

Licensure and Regulation of Dental Professionals

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CHAPTER OVERVIEW

Dentistry is a highly respected profession for many reasons. As individuals, dentists provide a valued service in their communities, enjoy strong relationships with their patients and are much regarded for their integrity, compassion and skills. Representatives of dentistry serve on state and regional regulatory boards as advocates for the public welfare. As a profession, dentistry maintains a clear commitment to high performance standards, life-long learning and support for strict accreditation standards of dental school programs and state licensure requirements.

State licensure requirements and scope of practice regulations, while serving to protect the public, can also have unintended and unfortunate consequences. Differences among states' rules can impede professional mobility and make it difficult for the dental workforce to respond to changes in the demand for skilled dental personnel, due to demographic changes in states or regions.

Differences among state Scope of Work regulations may also force some personnel out of the labor pool—particularly hygienists—if they must move to another state and find that they are required to take a battery of courses or exams to meet their new state's licensure requirements. Conversely, if their new home state defines Scope of Work more restrictively than their training allows, hygienists may not find it financially or professionally rewarding to continue their professional careers.

Further, differences among states may discourage the emergence of national consensus on dental curricula development. While dental educators work to build strong and innovative programs, reality may require that they keep a close eye on their students' facility with the material known to be key in their state examinations.

This chapter reviews dental licensure and regulation and identifies strategies to strengthen mechanisms that assure professional conduct and performance. The chapter considers:

- ◆ The scope of practice and licensing requirements for general and specialty dental practice and for allied dental health practice;
- ◆ Criteria for licensure and alternative approaches to traditional licensure examinations;
- ◆ Current procedures for assessing dentists' initial and continued competencies; and,
- ◆ The changing roles of federal, state, and local regulation of dental professionals.

I. LICENSURE AND REGULATION OF DENTAL PROFESSIONALS TODAY

A license to practice dentistry is a privilege granted by individual state and district governments. Through its legislature and licensing boards, each state or district promulgates statutes, rules and policies regarding professional licensure and regulation. The American Dental Association (ADA) describes the purpose of licensure as follows:

Dental licensure is intended to ensure that only qualified individuals provide dental treatment to the public. Among qualifications deemed essential are satisfactory theoretical knowledge of basic biomedical and dental sciences and satisfactory clinical skill. It is essential that each candidate for an initial license be required to demonstrate these attributes on examination, a written examination for theoretical knowledge and a clinical examination for clinical skill (ADA, 1976, 1977, 1989, 1992).

STATE BOARDS OF DENTISTRY

State boards of dentistry serve to ensure that dental professionals maintain their competence and practice in accordance with the law of that state. Dental board members include dentists, dental allied personnel, and representatives of the public. It is important for boards to have public representation as well as professionals with clinical knowledge and expertise that is critically needed to fulfill their responsibilities. Those responsibilities include evaluating dental professionals for licensure and disciplining errant dentists and allied personnel.

Two percent of all dental licensees had disciplinary actions filed against them by state boards of dentistry in 1997.

SCOPE OF PRACTICE

A dentist's "scope of practice" refers to the diagnosis and treatment a dentist can legally perform for a patient in the practice of dentistry by virtue of his or her license to practice within a state.

Most state dental practice laws specifically define or refer to the ADA definition of the practice of dentistry. Dentistry is defined by the ADA as:

The evaluation, diagnosis, prevention, and/or treatment (non-surgical, surgical, or related procedures) of diseases, disorders, and/or conditions of the oral cavity, maxillofacial area, and/or the adjacent and associated structures and their impact on the human body; provided by a dentist, within the scope of his/her education, training, and experience, in accordance with the ethics of the profession and applicable law (ADA, 1997).

The scope of practice in all of dentistry, including its specialties, has continually evolved. State board definitions of the scope of specialty practices have not kept pace with the dynamic advances in dental materials and techniques.

Most dental practice laws allow for licensure exemption for dentists in the military service or public health service, dentists offering clinical instruction who are teaching in their jurisdiction, and physicians and surgeons engaged in the practice of dentistry.

SPECIALTY PRACTICE

Each specialty defines its own scope of practice within its educational and training parameters. The type of license, requirements for licensure, and practice limitations of each specialty dental practice vary among jurisdictions.

Seventeen licensing jurisdictions have some specific statutes and/or regulations that define the scope of specialty practice and issue some sort of license for dental specialists. Twenty-two states set standards for announcements by licensed dentists who have not completed specialty training but choose to limit their practice to a special area.

While most states require that specialists also have a general dental license, a few states issue a specialty license that does not require the specialists to pass its general dentistry licensing examination. In these states, the specialist is limited to the practice defined for the specialty. The type of license issued may restrict the specialist's scope of practice.

Traditional areas of expertise for specialties have begun to overlap. For example, periodontists and oral and maxillofacial surgeons both perform implant surgical procedures. Similarly, some pediatric specialists now perform orthodontic procedures.

Dental boards in a number of states are working to address concerns raised by state medical boards about oral and maxillofacial surgeons who provide head and neck cosmetic procedures that have been traditionally defined under the state's "practice of medicine" statutes and regulations.

Another challenge facing dental boards is the issue of "dual degrees." Dental boards are struggling to define the scope of practice of oral and maxillofacial surgeons, for example, that have a dental degree and a medical degree but are licensed only under a medical degree. With the M.D. degree, the specialty graduate applies for a medical license and does not fall under the statutes and regulations governing dentistry in that state. The medically licensed oral and maxillofacial surgeon then performs procedures that are defined in the dental practice act as the "practice of dentistry." Dental boards across the country are developing new rules and regulations to address such dual-degree issues.

ALLIED DENTAL HEALTH PRACTICE

The three nationally and professionally recognized allied dental health fields are dental hygiene, dental assisting, and dental laboratory technology. To protect the health and safety of the public, licensing jurisdictions regulate certain tasks performed by allied dental personnel. Nowhere are the regulation and licensure and certification of dental personnel more varied from state to state than in the allied fields.

The competent performance of any allied professional who works under the supervision of the dentist is ultimately the responsibility of the supervising dentist.

Dental Hygiene

Most state dental statutes and regulations define the scope of practice for dental hygienists, who must be licensed to practice. The dental hygienist (except in Alabama) must be a graduate of an accredited educational program. There are 255 dental hygiene programs accredited by the Commission on Dental Accreditation (CDA) (ADA, 2001).

The scope of practice for dental hygiene varies from state to state. Although basic functions are universal, in some states expanded functions may be permitted if proof of additional education and training is accepted by the licensing jurisdiction.

Many states also allow for indirect or general supervision of dental hygienists by dentists. This

means that dental hygienists can provide services for patients without a dentist being present during the procedure as long as the dentist has directed that the procedure is appropriate. Each state establishes its own limitations and parameters. A few states allow the independent practice of dental hygiene.

The demand for dental hygienists has increased as consumers seek more preventive dental services. However, because of the differences in licensure from one state to another, it is often difficult for a hygienist trained in one state to transfer to another state. The need for more licensed dental hygienists has prompted many states to seek nontraditional educational pathways to increase the number of practicing hygienists.

States must consider these factors as they address the freedom of movement for dental hygienists, a greater uniformity in their scope of practice, and, most importantly, patient protection concerns.

Dental Assisting

Dental assistants are not licensed. The majority of state dental statutes and regulations do not define "dental assisting." Assistants are permitted to perform services specifically defined by each state dental practice act. The procedures allowed are always procedures that are reversible and do not fall under the definition of the practice of dentistry or dental hygiene. In all jurisdictions, a dental assistant's duties must be performed under the supervision of a licensed dentist.

Voluntary national certification programs have been established for dental assistants, and the CDA conducts site visits and accreditation reviews for most dental assisting programs. There are 258 accredited programs for dental assisting (ADA, 2001). However, since neither formal education nor certification is required many dental assistants are not formally educated, but are trained while employed by a licensed dentist.

Dental Laboratory Technology

The expansion of the predoctoral dental curriculum limits the amount of time dental schools have to teach their students the laboratory skills that were traditionally taught in the past. The aging of the population creates an increased demand for fabrication of fixed and removable prostheses to replace teeth and related dental structures. Dental laboratory technicians are helping to meet this demand, aided in part by more efficient laboratory procedures, materials and equipment.

Like dental assisting, dental laboratory technology has voluntary national certification programs. The ADA CDA conducts educational program site visits and has written standards. There are 28 CDA accredited programs (ADA, 2001).

Most states do not regulate dental laboratories or dental technicians. Generally, laboratories work as directed by prescriptions from licensed dentists.

LICENSING EXAMINATIONS

Basic Biomedical Sciences

Every dental licensing jurisdiction in the United States accepts the National Board dental examinations on the basic biomedical sciences, administered by the Joint Commission on National Dental Examinations. Some jurisdictions also require additional written examinations for licensure, such as a theory examination and a state jurisprudence examination. Increasingly, states are accepting the National Board written dental examination in lieu of other examinations.

Clinical Dental Sciences

Clinical dental sciences examinations are sometimes administered by the individual state or jurisdiction. However, many states have joined one of the regional testing services (Western Regional Examining Board [WREB], Southern Regional Testing Agency, Central Regional Dental Testing Service [CREDTS] and Northeastern Regional Board [NERB]) to pool their resources and improve the quality of their examinations.

Forty-one of the 53 licensing jurisdictions subscribe to the services of one or more regional testing services. The remaining 12 jurisdictions continue to examine individually. WREB and CREDTS mutually recognize their exams to be equivalent and urge their member states to accept these results. No governmental or private agency accredits dental licensing examinations.

Clinical examinations in dentistry have changed dramatically in recent years. The public, the practicing dental community, dental educators, examiners, examination candidates and others have demanded greater accountability from examining agencies.

The result has been a call for in-depth evaluation of clinical examination reliability and validity by the testing agencies. Many of the agencies are respond-

ing and now utilize psychometric standards and professional test analysts. The science of clinical examination analysis is evolving because of this self-evaluation, and the quality of clinical examinations continues to improve.

Expressing concern about patient welfare, liability, and examination variability, a number of interested parties have advocated removing live patients from the licensing examination process. Several licensing jurisdictions have instituted the use of mannequins and other artificial patients with varied results. Unfortunately, no simulation techniques are available that duplicate live-patient experience to the satisfaction of most testing agencies.

Alternative Approaches to Licensure

In 1997 clinical testing agencies, licensing jurisdictions, and organizations within the licensure community developed *The Agenda for Change*, which offers 12 objectives to facilitate improvements in the clinical licensure process. (See Table 5.1.) The *Agenda's* objectives address the development of uniform clinical content and standardized calibration of examiners, the use of human subjects in clinical licensure examinations, improving and standardizing the appeals process, and providing remediation programs for candidates who fail the clinical licensure examinations.

The *Agenda for Change* promotes acceptance by all licensing jurisdictions of the National Dental Board Examination in lieu of a separate written examination on oral diagnosis and treatment planning, and suggests collecting statistical data on examination results to begin to address the profession's concerns about failure rates on clinical examinations.

State-specific licensure requirements limit professional mobility and make it difficult for the dental workforce to respond to geographic shortages in personnel. *The Agenda for Change*, if coordinated with a proposed study of scoring practices and post-examination analyses, would constitute significant progress toward standardizing all clinical licensure examinations.

A number of alternatives to the traditional licensure examination are emerging.

PRE-GRADUATION EXAMINATION

Many examining agencies offer clinical examina-

T A B L E 5.1

Agenda for Change in the Clinical Licensure Examination Process

1. Promote the interaction of all testing agencies and boards of examiners to explore the concept of more uniform content and methodology in licensure examinations.
2. Develop and promote the acceptance of guidelines for administration of a common content clinical examination and standardized examiner calibration.
3. Encourage testing agencies to work with dental school faculties to develop and participate in calibration activities.
4. Minimize the use of human subjects in clinical licensure examinations, but where human subjects are used, ensure that the safety and protection of the patient is of paramount importance and that patients are procured in an ethical manner.
5. Develop and promote policies and procedures to make clinical licensure examinations more candidate-friendly.
6. Encourage the development of publications, orientation sessions and other methods to better communicate to candidates information regarding clinical examination logistics.
7. Minimize the time needed to notify candidates of examination results.
8. Improve and standardize to the extent possible the testing agencies' appeals process.
9. Urge the American Association of Dental Schools to encourage all dental schools to offer remediation programs for candidates who fail the clinical licensure examinations.
10. Promote further study of the pregraduation examinations by the clinical testing agencies and encourage the testing agencies and dental schools to work together to offer the pregraduation examinations to the extent possible.
11. Promote the acceptance by all licensing jurisdictions of the National Board Dental Examination in lieu of a separate written examination on oral diagnosis and treatment planning.
12. Address the profession's concerns regarding the failure rates on clinical examinations, by collecting statistical data on examination results within the limits imposed by the need to protect confidentiality.

* These objectives were developed by participants in the Invitational Conference for Dental Clinical Testing Agencies held March 4, 1997. The objectives were endorsed by the American Dental Association, the American Association of Dental Examiners, the American Association of Dental Schools, and the American Student Dental Association.

tions to senior dental and dental hygiene students prior to graduation. This allows the candidate to utilize more fully the dental school resources during the examination and to enter practice more rapidly after graduation.

LICENSURE BY CREDENTIALS

Licensure by credentials, or licensure without examination, is now an acceptable pathway in more than 30 licensing jurisdictions. Credentialing allows many established dentists and dental hygienists to obtain a license to practice without repeating a clinical performance examination.

The ADA has supported these efforts and has established "Guidelines for Licensure," which outlines attributes that states should consider when

granting a license by credentials. The licensing jurisdictions also have created individual requirements for licensure without examination, thereby reducing the uniformity among the requirements. Continuing competence may become an important aspect of credentialing.

The Canadian system of initial licensure is closely tied to institutional accreditation. Graduates of these accredited Canadian dental programs face minimal additional examinations for licensure, since licensing representatives are part of the accreditation process. This system relies almost wholly on the accreditation process and faculty evaluations, since outside examiners do not test individual candidates for clinical competence.

Graduates of Canadian dental schools are treated the same as graduates of dental schools in the

United States and Puerto Rico, because there is an accreditation agreement between the two accrediting agencies.

