REPORTS OF INTEREST TO THORACIC SURGEONS

THORACIC SURGERY WORKFORCE REPORT

The fourth report of the Thoracic Surgery Workforce Committee of The American Association for Thoracic Surgery and The Society of Thoracic Surgeons

To determine demographics, practice patterns, and work volume of North American thoracic surgeons, we sent a detailed survey to all members of The American Association for Thoracic Surgery and The Society of Thoracic Surgeons between January and May 1993 to determine data for 1992; 3049 of 3487 (87%) thoracic surgeons responded and 2677 (88%) were in active practice. Ninety-seven percent were male and 3% female, with a mean age of 52 years. Sixty-five percent considered fee-for-service as their primary compensation mode. Only 24% do isolated subspecialty work: 2% pediatric cardiac surgery, 10% general thoracic surgery, and 12% adult cardiac surgery. Seventy-six percent of respondents do both cardiac and thoracic operations. Workload data for adult cardiac, pediatric cardiac, general thoracic, peripheral vascular, and pacemaker operations were requested. Volume data were cross-correlated with age, 10 geographic regions including Canada, type of practice, and type of compensation and were cross-checked by hospital discharge data for 1992. These data were compared with data from similar surveys performed in 1976, 1980, and 1985, under the auspices of the same two societies; these latter surveys used diplomates of the American Board of Thoracic Surgery as their database. Workloads have increased over previous surveys. Most surgeons do a wide variety of thoracic operations, and exclusive designations are in the minority. (J THORAC CARDIOVASC SURG 1995;110:570-85)

Lawrence H. Cohn, MD,* Richard P. Anderson, MD,**
Floyd D. Loop, MD,** Richard G. Fosburg, MD,***
Joseph N. Cunningham, MD,*** and Hillel Laks, MD**

Surveys of the Thoracic Surgery Workforce and the work they do are important (1) to ascertain volume of work in particular areas, especially those that overlap other specialties; (2) to document that, in fact, The American Association for Thoracic Surgery (AATS) and The Society of Thoracic Surgeons (STS) do represent the group of surgeons performing the vast majority of thoracic surgical

procedures in the United States and Canada; and (3) to help determine if the numbers of thoracic surgeons are adequate for projected demand in the future.

Accordingly, in 1992 the fourth Ad Hoc Committee of the AATS/STS was formed to survey the Thoracic Surgery Workforce to determine demographics, caseloads by subspecialty area of thoracic surgery, and types of practice and practice patterns according to age, region of North America, and type of compensation and practice.

Methods

In December 1992 the first mailing of a two-page questionnaire of twelve detailed questions with a covering letter was sent to the entire membership of the AATS and STS. Two subsequent mailings in March and May 1993 were also done to maximize response. The anonymity of the respondent was preserved by the two-envelope system used in previous surveys. We mailed 3487 questionnaires

Received for publication March 10, 1995.

Accepted for publication March 15, 1995.

Address for reprints: Lawrence H. Cohn, MD, Department of Surgery, Division of Cardiac Surgery, Harvard Medical School, Brigham and Women's Hospital, Boston, MA 02115.

*Chairman (AATS/STS).

**Representing the STS.

***Representing the AATS.

Copyright © 1995 by Mosby-Year Book, Inc.

0022-5223/95 \$3.00 + 0 12/1/64941

STS/AATS Workforce Study

Fig. 1A. Age distribution by decades. N/R, No response.

and received 3049 responses (87%). Of the 3049 responses, 2677 were from practicing surgeons (88%). Twelve percent of respondents had retired—a slightly higher percentage than in the 1985 report ($\approx 8\%$ of respondents).¹

The questionnaire included the following: thoracic organization membership; age and sex; whether respondent was practicing; principal type of compensation and how obtained; primary mode of practice; board certification/eligibility; regional area; type and location of practice hospital; residency programs at hospital; number of procedures per year for adult cardiac surgery, pediatric cardiac surgery, general thoracic surgery, peripheral vascular surgery, and pacemaker procedures; and self-designation as to primary type of practice.

All responses were tabulated, collated, and analyzed at the headquarters of the STS by means of a data entry program called Knockout. Once entered, the data were then read into a tabulating program (A-Cross) for analysis, graphics, and statistics.

