ADEA AMERICAN DENTAL EDUCATION ASSOCIATION

New Opportunities for Dentistry in Diagnosis and Primary Health Care: Report of a Panel of the Macy Study

Acknowledgments

Panel 1 of the Macy study was funded by a grant from the National Institute of Dental and Craniofacial Research (NIDCR) R13 DE017508-01 and, in part, by the Josiah Macy, Jr. Foundation and the American Dental Education Association.

About This Report

A major study initiative, "New Models of Dental Education," funded by the Josiah Macy, Jr. Foundation, convened three panels of distinguished experts to examine issues related to the dental curriculum. This report is from Panel 1, held September 24–25, 2006, on the subject of diagnosis and primary health care. Staffing the panel were Allan J. Formicola (The Macy Study), Richard W. Valachovic (American Dental Education Association), and Jacqueline E. Chmar (American Dental Education Association). There were ten panelists:

- Ira B. Lamster, D.D.S., M.M.Sc., Dean, Columbia University College of Dental Medicine (chair)
- Lisa A. Tedesco, Ph.D., Vice-Provost for Academic Affairs–Graduate Studies and Dean of the Graduate School, Emory University (moderator)
- Deborah M. Fournier, Ph.D., M.S., Associate Dean for Institutional Planning and Evaluation, Boston University Henry M. Goldman School of Dental Medicine
- J. Max Goodson, D.D.S., Ph.D., Director of Clinical Research, The Forsyth Institute
- Alan R. Gould, D.D.S., M.S., Director, Oral Pathology Group, Indiana University School of Dentistry
- N. Karl Haden, Ph.D., President, Academy for Academic Leadership
- T. Howard Howell, Jr., D.D.S., Dean for Dental Education, Harvard School of Dental Medicine
- Titus K. Schleyer, D.M.D., Ph.D., Chair, Department of Dental Informatics, Temple University School of Dentistry
- Jonathan A. Ship, D.M.D., Director, Bluestone Center for Clinical Research and Professor, New York University College of Dentistry
- David T.W. Wong, D.M.D., D.M.Sc., Associate Dean of Research and Professor, Division of Oral Biology and Medicine, University of California, Los Angeles, School of Dentistry

Cover

Mr. Pooria Shahin and Ms. Tasneem Tangwala, Columbia University College of Dental Medicine Class of 2009, take blood pressure and medical history. Photograph courtesy of Douglas McAndrew, Columbia University College of Dental Medicine.

Additional copies of this report are available from ADEA at the address below.

American Dental Education Association
1400 K Street NW, Suite 1100
Washington, DC 20005
Phone: 202-289-7201
Fax: 202-289-7204
publications@adea.org
www.adea.org

Patient evaluation and diagnosis are essential to the practice of dentistry. Direct clinical observations and radiographic findings are used to identify existing problems and to select the most appropriate dental treatment. Evaluation of a patient's health status determines how systemic illnesses can modify oral, dental, and craniofacial diseases and a patient's ability to tolerate dental treatment.

New opportunities exist for expanding the concept of diagnosis in the dental office. Specifically, the relationship of oral infection to certain systemic diseases has re-emphasized the mouth-body connection, and saliva, cells, and other oral fluids are being studied as means to diagnose a host of oral and systemic disorders. This scientifically based, clinically relevant, contemporary emphasis presents logical opportunities to pursue primary health care in the dental office.

The experts in Panel 1 discussed how changes in the definition of dental practice could begin with changes to the dental school curriculum and clinical education. The ultimate goal is the training of dental practitioners who can more precisely evaluate oral, dental, and craniofacial diseases and help promote early diagnosis of systemic diseases.

Systemic Health, Dentistry, and Dental Education: Evolving Over Time

The health care environment, including dentistry, is evolving. The population is aging, patients are retaining their teeth, edentulism is declining, and more people with multiple chronic diseases are seeking dental care. We have an improved understanding of the etiology of oral and systemic disorders and of primary and secondary risk factors for oral, dental, and craniofacial disorders. Clinical care treatment options continue to expand as new approaches to treat partial and complete edentulism (e.g., implants), periodontal diseases (e.g., new drug therapies, regenerative surgery), and caries (e.g., remineralization, conservative tooth preparation) are introduced. With a growing body of knowledge suggesting that oral infection and the associated tissue inflammation may affect diseases and conditions (e.g., cerebrovascular/cardiovascular disease, pregnancy, respiratory disease, diabetes mellitus), there is an increased emphasis on the importance of oral diseases in the context of systemic health.