CREDENTIALS FROM NON-ACCREDITED SCHOOLS

The Commission on Dental Accreditation (CDA) is the recognized agency for accrediting educational programs in dentistry. The goal of accreditation is to assure students, licensing boards, and the public that a graduate of an accredited educational program is prepared to practice competently. The accreditation process evaluates the educational programs and the physical facilities, not the clinical skills of the graduating students. The CDA considers all dental schools outside the United States to be non-accredited except Canada by reciprocal agreement; therefore, graduates of these schools must meet individual state requirements before they can be licensed.

Most states will not license a graduate of a non-accredited school unless that individual attends an accredited school for a specified period of time and is either granted a degree or certified as equivalently educated by the accredited institution. Only California, Hawaii, and Ohio license a graduate of a non-accredited dental school without these requirements.

POSTGRADUATE TRAINING

As an alternative to the clinical performance examination, some United States licensing jurisdictions are considering granting licenses to dentists who have completed an additional year of training in an accredited postgraduate dental education program. No such programs have been implemented to date.

COMPUTER-BASED EXAMINATIONS

Computer-based clinical simulation examinations may soon provide an additional tool for measuring the diagnostic, treatment planning, and treatment application skills of new graduates and established practitioners.

INITIAL AND CONTINUING COMPETENCY

Initial Competency

In the early 1990s the American Association of Dental Examiners established criteria that licensing agencies across the country could use as a guide to

create more valid and reliable examinations of graduating dentists. These criteria addressed all aspects of the written and clinical examination, including qualifications of examiners, the format and content of the test, grading guidelines, test security, and the appeals process. Nevertheless, varied results continue. This may reflect the new graduates' lack of clinical experience and underscore the fact that dentistry is an art, which requires practiced skill, as well as a science.

As the scientific and technical aspects of education have expanded, some dental schools have added to their didactic curriculum, often having to reduce the clinical experiences for the students to do so. As a result, some graduates may have developed technical competence but have not received enough experience with patients to develop in-depth clinical competence. This can lead to poor test results on the initial competency exam.

A 1995 Institute of Medicine study (Field, 1995) recommended that reform in the accreditation process should focus on educational outcomes and on standards and methods that will identify and improve those schools that are not educating their students effectively.

Continuing Competency

The Dentist's Pledge affirms a commitment to an ongoing pursuit of knowledge and skills:

I shall accept the responsibility that as a professional, my competence rests on continuing the attainment of knowledge and skill in the arts and sciences of dentistry.

The ADA's Principles of Ethics and Code of Professional Conduct, 2A, requires this commitment stating:

The privilege of dentists to be accorded professional status rests primarily in the knowledge, skills, and experience with which they serve their patients and society. All dentists, therefore, have the obligation of keeping their knowledge and skill current.

At its 1999 House of Delegates meeting, the ADA defined continuing competency as the continuance of the appropriate knowledge and skills by the dentist in order to maintain and improve the oral health care of his or her patients in accordance with the ethical principles of dentistry.

Forty-seven states have mandatory continuing

education requirements for relicensure. All recognized dental specialties have initial certification procedures, and several have developed recertification processes to ensure that certified practitioners remain current. In addition, other organizations, such as the Academy of General Dentistry, have programs that grant fellowship and mastership status to general dentists who achieve milestones in continuing professional education.

Organized dentistry established wellness programs to protect the public and enhance professional competency by promoting the physical and mental well-being of dentists.

REGULATION OF THE PRACTICE OF DENTISTRY

Hundreds of regulations affect the practice of dentistry. Accounting procedures, the protection of patient records, and the use of specific equipment in certain clinical procedures are the more apparent areas where there are efforts to regulate details of clinical practice (Palmer, 2000a and 2000c; and Berthold, 2000). Regulation of the dental practice is so extensive today that new entrepreneurial entities have emerged offering courses to teach dental office personnel appropriate compliance techniques for city, state, and federal regulations. Regulations governing the dental practice range from local zoning requirements regarding parking lot requirements, to requirements for apparel worn in public places that could be contaminated from the workplace, to the disposal of wastewater.

Federal and State Regulation

In the United States, government has traditionally taken a "hands-off" position with respect to the doctor-patient relationship (Jost, 1997). Health care at one time was a private matter between the health care professional and the patient. As health insurance became commonplace, the third party payer entered into the relationship. The resulting complex of responsibilities, relationships and priorities created a mandate for regu-

lations to protect the interests of patients.

Complex and specialized care, provided in widely dissimilar environments, and an increasing ability to solve medical problems with new science and technology have provided additional impetus for protective regulations. The consequent cost is significant; it is estimated that the cost of federal regulation to a family of four is about \$7,600 each year (Wendy Lee Gramm, Personal Communication, May 15, 2000).

The health care system increasingly has been affected by regulations such as the Americans with Disabilities Act, which do not primarily target the health professions, but which have had profound implications for health care delivery. Other regulations, such as the Occupational Safety and Health Administration's (OSHA) Bloodborne Pathogen rule, which was written largely with the hospital environment in mind, have had significant cost implications for dental care. In each case, laws and the attendant regulations were created to respond to problems and address perceived needs. And in each case, these laws and regulations have had unforeseen consequences, some of which have worked counter to original intentions.

In recent years, the political environment has become less favorable for such sweeping regulations, especially when promulgating them has dramatic cost implications for the affected sector and its consumers without identifying offsetting funding. This trend began in 1995, when Congress began closely scrutinizing the procedures for rulemaking and culminated recently when it took the unprecedented step of repealing the prior administration's ergonomics standard. That action was a response to vigorous opposition to the rule.

Certainly, the ergonomics issue typifies the rule-maker's dilemma: how to impose restrictions on the marketplace that balance the costs and benefits. Purported benefits are difficult to estimate accurately. Nevertheless, estimates are needed. Potential costs are more easily developed and should be available for any regulation.

II. LICENSURE AND REGULATION OF DENTAL PROFESSIONALS IN THE FUTURE

Licensure and regulation are intended to protect the public safety and assure the provision of quality dental services. Regulation of the dental workplace is intended to protect the safety of dental practice employees and patients.

To a significant extent, licensure and regulation should reflect and encompass those advances in technology, education, and workforce that best serve the public interest. Thus, the most important assumption about changes in licensure, scope of

service regulations, competency examinations and workplace regulation may be that the nature of the requirements will undergo review and revision regularly, so as to recognize and encompass the many positive developments that will emerge over time.

FUTURE CHANGES IN MOBILITY, COMPETENCY AND SCOPE OF PRACTICE

The desire for greater professional mobility will promote more consistent examiner calibration, more uniform exam content, and more state recognition of multiple regional boards. There will be increased demand for continued development of computer-based simulation as a valid method for testing clinical skills. Current competency assessment will be an integral factor in decreasing barriers to mobility for dental professionals. Alternatives to traditional licensure and state-specific licensure will be implemented in an effort to reduce geographic shortages by allowing dental professionals easier interstate mobility.

There will be increased efforts to assure initial and continued competency. Greater demand will exist for documented and formalized continuing competency assessment. Greater emphasis will be placed on in-depth clinical competency for the initial competency examination.

Changing workforce requirements, advances in technology and recognition of the complexities and relationships between oral and systemic disease will require redefinition of the scope of practice for dentists and allied dental professionals.

Telehealth will require cooperation among state and national jurisdictions, and possibly the restructuring of dental governance. Telehealth may stimulate more uniform scopes of practice among the state statutes and regulations. Further restrictions on dental assistants could result in a reduction of available employees for dental offices and would therefore alter the delivery of dental care to the public. A critical under-supply of laboratory technicians will occur in the future unless the number of students in this field is increased. The exponentially expanding aspects of technology will provide new materials and procedures that will initiate expanded functions for allied personnel.

The complexities and interrelations of oral and systemic diseases will continue to evolve and require more extensive examination and diagnosis by a licensed dentist for every dental patient.

FUTURE CHANGES IN REGULATION OF DENTAL PROFESSIONALS

Federal and state activities are likely to increase in the near future in the area of access to care for Medicare beneficiaries, and for Medicaid and SCHIP beneficiaries.

Federal activity is also likely to occur in addressing issues of the workplace environment and likely will include new proposals that will increase the cost of delivering care, thereby increasing consumer costs and, ultimately, decreasing access to oral health care.

Two examples that pose this possibility in the near term are a promulgated but not yet enforced rule on medical information privacy and a guidance document issued by the U.S. Department of Health and Human Services (USDHHS) stating that health professionals must provide translation services to non-English speaking patients.

The privacy regulation, intended to guard the confidentiality of individually identifiable health information, includes oral communication in addition to paper and electronic records. This could possibly mean that health professionals would not be able to discuss patients' care in physical settings where the conversation might be overheard. The recent trend in dental office design has been toward exactly this type of open space, and a strict interpretation of this rule could have staggering compliance costs, much of which would be passed on to patients.

Similarly, a strict interpretation of the USDHHS guidance on providing translators for non-English speakers, with no counterbalancing funding, could create a situation in which dentists could no longer afford to provide routine preventive care to such patients. These are but two examples of why the regulatory pendulum will likely continue to swing between extremes of cost control and consumer protection.

III. PATHWAYS AND STRATEGIES FOR LICENSURE AND REGULATION OF DENTAL PROFESSIONALS IN THE FUTURE

Public policy as it is expressed in legislation and regulation may have significant impact on the dental profession in the coming decade. In 1983 the ADA House of Delegates adopted five recommendations from the Future of Dentistry report and one resolution from the House of Delegates as part of a strategic plan to be developed for the ADA. It was considered imperative that the profession's ability to influence public policy be strengthened. Since then, the demand for regulation has increased.

Public attitudes and opinions, shaped by the proliferation of ideas and assumptions, both correct and incorrect, must not be allowed to lead to legislative initiatives or regulations without scientific validation. All affected parties must work together to ensure that valid science is the basis for necessary and appropriate regulation. It appears very likely that one of the greatest issues of today—access to care—may be addressed tomorrow with regulation and legislation at state and federal levels.

All licensing jurisdictions should develop consensus regarding standards for the validity and reliability of all phases of licensure examinations, both written and clinical, and for licensure without examinations (credentialing). States should also assure that all regulation is based on valid scientific evaluation and solutions. More dental professionals should serve as advocates and resources for developing regulatory policy development.

It is very important that the dental profession continue to maintain the competency of dentists and allied dental personnel through innovative approaches to education, strengthened standards for continuing education credits, and outcome assessments for relicensure and recertification.

SCOPE OF PRACTICE

In the interest of increasing access to dental care, independent practice by dental hygienists and dental laboratory technicians does not best serve the public; however, allied personnel may be trained to perform more technical procedures of dentistry with the dentist being responsible for diagnosis, treatment planning, implementation, assessment, and supervision.

Increased recruitment efforts will be necessary to assure sufficient numbers of dental hygienists, dental assistants, and dental laboratory technicians.

State licensing boards should develop a uniform scope of practice for allied personnel that is mutually recognized among states. This will allow increased interstate mobility.

To increase access to preventive dental care for children of low socioeconomic status, medicine and dentistry should partner in certain aspects of patient care.

The aging population is creating a demand for more services that need the laboratory technician's expertise in the fabrication of fixed and removable prostheses to replace the teeth and related dental structures. The expansion of the predoctoral curriculum has limited the dental schools ability to teach their students the laboratory skills that were traditionally taught in the past. Dentistry must proactively promote dental laboratory technology as an attractive career choice, as well as increasing the availability of education for dental laboratory technicians.

LICENSING

The dental profession should be cautious about the creation of multiple types of licenses to practice dentistry (limited scope specialty licenses) because regulations and overlap of scope may render it difficult to establish clearly separate responsibilities. All licensing jurisdictions should meet basic psychometric standards for validity and reliability of all phases for licensure examinations, both written and clinical. Accreditation of the evaluation process for licensure examinations should be investigated. If and when the accreditation process includes outcome assessments of the clinical skills of dental school graduates, a diploma from an accredited dental school could eliminate an entry-level exam.

The dental profession should consider whether the Commission on Dental Accreditation should be involved in accrediting non-U.S. dental schools to ensure similar standards and outcome of graduating dentists.

Licensure without examinations (credentialing) should be encouraged as long as it includes a meaningful evaluation of the applicant's competence to practice dentistry and includes a thorough investigation of the applicant's personal history.

Alternatives to live-patient examinations should continue to be investigated. However, any alternative must prove to be equal to live-patient examina-

tions in measuring the candidate's clinical skills and abilities to solve high-level problems.

COMPETENCY

Dental professionals have many opportunities to meet competency requirements in a positive and beneficial manner. The challenge is to find more effective and efficient ways to continue to improve the process.

Dental schools must develop a system to give students more clinical experiences and remediation when needed. Currently, residency programs are available only to the highest-ranking students. One possibility is a mandatory PGY-1 curriculum or collaborative clinical experiences with off-campus clinics that serve populations of low socioeconomic status. Funding of this additional educational experience would require the cooperation of other entities.

The profession must be proactive to ensure that the policies promoted by advocacy groups are based on scientific fact, not anecdotal information. For example, increased federal regulation and the geographic mobility of dentists have stimulated the search for a simplified measurement by which to judge the competence of a dentist.

Outcome assessments could be a surrogate for relicensure and/or recertification. The ADA supports the science-based approach to outcome assessments as an integral part of relicensure or continued competency. In the ADA Environmental Scan Report of 1999, references to "best practices" criteria are presented in discussing the global perspectives.

Continuing education courses could be strengthened with more definitive pre- and post-tests. The Internet creates many possibilities for education as well as examination. Continuing competency examinations (as well as study) could be available over the Internet. By involving the appropriate accrediting agencies, the criteria for validity, reliability, uniformity, objectivity and current knowledge could be met in programs offered over the Internet. A flexible menu of competency assessment mechanisms could be developed, with the dentist's confidentiality ensured while testing his/her skills. If mandatory continuing competency examinations were developed, dentists might have a time window in which to take, learn, and retake exams without prejudice if necessary.

REGULATION

Regulation must be based on valid scientific eval-

uation and guard against over-regulation caused by special interest, single-focus groups. Dentistry must foster scientific examination, evaluation, and prevention in the area of regulation as it has in oral health. If successful, the profession will be able to continue its service to the public unimpeded by unnecessary regulation.

The ability of the profession to influence public policy must be improved by dentists participating in the legislative and regulatory activities. Representatives of the practicing dental community must be involved in the decision-making process as Medicare, Medicaid, and SCHIP evolve. The profession must be the inspiration for legislative and regulatory activity affecting dentistry. This time of great change may introduce operating systems that are not well thought out and certainly are not well tested. Such times endanger both the profession and the public. Time-proven, value-driven systems may be destroyed and lives hurt in the process unless there is an appropriate deliberative process for the institution of regulatory change. Regulation will be beneficial if it adds safety and value to the services provided.

