

Analysis of Pharmacotherapy
Recommendations Provided
by Doctor of Pharmacy
Clerkship Students

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ABSTRACT. This study was undertaken to collect and evaluate the types of pharmacotherapy recommendations made by Pharm.D. students at the University of Georgia College of Pharmacy assigned to a general medicine clerkship. Objectives of the study were to: (i) teach pharmacy students how to identify, document, solve, and prevent medication-related problems; (ii) document the number and types of recommendations made by Pharm.D. students to physicians; (iii) determine the acceptance rate of these suggestions by the physicians;

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and (iv) determine the potential impact of students' recommendations on patient care. Each student was responsible for preventing or resolving patient medication-related problems, providing drug therapy information, and making appropriate pharmacotherapy recommendations. Approximately 90% of the recommendations were accepted by the general medicine team. Improper medication selection (28.7%) and untreated indications (21.3%) accounted for the majority of medication-related problems. The most frequently accepted pharmacotherapy recommendations involved anti-infective (28.7%), cardiovascular (18.1%), and gastrointestinal (17.0%) medications. Using Hatoum's criteria for assessing potential impact on patient care, approximately 70% of the accepted recommendations were judged to have a significant (59.6%) or very significant (10.6%) potential impact on patient outcomes. An average impact score of 2.08 was achieved. Future studies are needed to help develop innovative, reliable, and valid methodologies for teaching pharmacy students how to identify, document, solve, and prevent medication-related problems. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-342-9678. E-mail address: getinfo@haworth.com]

INTRODUCTION

If the profession of pharmacy expects to embrace the concept of pharmaceutical care (1,2), pharmacy educators and practitioners will need to teach pharmacy students how to practice patient-focused care and assume responsibility for patient outcomes. In light of this, one of the major emphases of a pharmacy education program should be to prepare students to provide patient-focused care in a variety of health-care settings, including acute-care populations. Clinical clerkship rotations in Doctor of Pharmacy (Pharm.D.) curriculums should provide an excellent opportunity for students to learn and practice pharmaceutical care under the direct supervision of an experienced clinical pharmacy preceptor. In addition, clerkship experiences afford pharmacy educators opportunities to determine the quality of pharmacy students' patient-care activities and the benefit of those activities to the patients involved.

Although the literature is replete with reports on the concept and importance of pharmaceutical care, little has been published describing the process and outcomes of teaching patient-focused care to pharmacy students (3-6). Therefore, the purpose of this study was to collect and evaluate the types of pharmacotherapy recommendations made by Pharm.D. students at the University of Georgia College of Pharmacy during acute care clinical clerkship rotations. Objectives of the study were to: (i) teach pharmacy

students how to identify, document, solve, and prevent medication-related problems; (ii) document the number and types of pharmacotherapy recommendations made by Pharm.D. students to physicians; (iii) determine the physician acceptance rate of these recommendations; and (iv) determine the potential impact of students' recommendations on patient care.

METHODOLOGY

Seven Pharm.D. students participated in the study. Six of the seven student volunteers were tracking Pharm.D. students; the remaining student was a post-B.S. student. During the period of September 1994 through March 1995, the seven students were assigned to a four-week rotation on a general medicine service at the Medical College of Georgia Hospital, a 540-bed tertiary-care teaching facility located in Augusta, Georgia. The students were asked to document all pharmacotherapy interventions made during the assigned rotation using a standardized pharmacy recommendation form (Appendix A).

Pharm.D. students made rounds daily with the general medicine teams and actively participated in patient-care discussions. Within 48 hours after hospital admission, each patient was interviewed by a Pharm.D. student and the patient's medical record was reviewed. The student's responsibilities, under the direct supervision of the preceptor, included identifying, resolving, and preventing medication-related problems, making therapeutic recommendations, and recommending dosage adjustments based on patient-specific pharmacodynamic and pharmacokinetic parameters. The students followed the patients throughout their entire hospitalization or until the end of the clerkship.

Throughout the four-week clerkship, Pharm.D. students kept a record of all medication-related problems and pharmacotherapy recommendations using a standardized pharmacy intervention form. Each day, the students presented their findings and pharmacotherapy assessments and recommendations, along with the patient's medical history, hospital course, health status, and therapeutic monitoring plan, to the pharmacy preceptor. If the preceptor concurred with a student's findings and recommendations, these were communicated by the student to the appropriate medicine intern or resident. The students documented on the standardized pharmacy intervention form whether the recommendations were accepted or rejected and recorded the clinical results of each accepted recommendation. The same form was used to record student responses to all drug information inquiries generated by the general medicine team.

All completed forms were given to the preceptors at the end of the

clerkship for data collection and analysis. Intervention codes were used to classify interventions into one of fifteen pharmacotherapy-related categories (Appendix A), and those pertaining to a medication-related problem were further classified into one of eight medication-related problems as defined by Strand (7) (Table 1). Drug information inquiries and pharmacotherapy recommendations were also grouped according to their appropriate medication classification.

