



Association of
Professors of Medicine

APM Perspectives

The Association of Professors of Medicine (APM) is the national organization of departments of internal medicine at the US medical schools and numerous affiliated teaching hospitals as represented by chairs and appointed leaders. As the official sponsor of The American Journal of Medicine, the association invites authors to publish commentaries on issues concerning academic internal medicine.

For the latest information about departments of internal medicine, please visit APM's website at www.im.org/APM.

The Anticipated Physician Shortage: Meeting the Nation's Need for Physician Services

Gregory C. Kane, MD,^a Michael R. Grever, MD,^b John I. Kennedy, MD,^{c,d} Mary Ann Kuzma, MD,^e
Alan R. Saltzman, MD,^f Peter H. Wiernik, MD,^g Nicole V. Baptista, BS^h

^aDivision of Pulmonary Medicine and Critical Care, Department of Medicine, Jefferson Medical College, Philadelphia, Pa; ^bDepartment of Internal Medicine, Ohio State University College of Medicine, Columbus; ^cDepartment of Medicine, University of Alabama at Birmingham School of Medicine, Birmingham; ^dBirmingham VA Medical Center; ^eDepartment of Medicine, Drexel University College of Medicine, Philadelphia, Pa; ^fDepartment of Medicine, State University of New York at Buffalo School of Medicine and Biomedical Sciences, Buffalo; ^gDivision of Hematology and Oncology, Department of Internal Medicine, New York Medical College (Our Lady of Mercy), Bronx, NY; ^hAlliance for Academic Internal Medicine, Washington, DC.

PERSPECTIVES VIEWPOINTS

After 2 decades of consistent predictions that the US will face a physician surplus, leading professional organizations and advisory boards have now altered their calculations and projected that the nation might soon face physician shortages.¹⁻⁵ These organizations are calling for teaching hospitals, medical schools, and the federal government to respond to predicted shortages.⁶⁻⁸

The primary determinant of the number of practicing physicians in the US is the number of graduate medical education (GME) positions or training slots. These positions represent the only pathway to licensure for medical practice in the US. Since the Balanced Budget Act of 1997 capped the number of federally funded positions in each residency program at the 1996 level,

increases to the flow of new physicians into the workforce have been limited despite evidence of growing demand. The shortage of physicians is particularly significant in primary care specialties.

The Alliance for Academic Internal Medicine's (AAIM) recommendations to allow strategic growth in positions in primary care specialties and geographic areas of need would prevent an unregulated increase in positions for highly specialized training programs, which might raise health care costs without adding primary care physicians to address health care needs. However, increasing the number of primary care positions will not result in an increase of physicians practicing primary care unless steps are taken to enhance the attractiveness of primary care careers.

This position paper was created by the AAIM Advocacy Committee and approved by its 5 member organizations: the Association of Professors of Medicine, Association of Program Directors in Internal Medicine, Association of Specialty Professors, Clerkship Directors in Internal Medicine, and Administrators of Internal Medicine. This paper reviews the data that support the conclusion that the US faces the prospect of a shortfall of physicians, describes certain aspects of these data, particularly as they relate to the supply of primary care physicians, addresses the mechanisms necessary for expanding the pool of practicing physi-

Funding: None.

Conflict of Interest: None.

Authorship: This article has been endorsed by the Association of Professors of Medicine, Association of Program Directors in Internal Medicine, Association of Specialty Professors, Clerkship Directors in Internal Medicine, and Administrators of Internal Medicine.

Requests for reprints should be addressed to Gregory C. Kane, MD, Division of Pulmonary Medicine and Critical Care, Department of Medicine, Jefferson Medical College, 1025 Walnut Street, #805, Philadelphia, PA 19107.

E-mail address: gregory.kane@jefferson.edu

cians through increasing Medicare-funded GME slots, discusses the expansion of programs that distribute physicians to geographic areas of need, and comments on steps that can be taken to improve the efficiency of physician work.

