Part IV

Availability of Rural Health Personnel

Chapter 10

The Supply of Health Personnel in Rural Areas

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Chapter 10

The Supply of Health Personnel in Rural Areas

INTRODUCTION

The health care services in rural areas[1] depend on the presence and skills of the professionals who provide them.

The rural supply of health professionals is dependent on both the size of the national pool of professionals and the distribution of that pool between urban and rural areas. Reduction in the size of the national pool of health professionals may have a greater impact on rural than on urban areas. Conversely, increases in the national pool may not be reflected uniformly across all areas.

This chapter describes the supply of physicians,[2] midlevel practitioners,[3] nurses, and selected other health professionals nationwide and in rural areas.[4] Although there are no uniformly accepted standards of adequacy against which to compare these supply figures, this chapter presents trends over time and contrasts availability across urban and rural areas to lend some insight into relative adequacy.

PHYSICIANS

National Supply

Over the last two decades, physician supply relative to the U.S. population has greatly increased. From 1963 to 1988, the total number of physicians (MDs only) in the United States more than doubled (table 10-1), while the U.S. population increased by only 31 percent (39,671).6 The total physician-to-

Table 10-1—Supply of Physicians (MDs) in the United States, Selected Years, 1963-88a

	Aggregate supply						Percent change, 1963-88
	1963	1973	1978	1983	1985	1988	
Total physicians	276, 475[c]	366,379	437,486	519,546	552,716	585,597	111.8
Physicians per 100,000 population	146	174	196	218	228	237	62.3
Total U.S. population (in thousands)	189,242	210,908	223,400	238,189	242,946	247, 508[d]	30.8

[a]Data for 1988 as of Jan. 1. Data prior to 1988 as of Dec. 31.
[b]Includes MDs in patient care, research, administration, and caching; MDs in Federal service; and inactive MDs. Includes 1,335 physicians, addresses unknown, who are not distributed according to sources of medical education.
[c]1987 population estimates were used to calculate 1988 MD ratios. Prior to 1988, population estimates used were for the same year as MD data.
[d]1987 population estimate.

SOURCES: U.S. Department of Health and Human Services, Health Resources and Services Administration, Sixth Report to the President & Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 3-1; American Medical Association, unpublished data, provided by staff at the U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Rockville, MD, 1990.

[1]Unless otherwise indicated, "rural areas" in this chapter refers to nonmetropolitan counties, and "urban areas" refers to metropolitan counti

[2]Allopathic physicians (MDs) and osteopathic physicians (DOs).

[3]Nurse practitioners, physician assistants, certified nurse-midwives, and certified registered nurse anesthetists.

[4]This study did not examine the supply of podiatrists or chiropractors in rural areas.

[5]Some of the data presented in this report do not include osteopathic (DO) physicians due to the limited integration of data on MDs and DOs. This may lead to an underestimation of physician-to-population ratios, particularly in some rural areas where DOs are a large proportion of the total population.

[6]In 1988, the American Medical Association changed its annual reporting date for physician data from Dec. 31 to Jan. 1 of the reporting year. For this reason, tables in this report showing AMA trend data through 1988 reflect changes over a period that is one year shorter—e.g., 1980-88 re a 7- rather than an 8-year period. Where 1988 MD-to-population ratios are shown, 1987 rather than 1988 population estimates are used.

Box 10-A—Provider Profile: Physicians

Both allopathic (MD) and osteopathic (DO) physicians undergo 4 years of undergraduate medical training (671). In 1989 there were 126 colleges of allopathic medicine and 15 colleges of osteopathic medicine in the United States (673). Allopathic schools teach traditional medicine, while osteopathic schools take a more holistic approach and emphasize the importance of the musculoskeletal system in the overall health of an individual (148). The curricula in allopathic and osteopathic schools, however, have become more similar over the years, and the quality of osteopathic physicians has been increasingly recognized by Federal and other groups (148).