Results

Age. The age range of the thoracic surgery respondents ranged from 30 to 70+ years, with a mean of 52 and a median of 51.5 years. This continues a trend noted in previous surveys of increasing mean age: 46 years in 1976, 48 years in 1980, and 50 years in 1985. A total of 56 actively practicing thoracic surgeons were older than 70 years of age, and 68%

of respondents older than 60 years were still practicing. Fig. 1A demonstrates age distribution of respondents and Fig. 1B shows current practice status by age.

Sex. Of the respondents, 97% were male and 3% were female.

Memberships. Eighty-eight percent of respondents were members of the STS, 28% of the AATS, 20% of the Southern Thoracic Surgical Association, and 9% of The Western Thoracic Surgical Association.

Board eligibility/certification. All respondents were certified or eligible to be certified by the American Board of Thoracic Surgery (ABTS). Seven percent had vascular surgery certification, 6% had Royal College of Canada certification, and 5% had other board certification.

Regions. Table I lists geographic regions analyzed. Fig. 2 shows numbers of respondents per region. The Mid-Atlantic area with 497 and the Southeast with 395 had the highest number of respondents; the Rocky Mountain region had the lowest number.

Hospital and residency demographics. Twenty-one percent of respondents practiced in hospitals of fewer than 300 beds, and cardiothoracic residencies were found in less than 30% of respondents' hospitals. Fig.

Fig. 1B. Practicing or retired by age decade.

Table I. Regions

Northeast
Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island
Mid-Atlantic
New York, Pennsylvania, New Jersey, Maryland, Delaware, West Virginia
Southeast
North Carolina, South Carolina, Georgia, Florida, Alabama, Virginia
North Central
North Dakota, South Dakota, Minnesota, Michigan, Ohio, Nebraska, Iowa
Central
Indiana, Illinois, Wisconsin, Kansas
South Central
Missouri, Kentucky, Tennessee, Mississippi, Arkansas, Louisiana
Rocky Mountain
Montana, Idaho, Colorado, Wyoming, Utah
Far West
Washington, Oregon, California, Nevada, Alaska, Hawaii
Southwest
Oklahoma, Texas, Arizona, New Mexico
Canada

3 shows the types of hospitals in which respondents practice, with private teaching and community hospitals dominating.

Self-designation. Respondents were asked to list all types of operations performed and their self-designation as a practitioner. These data are seen in

Table II. Note that 1.9% do only pediatric cardiac surgery, 9.9% do only general thoracic, and 12.4% do only adult cardiac surgery. Thus approximately 75% of thoracic surgeons do combinations of the five major operative procedures.

Practice profile. Fig. 4A demonstrates primary type of practice and numbers of respondents in each category. The most common practice mode was the single-specialty private practice group. This was the mode of practice for 1199 or 45% of respondents. The percentage of geographic full-time academic respondents was 498 or 19%. Solo or individual practice of thoracic surgery was identified as the primary practice mode by 609 or 23% of respondents. Fig. 4B demonstrates individual practice versus single-specialty group by age, suggesting that as the respondents age they are more likely to become solo practitioners.

The compensation profile by all respondents is shown in Figs. 5A to 5C. Fee-for-service in 1992 was, by far, the most common mode of compensation (Fig. 5A). Fig. 5B shows distribution of fee-for-service versus salary compensation by type of practice; the percentage of salary compensation is highest in multispecialty group practice. Fig. 5C shows type of compensation for each region in the United States and Canada. The highest percentage of salaried thoracic surgeons is in the Northeast and the highest fee-for-service ratio is in Canada.

Workload in 1992. Table III lists the mean and median number of operations done by respondents

Fig. 2. Hospital location by region.

Fig. 3. Type of hospital of respondents practicing. VA, Veterans Administration.

of this survey in all categories. Fig. 6A shows performance in 1992 of adult cardiac cases in segments of 50 cases for 2103 surgeons responding that they did adult cardiac surgery in 1992. Of note is that 57% of respondents did 150 or fewer and 36% did 100 procedures or fewer per year. Fig. 6B shows the volume of procedures by age group. Most cardiac surgery volume is done in the age groups 30 to

50 years. Practicing respondents older than 70 years still do about 100 cases per year. Fig. 6C compares mean number of adult cardiac cases performed by the type of practice; the single-specialty groups do the highest mean number and the health maintenance organizations (HMOs) do the fewest. No significant difference by region was identified, although the Far West did the fewest per respondent

STS/AATS Workforce Study

Fig. 4A. Primary mode of practice.

STS/AATS Workforce Study

Fig. 4B. Solo versus single-specialty clinic correlated with age.

