

## BOARD OF DIRECTORS REPORT P TO THE 2006 CONGRESS OF DELEGATES

### FAMILY PHYSICIAN WORKFORCE REFORM:

#### Recommendations of the American Academy of Family Physicians

Draft Reprint No. 305b

### EXECUTIVE SUMMARY

#### (1) Background

- The American Academy of Family Physicians (AAFP) last approved workforce policy in Sept. 1998.
- The 1998 policy offered recommendations based on a scenario of 50 percent family physicians among all physician generalists, and ratios of 35.1 MD and 7.9 DO family physicians per 100,000 U.S. people.
- That model concluded that 3,332 to 3,682 MD and 350 to 400 DO family physician graduates from ACGME-accredited programs should be produced annually.
- From 1991 through 1996, unprecedented growth occurred in the number of U.S. senior medical students selecting family medicine, with a corresponding increase in the number of positions offered.
- In 1997, there were 3,727 positions offered in family medicine through the NRMP, 3,202 graduates of ACGME-accredited family medicine residencies, and 350-400 DO program graduates.
- By 2005, there were 31.2 family physicians per 100,000 people in the US.
- In 2006, 3,351 family physicians graduated from ACGME residencies and 266 family physicians graduated from AOA residencies.

#### (2) Assumptions

- Primary care has a positive impact on the health of the U.S. population.
- Factors such as household income, geographic location of residence, and education level affect the intensity of health care needs in a population.
- The U.S. population is growing, especially in the older age groups.
- People in America want a personal medical home with a primary care physician, which results in improved health outcomes and patient satisfaction.
- The number of internal medicine physicians practicing as generalists is decreasing.
- An increasing proportion of non-physician providers are limiting their practice to subspecialty areas.
- The new model of family medicine will permit family physicians to provide care for an increasing number of patients.

#### (3) Study Limitations

- Only non-government physician populations are addressed.
- The mix of U.S. medical school graduates and IMGs in residencies is not addressed.
- National trends in the U.S. economy are subject to unanticipated change.
- National trends in the evolution of medical technology are subject to unanticipated change.

#### (4) Needs-Based Workforce Study Outcomes

- These workforce recommendations are based on the projected needs of the population for medical care.
- Meeting the nation's anticipated need for primary care in 2020 will require a workforce of 139,531 family physicians, or a ratio of 41.6 family physicians per 100,000 people in the United States.
- To achieve that target, 3,725 family physicians will need to be produced annually by ACGME-accredited family medicine residencies and 714 annually by AOA-accredited family medicine residencies.
- To achieve that target, the typical ACGME-accredited family medicine residency would need to expand from an average of 21.7 residents to 24 residents.

## **BACKGROUND**

(5) The American Academy of Family Physicians (AAFP) last approved a workforce policy in September 1998. That policy offered recommendations based upon a scenario of 50-percent family physicians among all physician generalists, and ratios of 35.1 M.D. and 7.9 D.O. family physicians per 100,000 U.S. people. That model concluded that 3,332 to 3,682 M.D. and 350 to 400 D.O. family physician graduates from Accreditation Council for Graduate Medical Education (ACGME)-accredited programs be produced annually. In the period between 1991 through 1996, unprecedented growth occurred in the number of U.S. senior medical students selecting Family Medicine as a specialty, with a corresponding increase in the number of positions being offered. In 1997, there were 3,202 graduates of ACGME accredited Family Medicine residencies, and between 350 and 400 D.O. graduates. By 2004, there were 31.2 family physicians per 100,000 people excluding housestaff in training.<sup>1</sup>

(6) The 1998 policy based its predictions on the Eighth Council on Graduate Medical Education (COGME) Report.<sup>2</sup> This encompassed a scenario whereby Family Physicians make up 50% of all M.D. generalists, and D.O. family physicians would increase over 20 years by 125% and mid-level providers (physician assistants and nurse practitioners) would increase by 150% from 1995 levels across the same period. The 1998 recommendations held Family Medicine residency graduates constant between 3,700 and 4,100 from ACGME-accredited programs per year. While the report recognized the Balanced-Budget Act-1997 restrictions on residencies, it did not anticipate any negative impact, nor did it anticipate any decrease in the number of family medicine residency programs across the nation.<sup>3</sup> In reality, the number of positions offered in March and July has declined by 17% and 9% respectively between a peak in 1997 and 2006. The March fill rate with U.S. senior medical students has decreased from a peak of 66.2% in 1997 to 41.5% in 2006. Blunting this sharp decline has been a growth of positions offered outside the Match and a substantial number of International-Medical Graduates (IMG) and osteopathic applicants accepted into ACGME accredited Family Medicine postgraduate training.

