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This chapter summarizes supply projections for physicians—doctors of medicine (MD) and doctors of osteopathy (DO)-in the aggregate, by specialty, and by location. The elements to be covered are: 1) assumptions, 2) data sources, and 3) projections.

AGGREGATE SUPPLY

The future aggregate supply of physicians is based on assumptions of the following factors (USDHEW, 1979a):

- physicians currently active in practice,
- new graduates of U.S. medical and osteopathic schools, and
- immigration of physicians (including U.S. citizens studying abroad) educated in other countries.

The estimates based on these production factors assume that supply will not be affected by the demand for physicians; i.e., there is an inelastic relationship between physician production and demand.

Data on currently active physicians are obtained from the American Medical Association (AMA) and the American Osteopathic Association (AOA). Both AMA and AOA data rely on the physician's self-designation of specialty, so the published data are based on this self-identification of primary specialty and activity and provide no information on activities in other specialty areas nor on the proportion of time spent in actual patient care.

An additional factor is that the "not classified" category in the AMA data, introduced in 1971, has grown from 300 in 1971 to over 30,000 in 1976, plus approximately 8,800 physicians whose addresses were unknown. Seventy percent of this "not classified" category is below age 35 and most likely in active practice. In the trend analysis for estimating specialty distribution, this "not classified" category is not included. However, "not classified" is included in the aggregate projections, with the assumption that its specialty distribution is identical to physicians in residency programs.

For physicians currently active in practice, the starting point (base year) is 1974. Data for MDs include age, specialty, and country of medical education. DO data for 1974 start with 1971 AOA data and add new DOS and subtract retirements and deaths between 1971 and 1974.

Mortality and retirement rates for MDs are computed by age and sex as derived from studies on the physician population, not the general population. 1967 data on retirement rates are used, and mortality rates use an article published in 1975. These rates are also applied to osteopathic physicians. Both retirement and mortality data, therefore, do not reflect trends that might be occurring. Table 1 summarizes these estimates.

Trends in new graduates of U.S. medical and osteopathic schools start with estimates of first-year enrollments to arrive at the number of graduates per year after adjustments for attrition. 1974 data were the original starting point, but data from the latest academic year, 1977-78, are now used.

Estimates of first-year enrollments are based on trends in: 1) Federal cavitation support, 2) Federal construction grants activity, 3) new schools already planned, and 4) potential State and local support of new schools. Separate computations are made for first-year enrollments in

Table 1 .—Derivation of Male and Female MD Retirement Rates and Death Rates by 5-Year Age Cohort

Age	Total MDs	Number inactive	Percent inactive	Retirement rate	Death rate	Separation rate
			Male MDs			
Less than 30.	31,047	64	.0020	—	.0007	.0007
31-34	39,470	64	.0016	**.0000**	.0007	.0007
35-39	38,562	88	.0023	.0001	.0014	.0015
40-44	37,501	107	.0029	.0001	.0022	.0023
45-49	32,989	156	.0047	.0004	.0043	.0047
50-54	27,319	188	.0069	.0004	.0066	.0070
55-59	25,100	370	.0147	.0016	.0111	.0127
60-64	19,452	708	.0410	.0053	.0188	.0241
65-69	13,368	1,483	.1109	.0140	.0294	.0434
70-74	8,941	2,034	.2275	.0233	.0465	.0698
75 and over.	11,817	5,186	.4389	.0423	.1243	.1665
			Female MDs			
Less than 30.	3,568	70	.0196	—	.0005	.0005
31-34	2,929	157	.0536	.0007	.0008	.0015
35-39	2,617	166	.0634	.0020	.0013	.0033
40-44	2,894	226	.0781	.0029	.0023	.0052
45-49	2,313	163	.0705	.0015	.0028	.0013
50-54	1,832	151	.0824	.0024	.0043	.0067
55-59	1,410	126	.0894	.0014	.0064	.0078
60-64	1,105	139	.1258	.0073	.0098	.0171
65-69	993	242	.2437	.0236	.0152	.0388
70-74	779	290	.3723	.0257	.0250	.0507
75 and over.	964	630	.6535	.0562	.0916	.1478

Based on:1)Amerlcan Medical Association, Department of Survey Research, Selected *Characteristics of the Physician population,* **1963 and 1967 (Chicago, 1978), table 21, p.182; and2)R. Hendrickson, ''Specialists Outlive Generalists:' Prism, December 1975.**

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* **Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-833, p. 119.**

3-year programs because of different attrition rates. Transferees into U.S. medical schools are also estimated.

High, low, and basic projections are calculated for these first-year enrollments. Basic projections assume that full funding of cavitation grants and moderate funding of construction grants will be achieved by 1981, that seven new medical and osteopathic schools will be established after the 1977-78 school year, and that there will be some limited further State, local, and private support for additional enrollment growth. The low-level projections assume full funding of cavitation grants, but minimum funding of construction grants by 1981, the establishment of four new schools after 1977-78, and no additional growth in enrollments arising from State, local, or other support beyond 1977-78. The high-level projections assume full funding of both cavitation and construction grants by 1981, the establishment of 10 new schools after 1977-78, and additional growth in enrollments arising from State, local, or other support beyond 1977-78 at half the annual rate exhibited by the years 1953-54 through 1964-65 (before Federal programs had an impact). Tables 2, 3, and 4 summarize these estimates for MD and DO first-year students.

Attrition rates are based on historical trends for 3- and 4-year MD programs, for osteopathic programs, and for foreign-trained U.S. medical students who transfer to U.S. medical schools. Tables summarizes actual and projected graduates for 1978-79 to 1989-90, based on the foregoing assumptions. Table 6 summarizes similar projections made at about the same time for the Department of Health, Education, and Welfare's (HEW) (now the Department of Health **and** Human Services (DHHS)) annual report to the President and Congress (USDHEW, 1979b). The two tables show different projections for 1980 and 1990; for 1980, 16,375 v. 17,155; for 1990, 19,289 v. 19,987. The lower estimates are based on the foregoing assumptions.

There are also discrepancies between the first-year enrollment assumptions and the projected

Table 2.—MD First"Year Enrollment Projections Using 1977 First-Year Enrollment as Base, to 1987

	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86.	1986-87	1987-88
Low series											
Total	16,136	16,486	16,908	16,921	16,931	16,936	16,938	16,940	16,942	16,944	16,944
Base year	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136
Construction commitments	—	300	700	700	700	700	700	700	700	700	700
New schools	—	50	72	85	95	100	102	104	106	108	108
Basic series											
Total	16,136	16,725	17,350	17,525	17,612	17,690	17,765	17,838	17,909	17,980	18,047
Base year	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136
Construction commitments	—	450	950	1,025	1,025	1,025	1,025	1,025	1,025	1,025	1,025
New schools	—	74	134	169	191	204	214	222	228	234	236
Other	—	65	130	195	260	325	390	455	520	585	650
High series											
Total	16,136	17,013	17,748	18,019	18,188	18,340	18,485	18,628	18,769	18,906	19,037
Base year	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16,136	16.136	16.136
Construction commitments	—	650	1,150	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225
New schools	—	98	204	271	311	334	350	364	376	384	386
Other	—	129	258	387	516	645	774	903	1,032	1,161	1,290

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and welfare, Washington, D. C.: Health Resources Administration,* **DHEW publication No. (HRA) 19-633, P.135.**

Table 3.—First-Year Enrollment Projections Using 1976 First-Year Enrollment as Base, to 1987

	1976-1977	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88
Low series												
Total	1,068	1,218	1,309	1,354	1,411	1,429	1,447	1,464	1,481	1,498	1,515	1,532
Base year	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068
Construction commitments	—	90	154	184	214	214	214	214	214	214	214	214
New schools	—	60	87	102	129	147	165	182	199	216	233	250
Basic series												
Total	1,068	1,258	1,364	1,437	1,522	1,562	1,603	1,643	1,682	1,722	1,762	1,801
Base Year	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068
Construction commitments	—	95	164	199	234	234	234	234	234	234	234	234
New schools	—	84	111	138	177	207	237	266	295	324	353	382
Other	—	11	21	32	43	53	64	75	85	96	107	117
High series												
Total	1,068	1,273	1,432	1,534	1,658	1,721	1,782	1,843	1,903	1,963	2,024	2,084
Base year	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068	1,068
Construction commitments	—	100	214	264	264	264	264	264	264	264	264	264
New schools	—	84	188	241	282	322	361	361	400	439	478	517
Other	—	21	64	85	107	128	10	150	171	192	214	235

SOURCE: *Interim Report of* **the** *Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, .Education and* **Welfare, Washington D. C.. Health Resources Administration, DHEW publication No. (HRA) 19-633, P.136**

Table 4.—First.Year Enrollments in Medical and Osteopathic Schools Projected Under the Basic Assumption; 1978-79 Through 1987-88

Academic year	Total MD and DO first-year enrollments	MD first-year enrollments	DO first-year enrollments
1978-79	18,089	16,725	1,364
1979-80	18,787	17,350	1,437
1980-81	19,047	17,525	1,522
1981 -82	19,174	17,612	1,562
1982-83	19,293	17,690	1,603
1983-84	19,408	17,765	1,643
1984-85	19,520	17,838	1,682
1985-86	19,631	17,909	1,722
1986-87	19,742	17,890	1,762
1987-88	19,848	18,047	1,801

SOURCE: *Interim Report o! the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and We/fare,* **Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 19-633, p.146.**

Table 5.—U.S.-Trained Physicians, Graduates (MD and DO); Projected 1978-79 Through 1989.90

Academic year	Total graduates	MD graduates	DO graduates
1978-79	16,044	15,048	996
1979-80	16,375	15,346	1,029
1980-81	16,997	15,789	1,208
1981 -82	17,662	16,354	1,308
1982-83	18,333	16,956	1,377
1983-84	18,699	17,241	1,458
1984-85	18,818	17,322	1,496
1985-86	18,928	17,394	1,534
1986-87	19,036	17,464	1,572
1987-88	19,142	17,532	1,610
1988-89	19,201	17,554	1,647
1989-90	19,289	17,604	1,685

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and We/fare,* **Washington, D. C.: Health Resources Administration, DHEW publication No, (HRA) 19-633, p.147.**

Table 6.—U.S.-Trained Physicians, Graduates (MD and DO); Projected for 1980 and 1990

	MD		DO		
Year	Schools	Graduates	Schools	Graduates	Total graduates
1960	86	7,081	6	427	
1970	103	8,367		432	
1975	114	12,714	9	698	1 3,412
1980 (projected)	121	16,086	13	1,069	17,155
1990 (projected)	121	18,318	13	1,069	19,987

SOURCE: A *Report to the President and Congress on the Status of Health Professions Personnel in the United States,* **Washington, D. C.: Bureau of Health Manpower, Health Resources Administration, DHEW publication No. (HRA) 79-93, p,ll-29,**

numbers of graduates. The AMA's annual report, *Medical Education in the United States* (AMA, 1978), lists 122 medical schools accredi ted or provisionally accredited and 16,134 first-year students in 1977-78, plus 2 schools accredited or provisionally accredited for the first 2 years of the MD program whose first-year enrollments apparently were not included in the 1977-78 total of 16,134. And the Association of American Medical Colleges identified 2 addi-

tional medical schools in 1979, for a total of 126 (American Medical News, 1979). The projections of first-year enrollments for 1977-78 match the AMA's estimates of the number of first-year enrollees in medical school (16,136 v. 16,134). But the projections to 1980 and 1990 (table 6) state that there will be 121 medical schools and 13 osteopathic schools, compared to 114 medical schools and 9 osteopathic schools in 1975. Thus, it is not clear whether the alternative estimates of 7, 4, or 10 new medical and osteopathic schools include some of the 122 medical schools already in existence, or whether they represent additional schools, as the explanation of the methodology seems to say.

In addition, the assumption of full cavitation funding by 1981 also is unrealistic, and the projections also seem to indicate that full cavitation is expected to be *maintained* after 1981, Currently, the issue with cavitation is whether it will continue at all, not whether fully authorized levels will be appropriated.

Immigration of graduates of foreign medical schools are calculated separately for Canadian medical graduates (CMGS) and other foreign medical graduates (FMGs). The Canadian addition is currently estimated to equal losses from death, retirement, and emigration because the recent historical growth has leveled off.