PREDICTIONS OF A PHYSICIAN SHORTAGE

The Council on Graduate Medical Education (COGME) issued *Physician Workforce Policy Guidelines for the United States 2000–2020* in January 2005.⁹ COGME noted that although the absolute number of physicians would increase by 24% between 2000 and 2020, the population growth would exceed the rate of growth of physicians, resulting in a decrease in the ratio of full-time equivalent (FTE) physicians per 100,000 Americans. COGME also postulated that the demand for physician services will grow as the elderly population increases as a proportion of the total population. The council concluded that US medical school enrollment needed to increase by 15% by 2012 to meet demand.

In June 2006, the Association of American Medical Colleges (AAMC) issued the *AAMC Statement on the Physician Workforce*, which claimed there was “sufficient evidence” to recommend increasing by 30% the number of entry-level positions in Liaison Committee on Medical Education-accredited medical schools by 2012.⁷ AAMC stated that the 30% increase could be accomplished by increasing enrollment at existing schools as well as creating new medical schools. According to the statement, increased funding for GME positions should occur simultaneously to ensure graduating medical students could receive appropriate postgraduate training.

In December 2008, AAMC released updated projections indicating that a shortage of 124,000 FTE physicians will occur by 2025.¹⁰ According to their estimates, 37% of the shortage will be in primary care, 33% in surgery, 6% in medical specialties, and 23% in other specialties. The shortage of 124,000 physicians is based on the assumption that current supply, use, and demand patterns will remain the same for the next 16 years. Because it is unlikely that these patterns will remain stable, AAMC also created an alternative scenario assuming a continued increase in utilization rates, changes in work schedules, a moderate expansion in GME capacity, and improvements in productivity,

which projects a shortage of 159,300 FTE physicians by 2025.

Although academic institutions have responded to the calls from COGME and AAMC with an increase in allopathic medical school class size and the creation of several

new medical schools, new federal funding for additional US GME slots has not been forthcoming, except in a limited way from the Department of Veterans Affairs (VA). Increases to positions funded by other sources, although they exist, also have been minimal.¹¹

Beyond increasing support to expand GME positions, interest in primary care careers among medical school graduates also must increase to positively affect the supply of primary care physicians. Extensive data support the observation that decreased numbers of US medical school graduates are pursuing careers in primary care. For example, 3884 US medical students matched into internal medicine residency positions in 1985,

compared with 2660 in 2008.¹² In a recent study by Hauer et al,¹³ only 24 (2%) of the 1177 students in the 11 medical schools participating planned to pursue a career in general internal medicine. Conversely, whereas interest of US seniors in general internal medicine has decreased, the proportion of residents choosing specialty fellowships has increased from 50% in 1988 to 80% in 2006.¹⁴ According to Hauer’s study, today’s medical students prioritize lifestyle issues in career selection and perceive general internal medicine as a low-satisfaction, low-income, and uncontrollable career.¹³ The potential consequence of declining interest in general internal medicine careers is a decrease in the delivery of preventive measures and appropriate treatment of chronic diseases that often lead to disability and premature death. This consequence has direct implications for the growing number of the elderly in the US who require coordination of treatments for multiple complex, chronic conditions.

The geographic maldistribution of physicians in the US also has negative implications for ensuring an adequate supply of physicians. Several studies indicate a shortage most pronounced in rural areas and certain urban neighborhoods.^{15,16} A study of 20-year trends in

PERSPECTIVES VIEWPOINTS

- The United States is facing a shortage of physicians that is especially problematic in the area of primary care.
- AAIM recommends strategically increasing the number of Medicare-funded residency positions in primary care specialties to adequately meet the nation’s health care needs.
- AAIM recommends enhancing the attractiveness of primary care careers through several mechanisms including changes in the physician reimbursement system.
- We also need to increase the efficiency of our health care delivery system through a variety of mechanisms in order to maximize delivery of sound medical care.

geographic variation of physician distribution shows that an increase of 51% in practicing physicians did not translate into regional variation of practice location. Despite longstanding public policies, physicians continued to locate in areas of adequate-to-high physician-to-population ratios, further compounding issues for health professional shortage areas.¹⁷

PHYSICIAN SUPPLY

Assessing the country's future needs for physicians is a challenging and complex estimation of supply and demand. The supply side involves the output from multiple training pathways for initial medical degrees as graduates enter the final common pathway of residency training. Supply also is a product of physician effort and varies in relation to age, sex, and generational or lifestyle preferences.

