Prescription-Writing Patterns and Errors in a Family Medicine Residency Program

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Copies of 1814 prescriptions written by 20 residents were reviewed to determine prescribing patterns and the incidence of prescription-writing errors. An average of 0.69 prescriptions were written per patient visit at an average cost (to the pharmacist) of $13.35. Over one third of all prescriptions were written using the generic name, and "dispense as written" was specified on only 3.25%. On average, 21% (n = 373) of all prescriptions collected contained at least one prescription-writing error. Errors were characterized as omissions (6%), unfulfilled legal requirements (1%), incomplete directions (1%), dose or direction errors (3%), unclear quantity to be dispensed (3%), or prescriptions written for nonprescription products (5%). A correct diagnosis and treatment plan can be undermined by a written prescription that is incorrect or miscommunicates the intention of the prescriber.

The prescription order is the most frequent outcome of the outpatient physician visit. An estimated 61% of patient visits for a new medical problem will result in the patient receiving at least one prescription.[1] The prescription is a written communication between the physician and pharmacist, ultimately extending to the patient. Thus, the most carefully made therapeutic decision may be rendered useless unless the prescription communicates clearly to the pharmacist the intent of the prescriber and adequately instructs the patient on the use of the prescribed medication.

Prescriptions containing errors communicate incompletely or inadequately to the pharmacist and may have various detrimental consequences. Some errors will require the pharmacist simply to use additional professional judgment in the interpretation and execution of the prescription. Omissions may require further communication between pharmacist and physician or at worst may prevent the patient from receiving the medication at all.

The function of a residency program is to afford young physicians the opportunity to gain clinical experience and develop correct habits under the supervision of the faculty. Development of the ability to write complete, unambiguous prescriptions consistently is an essential, yet often neglected, part of this training process. Several investigators have evaluated prescribing patterns of residents in family practice residency programs.[2–5] None, however, has reported or evaluated prescription-writing errors. The purpose of this study was to describe the prescription-writing habits of physicians in a family medicine residency program and to develop criteria for categorizing and evaluating prescription-writing errors.

METHODS

This study was conducted in a university-affiliated outpatient family medicine teaching center where faculty, residents, and patients are assigned to and remain in one of four independent practice groups within the center. Demographic characteristics of the patients of the teaching center are presented in Table 1.

All prescription blanks in the office consist of an original and a carbonless copy. As part of an earlier project, all physicians in two of the four practice groups (n = 20) retained copies of all their written prescriptions. These copies were collected and processed by pharmacy personnel. Only residents in these two groups were included in the current study, as their habit of saving prescription copies was well

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TABLE 1. CHARACTERISTICS OF THE PATIENT POPULATION (N = 5324)

Characteristics	Percent
Race	
Black	68.4
White	30.0
Other	1.6
Sex	
Female	56.6
Male	43.4
Insurance coverage	
None	46.6
Medicare, Medicaid, private	53.4
Distribution by age group (years)	
<5	10.1
5–14	18.0
15–44	52.5
45–64	11.0
>65	8.5

established. These prescription copies were used to obtain the prescription-writing data for this study.

All copies of written prescriptions were collected over a 4-month period, from July 1 through October 31, 1987. Telephoned prescriptions and prescriptions for medications for in-office use were not included. Once collected, each prescription was numerically coded for future identification. For each prescription the following data were recorded: (1) generic name of the product, (2) therapeutic category, (3) physician, (4) whether the generic or brand name was used, and (5) whether it was signed "dispense as written" or "substitution permitted." The average wholesale price for the actual product and quantity prescribed was calculated using computerized price calculation software.[6]

Each prescription was evaluated by a clinical pharmacist for prescription-writing errors. Determination of what constituted an error was based on requirements outlined by Swinyard,[7] the Health Care Financing Administration Indicators for Assessing (Medicaid) Drug Reviews,[8] and Drug Enforcement Administration and South Carolina state prescription requirements.