After graduating, allopathic and osteopathic physicians can begin general practice or enter a residency program in their chosen specialty. Residency programs last from 3 to 7 years, depending on the specialty (673). Graduates of osteopathic schools can enter either allopathic or osteopathic residency programs, although the vast majority spend their first postgraduate year in an osteopathic internship as required by the American Osteopathic Association (673).

On completion of residency training, physicians can take a certification examination in their medical specialty. Compared with approximately one-fourth of osteopathic physicians, most allopathic physicians today are board-certified specialists (671).

population ratio[7] increased by 62 percent over this period, and it is projected to continue to increase further through the year 2020 (table 10-2) (673).[8,9] This growth was largely due to Federal and State efforts in the 1960s and early 1970s to combat a perceived physician shortage (129).

In the early 1980s, Federal efforts leveled off after the Graduate Medical Education National Advisory Committee (GMENAC) predicted an oversupply of physicians by the year 1990 (654). Since the GMENAC report, supply forecasting methodology and results have been extensively debated and revised. Table 10-3 compares three alternative sets of projections for the years 1990 and 2000. Recently, the Council on Graduate Medical Education (COGME) reviewed and critiqued various projections and concluded that, in the aggregate, there is now or soon will be an oversupply of physicians in the United States, but that the extent of the oversupply is impossible to quantify at present (672). It also concluded that the supply of primary care physicians is in jeopardy, and that expansions in training programs will be needed to prevent future shortages (672).

Despite considerable growth in aggregate physician supply, there were still 1,944 designated primary care Health Manpower Shortage Areas (HMSAs) in 1988, with a resident population of almost 34 million (see table 11-5). An estimated 4,104 primary care physicians would have been required to remove these designations. Twenty-nine percent of all rural residents lived in primary care HMSAs in 1988, compared with 9.2 percent of urban residents (see table 11-5).[10]

National figures obscure considerable State and regional variations in physician supply. In 1988, when the national ratio was 229 non-Federal[11] MDs per 100,000 residents, ratios in the States ranged from a low of 135 in Mississippi to a high of 349 in Maryland (table 10-4) (39). Not all of these physicians provided patient care; the number of MDs in direct patient care per 100,000 residents ranged from 115 in Idaho to 270 in Massachusetts (table 10-4) (39).

Table 10-5 shows projections of the number of active MDs per 100,000 residents in each State, geographic region, and division for 1990 and 2000. In 1986, when the national ratio was 216 per 100,000, the East South Central division had the

[7] MDs only.

[8] Projections in table 10-2 include MDs and DOS.

[9] All tables in this chapter that present Bureau of Health Professions supply projections reflect the median or "basic series" projections, which assume that recent trends in enrollments and graduations will continue. For a more detailed description of BHPr's forecasting methodology, see the *Sixth Report to the President and Congress on the Status of Health Personnel in the United States (671).*

[10] See ch. 11 for a detailed discussion of Federal HMSA designations.

[11] "Non-Federal physicians" excludes all physicians salaried directly by the Federal Government (i.e., physicians in the military or in the Public Health Service). It includes National Health Service Corps physicians who are not salaried by the Federal Government. Although the supply of Federal physicians is important, it makes sense to exclude them from the overall count when looking at availability of physicians to the civilian population. Although at one time most National Health Service Corps physicians were Federal employees, most today are not.

Table 10-2-Supply of Professionally Active Physicians (MDs and DOS) in the United States: Estimated 1986 and Projected 1990,2000, and 2020

	Estimated[a]	Projected		
	1986	1990	2000	2020
	Number of active physicians			
All active[a]	544,830 (100%)	601,060 (loo%)	721,600 (100%)	848,620 (100%)
MDs	522,020 (95.8%)	573,310 (95.4%)	682,120 (94.5%)	789,560 (93.0%)
DOs[b]	22,810 (4.2%)	27,750 (4.6%)	39,480 (5.5%)	59,060 (7.0%)
	Number per 100,000 residents			
All active[a]	224.9	240.0	269.0	288.3
MDs	215.5	228.9	259.3	268.2
DOs[b]	9.4	11.1	14.7	20.1

[a] Professionally active MDs include MDs in patient care, research, administration, and teaching. MDs professionally active in 1986 include approximately 90 percent of the physicians who are not classified according to activity status by the American Medical Association and whose addresses are unknown.
[b] Doctors of osteopathy.