## **CURRENT WORKFORCE ISSUES**

(7) Recent scholarly work has documented the positive role of primary care on the health outcomes of a population.<sup>4-7</sup> Nations with a substantial foundation of primary care have improved rates of mortality, morbidity, and preventive services, all at lower cost than the U.S. This suggests that enhancing the primary care sector in the American health system may lead to marked improvement of the quality and cost issues currently challenging the nation.

(8) Taken in context for co-morbidities and the multifaceted work of primary care, health outcomes in the United States show similar trends to the international studies on the value of a solid primary care base.<sup>8, 9</sup> Across a range of conditions, from stroke to preventive services, primary care provides greater access to needed services, improved outcomes and lower costs. Within the U.S., family physicians make up the majority of the rural physician workforce.<sup>10</sup> A continued mal-distribution exists of the physician workforce between urban and rural areas.<sup>11</sup> Further, care of the disadvantaged is disproportionately served by family physicians through Community Health Centers that now face a severe shortage of providers<sup>12,13</sup> at a time when there is an increase in the number of uninsured or underinsured Americans, and declining medical student selection of family medicine as a career.

(9) Setting institutional or social goals provides direction and alignment for work effort and resource allocation. Often, strategic planning to develop a vision and goals derives from an internal and external environmental analysis. Physician workforce planning serves to accommodate this analytical need. However, the complexity and multiple factors affecting the supply and demand of physicians creates great difficulties in offering firm predictions. Many of the processes involved, such as student selection and number of offered positions, lack predictability. In actuality, workforce decisions are locally based, not directly or immediately nationally influenced. Thus no model, regardless how complex or detailed, can provide definitive predictions.

Instead, varying assumptions can be used to develop informative scenarios to guide policy making and through policies, influence local decisions.

## RECENT LITERATURE ON PHYSICIAN AND PRIMARY CARE WORKFORCE PLANNING

(10) Varying models exist on how to calculate physician workforce estimates. A basic topography includes supply/utilization, demand or need, and econometric models. No single model has proven superior for policy making or prediction. Nor is there published data that more complex models are superior to simpler models in their utility to policy decision makers. In all likelihood, just as evidence-based medicine declares a final decision is the use of data and “objective” evidence infused with the experience and judgment in the context of a patient’s values and beliefs, so too developing conclusions on future physician workforce needs is best considered part data and part judgment in the context of values.

(11) One major knowledge gap in these analyzes is the impact of the health of the population in determining need for physician services. The previous COGME model did not adjust use of services by socioeconomic or morbidity indices. This can have an important effect on utilization and need for health care services. For example estimates exist that as many as 11-million undocumented immigrants reside in the U.S. and 48-million Americans may lack health insurance. A model estimating how to incorporate these demands for health care service needs would enhance the accuracy of the supply estimates to achieve reasonable care for all.

(12) The COGME study also estimated that information technology would create as much as a 30-percent improvement in physician efficiency. However, a review of 3 of the 4 cited studies and a broader literature review offer a different perspective. Masys offers the perspective that information technology will increase the demand for health professional services with the effectiveness of rendering services more a determinant of success than the technology alone.<sup>14</sup> Blumenthal cautions that any prediction of the effect of emerging healthcare technology is “fraught with peril” and concentrates his message on the potential impact of the attribute of professionalism rather than specific effects on productivity. Goldsmith, Blumenthal and Rishel note how Federal policy can enhance the adoption of the electronic health record which has potential to enhance the quality of care, but no specific mention is made of an impact on productivity.<sup>15</sup> (The fourth citation lists a presentation and the information was not available for review.) Several other works<sup>16-21</sup> emphasize that electronic health records and information systems are not a panacea and can have negative impacts on physician work. Additionally, the COGME report used an inflation index to account for future enhancements in work efficiency. Using the 2000 value as an index for a 1.0 FTE, COGME reported that same “FTE” in 2020 would equate to “1.2-FTEs” in productivity due to an increase in efficiency of twenty-percent. Thus, if a mean visit per FTE value in 2000 is 3,500 visits per year, by 2020 — assuming a 20% increase in efficiency—a productivity of 4,200 visits per year is equivalent to 1.2-FTEs from the base year of 2000.