Additions from the rest of FMGs are particularly uncertain at this time because of the curtailing legislation in the Health Professions Educational Assistance Act of 1976 (Public Law 94-484). Since historical trends will not be predictive of future additions to supply by FMGs, the 1974-76 period has been used, with major adjustments that essentially try to guess at the impact of the legislative changes. Temporary-visa FMGs are assumed to equal the number of graduate medical positions available to them through regulations that implement Public Law 94-484, which require a stepwise reduction in positions until available positions to FMGs reach zero by 1990. The addition of permanent-visa FMGs to the supply is based on estimates of the number of FMGs passing the National Board of Medical Examiners' Visa Qualifying Examination. This exam was begun in September 1977, so only 1 or 2 years of data are available.

Permanent-visa FMGs and the proportion of temporary-visa FMGs estimated to establish permanent status through marriage (based on actual trends) are assumed to have the same death and retirement rates as U.S.-educated physicians.

Of crucial importance is the apparent lack of analysis of the contribution from U.S. citizens studying medicine abroad, a situation currently under study by the General Accounting Office. The projections do account for students returning to the United States to *complete* their medical education in the United States, but they comprise only a small part of the pool of U.S. citizens studying medicine abroad.

Basic, high, and low projections are calculated for the FMG addition to supply. The basic projection is summarized in table 7, with the results of the alternative estimates of the active FMG supply from the basic, high, and low estimates summarized in table 8.

These supply projections are prepared in two matrices. The first matrix projects year-by-year future MD graduates and attrition from the active work force by country of medical education. The second matrix distributes these future graduates and attrition of active practitioners by specialty, each by country of medical education. The first matrix projects graduates and foreign additions utilizing estimates of first-year enrollments, student attrition, other medical-school-related trends, and the model of FMG (including Canadians) immigration. The second matrix distributes the graduates among medical specialties through projections of first-year residency trends, and computes deaths and retirements of active practitioners among the specialties, using the mortality and retirement rates described earlier. Comparable disaggregation of the data on DOS has not been developed, although estimates of total DO supply have been made.

The method is summarized in figure 1. Table 9 summarizes the projected supply of *physicians* through 1990. For comparative purposes, table 10 summarizes estimates made in early 1978 (USDHEW, 1979b). The estimates are approximately equal. It should be noted that the

Table 7.–Supply of Active Foreign"Trained Physicians, Using Basic Methodology, Projected 1975-90

	New entry supply			Losses			Active supply	
Year	Total	Permanent	Temporary	Total	Death and retirement	J-visa emigrants	FMG	CMG
1974	—	—	—	—	—	—	70,940	5,510
1975	7,316	3,898	3,418	2,166	764	1,402	76,090	5,510
1976	6,609	3,399	3,210	2,569	815	1,754	80,130	5,510
1977	6,596	3,399	3,197	2,626	872	1,754	84,100	5,510
1978	4,150	1,152	2,042	2,680	917	1,763	85,570	5,510
1979	4,857	2,521	2,336	2,737	983	1,754	87,690	5,510
1980	3,847	2,521	1,326	2,107	1,047	1,060	89,430	5,510
1981	4,591	2,521	2,070	2,371	1,109	1,262	91,650	5,510
1982	3,581	2,521	1,060	1,751	1,184	567	93,480	5,510
1983	4,325	2,521	1,804	2,355	1,276	1,076	95,450	5,510
1984	3,315	2,521	794	1,735	1,351	384	97,030	5,510
1985	4,059	2,521	1,538	2,349	1,453	896	98,740	5,510
1986	3,049	2,521	528	1,739	1,538	201	100,500	5,510
1987	3,793	2,251	1,272	2,353	1,640	713	101,490	5,510
1988	3,023	2,521	502	1,923	1,740	183	102,590	5,510
1989	3,287	2,521	766	2,227	1,862	365	103,650	5,510
1990	3,023	2,521	502	2,153	1,971	182	104,520	5,510

SOURCE. Interim *Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health Education, and We/fare,* **Washington, D.C.: Health Resources Administration, DHEW publication No. (HRA)19-633, p,140.**

Table8.–Basic, High,and Low Projections of the FMG Active Supply

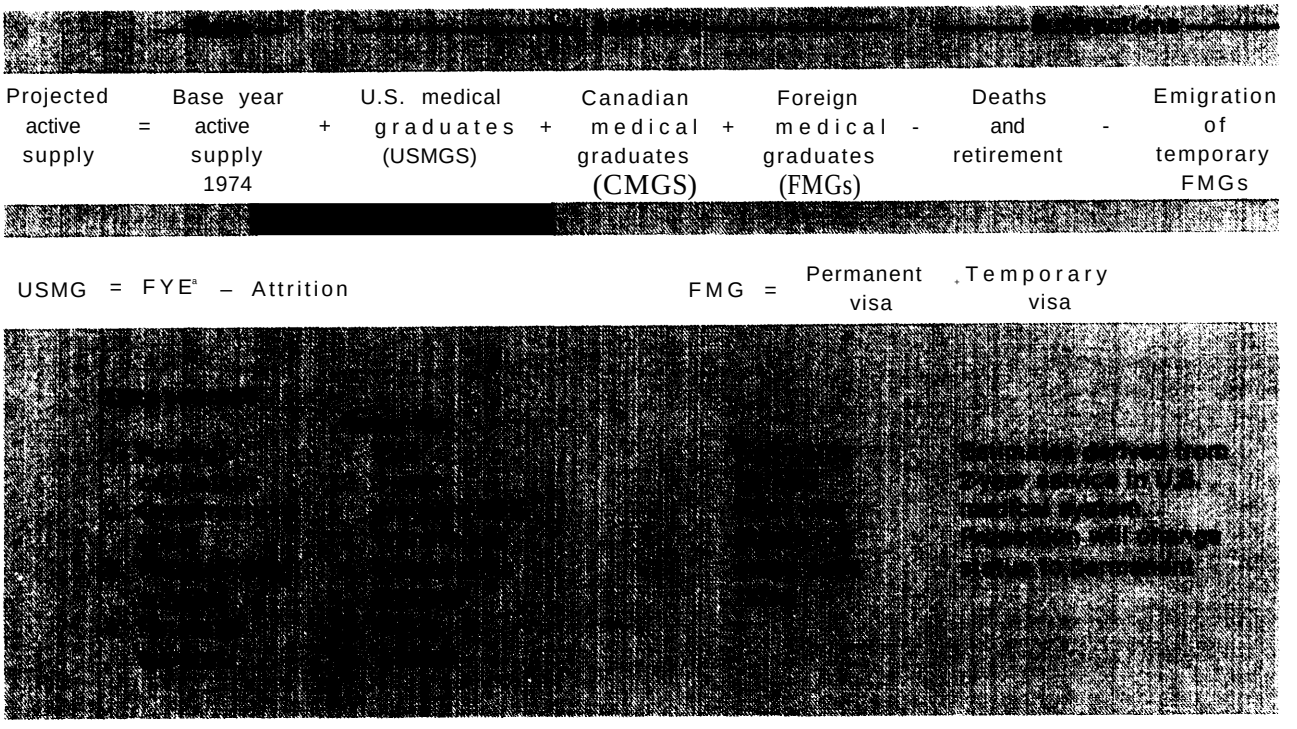
	Basic		High		Low	
Year	FMG	Canadian	FMG	Canadian	FMG	Canadian
1975	76,090	5,510	76,090	5,510	76,090	5,510
1980	89,430	5,510	92,340	5,510	86,270	5,510
1985	98,740	5,510	104,340	5,510	92,910	5,510
1990	104,520	5,510	112,580	5,510	96,320	5,510

SOURCE: Interim *Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education,* **and We/fare, Washington, D.C; Health Resources Administration, DHEW pubiication No. (HRA) 19-633, PP. 140-142.**

estimates in table 9 have lower projections of the graduate supply and higher projections of the FMG supply than the estimates in table lo. This is despite the optimistic projections of cavitation funding and even further curtailment of the FMG supply that underlie the table 9 projections.

Interestingly enough, projections from the Bureau of Health Manpower (BHM) made in 1974 (USDHEW, 1974) were similar to those made in its report to the President and Congress (USDHEW, 1979b) but the contribution from the graduate supply was lower and that from FMGs higher. In other words, the Bureau's previous estimates, made before the 1976 law curtailing FMG immigration, are more internally consistent with the estimates taking into consideration the effect of the 1976 law. So even though the aggregate projections of supply are similar for these different sets of assumptions, the contribution of the components of the aggregate estimates has differed significantly.

Figure 1.— Diagram of Projection of Supply of Active Physicians Through 1990



aFy E , first.year enrollment

SOURCE *Interim Report of the Graduate Medical Education* **National** *Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* **Washington, D C Health Resources Administration, DHEW publication No (HRA) 79.633, p, 112.**

Table 9.—Supply of Active Physicians (MD and DO) by Country of Medical Education Using Basic Methodology: 1974 and Projected 1975-90

Category	1974	1975a	1980	1985	1990
			Number of active physicians		
All active physicians	362,500	377,400	447,800c	523,600	596,800
U.S.-trained	286,000	295,800	352,800	419,300	486,900
MD	272,400	281,700	335,100	396,100	457,000
DO	13,600	14,100	17,700	23,200	29,900
Canadian-trained MDs	5,600	5,500	5,600	5,600	5,600
Foreign-trained MDs	70,900	76,100	89,400	98,700	104,500
			Rate per 100,000 population		
All active physicians	171.1	176.8	201.5	224.8	245.1
U.S.-trained	135.0	138.5	158.8	180.0	200.0
MD	128.6	131.9	150.8	170.1	187.7
DO	6.4	6.6	8.0	10.0	12.3
Canadian-trained MDs	2.6	2.6	2.5	2.4	2.3
Foreign-trained MDs	33.5	35.6	40.2	42.4	42,9
			Percent distribution		
All active physicians	100.0	100.0	100.0	100.0	100.0
U.S.-trained	78.9	78.4	78.8	80.1	81.6
MD	75.1	74.6	74.8	75.6	76.6
DO	3.8	3.7	4.0	4.4	5.0
Canadian-trained MDs	1.5	1.5	1.3	1.2	0.9
Foreign-trained MDs,	19.6	20.2	20.0	18.9	17.5

available estimates for 1975 and 1976 for active U. S,-trained MDs are 282,800 and 290,900 respectively; active FMGs are estimated at 76,200 and 79,700 resPOctivOlY. Active Canadian-trained MDs are estimated at 5,500 for both years.

bAss$_{ume5}$ that the percent active of the AMA "not classified" MDs is the same as the percent "professionally active" Of the classified MDs includlng those with address unknown.

corigInal table added this column incorrectly to total 477,800.

Population figures used (in millions): 1960: 185.4; 1970: 206.1; 1974: 21 1.9; 1975: 213.5; 1980: 222.2; 1985 232.9; 1990: 243,5.

SOURCE: */nferirn Report of tfre Graduate Med/ca/ .Educat/on rValiona/ Adwsory Cornrn/ttee to the Secretary, Deparfrnent of* **Health,** *Educat/err, and We/tare,* **Washington, D. C.: Health Resources Administration, DHEW publication No, (HRA) 19-633, p,144.**

Table 10.—Supply of Active Physicians (MD and DO) by Country of Medical Education Using Basic Methodology: Actual 1974, 1975; Projected 1980.90

Category	1974	1975	1980	1985	1990
			Number of active physicians		
All active physicians	362,500	378,600	444,000	519,-joo	594,000
U.S.-trained	286,000	296,700	353,600	42,$,400	495,700
MD	272,400	282,600	335,900	40"t ,100	465,900
DO	13,600	14,011	17,700	23,300	29,800
Canadian-trained MDs	5,600	5,700	6,000	6,100	6,200
Foreign-trained MDs	70,900	76,200	89,400	86,500	92,100
			Rate per 100,000 population		
All active physicians	171.1	177.3	199.3	2;)1 .7	242.4
U.S.-trained	135.0	138.9	158.7	181.3	202.3
MD	128.6	132.3	150.8	171.4	190.1
DO	6.4	6.6	7.9	10.0	12.2
Canadian-trained MDs	2.6	2.7	2.7	2.6	2,5
Foreign-trained MDs	33.5	35.7	37.9	37.8	37.6

SOURCE: *A Report to the Pres/derrt and Congress on the Srafus of Hea/th ProfessIons Personnel m the Ur?/ted States,* **Washington, D. C.: Bureau of Health Manpower, Health Resources AdminIstratIon, DHEW publication No. (HRA) 79-93, p A-25.**

SPECIALTY SUPPLY

Recall that aggregate supply was prepared in two matrices. The first matrix projects graduates and foreign additions utilizing estimates of first-year enrollments, student attrition, other medical-school-related trends, and the model of FMG immigration. The second matrix distributes the graduates among medical specialties through projections of first-year residency trends, and computes deaths and retirements of active practitioners among the specialties.

