

CURRICULA FOR THE PRESENT AND FUTURE PRACTICE OF PHARMACY

Sidney J. STOHS*

ABSTRACT

Health care reform is causing sweeping changes in patient care within the United States, and managed health care and universal access to health care are resulting in profound changes in the practice of pharmacy. The impact of factors associated with cost containment as the increasing role of both private and federal third party payers, increased emphasis on ambulatory care and outpatient surgery clinics, discriminatory pricing by drug companies, pharmacy automation and computerization, and the use of pharmacy technicians will be considered. The curricula within schools/colleges of pharmacy must rapidly adapt to the changing health care environment. Changes in curricula over the past 25 years will be reviewed, and projected curricular changes will be presented which reflect the decrease in the number of hospitalized patients with a shift to intermediate and ambulatory care settings, the decreased compounding function of pharmacists, the emphasis on seamless team health care, the increased role of pharmacists as therapeutic consultants and drug information specialists, and managed health care and health care economics. Greater educational emphasis will be placed on pathophysiology, therapeutics, health care systems and economics, communication skills, patient counseling, drug information management, patient physical assessment, and ethics with less emphasis on physicochemical and analytical laboratory-based courses.

Key Words: Health care reform, pharmaceutical care, clinical pharmacy, curriculum revision, outcome objectives

* School of Pharmacy and Allied Health Professions, Creighton University, 2500 California Plaza, Omaha, NE 68178 U.S.A.

INTRODUCTION

Pharmacy in most parts of the world has progressed through a series of ages or eras /1-3/. Until approximately 1940, pharmacy existed in what has historically been referred to as the galenic era, with emphasis on the compounding and dispensing of natural products and crude drugs or crude drug extracts. During this era, the pharmacist was considered to be a principal health care provider for many patients, serving as a primary source of health care information.

With the advent of the scientific era during the 1940's and 1950's, industrialization of pharmacy resulted in the formation of standardized and pre-packaged medications. As a result, pharmacists had less interaction with patients, and much of the mystique associated with compounding was lost. In addition, within the United States, laws passed in the early 1950's limited the scope of practice of pharmacy and the role of pharmacists as primary health care providers.

During the late 1960's many pharmacists and faculty members in the United States became increasingly frustrated with the limited roles and responsibilities of the current practice of pharmacy /3/. The education of pharmacists greatly exceeded the needs of most pharmacists. The dissatisfaction with the product-oriented practice of pharmacy resulted in a refocusing of attention on the patient, with the re-birth of the clinical practice of pharmacy. The clinical pharmacy movement has emphasized the concept of pharmaceutical care with the pharmacist as a therapeutic monitor and drug information specialist. As a consequence, major changes have occurred in pharmacy education within the United States over the past 20-25 years. This change in educational philosophy has resulted in the

adoption of the Doctor of Pharmacy degree as opposed to the Bachelor of Science in Pharmacy degree by many universities. The Doctor of Pharmacy (Pharm.D.) degree is a practice-oriented degree as opposed to the Doctor of Philosophy (Ph.D.) degree which is a research-oriented degree, and individuals possessing the Pharm.D. degree may subsequently complete the requirements for a Ph.D. degree. According to a recent survey by the American Association of Colleges of Pharmacy, approximately 72% of the U.S. schools/colleges of pharmacy will offer the Doctor of Pharmacy degree as the sole professional degree by the year 2000. Furthermore, the recent emphasis on health care reform within the United States may have a more profound impact on pharmacy education within the next five years than has been experienced during the past 25 years at some universities.

HEALTH CARE REFORM

Health care reform is currently a major legislative focus within the United States, and is also being experienced in Europe /4/. Although no major pieces of health care reform legislation have been adopted to date in the United States, the mere discussion of reform, and the types of reform which are being proposed have already had a major impact on the practice of pharmacy. The purpose of health care reform within the United States is to provide universal health care or affordable health care to all individuals, and the costs associated with available health care for all individuals constitutes a major concern. In order to contain costs associated with health care reform a wide range of mechanisms are being considered, and many of these factors may have a profound influence on the practice of pharmacy /5-12/ and ultimately pharmacy education. A number of these factors will be reviewed.

Agencies referred to as third party payors are playing an increased role in paying for health care. Rather than patients directly paying the pharmacist for their prescriptions, third party payors including insurance companies and government agencies as Medicare and Medicaid are now paying for a large percent of prescriptions within the United States /13/. Over 70 percent of all prescriptions are now being paid through third party payors. A co-pay by the patient is frequently required, and in order to contain costs, the co-pay for the generic version of a drug is less than for the proprietary (name brand) of the drug. As a consequence, third party payors are encouraging the dispensing and use of less expensive forms or suppliers of drugs.