Specific error categories, defined in Table 2, include (1) omissions (incomplete prescriptions), (2) dose or direction contrary to accepted recommendations, (3) unfulfilled legal requirements, (4) a prescription written for a proprietary product, (5) quantity to dispense unclear or inappropriate, or (6) incomplete directions. Complete directions for use of a medication include the quantity to be taken, route of administration (if other than oral), frequency of dosing, and, ideally, the reason for taking the product. The directions "take as directed" or specifying that the prescription should be taken "as needed" (prn) without stating the purpose for which the medication is needed were considered to be incomplete directions.

Some exceptions were made, using professional judgment, to provide a fair evaluation of the prescription in light of the drug prescribed. For example, it is common practice to prescribe oral contraceptives to be taken "as directed," and this instruction was not deemed to be an error. Prescriptions for insulin (insulin is available over the counter but requires a prescription for insurance payment) were not counted as a prescription for a nonprescription product. An error was tallied, however, if a product was available as both a prescription and a nonprescription item with different names, such as miconazole, which is available as a 2% cream as prescription-only Monistat-Derm and nonprescription Micatin.

Data were tabulated using dBase III PLUS software[9] and analyzed using Minitab Data Analysis Software.[10] Cost data were analyzed using a one-way analysis of variance, and error frequencies were compared using the chi-square statistic.

RESULTS

Prescribing Patterns

Over the 4-month period, 1814 copies for prescriptions written during 3633 patient visits were collected. This number represents an average of 0.69 prescriptions written at each patient visit. The number of prescriptions written per visit increased with each year of training, as outlined in Table 3.

The acquisition cost (average wholesale price) was calculated for each prescription. If the brand name was prescribed, this cost was used even if the prescription was signed "substitution permitted." The average cost per prescription was $13.35, ranging from $0.05 for a 1-week supply of generic reserpine to $139.59 for a 3-month supply of sulindac. Average prescription costs increased with each successive residency year, though the difference was not statistically significant ($F = 1.976$, $P = .1389$).

On the average, 34% of all prescriptions were written using the generic name. For brand products available generically, 45% of these prescriptions were written using the generic name, whereas only 11% of prescriptions for products without a generic component were written generically.

In South Carolina a two-signature-line prescription blank is required, allowing the physician to specify either "dispense as written" (DAW) or "substitution permitted" by signing on the left or right line, respectively. Since prescriptions are traditionally signed in the right bottom corner, those signed on the left (DAW) are usually the

TABLE 2. ERROR CATEGORIES

Error	Description
Omissions	So designated if any following components are not present. Major omissions prevent pharmacist from executing prescription without further contact with prescriber. Minor omissions prevent pharmacist from executing prescription unless further information is obtained from patient or prescriber; may require the pharmacist to exercise professional judgment in interpretation of prescription
Major omissions	Drug name, strength (if more than one available), quantity to dispense (unless it can be calculated from the *signa*)
Minor omissions	Patient name, date of prescription (coded as legal error if not present on controlled substances), directions for use, physician signature (coded as legal error if not present on controlled substances)
Dose or direction error	So judged if, relying on information presented on prescription, dose or directions substantially differ from normal standards, including specifying dosage forms not commercially available or doses in excess of manufacturer or literature recommendations
Legal requirements not met	Based on federal and state laws and statutes, eg, (1) failure to include all information, (2) specifying refills on Class II controlled substance prescriptions, (3) specifying more than five refills on Class III-V controlled substances, (4) prescribing more than a 30-day supply or 120 dosage units for Class II-V controlled substances, (5) failing to imprint name stamp on prescription (required for all study site prescriptions)
Prescription written for a nonprescription product	A nonprescription item ordered by prescription or a prescription written for a prescription product for which an identical nonprescription product is available. Exceptions are insulin and insulin syringes, which usually require a prescription for insurance payment or reimbursement
Unclear quantity prescribed	A nonstandard quantity or a quantity open to interpretation specified, eg, one tube, one bottle, or trade size, when more than one size is available. May require more communication between pharmacist and physician, or may result in the pharmacist making unqualified decisions as to amount to dispense
Incomplete ("as directed" or "prn") directions	If *signa* consists of "take as directed" or the sole instruction "as needed" (prn) is used without stating purpose for which prescription is to be taken. Exception made for oral contraceptives

result of a conscious effort to specify the brand-name product. Overall, residents signed DAW on 3% of all prescriptions. First-year residents signed DAW on 12% of all prescriptions, whereas second-year residents exercised this option 0.68% of the time, and third-year residents 4%.