Comparable disaggregation of the data on DOS has not been developed, although estimates of total DO supply have been made. The DO distribution between primary care specialties is difficult to predict because of the lack of basic data on graduate training positions and because the graduate osteopathic training system is changing. In addition, MD residency programs accept DOS, which could lead to increasing specialization by younger DOS.

Presently, about 58 percent of DOS are in primary care. If DO graduates enter first-year residency programs in the same proportion as projected for MDs, by 1990 only 52 percent would be in primary care. If DOS continue current trends in graduate osteopathic training, 64 percent would be in primary care in 1990 (USDHEW, 1979b). Although these are significant percentage differences, the absolute differences are not large. Out of a total DO supply of 30,000 in 1990, the 52-percent figure corresponds to about Is, SOO primary care DOS, and the 64-percent figure corresponds to 19,000. This is in contrast to 1990 estimates of total MD and DO supply of 600,000 and a primary care MD supply of 240,000.

The projections for MD speciaIty distribution of the aggregate supply depend principally on first-year residency trends and on the attrition rates of the various specialties and subspecialties.

The data sources for current specialty supply are summarized in table 11. Specialty designations are obtained from the AMA master file, Board certification data, and specialty society memberships. The AMA file contains self-designation of specialty, tending to overestimate specialty supply and underestimate general practice supply. And, as only the primary activity/specialty is identified, nothing is known about patient care time spent in the identified specialty or in activities usually associated with other specialties. About half of the physicians identified in the AMA files are not identified in the Board certification data. Also, Board certification data and especially society membership data result in duplicate counting, as physicians can belong to more than one specialty board or society. There are 22 medical and surgical boards and over 130 specialty societies.

BHM uses the AMA master file as its basic source, with the 1974 active supply as the starting point.

First-year residency trends, which are used to project additions of MD graduates (foreign and domestic) to the specialties, contain three assumptions: 1) that the first-year residency distributions for 1968, 1970-74, and 1976, can be used to predict future first-year residency trends; 2) that first-year residency counts for particular specialties are duplicative in the sense that a proportion of these residents do not go on to complete that specialty training, but move on to subspecialization or to another specialty altogether; and 3) that some residency positions are shared by different institutions, which also leads to duplicative counting. Considering the kinds of interpretation problems that accompany trying to project specialty distribution among active practitioners from first-year residency positions, the better method would be to analyze final-year residency counts, but the AMA does not keep year-by-year accounts of medical graduates, and first-year residency data represent the best available data.

Residency data sources and comments on their strengths and limitations are summarized in table 12. The principal data source is the *Directory of Accredited Residencies.*

The particular years chosen to establish trends, 1968, 1970-74, and 1976, are the most recent years on which to base such calculations,

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Table 11.–Data Sources on Physician Specialty Supply

Data sources	Strengths	Limitations
1. *The American Medical Association Master File,* **—Contains data on all known MDs in the United States, obtained** by surveys performed every 3 to 4 years, and updated annually by selected mailings to specific physicians for whom a change in status has been indicated.[a] Physicians are listed by self-designation as to their specialty, activity, and location according to how they spend the majority of their time. Sixty-eight specialities are included within which eight activity categories are included.	Most **complete source of data on allopathic physicians. Published and** updated annually providing trend data.	Self-designation of specialty gives no indication of specific training in the area and also tends to overestimate specialty manpower, and underestimate general practice manpower. Published data provide no information on the time devoted to other specialty areas and activities making it difficult to determine full-time equivalent manpower.[b] Accuracy of data on FMGs is debatable as is the accuracy of specialty distributions because increasing numbers of physicians are being relegated to the "nonclassified" category.[cd] Can be difficult and/or expensive to obtain unpublished tabulations. Published data usually 2 years out of date.
2. *The American Osteopathic Association MAster* File.—Contains information on both member and nonmember osteopathic physicians as to location and updated annually. Augmented by surveys performed in 1956, 1967, 1971, and 1976 which yielded additional data on specialty, age, and activity status.[e]	Most complete sources of data on **Osteopathic Physicians.** Updated annually, and thus, only sources of trend data on osteopathic physicians. In some cases the data are comparable to AMA data.	The problems associated with self-designation relating to AMA data also apply to AOA data. Specialty data only available for survey years, and when published contains information up to 3 years out of date. Accuracy of specialty data questionable because large numbers of physicians are relegated to the nonclassified category.[f] Not always comparable to AMA data.
3. *Licensure* data.—Provides data on numbers of physicians Licensed by State. Disaggregate by whether or not physician attended a U.S. or foreign medical school.	Contains data on physicians who have received licenses; therefore, one can be sure all uncredentialled physicians are excluded.[g] Published and updated annually, so trend data are available.	Underestimates true physician supply since it excludes all physicians who are not licensed, such as some of those in teaching and administration and research, and some FMGs who are providing important service despite their unlicensed status. No information on specialty and practice activity of licensed physicians. Duplication often occurs between various State licensure boards.
4. *Board certification data.—Gives* information the numbers of MDs certified by the 22 medical and surgical boards and the numbers of DOS certified by the 14 **Osteopathic** specialty boards.[h]	Most objective criteria of physicians postgraduate training in specific specialty areas. Published and updated annually so trend data are available.	Excludes almost half of MD supply as reported by AMA and 4/5 of the DO supply as reported by AOA. Duplicate counting occurs due to certification by more than one specialty board. Does not necessarily represent physician's present specialty activities.
5. *Specialty society memberships,—* Includes numbers and distributions of MDs in over 130 specialty societies.[i]	Gives some indication of physician's interests in specific areas of medicine not revealed in other AMA specialty classifications. Published and updated annually.	Gives no indication of physician's training or background in a specific specialty area represented by the society. Duplicate memberships often occur. Does not necessarily represent the present activities of the physician.

[a] American Medical Association Physician Master Fde, American Medical Association, Chicago, Ill., 1977.

[b] For example, a physician may report his or her professional activities in a typical workweek consisting of 30 hours of patient care and 20 *hours* of teaching and research, and In addition specialty activity is reported as 25 hours of internal medicine and 25 hours of dermatology. This precludes determination of number of FTE physicians in direct patient care

[c] According to cohort study of physicians immigrating to the United States between 1961 and 1971 an estimated 33 percent of 27,710 Immigrants in the cohort ware not on the AMA master file J C Kleinman, Physician Manpower Data: "The Cese of the Missing Foreign Medical Graduates," *Medical Care,* 12 906, 1974. Others believe that the AMA does account for all FMGs I Butler and M. Schaffner, "Foreign Medical Graduates and Equal Access to Medical Care," *Medical Care,* 9(2) 136-43, March, April 1974

[d] For 258 in 1970 to 30,129 in 1976 for MDs, Louis J Goodman, *Physician Distribution and Medical Licensure in the US,* 1976 Chicago, American Medical Association, 1977

[e] *1976 Directory,* American Osteopathic Association, Chicago, 1976

[f] From 901 in 1971 to 653 in 1976. M E Altenderfer, *Osteopathic Physic/arrs in the* U S A *Report of a 1971* Survey, BHRD, DHEW publication No (HRA) 75-60, 1975 and American Osteopathic Association, 1974 Master File, Liaison Committee on Osteopathic Information, *Osteopathic Manpower Information Project,* final report, May 20, 1977

[g] At present it is estimated that there are about 36,500 physicians in the country who do not hold a regular State license. Louis J Goodman, *Distribution of Physicians,* 1976, p 577

[h] For MDs the American Medical Association, Pro/da *of Medical Practice 1977,* Chicago, 1977, p 101 For DOS sea, Liaison Committee on Osteopathic Information, *Osteopathic Manpower Information Project,* Final Report, May 20, 1977

[i] In 1974, over 130 such societies existed, in which there were 342,090 members representing 104 percent of all active physicians during that year. American Medical Association, *Profile of Medical Practice 1975-76* Chicago, 1976.

SOURCE: *Interim Report of the Graduate Medical Education* **National** *Advisory Committee to the Secretary, Department of Health, Education, and We/fare,* **Washington, D. C,: Health Resources Administration, DHEW publication No. (HRA) 79-633, pp. 101-103.**

Table 12.—Internship and Residency Data Sources

Data sources	Strengths	Limitations
1. *Directory of Accredited Residencies* and previous editions of the *Directory of Approved Internships and Residencies.* — Contains data on distributions off first-year and total residents by specialty (30 listed), country of education, and affiliation status of hospital. Also lists numbers of positions offered and filled by specialty and affiliation and numbers of positions offered for the forthcoming year.[a]	Most complete source of data available on MDs in training. Published and updated annually.	Usually it is 2 years out of date. Does not provide distributions of residents by institutions. Physicians listed as first-year residents in some specialties may in fact be the second or third year of training. includes only first-year and total counts—intervening years not given. No data on fellowships.
2. *American Osteopathic Association Almanac.*—Contains data on residents in osteopathic hospitals by specialty and institution.[b]	Most complete source of data on DOS in training. Published and updated annually. Provides distributions of residents by institution.	Does not provide disaggregated data on residents by years in t raining. No information provided on DOS training in non-AOA-approved programs such as AMA-approved hospitals.
3. *Council of Teaching Hospitals.* — Provides data on interns and residents by institution.[c]	Provides distributions of interns and residents by institution. Published and updated annually. Timely, 1976 data available in 1976.	Does not provide distributions of resident specialty or years in training.
4. *National Intern and Resident Matching Program.*— Provides information on specialty distributions of first-year and other residents in AMA-approved hospitals who participate in the program.[d]	Provides indications of student specialty and institutional preferences. Timely, 1976 data available in 1976.	Does not provide trend information on unmatched graduates and foreign medical graduates variously estimated at 10 to 30 percent of the total first-year resident supply.[e,f,g]

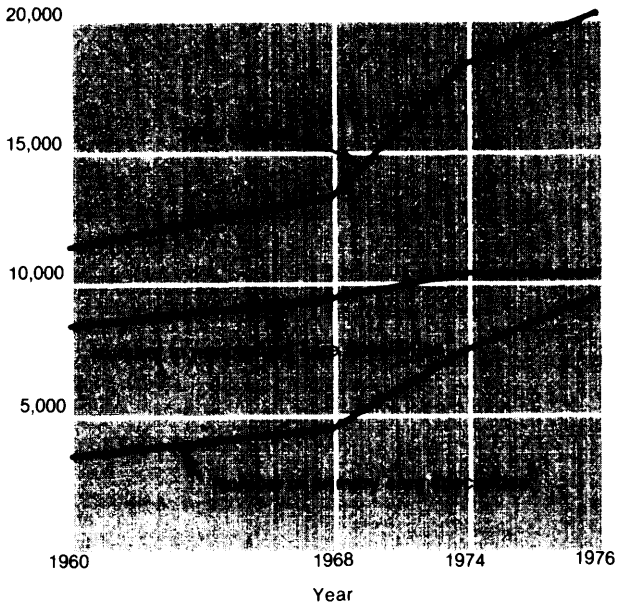
[a] American Medical Association, *Directory of Approved Internships and Residents 1975-1976,* Chicago, 1976.
[b] American Osteopathic Association, "Almanac, Supplement to Volume 76," 1975 *Journal of the American Osteopathic Association,* April 1977.
[c] Council of Teaching Hospitals, *Directory, 1976,* Association Of American Medical Colleges, January 1976.
[d] American Medical Association, *D/rectory of Approved InternShips and Residencies.*
[e] J. S. Graettinger, "Graduate Medical Education Viewed From the National Intern and Resident Matching Program," *J. Med. Educ., 51,* September 1976,
[f] B. Biles, communication to staff of the Senate Committee on Labor and Public Welfare, June 6, 1976.
[g] NIRMP does provide data for 1977 and 1978 on unmatched U.S. graduates. The program plans to collect such information periodically on all U.S. graduates, both those who use as well as those not using NIRMP.