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CHAPTER OVERVIEW

The generation of new knowledge through research and scholarship, and the transmission of that knowledge through teaching, learning and practice are at the heart of dental education's commitment to quality patient care and professional renewal.

The relationship between the quality of dental education and the training of dental professionals is clear—all dentists are the product of dental education. The contemporary dental school provides the dental profession with two critically important benefits. First, the nation's dental schools are the practicing profession's sole link to the university, and with it the esteem and professional status that dentistry enjoys. As Lord Rushton wrote more than 40 years ago, dentistry became a profession when it entered the university (Rushton, 1957). And second, dental schools continually generate and expand the science and technology base that permits dental professionals to maintain the public's trust, and to practice in a progressively more advanced and effective fashion.

Today, in 2001, the United States dental profession is stronger and healthier than ever before, and there is a legitimate sense of optimism among dental professionals about their future. United States' dental schools have achieved immense success and unparalleled accomplishments. However, many schools are financially over extended, operate in antiquated physical facilities, and face a serious faculty shortage. While the opportunities for future dental professional education are bright, the dental education system's ability to help its students realize those opportunities may be in some doubt.

This chapter explores the key issues facing dental schools and the implications of these issues for the future of the dental profession. The following topics are discussed:

- ◆ The dental schools' obligations and responsibilities to society;
- ◆ The relationship between the dental schools and their university environments;
- ◆ The financial resources that support dental education;
- ◆ The status of the applicant pool and the characteristics and interests of dental students;
- ◆ The challenges faced by dental schools in recruiting, developing and retaining a first rate cadre of dental academics;
- ◆ Dental school curriculums and their efforts to incorporate new knowledge and modern information technology;
- ◆ The state of the classrooms, dental laboratories, clinics and research facilities in dental schools;
- ◆ Future priorities of schools of dentistry in developing dental specialists as practitioners and teachers for the future;
- ◆ The implications of the changing dental workforce for the future of dental education;
- ◆ Trends and future directions for professional continuing dental education;
- ◆ Recent developments and challenges in the education of the allied dental team; and,
- ◆ Dental education's role in promoting improved workforce productivity by the dental team.

Dentistry's future has long been of interest to practicing and teaching dentists alike. An early exploration of the topic, published in 1872, notes: "To refuse to see that great changes are at hand, as concerns the standing and practice of the dental profession, is simply to shut one's eyes. Of no thing are we more fully assured than that the dentistry of today must either advance or give place; to attempt to confine it to its present limits is to seek to control that progress which is itself evolution." (Dental Cosmos, 1872.)

¹ All data and references to dental schools in this chapter pertain to schools located in the United States.

I. DENTAL EDUCATION TODAY

THE DENTAL SCHOOL'S RESPONSIBILITY TO SOCIETY

The 54 dental schools in the United States are national resources that educate general dental practitioners, dental specialists, and dental academics/researchers. Dental schools develop new technologies and information of value to the nation as a whole and provide important and much needed direct services to their communities.

Society grants dentistry the privilege of self-regulation in exchange for dental professionals' commitment to their patients and the advancement of oral health. Dental professionals maintain this responsibility by committing to a defined set of professional behaviors known as the Principles of Ethics and Code of Professional Conduct, and by embracing life-long learning through the pursuit of formal continuing dental education.

The fundamental objective of dental education is to educate dental professionals to accept responsibility to act in their patients' and society's interest. Society allows universities analogous privileges of self-regulation to enable the education of health care professionals, including dentists, to safeguard the public's health.

The nation's dental education institutions are central to the nation's future oral health through their contributions to:

- ◆ Education and training of the nation's dental health professionals;
- ◆ Conduct of research and the generation of new knowledge for application to oral health care; and,
- ◆ Direct provision of dental care services for the public.

Professional education and training is the most widely recognized responsibility of dental schools. Virtually all of the nation's dentists and a significant proportion of all registered dental hygienists have been educated and clinically trained in the nation's 54 dental schools.

The second responsibility of dental schools is to conduct research. Advancing dental science is also a well-recognized responsibility of dentistry.

The third responsibility, to provide direct patient care, is central to students' clinical training and to faculty involvement in the dental education process. The

amount of patient care that schools are able to provide, however, is limited in relation to the amount needed to actually meet the public's oral health care needs.

The strength and leadership of the nation's dental schools are essential to the achievement of these three responsibilities. Unfortunately, the dental education sector is stretched to its limit and faces difficult challenges.

A greater sensitivity on the part of public and governmental agencies regarding the resource needs of the academic dental centers is needed if dental education institutions are to continue to serve their obligations to society.

The status quo, or worse, the diminishment in the nation's dental education system exacerbate the range and depth of the oral health challenges and patient care deficiencies outlined in the Surgeon General's Report on Oral Health in America (U.S. Department of Health and Human Services, 2000).

DENTAL SCHOOLS AND THEIR ENVIRONMENTS

The University Setting

A positive relationship between a dental school and its parent university provides an environment that promotes a scholarly, research-based approach to clinical excellence in dental education (Haden and Tedesco, 1999).

However, in the early 1980s, it became apparent that not all the university-based dental schools were successful in maintaining that relationship. Dental schools were burdened by operating with the highest per student educational costs on the campus. Some had limited or unimpressive research programs. Faculty members and dental school leadership did little to promote interaction with the rest of the university community. And a surprising level of antagonism to dental education emerged—from within the practicing dental community itself.

The failure of some dental schools to meet the academic and research norms of their parent institutions, together with the acknowledged high cost of dental education, has compelled some university leaders to examine how much their dental education program contributes to the mission of the larger university (Haden and Tedesco, 1999).

The dental education community did not anticipate closure of its educational programs. In 1986, a dental school was closed in Oklahoma. Between 1988 and 1993, five more universities closed their

dental schools, and another closed in 1998.

Critical review of their dental programs will almost certainly be undertaken by private universities, which are not under state mandate to promote dental education and may not maintain a fundamental mission to support dental education. Indeed, all seven dental school closings occurred in private or private/state-assisted universities.

The closure of private schools is troublesome not merely because of the potential negative impact on the workforce, but because when prestigious private universities elect to close dental schools, it is a measure of the declining value academe places on the dental academia and research enterprise. These closures also potentially compromise oral health care and promotion of prestigious academic health centers. Although other dental schools are opening, confirming societies perceived need for dentists, they are not located in prestigious private universities, thereby adding momentum to the loss of academic esteem.

The Academic Health Center

The need for dental schools to be more attuned to the mission of their university was vigorously addressed by the 1995 Institute of Medicine (IOM) study, *Dental Education at the Crossroads* (Field, 1995); by the 75th Anniversary Summit Conference sponsored by the American Association of Dental Schools (AADS) (AADS, 1999); and by J.E. Albino (Albino, 1999).

The IOM study emphasized that dental schools must move closer to the academic, research, and patient care missions of medical schools specifically and academic health centers in general (Field, 1995). In many dental schools faculty members are following IOM recommendations and are collaborating with medical school faculty, especially in research, at unprecedented levels. Extensive dental/medical research interactions have, for example, been promoted and funded by the National Institute of Dental and Craniofacial Research (NIDCR), particularly through the P-01, P-20, P-50, and P-60 research programs operating in the nation's dental schools. The dental school/medical school collaboration is also evident in the curriculum of nine dental schools that share the first two years of basic sciences courses with the medical students (National Institute of Dental and Craniofacial Research [NIDCR], 2000).

Patients have also seen more interaction between dental and medical faculty resulting in better under-

standing of each other's competencies. This proliferation of interactions appears to have occurred because of the increasing number of dental faculty members who have the formal qualifications and higher degrees, the scholarly and clinical skills, and the resultant self-confidence to interact comfortably and productively as equals with research and clinical colleagues in schools of medicine, public health, nursing and pharmacy. Moreover, research trends in molecular biology, epidemiology, molecular genetics, bioinformatics, biomimetics, and new diagnostic technologies have increasingly focused on the inter-relationships of all systems in the human body. This has had the effect of lessening traditional distinctions between the medical and the dental sciences (NIDCR, 1997).

The Community

Each of the nation's dental schools serves as a resource for its immediate community and, to some extent, for the geographic region in which it is located.

The dental school's provision of patient services, in many cases for people who have no other access to good quality treatment, is critically needed in communities across the country. Some dental schools operate teaching/service clinics in remote geographic areas, further increasing access to care.

Like their medical counterparts, dental schools also possess a nucleus of tertiary care specialists who accept referrals, thus serving as a key resource for the practicing dental community.

Dental school faculty and students interface with community school systems in projects aimed at promoting and advancing science education in the kindergarten through grade 12 public school systems. Dental schools further serve their communities by offering extensive Continuing Dental Education (CE) programs whose purpose it is to periodically update the general practitioner and dental specialists, and thereby to elevate the standards of dental care available in the community.

Lastly, in each community where a dental school is located, the institution provides a substantial number of excellent jobs, and the school is therefore responsible for generating very significant economic activity within its service region.

FINANCING FOR DENTAL EDUCATION

Dental education is among the most costly, if not

the highest cost, professional training program. There is considerable variation in the per student cost of dental education among the nation's schools.

The most significant factor contributing to the high cost of dental education is the clinical education and patient care training programs—programs that are part of the university budget. This makes dental care program costs highly visible to university financial officers.

The cost of clinical education and patient care training in medicine is largely borne by hospital budgets, not the university. This type of cross-subsidy is not available to dental education programs.

Dental School Revenues

Dental schools receive operating revenues from a surprisingly broad array of sources. The relative importance of any source varies greatly among schools and is generally influenced by whether the institution is a public dental school, a private dental

school, or a private/state institution.

Table 6.1 provides a summary of revenue by source and school type. In 1998 the nation's dental schools reported aggregate revenues of over \$1.4 billion. The primary revenue source for public schools are state or university system appropriations, followed by clinic income, sponsored research/training, tuition and fees, other revenues, indirect cost recovery, gifts/endowment, and several lesser or indirect revenue sources. In contrast, for private schools tuition and fees are the most significant revenue sources, followed by clinic income, sponsored research, gifts/endowment, other income, and several lesser or indirect categories. The revenue pattern for the private/state-related schools is similar to that of private institutions.

While Table 6.1 provides the best data available, the data are incomplete and understate aggregate revenues necessary to operate the nation's dental schools. One major category of funding not reported is the extramural practice income of full-time clinical faculty. In contrast, intramural practice

TABLE 6.1

Summary of Dental School Revenues from All Major Sources, FYE 1998

Source of Income	Public Schools	Private Schools	Private-State Related Schools	All Schools
Student Tuition and Fees	\$136,488,706 (36)	\$206,264,263 (14)	\$44,181,424 (5)	\$386,934,393 (55)
State and Local Governments	410,292,736 (36)	3,193,612 (6)	11,214,652 (5)	424,701,000 (47)
Federal Government	2,061,421 (4)	8,171,600 (1)	247,613 (1)	10,480,634 (6)
Dental Clinic Revenue	156,900,972 (36)	80,041,528 (13)	15,239,522 (5)	252,182,022 (54)
Gift Revenue	31,899,761 (35)	33,471,236 (14)	2,938,618 (5)	68,309,615 (54)
Recovery of Indirect Costs	27,749,654 (35)	7,700,615 (13)	711,143 (4)	36,161,412 (52)
Other Educational Revenue	34,580,882 (28)	12,604,447 (13)	6,342,685 (2)	53,528,014 (43)
Educational Revenue: TOTAL	799,974,132 (36)	351,447,301 (14)	80,875,657 (5)	1,232,297,090(55)
Sponsored Education/Research/Training	113,263,892 (36)	32,409,679 (13)	3,437,350 (5)	149,110,921 (54)
Financial Aid Revenue	18,225,357 (33)	5,090,101 (10)	2,082,063 (4)	25,397,521 (47)
Revenue: GRAND TOTAL	931,463,381 (36)	388,947,081 (14)	86,395,070 (5)	1,406,805,532(55)

*Numbers in parentheses indicate the number of schools included in the calculations of summary values.
Source: ADA, 2000.

Dental Education

income is substantial, and is reported as a school revenue source by 42 institutions.

For all dental schools an annual challenge is to ensure that revenues will cover or exceed expenditures. This challenge is complicated by the diversity of revenues dental schools rely on to make their budget. A detailed analysis by Douglass and Fein reported dental school revenue trends for the 1973 to 1991 period, adjusted for inflation (Douglass and Fein, 1995). The trends revealed a major decline in federal support for dental education (more than 50%), while increases were noted for student tuition (doubled), clinical revenue (doubled), and other revenues, such as gifts, endowment income, and continuing education income (rose by 80%).

Table 6.2 provides dental education revenue trend information for the years 1992-1998 and reports CPI-adjusted revenue data, where 1998=100. The most significant recent trends for total dental education revenues are:

- ◆ Total annual revenues for 54 dental schools were \$201 million higher in 1998 than in 1992, measured in constant 1998-dollar terms. This represents an annual average growth rate of just over 2.6% for total revenues.
- ◆ Annual tuition and fee revenues increased \$106 million in constant dollars during the 1992-1998

period, an average annual increase of less than 5.5% per year.

- ◆ Annual revenues from state and local government, which had been essentially level from 1979 to 1991, declined from 1992 to 1998 by a total of \$46 million (constant 1998 dollars), for an average annual decrease of just over 1.5%.
- ◆ From 1992-1998 annual federal government support increased by \$13 million in constant dollar terms, for an average annual increase of 1.9%.
- ◆ Dental schools' annual clinic income between 1992 and 1998 increased \$52 million in constant dollars, for an annual growth rate of 4%.
- ◆ Other annual income revenue increased \$76 million in constant dollars, for an average annual growth rate of 10% over the 1992-1998 period.
- ◆ Continuing dental education annual revenues increased a modest \$2 million in constant dollars, for an annual growth rate of 2%.