The largest source of physicians entering the "funnel" of GME is provided by US allopathic medical schools. In 2005, 15,760 graduates of US allopathic schools and 2800 graduates of US osteopathic medical schools were eligible to enter GME programs.^{18,19} A total of 24,269 first-year GME positions in training programs approved by the Accreditation Council for Graduate Medical Education and the American Osteopathic Association were available for these new graduates.^{12,20} The gap between the number of available positions and the total graduates of US programs was filled by approximately 6000 graduates from medical schools in other countries.

Based on 2007 enrollment and class size increases, first-year enrollment into US medical degree programs

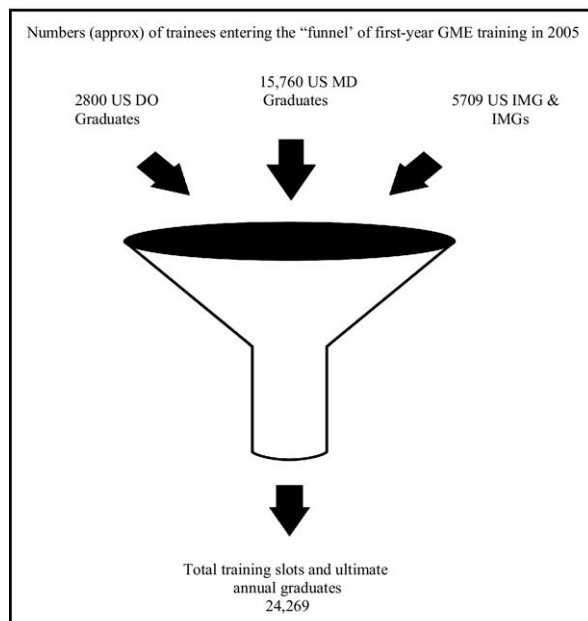


Figure 1 Funnel of graduate medical education before expansion of allopathic medical school classes (2005).

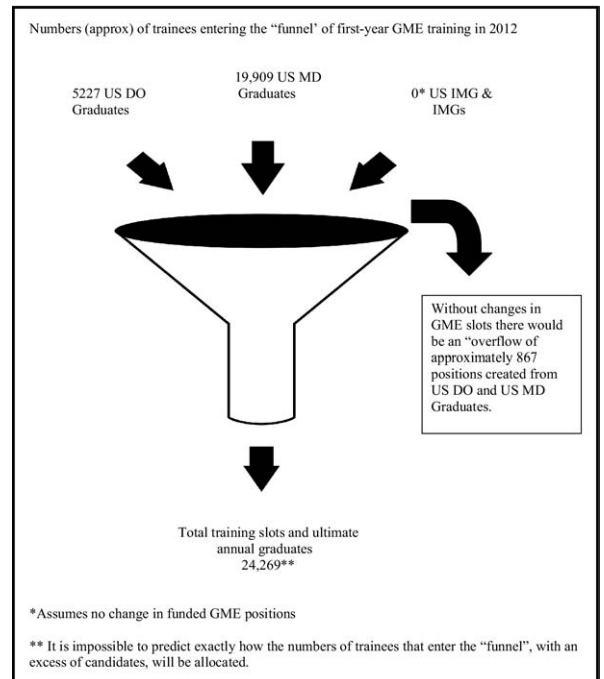
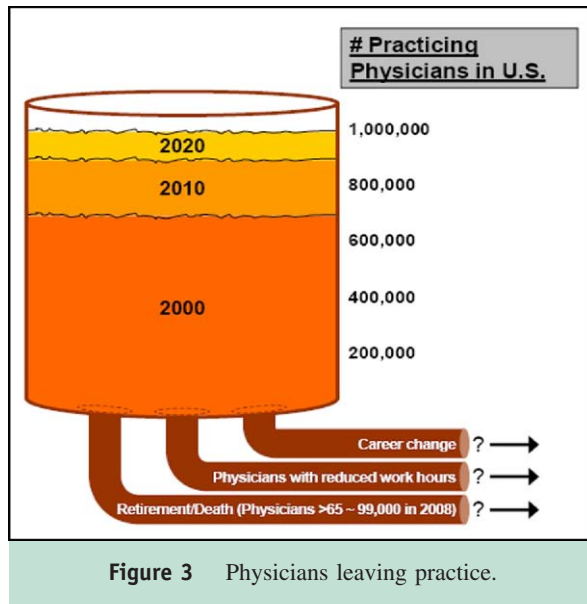