The dental profession must consider practice models that will be relevant for the remainder of the twenty-first century. A new "educational map" will influence what students learn in dental school and how they perform as dental practitioners. Patients, clinicians, and educators of the future will see greater emphasis in the following areas:

- diagnosis of oral diseases, using new technology and computer-based programs to augment decision making;
- knowledge of systemic diseases that modify oral diseases;
- diagnosis of systemic diseases that can be affected by oral diseases; and
- health care screening and interventions in the dental office.

What kinds of educational experiences will allow students to acquire competence in these areas? What attitudes should the student-dentist and practicing dentist possess to ensure appropriate patient care? How will the learning and shift in emphasis be assessed and evaluated? What are appropriate outcome measures? These general questions have been discussed in the literature, focusing on the linkage between oral infection and a number of systemic diseases and the broader issue of education of dentists and the scope of practice.[1–3] The opportunity now exists to create educational models that emphasize the dentist as a full member of the health care team. This evolution will result in a new standard of practice for the dental profession.

A discussion of the future of dental education and dental practice emphasizing diagnosis and primary health care is best begun with a review of the Gies report, funded by the Carnegie Foundation and published in 1926.[4] The Gies report followed the 1910 publication of the Flexner report on the future of medical education.[5] Officially titled "Dental Education in the United States and Canada," the Gies report offered suggestions for the future of the dental profession. In an era when proprietary dental education often clouded the path towards the standardized preparation of a well-trained dentist, the Gies report advocated a minimum of two years of college, dental education closely modeled on medical education, and optional postgraduate training. About seventy years later, the Institute of Medicine issued "Dental Education at the Crossroads: Challenges and Change."[6] This report firmly emphasized the need for dental education to integrate with medical education and for dental schools to become integral and contributing components of their parent universities.

Recent advances in health care—driven largely by improved understanding of basic biological science (e.g., genomics, proteomics), new pharmacological agents based on improved understanding of biological and pathological processes, and advances in technology (e.g., imaging and less invasive surgical interventions)—are changing the practice of medicine. Similar changes are occurring in oral health care. There is a clear trend toward increased tooth retention, dramatic improvements in dental materials, and regenerative techniques to help retain teeth and establish an ideal environment for placement of dental implants. These advances in dental treatment offer improved options for patients of all ages.

How Should Dental Education Change to Meet Future Practice Needs?

In this context, and in consideration of the role of the dental profession within the health care system, it is fair to ask if and how the preparation of dentists in dental school should change. New dental graduates must be prepared to incorporate the latest advances into dental practice. They must be prepared to treat patients who have complicated medical histories, especially those using multiple medications (polypharmacy). It is common for dentists to treat patients who present with systemic disorders (e.g., diabetes mellitus) or who engage in adverse health-related behaviors (e.g., cigarette smoking) that affect oral and dental diseases.

What level of knowledge about diagnosis and general health care is required for dental clinicians to function efficiently and effectively in this newly expanded health care role? What skills, attitudes, teaching strategies, and assessment strategies are needed to prepare dental students for this expanded role in the health care system?

Types and Level of Knowledge Required

Improving diagnostic skills is dependent on a thorough understanding of the biological basis of disease and on how diseases are identified by clinical and laboratory means. Understanding of the pathologic basis of oral and dental diseases will lead to new diagnostic tests and computer-based tools

for evaluating and managing patients in the dental office. An understanding of systemic diseases by dentists will improve the management of patients presenting for dental care and allow dentists to assess changes that can occur over the course of treatment.

In this context, the role of dentists in primary health care must be considered. With greater demands on the health care system to care for patients, the dental office represents an ideal location to assume some of these responsibilities, benefiting patients and clinicians alike. Considering that nearly two-thirds of Americans saw a dentist in the past year and that there is an increasing understanding of the relationship between oral/dental disorders and many systemic disorders, this paradigm shift represents a great opportunity for dentists to contribute to the improved health of the public and further integrate dentistry into the health care system.

