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Cardiology's Workforce Crisis: A Pragmatic Approach

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BETHESDA CONFERENCE REPORT

35th Bethesda Conference: Cardiology's Workforce Crisis: A Pragmatic Approach*

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Endorsed by the American Heart Association, the Association of Black Cardiologists, the American Society of Echocardiography, the American Society of Nuclear Cardiology, the Heart Rhythm Society, the Society for Cardiovascular Magnetic Resonance, the Society for Cardiovascular Angiography and Interventions, the Society of Geriatric Cardiology, and the Society for Vascular Medicine and Biology.

This Conference, sponsored by the American College of Cardiology Foundation, was held at Heart House, Bethesda, Maryland, October 17–18, 2003.

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35TH BETHESDA CONFERENCE

Introduction: The Origins and Implications of a Growing Shortage of Cardiologists

W. Bruce Fye, MD, MA, MACC, *Conference Chair*

During the past 50 years, many remarkable advances have occurred in our ability to diagnose, treat, and prevent cardiovascular disease. This progress contributed to a dramatic decline in cardiovascular mortality rates. Although there are many reasons to anticipate additional advances, the rate of discovery and diffusion of new knowledge and techniques is related to the resources devoted to cardiovascular research and practice. Many types of professionals, including basic scientists, clinical investigators, and population scientists, contribute to this critical effort. Cardiovascular specialists lead the huge team effort necessary to translate discoveries and innovations into enhanced outcomes. This report focuses on whether our nation is training enough cardiovascular specialists to accomplish these ambitious goals and to care for the growing burden of cardiovascular disease in our aging population. (J Am Coll Cardiol 2004;44:221–32) © 2004 by the American College of Cardiology Foundation

There is increasing concern that the U.S. is facing a serious shortage of cardiologists (1–3). The American College of Cardiology (ACC) Task Force on Workforce, appointed in 2001, undertook a two-year process of literature review, hypothesis generation, research design, data acquisition, and analysis. This intense effort included a Bethesda Conference in October 2003, to reach consensus on the accompanying report. The ACC task force believes the nation is confronting a growing shortage of cardiovascular specialists that will hinder access to care and undermine our vital research effort. To further enhance patient outcomes and accelerate discovery, the U.S. needs an adequate supply of highly trained and productive practitioner and academic cardiologists. These specialists deliver care, advance knowledge, and coordinate sophisticated teams of non-physician professionals dedicated to the prevention, diagnosis, and treatment of cardiovascular disease.

This Bethesda Conference document includes eight working group reports that propose several short- and intermediate-term strategies to help narrow the growing demand-supply gap for cardiologists. Some recommendations are fairly easy to implement at a local practice or institution level. Others will require a series of coordinated actions at a national level. This report concludes with a summary of the task force's recommendations. We hope this effort will catalyze actions by academic medical centers, regulatory organizations, federal policymakers, professional societies, and others that influence the output of cardiovascular specialists. This is critical because the U.S. must produce and maintain a cardiology workforce of sufficient size and sophistication to provide specialized care to a growing number of patients with cardiovascular disease, the leading cause of mortality and morbidity.

This document was approved by the American College of Cardiology Foundation in March 2004. It is endorsed by the following organizations: the American Heart Association, the Association of Black Cardiologists, the American Society of Echocardiography, the American Society of Nuclear Cardiology, the Heart Rhythm Society, the Society for Cardiovascular Magnetic Resonance, the Society for Cardiovascular Angiography and Interventions, the Society of Geriatric Cardiology, and the Society for Vascular Medicine and Biology.

BACKGROUND

The common wisdom at the end of the 20th century was that the U.S. was producing too many specialists, including cardiologists (4–6). A decade ago the rapid growth of for-profit managed care, with its gatekeeper model and other obstacles to specialty services, was transforming the medical landscape. At the same time, the Clinton administration was promoting an ambitious plan to reform health care delivery that emphasized primary rather than specialty care. In that context, in 1993, the ACC sponsored the 25th Bethesda Conference on "Future Personnel Needs for Cardiovascular Health Care." The resulting 54-page report, rich in content and insights, addressed six areas: 1) the underserved; 2) academic health centers; 3) partnerships in the delivery of cardiovascular care; 4) the relationship between cardiovascular specialists and generalists; 5) a profile of the cardiovascular specialist—trends in needs and supply and implications for the future; and 6) pediatric cardiology (7).

The 1993 Bethesda Conference report contained a wealth of information and many thoughtful recommendations. It also lent authority to the perception that the output of certain types of cardiologists exceeded the nation's needs. While acknowledging the difficulty of projecting demand in an unstable political and economic environment, the report concluded: "The cardiovascular community should adopt the general concept that the numbers of adult cardiology trainees be decreased" (8). It is important to note, however, that this prescription applied mainly to the rapidly evolving field of interventional cardiology, then just 15 years old:

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Table 1. Cardiology Training Programs and Trainees in the U.S. (1950–2002)

Year	Programs	Total Trainees (All Yrs)
1950	19	37
1960	72	142
1972	280	1,260
1980	239	1,492
1990	221	2,310
1994	209	2,419
1995	206	2,354
1996	202	2,309
1997	199	2,238
1998	189	2,138
1999	186	2,175
2000	181	2,106
2001	179	2,160
2002	175	2,223
2003	173	2,117

Source: W.B. Fye, American Cardiology (1996). Table A9, p. 346 (to 1990), *JAMA* Graduate Medical Education Issue (1995–2002), and Accreditation Council for Graduate Medical Education, Accreditation Data System. Accessed June 10, 2004. Total programs and residents reported from *JAMA* include programs and resident physicians as of August 1st for each year reported.

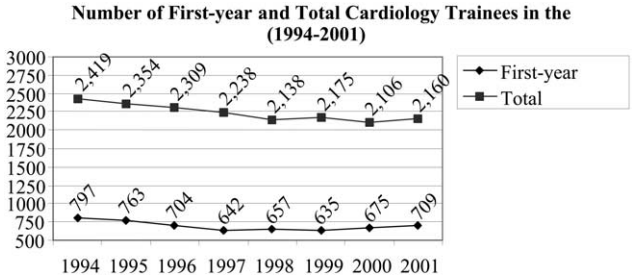

Figure 1. Number of total and first-year cardiology trainees in the U.S. (1994–2001). Source: American Board of Internal Medicine (www.abim.org/Workforce/Fellgen.htm) and JAMA Graduate Medical Education Issue (1995–2002). The year listed is the year the first-year trainee entered the program. Total number of residents includes resident physicians on duty as of August 1 for each year reported.

"The Task Force recognizes the excessive numbers of interventional cardiologists being trained and the need for more physicians trained in clinical and preventive cardiology" (9). Another section, amplifying the latter point, identified "an increased need for noninvasive cardiologists" (10). Meanwhile, a separate 1993 ACC member survey documented demand; 50% of the respondents had tried to recruit a cardiologist during the prior 12 months (11).

Considering the Bethesda Conference report and other inputs, the ACC Board of Trustees recommended, in 1994, a reduction in the number of adult cardiology training positions, especially interventional positions. The ACC president, Daniel J. Ullyot, explained, "We project that greater penetration of managed care in health care markets, more emphasis on primary care and the impact of cost-containment strategies on the use and development of technology will all tend to reduce the need for cardiovascular specialists" (12). Between 1994 and 1999, the number of first-year and total adult cardiology training positions fell by 20% and 10%, respectively. The number of trainees has fluctuated since then, but according to the latest published data, the number of first-year and total adult cardiology trainees is still 11% and 13%, respectively, below 1994 levels (Table 1, Fig. 1).

As the number of cardiologists being trained declined in response to pressures to rebalance the primary care/specialists mix, it was becoming evident that managed care's gatekeeper model was unpopular and patients were demanding access to specialty care. Health policy analyst Edward Salsberg explained recently that the plan of growing primary care and shrinking specialty care turned out to be "unrealistic," in part because it was "not based on the U.S. marketplace" (13). By 2000, there was increasing anecdotal evidence of strong and growing demand for cardiologists in many parts of the country (14,15). The following year, as president-elect of the ACC, I appointed the present task force to evaluate adult cardiology's physician workforce.

When the ACC task force steering committee first met in March 2002, we reviewed many articles on physician workforce beginning with the 1965 report of President Lyndon Johnson's Commission on Heart Disease, Cancer, and Stroke, which concluded there was a "critical shortage" of cardiologists (16). We also reviewed the 1981 report of the Graduate Medical Education National Advisory Committee (GMENAC), which predicted the U.S. would have 94% more cardiologists than needed in 1990 (17). When 1990 arrived, however, there was no surplus. The GMENAC report (based on a five-year effort that cost more than $5 million) illustrates the challenge of projecting physician workforce, especially in a field as dynamic as cardiology, something the ACC task force considered as we discussed our charge.

The task force also reviewed the ACC's 1993 Bethesda Conference report on workforce and considered four lists of factors that might influence the demand for, and supply of, cardiovascular specialists over the next decade. We decided to focus on the short and intermediate term because forecasting workforce needs has proved to be very difficult. The task force concluded that several potent scientific, social, and demographic "demand catalysts" would outweigh factors (emphasized in the 1993 report) that might decrease demand (Table 2). Active discussions among task force members and consultants led to a strong consensus that the U.S. was facing a serious shortage of cardiovascular specialists.

DEMOGRAPHICS AND DEMAND FOR CARDIOVASCULAR SERVICES

The cardiovascular disease burden in the U.S. is great and growing. Despite a dramatic decline in age-adjusted heart-related death rates over the past two decades, Cardiovascular disease still caused 38.5% of all deaths in the nation in 2001 (18). The incidence and prevalence of cardiovascular disease is projected to increase substantially in the future owing primarily to demographic and lifestyle trends in the U.S.

Table 2. Cardiovascular "Demand Catalysts"

1) Population: An aging population with more chronic cardiac patients living longer.
2) Metabolic syndrome: The "epidemics" of obesity and type 2 diabetes leading to more cardiovascular disease.
3) Superior outcomes: Compelling evidence that heart patients have better outcomes if they receive at least part of their care from a cardiologist.
4) Managed care decline: The decline of managed care's gatekeeper model that blocked access to specialists.
5) Consumerism: A better informed public with growing expectations in terms of their personal healthcare.
6) Women: Increasing awareness among women that they are more likely to die from cardiovascular disease than from cancer.
7) Clinical innovation: Continuing technological and procedural innovations and their rapid diffusion into practice.
8) Screening: More widespread use of cardiovascular screening tests that result in more referrals and procedures.
9) Subspecialization: Progressive subspecialization within cardiology that results in more "internal" referrals.

Demography projects a very substantial increase in size of our nation's elderly population. In addition, the current "epidemics" of obesity, type 2 diabetes, and the metabolic syndrome will increase the incidence (19). These two factors will lead to a significant increase in the number of affected persons who will need cardiovascular care. Ironically, our success in reducing the mortality rate from acute cardiac events such as acute myocardial infarction has increased the population of patients with chronic cardiovascular disease, especially heart failure.

The World Health Organization study of the Global Burden of Disease emphasizes that these problems are not limited to countries with developed economies. 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. These sobering predictions support the premise that we will need a larger cardiology workforce to provide the informed and specialized care that has been proven to save and enhance lives (20).

In 2000, Foot et al. (21) reported on demographics and cardiology from 1950 to 2050. These investigators 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." They declared: "Now is the time to confront this challenge. . . . There will be an opportunity during the early 2000s to develop a strategy to attract and retain the children of the boomers into the profession. . . . The opportunity to attract them into the cardiovascular medicine profession should not be missed." The ACC task force agrees that our nation must seize this opportunity.

The task force also reviewed a paper by health policy analyst and former medical school dean Richard Cooper and colleagues published in *Health Affairs* in 2002 (22). Cooper argued that the U.S. was facing a serious shortage of specialists. His position (and the economic demand model used to support it) fueled the smoldering national debate about workforce. The invited responses published with Cooper's study were informed and passionate. Some researchers challenged his model and assumptions. Others argued that the solution to a shortage of specialists was to shift more responsibilities to primary care physicians or non-physician clinicians (something that cardiologists have done for years). In response to Cooper's report, Uwe Reinhardt, a leading healthcare economist, acknowledged that mathematical models used to predict future surpluses or shortages of physicians are problematic because "any of the variables in the equation can change over time, sometimes in unforeseen ways" (23).

Reacting to Cooper's study, health policy analyst Jonathan Weiner admitted "the track record of U.S. workforce policy has not been stellar" and suggested that "for any forecasting effort, it is more appropriate to question assumptions rather then predictions" (24). Weiner, a long-time proponent of the specialty surplus scenario, speaks from experience. In 1994, he assumed that up to 65% of Americans would be receiving their care from "integrated managed care networks in the near future." By extrapolating HMO staffing ratios he predicted that in 2000 there would be an overall national surplus of 165,000 patient care physicians and "the supply of specialists will outstrip the requirement by more than 60%." Claiming his study was "the most complete forecast to date of the expected impact of health reform on national physician workforce requirements," Weiner emphasized that his forecasts were "surprisingly similar to those developed more than a decade ago by the Graduate Medical Education National Advisory Committee (GMENAC) using an entirely different methodology" (25). We now know that the massive surpluses of specialists that GMENAC predicted for 1990 and Weiner predicted for 2000 did not materialize.

In earlier publications, Cooper and associates outlined the challenges facing those who attempt to predict future physician workforce needs (26,27). The lack of an accepted model for workforce projections fuels the debate. Most workforce researchers have used one or more basic approaches to estimate future physician workforce needs including: 1) HMO staffing patterns, 2) economic demand, and 3) clinical need. Cooper's model emphasizes economic demand. But Canadian health policy analyst Morris Barer described Cooper's *Health Affairs* report as a "blizzard of linguistic and conceptual confusion." He complained that Cooper's approach allowed him "to dispense with the inconvenience of collecting a lot of detailed data or attempting to understand the dynamics of physician service provision." Barer argued that "physicians have considerable influence over both what services they provide and the other health care services 'demanded' by patients" (28).

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Cardiologists *do* influence the diagnostic and therapeutic care of patients in important ways. They have a professional obligation to help their patients navigate the complex and ever-growing maze of tests, procedures, and treatments. During the 1990s, some managed care organizations adopted proprietary guidelines that restricted access to specialty care and reduced a doctor's ability to make clinical decisions (29). Meanwhile, in an attempt to rationalize rather than ration cardiovascular care, the ACC and AHA accelerated their production of evidence-based clinical practice guidelines. Today, patients, physicians, payers, and policymakers benefit from these and other products of cardiology's sophisticated "trial-guideline-education process" (30).

Cooper's argument that the U.S. should produce more specialists reflects, in part, the pragmatic observation that there is little public or political support for restricting access to specialty care, despite concerns about healthcare costs (31). Referrals from primary care to specialists rose from 17.8% in 1997 to 25.5% in 2001, whereas the proportion of primary care physicians reporting problems arranging specialty referrals increased from 4.8% to 7.2% between 1997 and 2001. The waiting time to see a specialist also increased from 6.6 days or more in 1997 to 8.1 days or more in 2001 (32).

Returning to Cooper's 2002 study, it is understandable that there is tension around the issues he raised. Kevin Grumbach, an academic family physician and policy analyst, responded, "Reading the paper by Richard Cooper and colleagues is like watching a television commercial for a sport-utility vehicle (SUV). 'Buy more physicians' is the marketing pitch—and not just any physician, but the four-by-four (as in four years of medical school plus four or more years of residency training), gas-guzzling specialist model that creates an irresistible buying frenzy among American consumers eager to spend their discretionary income." Grumbach continued, "The 'Americans have a right to buy more specialists' view also raises the question of whether people are actually buying anything of benefit" (33).

The question of whether specialists—and here we are considering cardiologists—add value is not only relevant but is *critical* as our nation confronts the growing burden of cardiovascular disease in the context of finite resources. The ACC task force agrees that cardiovascular specialists, like all other healthcare providers, must consider the cost-effectiveness and cost consequences of their recommendations and actions. In recent years, many studies found that outcomes are enhanced significantly when patients with cardiac problems receive at least part of their care from a cardiologist (34–40). For example, a study sponsored by the American Board of Internal Medicine (ABIM) reviewed the care of all patients with acute myocardial infarction admitted to Pennsylvania hospitals in 1993. The investigators concluded: "If cardiologists had treated all of the study's approximately 30,000 patients, we estimate that 802 fewer in-hospital deaths could be expected when compared with treatment of all patients by primary care doctors" (41).

Several specialties have expressed concern recently about the adequacy of their workforces in the face of an aging American population. Angus et al. (42) concluded that "a shortfall in pulmonologist time will . . . occur before 2007" and this shortfall is projected to "increase to 35% by 2020 and 46% by 2030." Similarly, Rizza et al. (43) warned that "the number of endocrinologists entering the workforce will not be sufficient to meet future demand" and recommended "actions designed to increase the number of endocrinologists in practice in the years ahead." Addressing nephrology, Pogue et al. (44) declared, "Action on several fronts is required to combat the predicted shortfall in full-time nephrologists." Similar concerns have been raised about anesthesia (45), general surgery (46), and geriatrics (47).

Reflecting on two decades of workforce debate and reacting to Cooper's article, three officers of the Association of American Medical Colleges (AAMC) 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" (48). In October 2003, the Council on Graduate Medical Education (COGME) reversed its long-standing prediction of a surplus and now predicts a shortage of 85,000 physicians by 2020. In its report, COGME advocated for a 15% increase in medical school graduates to help address the shortfall they predict will develop between now and 2020 (Fig. 2). In addition, the report called for a change in the distribution of residency positions between primary care and specialties to better reflect market demand (49).

A recent survey of medical school deans and state medical society executives found that the majority of those surveyed perceive a current shortage of physicians in numerous specialties and subspecialties, including cardiology (50). Furthermore, the American Medical Association (AMA) adopted a new policy statement in 2003 that physician shortages do exist in some areas of the country, as well as in some specialties (51). Massachusetts, with several academic medical centers that train thousands of specialists annually, is already "experiencing a critical physician shortage" in five specialties, including cardiology, according to a recent study that also revealed that "physicians have been forced to react to these labor market shortages by increasing work hours (48%), adjusting professional staffing (37%), and altering the services they provide (31%) (52).

The current shortage of specialists documented by various surveys and reports is almost certain to get worse over the next several of decades. Internal analysis of workforce trends and disease prevalence by the ACC indicate that the demand among patients most likely to benefit from a cardiologist's care will require significant increases in patient loads by all cardiovascular specialists if nothing is done to

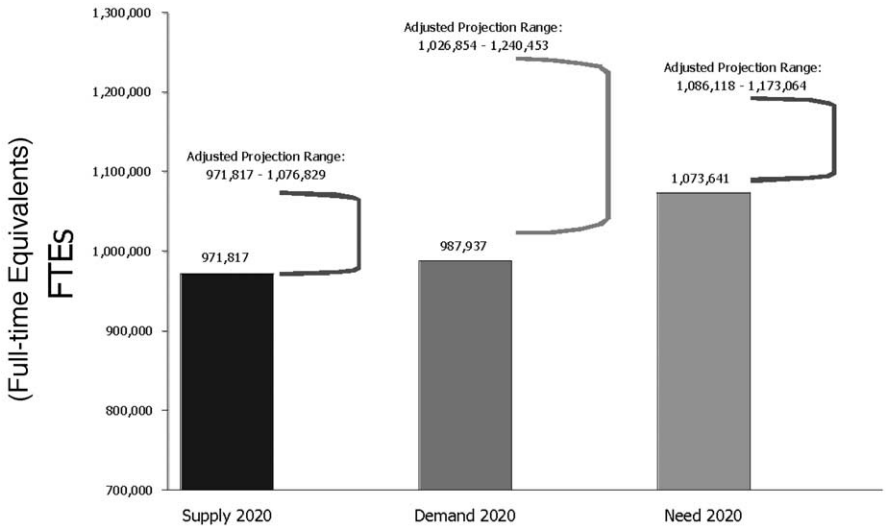

Figure 2. Projected physician supply, demand, and need in 2020. Source: Draft Report–Physician Workforce Policy Guidelines for the U.S. 2000–2020. Presentation to the Council on Graduate Medical Education, Center for Health Workforce Studies. School of Public Health, State University of New York at Albany, September 2003.

address the current and predicted shortages (Fig. 3). Indeed, ACC member survey data reveal that cardiologists have already used a variety of approaches to respond to increased patient loads (Table 3).

ACC SURVEY OF THE MARKET FOR CARDIOLOGISTS

Wennberg et al. (53) estimated that in 1996 there was an average of 6.3 cardiologists per 100,000 U.S. residents, but the numerator varied from 2.7 to 11.3 across "hospital referral regions." The age-adjusted (population and physician workforce) supply of cardiologists is predicted to remain relatively constant until 2005, after which increases in the elderly population will result in a decrease in the adjusted supply of cardiologists to approximately 5.0 per 100,000 by 2020. This trend is expected to continue through 2040 as the baby boom generation ages.

Many factors determine the market for cardiologists in specific locations, and there is no central mechanism to influence their distribution (54). Today, there are jobs for practitioner and academic cardiologists in most regions of the U.S. About 40% of the nation's hospitals with 100 or more beds are seeking cardiologists, and about one-half of these institutions believe it is "very hard" to recruit them (55). The ACC Practice Opportunity Line, a Web-based job database, included 638 listings in February 2004 (56). The number of journal ads for cardiologists has increased dramatically in the past five years. Several practices are trying to recruit more than one doctor. A dramatic example is a 2002 advertisement indicating that the Ochsner Heart and Vascular Institute in New Orleans, a group of 27 physicians, was seeking 13 additional specialists in electrophysiology (2), echocardiography (1), non-interventional cardiology (4), interventional cardiology (2), vascular medicine (2) and heart failure and transplantation (2) (57).

Seeking more data, the ACC task force developed four

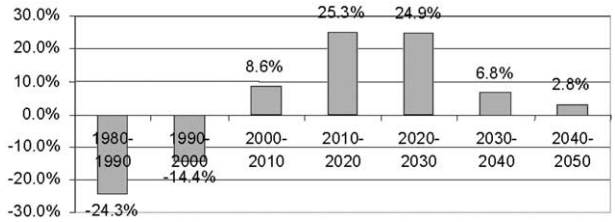

Figure 3. Estimated population 65 years old and older with cardiovascular disease per cardiologist (1980–2050). Source: ACC Workforce Analysis, Internal Task Force on Workforce Report, 2003.

Table 3. Change in the Day-to-Day Operation of ACC Members' Practices in Response to Patient Load/Effort to be More Efficient

	%
Number of patients seen	
Increased	58
Stayed the same	33
Decreased over the past 3 years	9
Response to patient load	
Hired non-MD personnel	57
Allowed non-MDs to take on more patient responsibilities	38
Hired more clerical help	30
Increased use of patient self-management (e.g., Internet, printed material)	10
Employed innovative strategies to recruit cardiologists	2
Contracted with locum tenens firm	2
Volunteered other actions	
Longer hours/more time in office	28
Used electronic systems for scheduling/medical records	12
Increased staff	12
Added more work for existing staff	8
Use outside providers	7
Improved efficiency	7
Spent less time with patients	7

Source: ACC Membership Survey, 2002.

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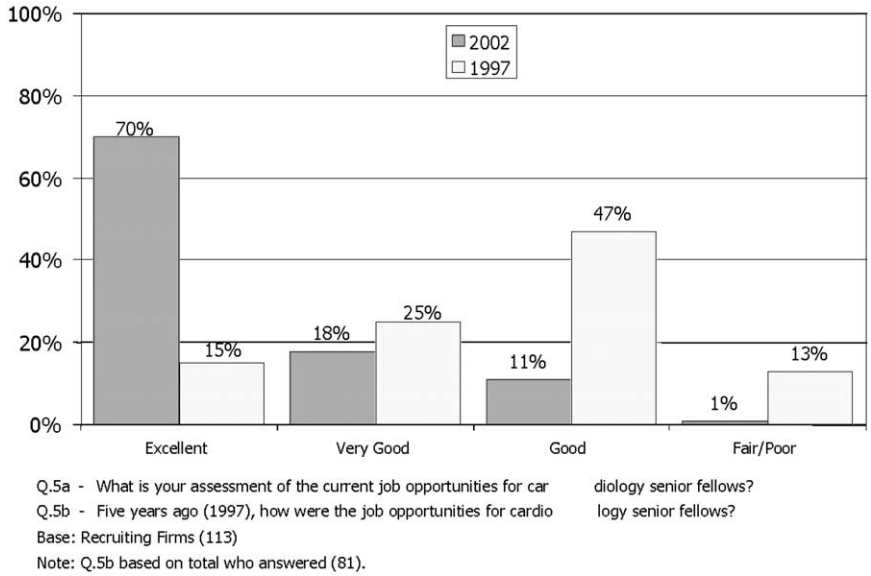

Figure 4. Assessment of current job market for cardiology senior fellows. Source: ACC Cardiology Workforce Study 2002.

questionnaires to assess the job market for cardiologists. A five-year time frame was chosen because long-term workforce predictions are notoriously inaccurate, and many ACC members, looking for help to manage their growing workloads, encouraged us to focus on the short-term. During the summer of 2002 surveys were sent to: 1) senior cardiology trainees, 2) cardiology training program directors, 3) recruiting firms, and 4) a sample of domestic ACC members. The responses revealed a high degree of concordance among the four groups with respect to perceptions of the current and projected five-year markets for cardiologists (58).

The ACC survey revealed that:

1. The supply of qualified candidates for existing cardiology training slots is adequate.
2. Training directors find it very easy (66%) or somewhat easy (29%) to fill their first-year cardiology training slots.
3. Recruiters believe the job market for trainees is excellent and has improved significantly in the past five years (Fig. 4).
4. Recruiters find it very difficult (76%) or somewhat difficult (21%) to fill cardiology positions (Fig. 5).
5. 83% of training program directors believe job opportunities for their senior cardiology fellows are excellent.

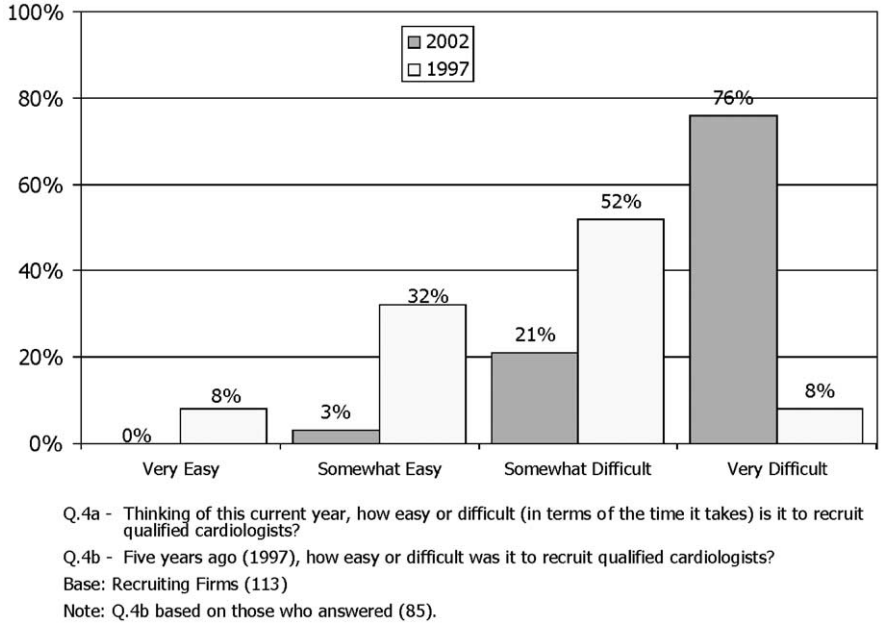

Figure 5. Ease or difficulty in recruiting qualified cardiologists (current vs. 1997). Source: ACC Cardiology Workforce Study, 2002.

Table 4. Trends in International Medical Graduate Cardiology Trainees

	International Medical Graduate (% of All Trainees)		
Year	General Cardiology Trainees (%)	Clinical Cardiac Electrophysiology (%)	Interventional Cardiology (%)
1996	36.6%	18.5%	NA
1997	40.0%	33.7%	NA
1998	42.0%	44.6%	NA
1999	41.2%	48.4%	39.7%
2000	38.6%	37.2%	55.8%
2001	36.7%	43.0%	49.1%
2002	32.9%	41.7%	42.1%

Source: Graduate Medical Education Issue, *JAMA* (1997–2003).

6. 77% of training program directors would expand their first-year slots by an average of 1.8 positions if funds were available to support these additional positions.
7. Senior trainees who had accepted positions were extremely satisfied (28%), very satisfied (42%), or somewhat satisfied (28%) with the opportunity. Only 2% were "not satisfied." The majority of their training directors agreed that job opportunities for them were excellent.
8. Senior trainees ranked "ultimate income potential" 8th among 18 factors that might influence their job search (see Working Group 7, Fig. 2 for more detail).

INTERNATIONAL MEDICAL GRADUATES

There is a long-term trend that fewer U.S.-trained medical students are becoming cardiologists. In 1970, 18% of cardiologists in the U.S. were international medical graduates (IMGs) (59). Between 1996 and 2002, the percentage of trainees in cardiology programs who were IMGs averaged about 40% (Table 4) (60). Not surprisingly, a similar trend has occurred in internal medicine residencies (61). For decades, IMGs have filled the gap between the number of U.S. medical graduates and first-year residency positions (23,62). But IMGs seeking U.S. training now face higher expectations with regard to clinical skills and language proficiency. They also face more restrictive immigration policies after the September 11 terrorist attacks (63). The steady supply of talented IMGs that the U.S. has depended on for decades to meet the demand for physicians is threatened by our nation's understandable concern about terrorism and the resulting new policies and procedures designed to reduce the threat. In this challenging context, there is renewed interest in expanding the capacity of U.S. medical schools to better align our nation's production of, and demand for, physicians (64,65).

WOMEN AND UNDERREPRESENTED MINORITIES

In contrast to the large number of IMGs entering cardiology, AAMC data reveal that African-Americans, Hispanics, and female graduates of U.S. medical schools are significantly underrepresented in cardiology training programs compared with the general population (66). The issue of underrepresented minorities in cardiology reflects a larger social phenomenon that is not unique to specialty medicine. Cohen et al. (67) concluded recently that, "the long-term solution to achieving adequate diversity in the health professions depends upon fundamental reforms of our country's pre-college education system." This observation does not justify inaction. The report of Working Group 3 includes several suggestions to help cardiology attract more underrepresented minorities. The task force also reaffirms the recommendations of the 25th Bethesda Conference with respect to providing care to underserved populations (68).

The dynamics of women choosing (or rather *not* choosing) careers in cardiology are different from the problem of attracting underrepresented minorities (69). In 2003, 49.7% of the new entrants to U.S. medical schools were female (70). Importantly, the percentage of female graduates has more than tripled in the past 30 years (71). The ACC task force is concerned that too few women choose cardiology as a career. The report of Working Group 2 contains a number of concepts we must embrace actively and actions we must take immediately if we hope to compete with other specialties for this growing pool of potential cardiologists.

One challenge we must confront if we hope to recruit more women to our specialty is cardiology's "macho" image. This is also an issue with male U.S. medical graduates. Reflecting larger social trends, medical graduates are making career choices based partly on perceptions of which specialties are more "family-friendly" or offer a more "controllable lifestyle" (72). Cardiology is perceived as very demanding in terms of hours worked and intensity. This impression is supported by AMA data showing that cardiologists report more hours of practice per week (60 h) than any other physician category (73). Cardiologists' workloads in some contexts have risen to levels that are not sustainable or desirable from a personal or a quality perspective. Today, U.S. trained medical students are very aware of the issue of work hours owing to recent American Council for Graduate Medical Education (ACGME) mandates (74,75). They also have access to published survey results that compare career satisfaction across specialties (76).

