

THE CLINICAL PHARMACIST AS APPLIED PHARMACOLOGIST ASSISTING
THE CLINICAL PHARMACOLOGIST IN INFLUENCING THE THERAPY OF
HOSPITALIZED PEDIATRIC PATIENTS

by

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A Thesis Submitted to the Faculty of the
DEPARTMENT OF PHARMACEUTICAL SCIENCES

In Partial Fulfillment of the Requirements
For the Degree of

MASTER OF SCIENCE
WITH A MAJOR IN PHARMACY

In the Graduate College
THE UNIVERSITY OF ARIZONA

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ACKNOWLEDGMENTS

The author wishes to thank Dr. Henry W. Winship for his guidance and the determination he displayed throughout this study.

The author also wishes to thank Dr. Philip Walson and Mr. Carl Trinca for their assistance and support during the clinical phase of this study.

Appreciation is expressed to the U. S. Army for making this study possible through its support and cooperation.

My special thanks goes to my wife, Susan, and my children, Alan Christopher and Charles, whose patience and understanding made possible the successful completion of this research.

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ABSTRACT

A study involving 100 hospitalized pediatric medical patients was conducted to document the ability of the clinical pharmacist to act as an applied pharmacologist and assist the pediatric clinical pharmacologist in providing drug information to attending pediatricians and influencing patient therapy. The pharmacist, acting as a member of the Department of Pharmacology, attended ward rounds and closely followed patient therapy. He attempted to provide all information requested by the attending team of pediatricians and identify all problems in therapy without involving the pharmacologist.

Regular meetings were held with the clinical pharmacologist in which the pharmacist made patient presentations and sought assistance in answering those requests for which he had been unable to provide sufficient information. The information provided by the pharmacist during the patient presentations was judged adequate for the clinical pharmacologist's evaluation of patient therapy 96.4 percent of the time. The pharmacist successfully answered 81.2 percent of the information requests and made 88.2 percent of the recommendations directed at change in therapy without involving the pharmacologist. The clinical pharmacist extended the influence of the pediatric clinical pharmacologist by acting as an applied pharmacologist and assisting in providing drug information to attending pediatricians and influencing the therapy of hospitalized pediatric patients. Five recommendations were made.

CHAPTER 1

INTRODUCTION

During the past 20 years research, product development and vigorous marketing by the pharmaceutical industry has placed a vast number of drugs at the disposal of the practicing physician. During this same time, however, the knowledge of therapeutics, adverse reactions and drug interactions has failed to keep pace with new developments in diagnostics, pharmacology, physiology, biochemistry and pathophysiology (Melmon and Morrelli 1972).

A new practitioner, the clinical pharmacologist, has appeared within the health profession to assume responsibilities in drug research and promote safer and more effective use of drugs in man. A clinical pharmacologist is a physician who is a specialist in the scientific study of drugs in man (Francke 1972). He has substantial training in pharmacology and clinical medicine with additional knowledge in physiology, biochemistry, genetics and biostatistics (World Health Organization 1970). While qualified for the position of drug strategist, both Francke (1972) and Walton (1974) feel that the effectiveness of the clinical pharmacologist has been reduced by the lack of adequately trained individuals. As a solution to this problem, a program whereby clinical pharmacologists would be supported by clinical pharmacists has been suggested as a means

of more effective manpower utilization (Francke 1972; Wardell 1974a, 1974b).

Pediatrics is an area of medical practice with an overwhelming shortage of information concerning therapeutics and drug action (Chudzik and Yaffe 1973). In addition to a critical shortage of pediatric clinical pharmacologists, drug legislation has reduced the number of clinical drug studies in pediatric patients so that most new pharmaceuticals are being marketed with labeling expressly cautioning against use in children (Shirkey 1972).

The lack of information on drug action and the failure of clinical drug studies to provide all of the necessary information for appropriate pediatric therapy have caused growing concern of both medical and legal significance among pediatricians. The question of whether to withhold potentially beneficial medications from children because of lack of study or whether to attempt treatment with drugs bearing prohibitive statements has arisen (Shirkey 1970). Questions concerning the effects of growth and development on drug absorption, excretion and metabolism and their significance in therapy must also be answered. Lockhart (1971) stated that increased availability of knowledge can provide an answer to this dilemma.

Data supporting the safety and effectiveness of medications in children are needed. It can be gained through appropriate clinical studies for new drugs and additional clinical trials and comprehensive surveillance for drugs currently marketed. Once available, however, this new information must be passed on to the pediatrician. As this

information is added to that already available on adverse reactions, drug interactions and new diagnostic procedures, it will become increasingly more difficult for the pediatrician to maintain rational therapy techniques. This type of investigation and information service is within the defined role of the clinical pharmacologist (World Health Organization 1970). However, inadequate resources have and will continue to curb the clinical pharmacologist's effectiveness (Walton 1974).

Purpose

The purpose of this study was twofold. First, it was to document the ability of the clinical pharmacist to act as an applied pharmacologist. Second, it was to document the ability of the pharmacist to assist the pediatric clinical pharmacologist in providing drug information to attending pediatricians and influencing the therapy of hospitalized pediatric patients.