In order to move this change forward, dental students should graduate with an understanding of the following:

Diagnosis of Oral and Dental Disease. It is critical to understand the etiology, risk factors, and epidemiology of oral diseases that present in the dental office (e.g., periodontal disease, coronal and root caries, oral dysplastic lesions and oral cancers, pathology of the epithelial and mesenchymal tissues, salivary gland disease and xerostomia, and neuro-muscular disorders of the head and neck including the temporomandibular joint).

It is also essential to understand current and experimental approaches and tests for the diagnosis of oral and dental disorders. Examples are laser fluorescence[7] and optical coherence tomography[8] for caries diagnosis. The student-dentist and practicing dentist must be aware that new diagnostic tools are in a state of evolution and assessment.[9] Computer-based risk assessment tools will also need to be incorporated into dental practice.[10,11]

Diagnosis of Systemic Diseases and Conditions That Can Be Affected by Oral Diseases. The current interest in periodontal medicine is mostly focused on how oral and dental diseases affect systemic conditions like cardiovascular, cerebrovascular, and respiratory diseases, diabetes mellitus, and pregnancy. Student-dentists and dentists need an in-depth understanding of these specific conditions. Baum recently called for a greater emphasis on internal medicine in the dental school curriculum.[12]

In addition, the long-recognized concern about bacteremia following dental procedures and the risk for infection at distant sites have taken on new significance.

Diagnosis of Systemic Diseases That Can Modify Oral and Dental Diseases. The most recognized systemic disorder associated with modified risk for oral/dental diseases is the increased risk for periodontitis associated with diabetes mellitus. This relationship requires a thorough understanding of the etiology and pathogenesis, diagnosis, and treatments for disorders such as diabetes mellitus.

A large number of other disorders can manifest in the oral cavity. Among them are hematological diseases (manifesting as a change in the color of the tissues or gingival bleeding), malignancy (metastases in the craniofacial region), autoimmune diseases (pemphigus, pemphigoids, Sjögren's syndrome), and recently described disorders such as osteonecrosis of the jaw associated with bisphosphonate therapy.

Dental practitioners will need a thorough understanding of drug usage and new pharmacologic agents being used by patients. With the aging of the population and increased longevity, polypharmacy routinely occurs among older adults. The implications of polypharmacy for the dentist who is writing additional prescriptions are critically important. Xerostomia is an adverse side effect of hundreds of medications, and adverse drug reactions are common in the elderly.

Primary Health Care Screenings and Interventions in the Dental Office. Cigarette smoking is a major risk factor for oral squamous cell carcinoma and periodontal disease. Smoking cessation programs in which dentists explain the importance of cessation for oral and dental health and general health should be part of regular dental care.

Dental practitioners should be keen observers of the status of patients who come for dental treatment. Any unusual or adverse findings should be questioned or pursued. Examples are dermatologic lesions on the face, head, and other exposed skin surfaces. Premalignant and malignant lesions of the face, head, and neck are best treated early to avoid disfiguring surgery required for more advanced stages of disease. Examination of the patient's face and other skin surfaces can be achieved using the light in the dental operatory. Other examples of findings that should be questioned are changes in skin color, the presence of edema, and objective and subjective comments by the patient.

Other interventions should be considered as data become available to support their inclusion in a dentist's work-up. Examples include diet management for overweight or obese patients. Dentists are familiar with discussion of food and carbohydrate intake with patients who are at risk for dental caries. These skills could be employed in a broader context. Further, as evidence accumulates suggesting other diagnostic linkages (e.g., osteoporosis based on dental radiographs[13]), these disorders should be included in the requirements for all students graduating from dental school. After assessment, appropriate referral to an internist or endocrinologist is warranted.

Patient-Centered Behavioral Sciences and Communication Skills. Dental practitioners need a fundamental understanding of the current research findings in areas related to behavioral sciences and patient-centered care, as well as their impact on diagnosis, effective practice, and patient satisfaction. A working knowledge of the research and practices in health literacy is also fundamental to a full understanding of contemporary behavioral sciences and patient-centered care.

Knowledge of the research and practice related to changing health behaviors, compliance with healthy regimens, and relapse prevention is also essential to the contemporary practice of dentistry and the maintenance of oral health.

In addition, fundamental to dental practice will be an understanding of classic interpersonal communication concepts and of contemporary research on basic approaches to patient-centered and culturally sensitive communications.