In recent years a new industry has arisen known as pharmacy benefits managers /7,9,14/. These are companies hired by the benefits departments of corporations as well as health care providers whose ultimate function is to contain drug costs. These pharmacy benefits management companies process prescription claims, determining which claims are justified and which will be paid. These companies negotiate contracts with drug companies for discounts on drugs. These discounts are negotiated for pharmacies associated with large corporations, chain pharmacies, corporations which own multiple hospitals, and drug buying consortia (group). Unfortunately, this places the independent pharmacist at a tremendous financial disadvantage unless the pharmacist joins a buying consortia and therefore has access to discounts. Pharmacy benefits management companies also are involved in monitoring physician prescribing to determine whether physicians overprescribe or underprescribe certain drugs, and whether the physicians are using the most effective, most economical form of a drug for a particular condition. A major problem associated with cost containment relative to drugs is the fact that only 7-8 percent of the total health care budget within the United States is spent on pharmaceuticals.

Hospitalization of patients is expensive. As a cost containment measure, increased emphasis is being placed on ambulatory care centers and outpatient surgery clinics. Following many surgeries, patients are convalescing at home rather than in hospital, and the same is true for medical conditions which are not acute. As a consequence, the number of drugs being dispensed in hospitals is decreasing, while the number of drugs being dispensed to ambulatory patients is rapidly increasing. As a consequence, there is a need for fewer pharmacists in the hospital setting, and an increased need for pharmacists in the ambulatory care setting. As was previously mentioned, drug companies are providing large discounts to large corporations and buying consortia, but not providing these same discounts to individual, retail pharmacists. As a consequence, it has become increasingly more difficult for independent community pharmacists to be competitive and survive, and over the past several years, large numbers of independent, community pharmacies have closed and are being replaced by corporate chain pharmacies. For example, the Walgreen Corporation anticipates having approximately 3,000 pharmacies within the United States by the year 2000. They currently have over 1,900 pharmacies at this time. These changes in the practice environment impact the preparation which pharmacy students must receive.

Automated, computerized prescription filling devices are beginning to have a major impact on the practice of pharmacy. The technology is now available to fill prescriptions with the push of a button or with a computerized prescription scanner. These systems are being adopted by large hospitals such as the Veterans Administration Hospitals, and mail-order pharmacies /15,16/. Pharmacists are still required to verify the accuracy of each prescription, but are not required to count tablets or capsules or pour liquids. The use of these technologies will most assuredly continue to increase. How does this impact the need for pharmacists? Fewer pharmacists will be required to conduct the manual activities of

filling prescriptions. Furthermore, the use of pharmacy technicians is becoming increasingly common. Pharmacy technicians can prepare labels for prescriptions, and fill prescriptions under the supervision of a registered pharmacist. Technicians can not dispense prescriptions to patients. Most states within the United States either have regulations or are developing regulations for the use of pharmacy technicians. The net impact of automation and the use of pharmacy technicians is a decrease in the compounding and dispensing functions of pharmacists. Faculty must consider the impact of these changes on the curricula within their schools/colleges of pharmacy.

Previous discussion alluded to the increased use of generic drugs as a cost containment measure. With many major drugs no longer protected by patent due to the expiration of the patents, generic forms of many drugs are available. Invariably the generic forms of the drugs are less costly than name brand versions of the drugs. Bioavailability and bioequivalence are major considerations in the use of these drugs. However, cost is frequently an overriding consideration, and pharmacists can play an important role in ensuring that appropriate generic forms of drugs are used.

Large mail order pharmacies have developed throughout the United States /15,16/. Their primary function of these pharmacies is provision of prescription drugs at presumably less cost to patients via the mail. Primary emphasis has been placed on drugs for chronic conditions, supplying patients with up to three months supply of a drug at a time. These companies are highly automated and very efficient. Unfortunately, patients do not have contact with their pharmacist and as a consequence do not receive direct patient counseling and monitoring which are so important to drug compliance. Patients can contact a pharmacist by telephone if any questions arise.

If pharmacists are spending less time compounding and dispensing, what is the role of pharmacists in providing health care and in the drug delivery system? The answer to this question lies in the fact that pharmacists can and should have a tremendous impact on the provision of affordable health care and the containment of health care costs by serving as therapeutic consultants, drug information specialists and patient monitors. The practice of pharmacy has evolved and continues to evolve from a primary role concerned with compounding and dispensing to one of patient care. In essence, the pharmacist of today and tomorrow is not only expected to select and dispense the most appropriate medication or device, but also to assume responsibility for therapeutic outcomes.

PHARMACEUTICAL CARE AND PHARMACY EDUCATION

The American Association of Colleges of Pharmacy has recently adopted "the position that pharmaceutical care is pharmacy's most essential and integral contribution to the provision of primary care." Pharmaceutical care is defined as the responsible provision of drug therapy for the purpose of achieving specific outcomes that improve a patient's quality of life including the cure of a disease, elimination or reduction of symptoms, arresting or slowing a disease process, and preventing a disease or the symptoms thereof /17/. Therefore, the evolving role of pharmacists is not only the dispensing of a drug, but the provision of appropriate drug information and patient monitoring in order to ensure an appropriate therapeutic outcome.

