Chapter 3

# MEDICAL EDUCATION AND ASSESSMENT

# 3.

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## INTRODUCTION

Although a clear demarcation exists between the formal education process of physicians in undergraduate and graduate (residency) education and the more informal learning process accompanying active patient care, it is now commonly recognized that medical education is a *continuum* spanning both processes. This recognition has been manifested in two ways.

First, continuing medical education for physicians, initially implemented on a voluntary basis, now is a formal requirement for reregistration by many State medical licensing boards and for recertification by some specialty boards.

Second, in evaluating the quality of care provided by physicians, criteria are usually grouped according to *structure, process,* or *outcome* measures. *Structural* measures refer to the availability of resources, including facilities, equipment, and the numbers and types of different health care personnel. Structural measures also include qualitative aspects of the personnel providing medical care, such as the extent of educational background and board certification in a specialty area. *Process* measures usually assess whether or not diagnosis and/or therapy have been appropriately conducted according to norms or standards, or the medical profession's *average care* or *judgment of what that* care *should be. Outcome* measures reflect the end results of medical interventions and relate to the condition of the patient.

Outcome measures could tell us more precisely when and how medical care can help patients. However, knowledge is still rudimentary concerning the relationship between medical interventions and specific health outcomes. Ideally, structure, process, and outcome measures could be related. Specific medical interventions (process) could be correlated with improvements in health status (outcome). This correlation would then be used to modify the learning process (structure): the content of education would be improved by learning from experiences in the actual practice of medicine.

Medical education and assessment as continuous processes are most observable in the formal and informal education and assessment activities (continuing education requirements, recertification, peer review systems) that have appeared in clinical practice. The continuity is also reflected in the trend to revise present educational and assessment strategies to more accurately reflect the explosion of medical knowledge and the fact that physicians practice in specialized areas of medicine. The amount of knowledge that is needed to address all types of medical problems is too large for any physician to consistently retain, recall, and apply. Physicians now need to know more-about every specialty of medicine, yet knowledge and medical capabilities are expanding across all specialties. The medical information explosion also results in changes in the content and methods of medical education and in the use of medical knowledge.

Changes are occurring in medical licensure as a result of this reformulation of educational and assessment strategies. The content areas to be tested are changing, and the types of medical care that individual physicians are authorized to provide also may change. Such changes would lead to a modification in the role of State licensing boards and possible involvement of the medical specialty boards in the licensing of physicians.

The continuity of medical education and assessment activities is graphically summarized in figure 5.

## UNDERGRADUATE MEDICAL EDUCATION

### Admissions

Medical school is the common denominator for all types of physicians. Students are selected from a pool of applicants on the basis of generally uniform criteria, modified by the desire and need for diversity. Schools seek diversity in their student bodies voluntarily, as a result of judicial actions, and/or as a condition of Federal and State financial support. Geographic origins and minority/disadvantaged applicants, for example, are now factors in the admissions process.

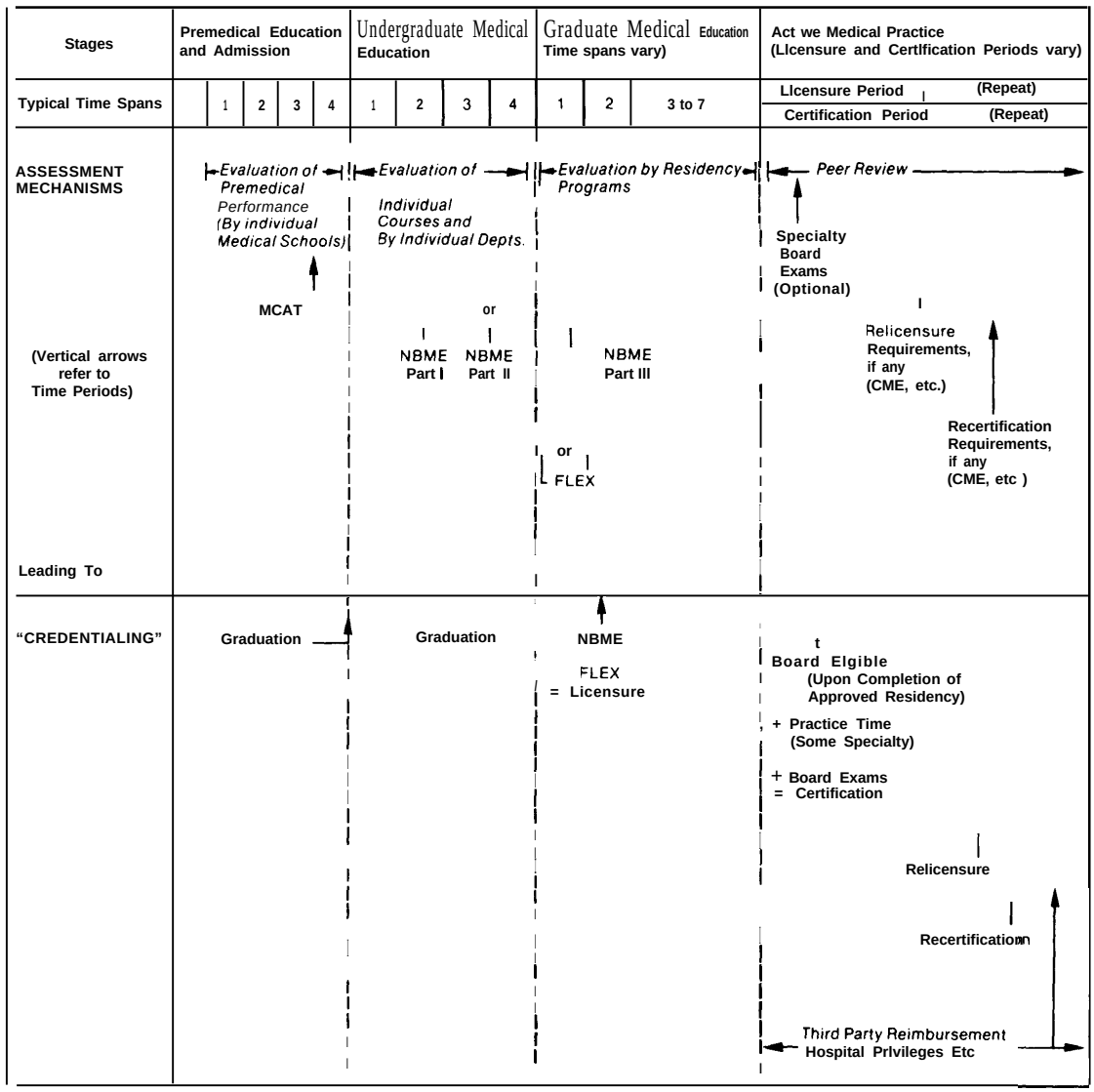
The geographic origin of a student is seen not only as a factor in student body diversity, but also as an important determinant of practice location. Consequently, attempts to influence the future geographic distribution of practicing physicians may be reflected in medical school admissions criteria. Such criteria are intended to improve access to medical services.