Skills Required for the Future Dentist

The fundamental skills required for this new emphasis in dental practice begin with the basic science and preclinical portions of the curriculum. These skills must be consistently reinforced in the clinical training that follows. The establishment of basic skills must be built on the foundation of knowledge provided in the basic biomedical sciences related to diagnostics and therapeutics and on the contemporary findings from behavioral sciences related to patient-centered, culturally sensitive care. To achieve the successful demonstration of the new skill areas described below, institutional commitments will be required that include change in patient evaluation systems and change in clinical pedagogy.

Prior to graduation—using an enhanced patient evaluation system based on an understanding of the pathophysiology of disease—a dental student should demonstrate the following skills:

- appropriate selection and application of new diagnostic tests for oral and dental conditions such as caries, periodontal disease, and squamous cell carcinoma;

- problem-solving strategies, including use of decision support tools to enhance the evaluation of the medical status of patients seen for dental care;
- interviewing of patients about their medical, dental, and social history;
- oral and written communication so that graduating dentists can communicate with other health care professionals to extend and enhance integrated care and follow-up;
- interpersonal communication that demonstrates sensitivity to patient perspectives, life circumstances, and ability to understand and comply with treatment recommendations; and
- observational acuity to recognize common physical changes associated with specific systemic illnesses.

For students to develop these skills, dental schools should:

- emphasize that patient care should be driven by diagnosis and identification of specific problems rather than by clinical procedures;
- focus attention on specific medical disorders (e.g., cardiovascular diseases) affected by oral diseases, on oral diseases modified by systemic diseases (e.g., diabetes mellitus), and on primary health care interventions (e.g., smoking cessation) with specific relevance to oral and dental disorders; and
- develop a system that allows dental students and their instructors to have access to the pertinent medical records of patients being treated in dental schools/health sciences centers, and create patient evaluation and education approaches that support oral-systemic health promotion, diagnosis, treatment, and follow-up.

Attitudes Required for the Future Dentist

The development and consistent expression of attitudes that represent and preserve clinical responsibility for diagnosis and greater involvement in primary care are crucial to rebalancing how dentistry is practiced today and in the future. Understanding the role of new diagnostic tests, decision support tools, and the importance of the oral-systemic relationship will not be enough to ensure consistent practice within a framework that is primary care-oriented. Positive attitudes and high value placed on these aspects of oral health have always had an important role in patient care; however, for contemporary clinical practice in dentistry, they are increasingly at the center of care. This new paradigm will only be achieved by focusing away from treating individual teeth and towards treatment of the patient who presents with dental problems. Only with mindful, consistent focus and a reordering of priorities in clinical practice will the student reach this standard of care.

Clearly, attitudes and values underlying this change in orientation and commitment will only come from educational experiences designed to instill new attitudes and values for a different focus in patient care. Contemporary clinical practice will be strengthened from educational experiences that create positive attitudes of importance and value for the habits of practice, mind, and professional self-definition. The contemporary clinician will value the following:

- diagnostic tests and an understanding of the role they play in patient evaluation;
- decision support mechanisms and how they improve diagnosis;
- the impact of oral health on systemic conditions and patient health;
- the relationship of improved patient outcomes for oral conditions to the general health of the patient;
- health maintenance when patients are medically healthy, and practices that monitor health status, promoting the dentist's role in disease prevention and health promotion through diagnostics;
- the speed of change in health care;
- adaptation to change and incorporation of change into practice as a result of new scientific information;
- a view of oneself as a constantly evolving practitioner with a commitment to staying current and incorporating new diagnostic techniques as they become available;
- self-evaluation and self-awareness of how one learns and changes;
- the dentist as part of the health care team, with consistent interprofessional collaboration; and
- increased access to health care services for all patients.

Teaching Strategies Required to Educate the Future Dentist

One of the hallmarks of pedagogy in the health professions is the opportunity for faculty to teach and students to learn through the fundamental meaning of a patient or case. In dental education, progress on case-based teaching, the development of related pedagogies, and educational reorganization to support innovation in classroom, small group, and clinical education have been consistent over the last two decades.[14–23] The role of patients and the cases they represent serve to convene faculty and student in mindful problem solving, which includes discovery and analysis of medical, dental, and social conditions using increasingly sophisticated diagnostics and increasingly socially sensitive conversation.