Many young doctors and physicians-in-training indicate that they hope to have a better balance between their professional and private lives than they perceive many practitioners do today (77). In a recent paper on dissatisfaction with medical practice, Zuger noted that, ". . . all [medical] students are now exposed to the breakneck pace, payment dilemmas, and paperwork of outpatient medicine. . . . The key to restoring a sense of contentment to the medical profession may lie in the hands of educators who encourage students to have more accurate expectations of a medical career than did the generations trained during the tumultuous past 50 years" (78). The inescapable conclusion is that patients' access to physicians will be affected by changing societal attitudes and professional expectations. If cardiology hopes to attract more U.S. medical graduates—especially women—we must respect this new social

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reality that demands a better balance between personal and professional time during training and throughout one's career. Changing societal work expectations will result in more cardiologists choosing to work part-time at certain stages of their careers. As Working Group 2 explains, we must encourage innovations such as job sharing, creative scheduling, and decreased "on-call" responsibilities so as to provide a more flexible and welcoming environment if we hope to compete with other specialties already perceived to offer these benefits. We must also expose potential cardiovascular specialists to the broad spectrum of activities that cardiologists undertake to prove that "family friendly" alternatives already exist within our specialty in many contexts.

INTERVENTIONAL CARDIOLOGISTS

Percutaneous transluminal coronary angioplasty (PTCA), invented by Andreas Grüntzig in 1977, changed cardiology in many profound ways (79). Within five years this innovative balloon-tipped catheter procedure designed to open narrowed or blocked coronary arteries had diffused to virtually every U.S. hospital with an open-heart surgery program. Between 1979 and 1985 the number of PTCAs performed in the U.S. skyrocketed from 2,000 to 82,000 (80). It is important to understand that this explosive growth of PTCA did not result from the gradual infusion into practice of new cardiologists who had completed formal 12-month interventional fellowships. Rather, it reflected the fact that during the early and mid-1980s, many of the nation's thousands of invasive cardiologists transformed themselves into interventionalists by attending brief demonstration courses or by being mentored by a local colleague who had already done so. In 1997, more than 6,534 physicians at 1,003 hospitals billed Medicare for percutaneous coronary interventions (PCIs) (81).

Based in part on concerns about the potential for suboptimal outcomes of PCIs performed by low-volume operators, the ACC's 1994 workforce statement encouraged a reduction in the number of interventional cardiologists trained. The Society for Cardiac Angiography and Interventions took a similar position (82). Meanwhile, during the 1990s, interventional training became much more rigorous (83,84). Today, many of the early first generation interventionalists have retired or stopped performing PCI. This trend will continue, and within a decade most of the interventionalists active before 1985 will no longer perform PCI. Meanwhile, procedural volumes continue to grow: 547,000 patients had a PCI procedure in 2000, a 260% increase since 1987 (18).

The ABIM introduced an examination for added qualification certification in interventional cardiology in 1999. Understandably, the number of cardiologists taking this test declined dramatically after the first year (Table 5). The requirements for admission to the exam became more stringent recently with the elimination of the so-called practice pathway after the 2003 exam. In a few years the number of candidates taking the test should reach a steady state that reflects the number completing ACGME-accredited interventional fellowships. As of March 2004, there were 114 ACGME-accredited programs in interventional cardiology and 229 positions were filled (85). Given today's strict program accreditation criteria and training requirements, the number of trainees passing the ABIM exam will likely fall from the 2003 number of first-time test takers (630) to fewer than 300 per year unless more positions are approved and funded.

Table 5. The ABIM Examination for an Added Qualification Certificate in Interventional Cardiology

	1999	2000	2001	2002	2003	Total
First-time test takers	2,526	871	551	570	630	5,148
First-time test takers certified	2,108	627	388	359	473	3,955
Total test takers certified	2,108	753	521	489	636	4,507

Source: American Board of Internal Medicine, www.abim.org/subspec/examdata.htm. Accessed January 31, 2004.

The demand for interventionalists continues to be stimulated by a series of procedural innovations, technological advances, and clinical trial results (86). For example, the proven benefit of PCI over thrombolytic therapy for acute myocardial infarction has led some to recommend that the procedure be offered in many more community hospitals (including those without open heart surgery programs) (87). Others have argued that a more efficient system of regional care be developed (88). If either approach were implemented fully, it would influence the demand for interventional cardiologists. Formal regionalization of specialized care has been advocated for decades, but market and other social forces have restricted the adoption of this model to a few fields such as trauma (89).

Clinical cardiac electrophysiology (EP) evolved much more gradually than PTCA. The introduction into practice of the implantable pacemaker (1960), the implantable defibrillator (1980), and catheter ablation (1982) catalyzed EP, but the market for these procedures was much smaller than for PTCA (90). The demand for electrophysiologists has increased recently, however, as clinical trial results and government reimbursement decisions greatly expanded the potential market for implantable devices (91,92). Like interventional cardiology, the current output of electrophysiologists is unlikely to meet this growing demand (Table 6).

Table 6. The ABIM Examination for an Added Qualification Certificate in Clinical Electrophysiology

	1999	2000	2001	2002	2003	Total
First-time test takers	69	69	64	89	88	379
First-time test takers certified	45	47	49	69	78	288
Total test takers certified	67	77	75	90	102	411

Source: American Board of Internal Medicine, www.abim.org/subspec/examdata.htm. Accessed January 31, 2004.

TEAM CARE FOR PATIENTS WITH CARDIOVASCULAR DISEASE

Considering the great and growing burden of cardiovascular disease in our aging population, it is important to distribute the work of preventing, diagnosing, and treating cardiovascular disease rationally. Berry et al. (93) articulated a pragmatic approach to help address the growing supply-demand mismatch that confronts several specialties and populations of patients: "Specialist physicians should do less of what generalist physicians can do, generalist physicians should do less of what non-physician providers can do, and non-physician providers should do less of what non-clinical staff can do. Each caregiver also should do less of what appropriately instructed patients and families can do for themselves." For this logical algorithm to succeed, however, each person in the continuum of care must be well trained, well informed, and have prompt access to professionals with more specialized knowledge and experience (94).

The ACC has consistently encouraged active collaboration among primary physicians and cardiologists in the care of patients with cardiovascular disease (95,96). Table 3 shows that ACC members are utilizing a team approach to respond to workforce demands. Although individual cardiologists may choose to provide some primary care services to their patients for various reasons, this practice continues to decrease in cardiology and other medical subspecialties (97). The ACC workforce survey revealed that current trainees want to practice cardiovascular medicine. They do not want to function as the primary care physician for patients with heart disease. In fact, senior trainees ranked the ability to practice pure cardiology as one of the most important factors they considered when choosing a job; this was deemed more important than starting income, ultimate income potential, frequency of being "on call," or vacation time.

Despite widespread agreement that general clinical cardiologists play a vital role in cardiovascular care, the survey shows that trainees continue to gravitate to procedural cardiology: 75% of respondents wanted to devote 50% or more of their effort to a cardiology subspecialty. Only 13% wanted to practice "mainly general cardiology," and only 3% wanted to practice 100% general cardiology. Data from the ABIM certification exams support this notion. Recently trained cardiologists want credentials to document their additional subspecialty training and experience. This reflects, in part, a trend that more hospitals and third-party payers are requiring formal recognition (by a specialty board or other certifying body) before they grant a physician specific privileges or reimburse him or her for performing specific procedures. In 2003 there were 710 first-time test takers for the general cardiovascular disease exam. The same year there were 630 first-time interventional test takers and 88 first-time EP test takers (98). Admittedly, the large number who took the interventional exam recently reflects the elimination of the popular "practice pathway" after 2003.

Table 7. ACGME-Accredited Cardiology Training Programs and Total Trainees (2003–2004)

	General Cardiology	Electrophysiology	Interventional
Approved programs	173	78	114
Approved positions	2288	173	269
Filled positions	2117	120	229

Source: Accreditation Council for Graduate Medical Education, Accreditation Data System. Accessed March 31, 2004.

Confronted with chronic workload-workforce mismatches, many private and academic cardiology practices have hired non-physician clinicians (e.g., nurse clinicians, clinical nurse practitioners, and physician assistants) to complement the care provided by cardiologists. In recent years both the number and the types of non-physician clinicians employed by doctors, clinics, and hospitals have increased dramatically (99). Many U.S. cardiologists already depend on these specialized healthcare professionals to help them document histories, perform tests and procedures, provide follow-up, and educate patients.

Team care—and many different models have been invented to address specific local needs—can enhance efficiency, increase patient satisfaction, improve physician morale, and lead to better outcomes (100). The ACC task force supports models of cardiologist-led teams of non-physician clinicians to help provide care to an expanding population of patients with known or suspected cardiovascular disease. Reflecting this philosophy, the ACC Board of Trustees approved a new membership category in 2003, the "Cardiac Care Associate." The board's historic action acknowledged the vital importance of the team concept as part of a strategy to improve access to high quality cardiovascular care. The biggest obstacle to expanding this team care model is that there is also a growing shortage of nurses (101–104).

INCREASING THE PRODUCTION OF CARDIOLOGISTS

The most obvious solution to the shortage of cardiologists is to increase the number trained. This will be difficult, however, because the output is strictly controlled by the ACGME and most academic medical centers are stressed financially. Moreover, the 1997 Balanced Budget Act froze the number of postgraduate medical education positions funded by Medicare to the number then in place. "This policy has effectively halted growth in residency positions," according to Kevin Grumbach, "since almost no hospitals and training programs have indicated a willingness to increase positions without receiving more Medicare GME dollars" (105,106).

Despite an adequate supply of qualified candidates (many of whom are IMGs), a significant number of unfilled training positions exist, especially in general cardiology and electrophysiology (Table 7). The ACC task force surveyed cardiology training program directors to better understand

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this finding. Of the factors that might contribute to unfilled positions (e.g, inadequate funding, faculty support, or clinical material), inadequate funding was cited most often. Working Group 1 identified several innovative approaches to help fund more training positions. One model, already used in a few locations, is that a private practice subsidizes an individual's cardiology and/or cardiology subspecialty training with the requirement that he or she join that group at the completion of their fellowship.

Considering the evident need to increase our nation's cardiology workforce (especially general clinical cardiologists) and to attract more U.S. medical graduates (especially women) to the specialty, the ACC task force concluded that the time and specific steps required to become a board-certified cardiovascular specialist should be reevaluated. The very long and highly structured course of postgraduate specialty and subspecialty training that evolved during the second half of the 20th century reflects the extraordinary explosion of knowledge, technology, and techniques that define our discipline (79). The training requirements mandated by the ACGME and ABIM are aligned and reflect, in large part, expectations developed by cardiology representatives responsible for a series of "Core Cardiology Training in Adult Cardiovascular Medicine" (COCATS) documents (107).

Today, a U.S. medical graduate whose career goal is to become a board-certified cardiologist must first complete a three-year general internal medicine residency and pass the ABIM general internal medicine exam (in addition to completing an ACGME-accredited cardiology fellowship). Some, perhaps many, outstanding medical students and residents choose not to become cardiologists because they do not want to delay the start of their "goal" specialty training three years after medical school graduation. Faced with a similar situation (and a critical shortage of applicants for their residency programs), the American Board of Thoracic Surgery recently made preliminary certification by the American Board of Surgery optional (108,109). Compelling reasons exist for cardiovascular specialists to learn a certain "core" of knowledge of general internal medicine, but the career path to cardiology must be cleared of unnecessary obstacles. Some ACGME and ABIM requirements implemented in recent decades do not reflect the realities of contemporary cardiology practice or the needs of the public. For example, all candidates for the ABIM general internal medicine examination (an obligatory stop on the career path to becoming a board-certified cardiologist) must document proficiency in paracentesis, arthrocentesis, and lumbar puncture, procedures totally irrelevant to cardiologists.

The growing cardiologist shortage 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 an opportunity to invent a 21st century version of the "short-track" approach ABIM experimented with in the 1970s. Working together, the ABIM, ACGME, COCATS, and ACC should invent a combined five-year program (e.g., two years of core internal medicine, one year of cardiovascular medicine, and two years of clinical cardiology). Depending on the trainee's career goals, the final three years of training could be customized and extended if he or she wants to become an interventionalist or an electrophysiologist. The report of WG 8 includes recommendations that would provide more training and certification options, alternatives that reflect the contemporary needs of our patients and profession (110). As pragmatic new training paradigms are developed and piloted, we should also make a greater effort to retain experienced cardiologists contemplating retirement (111).

ACADEMIC PROGRAMS

Our nation's academic medical centers, vital factories of new knowledge and physicians, face several significant obstacles as they consider whether and how to increase their output of cardiovascular specialists. Academic cardiologists share practitioner cardiologists' concerns 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" (112). This problematic situation was exacerbated by the recent ACGME mandate regarding the 80-h workweek limit for trainees.

Today, academic cardiologists are under growing pressure to generate income from clinical activities for their financially challenged institutions. As academics see their "protected" time for research decrease and their clinical duties increase, more will choose to enter private practice (113). If we hope to maintain the momentum of discovery, with its promise to reduce the cardiovascular disease burden, the U.S. must continue to invest heavily in academic medical centers and cardiovascular research. 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 more well-trained cardiologists who will devote themselves to prevention, early and accurate diagnosis, and cost-effective treatment. This Bethesda Conference report includes many specific recommendations to help achieve this important goal with its profound implications for the cardiovascular health of our nation and the world.

INTRODUCTION REFERENCES

1. Fye WB. Cardiology workforce: there's already a shortage, and it's getting worse! J Am Coll Cardiol 2002;39:2077–9.
2. Pepine CJ. President's page: counting heads, coming up short: the ratio of cardiologists to patients is becoming inadequate. J Am Coll Cardiol 2003;42:585–7.
3. Hurst JW. Will the nation need more cardiologists in the future than are being trained now? J Am Coll Cardiol 2003;41:1838–40.
4. Langdon LO, Cheitlin MD. Downsizing cardiology. Getting the process started. Circulation 1994;90:1101–2.
5. Beller GA, Vogel RA. Are we training too many cardiologists? Circulation 1997;96:372–8.
6. Rivo ML, Kindig DA. A report card on the physician work force in the United States. N Engl J Med 1996;334:892–6.

7. 25th Bethesda Conference: future personnel needs for cardiovascular health care. November 15–16, 1993. J Am Coll Cardiol 1994;24:275–328.
8. Ritchie JL, Cheitlin MD, Hlatky MA, Ryan TJ, Williams RG. Task Force 5: profile of the cardiovascular specialist: trends in needs and supply and implications for the future. J Am Coll Cardiol 1994;24: 313–21.
9. Gunnar RM, Williams RG. Excerpt from the 25th Bethesda Conference: future personnel needs for cardiovascular health care. November 15–16, 1993. J Am Coll Cardiol 1994;24:290–5.
10. King SB, III, Frye RL, Fuster V, Garson A, Jr., Gay WA, Jr., Popp RL. Task Force 2: academic health centers. J Am Coll Cardiol 1994;24:290–5.
11. Vetrovec GW, Gardin JM, Gregory JJ, et al. Adult cardiovascular physician resources and needs assessment. Report of the 1992 and 1993 American College of Cardiology Surveys on Physician Training and Resource Requirements. Physician Workforce Advisory Committee. J Am Coll Cardiol 1995;26:1125–32.
12. Ullyot DJ. President's page: work force issues in cardiology. J Am Coll Cardiol 1995;25:278–9.
13. Salsberg ES, Forte GJ. Trends in the physician workforce, 1980–2000. Health Aff (Millwood) 2002;21:165–73.
14. Lewis RP. President's page: too many cardiologists? J Am Coll Cardiol 1997;29:703–4.
15. Conti CR. Opportunities in cardiology. Clin Cardiol 2000;23:71–2.
16. The President's Commission on Heart Disease, Cancer and Stroke. Report to the President. Washington, DC: Government Printing Office, 1964;1.
17. Report of the Graduate Medical Education National Advisory Committee. September 1980. Washington, DC: United States Department of Health and Human Services. GMENAC Summary Report, 1981;1.
18. American Heart Association. Heart Disease and Stroke Statistics—2004 Update. American Heart Association. Available at: http://www.americanheart.org/presenter.jhtml?identifier=3018163. Accessed February 19, 2004.
19. Kereiakes DJ, Willerson JT. Metabolic syndrome epidemic. Circulation 2003;108:1552–3.
20. Steinwachs DM, Collins-Nakai RL, Cohn LH, Garson A, Jr., Wolk MJ. The future of cardiology: utilization and costs of care. J Am Coll Cardiol 2000;35:1092–9.
21. Foot DK, Lewis RP, Pearson TA, Beller GA. Demographics and cardiology, 1950–2050. J Am Coll Cardiol 2000;35:1067–81.
22. Cooper RA, Getzen TE, McKee HJ, Laud P. Economic and demographic trends signal an impending physician shortage. Health Aff (Millwood) 2002;21:140–54.
23. Reinhardt UE. Analyzing cause and effect in the U.S. physician workforce. Health Aff (Millwood) 2002;21:165–6.
24. Weiner JP. A shortage of physicians or a surplus of assumptions? Health Aff (Millwood) 2002;21:160–2.
25. Weiner JP. Forecasting the effects of health reform on U.S. physician workforce requirement. Evidence from HMO staffing patterns. JAMA 1994;272:222–30.
26. Cooper RA. Perspectives on the physician workforce to the year 2020. JAMA 1995;274:1534–43.
27. Council on Graduate Medical Education. Evaluation of Specialty Workforce Methodologies. Washington, DC: U.S. Department of Health and Human Services, 2000.
28. Barer M. New opportunities for old mistakes. Health Aff (Millwood) 2002;21:169–71.
29. Fye WB. Managed care and patients with cardiovascular disease. Circulation 1998;97:1895–6.
30. Fye WB. The power of clinical trials and guidelines, and the challenge of conflicts of interest. J Am Coll Cardiol 2003;41:1237–42.
31. Cooper RA. There's a shortage of specialists: is anyone listening? Acad Med 2002;77:761–6.
32. Trude S. So Much to Do, So Little Time: Physician Capacity Constraints, 1997–2001. HSC Tracking Report No. 8. Washington, DC: Center for Studying Health System Change, 2003.
33. Grumbach K. The ramifications of specialty-dominated medicine. Health Aff (Millwood) 2002;21:155–7.
34. Go AS, Rao RK, Dauterman KW, Massie BM. A systematic review of the effects of physician specialty on the treatment of coronary disease and heart failure in the United States. Am J Med 2000;108:216–26.
35. Jong P, Gong Y, Liu PP, Austin PC, Lee DS, Tu JV. Care and outcomes of patients newly hospitalized for heart failure in the community treated by cardiologists compared with other specialists. Circulation 2003;108:184–91.
36. Ahmed A, Allman RM, Kiefe CI, et al. Association of consultation between generalists and cardiologists with quality and outcomes of heart failure care. Am Heart J 2003;145:1086–93.
37. Ansari M, Alexander M, Tutar A, Bello D, Massie BM. Cardiology participation improves outcomes in patients with new-onset heart failure in the outpatient setting. J Am Coll Cardiol 2003;41:62–8.
38. Mark DB, Hlatky MA. Medical economics and the assessment of value in cardiovascular medicine: Part I. Circulation 2002;106:516–20.
39. Casale PN, Jones JL, Wolf FE, Pei Y, Eby LM. Patients treated by cardiologists have a lower in-hospital mortality for acute myocardial infarction. J Am Coll Cardiol 1998;32:885–9.
40. Indridason OS, Coffman CJ, Oddone EZ. Is specialty care associated with improved survival of patients with congestive heart failure? Am Heart J 2003;145:300–9.
41. Norcini JJ, Kimball HR, Lipner RS. Certification and specialization: do they matter in the outcome of acute myocardial infarction? Acad Med 2000;75:1193–8.
42. Angus DC, Kelley MA, Schmitz RJ, White A, Popovich J, Jr. Caring for the critically ill patient. Current and projected workforce requirements for care of the critically ill and patients with pulmonary disease: can we meet the requirements of an aging population? JAMA 2000;284:2762–70.
43. Rizza RA, Vigersky RA, Rodbard HW, et al. A model to determine workforce needs for endocrinologists in the United States until 2020. J Clin Endocrinol Metab 2003;88:1979–87.
44. Pogue VA, Norris KC, Dillard MG. Kidney disease physician workforce: where is the emerging pipeline? J Natl Med Assoc 2002;94:39S–44S.
45. Schubert A, Eckhout G, Cooperider T, Kuhel A. Evidence of a current and lasting national anesthesia personnel shortfall: scope and implications. Mayo Clin Proc 2001;76:995–1010.
46. Etzioni DA, Liu JH, Maggard MA, Ko CY. The aging population and its impact on the surgery workforce. Ann Surg 2003;238:170–7.
47. Kovner CT, Mezey M, Harrington C. Who cares for older adults? Workforce implications of an aging society. Health Aff (Millwood) 2002;21:78–89.
48. Snyderman R, Sheldon GF, Bischoff TA. Gauging supply and demand: the challenging quest to predict the future physician workforce. Health Aff (Millwood) 2002;21:167–8.
49. Federal advisory group predicts physician shortage looming. AMA News (November 3, 2003). Available at: http://www.ama-assn.org/amednews/2003/11/03/prsb1103.htm. Accessed January 31, 2004.
50. Cooper RA, Stoflet SJ, Wartman SA. Perceptions of medical school deans and state medical society executives about physician supply. JAMA 2003;290:2992–5.
51. Physician shortage predicted to spread. AMA News (January 5, 2004). Available at: http://www.ama-assn.org/amednews/2004/01/05/prl20105.htm. Accessed January 31, 2004.
52. Physician Workforce Study. Massachusetts Medical Society Online. Available at: www.massmed.org/pages/workforce03.asp. Accessed October 23, 2003.
53. Wennberg DE, Birkmeyer JD. The Dartmouth Atlas of Cardiovascular Health Care. Chicago, IL: AHA Press, 1999.
54. Reinhardt UE. Dreaming the American dream: once more around on physician workforce policy. Health Aff (Millwood) 2002;21:28–32.
55. Summary Report. 2003 Survey of Hospital Recruitment Trends. Merritt, Hawkins & Associates. Available at: http://www.merritthawkins.com/merritthawkins/pdf/2002_hospital_trends.pdf. Accessed January 31, 2004.
56. American College of Cardiology Practice Opportunity Line. American College of Cardiology. Available at: http://www.acc.org/home_links/jobopport.htm. Accessed February 13, 2004.
57. Ochsner Heart and Vascular Institute Advertisement. J Am Coll Cardiol 2002;32.
58. New ACC survey points to cardiologist shortage. Cardiology 2003; 32:1–4.
59. Mullan F, Politzer RM, Davis CH. Medical migration and the physician workforce. International medical graduates and American medicine. JAMA 1995;273:1521–7.
60. Graduate medical education. JAMA 2003;290:1234–8.

61. Steward DE. The internal medicine workforce, international medical graduates, and medical school departments of medicine. Am J Med 2003;115:80–4.
62. Iglehart JK. The quandary over graduates of foreign medical schools in the United States. N Engl J Med 1996;334:1679–83.
63. Whelan GP, Gary NE, Kostis J, Boulet JR, Hallock JA. The changing pool of international medical graduates seeking certification training in U.S. graduate medical education programs. JAMA 2002; 288:1079–84.
64. Physician Workforce. GAO-04-124. Washington, DC: GAO United States General Accounting Office, 2003.
65. Mullan F. The case for more U.S. medical students. N Engl J Med 2000;343:213–7.
66. Table 1. Women Applicants, Enrollees & Graduates—selected years 1949–1950 through 1988–1999. AAMC Section for Student Services. Available at: www.aamc.org. Accessed March 19, 2004.
67. Cohen JJ, Gabriel BA, Terrell C. The case for diversity in the health care workforce. Health Aff (Millwood) 2002;21:90–102.
68. Haywood LJ, Francis CK, Cregler LL, Freed MD, Skorton DJ. Task Force 1: the underserved. J Am Coll Cardiol 1994;24:282–90.
69. Fye WB. President's page: women cardiologists: why so few? J Am Coll Cardiol 2002;40:384–6.
70. Facts: applicants, matriculants and graduates. Association of American Medical Colleges. Available at: http://www.aamc.org/data/facts/2003/2003summary.htm. Accessed January 30, 2004.
71. Statistical Information Related to Medical Schools and Teaching Hospitals. Washington, DC: Association of American Medical Colleges, 2002:22.
72. Dorsey ER, Jarjoura D, Rutecki GW. Influence of controllable lifestyle on recent trends in specialty choice by U.S. medical students. JAMA 2003;290:1173–8.
73. Wassenaar JD, Thran S. Physician Socioeconomic Statistics. Chicago, IL: American Medical Association, 2003.
74. Philibert I, Friedmann P, Williams WT. New requirements for resident duty hours. JAMA 2002;288:1112–4.
75. Statement of Justification/Impact for the Final Approval of Common Standards Related to Resident Duty Hours. Accreditation Council for Graduate Medical Education (September 2003). Available at: www.acgme.org/DutyHours/ImpactStatement.pdf. Accessed November 17, 2003.
76. Leigh JP, Kravitz RL, Schembri M, Samuels SJ, Mobley S. Physician career satisfaction across specialties. Arch Intern Med 2002;162: 1577–84.
77. Generation gripe: Young doctors less dedicated, hardworking? AMA News (February 2, 2004). Available at: http://www.ama-assn.org/amednews/2004/02/02/prl20202.htm. Accessed January 31, 2004.
78. Zuger A. Dissatisfaction with medical practice. N Engl J Med 2004;350:69–75.
79. Fye WB. American Cardiology: The History of a Specialty and its College. Baltimore, MD: Johns Hopkins University Press, 1996.
80. Cardiovascular Specialists and the Economics of Medicine. Bethesda, MD: American College of Cardiology, 1994:64.
81. McGrath PD, Wennberg DE, Dickens JD, Jr., et al. Relation between operator and hospital volume and outcomes following percutaneous coronary interventions in the era of the coronary stent. JAMA 2000;284:3139–44.
82. Vetrovec GW. Right sizing interventional training: a statement by the society for cardiac angiography and interventions. Cathet Cardiovasc Diagn 1995;35:89–90.
83. Bottner RK, Feldman TE, Holmes DR, Cowley MJ, King SB. Who is an interventional cardiologist? Cathet Cardiovasc Diagn 1997;41: 120–3.
84. King SB, III. The development of interventional cardiology. J Am Coll Cardiol 1998;31:64B–88B.
85. List of ACGME Accredited Programs and Sponsoring Institutions. Accreditation Council for Graduate Medical Education. Available at: www.acgme.org/adspublic. Accessed November 17, 2003.
86. Feldman T. Interventional cardiology manpower needs: how many of us are there? How many should there be? How many will we need in the future? Cathet Cardiovasc Interv 2003;58:137–8.
87. Cannon CP. Primary percutaneous coronary intervention for all? JAMA 2002;287:1987–9.
88. Topol EJ, Kereiakes DJ. Regionalization of care for acute ischemic heart disease: a call for specialized centers. Circulation 2003;107: 1463–6.
89. Strickland SP. Regional Medical Programs: The Life and Death of a Small Initiative of the Great Society. Lanham, MD: University Press of America, 2000.
90. Jeffrey K. Machines in Our Hearts: The Cardiac Pacemaker, the Implantable Defibrillator, and American Health Care. Baltimore, MD: Johns Hopkins University Press, 2001.
91. Reynolds DW, Naccarelli GV, Wilber DJ. NASPE expert consensus statement: physician workforce in cardiac electrophysiology and pacing. NASPE task force, Washington, DC. Pacing Clin Electrophysiol 1998;21:1646–55.
92. Ezekowitz JA, Armstrong PW, McAlister FA. Implantable cardioverter defibrillators in primary and secondary prevention: a systematic review of randomized, controlled trials. Ann Intern Med 2003;138: 445–52.
93. Berry LL, Seiders K, Wilder SS. Innovations in access to care: a patient-centered approach. Ann Intern Med 2003;139:568–74.
94. Klocke FJ, Douglas PS, Nissen SE, Popp RL. The role of the American College of Cardiology in promoting and maintaining the delivery of quality cardiovascular care in the future. J Am Coll Cardiol 2000;35:99B–101B.
95. Goldstein S, Pearson TA, Colwill JM, Faxon DP, Fletcher RH, Moodie DS. Task Force 4: the relationship between cardiovascular specialists and generalists. J Am Coll Cardiol 1994;24:304–12.
96. Fye WB, Goldschlager NF, Messer JV, Rubenstein SA. 28th Bethesda Conference. Task Force 4: referral guidelines and the collaborative care of patients with cardiovascular disease. J Am Coll Cardiol 1997;29:1162–70.
97. Sox HC. Supply, demand, and the workforce of internal medicine. Am J Med 2001;110:745–9.
98. Certification Examination Data. American Board of Internal Medicine. Available at: www.abim.org/subspec/examdata.htm. Accessed January 31, 2004.
99. Cooper RA, Laud P, Dietrich CL. Current and projected workforce of nonphysician clinicians. JAMA 1998;280:788–94.
100. Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: National Academy Press, 2001.
101. Fleming KC, Evans JM, Chutka DS. Caregiver and clinician shortages in an aging nation. Mayo Clin Proc 2003;78:1026–40.
102. Buerhaus PI, Needleman J, Mattke S, Stewart M. Strengthening hospital nursing. Health Aff (Millwood) 2002;21:123–32.
103. Minnick AF. Retirement, the nursing workforce, and the year 2005. Nurs Outlook 2000;48:211–7.
104. Hooker RS, Berlin LE. Trends in the supply of physician assistants and nurse practitioners in the United States. Health Aff (Millwood) 2002;21:174–81.
105. Grumbach K. Fighting hand to hand over physician workforce policy. Health Aff (Millwood) 2002;21:13–27.
106. American Academy of Pediatrics. Financing graduate medical education to meet pediatric workforce needs. Pediatrics 2001;107:785–9.
107. Beller GA, Bonow RO, Fuster V, et al. ACC revised recommendations for training in adult cardiovascular medicine core cardiology training II (COCATS 2). American College of Cardiology Website. Available at: www.acc.org/clinical/training/cocats2.pdf. Accessed April 26, 2004 and October 25, 2003.
108. Shemin RJ, Dziuban SW, Kaiser LR, et al. Thoracic surgery workforce: snapshot at the end of the twentieth century and implications for the new millennium. Ann Thorac Surg 2002;73: 2014–32.
109. Bonchek LI, Harley DP, Wilbur RH, et al. The STS future planning conference for adult cardiac surgery. Ann Thorac Surg 2003;76:2156–66.
110. Fuster V, Nash IS. The generalist/cardiovascular specialist: a proposal for a new training track. Ann Intern Med 1997;127:630–4.
111. Pepine CJ. Rethink retirement: plan a second career in cardiology. J Am Coll Cardiol 2003;42:1316–7.
112. Hill JA, Kerber RE. Quo vadis? How should we train cardiologists at the turn of the century? Circulation 2000;102:932–6.
113. Fye WB. The origin of the full-time faculty system. Implications for clinical research. JAMA 1991;265:1555–62.

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WORKING GROUPS

Working Group 1: How to Increase the Output of Cardiologists

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OBJECTIVE/SCOPE

Working Group 1 was asked to evaluate ways to increase the number of cardiologists trained annually in the U.S. The working group considered several factors that influence the production of new cardiovascular specialists and evaluated various ways to increase the number of cardiology trainees. Throughout, we emphasized solutions that would increase the output of new cardiologists while preserving the high standards of U.S. training programs. We also considered how senior cardiologists might be encouraged to delay retirement, especially early retirement.

As discussed in the introduction to this Bethesda Conference report, compelling evidence points to a growing shortage of cardiovascular specialists to care for our aging U.S. population. This conclusion, reached by the participants in the Bethesda Conference, is very significant because before we encourage cardiology training programs to consider increasing the number of fellows they produce, we had to demonstrate significant unmet demand now and in the future for cardiovascular specialists. This is important, because just a decade ago cardiology division and training program directors, like everyone interested in health care delivery, were told the U.S. was producing too many specialists.

