of practice.

Subjects for this study were 200 primary care providers from a health maintenance organization (HMO) in southeastern Michigan. The majority of the physicians were in family/general practice followed by internal medicine and gastroenterology. Specifics regarding the study population are described elsewhere (13). An eight-page mail questionnaire which contained the measures for the variables in the model and a cover letter were mailed to these physicians. One month later a second cover letter and replacement questionnaire were sent to all non-respondents.

DATA ANALYSIS

Multiple regression analysis was used to test the effects of the appraisals and attributes on attitudes and subject norms. Attitudes and subjective norms were regressed on ease of use, degree of usefulness, quality of information on harmful effects and on drug efficacy, and availability. The same models were repeated with the addition of past behavior (not shown in Figure 1). The inclusion of past behavior as a predictor allows us to control for habit and discover the effects of the other variables, which represent cognitive processes. To determine the effects of the moderating factors (as suggested by Johnson (19)), the sample was split on the median for each moderator, and the aforementioned regression analyses were repeated. The regression equations were examined for significant coefficients in each half of the sample. Dummy variable regression was then applied to the entire sample to jointly determine the significance of the regression coefficients across the median split (19). Testing for significance in such a manner provides for a more stringent test of significance than use of the t-test alone on mean differences. The following is a list of the dummy variables and their values: the number of patients started on H_2 antagonists during the past month ($0 = \geq 11$, $1 = \leq 10$); the number of patients seen daily ($0 = \geq 22$, $1 = \leq 21$); and the number of other physicians at the primary practice site ($0 = \geq 4$, $1 = \leq 3$). The dummy variables were used to test for significant differences in the mean level of attitudes or subjective norms toward use across the split sample. Interaction terms were created with the dummy variables to test for differences between the regression coefficients across the median splits.

RESULTS

One hundred and eight physicians provided useable responses (54%). To test for non-response bias, a comparison of early and late responders on the practice characteristics did not reveal any significant differences (13). The respondents, on average, cared for 24 patients daily, practiced with 9 other physicians at their primary place of practice, and started 13 patients on H_2 antagonists during the previous month. Additional descriptive information can be found elsewhere (18).

Determinants of Attitudes

The majority of the drug information sources were positively affected by one of the appraisals and several of the attributes (see Table 1). The amount of variance explained in attitudes toward use of the drug ranged from .33 to .69. The tables include both standardized and unstandardized regression coefficients, so that results can be compared within and between the regression equations. Degree of *usefulness* was a significant, positive determinant for all of the drug information sources, except one (medical textbooks). The degree of usefulness either alone (for physician colleagues), or with quality of information on harmful effects (for the PDR, medical journals/newsletters, and pharmacists), and with the quality of information on drug efficacy (for pharmaceutical manufacturers' representatives) was a positive determinant of attitudes. Availability, along with the quality of information on harmful effects, was a positive predictor of attitudes toward use for medical textbooks, but was a negative predictor ($b = -.24$)along with degree of usefulness and quality of information on drug efficacy for pharma-

Table 1. Effects of Appraisals and Attributes on Attitudes[a]

Information Source	Attitudes toward Act[b] = EOU β[c]	+	USF β	+	HM β	+	DE β	+	AV β	R^2
Physicians' Desk Reference (n = 85)[d]	.06 (.10)		.36*** (.45)		.40** (.25)		−.04 (−.04)		.05 (.03)	.34***
Medical Textbooks (n = 87)	.04 (.05)		.11 (.15)		.37** (.28)		.23 (.16)		.26** (.21)	.34***
Medical Journals/ Newsletters (n = 87)	.07 (.08)		.47*** (.50)		.37*** (.28)		.18 (.12)		.03 (.02)	.52***
Pharmaceutical Manufacturers' Literature (n = 89)	.09 (.09)		.62*** (.63)		.14 (.09)		.26** (.18)		−.24** (−.15)	.64***
Pharmaceutical Manufacturers' Representatives (n = 89)	−.03 (−.03)		.73*** (.75)		.01 (.01)		.26** (.16)		−.03 (−.01)	.69***
Physician Colleagues (n = 87)	.10 (.14)		.37*** (.42)		.18 (.16)		.12 (.09)		.05 (.04)	.33***
Pharmacists (n = 83)	.07 (.07)		.27*** (.30)		.59*** (.40)		−.01 (−.01)		.21 (.14)	.55***

[a] *$p \leq 0.10$; **$p \leq 0.05$; ***$p \leq 0.01$.
[b] EOU = Ease of Use; USF = Usefulness; HM = Harmful Effects; DE = Drug Efficacy; AV = Availability.
[c] β = Unstandardized regression coefficient. Standardized regression coefficients are in parentheses.
[d] n's are less than 108 due to listwise deletion of missing data.

ceutical manufacturers' literature. When past behavior (b = .20) was added to the analysis (not shown in tables), it was only significant with degree of usefulness (b = .32), and quality of information on harmful effects (b = .33) in predicting attitudes toward the use of the PDR. *Ease of use* did not have any significant effects on attitudes toward use of any of the drug information sources.