Teaching strategies and educational organization must be guided in order to adequately and substantively support an oral-systemic emphasis and the primary care connections in patient care in the following ways:

Curriculum Organization and Management. Multidisciplinary education must become the norm and represent the meaning and purposes of primary care as it applies to dentistry. Educational sequences should include rotation strategies across discipline specialties in medicine and dentistry, clerkships and hospital rotations, and experience in faculty and residency clinics. For example, a dental presence in medical rotations to specialty clinics in endocrinology or dermatology, or in special facilities for geriatric patients, would advance the goals presented above.

Teaching Techniques. Case-based/problem-based teaching and learning techniques should be designed to support the oral-systemic diagnostic emphases discussed above. Time should be allowed for small group discussions, classroom discussion, and case examination. Students should have regular access to examples of how expert clinicians think, analyze, and use the diagnostic tools available for contemporary practice.

Basic Science Education. The scientific basis on which the curriculum is designed and delivered must be examined for coherence and integrity as it applies to a primary care, diagnostics, and therapeutics orientation to patient care. Concomitant placement of basic science content in proximity or in parallel to clinical education and clinical application will be essential to modeling new professional practices that are patient-centered and diagnostically driven. Basic science education must be emphasized in the clinical years of the dental school curriculum, where the focus is on attainment of specific skills. This can be achieved in part through case-based and problem-based discussions.

Behavioral Science Education. Curriculum content in the behavioral sciences for supporting a primary care orientation in classroom and clinic settings must include more depth and breadth in patient interviewing; social, medical, and dental history taking; behavior change strategies for compliance; and health promotion. The design and implementation of a supportive behavioral science curriculum will result from inclusive and mindful collaborations with colleagues who have expertise in effective communication, the biopsychosocial model, and patient-centered care.[24–27]

Educational and Clinical Infrastructure.
Revising the educational and clinical infrastructure will be paramount to new systems for contemporary practice based on a full understanding of oral-systemic connections and how this may influence primary care activities in the dental office. Patient care records, shared by dentistry and medicine, much like in the U.S. Department of Veterans Affairs system, will be required.

Assessment Strategies Required to Determine the Readiness of the Future Dentist to Practice
Evaluating the educational goals stipulated by a curriculum or training sequence is challenging enough for simple behaviors. For complex behaviors and assessment of attitudes and values, the task is considerably more difficult. The design of assessment strategies should mirror realistic situations and set a standard for "successful response" patient-centered processes. Testing for these process outcomes will require the student to demonstrate not only use of a foundation of knowledge and success in the application of skill or techniques, but also whether attitudes and values have been shaped to ensure the appropriate use of behavioral science and communications skills that support patient-centered practice.[17]

Borrowing from other general education areas, health professions educators have used several assessment approaches aimed at evaluating the student's knowledge, skills, and attitudes, applied to a case or a simulated set of circumstances, at varying levels of difficulty. Portfolio assessments, objective structured clinical examinations (OSCEs), case reviews, and videotaping of clinical encounters or standardized patients are increasingly used in health professions education.[28–31]

All of these types of knowledge, skills, and attitudes, imparted with successful teaching strategies and assessed effectively, will be needed to prepare dental students for their expanded roles as practitioners in the future health care system.

REFERENCES

1. Giddon DB, Assael LA. Should dentists become "oral physicians"? J Am Dent Assoc 2004; 135(4):438–49.

2. Gould AR. Well, what do we want to be? Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005; 100(3):261–2.

3. Garfinkel AA. Reconfiguring the dental-medical symbiosis: back to basic sciences. Compend Cont Educ Dent 2006; 27(7):390–4.

4. Gies WJ. Dental education in the United States and Canada: a report to the Carnegie Foundation for the Advancement of Teaching. New York: Carnegie Foundation, 1926.

5. Flexner A. Medical education in the United States and Canada: a report to the Carnegie Foundation for the Advancement of Teaching. New York: Carnegie Foundation, 1910.

6. Field MJ, ed. Dental education at the crossroads: challenges and change. A Report of the Institute of Medicine. Washington, DC: National Academy Press, 1995.

7. Iwami Y, Shimizu A, Hayashi M, Takeshige F, Eloisu S. Relationship between colors of carious dentin and laser fluorescence evaluation in caries diagnosis. Dent Materials J 2006; 25(3):584–90.

8. Colston BW, Everet MJ, Sathyam US, Dasilva LB, Otis LL. Imaging of the oral cavity using optical coherence tomography. Monogr Oral Sci 2000; 7:32–55.