Assumptions

It was assumed in this study that attending pediatricians request drug information from the pediatric clinical pharmacologist. It was also assumed that the clinical pharmacist and the pediatric clinical pharmacologist could by close observation of patient therapy identify problems and recommend solutions without specific request from the physicians.

Limitations

This study had three limitations. First, the patient population observed was limited to those patients admitted to the pediatric

medical service of the University Hospital, University of Arizona Medical Center. The therapy of patients admitted to other pediatric services was not closely observed and no patient data were maintained.

Second, the interns and residents of the attending staff were nine months into their pediatric clinical experience. Knowledge gained during this time may have altered the number and nature of the consultations involving the clinical pharmacist and clinical pharmacologist.

Third, any conclusions reached by this study apply only to the inpatient pediatric medical service the the University Hospital, University of Arizona Medical Center.

Definitions

1. Applied Pharmacologist: An applied pharmacologist was an individual with experience and training in the mechanisms of drug action who put to practical use his knowledge of biopharmaceutics, pharmacology, toxicology and the proper therapeutic applications of drugs.
2. Attending Staff: Attending staff was defined as the team of pediatricians with primary responsibility for the care and treatment of the patient. All members of the team including interns and residents were specializing in pediatrics. The team was headed by one or more faculty members from the Department of Pediatrics, College of Medicine referred to as attending physicians. It was further composed of a chief resident, residents, interns, and at times medical students.

3. Clinical Pharmacist: Clinical pharmacist meant a pharmacist with training and experience in drug safety, efficacy and therapeutics beyond that associated with the bachelor's degree.
4. Consultation: Consultation was defined as any discussion or conference in which the pharmacist or pharmacologist was involved in providing solicited or unsolicited information or advice. The initiator of a consultation was the individual who began the discussion by requesting information or assistance or providing unsolicited information or advice. Consultations were divided into four categories: pharmacological; therapeutic; pharmaceutical and diagnostic. Pharmacological consultations dealt with drug action, interaction or toxicology. Therapeutic consultations included those involving dosage, routes of administration, scheduling or the selection of the appropriate therapeutic agent. Pharmaceutical consultations were concerned with drug identification or the availability, strength or composition of dosage forms. Any discussion involving diagnostic procedures to define pathology, determine disease etiology, determine the need for medications or assess the effects of medications was termed diagnostic consultations.
5. Drug Information: Drug information was defined as knowledge concerning the composition, action, interaction, or proper therapeutic use of medications.

6. Drug Information: Drug information was defined as knowledge concerning the composition, action, interaction, or proper therapeutic use of medications.
7. Pediatric Clinical Pharmacologist: Pediatric clinical pharmacologist meant a pediatrician with advanced specialized education or experience in the scientific study of drugs.
8. Pediatric Patient: A pediatric patient was a patient 18 years of age or under admitted to the inpatient pediatric ward.

CHAPTER 2

RELATED LITERATURE

A review of Index Medicus, International Pharmaceutical Abstracts and Science Citation Index revealed that little literature has been published dealing with the direct relationship of clinical pharmacists and clinical pharmacologists. While information sources were provided on several aspects of clinical pharmacy practice, literature concerning pharmacists and pharmacologists was limited to discussions of the basic concept and the potential benefits of such an arrangement. Information concerning clinical pharmacy generally lacked documentable evidence of contributions to patient care. There were few articles dealing with pediatric clinical pharmacy. Other literature noting the limited nature of pediatric pharmacology provided background and insight into this problem.

Preliminary human drug studies in biochemistry, pharmacology, toxicology and clinical use are intended to determine the use, dosage, toxicity and effectiveness of the agents in question. Miller (1973) pointed out that drugs have been marketed and used without adequate knowledge of the efficacy or total clinical effects. Drugs prescribed even under normal use in medical practice have been responsible for unsuspected pharmacologic, idiosyncratic and adverse reactions. Lack of

effectiveness was emphasized when over three thousand prescription products marketed in the United States between 1938 and 1962 were reviewed by the Division of Medical Sciences of the National Academy of Science--National Research Council. In the final report seven percent of these medications were rated "ineffective" and the efficacy of many others could not be determined because sufficient information had not been supplied by the manufacturers (National Research Council, National Academy of Science 1969).

Legislative reaction to adverse drug effects in children was responsible for amendments to the Food and Drug Act in 1938 and 1962. The requirement for proof of safety in 1938 followed the sulfanilamide tragedy and proof of effectiveness was the result in 1962 of the thalidomide disaster. Clinical trials to determine safety and efficacy of drugs in adults have continued since 1962, but the failure to undertake such studies in the pediatric age group has produced a class of "therapeutic orphans." Drug manufacturers have marketed their products for adult use with labeling specifically excluding the pediatric patient. Pediatricians have been given the choice of withholding newer drugs from patients or attempting their use with little or no information (Shirkey 1970). Because changes during growth and development from infancy to adolescence alter drug absorption, distribution, metabolism and excretion, results from adult studies cannot be accurately applied to pediatrics. Children cannot be treated as small adults and doses reduced in proportion to size (Chudzik and Yaffe 1973). The Boston Collaborative Drug Surveillance Program, a comprehensive drug

surveillance system, has proven valuable in investigating a wide range of problems associated with the clinical effects of drugs. While the Boston Program has remained adult oriented, a pilot study in pediatrics confirmed suspected differences between children and adults in the type and number of drug exposures and reactions (Lawson et al. 1972).