Determinants of Subject Norms

Ease of use alone, or with other appraisals and attributes, had significant effects on subjective norms toward use, for the majority of sources (see Table 2). It was a significant, positive predictor along with the degree of usefulness and the quality of information on harmful effects for subjective norms toward use of the PDR and medical textbooks. Ease of use, along with the quality of information on harmful effects, was a significant predictor for medical journals/newsletters, and with the degree of usefulness and quality of information on drug efficacy for pharmaceutical manufacturers' literature. It was also a significant determinant for subjective norms toward use for physicians colleagues (b = .21). Degree of usefulness was the only significant determinant for pharmaceutical manufacturers' representatives (b = .33). None of the appraisals or attributes had significant effects on subjective norms toward use of the pharmacist. The regression equation for physician colleagues was not significant, and the amount of variance explained by the equations ranged from .14 to .37. The addition of past behavior to the analyses did not change the results. Next, the moderating effects of the practice characteristics are presented.

Number of Patients Seen Daily

The significance of the dummy variables (means or intercepts) and the interaction terms (slopes), obtained from the dummy variable regressions were examined to determine the moderating effects of the practice characteristics. The number of patients cared for daily had several moderating effects on attitudes and subjective norms toward use (see Table 3). Significant differences across the mean levels of attitudes or subjective norms toward use were found for the PDR, pharmaceutical manufacturers' representatives and pharmacists (significant differences across the median split are noted by the "+" signs in the tables). Those physicians who saw more patients had more positive attitudes toward the PDR and pharmaceutical manufacturers' representatives, but had a greater feeling of colleague disapproval toward use of the pharmacist. In comparison to the non-moderated analysis, ease of use significantly affected attitudes toward use. It had a positive effect on attitudes for those who saw fewer patients for the PDR (b = .26) and physician colleagues (b = .23), while it had a negative, non-significant effect on attitudes for this group for medical journals/ newsletters (b = −.04).

Other effects on attitudes toward use that were moderated by the number of patients seen daily included degree of usefulness, availability (Table 3) and past behavior (not shown in

Table 2. Effects of Appraisals and Attributes on Subjective Norms[a]

Information Source	Subjective norms[b] = EOU β[c]	+ USF β	+ HM β	+ DE β	+ AV β	R^2
Physicians' Desk Reference (n = 85)[d]	.24** (.25)	.31** (.26)	.46* (.19)	−.12 (−.07)	.27 (.12)	.23***
Medical Textbooks (n = 87)	.17* (.16)	.20* (.21)	.55** (.32)	.07 (.04)	.11 (.07)	.28***
Medical Journals/ Newsletters (n = 87)	.29** (.23)	.09 (.07)	.49* (.25)	.16 (.07)	−.05 (−.03)	.19***
Pharmaceutical Manufacturers' Literature (n = 89)	.21* (.18)	.34*** (.31)	−.07 (−.04)	.60*** (.38)	−.00 (−.00)	.37***
Pharmaceutical Manufacturers' Representatives (n = 89)	.14 (.13)	.33*** (.31)	.17 (.09)	.34 (.19)	.07 (.04)	.31***
Physician Colleagues (n = 87)	.21* (.19)	−.23 (−.17)	.23 (.13)	.19 (.09)	−.20 (−.11)	.08
Pharmacists (n = 83)	.09 (.09)	.07 (.07)	−.10 (−.06)	.27 (.17)	.34 (.21)	.14**

[a] $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$.
[b] EOU = Ease of Use; USF = Usefulness; HM = Harmful Effects; DE = Drug Efficacy; AV = Availability.
[c] β = Unstandardized regression coefficient. Standardized regression coefficients are in parentheses.
[d] n's are less than 108 due to listwise deletion of missing data.

table). Once again, the degree of usefulness of a drug information source was a significant determinant of attitudes for all of the sources (except medical textbooks). The only significant difference for usefulness across the median split was for those physicians who cared for more patients daily; the perceived degree of usefulness of pharmacists had a large, positive effect on attitudes (b = .51). For those physicians who cared for fewer patients, availability had a positive effect on attitudes toward the PDR (b = .44) (negative and non-significant otherwise), and a negative, non-significant effect on medical journals/ newsletters (b = −.19) (positive and significant otherwise). Past behavior (b = .51) was a significant, positive predictor for attitudes toward use of the PDR for those who saw more patients, but negative for those who saw fewer patients (b = −.05).

Turning to subjective norms toward use of the drug, one appraisal and two attributes significantly differed across the split sample. Significant differences across the split samples were found for the quality of information on harmful effects for the PDR, the degree of usefulness of medical textbooks, and the availability of medical journals/newsletters (Table 3). Seeing more patients daily translated into positive effects for the quality of information on harmful effects (b = 1.0) and the degree of usefulness (b = .22), and negative effects for availability (b = −.53) of a drug information source. Ease of use of a drug information source was a significant determinant of subjective norms toward use, but none of the coefficients differed significantly across the split samples. In addition, past behavior did not have any significant effects on subjective norms toward use.