Figure 2 Funnel of graduate medical education after expansion of allopathic medical school classes (2012).

is projected to increase from 16,488 in 2002 to nearly 19,909 in the 2012 academic year (AY). Similarly, substantial growth in first-year enrollment of osteopathic schools is expected, from 2148 in AY 2002 to 5227 in AY 2012 (a 70% increase).²¹ As a result, unless the number of first-year positions in GME training increases, not enough positions will exist to accommodate all US medical graduates by the year 2012 (Figures 1, 2).

It is estimated that international medical graduates (IMGs) now account for 24% of the total US physician workforce.²² Although concerns about depletion of the physician supply in IMG home countries also exist, the current demand for physicians in the US can be met only by the continued training and retention of IMGs. If more residency positions are not funded, increasing the number of US medical school graduates will be a zero-sum game in terms of the number of practicing physicians in the US.¹⁹ Currently, more than a quarter of the nation's primary care physicians are IMGs.

The supply of physicians also is influenced by the rate at which physicians leave practice (Figure 3). Just as the total US population has aged, the population of practicing physicians also has aged. It was estimated that there would be 99,000 US physicians over the age of 65 years in 2008.¹⁹ Furthermore, changing demographics and emerging expectations about professional life by both male and female physicians will lead to increasing numbers of practicing physicians with reduced work hours.^{23,24}



Projections from 2007 suggest that the number of practicing physicians in the US will increase from 733,852 in 2000 to 906,278 in 2010, and will increase further to 988,100 in 2020.²⁵ However, despite the increase in numbers of physicians, the projected increase in the US population will mean that the ratio of active physicians to population (per 100,000) will increase only modestly from 278.5 in 2000 to 293.4 in 2010, and it will remain essentially unchanged for the next decade at 294.2 in 2020. These statistics do not account for the anticipated functional reduction in work capacity anticipated as a result of changing work habits and patterns of practice. Assessing the need or demand of the population for physician services is a complex and controversial topic. However, it is clear that the physician supply must increase to accommodate the growing and aging population, as well as the growing number of medical students entering the pipeline.

RESPONDING TO PHYSICIAN WORKFORCE PROJECTIONS

Recommendation 1: AAIM recommends strategically increasing the number of Medicare-funded residency positions in primary care specialties to adequately meet the nation's health care needs as defined by COGME. In addition, AAIM believes GME slots should be added in geographic areas of demonstrated need.

According to COGME, meeting the nation's future physician workforce demand and need will require increasing to 27,000 the number of physicians entering residency training each year by 2015, which would represent an increase of approximately 3000 positions annually. Based on its recent projections, AAMC has advocated for an increase of 5000 positions annually over an average of 4 years of training to respond to its

recommended 30% increase in medical school class size. A global, unregulated increase in GME positions is unlikely to meet regional or specialty-specific shortages. A deliberate and strategic increase should be considered to justify the creation of new GME slots. AAIM's recommendation for Medicare to fund new positions in primary care includes a call for support for an average of 4 years per position. Whereas training in internal medicine, pediatrics, and family medicine is 3 years, training in combined programs such as internal medicine-pediatrics takes 4 years.

