The common wisdom at the end of the 20th century was that the United States was training too many specialists, including cardiologists. By 2001, however, there was increasing evidence that the supply of cardiologists was not meeting the growing demand. That year, as president-elect of the American College of Cardiology (ACC), I appointed a task force to evaluate cardiology workforce. The task force undertook a 2-year process of literature review, hypothesis generation, research design, data acquisition, and analysis. This intense effort included a Bethesda Conference at which consensus was achieved on a report that will be published in the Journal of the American College of Cardiology.

Based on various types of information and data, the ACC task force concluded that the United States is facing a shortage of cardiologists. This will reduce access to specialty care of proven benefit and will undermine our nation’s vital cardiovascular research effort. The Bethesda Conference report includes 8 working group documents that recommend several short- and intermediate-term strategies to help narrow the growing demand-supply gap for cardiologists (see Table 1). Some recommendations can be implemented at a local practice or institution level. Others will require a series of complex and coordinated actions at a national level. Hopefully, the report will catalyze actions by academic medical centers, regulatory organizations, federal policymakers, professional societies, and others that influence the output of cardiovascular specialists.

The Growing Demand for Cardiologists

Several things continue to drive demand for cardiologists. Elsewhere, I have argued that various scientific, social, and demographic “demand catalysts” outweigh factors that might decrease demand for cardiologists during the next decade (see Table 2). Although the relative influence of each demand factor will change over time, one thing is certain: the cardiovascular disease burden in the United States is great and growing. Even if the public focuses more energy on self-preservation and makes better choices with respect to cardiotoxic habits such as smoking or cardioprotective habits such as exercise and healthy diets, demographers warn that we are confronting an expanding population of older Americans that will require much more cardiovascular care.

The American Heart Association (AHA) has documented a dramatic decline in age-adjusted heart-related death rates over the past 2 decades. Despite this trend, cardiovascular disease still caused 38.5% of all deaths in 2001. Ironically, our success in reducing the mortality rate from acute cardiac events has increased the population of patients with chronic cardiovascular diseases, especially heart failure. Moreover, the current “epidemics” of obesity, type 2 diabetes, and the metabolic syndrome are increasing the burden. These sobering facts support the conclusion that a larger cardiology workforce will be needed to provide the specialized care proven to save, prolong, and enhance lives.

In 2000, Foot et al published a detailed report on demographics and cardiology from 1950 to 2050. The authors concluded that a shortage of cardiologists was imminent and would be especially problematic in the 2010s and 2020s, “when the [baby] boomers reach the prime heart disease ages and the boomer physicians are retiring” (p 78B). They declared, “‘Now is the time to confront this challenge . . . There will be an opportunity during the early 2000s to develop a
In December 2003, there were 613 job postings on the ACC academic cardiologists in most regions of the United States. The demise of the gatekeeper model resulted in enhanced access to cardiologists, and about one half of these institutions think it is “very hard” to recruit them. A 2002 ACC survey to assess the market for cardiologists found that job prospects for senior trainees were excellent and had improved significantly in the past 5 years. Recruiters polled were finding it very difficult (76%) or somewhat difficult (21%) to fill cardiology positions.

The current strong demand for cardiologists reflects, in part, a reduction in the number of trainees beginning in the mid-1990s. A decade ago, the rapid growth of for-profit managed care (with its gatekeeper model) was transforming the medical landscape. Based on HMO staffing patterns, health policy analyst Jonathan Weiner predicted in 1994 that the medical landscape. Based on HMO staffing patterns, health policy analyst Jonathan Weiner predicted in 1994 that the projections of oversupply made in 1980 by GMENAC [Graduate Medical Education National Advisory Committee] and those made in the early 1990s using HMO staffing patterns were seriously in error (Snyderman et al, 10 p 168).

Procedural and technological innovations and clinical trial results have a tendency to increase the demand for cardiologists. Several studies have demonstrated the benefit of specific interventions provided by subspecialty cardiologists such as primary percutaneous coronary intervention (PCI) for acute myocardial infarction and prophylactic defibrillator implantation in patients with a 30% or lower ejection fraction at least 1 month after infarct. Results such as these drive demand for cardiologists with subspecialty procedural expertise. Importantly, several studies have shown that patients with cardiac problems have improved outcomes if part of their care is provided by a cardiologist.