Most cardiology training program directors are acutely aware of the strong and growing demand for cardiologists because they receive inquiries from practitioner cardiologists and recruiting firms regularly. Moreover, the ACC Cardiology Workforce Study 2002 (hereafter the ACC workforce survey) demonstrated that cardiology training program directors perceived a dramatic increase in demand for their graduating fellows since 1997. In the ACC workforce survey 83% of program directors believed cardiology job opportunities for trainees were excellent whereas only 36% believed this was true in 1997 (Fig. 1) (1).

As we consider ways to increase the number of cardiology trainees, one important issue is whether the applicant pool is of sufficient size and quality to support adding more fellowship positions. The ACC workforce survey provides evidence that this is the case. Of the training directors, 61% believed they had many more qualified applicants than approved positions. This is in contrast to the situation in thoracic surgery, where the ratio of applicants to available training slots is almost 1 to 1 (2). When cardiology training program directors were asked how many additional fellows their institution could train annually (assuming adequate staff and other resources and Accreditation Council for Graduate Medical Education [ACGME]-approval), 77% of them thought they could add an average of 1.8 first-year positions.

If each of the nation's 173 cardiology training programs increased their first-year positions by 1.8 trainees, this could theoretically result in an additional 311 cardiologists completing training annually. This represents a 44% increase over the current output of approximately 706 cardiologists each year. This scenario is very unlikely, however, because a complex series of decisions would be required at the local institutional and federal levels to operationalize such an ambitious growth plan. The two major rate-limiting steps for many institutions are 1) obtaining approval from the ACGME to increase the number of cardiology training positions and 2) finding funds to support additional positions.

The ACGME is a private professional organization that accredits approximately 7,800 residency training programs in 110 specialty and subspecialty fields of medicine. The accreditation process is carried out by ACGME's 27 Residency Review Committees (RRC). These committees write the ACGME specialty-specific requirements and periodically review each program to assure its compliance with their standards. The Internal Medicine RRC is responsible both for general internal medicine residencies and for all internal medicine subspecialties, including cardiovascular disease. The Internal Medicine RRC includes five representatives each from the American Board of Internal Medicine (ABIM), the American College of Physicians (ACP), and the Committee on Medical Education of the American Medical Association. In addition, the Internal Medicine RRC includes one resident physician representative.

The RRC, as part of the accreditation process, must approve the number of training positions for each program. Its decisions are not influenced directly by perceived workforce shortages or surpluses. The number of approved training positions is determined by a program's educational resources (e.g., number of patients, procedural volumes, and faculty commitment). Many cardiology programs have the educational resources to accommodate more trainees. Be-

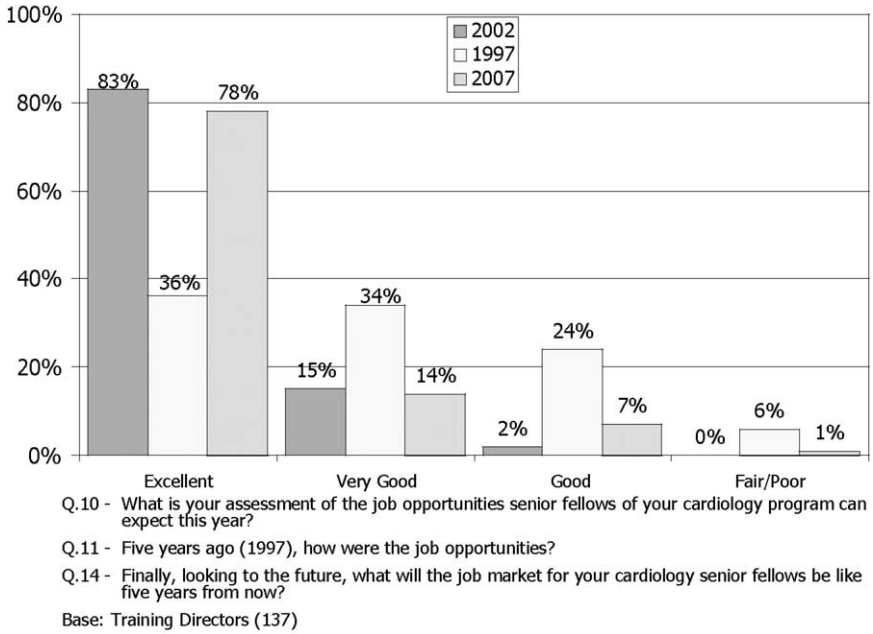

Figure 1. Job opportunities for senior fellows now, five years ago (1997), and in the future (training directors). Source: ACC Cardiology Workforce Study, 2002.

fore an application to expand the number of cardiology trainees can be forwarded to the RRC, however, it must be approved by the training director of the parent internal medicine residency program. It is also important to have the support from the chair of the internal medicine department. Unfortunately, even with RRC approval, many institutions do not have the funds to expand their cardiology training programs.

Fellowship funding is one of the most important factors that will determine how many more trainees can be accommodated in our nation's cardiology fellowship programs. For several decades graduate medical education (GME) in the U.S. has been funded mainly by two types of government payments made to teaching hospitals as part of the Medicare reimbursement system. These federal funds help support the training of internal medicine residents, cardiology fellows, and trainees in other approved medical and surgical specialties and subspecialties. They consist of direct medical education (DME) payments and indirect graduate medical education (IME) payments.

The DME payments are provided to help cover the direct costs of post-medical school education and training of physicians, such as salaries, benefits, supervisory faculty, and hospital overhead expenses related directly to the training program. The IME payments are meant to compensate teaching hospitals for costs they incur as a result of their training programs. This acknowledges that teaching hospitals are often referral centers or inner-city institutions that provide care to patients with complicated health conditions or who are poor and uninsured. Although Medicare DME and IME payments to teaching hospitals represent the major source of training program funding, states also provide funds through Medicaid reimbursement or other mechanisms.

According to the Council on Graduate Medical Education (COGME) Medicare spent $6.8 billion for GME in 1997, the year that Congress passed the Balanced Budget Act (BBA) of 1997. This law restricted the growth of GME (including internal medicine residencies and cardiology training programs). The BBA also placed a cap on the number of residents enrolled in hospital programs and reduced payment adjustment factors for IME. Meanwhile, it is important to note that the payments for clinical fellows (such as cardiology trainees) are only one-half that of an internal medicine resident. The average cost per cardiology trainee is in the range of $70,000 to $100,000 per year (3). It has been estimated that additional indirect costs related to increased overhead costs incurred as the result of a training program can increase the total cost per fellow to nearly $180,000 (4). Although some positive changes in the IME payment system have occurred since the BBA of 1997, there appears to be little support for increasing overall Medicare expenditures for GME significantly. A sustained advocacy effort will be necessary to accomplish this goal.

ACADEMIC WORK LOAD

One of the factors driving the demand for additional practitioner cardiologists in the U.S. is the increasing volume and complexity of care provided by cardiovascular specialists in private practice. Academic cardiologists, the individuals most responsible for training cardiology fellows, are also working harder providing more clinical care in most teaching institutions (5). This situation (which can compete with the academic mission of education and research) was further aggravated when strict ACGME work hour and on-call guidelines for residents and fellows were implemented

on July 1, 2003. Ironically, these new rules shifted additional clinical responsibilities to cardiology full-time faculty members at a time most of their institutions are prohibited from hiring additional internal medicine residents or cardiology trainees because of the ACGME–RRC caps on training positions. The various philosophical and pragmatic arguments that have been advanced in support of and against these rigid work hour restrictions are beyond the scope of this document. The 80-h workweek and related regulations may encourage some academic cardiology divisions to ask their institutions to hire more non-physician clinicians (e.g., nurse clinicians, nurse practitioners, and physician assistants) to help blunt the impact on the full-time faculty. Team care in cardiology is the focus of Working Group 5 and will not be discussed here.

As cardiology workloads increase, care becomes more complex, and the workforce does not grow to meet demand, it is important to remain focused on three factors: 1) the quality of care provided to patients with cardiovascular disease, 2) the quality of education provided to the trainees who will join the ranks of academic and practitioner cardiologists upon the completion of their fellowships, and 3) the importance of work–life balance for trainees and cardiologists throughout their careers. Moreover, as modifications of the traditional cardiology training program are considered, the trainees' experience must focus on education and the Core Cardiology Training Symposium (COCATS) curriculum rather than the service needs of the hospital, faculty or practice plan to which the training program is attached (6,7).

As each of America's academic medical centers discusses and decides how to respond to the growing national shortage of cardiovascular specialists, they will surely consider the impact their decisions may have on their own institution's cardiology programs. It is important to recognize that one component of the financial health of teaching institutions relates to their ability to compete in the marketplace for cardiology patients and procedures. For decades academic cardiology programs have, in fact, trained their competition. This is one of the ironies of the academic mission of teaching institutions. Another way to look at this dilemma, however, is to see it as an opportunity for enhanced cooperation between academic medical centers and private physicians and groups seeking cost-effective and resource-efficient ways to care for the increasing burden of cardiovascular disease. Moreover, academic cardiology programs function best when they have an adequate number of cardiovascular specialists with sufficient time to pursue their interests in research and education.

FUNDING ADDITIONAL CARDIOLOGY TRAINING POSITIONS

Today, many U.S. teaching hospitals are confronting significant fiscal challenges. The Association of Professors of Cardiology (APC) estimates that approximately 100 major teaching hospitals are stressed financially (8). Very few institutions are in a position to internally fund the additional cardiology training positions necessary to meet the growing demand for cardiovascular specialists. As noted earlier, most GME funding in the U.S. comes from the federal government, a situation that reflects the high value our nation and its policymakers place on training physicians to care for our population. The Medicare GME funding model has succeeded in helping academic centers produce our nation's superb physician workforce. It is therefore appropriate to advocate for extension of federal funding to cover the entire period of postgraduate training, including the time devoted to cardiology fellowship training.

The current federal GME reimbursement policy provides support to hospitals for postgraduate training only up to the time of the first board certification. This is a major disincentive for hospitals to consider expanding subspecialty training positions such as cardiology fellowships. Deans, chairs of medical departments, and other academics in positions of influence must be informed about the growing shortage of cardiologists and its important implications. Fortunately, a majority of deans already perceive a shortage of some specialists (including cardiologists) and recognize that this can have a negative effect not only on the academic mission of teaching institutions but also on the care of patients (9).

Because changing federal policies dealing with GME funding will take time and effort, deans should be encouraged, wherever possible, to use discretionary dollars to fund an increased number of cardiology training positions in their institutions. This approach may be most appropriate in locales where there is a perceived shortage of cardiovascular specialists in the area or on the faculty. Some state governments may be willing to help fund cardiology training positions if there is a demonstrated shortage of cardiologists in their area. Another possibility is that states could reimburse a cardiology trainee's medical school loans in return for a commitment to provide cardiology services for a specified period of time to patients in an underserved area.

Given the growing need for general clinical cardiologists and certain types of cardiology subspecialists such as electrophysiologists, the ACC should explore with medical industry various models that would expand their sponsorship of cardiology fellowships from research positions to selected clinical training positions. One approach might be to use the "matching grant" model, i.e., one-half of the funds for a new cardiology training position would come from a teaching hospital's discretionary funds and the other one-half would come from industry. Philanthropic organizations and grateful patients could also be approached to support the cost of training one or more additional fellows each year in the way that some full-time faculty positions are supported by the "named chair" model. The other potential source of funding for cardiology training positions is third-party payers. As discussed in the introduction to this report, there is compelling evidence that patients with a variety of cardiac disorders have better outcomes if they receive some of their care from a cardiovascular specialist.

Most of the demand for cardiovascular specialists is in the private practice setting. This fact suggests that more atten-

tion should be paid to a funding model (already used in some settings) that addresses the concerns of both the academic institution and the private practice. The most popular cardiology practice model in the U.S. is the single-specialty group. Some private groups may consider it a wise investment to subsidize a cardiology fellow's training in exchange for a commitment to join the practice at the completion of his or her fellowship. It must be acknowledged, however, that a series of significant reductions in reimbursement for cardiology services in recent years makes this model more problematic.

Another possible solution would be to have academic medical centers partner with private practice groups in their community in order to use local facilities and faculty more effectively. This may be particularly applicable to subspecialty training in interventional cardiology and clinical cardiac electrophysiology (EP). One scenario would have the academic medical center be responsible for recruiting the cardiology trainees and for ensuring that all ACGME requirements for training are met. Some portion of the clinical training, however, would be performed at private or affiliated hospitals that have adequate educational resources (e.g., number of patients, procedural volumes, and faculty commitment). Although local affiliated hospitals are now used for adjunctive training in some programs, this concept could be expanded to include hospitals that are further from the sponsoring academic medical center.

Currently, the ACGME requires that a teaching institution must have an approved general cardiology training program before it can apply to offer a subspecialty fellowship in either interventional cardiology or EP. The model we propose would permit selected private hospitals to train interventionalists and electrophysiologists in partnership with an academic medical center without developing a separate general cardiology training program of their own. The financial support for such a program would come from the private hospital (or perhaps partly from a private practice group). These monies could also help support the cardiology training program at the sponsoring academic medical center. In this way, the total number of trainees could be expanded, and both the academic medical center and the private facility would benefit. This arrangement would also have the advantage of providing cardiology trainees with additional exposure to private practice. Many private cardiology groups provide patients for clinical trials and other research endeavors. Patients would also likely benefit from a closer linking of private and academic cardiology practice.

This affiliated institution concept is not new, and many cardiology training programs already use it to some degree. It would be helpful, as academic institutions evaluate their options with respect to increasing the size of their training programs, to have outlines and narrative summaries describing joint programs that have been successful in accomplishing the goal of training excellent general clinical cardiologists using a combination of academic and community hospitals. Rather than large blocks of time, as suggested above for interventional or EP training, focused rotations at the private facility could be an integral part of the general cardiovascular program. The funding for the fellow's time would be provided by the private facility and would be used to help fund the fellowship program in general, creating an advantage for both.

For decades the part-time medical faculty played a major role in helping to train cardiologists in many institutions (and still do in several settings). There is now an opportunity to reinvigorate this model and employ it in both outpatient and inpatient care. By partnering with the private practice community, the academic institution's cardiology trainees would benefit from a broader experience in varied settings. Moreover, many practicing cardiologists would welcome the intellectual stimulation of helping to train general clinical cardiologists. The importance of producing a larger number of general clinical cardiologists is discussed by Working Group 8.

INCREASING THE NUMBER AND SCOPE OF CARDIOVASCULAR TRAINING PROGRAMS

Although this working group agrees that, in general, it is preferable to increase the size of current ACGME-approved cardiology training programs rather than create new ones, there may be some circumstances that justify establishing a new program or reactivating one that was discontinued during the 1990s, when it seemed the U.S. was training too many specialists. For example, if a cardiology training program was discontinued mainly because it could not provide an adequate research experience, a formal arrangement could be developed with an affiliated academic institution. The trainee could participate in research at one institution and receive the majority of his or her clinical training at another institution.

As we reexamined the length and content of the current internal medicine residency and cardiology training, this working group concluded that a new "short track" should be developed. Our conclusions and recommendations regarding this important subject were incorporated into the report of Working Group 8, because this was the focus of its effort. Furthermore, as discussed by that working group, it may not be necessary for every cardiology trainee to have dedicated research time as part of their fellowship if their career goal is to practice general clinical cardiology.

We believe the ACGME, ABIM, and ACC should consider endorsing two separate tracks for cardiovascular training that acknowledge the fact that many trainees choose to use "research" time to gain additional clinical experience that will prepare them for practice or additional subspecialty training. One cardiology training track would be entirely clinical. The other track would include an additional year devoted to research. This would allow those institutions interested in developing a clinical cardiology training program but are unable to provide an adequate research experience to focus on training general clinical cardiologists—the type of cardiovascular specialist in

greatest demand. Meanwhile, teaching institutions should be allowed greater flexibility in the sequencing of the clinical and research years in the case of individuals interested in academic careers that focus on clinical investigation or clinical practice combined with basic cardiovascular research. Currently the ACGME requires that general cardiology fellowship training be completed in three years. This eliminates the option of "sandwiching" two years of research experience between the two clinical years of clinical training.

PROGRAMS TO TRANSFORM GENERAL INTERNISTS INTO CARDIOVASCULAR SPECIALISTS AND TO RETAIN SENIOR CARDIOLOGISTS IN PRACTICE

The professional goals of physicians continue to evolve after they complete their formal training. The demographics of the U.S. population and of physicians dictate that much of the ongoing care of patients with cardiovascular disease is provided by general internists and family physicians. Some experienced internists may want to get additional formal training (beyond attending continuing medical education courses) to better equip themselves to care for cardiac patients. Importantly, some of these practicing internists might want to devote the necessary time and energy to become fully trained, board-certified cardiologists. Those seeking this formal additional training should be encouraged to apply to cardiology training programs.

Our working group also encourages the ACGME and other pertinent organizations to explore models that would allow selected generalist internists to fulfill the requirements for board eligibility in cardiovascular diseases on a part-time basis over a longer time frame. For example, one model might allow an internist to devote half-time to their cardiology training while continuing to practice internal medicine half-time. This approach would be easier to implement if two internists shared each role in one institutional or practice setting. This type of approach might also be applied in select circumstances where a board-certified general clinical cardiologist wants to receive formal training in interventional cardiology or EP. Our goal is not to elaborate specific models. Rather, we hope to stimulate innovation and experimentation with respect to the current rigid approach regarding training cardiovascular specialists.

Much of this Working Group's report focuses on how to increase the production of newly trained cardiologists. There is another complementary approach that may help to reduce the growing gap between the demand for and the supply of cardiovascular specialists: encouraging cardiologists not to retire early or to consider part-time work as an alternative to total retirement. Several factors contribute to an individual's decision to retire from medical practice. In some instances the catalyst for retirement is the desire to go "off-call" or to work part-time, but the cardiologist's institution or group does not allow this degree of flexibility. We agree with Working Group 2 (which focuses on how to encourage more women to choose a career in cardiology) that greater flexibility in work hours and work patterns is necessary as we confront changing societal expectations with respect to work–life balance in the early 21st century.

Cardiologists are familiar with the physiological concept known eponymically as the "Bowditch all-or-none law of cardiac contraction." If we hope to optimize and energize our nation's cardiology workforce we must not have a similar "all-or-none" philosophy when it comes to linking specific responsibilities such as "call" to the ability to remain in practice (either academic or private). Senior cardiologists considering retirement might be encouraged to remain in practice (at least part-time) if their duties were confined to outpatient practice, ECG interpretation, or other scheduled responsibilities.

RECOMMENDATIONS

1. In concert with the APC and other entities, the ACC should advocate to the ACGME and its Internal Medicine RRC for an increase in the number of approved cardiology training positions.
2. Identify additional public and private sources of funding to support an increase in the number of cardiology trainees.
3. Identify and publicize models where academic institutions have partnered with private cardiology groups to enhance the training process.
4. Identify and publicize models that have been successful in encouraging cardiologists to defer retirement.

WORKING GROUP 1 REFERENCES

1. Beller GA, Alexander J, Baughman KL, Gardin JM, Limacher MC, Moodie DS. The ACC training outcomes survey of recently trained cardiology fellows. J Am Coll Cardiol 2000;35:808–14.
2. Shemin RJ, Dziuban SW, Kaiser LR, et al. Thoracic surgery workforce: snapshot at the end of the twentieth century and implications for the new millennium. Ann Thorac Surg 2002;73:2014–32.
3. Franzini L, Chen SC, McGhie AI, Low MD. Assessing the cost of a cardiology residency program with a cost construction model. Am Heart J 1999;138:414–21.
4. Graduate Medical Education Primer. American Medical Student Association. Available at: http://www.amsa.org/hp/gmeprimer.cfm. Accessed February 1, 2004.
5. Vetrovec GW, Gardin JM, Gregory JJ, et al. Adult cardiovascular physician resources and needs assessment. Report of the 1992 and 1993 American College of Cardiology Surveys on Physician Training and Resource Requirements. Physician Workforce Advisory Committee. J Am Coll Cardiol 1995;26:1125–32.
6. Beller GA, Bonow RO, Fuster V. ACC revised recommendations for training in adult cardiovascular medicine. Core Cardiology Training II (COCATS 2). (revision of the 1995 COCATS training statement.). J Am Coll Cardiol 2002;39:1242–6.
7. COCATS Guidelines. Guidelines for Training in Adult Cardiovascular Medicine, Core Cardiology Training Symposium. June 27–28, 1994. American College of Cardiology. J Am Coll Cardiol 1995;25:1–34.
8. The Crisis. Association of Professors of Cardiology. Available at: http://www.cardiologyprofessors.org/The_Crisis. Accessed January 19, 2003.
9. Cooper RA, Stoflet SJ, Wartman SA. Perceptions of medical school deans and state medical society executives about physician supply. JAMA 2003;290:2992–5.

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Working Group 2: How to Encourage More Women to Choose a Career in Cardiology

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INTRODUCTION

In 2003, 50.8% of applicants and 49.7% of matriculants of U.S. medical schools were women (1). This was the first time in our nation's history that women made up more than half of medical school applicants (2). Currently, 22.2% of female medical graduates choose an internal medicine residency. Although this number is high, only 6.3% of women trainees chose to enter an internal medicine subspeciality (3). In 2003, approximately 14% of American College of Cardiology (ACC) fellows-in-training were women (431 women, 2483 men, 273 unknown) (ACC data), and 6% of the total number of fellows of the ACC are women (4). According to data from the American Board of Internal Medicine (ABIM), the percentage of first-year cardiology trainees who are females has increased from 13% in 1994 to 1995 to 18% in 2002 to 2003, the most recently reported data for cardiology training programs (5). However, considering that nearly one-half of U.S. medical students are now female, the fact that only 18% of first-year cardiology trainees are women is cause for concern.

Women bring a different skill-set to the workplace, and the lingering shortfall of females in cardiology is striking compared with other sciences where the number of women is increasing more rapidly (6). It is interesting to note that a higher proportion of female pediatric residents choose cardiology than do female internal medicine residents. Today, cardiology training programs are facing additional challenges because international medical graduates (IMGs), some of whom are women, are confronting new barriers when they attempt to continue their medical training in the U.S. Working Group 4 deals with the important topic of IMGs in cardiology.

A 1998 report of the ACC Committee on Women in Cardiology included data derived from a questionnaire that was mailed in March 1996 to all 964 female ACC members and an age-matched sample of 1,119 male members who had completed training (7). That report is rich in detail and includes important conclusions and valuable suggestions. Our working group report combines some of its findings with data and impressions from other sources. Moreover, several of our observations relate to medicine as a whole, not just cardiology. The 1996 ACC survey found that family responsibilities may represent an obstacle for women considering a career in cardiology because it is not perceived as being as "family friendly" as are some other specialties.

Although significant societal changes have occurred in parenting, these have yet to be integrated into the medical community. Women, more than men, perceive that family responsibilities hinder their ability to pursue a professional career in medicine. Women are also more likely than men to interrupt their training or their practice for more than a month, usually related to pregnancy or childcare. Even if a woman physician works full time, in most instances she is likely to provide more childcare than her husband. Moreover, the implications for childbearing of six to seven years of postgraduate medical training (internal medicine plus cardiology fellowship) cannot be ignored as we consider how to attract more women into cardiology. After her training is completed, family responsibilities often limit a female physician's ability to travel to attend continuing medical education or other professional advancement programs and to serve on regional or national committees of organizations such as the ACC or the American Heart Association (AHA).

The 1996 survey compared the female and male respondent's primary practice setting and type of cardiology practice. Female cardiologists were more likely than males to define their primary or secondary role as a clinical cardiologist, echocardiographer, transplant cardiologist, or researcher. This finding has important implications with respect to the chronic unmet demand for general clinical cardiologists. These choices with respect to what type of cardiology practice women seem to prefer relate, at least in part, to the perception that some cardiology subspecialties (e.g., interventional cardiology) allow less flexibility with respect to on-call duties that, in turn, have important implications for parenting and for what has been termed a "controllable lifestyle." The emphasis placed on acute cardiac care and emergency interventional procedures that both medical students and internal medicine residents witness during training surely reinforces this impression (8).

It is imperative that female medical students and internal medical residents become better informed about the broad spectrum of career opportunities in cardiology, several of which are compatible with a desire to achieve better work–life balance. We, as a specialty, must assume the responsibility for educating potential cardiologists about these career options. Working Group 8 discusses several types of cardiology practice and proposes a model for training more general clinical cardiologists, for whom the demand is great and growing. This role might hold special appeal for women cardiologists because much of the care provided by general clinical cardiologists is in the outpatient setting.

In terms of job satisfaction, the 1996 ACC survey revealed that 88% of women (versus 92% of men) were moderately or very satisfied with their work. The levels of satisfaction among women were similar in academic and private practice settings. This finding should be reassuring to female medical students or internal medicine residents considering a career in cardiology. Importantly, a majority of both female (54%) and male (61%) respondents reported that they were likely to recommend cardiology as a career choice to those who asked their opinion. A minority of cardiologists (20% of the female and 15% of the male respondents) would discourage students or residents from pursuing a career in cardiology. It is likely that job satisfaction will increase for all cardiologists if their workload is reasonable and they have more control over their personal work–life balance.

One area where women cardiologists were significantly less satisfied than their male counterparts was with respect to career advancement, especially those in academic medicine. The 1996 survey revealed that 39% of women in academic medicine reported achieving lower or much lower levels of advancement compared with only 3% of men (7). In terms of discrimination in the workplace, 71% of women compared with 21% of men felt they had experienced some form of discrimination, and they believed that it affected their interactions with colleagues. The predominant type of discrimination was gender-related for women and race-related for men.

These concerns are not unique to cardiology—they reflect the experience of women in other professional fields. Nevertheless, our working group wants to emphasize that perceptions (negative or positive) can have a very significant effect on female medical students contemplating a career in cardiology. Importantly, we hope our efforts (and those of other working groups) will encourage positive changes in the cardiology training and work environments that will make our specialty more attractive to women medical students and internal medicine residents.

In addition to the valuable insights provided by the 1996 ACC survey our working group reviewed several other sources of information including perspectives gained from focus groups with female medical students, residents, and trainees (9). One recurring theme is the vital role that mentors play in recruiting and retaining women in cardiology training programs. Women should have effective mentors at all levels of training (i.e., as premedical students, medical students, internal medicine residents, cardiology trainees, and beyond). It is important to note that male cardiologists can also be effective mentors of female students, residents, and fellows. Indeed, they *must* share this responsibility with their female colleagues if we hope to attract more women to our specialty.

Because the number of female physicians in most academic institutions is still small, women are often asked to participate in committee and other administrative responsibilities. Mentors should encourage women to choose carefully with respect to which, if any, of these duties they accept because they have the potential to take time away from academic pursuits that may be more important in career advancement. These are personal choices, however, that will reflect the professional interests and ambitions of the individual cardiologist.

There are certain critical steps in the process of choosing a specific career path in medicine. Personal interviews are usually part of each successive step in selecting an institution and, ultimately, a career and a job. Ideally, female applicants to medical school, residency, and fellowship positions should have the opportunity to meet with women in the position they are considering. In terms of our focus, female medical students or internal medicine residents considering a career in cardiology should have the opportunity to meet with female trainees and faculty members.

It would be useful to have a standard set of questions women could ask when they apply to different cardiology programs. These could include questions about the number of women in the program, mentoring practices, and maternity policies. Correspondingly, each cardiology program should be encouraged to develop a set of answers for all applicants, both men and women, to emphasize that lifestyle issues are not gender-specific. This exercise might also point out opportunities for cardiology training programs to enhance the approaches they use to support their trainees (and faculty members), most of whom are trying to balance professional and personal responsibilities. It is important for the training program director or his or her representative to outline their institution's policies with respect to family leave and other matters that relate to work–life balance. Positive feedback from current female residents and trainees has a powerful impact on the recruitment process, because interviewees usually value resident and fellow satisfaction highly when considering a training program.

Although some useful evidence about factors that women consider as they choose careers in medicine is available, this working group believes that a more detailed survey should be conducted of female medical students, internal medicine residents, and cardiology trainees to determine more precisely the factors that influenced (or are influencing) their career choices. The perceived challenges and obstacles to following a cardiology path may then be addressed more effectively.

Recruitment and visibility. The option of cardiology as a career choice needs to be actively demonstrated to high school and college students, with an emphasis on increasing the visibility of female cardiologists. Similarly, female medical students and internal medicine trainees need to be exposed to the possibility of cardiology as a subspecialty choice early in their training. Because the majority of cardiology trainees choose to enter private practice rather than stay in academic medicine, the broad spectrum of private practice options needs to be underscored. Specific steps should be taken to enhance the visibility and impact of female cardiologists in private practice, in academic medicine, and in regional and national organizations.

Various approaches exist to encourage women to consider a career in cardiology that can take place at the local, regional, or institutional level. We must identify cardiology

training programs that have been especially successful at recruiting and graduating female trainees and recruiting, retaining, and promoting female faculty members. The training program director and/or division director (as well as the female trainees) of these institutions should be encouraged to share their perspectives on what specific steps they have taken to increase the number of women in their cardiology programs. This subject would be worthy of a panel discussion at national meetings of the cardiology training program directors. The goal would be to share information on best practices and to learn from programs that have demonstrated success in attracting a diverse faculty. This approach could also be used to attract underrepresented minorities, as discussed by Working Group 3.

There is a need to increase the visibility of female cardiologists in order to attract more women to our specialty. All cardiology divisions and departments of medicine should make an effort to enhance the visibility of female cardiologists that are either full-time or part-time members of the staff or trainees. The state or regional chapters of the ACC can also play a role in increasing the visibility of female cardiologists as potential role models by coordinating presentations at local high schools or colleges during "career day" events.

With respect to medical students and internal medicine residents, it is especially important to inform them of the broad range of career options available *within* cardiology. Women cardiologists are active in each of the various "types" of cardiology practice described in detail by Working Group 8. This would demonstrate to medical students and residents that there are many viable career tracks available in cardiology today. Another opportunity to reach out to potential cardiologists would be to encourage women cardiologists to participate in regional and national meetings of the American College of Physicians (ACP). The ACC could provide opportunities for actual or "virtual" mentoring for female housestaff and trainees. This could be done by enhancing the Women in Cardiology portion of the ACC website (http://www.acc.org). We propose piloting a project that links electronically an experienced (and willing) female faculty member with one or more female medical students, residents, or trainees at institutions that do not have enough local mentors.

Female cardiologists interested in participating actively in cardiology organizations such as the ACC, the AHA, and/or one of cardiology's specialty societies should be encouraged to make their interest known to officers or other leaders of those organizations. Depending on her interests she might be invited to be a speaker or moderator at educational sessions, to participate in or chair committees and working groups, or to serve on governing bodies or other leadership groups. Obviously, each of these activities (at the local, regional, and national level) takes time, and the number of female cardiologists in the U.S. today is limited. Most female cardiologists are already busy both professionally and outside the workplace. This presents a challenge in terms of encouraging women cardiologists to take on additional work. Women willing and able to devote energy to mentoring or to educating others about careers in cardiology are making an investment in the future of cardiology that will benefit cardiovascular specialists and patients with cardiovascular disease.