Csaky (1973) discussed the changing curriculum for the education of both physicians and pharmacists. There has been declining emphasis on the basic sciences in preclinical medical instruction. This has resulted in physicians inadequately trained in the field of pharmacology, drugs and drug effects. At the same time there has been increased emphasis in pathology, pharmacology, therapeutics and clinical involvement in the pharmacy curriculum. The net result has been a class of pharmacy graduates with twice the exposure to pharmacology and therapeutics of medical students. Shirkey (1970) demonstrated a deficiency in the education of medical students and pediatric house officers. A questionnaire was sent to the chairmen of all university departments of pediatrics in the United States and Canada. Eighty-six percent of the chairmen responded. Only 35 percent indicated that their students and 49 percent that their house officers had been sufficiently trained in clinical pharmacology.

The World Health Organization (1970) outlined the scope of clinical pharmacology as consisting of four elements: promoting safer and more effective use of drugs in man; research; teaching and providing analysis, drug information and advice on experimental design. There has been an increasing demand over the past 20 years for this specialty in

education, medical practice and research, but there are relatively few trained clinical pharmacologists available (Wardell 1974a). Shirkey (1972) reported that only 11 pediatric departments in the United States offer fellowship training in pharmacology.

Proposals have been made to utilize the clinical pharmacist in supporting roles to maximize the efficiency of the clinical pharmacologist. Francke (1972) discussed the use of the pharmacist as an applied pharmacologist based on his increased education and training particularly in the area of biopharmaceutics and pharmacokinetics. In that respect the pharmacist could assist the clinical pharmacologist in research, drug therapy and adverse reaction monitoring, providing clinical information and preparation of therapeutic references. Francke held the view that the pharmacist would be more effective in his dealings with physicians if he were supported by a physician. Wardell (1974b) indicated that clinical pharmacologists should not overlook the requirement for a competent technical staff in promoting successful operations. He suggested that the potential of the clinical pharmacist be explored. Walton (1974) pointed to the increased qualifications and clinical involvement of pharmacists as a resource for improving patient care. He stated that with a clinical pharmacist serving as drug tactician, the function of the clinical pharmacologist as strategist would be enhanced allowing an expanded influence on drug therapy throughout the health care system.

A review of the literature revealed that clinical involvement for the pharmacist has developed along two different courses. One

relied upon decentralized service programs in which the pharmacist moved into the patient care areas to conduct the more traditional dispensing and service functions. The pharmacist demonstrated an increased interest in developing distribution systems, reducing medication errors and identifying medication incompatibilities and adverse drug reactions (Smith 1967; Canada 1968; Paxinos 1969; Hill, Blair, and Mitchell 1970; Thielke 1971; Cupit 1974). The second course placed the pharmacist in the role of drug information specialist and therapy advisor with little or no service component.

Piecoro, Wolf, and Knapp (1967) studied the role of the pharmacist on hospital ward rounds. Requests for information from physicians on rounds were recorded and classified as to type and category of the requester. The majority of requests were pharmacological in nature and the largest number of requests were received from attending physicians. Changes in patient therapy as a result of the information provided was not determined.

Bell et al. (1973) studied physician acceptance of information provided by a pharmacist. Results indicated that the acceptance of information provided by the pharmacist was no greater than the acceptance of the information provided by a drug information center at the physicians' requests. It was determined that 25 percent of the patients in the study benefited from the information provided by the pharmacist.

The contribution of a pharmacist serving as a drug information source for a medical team was studied by Hull and Eckel (1973). Two-thirds of all unsolicited suggestions made by the pharmacist resulted in

changes in therapy. During the study fewer suggestions were accepted by attending physicians than by any other category of attending staff.

All these studies were conducted with adult patients. The pharmacist worked independently and there was no documentation of interaction with clinical pharmacologists.

A review of the literature produced information concerning the defined role of the clinical pharmacologist and the need for this type of expertise particularly in pediatrics. It also pointed out the critical manpower shortages in this area. With the increased emphasis in pathology, pharmacology, biopharmaceutics, therapeutics and clinical involvement for pharmacists, using the pharmacist as an assistant seemed to be a logical approach to expanding the clinical pharmacologist's influence. Since no published evidence was available supporting this approach, this study was undertaken to document the ability of the pharmacist to function as an applied pharmacologist and to assist the pediatric clinical pharmacologist in providing drug information to attending pediatricians and influencing the therapy of hospitalized pediatric patients.

CHAPTER 3

DESIGN OF THE STUDY

Introduction

This study was conducted on the pediatric inpatient ward of the University Hospital, University of Arizona Medical Center. The inpatient facility consisted of 38 beds, four intensive care beds and two isolation beds. There were approximately 1,100 admissions during 1973 consisting of Mexican-Americans, American Indians, Blacks and Caucasians.