Favoring minority/economically disadvantaged applicants in the admissions process also addresses access questions, but of two different types. Access to medical services is one; students selected on the basis of these criteria are assumed to have a greater rate of practice in the types of communities from which they come. The primary consideration, however, is access *into* the medical profession by the disadvantaged.

Factors entering into the decisions of medical school admission committees include: 1) Medical College Admissions Test (MCAT) results; 2) the applicant's academic background and overall grade point average, difficulty of courses taken, and performance in related courses such as biology, chemistry, physics, and mathematics; 3) biographical data, including applicant's State of residence, ethnic background, and participation in nonacademic activities such as student government; 4) recommendations and reports from the applicant's premedical health profession advisor; 5) information and impressions from the personal interview, which is intended to allow the applicant to demonstrate communication and personal interaction abilities, and includes questions regarding the applicant's plans for career and location, as well as motivation for the study of medicine; and 6) results of other assessment instruments such as Miller Analogies, Myers-Briggs personality assessments, and any special knowledge tests used by selected medical schools.

Each school's admissions committee has its own particular needs and methods of judging the relative importance of each of the above criteria in choosing among applicants. The mix of criteria used depends largely on a school's previous experience with accepted applicants. In addition, most State-supported medical schools favor resident applicants by limiting the admission of nonresident students to 10 to 15 percent of the entering class (Association of American Medical Colleges, 1978a).

**Figure 5.—The Medical Education and Assessment Continuum**




In 1977-78, there were 15,493 first year positions available in U.S. medical schools. There were 40,569 applicants competing for admission, of which 15,977 (39.4 percent) were accepted for first or later year positions (Gordon, 1978). Table 4 summarizes trends and projections in the numbers of medical schools, graduates, and physicians in practice between 1960 and 1990.

**Table 4.—Number of Medical Schools, Graduates, and Physicians in Practice, Selected Years**

| Year | Number of schools[1] | Number of graduates[1] | Number of physicians | |
|---|---|---|---|---|
| | | | M.D. | D.O. |
| 1960 | 85 | 7,081 | 247,300 | 12,000 |
| 1970 | 101 | 8,367 | 311,200 | 12,000 |
| 1975 | 114 | 12,714 | 364,500 | 14,100 |
| 1980 (projected) | 122-124 | 16,086 | 426,300 | 17,700 |
| 1990 (projected) | — | 18,318 | 564,200 | 29,800 |

[1]M.D. schools and graduates only

SOURCES "Medical Education in the United States, 1977 -1978," JAMA 2402822 (December 1978). Bureau of Health Manpower, Health Resources Administration, DHEW, 1978

## Curriculum

The majority of U.S. medical schools conduct traditional 4-year undergraduate medical education programs. Approximately 6 percent of the schools have programs in which the student can receive the M.D. degree in 3 years (34 to 36 months) (Association of American Medical Colleges, 1978b). In this setting, the student takes coursework essentially on a 12-month basis. Although there are slight reductions in the total hours of some courses, the basic content of these courses is similar to the courses in traditional 4-year programs. Some schools accept students into a special program immediately following graduation from high school. Assuming normal academic progress, the students graduate approximately 6 years later. Other schools accept highly qualified students after the junior year in undergraduate college and award the M.D. degree 4 years later, for a total of 7 years.