Interventional cardiology has long been a lightning rod for workforce debate, mainly as a result of concerns about the “low-volume operator.” The low-volume operator phenomenon reflects a ratio of the total number of patients treated with a PCI divided by the total number of cardiologists performing these procedures. This ratio is dynamic, and discussions about the low-volume operator have not acknowledged what I call the “balooner boomer” phenomenon that reflects the unique scientific and social history of PCI.

Andreas Gruntzig invented percutaneous transluminal coronary angioplasty in 1977. This balloon-tipped catheter technique was an attractive alternative to coronary artery bypass surgery for treating angina. Between 1979 and 1985 the number of PCIs performed in the United States skyrocketed from 2000 to 82 000. This stunning growth reflected the fact that by 1985 many of the nation’s thousands of invasive cardiologists had transformed themselves into interventionalists by attending brief demonstration courses or by being mentored by a colleague who had already done so. This ballooner-boomer phenomenon drove the denominator in the low-volume operator equation that, in turn, contributed to a consensus in the 1990s that too many interventionalists were being trained.

<table>
<thead>
<tr>
<th>TABLE 1. Working Groups of the ACC Task Force on Workforce</th>
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<tbody>
<tr>
<td>Increasing the number of cardiologists being trained</td>
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<tr>
<td>Encouraging more women to become cardiologists</td>
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<tr>
<td>Encouraging more underrepresented minorities to become cardiologists</td>
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<tr>
<td>International medical graduates and cardiology</td>
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<tr>
<td>Implementing innovative cardiac care team models</td>
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<tr>
<td>Using technology to increase efficiency and productivity</td>
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<td>Enhancing the cardiology “job-matching” process</td>
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<td>Optimizing the career path to cardiology and its subspecialties</td>
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<table>
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<tr>
<th>TABLE 2. Cardiovascular “Demand Catalysts”</th>
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<tr>
<td>An aging population with more chronic cardiac patients living longer</td>
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<td>The “epidemics” of obesity and type 2 diabetes leading to more cardiovascular disease</td>
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<td>Heart patients’ outcomes are better if they receive part of their care from a cardiologist</td>
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<tr>
<td>The demise of the gatekeeper model resulted in enhanced access to cardiologists</td>
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<tr>
<td>A better informed public with growing expectations in terms of their health care</td>
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<tr>
<td>More women learning they are more likely to die from cardiovascular disease than cancer</td>
</tr>
<tr>
<td>Continuing technological and procedural innovations that diffuse rapidly into practice</td>
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<tr>
<td>Growing use of cardiovascular screening tests that result in more referrals and procedures</td>
</tr>
<tr>
<td>Progressive subspecialization within cardiology that result in more “internal” referrals</td>
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In 2000, “the supply of specialists will outstrip the requirement by more than 60%” (p 222). Meanwhile, the Clinton Administration was promoting a plan to reform healthcare delivery that emphasized primary care. These challenging circumstances contributed to a 20% reduction in the number of first-year adult cardiology trainees between 1994 (797) and 1999 (635). Many informed observers now believe the nation is facing a significant shortage of specialists. Health policy analyst and former medical school dean Richard Cooper has warned repeatedly of this. Reflecting on 2 decades of workforce debate, 3 officers of the Association of American Medical Colleges stated recently that “all available market indicators, limited as they are, suggest that a shortage of physicians, particularly of specialty physicians, may well exist in some regions of the country. The conclusion seems inescapable that the projections of oversupply made in 1980, by GMENAC and those made in the early 1990s using HMO staffing patterns were seriously in error” (Snyderman et al, 10 p 168).
Typical of the process of professionalization, interventional training became much more rigorous during the 1990s. The policies of the Accreditation Council for Graduate Medical Education (ACGME) and American Board of Internal Medicine (ABIM) policies now limit the number of cardiologists eligible to take the added qualification examination in interventional cardiology. Meanwhile, procedural volumes continue to grow; 547,000 patients had a PCI procedure in 2000, a 260% increase since 1987. Currently, there are only 213 ACGME-accredited training positions in interventional cardiology. As many of the ballooner boomers retire or stop performing PCI during the next decade, the stage is set for a significant demand-supply mismatch with important implications for patient access and outcomes.