(131) (Fig. 6D). In Fig. 6E cardiac cases in 50 case segments are divided by type of practice. The lower the number of cases per year, the higher the percentage done by individuals; the higher the caseload, the greater the percentage done by surgeons in single-specialty groups.

Fig. 7A demonstrates the number of those respondents performing pediatric cardiac surgery by 25 case segments per year. The percentage doing 25 cases or fewer per year is 50% of those reporting. Academic centers have the highest average caseload (Fig. 7B) and, regionally, Canada's mean number of

Fig. 5A. How compensation is received.

cases was higher (42) than that for any region in the United States.

The average number of general thoracic procedures for the 2262 individuals reporting that they do thoracic procedures are shown in Fig. 8A; 67% of individuals responding did 50 cases or fewer per year. Fig. 8B shows the mean number of cases by age designation; the highest numbers are in the 50- to 70-year age group. In this analysis (Fig. 8C) practitioners in HMOs and academic centers did more general thoracic procedures than practitioners in other types of practices. Regionally (Fig. 8D), surgeons in the Northeast (87) did slightly more than surgeons in other United States regions, and Canada had the highest mean total (100). Again, single-specialty groups did more general thoracic surgery than surgeons in other types of practice (Fig. 8E).

In Fig. 9A are numbers of individuals doing peripheral vascular surgery (mean 49 per year). More than 50% of actively practicing respondents, 1455 of 2677 (54%), did some peripheral vascular surgery in 1992. Of those doing peripheral vascular surgery, 65% did 50 cases or fewer per year. Fig. 9B shows the average number of procedures by age group, suggesting that older surgeons (50 to 70 years) do more peripheral vascular surgery. In analysis of type of practice, solo practice individuals do more peripheral vascular surgery, and the Southwest region has the highest mean total (63).

Pacemaker procedures averaged 22 per year with a median of 17, which reflects decreasing numbers

Table II. Self-designation

	No.	%
Pediatric only	51	1.9
General thoracic only	266	9.9
Adult cardiac only	333	12.4
Peripheral vascular only	18	0.7
Other only	27	1.0
General thoracic/adult cardiac/peripheral vascular	737	27.5
General thoracic/adult cardiac	457	17.1
General thoracic/peripheral vascular	294	11.0
Pediatric cardiac/general thoracic/adult cardiac/peripheral vascular	81	3.0
Pediatric cardiac/general thoracic/adult cardiac	81	3.0
Pediatric cardiac/adult cardiac	75	2.8
Adult cardiac/peripheral vascular	51	1.9
General thoracic/peripheral vascular/other	28	1.0
General thoracic/adult cardiac/peripheral vascular/other	27	1.0
General thoracic/adult cardiac/other	17	0.6
General thoracic/other	16	0.6
Adult cardiac/other	10	0.4
Pediatric cardiac/general thoracic/peripheral vascular/other	10	0.4
Pediatric cardiac/general thoracic/adult cardiac/peripheral vascular/other	9	0.3
Pediatric cardiac/adult cardiac/peripheral vascular	5	0.2
Pediatric cardiac/general thoracic	4	0.1
Pediatric cardiac/adult cardiac/other	3	0.1
Adult cardiac/peripheral vascular/other	2	0.07
Pediatric cardiac/general thoracic/other	2	0.07
Pediatric cardiac/general thoracic/peripheral vascular	1	0.03
Peripheral vascular/other	1	0.03
Pediatric cardiac/peripheral vascular	1	0.03
No response	70	2.6

Table III. 1992 work load (AATS/STS)

Procedure	No. performing operations*	Mean No. of procedures	Median No. of procedures
Adult cardiac	2103	151	134
Pediatric cardiac	451	27	26
General thoracic	2262	64	36
Peripheral vascular	1455	49	36
Pacemaker	1690	22	17

*n = 2677.

done by surgeons and increasing numbers done by cardiologists. A total of 1690 individuals (63% of respondents) indicated they did some pacemaker operations in 1992, and 1203 (71%) did 20 pacemaker operations or fewer per year (Fig. 10). Regions with the highest frequency of pacemaker

Fig. 5B. Compensation by type of service, comparing fee-for-service versus salary.

Fig. 5C. Compensation by region, salary versus fee-for-service.

implantations by thoracic surgeons were the Mid-Atlantic states (29) and Canada (30). The number of procedures by type of practice setting was evenly distributed, but the lowest mean number was found in academic centers (18).

Overall caseload including "other" (probably general surgery) averaged 249 cases per year with a median of 228 for all respondents.