The general 4-year program of undergraduate medical education is divided into two major portions—the basic medical sciences and clinical sciences. The basic sciences generally span the first two academic years of the program and include anatomy, biochemistry, physiology, microbiology, pathology, and pharmacology. These disciplines may be taught either independently as separate disciplines, or together as separate aspects of particular human organ systems, such as the cardiovascular system or the central nervous system. In either case, the material is taught via a mix of lectures, laboratory exercises, and discussion and/or correlative sessions. When the curriculum is taught by the separate disciplines, the usual sequence is anatomy, biochemistry, and physiology in the first academic year; microbiology, pathology, and pharmacology are taught in the second academic year. In interdisciplinary curricula, where the disciplines are taught together within particular human organ systems, there is no given sequence of courses arranged according to discipline. Other types of nontraditional curricula are offered in which the student is permitted to study and progress through the curriculum at his/her own pace.

A variety of educational support services are employed in the medical school program. Although the primary form of presenting didactic information is the lecture, other associated learning resources include audiovisual aids, case study materials, and computer-assisted instruction (CAI). Sixty percent of U.S. medical schools incorporate CAI into the curriculum. CAI is generally in the form of independent units of instruction that are available to the student upon his/her request (Association of American Medical Colleges, 1977).

Attempts to introduce early patient encounters during the two basic science years as a means of demonstrating the relationship between the basic sciences and patient care are

increasing. Through these programs, there are opportunities to use the knowledge learned and to expose students to problem-solving and patient diagnosis exercises.

In the transition from the basic science to clinical science years, learning through formal lectures decreases while learning through working with patients increases. The transition to clinical medicine is aided by the development of physical diagnosis, history taking, and physical examination skills and by introductory courses in the various major clinical specialties.

There are generally six clinical areas in which the student is required to serve: family medicine, internal medicine, obstetrics and gynecology, pediatrics, surgery, and psychiatry. Students serve a period of 8 to 12 weeks in each of these six clinical areas. During each clerkship, students learn via lecture, discussion, and considerable interaction with clinical faculty on their rounds in the hospital or clinic. Students conduct physical examinations, take patient histories, and participate in the formulation of treatment plans and requests for laboratory analyses. As the student progresses through a particular clerkship, he/she is required to assume an increasing share of responsibility for patient diagnosis and treatment under the supervision of the clinical faculty and house staff. The student is evaluated in each clinical clerkship by the faculty member(s) supervising the clerkship and by house staff.

Following the required rotations, which usually occur during the entire third year of medical school, the student may select certain specialty areas according to interest and career choice. Fourth year electives can be either a mixture of basic science areas and clinical specialties or totally clinical electives. The student interested in medical research, for example, might choose to take additional basic science coursework as well as clinical electives. Regardless of the particular choices, the student spends the majority of the fourth and last year of medical school in his/her chosen area.

## Assessment of Student Performance

The purpose of evaluation in undergraduate education is to assure that students achieve the educational objectives of the medical school and thereby qualify for the academic degree. The extent of a student's knowledge is assessed through objective tests that are administered throughout the student's medical school career. Student acquisition and use of clinical judgment skills are assessed primarily through the use of evaluation forms in the clerkship phase of medical education.

Within the basic sciences, objective examinations are both written and practical. They are designed essentially to assess the acquisition of knowledge and understanding of concepts within each discipline of the basic medical sciences. Faculty use their own tests and simulations as well as more widely used and standardized ones. The National Board of Medical Examiners (NBME) provides standardized tests for intramural use by medical school departments and faculty for student assessment. Based on the student's performance on locally developed examinations, he/she either advances in the program or is required to take remedial and/or tutorial instruction. The particular pass/fail criteria are a matter of the individual department's policy, Students often take the comprehensive examinations administered nationally by NBME at the end of the basic science portion of medical school (NBME Part I). Approximately three-fourths of all medical schools also require students to take Part I, and some schools also require Part II (Association of American Medical Colleges, 1978b). The extent to which medical schools require passing performance on this exam varies. Some schools require a passing score on

*each* discipline section; others, an overall passing score. Some require the student only to take the exam. The degree to which the NBME Part I scores contribute to the student's evaluation varies considerably among schools.

In addition to these methods of evaluation, many programs offer opportunities for self-evaluation. Often these self-evaluation methods utilize computer-simulated situations and computerized sets of test items and test situations. The availability of these facilities allows students to continuously assess their performance and progress.

The methods of assessing student performance in the clinical sciences are quite different from the basic sciences. The clinical evaluation contains a high degree of subjectivity and, although a standard institutional form may be used, often the clinical sciences are designed to determine the student's ability to integrate and synthesize the basic science information in clinical settings. Written, oral, and practical evaluations occur in each of the clinical rotations; and emphasis is placed on the student's ability to interact with patients, conduct physical examinations, take patient histories, make accurate diagnoses, and properly adapt basic science knowledge to the diagnosis and treatment of patients.