Current data suggest that as many as one half of physicians trained in a specific locale will stay there for their practice careers.¹⁷ To allow residents to train in areas of demonstrated need, Medicare GME funding regulations must change to permit residents time spent outside of the academic health care setting to count for purposes of GME funding. Currently, the use of non-hospital training sites is restricted by Centers for Medicare & Medicaid Services regulations that require a training program to incur 90% of all costs for a resident or fellow rotating outside of the teaching hospital, which disallows private practitioners and other community faculty from volunteering their time and presents a barrier to increasing training in venues outside of the teaching hospital. Without funding, hospitals stop sending residents to nonhospital settings or use precious limited resources for this training at the cost of other programs. Removing current restrictions and breaking down barriers for reimbursement would increase residents' opportunities to practice in a variety of settings, including rural, inner city, and other underserved locations. Aside from providing experiences in areas where a resident may ultimately care for patients, allowing residents to practice outside of teaching hospitals also can serve as a successful recruitment mechanism for communities in need. Although ultimate practice locations of physicians cannot be controlled, increases in GME should be made with geographic factors in mind.

The Medicare program provides approximately 40% of total GME funding. The remainder is supported by other sources that vary by institution and state and are often subject to the annual appropriations process.²⁶ An increase in postgraduate year-1 slots to respond to health care needs is possible only with increased funding. AAIM understands the restrictions of state, institutional, and federal budgets to increase funding for medical education. As a result, AAIM supports a system in which all insurers contribute to GME costs.

As long as Medicare funding is provided for GME positions, the per-resident amounts paid to hospitals must be reassessed. Per-resident amounts for Medicare direct GME payments were originally set in 1984. Although adjustments have been made, the per-resident amount has not been altered to account for changes in

training. Mandated competency-based education and evaluation, as well as duty-hour restrictions, require significant resources, as do health care simulation, centralized oversight of regulatory compliance, and faculty development. These changes and many others that require additional resources and resident time have not been considered in the current GME financing system.

In 2005, the Centers for Medicare & Medicaid Services redistributed 3000 unused GME slots to hospitals that demonstrated greatest need. While this redistribution helped more than 350 hospitals mostly in rural areas, it also proved disadvantageous because Congress lowered the percentage of indirect graduate medical education payments associated with the positions. AAIM recommends that any increase in GME positions must include indirect graduate medical education payments equal to those provided to existing positions.

For hospitals and institutions with the capacity for additional training positions, funding should remain earmarked for primary care specialty positions and must not be redirected to other specialty slots. In addition, institutions and hospitals must make a commitment to keep current levels of primary care positions to receive funding for additional positions. Any move to decrease current primary care slots and use the funding for other specialty positions or fellowship training will not positively affect the total output of physicians entering primary care. Also, institutions must document their means and ability to add positions with respect to teaching resources.

ENHANCING THE ATTRACTIVENESS OF PRIMARY CARE CAREERS

Recommendation 2: AAIM recommends enhancing the attractiveness of primary care careers by altering the physician reimbursement system, increasing job satisfaction for current and future primary care practitioners, providing incentives for geographic distribution of primary care physicians in areas of greatest need, and applying innovations to educational models.

If the capacity for GME in internal medicine is enhanced by providing more funding for residency slots, simply increasing the number of graduates from US medical schools without improving the attractiveness of general internal medicine will not produce the desired effect. Without providing incentives for selecting a career as a general internist, larger class sizes will likely increase the number of specialists in a variety of attractive practice disciplines. Education, training, and reimbursement should be restructured to ensure positive exposure to general internal medicine for physicians-in-training and job satisfaction for individuals who choose a career in general internal medicine.