Number of Other Physicians at Practice Site

Only two differences were found for this practice characteristics in the mean levels of attitudes. This was for attitudes toward pharmaceutical manufacturers' representatives and literature (see Table 4). Those physicians who worked with fewer physicians had more positive attitudes toward these two sources than those who worked with more physicians. This practice characteristic did not moderate any of the mean levels of subjective norms toward use.

When examining the moderating effects on the appraisals and attributes, working with fewer physicians had positive effects on attitudes for ease of use of medical textbooks (b = .25), medical journals/newsletters(b = .23), quality of information on harmful effects for pharmaceutical manufacturers' literature (b = .42) and quality of information on drug efficacy for manufacturers' representatives (b = .50), while working with more physicians had negative effects. No significant differences across the median split were found for degree of usefulness and availability for any of the drug information sources.

A greater number of moderating effects of this practice characteristic was found for the individual components for subjective norms toward use (see Table 4). Working with fewer

Table 3. Moderating Effects of the Number of Patients Seen Daily on Attitudes and Subjective Norms Toward Use[a,b]

Information source	N[d]	Median split[e]	Attitude toward Act[c] = Mean (SD)	EOU β[f]	+ USF β	+ HM β	+ DE β	+ AV β	R^2	Subjective norms = Mean (SD)	EOU β	+ USF β	+ HM β	+ DE β	+ AV β	R^2
Physicians' Desk Reference	46	≤21	4.7^{++} ±1.6	.26*** (.36)$^{++}$	.35*** (.43)	.60** (.35)	−.15 (−.12)	.44** (.27)$^{++}$	.48***	4.6 ±2.2	.30** (.30)	.54*** (.49)	−.07 (−.03)$^{+}$	−.08 (−.05)	.38 (.17)	.35***
	36	≥22	5.5^{++} ±1.5	−.05 (−.09)$^{++}$	.28** (.34)	.51** (.36)	.05 (.04)	−.16 (−.12)$^{++}$	.35**	4.4 ±2.4	.13 (.14)	−.07 (−.05)	1.0** (.43)$^{+}$	.13 (.06)	.34 (.15)	.29*
Medical Textbooks	46	≤21	5.2 ±1.5	.14 (.20)	.05 (.07)	.25 (.20)	.16 (.12)	.37** (.30)	.31***	4.2 ±2.1	.09 (.09)	.35*** (.35)$^{+}$	.52 (.30)	.32 (.17)	.05 (.03)	.43***
	38	≥22	5.2 ±1.9	−.11 (−.12)	.13 (.16)	.35 (.25)	.50 (.34)	.24 (.18)	.46***	3.7 ±2.1	.37** (.36)	.22 (.23)$^{+}$	.31 (.19)	−.19 (−.11)	.10 (.07)	.25*
Medical Journals/ Newsletters	46	≤21	5.7 ±1.2	−.04 (−.05)$^{++}$	.35*** (.42)	.29 (.19)	.15 (.10)	−.19 (−.16)$^{+}$	.30***	5.3 ±1.7	.22 (.18)	.09 (.08)	.46 (.21)	−.05 (−.02)	.37 (.21)$^{++}$	.14
	38	≥22	5.7 ±1.4	.14** (.17)$^{++}$	.58*** (.56)	.31** (.25)	.14 (.10)	.20* (.15)$^{+}$	.80**	4.7 ±2.1	.33* (.28)	.33 (.22)	.25 (.13)	.44 (.22)	−.53* (−.27)$^{++}$	.33**
Pharmaceutical Manufacturers' Literature	47	≤21	3.6 ±1.6	.16 (.16)	.55*** (.57)	.15 (.09)	.25 (.18)	−.17 (−.11)	.61***	4.2 ±1.8	.24* (.22)	.40*** (.37)	−.13 (−.07)	.57*** (.38)	.19 (.11)	.44***
	39	≥22	4.2 ±1.9	.03 (.03)	.68*** (.66)	.19 (.12)	.24 (.16)	−.32* (−.19)	.68***	4.5 ±2.1	.16 (.13)	.27 (.25)	.04 (.02)	.65*** (.39)	−.23 (−.13)	.32**
Pharmaceutical Manufacturers' Representatives	47	≤21	3.4^{+} ±1.8	.13 (.14)	.60*** (.63)	.14 (.09)	.25 (.17)	−.18 (−.11)	.64***	4.0 ±2.0	.34** (.34)	.33** (.31)	.39 (.22)	.26 (.16)	−.33 (−.19)	.48***
	39	≥22	4.2^{+} ±2.0	−.09 (−.09)	.89*** (.91)	−.29 (−.14)	.17 (.09)	.06 (.03)	.81***	4.1 ±2.2	.03 (.03)	.25 (.23)	−.04 (−.02)	.32 (.16)	.50 (.24)	.22
Physician Colleagues	47	≤21	5.6 ±1.0	.23** (.34)$^{++}$	.27*** (.37)	.21 (.20)	.01 (.01)	.05 (.05)	.29***	5.0 ±1.8	.15 (.13)	−.23 (−.18)	.49 (.27)	−.43 (−.18)	−.33 (−.19)	.11
	37	≥22	5.7 ±1.3	−.04 (−.05)$^{++}$	.59*** (.55)	.09 (.07)	.20 (.15)	.01 (.01)	.43***	4.6 ±2.0	.33* (.31)	−.21 (−.14)	−.38 (−.21)	.93* (.50)	−.33 (−.18)	.18
Pharmacists	43	≤21	5.1 ±1.5	.10 (.12)	.11 (.14)$^{++}$	.55* (.41)	−.09 (−.07)	.30 (.23)	.46***	4.9^{++} ±1.5	.05 (.06)	.13 (.16)	−.02 (−.02)	.23 (.17)	.40* (.31)	.29**
	37	≥22	4.5 ±2.0	.04 (.05)	.51*** (.51)$^{++}$	.53* (.33)	.04 (.02)	.06 (.04)	.69***	4.0^{++} ±2.1	.13 (.13)	.03 (.03)	−.50 (−.28)	.49 (.29)	.31 (.17)	.10