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* Washington, D. C.: Health Resources Administration, DHEW publication No, (HRA) 79-633, pp. 105-108,

but they also are unfortunate choices in the sense that major changes were occurring in addition to the general drive to increase the aggregate supply of physicians and particularly those in primary care. In 1971, the AMA decided to terminate the free-standing internship after July 1, 1975, and instead to integrate the first year of graduate medical education into specific residency programs. During this time, the number of first-year residency positions increased dramatically. Most of this increase occurred in the primary care specialties, especially internal medicine (see figures 2 and 3). It would be reasonable to presume that much of this growth **was** not related to interest in primary care as a career. Instead, the first year of primary care residency training most likely substituted for the internship of previous years.

This overcounting of specialists through the use of first-year residency data is not a phenomenon solely related to the discontinuation

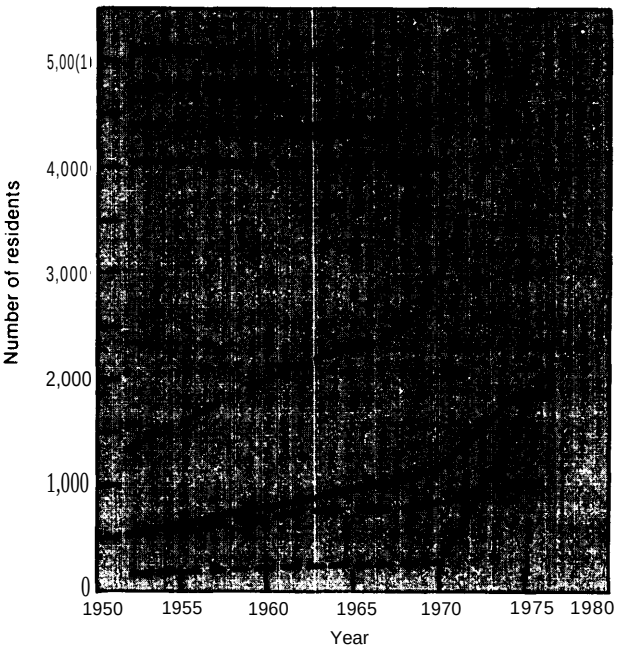
Figure 2.—Trend Data on Number of First-Year Residents: Total, Primary, Nonprimary Care Specialties; 1960, 1968, 1974, and 1976



[a]Nonprimary specialties are total less primary care specialties.
[b]Primary care specialties include general and family practice, internal medicine, and pediatrics.

SOURCE: *interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and We//are,* **Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-633, p. 51.**

Figure 3.—Trend in Number of First-Year Allopathic Residents in Four Selected Specialties



SOURCE: *Interim Report of the Graduate Medma/ Education Nat/ona/ Advisory Committee to the Secretary, Department of Hea/th, Educat/on, and We/fare,* **Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-633, LI. 50,**

of the free-standing internship. It has been known for some time, although hard to quantify, that some graduate trainees take a second first-year residency in a more specialized area of the same specialty or move on to more advanced training in another specialty altogether. For example, there is an observed 22-percent increase between the first and second year in the surgical specialties (USDHEW, 1979a).

The way in which the overcounting is minimized is to adjust the first-year residency data in the *Directory of Accredited Residencies* by subtracting the appropriate subspecialties from the general residencies 1 year later. These adjustments are performed for internal medicine, pediatrics, general surgery, psychiatry, and pathology (USDHEW, 1979a).

For internal medicine, 9 percent of first-year residents are subtracted first, this percent is assumed to take another first-year residency in a medical subspecialty or in another specialty. Of the remainder, 25 percent is assumed to go on to subspecialty training. Thus, a total of about 32 percent (25 percent of the remainder of first-year residents after subtracting 9 percent, plus the original 9 percent of the total) of all internal medicine first-year residents are subtracted and "lost" to medical subspecialties or other specialties.

More recent data estimates that only 38 percent of first-year internal medicine residents end up in general internal medicine, as compared to the 68 percent summarized above (USDHEW, 1979a). However, these percentages are not directly comparable because of the way in which internal medicine subspecialties are counted or not counted as primary care. The 68 percent remaining in primary care internal medicine excludes gastroenterology, pulmonary disease, cardiovascular disease, and allergy, but

includes allergy and immunology, diabetes, endocrinology, geriatrics, hematology, immunology, infectious diseases, neoplastic diseases, nephrology, nutrition, oncology, and rheumatology (table 13). Whether a subspecialty of medicine is included in the internal-medicine primary care count is of crucial importance, as the first-year residency distribution of primary care specialties is heavily weighted toward internal medicine. Internal medicine comprises more than so percent of all first-year primary care residency positions (table 13).

The adjustment to pediatric first-year residency positions is 9 percent, representing losses to pediatric allergy and pediatric cardiology. The surgical figures are adjusted downwards by 62 percent, representing all surgical specialties except obstetrics-gynecology and ophthalmology. Pathology is adjusted downwards by 2.7 percent, representing forensic pathology. And psychiatry is adjusted downwards by 20 percent, representing child psychiatry. The "miscellaneous" category is assumed to remain proportionate to the overall numbers of MDs throughout the projection period. The adjusted and unadjusted first-year residency distribution for 1974 is summarized in table 13.

The same adjustments made for the 1974 year are made for all historical years, 1968, 1970-74, 1976, that are used to establish the trend. For 1968, the use of these specific adjustment percentages may not be very relevant, since it was several years before announcement by AMA of its intention to discontinue the internship.

A more technically oriented summary is provided in the following excerpt (with table numbers changed to match the sequence of this report) from the Graduate Medical Education National Advisory Committee (GMENAC) interim report (USDHEW, 1979a). Note that the trend in distribution of residents among the various specialty training programs assumes a similar trend for 1974 to 1980-81 as the base years of 1968-74 (which were also modified to include 1976 data). After 1980-81, the residency distribution is held constant. BHM's justification for the constant distribution after 1980-81 is primarily that the base years which have been chosen to establish the trend covered 6 years, so the trend extrapolation is limited to 6 years.

The total projection method is summarized in figure 4. Tables 16 and 17 summarize specialty projections for MDs to 1980, 1985, and 1990.

> Projections of filled first-year residencies were made by extrapolating the results of simple linear regression applied to the trend in filled first-year residency percent distributions for the years 1968, 1970-74, and 1976. The procedure was applied for each specialty individually except for the category "miscellaneous," which was assumed to remain constant at **6.7** percent (see tables 14 and 15). Also, rates were developed separately for U. S., Canadian, and other medical school graduates.
>
> In these regression analyses, the slope of the regression line was computed from historical trends, and the constant term (base year) was taken from the first-year residency distribution of 1974, adjusted for the duplication caused by physicians first taking a residency in a general area and then in a specialty (table 13). Where this adjusted value differed significantly from the original vaIue, as in general surgery, the yearly rate of change (slope) was decreased by the ratio of the unadjusted to the adjusted value. The degree to which simple linear regression represents historical trends in individual specialties is reflected in the F and R2 values displayed in tables 14 and 15. Most specialty trends are adequately "explained" using this statistical method. However, recent cultural, political, and fiscal interventions have affected certain specialties so that they behave erratically, and therefore have statistically nonsignificant F and R2 values for a linear fit. In two cases, U. S./CMG general practice and radiology, the linear trend produced actual negative percent values. These values were set and held at zero for these two specialties. This is a reasonable assumption since general practice is being replaced by family practice, and general radiology is being replaced by the diagnostic and therapeutic training programs.
>
> The effects of recent legislation (Public Law 94-484) have not been evaluated and incorporated into the projections. However, the percent of U.S. /CMG filled first-year residencies in primary care for 1980 are projected to meet the legislative mandates.

Table 13.–First.Year Residency Distribution With Subspecialty Adjustment: Sept. 1,1974

Specialty	AMAa				Adjustments		Adjusted AMA			
	US/CMGs		FMGs		US/CMGs	FMGs	US/CMGs		FMGs	
	Number (1)	Percent (2)	Number (3)	Percent (4)	Number (5)	Percent (6)	Number (7)	Percent (8)	Number (9)	Percent (Io)
Total active physicians	13,519	100.0	5,216	100.0			12,626	100.0	4,755	100.0
Primary care	5,978	44.2	1,746	33.5			4,735	37.5	1,394	29.3
General practice	23	0.2	139	2.7			23	0.2	139	2.9
Family practice	1,131	8.4	68	1.3			1,131	9.0	68	1.4
Internal medicineb	3,591	26.6	962	18.4	– 1,144	–306C	2,447	19.4	656	13.8
Pediatrics	1,233	8.4	577	11.1	– 99	– sad	1,134	9.0	531	11.2
Other medical specialties	335	2.5	46	0.8			1,155	9.1	266	5.6
Dermatology	248	1.8	16	0.3			248	2.0	16	0.3
Pediatric allergy	46	0.3	13	0.2			46	0.4	13	0.3
Pediatric cardiology	41	0.3	17	0.3				0.3	17	0.4
Internal medicine subspecialtiese	—	—			+ 820	+ 220f	8 ; ;	6.5	220	4.6
Surgical specialties	4,395	32.5	1,454	2;.9			3,280	26.0	936	19.7
General surgery	1,803	13.4	836	16.0	– 1,118	– 5189	685	5.4	318	6.7
Neurological surgery	114	0.8	15	0.3			114	0.9	15	0.3
Obstetrics and gynecology	742	5.5	288	5.5			742	5.9	288	6.1
Ophthalmology	468	3.5	36	8.7			468	3.7	36	0.8
Orthopedic surgery	547	4.0	62	1.2			547	4.3	62	1.3
Otoiaryngology	227	1.7	43	0.8			227	1.8	43	0.9
Plastic surgery	148	1.1	36	0.7			148	1.2	36	0.8
Colon andrectalsurgery		0.1	10	0.2			20	0.2	10	0.2
Thoracicsurgery	%	0.7	50	1.0			97	0.8	50	1.1
Urology	232	1.7	78				232	1.8	78	1.6
Otherspecialties	2,808	20.8	1,970	3;::			3,456	27.4	2,159	45.4
Anesthesiology	367	2.7	348	6.7			367	2.9	348	7.3
Neurology	252	1.9	109	2.1			252	2.0	109	2.3
Pathology	397	2.9	410	7.9	– 11	– l l h	386	3.1	399	8.4
Forensic pathology	17	0.1	7	0.1			17	0.1	7	0.1
Psychiatry	952	7.0	612	11.7	– 180	- l l G i	771	6.1	496	10.4
Child psychiatry	189			1.9			189	1.5	98	2.1
Physical medicineand rehabilitaticm	29	: : ;	!%	1.8			29	0.2	93	2.0
Radiology	88	0.7	137	2.6			88	0.7	137	2.9
Diagnostic radiology	452	3.3	101	1.9			452	3.6	101	2.1
Therapeutic radiology	65	0.5	55	1.1				0.5	55	1.2
Miscelianeousj	—	—	—	—	+ 840	+316k	8 : ;	6.7	316	6.7

aDirectO~OfACCredited **Residencies, AMA,Chicago, 1977.**

blncludesa~ergy and immunology, diabetes, endocrinology, geriatrics, hematology, immunology, infectiousdiseases, neoplasticdiseases, nephrology, nutrition, oncology, and rhematology.

cF orexp lanat on o fg an d 2$percent adjustments, seetext.

d1974FyR s i n pedi a tfi ca ~ ergy and pediatric cardiology(l17) divided by 1973 FYRsin pediatrics (l,899)is 8.9 percent, theproportion excluded from the 1974 FYRsin pediatrics.

elnclude.g gastroenterology, pulmonary disease, cardiovascular disease, andallergy.

fl,~figure from footnotec.

g1974 FYRs (1,679) in surgical Subspecialties (excluding obstetrics/gynecology, and ophthalmology) divided by 1973 FYRs(2,6g8) in general surge~ is 62percent, the proportion subtracted out of the 1974 FYRsin general surgery.

hlg74FyRs(24) in forensic pathology divided by 1973 FYRs(896) in pathology is2.7 percent, theproportionexcluded from the1974FYRsin pathology.