Data were gathered by the investigator hereafter referred to as the clinical pharmacist. The clinical pharmacist had both graduate education and practical experience in clinical pharmacy practice but limited experience in pediatric therapy. The pediatric clinical pharmacologist was a practicing pediatrician and Assistant Professor of Pediatrics and Pharmacology, College of Medicine, University of Arizona Medical Center.

Neurology, hematology/oncology, cardiology, surgery and pediatric medical services were active on the pediatric ward admitting patients during the time of the study. However, only the medical service held ward rounds on a regularly scheduled basis. In order to assure continuity of involvement and availability of a full attending staff, the patient population for this study was limited to patients admitted to the pediatric medical service. One hundred consecutive

admissions were studied during a ten-week period from 14 March through 22 May 1975. Only these patients more closely followed by the pharmacist and presented to the clinical pharmacologist. Because of a monthly rotation schedule, the composition of the attending staff for pediatric medical service changed three times during the study. The clinical pharmacologist had served as consultant and attending physician for pediatrics prior to the study and was well known to members of the attending staff.

Methodology

The clinical pharmacist introduced himself to the attending staff as a pharmacist, a member of the Department of Pharmacology and clinical assistant to the clinical pharmacologist. After permission was obtained from the attending physician to attend ward rounds, an explanation of the pharmacist's function was given. He was to act as liaison between the attending staff and the clinical pharmacologist and be available to provide drug information upon request. Any request that could not be answered by the pharmacist would be referred to the clinical pharmacologist. The pharmacist would also closely follow patient therapy and progress and make patient presentations to the clinical pharmacologist. During these presentations the diagnosis and treatment of patients would be discussed and any recommendations made by the clinical pharmacologist would be relayed to the physicians by the pharmacist. The presence of the pharmacist was promoted as a method of expanding the clinical pharmacologist's services. The physicians were not informed

that records were being maintained to document the pharmacist's ability to provide information and influence therapy.

The pharmacist began following patients after completion of the admitting history and physical examination by the medical staff. While being studied, each patient was identified by a study number and by name for convenience. All references to name were destroyed after the study to preserve patient confidentiality. Patients were followed using a problem-oriented approach. The form designed for this purpose was termed the patient information and consultation record (Appendix A). It provided a method of recording subjective patient information (signs and symptoms), objective patient information (results of diagnostic examination), assessment of the patient's condition, plan for treatment (medications or other therapy) and the patient's active problems. It also served as a record of consultations. Pertinent diagnostic and historical information was extracted from the patients' medical records. Laboratory tests and results, therapy and patient progress were closely observed and recorded. All drug therapy was evaluated with special attention given to the appropriateness, dosage and scheduling of medications. Patient medical records were reviewed and entries on the patient information and consultation record were updated daily. The information maintained was used as the basis for patient presentations to the clinical pharmacologist.

The clinical pharmacist was present on the wards Monday through Friday and attended ward rounds four times a week. While on the ward and during rounds, he participated in the physicians' discussions

concerning patient therapy making recommendations and providing information requested through his own resources either from personal knowledge or literature search before referring the request to the clinical pharmacologist. The initiator, category, method of providing information and results of all consultations were recorded.

The clinical pharmacologist was available to the pharmacist on a daily basis and problems could be presented at any time. However, regular meetings were scheduled three times a week. During these meetings the pharmacist made patient presentations and discussed ward activities and consultations. He also sought assistance in completing any consultation for which he had been unable to gather sufficient information. The purpose of these presentations was to keep the clinical pharmacologist informed and provide him with enough information to accurately assess the patients' diagnoses, therapy and progress and make recommendations to the attending staff. Any recommendations made by the clinical pharmacologist, while presented to the physicians by the pharmacist, were considered consultations initiated by the clinical pharmacologist. The pharmacist's success in providing all the information required during the presentations and all consultations initiated by the clinical pharmacologist were recorded.

CHAPTER 4

RESULTS AND DISCUSSION OF DATA

During the time necessary to follow 100 consecutively admitted patients to the pediatric medical service, an additional 137 patients were admitted to the other pediatric services. While each of these services was headed by separate attending physicians, house officer duties were performed by the same interns and residents serving the medical service. Patients from other services were rarely discussed in medical service rounds. However, because of the service overlap of the house officers, the pharmacist became involved in consultations on patients not followed as study patients. Failure to act on such requests would have discouraged physician participation and damaged the rapport developed between the pharmacist and physicians. The purpose of this study emphasized the documentation of the pharmacist's ability to assist the clinical pharmacologist in providing information and influencing therapy and not the development of statistics on a given patient population. For these reasons consultations concerning non-study patients were given the same attention as those for study patients. Data reported on consultations are a combination of the results from both study and non-study patients. The data used in comparing the hospitalization of consultation and non-consultation patients, however, represent

information on study patients only since the pharmacist did not maintain this type of information on non-study patients.

The pharmacist and clinical pharmacologist were involved in a total of 84 consultations during the study. Twenty (23.8 percent) of these consultations were initiated by the pharmacist and clinical pharmacologist. The remaining 64 consultations (76.2 percent) were initiated by members of the attending staff or nurses. Only 29 of the 100 study patients were involved in consultations. There were 65 consultations for these 29 patients. The remaining 19 consultations (22.6 percent) were for 19 non-study patients.