Discussion

This is the first comprehensive survey of workforce data for thoracic surgeons in the United States

and Canada since 1985.¹ These data have pointed out the increasing workload in adult cardiac surgery and general thoracic surgery and decreasing workload in peripheral vascular surgery and pacemaker implantation when compared with previous surveys in 1976,² 1980,³ and 1985.¹ The data reported here represents 87% of the AATS/STS membership, a reasonably accurate estimate of the vast majority of cardiothoracic operative activity in the United States and Canada in 1992.

These data, although important, do have certain limitations. First, this is a questionnaire and actual

Base = 2677/N = 2103

N/R = 574/21%

STS/AATS Workforce Study

Fig. 6A. Number of adult cardiac procedures performed in 50-case segments.

Base = 2677

N/R = 574/21%

STS/AATS Workforce Study

Fig. 6B. Mean number of adult cardiac procedures performed by age of surgeon.

numbers depend on accurate input from busy surgeons. Second, are the total numbers reasonably accurate and representative of what thoracic surgeons do? We consulted Abt Associates of Cambridge, Massachusetts, a consultant group, to provide a check of these data. The 1992 National Hospital Discharge Service (NHDS), designed to produce national estimates of volumes of in-patient discharges by DRG and ICD-9 procedure codes,*

was used to validate this survey. We selected thoracic and cardiac surgery DRGs and ICD-9 codes for cardiothoracic surgery.

Table IV is a summary of cardiothoracic procedures from NHDS for 1992 summarized by Abt Associates. Because 2103 respondents in our survey said they did adult cardiac surgery at a mean of 151 cases, this equaled approximately 317,000 cases. For DRG 104, 105, 106, and 107, the most common adult cardiac DRGs from the NHDS, the total was 330,000 cases. The discrepancy of about 13,000 cases may reflect respondent conservatism, miscoding by hospital discharge, a small number of procedures

*DRG = Diagnosis-related group; ICD = International Classification of Disease.

Base = 2677
N/R = 53/2%

STS/AATS Workforce Study

Fig. 6C. Mean number of adult cardiac procedures according to primary practice mode.

Base = 2677
N/R = 21/1%

STS/AATS Workforce Study

Fig. 6D. Mean number of adult cardiac procedures by region.

done by nonmembers of either society, procedures done by osteopathic surgeons, and procedures done by nonrespondents. For the general thoracic surgery survey, 2262 respondents reported performing a mean of 64 procedures per year, equaling 144,768 procedures in 1992. Calculation of the common general thoracic DRGs from NHDS totaled 159,953. This difference of about 15,000 procedures is 10% of the total volume, less than the 14% estimated by Loop and associates¹ in 1985 as the

number of procedures done by non-board-certified thoracic surgeons. Our 10% figure represents thoracic procedures done by general surgeons, nonsociety members, osteopathic surgeons, and nonresponders. Complexity of cancer protocols and integrated staging procedures have probably helped to increasingly attract patients into thoracic surgery clinics.

Pediatric heart surgery was specifically addressed in some depth for the first time in this AATS/STS

Fig. 6E. Number of adult cardiac procedures by comparison of type of practice.

Base = 2677/N = 451
N/R = 1575/59%

STS/AATS Workforce Study

Fig. 7A. Number of pediatric cardiac procedures by 25, 50, and 100 case segments.

workforce report. With the exception of the large academic centers, the annual volume of pediatric surgery is low, with an overall mean of 27 cases per year and a median of 26; 50% of surgeons did fewer than 25 cases per year. With 451 surgeons performing a mean of 27 cases per year, the total was 12,177 (23,622 were documented in 1992 by NHDS). Our

data may be low because of misdiagnoses and failure to report operations by nonresponding members doing pediatric surgery, some operations done by nonmembers, inclusion into the NHDS data of operations for congenital disease done in adults, or misdiagnosis or miscoding of hospital charts. The ABTS requirement for resident performance of

Base = 2677
N/R = 53/2%

STS/AATS Workforce Study

Fig. 7B. Mean number of pediatric cardiac procedures performed according to primary practice.

STS/AATS Workforce Study

Fig. 7C.

congenital heart surgery is 20 operations per resident. It would appear that the major academic centers will be providing case material for most residents in training.