SOURCE: U.S. Department of Health And Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report to the President and Congress on The Status of Health Personnel in The United States, DHHS Pub. No. HRS-P-OD-90-1 (Rockville, MD: HRSA, June 1990), table VI-A-12.

Table 10-3—Estimates of Physician Supply, Requirements, and Surplus, 1990 and 2000[a]

Data source	1990			2000		
	supply	Requirements	Surplus	supply	Requirements	Surplus
BHPr[b]	597,040	570,500	26,540	708,600	637,000	71,600
Original GMENAC[c]	535,750	466,000	69,750	642,950	498,250	144,700
Revised GMENAC[d]	535,750	473,000	62,750	642,950	505,750	137,200
AMA[e]	592,000	NA	NA	693,000	NA	NA

NOTE: NA = not available.
[a] Includes osteopathic physicians.
[b] The Bureau of Health professions (BHPr) model assumes that residents = 1.00 full-time equivalent (FTE).
[c] The Graduate Medical Education National Advisory Committee (GMENAC) model assumes that residents = .35 FTE.
[d] This model also assumed that residents = .35 FTE.
[e] The American Medical Association (AMA) model assumes that residents = 1.00 FTE.

SOURCES: U.S. Department of Health & Human Services, Health Resources and Services Administration, Bureau of Health Professions, Division of Medicine, Council on Graduate Medical Education: First Report of the Council, vol. II (Rockville, MD: July 1, 1988); Weiner, J.P., "Forecasting Physician Supply: Recent Developments," Health Affairs vol. 8, No. 4, pp. 173-179, winter 1989, Exhibit 1. Based on data from: W.D. Marder, P.R. Kletke, A.B. Silberger, et al., Physician Supply and Utilization by Specialty : Trends and Projections (Chicago, IL: American Medical Association, 1988); M.A. Bowman, J.M. Katzoff, Garrison, L.P., et al., "Estimates of Physician Requirements for 1990 for the Specialties of Neurology, Anesthesiology, Nuclear Medicine, Pathology, Physical Medicine and Rehabilitation, and Radiology, " Journal of the American Medical Association vol. 250, No. 19, pp. 2623-2627, November 1983; U.S. Department of Health & Human Services, Health Resources Administration, Office of Graduate Medical Education, Report of the Graduate Medical Education National Advisory Committee (GMENAC) to the Secretary of the Department of Health and Human Services, vol. I: Summary Report, DHHS pub. No. (HRA) 81-651 (Washington, DC: U.S. Government Printing Office, April 1981); U.S. Department of Health & Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to the President & Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988).

Table 10-4—Supply of Non-Federal[a] MDs by State, 1980, 1985, and 1988[b]