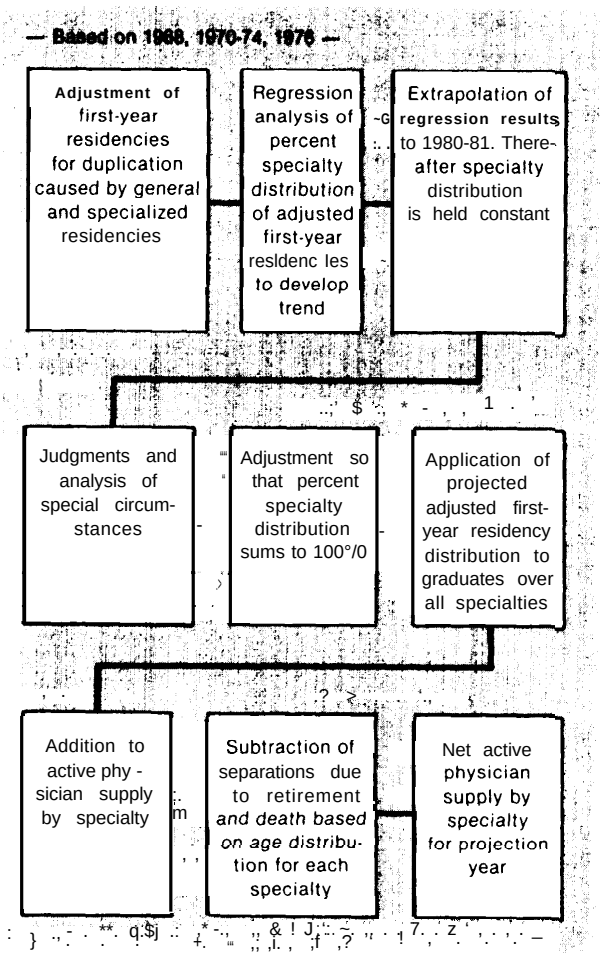
i1974FYR s(287) **inchildps ,,hi,t,di,id,d by the 1973 FYRs(l,472)** in psychiatvis20 percent, the proportion subtractedout of the 1974 FYRsin psychiatry.

lIncludes aerospace medicine, public health, general preventive medicine, occupational medicine, "other,"a ndunspecified.

'For explanation, see text.

SOIJRCE: Interim Report of the Graduate Medical ~duc~~io~ ~S'tkVM/ AdvisoW Committee to the Secretary, Deparfrnerrt of Health, Educatiorr, and We/fare, **Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-833, pp. 124-125.**

Figure 4. -Projection of Active Physicians by Specialty



SOURCE: *Interim Report of the Graduate A.fed/ca/ Education Naf/ona/ Advisory Cornrn/tree to fhe Secretary, Depar?nrenf of* **Health,** *Educaf/on, "and We/fare,* **Washington, D. C.. Health Resources Admlnistratlon, DHEW publication No (HRA) 79-633, p 122,**

As mentioned, judgment was used in specific instances where straightforward extrapolation appeared to produce intuitively unreasonable results. Such was the case with specialties showing a curvilinear trend. This trend was terminated in 1977 for these specialties, not only because the projected numbers appeared unreasonable, but also because the historical data in no instance showed a strong curvilinear trend in one direction that lasted more than 3 years. The USMG radiology trend was allowed to fall to zero by 1980 because of the reported phasing out of general radiology as a prerequisite for entry into one of the radiology subspecialties.

It is readily acknowledged that such use of regression in this analysis implied an assumption that the conditions underlying and responsible for past trends will also be in force in the future. Even though the situation is rapidly changing in the GME environment, it is nonetheless believed that such projections, when interpreted in a cautious manner, can be of value as "baseline" estimates, indicating what the specialty configuration might be if residency developments continue as they have in the past.

Using this approach, extrapolations of each distinctive residency trend were developed. Because each residency category was projected separately, however, a few minor changes had to be made to adjust the overall distribution to the control total for all residencies. In other words, when the projected percentage distribution of residencies did not add to 100 percent because of unusually strong trends in one specialty, the specialties which remained constant (10 out of *29* in the case of USMGS) in the historical trend period were adjusted slightly to make up the difference.

For several reasons, this methodology was employed for the period of 1980-81. Thereafter, the 1980-81 residency distribution was held constant. One reason for this is that extrapolation is not statistically justified for longer periods in the future than are represented by the historical data on which it is based, in this case 6 years. Another reason is that most trends of the type observed have a tendency to level off after their initial spurt. (Additional research and trend analysis is continuing on this aspect of the projections.)

These assumptions are the working assumptions of the Division of Manpower Analysis, BHM, for specific purposes. They have not been endorsed by GMENAC, which will develop its own assumptions concerning requirements rates, foreign medical graduates projections, specialization rates, cavitation grants to medical schools and other issues. It is GMENAC'S intent to investigate and, as needed, modify these assumptions (USDHEW, 1979a).

Table 14.—Percent Distribution of U.S/CMG First-Year Residency Projections Using Simple Linear Regressions (1976 actual, 1977-81 projections)

Specialty	1976a	1977	1978	1979	1980	1981	Fb	R2b
Total[c]	100.0	100.0	100.0	100.0	100.0	100.0		
Primary care	43.2	43.8	46.0	48.1	50.2	52.2		
General practice	0.1	0.0	0.0	0.0	0.0	0.0	18.2	.78
Family practice	12.0	13.5	15.1	16.6	18.1	19.5	385.9	.99
Internal medicine	22.6	21.2	21.7	22.2	22.7	23.2	10.1	.67
Pediatrics	8.5	9.1	9.2	9.3	9.4	9.5	9.6	.66
Other medical specialties	9.8	9.6	9.5	9.7	9.8	9.9	–	–
Dermatology	1.6	1.7	1.6	1.6	1.5	1.5	2.7	.36
Pediatric allergy	0.4	0.4	0.4		0.4	0.4	0.1	.02
Pediatric cardiology	0.2	0.3	0.2	0.4	0.2	0.2	2.6	.34
Internal medicine subspecialtiesd	7.6	7.2	7.3	7.5	7.7	7.8	16.1	.76
Surgical specialties	22.5	21.8	20.7	19.4	18.0	16.9	–	–
General surgery	4.8	4.2	3.8	3.4	3.0	2.6	60.3	.92
Neurological surgery	0.6	0.6	0.5	0.5	0.4	0.3	24.9	.83
Obstetrics and gynecology	5.9	5.8	5.8	5.7		5.6	0.4	.07
Ophthalmology	3.1	2.8	2.6	2.3	5.6	1.8	500.0	.99
Orthopedic surgery	3.4	3.6	3.4	3.2	3.0	2.8		.61
Otolaryngology	1.4	1.4	1.3	1.1	1.0	0.9	3:::	.88
Plastic surgery	1.0		1.1	1.1	1.1	1.1	8.8	.40
Colon and rectal surgery	0.1	1.1	0.2		0.2	0.2	22.7	.82
Thoracic surgery	0.7	0.6	0.6	0.2	0.5	0.5	5.4	.52
Urology	1.4		1.4	1.3	1.2	1.1	5.3	.51
Other specialties	24.6	24.6	23.8	22.9	22.1	21.2	–	–
Anesthesiology	2.2	2.0	1.7	1.4	1.1	0.9	113.9	.96
Neurology	1.8	1.8	1.6	1.5		1.3	6.1	.55
Pathology	3.2	2.9	2.8	2.7	1.4	2.5	11.7	.70
Forensic pathology	0.1	0.1	0.1	0.2	0.2	0.2	0.5	.11
Psychiatry	4.8	4.5	3.9	3.3	2.7	2.2	26.0	.84
Child psychiatry	1.3	1.5	1.5	1.5	1.5	1.4	0.01	.002
Physical medicine and rehabilitation	0.4	0.2	0.2		0.1	0.0	5.1	.50
Radiology	0.2	0.0	0.0	0.1	0.0	0.0	57.1	.92
Diagnostic radiology	3.5		4.8	5.0	5.3	5.5		.28
Therapeutic radiology	0.4	4.6	0.5	0.5	0.5	0.5	0.07	.02
Miscellaneous	6.7	6.7	6.7	6.7	6.7	6.7	–	–

[a] Actual figures.
[b] The degree to which simple linear regression represents actual historical trends in the individual specialties is reflected in the F and R^2 values.
[c] Figures may not total due to independent rounding.
[d] Includes gastroenterology, pulmonary disease, cardiovascular disease, and allergy.
[e] Includes aerospace medicine, public health, general preventive medicine, occupational medicine, "other," and unspecified.

The "F Test," as applied to the regression on historical residency data, measures the statistical significance of the linear trend as an estimate of the past changes in the number of first-year residents by specialty 1968-76. Values of F greater than 6.6 are statistically significant at the 95-percent confidence level.

R^2, the square of the Pearson product-moment correlation coefficient, is frequently referred to as "The Correlation Index." On a scale from zero to one, it measures the degree to which the linear trend estimates the actual changes in the number of first-year residents, by specialty, 1968-76.

SOURCE: Interim Report of *the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* Washington, D. C.: Health Resources Administration, DHEW publication No. (HRA) 79-633, pp. 127-128.

LOCATIONAL DISTRIBUTION

Where **physicians reside and practice** medicine is generally obtained from the same data sources as for aggregate and specialty supply. Distribution is usually described at the State, county, or Health Service Area (HSA), and, for comparative purposes, quantified as a physician-to-population ratio.

The limitations of the data sources in simply describing where physicians live and practice are similar to the data limitations in describing aggregate and specialty supply. In addition, describing locational distribution by States, by counties, by metropolitan versus nonmetropolitan areas, and even by HSAS may be most con-

Table 15.—Percent Distribution of FMG First-Year Residency Projections Using Simple Linear Regressions
(1976 actual, 1977.81 projections)

Specialty	1976a	1977	1978	1979	1980	1981	Fb	RZb
Total:.	100.0	100.0	100.0	100.0	100.0	100.0		
Primary care	33.2	31.6	32.1	32.6	33.1	33.6		
General practice.	4.4	3.5	3.6	3.7	3.8	3.9	0.7	.12
Family practice.	3.1	3.1	3.5	3.9	4.3	4.7	27.2	.87
Internal medicine.	13.2	13.3	13.1	12.9	12.7	12.5	2.0	.28
Pediatrics	12.5	11.7	11.9	12.1	12.3	12.5	1.3	.21
Other medical specialties	5.4	5.2	5.2	5.1	4.9	4.7	—	—
Dermatology.	0.3	0.2	0.2	0.2	0.2	0.1	6.7	.57
Pediatric allergy.	0.3	0.3	0.3	0.3	0.3	0.3	0.1	.02
Pediatric cardiology.	0.4	0.3	0.3	0.3	0.3	0.2	10.4	.68
Internal medicine subspecialties[d].	4.4	4.4	4.4	4.3	4.2	4.1	2.2	.31
Surgical specialties.	20.5	19.0	18.2	17.6	17.0	16.2	—	—
General surgery.	7.0	6.6	6.4	6.1	5.9	5.7	16.4	.77
Neurological surgery.	0.8	0.5	0.5	0.5	0.5	0.5	0.1	.02
Obstectrics and gynecology	5.4	5.0	4.6	4.1	3.7	3.3	138.7	.97
Ophthalmology.	0.5	0.6	0.5	0.5	0.5	0.4	3.6	.42
Orthopedic surgery	2.0	1.7	1.7	1.8	1.9	1.9	2.3	.31
Otolaryngology.	0.9	0.9	0.9	0.9	0.9	0.9	0.7	.13
Plastic surgery	0.8	0.9	0.9	1.0	1.0	1.0	41.3	.89
Colon and rectal surgery	0.3	0.3	0.3	0.4	0.4	0.4	9.5	.65
Thoracic surgery	0.9	0.8	0.7	0.6	0.5	0.4	14.9	.75
Urology	1.8	1.7	1.7	1.7	1.7	1.7	.00005	.00001
Other specialties	40.9	44.3	44.5	44.8	45.1	45.5	—	—
Anesthesiology	6.2	6.6	6.2	5.9	5.5	5.2	6.5	.56
Neurology	1.9	2.3	2.3	2.4	2.4	2.5	2.7	.35
Pathology	7.1	7.5	7.2	6.8	6.5	6.2	6.7	.57
Forensic pathology	0.2	0.2	0.2	0.2	0.2	0.2	0.4	.10
Psychiatry	8.5	9.2	9.4	9.6	9.9	10.1	1.5	.23
Child psychiatry.	2.0	2.3	2.5	2.7	2.9	3.1	55.5	.92
Physical medicine and rehabilitation	2.5	2.5	2.7	2.9	3.0	3.2	38.5	.89
Radiology	1.3	1.6	1.2	0.8	0.5	0.1	29.5	.86
Diagnostic radiology	3.0	3.6	4.1	4.6	5.1	5.6	239.7	.98
Therapeutic radiology	1.5	1.8	2.0	2.2	2.4	2.6	154.7	.97
Miscellaneous.	6.7	6.7	6.7	6.7	6.7	6.7	–	–

[a] Actual figures.
[b] The degree to which simple linear regression represents actual historical trends in the individual specialties is reflected in the F and Revalues.
[c] Figures may not add to total due to independent rounding.
[d] Includes gastroenterology, pulmonary disease, cardiovascular disease, and allergy.
[e] Includes aerospace medicine, public health, general preventive medicine, occupational medicine, "other," and unspecified,

The "F Test," as applied to the regression on historical residency data, measures the statistical significance of the linear trend as an estimate of past changes in the number of first-year residents by specialty 1966.76, Values of F greater than 6,6 are statistically significant at the 95-percent confidence level,

R^2, the square of the Pearson product-moment correlation coefficient, is frequently referred teas "The Correlation index" On a scale from zero to one, it measures the degree to which the linear trend estimates the actual changes in the number of first-year residents, by specialty, 1968-76.