(13) The COGME Report built into its baseline model lifestyle decisions affecting the physician workforce. To account for generational and gender-influenced changes in the workforce, COGME estimated a 10 percent reduction in work per full time physician, with a potential range of 5 to 20 percent. This had an effect of offsetting the percent increases over time and the ultimate FTE physicians in the supply model. A study conducted by Linzer, Rosenberg, McMurray and Glassroth estimated the effect of lifestyle changes on a general internal medicine workforce.<sup>22</sup> Their analysis determined a 10-percent increase in the workforce would be needed to take into account changing lifestyles.

(14) The current work sought to provide a different model to estimate the number of Family Physicians needed by 2020, to take into account the following aspects: socioeconomic and health risk factors that would adjust for varying health needs of a population, and converting FTE physicians to number of physicians. The socioeconomic and health factors adjust the needs model to take into account rural vs. urban locations<sup>23</sup> and the need of high risk or sicker individuals for more services beyond what age and gender weighting alone would achieve.

## ANALYSIS AND RECOMMENDATIONS

### Achieving a Needs-Based Workforce Model

(15) This workforce analysis is a needs-based approach built upon a model that was constructed specifically for the AAFP by a team of consultants from the University of Utah School of Medicine and the Utah Medical Education Council. Their full report is available from the AAFP Division of Medical Education. The model has been previously described<sup>24, 25</sup> examining the primary care needs in a Canadian region. This model begins with an age- and gender-adjusted encounter rate by location (in this case individual states were used and the visit numbers were visits to all primary care providers, physicians and mid-level providers). Then this value is adjusted for the health of the population by using a socioeconomic index and an index for the degree of premature mortality. This calculates a “needed” visit rate. The actual and needed visit rates are then multiplied by the region’s population to give a total projected number of visits. By dividing this value by the mean annual visit rate per FTE physician, the result is the FTE physicians needed to provide that level of service to the population. The difference between the actual physician FTE and the needed physician FTE shows the surplus or deficit based upon need.

(16) Several additional factors have been used to modify the results in keeping with various scenarios as presented by the COGME report. The COGME report specified FTE physicians, but did not convert these values to the number of physicians required. Two adjustments made by the need-based model take into account the number of physicians not involved in direct patient care (administration and teaching) and the number of residents in the workforce.

### Data Sources

(17) Several data sources were used to build this model. The National Ambulatory Medical Care Survey<sup>26</sup> (NAMCS) is an annual survey of a sample of non-federally employed office-based physicians. This data is weighted to produce national projections of office-based care. The National Hospital Ambulatory Medical Care Survey<sup>27</sup> (NHAMCS) is similar to the NAMCS with one major exception: instead of surveying office-based physicians, its focus is on hospital-based clinics and emergency room care. The Medical Group Management Association (MGMA) Physician Compensation and Production Survey<sup>28</sup> is a self-reported survey of productivity data by physician groups. Over 3,000 family physicians have responded to this survey in 2004. The Area Resource File (ARF)<sup>29</sup> from the Department of Health and Human Resources is a compilation of multiple databases, include the AMA and the American Osteopathic Association, and has multi-year data. Mortality data was derived from the National Center for Health Statistics within the CDC.<sup>30</sup> Finally, the U.S. Census<sup>31</sup> provided the projections for population changes by age and gender up through 2020.

### Determining Need from Demand and Supply Data

#### *Demand Model*

(18) Age- and sex- specific outpatient visit rates for the year 2000 were developed from the National Ambulatory Medical Care Survey (NAMCS), the National Hospital Ambulatory Care Survey (NHAMCS) and the United States Census. The age/sex- specific visit rate was applied to the population of each state to produce the number of outpatient visits in each state. Total visits per state were converted to number of physicians using the following formula:

Needed Physicians =  $(V_T * V_{PC} * V_{FM}) / ((V_{FTE} * R_F * R_P) + (V_{FTE} * LS_F * LS_P) + (V_{FTE} * NPC_F * NPC_P))$  where:

$V_T$  – Total needed outpatient visits in a given state

$V_{PC}$  – Fraction of visits considered Primary Care (Family Medicine, General Practice, General Internal Medicine and General Pediatrics)

$V_{FM}$  – Fraction of Primary Care visits that are seen by Family Medicine/General Practice.

$V_{FTE}$  – Number of visits that equal 1 Full Time Equivalent (FTE) Physician per year.

$R_F$  – FTE for a single year of a Resident Physician

$R_P$  – Percent of all practicing Family Medicine Physicians who are Residents

$LS_F$  – FTE adjustment for life style considerations of physicians (academic, teaching, and part-time).