**Potential Solutions to a Growing Shortage of Cardiologists**

Confronted with chronic workload-workforce mismatches and difficulty recruiting cardiologists, many private and academic practices have hired nonphysician clinicians (eg, nurse clinicians, clinical nurse practitioners, and physician assistants) to complement the care provided by cardiovascular specialists. In recent years, the number and types of nonphysician clinicians employed by doctors, clinics, and hospitals have increased dramatically. Many cardiologists now depend on these specialized healthcare professionals to help them document histories, perform tests and procedures, provide follow-up, and educate patients.

One logical solution to the growing shortage of cardiologists is to increase the number trained. This will be difficult, however, because the ACGME regulates the number of cardiology training programs and positions, and federal funding of graduate medical education (GME) through Medicare was capped in 1997. Space does not permit a discussion of the methods of GME financing that have evolved in the United States since the late 1940s, when lawmakers decided to endow academic medical centers. Acknowledging the challenging fiscal environment of medicine today, the ACC task force report includes several recommendations to help them document histories, perform tests and procedures, provide follow-up, and educate patients.

Ironically, as reimbursement for most cardiovascular services continues to decrease, the career path to become a cardiologist keeps getting longer. The highly structured and protracted course of postgraduate specialty and subspecialty training that evolved during the second half of the 20th century reflected the ongoing explosion of knowledge, technology, and techniques that continue to define modern cardiology. It is important to note that the rigorous ACGME and ABIM training requirements reflect, in large part, expectations cardiologists developed, as described in a series of Core Cardiology Training in Adult Cardiovascular Medicine (COCATS) documents.

Some, perhaps many, outstanding US medical school graduates choose not to become cardiologists because they do not want to delay the start of their "goal" specialty training by 3 or more years. Today, a medical graduate whose goal is to become a board-certified clinical cardiologist must complete a 3-year general internal medicine residency, pass the ABIM general internal medicine examination, complete a 3-year cardiology fellowship, and pass the ABIM cardiovascular examination. Cardiology subspecialty training in PCI or electrophysiology adds another year for a total of 15 years of post high school education and training.

The growing shortage of cardiologists and the steady shift to pure specialty practice (rather than a blend of cardiology and internal medicine, common a generation ago) provides the ABIM with a prime opportunity to invent a 21st century version of the "short-track" approach the organization experimented with in the 1970s. Working together, the ABIM, ACGME, COCATS, and ACC should invent a combined 5-year program (eg, 2 years of core general internal medicine, 1 year of cardiovascular medicine, and 2 years of clinical cardiology) that would focus on knowledge and skills needed to be a general clinical cardiologist. Depending on the trainee’s career goals, the final 3 years of training could be customized and extended if he or she wants to become an interventionalist or an electrophysiologist. The ACC task force report includes recommendations that would provide more training and certification options—alternatives that reflect the contemporary needs of our patients and profession.

**Academic Cardiology**

Our nation’s academic medical centers, vital factories of new knowledge and physicians, confront several serious issues as they consider increasing their output of cardiovascular specialists. Like practitioner cardiologists, academics are concerned about the twin challenges of increasing workload and decreasing reimbursement. Hill and Kerber warn, “These issues threaten to jeopardize an entire generation of cardiovascular practitioners and investigators and may adversely affect American preeminence in cardiovascular medicine” (p 932).

Today, academic cardiologists are under growing pressure to generate income from clinical activities for their financially challenged institutions. As they see their “protected” research time decrease and their clinical duties increase, more academics will enter private practice. If we hope to maintain the momentum of discovery, with its promise to reduce the cardiovascular disease burden, the United States must continue to invest heavily in academic medical centers. Basic research and clinical investigation are vital if we hope to eliminate atherosclerotic cardiovascular disease and its many deadly complications. Until then, we must produce an adequate number of well-trained cardiologists who will devote themselves to prevention, early and accurate diagnosis, and cost-effective treatment of cardiovascular diseases.

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