Table 1 shows patients involved in consultations required longer hospitalization (an average of 8.0 days) and more medication (an average of 3.2 medications) than patients without consultations. Patients without consultations averaged 4.6 days of hospitalization and received an average of 2.0 medications. The increased hospital stay and greater number of drugs administered for patients requiring consultation is consistent with data reported by Bell et al. (1973) when pharmacist activities with an adult population were observed.

Table 2 illustrates the distribution by category and initiator of all consultations in which the pharmacist was involved during the study. Therapeutic information was requested most frequently accounting for 36 or 42.8 percent of the total consultations. This was followed closely by 34 pharmacological consultations representing 40.5 percent of the total. The least frequent category was diagnostic consultations with only 4 (4.8 percent).

Table 1. Comparison of selected characteristics of hospitalization and care for consultation and non-consultation patients in the study population.

Characteristics	Consultation Patients (N = 29)	Non-consultation Patients (N = 71)
Average number of days of hospitalization	8.0	4.6
Average number of medications administered per patient	3.2	2.0
Number of patients receiving no medications during hospitalization	2(6.9%)	7(9.9%)
Number of patients receiving only analgesics, antipyretics or diagnostic agents during hospitalization	3(10.3%)	15(21.1%)

Table 2. Frequency distribution of consultations initiated for four selected categories and eight classifications of initiator.

Classification of Initiator	Category of Consultation				Total by Initiator
	Therapeutic	Pharmacological	Pharmaceutical	Diagnostic	
Intern	13	8	5	0	26
Attending Physician	2	18	4	0	24
Clinical Pharmacist	14	0	1	0	15
Resident	4	3	0	0	7
Clinical Pharmacologist	1	0	0	4	5
Chief Resident	2	1	0	0	3
Medical Student	0	2	0	0	2
Nurse	0	2	0	0	2
Total by Category	36	34	10	4	84

Interns initiated the highest number of consultations with 26 (31.0 percent). Attending physicians were second initiating 24 (28.6 percent) and the pharmacist followed third with 15 (17.8 percent). Medical students and nurses initiated the fewest consultations each with 2 (2.4 percent). Interns and attending physicians were responsible for 50 (59.5 percent) of the total consultations reported in the study.

A possible explanation for the frequency and category of consultations for each classification of members of the attending staff may lie in their individual experience level and type of responsibility in the total care of the patient. Attending physicians were ultimately responsible for the care of all service patients. In this position they acted as director and consultant for the staff making recommendations, guiding and giving final approval for all decisions made by the house officers. They were both experienced physicians and teachers. Most of the consultations initiated by them were pharmacological in nature and directed at providing information to enhance the education and training of the house staff.

The chief resident represented the highest level of experience of the house officers. He acted as consultant and coordinator for the house staff. Much of his responsibility involved the administrative management and disposition of patients. Residents were team leaders with a high level of training and experience. While they were directly involved in patient care and supervised the interns' patient management, most of the mechanics of patient care was left to the interns.

Interns represented the lowest level of experience and training of those individuals held responsible for initiating patient care. Their management technique was closely scrutinized by other members of the attending staff. They were responsible for implementing the decisions of the staff and, therefore, initiated virtually all of the physicians' orders in the patients' medical records. They sought assistance through all categories of consultations except diagnostic, with the most frequent area being therapeutic.

The medical students assigned to the attending staff were completing their second year of medical education. During this portion of their clinical clerkship, primary emphasis was placed on patient history, physical examination and diagnosis. Their purpose was to expand their scope of knowledge in these areas and involvement in therapy was generally by observation only.

This study emphasized the pharmacist's involvement with physicians. The pharmacist was not readily accessible to the nursing staff and information requests from nurses were not actively solicited. Only two consultations were initiated by nurses.

Of the 20 consultations initiated by the pharmacist and clinical pharmacologist, 17 were directed at change in patient therapy. Table 3 shows the physician acceptance rate experienced. In 15 of the consultations, the information provided by the pharmacist and the clinical pharmacologist was considered significant enough by the attending staff to alter patient therapy. This represents an over-all physician acceptance rate of 88.2 percent when recommending a change in patient

Table 3. Number and percentage of consultations initiated by the pharmacist and clinical pharmacologist directed at change in therapy which resulted in change in therapy.

Initiator	Directed at change in therapy	Resulted in change in therapy	Percentage
Pharmacist	15	14	93.3
Clinical Pharmacologist	2	1	50.0
Combined	17	15	88.2

therapy. Since these 15 consultations involved 15 different study patients, the pharmacist and clinical pharmacologist directly influenced the therapy of 15 percent of the patient population. In 12 other instances physicians requested the pharmacist's opinion before initiating drug therapy. Although subsequent orders written agreed with the pharmacist's recommendations in every case, there was no way to document the pharmacist's influence in these instances. The physician may have followed the pharmacist's recommendations or he may have had a similar therapy plan in mind and was seeking a second opinion.