[a] $^{*}p \leq 0.10$; $^{**}p \leq 0.05$; $^{***}p \leq 0.01$.
[b] Significant differences between subgroups are denoted with plus signs; $^{+}p \leq 0.10$ across ≤ 21 ≥ 22; $^{++}p \leq 0.05$ acros ≤ 21 ≥ 22; $^{+++}p \leq 0.01$ across ≤ 21 ≥ 22.
[c] EOU = Ease of Use; USF = Usefulness; HM = Harmful Effects; DE = Drug Efficacy; AV = Availability.
[d] N's are less than 108 due to listwise deletion of missing data.
[e] Based on median value of the number of patients seen daily.
[f] β = Unstandardized regression coefficient. Standardized regression coefficients are in parentheses.

Table 4. Moderating Effects of the Number of Physicians at Primary Practice Site on Attitudes and Subjective Norms Toward Use[a,b]

			Attitude toward Act[c] =								Subjective norms =							
Information source	N[d]	Median split[e]	Mean (SD)	EOU β[f]	+	USF β	+	HM β	+	DE β	+	AV β	R^2	Mean (SD)	EOU β	+	USF β	+	HM β	+	DE β	+	AV β	R^2
Physicians' Desk Reference	34	≤3	5.5 ±1.4	.05 (.09)		.24* (.31)		1.0*** (.50)		−.18 (−.14)		.00 (.00)	.41***	4.6 ±2.4	.31* (.31)		−.18 (−.13)$^{++}$		1.66*** (.48)		−.03 (−.01)		.05 (.03)	.28*
	48	≥4	4.7 ±1.7	.08 (.11)		.42*** (.50)		.14 (.10)		.04 (.03)		.21 (.11)	.34***	4.5 ±2.2	.27** (.28)		.61*** (.54)$^{++}$		.07 (.04)		−.18 (−.10)		.78** (.29)	.44***
Medical Textbooks	35	≤3	5.3 ±1.6	.25* (.30)$^{++}$		.10 (.14)		.09 (.07)		.65* (.42)		−.05 (−.05)	.38***	4.7 ±2.1	.34* (.32)$^{+}$		.08 (.08)		.40 (.23)		−.07 (−.04)		.49 (.31)	.32**
	49	≥4	5.1 ±1.7	−.07 (−.09)$^{++}$		.21** (.26)		.42* (.30)		.13 (.09)		.37** (.28)	.45***	3.6 ±2.1	.05 (.05)$^{+}$		.31** (.31)		.50 (.29)		.11 (.06)		−.04 (−.03)	.31***
Medical Journals/ Newsletters	35	≤3	5.4 ±1.4	.23** (.26)$^{+}$		.25* (.28)		.32* (.24)		.44* (.29)		.15 (.12)	.55***	5.1 ±2.0	.18 (.14)		−.35* (−.27)		.73** (.38)$^{+}$		1.26*** (.58)$^{+++}$		−.27 (−.14)	.51***
	49	≥4	5.8 ±1.2	−.08 (−.10)$^{+}$		.64*** (.68)		.39** (.29)		.11 (.08)		−.05 (−.04)	.64***	5.0 ±1.8	.44*** .38		.13 (.09)		.44 (.22)$^{+}$		−.41 (−.20)$^{+++}$		−.02 (−.01)	.21*
Pharmaceutical Manufacturers' Literature	36	≤3	4.6^{++} ±1.7	.00 (.00)		.51*** (.53)		.42* (.30)$^{++}$		.26 (.18)		−.29 (−.18)	.63***	4.9 ±1.9	.24 (.20)		.06 (.06)		.36 (.23)		.42 (.26)		−.23 (−.13)	.25
	50	≥4	3.4^{++} ±1.7	.13 (.14)		.76*** (.81)		−.02 (−.03)$^{++}$		.01 (.01)		−.09 (−.07)	.72***	3.9 ±1.9	.17 (.16)		.55*** (.52)		−.43* (−.23)		.49** (.31)		.17 (.10)	.48***
Pharmaceutical Manufacturers' Representatives	36	≤3	4.7^{+++} ±1.8	−.09 (−.09)		.77*** (.81)		−.21 (−.12)		.50** (.33)$^{++}$		−.06 (−.04)	.80***	4.8 ±2.0	.09 (.09)		.06 (.06)$^{+}$		.71 (.38)		−.08 (−.05)		.00 (.00)	.16
	50	≥4	3.1^{+++} ±1.7	.08 (.09)		.71*** (.79)		.05 (.03)		−.01 (−.01)$^{++}$		−.02 (−.02)	.68***	3.6 ±2.0	.12 (.12)		.51*** (.49)$^{+}$		−.07 (−.04)		35 (.20)		.14 (.08)	.42***
Physician Colleagues	35	≤3	5.5 ±1.4	.08 (.11)		.38** (.40)		.19 (.15)		.15 (.08)		.07 (.06)	.32**	4.7 ±2.0	.17 (.16)		−.30 (−.23)		−.13 (−.07)		1.70*** (.66)$^{+++}$		−.33 (−.14)	.35**
	49	≥4	5.7 ±1.0	.12 (.18)		.35*** (.44)		.17 (.17)		.11 (.10)		.01 (.01)	.31***	4.9 ±1.8	.36** (.31)		−.18 (−.13)		.49 (.28)		−.45 (−.25)$^{+++}$		−.57** (−.29)	.19*
Pharmacists	34	≤3	4.1 ±1.8	.15 (.18)		.35** (.38)		.23 (.16)		.33 (.22)		−.02 (−.01)	.58***	4.1 ±2.0	.32 (.33)		−.23 (−.22)		−.49 (−.29)		.94** (.54)		−.01 (.00)	.27
	46	≥4	5.4 ±1.5	−.00 (−.00)		.19 (.22)		.78*** (.54)		−.30 (−.22)		.41* (.25)	.46***	4.8 ±1.7	−.04 (−.04)		.24 (.24)		.28 (.17)		−.22 (−.14)		.51* (.28)	.22*

