Confronting the Complexity of the Physician Workforce Equation

Darrell G. Kirch, MD
David J. Vernon, BA

The United States is a nation in which 47 million citizens have no health insurance, more than 16% of the country’s gross domestic product is spent on rapidly increasing health costs, and stark disparities exist in health care access, exemplified by 20% of the population currently residing in federally designated health professional shortage areas. These formidable challenges have led to renewed interest in reforming the health care system while engendering intense debate among policy makers and politicians.

One area of increasing focus has been the current and future size of the US physician workforce. If the health care system’s purpose is to provide quality care and appropriate access to care, a critical factor is to have an adequate supply of well-educated providers. Although physicians are not the only professionals providing health services, they are a key component of the overall health care workforce. Therefore, determining the number of physicians necessary to meet current and future US needs has become a critical question. The debate regarding this question, however, is at risk of becoming overly simplistic and polarized.

Problems With Focusing on a Single Variable

An accurate prediction of physician workforce needs involves a complex array of variables, each presenting different problems in determining the quantitative value that should be assigned to that variable. Rather than acknowledging this multivariate complexity, however, the physician workforce discussion all too often has focused on a single variable, resulting in a recommendation of how that variable alone should be manipulated to solve the problem. At best, the result is narrow thinking, leading to conclusions not informed by the full range of relevant data. At worst, the outcome is poor policy decisions, with negative ramifications that may persist for decades. The future health of US citizens requires embracing fully the problem of the multivariate analysis regarding physician workforce needs.

In 1997, several major studies and groups concluded that a physician surplus loomed. Six key national medical organizations based a joint policy proposal on this projected surplus. In hindsight, this policy was strongly influenced by focusing on a single variable: the inaccurate assumption that a major national shift in the health care delivery system would occur toward tightly managed care. It could be argued that this policy, based primarily on a prediction regarding delivery system reform, in turn became a causative factor in the current apparent physician shortage.

More recently, focusing on the variable of national economic output, Cooper et al observed that the US health care spending has outpaced gross domestic product growth by a ratio of 1.5 to 1.0. Their historical analysis also showed that for every 1.0% increase in gross domestic product, the physician supply has increased by 0.75%, and the authors concluded that there must be a response to these correlations by increasing the supply of clinicians to avoid severe workforce shortages. Assuming this historic correlation between economic growth and health services use is essentially fixed led the authors to urge that production of physicians by medical schools and residency training programs be significantly increased to keep pace with economic growth.

Countering the conclusion by Cooper et al by focusing on yet another variable, Goodman and Grumbach asserted that financing delivery system reorganization should take precedence over investment in the growth of US medical school enrollment. In an analysis of patterns of health services use and health care spending and the accompanying marked geographic variation observed in the United States, a positive correlation was found between higher levels of health care spending and greater numbers of medical specialists. It is a significant leap, however, to go beyond the observed correlation to conclude that variation in health services use and attendant costs can or should be resolved by restricting the future supply of physicians. The issue is presented as an either-or proposition in which the nation either pays for delivery system reorganization or for increasing medical school enrollment.

Concluding that the weight of evidence indicates a future physician shortage, the Association of American Medical Colleges recommended that US medical schools increase their enrollment by 30% by 2015, which is now occurring through the expansion of existing schools and the establishment of new schools. The production of gradu-
ates with MD degrees by medical schools, however, represents only one source of input into the nation’s residency programs, with international medical graduates (IMGs) and osteopathic medical graduates (DOs) representing an increasing proportion of residents entering residency training. The number of residents being trained (currently constrained by caps on Medicare support for graduate medical education) is the ultimate rate-limiting step in the number of practicing physicians. Because of the lack of clarity regarding the preferred number of physicians US medical schools and residency training programs should be producing, the need for much better analysis is clear.

**Key Variables Affecting US Physician Supply and Demand**

“Solving” the physician workforce equation requires analyzing as many key variables as possible. Major variables affecting supply include physician retirement patterns, sex and generational differences in work patterns, length of training, education cost and debt, US MD and DO program enrollment, IMG importation, and numbers of residency positions. Key variables influencing demand include reforms in insurance coverage and reimbursement, delivery system changes, introduction of new technologies, nurse practitioner and physician assistant production, geographic distribution of clinicians, overall status of the economy, and the growth rate, aging, and health care use patterns of the population. Several variables especially difficult to quantify can be highlighted.

Physician sex and generational differences are emerging as major factors. Half of current medical school matriculants are women, and younger physicians in general are expressing different expectations regarding work-life balance than older physicians. When physicians younger than 50 years were asked to rate the importance of lifestyle factors, 71% answered that time for family/personal life was very important, whereas only 42% said that long-term income potential was very important. Currently, only 72% of women are active in medicine full time compared with 97% of male colleagues. As the demographic features of medicine change, it becomes increasingly difficult to calculate the future number of “clinical full-time equivalents” that will exist in the total physician workforce.