We conclude our report with a list of other efforts the ACC (and/or its chapters) could launch or coordinate:

1. Through its chapters, the ACC could develop a high school scholarship program using female cardiologists as faculty. A series of 1-h lectures could be given on three or four consecutive weekends about various aspects of the heart in health and disease followed by an examination. Pupils with the best scores could receive scholarship money to help pay for their college education. This plan has some synergy with an approach used for underrepresented minorities and serves to highlight potential career opportunities that might not otherwise be considered by some high school students.
2. The ACC could develop and distribute a set of slides to be used by faculty members willing to participate in "mini-med school" or physiology courses in high schools, colleges, or medical schools to stimulate the consideration of cardiology as a career.
3. The ACC, with other organizations and local institutions, could use print and broadcast media to demonstrate that there are many women who have successful and rewarding careers as practitioner or academic cardiologists. Indeed, the nation's two largest organizations devoted to cardiovascular disease will have female presidents in 2005 (Pamela S. Douglas will be ACC president and Alice K. Jacobs will be AHA president during that year). Many other female cardiologists are in leadership positions in these and other cardiovascular organizations. A television documentary (accompanied by a booklet for public distribution) focusing on cardiology as a career for women would resonate with the current emphasis that is being placed on enhancing public awareness of the importance of cardiovascular disease as a cause of morbidity and mortality among women. Such a program would have the potential to reach a large audience, including high school students who might not otherwise have considered a career in cardiology. A similar impact might be felt by female medical students, particularly in those programs where there are few, if any, female faculty.
4. The ACC, either nationally or through its chapters, could identify a core group of female visiting professors willing to visit programs with no or few female faculty and encourage interaction with the female trainees.
5. The ACC should identify ways to increase the involvement by a larger number of female college members in the various activities of the organization. Some examples follow: a) the ACC Program Committee should encourage members to suggest qualified women as session

moderators, chairs, and speakers at the annual scientific sessions, b) the ACC should increase the number of females serving on committees, task forces, and working groups, c) the ACC should promote visibility of female cardiologists in practice by sponsoring networking and workshops at the Scientific Sessions and at chapter meetings, d) the ACC chapters should facilitate interaction of female cardiologists in practice with internal medicine trainees and students. This might involve having a medical student or resident spend one or more days with the cardiologist. The chapter could also serve as a resource for women to participate in college or high school career fairs. Female trainees could be invited to attend chapter meetings when the format is appropriate, e) the ACC should publicize the need for more general clinical cardiologists to help deliver care to growing numbers of elderly cardiac patients, f) the ACC should invite physicians with a track record of successfully mentoring female cardiologists to present at the ACC training directors meeting, g) the ACC should collect and disseminate successful practice and academic models that have created family-friendly programs and call schedules. There are alternative models in place in some institutions and groups that encourage shared practice opportunities that allow greater flexibility in scheduling. Such models might also encourage older cardiologists to remain in practice rather than to retire early. It would also be useful if the ACC sponsored a forum at the annual scientific sessions that described experiences with successful alternative practice models. This could include both "shared" fellowship opportunities as well as part-time practice opportunities in the academic and private settings for junior faculty members and partners starting families, and h) the ACC Practice Opportunities Line (available at http://www.acc.org) should be modified to include specific data about flexible practices and possible job-sharing opportunities.

WORKING GROUP 2 REFERENCES

1. Facts: applicants, matriculants and graduates. Association of American Medical Colleges. Available at: http://www.aamc.org/data/facts/2003/2003summary.htm. Accessed January 30, 2004.
2. Applicants to U.S. Medical Schools Increase. Association of American Medical Colleges (Press Release. November 4, 2003). Available at: http://www.aamc.org/newsroom/pressroom/pressrel/2003/031104.htm. Accessed February 1, 2004.
3. Table 3. Distribution of Women Residents, 2002. Association of American Medical Colleges. Available at: http://www.aamc.org/members/wim/statistics/stats03/table3.pdf. Accessed February 19, 2004.
4. Fye WB. President's page: women cardiologists: why so few? J Am Coll Cardiol 2002;40:384–6.
5. Summary of Workforce Trends in Internal Medicine Training. American Board of Internal Medicine. Available at: http://www.abim.org/Workforce/Fellgen.htm. Accessed February 19, 2004.
6. Women, Minorities and Persons with Disabilities in Science and Engineering, 2002. National Science Foundation. Available at: http://www.nsf.gov/sbe/srs/nsf03312/c0/intro.htm. Accessed April 19, 2004.
7. Limacher MC, Zaher CA, Walsh MN, et al. The ACC professional life survey: career decisions of women and men in cardiology. A report of the Committee on Women in Cardiology. American College of Cardiology. J Am Coll Cardiol 1998;32:827–35.
8. Hurst JW. Will the nation need more cardiologists in the future than are being trained now? J Am Coll Cardiol 2003;41:1838–40.
9. Mutha S, Takayama JI, O'Neil EH. Insights into medical students' career choices based on third- and fourth-year students' focus-group discussions. Acad Med 1997;72:635–40.

Working Group 3: How to Encourage More Minorities to Choose a Career in Cardiology

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INTRODUCTION AND DISCUSSION OF RACIAL AND ETHNIC DISPARITIES IN HEALTH STATUS, MORBIDITY, AND MORTALITY

The report of this working group focuses on ways to increase the number of cardiovascular specialists who are classified as members of an underrepresented minority (URM). The Association of American Medical Colleges (AAMC) defines URMs as blacks, Mexican Americans, mainland Puerto Ricans, and Native Americans–American Indian, Alaskan Natives, and Native Hawaiians (1). In 2001, according to the American Medical Association, of more than 127,574 total physicians in internal medicine, only 2.72% were black and 3.29% were Hispanic. Of 21,726 cardiovascular physicians, 2% (n = 440) were black, 3.8% (n = 829) were Hispanic, and 12.7% (n = 2,755) were Asian (Fig. 1) (2). In 2002, of 2,223 total trainees in cardiology training programs 3.4% were black and 5.7% were Hispanic, and 29.5% were Asian (3,4).

It is challenging to address a subject as complex as how to significantly enhance career opportunities and influence career choices of URMs in the context of a document that must be concise and, by definition, focus on cardiology workforce. This specific focus is very important for many reasons, including the fact that URM physicians are more likely than other doctors to provide healthcare to minority communities, to practice in medically underserved areas, and to care for patients from their own ethnic or cultural group (5,6). Research has shown that the per capita number of physicians in low-income urban communities is substantially lower than in more affluent communities (7). Black and Hispanic physicians are more likely than non-Hispanic

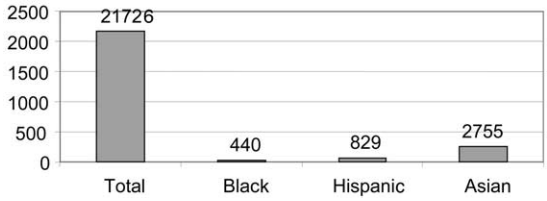

Figure 1. Cardiovascular physicians by race/ethnicity (2001–2002). Source: AMA Physician Characteristics and Distribution in the U.S., 2003–2004 edition.

whites to practice in physician shortage areas and to care for more black and Hispanic patients (8). This is just one of many reasons to encourage URMs to aspire to a career in medicine, and to help them achieve this goal.

Major racial and ethnic disparities in health status, morbidity, and mortality have been documented across a wide range of medical conditions. Compared with other Americans, blacks have the highest mortality rates from cardiovascular disease (9). Lack of access to health care, particularly cardiac care, has been shown to be a major contributor to racial and ethnic health disparities in cardiovascular disease (10). The Institute of Medicine's important study "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care" (11) documents that ethnic health disparities are prominent throughout the U.S.

Several studies have demonstrated racial and ethnic differences (independent of income, insurance status, and education) in the use of cardiac procedures such as coronary angiography, percutaneous coronary interventions (PCI), and coronary artery bypass graft surgery (CABG) (10,12). For example, blacks are only one-half as likely as whites to be treated with PCI or CABG (13). Of several possible explanations for these disparities in care, one factor is the inadequate number of cardiovascular specialists serving minority communities. This is just one reason—but a very important one—why the nation should seek to increase the number of URM cardiologists.

MINORITY MEDICAL SCHOOL ACCEPTANCES, MATRICULATION, AND GRADUATION

Many factors contribute to the shortage of URM cardiologists, but one of the most significant is the limited size of the pool of qualified applicants. The varied and complex social and economic factors contributing to racial and ethnic disparities in educational opportunities and achievement are beyond the scope of this document. Nevertheless, it is appropriate to outline a few specific suggestions that will help achieve the goal of attracting a greater number of URMs to careers in medicine—and from there—to cardiology.

Strategies to increase the number of URM cardiovascular specialists must consider the long educational path that begins before elementary school and continues through high school, college, medical school, and beyond. There is a definite need to develop more effective programs to improve science proficiency among certain URMs, especially blacks and Hispanics (Fig. 2). Emphasis should also be placed on fundamental skills such as reading comprehension and verbal communication. Consistent efforts must be made to address deficiencies in elementary and high school education and to encourage action at the college level in terms of identifying, advising, and supporting students who have potential to succeed as physicians.

As our nation's educators and policymakers consider ways to improve the academic skills of underprivileged and minority students in order to help them achieve their full potential as members of society, it is vitally important that

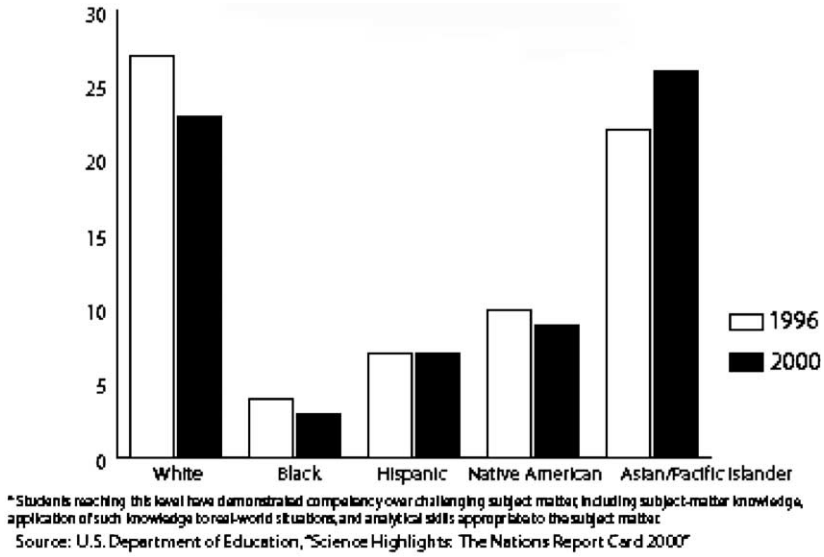

Figure 2. Percent of U.S. grade 12 students who are proficient in science by race/ethnicity (1996, 2000). Source: Minority Students in Medical Education, Facts and Figures XII is a publication of the Association of American Medical Colleges (AAMC), copyright October 2002. Reprinted with permission of the AAMC.

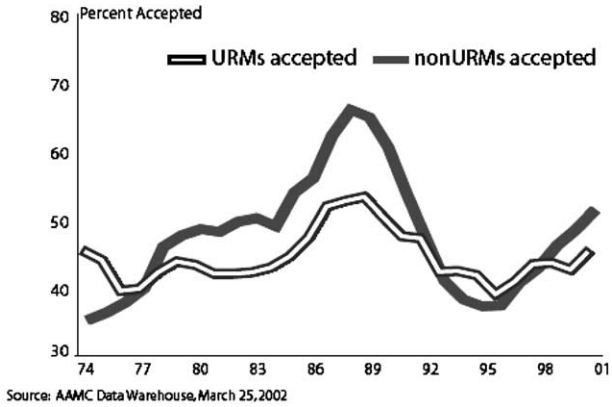

Figure 3. Acceptance rates for underrepresented minorities (URM) and non-URM applicants to medical school, 1974–2001. Source: Minority Students in Medical Education, Facts and Figures XII is a publication of the Association of American Medical Colleges (AAMC), copyright October 2002. Reprinted with permission of the AAMC.

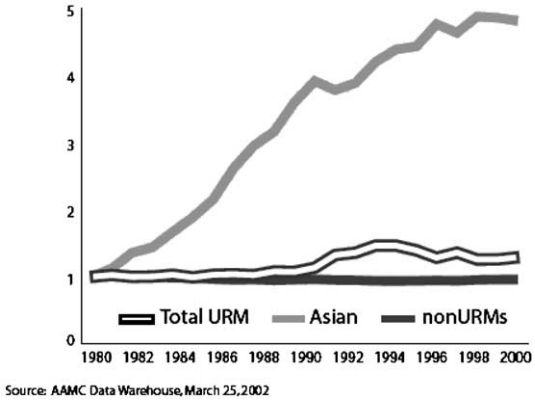

Figure 5. Medical school matriculants, 1980–2000 (expressed as a percentage of 1980 matriculants). Source: Minority Students in Medical Education, Facts and Figures XII is a publication of the Association of American Medical Colleges (AAMC), copyright October 2002. Reprinted with permission of the AAMC.

we acknowledge the existence of a significant population of minority students who are already fully capable of becoming excellent physicians. Mentoring of bright high school and college URM students who express interest in pursuing a medical career is vitally important (14). Because racial and ethnic disparities in health status cross social and economic boundaries, there is a need to increase the awareness and attractiveness of medical careers for middle-class URM students as well as those who are economically disadvantaged.

It is useful to summarize recent URM trends with respect to medical school applications, medical school enrollment, medical school graduation, internal medicine residency training, and specialization in cardiovascular disease. This information should help academic institutions, professional organizations, and other entities develop policies, procedures, and practices to increase the size of the URM cardiology workforce. The number of U.S. medical school applicants peaked at 46,965 in 1996 to 1997, when there were 5,157 URM applicants. Medical school acceptance rates vary among different racial and ethnic groups. They also fluctuate for the general categories of URMs and non-URMs. (Fig. 3) (1). In general, enrollment of URMs continues to be low (Fig. 4) (1) compared with their representation in the population. One striking exception in the past two decades has been the steady increase in the percentage of matriculants who are Asian (Fig. 5) (1).

Between 1990 and 1996, the number of black applicants increased by 56%, with a record number of 3,527 applicants in 1996 (Fig. 6) (1). Beginning in 1997, anti-affirmative action ballot initiatives and court decisions in California (15) and Texas (16) resulted in laws that prohibited the use of race and ethnicity in decisions regarding admissions to public educational institutions. These major legal events had an immediate and lingering effect on minority medical education throughout the nation, because California and Texas are the states that produce the largest number of URM medical students (1).

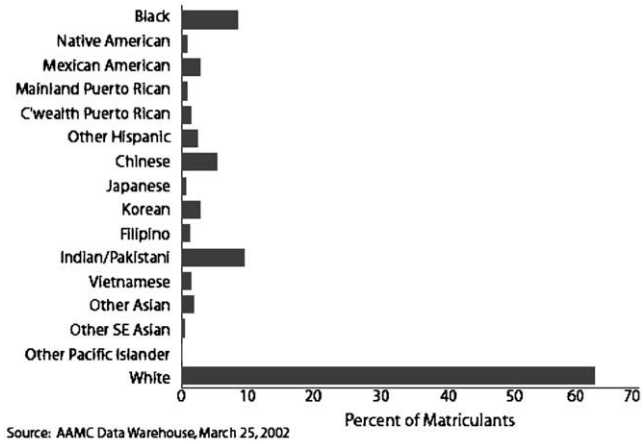

Figure 4. Race/ethnicity of 2001 matriculants to medical school. Source: Minority Students in Medical Education, Facts and Figures XII is a publication of the Association of American Medical Colleges (AAMC), copyright October 2002. Reprinted with permission of the AAMC.

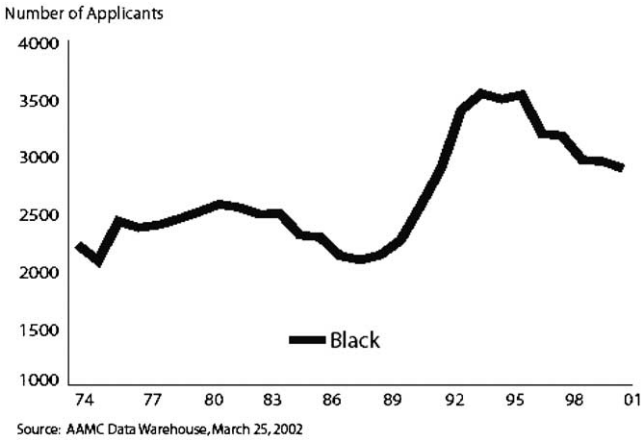

Figure 6. Black applicants to medical school, 1974–2001. Source: Minority Students in Medical Education, Facts and Figures XII is a publication of the Association of American Medical Colleges (AAMC), copyright October 2002. Reprinted with permission of the AAMC.

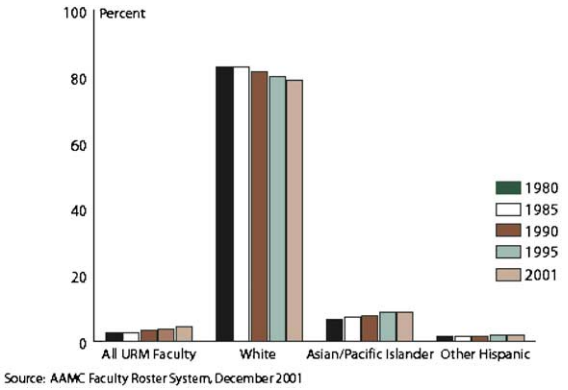

Figure 7. Distribution of U.S. medical school faculty by race/ethnicity, 1980–2001. Source: Minority Students in Medical Education, Facts and Figures XII is a publication of the Association of American Medical Colleges (AAMC), copyright October 2002. Reprinted with permission of the AAMC.

Diversity among medical school faculty, medical students, residents, and fellows contributes to "cultural competency" that eventually will help all physicians relate more effectively to patients from a wide range of ethnic, racial, and socioeconomic backgrounds. Although there has been an increase in the racial and ethnic diversity of medical school faculties between 1980 and 2001, URM faculty still only account for 4.2% of the total (Fig. 7) (1). Racial and ethnic disparities also exist in academic rank. Fewer than 10% of URMs are full professors. This may reflect, in part, the fact that URM faculty are less likely to be involved in research and less likely to receive research awards from the National Institutes of Health (NIH), especially RO1 grants (17).

Because of their small numbers in many medical schools, URM faculty frequently find themselves overextended. There is a growing and unmet need for mentors and preceptors, regardless of race or ethnicity, who can connect on a personal level with students of diverse backgrounds. Full-time and part-time medical school faculty members play a vital role in helping students make informed career choices. They serve as role models and help shape students' impressions of potential career paths from an academic research-oriented position to private practice as a primary care physician or specialist. Medical student career choices are also affected by attitudes and actions of their peers as well as residents and fellows in various specialties and subspecialties. The attitudes and interests of students and residents are also influenced by the quality of teaching, level of professionalism, and commitment to excellence in patient care they observe among attending physicians and others.

The output of new cardiologists is a function of the number of medical students that choose an internal medicine residency and, subsequently, a cardiology fellowship. The significant role of international medical graduates (IMGs) in this equation is discussed by Working Group 4. The number of URMs choosing to train in internal medicine is low compared with their representation in the U.S. population. This is important because the career path to cardiology begins with a residency in general internal medicine. The situation is aggravated by a recent trend that reflects declining interest in primary care specialties including general internal medicine (18).

Casual comments or strongly voiced opinions about certain specialty choices in terms of income potential, career satisfaction, and work–life balance can discourage medical students from considering certain specialties. It is true that the current practice environment is stressed because of rising requirements with respect to documentation, exorbitant medical liability costs, and increasing workloads—all in the face of declining reimbursement in most specialties. Despite these challenges most physicians enjoy what they do and value their unique role in caring for patients. It is important to remember that we can emphasize the negative aspects of being a physician in the 21st century, or we can focus on the extraordinary difference that we, as cardiologists, can make in the lives of millions of persons with cardiovascular disease.

This working group believes it is vitally important that more URM medical students choose the career path that we have followed. We recognize that a decrease in the number of URM cardiologists would be especially problematic for poor and underserved patients because they already carry a disproportionate burden of cardiovascular disease, especially hypertension, coronary heart disease, heart failure, and stroke (19). Numerous reports have documented the limited access to primary and specialty care in most low-income, rural, inner city, and minority communities. The tendency for new physicians, whether URMs or not, to choose to practice in more affluent urban or suburban locations, rather than inner city or rural environments, has contributed to a mal-distribution of practitioners. Ironically, the nation's growing shortage of cardiologists is creating more opportunities for new cardiology graduates (including URM and IMGs) to practice in locations that are perceived to be highly desirable from various standpoints. Thus, the shortage of cardiologists will likely have a detrimental effect on the poor and minority patients' access to specialty care—the very kind of care that has been shown to enhance outcomes in the types of cardiovascular diseases that affect minority and underserved populations disproportionately.

Increasing the number and proportion of URM cardiologists will require designing and implementing more effective strategies at all levels of the educational continuum. There are many reasons to devote more financial and intellectual resources to confront this challenging problem. Cardiologists have embraced the importance of risk-factor modification as a powerful tool to reduce the burden of cardiovascular disease in our society. If we hope to reduce the disproportionate burden of cardiovascular disease that affects the poor and underserved, both our nation and our profession must work together to make it possible for more black, Hispanic, and other URMs to enter medicine and become cardiovascular specialists.

RECOMMENDATIONS

1. The medical profession should support local and national efforts to enhance the educational opportunities for minority students so there is a larger pool of qualified URM applicants to medical school—the first formal stop on the career path to cardiology.
2. Academic medical centers should work hard to create and maintain an atmosphere that values diversity and, reflecting the focus of our working group, an environment that actively supports and encourages URM students, postgraduate trainees, and faculty members.
3. Academic and practitioner cardiologists should actively encourage URM medical students and internal medicine residents to consider a career in cardiology.
4. Internal medicine training program directors and cardiology training program directors should make an active effort to recruit, matriculate, and graduate increased numbers of URMs.
5. The ACC, together with the Association of Black Cardiologists (ABC), the American Heart Association (AHA), and the Association of Professors of Cardiology (APC), and the cardiology training program directors, should collaborate in the development and implementation of curricula on racial and ethnic disparities in cardiovascular disease status, outcomes, morbidity, and mortality.

WORKING GROUP 3 REFERENCES

1. Minority Students in Medical Education, Facts and Figures XII. Association of American Medical Colleges. 2002. Available at: http://www.aamc.org/publications/medicalschoolapplicants.pdf. Accessed January 31, 2004.
2. Smart DR. Physician Characteristics and Distribution in the U.S. 2004. Chicago, IL: American Medical Association, 2003.
3. Brotherton SE, Simon FA, Etzel SI. U.S. graduate medical education, 2001–2002: changing dynamics. JAMA 2002;288:1073–8.
4. Brotherton SE, Rockey PH, Etzel SI. U.S. graduate medical education, 2002–2003. JAMA 2003;290:1197–202.
5. Cantor JC, Miles EL, Baker LC, Barker DC. Physician service to the underserved: implications for affirmative action in medical education. Inquiry 1996;33:167–80.
6. Moy E, Bartman BA. Physician race and care of minority and medically indigent patients. JAMA 1995;273:1515–20.
7. Kindig DA, Movassaghi H. The adequacy of physician supply in small rural counties. Health Aff (Millwood) 1989;8:63–76.
8. Komaromy M, Grumbach K, Drake M, et al. The role of black and Hispanic physicians in providing health care for underserved populations. N Engl J Med 1996;334:1305–10.
9. Heart Disease and Stroke Statistics—2004 Update. American Heart Association. Available at: http://www.americanheart.org/presenter.jhtml?identifier=3018163. Accessed February 19, 2004.
10. Racial/Ethnic Differences in Cardiac Care: The Weight of the Evidence. Summary Report. Henry J. Kaiser Family Foundation and the American College of Cardiology Foundation, 2002.
11. Unequal Treatment: Confronting Racial and Ethnic Disparities in Health. Washington, DC: The National Academies Press, 2004.
12. National Healthcare Disparities Report 2003. Agency for Healthcare Research and Quality. Available at: http://www.qualitytools.ahrq.gov/disparitiesreport/download_report.aspx. Accessed January 31, 2004.
13. Mayberry RM, Mili F, Ofili E. Racial and ethnic differences in access to medical care. Med Care Res Rev 2000;57 Suppl 1:108–45.
14. American Medical Student Association. Study Group on Minority Medical Education: Findings From Literature Search and Anecdotal Data. Final Report. September 20, 1996. Health Resources and Services Administration, U.S. Department of Health and Human Services.
15. California Constitution. Article I, Paragraph 31. 2003.
16. Hopwood v. Texas. 78 F3d 932 (5th Cir). 1996. 116 SCt 2581. Cert denied.
17. Fang D, Moy E, Colburn L, Hurley J. Racial and ethnic disparities in faculty promotion in academic medicine. JAMA 2000;284:1085–92.
18. Greene, J. Primary Care Matches Down Again: Fourth Year of Decline Worries Some. American Medical News. Available at: http://www.ama-assn.org/amednews/2001/04/09prse0409.htm. Accessed April 9, 2001.
19. Barondess JA. Specialization and the physician workforce: drivers and determinants. JAMA 2000;284:1299–301.

Working Group 4: International Medical Graduates and the Cardiology Workforce

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INTRODUCTION

International medical graduates (IMGs) are physicians in practice or in post-graduate training in the U.S. who graduated from medical school outside the U.S., Puerto Rico, or Canada. Although many IMGs are foreign-born and are here on special visas (e.g., J-1 or H), a significant number are U.S.-born citizens and permanent residents who graduated from medical school in another country. Over the years, IMGs have been very important contributors to the science and practice of medicine in the U.S. During the past quarter-century they have filled the large gap between the number of U.S. medical graduates and the number of residency positions and subsequent opportunities in private practice and academic medicine. Several changes in licensing examinations and immigration laws have occurred over the past few years, however, that have potential impact on the contribution of IMGs to our nation's physician workforce. The present document examines the current status and future prospects of IMGs in cardiology training and practice in the U.S.

Table 1. Approximate Number of IMGs 1980 and 2000

	1980	2000	% Change
Cardiology IMGs	2,248	6,178	+175%
Total IMGs	97,726	196,000	+100%

Source: American Medical Association. Physician Characteristics and Distribution in the U.S. 2002–2003 Edition. Chicago, IL: American Medical Association 2002.
IMG = international medical graduate.

IMPORTANCE OF IMGS IN THE WORKFORCE

Since the 1960s, IMGs have constituted an important part of the physician workforce. In 1963, they comprised about 10% of the physician workforce in the U.S.; by 1970, this had increased to almost 18%, due mainly to a perceived shortage of practicing physicians (1). In the 1980s and 1990s, a further increase in IMGs occurred, attributed to changes in licensing examinations, new immigration laws, and the break-up of the Soviet Union (2). Currently, IMGs fill approximately 40% of cardiology training positions and represent about 25% of cardiologists in practice in the U.S. The approximate number of IMGs and their activities from 1980 to 2000 are represented in Table 1. Although the total number of IMGs (practicing in all areas of medicine) increased by approximately 100% during this 20-year interval, the number of IMG cardiologists increased by approximately 175%.

The percentage growth of practicing cardiologists who are IMGs is depicted in Figure 1. Although there has been a decline in the growth rate of IMG cardiologists from 1975 to 1980, there has been continued growth (17.7%) over the last five-year period. The actual number of IMG cardiologists in practice increased from 1,249 physicians in the year 1970 to 6,178 in the year 2000 (3).

Traditionally, IMGs have been considered an important resource for providing care to patients in rural and underserved urban (inner-city) areas. This has been a principal mechanism by which IMGs on the J-1 Visitor Exchange visa have been allowed to waive the standard requirement that they return to their country of origin for two years after they complete their training in the U.S. Currently, less than one-third of IMGs in training are on the J-1 Visitor Exchange visa (Fig. 2). Data from a New York State study, however, suggest that IMGs tend to practice in suburban or urban settings similar to non-IMGs after they complete their required term of practice in a medically underserved area as required by the waiver (3).

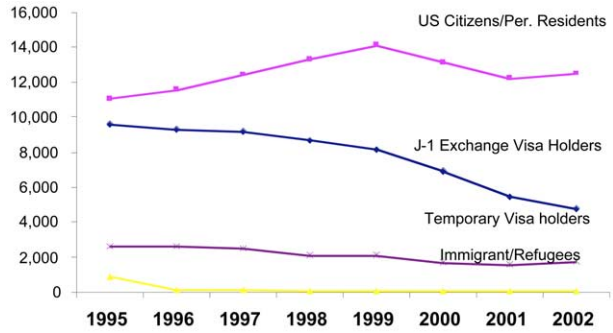

Figure 2. International medical graduates' (IMGs) visa status: approximately one-half of IMGs in U.S. residencies are U.S. citizens or permanent residents. Source: Area Resource File 2003. The National Center for Health Workforce Analysis, Bureau of Health Professions, Health Resources and Services Administration (HRSA).

The IMGs also add ethnic and cultural diversity to the nation's physician population. Recent data suggest that some IMGs tend to migrate to areas, often urban, with higher proportions of persons of similar ethnic or national backgrounds, although this varies by ethnic group (1). It is interesting to note that IMGs contribute proportionally more women to the physician workforce than do U.S. medical graduates (especially women who are foreign nationals) (4).

IMGS AND TRAINING PROGRAMS

Although the number of cardiology trainees decreased during the past decade, the percentage of cardiology trainees (including those in interventional and electrophysiology fellowships) that are IMGs has remained fairly stable at about 40% since 1996. In terms of general cardiology trainees, however, there has been a decrease in the percentage that are IMGs (Table 2) (5–11).

Data from New York State Graduate Exit surveys indicate that IMGs on J visas are almost twice as likely as U.S. medical graduates to subspecialize (62% vs. 36%), but IMGs who are U.S. citizens or permanent residents subspecialize

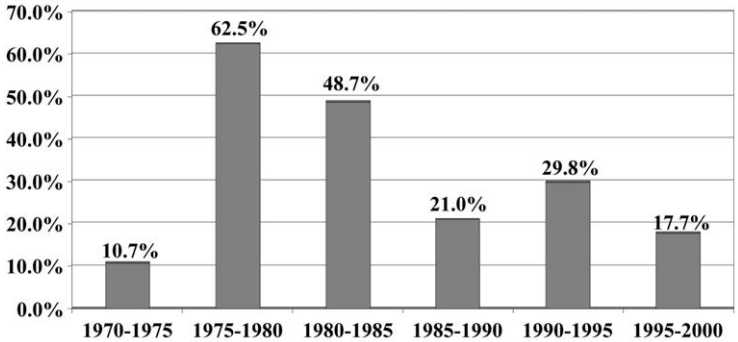

Figure 1. Percentage growth of international medical graduate (IMG) practicing cardiologists. Source: American Medical Association. Physician Characteristics and Distribution in the U.S. 2002–2003 Edition. Chicago, IL: American Medical Association; 2002.

Table 2. IMG Cardiology Residency Trends

	IMG (% of All Trainees)		
Year	General Cardiology Trainees (%)	Clinical Cardiac Electrophysiology (%)	Interventional Cardiology (%)
1996	36.6%	18.5%	NA
1997	40.0%	33.7%	NA
1998	42.0%	44.6%	NA
1999	41.2%	48.4%	39.7%
2000	38.6%	37.2%	55.8%
2001	36.7%	43.0%	49.1%
2002	32.9%	41.7%	42.1%

Source: JAMA Annual Medical Education Issue. *JAMA,* 1997–2003.
IMG = international medical graduate.

at a rate comparable to U.S. medical graduates (12). Active IMG physicians come from many countries. Some countries of origin tend to be overrepresented in the U.S. population of IMGs, however, such as India (18%) and the Philippines (9%). These two countries account for almost one-third of active IMG physicians practicing in the U.S. (Fig. 3) (2). This may reflect, in part, the fact that most college-educated students in those countries learned to speak and read English during (or even before) secondary school. Meanwhile, IMGs from Spanish-speaking countries are underrepresented. For example, only 5% of IMGs are from Mexico. These data are interesting, considering the fact that the Hispanic population is the fastest growing minority group in the U.S., and that the census from the year 2000 counted 34.3 million Hispanic Americans.