Dental School Expenditures

The typical dental school has a complex table of operating expenses. As indicated in Table 6.3, the total expenditures of 54 dental schools in the United

TABLE 6.2

Summary of Dental School Revenues (in millions of dollars), by Source, 1992-1998
(Adjusted for Inflation: 1998=100)

	Total Revenue		Tuition & Fees		State & Local		Federal		Clinic Revenue		Other Revenue		Continuing Education	
	Dollars	%Change	Dollars	%Change	Dollars	%Change	Dollars	%Change	Dollars	%Change	Dollars	%Change	Dollars	%Change
1992	\$1,206	NA	\$281	NA	\$496	NA	\$129	NA	\$200	NA	\$100	NA	\$16.1	NA
1993	\$1,234	2.33%	\$296	5.12%	\$476	-4.04%	\$143	11.09%	\$212	6.13%	\$107	7.25%	\$15.7	-2.91%
1994	\$1,257	1.87%	\$311	5.32%	\$472	-0.88%	\$134	-6.34%	\$223	5.28%	\$117	8.79%	\$15.7	0.31%
1995	\$1,291	2.69%	\$325	4.46%	\$464	-1.62%	\$141	5.21%	\$240	7.30%	\$121	3.67%	\$15.6	-0.72%
1996	\$1,299	0.59%	\$339	4.16%	\$428	-7.79%	\$149	5.23%	\$240	0.17%	\$143	18.62%	\$16.4	5.12%
1997	\$1,347	3.70%	\$360	6.15%	\$444	3.69%	\$135	-9.08%	\$245	1.99%	\$164	14.05%	\$17.2	4.56%
1998	\$1,407	4.48%	\$387	7.65%	\$450	1.40%	\$142	5.13%	\$252	2.96%	\$176	7.64%	\$18.1	5.46%
1992-1998		2.61%		5.48%		-1.54%		1.87%		3.97%		10.00%		1.97%

Source: ADA, *Surveys of Predoctoral Dental Educational Institutions*; and U.S. Department of Labor, Consumer Price Index, Bureau of Labor Statistics.

States were more than \$1.34 billion in 1998. Comparing this amount with the \$1.41 billion aggregate revenue 1998 figure presented in Table 6.1, it appears that dental schools generated sufficient revenues to offset their aggregate expenses.

Table 6.3 also indicates that the differences in expenditure patterns among the three categories of schools (public, private, and private/state assisted) are not as pronounced as are the differences in revenue sources.

An important question suggested by Table 6.3

is whether dental schools are allocating expenditures in an appropriately strategic fashion. For example, 42 dental schools report intramural practice revenues, yet only 34 report practice expenditures. Also, in 1998, 47 dental schools allocated only 0.98% of expenditures to computers and information technology services. This figure is surprisingly low, and may reflect that the central university campus financially supports dental school information technology development activity.

TABLE 6.3

Summary of Dental School Expenditures to All Major Sources, FYE 1998

	Public Schools	Private Schools	Private-State Related Schools	All Schools
Instructional Expenses				
Basic Science	\$103,326,718 (35)	\$18,914,878 (14)	\$6,099,696 (4)	\$128,341,292 (53)
Clinical Science	266,132,427 (36)	80,920,053 (14)	23,925,173 (4)	370,977,653 (54)
Behavioral Science	9,211,614 (24)	672,412 (7)	3,745,603 (4)	13,629,629 (35)
Continuing Education	14,327,062 (32)	5,021,789 (13)	470,198 (4)	19,819,049 (49)
TOTAL	392,997,821 (36)	105,529,132 (14)	34,240,670 (5)	532,767,623 (55)
Sponsored Educational Programs				
Basic Science	519,053 (7)	- (0)	- (0)	519,053 (7)
Clinical Science	6,704,294 (13)	4,738,956 (5)	18,362 (1)	11,461,612 (19)
Behavioral Science	8,145 (1)	- (0)	- (0)	8,145 (1)
Learning Science	- (0)	- (0)	- (0)	- (0)
Other	270,479 (2)	3,037,342 (3)	75,023 (1)	3,382,844 (6)
TOTAL	7,501,971 (15)	7,776,298 (7)	93,385 (2)	15,371,654 (24)
Sponsored Research and Training				
Basic Science	49,942,177 (27)	8,491,132 (9)	1,616,659 (4)	60,049,968 (40)
Clinical Science	40,361,169 (32)	10,514,507 (12)	623,233 (2)	51,498,909 (46)
Behavioral Science	4,288,661 (10)	539,161 (2)	10,305 (1)	4,838,127 (13)
Training Grants	8,881,192 (25)	1,762,258 (7)	351,320 (1)	10,994,770 (33)
TOTAL	103,473,199 (35)	21,307,058 (12)	2,601,517 (4)	127,381,774 (51)
Other Educational Expense				
Library Expenses	15,909,474 (35)	4,827,974 (14)	1,608,915 (5)	22,346,363 (54)
Learning Resources	4,176,108 (30)	1,026,120 (13)	113,011 (1)	5,315,239 (44)
Computer Services	10,388,971 (33)	2,604,077 (12)	655,307 (2)	13,648,355 (47)
Dental School Administration	60,979,843 (36)	38,616,419 (14)	7,936,311 (5)	107,532,573 (55)
Patient Care Services	201,202,546 (36)	96,055,971 (14)	20,065,734 (5)	317,324,251 (55)
Physical Plant	53,873,534 (35)	25,231,348 (14)	3,518,523 (4)	82,623,405 (53)
General University Overhead	66,835,415 (35)	36,168,860 (14)	11,785,280 (5)	114,789,555 (54)
Financial Aid	19,003,876 (30)	11,113,205 (12)	2,787,507 (5)	32,904,588 (47)
Other	15,043,095 (19)	6,193,209 (8)	636,968 (2)	21,873,272 (29)
TOTAL	447,412,862 (36)	221,837,183 (14)	49,107,556 (5)	718,357,601 (55)
Sub-Dental Expenses: TOTAL	776,700,548 (36)	322,855,185 (14)	70,401,380 (5)	1,169,957,113 (55)
Other Expenses: TOTAL	174,685,305 (34)	33,594,486 (8)	15,641,748 (4)	223,921,539 (46)
Expenses: GRAND TOTAL	951,385,853 (36)	356,449,671 (14)	86,043,128 (5)	1,339,878,652 (55)

*Numbers in parentheses indicate the number of schools included in the calculations of summary values.
Source: ADA, 2000.

DENTAL SCHOOL APPLICANTS

The Applicant Pool

Like other professions, dentistry goes through cycles during which the applicant pool rises, declines, rises again, continuing in this wavelike pattern over time.

As indicated in Figure 6.1, the number of dental school applicants peaked in 1978, and then dropped precipitously to a 30-year low in 1989. The next year, in 1990, applications began a dramatic increase and reached a high in 1997 of just over 9,800. Between 1998-2000, applications have

A second reason the decline is not expected to be long lasting is that the current environment for dental practice is extremely favorable, and especially so for new practitioners. Whether relying on anecdotal reports of increasing practice opportunities, or on the reports that assert or predict dental workforce maldistribution, virtually all signs point to a favorable professional practice climate for the next few cohorts of dentists. Such a situation should also act as a brake on the current decline in the applicant pool.

Third, the potential size of the applicant pool has grown significantly since 1980, some say it has nearly doubled, due to an increased number of female applicants. In most schools women now represent 30-40% of the student body.

Fourth, the number of dental school seats to be filled is 30% smaller than was the case in the early 1980s. This suggests that some decline in the size of the applicant pool can be accommodated without serious academic consequences.

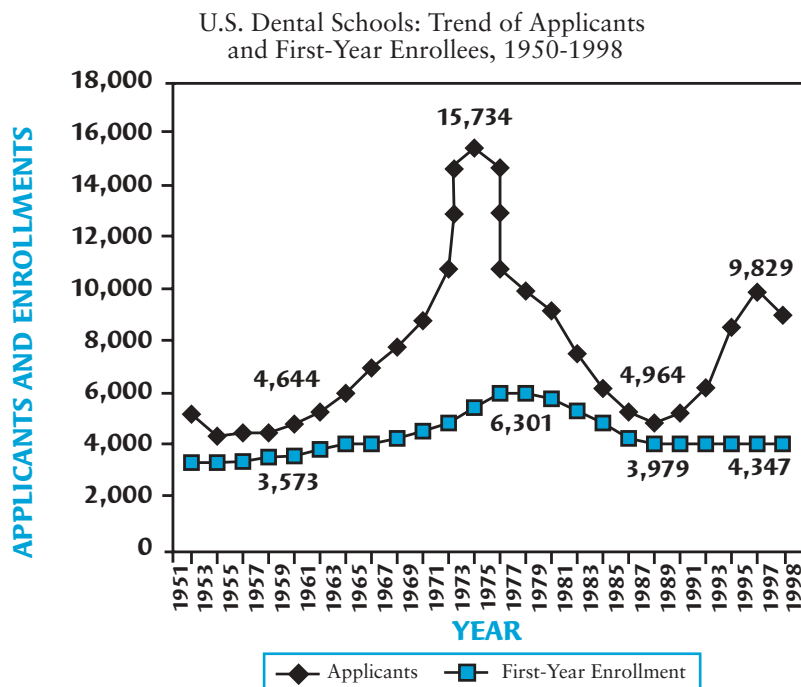
Fifth, there is informal evidence from dental admissions directors that, contrary to past experience, the modest decline in the size of the applicant pool has not been accompanied by a parallel decline in the grade point average (GPA) of entering students. In fact, quite the opposite seems to have occurred in a number of schools, a phenomenon that requires explanation.

In spite of these positive factors, it would be foolish to be complacent about the current decline in the size of the dental applicant pool. Much more

needs to be done to understand it in order to better manage dental school admissions policies and programs in the future.

A potentially important factor that may discourage dental school applicants may be the recent rise in dental school tuitions, and the associated increase in indebtedness among the graduates from dental schools. Dental students graduate with somewhat higher debt loads as compared to medical students. This applies to comparisons

FIGURE 6.1



Source: ADA, *Surveys of Predoctoral Dental Educational Institutions*.

declined modestly. The latest decline, however, has not led to a corresponding enrollment or academic decline. There is some concern that the almost 30% drop in Dental Aptitude Test (DAT) participants in early 2000 may presage a sharper, short-term decline in dental school applicants.

There are some factors that suggest that the latest decline in size of the dental applicant pool may be less drastic and have lesser consequences than the dramatic applicant pool shrinkage experienced during the 1980s.

across public, private and private/state related dental and medical schools. Nevertheless, student indebtedness in other professional schools is also surprisingly high, suggesting that students considering dentistry will not get significant short-term financial relief by choosing other professions.

Indebtedness of Dental Students

Debt financing for education is a widely accepted vehicle to allow students to invest in their university education for the ultimate opportunity of graduating into satisfying and financially rewarding careers and professions. The evidence is strong that successive levels of university education are associated with progressively higher income levels. Studies reported between 1969 and 1994 repeatedly showed that the rate of return on a dental education is consistently positive, whether using the return-on-investment or the internal rate-of-return method (Maurizi, 1969; Nash and House, 1982; Dunlevy and Niessen, 1984; Burnstein and Cromwell, 1985; Weeks et al, 1994; and Capiluto et al, 1995). More recently, however, career opportunities in the information technology fields have caused some to question whether prolonged attendance in universities is highly compensated by downstream earnings as once may have been the case. For the moment, it seems that dentistry and medicine still hold a strong attraction for the best of university students, and such students indicate a continued willingness to invest financially for the sake of their future careers.

As indicated in Table 6.4, in 1982, students graduated from dental school with an average debt of \$26,000. By 1998, the equivalent figure had risen to \$84,089. The average 1998 indebtedness is lower for students graduating from public schools (\$70,752), highest for those finishing the private schools (\$108,256), and at an intermediate level for private/state schools (\$97,684). Using

the Consumer Price Index (CPI) to adjust for inflation, with 1998=100, per capita dental student debt has nearly doubled since 1982. In inflation-adjusted terms, the annual rate of growth in student indebtedness was 4.0%. Concern over this growth rate above the level of inflation is heightened when comparing the graduating students' indebtedness trend with the growth in dentists' average net income from the primary practice. Nominal average net income from dental practice from 1982 to 1998 rose at an annual rate of 6.4%, while inflation-adjusted net income rose by 3.0%. This suggests that, in constant dollar terms, dental graduates' indebtedness is accelerating at a faster rate than the real net income of practicing dentists.

TABLE 6.4

Growth in Graduating Dental Student Debt vs. Practice Net Income, 1982-1998

Year	Graduating Dental Student Mean Debt		Mean Net Income from Primary Private Practice, Independent Dentists	
	Nominal Dollars	Real Dollars (base=1998)	Nominal Dollars	Real Dollars (base=1998)
1982	\$26,600	\$44,931	\$59,530	\$100,553
1984	32,000	50,202	65,460	102,695
1986	37,200	55,325	74,040	110,114
1988	39,300	54,150	85,690	118,068
1990	54,550	68,031	96,500	120,348
1992	55,550	64,538	107,220	124,568
1993	59,387	66,990	115,280	130,039
1994	62,776	69,045	127,430	140,156
1995	67,772	72,486	134,590	143,951
1996	75,748	78,693	135,870	141,152
1997	81,688	82,960	144,940	147,198
1998	84,089	84,089	158,810	158,810
Annual Growth	7.5%	4.0%	6.4%	3.0%

Source: AADS, *Surveys of Dental School Seniors*; and ADA, *Surveys of Dental Practice*.

The full effect of dental students' debt has not been fully analyzed. These increases in indebtedness may be a barrier to individuals seeking careers in dentistry, especially for individuals from disadvantaged backgrounds. In addition, indebtedness may be a barrier to some post-dental school career choices.

Dental Student Diversity

The demographic profile of dental students, and of the dental applicant pool, is a key indicator of the ability of dentistry to improve its diversity. Recent studies indicate that individuals prefer to be treated by physicians and other professional caregivers that share the patients' racial and ethnic background. The demographics of dentists in practice, research and education and the student population are not reflective of the nation's population.

GENDER

During the past 30 years significant changes have occurred in the gender composition of the dental student body. As shown in Figure 6.2, the number of women enrolled in dentistry increased dramatically, and appears to have leveled at 35% to 38% of overall enrollment.

The dental school experience for women students has improved considerably as the proportion of women in the dental student body has risen.

Women students feel less isolated than before, and are forming strong peer support networks.