[a] $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$.
[b] Significant differences between subgroups are denoted with plus signs; $^{+}p \leq 0.10$ across $\leq 3 \geq 4$; $^{++}p \leq 0.05$ across $\leq 3 \geq 4$; $^{+++}p \leq 0.01$ across $\leq 3 \geq 4$.
[c] EOU = Ease of Use; USF = Usefulness; HM = Harmful Effects; DE = Drug Efficacy; AV = Availability.
[d] N's are less than 108 due to listwise deletion of missing data.
[e] Based on median value of the number of other physicians at primary practice site.
[f] β = Unstandardized regression coefficient. Standardized regression coefficients are in parentheses.

physicians produced a negative effect on subjective norms toward use for the degree of usefulness of the PDR (b = −.18), while it was positive for working with more physicians (b = .61). Working with fewer physicians also had a large, positive effect on subjective norms for ease of use of medical textbooks (b = .34), and quality of information on harmful effects (b = .73) and on drug efficacy (b = 1.26) for medical journals/newsletters. Working with more physicians had a larger, positive effect for degree of usefulness of manufacturers' representatives (b = .51), but had a smaller, negative effect for quality of information on drug efficacy of physician colleagues (b = −.45), when compared to those physicians who worked with fewer physicians. No significant differences across the median split were found for availability and past behavior.

Number of Patients Started on H_2 Antagonists

Significantly different means between the groups were found for attitudes toward the use of medical journals/newsletters, and subjective norms toward the use of the PDR, medical journals/newsletters, physician colleagues, and pharmacists (see Table 5). In each case, those physicians who started fewer patients on an H_2 antagonist during the past month either had more positive attitudes, or felt greater colleague approval of the information sources than those who started more patients.

Moderating effects on attitudes toward use could be seen when examining the regression coefficients for several of the drug information sources. Ease of use significantly affected only two drug information sources, but only one had significant effects across the median split. Starting fewer patients on H_2 antagonists had a positive effect on attitudes for pharmacists (b = .18), while starting more patients had negative effects. The degree of usefulness had significant effects on all of the information sources, but significant differences were only found for physician colleagues. Those physicians' attitudes toward use who started more patients on H_2 antagonists were more positive than those who started fewer patients. The effects of quality of information on harmful effects and on drug efficacy, and availability did not differ across the split samples.