Another factor of increasing importance is the influx of IMGs into US residency programs. Forces influencing this variable include attitudes toward the importation of IMGs from less-developed countries, future competition for IMGs in a truly global health services market, and the reliance of underserved areas on IMGs via J-1 visa waiver programs. Although currently more than 25% of first-year residents graduated from non-US medical schools, the future rate of physician migration into the United States is difficult to predict.

Variation in use of health services is the focus of considerable attention. Yet it is unclear which forces are driving that use and the accompanying patterns of variation. It continues to be a problem to separate the wasteful consumption of services from meritorious services that may improve health. Consequently, any indiscriminate attempt to reduce overall health expenditures by restricting supply is likely to eliminate both valuable and wasteful care. The unique geographic and socioeconomic diversity of the United States makes it difficult to fully understand variation in health services use. Because of this complexity, it may be unrealistic to imagine that the United States is on the verge of a sweeping national shift toward decreased health care use that will dramatically decrease the demand for physicians. Furthermore, addressing disparities of care may in some cases require an increase in services for some patients.

Another key variable affecting demand is the future use of nonphysician professionals (NPPs) providing direct patient care. Currently, the nurse practitioner and physician assistant workforces equal 120,000 and 68,000, respectively. It is less clear what roles these NPPs will fill. Some predict they will largely replace primary care physicians, whereas others foresee an increased role for NPPs as members of medical-surgical specialty care teams.

Looming above all on the demand side is the aging population. Data show that the population older than 65 years (predicted to be 70 million individuals by 2030) makes twice as many physician visits as the population younger than 65 years. The magnitude of the resultant surge in demand for health care services will greatly affect total numbers, as well as composition, of the health care workforce.

It also is clear that different dynamics are at work for each medical specialty, with elements such as reimbursement driving specialty selection. Although beyond the scope of this article, ultimately, any multivariate model will need to assess specialty-specific factors.

**Call for a Comprehensive Study of National Health Professions Workforce Needs**

Determining the “correct” size of the future physician workforce involves deciphering an extremely complicated, multivariate equation that defies simple solutions. There is, however, the opportunity to learn from mistakes and more carefully analyze the full range of variables that determine how many physicians and other clinicians are needed to create the best possible health care system. The Association of American Medical Colleges Center for Workforce Studies has begun to explore this multivariate complexity, but much needs to be done, and one organization cannot do it alone. There must be a commitment to study these factors and to understand better the risks and benefits underlying the attempts to alter any single variable. It is a matter of debate whether such an effort should be publicly sponsored at the federal or state level, be led by the nongovernmental sector, or represent a joint public-private effort. What cannot be argued is the importance of establishing an effort to attain a much better understanding of future national health care workforce needs. The health of the public demands nothing less.
Biofilms and Chronic Infections
Randall D. Wolcott, MD
Garth D. Ehrlich, PhD

THE PREVAILING PARADIGM OF INFECTIOUS DISEASE IS based on the work of Koch and colleagues, who more than 150 years ago isolated individual strains of bacteria and developed the pure culture method that is still used today. That work enlightened medicine by firmly establishing the germ theory of transmissible diseases and demonstrated that diseases like dysentery, tuberculosis, and anthrax are caused by microbiological agents.1 Hence, the field of microbiology developed around Koch’s methods with clinical microbiologists working overwhelmingly with pure log-phase cultures in nutrient-rich media because this approach provided such a powerful tool for the study of acute epidemic bacterial diseases. However, this approach that examines only planktonic bacteria (free-floating, single cell phenotype) may have limited development of a more thorough understanding of microbial processes. In most natural environments and in chronic bacterial infections, the planktonic phenotype generally exists only transiently, and usually as a minor population.

Emerging evidence describes bacterial populations as predominantly polymicrobial, sessile, community-based aggregations embedded in a self-secreted matrix that provides numerous advantages for persistence in the face of environmental and host challenges. Therefore, biofilms and the existence of a complex bacterial life cycle provide a new perspective through which to view infectious diseases. Much of the support for this perspective has come about through the application of new detection and visualization methods that have provided evidence for the theory that chronic infections are fundamentally different than acute infections, and that different interventional approaches are necessary to treat these biofilm infections more efficiently.

What Is a Biofilm?
A biofilm is a thin layer of microorganisms that adhere to the surface of an organic or inorganic structure, together with their secreted polymers. Biofilms are the predominant phenotype of nearly all bacteria in their natural habitat, whether pathogenic or environmental. The biofilm provides a bulwark against environmental stressors and can include organisms from multiple kingdoms as in the case of mixed bacterial-fungal biofilms. Thirty years ago, Costerton et al2 was the first to examine the attributes of biofilms, examining the extracellular polymeric substances (EPS) that holds these community bac-