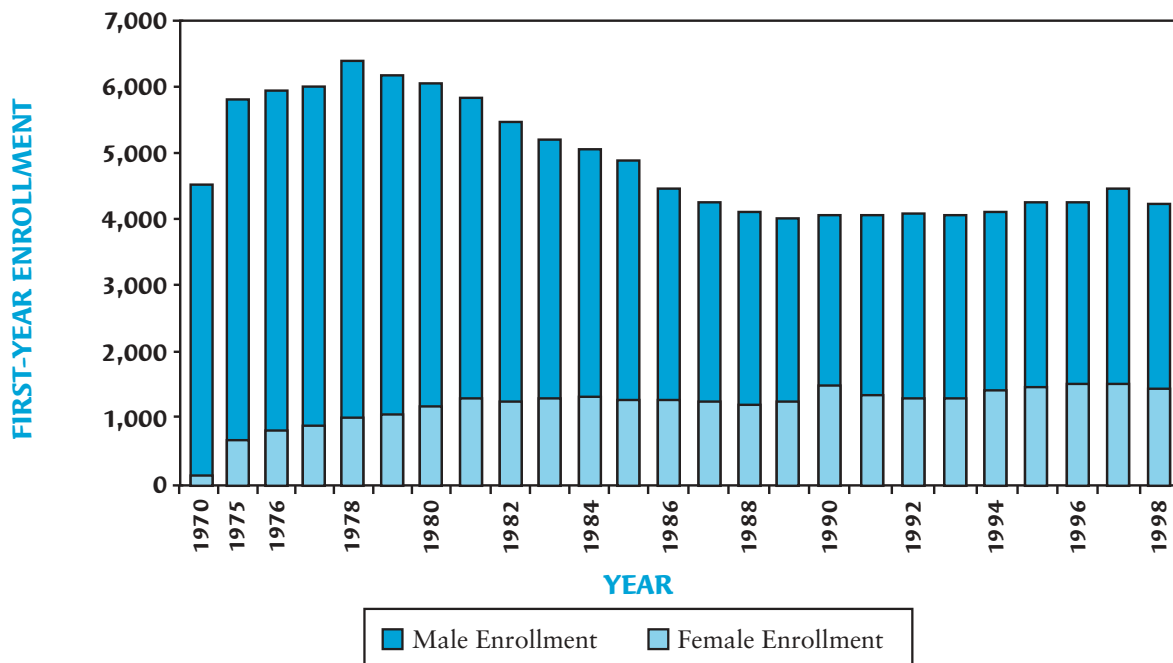
MINORITY POPULATION ENROLLMENT

In 1998, 34% of first-year dental school enrollees were members of minority groups, an increase from only 13% in 1980. Nationwide, the majority of this increase is due to Asian/Pacific Islander students entering dental school in substantially larger numbers. Enrollment of Asian/Pacific Islander students increased from 5% of enrollees in 1980 to about 24% in 1998. Enrollments of other minorities, primarily African American, Hispanic, and Native American students, have increased only slightly from 7.5% in 1980 to nearly 10% in 1998 (Valachovic, 2000).

Most minority enrollment gains were achieved in the 1980s. As Table 6.5 illustrates, the enrollment of under-represented minority students has declined appreciably since 1994. Much of that decline is due to a decrease in the enrollment of African American dental students. Data reporting the enrollment of Hispanic dental students is also disappointing. During

FIGURE 6.2

First-Year U.S. Dental School Enrollment by Gender, 1970-1998



Source: ADA, *Surveys of Predoctoral Dental Educational Institutions*.

TABLE 6.5

Under-Represented Minority Dental Student Enrollments, 1994-1999

Academic Year (Total)	African Americans	Hispanics	Native Americans	Total Number of Under-Represented Minority Students
1994	973 (5.95%)	1,045 (6.39%)	56 (0.34%)	2,074 (12.68%)
1995	951 (5.75%)	966 (5.84%)	73 (0.44%)	1,990 (12.02%)
1996	891 (5.40%)	824 (5.00%)	83 (0.50%)	1,798 (10.90%)
1997	883 (5.22%)	825 (4.87%)	96 (0.57%)	1,804 (10.66%)
1998	841 (4.93%)	823 (4.83%)	97 (0.57%)	1,761 (10.33%)
1999	810 (4.68%)	913 (5.28%)	99 (0.57%)	1,822 (10.53%)
% of U.S. Population in 1990	12.1%	9.0%	0.8%	21.9%
% of U.S. Population in 2025	12.9%	18.1%	0.8%	31.8%

Source: ADA, *Surveys of Predoctoral Dental Educational Institutions*; and 1990 U.S. Census Projections - Internet Release January 13, 2000.

the 1999 academic year, African American students constituted 4.7% of the total dental student population, Hispanics 5.3%, and Native Americans 0.6%.

Among all three populations, enrollment percentages were below the equivalent representation of these minority groups in the total United States population. By 2025, the relative growth in under-represented minority groups will have occurred largely among Hispanics, whose relative presence in the United States population will have doubled by that time, moving past African Americans in numbers.

There is a high concentration of minority dental students in a few schools. During 1998-99, Howard University and Meharry Medical College enrolled 42% of all African American dental students, while the University of Oklahoma enrolled 27% of all Native American dental students (Furlong, 1999).

The Joint Oversight Committee on Minority Recruitment and Retention, an ADA and American Dental Education Association (ADEA) jointly funded program, has identified four critical reasons dental education needs a proactive recruitment and retention program focused on minorities: (1) to promote access to health care, (2) to encourage culturally sensitive care, (3) to encourage access to the profession, and (4) to ensure future leadership.

These aims are consistent with objectives adopt-

ed by the ADA entitled *Exploring Common Ground* (ADA, 1999). The first *Common Ground* objective states, "Recognize the need for building a dental workforce that reflects the cultural, racial, and gender diversity of the nation." Another objective states, "Create a collaborative effort and develop programs as appropriate, to recruit qualified minority applicants to dental schools."

For universities and their dental schools, the combined effects of three decisions regarding affirmative action--the Bakke decision (MIT, 2001), *Hopwood vs. Texas* (Texas Aggie, 2001), and Proposition 209 (MIT, 2001) in California--have complicated the process of continuing and improving education-based solutions through pro-active diversity programs. Progress has been made in improving the dental school experience for minority students, but the rate of improvement has not equaled that achieved by women students. Virtually all dental schools make significant and meaningful efforts to provide a supportive learning and professional socialization environment, and minority students appreciate these efforts. Nevertheless, the relatively small numbers of minority dental students in each class, and the lack of minority teachers, inhibit the development of peer networks and diminish the presence of role models. These are voids felt strongly by the minority students.

THE TEACHING FACULTY

Faculty Overview

Perhaps the most critical element in ensuring a strong and excellent dental education system for the United States is the quality of the system's teaching faculty. Reports suggest new challenges in the retention of full-time faculty (FT).

Past dental school retention efforts focused on preventing faculty losses to competing dental schools. Today's retention issue, however, centers on the loss of faculty to more financially attractive opportunities. Competition today comes from full-time private practice, often in the geographic region immediately surrounding the university. Depending on the dental specialty, income differentials can significantly favor practice-based opportunities. A study by Haden et al. reports that after retirement, entering private practice is the second most common reason for full-time faculty separations in United States schools of dentistry (Haden et al, 2000).

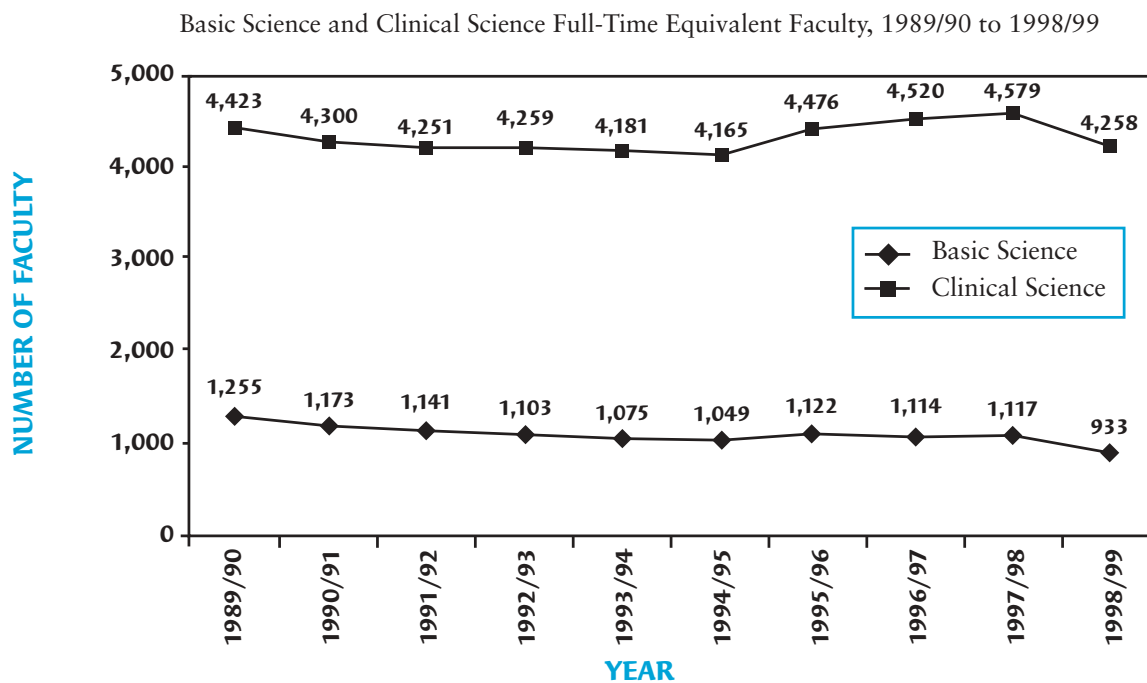
A reliable analysis of faculty characteristics and trends in dental education is not available. The studies that are available, especially those longitudinal

studies reporting trends since 1980 or earlier, tend to ignore the decline in the number of dental schools.

It seems intuitively obvious that the decline in the number of dental schools, and an even greater decline in the number of students enrolling in dental education (6,301 in 1978; 3,979 in 1990), would be accompanied by some adjustment in the dental education workforce. In some respects, the major conclusion from the currently available data is that detailed analyses will be required against which current perceptions and anecdotal evidence can be evaluated. Figure 6.3 provides a longitudinal series of the numbers of clinical and basic science full-time equivalent (FTE) faculty employed by dental schools. Table 6.6 presents similar data, enrollment figures, and adds student-to-FTE faculty ratio data for both the basic and clinical sciences (ADA, 2000). Figure 6.3 and Table 6.6 together indicate that:

- ◆ The number of full-time equivalent (FTE) clinical faculty declined from 1986 to 1994, rose through 1997/98, and has begun to decline again.
- ◆ The number of FTE basic science faculty declined by 322 from 1989/90 to 1998/99.

FIGURE 6.3



Source: ADA, *Surveys of Predoctoral Dental Educational Institution*; and AADS, *Surveys of Dental Educators*.

TABLE 6.6

Student to Faculty Ratios for Basic and Clinical Sciences, 1986-1997

Year	FTE Faculty		Total Enrollment	Enrollment to Basic Faculty Ratio	Enrollment to Clinical Faculty Ratio
	Basic	Clinical			
1986	1,442	4,611	17,985	12.47	3.90
1987	1,436	4,512	17,412	12.13	3.86
1988	1,296	4,509	16,823	12.98	3.73
1989	1,255	4,423	16,404	13.07	3.71
1990	1,173	4,300	15,068	12.85	3.50
1991	1,141	4,251	15,865	13.90	3.73
1992	1,103	4,259	15,959	14.47	3.75
1993	1,075	4,181	16,353	15.21	3.91
1994	1,049	4,165	16,336	15.57	3.92
1995	1,122	4,476	16,552	14.75	3.70
1996	1,114	4,520	16,570	14.87	3.67
1997	1,117	4,579	16,926	15.15	3.70

Source: ADA, *Surveys of Predoctoral Dental Educational Institutions*.

◆ The basic science student-to-FTE ratio has risen from 12.5:1 in 1986 to 15.1:1 in 1997.

◆ The clinical science student-to-FTE ratio has remained relatively steady—varying between 3.5:1 and 3.9:1 during the 1986-1997 period.

Faculty Shortages

The observations noted above indicate that a dental faculty shortage may be developing—a conclusion some analysts have already drawn (Meskin, 2000).

Table 6.7 presents data from an American Dental Education Association (ADEA) survey of deans and department chairs that inquired about vacant, funded faculty lines in dental schools (Bertolami et al, 1999; and Haden et al, 2000) report on similar data collected by the ADEA in the summer and fall of 1999.

Table 6.7 indicates a steady rise in reported vacant faculty positions in schools since 1992-93. The reports are particularly dramatic for the clinical FT category, which shows 244 vacant positions in 1996-97. Folding in other categories of faculty positions increases the reported number of vacancies to 311 across 54 dental schools, an average of 5.8 positions vacant per school.

Generally, in examining dental faculty data it is important to recognize methodological differences related to the ADEA data and those from the ADA reported in Figure 6.3 and Table 6.6. The ADA methodology pools full- and part-time faculty into FTE faculty, and reports data using these FTE units. The ADEA reports raw counts of full-time faculty and part-time faculty separately, and occasionally pools only the latter category into full-time equivalents.

TABLE 6.7

Vacant Faculty Positions Reported by Dental Schools

	1992-93 N=55	1993-94 N=54	1994-95 N=54	1995-96 N=54	1996-97 N=54
Clinical FT	139	156	212	218	244
Science PFTE	66	55	23	13	14
Basic FT	16	19	10	16	38
Science PFTE	10	1	0	.5	.5
Allied FT	6	6	9	4	14
PFTE	1	2	3	.1	.1
Total FT	161	181	231	238	296
PFTE	77	58	26	14	15
FT+PFTE	238	239	257	252	311

*FT=full-time and PFTE=full-time equivalence of part-time faculty.

Source: Bertolami et al, 1999.