Analyses of peripheral vascular surgery indicated that these procedures, which include abdominal aortic surgery, infrainguinal arterial bypass, and carotid endarterectomy, are done by the majority of practicing

thoracic surgeons, 1455 of 2677 or 54%. The 49/36 (mean/median) is virtually identical to the report of 1985 but less than that of 1980 (mean = 56). Seven percent of respondents have special certification in vascular surgery under general surgery, and a small number of cardiothoracic resident training programs have the ability to certify for the vascular certificate. Because all diplomates of the ABTS have American

Base = 2677/N = 2262

N/R = 415/16%

STS/AATS Workforce Study

Fig. 8A. Number of general thoracic procedures performed by respondents.

Base = 2677

N/R = 415/15.5%

AGE

STS/AATS Workforce Study

Fig. 8B. Mean number of thoracic procedures according to age of surgeon.

Board of Surgery certification, it is likely that peripheral vascular surgery will continue to be a significant part of the practice of cardiothoracic surgery, especially in private, single-specialty groups.

Numbers of pacemaker operations done by thoracic surgeons are similar to the numbers done in 1985 but were fewer than in 1980, apparently because increasing numbers of pacemakers are inserted by electrophysiologic cardiologists. The number of pacemaker operations documented by the NHDS for 1992 was 98,661. We documented approximately 37,000 cases from our respondents, which suggests that sur-

geons do about 40% of all pacemaker/implantable cardioverter defibrillator implants. The ABTS requirement of 10 pacemaker operations per resident is now accomplished by a combination of implantable cardioverter defibrillator insertion and new transvenous pacemaker insertion.

This study documents the workforce patterns of thoracic surgery in 1992. It is only a snapshot in time, but it does provide some trends concerning the components of thoracic surgical practice: cardiac, general thoracic, peripheral vascular, and pacemaker, when compared with workforce numbers of

Base = 2677
N/R = 53/2%

STS/AATS Workforce Study

Fig. 8C. Mean number thoracic procedures according to type of practice.

Base = 2677
N/R = 21/1%

STS/AATS Workforce Study

Fig. 8D. Mean number of thoracic procedures according to region.

previous reports. In the last report, published in 1985,¹ detailed projections regarding future workforce needs were made correlating the procedure numbers, graduating residents, and number of training programs and thoracic operations done by non-cardiac surgeons. Projections of workforce needs in the United States at this time are more difficult because of today's rapidly changing payment mechanisms and variation in economic credentialing. Capitation, increasing HMO market penetration,

global fees, and fee reductions for all procedures may radically alter projections of workforce needs. Pricing competition in all areas will be severe, and general thoracic, pacemaker, and peripheral vascular procedures are already being thrown into direct price competition between general and thoracic surgeons. Also, increasing interventional cardiology procedures such as stents, atherectomy, and percutaneous transluminal coronary angioplasty may alter what surgeons do. In 1992, about 100,000 more

Fig. 8E. Mean number of thoracic procedures according to type of practice.

Base = 2677/N = 1455
N/R = 980/37%

STS/AATS Workforce Study

Fig. 9A. Peripheral vascular procedures by 25- to 50-case segments.

interventional cardiology procedures were done than coronary bypass procedures (Table IV). However, the high incidence of lesion recurrence and paucity of good long-term results of these procedures continue to be problems. In addition, the more complicated procedures such as coronary stenting may turn out to be more costly than coro-

nary bypass. Thus it is unclear whether coronary bypass will play a greater or lesser role in the future of treatment for coronary artery disease.

Stretching the “envelope” of operability has been increasing in all aspects of cardiothoracic care so that thoracic surgeons have been operating on more elderly patients, more acutely ill patients, and more

Fig. 9B. Mean peripheral vascular procedures by age groups.

Base = 2677/N = 1690
N/R = 822/31%

STS/AATS Workforce Study

Fig. 10. Number of pacemaker procedures by 10- to 25-case segments.

patients who are in compromised condition. Whether payors can or will sustain payment for the elderly, extremely ill, or very high-risk patient will be a struggle of economic forces against the quest for access and quality care for all segments of the population.

How do the workforce numbers compare with those of other advanced countries regarding use of certain procedures? Ebert,⁴ in his address to the STS Managed Care Conference in September 1994, pointed out that cardiac cases per 100,000 population in France, Germany, and England were about

one third the rate of that of the United States, with one third the number of centers. Izzat and associates⁵ recently reported a practice volume of coronary bypass in the United Kingdom. In 1992 United Kingdom surgeons averaged 243 coronary bypass cases per surgeon, compared with 151 adult cardiac cases per surgeon for the same period in the United States according to our data.