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Educa(/err, and We/fare,* Washington, D.C : Health Resources Administration, DHEW publication No. (HRA) 79-633, p 129-130

venient from a data availability point of view, but it does not necessarily follow that physicians are available to the populations they are matched against. Nor are populations identified on these bases comparable, and one area (e. g., county) may have people with significantly different health problems than people in other areas. So in addition to the basic problem of being able to count the numbers of practicing physicians and their clinical specialties in an identified area, there is the additional problem of whether these physicians actually provide medical services to the designated population (including whether they may be providing services to people in adjacent areas). This qualification becomes important when such comparative data are used to implement programs that single out "health manpower shortage areas" for support. In these aid programs, a specific physician-to-population ratio is chosen as the cutoff point and used in conjunction with other indices of medical need to determine

Table 16.—Active Physicians (MD), by Major Specialty Group: Actual 1974; Projected (under the basic assumption) 1980-90

Specialty group	Base year 1974	Projected 1980	1985	1990
	Number of active physicians			
Total	348,960	430,150	500,340	566,940
Primary care	133,240	166,790	203,370	239,830
Other medical specialties	18,930	26,580	33,800	41,080
Surgical specialties	97,720	113,200	122,160	129,610
Other specialties	99,070	123,580	141,050	156,410
	Percent distribution			
Total	100.0	100.0	100.0	100.0
Primary care	38.2	38.8	40.6	42.3
Other medical specialties	5.4	6.2	6.8	7.2
Surgical specialties	28.0	26.3	24.4	22.9
Other specialties	28.4	28.7	28.2	27,6
	Rate per 100,000 population			
Total	165.5	193.1	213.8	231.3
Primary care	63.2	74.9	86.9	97.9
Other medical specialties	9.0	11.9	14.4	16.8
Surgical specialties	46.3	50.8	52.2	52.9
Other specialties	47.0	55.5	60.3	63.8

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Hea/th. Education. and We/tare.* **Washingtøn. Ḍ. C,: Health Resources Administration. DHEW ṭṃblicatlon No, (HRA) 79-633; p. 155.**

whether an area is eligible or not for aid. This concept of "shortage" is a question more basic to comparing supply with requirements and is discussed in the chapter on requirements.

The distribution of physicians by the most common methods of description and quantification is summarized in tables 18 and 19 and figure s. Table 18 provides physician-to-population ratios for selected specialties in the aggregate and for the States with the highest and lowest ratios. Table 19 contrasts non-Federal MDs in metropolitan with nonmetropolitan counties. And figure 5 contrasts the supply of surgeons and primary care physicians as grouped by HSAS. DHHS also compiles these statistics through a "GINI index, " a statistical tool that expresses unevenness as a single number. To compute the GINI index, the percentage of the total population is graphically accumulated on one axis and the percentage of practitioners similarly accumulated on the other axis, starting with the area with the lowest physician-to-population ratio and going to the area with the highest ratio. If the distribution were perfect, the result would be a 45-degree "line of equality. " The GINI index is the ratio of the area between the actual curve and the line of equality to the total area under the line of equality (USDHEW, 1979b).

The GINI index value varies between zero, indicating no maldistribution, and 1.0, indicating the greatest possible maldistribution. In general, smaller index values (indicating less unevenness) can be expected when making comparisons among larger geographical units. This can be seen in the following GINI index for active non-Federal MDs in 1973:

By State (50 States) 0.161
By Census-Defined State Economic Area (173 areas) ... , ...0.292
By county (3,071 counties). 0.361
(Source: USDHEW, 1979b)

Osteopathic physicians (estimated at 17,700 in 1980 out of a total supply of active physicians of **447,800)** are unevenly distributed among the States because they were not allowed to practice in some States until recently and because of the limited number of schools. In 1977, Michigan had **2,760** osteopaths, Alaska, only 7. More than 20 States had less than 100 osteopathic physicians and students.

Table 17.–Supply of Active Physicians (MD), by Specialty: Actual 1974; Projected 1980-90

Specialty	Number of Dhvsicians				Percent distribution			
	1974	1980	1985	1990	1974	1980	1985	1990
Total active physicians	348,960	430,150	500,340	566,940	100.0	100.0	100.0	100.0
Primary care	133,240	166,790	203,370	239,830	38,2	38.8	40.6	42.3
General practice	46,530	39,290	32,870	26,350	13.3	9.1	6.6	4.6
Family practice	9,480	22,380	39,190	56,480	2.7	5.2	7.8	10.0
Internal medicine	54,780	73,280	91,020	108,530	15.7	17.0	18.2	19.1
Pediatrics	22,460	31,830	40,290	48,470	6.4	7.4	8.1	8.5
Other medical specialties	18,930	26,580	33,800	41,080	5.4	6.2	6.8	7.2
Dermatology	4,470	5,830	6,720	7,610	1.4	1.4	1.3	1.3
Pediatric allergy	480	870	1,210	1,500	0.1	0.2	0.2	0.3
Pediatric cardiology	590	850	1,030	1,200	0.2	0.2	0.2	0.2
Internal medicine subspecialtiesa	13,120	19,030	24,850	30,730	3.8	4.4	5.0	5.4
Surgical specialties	97,720	113,200	122,120	129,610	28.0	26.3	24.4	22.9
General surgery	32,100	34,700	35,210	35,140	9.2	8.1	7.0	6.2
Neurological surgery	2,990	3,470	3,360	3,710	0.9	0.8	0.7	0.7
Obstetrics and gynecology	22,080	26,620	30,040	33,230	6.3	6.2	6.0	5.9
Opthamology	11,220	12,630	13,210	13,730	3.2	2.9	2.6	2.4
Orthopedic surgery	11,550	14,280	16,170	17,890	3.3	3.3	3.2	3.2
Otolaryngology	5,870	6,640	6,980	7,310	1.7	1.5	1.4	1.3
Plastic surgery	2,330	3,370	4,280	5,150	0.7	0.8	0.9	0.9
Colon and rectal surgery	680	800	890	980	0.2	0.2	0.2	0.2
Thoracic surgery	2,100	2,750	3,080	3,350	0.6	0.6	0.6	0.6
Urology	6,790	7,960	6,620	9,150	1.9	1.9	1.7	1.6
Other specialties	99,070	123,580	141,050	156,410	28.4	28.7	28.2	27.6
Anesthesiology	13,330	15,600	16,210	16,830	3.8	3.6	3.2	2.9
Neurology	4,200	6,070	7,360	8,520	1.2	1.4	1.5	1.5
Pathology	12,310	15,860	18,120	20,020	3.5	3.7	3.6	3.5
Forensic pathology	220	360	540	700	0.1	0.1	0.1	0.1
Psychiatry	24,740	28,560	29,900	30,690	7.1	6.6	6.0	5.4
Child psychiatry	2,730	4,460	5,970	7,730	0.8	1.0	1.2	1.3
Physical medicine and rehabilitation	1,780	2,450	2,780	2,990	0.5	0.6	0.6	0.5
Radiology	11,900	11,710	10,950	9,970	3.4	2.7	2.2	1.8
Diagnostic radiology	3,650	8,180	13,440	18,660		1.9	2.7	3.3
Therapeutic radiology	1,200	2,000	2,760	3,420	: : :	0.5	0.6	0.6
Miscellaneous	23,010	28,320	33,030	37,670	6.6	6.6	6.6	6.6

al"~ludes allergy, cardiovascular disease, gastroenterology, and Pulmonary disease,
bl„l,d,s aerospace medicine, general preventive medicine, occupational medicine, public health, unspecified, and "other Specialties."

NOTE: Figures may not add to subtotals and totals due to independent rounding.

SOURCE: *InterimReportofthe Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Educat/err, and Welfare,* **Washington, D.C : Health Resources Administration, DHEW publication No. (HRA) 79-633, p. 153.**

These estimates of MD and DO locational distribution do not address the question of future distributional patterns. Such predictive efforts are used for programs which intend to place physicians in identified areas of shortage and for which such shortage designations also make the identified areas eligible for governmental (Federal and State) funds.

Prior to the Health Professions Educational Assistance Act of **1976,** different criteria had been developed for designation as a Health Manpower Shortage Area (HMSA) for BHM programs and as a Medically Underserved ..Area (MUA) for the Bureau of Community Health Services' (BCHS) programs. Following the passage of the 1976 Act, these definitions have been consolidated under the HMSA designation. Thus, once designated a HMSA, such areas: 1) would be eligible for National Health Service Corps (NHSC) staffing of Corps practice site, 2) would be areas in which students who borrowed money under health professions student loan programs could practice in lieu of repaying the loans in money, 3) would be eligible for grants in various health manpower training programs,

Table 18.–Patient Care MDs (non-Federal) by Selected Specialties and for High and Low States (1976)

Specialty	MDs per 100,000 population, all States	Ratio for highest State	Ratio for lowest State
All specialties	137.0	New York. 198	South Dakota. 78
Primary carea.	58.4	New York. 84	Alaska 35
General and family practice.	23.9	California . 30	Alabama. 19
internal medicine	22.2	Massachusetts . 43	South Dakota . 7
Pediatrics	8.9	Maryland . 17	South and North Dakota. 3
Obstetrics and gynecology	9.3	Maryland . 16	South Dakota . 3
General surgery	13.5	New York. 20	South Dakota and Alabama. 2
Psychiatry	9.0	New York. 20	South Dakota and Alabama. 2
Ophthalmology.	4.9	New York. 7	South Dakota . 2
Orthopedic surgery.	4.9	Massachusetts, Connecticut, and California. 7	South Dakota, Alabama, and Mississippi . 3
Anesthesiology.	5.3	Massachusetts. 9	South Dakota. 1

aDefined as general arlcJ family practitioners, Internists, and pediatricians

SOURCE. *Inter/m Report of the Graduate Med/ca/ Education National Adv/sory Committee to the Secretary, Department of Hea/tn, Educat/on, and We/fare,* **Washington, D.C : Health Resources Adminlstratlon, DHEW publication No. (HRA) 79-633, pp. 65-87,**

Table 19.—Non.Federal Physicians (MD) Providing Patient Care in Metropolitan and Nonmetropolitan Areas 1963.76