TABLE 6.8

Full-Time Dental Faculty by Race/Ethnicity and Gender

Race/Ethnicity	1990 (56 Schools)	1994 (54 Schools)	1997 (55 Schools)	1999 (55 Schools)
Native American	14 (0.3%)	26 (0.5%)	43 (0.8%)	28 (0.6%)
Asian/Pacific Is.	270 (5.1%)	306 (6.1%)	369 (7.2%)	376 (7.7%)
African American	230 (4.3%)	253 (5.0%)	230 (4.5%)	246 (5.1%)
Hispanic	133 (2.5%)	148 (2.9%)	162 (3.2%)	183 (3.8%)
White	4,336 (81.5%)	4,051 (80.4%)	4,228 (82.5%)	3,843 (79.0%)
Other/Not Reported	335 (6.3%)	254 (5.0%)	92 (1.8%)	188 (3.9%)
Gender				
Male	4,305 (81.0%)	4,021 (81.0%)	3,972 (77.5%)	3,683 (75.7%)
Female	918 (17.3%)	1,016 (17.3%)	1,152 (22.5%)	1,181 (24.3%)
Not Reported	95 (1.8%)	1 (1.8%)	5 (0.1%)	0 (0.0%)
TOTAL	5,318	5,038	5,124	4,864

Source: Haden et al, 2000; and ADA, *Surveys of Predoctoral Educational Institutions*.

Dental Faculty Diversity

GENDER

The number of women faculty members has significantly increased. As indicated in Table 6.8, however, the proportion of women faculty members continues to lag behind the increasing number of women dental students. By 1999, women constituted 24.3% of the total full-time faculty. Based on the 35-38% dental school enrollment rate by women at the end of the 1990s, the percentage of full-time women faculty in United States dental schools can be expected to continue its rise in the years ahead.

UNDER-REPRESENTED MINORITIES

Relatively few minority faculty members are teaching in the nation's dental schools (see Table 6.8). In 1999, for the total faculty among the 54 dental schools, there were 5.1% African Americans, 7.7% Asian/Pacific Islander Americans, 3.8% Hispanics, 0.6% Native Americans, and 82.9% White and others (Haden et al, 2000). Howard University and Meharry Medical College employ a

substantial proportion of the African American faculty, and the University of Puerto Rico employs a large proportion of the Hispanic faculty.

Again, the recent legal proceedings in Texas and California have impinged somewhat upon traditional approaches to recruiting minority faculty.

Logically, greater success in recruiting minority students will ultimately increase the possibility of recruiting more minority faculty members. However, even with successful minority dental student recruitment now, developing minority faculty for the future requires leadership, commitment, and nurturing on a continuing basis. The strategy of enrolling and advancing minority students through dental school, guiding them to and through advanced dental education qualifications, then recruiting the subset interested in academic positions back into the university is realistic, but long-term, and subject to the vagaries of time.

Three issues of great concern to women and minority dental faculty are: (1) that their relative under-representation on the faculty now creates a void in the mentoring and role-modeling opportunities for women and minority dental students; (2)

that faculty-to-faculty mentoring and support are perceived to be lacking for women and minority dental faculty in the dental schools; and (3) that opportunities for tenure, promotion, and advancement to higher positions in the school and university are perceived to be disproportionately limited for women and minority dental faculty.

Dental schools must be both leaders and partners with other university units and professional organizations to do all that is possible to ensure a positive and equitable career environment for women and minority faculty in the nation's dental schools.

ADVANCED DENTAL EDUCATION

Full-time, certificate and/or degree granting post-DDS advanced dental education programs fall into three broad categories: (1) ADA-recognized clinical specialty programs, (2) General Practice Residency (GPR) and Advanced Education in General Dentistry (AEGD) programs, and (3) non-ADA-recognized clinical specialty training programs.

Enrollment has increased more or less steadily since 1971, largely due to the influence of increasing enrollments into GPR and AEGD programs.

ADA-Recognized Specialty Training

There are nine ADA-recognized specialty training programs; eight are patient-based clinical specialties and one, Dental Public Health, is non-patient-based specialty. In 1999, the ADA House of Delegates approved the recognition of Oral and Maxillofacial Radiology as a ninth specialty program.

Since 1971, annual first-year enrollment into ADA-recognized specialty programs has consistently hovered at just under 1,200 students per year. This stability in enrollment is quite remarkable in light of two factors. First, there was the very significant decline in the annual number of dental school graduates during the 1980s and 1990s, as was previously noted. Yet this decline in the number of dental graduates had no depressing effect on applications to the ADA-recognized specialty programs. Second, the enrollment numbers seem to defy explicit calls for a reduction in dental clinical specialty training. The 1980 Kellogg/AADS Study recommended a one-third reduction in first year positions in the ADA-recognized clinical specialty training programs. This recommendation was not implemented. Between 18-21% of dental school

seniors apply to dental specialty programs (Valachovic, 2000).

Changes in federal legislation have made clinical training in dental specialties eligible for both Direct and Indirect Graduate Medical Education (DGME and IGME) funds. Provided by Medicare, DGME and IGME funds are available for training clinical dental residents if the dental school can work out a formal agreement with a partnering hospital. Eligibility is limited to residents who are United States nationals and resident aliens.

Dental residents that qualify for DGME and IGME funds receive a healthy stipend while training to become specialists. This removes one of the major financial burdens currently faced by dental specialty training programs, whether based in a dental school, a hospital, or other institutional setting. Removing the burden for funding, dental specialty residents will significantly facilitate training opportunities. It must be kept in mind, however, that advanced dental education's eligibility for GME funds is constantly subject to governmental review and modification.

General Practice Residency (GPR) and Advanced Education in General Dentistry (AEGD)

The number of students that continue for dental specialty training has been stable for nearly 30 years. However, increasing numbers of dental seniors are successfully completing GPR and AEGD programs. These programs must continue to evolve but are clearly an important factor in the education and training of dental generalists system-wide. GPR programs are increasingly one- or two-year hospital-based training programs that focus on in-patients, medically compromised patients, or other special-need individuals. With rising frequency, GPR programs may be better understood as hospital dentistry programs.

The AADS reports that 30% of senior dental students apply to either GPR or AEGD programs or both for the over 1,300 positions available (Valachovic, 2000). AEGD programs are generally not eligible for GME funds. GPR residency positions may be funded under the Medicare GME program.

GPR programs vary considerably among different institutions, and are often shaped by the interests of the respective program directors. Some GPR programs have retained the original emphasis on general dentistry, others provide heavier emphasis on

cases treated in the hospital operating room, while yet others attempt to focus on oral medicine, placing special emphasis on managing oral soft tissue diseases.

As American hospitals have come under increasing financial pressures during the late 1990s, some GPR programs are being asked to contribute to patient care income. This trend has placed considerable pressures on GPR programs, forcing some to significantly refocus their missions.

AEGD programs were first established in the early 1980s, and have experienced growth ever since. The number of students enrolling in AEGD programs exceeds the number enrolling in GPR programs.

AEGD programs are typically housed in dental schools, and are usually one year in duration. AEGD programs consolidate, through intensive and supervised practice, the clinical training the new dental graduate receives in the four-year DDS program. AEGD residents participate to varying degrees in structured educational experiences such as seminars and colloquia, but their major effort is directed at engaging in active clinical practice across the various clinical fields that constitute dentistry. Some practice management skills may also be developed in AEGD programs. In a dental school, the AEGD experience most replicates how the general dentist functions in private practice.

Non-ADA Recognized Advanced Training

Some dental schools and hospitals offer advanced clinical training programs that are not recognized as specialties by the ADA. Oral medicine, geriatric and special care dentistry, dental anesthesiology, and operative dentistry are four examples of such programs.

These programs serve a valuable function in dentistry. First, they offer significant scholarly, research and clinical outlets for faculty who have a special interest in these fields. Second, in most cases, faculty members who focus on these informal areas receive referrals from dentists in the practicing community. These referrals are of major benefit to the patient and the referring dentist, and ensure that the public sees the dental profession as providing the broadest and most comprehensive forms of patient care possible.

One-Year Postgraduate Experience (PGY-1)

The significant increase in scientific knowledge and the rapid technological changes so prevalent in dentistry make it difficult to offer a full, well-round-

ed education and clinical training program within the confines of the current 4-year curriculum. Therefore, the concept of making available a one-year postgraduate experience (PGY-1) to all dental graduates has tremendous appeal. Financing the PGY-1 experience has been the major impediment to its wider implementation. The AEGD, GPR and dental specialty programs together provide the equivalent of a PGY-1 experience for approximately half the dental graduates in the United States.

THE ALLIED DENTAL TEAM

It is universally held that success in providing optimal oral health of the public requires an effective, team-based dental care delivery system. For the most part, the chief components of that team are the dentist, the dental assistant, the dental hygienist and the dental technician, although office managers, insurance clerks and other administrative team members may be active in larger group dental practices. Only dentists and dental hygienists require licenses to permit professional practice. In terms of dental care productivity, the actual contributions and effectiveness of the various dental team members are best analyzed within the context of studies and human resource economics. (See also Chapter 3, *Clinical Dental Practice and Management*.)

A number of significant differences are apparent between dental education and dental assisting, dental hygiene and dental technician education. Among these differences are the focus of education, the duration of education, the degree/certificate earned, the application of accreditation standards, and the availability of alternative pathways qualification, including on-the-job training. The disparate educational routes for dental team members have a major bearing on their respective entry into the dental workforce.

Because of the heterogeneity in education and training of allied dental team members, the data that describe current and likely future educational issues are relatively shallow and rather uneven. A brief overview of trends in allied dental education follows.

Table 6.9 indicates that between 1990 and 2001, the number of accredited dental hygiene programs increased by 26% (ADA, 2001a). With the exception of Alabama, dental hygienists must earn their educational qualification in an accredited program; hence the growth in accredited programs has a significant bearing on the capacity and the distribution of the system for dental hygiene education.

TABLE 6.9

Number of Accredited Allied Dental Education Programs, 1990-2001

Year	Dental Hygiene	Dental Assisting	Dental Laboratory Technician	Total
1990	202	244	49	495
1991	204	242	47	493
1992	209	228	43	460
1993	208	231	41	480
1994	214	231	38	483
1995	215	230	35	480
1996	223	237	35	495
1997	230	240	35	505
1998	237	250	34	521
1999	250	251	33	534
2000	256	257	30	543
2001	255	258	28	541

Source: ADA, *Surveys of Allied Dental Education*.

Table 6.9 also indicates a 5.7% growth in accredited dental assisting programs during the 11-year period. There has been a 42.9% decline in the number of dental technician programs during the same period.

It is unclear whether allied dental education programs are enrolling students to the level of program capacity. In 1998-99, it appears that dental hygiene enrolled 6,087 first year students against a first-year capacity of 6,471. For dental assisting, the equivalent figures were 6,162 (enrollment) against 8,270 (capacity). In the case of dental laboratory technicians, 487 first-year students enrolled against a capacity of 1,026 student spaces. In the case of dental assistant and dental technician students, it is not clear whether these numbers allow for any further first-year attrition in student numbers. Thus by mid- or end-of-year, first-year enrollments could be lower.

Table 6.10 indicates an appreciable growth in the number of dental hygienists trained. Overall, the number of dental hygienist graduates increased from 3,904 in 1989/90 to 5,281 in 1998/99, an increase of 35.3%. Interestingly, the 5,281 graduates in 1998/99 compare to an initial enrollment of 5,868, and a capacity of 5,990 two years earlier. If dental hygiene education enrollment continues to increase, and appli-

cation numbers do not drop, it may be expected that the number of dental hygiene program graduates will continue to increase in the short to medium term.

Table 6.10 also indicates that the number of graduates from accredited dental assisting programs increased from 1989/90 to 1996/97, thereafter trending downward once again. It is clear from ADA Survey data that attrition in dental assisting programs is moderately high. Assuming a one-year training program, the 4,720 dental assistant graduates in 1998/99 resulted from an enrollment of 6,350 and a capacity of 8,220 a year earlier. With respect to dental laboratory technicians, the number graduating from accredited programs has declined markedly. In 1998/99 a total of 490 dental technicians graduated, from an enrollment pool of 702 and a capacity of 960. Enrollment data suggest that further decreases in the dental technician graduation numbers may be expected in the near term.

For both dental assistant and dental technician careers, formal post-high school education is not a barrier to entry. Thus, there may exist significant numbers of non-accredited training programs. More importantly, it is virtually certain that an unknown capacity for on-the-job training is a major

TABLE 6.10

Graduates of Allied Dental Education Programs, 1989-1998

Year	Dental Hygiene	Dental Assisting	Dental Laboratory Technician
1989/90	3,904	3,960	722
1990/91	3,953	3,940	596
1991/92	4,229	3,999	655
1992/93	4,431	4,077	585
1993/94	4,637	4,382	638
1994/95	4,553	4,490	608
1995/96	4,668	4,679	510
1996/97	4,855	5,032	507
1997/98	5,023	4,967	436
1998/99	5,281	4,720	490

Source: ADA, *Surveys of Allied Dental Education*.

factor in bringing dental assistants and dental technicians into the dental workforce.

Applications and Admissions

During the period from 1994/95 to 1998/99, applications to dental hygiene programs have consistently exceeded 20,000 students per year for a system capacity of between 5,883 and 6,471 first-year spaces. Dental hygiene program admission requirements vary significantly: 46% of programs require a high school diploma/GED; 16% require some college courses; 27% require one year of college; 8% require two years of college; and 3% use some other standard. Males accounted for 3.0% of all enrolled dental hygiene students in 1998/99, while African Americans constituted 3.1% of the dental hygiene student body.

Dental assisting applications have exceeded 11,000 in each year of the 1994/95 to 1998/99 enrollment. Acceptances exceeded 8,000 in four of the five years. For 98% of programs, the minimum entry qualification was a high school diploma/GED. Males constituted 3.0% of enrolled dental assisting students in 1998/99, while African American students accounted for 12.1% in the same year.

Dental laboratory technology applications have declined from 1,469 in 1994/95 to 1,100 in

1998/99. Acceptances fell from 1,118 to 856 during the same period. All but one program required a high school diploma/GED as a minimum entry requirement. In 1998/99, dental laboratory technician programs enrolled 224 males and 263 females into first year and 215 males and 198 females into second year. African Americans constituted 13.9% of the enrolled dental laboratory technician students.