The assessment of student performance and preparedness during the course of undergraduate medical education is only one of the purposes of the assessment activity in medical school. A second and equally important purpose is to determine the adequacy and effectiveness of the curriculum itself. In most medical schools there exists an Office of Medical Education Research and Development that develops the internal mechanism for continuous student and curriculum assessment within the medical school.

## GRADUATE MEDICAL EDUCATION

Graduate medical education (GME) is a period of training that leads to qualification in a specialty. Medical students begin interviewing for graduate medical education positions (residencies) in the spring, summer, and fall between their junior and senior years. Students usually apply through the National Residency Matching Program (NRMP) for first-year appointments by the end of December of their senior year. Residency appointments are released in the spring.

Although based on different criteria, the same type of assessment that occurs in the medical school application process also occurs in the residency application process. Program directors review the applicant's academic performance in undergraduate medical education, recommendations of the faculty (particularly clinical faculty), and, if applicable, performance on Parts I and II of the NBME test. The results of the program director's interview with the applicant, if conducted, are also considered. Finally, the graduate program director's past experience with graduates of specific medical schools enters into the consideration.

The first year of GME is designated as the first year of an approved residency program. Beginning in July 1975, the term *internship* has not been used in approved graduate training programs (American Medical Association, 1977a). Although an integral part of the approved residency is a specialty, the first year is designated as either a categorical or a flexible first year. Such categorization reflects the fact that the first-year residency program is not necessarily limited to one specialty. One type of categorical first-year residency limits the program's content to the specialty field of the sponsoring programs. A

second type may include two or more specialty fields as determined by a sponsored program. A flexible first year is sponsored by two or more approved residencies and is jointly planned and supervised by the directors of such residency programs.

Following the first year of GME, additional periods of education are required to satisfy qualifications for specialty board certification. The years of required training for each specialty are summarized in figure 6.

During residency, the assessment of professional attitudes, self-discipline, communication skills, and various aspects of clinical judgment is accomplished chiefly through the subjective evaluations of the attending physicians and program directors. A number of specialty boards are now encouraging and introducing evaluative techniques for use during the residency training period. These in-training examinations assist the resident and the program directors to identify the resident's strengths and weaknesses in diagnostic techniques, medical procedures, and basic scientific knowledge in the specialty area.

## LICENSURE AND SPECIALTY CERTIFICATION

### Licensure

States and U.S. territorial jurisdictions (the District of Columbia, Puerto Rico, the Virgin Islands, and Guam) have the authority to license physicians. A physician must be licensed in each State or territory in order to practice there, although licensure reciprocity exists between most of them. Each jurisdiction establishes, through laws and regulations, the requirements for eligibility to take the licensing exam.

There are two primary examination pathways for licensure in the United States: 1) Parts 1, 11, and III of the NBME exam, and 2) the Federation Licensing Examination (FLEX). FLEX is constructed by the Federation of State Medical Boards and produced through NBME. It is the examination administered by individual State medical licensing boards. For foreign physicians, some States accept a Canadian license; others accept specialty board certification.

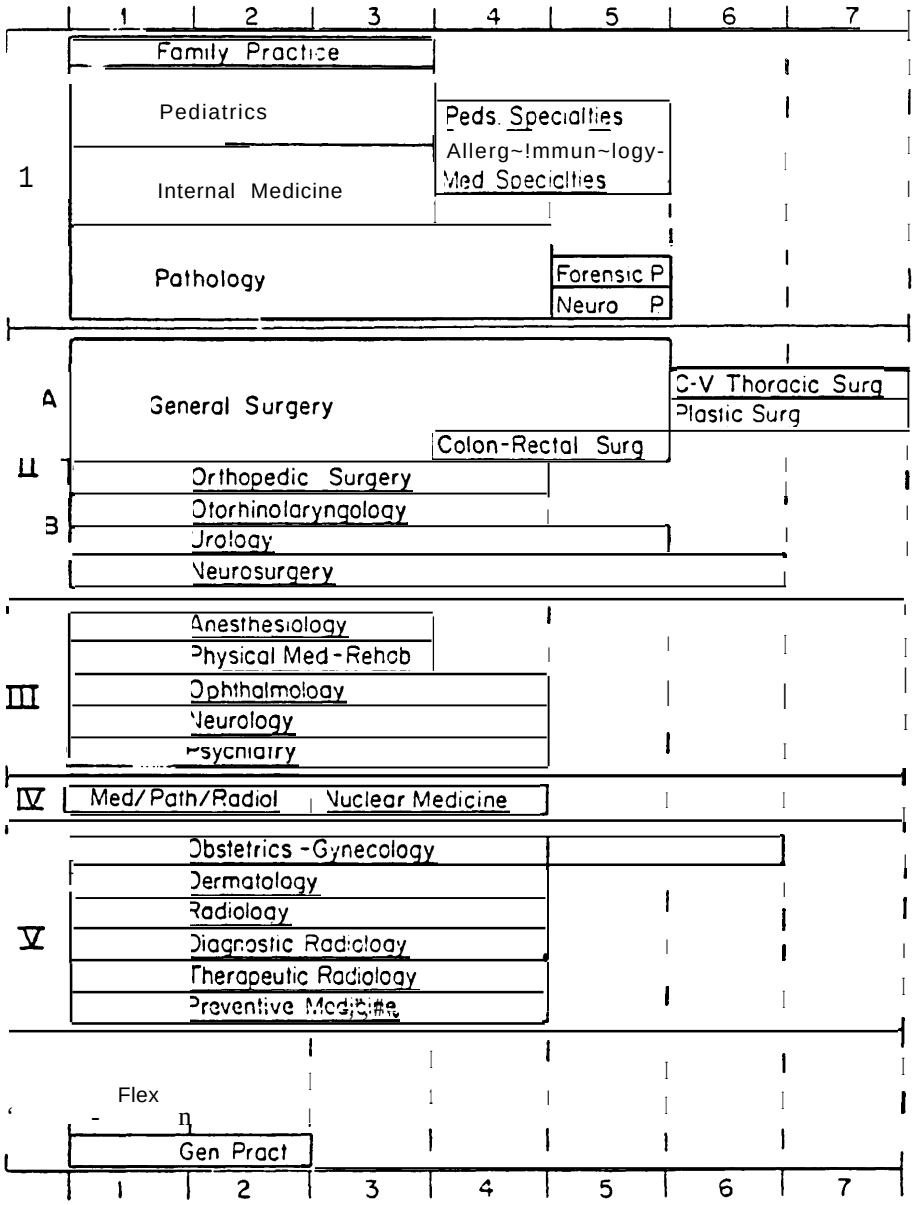
The NBME examination is composed of three parts. Part I, usually taken upon completion of the basic medical sciences, assesses the student's grasp of knowledge and concepts within the basic sciences. It is a comprehensive, 2-day examination consisting of approximately 1,000 multiple choice questions equally distributed among the disciplines of anatomy, behavioral sciences, biochemistry, microbiology, pathology, pharmacology, and physiology.

