Physicians, Pharmaceutical Sales Representatives, and the Cost of Prescribing

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Objective: To evaluate the influence of primary care physicians' attitudes toward and use of information provided by pharmaceutical representatives on prescribing costs in ambulatory practice.

Design: A mailed questionnaire collected information about physician demographic and practice characteristics and attitudes toward and use of information provided by pharmaceutical representatives.

Participants: Kentucky physicians practicing primary care adult medicine (family medicine, general practice, general medicine; n=1603).

Main Outcome Measure: Relative cost of prescribing, based on physician responses to treatment choices for ambulatory clinical scenarios in primary care. A multivariable regression model assessed predictive relationships between independent variables and prescription costs.

Results: Four hundred forty-six returned questionnaires were suitable for analysis. No significant differences were noted in age, gender, days worked per week, or years since graduation between responders and a sample of nonresponders. A significant positive correlation was found between physician cost of prescribing and perceived credibility, availability, applicability, and use of information provided by pharmaceutical representatives ($P<.01$, Pearson's Product-Moment Correlation Coefficient). Physicians in academic or hospital-based practice settings had significantly lower prescribing costs than physicians in nonacademic and nonhospital practices ($P=.001$, analysis of variance). Frequency of use of information provided by pharmaceutical representatives ($P=.01$, multiple linear regression) and the group practice setting ($P=.02$, multiple linear regression) remained significant, independent positive predictors of cost in the multivariable regression model.

Conclusions: Frequency of use of information provided by pharmaceutical representatives and the group practice, nonacademic and nonhospital setting may be associated with increased primary care physician prescribing costs.

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THE PHARMACEUTICAL industry plays an important role in research and development of new drugs. Once a new drug product is approved and marketing begins, the role of the industry changes from that of scientist to that of corporate promoter. This role change has prompted widespread concern about the potential for commercial influence in the relationship of the pharmaceutical industry with practicing physicians.[1-3]

The pharmaceutical industry uses various techniques to market new products, investing up to 40% of its revenue in promotional efforts.[4] Advertising in professional journals and direct mailing to physicians are widely used for dissemination of drug information. However, marketing by pharmaceutical sales representatives is currently the most expensive and widely applied method used by the pharmaceutical industry to promote drug products. In some Western countries, the pharmaceutical industry deploys one sales representative for every eight general practitioners.[5] These heavy marketing practices have raised concern regarding effects on physician decision making and, ultimately, the cost of prescribing.

Because the pharmaceutical industry's implicit goal is to increase sales of new and frequently more expensive agents, many practitioners and policy makers view the information provided by pharmaceu-

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MATERIALS AND METHODS

INSTRUMENT DEVELOPMENT

We developed a questionnaire to collect information for this study that consisted of five components: (1) physician demographics, (2) physician practice setting characteristics, (3) physician attitudes toward many common information sources (including pharmaceutical representatives), (4) physician use of information provided by those resources, and (5) three clinical management scenarios. The demographic component elicited the physicians' age, gender, hours worked per week, years in practice, and specialty. The practice setting characteristics component described the type of practice (solo, group, or academic or hospital based), community size, proportion of patients in the practice whose medications were paid for by a third-party payer, and physicians' awareness of any policy that limited their access to pharmaceutical representatives.

The physician attitudes component included items from a survey previously used by Connelly and colleagues[9] that assessed physician perceptions of information sources, including pharmaceutical representatives, used in clinical practice. Physicians were asked to rate the information provided by journals, texts and handbooks, clinical colleagues, and pharmaceutical representatives on three dimensions: their confidence in each source's correctness (credibility), how readily available the information is (availability), and the ease of applying the information to patient care (applicability). A five-point scale (ie, 5 represents most credible, 1, least credible) was used to rate each of the three dimensions. The attitudes component of the survey also included items from a study by McKinney and colleagues[10] that assessed agreement with statements focusing on physician perceptions of the educational value of pharmaceutical representatives and the extent to which physician interactions with them influence prescribing behaviors. In the fourth component, physicians were asked to rate how frequently they used each of these information sources in patient treatment (daily, weekly, monthly, yearly, or never).