Studies of student career choice highlight lifestyle issues as a high priority in the decision-making process. Internal medicine has been identified as a specialty with

uncontrollable lifestyle regarding work hours and patient care duties. In 2008, a study noted that clerkship students choosing a career in internal medicine and those choosing careers in other specialties perceive internal medicine residents as less satisfied than residents in other specialties.¹³ Exposure of medical students and residents to faculty who feel overwhelmed and devalued will inhibit new physicians entering the field of primary care.

Aside from training, a major challenge primary care faces in becoming a successful career option is the current physician reimbursement system. Today's system proves lucrative for procedure-based specialties, while primary care and cognitive specialties are inadequately reimbursed for time spent delivering comprehensive patient care. Reviewing the process for determining the current value of physician services should be the first step in ensuring that the work of primary care physicians is not devalued. The Medicare Payment Advisory Commission has made this recommendation to Congress along with recommendations to increase Medicare payments for primary care services and establishing a "medical home" pilot project through Medicare.²⁷ The ultimate enhancement of adequate reimbursement by federal, state, and private insurers for high-quality cognitive care will provide tremendous incentive for physicians to seriously consider primary care as a career choice.

Understanding job satisfaction for the general internist requires more than examining physician income. Outpatient schedules with inadequate time to carefully evaluate the patient results in less than optimal care and increased frustration for physicians.

Job satisfaction has the potential to increase with adequate professional support. As the numbers of primary care physicians decrease, fewer colleagues will share the clinical load. Increasing use of physician extenders may help to ease the burden of care; however, the prestige of the generalist also must be considered. While physician extenders can help ease the amount of work for primary providers, it is important to note that they are not replacements for physicians who are uniquely situated to identify and treat multisystem issues and complex diagnoses.

Successful distribution of physicians to locations where primary care physicians are most needed will require additional incentives. Financial incentives for loan repayment may be successful in attracting primary care physicians to locations of most need. In addition, focus should be placed on recruiting and providing incentives to potential trainees from underserved areas. Studies show that medical school matriculants from underserved areas or with career plans to serve in such areas are more likely than their peers to serve as rural primary care providers. Programs developed to increase the supply of rural primary care physicians have proven

successful.^{28,29} While political and other forces that would be needed to make these adjustments will require considerable strategy, these changes would improve the overall health of the nation if the best graduates were encouraged to consider primary care. Potential strategies at the national level for increasing the number of physicians in health professional shortage areas include enhancing the National Health Service Corps and health professions education programs, passing legislation such as the Rural Training Act to remove regulatory barriers to having residents train in nonhospital and rural settings, and increasing the number of waivers through the J-1 visa waiver program to previous levels. Steps also can be taken at the state level.

The understanding that the primary care physician is essential to access and to optimal health outcomes underscores the need to address explanations behind the current deficiency in the number of these essential providers. Understanding how best to integrate these physicians with other professional colleagues such as nurse practitioners and physician assistants rather than promoting their displacement by these individuals will ultimately lead to the optimal team approach. Focusing on the needs of the future health care workforce is critically important, and national strategies are urgently required to avoid a shortage of primary care physicians. The challenge of appropriate funding will require redistribution of financial resources and reimbursement to reflect the fair cost of delivering high-quality care to the US population.

IMPROVE HEALTH CARE DELIVERY

Recommendation 3: AAIM recommends increasing efficiency in the health care delivery system by broadening the use of electronic health records (EHRs) and other advances in health information technology and capitalizing on the use of physician extenders. Additional options for improving health care delivery should be considered.

The projected physician shortage could be mitigated by maximizing the efficiency of physicians. In the future, optimizing efficiency might actually reduce the number of physicians required to provide optimal care. AAIM proposes improving the health care delivery system by promoting widespread use of EHRs, capitalizing on the use of physician extenders, and considering other options for increasing efficiency, such as improving access to health care screening.

A study conducted at community health centers concluded that EHRs present a clear value to patients and stakeholders. Patients received better care and payers were likely to reap EHR-related downstream benefits in avoided specialist, emergency department, and hospital spending.³⁰ EHRs help physicians and staff members view, chart, and interact with patients' health information in a timely and accurate manner. While computer-

ized physician order entry systems may prove cost-prohibitive for some institutions, the use of order sets or clinical practice guidelines also could serve to increase efficiency in patient care.