Year	Number of physicians			MDs per 100,000 population			Percent of MDs		
	All counties	Metropolitan	Nonmetropolitan	All counties	Metropolitan	Nonmetropolitan	All counties	Metropolitan	Nonmetropolitan
1963	225,427	178,403	47,024	120.3	144.2	73.8	100.0	79.1	20.9
1964	232,067	184,298	47,769	122.0	146.8	73.9	100.0	79.4	20.6
1965	239,482	189,211	48,271	123.2	148.7	73.6	100.0	79.7	20.3
1966	241,473	192,871	48,602	123.7	148.9	74.1	100.0	79.9	20.1
1967	247,256	200,880	46,376	125.4	150.0	73.3	100.0	81.2	18.8
1968[b]	236,458	192,242	44,216	118.7	141.6	69.7	100.0	81.3	18.7
1969	245,368	200,247	45,121	121.8	145.7	70.5	100.0	81.6	18.4
1970	252,778	206,676	46,102	124.2	148.7	71.5	100.0	81.8	18.2
1971	261,335	217,187	44,148	127.5	152.9	70.1	100.0	83.1	16.9
1972	266,587	225,424	41,163	128.5	152.9	68.6	100.0	84.6	15.4
1973	270,412	231,529	38,883	129.1	150.9	69.4	100.0	85.6	14.4
1974	276,070	235,994	40,076	130.9	153.3	70.4	100.0	85.5	14.5
1975	287,837	249,218	38,619	134.8	156,9	74,1	100.0	86.6	13,4
1976	294,730	255,102	39,628	137.4	158.2	74.4	100.0	86.6	13.4

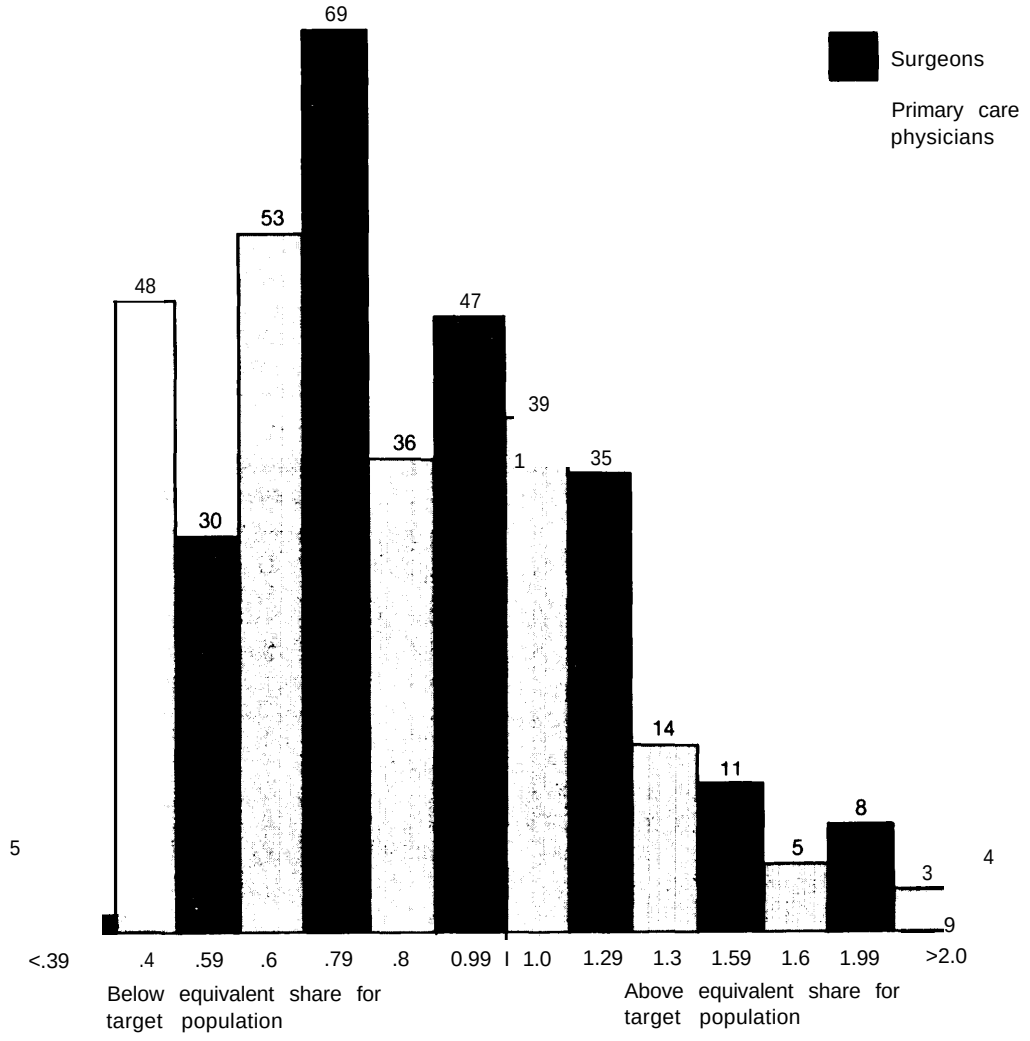
aFor 1963.66, metropolitan Counties include those in SMSAs on basis of 1962 population and nonmetropol itan counties include those adjacent to metropolitan counties and isolated rural and semirural counties.
For 1967-76, metropolitan counties include those in SMSAs on basis of 1967 population and nonmetropolitan counties include potential metropolitan counties and all others outside SMSAs.
b Beginning in 1968, the AMA changed its methods of classifying physicians to reflect the number of hours spent in various activities and specialties. This resulted in a loss in physicians in patient care with corresponding Increases in physicians in "other activities" and inactive.
Based on annual reports on the distribution physician in the United States by the American Medical Association, 1963-67.

SOURCE: *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and We/fare,* **Washington, D.C.: Health Resources Administration, DHEW publication No. (HRA) 79-633, pp. 91-92.**

4) would be eligible or given preference for grant funds for several BCHS programs such as the urban and rural health initiatives, and 5) would be the only areas in which rural health clinics could be certified for reimbursement of nurse practitioner and physicians' assistant services under Medicare and Medicaid.

Through the 1976 Act shortage designation for eligibility for NHSC physician services is now available not only to geographic areas (the old emphasis on alleviating rural shortages), but also to population groups and institutional settings of care. The former include Native Americans, migrants, and the aged. The latter include hospitals, state mental health facilities, rehabilitation facilities, long-term care facilities, community health centers, community mental health centers, migrant health centers, and Federal and State prisons.

Figure5.— Frequency Distribution of Physician Availability Indexes—primary Care Physicians and Surgeons for the 204 HSAs



The availability index is a weighted average of the ratio between the portion of the Nation's physicians in each of the HSA'S counties and the portion of the Nation's population living in each of those counties. If the HSA has attracted a portion of the Nation's physicians equivalent to its portion of the U.S. 'S population, its physician availability index would be 1.0.

SOURCE. *Inter/m Report of the Graduate Medical Education National Advisory Committee to the Secretary, Department of Health, Education, and Welfare,* **Washington D.C. Health Resources Administration, DHEW publication No, (HRA) 79-633, p. 95.**

From this wide array of potential shortage areas, the NHSC program had to develop subsets that would actually receive Corps attention.

NHSC includes obstetrician-gynecologists as primary care physicians, in addition to family practitioners, general practitioners, pediatricians, and internists. Psychiatrists are included for mental health facilities and osteopaths also are included, although not specifically in their projections, which concern allopathic physician supply.

For nonmetropolitan areas there is a primary care physician-to-population designation ratio of 1:3,500, which means that only those areas

with that ratio or higher (fewer physicians) would be eligible for Corps staffing. The target ratio is 1:2,000. Once designated and selected for Corps staffing, Corps physicians would be provided until a ratio of 1:2,000 was achieved (USDHEW, 1978a).

As part of the process of planning for how much effort is needed in specific practice settings, estimates must be made of the numbers and types of physicians who will settle in these areas voluntarily. DHHS, through the joint efforts of its BHM of the Health Resources Administration and the Office of Planning, Evaluation, and Legislation of the Health Services Administration, has developed a computerized model to project the number and distribution of active, non-Federal, office-based patient care physicians in the so States and all counties from 1972 through 1990.

As the Health Professions Educational Assistance Act of 1976 enlarged the definition of HMSAS, separate estimates are made for: 1) rural counties, 2) urban areas, 3) Federal and State prisons, 4) State mental hospitals and community mental health centers, and 5) the Indian Health Service. The computerized model is used to project future supply in rural counties, but it cannot be used to project supply in the other categories. Hence, other methods must be used for these other categories. For prisons, mental health facilities, and the Indian Health Service, the sponsoring agencies have provided estimates of both supply and requirements. Essentially, these agencies forecast a steady state supply (USDHEW, 1978a).

The NHSC task force's estimates of the supply of primary care physicians in rural and urban areas are summarized below.

Rural areas.—The projections are based on: 1) existing supply (DOS and MDs, domestic and foreign graduates); 2) anticipated deaths, retirements, and relocation of existing physicians; 3) anticipated graduations, specialty choices, and practice locations; and 4) anticipated population growth. Beginning with 1972 as the base year, total physician and primary care and nonprimary care physician-to-population ratios are projected for each county (urban as well as rural) for each year. The method is thus similar to aggregate and specialty supply, with the added factor of accounting for where physicians locate.

Counties are assumed to maintain population as fixed proportions (derived from 1972 data) of their respective State populations.

Starting with the 1972 active, non-Federal, office-based, patient-care physicians in each county, year-by-year reductions from deaths and retirement are calculated.

The number of new physicians expected to enter practice is estimated by the method described earlier for aggregate supply. These numbers are summarized in table 20.

Total new physicians entering practice each year are reduced for: 1) Federal employment, 2) nonpatient care activities, and 3) practices in areas other than the **so** States.

The physician distribution among the States for 1973-87 (since updated to the 1990's) is based on the historical pattern of distribution for graduates from 1965 to 1969, modified for percent changes in State populations projected for 1972 to 1987.

The percent of physicians entering practice from 1973 to 1987 as primary care specialists is

Table 20.—New Physicians Entering Practice, 1973-87

Year	USMG	FMG	DO
1973	8,367	3,665	472
1974	8,974	5,081	485
1975	9,551	5,202	649
1976	10,391	2,709	587
1977	11,613	3,799	702
1978	12,714	5,265	809
1979	13,561	3,517	908
1980	13,607	3,895	964
1981	14,598	1,903	996
1982	15,048	2,187	1,029
1983	15,346	1,849	1,208
1984	15,789	2,372	1,308
1985	16,354	2,034	1,377
1986	16,956	2,246	1,458
1987	17,241	1,908	1,496

SOURCE: Memorandum from the Chairmm, **NHSC Needs Task Force A, to the Director, Bureau of Community Health Services, Health Services Administration; the Deputy Director, Bureau of Health Manpower, Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D. C,, May 26,1978.**

projected to increase to the proportions listed in table 21. This should be distinguished from the percent of the total physician supply that is projected to be in primary care (tables 16 and 17).

Physicians are projected to enter practice in county classes in the percentages summarized in table 22.

Newly entering physicians are allocated to individual counties by specialty according to the **1974** observed pattern of 30-to 44-year-old physicians of the same specialty. This new supply is added to the existing supply, modified yearly for attrition from deaths and retirements.

Table 21 .—Percent of New Physicians Expected To Enter Primary Care

Year	Percent in primary care
1973	25.2
1974	26.4
1975	28.1
1976	33.5
1977	37.5
1978	43.2
1979	43.8
1980	46.0
1981	48.1
1982	50.2
1983	52.2
1984-87	52.2

SOURCE: Memorandum from the chairman, NHSC Needs Task Force A,to the Director, Bureau of Community Health services, Health Services Administration; the Deputy Director, Bureau of Health Manpower, Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D.C., May26,1978.