The final component of the survey contained three case scenarios that presented common ambulatory problems seen in primary care: acute bronchitis, mild hypertension, and an uncomplicated urinary tract infection. Academic internists with extensive experience in treating each problem served as consultants in developing each case. Four choices of drug treatment for each problem were offered based on current recommendations of the literature, with widely varying costs but equal efficacy. The physicians were asked to indicate the percentage of the time they would choose each drug in each scenario and to choose from eight other considerations that might influence their choice (iatrogenic effects, side effects or drug allergies, cost to the patient, compliance with the dosage, restricted formulary, availability in local pharmacies, interactions with other medications, and patient requests for specific drugs). The five components were compiled into a four-page questionnaire that was piloted among general internists and chief residents in the Department of Medicine at the University of Kentucky, Lexington, and revised by means of that feedback to improve face validity.

DEPENDENT MEASURE

Choices of medications available for treatment of common ambulatory problems vary widely in costs, depending on the availability of generic equivalents and market forces. The relative cost of a course of a given treatment regimen may vary as much as 100-fold, so that even if a practitioner chooses the lowest-cost generic equivalent in most cases, the rare choice of an expensive drug may inordinately skew that practitioner's average cost of care. To normalize the dependent measurement (cost of prescribing) across the scenarios, we developed a relative value index in calculating the cost of prescribing for each physician.

Each drug choice for each case scenario was assigned a score based on its average wholesale cost to the pharmacist relative to the alternative drug choices for a complete course of antibiotic therapy or a 30-day supply of the antihypertensive agent.[11] The most expensive choices were given a score of +1, those of intermediate expense were given a score of 0, and the least expensive choices were given

tical sales representatives with suspicion. Despite this prevailing attitude, studies have shown that this information is used frequently by physicians in their daily practice.[6,7] Although there are reports that physician attitudes toward information provided by pharmaceutical representatives are positively associated with physician use of that information when prescribing,[8] little research is available relevant to the effect of that information on an important outcome, prescription costs. We investigated the effects of physician characteristics, practice environment characteristics, and physician attitudes toward and use of information provided by pharmaceutical representatives on the cost of prescribing for primary care physicians in Kentucky.

RESULTS

Of 1603 surveys originally mailed, 569 (35.5%) were returned. Of the returned surveys, 123 were excluded as unusable, leaving 446 usable questionnaires for analysis. No significant differences were noted in age, gender, hours worked per week, or years since graduation between responders and nonresponders (**Table 1**). A significantly larger proportion of general internists than general practitioners responded. Nearly two thirds of respondents practiced family medicine and one quarter were general internists. In comparison of the practice environment characteristics, no significant differences were noted between responders and nonresponders in physicians' group practices, in the size of the community served, or in the proportion of patients whose medications were covered by a third-party payer. However, significantly fewer solo practitioners responded, while a larger proportion of physicians practicing in academic or hospital settings responded.

Table 2 lists the mean responses of the physicians about their attitudes toward the educational value of pharmaceutical representatives and the extent to which the physicians believed that interactions with pharmaceutical representatives influence prescribing behavior. As pre-