Why do pharmacists need to counsel patients and monitor their therapeutic outcomes? Are these functions truly necessary in order to provide quality health care? Furthermore, if pharmacists are going to devote their time and energy to these activities, what is the

education and training that pharmacists will require in order to perform these functions associated with pharmaceutical care? The following facts will illustrate the need for pharmaceutical care /18,19/. Approximately 1.8 billion prescriptions are filled annually in the United States, and various studies have shown that approximately one-half of all medications are not taken properly. As a consequence, an estimated 20-25 percent of all hospitalizations occur due to inappropriate use of drugs, drug-drug interactions, drug allergies, and adverse effects of drugs. More specifically, studies have shown that noncompliance with prescription medications is responsible for over 30 percent of all hospital admissions among the elderly, and 23% of all nursing home admissions. Forty percent of the elderly who take drugs experience adverse drug reactions. Similarly, noncompliance with prescription medications results in significant increases in the number of outpatient visits to physicians. The failure to fill or refill prescriptions and noncompliance results in an estimated annual cost of over \$8.5 billion for increased hospital admission and physicians visits, a sum amounting to nearly 1 percent of the country's total health care expenditures.

More specific examples of the costs associated with patient noncompliance can be given. For patients with moderate to severe hypertension who do not take their medications correctly, the overall cost of treatment per year is an estimated \$10,500 per patient, more than double the cost when patients are compliant. Each year, noncompliance with cardiovascular medications accounts for approximately 125,000 deaths in the United States, over 300,000 hospitalizations, and a loss of 20 million work days. Of women taking estrogen therapy for osteoporosis, only 30 percent take their medications correctly, contributing to the estimate \$5.2 billion in annual direct medical costs to treat osteoporosis in women aged 45 and older. Another study has reported that an estimated \$22-25 billion is spent annually

to treat non-drug compliance. One study has estimated that the overall costs associated with noncompliance of drug therapy including lost productivity and increased health care costs exceeds \$100 billion per year in the United States /18,19/. Thus, patient counseling and monitoring are highly cost effective, and a profound need exists for health care professionals to provide this service. If pharmacists are not willing to assume these roles, they will rapidly be assumed by other health care professionals including nurse practitioners and physician assistants.

Patient counseling by pharmacists is one important aspect of the overall provision of pharmaceutical care. The Federal Omnibus Budget Reconciliation Act of 1990 (OBRA '90) mandates a standard of pharmacy practice in the United States in three essential areas: collecting patient information, prospective drug utilization review and patient counseling /20/. These activities can only be effectively and efficiently accomplished through the use of computers and computer technology. It is imperative that computers become an integral component of pharmacy education and that students are highly computer literate upon graduation. Without this background, students will not be capable of competing in the work place with respect to the provision of pharmaceutical care. Over 95 percent of pharmacies in the United States are computerized, and all pharmacies out of necessity will be computerized within the next several years. The collection of patient information includes maintaining drug profiles, and collecting and retaining information on chronic medical conditions, known allergies and drug reactions of all patients /20/.

With respect to prospective drug utilization reviews which are mandated by OBRA '90, pharmacists must evaluate and screen for over and/or under drug utilization, monitor for the existence of therapeutic duplications, and assess potential drug-disease, drug-drug and

drug-allergy interactions. Furthermore, pharmacists must ensure that the correct dosage is given and that an appropriate duration of treatment is being recommended. In addition, pharmacists must monitor for clinical abuse or misuse of drugs /20/.

With respect to patient counseling, OBRA '90 legislation requires that patients be informed regarding the name (trade, generic) of the medication, its intended use, dose, dosage form, dosage and administration schedule, specific directions for preparation and administration of the drug, precautions to be observed during drug administration, common side effects including their avoidance and action required should they occur, techniques for self monitoring of drug therapy, proper storage, potential interactions and therapeutic contraindications, refill information, action to be taken in the event of a missed dose, and any other information peculiar to the specific patient or drug. These requirements exert a tremendous impact on pharmacy education, and may require extensive curricular revision /20/.

The OBRA '90 legislation was based on numerous studies that have shown that patient counseling, drug utilization reviews, and maintaining appropriate patient profiles can greatly decrease drug costs to patients, markedly improve therapeutic outcomes, decrease hospitalization time and decrease the number of hospital admissions. All of these functions and activities result in greatly increased health care delivery at decreased cost.

As health care reform is progressing within the United States, a concept known as "seamless health care" is emerging. This concept can be defined as a seamless or continuous web of multi-professional, patient-centered services delivered to provide maximum quality at a socially acceptable cost. If pharmacy is to continue to evolve as a health care profession and

remain an integral component of the health care delivery team with duties and responsibilities which extend far beyond compounding and dispensing, pharmacists must be a true partner in this multi-professional health care delivery system. Historically, the hospital has served as the focal point for the health care system within the United States. However, complex, multi-functional ambulatory primary care centers are being developed to address many health care needs at lower cost than has historically been provided in the hospital setting. As a consequence, the educational needs of pharmacists will most assuredly need to change in order to meet changing practice environment for pharmacists.