Part 11, taken either during the third or fourth year of medical school, is designed to measure knowledge and comprehension of the clinical sciences. Approximately 900 multiple choice test items are administered over a 2-day period. Questions are derived equally from internal medicine, obstetrics and gynecology, pediatrics, preventive medicine and public health, surgery, and psychiatry.

Part III, usually taken during the first year of graduate medical education, focuses on problem-solving abilities. The exam utilizes programed testing in the form of patient management problems as well as multiple choice questions, many of which require interpretation and analysis of illustrations, graphs, and tables of data.

Since the sequence of the NBME exam begins during undergraduate medical education, the majority of students successfully completing Parts I and II will use the NBME as their method of achieving licensure. Approximately 80 percent of U.S. medical school

**Figure 6.—Years of Graduate Medical Education**




SOURCE: Graettinger, 1977

graduates achieve initial licensure by successfully completing Parts I, II, and 111 of the NBME exam (American Medical Association, 1977b). The percentage of graduates achieving licensure through the NBME exam is influenced by the fact that a number of schools require their students to take and pass Parts I and/or II of the NBME exam as a part of their intramural evaluation system. However, the student always has the option to choose between the two certifying methods, regardless of whether or not parts of the NBME exam were taken in medical school.

If the physician does not take the NBME tract, he/she is required to take FLEX. Candidates usually take FLEX during the first year of graduate education. The examination is composed of three parts that must be taken at one time in 3 successive days. FLEX also differs from the NBME exam in its method of scoring; less emphasis is placed on the basic sciences. Although FLEX, at any one administration, is the same for all States, and all boards require a minimum weighted average score of 75, there are interstate variations on the acceptable minimum scores for individual subject areas. Thus, although the reported scores are uniform, there is some variance among licensing jurisdictions regarding acceptable passing scores (Merchant, 1978).

The composition of FLEX is derived from test items within those developed and validated by NBME. Questions are selected by committees, the members of which represent various State medical licensing boards. The 3 days of tests are similar to Parts I, II, and III of the NBME exam. The first day covers the basic medical sciences, the second day covers the clinical sciences, and the third day covers clinical problem-solving.

FLEX is the main route to licensure for foreign medical graduates; 78 percent of candidates taking FLEX in 1977 were foreign medical graduates (Merchant, 1978).

None of the State boards require a relicensing examination. However, as of December 1978, 23 States and Puerto Rico had enacted legislation or written regulations requiring continuing medical education (CME) for reregistration of the license to practice medicine. These States are identified in table 5. In the other States, relicensure remains a pro forma process accomplished by paying a renewal fee.

## Specialty Certification

The successful completion of a residency program, and, in a number of specialties, additional practice, qualify the physician for specialty board certification. Specialty board certification is not legally required. Rather, it is a voluntary process designed to indicate the type of specialized medical expertise a physician possesses beyond the general ability to practice medicine. The physician who has completed a residency program and received a license to practice is legally qualified to practice in that respective specialty without passing a certification exam. However, a physican will not be considered board certified.

The requirements necessary to achieve specialty certification are determined by the boards themselves. The 22 specialty boards and several other organizations are members of the American Board of Medical Specialties (ABMS). Among its functions, ABMS establishes standards, policies, and procedures for assuring the continued competence of physicians (Amercian Board of Medical Specialties, 1977). The recognized plans and educational standards for graduate training in each of the specialties are published annually in the Directory of Accredited Residencies (American Medical Association, 1977a).