The drugs and drug classes most frequently prescribed by the study physicians are compared with national data[1] in Table 4. These 10 products most frequently prescribed by the study physicians accounted for 30% of all prescriptions written. Five drugs were common to both lists.

Prescription-Writing Errors

Figure 1 depicts the frequency of each error type identified among the collected prescriptions. Of all prescriptions collected, 21% (n = 373) contained at least one error. Prescriptions with omissions accounted for 39% of those with errors and 5% of all prescriptions. Only a small percentage

TABLE 3. PRESCRIBING CHARACTERISTICS, BY RESIDENCY YEAR

Characteristics	Residency Year 1	2	3	Total
Number of visits	259	1001	1368	2628
Number of prescriptions	90	589	1135	1814
Prescriptions per visit	0.35	0.59	0.83	0.69
Error rate*	22.20	27.20	17.27	20.78
Average cost (AWP) ($)	10.93	12.72	13.87	13.35
Cost range ($)	(0.15–54.00)	(0.12–139.59)	(0.02–139.59)	(0.02–139.59)
DAW specified*	12.22	0.68	3.88	3.25
Generic name used†	38.10	49.88	44.80	44.80

** Percentage of total prescriptions written*
† Frequency of prescribing by generic name when a generic produce was available
AWP—average wholesale price
DAW—Dispense as written

TABLE 4. MOST FREQUENTLY PRESCRIBED DRUGS

All Study Residents	Nationally
Individual Drugs	
1. Hydrochlorothiazide	1. Hydrochlorothiazide
2. Amoxicillin	2. Amoxicillin
3. Ibuprofen*	3. Erythromycin
4. Erythromycin*	4. Codeine
5. Clotrimazole	5. Penicillin
6. Hydrochlorothiazide-triamterene†	6. Digoxin
7. Metronidazole†	7. Furosemide
8. Sulindac	8. Trimethoprim
9. Diltiazem	9. Ibuprofen
10. Miconazole	10. Triamterene
Drug class	
1. Antibiotics, oral	1. Antibiotics
2. Diuretics	2. Antihypertensive or vasodilating agents
3. Nonsteroidal anti-inflammatory agents	3. Nonsteroidal anti-inflammatory agents
4. Cardiovascular agents	4. Diuretics
5. Antihypertensive agents	5. Cardiovascular agents

**Tie between ibuprofen and erythromycin*
†Tie between hydrochlorothiazide-triamterene and metronidazole

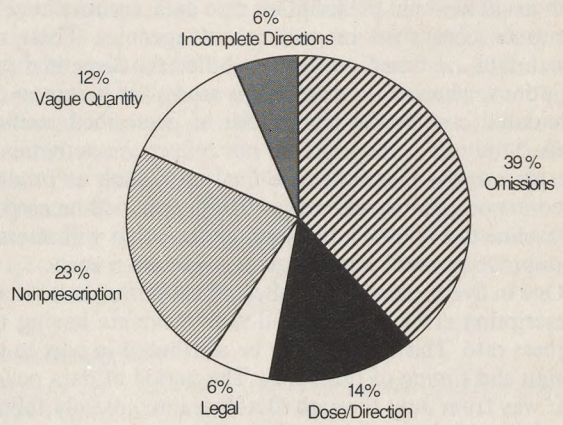

Figure 1. Breakdown of errors, all residents

of prescriptions (1%) did not meet necessary legal requirements.

Omission errors were further characterized as being of either major or minor importance. Major omissions were sufficient to prevent the pharmacist from executing the prescription. Thirty-three prescriptions, constituting about 2% of the sample, contained major omissions. Failure to specify drug strength was the most common omission. All major omissions would require the pharmacist to contact the physician. Minor omissions required the pharmacist to obtain additional information from the patient or exercise professional judgment, and would not necessitate contact with the physician. Examples included omission of the patient name, physician signature, date (if this was omitted from a controlled substance, it was considered a legal error), or failing to specify 21- or 28-day packet of contraceptives. Two thirds (n = 68) of omissions were characterized as minor.