$LS_P$  – Percent of all practicing non-Resident Family Medicine Physicians

$NPC_F$  – FTE adjustment for Family Medicine Physicians who do not see patients

$NPC_P$  – Percent of all non-Resident Family Medicine Physicians who do not see patients.

(19)  $V_{FTE}$  was set at 3400 patient visits per year for the years 2000-2005 based on a weighted average of MGMA data from family physicians, including those that do and do not provide maternity care. It was predicted to increase linearly to 4200 patient visits per year through 2020 based on projections from the Future of Family Medicine project, as well as the COGME study and multiple other reports estimating substantial improvements in physician efficiency and productivity through the application of electronic health records and other information technology advances. Of note, 4,200 patient visits per year are still less than the MGMA 75<sup>th</sup> percentile of 4,783 to 5,085 patient visits per year, with and without maternity care practice included. The model was projected forward yearly from 2005 to 2020 using the US Census Bureau's state age and sex projections and the above described  $V_{FTE}$  increase. The total U.S. demand was calculated as the sum of the states' individual needs during the given year.

### ***Converting Demand to Need (Needs Model)***

(20) To convert the demand to the need for care, the above described demand calculations were modified in a two step process (socioeconomic adjustment and premature mortality adjustment). The socio-economic adjustment was calculated by identifying 10 variables (Table 1) that were significantly correlated ( $p < 0.05$ ) with the premature mortality rate (PMR) for each state. This analysis was then modified to account for the differences in the health status of area residents measured by premature mortality rates (number of deaths of residents 0-74 divided by the total residents 0-74 residing in each state), to result in a final needs estimate of visits per person per year.

### ***Supply Projections***

(21) Three components made up the estimates for the future supply of family physicians: the existing number of GP/FP active physicians in the workforce, the graduates from ACGME residencies, and the graduates from AOA residencies. While the proportion of IMGs making up the entry level of graduate training has been increasing, this study focused on the total number of first year training positions within family medicine. The percent of entering residents that were foreign educated medical students was not addressed as this would not affect the number of the class size, but rather its make up.

(22) Given the substantial change in the number of students selecting primary care and family medicine in both M.D. and D.O. programs over the past decade, projecting this variable forward is problematic due to the instability of the process. To accommodate this variation, a power regression model using the number of graduates from ACGME programs (which include graduates from LCME, AOA, and international medical schools) between 1976-2004 was used. For graduates from AOA family medicine residency programs, the total number of graduates between 1968 and 2004 was used and projected forward using linear regression.<sup>2</sup>

(23) The number of all family and general practice physicians, D.O. and M.D. and two-thirds of residents in both D.O. and M.D. programs in 2004 served as the base year. This totaled 100,211 based upon data from the Graham Center.<sup>2</sup> Given that the need model sought to project the total number of physicians in active patient care, teaching, and administration, this supply model also sought to incorporate this value. An annual attrition rate of 2.26% was used after examining both M.D. and D.O. exit rates.

***Study Limitations***

(24) This needs-based study of the U.S. physician workforce does have its limitations. The analysis is based on statistics that exclude government employed physicians. A great deal of health care is provided by physicians in governmental service, including the U.S. military, and that care is not included in this study. Projected changes in the U.S. population, as well as those in individual physician specialty populations, are based on mathematical models constructed from recent historical trends that are not necessarily predictive of future trends. Similarly, the variables of trends in socioeconomic status, health indicators, employment, retirement, housing and education are all vulnerable to unanticipated changes in the U.S. economy. Finally, estimates of physician service efficiency and the populations they care for are all vulnerable to unanticipated changes in national disease profiles and in medical technological innovations.

**THE PRIMARY CARE WORKFORCE**

(25) The AAFP's goals and its recommendations for the family physician workforce are designed to support efforts to ensure that all Americans have access to high-quality primary health care services, and that the needs of underserved rural and urban populations are met. The AAFP recognizes that the United States has a pluralistic health care delivery system and that not all primary care services will be provided by family physicians. Nonetheless, the AAFP also recognizes that family physicians are the primary care providers of choice in most international delivery systems.

(26) The nation's ACGME-accredited family medicine residency programs graduated 3,196 family physicians, both M.D. and D.O., in 2005.<sup>32</sup> Changes in the financing of graduate medical education through the Balanced Budget Act of 1997 have significantly restricted the creation of new family medicine residencies and the growth of mature and young family medicine residencies due to caps on the federal financing of positions. It is unknown at this time whether amendments to the bill or other legislative changes will result in recommendations calling for federal legislation to support increased training of family physicians.