MAJOR CHANGES IN EMPHASIS IN PHARMACY CURRICULA

The evolving role of pharmacists in the health care delivery system is mandating major changes in the courses which are taught in pharmacy curricula /1,21-25/. In general, pharmacy education must become more patient oriented as compared to product oriented in its approach. In order to do this, the use of case studies, and a case-oriented approach to the presentation of material provides students with a more realistic approach to expectations in practice, and enables them to better apply theory to practice /26-31/. Since nearly all pharmacies are computerized within the United States, a high tech approach to education is also required, with the integration of computer technologies into a wide range of courses including communication skills, drug information, pharmacology, therapeutics, pharmacokinetics, pharmacoeconomics, anatomy, pathology, dispensing, parenterals, medicinal chemistry, and other courses.

If pharmacists are going to receive the proper education and training in order to comply with OBRA '90 regulations, the development of drug information management skills is

essential. Furthermore, if pharmacists are expected to assume the roles of patient counselors regarding drug therapy, excellent communication skills must be developed /31,32/. In addition, pharmacists must effectively communicate with other health care professionals including physicians.

Other major changes which have occurred in pharmacy curricula and which are continuing to occur include greater emphasis on biological sciences, a decrease in laboratory courses, and a decreased emphasis on physical and chemical sciences /1,21-24/. Some of these changes which are occurring will be described in more detail. In addition, the American Association of Colleges of Pharmacy (AACP) is encouraging its member schools/colleges of pharmacy "to develop or enhance relationships with other primary care professionals and educational institutions in the areas of practice, professional education, research and information sharing." In other words, AACP is encouraging the development of programs with courses being taken concurrently between pharmacy students and students in other health care professions as medical students. An example would be courses in pharmacology, physiology or patient assessment. Clinical clerkships in areas such as internal medicine, family practice, oncology, nephrology, pediatrics or psychiatry provide additional opportunities for the interaction between pharmacy and medicine students. Collaborative research programs greatly expand the research opportunities for pharmacy faculty as well as faculty members in other areas as medicine, dentistry and nursing.

As a result of the evolving role of pharmacists which has occurred over the past twenty years, and the more recent impact of health care reform, major changes are occurring in courses taught in pharmacy curricula. The importance of courses in communication skills and drug information systems were previously noted. Courses in health care systems are

essential so that pharmacists effectively deal with reimbursement through third party payors, interface with pharmacy benefits managers, are familiar with the changes which are occurring with respect to health care reform, and effectively cope with the rapidly expanding bureaucracy associated with the health care delivery system.

As pharmacists assume more decision making roles in the health care system, they are faced with complex ethical decisions /33,34/. As a consequence, required courses in medical ethics are exceedingly important to adequately prepare pharmacists for the dilemmas which they will face. Technological advances have greatly increased the complexities of the ethical problems faced by health care professionals. Patient assessment has historically remained in the domain of physicians and nurses. However, with the changing and expanding roles of pharmacists, the development of patient assessment skills is essential. Pharmacists must possess basic patient assessment skills including the ability to conduct drug and medical histories. These skills are essential if pharmacists are to function as gate keepers in the health care system and provide primary care. It is not essential that a patient's blood pressure, heart rate, lipid levels, cholesterol, or blood sugar levels be monitored in a physician's office. These functions can be performed by pharmacists at a fraction of the cost associated with the visit to a physician's office.

A knowledge of basic immunology is essential for the practicing pharmacist. With the development of biotechnologically derived drugs and new advances in the use of immunizing biologicals, immunopharmacology must be a required component of the curriculum. This subject matter may be taught either as a free standing course, or integrated into existing courses. Since pharmacists constitute the first health care professional with whom many patients interact, a working knowledge of clinical toxicology is also essential to the effective

practice of pharmacy. One of the most effective mechanisms for teaching pharmacy students to apply theory to practice is the use of therapeutic case studies. Not only should case studies be utilized as an integral component of required courses in pharmacotherapeutics, but should be integrated in all courses within the curriculum. This enables students not only to apply theory to practice, but helps them integrate information from various courses within the curriculum to solve realistic problems.

Over three-quarters of all community pharmacies provide home diagnostic equipment and supplies, such as blood glucose monitors for patients with diabetes /18,19/. As a consequence, it is essential that pharmacists be able to not only utilize this equipment, but also teach patients how to appropriately and effectively utilize these diagnostic tools. Furthermore, more than 20 percent of community pharmacies help fit patients with braces and surgical appliances. Home infusion therapy continues to be a growing and innovative part of community pharmacy practice. Over 11 percent of all community pharmacies offer at least one type of home infusion therapy. As a consequence, required courses in home medical equipment are rapidly becoming essential in the curriculum. The advent of home infusion therapy as well as the large number of pharmacists employed in hospitals also necessitates that all pharmacy students are adequately prepared in the preparation of sterile, parenteral products.