a score of −1. For example, in the first scenario, the cost of each 10-day course of treatment for acute bronchitis was $2 (sulfamethoxazole-trimethoprim), $51 (amoxicillin–clavulanate potassium [Augmentin]), $61 (cefuroxime axetil [Ceftin]), or $3 (doxycycline), and the relative values assigned were −1, +1, +1, and −1. In the second scenario, the cost of a 30-day course of treatment for hypertension was less than $1 (hydrochlorothiazide), $29 (hydrochlorothiazide-triamterene [Maxzide-25]), $23 (sustained-release verapamil), or $8 (enalapril), and the relative values assigned were −1, +1, +1, and 0. In the third scenario, the cost of a 10-day course of treatment for an uncomplicated urinary tract infection was $2 (sulfamethoxazole-trimethoprim), $51 (norfloxacin [Noroxin]), $6 (cephalexin), or $41 (ciprofloxacin hydrochloride [Cipro]), and the relative values assigned were −1, +1, −1, and +1. The drug choices were randomly listed in each scenario, and the proportion of the time the physician prescribed each choice for each case (expressed in percentages) was multiplied by the drug's score and a total score was calculated for each scenario. The scores for the three scenarios for each physician were summed for a total cost of prescribing score. A constant (+3) was added to each total score to eliminate negative values, with a possible cost score of 0 to +6 for each physician.

SURVEY PROCEDURE

Survey materials included a cover letter, the four-page questionnaire, and a self-addressed, stamped return envelope. The cover letter included information to establish the credibility of the investigators, to outline the intent and importance of the research, and to assure confidentiality of participants and notify recipients that a research assistant would be contacting them about their participation. The survey packets were mailed to the target population, and a research assistant contacted all physicians on the mailing list by telephone to ensure receipt of the survey, offer assistance to the recipients, and encourage return of the survey. After the initial mailing and follow-up telephone contact, two additional mailings were sent to the nonresponding physicians.

A random sample of nonresponding physicians (n=91) was contacted, and information on physician and practice setting characteristics was collected to compare the demographic characteristics of nonresponding and responding physician.

TARGET POPULATION

The survey was mailed to all physicians in Kentucky with primary care specialties (family practice, general practice, and internal medicine), based on data supplied by the American Medical Association Master File (n=1603). Returned questionnaires were excluded from analysis if any of the following applied: (1) the survey was returned by the post office as undeliverable, (2) the physician had died or retired, (3) the physician indicated a practice other than those defined as primary care, (4) the physician indicated practicing a medical subspecialty, and (5) the physician was currently practicing as a resident in training.

ANALYSES

Univariate and bivariate analyses, including descriptive statistics, χ^2, Student's t test, and analysis of variance, were used to report and compare physician and practice characteristics and mean prescribing costs. Pearson's Product-Moment Correlation Coefficient was used to compare demographic characteristics of responders with nonresponders where appropriate to explore individual relationships of the dependent and independent variables. The dependent variable used was the cost of prescribing as measured by the cost index score of each physician according to their responses to the scenarios. Independent variables included physician characteristics, practice setting characteristics, physician attitudes toward pharmaceutical sales representatives, and use of information provided by pharmaceutical sales representatives. A multivariable linear regression model was then used to assess the predictive relationship between the independent and dependent variables. All results are reported with use of two-sided P values obtained with a commercially available computer program (SAS 6.07, SAS Institute Inc, Cary, NC).

viously observed in the academic setting,[10] physicians valued the information provided by pharmaceutical representatives but tended to favor banning presentations at their practice site. Of interest, physicians did not believe that promotional gifts affected their prescribing but disagreed with the statement, "I would have the same degree of contact with pharmaceutical representatives whether or not promotional gifts were distributed."

Mean responses to the perception of the credibility, availability, and applicability of information provided by pharmaceutical representatives on a five-point scale were essentially neutral (**Table 3**). Physician perception of the credibility of pharmaceutical representatives was positively correlated with their perception of both the availability of the information (r=.30, P<.001) and the applicability of the information (r=.38, P<.001). Availability of pharmaceutical representatives and applicability of their information also had a significant positive correlation (r=.54, P<.001).