**DISCUSSION**

(27) What is the right number of total physicians, and particularly generalist physicians? What impact would enfranchisement of the entire population for covered health care services have on the current physician workforce?

(28) In 1961, half of U.S. physicians were generalists, mostly general practitioners. Since then, the percentage has dramatically declined.

(29) The health care systems of countries now dedicated to universal coverage for and access to health care are based on a foundation of generalist physicians, usually family physicians, at a higher proportion than is now present in the United States. These countries, as well as the more cost-efficient, closed-panel health maintenance organizations (HMOs) in the United States, tend to use fewer physicians and a higher proportion of generalist physicians,

(30) The increasing generalist-specialist imbalance in the United States undermines the nation's ability to achieve universal health care access and limits its capability to meet needs of underserved rural and urban populations. Primary care services provided by limited specialists and sub-specialists who have had little or no primary care training or continuing education can be expected to be both costly and inefficient as limited specialists tend to use technologies and procedures of their specialties more than generalists. Furthermore, because of their narrower educational focus, limited specialists will more frequently seek consultation for patients who have common acute and chronic illnesses. Services may be fragmented and duplicated by visits to multiple specialists, and preventive services may not be provided adequately.<sup>33-35</sup>

(31) Many nationally recognized groups, including the Council on Graduate Medical Education, the Association of American Medical Colleges, the Robert Wood Johnson Foundation and the Pew Health Professions Commission, have called for 50 percent of U.S. medical graduates to enter generalist careers.<sup>36-39</sup> A previous AAFP position was that half of physicians produced in the United States should be generalists (or primary care), and half the generalists should be family physicians.<sup>40</sup> However, the aging of the U.S. population will undoubtedly increase the demand for primary care providers. Recent projections from multiple workforce reports and publications predict major shortages in primary care providers, especially for the adult population. The American College of Physicians has expressed overt concern regarding the decline in the number of general internists.<sup>41</sup> The AAMC reports an impending “crisis” in provider access, and even the organizations of mid-level providers are struggling with trends toward specialization and away from primary care.<sup>42-43</sup> Recent trends in graduate medical education suggest that the number of general pediatricians, general internists and even AOA trained family physicians produced by their training programs is dropping.<sup>44</sup> With the declining numbers of other providers of primary care, the number of ACGME trained family physicians must be increased to meet the public’s needs.

(32) For all in America to achieve adequate access to a primary care physician as a medical home, assuming declines in the production of general internists and general pediatricians based on current and projected trends, 139,531 family physicians will be needed by the year 2020, resulting in a ratio of 41.6 family physicians per 100,000 U.S. population. (Table 2) In order to achieve this goal, ACGME family medicine residency programs will need to produce 3,381 family physicians in 2007, and increase that to 3,725 per year by 2020. Similarly, AOA family medicine residency programs will need to produce 553 family physicians in 2007, and increase that to 714 per year by 2020.

(33) A determined number of PGY-I positions should be available annually for exchange visitors whose costs are paid by their home countries and who return to practice in their home countries upon graduation.

(34) Rather than call for a specific expansion in medical school class size or the opening of medical schools, all medical schools (M.D./D.O.) should continually assess their enrollment numbers to address ongoing concerns of physician shortage.

(35) Federal funding for graduate medical education should reflect physician workforce policy, with preferential funding for training primary care physicians, particularly family physicians, and concomitantly less funding for the training of other physicians. All payers of health care services should contribute to paying the costs of medical education. There should be established a public-private entity to allocate funding for residency positions among training programs. Residency programs should be preferentially funded which have a track record of producing generalist physicians, physicians located in and or serving rural and inner-city populations, or physicians from underrepresented minorities.

(36) The recommendations in this AAFP report are based on a 15-year projection, beginning with 2005 numbers, using 2020 as a target. The best approach at this time seems not to attempt a certain numerical prediction of the future but to make reasonable assumptions and immediately start to accomplish necessary educational and legislative action to provide effective physician workforce reform. However, it is important that these recommendations are reviewed and revised as necessary, to make midcourse corrections to achieve desired goals.

(37) A critical issue which is central to the AAFP's current recommendations is the identification of the family physician as the provider of choice for primary care services for Americans, rather than abdicating the role of primary care provider to others. The consequence of not abandoning the field of primary care to other disciplines is inherently the potential for competition in primary care. Given the extent and breadth of training, the quality outcomes and cost efficiency of practice, as well as the demands of delivery systems and satisfaction of patients, family physicians will be at a competitive advantage and will fill critical roles in the health care marketplace. The current recommendations are intended to support efforts to ensure health care access for all in America and to meet the needs of underserved rural and urban populations.