The advent of courses in research design and biostatistics in the pharmacy curriculum is not intended to prepare pharmacists as scientists and scholars, although these courses do provide a fundamental background which can be expanded to develop scholarly proficiencies in these areas. The primary intent is to enhance skills as drug information specialists and enable pharmacists to review and appropriately interpret the primary drug literature. Pharmacists

should be capable of reading an article concerned with a clinical drug trial and determining whether the study was appropriately designed with the necessary controls, whether an adequate number of subjects was employed, whether appropriate statistical methods were used, and whether the conclusions drawn by the author(s) are justified.

In addition to the above courses, the AACP supports the development and implementation of curricular components and associated instructional strategies which assure a common set of core competencies and knowledge concerning population-based epidemiology, the determinance of health, effective programs in health promotion and disease prevention, and primary health services delivery for pharmacists. As a consequence, mechanisms must be devised for inclusion of these areas of knowledge into the curriculum, a difficult task in light of all other curricular requirements and changes.

Doctor of Pharmacy programs typically require 10-12 months of clinical education and experience. Courses in clinical pharmacy are frequently referred to as clerkships or clinical rotations. In clinical clerkships, students normally spend eight hours per day, five days per week for four-six weeks. At Creighton University, each clerkship is four weeks in duration. One semester credit hour is received for every 40 hours (one week) of time spent on a clerkship. At our institution, students are required to take a four-week clinical rotation each in internal medicine (inpatient clinical practice), pharmacokinetics, drug information, community practice, inpatient hospital practice, and extended care. Based on changes in health care reform, and the development of ambulatory, primary care centers, we anticipate the development of a required clerkship in ambulatory care within the next several years.

At Creighton University, students are also required to take five elective four-week clinical

rotations. Students may take an advanced clinical rotation in one of the six required areas, or select from a list of additional elective rotations. For example, if students are interested in community practice, they may elect to take an additional clinical clerkship in community practice.

In order to accommodate the broad interests of our students, and prepare them for a wide range of practice opportunities, the School has developed a wide range of elective clinical rotations which includes: infectious disease, cardiology, oncology/hematology, nephrology, family practice, ambulatory care, pediatrics, psychiatry, nuclear medicine, poison control, managed care, nutrition support, pharmaceutical industry, Indian Health Service, independent research and academics. The independent research rotation allows students to work with a selected faculty member and engage in either a basic science or clinical research project. They may also work on a research project which is primarily computer-based. The School is developing a concurrent Pharm.D./Ph.D. program. The independent research rotation will enable students to conduct research on their graduate degree project while completing the requirements for the Doctor of Pharmacy degree. Furthermore, this optional rotation enables students to determine whether they have a serious interest in a particular area of research endeavors.

The School has also recently developed an academic rotation which enables a student to "shadow" or follow a faculty member for four weeks, present a limited number of lectures, experience the activities of a faculty member, and determine whether they may ultimately be interested in pursuing a career in academia.

In addition to clinical clerkships which have been added to pharmacy curricula in recent years, numerous other courses have been added to pharmacy curricula during the past 20-25 years. Courses which were not present, for example in 1970, in pharmacy curricula include anatomy, pathology, biopharmaceutics, immunology, immunopharmacology, clinical toxicology, nutrition and diet therapy, pharmacokinetics, clinical pharmacokinetics, patient assessment, therapeutics, drug information, health care systems, communication skills, ethics, home medical equipment, research design and biostatistics as well as clinical clerkships /21-24/. The obvious question which arises relates to the source of time within the curriculum to allow insertion and inclusion of courses such as these.

A number of sources exist for the time required to accommodate the addition of numerous courses. Time for the addition of clinical clerkships has been achieved by expanding the curriculum by an additional year. However, this does little to accommodate all of the remaining courses which were enumerated above. Three major sources exist for the identification of this additional time, including, deletion of courses, deletion of laboratories, and curriculum expansion. With respect to curriculum expansion, the average student took approximately 16 credit hours per semester for the duration of their pharmacy education 20-25 years ago. Currently, the average student takes approximately 18 credit hours per semester for the duration of the pharmacy curriculum. Thus, the average student will take at least 12 additional credit hours over the first three professional years of the curriculum. In addition, some pharmacy programs have increased the length of their programs by three semesters rather than simply two semesters to accommodate the year of clinical clerkships.

A number of pharmacy courses have been eliminated or combined /21-24/. For example, the industrialization of pharmaceutical industry has greatly decreased the importance of

pharmacognosy in the curriculum. In general, pharmacognosy lecture and laboratory have been eliminated from the curriculum. A need for crude drug identification by pharmacists no longer exists. Furthermore, the preparation of galenicals (extracts, tinctures, etc.) has been eliminated from compounding and dispensing laboratories, and the important components of pharmacognosy have been incorporated into other courses. For example, information regarding antibiotics is included in pharmacology, medicinal chemistry and therapeutics. Many of the natural toxins are now included in toxicology, while natural products used in drug formulations are included in pharmaceutics.

Courses in qualitative and quantitative pharmaceutical analysis are seldom found in pharmacy curricula. In the practice setting, pharmacists are not required to either identify or quantitate drugs. Inorganic medicinal chemistry is another course which is no longer clearly identifiable as an independent course. Appropriate information is included in other courses such as medicinal chemistry, over-the-counter drug products, or nutrition.