The certifying exam for specialty board certification is developed by each of the 22 specialty boards. A number of specialty boards are receiving assistance and guidance

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**Table 5.—Jurisdictions With Authority to Require Continuing Medical Education for Reregistration of the License to Practice Medicine**

| State | Requirement in effect |
|---|---|
| Alaska | No |
| Arizona | Yes |
| Arkansas | No |
| California | Yes |
| Colorado | Yes |
| Hawaii | Yes |
| Illinois | Yes |
| Iowa | No |
| Kansas | Yes |
| Kentucky | No |
| Maryland | Yes |
| Massachusetts | Yes |
| Michigan | Yes |
| Minnesota | Yes |
| Nebraska | No |
| New Hampshire | Yes |
| New Mexico | Yes |
| Ohio | Yes |
| Pennsylvania | Yes |
| Puerto Rico | No |
| Rhode Island | Yes |
| Utah | Yes |
| Washington | Yes |
| Wisconsin | Yes |

SOURCE" ''Medical Education In the United States, 1977.1978,''JAMA 240:2850(December1978)

from NBME in the development and validation of their exams. The certifying exam for most specialty boards consists of oral and written tests. The written exam assesses basic scientific knowledge pertinent to the specialty. The examination of skills necessary to apply basic knowledge to the management of clinical problems is assessed chiefly through the oral exam. Skills, such as the ability to obtain and interpret information required for the proper diagnosis, the proper selection of therapy, and general patient management, are also assessed by the oral exam. Using standard techniques to specify and assess corn-petence in specialty training becomes increasingly difficult, however, as the sophistication ofatient care and management techniques increases.

All 22 medical specialty boards have established policies to provide recertification. Seventeen boards have established dates on which recertification will begin; six boards have already administered their first exam. Five boards have made recertification mandatory. Table 6 summarizes these developments.

## Emerging Developments

As a result of a report of the Committee on Goals and Priorities of NBME (National Board of Medical Examiners, 1973), the methods of assessing the readiness of a medical school graduate to enter GME has received considerable attention. NBME is presently under contract to the Bureau of Health Manpower, Department of Health, Education, and Welfare (HEW), to develop and validate methodologies for an examination, the Comprehensive Qualifying Examination (CQE), to be administered Prior to graduate medical education (National Board of Medical Examiners, 1979). NBME is developing a rating scale and a behavioral checklist for the exam and methods for assessing skills in sequential diagnostic problem-solving.

**Table 6.— Implementation of Recertification by the Specialty Boards**

| Board | Implementation date | Mandatory requirement |
|---|---|---|
| Allergy and immunology | 1 0/77 | No |
| Anesthesiology | 1984 | No |
| Colon and rectal surgery | 1985 | *Yes* |
| Dermatology | 1985 | No |
| Family practice | 10/76 | *Yes* |
| Internal medicine | 10/74 | No |
| Neurological surgery | None | — |
| Nuclear medicine | None | — |
| Obstetric-gynecology | 12/77 | No |
| Ophthalmology | 1983 | No |
| Orthopedic surgery | None | — |
| Otolaryngology | 1980 | No |
| Pathology | 1983-84 | *Yes* |
| Pediatrics | 1/80 | No |
| Physical medicine and rehabilitation | 1978 | No |
| Plastic surgery | 1978 | No |
| Preventive medicine | None | — |
| Psychiatry and neurology | None | — |
| Radiology | 1980 | No |
| Surgery | 1986 | Yes |
| Thoracic surgery | 1986 | *Yes* |
| Urology | 1980 | No |

SOURCE "Medical Education in the Unlted States, 1977.1978," ./AMA 24O: 2850(December. 1978)

CQE could provide an assessment of the medical school graduate's readiness for graduate training; such assessments are not conducted currently. In addition, CQE could be offered to all those entering graduate training for specialization: graduates of U.S. and foreign medical schools.

This new examination may lead to: l) a limited license to practice upon attainment of specialty status, and 2) intermingling of licensure by State medical licensing boards with specialty certification by the independent specialty boards. First, the graduate trainee would concentrate on a specialized area of medicine. If CQE is eventually acceptedly State medical licensing boards as a license to practice in the supervised setting, then the subsequent license to practice in the unsupervised setting may also be limited to the physician's specialty area. Second, all physicians who presently wish to practice must successfully pass the State licensing exam or other recognized tests. Those who qualify through specialty certification might not be required to be examined by the State if they successfully pass their specialty board certification exams (Merchant, 1978; Evans, 1978). Widespread adoption by State medical licensing boards of specialty certification, in lieu of the licensing exam, would further link the governance powers now vested in public agencies, the State medical licensing boards, with the powers of private organizetions, the specialty boards.