Current trends indicate an increase in the proportion of IMGs who are U.S. citizens or permanent residents (see subsequent text), now about two-thirds of all IMGs (13). Data from the 158 cardiology programs participating in the National Residency Matching program for 2004 indicate that 30% of physicians in the match were IMGs (14). The geographic distribution of IMGs after graduation tends to follow the same state as their last residency training location (15) and, at least for J-1 visa waiver physicians, is more likely to be located in areas with low physician/population ratios (16–18).

CURRENT CHALLENGES TO IMGS

IMGs face several challenges, including board certification, immigration issues, and ultimate employment opportunities. Certification requires passing steps 1 and 2 of the United States Medical Licensing Examination (USMLE), and more recently, an English proficiency test and the Educational Commission for Foreign Medical Graduates (ECFMG) clinical skills assessment (CSA). The CSA became mandatory for all IMGs in 1998. It is relatively expensive, and until Atlanta was added recently, the CSA test was offered only in Philadelphia.

Beginning in June 2004, the CSA will be phased out and replaced by the new USMLE clinical skills examination (CSE). The CSE is being implemented as a component of the USMLE Steps examination and will be mandatory for all U.S. medical students and graduates as well as IMGs. The CSE has been developed and tested in coordination with the ECFMG and will be similar to the current CSA in content and format. As a result of the transition to the CSE, the test will be given in more cities (Atlanta, Chicago, Houston, Los Angeles, and Philadelphia). Despite recent national security concerns that make the process of obtaining a visa to the U.S. more prolonged and difficult (especially for citizens of countries in the Middle East), there are no plans to offer the CSE at international testing centers. All of these factors have contributed to a decrease in the

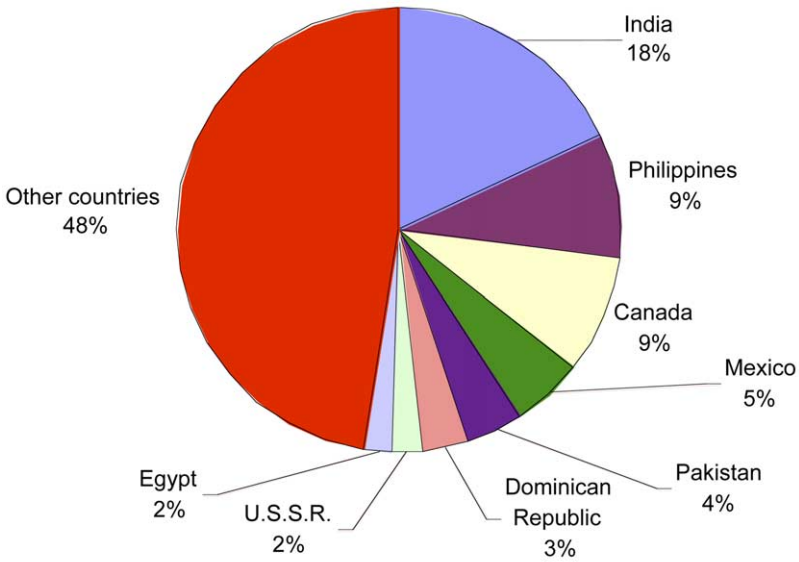

Figure 3. Country of medical education, active international medical graduate (IMG) physicians, 2002. Note: chart includes trainees from Canada which are normally excluded when considering IMGs. Nearly 1 in 5 (18%) IMGs come from India, and 1 in 10 (9%) come from Philippines. Source: Area Resource File, 2002, DHHS, HRSA/BHPr/NCHWA.

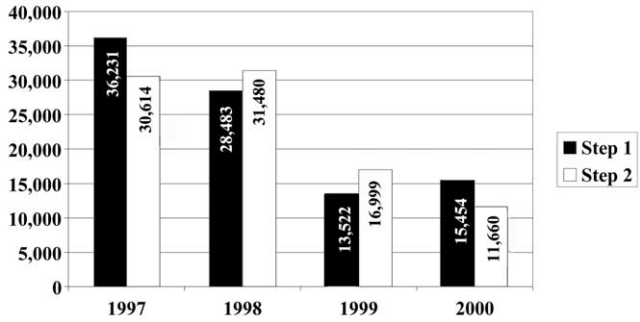

Figure 4. International medical graduate (IMG) registrations for the United States Medical Licensing Examination (USMLE) step 1 and step 2 examinations. Source: A coming shortage of foreign-trained doctors? ACP-ASIM Online http://www.acponline.org/journals/news/sep01/imgs.htm. Accessed August 19, 2003.

number of IMG registrations for the certification examinations (Fig. 4) (19). This decrease in foreign-born IMGs seeking certification also has resulted in U.S. citizens representing a higher percentage of all candidates seeking ECFMG certification. Although U.S. citizens represented only 10% of the IMG applicant pool taking the Steps examination in 1995, in 2001 they represented nearly 25%. These trends are unlikely to change even after the number of testing centers is increased as a result of the implementation of the CSE.

Measures of performance on the USMLE indicate that current IMGs are more likely to pass the test on their first attempt than in previous years (possibly a manifestation of self-selection among applicants) (13). Generally, IMGs have scored higher than U.S. medical graduates on the In-Training Examination in Internal Medicine (Fig. 5) (20).

In addition to affecting their residency and subspecialty training opportunities, immigration laws that apply to IMGs can also influence their chances of joining the workforce after graduation. Recently, two-thirds of IMGs entering practice are either U.S. citizens, permanent residents, or refugees with permanent status. This means that immigration laws affect less than one-third of IMGs, primarily those who enter residency training on exchange visas (Fig. 2) (1,21,22). Multiple factors are likely responsible for this, including the new requirements for testing discussed above. As a corollary, non-U.S. citizen IMG participants in the National Residency Match Program (NRMP) declined by 36% between 1997 (8,100) and 2001 (5,100) (19,23). Cardiology-specific data available from the New York State Resident Exit survey indicated a similar decrease in the percentage of IMG residents from 32% in 2000 to 23% in 2001 (24). With increased security concerns following the September 11, 2001, terrorist attack, these trends are likely to continue.

Post-training employment opportunities for IMGs are related significantly to visa status. For U.S. citizens and permanent U.S. residents, the current high demand for cardiologists virtually ensures employment (25). For individuals on H visas, an employment offer may allow him or her to apply for permanent immigration status. However, the J-1 visa holders, face significant obstacles if they seek employment in this country. In the past, the U.S. Department of Agriculture (USDA) was the major source of J-1 visa waivers in exchange for a three-year commitment from the physician to practice in a federally designated Health Professional Shortage Area (HPSA) or medically underserved area (26). In February 2002 the USDA stopped providing placements for IMGs through this mechanism based on security concerns (27). This policy change led Congress to increase the number of waivers that individual states could make under the so-called Conrad 20 program. Details of this program are beyond the scope of this review, but the effect is to increase the number of waivers each state

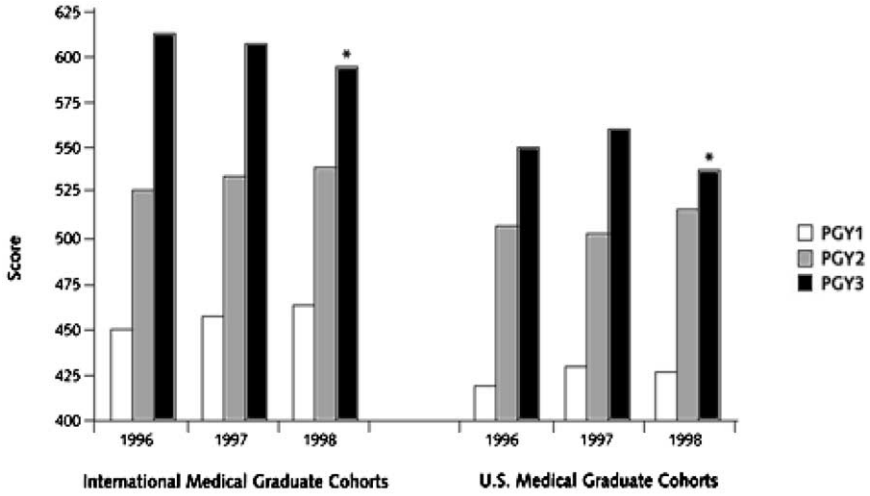

Figure 5. Comparison of scores on the in-training examination in internal medicine between international medical graduates and U.S. medical school graduates. In each cohort, resident performance on the examination is shown by training year (postgraduate year 1, 2, or 3 [PGY1, PGY2, PGY3]). *Examination was administered in October instead of July. Reprinted with permission from Garibaldi et al. Ann Intern Med 2002;137:505–10.

can issue from 20 to 30. This program has implications for IMG cardiologists because only 25% of waivers can go to specialists (75% go to primary care physicians) (28). Finally, many states do not accept application for J-1 visa waivers to fill primary care slots from trainees who have had any subspecialty training (19). This will adversely affect placement of cardiology trainees in the J-1 visa program.

IMGs face cultural obstacles that, in some cases, have been exacerbated by recent international events. Similar to other immigrants to the U.S. and U.S. born citizens from minority ethnic or racial groups, IMGs and their families may confront various types of prejudice and bias, which may be more prevalent in some rural communities that traditionally have not been as diverse as large cities. In the past, however, the HPSA program resulted in a significant number of IMGs on J-1 visa waivers practicing in rural communities that were medically underserved.

As a result of visa requirements, the initial post-training job options for IMGs are more limited than is the case for U.S. medical graduates whose postgraduate training may be equivalent to that of the international graduate. Many circumstances affect the ability of fully trained cardiologists and cardiology subspecialists who are IMGs to find a position that matches their interests and abilities. For example, highly trained electrophysiologists or interventional cardiologists sometimes must work as general clinical cardiologists in small community hospitals that do not have the need or the support structure for subspecialty cardiology. Given the nation's need for more general clinical cardiologists, the IMGs who serve in these areas contribute significantly to the care of patients with cardiovascular disease who otherwise might not have access to a trained cardiovascular specialist.

Communication obstacles may present IMGs with subtle and unanticipated challenges. Understandably, some IMGs have accents that may interfere with communication between the physician and his or her patients and their family members, staff, and other physicians. Thus, IMGs may find it more difficult to treat the "whole patient" due to differences in values, and to ethical and religious beliefs that may influence important medical decisions such as end-of-life care (29–31). Clinical skills in practicing medicine extend beyond English proficiency and involve the understanding of subtle implications and meanings of words and phrases, the cultural context of life-changing events, the impact of illness on the physical, financial, and emotional well-being of the patient and his or her family. Both IMGs and patients may have difficulty in voice, face, and name recognition accuracy, which might influence the perception of the efficiency and effectiveness of some IMGs practicing in the U.S. (32). It is evident, however, that a large percentage of IMGs are willing to work hard to overcome such obstacles in order to live and practice in the U.S. for a variety of social, economic, and professional reasons.

CONSIDERATION FOR "SHORT-TRACK" TRAINING OF IMGS WITH PREVIOUS POST-GRADUATE TRAINING

Regardless of post-graduate training abroad, IMGs are presently required to obtain full post-graduate residency and fellowship training in the U.S. in order to qualify for licensure and board certification. Significant variations exist in the content, length, and quality of pre-medical education, medical education, and postgraduate education in countries around the globe. This is one of the main justifications for requiring IMGs to pass specific examinations and repeat postgraduate training in the U.S. before they can be licensed or become board eligible. Many IMGs who have done additional (and often redundant) post-graduate medical training in the U.S. acknowledge that the cultural adaptation and skills acquired during their training were of great value, even if portions of their technical medical training were somewhat repetitive.

On a case-by-case basis it might be reasonable to consider giving an IMG who has had extensive internal medicine and cardiology training (and perhaps practice or academic faculty experience) abroad credit toward the required years of training in the U.S. At present, however, no established mechanisms exist to identify, verify, or test such individuals. Piloting a program for individuals who have completed both their internal medicine residency and cardiology fellowship training abroad that would give them credit for one year of internal medicine training in the U.S. seems reasonable. The length of cardiology training would be unchanged. Outcome measures could be developed, including performance on ABIM examinations, to evaluate the impact such a change might have on the quality and competence of trainees.

CURRENT AND FUTURE IMPLICATIONS OF THE CHANGING POOL OF IMGS ON THE CARDIOLOGY WORKFORCE

Currently, the supply of cardiologists in the U.S. is not meeting the demand as outlined in the introduction to this report. As noted earlier, various social, economic, and political factors affect the prospects of IMGs joining the U.S. cardiology workforce. For example, if the percentage of IMGs in cardiology training positions were to remain stable but immigration issues prohibit IMGs from remaining in the U.S. after training, the numbers of newly trained cardiologists available to accept positions in private practice or academic medicine would be reduced significantly. Thus, any increase in recruitment of IMGs into traditional or innovative "short-track" internal medicine–cardiology training programs must be matched by supportive immigration and visa policies so as to have a positive impact on the total numbers of cardiologists in the U.S.

Recent international events and concerns over immigration and terrorism could further discourage or limit IMGs from entering the U.S. for postgraduate training. Although

the ACC workforce survey indicated there were adequate numbers of qualified applicants, restricting talented and highly qualified IMGs from the applicant pool might have a negative impact on the nation's output of cardiologists (33). Monitoring the impact of these factors on the pool of IMG applicants and their eventual role in cardiology practice and academic medicine will be important. This will help inform future decisions and policies affecting the role of IMGs in American cardiology.

BALANCING WORKFORCE NEEDS WITH THE ETHICS OF INTERNATIONAL RECRUITMENT

One important consideration with respect to the long-standing tradition of encouraging IMGs to come to the U.S. for postgraduate medical and specialty training (with the assumption that a significant number will remain here to meet our nation's demand for physicians) is the impact this phenomenon has on the physician's home country. Many IMGs come to the U.S. from nations that could benefit from the additional training they receive in the U.S. Some of these countries have a shortage of physicians. This is a challenging issue that applies to all medical fields, not only to cardiology. It is especially problematic, however, as evidence now indicates that the incidence of cardiovascular disease is growing significantly in developing nations.

Developing countries often do not have the resources to effectively absorb all their medical graduates into post-graduate training programs. This contributes to physician migration from developing to developed countries. Some nations even provide stipends for physicians to train abroad. Economic and other incentives, particularly in the U.S., however, tend to promote retention of IMGs in this country, possibly depriving other countries of some of their brightest and best-educated physicians. In many nations the cost of medical school is subsidized mainly by the government. Therefore, the recruitment of post-graduate physicians from developing countries to the U.S., England, and other developed countries has been criticized because there is no mechanism to compensate the country of origin for its educational investment in the emigrating physician. A unilateral "brain drain" of IMGs from developing countries is likely to have a negative impact on world health care.

In response to these issues, the 5th World Organization of National Colleges, Academies, and Academic Associations of General Practitioners/Family Physicians (WONCA) World Rural Health Conference submitted a document in May 2002 outlining an ethical code of practice for international recruitment of health care professionals entitled "the Melbourne Manifesto" (34). The World Medical Association also recently created a committee to develop a policy concerning the exploitation of doctors recruited to work in other countries (35). Balancing and matching training opportunities with health care needs at the local, national, and international levels is desirable.

WORKING GROUP RECOMMENDATIONS

The infusion of IMGs into cardiology and medicine in general in the U.S. has had a significant number of beneficial effects that transcend the diversity they bring to our nation and its health care system. Although most IMGs practice—and provide care to a significant percentage of our population—many remain in academic medicine where they contribute to research and education. In formulating recommendations regarding IMGs, our working group believed that any changes in policy should acknowledge the vital contributions that IMGs have made and potentially will make to the delivery of care to an expanding population of patients with cardiovascular disease.

Recommendations

1. Continue to acknowledge that IMGs are a vital component of the U.S. cardiology community and make important contributions to practice, research, and education.
2. Because IMGs have demonstrated their ability to compete effectively with U.S. medical graduates for positions in the nation's cardiology training programs, there should be no arbitrary system developed that precludes qualified IMGs from applying to internal medicine and cardiology training programs in the U.S.
3. Consider developing and piloting a "short track" training program for select IMGs who already completed internal medicine and cardiology training before entering a post-graduate training program in the U.S.
4. Develop programs that encourage greater international exchange between cardiologists. For example, programs could be piloted that would make it possible for IMGs who practice, perform research, or teach in the U.S. to return to their country of origin for variable periods of time in order to contribute to that country's healthcare. The ACC sponsored such programs (known as International Circuit Courses) for several decades and should consider reestablishing this model of international outreach.

WORKING GROUP 4 REFERENCES

1. Mullan F, Politzer RM, Davis CH. Medical migration and the physician workforce. International medical graduates and American medicine. JAMA 1995;273:1521–7.
2. IMGs by Country. American Medical Association. Available at: http://www.ama-assn.org/ama/pub/category/1550.html. Accessed October 1, 1999.
3. Physician Characteristics and Distribution in the U.S. 2001. 2002–2003 edition. Chicago, IL: American Medical Association, 2001.
4. Mick SS, Sutnick AI. Women in US medicine: the comparative roles of graduates of U.S. and foreign medical schools. J Am Med Womens Assoc 1997;52:152–8.
5. Graduate Medical Education. Appendix II, Table 6. Citizenship/Visa Status of All Resident Physicians and International Medical Graduates (IMGs) on Duty in ACGME-Accredited and in Combined Specialty Programs August 1, 1993. JAMA 1993;270:1079–82.
6. Graduate Medical Education. Appendix II, Table 6. Citizenship/Visa Status of All Resident Physicians and International Medical Graduates

(IMGs) on Duty in ACGME-Accredited and in Combined Specialty Programs August 1, 1997. JAMA 1997;278:775–84.
7. Graduate Medical Education. Appendix II, Table 6. Citizenship/Visa Status of All Resident Physicians and International Medical Graduates (IMGs) on Duty in ACGME-Accredited and in Combined Specialty Programs August 1, 1998. JAMA 1998;280:842–5.
8. Graduate Medical Education. Appendix II, Table 6. Citizenship/Visa Status of All Resident Physicians and International Medical Graduates (IMGs) on Duty in ACGME-Accredited and in Combined Specialty Programs August 1, 1999. JAMA 1999;282:893–906.
9. Graduate Medical Education. Appendix II, Table 6. Citizenship/Visa Status of All Resident Physicians and International Medical Graduates (IMGs) on Duty in ACGME-Accredited and in Combined Specialty Programs August 1, 2000. JAMA 2000;284:1159–72.
10. Graduate Medical Education. Appendix II, Table 6. Citizenship/Visa Status of All Resident Physicians and International Medical Graduates (IMGs) on Duty in ACGME-Accredited and in Combined Specialty Programs August 1, 2001. JAMA 2001;286:1095–107.
11. Graduate Medical Education. Appendix II, Table 6. Citizenship/Visa Status of All Resident Physicians and International Medical Graduates (IMGs) on Duty in ACGME-Accredited and in Combined Specialty Programs August 1, 2002. JAMA 2002;288:1151–64.
12. Salsberg E, Nolan J. The post-training plans of international medical graduates and U.S. medical graduates in New York State. JAMA 2000;283:1749–50.
13. Whelan GP, Gary NE, Kostis J, Boulet JR, Hallock JA. The changing pool of international medical graduates seeking certification training in U.S. graduate medical education programs. JAMA 2002;288:1079–84.
14. Match Result Statistics: Medical specialties matching program (MSMP). National Residency Match Program (Appointment Year 2003). Available at: http://www.nrmp.org/fellow/match_name/msmp/stats.html. Accessed January 31, 2004.
15. Polsky D, Kletke PR, Wozniak GD, Escarce JJ. Initial practice locations of international medical graduates. Health Serv Res 2002; 37:907–28.
16. Mick SS, Lee SY, Wodchis WP. Variations in geographical distribution of foreign and domestically trained physicians in the United States: 'safety nets' or 'surplus exacerbation'? Soc Sci Med 2000;50: 185–202.
17. Mick SS, Lee SY. International and U.S. medical graduates in U.S. cities. J Urban Health 1999;76:481–96.
18. Cooper RA. There's a shortage of specialists: is anyone listening? Acad Med 2002;77:761–6.
19. Maguire, P. A coming shortage of foreign-trained doctors? American College of Physicians-American Society of Internal Medicine (2001). Available at: http://www.acponline.org/journals/news/sep01/imgs.htm. Accessed August 19, 2003.
20. Garibaldi RA, Subhiyah R, Moore ME, Waxman H. The in-training examination in internal medicine: an analysis of resident performance over time. Ann Intern Med 2002;137:505–10.
21. Biviano M, Makarehchi, F. Globalization and the Physician Workforce in United States. Sixth International Medical Workforce Conference. HRSA. Available at: ftp://ftp.hrsa.gov/bhpr/nationalcenter/gpw.pdf. Accessed April 25, 2002.
22. Weiner JP. A shortage of physicians or a surplus of assumptions? Health Aff (Millwood) 2002;21:160–2.
23. Applicants in the Matching Program, 1997–2003. National Residency Match Program (2003 Match Data). Available at: http://www.nrmp.org/res_match/tables/table2_2003.pdf. Accessed February 1, 2004.
24. NYS Resident Exit Survey. Center for Health Worforce Studies. Available at: http://chws.albany.edu/. Accessed March 17, 2004.
25. New ACC survey points to cardiologist shortage. Cardiology 2003; 32:1–4.
26. House Clears Doctors' Visa Waivers. Guardian Unlimited. Available at: http://www.guardian.co.uk/uslatest/story/0,1282,-2045779,00.html. Accessed September 26, 2002.
27. Mueller, K. J. The immediate and future role of the J-1 Visa Waiver Program for physicians: the consequences of change for rural health care service delivery. Special J-1 Visa Waiver Program Task Force. RUPRI Center for Rural Health Policy Analysis. Available at: http://www.rupri.org/pubs/archive/reports/P2002-3/P2002-3. Accessed April 1, 2002.
28. The J-1 Visa Waiver Program Fact Sheet. Office of Community and Rural Health. April 26, 2004. Washington State Department of Health. Available at: http://www.doh.wa.gov/hsqa/ochrh/r&r/j1.htm. Accessed December 6, 2002.
29. Halliday R. Medical futility and the social context. J Med Ethics 1997;23:148–53.
30. Doty WD, Walker RM. Medical futility. Clin Cardiol 2000;23:II6–16.
31. Ullyot DJ. President's page: work force issues in cardiology. J Am Coll Cardiol 1995;25:278–9.
32. Doty ND. The influence of nationality on the accuracy of face and voice recognition. Am J Psychol 1998;111:191–214.
33. Fye WB. Cardiology workforce: there's already a shortage, and it's getting worse! J Am Coll Cardiol 2002;39:2077–9.
34. A Code of Practice for the International Recruitment of Health Care Professionals: The Melbourne Manifesto. The Fifth Wonca World Conference on Rural Health. Available at: http://www.globalfamilydoctor.com/aboutWonca/working_groups/ruralconf_2002/index.html. Accessed April 23, 2004.
35. Wharry S. Pressure mounting to curb MD poaching by rich nations. CMAJ 2002;166:1707.

Working Group 5: Innovative Care Team Models and Processes That Might Enhance Efficiency and Productivity

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BACKGROUND

Nurses have assisted physicians in delivering care for generations. During the past half-century cardiologists, nurses, and other non-physician clinicians have collaborated in a variety of ways in various contexts to develop new models of healthcare delivery to patients with known or suspected heart disease. The most visible and dramatic example of the development of the team-care concept in cardiology was the creation of the coronary care unit concept in the 1960s. Nurses and other non-physician clinicians (such as nurse practitioners and physician assistants) and individuals trained to assist in diagnostic tests (such as sonographers and X-ray technicians) are now indispensable members of the cardiac care team.

The need to provide efficient, high-quality care to a large

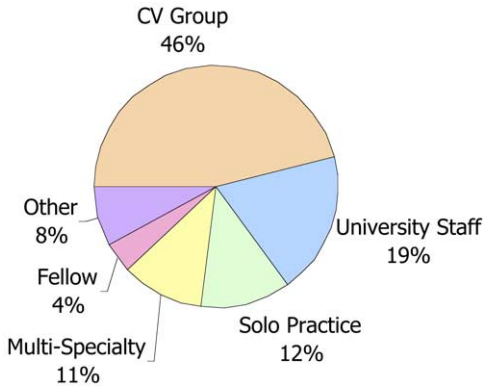

Figure 1. Practice setting among ACC members (2002). Source: ACC Membership Survey. 2002.

and growing population of patients with cardiovascular disease has catalyzed the development of several models of team care in various inpatient and outpatient settings. Increasingly, non-physician clinicians (under the supervision of a physician) are providing many services traditionally provided by cardiologists (1). Cardiologists employ nurses, medical assistants, and technologists to support the office- or clinic-based care of their patients. In some contexts, private cardiologists or cardiology groups employ non-physician clinicians to help them care for their hospitalized patients. The role of non-physician health clinicians in cardiology practices varies widely. This reflects, in part, the diversity of cardiology practices in the U.S. The 2002 ACC workforce survey reflects this diversity (Fig. 1).

Hospitals also employ a wide range of individuals who provide a spectrum of clinical, technical, and support services to cardiac inpatients. As the complexity and demands of cardiac care have increased over the past generation, many types of health professionals have been incorporated into cardiac team care including nutritionists, clinical pharmacists, exercise physiologists, ECG technicians, pacemaker nurses, hemodynamic monitoring technicians, clinical biomedical engineers, imaging technologists, and emergency medical technologists, among others. The number of clinical nurse specialists, nurse practitioners, and physician assistants that have joined the cardiac care team in recent years has increased significantly as demand for cardiovascular services has grown in response to advances in the field and an expanding population of patients with cardiovascular disease.

Cardiologists play a critical role in leading these comprehensive cardiac care teams that provide care to inpatients and outpatients with cardiovascular disease. As we seek to improve the coordination of acute inpatient care with ongoing outpatient management of patients with chronic cardiovascular disease, it is important that the cardiac care team is used effectively and efficiently. This will have benefits not just for the individual patient but also for society as a whole. The cardiac care team model can also enhance the attractiveness of cardiology practice at a time when new medical graduates and all physicians are seeking a better work–life balance.

This working group believes that the present and projected shortage of cardiologists in the U.S. can be mitigated to some extent by increasing the use and improving the efficiency of non-physician clinicians. This would allow cardiologists to use their unique skills and abilities to cope with increasing demand for their specialized services. Moreover, the optimal use of the cardiac care team model should help individual cardiologists and groups of cardiologists to achieve a better work–life balance. This, in turn, should increase the appeal of cardiology as a career goal for some highly qualified candidates who perceive it as a specialty where physicians are overworked and have little control over their practices or their lives.

It is important to acknowledge that most private and academic practices already depend on these individuals to help them cope with the high demand for cardiovascular services. Meanwhile, the supply of physician assistants and nurse practitioners is somewhat limited, and there is growing concern about the nation's shortage of nurses, a situation that is likely to worsen (2,3). There were 2.6 million registered nurses in the U.S. as of January 1, 2003, and approximately 120,000 of them were advanced practice nurses (nurse practitioners or clinical nurse specialists) (4,5). It is unknown how many of these are employed by cardiologists, and we believe the ACC should help develop a method to quantify and track this important segment of the nation's cardiology workforce. Of the 50,000 physician assistants in practice, about 3% of them are in cardiology practice, and an additional 3% are in cardiothoracic surgical practice.

The duties of non-physician cardiovascular clinicians are determined by a combination of factors, including local traditions and needs as well as rules and regulations created by hospitals, organizations, licensing bodies, and the government. In the outpatient and inpatient setting, an increasing number of cardiologists employ nurse clinicians, nurse practitioners, and/or physician assistants to help them perform the initial clinical assessment of the patient, document the findings of the history and physical examination and the treatment plan, communicate with patients and family members, and help provide routine follow–up care. Each of these activities is supervised by the cardiologist who outlines a plan of diagnosis and treatment for each patient.

In hospital practice many cardiologists also use non-physician clinicians to help them deliver a broad spectrum of diagnostic and therapeutic services. For example, many hospitals with active interventional cardiology programs have trained non-physician clinicians to perform specific tasks such as post-procedure catheter removal and groin care. Duke University Hospital investigators reported their experience recently with training physician assistants to perform diagnostic coronary angiography under the supervision of a staff cardiologist (6). This demonstrates that workforce shortages and high demand for cardiovascular services continue to stimulate innovation in the delivery of

heart care. Increasingly, in response to new ACGME regulations that restrict work and on-call hours, hospitals are hiring non-physician clinicians to provide some services that traditionally were the responsibility of internal medicine residents or cardiology trainees.

The growing demand for cardiac services and progressive subspecialization has led some private and academic practices to hire general internists to complement the care they deliver. Of course, family physicians and general internists provide many services to patients with stable, chronic cardiovascular diseases without the active involvement of cardiologists. In many rural or underserved urban locations physician assistants and nurse practitioners provide primary care without on-site supervision by a physician (5,7). In contrast to primary care, unsupervised or independent practice by non-physician clinicians in cardiology is rare. As discussed by Working Group 6, future development of telemedicine and electronic medical records may further enhance the ability of non-physician clinicians to provide primary and preventive cardiac care at the same time these innovations promote greater collaboration between cardiologists and primary care physicians.

Great variation exists in the geographic distribution of cardiologists and in numbers of cardiac services delivered across the U.S. (8). Uwe Reinhardt, a leading health care economist, notes, however, that "no one knows what differences in the quality of patients' lives are associated with the stunning geographic variations in practice style" (9). Wennberg et al. (8) have claimed that the clearest predictor for per capita consumption of cardiac services is the per capita distribution of cardiologists. This broad spectrum of usage presumably reflects a combination of over- and underuse with respect to expert consensus or evidence-based guidelines that hope to define appropriate care for specific cardiac conditions. The ACC/AHA guidelines are designed to provide evidence-based recommendations to help physicians and others provide appropriate care. These guidelines should be helpful to non-physician clinicians as well as the cardiologists who supervise their activities and actions.

There are financial implications of shifting more responsibilities from physicians to non-physician clinicians. Third-party payers may encourage the expanded use of non-physician clinicians mainly to reduce the costs of care. Therefore, it is important that we develop better ways to evaluate outcomes so decisions about the sharing or shifting of specific responsibilities can be based on evidence that these innovations enhance outcomes. Currently, there is great interest in developing outcome measures that will be useful to individual practitioners and to institutions as they introduce care models designed to provide more efficient and cost-effective care. As the role of non-physician clinicians in the care of patients with cardiovascular disease expands, we must be able to demonstrate that models we use maintain or enhance outcomes compared with traditional approaches.

Although the expanded use of non-physician clinicians helps cardiologists provide care more efficiently, this model presents some challenges with respect to the boundaries that define the content and value of specialty care (10). Close collaboration between cardiologists and non-physician clinicians is important if the goals of increased access and efficiency are to be achieved. Meanwhile, a lack of coordination and autonomous, unsupervised practice by non-physician clinicians may result in less desirable outcomes and other problems (11,12).

Pharmacists are a valuable part of the health care team, and closer collaboration between them, physicians, and non-physician clinicians is also desirable. Pharmacists possess extensive knowledge of clinical pharmacology and drug interactions. They often have complete and up-to-date individual patient prescription records that may not be readily available to the various independent physicians prescribing for a single patient. Pharmacists are also in an ideal position to alert both patients and their physicians to potential side effects and drug interactions and to suggest alternatives. There are some areas of tension, however. For example, cardiologists share concerns voiced by other physicians that granting pharmacists independent authority to substitute "equivalent" drugs for those initially prescribed is problematic. It usurps the physician's authority to prescribe specific medications for valid reasons based on his or her interpretation of the unique clinical situation. Meanwhile, unauthorized substitution does not free the patient's physician from responsibility for potential adverse effects or complications that might result from unauthorized substitution. Effective communication is key to resolution and prevention of these types of conflict between professionals. As discussed by Working Group 6, the Internet, the electronic medical record, and other advances in data storage and communication may facilitate the successful integration of non-physician clinicians and cardiologists into a highly effective cardiac care team.