What do these numbers mean in reference to workforce needs and supply of thoracic surgeons? A 40% growth rate in the numbers of thoracic sur-

geons has been identified from 1965 to 1990 but a virtually flat curve since 1975, whereas cardiology and gastroenterology disciplines have had 734% and 1038% growth rates, respectively, in a similar period. Similarly, the number of thoracic surgery residents has remained relatively stable: 294 in 1982 to 1983, 289 in 1988 to 1989 (according to the Accreditation Council for Graduate Medical Education), and 333 in 1994 to 1995. The workforce data for 1992 and the rapidly changing medical economic/reimbursement scene today obviously mandate no further increases in the training of thoracic surgeons and may, in fact, suggest reduction in thoracic surgical trainees.

Workforce needs will be significantly affected by changes in health care financing and need for primary care physicians versus specialists.⁶ It has been predicted that by 2000, more than 75% of the United States population will be covered by managed care programs, which place a major emphasis on primary care, rather than the specialist. Managed care programs selectively contract with a limited number of providers who meet certain minimum volume levels. Thus these alternative reimbursement methods, such as capitation, will affect volume of services performed. For example, whereas HMOs tend to serve younger patients, even Medicare age-adjusted data show lower use in patients older than 65 years.⁷ In a recent report, the Council on Graduate Medical Education⁸ estimated that by the year 2000 there will be a shortage of 35,000 generalist physicians and a surplus of 115,000 specialist physicians if the present patterns of specialty choice and number of graduates persist.

The workforce numbers reported here are important for the profile of thoracic surgery. Although much will change because of economic pressures in the medical marketplace before the next report is written, our specialty should continue its challenging quest for the highest quality training of men and women to satisfy the thoracic surgical needs of the United States.

Special thanks go to The Society of Thoracic Surgeons for statistical services and to Don Turney for consultation and guidance.

REFERENCES

1. Loop FD, Wilcox BR, Cunningham JN, et al. Thoracic surgery manpower: The fourth manpower study of thoracic surgery: 1985 report of the Ad Hoc Committee on Manpower of The American Association for Thoracic Surgery and the Society of Thoracic Surgeons. *Ann Thorac Surg* 1987;44:450-61.

Table IV. Summary of discharge diagnoses of cardiothoracic DRGs

DRG	Total patients
075—Major chest operation	82,697
076—Other respiratory operation excluding chest with cardiac catheterization	61,515
077—Other respiratory operation excluding chest without cardiac catheterization	15,741
104—Cardiac valve operation, pump with catheterization	22,902
105—Cardiac valve operation, pump without catheterization	43,721
106—Coronary bypass with catheterization	122,327
107—Coronary bypass without catheterization	153,274
108—Other cardiothoracic operation	23,622
110—Major cardiovascular operation with cardiac catheterization	86,321
111—Major cardiovascular operation without cardiac catheterization	17,380
112—Percutaneous cardiovascular operation	374,968
115—Permanent pacemaker with acute myocardial infarction, congestive heart failure, shock	9,312
116—Permanent pacemaker without acute myocardial infarction, congestive heart failure, shock	70,011
117—Pacemaker review excluding device replacement	6,596
118—Pacemaker device replacement	12,742
Total	1,103,129

Data supplied by Abt Associates, Cambridge, Massachusetts, and the 1992 National Hospital Discharge Survey (NHDS).

2. Adkins PC, Orthner HF. The Society of Thoracic Surgeons Manpower Survey for 1976: a summary. *Ann Thorac Surg* 1979;28:410-2.
3. Cleveland RJ, Orthner HF, Bahnson HT, et al. Thoracic surgery manpower. The third manpower study of thoracic surgery: 1980 report of the Ad Hoc Committee on Manpower of The American Association for Thoracic Surgery and The Society of Thoracic Surgeons. *J THORAC CARDIOVASC SURG* 1982;84:921-32.
4. Ebert P. Presentation. Society of Thoracic Surgeons Managed Care Conference. Atlanta: September 1994.
5. Izzat MB, West RR, Bryan AJ, et al. Coronary artery bypass surgery: current practice in the United Kingdom. *Br Heart J* 1994;71:382-5.
6. Physician Payment Review Commission Annual Report, 1992.
7. Group Health Association of America Sourcebook on HMO Utilization Data, 1992.
8. Fourth Report—Council on Graduate Medical Education: Recommendation to improve access to health care through physician workforce reform. Washington DC: US Department of Health and Human Services, January 1994.