## SUMMARY RECOMMENDATIONS

- (39) *The AAFP should pursue the development and implementation of the new model of family medicine (NMFEM) as defined by recommendations of the Future of Family Medicine report.*
- (40) *The AAFP should regularly assess and report on the family physician workforce, including attention to GME positions, the number of family physicians, their geographic distribution, racial and ethnic diversity, and market share.\**
- (41) *Family medicine residencies should prepare family physicians for the evolving demography of the US population, with special attention to care of the older adult, health disparities, and the management of complex patients with chronic illness.\**
- (42) *There should be an increased emphasis on the recruitment of a diverse student population reflecting those most likely to care for rural, underserved, and elderly populations, and who more closely resemble the racial and ethnic make-up of the US population.\**
- (43) *To support efforts to ensure health care access for all Americans, to meet the needs of underserved populations, and to meet the increasing demands for health care services of an aging population, by the year 2020, 30% of ambulatory patient care in the U.S. will need to be provided by family physicians. This will require a workforce of 139,531 family physicians, or a ratio of 41.6 family physicians per 100,000 U.S. population.*
- (44) *To achieve the projected ratio of 41.6 family physicians per 100,000 U.S. population, 3,725 family physicians will need to be produced annually in the U.S. by ACGME accredited family medicine residencies, and 714 annually by AOA accredited family medicine residencies.*
- (45) *Primary care nurse practitioners and physician assistants should be practicing in integrated practices under the supervision of primary care physicians.\**
- (46) *International medical graduates will continue to be important contributors to the US physician workforce. Care must be taken to avoid the recruitment of physicians from countries with shortages of health care providers and the creation of a “brain drain” that will worsen the health care needs of their home countries.\**
- (47) *A determined number of training positions should be available for exchange visitors who plan to return to practice in their home countries upon graduation.\**
- (48) *All medical schools should manage their recruitment efforts to attract students most likely to select career paths and practice locations that will improve the current state of geographic mal-distribution of both types and numbers of physicians across the nation.\**
- (49) *The U.S. should increase payments to family physicians in order to attract them to and sustain them in the new model of family medicine, and to promote improvement in health care delivery outcomes.*
- (50) *All payers of health care services should be contributing to the costs of medical education.\**
- (51) *There should be established a public-private entity to allocate funding for graduate medical education positions among training programs.\**
- (52) *Training programs should be preferentially funded which produce physicians in accordance with AAFP workforce policy, physicians from underrepresented minorities, or those whose graduates practice in underserved communities or serve rural and inner-city populations.\**

- (53) *National funding for graduate medical education should reflect physician workforce policy in the US which preferentially funds training for needed generalist physicians, particularly family physicians, with concomitantly less funding for the training of other physicians.\* Specifically, additional positions will need to be funded for family medicine rather than for other specialties.*

\* Current AAFP policy

## ACKNOWLEDGEMENTS

The Commission on Education of the American Academy of Family Physicians appreciates the assistance of A. Peter Catinella, M.D., MPH, Steve Alder, PhD, and Scott Benson, M.D., MPH, PhD of the University of Utah School of Medicine, and Jennifer Ha, Research Consultant, and Gar Elison, MHA, Executive Director of the Utah Medical Education Council.