Of the 87 prescriptions written for nonprescription products, 73 were written for products that have no prescription-only counterpart, eg, bacitracin topical ointment. Fourteen prescriptions were written for prescription-only products that are available under other names without a prescription.

Errors in dosage or directions or incomplete directions were found in 117 (6%) of the study prescriptions. They were roughly divided equally between dose or direction error (n = 54) and the use of as-directed or prn directions without the purpose stated (n = 63).

The quantity to be dispensed was unclear on 49 prescriptions (3%). While prescriptions with an unclear quantity prescribed are not usually a health hazard, they can lead to confusion and increased patient cost. This categorization commonly resulted from specification of non-trade-size topical preparations or liquid antibiotics, or quantities not matching the directions (eg, take 1 tablet 3 times a day for 10 days, dispense #40).

Differences in error rates by residency year were also compared and are shown in Figure 2 ($\chi^2 = 25.11$, $P < .0001$).

DISCUSSION

The prescribing behaviors of residents in this family practice residency program are similar to those identified for physicians in other family medicine programs[2–5] and to habits nationwide.[1] The frequency with which drugs were prescribed by their generic name was much higher when the generic product was available than when the prescription was for a single-source product (45% vs 11%).

That over one third of all prescriptions were written using the generic name may reflect the philosophy generally advocated in medical school pharmacology courses that the generic name should be used when prescribing. The much more frequent use of generic names when prescribing multiple source products, however, may be due to cost consciousness on the part of the prescriber.

The average cost per prescription cannot be compared with usual national prescription cost data accumulated by insurance companies or government agencies. These national data are based on the cost billed for dispensed prescriptions, whereas data from this study are based on the calculated cost to the pharmacist of prescribed medications. Study data therefore do not reflect the activities of the pharmacist that influence final cost, such as product selection or quantity alteration. These data will be used as a baseline to evaluate a teaching method that will attempt to improve resident knowledge of medication costs.

One in five prescriptions collected contained at least one prescription error, with second-year residents having the highest rate. This finding may be attributed in part to the design and timing of this study. The period of data collection was from July through October, immediately following the residents' transition from first- to second-year status. Thus during the study period the new second-year residents had moved from a primarily inpatient service to practice in the office setting, writing almost 10 times more prescriptions as the first-year residents. Third-year residents made fewer errors, perhaps because of the additional year of experience in the family medicine office.

Omission, or failure to provide enough information to the pharmacist, was the most frequent error. Omission errors cause the pharmacist, physician, and patient to waste time while the pharmacist calls the physician to complete the communication process. This category of errors decreased with each residency year, perhaps reflecting the role of experience in the development of prescribing habits.

That a considerable number of prescriptions were written for nonprescription products probably reflects the residents' lack of awareness that these products are available to the patient without prescription, although it is possible that the prescribers were trying to take advantage of the placebo effect of the written prescription. Several potential consequences occur when a prescription is written for a nonprescription item. Prescriptions requiring the time and expertise of a pharmacist will generally be associated with a higher cost to the patient than would a product selected off the pharmacy shelf. If the pharmacist does not process the prescription in the normal fashion, however, but directs the patient to the nonprescription item, the patient does not benefit from the directions on the prescription. Lastly, most insurance companies will not reimburse the patient or pharmacist for a nonprescription product even if a prescription was written. Thus, a prescription for a nonprescription product may generate ill will toward the physician or pharmacist when the patient is informed that he or she must pay for the product.