Tuition and Fees for Allied Dental Education

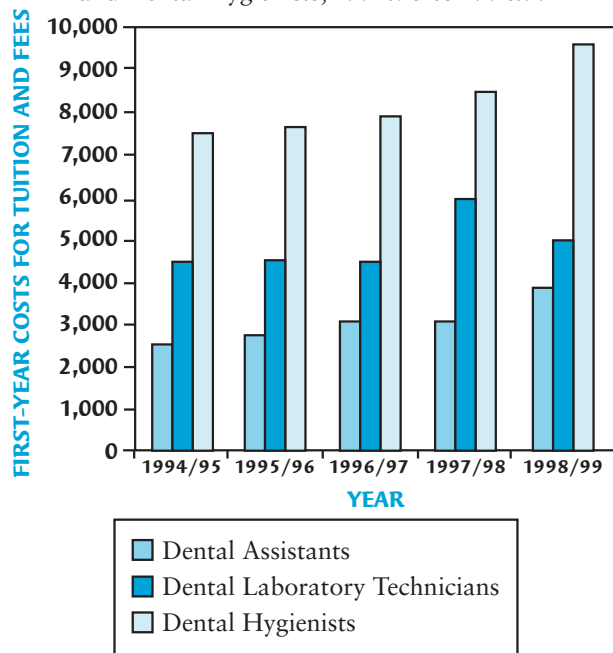
Figure 6.4 provides the trend in the cost of tuition and fees related to allied dental education. The data reflect first-year educational costs applicable to "in-district" students (i.e., students who live in the district the school or community college serves). The costs are close to "in-state" tuition and fees, though the latter are about \$1000 higher in the late 1990s. For publicly-funded institutions, out-of-state tuitions and fees are substantially higher for all allied dental education programs. However, most allied dental education students tend to enroll in programs fairly close to their place of residence, suggesting that in-district or in-state tuition and fees would be the norm. The data presented in Figure 6.4 include university, community college, technical institute, vocational school and other category tuition and fee structures. Except for dental hygiene, there are relatively few university-based allied dental education programs.

Allied Dental Education Teaching Faculty

There is relatively little information describing the teaching faculty for allied dental education. Anecdotal reports suggest that dental hygiene, in particular, finds it increasingly difficult to recruit faculty for its programs. This problem has been exacerbated in part by the continuing decline in the number of university-based dental hygiene programs, institutions that have traditionally supplied a significant proportion of the faculty and faculty leadership for dental hygiene teaching programs in general.

FIGURE 6.4

Mean In-District First-Year Costs for Tuition and Fees for Dental Assistants, Dental Laboratory Technicians, and Dental Hygienists, 1994/95 to 1998/99



Source: ADA, *Surveys of Allied Dental Education*.

Contemporary Allied Dental Education Issues

There are a number of issues related to allied dental personnel and the oral health care delivery system that are encountered in the environment of the dental workplace, rather than the educational setting. These dental workforce issues are often colored by emotion and controversy. Recruitment, salary, flexible schedules, organizational behavior, professional respect, retention, and other major challenges are vexing problems within the oral health care delivery system. Dental education has a role to play in seeking solutions to these challenges.

EDUCATIONAL CAPACITY

It is clear from the data in Tables 6.9 and 6.10 that the allied dental education system responds quite rapidly to changes in demand for allied dental personnel. It is very difficult for dental schools to implement or terminate a program to respond to market conditions. In some settings it may be easier to start a new program than to expand an existing program, so long as economies of scale do not

become an over-riding concern. The relative ease of capacity building has the additional advantage that it enables state community college systems to locate training programs in a larger variety of communities, thereby creating a more effective geographic distribution of the needed allied dental workforce.

PROGRAM ATTRITION

One of the significant problems faced by all allied dental education programs is attrition among enrolled students, particularly those in first year. Excessive attrition among enrolled students has multiple causes, both internal and external to the particular educational program. But in all cases such attrition reduces the economic efficiency of the training program, becoming a greater problem the costlier the program per student. Fortunately, the student attrition among dental hygiene students appears to be declining. While student attrition can never be eliminated, more efforts may be advised to understand and counteract the problem.

BACCALAUREATE AND CERTIFICATE EDUCATION

There is an unfortunate tension between those who see only an either/or relationship between baccalaureate and certificate education of dental hygienists, and those who see opportunity and benefit in the complementary nature of these two educational outcomes. The clear majority of dental hygienists graduated each year leave college with a certificate or an associate degree. True baccalaureate hygienists are in the minority. However, the majority of both groups enter in-office dental hygiene practice.

Among the baccalaureate dental hygienists are significantly greater numbers who have the education background and the leadership capabilities that make them ideal professionals for the teaching and the dental public health sectors. The long-term vitality of the United States dental hygiene services depends on strong and capable educational leadership functioning on behalf of the 255 accredited dental hygiene programs in this country.

APPROPRIATE DUTIES

Historically there has been great concern about the scope of duties for all members of the allied dental team. Quality dental hygiene programs can train dental hygienists properly for a variety of duties

beyond the minimal set permitted. Quality dental assisting programs may also have the potential to teach expanded duties to well-qualified dental assisting candidates. The rational delegation of duties can only be resolved and codified by state licensing boards. Therefore, the dental and allied dental education communities are dependent upon aspects of the oral health care delivery system, other than themselves, to determine what, where and to whom appropriate patient care procedures may be taught.

ACCREDITATION OF PROGRAMS

Dental educators are strong supporters of accredited programs for professional and health care related education. Subjecting one's program to evaluation and accreditation by external agencies is always a stressful and expensive undertaking. The benefits gained in higher and more uniform standards, as well as in facilitating the movement of professionals, vastly outweigh the institutional stresses and anxieties that accreditation brings.

DISTANCE EDUCATION

Dental assisting and dental hygiene programs, especially the latter, are showing considerable innovation and leadership in successfully introducing a variety of distance education modalities into their training programs. Using both satellite and Internet-based technologies, these innovative programs are bringing quality didactic presentations to more remotely located students. In these cases, clinical training is accomplished through intensive, institution-based programs, combined with organized and supervised local opportunities. Programs such as these, operating in states as diverse as Louisiana, Wisconsin and Virginia, are important indicators of future potential.

DENTAL LABORATORY TECHNOLOGY

As Tables 6.9 and 6.10 show, the major problem faced by dental laboratory technology education appears to be its imminent demise if current trends continue. The seeds of the decreasing number of dental laboratory technology graduates may be numerous, but chief among them is the lack of a sufficient salary differential for entry positions in the commercial dental laboratory sector. One implication to be drawn from this situation is that in pure-

ly economic terms there may be insufficient value provided by dental laboratory technology education to justify a salary premium. In addition, as commercial entities, the dental laboratories may simply be more efficient with their in-house training methods. Another reason for decreasing student interest in dental laboratory technology may be related to the reports, mostly anecdotal, of a steady migration of dental laboratory work to cheaper labor markets in Asia, as well as in Central and South America.

DENTAL SCHOOL CURRICULUM

In the United States, formal and comprehensive studies of the dental school curriculum began with the publication of the landmark Gies Report (Gies, 1926). Undertaken at the request of the Carnegie Foundation for the Advancement of Teaching, the Gies Report established the university-based pre-dental plus professional school curriculum that is still in use today. The ADA first recommended in 1934 the four-year professional curriculum that is the norm today (Field, 1995).

As reviewed by Tedesco, a number of subsequent studies of the dental curriculum have followed, most by either the Council of Dental Education of the American Dental Association, or by the American Association of Dental Schools (now the American Dental Education Association) (Tedesco, 1995). The most recent in-depth study of United States dental education, including the dental school curriculum, was undertaken and published by the Institute of Medicine, a part of the United States National Academy of Sciences, as *Dental Education at the Crossroads: Challenges and Change* (Field, 1995).

During the past two decades in part through the active collaborations of many individual dental faculty members, and organizational entities including the ADA Council On Dental Education, the Commission on Dental Accreditation, and the AADS, there has been much progress in developing a competency-based curriculum for dental education. Concurrently, a number of dental schools have adapted problem-based learning (PBL) from medical schools, and have initiated full or partial PBL-based curricula.

There is considerable heterogeneity in the dental curricula among dental schools. Data collected by the ADA and the Commission on Dental Accreditation concerning the hours of instruction devoted to various topics in the modern dental curriculum shows wide variances. Differences in curriculum time allo-

cation among dental schools enable an ongoing assessment of curriculum performance, and help the dental education community to develop strategies to more effectively and efficiently teach the dental sciences. Thus, retaining a certain amount of diversity in curricular content is healthy and positive.

Observers of dental education are surprised by the speed with which new clinical information and technology is integrated into dental curriculum. Recent examples include digital image processing, osseointegrated dental implants, digitally generated ceramic dental inlays, modern cleft lip/palate treatment, diagnostics of oral viral lesions, and the rotary cutting technologies for endodontics. As faculty and curriculum committees identify outdated techniques these procedures are de-emphasized or eliminated from the dental curriculum.

DENTAL EDUCATION FACILITIES

The majority of dental education facilities are more than 30 years old. While significant efforts have been made to keep the equipment in these facilities up-to-date, like dental practice, dental education has undergone immense technical changes that are rendering the physical facilities in which most dental schools must function increasingly obsolete.

From the 1950s to the early 1970s, federal and state governments allocated resources to permit the construction and expansion of dental schools. The nation once again faces a qualitative, if not quantitative, deficit in the physical facilities available for dental education. There are signs that in some states initial steps are being taken to address the facilities issue. However, the problem is national in scope, and a great deal of timely and high quality planning will be necessary to bring about the necessary facility upgrades.

Further considerations need to be addressed as well. For example, if significant changes to the size and or composition of the dental workforce become necessary, this too will have facility implications. Moreover, if significant alternative models to dental education evolve, including more emphasis on community-based clinical education, that also will require the facility question to be addressed.

DENTAL EDUCATION'S ROLE IN LIFE-LONG LEARNING

The dental profession maintains a fundamental commitment to life-long learning through continu-

ing dental education (CE). There is clear evidence that the dental profession's commitment to life-long learning is increasing. The number of CE programs and courses offered by commercial businesses, professional organizations and universities has been greatly increased.

In addition, a growing number of state dental licensing bodies have implemented mandatory continuing dental education for re-licensure. Prior to 1990, only 18 states linked mandatory CE to dental license renewal. Today, 47 states require mandatory CE for renewal of practice licenses for dentists and dental hygienists. Most have also implemented advanced approval systems for identifying credit eligibility of CE sponsors and courses. Ten states require CE for registration renewal by dental assistants (ADA, 2001b).

Life-long learning is a major tenet in the education of every dental student. Many schools require dental students to earn a certain number of CE credits in order to qualify for graduation. It is believed that such a CE requirement reinforces the practitioner role model the dental schools seeks to develop as students prepare toward graduation, and a career as an independent health care professional.

Virtually all United States dental schools are major providers of continuing dental education. Dental schools have multiple motivations for the delivery of dental CE. One reason is certainly economic. A menu of quality dental CE courses can generate sizable income for the dental school and its faculty. Secondly, CE also is offered by dental schools as a means to expose clinical faculty to the external practicing community, thereby cultivating healthier town-gown relationships and increasing the potential to generate referrals for the school's practicing clinical specialists is increased. A third reason that dental schools offer CE is to help practitioners who may be referred to the school by the state licensing board to fill gaps in the individual's knowledge base or clinical skills.

The vast majority of CE offered by dental schools is of the lecture format variety. However, an important but lesser utilized form of dental CE has consisted of participation courses. Longer duration, hands-on programs have been most conveniently offered within dental schools, using the institutions' laboratory and clinical facilities. Recent expansion in the availability of participation courses can be linked to the more rapid deployment of advanced, new dental treatment technologies. These technolo-

gies, such as osseointegrated implants, guided tissue regeneration, and CAD/CAM technology for ceramic inlays are examples of clinical innovations requiring hands-on experience for successful adoption of the new technology in dental practice. A third form of CE consists of a collaboration between professional dental organizations and dental schools to offer a set of journal-based articles and valid testing procedures to evaluate course participants' performance for the purpose of providing CE credits. One emerging strategy is for dental schools to take advantage of self-directed and/or distance

learning technology by partnering with an established commercial vendor of Internet or computer services. Thus far, dental schools' experiences and successes in pursuing such partnerships remain very limited.

In short, while Internet-based CE is still quite novel, there appears little doubt that for most dental schools it will become an increasingly important dental CE delivery modality in the not-too-distant future. Failure for dental schools to become involved in this new modality of dental CE delivery risks the dental schools' future in the CE arena.

II. DENTAL EDUCATION IN THE FUTURE

This chapter has focused on the broad array of factors that contribute to dental education and the development of a well trained, professionally responsible and individually committed dental workforce. The following section looks forward to anticipate the impact of these factors on the future of dental education and dentistry itself.

The quality of dental professional education and training, and the capacity of the dental care workforce, will be intimately shaped by dental education's ongoing efforts to become more effective, efficient and productive in transmitting knowledge, in generating scientific research, and in raising the clinical quality of dentistry.

The quality, comprehensiveness and ethics of dental education bear directly on the vitality and standards of the dental profession, which in turn impact the oral health and the quality of dental care available to the American public.

FINANCIAL SUPPORT FOR DENTAL EDUCATION

Without concerted effort by the organized dental profession at both the national and the state level, public (governmental) financial support for dental education will continue to decline, resulting in multiple and serious compromises to the quality of dental education in the United States. Continued erosion in state and federal financial support to dental education will continue to shift dental educational institutions to lower tier institutions, both public and private. Such a trend appears currently underway, and if it continues will cause the gap between medical and dental schools to widen rather than to narrow, as was recommended by the IOM Report (Field, 1995).

Research funds, primarily available through the National Institutes of Health (NIH), reflect societal interest and commitment to the value of dental schools in advancing the science base of dentistry.

Significantly more public investment will be needed if the nation's dental schools are to reverse their currently declining infrastructure, and prepare themselves to meet the challenges of the future oral health care system.

THE SUPPLY OF APPLICANTS TO DENTAL EDUCATION

Subject to a sound, market-based dental care economy, there will be a continuing flow of well-qualified applicants to dental education. This assumption incorporates the reality that there will be acceptable sinusoidal swings in the dental applicant pool.

Several factors indicate that the latest decline in dental school applicants may be less drastic and have fewer consequences than the experience during the 1980s. First, the 1999/2000 academic year was the first time that potential school applicants took the Dental Aptitude Test (DAT) program online. The new method and the new access locations for taking the online dental aptitude tests may have had a temporary attenuating effect on the numbers of test takers.

The environment for dental practice is extremely favorable, and especially so for new practitioners. Perhaps most important, there is informal evidence from dental admissions directors that the modest decline in the size of the applicant pool has not been accompanied by a parallel decline in the grade point average of entering students. In fact, quite the opposite seems to have occurred in a number of schools.

GENDER AND DIVERSITY IN THE DENTAL STUDENT BODY

Attainment of dental student diversity will require ongoing, proactive effort. Such efforts should be rewarded by increases in under-represented minority dental students. Women students will continue to constitute about 40 percent of dental school enrollees, although market place changes could cause this percentage to increase slowly.