## REFERENCES

1. Family Physician Workforce Reform: Recommendations of the American Academy of Family Physicians. AAFP Reprint No. 305. American Academy of Family Physicians. Kansas City, MO: September 1998.
2. Green LA, Dadoo MS, Ruddy G, et al. The Physician Workforce of the United States: A Family Medicine Perspective. Washington, D.C.: The Robert Graham Center; 2004 Oct-2004.
3. Council on Graduate Medical Education. Physician Workforce Policy Guidelines for the United States, 2000-2020. Rockville, M.D.: U.S. Department of Health & Human Services January 2005. Report No.: Sixteenth Report.
4. Schneeweiss R, Rosenblatt RA, Dovey S, et al. The effects of the 1997 Balanced Budget Act on family practice residency training programs. *Fam Med* 2003;35(2):93-9.
5. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q* 2005;83(3):457-502.
6. Starfield B, Shi L, Grover A, Macinko J. The Effects Of Specialist Supply On Populations' Health: Assessing The Evidence. *Health Aff (Millwood)* 2005.
7. Macinko J, Starfield B, Shi L. The contribution of primary care systems to health outcomes within Organization for Economic Cooperation and Development (OECD) countries, 1970-1998. *Health Serv Res* 2003;38(3):831-65.
8. Starfield B. Primary care and health. A cross-national comparison. *JAMA* 1991;266(16):2268-71.
9. Starfield B, Lemke KW, Bernhardt T, Foldes SS, Forrest CB, Weiner JP. Co morbidity: implications for the importance of primary care in 'case' management. *Ann Fam Med* 2003;1(1):8-14.
10. Shi L, Macinko J, Starfield B, Xu J, Politzer R. Primary care, income inequality, and stroke mortality in the United States: a longitudinal analysis, 1985-1995. *Stroke* 2003;34(8):1958-64.
11. Geyman JP, E. NT, Hart LG. *Textbook of Rural Medicine*. New York: McGraw-Hill; 2001.
12. Colwill JM, Cultice JM. The future supply of family physicians: implications for rural America. *Health Aff (Millwood)* 2003;22(1):190-8.
13. Rosenblatt RA, Andrilla CH, Curtin T, Hart LG. Shortages of medical personnel at community health centers: implications for planned expansion. *JAMA* 2006;295(9):1042-9.
14. Masys DR. Effects of current and future information technologies on the health care workforce. *Health Aff (Millwood)* 2002;21(5):33-41.
15. Goldsmith J, Blumenthal D, Rishel W. Federal health information policy: a case of arrested development. *Health Aff (Millwood)* 2003;22(4):44-55.
16. Baron RJ, Fabens EL, Schiffman M, Wolf E. Electronic health records: just around the corner? Or over the cliff? *Ann Intern Med* 2005;143(3):222-6.
17. Caudill-Slosberg M, Weeks WB. Case study: identifying potential problems at the human/technical interface in complex clinical systems. *Am J Med Qual* 2005;20(6):353-7.

18. Goodman C. Savings in electronic medical record systems? D.O. it for the quality. It is unrealistic to hold out widespread adoption of health information technology as a net cost saver. *Health Aff (Millwood)* 2005;24(5):1124-6.
19. Han YY, Carcillo JA, Venkataraman ST, et al. Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system. *Pediatrics* 2005;116(6):1506-12.
20. Kleinke JD. Release 0.0: clinical information technology in the real world. *Health Aff (Millwood)* 1998;17(6):23-38.
21. Wagner MM, Hogan WR. The accuracy of medication data in an outpatient electronic medical record. *J Am Med Inform Assoc* 1996;3(3):234-44.
22. Linzer M, Rosenberg M, McMurray JE, Glassroth J. Respecting the lifecycle: rational workforce planning for a section of general internal medicine. *Am J Med* 2002;113(5):443-8.
23. 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(9):1041-8.
24. Roos NP, Fransoo R, Bogdanovic B, et al. Needs-based planning for generalist physicians. *Med Care* 1999;37(6 Suppl):JS206-28.
25. Roos NP, Fransoo R, Carriere KC, et al. Needs-based planning: the case of Manitoba. *CMAJ* 1997;157(9):1215-21.
26. National Ambulatory Medical Care Survey (NAMCS). National Center for Health Statistics. U.S. Public Health Service. (Accessed at <http://www.cdc.gov/nchs/about/major/ahcd/ahcd1.htm>.)
27. National Hospital Ambulatory Medical Care Survey. 1992-2004. (Accessed Confirmed as of June 8, 2006, at [ftp://ftp.cdc.gov/pub/Health\\_Statistics/NCHS/Dataset\\_D.O.cumentation/NHAMCS/](ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_D.O.cumentation/NHAMCS/).)
28. Medical Group Management Association. Physician Compensation and Production Survey: 2005 Interactive Report Based on 2004 Data (CD Single User). CD-ROM: John Wiley & Sons, Inc.; 2005.
29. US Department of Health and Human Services. Area Resource File (ARF). In: *Health Resources and Services Administration BoHP*, ed.; February 2005.
30. Mortality Data. National Center for Health Statistics, U.S. Public Health Service. (Accessed Confirmed as of June 08, 2006, at [http://www.cdc.gov/nchs/health\\_data\\_for\\_all\\_ages.htm](http://www.cdc.gov/nchs/health_data_for_all_ages.htm).)
31. Annual Projections by Single Year of Age by Sex: July 1 2004-2030. U.S. Census Bureau, 2005. (Accessed Confirmed as of June 8, 2006, at <http://www.census.gov/population/projections/D.O.wnldFile4.xls>.)
32. American Academy of Family Physicians. American Academy of Family Physicians' residency census survey. Reprint no. 150. Leawood, Kan: American Academy of Family Physicians, 2005.
33. Rivo ML, Saultz JW, Wartman SA, DeWitt TG. Defining the generalist physician's training. *JAMA* 1994; 271(19): 1499-1504.
34. Rosenblatt RA, Hart LG, Baldwin LM, Chan L, Schneeweiss R. The generalist role of specialty physicians. *JAMA* 1998; 279(17): 1364-70.
35. Greenfield S, Nelson EC, Zubkoff M, et al. Variations in resource utilization among medical specialties and systems of care: results from the medical outcomes study. *JAMA* 1992; 267(12):1624-30.
36. Patient Care Physician Supply and Requirements: Testing COGME Recommendations. Council on Graduate Medical Education Eighth Report. US Department of Health and Human Services, Public Health Service, Health Resources and Services Administration publication HRSA-P-DM 95-3. Rockville, M.D.: 1998.
37. Pew Health Professions Commission. Critical Challenges: Revitalizing the Health Professions for the Twenty-First Century. The Third Report of the Pew Health Professions Commission, San Francisco, CA: December 1995: 21.
38. Cohen JJ, Whitcomb ME. "Are the recommendations of the AAMC's task force on the generalist physician still valid?" *Academic Medicine* 1997; 72(1): 13-16.
39. Robert Wood Johnson Foundation Press Release. Nominations for 1996 Grants. Princeton, NJ: April 28, 1995.
40. American Academy of Family Physicians Transactions of the Annual Session of the Congress of Delegates. American Academy of Family Physicians. Kansas City, MO: September 1992: 6.
41. American College of Physicians, The Impending Collapse of Primary Care Medicine and Its Implications for the State of the Nation's Health Care, January 30, 2006
42. Association of American Medical Colleges (AAMC) Center for Workforce Studies – Physician Workforce Research Conference - *2020 Vision – Focusing on the Future* , May 4-5, 2006, Washington, DC