Non-physician clinicians and the American College of Cardiology. The ACC recognizes the major contributions that non-physician clinicians have made and continue to make to the care of patients with cardiovascular disease. In order to better understand the spectrum of roles and relationships that have evolved in different care contexts over the past several years, the ACC created a Cardiac Care Team Task Force in 2002. This task force convened focus groups of nurses and physician assistants to learn how they function as part of a cardiac care team and to assess their educational and professional interests and needs.

The discussions were very informative and helpful. It was especially valuable to learn from participants in the focus groups about the various roles and responsibilities of non-physician clinicians in different care contexts. We believe that ACC members, as they evaluate options to help them cope with increasing practice demands, will find it very helpful to learn how their colleagues around the country have incorporated non-physician clinicians and other health

care professionals into their inpatient and outpatient practices. This should help cardiologists decide whether (and how) to incorporate non-physician clinicians into their own practices as they confront increasing workloads at a time when recruiting cardiologists is becoming increasingly difficult in many settings.

Non-physician clinicians undertake many activities on behalf of the cardiologists or institutions that employ them. In addition to providing direct patient care, nurses, physician assistants, and other non-physician health professionals have been assigned the responsibility of gathering data to profile practice patterns using ACC/AHA guidelines and various tools that have been developed to facilitate continuous quality improvement. This is true for practices and institutions that participate in the ACC's National Cardiovascular Data Registry (NCDR) or are required by payers to provide information regarding utilization and/or outcomes.

The Cardiac Care Team Task Force delivered its report to the ACC Board of Trustees (BOT) early last year. That report supported a recommendation that the BOT establish a new membership category for non-physician clinicians. In March 2003, the BOT unanimously approved a motion that nurses, nurse practitioners, clinical nurse specialists, and physician assistants involved actively in cardiology practice can apply to become an associate member of the ACC if they are sponsored by an ACC member. This historic decision resulted in the creation of a new category of membership, the Cardiac Care Associate. In addition, the ACC created a Cardiac Care Team Committee, now co-chaired by a cardiologist and a nurse, that includes nurses, physician assistants, and fellows of the ACC.

The immediate goals of the Cardiac Care Team Committee include: 1) identifying and promoting awareness of cardiac team care practice models that operate efficiently and effectively, 2) collecting information about the various approaches used to train non-physician clinicians to perform their assigned duties effectively in different institutional contexts, 3) encouraging the ACC to develop and/or identify educational programs and tools that would be of special interest to cardiology non-physician clinicians, 4) identifying opportunities for cardiologists and non-physician clinicians to meet and network (e.g., at ACC Chapter meetings or receptions at the ACC Annual Scientific Sessions), and 5) identifying ACC committees, working groups, and task forces that would benefit from the appointment of one or more non-physician clinicians. The final report of the ACC Cardiac Care Team Task Force will expand on this short list of opportunities that we have identified to enhance collaboration and communication between physician and non-physician members of the cardiac care team.

The ACC BOT decision reflects its conviction that the care of patients with cardiovascular disease can be enhanced by the cardiac care team approach, when the members of that team are supervised appropriately by a cardiovascular specialist. Cardiologists in many practice settings have demonstrated by their actions that they value collaboration as a vitally important component of high-quality health care delivery. The ACC should encourage further refinement of the various models now in place in order to publicize best practices with respect to the cardiac care team model.

Effective national organizations exist for nurses and physician assistants. These groups address advocacy issues on behalf of the health care professionals they represent and the patients their members serve. The ACC should seek to identify common issues with these organizations and coordinate advocacy efforts. Understandably, issues related to scope of practice and appropriate reimbursement for services delivered by non-physician clinicians will need further discussion as the cardiac care team approach continues to evolve. Throughout these discussions it is important to acknowledge the vital role that the cardiologist plays in coordinating team care in addition to providing many services directly to patients.

The remainder of our working group report consists of observations and recommendations we believe would further enhance the cardiac care team models that are continuing to emerge and evolve throughout the nation. From the Cardiac Care Team Taskforce focus groups and from internal ACC data it became apparent that the college's educational programs and products are used widely and valued highly by non-physician clinicians who care for patients with cardiovascular disease. The nurses with whom we spoke felt that contemporary national nursing organizations serve many useful purposes, but their publications and meetings do not focus on cardiology. As a result, many non-physician clinicians rely on the ACC, AHA, and local hospital-based conferences for their formal continuing education in cardiology. Indeed, it became apparent that nurses and physician assistants perceived the ACC's educational programs and products as the most important benefit of potential membership in the college.

We identified several areas that would enhance ACC educational activities related to non-physician clinicians and other health professionals:

1. Nurses who attend the ACC Annual Scientific Sessions or other ACC-sponsored CME programs and/or who use ACC products should be able to receive continuing nursing education credits for these educational activities.
2. The Spotlight Session for non-physician health professionals which was piloted at the ACC Annual Scientific Sessions (and attracted 600 attendees in 2003) should be continued and publicized widely.
3. When relevant and appropriate (based on the topic, purpose, and target audience), non-physician clinicians who are Cardiac Care Associate members of the College should be invited to participate in ACC programs as speakers, panelists, or co-chairs.

4. Cardiac Care Associate members of the ACC should be appointed to educational planning committees and other College committees, task forces, and working groups where their perspective would inform the discussions and enhance the outcomes.
5. The ACC should develop programs and products designed to help prepare nurses and physician assistants to function effectively as non-physician clinicians in a cardiology practice. These programs, designed to supplement prior education and work experience and on-the-job training, should be offered at various sites around the country. The ACC chapters could play a significant role in developing and sponsoring these educational programs.
6. Chapters should invite nurses, nurse practitioners, and physician assistants to attend their educational programs and (when appropriate) to participate as speakers and panelists to foster interdisciplinary education. Topics relevant to their roles in practice should be presented.
7. Non-physician health professionals should be encouraged to submit articles relevant to cardiology practice for publication in ACC journals.
8. Condensed versions (e.g., pocket format) of ACC/AHA guidelines should be made available to members of the cardiac care team.
9. Tools should be developed that facilitate recording, retrieving, and analyzing the data required by the ACC/AHA performance measures.
10. Focused educational modules for cardiology non-physician clinicians should be developed that would help prepare them for practice as part of a cardiologist-led cardiac care team. Topics might include preventive cardiology and patient counseling in nutrition and exercise, management of chronic heart failure, the conduct of office-based research studies, data management for performance measurement, and use of performance based guidelines, among others.

CONCLUSIONS AND RECOMMENDATIONS

The members of Working Group 5 believe that the cardiac care team model (in which appropriately trained non-physician clinicians are supervised by a cardiovascular specialist) can enhance both access to and the quality of cardiovascular care. Various models of this nature already exist. They have grown, in part, as a pragmatic response for several years to the gap between the demand and supply of highly trained cardiovascular specialists. As our nation seeks ways to cope with the growing burden of cardiovascular disease, we suggest that the ACC consider several steps to facilitate recruitment, training, efficient and effective use, and acceptance of non-physician clinicians in cardiology practice:

1. The ACC (possibly in cooperation with other organizations) should create a member survey designed to gather detailed information on the use of cardiovascular non-physician clinicians in several contexts (e.g., academic and various private practice models). This survey should collect information about methods used to train non-physician clinicians, their responsibilities and scope of practice, reimbursement issues, and integration within the practice, among other things.
2. The ACC should analyze the results of the survey and use them as one method to inform cardiologists about care team models that appear to be very successful in terms of incorporating non-physician clinicians in the inpatient and outpatient practice of cardiology.
3. The ACC should describe the potential benefits of employing non-physician clinicians to cardiology office managers and administrators.
4. The ACC should educate the public that high-quality cardiac care is a team effort, and that a cardiovascular specialist is the coordinator of this skilled team. Patients should appreciate that non-physician clinicians can significantly enhance the ability of the cardiologist to give patients the best possible care. Handouts and other materials for office waiting areas should be developed to spread the message that sophisticated, state-of-the-art cardiovascular care depends on a coordinated team effort.

WORKING GROUP 5 REFERENCES

1. Hooker RS, Berlin LE. Trends in the supply of physician assistants and nurse practitioners in the United States. Health Aff (Millwood) 2002;21:174–81.
2. Harper DC, Johnson J. The new generation of nurse practitioners: is more enough? Health Aff (Millwood) 1998;17:158–64.
3. Ward D, Berkowitz B. Arching the flood: how to bridge the gap between nursing schools and hospitals. Health Aff (Millwood) 2002; 21:42–52.
4. Spratley, E, Johnson, A, Sochalski, J, Fritz, M, Spencer, M. The Registered Nurse Population: Findings From the National Sample Survey of Registered Nurses. U.S. Department of Health and Human Services. Available at: http://hhpr.hrsa.gov/healthworkforce/reports/rnsurvey/default.htm. Accessed December 1, 2003.
5. Salsberg, E. Making Sense of the System: How States Can Use Health Workforce Policies to Increase Access and Improve Quality of Care. Milbank Memorial Fund Electronic Report. Available at: http://www.milbank.org/reports/2003salsberg/2003salsberg.html. Accessed December 1, 2003.
6. Krasuski RA, Wang A, Ross C, et al. Trained and supervised physician assistants can safely perform diagnostic cardiac catheterization with coronary angiography. Catheter Cardiovasc Interv 2003;59:157–60.
7. Phillips RL, Jr., Harper DC, Wakefield M, Green LA, Fryer GE, Jr. Can nurse practitioners and physicians beat parochialism into plowshares? Health Aff (Millwood) 2002;21:133–42.
8. Wennberg DE, Birkmeyer JD. The Dartmouth Atlas of Cardiovascular Health Care. Chicago, IL: AHA Press, 1999.
9. Reinhardt UE. Analyzing cause and effect in the U.S. physician workforce. Health Aff (Millwood) 2002;21:165–6.
10. Christensen CM, Bohmer R, Kenagy J. Will disruptive innovations cure health care? Harv Bus Rev 2000;78:102–12 , 199.
11. Cooper RA, Henderson T, Dietrich CL. Roles of nonphysician clinicians as autonomous providers of patient care. JAMA 1998;280: 795–802.
12. Grumbach K, Coffman J. Physicians and nonphysician clinicians: complements or competitors? JAMA 1998;280:825–6.

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Working Group 6: The Role of Technology to Enhance Clinical and Educational Efficiency

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INTERNET-BASED EDUCATIONAL APPROACHES CAN FACILITATE PARTICIPATION IN CME PROGRAMS

For practicing physicians, the primary means for keeping abreast of change has been continuing medical education (CME), which is also linked to medical licensure in many states. In recent years, CME has faced a number of challenges, including the apparent failure of some conventional educational offerings to change physician practices and a decreased willingness on the part of many physicians to devote the time and money necessary to travel to participate in traditional CME events. Concerns have also been raised about the degree to which some CME providers depend on industry funding because more than one-half of the dollars spent on CME come from commercial entities (1).

As Internet use by physicians has increased dramatically, it has been suggested that some of the challenges providers and consumers of CME face could be ameliorated by shifting to web-based educational materials. Meanwhile, there has been explosive growth in both traditional and online CME offerings. According to Bernard Sklar, a physician who has followed online CME trends, there were 150 CME websites offering 3,510 activities for 5,500 credit hours in December 2000. By June 2002, there were 209 sites offering 10,952 activities and 18,263 credit hours (2). Despite this dramatic growth in providers and offerings, however, online CME credits still constitute a small fraction of total CME credits awarded. According to a 2001 survey by the Boston Consulting Group, physicians are changing their online information-seeking practices. Doctors appear to be reducing the number of sites they use for medical information, and professional association sites such as the ACC's Cardiosource (www.cardiosource.com) are showing the greatest gains in use (3).

Online CME use by physicians will continue to grow as concerns and issues raised by CME consumers are addressed:

1. Online CME must become easier to find, and sponsors of it must provide better directories of the content and more information about the source of that content.
2. Online CME offerings must become more engaging to overcome the natural preferences of many physicians for paper-based models. This may require more development of Internet-based simulations and interactive clinical problem-solving exercises.
3. The CME consumers, especially those in mid-career, will need ongoing support if they are to take advantage of the Internet and other innovations in information transfer. It is apparent that competency in electronic information management will be a necessity for physicians who want to practice state-of-the-art medicine.
4. The role and influence of industry in CME requires further clarification, in terms of online and traditional types of educational offerings. The CME consumers must be able to determine the quality, source, and objectivity of information provided. This should be a major determinant of user preference; it also presents organizations such as the ACC with both opportunities and challenges.

"Just in time" education to meet the needs of practitioners providing care to patients. It is believed that the most "teachable moment" occurs when a medical student, resident or practicing physician is actively engaged in the care of a specific patient. Information obtained in that setting is more likely to be remembered and to have a lasting impact on practice behavior. As providers gravitate toward electronic medical record (EMR) systems and computers become even more common in the hospital and office settings, the likelihood increases that physicians will have (or will demand) more access to so-called "just-in-time" learning (i.e., CME that occurs in real-time in the context of patient care). Applications that focus on this type of context-based learning are being developed. Meanwhile, evidence-based practice databases are being imbedded in various types of EMR products, such as physician order-entry and standardized order sets.

An example of "contextual" online medical information and CME is the Stanford SKOLAR MD program. Subscribers can access a number of medical reference books, full-text journals, drug databases, practice guidelines, evidence-based medicine resources and patient educational material. They can also receive Category-I credit for conducting a search and answering online questions regarding the material. It seems likely that this type of "granular CME" has the potential to increase the efficiency of obtaining CME credit and to reward physicians for using information resources while taking care of patients.

Meanwhile, trends in consumer education are affecting the content and context of communications between patients and their physicians. Many patients now use the Internet to gain insights into their health problems and treatment alternatives. Already, consumers use the Internet to obtain health information more than for any other reason (4). More people go online daily to look up health care information (6 million) than visit doctors. In 2000, the Pew

Internet and American Life Project reported that 52 million Americans relied on the Internet to make crucial health care decisions; in 2002 that number increased to 73 million.

The growth and impact of direct to consumer advertising in recent years has also been dramatic. Despite these trends, many patients still prefer to receive health information directly from their physician or a member of his or her staff. One concern about patients using the Internet to seek health information relates to the reliability of what they find and read. To help physicians direct their patients to reliable health information on the Internet, the National Library of Medicine (NLM) and the American College of Physicians (ACP) are piloting an "information prescription" program. This allows a physician to provide a patient with a predesigned prescription that takes him or her directly to high-quality health information on Medline Plus. Similar partnerships, designed more specifically for cardiologists and patients with cardiovascular disease, may be possible for the ACC.

Point-of-care education and advice via wireless devices. The growing use of personal digital assistants (PDA) by physicians represents another opportunity for point-of-care education and interactivity. A 2002 ACC survey found that 54% of members reported using a PDA for one or more professional functions. The scope and sophistication of clinical and professional applications designed for PDAs continue to increase dramatically. The case of the free drug database application, ePocrates Rx, is instructive. This application (used by more than 100,000 health professionals) was the subject of a recent survey reported by Bates and colleagues at the Brigham and Women's Hospital in Boston (5). They surveyed a random sample of 3,000 ePocrates Rx users; 32% responded. Users identified several advantages of this program, including saving time during information retrieval, ease of incorporation into patient workflow, and enhanced decision making in drug selection and dosing. Respondents also believed their use of the database reduced preventable adverse drug events. Systems that will document the use of PDA resources as a way to receive CME credit will likely be developed. The convergence of PDAs and bar code technologies in the healthcare industry will provide opportunities to link specific information searches (e.g., guidelines) to specific patient evaluations in a way that can be used to document an individual physician's attempts to provide high-quality care.

ELECTRONIC COMMUNICATION BETWEEN PATIENTS AND PHYSICIANS

The Internet provides opportunities to improve satisfaction and outcomes by enhancing communication among patients, their physicians, and other health care providers. Just as the telephone replaced much written correspondence during the second half of the 20th century, e-mail is now replacing the telephone as the primary means of communication. Patient privacy concerns, especially in view of new HIPPA regulations, have implications for how physicians communicate with their patients. Although some practices use e-mail for patient communication, this may be more problematic if the messages are not encrypted for privacy. Moreover, the communication is not just between a single patient and his or her private physician. Many practices now rely on non-physician clinicians or other staff members to inform patients of laboratory results or to help educate them. The majority of cardiologists now practice as a member of a group, and team care offers many advantages, as discussed by Working Group 5. These important innovations make it necessary to focus on the security of patient information that is transmitted electronically.

The impact of e-communication will vary depending on the balance between health care practitioners "pushing" information to patients and patients/consumers demanding or "pulling" information from health care providers (6). Kaiser, the large California HMO, has a members-only consumer website designed to give members an alternative to calling or visiting their physician or other health care provider. The service includes health-learning materials, health assessment tools, and links to selected health-related sites. Patients can also communicate with other members, Kaiser staff, and physicians.

Although e-mail is now the preferred method of communication among friends, family members, and colleagues, anecdotal information suggests that physicians are reluctant to use e-mail for patient correspondence because they are concerned about the volume of messages they may receive from patients or concerned family members. Moreover, there is no reimbursement for e-mail (or telephone or written) advice. Still, using e-mail to answer patient questions and/or to provide educational materials could reduce the amount of "communication time" with patients, as direct telephone conversation may be lengthy compared with more succinct replies via e-mail. Written messages to patients could enhance the ability of patients to follow instructions.

Tools that provide information that supports self-care and decision making by patients may ultimately reduce demand for unnecessary services (7). For a significant transition from face-to-face visits to online communication between physicians and patients to occur, however, reasonable reimbursement for the services provided electronically must be established. Recently, Blue Shield of California made a decision to reimburse physicians for time spent providing online consultations for patients via e-mail (8).

Another approach used by some medical practices is to establish a Website with a secure connection for health care providers and patients. The VeriSign Secure Site, or similar programs that employ security measures akin to those used by banking and e-commerce sites on the Internet, enhance the privacy of submitted information. The establishment of such a secure site is likely to be cost-effective for many practices that want to communicate with patients in a secure fashion. This may reduce costs and increase convenience because a patient can receive information from his or her physician about test results, treatment options, and prescrip-

tions without actually visiting the doctor's office. In contrast to e-mail, this form of secure e-communications addresses privacy issues that are of such concern in contemporary medical practice. There are many potential uses for and advantages of such a system for patients as well as physicians and members of their staff. These include:

1. Prior test results are available, making it possible to review trends (e.g., lipid levels, glucose levels, internal normalized ratios, weight, blood pressure, etc.).
2. Some EMR packages offer the ability for real-time transfer of laboratory results between facilities. After review and added comments, the information can be transferred directly to the patient's personal "mailbox."
3. Reminders can be e-mailed to patients who require a follow-up visit or laboratory tests.
4. Patients and medical staff can communicate about symptoms and questions.
5. Patient appointments can be scheduled or rescheduled online with automated programs that respect patient convenience and reflect provider availability.
6. Electronic claim submission can facilitate timely reimbursement.
7. Patients can review the status of their bills and insurance payments. They can also arrange for electronic fund transfer to pay for services they have received.
8. Patients can subscribe to newsletters that provide general healthcare information, news about new services offered by the practice, or information about clinical trials.
9. Links can be created to other sites that provide information that might be useful to patients and their families.
10. Patients or other authorized individuals can access all or portions of the medical records anytime, after appropriate approval and authentication.
11. Prescription renewals can be forwarded electronically to specific pharmacies that have established systems to handle this method of communication among patients, physicians, and pharmacists.

THE ELECTRONIC MEDICAL RECORD (EMR)

Although a minority of physicians currently use an EMR in their outpatient practices, this method of documentation and communication will play a vital role in the future of health care (9–11). The EMR offers several advantages to individual physicians, group practices, and hospitals. Ideally, it should be comprehensive and include links to all relevant patient information such as outpatient and inpatient notes, laboratory and X-ray results, and procedure and pathology reports. Such connectivity has the potential to increase the efficiency of the physician and the health care team by facilitating data retrieval and the coordination of care and follow-up. The relative ease of accessing patient data should facilitate decision making. Finally, an optimal EMR should enhance the quality of care delivered and the outcomes of that care. Although no single EMR has emerged as superior to all others, the EMR developed for the Veteran's Affairs hospital system is one of the most integrated and sophisticated in existence.

The EMR is considered to be an essential tool to improve health care efficiency and enhance outcomes. Nevertheless, obstacles such as cost and resistance to change have delayed its widespread adoption (12). A recent survey of 1,587 physician organizations showed that clinical use of information technology (IT) systems for electronic data capture was inconsistent (13). When asked if their electronic data system included a standardized problem list, progress notes, medications prescribed, medication decision support, laboratory results, and radiology results, the average physician organization had only 1.4 (23%) of these six capabilities; 49.9% had none and 78.5% had two or less. For the immediate future, partial integration of EMR systems is likely to limit the attainment of potential efficiencies on physician workflow. Utilization of EMRs in health care will be imperative to consolidate patient data efficiently and to optimize the display of relevant clinical information used to make medical management decisions. After a steep learning curve, the EMR should improve overall productivity and practice efficiency.

The ability to enter relevant patient care information at the bedside quickly and accurately should enhance patient care and improve outcomes. Physicians and other providers can become more efficient if they can enter or access data at several convenient locations in the hospital or outpatient setting. Key findings and progress notes can be entered at the point of care and transferred to the hospital record and/or a provider's EMR through a wireless network. Palmtops and PDAs are being used increasingly as a point-of-care tool. Software applications that are particularly useful to physicians include patient tracking, laboratory order entry and results checking, medical calculations, prescription writing, and charge capture (14). Providers can also monitor real-time data via a Web browser or wireless application (15). Potential efficiencies include the avoidance of duplicative efforts, enhanced decision making, and reduction in workload for physicians, non-physician clinicians, and other personnel. Problems with legibility of progress notes would be eliminated, reducing potential errors and saving time for other medical personnel involved in the patient's care.

Point-of-care technology includes the use of palmtops not only to retrieve patient clinical data, but also to retrieve important scientific information useful in patient care and decision making. As mentioned earlier, ePocrates is an example of medication software that provides ready access to information on cost, dosing, drug interactions, and adverse reactions (16). A survey of physicians using ePocrates Rx revealed that this tool facilitated information retrieval, was easily incorporated into the workflow, and improved the quality of decision making (5). Although many physicians use PDAs, only 4% were estimated to use

them for writing prescriptions (17). It is likely that electronic prescription "writing" will replace the traditional handwritten prescription because it can facilitate documentation and communication and reduce errors (18). Barriers must be overcome to encourage the widespread utilization of these tools. A 2001 Harris Poll showed that 26% of physicians used PDAs, but this number is expected to double by 2005 (19).

Computerized physician order entry (CPOE) has also been demonstrated to improve quality and reduce resource utilization; but many studies suggest it takes longer to enter orders (20). One study showed that physicians in training spent 9% of their time on CPOE functions compared with 2% with paper order entry. Some of the increased time spent on CPOE can be counterbalanced by decreased time used by other personnel such as pharmacists and nurses.

Rapid electronic retrieval of laboratory, pathology, and radiology reports. The ability to retrieve clinical information promptly plays an integral role in optimizing decision making and providing quality care. The near instantaneous electronic acquisition and/or display of data at the physician's fingertips can substantially reduce the time of an office visit. Commercially available computer systems make it possible to view pathology specimens, radiology films, and other imaging studies from any computer workstation in a hospital or other integrated practice location. This eliminates the need to visit the laboratory or X-ray department to view studies, which, in turn, should increase the likelihood that the ordering physician will review the actual images rather than rely entirely on written or verbal reports.

In a study of so-called picture archiving and communication systems (PACS), referring physicians unanimously preferred PACS over film, and 91% of users believed they increased their productivity (21). Integration of a PACS into an EMR maximizes efficiencies in the system (22). Extending the ability to view imaging tests electronically to a physician's office can further enhance efficiency and productivity. Remote viewing of imaging studies also makes it possible to show patients and family members the actual echocardiogram or angiogram images used to make treatment decisions.

ELECTRONICALLY PROVIDED "DISEASE MANAGEMENT" GUIDELINES

Prompt access to current and relevant scientific evidence has become increasingly important in the clinical decision-making process. The body of knowledge in medicine is expanding at an explosive rate (23). Clinicians cite time constraints as a major reason they do not seek answers to questions that may be relevant to patient management (24). Textbooks and journals may not be readily available. Evidence-based clinical practice guidelines have become a mainstay in cardiology and many other specialties. Although authoritative guidelines such as those produced by the ACC and AHA can inform medical decision making, the creation and distribution of guidelines does not ensure their use (25). To be most helpful, guidelines must be in an accessible format that is easy to use and up-to-date.

A recent physician survey showed that 68% had received guidelines from health plans and 57% had access to disease management (DM) programs (26). Eighty-five percent of generalists and 71% of specialists found clinical guidelines useful; 83% of generalists and 74% of specialists found DM programs useful. By enhancing quality of care through better adherence to guideline recommendations, it is also possible that reductions in health care utilization might occur, thereby reducing unnecessary scheduled patient visits, phone calls, and hospitalizations.

TELEMEDICINE POTENTIAL

Telemedicine is defined as facilitated remote consultation and diagnosis using telecommunication technologies. The primary rationale for the development of telemedicine is to serve populations that, for various reasons, have limited access to traditional, high-quality diagnostic or therapeutic medical services. Although telemedicine lends itself particularly well to specialties where images are crucial to diagnosis, such as dermatology, it is used effectively by many specialties. Two modalities are available for using telemedicine: 1) store-and-forward and 2) real-time.

In the "store-and-forward" approach, clinical images (e.g., information derived from an examination or a procedure) are sent to another site for display, interpretation, and permanent storage. The advantage of the store-and-forward technology is that it obviates the need for simultaneous availability of the consulting parties. The low bandwidth requirements for this technique also make it less expensive. The store-and-forward format is appropriate when a formal report is not required for immediate decision making. A much more demanding telemedicine approach is the "real-time" transfer of an examination record so that two (or more) caregivers (and a patient) in different locations can simultaneously assess the results provided by the imaging examination. Logistical issues such as scheduling all the parties at the same time and accessing bandwidth on demand have limited the use of real-time telemedicine.

Meanwhile, development of the Digital Imaging and Communication in Medicine (DICOM) led to the acceptance of a standardized format and media (CD-ROM) for archiving, exchanging, and transferring images. The acceptance of the DICOM standard means that coronary angiograms can be viewed in different institutions and over time (facilitating comparison with prior studies). With the availability of the standardized DICOM format, in addition to the image acquired at the site of procedure (e.g., a community hospital) the images can be displayed at a remote site (e.g., a tertiary referral center). In interventional cardiology, for example, this approach is an excellent tool for education and practice.

In contemporary cardiology practice the most common

application of telemedicine is the transmission of electrocardiograms. It has been shown to be especially effective in pediatric cardiology, where the prompt and accurate diagnosis of congenital heart disease in the neonate may be crucial to the outcome of the patient (27,28). One benefit of the telemedicine link is to be able to provide a remote diagnosis from transmitted images to help decide whether and when patient transfer is indicated. Telemedicine can enhance patient care and inform decisions with respect to the need to transfer patients from community hospitals to referral centers.

The use of telemedicine in the catheterization laboratory is still in its infancy. There are four important areas of potential application for real-time catheterization procedure data transfer: 1) physician training, 2) clinical conferencing, 3) support for clinical trials, and 4) support for clinical procedures. Except for clinical conferencing, the other applications require accurate replication of angiographic, echocardiographic, and intravascular sound data. This would require high-fidelity, and higher bandwidth telecommunications systems. The cost of such systems may preclude the routine use of telemedicine in cardiology at the present time. Telemedicine holds much promise for cardiology practice, but some important issues need to be resolved (e.g., reimbursement, licensure, and HIPPA) before it can achieve its full potential.

RECOMMENDATIONS

1. The ACC should play a leading role in the effort to develop and implement functional requirements and characteristics of cardiovascular information management systems.
2. The Accreditation Council for Graduate Medical Education (ACGME) should endorse and implement new models of point-of-care learning and continuing medical education.
3. The expanded use of high-quality telemedicine to supplement traditional cardiovascular care to all appropriate patients and communities should be encouraged.
4. The ACC should help educate cardiovascular specialists about existing and emerging technologies that can improve the quality and efficiency of patient care.
5. The Internet and other new technologies such as PDAs should be used to facilitate the dissemination and implementation of clinical practice guidelines.
6. New technologies such as e-mail and other Internet-based functions should be used to enhance cardiac care team-patient communication, education, and disease management.

WORKING GROUP 6 REFERENCES

1. ACCMR Annual Report Data 2002. Accreditation Council for Continuing Medical Education. Available at: http://www.accme.org/incoming/156_2002_Annual_Report_Data.pdf. Accessed February 13, 2004.
2. Sklar BM. Online CME—An Update. Available at: http://www.cmelist.com/resule.htm. Accessed February 19, 2004.
3. Silverstein MB, Lovich D, Von Knoop C. Vital Signs Update: Doctors Say E-Health Delivers. 2001. Boston Consulting Group.
4. Fox S, Rainie L. E-patients and the online health care revolution. Physician Exec 2002;28:14–7.
5. Rothschild JM, Lee TH, Bae T, Bates DW. Clinician use of a palmtop drug reference guide. J Am Med Inform Assoc 2002;9:223–9.
6. Seror AC. Internet infrastructures and health care systems: a qualitative comparative analysis on networks and markets in the British National Health Service and Kaiser Permanente. J Med Internet Res 2002;4:E21.
7. Robinson TN, Patrick K, Eng TR, Gustafson D. An evidence-based approach to interactive health communication: a challenge to medicine in the information age. Science Panel on Interactive Communication and Health. JAMA 1998;280:1264–9.
8. Containing Costs While Maintaining Quality. Drug Benefit Trends. April 29, 2004. Medscape. Available at: http://www.medscape.com/viewarticle/447793?mpid=9737. Accessed February 3, 2003.
9. Bates DW, Ebell M, Gotlieb E, Zapp J, Mullins HC. A proposal for electronic medical records in U.S. primary care. J Am Med Inform Assoc 2003;10:1–10.
10. Weber D. 25 Health care trends. What's hot, what's not, and what does the future hold. Physician Exec 2003;29:6–14.
11. Terry K. EMRs boost efficiency, too. Med Econ 2002;79:38–4043.
12. Agrawal A. Return on investment analysis for a computer-based patient record in the outpatient clinic setting. J Assoc Acad Minor Phys 2002;13:61–5.
13. Casalino L, Gillies RR, Shortell SM, et al. External incentives, information technology, and organized processes to improve health care quality for patients with chronic diseases. JAMA 2003;289:434–41.
14. Sausser GD. Use of PDAs in health care poses risks and rewards. Healthcare Financ Manage 2002;56:8688.
15. Pollard JK, Fry ME, Rohman S, Santarelli C, Theodorou A, Mohoboob N. Wireless and Web-based medical monitoring in the home. Med Inform Internet Med 2002;27:219–27.
16. Epocrates. Available at: http://www2.epocrates.com/index.html. Accessed April 23, 2004 and July 10, 2003.
17. Firms Push to Have Doctors Abandon Pen for PDA. USA Today June 24, 2001.
18. A Call to Action: Eliminate handwritten prescriptions within three years. Institute for Safe Medication Practices (White Paper, 2000). Available at: http://www.ismp.org/MSAarticles/WhitepaperPrint.htm. Accessed July 10, 2003.
19. Medscape from WebMD. Available at: www.medscape.com/view. Accessed March 18, 2001.
20. Shu K, Boyle D, Spurr C, et al. Comparison of time spent writing orders on paper with computerized physician order entry. Medinfo 2001;10:1207–11.
21. Chan L, Trambert M, Kywi A, Hartzman S. PACS in private practice—effect on profits and productivity. J Digit Imaging 2002;15 Suppl 1:131–6.
22. Siegel EL, Reiner BI. Filmless radiology at the Baltimore VA Medical Center: a 9 year retrospective. Comput Med Imaging Graph 2003;27:101–9.
23. Masys DR. Effects of current and future information technologies on the health care workforce. Health Aff (Millwood) 2002;21:33–41.
24. Cartwright J, de Sylva S, Glasgow M, Rivard R, Whiting J. Inaccessible information is useless information: addressing the knowledge gap. J Med Pract Manage 2002;18:36–41.
25. Davis DA, Taylor-Vaisey A. Translating guidelines into practice. A systematic review of theoretic concepts, practical experience and research evidence in the adoption of clinical practice guidelines. CMAJ 1997;157:408–16.
26. Christianson JB, Wholey DR, Warrick L, Henning P. How are health plans supporting physician practice? The physician perspective. Health Aff (Millwood) 2003;22:181–9.
27. Julsrud PR, Breen JF, Jedeikin R, Peoples W, Wondrow MA, Bailey KR. Telemedicine consultations in congenital heart disease: assessment of advanced technical capabilities. Mayo Clin Proc 1999;74:758–63.
28. Finley JP, Human DG, Nanton MA, et al. Echocardiography by telephone—evaluation of pediatric heart disease at a distance. Am J Cardiol 1989;63:1475–7.