Dosage or direction errors on prescriptions were generated most frequently by third-year residents, a finding not expected in light of their increased experience. Perhaps

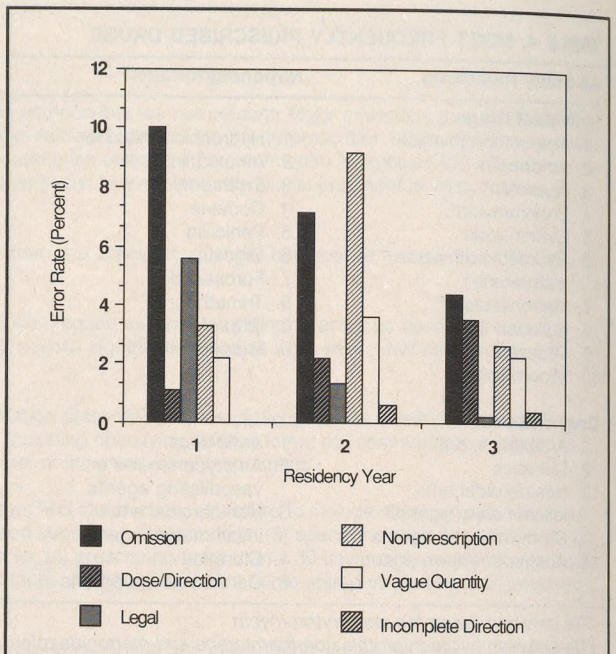

Figure 2. Error rates by resident year (percent of all prescriptions written)

expanded use of medications less familiar to them resulted in dosage errors.

Unfulfilled legal requirements prevent the prescriptions from being executed or may transfer liability to the pharmacist if the prescription is dispensed. Unclear or inappropriately prescribed quantities again may require further pharmacist-physician communication or result in increased cost to the patient.

No other studies of prescription-writing errors have been reported. Little and Layton[2] reported finding few prescription-writing errors in their evaluation of prescribing patterns in a family practice residency program, though their criteria for evaluating prescriptions and actual results were not reported. The criteria developed for use in this study may seem somewhat strict and unimportant; however, minor details that are omitted or unclear on prescriptions are important to the pharmacist, who often is required to make assumptions and decisions based on inadequate information. Since it is not always practical or possible to contact the prescriber each time a prescription is written incorrectly, the pharmacist may unintentionally dispense or label a prescription in a manner not intended by the prescriber. Thus every effort should be made to assure the development of proper prescription writing habits.

The criteria for evaluation of prescriptions were sufficiently rigid for only one reviewer to analyze the prescrip-

tions. A practicing pharmacist scrutinizes hundreds of prescriptions over the course of a day and over time becomes keenly aware of omissions or other errors. In addition, a 1-month pilot study was performed to allow the prescription reviewer to become accustomed to the criteria so that variability was decreased.

The design of this study may have had some influence on the results. Collection of prescription copies required the voluntary participation of the physicians, and some prescriptions were probably not evaluated. Except for first-year residents, however, all physicians in the study had been providing prescription copies for at least 1 year to allow pharmacy personnel to maintain the medication list in the patient record. This record-keeping service provided an incentive to the prescribers to supply the copies necessary for data collections.

Second, the criteria for evaluating prescription writing were developed to provide an efficient method of screening prescriptions for errors. The evaluation required only the prescription copy; no other patient information was necessary. In this way every prescription written could be reviewed, and those with errors could be returned to the prescriber in an attempt to influence future prescription writing.

Without the benefit of other patient information, this method of evaluation may lead to overreporting or underreporting of dosage or direction errors. Occasionally, a resident physician may need to deviate from accepted doses or regimens for a valid reason, though this deviation would be characterized as an error using these criteria. Conversely, inappropriate dosing may not be evident without obtaining patient information not found on the prescription. Assessing patient information to evaluate each prescription would be very time-consuming and would limit the usefulness of this screening.

CONCLUSIONS

Residency programs concentrate on furthering graduate physicians' skills of diagnosis and clinical decision making. Therapeutic drug selection is receiving stronger emphasis in residency training with the addition of clinical pharmacists to the teaching faculty. The development of clear and accurate prescription-writing habits, however, is often left to chance. At best, poor prescription writing results in time wasted on clarification. At worst, patient care suffers as a result of the inappropriate or suboptimal use of medications. The physician's effort in determining the correct diagnosis and then choosing the best medication for the patient and illness can be undermined by a written prescription that is incorrect or miscommunicates the intention of the prescriber.

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