Large blocks of time have become available in pharmacy curricula through the elimination of laboratory courses and a number of reasons exist for the elimination of the laboratory portion of various courses. Laboratories are a very inefficient method of teaching, as well as being expensive to operate. Laboratories are also exceedingly time-consuming for faculty. The same information that a student learns in a three-four hour laboratory can be taught in a lecture format or lecture/demonstration in usually less than one hour of time. Furthermore, much of the information taught in these laboratories is not relevant to the current practice of pharmacy. The credit hours which have been obtained by elimination of laboratories have been converted to lecture credit hours either in the same course (as pharmacology), or have been used to teach new subject matter as drug information,

anatomy, and parenteral products. The elimination of laboratories has allowed the faculty more time to devote to research and the teaching of other courses. As noted above, practicing pharmacists do not need the laboratory skills which may have been required in the past.

The laboratory courses typically taught in pharmacy programs in 1970, 1980, 1990 and 1994 are summarized in Table 1 /21-24/. In 1970, approximately 15 laboratory courses were taught during the last three years of the average pharmacy curriculum. As can be seen in the table, a major decrease in the required number of laboratory courses occurred between 1970 and 1980, and the number of laboratories has remained relatively constant since that time. Due to the changing needs of practitioners both within the community and hospital setting, we have recently added a required laboratory in parenteral drug delivery systems. In addition, with decreasing emphasis on the dispensing function of pharmacists, we have combined our pharmaceuticals and dispensing laboratory courses into a single one semester credit hour laboratory course. For the one semester credit hour, students receive three-four hours of laboratory instruction per week for 15 weeks.

Within most schools/colleges of pharmacy in the United States, students are provided with a broad, general education, and they are frequently referred to as "generalists." A small amount of time is usually provided during the curriculum in the form of elective credit hours or elective clinical rotations to facilitate special interests of students and provide a very limited degree of specialization. For students wishing a higher level or degree of specialization, students are encouraged to pursue one-two year residencies/fellowships prior to seeking full-time employment. Residencies primarily involve advanced clinical education in an area of specialization, while fellowships involve advanced training and research in an

TABLE 1
Required Pharmacy Laboratory Courses

Course	Total Semester Hours of Credit			
	1970	1980	1990	1994
Microbiology	1	-	-	-
Physiology	2	-	-	-
Biochemistry	1	-	-	-
Pharmacognosy	2	-	-	-
Pharmacology	2	-	-	-
Pharmaceutics	3	2	1	-
Dispensing	2	1	1	1
Medicinal Chemistry	2	-	-	-
Parenteral Drug Delivery Systems	-	-	-	1
TOTAL	15	3	2	2

Changes in laboratory requirements for various pharmacy courses with time.

area of specialization. Residencies are available in numerous areas including internal medicine, infectious disease, cardiology, oncology, ambulatory care, pediatrics, psychiatry, nuclear medicine, pharmacokinetics, drug information, nutrition support, and other areas.

In order to accommodate the training of pharmacists in specialty areas, the use of "tracking" systems might be appropriate for schools/colleges of pharmacy in some countries /22,23/. This system is not utilized in the United States since graduates wishing to practice in most states must pass the same general national board (certification) examination in order to become licensed to practice, regardless of the area of practice. The proposed tracking system permits specific areas of emphasis for students interested in a particular area of pharmacy practice. Examples of specialty areas (tracks) include community pharmacy, hospital pharmacy, industrial pharmacy, and research/graduate education. This system of education assumes that all pharmacy students require most of the same fundamental information, but will require some specialized information in a practice area of specific interest to each student. For example, an institution may have no need to train pharmacists for the traditional role of manufacturing pharmacy. However, for institutions which have a large number of students who enter pharmaceutical industry, time must be established in the curriculum for the teaching of courses to address this need. Not all students should be taught a course in manufacturing pharmacy, if only a small percentage of the graduates enter this area of practice. A problem associated with a tracking system is that it is predicated on the assumption that students will know precisely the area of pharmacy practice they wish to pursue. In order to accommodate the training of pharmacists in specialty areas, appropriate blocks of time must be devoted to each of the specialty areas. For example, a curriculum may allow 12, 14 or 16 semester credit hours of work to be devoted to specific areas of interest (tracks) /23/.

EMPLOYMENT OPPORTUNITIES FOR CLINICALLY TRAINED PHARMACISTS

In addition to practicing in the community and hospital settings, numerous practice opportunities exist for pharmacists in the United States, particularly those with extensive clinical training and who possess the Doctor of Pharmacy degree. Various studies indicate that the degree of acceptance by physicians of the clinical role of pharmacists is directly proportional to the exposure of the physician to the clinical services offered by pharmacists. Furthermore, the advent of health care reform and the rapid changes in health care delivery offer numerous opportunities to pharmacists.