Physicians indicated that they used information supplied by pharmaceutical representatives in their clinical practice: 5.4% daily, 31.3% weekly, 47.7% monthly, 14.4% yearly, and 1.1% never. Each of the three attitudinal measures was significantly correlated with the frequency of their use of pharmaceutical representatives as a source of information (credibility, r=.41, P<.001; availability, r=.30, P<.001; and applicability, r=.35, P<.001). Furthermore, cost of prescribing was significantly associated with positive attitudes toward pharmaceutical representatives as an information source (credibility, r=.14, P<.01; availability, r=.15, P<.01; and applicability, r=.15, P<.01). The frequency of use of pharmaceutical representatives as an information source was also associated with cost of prescribing (use, r=.23, P<.001). The physician characteristics of age, hours worked per week, and years since graduation were not correlated with cost of prescribing.

To assess other considerations that influenced the prescribing physicians' choice of drugs, the eight pos-

Table 1. Physician and Practice Characteristics of Responders and Nonresponders

	Responders (N=446)	Sample of Nonresponders (N=91)	P*
Age, y	47.5	49.5	NS
Gender, % M	87.3	89.0	NS
Hours worked per week	55.9	52.8	NS
Years since graduation	21.5	25.0	NS
Specialty, %			
Family medicine	62.8	68.9	NS
General practice	12.7	29.5	.001
Internal medicine	24.5	1.6	.001
Practice type			
Solo	46.0	60.4	.01
Group	42.6	36.3	NS
Academic/hospital	12.3	2.2	.01
Population of practice location, %			
<5000	16.9	17.2	NS
5000-15 000	27.2	33.3	NS
15 000-25 000	13.8	8.0	NS
25 000-35 000	7.5	5.7	NS
>35 000	34.7	35.6	NS
Patient medications covered by third-party payer, %	42.1	36.4	NS

*NS indicates not significant.

Table 2. Physician Attitudes Toward the Educational Value and Behavioral Influence of Pharmaceutical Representatives (PRs)

Item	Mean±SD Response*
Educational value	
PRs provide useful and accurate information about newly introduced drugs	3.59±0.83
PRs provide useful and accurate information about already established drugs	3.51±0.80
PRs perform an important teaching function where I practice	3.05±1.00
PRs help to support important conferences and speeches where I practice	3.87±0.83
PRs should be banned from presentations where I practice	4.21±0.88
Behavioral influence	
I would have the same degree of contact with PRs whether or not promotional gifts were distributed	2.00±0.83
Discussions with PRs affect my prescribing behavior	3.19±0.97
Acceptance of promotional gifts from PRs affects my prescribing behavior	1.79±0.78

*Agreement on a five-point scale: 5, strongly agree; 3, neutral; 1, strongly disagree.

Table 3. Physician Attitudes Toward Pharmaceutical Representatives as an Information Source

Item	Mean±SD Response*
Credibility	
How great is your confidence in the correctness of information?	2.76±0.81
Availability	
How easy is it to find needed information?	3.14±1.00
Applicability	
How easy is it to apply in your clinical practice to patient treatment?	3.17±1.00

*Agreement on a five-point scale; 1, not at all; 5, extremely.

sible selections were ranked from most frequently chosen to least frequently chosen among three categories of prescribers: low-cost prescribers, high-cost prescribers, and prescribers reporting frequent (ie, daily or monthly) use of information provided by pharmaceutical sales representatives. In all three categories, the three most frequently selected considerations were side effects or drug allergies, cost to the patient, and compliance with dosage. Cost to the patient was the most frequently chosen consideration among low-cost prescribers, with side effects or drug allergies and compliance ranking second and third. Conversely, both the high-cost prescribers and frequent users of pharmaceutical sales representatives' information chose side effects or drug allergies most frequently, cost to the patient second, and compliance third.

Analyses exploring the effect of practice environment characteristics on the cost of prescribing are shown in **Table 4**. Practitioners in academic or hospital-based settings had significantly lower prescribing costs than their counterparts in nonacademic and non–hospital-based settings ($P<.001$). No significant differences were noted between cost of prescribing and the other practice environment variables (ie, specialty, practice location, and proportion of patients whose medications were covered by third-party payers).