Each accepted pharmacotherapy recommendation was independently ranked and scored by two preceptors as to its potential impact on patient care, using Hatoum's criteria (8) and the point scale illustrated in Table 2. The average significance score for all accepted recommendations was calculated by adding the significance scores of all accepted recommendations and dividing by the total number of accepted recommendations.

TABLE 1. Medication-related problem categories.^a

Untreated Indication	The patient has a medical problem that requires medication therapy (an indicator for medication use), but is not receiving a medication for that indication.
Improper Medication Selection	The patient has a medication indication, but is taking the wrong medication. This includes allergy to the medication and availability to a less expensive, equally effective medication therapy.
Subtherapeutic Dosage	The patient has a medical problem being treated with too little of the correct medication.
Failure to Receive Medication	The patient has a medical problem that is a result of his or her not receiving a medication.
Overdosage	The patient has a medical problem that is being treated with too much of the correct drug (toxicity).
Adverse Drug Reactions	A medical problem has the potential to develop, or has already developed, as the result of an adverse effect.
Medication Interactions	The patient has a medical problem that is the result of a drug-drug, drug-food, or drug-laboratory interaction.
Medication Use Without Indication	The patient is taking a medication for no medically valid indication, or a therapeutic medication duplication exists in which one medication should be effective.

^aDerived from Strand LM, Morley PC, Cipolle RJ, Ramsey RR et al. Drug-related problems: their structure and function. *DICP Ann Pharmacother*. 1990; 24:1093-7.

TABLE 2. Recommendation significance scale.

Score	Significance	Definition
-1	Adverse significance	Recommendation may lead to adverse outcomes.
0	No significance	Recommendation is informational (not specifically related to the patient in question).
1	Somewhat significant	Benefit of the recommendation to the patient could be neutral, depending on professional interpretation.
2	Significant	Recommendation would bring care to a more acceptable and appropriate level.
3	Very significant	Recommendation qualified by a potential or existing major organ dysfunction.
4	Extremely significant	Information qualified by a life-and-death situation.

RESULTS

The seven students who participated in the study made 105 recommendations and responded to 64 drug information inquiries in 75 general medicine patients. Of the 105 recommendations, 94 (89.5%) were accepted by the medical team. The most frequent type of interventions were related either to indication or the dose, frequency, or rate of drug administration (Table 3). Improper medication selection and untreated indications accounted for approximately one-half of the medication-related problems (Table 3). Among the medication classifications, the most frequently accepted recommendations were anti-infective (28.7%), cardiovascular (18.1%), and gastrointestinal (17.0%) agents (Table 4). The most frequent type of drug information questions asked were those related to anti-infective and analgesic medications (Table 5). Approximately 92 percent of the accepted recommendations were considered somewhat significant (11.7%) or significant (79.8%), with an average significance score of 2.08 (Table 6).

DISCUSSION

The primary purpose of this study was to evaluate the effects of teaching students to identify, document, solve, and prevent medication-related problems during a general medicine clinical clerkship. The seven Pharm.D.

TABLE 3. Medication recommendation category/intervention codes.

Type of Medication-Related Recommendations Intervention Codes	No. (%)
Improper medication selection	27 (28.7)
Duplication	7
Allergy	5
Route	12
Formulary vs. nonformulary	3
Untreated Indication	20 (21.3)
Indication	20
Subtherapeutic dosage	19 (20.2)
Dose/Frequency/Rate	19
Overdosage	18 (19.1)
Dose/Frequency/Rate	18
Adverse drug reaction	5 (5.3)
Adverse drug reaction	5
Drug-drug/drug-food interaction	5 (5.3)
Drug interaction	5
Total	94 (100.0)

students in this study actively participated in patient care by providing information to health-care practitioners and by identifying and resolving medication-related problems. Approximately 15 recommendations and 9 medication information consults were provided by each student.

Of the 105 pharmacotherapy recommendations that were made by the students, 94 were accepted. This acceptance rate of 89.5% is similar to the 85.5% reported in the literature for the acceptance of recommendations made by practicing pharmacists (9). Our acceptance rate of 89.5% also compares well with the 79 to 95 percent acceptance rates reported in earlier studies involving pharmacy students (6,3). Of the eleven recommendations that were not accepted, seven dealt with medications that consulting physicians had prescribed. The remaining four recommendations were for medications that were not on formulary at the Medical College of Georgia.

The finding in this study that medication-related problems most often involve anti-infective and cardiovascular drugs (Table 4) is consistent with other studies performed in the acute-care setting (3,10). These data suggest

TABLE 4. Medication classification of recommendations.