In comparison to attitudes, a greater number of significant differences were found when examining the effects of the individual components on subjective norms (Table 5). Starting more patients on an H_2 antagonist had a larger, and more significant positive effect for ease of use on subjective norms toward each of the sources(except manufacturers' representatives) than those who started fewer patients. Starting fewer patients on an H_2 antagonist had negative effects on availability for physician colleagues (b = −.50) and pharmacists (b = −.04). The addition of past behavior to the analyses did not lead to any other significant differences.

Although not specified in the objectives, another practice characteristic that may have an important relationship with past behavior is years since graduation from medical school. Years since graduation from medical school was found to moderate the relationship for the effects of past behavior on subjective norms toward the use of pharmacists. For those physicians who graduated since 1975, past behavior had a negative effect on subject norm (b = −.48), while for those who graduated earlier the effect was positive, but non-significant (b = .36).

DISCUSSION

The overall purpose of this study was to determine if a specific set of appraisals and attributes could be used as antecedents of decision-making. More specifically, we wanted to determine if a set of appraisals and attributes—analogous to those found in the literature on diffusion of innovations and physician prescribing behavior but specifically formulated to apply to the health setting—could be used to explain physician attitudes and subjective norms toward the use of drug information sources. Research in the diffusion of innovation suggests general categories of antecedents. Our study specified and tested a small number of fundamental antecedents of particular relevance to the use of sources of drug information by physicians. Prior research using the theory of reasoned action indicates that attitudes and subjective norms are predictors of physicians' intention to use selected sources of drug information, but an understanding of the mechanisms behind their use is needed (13). Identification of a set of appraisals and attributes that are practical can be used as a guide to improve physician information seeking behavior. Our results indicate that meaningful antecedents can be generated that may prove useful in furthering our understanding of physicians' use of drug information sources.

In general, our antecedents explained a large amount of variance in attitudes. Over 50 percent of the variance in attitudes toward medical journals/newsletters, pharmacists, and pharmaceutical manufacturers' literature and representatives was explained by the appraisals and attributes in the model. Specifically, the perceived degree of *usefulness* of a drug information source was an important determinant of attitudes toward use. It had the largest effect on pharmaceutical manufacturers' literature and representatives. Pharmaceutical manufacturers may be interested in further exploring the concept of usefulness as a method in which to improve physician attitudes toward their products.

Quality of information also had varying effects depending upon the type of information sought. Physicians tended to look for information on harmful effects in more "traditional" sources (i.e. the PDR, medical textbooks and journals/newsletters), while information on drug efficacy was sought out in pharmaceutical manufacturers' literature and representatives. This finding is of particular importance given the fact that a recent study found that 11 percent of the statements made by manufacturers' representatives were inaccurate (12).

The quality of information on harmful effects positively affected physicians' attitudes toward the use of pharmacists. This finding supports prior research which indicates that pharmacists are looked to as knowledgeable sources of information on adverse effects (20,21). Pharmacists may represent an unbiased source of information, hence the positive effects found herein.

Availability was also a determinant of attitudes toward use. Interestingly, it had a negative effect on pharmaceutical manufacturers' literature. In light of the previous findings regarding the quality of information on drug efficacy, it seems physicians view pharmaceutical manufacturers' representatives and literature differently than other sources of drug information. Physicians see these two sources as having good information on the efficacy of a drug; however, their easy availability does not mean that either source will be used extensively. In light of these findings, if they want their materials to be used more,

Table 5. Moderating Effects of the Number of Patients Started on H_2 Antagonists During the Past Month on Attitudes and Subjective Norms[a,b]