A multivariate model was constructed to explore further the independent variables as predictors of the cost of prescribing. In the first step of the regression analysis, variables measuring physician and practice environment characteristics were entered into the model. At this step, only practice type was significant in explaining variation in cost, but the overall model was not significant. Next, the physician attitudes toward and frequency of use of pharmaceutical representatives as a source of information were entered stepwise into the model. All were significant predictors of cost. Finally, the physician attitudes toward and use of pharmaceutical representative information were grouped and entered into the model in a hierarchical fashion (**Table 5**). After all independent variables were entered, and controlling for other considerations when the drugs were chosen, only frequency of use of the information and group practice setting remained significant, independent positive predictors of the cost of prescribing.

COMMENT

The pharmaceutical industry liberally supplies physicians with information about drug products. Pharmaceutical sales representatives are a common advertising method used to bring product information to physicians.[5] Marketing practices and the risk of the occurrence of ethically unsound relationships between individual physicians and the pharmaceutical industry have prompted major medical organizations to propose guidelines for physician interactions and acceptance of gifts from the pharmaceutical industry.[12-14] These policies ad-

Table 4. Cost of Prescribing Comparisons for Physician and Practice Characteristics

Category	Mean Cost of Prescribing Index*
Specialty	
Family medicine	2.90
General practice	2.94
Internal medicine	2.80
Practice type	
Solo	2.94
Group	2.97
Academic/hospital	2.41†
Population of practice location	
<5000	2.83
5000-15 000	2.83
15 000-25 000	3.11
25 000-35 000	2.67
>35 000	2.91

*Possible range of scores, 0 to 6.
†P<.001 by analysis of variance.

Table 5. Multivariable Regression Model for Independent Predictors of Prescription Costs*

Predictors	β	P
Physician characteristics: age, gender, hours worked, years since graduation, specialty	...	NS
Practice characteristics: practice location, medication covered by third-party payer	...	NS
Practice type (group)	.460	.02
Physician attitudes toward PRs		
Credibility	.097	NS
Availability	.067	NS
Applicability	.015	NS
Frequency of use of PR-supplied information	.155	.01

*NS indicates not significant; PR, pharmaceutical representative.

dress ethical considerations of these interactions but do not directly address a second concern—the effect of these interactions on costs of physician prescribing. Heavily marketed prescription medications are often more expensive than generic drugs of equal efficacy; therefore, the use of this information may increase health care costs.

Numerous studies have shown that information provided by the pharmaceutical industry is frequently used by practicing physicians. Surveys of general practitioners have reported that physicians respond favorably to pharmaceutical representatives in their role of answering questions in relation to marketed products.[15-17] In an early study by Avorn and colleagues,[18] physicians who used heavily marketed drugs more frequently than over-the-counter preparations of equal efficacy relied on industry sources of information instead of scientific data when prescribing. In 1987, Stross[7] confirmed that pharmaceutical representatives were often the major source of information used by physicians in his report about information sources used in treating patients admitted for acute exacerbations of chronic obstructive pulmonary disease.

Physician attitudes toward the credibility, availability, and applicability of information provided by pharmaceutical representatives have previously been linked to physician use of that information. Becker and associates[8] found that physicians who had more appropriate prescribing habits viewed pharmaceutical representatives as unreliable sources of prescribing information. McKinney and colleagues[10] reported that most faculty and residents surveyed in an academic internal medicine environment believed that physicians are at risk of being influenced by accepting gifts from the pharmaceutical industry; however, both groups believed that their discussions with pharmaceutical representatives did not have any influence on their personal prescribing behavior. The majority of both groups agreed that presentations by pharmaceutical representatives should be eliminated at their institutions.