Classifications	No. (%)
Anti-infective	27 (28.7)
Cardiovascular	17 (18.1)
Gastrointestinal	16 (17.0)
Anticoagulants/Antiplatelets	7 (7.4)
Electrolyte, caloric, and water balance	7 (7.4)
Analgesics	6 (6.4)
Anxiolytics, sedatives, and hypnotics	4 (4.3)
Miscellaneous*	10 (10.6)
Total	94 (100.0)

* Miscellaneous classification includes hormones and synthetic substitutes, vitamins, anticonvulsants, antidiabetics, and chemotherapeutic and psychotherapeutic agents.

that patients on these medications should be targeted for more extensive pharmacotherapy monitoring.

The health care of patients can be improved by preventing therapeutic misadventures and by identifying and solving medication-related problems. Therefore, it is important to evaluate interventions according to their potential impact on the outcomes of patient care. To minimize bias, the potential impact of the interventions in this study was determined by the preceptors using Hatoum's scale (Table 2). Although the preceptors independently ranked each recommendation, 70 percent of the interventions (66 recommendations) were given identical numerical scores by the two preceptors, thus illustrating consistency in rating.

Similar to Briceland's study (6), more than 90 percent of the interventions in this study were classified as having a significant or somewhat significant impact on patient-care outcomes (Table 6). More than 8 percent of the recommendations were judged to have very significant or extremely significant impacts on patient care. According to the average accepted recommendation significance score of 2.08, most recommendations were considered to have a significant impact on patient outcomes as judged by the pharmacy preceptors. It is important to note that all recommendations

TABLE 5. Medication classification of information inquiries.

Classifications	No. (%)
Anti-infective	28 (43.8)
Analgesics	14 (21.9)
Cardiovascular	13 (20.3)
Gastrointestinal	5 (7.8)
Anxiolytics, sedatives, and hypnotics	2 (3.1)
Miscellaneous*	2 (3.1)
Total	64 (100.0)

*Miscellaneous classification includes hormones and synthetic substitutes, vitamins, anticonvulsants, antidiabetics, and chemotherapeutic and psychotherapeutic agents.

TABLE 6. Significance of recommendations.^a

Interval Score	Classification	No. (%)
1.0-1.9	Somewhat significant	28 (29.8)
2.0-2.9	Significant	56 (59.6)
3.0-3.9	Very significant	10 (10.6)
	Total	94 (100.0)

^aDerived from Strand LM, Morley PC, Cipolle RJ, Ramsey RR et al. Drug-related problems: their structure and function. *DICP Ann Pharmacother.* 1990; 24:1093-7.

in this study were prescreened through an experienced clinical practitioner, which may have inflated the ratings of the potential impact score.

In 1992, Anderson and colleagues reported that 34 percent of pharmacy departments felt that they did not receive tangible benefits from training pharmacy students, even though the college paid the practice site a fee for each student (11). Supported by the data in this study, we believe that although the primary purpose of clerkships is to teach students the practice of pharmacy, clerkship students can make contributions to patient care that are beneficial to both patients and institutions.

CONCLUSIONS

In order to assume responsibility for patients' therapeutic outcomes, it is mandatory that students be taught how to identify, document, solve, and prevent medication-related problems. This study provides additional evidence that students who are taught how to practice patient-focused care can make important pharmacotherapy contributions in the acute-care setting. The most important benefit for teaching the practice of pharmaceutical care is to positively influence students as future pharmaceutical care practitioners. Future studies should be directed toward measuring the impact of pharmaceutical care activities provided by students on patient outcomes.

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APPENDIX A

Standardized Pharmacotherapeutic Recommendation/Intervention Form

Pharmacy Department _____ Month/Day/Year _____
 Medical College of Georgia _____ Prepared by: _____
 Hospital & Clinics _____

Pharmacotherapeutic Interventions and Recommendations

Name	Pt #	Room #
Age / Sex / Wt	Diagnosis	Other pertinent information

Intervention Codes: (Check all that apply)

<input type="checkbox"/> Indication	<input type="checkbox"/> Length of tx	<input type="checkbox"/> Clarification / Incomplete Order
<input type="checkbox"/> Duplication	<input type="checkbox"/> Drug Interaction	<input type="checkbox"/> TPNIV Reformulation (compat)
<input type="checkbox"/> Allergy	<input type="checkbox"/> Adverse Drug Reactions	<input type="checkbox"/> Dosing / Therapeutic Monitoring
<input type="checkbox"/> Dose/Frequency/Rate	<input type="checkbox"/> Formulary vs Nonformulary	<input type="checkbox"/> Drug Information
<input type="checkbox"/> Route (po/IV)	<input type="checkbox"/> Less Expensive Alternative	<input type="checkbox"/> Other

Drug	Explanation of Problem
Physician: _____	Service: _____
Recommendation:	
Solicited / Unsolicited (Circle one)	
Outcome / Resolution: Accepted / Denied	
If denied, was reason acceptable? yes / no	
If denied, what was reason:	
Follow-up:	

Form created by Dianne B. Williams at the Medical College of Georgia, Drug Information Center, Augusta, Georgia.