Information source	N[d]	Median split[e]	Attitude toward Act[c] = Mean (SD)	EOU β[f]	+ USF β	+ HM β	+ DE β	+ AV β	R^2	Subjective norms = Mean (SD)	EOU β	+ USF β	+ HM β	+ DE β	+ AV β	R^2
	50	≤10	4.7	.01	.27**	.38	.10	.20		4.7^{+}	.08	.46***	.24	−.19	.33	
Physicians'			±1.6	(.02)	(.33)	(.22)	(.09)	(.14)	.26**	±2.2	(.09)$^{+}$	(.42)	(.10)	(−.11)	(.17)	.20*
Desk																
Reference	35	≥11	5.4	.19**	.42***	.27	−.28	−.28		4.2^{+}	.50***	.09	.70*	−.02	.07	
			±1.5	(.30)	(.54)	(.19)	(−.22)	(−.19)	.55	±2.5	(.49)$^{+}$	(.07)	(.30)	(−.01)	(.03)	.41***
	51	≤10	5.1	.04	−.00	.21	.46	.25		4.2	−.05	.10	.44	.59	−.21	
Medical			±1.6	(.05)	(−.01)	(.15)	(.32)	(.20)	.31***	±2.1	(−.05)$^{+++}$	(.10)	(.24)	(.33)	(−.13)	.32***
Textbooks	36	≥11	5.4	.02	.24**	.42**	.07	.24		3.8	.57***	.24*	.56**	−.53*	.31	
			±1.6	(.02)	(.34)	(.36)	(.06)	(.20)	.45***	±2.1	(.53)$^{+++}$	(.26)	(.36)	(−.30)	(.19)	.53***
Medical	53	≤10	5.8^{++}	.07	.36***	.42**	.07	.09		5.4^{++}	.13	.10	.43	.02	.11	
Journals/			±1.1	(.09)	(.44)	(.33)	(.05)	(.08)	.45***	±1.7	(.11)$^{+}$	(.08)	(.21)	(.01)	(.07)	.11
Newsletters	34	≥11	5.5^{++}	.11	.63***	.24	.34*	−.05		4.6**	.52***	.11	.36	.50	−.04	
			±1.5	(.12)	(.60)	(.17)	(.23)	(−.03)	.68***	±2.1	(.43)$^{+}$	(.08)	(.19)	(.25)	(−.02)	.42***
Pharmaceutical	53	≤10	3.8	.03	.64***	.04	.31**	−.21		4.3	.04	.46***	−.19	.57**	.10	
Manufacturers'			±1.8	(.02)	(.66)	(.02)	(.21)	(−.13)	.68***	±1.9	(.04)$^{++}$	(.44)	(−.10)	(.37)	*(.06)	.43***
Literature	36	≥11	4.2	.19	.59***	.18	.23	−.24		4.5	.52***	.10	−.06	.64**	−.01	
			±1.7	(.19)	(.56)	(.13)	(.15)	(−.14)	.58***	±1.9	(.43)$^{++}$	(.09)	(−.04)	(.38)	(−0.1)	.40***
Pharmaceutical	53	≤10	3.5	−.02	.71***	.17	.16	.04		4.0	.14	.41***	.20	.45	−.07	
Manufacturers'			±2.0	(−.02)	(.73)	(.10)	(.10)	(.02)	.74***	±2.2	(.13)	(.39)	(.11)	(.25)	(−.04)	.43***
Representatives	36	≥11	4.3	−.05	.72***	−.27	.33	−.16		4.3	.21	.18	.00	.26	.19	
			±1.7	(−.05)	(.73)	(−.15)	(.21)	(−.10)	.61***	±1.9	(.21)	(.16)	(.00)	(.15)	(.10)	.15
	52	≤10	5.6	.09	.25***	.27*	.16	−.00		5.1^{+}	−.04	−.35**	.51*	−.05	−.50**	
Physician			±1.0	(.12)	(.35)$^{++}$	(.24)	(.12)	(−.00)	.28***	±1.8	(−.03)$^{+++}$	(−.30)	(.28)	(−.02)	(−.28)$^{++}$	.20*
Colleagues	35	≥11	5.6	.10	.70***	.10	−.04	.07		4.5^{+}	.42**	.02	−.06	.46	−.10	
			±1.4	(.14)	(.62)$^{++}$	(.08)	(−.03)	(.06)	.49***	±1.9	(.40)$^{+++}$	(.01)	(−.03)	(.24)	(.06)$^{++}$	.21
	51	≤10	4.9	.18*	.30**	.56**	.19	−.06		4.8^{+}	−.05	.12	.27	.12	−.04	
Pharmacists			±1.7	(.20)$^{+}$	(.32)	(.39)	(.12)	(−.04)	.61***	±1.7	(−.05)$^{++}$	(.13)	(.18)	(.07)	(−.02)$^{+}$	.09
	32	≥11	4.9	−.18	.15	.86**	−.17	.59**		4.1^{+}	.45**	.03	−.52	.36	.54*	
			±1.7	(−.19)$^{+}$	(.18)	(.56)	(−.13)	(.39)	.58***	±1.9	(.43)$^{++}$	(.03)	(−.31)	(.24)	(.33)$^{+}$	.43***

[a] $*p \leq 0.05$; $**p \leq 0.05$; $***p \leq 0.01$.

[b] Significant differences between subgroups are denoted with plus signs; $^{+}p \leq 0.10$ across ≤ 10 ≥ 11; $^{++}p \leq 0.05$ across ≤ 10 ≥ 11; $^{+++}p \leq 0.01$ across ≤ 10 ≥ 11.

[c] EOU = Ease of Use; USF = Usefulness; HM = Harmful Effects; DE = Drug Efficacy; AV = Availability.

[d] N's are less than 108 due to listwise deletion of missing data.

[e] Based on median value of the number of patients started on H_2 antagonists during the past month.

[f] β = Unstandardized regression coefficient. Standardized regression coefficients are in parentheses.

pharmaceutical manufacturers may wish to attempt to better balance the information on drug efficacy with information on harmful effects.

Subjective norms toward use of the sources of drug information were affected by each of the appraisals and attributes (except availability). Ease of use and degree of usefulness emerged as significant determinants for many of the sources. Quality of information on harmful effects was the largest determinant for medical textbooks and medical journals/newsletters, while the quality of information on drug efficacy was the largest determinant for pharmaceutical manufacturers' literature. Subjective norms toward the use of the pharmacist was not predicted by any of the appraisals or attributes, and only ease of use emerged as a significant determinant for physician colleagues. Either other unmeasured characteristics influence colleague approval, or subjective normative reactions constitute global, undifferentiated responses with respect to pharmacists and physician colleagues.