Working Group 7: Enhancing the Job "Matching" Process

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Job satisfaction, an important ingredient of a healthy professional environment that encourages efficiency and teamwork, which can result in better outcomes. This working group focused on methods to enhance the process of matching cardiologists with job opportunities. The group included cardiologists from academic and private practice and a cardiologist who had recently completed training. We used data from the ACC Cardiology Workforce Study 2002 (hereafter ACC workforce survey) to inform our discussions and recommendations. This report focuses mainly on the job-matching process from the perspective of the job seeker. Although most individuals actively seeking jobs in cardiology are trainees, many experienced academic or practitioner cardiologists are seeking a different position. The report includes suggestions for various types of educational programs that would help to inform trainees about the current cardiology job market and ways to improve their chances of finding a position that matches their interests and needs. We also discuss ways that the ACC, because of its national scope, local chapters, and affiliates-in-training program, is well-positioned to facilitate the job-matching process.

Trainees completing their cardiology fellowships now have the good fortune of a very active job market that presents them with a wide range of options in terms of job content and location. The results of the ACC workforce survey sent to senior cardiology trainees, cardiology training program directors, and recruiting firms provide compelling evidence that many open positions exist in general clinical cardiology and its subspecialties (e.g., interventional cardiology and eletrophysiology). Bruno and Ridgway Research Associates assisted ACC leaders and staff in constructing and conducting the survey. Their detailed analysis of the survey results led them to conclude, "The data from these three important segments impacting cardiology workforce point to the inescapable conclusion that, while there is ample supply of cardiology and high and increasing demand for their services once graduated, there are not enough training slots to meet that demand. Also, the evidence is that the disparity of supply versus demand will continue since programs seemingly can only make modest increases *even* if they had the resources." The survey data also led these consultants to predict that "the job market will continue to be very favorable toward senior fellows, recruiting for their services will continue to be very competitive, and the current workforce will have to face an increased patient demand" (1). The ACC workforce survey revealed that 71% of senior cardiology trainees believed that their job search was relatively easy. When the survey was conducted in the summer of 2002, 74% of the senior fellows had already secured a post-training position. Those who had accepted a position received an average of five job offers; those who had not yet accepted a position received an average of four job offers. Importantly, a majority of those who had accepted a position were satisfied with it (Fig. 1).

The ACC workforce survey provided useful information about what factors senior cardiology trainees thought were most important as they considered different positions (Fig. 2). Our consultants explained, "An analysis of gaps between satisfaction with features of a first post-training position in a cardiology practice and importance of those same features reveals that there are hardly any gaps at all. It seems that each of the very important features on the senior fellow 'wants and needs list' has been satisfied" (2). Each cardiology trainee (with his or her spouse, partner, or family) must consider many things as they evaluate potential job opportunities. The ACC workforce survey provides a useful perspective on the relative importance of several aspects of finding an ideal position.

One of the biggest challenges facing our specialty and patients with cardiovascular disease is a continuing (and worsening) shortage of general clinical cardiologists. It is evident from the ACC workforce survey that currently only a small percentage of senior trainees are seeking this type of position. Figure 3 provides a summary of the type of opportunities that senior fellows were seeking. Working Group 8 proposes an excellent model that would facilitate training more general clinical cardiologists.

The results of the ACC workforce survey suggest that most senior trainees are quite satisfied with the positions they have chosen or are considering. We believe, however, that the job-matching process could be enhanced by providing trainees and cardiology training program directors with more information about the job market and job seeking. We are unaware of recent published data that reveal how often cardiology training programs sponsor formal presentations or otherwise try to facilitate the job-search process in a structured way. It is our impression that most training programs do not address these topics. However, several recruiting firms focus on cardiology, and some of them sponsor seminars or otherwise provide job seekers with information about the market for cardiovascular specialists.

From the standpoint of the cardiologist looking for a position (and most will be senior cardiology trainees or

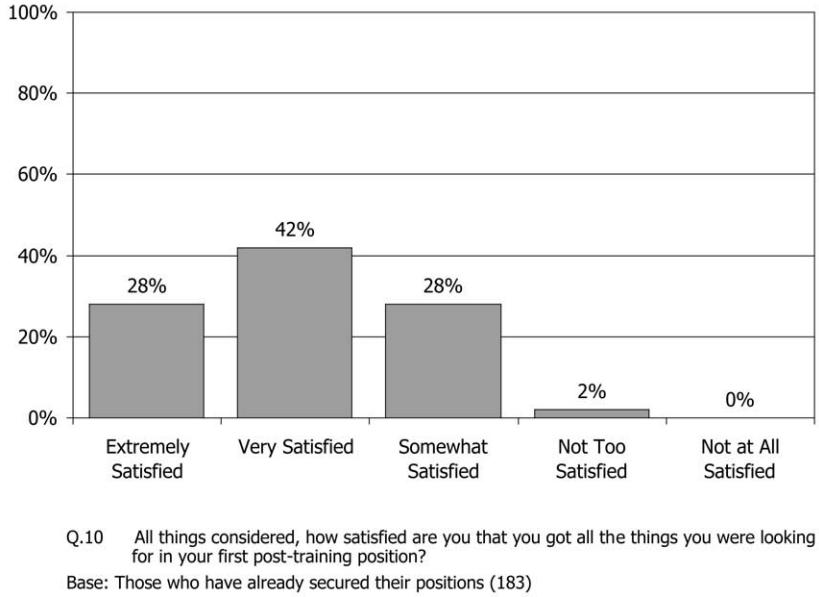

Figure 1. Overall satisfaction with first post-training position features and benefits (senior fellows). Source: ACC Cardiology Workforce Study 2002.

recent graduates of training programs), the job-matching process consists of two distinct but complementary phases. The first phase relates to the general type of position the cardiologist is seeking (Table 1). The second phase consists of a candidate selecting a specific position from the opportunities offered to him or her. This important stage may take several months to complete, based on the cardiologist's interests and aspirations, the job market at the time, and the need to address the many professional and personal details involved in the decision to accept a position. The ACC workforce survey revealed that (of the respondents) 75% of the senior trainees were married, 82% were male, their median age was 34, and 53% had graduated from a U.S. medical school. The fact that three-quarters of trainees seeking a job are married emphasizes the fact that many of the decisions about where to locate are shared with a spouse (who will often have his or her own specific work or life goals).

The most popular private practice model for both ACC members and senior cardiology trainees is the single-specialty group. In cardiology there has been a steady trend away from solo or small group practice to large single-specialty group practice over the past quarter-century. The popularity of this practice model can be attributed to a combination of factors, including a greater degree of functional autonomy and a higher potential salary compared with private multispecialty groups. Academic positions are most closely related to the multispecialty group practice model, but full-time academic cardiologists practice in a teaching hospital and usually have a significant commitment to research and/or teaching in addition to patient care responsibilities.

As we considered how to enhance the job-matching process, we recognized that a significant number of recent cardiology trainees change jobs within five years of accepting their first position. It would be useful to gather data on this aspect of job-matching in order to reduce the number of unsatisfactory matches. Many factors enter into a trainee's decision to accept their first position, and many professional and personal factors contribute to his or her decision to leave that job for another position. In some instances the practice or institution decides not to keep the cardiologist as a member of their group or staff after an associate period of one or more years. We believe that better and more stable job matches will result from enhancing the original search and match process through education and by providing greater awareness of the number and types of positions that are available.

The training program director or another interested cardiology faculty member should discuss at an early stage of a fellow's training the type of career he or she is most likely to seek upon completion of their fellowship. Indeed, it is useful to discuss this with internal medicine residents if they express interest in cardiology or when they are interviewing for a cardiology fellowship position. Each training program should develop a formal system that encourages fellows to discuss their career goals at regular intervals either with the director of the program or another faculty member. Understandably, the career goals of a significant number of cardiology trainees change during their fellowship as they are exposed to various cardiology subspecialties and learn more about the various types of careers open to them. Working Group 8 describes the broad spectrum of careers that now exist in cardiology.

Many (probably most) trainees see academic and practitioner cardiologists mainly during busy inpatient clinical rotations or when they are "on call," a time that can be especially hectic. These experiences present a distorted view of cardiology practice and surely discourage some highly qualified medical students and internal medicine residents from considering a career in the specialty. An effort should be made to provide trainees a more balanced view of the spectrum of cardiology opportunities. For example, it would be useful for internal

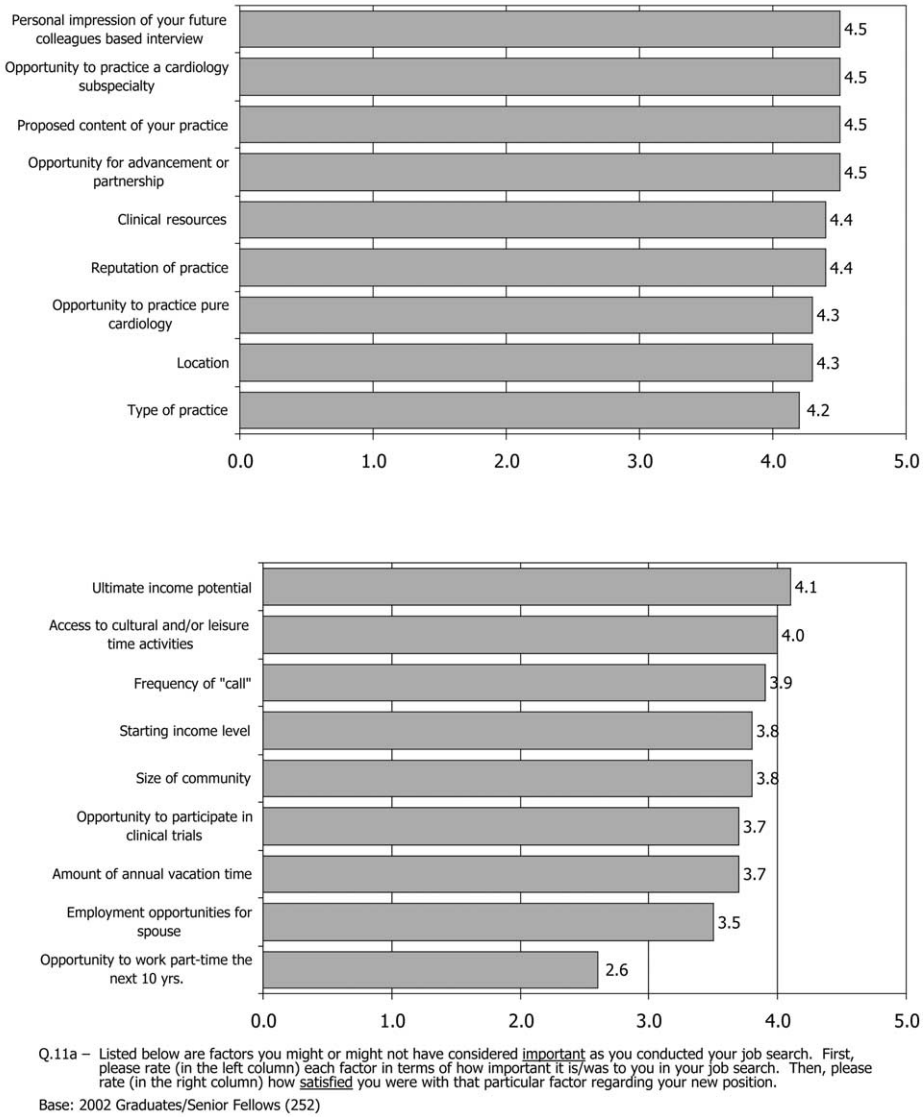

Figure 2. Summary of "mean" ratings for factors considered in job search (5 = extremely important, 1 = not at all important). Source: ACC Cardiology Workforce Study 2002.

medicine residents or cardiology fellows interested in private practice to have an opportunity to have one or more outpatient rotations in various types of practices. This would afford them an opportunity to explore and better understand the spectrum of clinical activities that take place outside a busy hospital inpatient service. It seems likely that some members of the part-time faculty affiliated with the academic medical center or cardiologists in nearby communities would welcome this opportunity, although the time pressures that practitioners face in all settings today may reduce their interest in taking on this added responsibility.

If a formal offsite outpatient cardiology rotation is not feasible, an informal arrangement during elective or vacation time might be possible. The local ACC chapter could help identify cardiology groups or individual cardiologists willing to serve as mentors. The practitioners who participate would in turn become acquainted with trainees considering private practice opportunities. Such a relationship might facilitate hiring one of these fellows in the future. Groups having difficulty recruiting might be willing to offer opportunities to trainees interested in seeing their practice firsthand. Working Groups 2 and 3 also emphasize the importance of mentoring in various contexts as we seek to attract the most qualified candidates to our specialty.

A similar mentoring experience could be arranged for trainees considering a career in academic medicine or industry. Ideally, in the academic setting, a full-time faculty member should be assigned to mentor a trainee who shares his or her professional interest. The mentor should meet regularly with the trainee to provide feedback and advice. This faculty member could also help the trainee identify open positions in other academic medical centers. Trainees seeking specific types of academic or private practice opportunities should also be encouraged to attend local, regional, and national cardiology continuing medical educational meetings and ACC chapter meetings. These meetings

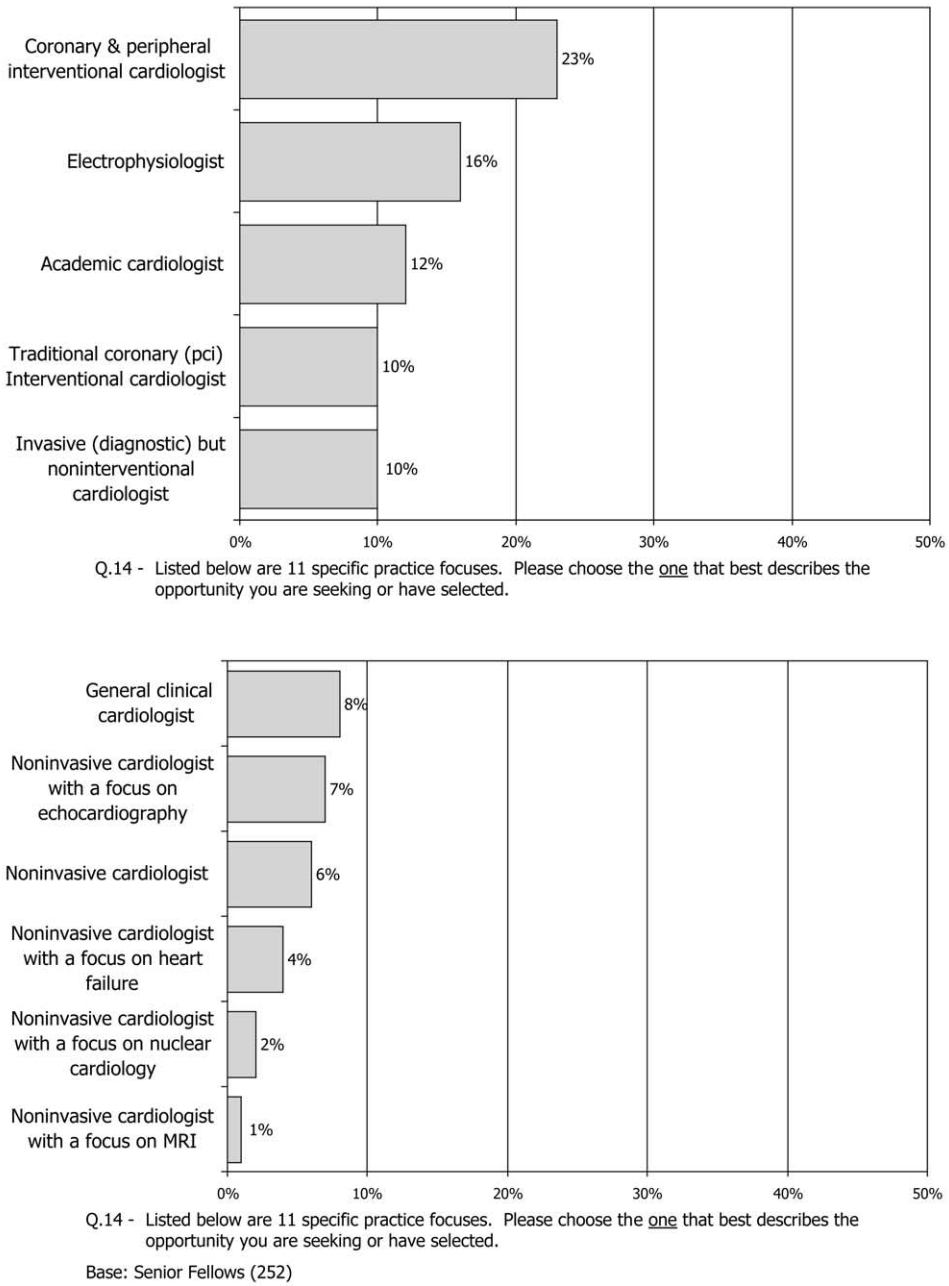

Figure 3. Practice focus that best describes opportunity sought/selected. Source: ACC Cardiology Workforce Study 2002.

provide trainees an opportunity to meet formally or informally with a variety of individuals who can describe various professional opportunities.

The California chapter of the ACC developed a program that has been very successful in connecting trainees with academic and practitioner cardiologists. This model, which takes advantage of the ACC's network of 39 chapters, could be replicated throughout the country because most cardiology training programs are located in states with chapters. For several years the California ACC chapter has sponsored a popular one-half day program during its annual meeting that informs trainees about the academic and private practice job markets. Other chapters have incorporated similar programs into their meetings.

Ideally, senior trainees and recent cardiology graduates should participate in the planning of this type of local program. Many subjects might be included. For example, the program might include "case studies," examples of job searches that went well or perhaps not so well. Some ACC chapters have sponsored a "job fair" that enables trainees seeking a specific type of position to meet with representatives of academic programs, private practices, and industries that are seeking cardiologists. (See Appendix for the agenda of the California Chapter Fellows Session.) It would be

Table 1. Types of Cardiology Practice and ACC Member Profile (2002)

Type	Domestic ACC Members Identifying This as the Type of Practice They Are In
Single-specialty private group	46%
Multispecialty group practice	11%
Solo practice	12%
Full-time academic practice	19%
Other*	12%

Source: ACC Membership Survey (2002). *Includes fellows who are ACC members (4% of total surveyed)

useful if the didactic portions of some of these programs devoted to job-seeking could be recorded for distribution to interested trainees and training program directors.

Trainees considering an academic career should consider attending the conference "How to Become a Cardiovascular Investigator," which addresses various aspects of academic cardiology positions, with emphasis on research. These conferences, held at the ACC's Heart House, have been sponsored jointly by the ACC, American Heart Association (AHA), and the National Institutes of Health (NIH). This one and one-half day session provides valuable insight into various aspects of beginning a career in academic medicine. Subjects discussed include: 1) the spectrum of clinical and research opportunities available in most academic centers, 2) writing grant applications, 3) choosing a research project, 4) writing scientific papers, and 5) job searches, among other topics. There is no registration fee for this program. Recordings of these conferences should be made available to training program directors. If there is sufficient interest, this program could be expanded to a second site, such as the West Coast, to facilitate access. Attendees have commented that the face-to-face interactions with faculty have been particularly valuable.

The 2004 ACC Scientific Sessions included a symposium dealing with job opportunities and job seeking. The topics included "Career Choices: How to Network, Identify the Decisions that Count, and Make it Happen" and "How a Fellow-in-Training Got Started in the Real World," among others. This working group believes that programs such as these will continue to be popular among trainees and may encourage more of them to attend the ACC Annual Scientific Sessions.

Other topics of interest to job seekers that could be incorporated into the mentoring process at individual institutions or could be part of a structured program offered by the ACC, its chapters, or other organizations might include: 1) the role of professional recruiters, 2) the business aspects of private practice, 3) legal issues related to contracts of employment, 4) the most popular methods of compensation (including salary, bonuses, and benefits), 5) how to access published surveys that list starting and mean salaries for different types of cardiologists in various geographic locations and types of practice, and 6) how to evaluate the financial stability and physician turnover history of a practice, among other things.

The ACC also sponsors a "Computerized Placement Center" at the Annual Scientific Sessions. This includes a dedicated on-site facility with electronic access to the College's ACC Cardiology Careers (discussed in the subsequent text). The ACC staff members are available at the job-placement center during the annual meeting to assist trainees and cardiologists seeking positions to post their resumes that include their specific interests. The facility provides space for meetings and interviews between job seekers and individuals representing institutions or practices that are recruiting. Shortly, the College will begin to offer assistance to retired or semi-retired cardiologists seeking to return to practice on a part-time or full-time basis.

The ACC provides several services to facilitate job matching. One that has proved to be very popular is the Web-based ACC Cardiology Careers (http://www.acc.org/home_links/jobopport.htm, Accessed June 13, 2004). In June 2004 there were 577 cardiology jobs posted at this site, and several postings describe more than one open position. When initiating a job search, the fellow may submit his or her resume to ACC Cardiology Careers at http://www.acc.org for maximal exposure and to directly contact practices offering specific types of opportunities or in specific geographic areas. Once again, the ACC chapters should consider how they might better serve their members seeking partners and the affiliates-in-training in their state or region.

In summary, this is a time of great opportunity in cardiology, one of medicine's most interesting and dynamic specialties. Fellows completing their training are entering a job market that offers a wide range of positions in academic medical centers and in private practice. To enhance the job-matching process and to reduce the likelihood of dissatisfaction trainees should take advantage of the tools available to them (such as ACC Cardiology Careers) to be better informed about their options. Meanwhile, academic medical centers, the ACC, and local ACC chapters should continue to improve the process of matching the right person with the right position.

RECOMMENDATIONS/CONCLUSIONS

1. Each cardiology trainee should have a faculty mentor whose responsibilities include helping the fellow consider career options early in their training.
2. Opportunities for outpatient rotations in private practice settings should be made available to interested trainees.
3. ACC chapters should consider ways to facilitate job matching between their members and trainees in their state or region. Successful programs, such as the one conducted by the California chapter, can serve as models for other ACC chapters.
4. The special symposium on job hunting should be a standard part of the ACC Annual Scientific Sessions.
5. Formal national ACC or ACC chapter symposia dealing with job searching should be recorded and made avail-

able to all training program directors and interested trainees.

6. Trainees interested in an academic career should attend the Learning Center Program "How to be a Cardiovascular Investigator."
7. The ACC Cardiology Careers Website and the on-site Computerized Placement Center at the ACC Annual Scientific Sessions should be given increased exposure to all trainees, faculty, and the membership at large.

WORKING GROUP 7 REFERENCES

1. Bruno and Ridgway Research Associates, Inc. ACC Cardiology Workforce Study conducted for the American College of Cardiology. M-2. 2002.
2. Bruno and Ridgway Research Associates, Inc. ACC Cardiology Workforce Study conducted for the American College of Cardiology. S-7. 2002.

Appendix

FELLOWS-IN-TRAINING SECTION CONFERENCE
SATURDAY, DECEMBER 7, 2002 – 1:00PM –6:30PM

WHAT YOU NEED TO KNOW TO GET STARTED IN CARDIOLOGY PRACTICE

PROGRAM

1:00-1:05PM
Introduction: *Nora F. Goldschlager, MD, FACC*
Advisor, Fellows-in-Training Section

1:05-1:45PM
ACC/AHA Guidelines for General Cardiology and Subspecialty Training
Joseph Alpert, MD, FACC
Chief, Div.of Cardiology, Health Sciences Ctr.
Department of Medicine
University of Arizona, Tucson
The revised ACC/AHA guidelines for cardiology fellowship training was completed in September 2000 and published in January 2001. Dr. Alpert will provide an overview of the guidelines before opening up the session to discussion. The guidelines cover training in general cardiology as well as subsequent cardiac subspecialization (e.g. invasive, interventional, electrophysiology, nuclear medicine, echocardiography, adult congenital heart disease, MRI, heart failure and transplant). Dr. Alpert will also discuss the requirements for obtaining a nuclear medicine license. The relationship of the Residency Review Committee (RRC) to the ACC will be discussed as well. This should be an excellent session to make certain that you obtain the proper training prior to applying for further training and board certification/licensure.

1:45-2:30PM
"The Cardiovascular Marketplace: Understanding The Critical Factors In The 21st Century"
John Mininger, Cardiology Match
I. National Trends- Demand for Cardiology Services, Procedure Growth, Population Demographics
II. National Trends - Manpower for Cardiology Services, Status of Supply of Cardiologists, Ratios of Cardiologists by Geographic Area, Effect of Sub-Specialization
III. The Marketplace for Fellows
IV. Strategies for Maximizing Search Efforts

2:30-3:30PM
Getting Started in Academic Medicine
Hal Barron, MD, FACC, San Francisco
Anthony DeMaria, MD, FACC, San Diego
Karol Watson, MD, Los Angeles
California ACC Fellow Moderator:
Jacob Mishell, MD, San Francisco
How do you build a career in academic medicine? This session will cover the different academic tracks and what is required for promotion. What qualities should be found in an ideal mentor? How do you negotiate salary, protected time, and clinical duties? What do you need to know about research funding? What funding sources are available?
Dr. Anthony DeMaria, UCSD will discuss academic careers in clinical cardiology.
Dr. Karol Watson, UCLA will discuss academic careers in basic science.
Dr. Hal Barron, Assistant Professor of Medicine at UCSF and Director of Cardiovascular Research at Genentech, will discuss the relationship of industry to academic medicine.

3:30-3:45 Refreshment Break

3:45-4:45PM
Getting Started in Cardiology Practice
Ralph Brindis, MD, FACC, San Francisco
Richard Wright, MD, FACC, Santa Monica
Kent Ivey, Esq., Los Angeles
Mark Hiepler, Esq., Oxnard
California ACC Fellow Moderator:
Steven Kang, MD, Los Angeles
What do you need to know when you are looking for a practice opportunity in cardiology? Are you interested in a hospital or clinic-based practice or both? What are the advantages and disadvantages of HMOs vs. large specialty groups vs. small single specialty groups? Learn how to assess the structure of a practice in terms of physician responsibilities, call and back-up call, administrative time and overhead costs, patient population, and average workday, vacation, and weekends. Other topics to be covered will be negotiation of your job description and what you should know about contracts, partnerships, and compensation alternatives. Dr. Brindis works at Kaiser, the largest HMO in the state and Dr. Richard Wright is part of a small, single specialty group.
Mr. Ivey is an attorney who will discuss some of the critical aspects of physician contracts.
Mark Hiepler will cover all aspects of HMOs.

4:45-5:00PM
How I did it – From Training to Practice
Richard Wong, MD

5:00-5:30PM
The Future of Cardiology: ACC Perspective
W. Bruce Fye, MD, MA, FACC, ACC President
5:30PM
Job Fair – Bring your CVs

Working Group 8: Defining the Different Types of Cardiovascular Specialists and Developing a New Model for Training General Clinical Cardiologists

Valentin Fuster, MD, PhD, FACC, *Chair*, John W. Hirshfeld, Jr, MD, FACC, *Co-Chair*
Alan S. Brown, MD, FACC, Bruce H. Brundage, MD, MACC, W. Bruce Fye, MD, MA, MACC,
Richard P. Lewis, MD, MACC, Ira S. Nash, MD, FACC, Michael H. Sketch, Jr, MD, FACC,
George W. Vetrovec, MD, FACC

INTRODUCTION

The two main objectives of Working Group 8 were: 1) to present detailed definitions of the various "types" of cardiovascular specialists, and 2) to offer a new model for training general clinical cardiologists. It is important to establish common definitions of cardiology's recognized and emerging subspecialties. This standardized nomenclature will be of value to a wide range of individuals and organizations. Now is the time to develop and pilot a more focused and shorter training path for physicians whose career goal is to be a general clinical cardiologist. In response to the ongoing expansion of knowledge, technology, and techniques that define cardiology, the period of training required to become a board-certified cardiovascular specialist or subspecialist has lengthened. Meanwhile, the time devoted to preliminary training in general internal medicine has remained constant (three years). The growing shortage of cardiologists presents an opportunity for our nation's academic centers and regulatory bodies to become partners in the development of innovative alternatives to the traditional model of internal medicine and cardiology training.

A comprehensive system for classifying cardiologists. A more comprehensive system for classifying the various types of cardiovascular specialists active today will be of value: 1) to medical students, internal medicine residents, and cardiology trainees as they contemplate career options, 2) to institutions and organizations as they consider the spectrum of services they provide and the educational programs they sponsor, and 3) to various public and private organizations and agencies concerned with a wide range of socioeconomic aspects of cardiology. A standardized nomenclature for classifying the different types of cardiovascular specialists will also be very helpful for enhancing workforce projections because each type of cardiovascular specialist is likely to have a different supply/demand ratio depending on a variety of factors.

As cardiology evolved as a specialty during the second half of the 20th century, several distinct subspecialties emerged—mainly as a result of scientific advances and a series of technological and procedural innovations relevant to patient care. For example, the term *invasive cardiologist* appeared after the introduction of cardiac catheterization in the 1940s. Today, several different types of cardiologists provide specific services to patients and to other types of cardiologists, but there is no uniform system of classifying them for the purpose of surveys, workforce assessments, and a range of other purposes (Table 1).

For our purpose we chose to limit this classification to individuals who share one credential: they are board certified in cardiology. We recognize that much of the acute and chronic care provided to patients with cardiovascular disease is delivered by general internists, family physicians, and other providers, depending on the context. The working group also thought it would be more helpful to develop comprehensive descriptions of each type of cardiologist rather than brief, incomplete ones. It is important to acknowledge that many cardiologists actually blend two or more of these types in practice, and this trend is likely to continue. The boundaries are not fixed, although trends in certification and reimbursement are leading to more distinct rules regarding what training, experience, and credentials are required to provide certain types of care or perform and interpret some procedures. Several of the subspecialties that we define below require a "critical mass" of patients and specialized facilities and support staff. For this reason, many of them practice in academic institutions, referral centers, or in large single-specialty or multispecialty group practices.