Home health care is a relatively new industry in the United States. Pharmacists are involved in the preparation of intravenous solutions for administration to patients in their homes. The pharmacists are also responsible for monitoring these patients for drug-drug interactions, drug-disease interactions, drug-laboratory interactions, appropriate drug dosage administration, and potential change from intravenous medication to oral medication if appropriate.

Pharmaceutical industries are hiring large numbers of clinically trained pharmacists to fill positions as clinical research monitors or clinical research project directors. In addition, many pharmacists are being employed by pharmaceutical industry as professional sales representatives. As industrial representatives, the clinical training allows pharmacists to more readily interact with physicians, and better understand the clinical problems which physicians may be experiencing relative to medication needs of patients. Clinically trained pharmacists are also being hired by pharmaceutical industries to assume positions in their drug information and regulatory affairs departments. Within the United States, drug

companies are not hiring large numbers of pharmacists to fulfill roles in drug manufacturing and quality control. A degree in pharmacy is not required to fulfill these functions, and in general, persons with degrees in chemistry are most appropriate for these positions.

Governmental drug regulatory agencies as the Food and Drug Administration also hire clinically trained pharmacists in positions associated with drug regulation and drug information. In addition, pharmacists are employed at poison information and poison control centers.

Large numbers of pharmacy graduates possessing the Doctor of Pharmacy degree are being hired by schools/colleges of pharmacy as faculty members. Is a Ph.D. degree necessary to be an effective teacher and faculty member in pharmacy? The answer is clearly no. The majority of clinical pharmacy faculty members hold the Pharm.D. degree and not the Ph.D. degree. In many schools/colleges of pharmacy, the number of clinical pharmacy faculty members (Pharm.D.'s) now equal or exceed the number of basic science faculty members (Ph.D.'s). Individuals with a Doctor of Pharmacy degree can be highly effective teachers and researchers if they have acquired post-Pharm.D. degree experience including a residency and a fellowship. Individuals with this experience can effectively compete and function as faculty members. However, clinical pharmacy (Pharm.D.) faculty without fellowship (research) experience have difficulty in being effective researchers and scholars, and require extensive mentoring. The establishment of programs to mentor all young faculty (Pharm.D.'s and Ph.D.'s) is highly beneficial to the success and development of faculty members. The degree which a faculty member possesses, be it a Pharm.D. degree or Ph.D. degree or both should not be a deterrent or prerequisite regarding faculty appointment and promotion.

SUMMARY AND CONCLUSIONS

Numerous changes have occurred in the practice of pharmacy during the past 20-25 years, and as a consequence, extensive changes have been required in pharmacy education. It is also highly apparent that in the United States as a result of health care reform and health care cost containment, further significant changes will occur in pharmacy practice and practice opportunities. In response to these changes, schools/colleges of pharmacy must be prepared to quickly and decisively address the needs and changes which will occur.

Pharmacy curricula must be based on outcome objectives. We must prepare our students to meet specific needs within the health care delivery system. However, since the current directions which health care reform may take, the extent to which health care reform will occur, and the rate at which these changes occur are not clear at this time, our current vision for the future of the practice of pharmacy as well as the expectations of pharmacy education are lacking total clarity. However, projections can be made, and many changes in curricula which are being implemented will need to be made regardless of the final outcomes with respect to health care reform and the development of universal, affordable health care in the United States. There is little doubt that major changes will occur with respect to both pharmacy practice and pharmaceutical education.

The product which pharmacy must offer is pharmaceutical care, not simply the dispensing of a drug product or device, and colleges/schools of pharmacy must provide the necessary educational focus, innovative curricula, and professional leadership. Curriculum modifications are essential if we are to provide quality, timely and appropriate education for our students for the current practice of pharmacy, the future practice of the profession,

and the broad range of practice opportunities which now exist and will continue to develop in the future.

Changes in a curriculum should not be made simply for the sake of change. Making major curriculum revisions is challenging, intellectually stimulating, exciting, stressful, frustrating and sometimes traumatic. Many faculty members find curricular revision to be exceedingly difficult and unpleasant, particularly with respect to recommendations involving the deletion of all or part of a required course in the curriculum which an individual may have taught throughout his/her academic career. In such cases, systems must be provided to assist faculty in becoming retrained and refocused in productive areas of the educational system. Courses should never be retained in the curriculum simply because a faculty member has taught a particular course or subject matter for many years, and would "simply have nothing to teach if the course were eliminated."

For the past 40 years pharmacy has been graduating highly trained, scientifically prepared individuals, many of whom are frustrated and disillusioned because their education has not coincided with the real-world practice of pharmacy which has involved a primary focus on compounding and dispensing. The frustrations which graduating pharmacists have experienced with respect to the realities of pharmacy practice relative to pharmacy education can be overcome by appropriate curricular revisions and changes in the educational system. The refocusing of attention on the patient and on pharmaceutical care provides an educational system which meets the needs of the profession and of society. If pharmacy is expected to remain an integral component of the health care and delivery system, major changes in both pharmacy practice and pharmaceutical education must occur. Pharmacists and pharmacy must offer a sustainable competitive advantage.