Urban area.—Predicting the future supply of physicians for urban areas in order to assess the need for additional physicians is not computed on a county basis. If measured by county, the number of primary care physicians is usually adequate, so the needs in urban areas are measured by the needs of certain population groups which have financial and sociocultural barriers to access instead of the geographic barriers of rural **areas, for which physician-to-population ratios serve as substantial proxy measures. Thus, an estimate of the number of physicians required to meet the needs of metropolitan low-income areas as defined by the Bureau of the Census is used.**

Such identified low-income area populations declined from 17,936,000 in 1974 to 16,554,000 in 1976, or a decline of 3.8 percent per year. But the task force concluded that the decrease is not expected to continue indefinitely and that there is a current trend for physicians in central cities to move to the suburbs. It therefore assumed that the decrease in low-income population will be offset or more than offset by the emigration of physicians from the inner city. In other words, present supply as expressed in physician-to-population ratios also predicts what the future supply will be. This average is 13.3 full-time-equivalent primary care physicians per 100,000population。

Parenthetically, it was determined that 42.3 primary care physicians per 100,000 population

Table 22.—Projected County Classes of Newly Practicing Physicians

	MD			
County class[a]	Family practice	Primary care[b]	Non primary care	DO
1	2.7	0.2	0.1	3.0
2	7.5	2.0	0.5	6.7
3	10.6	5.1	1.6	6.4
4	9.4	6.9	3.7	5.2
5	2.3	2.2	1.2	2.2
6	26.8	19.5	24.6	17.6
	13.2	12.8	13.1	13.9
7::	21.9	35.5	37.0	40.1
9	5.6	15.0	18.2	4.9
	100.0	100.0	100.0	100.0

[a]AMA demographic county classification (1-4 = rural; 5-9 = urban).
[b]Excluding family practice. This definition of "primary care" includes obstetrics-gynecology, in addition to general practice, family practice, internal medicine, and pediatrics.

SOURCE: Memorandum from the Chairman, NHSC Needs Task Force A, to the Director, Bureau of Community Health Services, Health Services Administration; the Deputy Director, Bureau of Health Manpower, Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D.C., May 26,1978.

(a staffing ratio of 1:2,000) would be needed in these low-income areas and that the 13.3 number meant that 31.4 percent of need was already met. The analysis then goes on to say that separate analyses of the underserved population's "usual source of care" resulted in the figures in table **23** and confirmed the 31.4-percent figure.

The analysis then goes on to equate the sum of care from "hospital," "neighborhood health center, " and "none" with unmet need of **62.6** percent of the population and goes on to estimate additional physicians needed on this basis. Yet only **8.6** percent of the 62.6 percent received no **care.** Hospital care does not represent "unmet need" but involves the question of what is appropriate care. And since this analysis was made to estimate the number of NHSC physicians that might be placed in these areas, identifying "neighborhood health center" care as "no care" must mean that the presumption is that such centers will be staffed only by NHSC physicians in the future.

Table 23.—Usual Source of Care for Urban Underserved Areas

	Percent
Private physicians	31.4
Hospital (emergency room and outpatient treatment)	31.3
Neighborhood health center	22.7
None	8.6
Other	6.0
Total	100.0

SOURCE: Memorandum from the Chairman NHSC Needs Task Force A, to the Director, Bureau of community Health sewices, Healtfl se~ices A& ministration; the Deputy Director, Bureau of Health Manpower, Health Resources Administration; and the Chairman, NHSC Needs Task Force, Washington, D. C., May 26,1978.

SUMMARY

Comparing the methods for estimating supply with those used for estimating requirements, we would expect more certainty in the supply projections. Yet the foregoing description of supply projections shows that there are many weaknesses in the data bases, some questionable assumptions underlying the projections, different interpretations given to some commonly used terminologies such as "primary care" and "full-time-equivalent, " etc.

The description of how supply projections are made can quickly become quite detailed. So let us summarize: 1) the components and primary assumptions of the supply estimates, and 2) some definitional problems that are linked to substantive issues and which are compounded by weaknesses in the data.

Supply is the sum of practicing physicians and additions of foreign and domestic medical and osteopathic school graduates (there are no foreign additions to the osteopathic supply). Attrition from deaths and retirements for the practicing physician component is estimated by age-specific rates. For specialty supply, the same death and retirement rates are applied to each specialty.

Additions to supply are the sum of foreign and domestic graduates. Estimates of first-year enrollments and attrition prior to graduation are made to arrive at the number of domestic graduates. The high, low, and basic first-year enrollment estimates all assume full cavitation funding by 1981, and 4, 7, or 10 new medical schools after **1977-78.** For FMG additions, the Canadian addition is currently estimated to equal losses from death, retirement, and emigration. Estimates of the addition to supply from other FMGs rely heavily on the presumed impact of the 1976 Act, which contained major restrictions on FMG immigration. It should be noted that the resulting total projections of supply made before and after the 1976 Act have not varied greatly (estimated at approximately 600,000 in 1990). The component projections, however, have varied wiclely. In essence, present projections of domestic graduates are larger than previous estimates, and present projections of FMG additions are less than prior estimates. In the current projections, the assumption of full cavitation funding is not very realistic and tends to increase the supply projections. On the other hand, the additions from the FMG supply may be too optimistic in terms of legislative impact

on decreasing this source of supply, particularly with the large pool of U.S. citizens studying medicine abroad, for whom immigration restrictions are not applicable, although they have to pass a competency exam in order to practice medicine in the United States.

Additions to specialty supply use projections of first-year residency trends to allocate foreign and domestic graduates among the specialties. The predictive power of first-year residency choices is a problem because they may not reflect ultimate specialty practices. This is particularly true for internal medicine, where at least one-third of the first-year residency positions is used as a general medicine traineeship for physicians ultimately subspecializing or choosing another specialty altogether. The trend in specialty choice is determined by the trend reflected in the years 1968, 1970-74, and 1976, years in which major changes were occurring in the structure of postgraduate medical training programs. Statistical techniques also limit the applicability of these trend years up to 1981, at which point the distribution is held constant for future years.

Methods for predicting the locational distribution of physicians are generally similar to those for aggregate and specialty supply. For rural areas, the active, non-Federal, office-based physician supply in each county is reduced for deaths and retirements. The supply of new physicians is allocated to individual counties by specialty according to the 1974 observed patterns of 30- to 44-year-old physicians of the same specialty (counties are allocated to nine classifications from rural to urban). For urban (inner city) areas, physician supply is assumed to decrease (no numbers given), reflecting continued emigration to the suburbs. For prisons, mental health ,services, and the Indian Health Service, future supply is generally assumed to hold constant at its present rate.

In addition to absolute numbers, a relative standard is used, the physician-to-population ratio, which is also commonly expressed as the number of physicians per 100,000 population; e.g., 1:1,000 or 100/100,000. This ratio is used to provide a more complete quantification of supply; i.e., we need to know not only the numbers of physicians in practice, but also the populations which they serve.

For aggregate and specialty supply, the Census Bureau's Series II (or Series III, which projects slower growth) estimates of population are used. As these reflect the **1970** Census, more accurate information will be available from the upcoming 1980 Census.

For locational distribution, the population estimates try to be more specific, as supply estimates are part of programmatic efforts to identify HMSAS. For rural areas 1972 State population estimates are used, and counties are assumed to maintain fixed proportions of their respective State populations. For urban areas, the population is that identified by the Bureau of the Census as metropolitan low-income areas. Although these low-income populations have declined (17,936,000 in 1974 to 16,554,000 in 1976, or a decline of 3.8 percent per year), the physician-to-population ratio is assumed to hold constant in the future because of the previously mentioned expectation of continued emigration of physicians out of the inner cities.

It should be obvious that supply, as referenced to population, depends not only on the physician supply projections, but also on the population projections. An example is the distinction between projections of physician supply which include or exclude Federal physicians. In projecting supply for rural areas, table 19 estimated that there were 287,800 active non-FederaI MDs in 1975. **Table 9 estimates that there were 363,400** active MDs (including Federal) in 197s (377,500 minus 14,100 DOS). The 287,800 figure was used to allocate physicians among all counties. However, in subtracting the Federal physician supply, no effort was made to decrease the population by a proportional amount (these Federal physicians were active and presumably providing patient care). In addition, 1967 population estimates were used in table 19, whereas table 9 used population estimates that included projections of population growth.

On the physician side of the ratio, table 9 assumed that a portion of "not classified" MDs were active; whereas table 19 excluded this category from its count (approximately 30,000 phy-

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sicians, or about 10 percent). In addition, table 9 included DOS, table 19 did not.

So even though at first glance the differences in the number of active physicians represented in tables **9** and 19 (377,500 v. 287,800) might seem accounted for from the exclusion of Federal MDs, "not classified" physicians, and DOS in table 19, the method of quantifying the population also contributed to the different physician-to-population ratios (176.8/100,000 v. 134.8/100,000).

We have already seen that there are definitional problems associated with quantifying physician supply. These definitional problems will take on even more significance once we begin to quantify requirements and try to match that with supply. Two basic problems are involved: 1) the amount of patient care that is attributed to the average physician, and 2) the type of patient care provided.

The first problem is usually couched in terms such as "productivity" or "full-time-equivalent, " which attempt to provide a common reference by which the number of physicians can be equated to a certain volume of patient care services. For example, physicians' assistants in prisons were assumed to be equal to 0.5 physicians (USDHEW, 1978a). In this case, a physician was equal to a full-time-equivalent (FTE), whatever the particular hours or number of patients seen by prison physicians. Implicit in this definition are assumptions on physician productivity. Other uses of FTE are more explicit. Indiana uses a definition of a FTE primary care physician as a general or family practitioner in the age group 35 to 39, which has the highest output in terms of visits per year for that specialty (Hindle et al., 1978). A more common method is to use average productivity figures by specialty, either as measured by the average patient care hours worked per week (hospital and ambulatory care), the number of patients seen per week (usually expressed as the number of ambulatory visits), or both. And still another method is to estimate what percent of time is spent on nonpatient care activities and subtract that percentage from the total (aggregate or by specialty) supply. These productivity or FTE estimates are crucial when comparing supply with requirements, because they are the basic methods underlying the comparison. Given the same basic numbers of physician supply as provided through "head counts" by the methods summarized earlier, whether supply equals, falls short, or exceeds demand obviously depends on the productivity assumptions applied to the physician.

The definition of "primary care" involves more than the simple identification of which specialties "qualify" for that designation. Yet we have already seen that what specialties count as primary care is quite confusing. Even if we limit the specialties to general practice, family practice, general internal medicine, and general pediatrics, there can be great variations in the quantification of primary care physicians, because over 50 percent are in the internal medicine category. Yet, at various times, some subspecialties of internal medicine are included and some are not. For example, table 13 excludes dermatology, gastroenterology, pulmonary disease, cardiovascular disease, and allergy from the primary care internal medicine subspecialties, but *includes* allergy and immunology, diabetes, endocrinology, geriatrics, hematology, immunology, infectious diseases, neoplastic diseases, nephrology, nutrition, oncology, and rheumatology.

The Institute of Medicine (1978) reviewed 38 definitions of primary health care, and concluded that primary care cannot sufficiently be defined by the location of care, by the provider's disciplinary training, or by the provision of a particular set of services. It then goes on to elaborate on what it considers primary health care's five essential attributes: 1) accessibility, 2) comprehensiveness, 3) coordination, 4) continuity, and 5) accountability.

In a study examining the general care content of different specialty practices, the data was disaggregate into five components: 1) first encounter, 2) episodic care, 3) principal care, 4) consultative care, and 5) specialized care (Aiken et al., 1979). Principal care was defined as:

> There is evidence of continuity; the physician reports having seen the patient before and considers him or her to be a regular patient. Com-

prehensiveness is suggested, since the physician indicates that he or she provides most of the patient's care.

Principal care thus falls short of the Institute of Medicine's definition of primary health care. Obviously, quantifying the supply and requirements for specific physician specialties will differ between these definitions, and they will substantially affect the quantification of specialty distribution.

This difference also points out the use of specific assumptions on FTEs and productivity. If many specialty types are providing principal care, the use of FTEs will serve as proxy measures for some part of the total demand for the specific specialties. But the different specialties may also have different productivity rates. For example, internists generally see sicker and older patients than seen by general and family practitioners, and their average patient loads may be considerably less than the latters' (table 424).

Different results can be easily obtained on: 1) what exactly is primary health care, 2) which specialties qualify, 3) the proportions within each specialty which provide principal health care, and 4) the use of different productivity values for each specialty. And different requirements projections also easily result when these factors, in addition to the specialty care responsibilities of each specialty, are used to translate these FTE/productivity values into head counts for each specialty. And similar estimates must be made for the supply head counts in order to ultimately compare the supply with the requirements projections.

Table 24.—Estimated Principal"Provider Patient Loads of General Practitioners, Family Practitioners, and General Internists

Specialty	Average number Of Persons covered per physician
General practitioner	870- 965
Family practitioner	1,004-1,127
General internal medicine	468- 523

SOURCE. L. H Aiken et al , "The Contribution of Specialists to the Delivery of Primary Care,'" 1979, table 4.