The *General Clinical Cardiologist* focuses on the diagnosis, medical management, and prevention of cardiovascular disease. He or she will be actively involved in the long-term care of patients with known cardiovascular disease. These cardiologists may limit their practice to outpatients or may combine office work with inpatient practice. General clinical cardiologists are frequently asked to see the patients in consultation by primary care physicians, other medical specialists, and surgeons. A general clinical cardiologist is skilled at selecting appropriate medications for the treatment of the broad spectrum of cardiovascular conditions. Most general clinical cardiologists will interpret electrocardiograms, Holter monitors, and exercise stress tests. Depending on the interests and training of the individual clinical cardiologist and the needs of their practice or institution he or she might interpret transthoracic echocardiograms and/or standard nuclear cardiology procedures,

Table 1. Types of Cardiovascular Specialists, Years of Training, and Certifications (2004)

Type (Focus of Practice)	Years IM + CV + Advanced CV	ABIM Certification or Other Certification*
General Clinical Cardiologist	3 + 3	ABIM IM + ABIM CV
Interventional Cardiologist	3 + 3 + 1	ABIM IM + ABIM CV + ABIM IV
Electrophysiologist	3 + 3 + 1	ABIM IM + ABIM CV + ABIM EP
Echocardiologist (Echocardiographer)	3 + 3	ABIM IM + ABIM CV + NBE
Nuclear Cardiologist	3 + 3	ABIM IM + ABIM CV + CBNC
MR/CT Cardiologist	3 + 3	ABIM IM + ABIM CV
Heart Failure & Transplant Cardiologist	3 + 3	ABIM IM + ABIM CV
Preventive Cardiologist	3 + 3	ABIM IM + ABIM CV
Vascular Medicine Specialist	3 + 3	ABIM IM + ABIM CV
Cardiovascular Investigator	3 + 3	ABIM IM + ABIM CV

*This table includes current (2004) minimum training time requirements to be eligible for specific certifying board examinations. Many cardiovascular trainees spend one or more additional years in training beyond the minimum required years. New certifications are being considered, and the requirements for some types of certification continue to change.
ABIM = American Board of Internal Medicine; CBNC = Certification Board of Nuclear Cardiology; CT = Computed Tomography; CV = Cardiovascular; EP = Clinical Cardiac Electrophysiology; IM = Internal Medicine (general); IV = Interventional; MR = Magnetic Resonance; NBE = National Board of Echocardiography.

care for patients admitted to the coronary care unit, and perform diagnostic cardiac catheterization and coronary angiography. A general clinical cardiologist will not be trained or expected to perform interventional procedures or interpret more complex diagnostic tests such as cardiac MRI studies.

The *Interventional Cardiologist* performs high-technological invasive therapeutic procedures such as percutaneous coronary intervention (PCI) for the treatment of acute coronary syndromes and non-acute coronary heart disease, balloon dilatation of the mitral valve, and percutaneous device closure of a patent foramen ovale. Depending on training and local need, an interventional cardiologist may perform percutaneous angioplasty on non-coronary vessels such as the carotid, renal, or femoral arteries. The scope of interventional practice continues to expand as new devices are invented and new techniques are developed. Interventional cardiologists should have special knowledge of how to use drugs that improve the outcome of PCI such as glycoprotein IIb/IIIa platelet receptor antagonists. He or she should also be familiar with how to incorporate the results of newer imaging modalities that assess viability (such as positron emission tomography [PET] scanning) into their decision-making process.

The *Electrophysiologist* focuses his or her practice on the diagnosis and management of patients with cardiac arrhythmias. The electrophysiologist's armamentarium has grown substantially in the past two decades and continues to evolve rapidly. These specialists employ sophisticated invasive, high-technology procedures to characterize and treat cardiac arrhythmias. Pacemakers, invented in the late 1950s, are now very complex devices that require a sophisticated understanding of their capabilities and appropriate use. Although other types of cardiologists implant pacemakers, it is likely that these procedures will gravitate to electrophysiologists in many contexts. The electrophysiologist is skilled at performing catheter-based ablation procedures and implanting antiarrhythmia devices such as dual chamber pacemakers and cardioverter-defibrillators. He or she also has a sophisticated knowledge of antiarrhythmic drugs.

The *Echocardiologist* or *Echocardiographer* will have level 2 or 3 training as defined by the American Society of Echocardiography and the ACC. He or she performs and/or interprets the entire spectrum of echocardiography techniques including comprehensive quantitative transthoracic echo-Doppler, stress echocardiography, and transesophageal echocardiography. In addition, some echocardiographers (depending on their interests and local needs) perform intraoperative echo and may be involved in evolving techniques such as intravascular ultrasound, three-dimensional echocardiography, and myocardial contrast echocardiography.

The *Nuclear Cardiologist* will have training as defined by the American Society of Nuclear Cardiology and the ACC. He or she is trained to interpret all standard nuclear cardiology studies such as myocardial perfusion imaging, radionuclide angiography, and myocardial viability studies. He or she is skilled at helping other cardiologists and non-cardiologists decide which nuclear cardiology techniques are likely to provide the most useful information in a specific clinical situation. In an increasing number of institutions, nuclear cardiologists also interpret PET studies to evaluate myocardial viability.

The *Computed Tomography/Magnetic Resonance Imaging Cardiologist* focuses on using state-of-the-art computed tomography (CT) and magnetic resonance (MR) techniques to aid in the noninvasive diagnosis and clinical management of cardiovascular disease. He or she will have significant advanced training in these techniques beyond the basic exposure available in many cardiology training programs today. Cardiac CT and MR are powerful tools that provide anatomic and physiological information that may complement other forms of cardiac imaging such as echocardiography and nuclear cardiology studies. Although in many institutions cardiac CT and MR studies are performed and interpreted by radiologists, there is a significant trend toward active collaboration between cardiologists and radiologists. In a growing number of settings, cardiology groups have purchased this equipment.

The *Heart Failure and Transplant Cardiologist* has special training and expertise in the treatment of patients with

advanced or refractory heart failure. Most patients with compensated heart failure are followed mainly by general clinical cardiologists and/or primary care physicians. The heart failure cardiologist has sophisticated knowledge of state-of-the-art pharmacological treatments and device therapies for patients with severe or decompensated heart failure. He or she will be familiar with the indications for cardiac transplantation and left ventricular assist device implantation and will have expert knowledge about the various pharmacological approaches for treatment of heart failure. These cardiologists will also be involved in the ongoing care of patients with significant heart failure, usually in conjunction with other physicians.

The *Adult Congenital Cardiologist* has special training and expertise in congenital heart disease, especially as it exists in patients over the age of 18. He or she will have detailed understanding of the anatomy and physiology of the entire spectrum of treated and untreated congenital heart disease. Depending on their training, interests, and local need, the adult congenital cardiologist may limit his or her practice to non-invasive diagnosis and medical treatment. The adult congenital cardiologist may, however, perform a variety of invasive diagnostic and interventional therapeutic techniques.

The *Preventive Cardiologist* is a general clinical cardiologist with special interest and training in the primary and secondary prevention of cardiovascular disease. All types of cardiologists must know the basics of preventive cardiology and recommend appropriate therapy for patients they see in consultation or follow long term. The preventive cardiologist possesses a more detailed understanding of the interplay of known and emerging risk factors and will have expertise in treating patients with challenging lipid disorders. As knowledge about the complex pathophysiology of (and synergy between) various risk factors grows, it is important to have specialists who help to translate this growing scientific knowledge base into clinical practice. The preventive cardiologist will have a sophisticated understanding of vascular biology, clinical genetics, cardiovascular epidemiology, clinical pharmacology, and clinical trials that focus on prevention. In addition, he or she may coordinate multidisciplinary teams that focus on smoking cessation, cardiac rehabilitation, nutritional counseling, and other approaches to reducing cardiovascular risk.

The *Vascular Medicine Specialist* has specialized training in the diagnosis and management of non-coronary vascular disease. This physician is involved in the management of patients with all aspects of vascular disease, including cerebrovascular, upper and lower extremity arterial, aortic, mesenteric, and renal artery disorders; venous thromboembolic disease (both acute and chronic); lymphatic disorders; vasculitis; hypercoagulable states; environmental and occupational vascular disorders. This specialist has expertise in vascular laboratory diagnostic testing. Vascular medicine specialists evaluate patients on both an outpatient and inpatient basis, and are involved in the long-term management of these patients. Physicians who obtain COCATS-II Level 3 training may also perform peripheral endovascular interventional procedures.

The *Cardiovascular Investigator* is a cardiologist who devotes significant effort to one or more types of research (e.g., basic, clinical, and population-based) dealing with the cardiovascular system. History makes it abundantly clear that advances in the care of patients with cardiovascular disease have resulted from discoveries made in many disciplines—some quite remote from cardiology. Our definition excludes PhD scientists and other non-physicians who perform cardiovascular research because we are focusing on physicians whose career path included training in general clinical cardiology.

A NEW SHORT-TRACK MODEL FOR TRAINING GENERAL CLINICAL CARDIOLOGISTS

Background to the proposal. As outlined in the introduction to this Bethesda Conference report, the U.S. is facing a growing shortage of cardiologists. Of the various types of cardiologists described above, the evolving supply–demand mismatch is likely to be greatest for general clinical cardiologists. The ACC Cardiology Workforce Study 2002 of senior cardiology fellows revealed that a majority of current trainees hope to devote most of their time to one of cardiology's subspecialties (e.g., interventional cardiology or electrophysiology). Only 13% hoped to practice mainly general clinical cardiology (Fig. 1).

The need to train more general clinical cardiologists was emphasized in 1994 (1), and this goal was reemphasized recently by Willis Hurst (2). Based on demographic trends and our success at reducing the mortality from acute coronary syndromes, the number of Americans with chronic cardiovascular disease will increase significantly during the first quarter of the 21st century and beyond (3). Although the demand for high-technology diagnostic and therapeutic procedures continues to grow, going forward the greatest unmet need will likely be for sophisticated long-term outpatient care of adults with various types of chronic cardiovascular disease. This would be a major practice focus of the general clinical cardiologist—the type of cardiologist who is already in short supply. As discussed in the introduction to this report and by Working Group 5, patients with cardiovascular disease benefit from team care that coordinates and blends the skills of primary care physicians, specialists, subspecialists, and non-physician clinicians. The general clinical cardiologist should be a key member of this team in many clinical situations.

The notion that we need to train more general clinical cardiologists has widespread support. The fact that we have not succeeded in this goal reflects a combination of factors including the current length and structure of U.S. cardiology training. Today, as discussed by Working Group 1, there are not enough ACGME-approved and funded training slots to meet the growing demand for cardiovascular

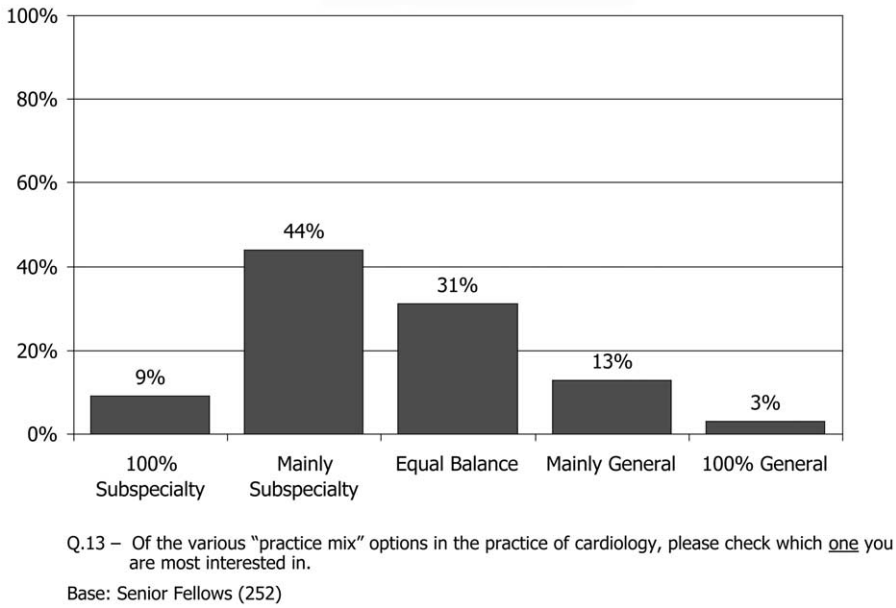

Figure 1. Proportion of senior fellows interested in different practice mix options (senior fellows). Source: ACC Cardiology Workforce Study 2002.

specialists, especially general clinical cardiologists who do not perform high-technology procedures (2,4,5). We believe our short-track model will help satisfy society's growing need for this important type of cardiologist. The model is a modified version of a 1997 proposal to create a hybrid "Generalist/Cardiovascular Specialist" (5).

Short-track model for training general clinical cardiologists. We propose that a five-year "short track" internal medicine–cardiology training program be developed and piloted for physicians whose career goal is to be a general clinical cardiologist. We defined the likely scope of practice for a general clinical cardiologist in the first section of our report, but there are many possible variations that reflect individual interests and local needs. The first two years of the program would consist of core training in internal medicine as defined by the ACP, the ABIM, and other entities that influence the content of general internal medicine training. The middle year of this five-year program would be devoted to clinical cardiovascular medicine. The focus of this year would be on the non-procedural aspects of cardiology with emphasis on primary and secondary prevention and the medical management of patients with cardiovascular disease (6). It might include, for example, elective rotations in endocrinology (reflecting the importance of diabetes as a cardiovascular risk factor), clinical pharmacology, peripheral vascular disease, or research. We believe it is important, however, to allow trainees and internal medicine and cardiology program directors to customize this middle year of cardiovascular medicine to reflect the interests of the trainee and to take advantage of the strengths of the institution. The final two years of the "short track" internal medicine-clinical cardiology training program would consist of traditional clinical cardiology fellowship training as outlined in COCATS II (7).

The product of this short-track model would be a general clinical cardiologist who is eligible for ABIM certification in internal medicine and cardiovascular disease. The scope of practice of most of the individuals completing this new model would fit the definition of the general clinical cardiologist proposed in this report. We anticipate that individuals completing this program will find opportunities both in academic medicine and in private practice because the general clinical cardiologist is the ideal physician to bridge the growing gap between primary care physicians and cardiology subspecialists—most of whom prefer to focus their practice on a specific type of problem (e.g., heart failure) or certain procedures (e.g., interventional cardiology).

Attracting applicants to a short-track general clinical cardiologist model. A five-year training program of core general internal medicine (2 years)–cardiovascular medicine (1 year)–general clinical cardiology (2 years) would replace the current six-year general internal medicine (3 years) cardiology training (3 years) program. This short-track option would be designed to train general clinical cardiologists and would likely attract a large number of qualified candidates. The ACC workforce survey of cardiology training program directors documented that there are many more qualified applicants for cardiology fellowships than there are ACGME-approved and funded positions. This short-track model might be especially attractive to female medical students and internal medical residents who are interested in general clinical cardiology but who do not want to delay their entry into practice for six or seven years after they receive their medical degree. This five-year short-track model would be an attractive option for any physician seeking an outpatient cardiology practice that focuses on noninvasive diagnosis, preventive cardiology, and expert

long-term expert management of patients with cardiovascular diseases.

The intent of the short-track model we propose is clear, and individuals applying for these positions should have a sincere desire to practice general clinical cardiology. Understandably, some trainees will change their minds as they progress through the five-year program. Some may wish to extend their cardiology training by one or more years in order to become qualified to practice and be certified in a cardiology subspecialty. Meanwhile, some first-year cardiology trainees enrolled in a standard three- or four-year cardiology fellowship may decide to apply for the short-track. These options should exist, but if applicants for the short-track have a clear understanding of the intent, content, and consequences of the model and are selected carefully, shifts in or out of the five-year model should be infrequent.

In general, if innovations in graduate medical education are to succeed there must be a perceived benefit that justifies change and a critical mass of support to implement the proposed modifications. Although the model we propose has a clear purpose that would help meet a growing societal need, it will require the active support of several national organizations, including the ACGME, RRC, ABIM, ACP, and ACC, among others. Ideally, representatives of these bodies could be selected and meet soon with internal medicine and cardiology training directors from a few institutions willing to consider piloting a short-track program. The goal would be to develop a detailed model that could be piloted in a few selected academic medical centers within three years. As the details are worked out it will be important to establish criteria that will be used to evaluate whether this short-track model is achieving predetermined goals.

Theoretically, implementation of a short-track model should result in some cost saving for participating academic institutions, because general clinical cardiologists trained in this way would complete their postgraduate training in five rather than six years. Assuming a pilot institution receives the same amount of GME funding it might be possible to reallocate some of these funds to increase the total number of cardiologists they train. Moreover, philanthropic foundations might be interested in sponsoring one or more of these pilots because they represent an excellent opportunity to introduce innovations in graduate medical education and health care delivery that address a growing societal need for more general clinical cardiologists.

It is important to consider what impact a five-year program to train general clinical cardiologists might have on the traditional approach to training cardiovascular specialists. Because we believe there is a national need for more cardiologists, the model we propose does not recommend a commensurate decrease in the output of subspecialty cardiologists (whose training will last six or seven years following medical school graduation). In addition to being board eligible in internal medicine and cardiology (as would the five-year trainees), these cardiology subspecialists would also be eligible to take the ABIM examinations for added qualification in interventional cardiology or electrophysiology or similar examinations that have been (or will likely be) developed to acknowledge advanced training in other cardiology subspecialties.

Finally, this model should not undermine the research mission of academic medical centers. Indeed, it might actually enhance the research opportunities for trainees who have a sincere interest in this vital activity. Although the third year of cardiology training was originally envisioned as a means to expose all cardiology trainees to research, the growth of diagnostic and therapeutic procedures and the demand for additional elective time has already eroded the time most trainees devote to research.

In summary, we believe that now is the time to design and pilot a new training path for physicians that want to practice general clinical cardiology. Because they can fill a growing void between primary care physicians and cardiology subspecialists, it is likely that these individuals will find ample opportunities in private practice, academic medical centers, and other contexts. The dramatic and rapid growth of the hospitalist model of inpatient care in recent years demonstrates how innovations in health care delivery that meet the needs of physicians, patients, and institutions can succeed in a short period of time. We believe that a short-track program can be developed that will produce a cadre of cardiovascular specialists who are experts in general clinical cardiology.

WORKING GROUP 8 REFERENCES

1. Gunnar RM, Williams RG. Excerpt from 25th Bethesda Conference: Future personnel needs for cardiovascular health care. November 15–16, 1993. J Am Coll Cardiol 1994;24:290–5.
2. Hurst JW. Will the nation need more cardiologists in the future than are being trained now? J Am Coll Cardiol 2003;41:1838–40.
3. Foot DK, Lewis RP, Pearson TA, Beller GA. Demographics and cardiology, 1950–2050. J Am Coll Cardiol 2000;35:1067–81.
4. Fye WB. Cardiology workforce: there's already a shortage, and it's getting worse! J Am Coll Cardiol 2002;39:2077–9.
5. Fuster V, Nash IS. The generalist/cardiovascular specialist: a proposal for a new training track. Ann Intern Med 1997;127:630–4.
6. Merz CN, Mensah GA, Fuster V, Greenland P, Thompson PD. Task force #5—the role of cardiovascular specialists as leaders in prevention: from training to champion. 33rd Bethesda Conference. J Am Coll Cardiol 2002;40:641–51.
7. Beller GA, Bonow RO, Fuster V. ACC revised recommendations for training in adult cardiovascular medicine core cardiology training II (COCATS 2). American College of Cardiology web site. Available at: http://www.acc.org/clinical/training/cocats2.pdf. Accessed October 25, 2003.

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Summary of Task Force Recommendations to Address the Growing Shortage of Cardiologists

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The nation's growing shortage of cardiologists, if not addressed, will adversely affect the care of patients with cardiovascular diseases. The shortage will impair patient access to cardiovascular specialty care (that has proven benefits in terms of timely diagnosis, appropriate treatment, and enhanced outcomes). Cardiovascular research programs will suffer because many academic cardiologists will be expected to devote more time to patient care.

Over the past two years, the American College of Cardiology (ACC) Task Force on Workforce studied several aspects of the nation's growing shortage of cardiologists. This final section summarizes the recommendations of eight working groups and the participants in the 35th Bethesda Conference. The strategies to accomplish these goals are discussed in the following text, and an outline of specific recommendations is at the end of this paper. Each working group report includes more detail about the rationale for its recommendations and suggestions for implementing them. For the purposes of this brief summary, the task force's recommendations fall into two broad categories: 1) how to increase the number of cardiologists, and 2) how to enhance the efficiency of cardiologists and the care teams they lead.

HOW TO INCREASE THE NUMBER OF CARDIOLOGISTS

Increase the capacity of U.S. cardiovascular training programs. The most obvious solution to the growing shortage is to produce more cardiologists by increasing the number of trainees. In particular, there is a need for general clinical and preventive cardiologists as emphasized by several of the working groups. It is important to emphasize that effective disease prevention (both primary and secondary) is a cornerstone of improved public health. Studies have demonstrated that cardiovascular specialists are particularly effective at implementing known disease-prevention strategies. Two complementary actions would increase the supply of general clinical cardiologists: 1) expand the number of first-year training slots, and 2) reduce the time it takes to complete an internal medicine residency and a general cardiology fellowship. Working Groups 1 and 8 provide useful background and justifications for these recommendations.

Theoretically, the annual output of new cardiovascular specialists is linked closely to the number of first-year trainees. The current minimum time between medical school graduation and completion of a general cardiology fellowship is six years. The ACC Task Force agrees with the recommendation of Working Group 8 that the time required to become a board-eligible general clinical cardiologist should be reduced from six to five years.

A significant percentage of cardiology trainees will want to practice a cardiology subspecialty. Working Group 8 proposes a comprehensive approach to identifying the various types of cardiovascular subspecialists according to their training and the focus of their practice. As cardiology and its subspecialties continue to evolve, it will be important to modify training curricula so we produce cardiologists whose knowledge and skills meet the demand for high-quality and cost-effective cardiovascular care. Training program capacity is a precious resource, and it is imperative that training be efficient and effective.

The ACC Cardiology Training Program Directors Survey revealed that there is a surplus of qualified candidates for the nation's 173 training programs. Despite an adequate number of applicants, about 7.5% of the nation's Accreditation Council for Graduate Medical Education (ACGME)-approved general cardiology fellowship positions were not filled as of March 31, 2004 (1). This is mainly because several training programs do not have sufficient funds to support a full complement of trainees. This unused capacity is problematic as our nation's cardiovascular disease burden continues to grow. Thus, along with seeking an increase in the number of ACGME-approved general cardiology training positions, it is imperative that we identify additional funds to support the training of more cardiologists. In addition to advocating for an increase in graduate medical education (GME) funds provided as part of Medicare reimbursement to teaching hospitals, it is important to seek other sources of financial support. Potential sources include managed care organizations, health insurance companies, industry, private cardiovascular practices, and philanthropic organizations. Outcome studies demonstrate the value of cardiovascular specialty care, and many of these entities would benefit (as would patients) if the growing need for cardiovascular specialists was met (2–8).

Pilot programs should also be developed that would permit experienced internists, who would like to be formally trained to function as general clinical and preventive cardiologists, to apply for positions in selected cardiology training programs.

Improve recruitment to the specialty of cardiovascular medicine. Currently, the number of qualified applicants exceeds the number of ACGME-approved and -funded cardiology training positions in the U.S. Although this is encouraging, we must seek to maintain and enhance practitioner quality by attracting the most talented physicians to the cardiovascular field. This process begins by making

potential candidates aware of cardiology's many attractions. Recruitment activities should start with interested high school and college students, but they should focus on medical students and internal medicine residents. Academic cardiology divisions play a vital role in these efforts, but local practitioner cardiologists should be encouraged to participate in programs that reveal the broad spectrum of career opportunities in cardiology. The ACC (and its chapters), the American Heart Association (AHA), and other cardiovascular organizations should also contribute to this long-term recruiting effort.

Currently, international medical graduates (IMGs) constitute an important component of the cardiovascular workforce. The immigration, training, and certification systems should be monitored to ensure they do not become insurmountable barriers that would significantly restrict the entry of appropriately qualified and skilled IMGs into U.S. training programs and practice. As the demographics of our nation and of medical students evolve, it is important for cardiology to recruit more women and underrepresented minorities. We must encourage and support efforts to help all cardiologists achieve a better work-life balance, thus reflecting larger social trends that contemporary medical graduates consider as they evaluate specialty choices.

Encourage cardiologists to remain active in practice (or academics). The total number of cardiovascular practitioners is also affected by the exit rate from active practice. Cardiology is a demanding specialty because of the urgency and seriousness of many cardiovascular problems. There are, however, many opportunities within cardiology to develop a career that focuses on noninvasive diagnosis, outpatient practice, and prevention. These opportunities may appeal especially to younger cardiologists seeking a more controllable lifestyle and older cardiologists contemplating retirement because they no longer want to perform invasive procedures or participate in night or weekend "call." It is important that cardiologists have access to career paths that permit them to work at a level that reflects their professional interests and personal goals as they contribute to the care of a growing population of patients with cardiovascular disease.

ENHANCING THE EFFICIENCY OF CARDIOLOGISTS AND THE CARE TEAMS THEY LEAD

If a cardiologist is able to practice more efficiently, he or she will be able to deliver care to more patients. Thus, one important component of our effort to assure patients adequate access to cardiovascular specialty care is to increase efficiency and emphasize teamwork.

Promote the cardiovascular care team approach. The past decade has seen a dramatic increase in the number and types of non-physician clinicians employed by cardiologists and institutions. Supervised by a cardiovascular specialist, these cardiac care teams include nurses, physician assistants, and other types of health care professionals whose careers focus on patients with cardiovascular disease. Designed to increase efficiency, the team care model can also enhance outcomes by assigning specific responsibilities to the health care professional whose training, experience, and interests best match the needs of a patient at a certain point in time.

The ACC formally acknowledged the value of team care when it created the Cardiac Care Associate membership category. The continuing education and training of all members of the cardiovascular care team should be fostered. This includes recruitment of qualified individuals to enter these fields and the development of curricula and programs to deliver education and training. The ACC and other cardiovascular societies should sponsor continuing education programs that are of interest and value to all members of the cardiovascular care team.

Improve cardiovascular practice organization. Although there is no standard model for a cardiovascular practice, the single-specialty group is the most popular private practice arrangement. Academic cardiology practices resemble more closely the multispecialty group practice model. The ACC should collect, collate, and share information on cardiovascular practice models with its members in order to inform them of models of care that might enhance the efficiency and effectiveness of the care they deliver.

Improve and standardize cardiovascular information systems. More than ever, effective information systems are now vital to medical practice. State-of-the-art cardiovascular practice requires rapid access to a wide range of information and different types of data. Currently, cardiovascular information systems are evolving; operational systems are heterogeneous and of variable effectiveness. The development of standardized performance criteria including uniform data elements and reporting tools would enhance the effectiveness of cardiovascular information systems. Many technologies are developing rapidly that will enhance communication of medical information among cardiologists, their patients, and other health care professionals.

The ACC, together with the AHA and other organizations, has created a series of evidence-based guidelines to help clinicians make informed decisions as they care for individual patients. It is important that these guidelines be applied appropriately in practice. Current information technology has the potential to enhance practitioner communication, to foster the guideline application, and to monitor other aspects of cardiovascular care for appropriateness and consistency. Cardiovascular specialty societies should promote the adoption of such technology to enhance patient care.

RECOMMENDATIONS

1. Increase the Number of Cardiologists
   a. Increase Training Capacity and Trainee Quality
      - Increase the number of cardiology training positions

- Fill all ACGME-approved cardiology training positions
- Advocate for more ACGME-approved cardiology training positions
- Develop partnerships between selected academic and community hospitals so trainees can be exposed to cardiac care delivered in diverse contexts

- Increase funding for GME
  - Advocate for more federal GME funding to train more cardiologists
  - Advocate for more National Institute of Health (NIH) funding to support academic (research) careers
  - Develop innovative funding arrangements with physician groups, managed care organizations, industry, philanthropic foundations, and so forth
- Shorten the number of years of internal medicine-general cardiology training from six to five
  - Develop and pilot a "short track" curriculum for training general clinical cardiologists
  - Foster the training of general clinical cardiologists and preventive cardiologists
- Enhance training program effectiveness
  - Identify "best practices" for training program operation
- Adopt the standardized nomenclature for defining cardiovascular specialists as outlined by Working Group 8

b. Improve Recruitment to the Specialty of Cardiovascular Medicine
- Enhance awareness of the broad spectrum of careers available in cardiology
- General recruitment tactics
  - Encourage high school, college, and medical students to consider a career in cardiology through presentations, role modeling, mentoring, and other mechanisms
  - Academic cardiologists, the ACC and its chapters, and other cardiovascular organizations should intensify their recruiting efforts among medical students and residents
  - Encourage alternative practice models that allow better work-life balance
- Encourage women and underrepresented minorities to consider a cardiology career
  - Role models and mentoring are very important
  - Alternative practice models must become more accepted
  - Academic programs should attempt to recruit and retain a more diverse faculty
  - Cultural competence is increasingly important as the U.S. population becomes more diverse
- Continue to recruit highly qualified IMGs
- Advocate for a visa system that acknowledges the unique contributions that IMGs have made (and continue to make) to cardiology care, research, and education
- Continue to enhance the ACC's job-matching programs

c. Encourage Experienced Cardiologists to Delay Retirement
- Develop alternative practice models for older cardiovascular specialists
  - Encourage part-time (or shared) positions
  - Provide opportunities for invasive and interventional cardiologists to transition to an outpatient or noninvasive practice

2. Improve Practitioner Efficiency, Productivity, and Satisfaction

a. Promote the Cardiovascular Care Team Approach
- Identify best practices with respect to cardiologist-led team care
- Promote successful cardiac care team models
- Facilitate the training of non-physician clinician care team members
  - Develop a standard curriculum to train nurses and physician assistants to become non-physician clinicians in a cardiology care team
  - Develop continuing medical education (CME) curricula designed for all members of the cardiac care team
- Encourage long-term collaborative care that thoughtfully integrates primary and specialty care and assures access to cardiovascular specialists

b. Improve Cardiovascular Practice Organization
- Disseminate information about efficient practice organization models

c. Use Technology to Enhance Patient Care and Facilitate CME
- Develop and implement cardiovascular information management systems
- Develop performance criteria for cardiovascular information systems
- Expand the use of telemedicine
- Evaluate the use of the Internet and e-mail as tools to increase communication and enhance efficiency

d. Enhance the Job-Matching Process
- Each cardiology fellow should be assigned to a mentor who can help each trainee consider job opportunities
- The ACC should continue to enhance its valuable electronic ACC Cardiology Careers available at www.acc.org
- Trainees should be made aware of the broad spectrum of cardiology careers that exist
- The ACC's annual scientific session and ACC chapter meetings are excellent opportunities for trainees to meet cardiologists or representatives of groups that are seeking cardiovascular specialists

RECOMMENDATIONS REFERENCES

1. Accreditation Data System. Accreditation Council for Graduate Medical Education. Available at: www.acgme.org/adspublic. Accessed March 31, 2004.
2. Go AS, Rao RK, Dauterman KW, Massie BM. A systematic review of the effects of physician specialty on the treatment of coronary disease and heart failure in the United States. Am J Med 2000;108:216–26.
3. Jong P, Gong Y, Liu PP, Austin PC, Lee DS, Tu JV. Care and outcomes of patients newly hospitalized for heart failure in the community treated by cardiologists compared with other specialists. Circulation 2003;108:184–91.
4. Ahmed A, Allman RM, Kiefe CI, et al. Association of consultation between generalists and cardiologists with quality and outcomes of heart failure care. Am Heart J 2003;145:1086–93.
5. Ansari M, Alexander M, Tutar A, Bello D, Massie BM. Cardiology participation improves outcomes in patients with new-onset heart failure in the outpatient setting. J Am Coll Cardiol 2003;41:62–8.
6. Mark DB, Hlatky MA. Medical economics and the assessment of value in cardiovascular medicine: part I. Circulation 2002;106:516–20.
7. Casale PN, Jones JL, Wolf FE, Pei Y, Eby LM. Patients treated by cardiologists have a lower in-hospital mortality for acute myocardial infarction. J Am Coll Cardiol 1998;32:885–9.
8. Indridason OS, Coffman CJ, Oddone EZ. Is specialty care associated with improved survival of patients with congestive heart failure? Am Heart J 2003;145:300–9.