During the study the pharmacist received 64 requests for information. He attempted to provide all the information required before referring the consultation to the clinical pharmacologist. Figure 1 is an illustration by category of the ability of the pharmacist and clinical

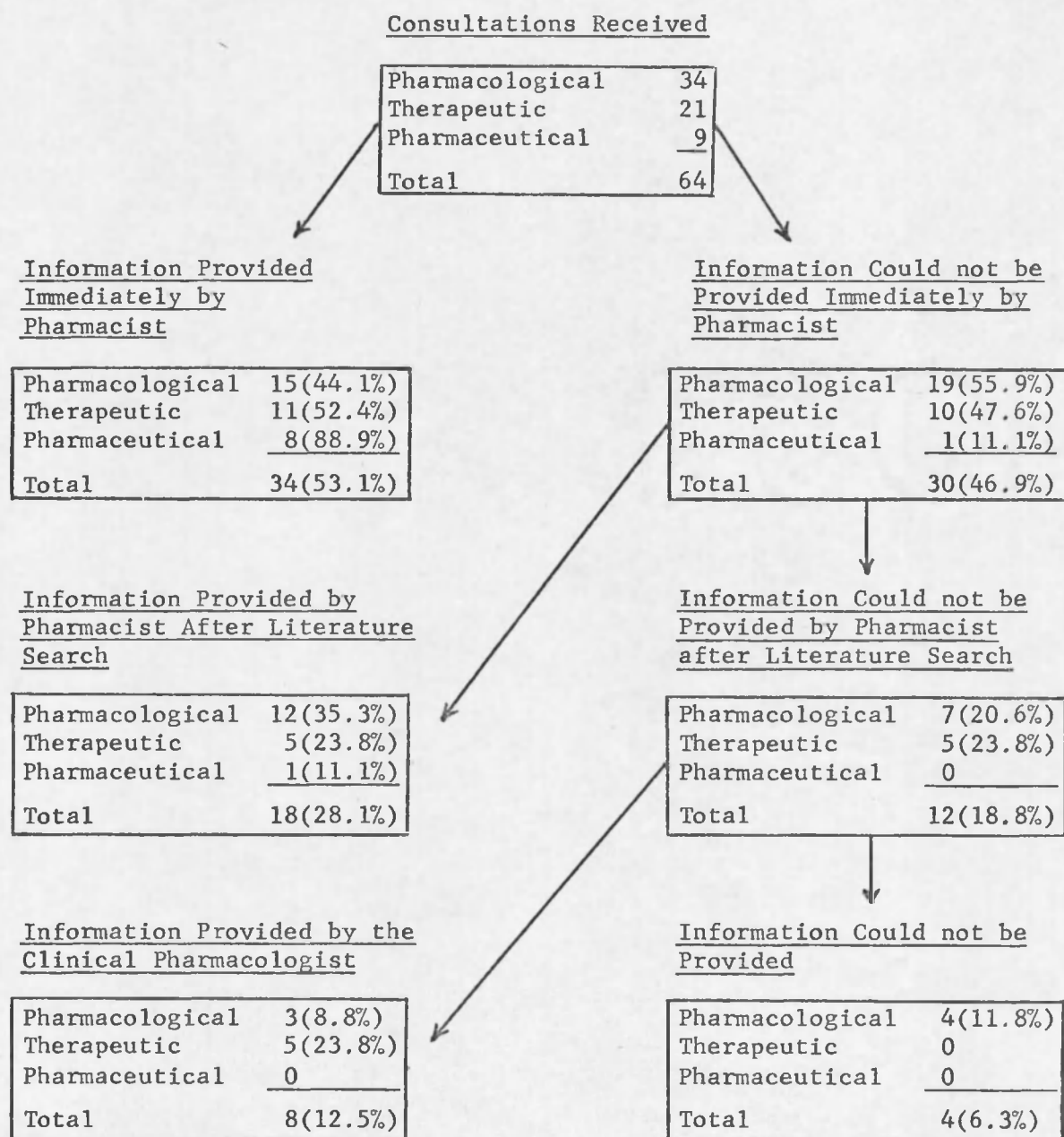


Figure 1. Flow chart of ability of pharmacist and clinical pharmacologist to provide information requested for three selected types of consultations.

pharmacologist to provide the information and shows the sequence used for the completion of the consultations. The pharmacist was able to provide the information for 27 (79.4 percent) of the pharmacological consultations, 16 (76.2 percent) of the therapeutic and 9 (100 percent) of the pharmaceutical consultations. The pharmacist had to refer five (23.8 percent) of the therapeutic consultations and seven (20.6 percent) of the pharmacological consultations to the clinical pharmacologist. The clinical pharmacologist completed five (23.8 percent) of the therapeutic and three (8.8 percent) of the pharmacological consultations. Both the pharmacist and the clinical pharmacologist were unable to provide sufficient information to complete four (11.8 percent) of the pharmacological consultations.

Table 4 shows the success rate of the pharmacist and clinical pharmacologist in completing the 64 consultations. The pharmacist was able to complete 52 (81.2 percent) of the consultations without involving the clinical pharmacologist. Fifty of these consultations were initiated by physicians. The clinical pharmacologist provided information for eight (12.5 percent) of the consultations. Four (6.3 percent) of the consultations could not be completed. A review of medical literature was required by the pharmacist before he could complete 18 of the 52 consultations. This research was performed in the Medical Center library. A total of 18.5 hours of library research time was recorded and on three occasions the pharmacist was assisted by a research librarian.