## CLINICAL PRACTICE

The process of assessing a physician's performance during practice is different from the one used during formal training. Some elements of the process are the same; for example, continuing education requirements and recertification exams are similar to learning and testing in the physician's formal training years. However, the practicing physician also is subject to the requirements of various programs designed to measure, evaluate, monitor, and/or improve medical services. Many of these programs are commonly known as "quality assurance" programs because of these objectives. There are generally

two major categories of such programs. Programs may be designed primarily to assess and improve the quality of medical care by *retrospective* analyses of physicians' treatment of patients. These programs rely on the analysis and interpretation of data about the medical care process and are designed to evaluate care already delivered. Other programs are designed to provide guidance to the physician during diagnosis and treatment. Such programs are commonly referred to as concurrent programs. Both retrospective and concurrent programs frequently have two distinct goals: 1) intervention in the medical care process in order to improve the quality of care rendered, and 2) reduced costs of medical care through reduction of inappropriate and/or excessive medical services.

Some quality assurance programs are federally mandated, such as the Professional Standards Review Organization (PSRO) program; others are privately sponsored. The PSRO program has established a major system of hospital quality assurance through concurrent review and medical care evaluation studies; efforts are now underway to identify variations in medical services through the development and analysis of provider and patient profiles. Recently enacted legislation established State government units to identify and detect cases of fraud and abuse in the Medicaid Program. A standardized data processing system, the Medicaid Management Information System (MMIS), has been installed in several States and is scheduled for full-scale national implementation. The Joint Committee on Accreditation of Hospitals (JCAH) promotes its own recommended hospital quality assurance programs and has recently entered the area of ambulatory care. Insurance companies have increasingly turned to review of claims data to isolate cases of flagrant abuse. Descriptions of a number of these review systems follow.

Hospital discharge abstract processing systems use data abstracted from hospital records by hospital medical records personnel. Abstract forms designed by a processing service include, at the minimum, the Uniform Hospital Discharge Data Set (UHDDS). The processor prepares a number of reports, such as the disease and operations index. Most abstract forms have been modified to include PSRO data elements to accommodate PSRO requirements for concurrent review information. Hospital discharge abstract processing systems are intended both to assist the institution in meeting the requirements imposed by JCAH and to provide the information for the hospital medical staff's various committees, such as the Utilization Review, Tissue, Tumor, and Infection Committees. Peer review and quality assurance activities are performed retrospectively. Reports derived from the abstracted data can be used by the physician committees to examine institutional and physician care patterns more clearly.

Private health insurance companies, which serve as intermediaries for Federal health insurance programs and PSROs, use a variety of methods for processing claims data for quality and utilization review. One such method, employed by Blue Shield of California, utilizes the electronic data system's retrospective analysis of medical services (RAMS) programs (E.D.S. Federal Corporation, 1978). Data submitted on the claims form for services are used for this retrospective analysis as well as for payment of claims. Systems are designed to analyze the relationships among patients, medical problems, providers, and procedures used to assess the appropriateness of care (quality and utilization). This assessment is performed by employing predefine criteria to evaluate problem and treatment interactions (proper treatment for specific problems) and to report any deviations for further study. The treatment model concept (analysis of problems versus treatment procedures) allows evaluation of the health care services delivered for a specific problem (diagnosis) by comparing the services actually rendered with the ideal or expected patterns of care. The established peer group norm concept is used as a supplement to the treatment model approach. Treatment analysis profiles are developed using previously defined models and community norms to evaluate a provider's practice by diagnostic

categories. Patterns of care failing these explicit criteria are noted as exceptions for further study and review. Summary profiles that report percent of deviation from the group norm and any deviation based on high and low parameters, which the user may select, are available for review. These profiles are used to indicate the necessity of further, more detailed review of patients and their providers. The computer, with its capability to store large data bases, allows comparison of criteria, establishment of practice norms, and production of practice pattern profiles.

The Commission on Professional and Hospital Activities (CPHA), a nonprofit organization based in Michigan, began to provide discharge abstract services as early as 1955 and has developed a data base consisting of approximately 150 million patient records from 2,200 U.S. and Canadian hospitals. The Commission has developed average lengths of stay for selected diagnoses or groups of diagnoses; these serve a useful function in admissions certification and concurrent review activities in the PSRO program. In addition to the Professional Activities Study (PAS), CPHA offers the Quality Assurance Monitor (QAM) from which three quarterly reports are prepared: 1) priority for investigation, 2) monitor profile, and 3) audit trail listings. These reports can be used by the various medical care committees to assist their review activities.

The computerized MMIS (U.S. Department of Health, Education, and Welfare, 1973) is a collection of subsystems designed by HEW's Health Care Financing Administration to assist States in the management of their Medicaid programs. Fifteen States are currently operating certified MMISs; 11 are expected to have their systems certified; and 23 are developing, or have partially implemented, MMIS.

One of the MMIS modules is the Surveillance and Utilization Review module (S/UR). The S/UR module is designed to: 1) produce a prescreen set of profiles that have been compared to the average pattern of care as defined by the State, 2) limit production of profiles to those providers showing aberrant behavior, 3) perform postpayment utilization review, and 4) offer options in the individual State's approach to utilization review. S/UR is a retrospective review mechanism for care that has already been provided and reimbursed. S/UR operates by using an edited paid claims tape to: 1) accumulate totals (for example, total number of providers in class group and total number of office visits); 2) select data items; 3) produce averages and standard deviation reports; 4) produce exception control limits reports; 5) produce exception summaries; 6) print exception provider profiles; and 7) produce, for hospitals, treatment analyses that relate the care provided to diagnosis and age group categories.