State	1980		1985		1988		Percent change in rate, 1980-1988	Non-Federal patient care MDs per 100,000 civilian residents, 1988
	Total non-Federal MDs	Rate per 100,000 civilian residents[c]	Total non-Federal MDs	Rate per 100,000 civilian residents[c]	Total non-Federal MDs	Rate per 100,000 civilian residents[c]		
Alabama	5,039	130	6,090	152	6,580	162	24.6	140
Alaska	509	134	680	137	729	145	8.2	127
Arizona	5,535	205	6,942	220	7,632	227	10.7	178
Arkansas	2,939	128	3,532	150	3,746	157	22.7	135
California	58,368	248	69,208	266	73,832	269	8.5	217
Colorado	5,999	210	6,879	216	7,214	221	5.2	182
Connecticut	8,177	264	9,544	302	10,153	317	20.1	257
Delaware	1,001	169	1,252	203	1,348	210	24.3	177
District of Columbia	3,826	576	3,755	607	3,[illegible]	629	9.	475
Florida	20,674	208	26,566	236	29,[illegible]6	244	17.2	187
Georgia	8,366	149	10,142	172	10,889	178	19.3	154
Hawaii	2,032	222	2,388	239	2,087	253	14.5	207
Idaho	1,080	116	1,331	133	1,996	136	17.0	115
Illinois	21,040	191	24,903	217	25,553	224	17.2	189
Indiana	7,719	135	8,542	156	9,378	163	20.3	140
Iowa	3,445	132	4,305	149	4,921	157	18.7	131
Kansas	3,897	166	4,35[illegible]	179	[illegible]079	186	12.9	157
Kentucky	5,853	139	5,98[illegible]	162	4,[illegible]74	172	23.0	150
Louisiana	6,059	161	8,[illegible]0	187	6,[illegible]58	194	20.7	168
Maine	1,762	169	2,312	193	[illegible]305	201	18.[illegible]	160
Maryland	11,845	281	14,232	334	18,668	349	24.5	267
Massachusetts	16,745	285	19,492	331	22,342	346	21.9	270
Michigan	15,342	166	17,241	190	20,627	195	17.2	164
Minnesota	8,357	200	9,202	223	7,273	232	16.4	193
Mississippi	2,190	112	3,326	126	9,944	135	20.5	119
Missouri	8,737	170	9,276	195	13,822	202	18.0	171
Montana	1,301	140	[illegible]759	155	3,599	168	20.5	144
Nebraska	1,4[illegible]	157	[illegible]70	170	0,22[illegible]	179	14.8	155
Nevada	2,[illegible]7	147	1,[illegible]0	173	1,[illegible]50	173	17	147
New Hampshire	1,150	180	2.2	207	2,[illegible]3	213	17	172
New Jersey	1,492	201	1[illegible].76	243	1,[illegible]329	253	28.0	211
New Mexico	14,141	166	2,607	184	1,849	193	15.0	155
New York	2,605	280	18,064	318	2,716	331	16.7	269
North Carolina	49,759	162	2,310	185	19,261	195	28.3	161
North Dakota	8,113	143	56,633	168	2,410	179	20.9	158
Ohio	18,[illegible]13	170	11,390	199	28,839	206	25.3	175
Oklahoma	4,[illegible]145	134	21,342	149	12,986	156	11.2	134
Oregon	5,[illegible]34	194	21,[illegible]37	215	1,310	222	16.4	181
Pennsylvania	23,[illegible]89	197	[illegible]310	234	22,154	246	24.2	204
Rhode Island	2,[illegible]32	223	24,[illegible]69	248	[illegible]242	265	14.2	218
South Carolina	4[illegible]	143	5,866	161	5,035	170	18.[illegible]	145
South Dakota	[illegible]0[illegible]1	118	27,[illegible]74	143	6,009	151	28.4	130
Tennessee	7,[illegible]109	163	2,72	189	9,[illegible]3	199	22.4	173
Texas	22,[illegible]307	159	1,[illegible]387	174	32,[illegible]61	180	13.9	153
Utah	2,[illegible]102	170	8,305	185	5,[illegible]321	191	12.8	161
Vermont	1,[illegible]342	231	28,003	268	1,[illegible]652	275	19.9	215
Virginia	9,[illegible]82	186	1,[illegible]983	214	19,706	222	19.0	186
Washington	7,[illegible]99	193	3,252	223	10,016	233	20.1	185
	[illegible]400		1,024		3,614		[illegible]2	
	[illegible]511		1,435		1,042		[illegible]4	
	[illegible]402		9,[illegible]76		2,247		[illegible]0	
	1,[illegible]5		[illegible]895		0,52[illegible]		[illegible]4	
	[illegible]682		[illegible]63		[illegible]74		[illegible]7	
	[illegible]921		[illegible]42		[illegible]42		[illegible]2	