Utilizing physician extenders also can increase efficiency by freeing up the primary physician's time and providing greater continuity of care. In primary care practices, nurse practitioners and physician assistants can improve productivity by providing some direct and indirect patient care, including routine examination and review of medical histories, telephone triage, patient education, counseling, and health awareness. Physician satisfaction with the use of the physician extender model to increase efficiency is very high.³¹

Additional options for increasing efficiency in the health care delivery system should be explored. For example, consideration should be given to regionalizing expensive treatments and applying the certificate of need system globally; improving access to health care screening to reduce the need for future hospitalization; and other innovative measures to enhance efficiency. AAIM believes that addressing the physician shortage successfully will take both an increase in the number of physicians and improvements to the health care delivery system.

CONCLUSION

The nation is facing a physician shortage that is likely to adversely affect public health. AAIM recommends increasing the supply of Medicare-funded positions in primary care specialties, including internal medicine and internal medicine-pediatrics. National numerical targets should coincide with the physician-to-population ratio adequate to meet the nation's health care needs as defined by COGME.

The evidence that the nation faces a shortfall of physicians is compelling and impossible to ignore. At the same time, an unbridled increase in GME positions without respect to specialty or practice region would be imprudent. AAIM believes that selective increases in GME slots can and should occur in primary care. Allowing local communities and their legislators to demonstrate the need for primary care providers could provide a mechanism to address the geographic maldistribution of physicians. In addition, steps must be taken to increase efficiency in the current health care delivery system and enhance the attractiveness of generalist careers, including internal medicine and combined programs such as internal medicine-pediatrics.

AAIM has already begun such efforts with its statement, *Redesigning Residency Training in Internal Medicine: the Consensus Report of the Alliance for Academic Internal Medicine Education Redesign Task Force*.³² While the nation seeks to increase the physician supply, it also must examine and implement measures that will improve physician efficiency and effec-

tiveness. Ignoring the imminent shortage of physicians puts the nation's health and well-being at risk.