Earlier studies suggest that detailing by the pharmaceutical industry may influence physician prescribing; however, the influence of the information on cost of prescribing has not previously been measured. Furthermore, these studies have not adequately addressed the diversity of medical practices in the United States today. Alternative modes of reimbursement, variations in medical practice settings, physician characteristics, and diversity in institutional policies all may affect physician-industry interactions and influence the use of information provided by pharmaceutical representatives.

The physicians in our sample reported that pharmaceutical representatives provide useful and accurate information about drugs and also help support important conferences and speeches in their practices. Physicians also reported that they believed that acceptance of promotional gifts from pharmaceutical representatives did not affect their own prescribing behavior. Despite these attitudes, most agreed that pharmaceutical representatives should be banned from presentations in their practices. These findings coincide with the previous study that measured academic physicians' attitudes toward the educational value and behavioral influence of pharmaceutical representatives.[10]

Not surprisingly, physicians' attitudes toward the credibility, availability, and applicability of information provided by pharmaceutical representatives were highly correlated with each other. Each of these attitudes was also individually correlated with physician use of pharmaceutical representatives as a source of information. Furthermore, physicians' attitudes toward the credibility, applicability, and availability, as well as use, of information provided by pharmaceutical sales representatives all had significant positive correlation with cost of prescribing in the bivariate analyses. These associations suggest that physicians' attitudes toward and use of pharmaceutical representative information may influence the cost of prescribing.

Physician and practice environment characteristics had little effect on the cost of prescribing. Academic or hospital-based practitioners tended to have lower costs of prescribing than private practitioners, although this may result from restricted formulary availability to institutionally based practitioners. Other measures of physician or practice environment characteristics, including age, hours worked per week, years since graduation, proportion of patients with medications covered by third-

party payers, specialty, and practice location (rural vs urban) were unassociated with the cost of prescribing. Physicians in this sample who prescribed lower-cost drugs ranked cost to the patient as the number 1 consideration that influenced their choice. Conversely, higher-cost prescribers and those who reported more frequent use of information provided by pharmaceutical sales representatives ranked side effects or drug allergies as the number 1 consideration when they chose drugs. Although direct inferences from these data are not possible, consideration of side effects is frequently emphasized in drug detailing, and this finding may be an indicator of successful detailing of frequent users of information provided by pharmaceutical sales representatives. These data also suggest that such detailing may increase costs of prescribing by deemphasizing consideration of costs when a drug is selected.

In the multivariable analyses, only the use of the information provided by pharmaceutical representatives and the group practice setting were independent positive predictors of prescribing costs. This finding persisted after controlling for physician characteristics, other practice environment characteristics, and physicians' attitudes toward pharmaceutical representatives as information sources in the regression model. Physicians' attitudes were not independently predictive of costs, likely because of their significant positive associations with each other and with the use of the information.

Several limitations must be emphasized when the implications of these findings are considered. This study relied on physician responses to a survey; therefore, we could study only a limited number of case scenarios, with limited treatment choices and self-reported measures of prescribing practices. Generalizability may also be limited because this survey involved only physicians in a limited region (Commonwealth of Kentucky). Kentucky does, however, provide a reasonable mix of primary care physicians in urban, suburban, and rural locations in a variety of practice settings, which we found in our demographic analysis of the respondents. Our sample may underrepresent general and solo practitioners, so generalization of the findings to these practices must be interpreted with caution.

Nevertheless, our findings support concerns that increased frequency of use of information provided by pharmaceutical sales representatives may increase the cost of physician prescribing, at least in certain populations and for certain conditions. These apparent influences may provide the rationale for the pharmaceutical industry's costly, aggressive marketing practices in current use. Additional research will be required to characterize further the possible influences of pharmaceutical representatives on the actual costs of physician prescribing for a wide variety of clinical problems, as well as the role of practice setting and physician education in mediating these effects. In the interim, our data emphasize the need for physicians to evaluate carefully their use of information supplied by pharmaceutical representatives in light of the need to reduce inefficient expenditures for medical care.

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