Past behavior did not have any main effect on subjective norms toward use for any of the sources of drug information. Its only main effect was on attitudes toward use for the PDR. This suggests that past behavior may not be very instructive for determining attitudes or colleague approval for certain sources of drug information. Interestingly, for those physicians who have been in practice a shorter period of time, past behavior had a negative effect on colleague approval toward the use of pharmacists. It is not clear why this group of physicians would view pharmacists in this manner. As stated previously, further investigation is needed into these effects.

Turning to the moderating effects of the practice characteristics, differences were found in the mean levels of attitudes and subjective norms for several of the drug information sources. Negative attitudes were expressed toward pharmaceutical manufacturers' literature and representatives by those physicians who examined fewer patients and worked with more colleagues. Sources of drug information such as medical journals, pharmacists, etc. were viewed more positively and had greater colleague approval by those physicians who had less experience with H_2 antagonists. These findings suggest that, for those physicians who had less experience with the target class of medication, greater reliance is placed on drug information sources, rather than clinical experience when making prescribing decisions. It may be that seeing fewer patients and working with more colleagues leave physicians more time to read and evaluate these drug information sources.

When examining the differences across the regression coefficients, findings varied. In many cases, significant differences across the split samples were in opposing directions. For example, caring for fewer patients and working with fewer colleagues was associated with more positive attitudes toward adopting the source for ease of use of the PDR, physician colleagues, medical textbooks and medical journals/newsletters, while negative effects were found for these same factors for physicians who cared for more patients, and worked with a greater number of colleagues. A similar pattern emerged for the moderating effects of the practice characteristics on subjective norms toward use. Starting more patients on H_2 antagonists during the past month was associated with greater colleague approval for ease of use of medical textbooks, physician colleagues, and pharmacists, while for those physicians starting fewer patients, less colleague approval was found. These findings suggest that the effects of practice characteristics may be more complex than indicated by previous studies (9–11). Further investigation is needed into the manner in which these and other practice characteristics moderate the utilization of drug information sources.

The results of this study are limited by the use of primary care physicians from one HMO. Therefore, the findings may not generalize to all physician populations. In addition, some of the regression results of the moderating effects may have been affected by the small sample size. It is suggested that these analyses be repeated with a larger number of physicians in a variety of HMO's.

CONCLUSIONS

As a way to improve upon the theory of reasoned action and apply it to pharmaceutical research, the purpose of this study was to determine if a specific set of appraisals (degree of usefulness and ease of use), attributes (quality of information on harmful effects and on drug efficacy, availability), and past behavior could be used to determine the antecedents of decision-making regarding physicians use of drug information sources. The *degree of usefulness* of drug information sources and *quality of information* provided on harmful effects tended to be the more important predictors of *attitudes* toward the use for several of the sources, while *ease of use* and *degree of usefulness* of the source were important predictors of *subjective norms*. *Practice characteristics* such as the number of patients seen daily, the number of other physicians at the primary practice site and experience with a similar class of medication moderated the effects of the appraisals and attributes on the sources of drug information. In many cases, moderated effects were in opposing directions. The findings of this study suggest that practical and non-abstract factors can be used to predict attitudes and subjective norms toward use. Further research is needed on other appraisals, attributes, and practice characteristics that can influence decision-making regarding physicians' use of drug information sources and improve the usefulness of the theory of reasoned action.

APPENDIX A: QUESTION FORMAT USED TO MEASURE DEGREE OF USEFULNESS, EASE OF USE, QUALITY OF INFORMATION ON HARMFUL EFFECTS AND DRUG EFFICACY, AND AVAILABILITY

Degree of Usefulness

Please express how *useful* each of the following would be if you were to use them anytime during the next month for obtaining information on Tionidine:

[Drug Information Source]

extremely not useful	1:	2:	3	4:	5:	6:	7:	extremely useful

Ease of Use (Reverse-Scored)

Please express how *easy* it would be to use each of the following anytime during the next month for obtaining information on Tionidine:

[Drug Information Source]

extremely easy to use	1:	2:	3	4:	5:	6:	7:	extremely difficult to use

Quality of Information on Harmful Effects

For Tionidine, please indicate how each of the following sources would rate on the topic listed below (circle number):

Harmful Effects (e.g., contraindications drug-drug interactions, adverse reactions)

[Drug Information] Source]	very low quality	1	2	3	4	5	very high quality

Quality of Information on Drug Efficacy

For Tionidine, please indicate how each of the following sources would rate on the topic listed below (circle number):

Drug Efficacy

[Drug Information] Source]	very low quality	1	2	3	4	5	very high quality

Availability

For Tionidine, please indicate how each of the following sources would rate on the topic listed below (circle number):

Availability of Source

[Drug Information] Source]	highly unavailable	1	2	3	4	5	highly available

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