References

1. US Department of Health and Human Services Graduate Medical Education National Advisory Committee. *Report of the Graduate Medical Education National Advisory Committee. Summary Report*. Washington, DC: US Government Printing Office; 1981.
2. Tarlov AR. HMO enrollment growth and physicians: the third compartment. *Health Aff (Millwood)*. 1986;5:23-35.
3. Grumbach K, Lee PR. How many physicians can we afford? *JAMA*. 1991;265:2369-2372.
4. US Department of Health and Human Services Council on Graduate Medical Education. *Fourth Report: Recommendations to Improve Access to Health Care through Physician Workforce Reform*. Washington, DC: COGME; 1994.
5. Weiner JP. Forecasting the effects of health reform on US physician workforce requirement. Evidence from HMO staffing patterns. *JAMA*. 1994;272:222-230.
6. American Medical Association. *AMA Revises Policy to Address Continued Demand for Physicians*. December 9, 2003. Available at: <http://www.ama-assn.org/ama/pub/article/print/1616-8229.html>. Accessed February 1, 2004.
7. Association of American Medical Colleges. *The Physician Workforce: Position Statement—June 2002*. Washington, DC: Association of American Medical Colleges; 2002.
8. US Department of Health and Human Services Council on Graduate Medical Education. *Reassessing Physician Workforce Policy Guidelines for the US 2000-2020*. Washington, DC: COGME; 2003.
9. US Department of Health and Human Services Council on Graduate Medical Education. *Physician Workforce Policy Guidelines for 2000 – 2020*. Rockville, MD: COGME; 2005.
10. Association of American Medical Colleges Center for Workforce Studies. *The Complexities of Physician Supply and Demand: Projections through 2025*. Washington, DC: Association of American Medical Colleges; 2008.
11. Salsberg E, Rockey PH, Rivers KL, et al. US residency training before and after the 1997 Balanced Budget Act. *JAMA*. 2008;300:1174-1180.
12. National Residency Matching Program. *Results and Data: 2008 Main Residency Match*. Available at: <http://www.nrmp.org/data/index.html>. Accessed October 5, 2008.
13. Hauer KE, Durning SJ, Kernan WN, et al. Factors associated with medical students' career choices regarding internal medicine. *JAMA*. 2008;300:1154-1164.
14. Bodenheimer T. Primary care—will it survive? *N Engl J Med*. 2006;355:861-864.
15. Agency for Healthcare Research and Quality. *National Healthcare Disparities Report 2004*. Available at: <http://www.ahrq.gov/qual/nhdr04/nhdr04.htm>. Accessed September 5, 2008.
16. National Association of Community Health Centers. *Access Denied: A look at America's medically disenfranchised*. Available at: http://www.nachc.com/client/documents/research/Access_Denied42407.pdf. Accessed August 1, 2008.
17. Goodman D. Twenty-year trends in regional variations in the US physician workforce. *Health Aff (Millwood)*. 2004;Suppl Web Exclusives:VAR90-97. Available at: <http://content.healthaffairs.org/cgi/content/full/hlthaff.var.90/DC2?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=goodman&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&resourcetype=HWCIT>.
18. Association of American Medical Colleges. *Table 25: Total Graduates by U.S. Medical School and Sex, 2002-2007*. Available at: <http://www.aamc.org/data/facts/2007/schoolgrads0207.htm>. Accessed September 20, 2008.
19. Salsberg E, Grover A. Physician workforce shortages: implications and issues for academic health centers and policy makers. *Acad Med*. 2006;81:782-787.
20. Obradovic JL, Beaudry SW, Winslow-Falbo P. Osteopathic graduate medical education. *J Am Osteopath Assoc*. 2006;106:59-68.
21. Association of American Medical Colleges. *Medical School Enrollment Plans: Analysis of the 2007 AAMC Survey*. Washington, DC: Association of American Medical Colleges; 2008.
22. Akl EA, Mustafa R, Bdair F, Schünemann, HJ. The United States physician workforce and international medical graduates: trends and characteristics. *J Gen Intern Med*. 2007;22:264-268.
23. Kirch DG, Vernon DJ. Confronting the complexity of the physician workforce equation. *JAMA*. 2008;299:2680-2682.
24. Cooper RA. Weighing the evidence for expanding physician supply. *Ann Intern Med*. 2004;141:705-714.
25. Inglehart JK. Grassroots activism and the pursuit of an expanded physician supply. *N Engl J Med*. 2008;358:1741-1749.
26. US Department of Health and Human Services Council on Graduate Medical Education. *Nineteenth Report: Enhancing Flexibility in Graduate Medical Education*. Washington, DC: COGME; 2007.
27. Medicare Payment Advisory Commission. *Report to the Congress: Reforming the Delivery System*. Available at: http://www.medpac.gov/documents/Jun08_EntireReport.pdf. Accessed June 2008.
28. Rabinowitz HK, Diamond JJ, Markham FW, Paynter NP. Critical factors for designing programs to increase the supply and retention of rural primary care physicians. *JAMA*. 2001;286:1041-1048.
29. Rabinowitz HK, Diamond JJ, Markham FW, Hazelwood CE. A program to increase the number of family physicians in rural and underserved areas: impact after 22 years. *JAMA*. 1999;281:255-260.
30. West CE, Miller RH. The value of electronic health records in community health centers: policy implications. *Health Aff (Millwood)*. 2007;26:206-214.
31. Rodysill KJ. Increasing physician productivity using a physician extender: a study in an outpatient group practice at the Mayo Clinic. *J Med Pract Manage*. 2003;19:110-114.
32. Meyers FJ, Weinberger SE, Fitzgibbons JP, et al. Redesigning residency training in internal medicine: the consensus report of the Alliance for Academic Internal Medicine Education Redesign Task Force. *Acad Med*. 2007;82:1211-1219.