The pharmacist made a total of 56 patient presentations to the clinical pharmacologist. These included all 29 consultation patients

Table 4. Number and percentage of consultations completed by the pharmacist and clinical pharmacologist initiated by physicians and nurses.

Manner of Completion	Consultations Completed			Percentage
	Physician Initiated	Nurse Initiated	Both	
By pharmacist immediately	32	2	34	53.1
By pharmacist after literature search	18	0	18	28.1
Total by pharmacist	50	2	52	81.2
By clinical pharma- cologist	8	0	8	12.5
Total by pharmacist and clinical pharma- cologist	58	2	60	93.7
Could not be completed	4	0	4	6.3
Combined	62	2	64	100.0

and 27 other study patients with interesting pathologies or involved therapies. Through these presentations the clinical pharmacologist was able to follow patient therapy, judge the pharmacist's performance in initiating and completing consultations and make recommendations to the attending staff. The clinical pharmacologist determined that the pharmacist provided all the information necessary for his accurate assessment of the patient in 54 (96.4 percent) of the patient presentations. The remaining two presentations (3.6 percent) required additional review of medical records to provide the information needed.

Of the 20 consultations initiated by the pharmacist and clinical pharmacologist, 15 (75.0 percent) were initiated by the pharmacist and five (25.0 percent) by the clinical pharmacologist. The clinical pharmacologist agreed with all recommendations made in the 15 consultations initiated by the pharmacist. From the information provided by the pharmacist during the patient presentations, the clinical pharmacologist initiated five additional consultations. Four of these concerned diagnostics and one therapeutics. The pharmacist was responsible for one pharmaceutical and 14 of the 15 therapeutic consultations. However, all recommendations in the area of diagnostics were made by the clinical pharmacologist. The pharmacist had little training or experience in diagnostics. This may have been the reason for his failure to identify any problems or make any recommendations in this area.

CHAPTER 5

SUMMARY AND RECOMMENDATIONS

This study was undertaken to document the ability of the clinical pharmacist to act as an applied pharmacologist assisting the pediatric clinical pharmacologist in providing drug information to attending pediatricians and influencing the therapy of hospitalized pediatric patients.

The pharmacist followed closely the hospital course of 100 consecutively admitted pediatric medical patients. Twenty-nine of these patients were involved in consultations. Data maintained on the 100 patients indicate that consultations were requested for patients who required longer hospitalization and more medication. An additional 137 patients were admitted to other pediatric services active on the wards during the study. While the pharmacist did not monitor the therapy of these patients, 19 were involved in consultations as a result of requests for information from physicians.

The clinical pharmacist and clinical pharmacologist were involved in a total of 84 consultations. Sixty-five of these concerned study patients and 19 concerned non-study patients. The pharmacist and clinical pharmacologist initiated 20 consultations. The remaining 64 were initiated by members of the attending staff or nurses. Consultations involving therapeutic information occurred most frequently with 36.

Pharmacological consultations were second with 34 and consultations concerning diagnostics were least frequent with only four.

While serving as a member of the Department of Pharmacology, the pharmacist never lost his professional identity and there was no hesitation from physicians in utilizing the information provided. The pharmacist was able to relate with physicians of all experience levels. During this study physicians initiated 62 requests seeking information from the clinical pharmacist. The pharmacist provided satisfactory information for 50 of these requests. The other 12 were referred to the clinical pharmacologist who answered eight. For the remaining four requests neither the pharmacist nor the clinical pharmacologist could provide sufficient information. Another indication of physician willingness to accept recommendations from the clinical pharmacist is that 14 of the 15 (93.3 percent) recommendations for changes in therapy made by the pharmacist were accepted.

The study demonstrated that the pharmacist acted as liaison between the clinical pharmacologist and the attending staff. He monitored patient therapy, provided drug information and served as therapy consultant to the attending staff and informed the clinical pharmacologist of patient status and trends in therapy. Minimal patient involvement was required for the clinical pharmacologist to assess therapy and make recommendations. The clinical pharmacologist determined that the pharmacist provided all the information necessary for his accurate assessment of the patient in 52 of 54 patient presentations. Time required of the clinical pharmacologist was further reduced by the ability of the

pharmacist to provide most of the information requested and identify most of the therapy problems without involving the clinical pharmacologist. The pharmacist initiated 15 of the 20 total consultations initiated by both the pharmacist and clinical pharmacologist. Therefore, it may be concluded that the pharmacist effectively functioned as an applied pharmacologist and assisted the pediatric clinical pharmacologist in providing drug information to attending pediatricians and influencing the therapy of hospitalized pediatric patients.

Recommendations

The ability of the clinical pharmacist to assist the clinical pharmacologist in providing drug information and to influence patient therapy has been demonstrated. It is recommended that the pharmacist be permitted to function independently utilizing the clinical pharmacologist as a consultant, thus expanding the influence of the clinical pharmacist.

This study demonstrated the pharmacist's ability to function as an applied pharmacologist with a limited population. It is recommended that additional studies be conducted with patients of all service classifications.