DENTAL STUDENT INDEBTEDNESS

Due to student indebtedness, talented students from lower-income families and under-represented minorities may shy away from dental careers.

- ◆ The direct and indirect negative effects may result in reduced access to oral health care for families of lower socioeconomic status.
- ◆ Indebted young practitioners might emphasize monetary priorities during the critical early phases of their practices.
- ◆ Personal bankruptcies may continue to increase.

Dental student tuition and student indebtedness will continue to rise in the absence of extraordinary interventions by state and federal governments. An important factor that could reduce the size and quality of the dental school applicant pool is the recent rise in dental school tuitions and the associated rise in debts incurred by graduates from dental schools. This cost disparity applies across public, private, and private/state dental and medical schools. Increased state and federal government support for dental students, if it occurs at all, will be tied to increasingly robust service payback schemes.

THE FUTURE FACULTY FOR DENTAL EDUCATION

Concern is growing that there will be a shortages of qualified and committed dental teaching faculty. A thorough and intensive follow-up study on the extent and future magnitude of a dental faculty shortage is urgently needed to allow better policy formation regarding future dental faculty development. Such a study must also place major emphasis on recommending solutions to avoid dental faculty shortages. Emphasis should be placed on identify-

ing the true, underlying causes of the dental faculty shortage that appears looming at present.

Moreover, it would be helpful to know the acceptable base-rate of dental faculty vacancies. The assertion that over 300 faculty vacancies are fully funded at the present time needs to be substantiated. Such a study must also make clear that the university expectations of future dental faculty will be higher than has been the case over the past few decades, which can only exacerbate the current faculty shortage. A formally qualified, scholarly and adequately sized full-time dental faculty will be essential for dental schools to maintain their standing in the university community. Part-time dental faculty cannot provide, long-term, the standards or productivity in academic scholarship required by the modern research university. The future availability of quality dental faculty will be strongly influenced by:

- ◆ The overall dental workforce supply (e.g., shortage will have a negative impact, while an excess will have a positive impact);
- ◆ Disparities in salaries between private practice and university settings (e.g., increased disparities will have negative impact, while decreased disparities will have a positive impact); and,
- ◆ The dental care economy (e.g., a weak dental care economy will have a positive impact, while a strong dental care economy will have a negative impact).

Diversity of the dental faculty, in terms of gender, race and ethnicity, will need continuing encouragement. Mentoring for women and under-represented minority faculty will require increased effort.

THE EVOLUTION OF THE DENTAL CURRICULUM

The dental curriculum will continue to evolve in periodic burst-like fashion, and will adapt in this way to the changing dental environment, both technical and economic, in which dental education operates. Dental education will generate both technological and quality change in dentistry, and similarly will efficiently absorb into the curriculum externally generated technological advancements.

For the first decade of the 21st century, digital information technology will be the most influential force shaping the dental curriculum and changing even more profoundly its delivery to the dental student.

While the clinical curriculum will be delivered mainly in the traditional dental school based clinic, a variety of community-based initiatives may be developed to provide new sites for dental students to obtain a portion of their clinical training. This development will occur as one possible way to counter the higher cost of operating university campus-based clinical facilities. The longer-term economic viability of such arrangements still needs to be tested.

The demographics of the ever-growing United States population are changing dramatically. The proportion of the population 60 years or older will rise to an unprecedented level, bringing with it changing demand for dental and oral health care. The current dental curriculum, and the current specialization structure of the dental profession, has barely begun to think seriously about the implications of this change.

New basic science and clinical science discoveries will diffuse into the dental curricula. For the next 10-15 years, there simultaneously exists the major challenge of altering the delivery of the dental curriculum. The ongoing approach to absorbing emerging science and technologies into dental education and clinical practice can be expected to continue, and perhaps, even to accelerate.

This new challenge is squarely linked to the immense changes in how information is transmitted through the use of modern information technology, the emergence of the World Wide Web, and the development of the Internet/Intranet. The scale and completeness of the changes in how information is created, transmitted, received, perceived, and managed for future reference is still not fully apparent to all.

Dental education must embrace the new information science technology, the World Wide Web and the Internet, and dentistry must shape these technologies and their use in the educational process. That process includes the didactic, laboratory and clinical phases of dentistry.

Because the task dentistry faces in adapting to the information technology revolution is so extremely large and complex, it may be anticipated that the next 10 years will be spent on grappling with approaches to digital information processing and delivery, while ensuring that issues of curricular content are not ignored. The challenge of developing the electronic curriculum is daunting from three points of view - namely (1) complexity of the new technology; (2) the cost of establishing and maintaining modern and robust networking technologies; and (3), the production costs necessary to produce sufficiently profes-

sional software to hold the learners' interests.

Coping with both the complexity and the cost of developing the electronic dental curriculum of the future may require a commitment to collaboration and cooperation among institutions in ways not considered previously. The age of the Internet has furthered electronic communications in ways not dreamed of only a few years ago, and already academics are collaborating much more easily on projects with colleagues at dental and medical institutions around the world.

The process of educational research has changed. But while the ability to interact with colleagues has never been simpler and more effective, the challenge of the electronic curriculum of the future is an immense undertaking that will require significant financial and institutional commitment.

Early and fragmented experiences suggest that the development of new electronic curriculum products may require the recruitment into dental schools of specialized computer and Internet expertise that traditionally has not resided in schools of dentistry. The challenge of information technology (IT) product design and development is such that even the most talented clinician may be insufficiently trained in the IT aspects of education. The implication is that a cooperative division of labor between dental teacher and IT specialist may well lead to better dental curriculum products for the future.

Historically, when the practice of certain clinical procedures became sufficiently infrequent, that procedure was gradually eliminated from the dental school curriculum. However, with the promise of sophisticated three-dimensional simulation, e.g. virtual reality, uncommon clinical conditions and their treatment could be taught effectively. The question will be: How much in the way of resources should be devoted to develop simulation technology for managing uncommon conditions, or conditions observed with inevitably declining frequency?

In some settings, e.g. the military and civil aviation, virtual reality is already being used extensively in training adults to carry out procedures with a high level of success. Dental education will similarly need to evaluate its own position with respect to simulation technologies.

DENTAL SPECIALTY EDUCATION IN THE FUTURE

Dental specialty education will remain at current capacity in the aggregate, resulting in about 30% of dental graduates choosing to specialize. Shifts toward

and away from individual dental specialties will be determined in the main by economic factors, particularly supply and demand. New, officially recognized dental specialties will form over time, particularly in response to demonstrated service demand by patients, and to some degree by pressure from members of informal but aspiring specialties.

A one-year postgraduate experience (PGY-1) will continue to be seen as an essential and widely supported form of education that assists the new dental graduate to consolidate recently acquired clinical skills.

Specialty training choices will greatly impact the future of dentistry. While certain broad professional, social and economic forces affect all the dental specialties, factors shaping individual dental specialties may also have considerable impact on future trends in dental education.

Specialty-specific forces will continue to be very important in shaping the future development of the individual dental specialties, and in turn their contributions to dental education. Moreover, it continues to be a problem to attract potentially high-earning dental specialists to a career in dental education.

Two general considerations will likely affect the dental specialties in a more systematic fashion. First, as the ADA 1997 *Survey of Dental Practice* revealed, the net income of dental specialists is double that of general dentists (ADA, 1998). Moreover, in a recent economic study focusing on orthodontics and oral and maxillofacial surgery, it was determined that there remains a strong incentive to invest time and resources into dental specialty training based on the usually accepted economic indices (return-on-investment, internal-rates-of-return) for economic evaluation of decisions.

The same methodology has not been applied recently to evaluate the economic outcome related to training and working in other dental specialties, but positive returns may be expected relevant to the majority of the dental specialties. As long as there are positive financial incentives to specialization, dentists will become specialists.

Recognized dental specialties represent less than 25% of the dentist workforce. Thus, dentistry is not in imminent danger of becoming overspecialized, although a slow increase to the 30% level is quite likely. Moreover, the demand for specialized dental services appears to be growing, while interest in becoming a specialist has held remarkably steady, in absolute numbers, for the past three decades.

It is reasonable to expect that the economic incen-

tives for dental professionals to specialize will continue to be present in the foreseeable future. During a time when many aspects of dentistry are being increasingly affected by rapid technological change, specialization is a dental professional's rational response to be better grounded in the delivery of more advanced and complex clinical services for patients.

Well-trained, scholarly dental specialists will also be increasingly important to help the nation's dental schools to maintain a first-class teaching faculty. The shortage of full-time teaching faculty across the aggregated dental schools has been commented upon elsewhere in this chapter. While the faculty shortage is reflected by more than just the clinical dental specialties, it remains the case that scholarly dental specialists should continue to form the backbone of the full-time teaching faculty in American dental schools.

In the nation's dental schools a great deal of the applied and clinical research will be carried out by investigator teams functioning within one or other of the dental specialties. That most of such research will be collaborative, spanning several other dental, medical and biological sciences, does not alter the tendency for most of such research to focus on specialty-specific clinical problems. As such, teams involving dental specialists, their graduate students and postdoctoral students will generate much of the growth of dentistry's future clinical knowledge. This scenario suggests that specialists, dental and non-dental alike, through their capacity to generate new knowledge for dentistry, will be essential to a dynamic dental education system, and thus will be critical to the future vitality of the whole dental profession.

Monitoring of non-ADA recognized specialty training is needed. As it has recently done for oral and maxillofacial radiology, the dental profession would do well to continue reviewing the informal specialties for their potential to rise to formal specialty status. Given the rapidly changing population demographics, it may be advisable to study the merger of GPR, hospital dentistry and geriatric dentistry programs into a specialty of geriatric/special care dentistry.

LIFE-LONG LEARNING AND CONTINUING DENTAL EDUCATION

Life-long learning is an integral element of the dental profession, a theme first taught in the dental school. Ample availability of high quality continuing

dental education is the vehicle for life-long learning in dentistry. Dental education's long-standing leadership role in continuing dental education will be increasingly challenged by for-profit entities, both dental and non-dental in nature. Continuing dental education will be increasingly delivered in three formats:

- ◆ The standard, traditional lecture;
- ◆ Interactive self-instruction, along with automated real-time testing, both via the Internet; and,
- ◆ Hands-on, participation courses.

Continuing education (CE) will take advantage

of Internet communication. Most dental CE experts predict that much of the current lecture-style dental CE format will increasingly move to the Internet, where sophisticated interactive programs will offer a very large range of high quality CE courses at relatively low prices. Many individual dental faculty members have already become involved in offering dental CE using the Internet as the registration, payment, delivery and testing system. Internet-based dental CE will pose a major challenge to dental schools because of the academic institutions' low investments in, and generally limited resources for, the types of information technology (IT) and production facilities necessary for competitive Internet-based dental CE program offerings.

III. PATHWAYS AND STRATEGIES FOR DENTAL EDUCATION IN THE FUTURE

The United States should have a dental education system that generates the knowledge base and that provides the ethical and professional dental workforce necessary to meet the nation's oral health needs.

Today's dental education system must be strengthened and made more dynamic if the country is to achieve this vision. Achieving this goal will require energetic leadership and willingness to embrace needed change, by the dental profession, the dental education community and the public.

The public, through the leadership of its state and federal agencies, must recognize the value of optimal oral health and must therefore accept the ultimate responsibility to ensure the education of dental researchers, dental teachers and dental care providers. Only in this way will dental knowledge be transmitted by dental educators to dental students who become the providers of professional dental services for the public. Research, education and service are the triad that will assure a healthy public.

The dental profession, as individuals and through its professional organizations, also benefits from a high quality dental education system. In the United States that system takes just four years to transform talented university students into highly competent and ethical dental professionals whose provision of complex services for the public allow the dental professionals to enjoy a fulfilling and rewarding career. All dental professionals are the product of dental education, a reality on which dentistry and dental education could well build a stronger and more pro-

ductive partnership for the future.

Dentistry and dental education should both realize that modern science points to an ever-increasing convergence between oral health and total health. This powerful reality does not presage the weakening or disappearance of dentistry, rather it provides the rationale for dentistry to play a more confident role in the modern academic health center, and for dentists to develop a closer partnership with their medical colleagues. In all academic health centers medicine is the lead engine of health care education and research, and dentistry flourishes and becomes more if it pulls in unison with the other partners in the academic health setting. In the long run, neither dentistry nor dental education will flourish if dentistry seeks to go it alone at every opportunity.

In working toward the vision for dental education for the future, there are many actions that the dental profession, as individual practicing and retired dentists or through their leadership organizations, can undertake. For example, the dental profession should continue efforts to educate Congress and the state legislatures about the pressing need for substantially increased facilities and financial operating support for dental education. Other actions include:

- ◆ Collaborate with the ADEA to fund and formulate a program to proactively and constructively promote dental education within the nation's universities and academic health centers.

- ◆ Conduct a comprehensive, sophisticated and well-financed study of the future United States dental workforce. Such a study must generate alternative models that include existing categories of dental personnel, as well as potentially new or modified categories of dental care providers.
- ◆ Advocate governmental programs to reduce dental student indebtedness, including incentive and loan forgiveness programs in exchange for specified service commitments in designated underserved areas.
- ◆ Seek major funding to undertake a comprehensive study of methods to assure an adequate future supply of full-time dental school faculty. Such a study must account for specialty and regional effects that will bear on the faculty question.
- ◆ Encourage dental schools to become more active and sophisticated in their fund raising programs for the specific purpose of raising philanthropic funds designated for endowments to support faculty professorships and dental student scholarships.
- ◆ Keep as a priority for dental education the development of programs to recruit, mentor and retain women and under-represented minority faculty.
- ◆ Consider providing financial support and thereby stimulating the development of IT-based dental curriculum materials for which one-time production costs are so extraordinarily high.
- ◆ Monitor, and act proactively when appropriate, to encourage the formation of new specialties and related advanced dental education programs. Geriatric dentistry, based in large part on the existing dental GPR training in many hospitals, would appear a prime candidate given the emerging population demographics after 2010.
- ◆ Encourage the establishment and funding of additional PGY-1 positions as a preferred way for new dental graduates to consolidate their clinical skills.
- ◆ Encourage dental schools to examine their future role in continuing dental education to ensure that the infrastructure and/or partnerships are developed to support the main CE modalities in the future.

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