S/UR was designed to be a statistical reporting system, using means and standard deviations instead of norms. It is a flexible system because it can modify exception control limits through tables instead of through computer program changes.

PSROs were federally mandated and organized primarily to determine the medical necessity and appropriateness of care in Medicare, Medicaid, and Maternal and Child Health. PSROs are required to develop standards based on the care normally provided within the PSRO region. Major functions of the review process include admissions certification, continued stay review, retrospective review, and Medical Care Evaluation (MCE) studies (Goran et al., 1975). Determination of the necessity and appropriateness of medical services required developing criteria and standards for various types of diagnoses referenced to various patient characteristics, such as age and sex. Average length of stay based on these parameters has been calculated by the Commission on Professional Hospital Activity, but this data base does not include data from all hospitals in the country. AUTOGRP, an interactive computer system, provides the means by which each in-

stitution can more clearly investigate its own case mix characteristics, and to further define its criteria for length of stay (Mills, et al., 1976).

Admissions certification requires assessment of the status of the patient by a review coordinator to determine whether the diagnosis is appropriate for treatment at the health facility; the coordinator also determines whether admissions criteria for that diagnosis are met. If the review coordinator questions that admission, the case is referred to a physician advisor, who decides whether or not the admission should be certified. If the admission is appropriate, the coordinator determines the average length of stay for that particular diagnosis by age and sex, and indicates that a review of the case will be necessary within a prescribed number of days.

Review after admission is termed continued stay review. The coordinator reviews the patient's chart to determine when the patient may be discharged and whether the discharge falls within the prescribed length of stay. If the length of stay needs to be extended, the coordinator may either approve an extended length of stay or refer the case to the physician advisor. If inappropriate admission or stay occurs, the patient and the admitting or attending physician are notified that the stay may not be certified for payment.

Retrospective review is also performed by PSROs through profiling. Patient, practitioner, and institutional profiles are developed and reviewed to sharpen the length of stay indicators and to identify potential problems.

Finally, the PSRO's MCE studies focus on specific administrative and clinical problems and, after appropriate action has been taken, determine whether or not the problem has been solved.

Computers are principally used in the PSRO program both to schedule admissions certification and concurrent review activities and to evaluate the patterns of care. Computerized data bases that provide length of stay indicators and norms and standards are also used in order to properly certify the appropriate length of stay for a particular case. Computer applications in review functions include profiling and, to some extent, MCE studies. The computer is particularly useful in aggregating data elements for profiling because it is able to handle a wide variety and number of cases, and it can perform statistical analyses to obtain new dimensions of the information in a variety of displays. The computer is used in MCE studies to process data that focus on the individual problems being studied and to monitor the impact of efforts to solve these problems (Martin, 1978).

The PSRO Management Information System (PMIS) (USDHEW, 1975) is a system originally designed for use by the Health Standards and Quality Bureau, HEW, to process data required from each PSRO. These data are used to monitor and evaluate the performance of PSRO. By aggregating data from the various PSROs, it is possible to cluster them to allow self-evaluation. In addition, PMIS aggregates data regarding length of stay and other indicators of the medical appropriateness and necessity of admissions and hospital use. An inventory of selected MCE study designs and outcomes is also maintained and forwarded to the PSROs to assist them in conducting these studies.

PSRO projects may also cover ambulatory care. The physician ambulatory care evaluation (PACE) program (Nelson et al., 1976), operated by the Utah Professional Review Organization (UPRO), is a physician-directed professional review effort that utilizes both claims data and an advanced automated system for building histories of ambulatory patients and screening them for compliance with clinical guidelines. Both quality and utilization issues are addressed. Where patterns of variation from peer expecta-

tions are observed, intervention is directed toward improving patient care. The approach involves educational contacts with physicians rather than immediate punitive action. Denial of payment is only employed when other methods fail.

The New Mexico Professional Standards Review Organization's Revised Medicaid Ambulatory Care Review System (Health Care Management Systems, Inc., 1976) contains both a prepayment and a retrospective review system component based on claims that have been processed by the fiscal intermediary for claims payment. A small sample of New Mexico providers is reviewed before payment as a result of previous analyses of their practice patterns that have indicated substantial deviations from standard patterns. All other providers are reviewed retrospectively at least twice a year if their claims volume justified such a review. Both prepayment and retrospective review employ criteria developed by physician committees, and claims data are subject to these guidelines. Physicians failing the retrospective guideline review are reported to educational committees. The educational committee assigns one or more of its members to follow up the case. The case is researched by an educational committee member, who writes the physician in question explaining why certain standards should be met. This explanation is supported by appropriate scientific and medical facts and includes literature citations. Physicians on prepayment review whose responses fail the guidelines may be denied all or partial payment and may be referred to the ambulatory care review committee for possible future educational intervention by the committee.