The use of the pharmacist to assist in the research and teaching functions of the clinical pharmacologist is recommended. The pharmacist may assist in the education of medical students or the development of continuing education programs for physicians. Demographic and epidemiological data collected by the pharmacist may prove valuable tools in conducting clinical drug studies or developing therapy protocols.

Experimentation in these areas could lead to total programs of involvement for the pharmacist.

In this study the clinical pharmacologist was assisted by only one pharmacist. There are indications that a clinical pharmacologist may effectively utilize a number of pharmacists in this capacity. Further study is recommended to determine the optimum pharmacist to clinical pharmacologist ratio.

The pharmacist relied on the availability of library services as well as the advice of the clinical pharmacologist in completing many of the consultations in the study. Because of the expense of personnel and materials, these resources are limited in many hospital settings. It is recommended that a study of the possibility of effectively extending a clinical pharmacologist's services outside the medical center setting utilizing the pharmacist as an applied pharmacologist within a regional service area be conducted.

APPENDIX A

PATIENT INFORMATION AND CONSULTATION RECORD

Name and Hospital Number _____

Study Number _____

Admitting Diagnosis _____

Date of Admission _____

Demographics: _____ History: _____

Significant Physical and Laboratory Findings: _____

Therapy and Progress: _____

Consultations: _____

REFERENCES

- Bell, J. Edward, Vincent E. Bouchard, John C. South, and Sister M. Gonzales Duffy. "A New Approach to Delivering Drug Information to the Physician Through a Pharmacy Consultation Program." American Journal of Hospital Pharmacy, 30:300-310, April 1973.
- Canada, Andrew T., Jr. "The Role of the Clinical Pharmacist." American Journal of Pharmacy, 40:152-156, September-October 1968.
- Chudzik, Gergory M. and Sumner J. Yaffe. "Introduction to the Special Problems of Pediatric Drug Therapy." Drug Therapy, 3:17-18, 23-25, July 1973.
- Csaky, T. Z. "Clinical Pharmacy and Pharmacology: Friends or Foes?" Journal of Medical Education, 48:905-910, October 1973.
- Cupit, Gary C. "An Approach to Pediatric Pharmacy Practice." Hospital Pharmacy, 9:399-402, October 1974.
- Francke, Donald E. "Relationship Between Clinical Pharmacology and Clinical Pharmacy." The Journal of Clinical Pharmacology, 12:384-392, October 1972.
- Hill, Wendell T., Jr., William T. Blair, and Nell M. Mitchell. "Satellite Service." Hospitals, 44:96-102, March 1970.
- Hull, J. Heyward III and Fred M. Eckel. "Evaluation of the Pharmacist as a Drug Therapy Advisor on Ward Rounds." American Journal of Hospital Pharmacy, 30:687-694, August 1973.
- Lawson, David H., Samuel Shapiro, Dennis Slone, and Hershel Jick. "Drug Surveillance Problems and Challenges." Pediatric Clinics of North America, 19:117-129, February 1972.
- Lockhart, Jean D. "The Information Gap in Pediatric Drug Therapy." FDA Papers, 5:6-9, February 1971.
- Melmon, Kenneth L. and Howard F. Morrelli. Clinical Pharmacology. New York: Macmillan Publishing Co., 1972, Preface.
- Miller, Russel R. "Drug Surveillance Utilizing Epidemiologic Methods." American Journal of Hospital Pharmacy, 30:584-592, July 1973.

- National Research Council, National Academy of Science. Drug Efficacy Study: Final Report to the Commissioner of Food and Drugs, Food and Drug Administration. Washington, D.C.: U. S. Government Printing Office, 1969.
- Piecoro, John J., Harold H. Wolf, and David A. Knapp. "A Pharmacist on Hospital Ward Rounds." Journal of the American Pharmaceutical Association, NS11:630-633, December 1967.
- Paxinos, James. "What Role Can Pharmacists Play in the Clinical Environment?" Hospital Topics, 47:75-78, May 1969.
- Shirkey, Harry C. "Therapeutic Orphans 1970." Journal of Infectious Disease, 121:348-350, March 1970.
- Shirkey, Harry C. "Clinical Pharmacology in Pediatrics." Clinical Pharmacology and Therapeutics, 13:827-830, September-October 1972.
- Smith, William E. "The Future Role of the Hospital Pharmacist in the Patient Care Area." American Journal of Hospital Pharmacy, 24:228-231, September 1967.
- Thielke, Thomas S. "Activity Analysis of Clinical Pharmacists." American Journal of Hospital Pharmacy, 28:704-706, September 1971.
- Walton, Charles A. "Clinical Pharmacology and Clinical Pharmacy: A Necessary Alliance for Practical Advances in Rational Drug Therapy." The Journal of Clinical Pharmacology, 14:1-8, January 1974.
- Wardell, William M. "Clinical Pharmacology at University Medical Centers. I. Functions and Organizations." The Journal of Clinical Pharmacology, 14:309-324, July 1974a.
- Wardell, William M. "Clinical Pharmacology at University Medical Centers. II. Requirement." The Journal of Clinical Pharmacology, 14:408-414, August-September 1974b.
- World Health Organization. Clinical Pharmacology: Scope, Organization, and Training. Technical Report Series 446, Geneva, Switzerland, 1970.