- 43. Robert Graham Center, Physicians Assistant and Nurse Practitioner Workforce Trends. One-Pager Number 37, October 2005
- 44. National Resident Matching Program (NRMP) – Results and Data: 2006 Match Washington, DC: May 2006

Table 1: Parameters significantly correlated to Premature Mortality Rate (PMR)

Variable	p-value
% Persons 25+ without high school diploma or more	<0.001
% Non-White Collar Workers	<0.001
Unemployment Rate, 16+	0.026
Median Household Income	<0.001
% Families with Female Head	<0.001
% Single Parent Households	<0.001
% Non-English Speaking	0.043
% Foreign Born Population	0.012
Poverty Parameter	<0.001
Housing Parameter	0.001

Table 2: Number of Family Physicians by State and Total U.S. for 2006 and 2020 Projected by Needs-Based Model, Based on U.S. Census Bureau Projections and Adjusted for Socioeconomic Index and Premature Mortality Rate, to Achieve a Ratio of 41.6 Family Physicians per 100,000 U.S. Population

State	Family Physicians		State	Family Physicians	
	2006	2020		2006	2020
AL	2,248	2,912	MT	300	413
AK	208	302	NE	525	666
AZ	1,773	3,114	NV	895	1,599
AR	1,322	1,781	NH	412	593
CA	10,560	15,181	NJ	2,680	3,551
CO	1,421	1,989	NM	611	851
CT	1,118	1,447	NY	5,856	7,345
DE	290	416	NC	3,206	4,777
DC	330	346	ND	195	242
FL	7,035	11,497	OH	4,031	5,031
GA	2,919	4,302	OK	1,463	1,896
HI	393	530	OR	1,105	1,595
ID	408	615	PA	5,253	6,652
IL	3,723	4,747	RI	335	438
IN	2,077	2,691	SC	1,867	2,639
IA	913	1,142	SD	236	303
KS	825	1,064	TN	2,650	3,692
KY	1,844	2,409	TX	6,661	10,091
LA	2,249	2,879	UT	682	1,017
ME	438	589	VT	201	277
MD	1,794	2,529	VA	2,287	3,302
MA	1,974	2,565	WA	1,872	2,758
MI	3,226	4,165	WV	893	1,098
MN	1,542	2,153	WI	1,696	2,268
MS	1,631	2,102	WY	159	211
MO	2,099	2,764	<b>United States</b>	<b>100,431</b>	<b>139,531</b>