REFERENCES

1. Stohs SJ, Akubue PI. Trends in pharmacy education and practice: Part I. *J West Afr Pharm* 1992; 6:8-16.
2. Smith HA, Swintosky JD. The origin, goals and development of a clinical pharmacy emphasis in pharmaceutical education and practice. 1983; 47:204-210.
3. Hepler CD. The third wave in pharmacy education: The clinical movement. *Amer J Pharm Ed* 1987; 51:369-385.
4. Rosendahl I. European pharmacies rely more on OTCs. *Drug Topics* 1994; September: 64.
5. Reeder CE. Drugs, pharmacy and the healthcare reform debate. *Healthcare Trends & Transition* 1994; 5:12-16.
6. Navarro R. Managed geriatric pharmacy care. *Med Interface* 1993; 6:55-56.
7. Reissman DL. Cost containment strategies in managed care pharmacy programs. *J Pharm Pract* 1992; 5:72-74.
8. Lively BT, Holiday MG, Baker JB, Rappaport HM. Introduction to managed care and proactive management of the costs of absenteeism and turnover. *Pharm Bus* 1991; 2:17-19, 21-23.
9. Wertheimer AI. Managed care pharmacy service. *Top Hosp Pharm manage* 1990; 10:1-7.
10. Curtiss FR. Managed care: Second generation. *Am J Hosp Pharm* 1990; 47:2047-2052.
11. Curtiss FR. Managed care and its effects on pharmacy services. *J Res Pharm Econ* 1989; 1:3-42.
12. Kushner D. Managed care and market forces. *Am Drug* 1987; 195:44,47.

13. Gagnon JP. Life in pharmacy after health care reform. *Amer Pharm* 1994; NS34:5-6.
14. Muirhead G. The ABCs of PBMs. *Drug Topics* 1994; Sept 5:67-76.
15. Mullins CD. Drug firm-mail order mergers: Marriages of convenience? *Amer Pharm* 1994; NS34:38-42.
16. Caroll NV, Fincham JE. Elderly consumers' perceptions of the risks of using mail-order pharmacies. *J Soc Admin Pharm* 1993; 10:123-129.
17. Hepler CD, Strand NL. Opportunities and responsibilities in pharmaceutical care. *Amer J Hosp Pharm* 1990; 47:533-542.
18. Dankmyer T. The independent retail pharmacist: A fact sheet. *NARD News Release* 1993.
19. Webb E. Personal and economic consequences of patient noncompliance, adverse drug reactions and medication errors. *Coalition for Consumer Access to Pharmaceutical Care* 1993.
20. Brushwood DB, Catizone CA, Coster JM. OBRA '90: What does it mean to your practice? *U.S. Pharmacist* 1992; October:64-73.
21. Stohs SJ. Changes in course offerings and student qualifications at the University of Nebraska, 1969-79. *Amer J Pharm Ed* 1980; 44:241-245.
22. Stohs SJ, Muhi-Eldeen Z. The transition to more clinically oriented pharmacy education and the clinical practice of pharmacy. *J Clin Pharm Therap* 1990; 15:435-454.
23. Stohs SJ, Akubue PI. Trends in pharmacy education and practice: Part II. *J West Afr Pharm* 1993; 7:1-7.
24. Gourley DR. Curriculum evaluation: What progress have we made? *Amer J Pharm Ed* 1989; 53:375-379.

25. Manasse HR. Considerations for a philosophy of education for the profession of pharmacy in the next century. *J Soc Admin Pharm* 1991; 8:101-107.
26. Roche VF. The use of case studies in medicinal chemistry instruction. *Amer J Pharm Ed* 1993; 57:436-439.
27. Winslade N. Large group problem-based learning: A revision from traditional to pharmaceutical care-based therapeutics. *Amer J Pharm Ed* 1994; 58:64-73.
28. Delafuente JC, Munyer TO, Angaran DM, Doering PL. A problem solving active-learning course in pharmacotherapy. *Amer J Pharm Ed* 1994; 58:61-64.
29. Sims PJ. Utilizing the peer group method with case studies to teach pharmacokinetics. *Amer J Pharm Ed* 1994; 58:73-78.
30. Sims PJ. Utilizing the peer group method with case studies to teach pharmaceuticals. *Amer J Pharm Ed* 1994; 58:78-82.
31. Parkhurst C. Assessing and improving students' verbal communication abilities in pharmacy courses. *Amer J Pharm Ed* 1994; 58:50-55.
32. Holliday-Goodman M, Lively BT, Nemire R. Development of a teaching module on written and verbal communication skills. *Amer J Pharm Ed* 1994; 58:257-261.
33. Haddad A. Ethical problems in pharmacy practice: A survey of difficulty and incidents. *Amer J Pharm Ed* 1991; 55:1-6.
34. Haddad A, Kaatz B, McCart G, McCarthy R, Pink L, Richardson J. Curriculum guidelines for pharmacy education: Final report of the Ethics Course Content Committee. *Amer J Pharm Ed* 1993; 57(Suppl):34S-43S.