9. Baelum V, Heidmann J, Nyvad B. Dental caries paradigm in diagnosis and diagnostic research. Eur J Oral Sci 2006; 114:26–77.

10. Bratthall D, Petersson GH. Cariogram: a multifactorial risk assessment model for a multifactorial disease. Community Dent Oral Epidemiol 2005; 33(4):256–64.

11. Page RC, Martin J, Krall EA, Mandel L, Garcia R. Longitudinal validation of a risk calculator for periodontal disease. J Clin Periodontol 2003; 30:819–27.

12. Baum BJ. Inadequate training in the biological sciences and medicine for dental students: an impending crisis for dentistry. J Am Dent Assoc 2007; 138(1):16–26.

13. Devlin H, Allen PO, Graham J, Jacobs R, Karayianni K, Lindh C, et al. Automated osteoporosis risk assessment by dentists: a new pathway to diagnosis. Bone 2007; 40: 835–42.

14. Kassebaum DK, Hendricson WD, Taft T, Haden NK. The dental curriculum at North American dental institutions in 2002–03: a survey of current structure, recent innovations, and planned changes. J Dent Educ 2004; 68(9):914–31.

15. Tedesco LA. Issues in dental curriculum development and change. IOM report background papers. J Dent Educ 1995; 59(1):97–147.

16. Iacopino AM. The influence of "new science" on dental education: current concepts, trends, and models for the future. J Dent Educ 2007; 71(4):450–62.

17. Richards PS, Inglehart MR. An interdisciplinary approach to case-based teaching: does it create patient-centered and culturally sensitive providers? J Dent Educ 2006; 70(3):284–91.

18. Hendricson WD, Cohen PA. Oral health in the 21st century: implications for dental and medical education. Acad Med 2001; 76(12):1181–207.

19. Hendricson WD, Andrieu SC, Chadwick DG, Chmar JE, Cole JR, George MC, et al. Educational strategies associated with development of problem-solving, critical thinking, and self-directed learning. J Dent Educ 2006; 70(9):925–36.

20. Bertolami CN. Rationalizing the dental curriculum in light of current disease prevalence and patient demand for treatment: form vs. content. J Dent Educ 2001; 65(8): 725–35.

21. DePaola DP, Slavkin HC. Reforming dental health professions education: a white paper. J Dent Educ 2004; 68(11):1139–50.

22. Marshall SE, Formicola A, McIntosh J. Columbia University's community dental program as a framework for education. J Dent Educ 1999; 63(12):944–7.

23. Formicola AJ, Myers R, Hasler JF, Peterson M, Dodge W, Bailit HL, et al. Evolution of dental school clinics as patient care delivery centers. J Dent Educ 2006; 70(12):1271–88.

24. Association of American Medical Colleges. Contemporary issues in medicine: communication in medicine. Medical School Objectives Project, Report III. Washington, DC: Association of American Medical Colleges, 1999.

25. Borrell-Carrio F, Suchman AL, Epstein RM. The biopsychosocial model 25 years later: principles, practice, and scientific inquiry. Ann Fam Med 2004; 2(6):576–82.

26. Suls J, Rothman A. Evolution of the biopsychosocial model: prospects and challenges for health psychology. Health Psychol 2004; 23(2):119–25.

27. Gertais M, Edgman-Levitan S, Daley J, Delbanco TL, eds. Through the patient's eyes: understanding and promoting patient-centered care. San Francisco: Jossey-Bass, 1993.

28. Sloan DA, Donnelly MB, Schwartz RW, Felts JF, Blue AV, Strodel WE. The use of the objective structured clinical examination (OSCE) for evaluation and instruction in graduate medical education. J Surg Res 1996; 63(1):225–30.

29. Hodges B, Turnbull J, Cohen R, Bienenstock A, Norman G. Evaluating communication skills in the OSCE format: reliability and generalizability. Med Educ 1996; 30(1): 38–43.

30. Davis MH, Friedman BD, Harden RM, Howie P, Ker J, McGhee C, et al. Portfolio assessment in medical students' final examinations. Med Teacher 2001; 23(4):357–66.

31. Snadden D, Thomas M. The use of portfolio learning in medical education. Med Teacher 1998; 20(3):192–9.

1400 K Street, NW, Suite 1100
Washington, DC 20005
www.**adea**.org