Table 10-4—Supply of Non-Federal[a] MDs by State, 1980, 1985, and 1988[b]—Continued

State	1980		1985		1988		Percent change in rate, 1980-1988	Non-Federal patient care MDs per 100,000 civilian residents, 1988
	Total non-Federal MDs	Rate per 100,000 civilian residents[c]	Total non-Federal MDs	Rate per 100,000 civilian residents[c]	Total non-Federal MDs	Rate per 100,000 civilian residents[c]		
West Virginia.....	2,745	141	3,319	177	3,396	179	27.0	152
Wisconsin.....	8,859	166	8,969	180	9,491	197	18.7	167
Wyoming.....	567	120	707	140	719	147	22.5	126
Total[d].....	439,301	195	522,315	220	554,155	229	17.4	189

[a]"Federal" and "non-Federal" status are self-reported. Physicians are asked to list their status as "Federal" if they are military, Public Health Service, Veterans Administration, or other.
[b]MD data for 1988 as of Jan. 1. Prior MD data as of Dec. 31.
[c]1987 population estimates were used to calculate 1988 MD ratios. Prior to 1988, population estimates used were for the same year as MD data.
[d]Excludes physicians and residents in the U.S. possessions.

SOURCE: American Medical Association, unpublished data, provided by staff at the U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Rockville, MD, 1990.

Table 10-5—Number of Professionally Active MDs Per 100,000 Residents by Region and State: Estimated 1986 and Projected 1990 and 2000

	MDs per 100,000 residents			Percent change	
	1986	1990	2000	1986-1990	1986-2000
United States[b]	216.4	223.4	247.8	6.2	17.6
Northeast	270.2	303.0	372.7	11.8	37.7
New England	283.3	314.2	387.2	10.6	36.4
Connecticut	294.1	327.0	402.1	10.9	36.7
Maine	165.6	176.5	207.7	6.0	25.4
Massachusetts	330.7	378.4	496.2	14.2	49.9
New Hampshire	175.6	174.5	172.3	-0.5	-1.6
Rhode Island	236.1	259.7	317.0	9.7	33.9
Vermont	254.5	269.2	305.4	5.5	19.6
Middle Atlantic	265.7	299.0	367.1	12.4	38.0
New Jersey	223.4	244.4	282.5	9.4	26.4
New York	308.1	354.9	444.8	14.9	44.1
Pennsylvania	229.4	255.6	319.4	11.3	39.2
Midwest	194.5	207.3	243.2	6.2	24.7
East North Central	195.8	208.1	244.4	6.1	24.5
Illinois	225.5	245.5	295.5	8.9	31.0
Indiana	152.1	159.2	184.2	4.6	21.0
Michigan	188.4	195.7	224.4	3.7	19.1
Ohio	195.6	210.4	253.6	7.2	29.7
Wisconsin	188.8	195.8	217.2	3.7	14.8
West North Central	191.4	205.4	240.4	7.3	25.6
Iowa	156.4	160.6	186.0	2.6	18.5
Kansas	188.3	202.4	234.6	7.4	24.4
Minnesota	232.5	251.1	298.6	7.7	28.4
Missouri	193.7	211.2	249.3	8.8	28.4
Nebraska	179.0	189.2	210.2	5.6	17.3
North Dakota	162.7	172.3	193.7	5.5	19.1
South Dakota	138.3	149.2	171.5	7.2	23.9
South	182.7	184.9	194.5	4.0	9.6
South Atlantic	206.0	198.0	206.8	4.2	9.0
Delaware	181.4	201.0	232.7	10.5	28.1
District of Columbia	731.3	998.8	587.8	36.5	117.1
Florida	181.0	173.4	153.0	-3.8	-15.4
Georgia	163.7	177.3	191.8	7.9	17.1
Maryland	358.7	396.0	465.0	10.3	29.6
North Carolina	174.4	187.6	208.9	7.5	19.5
South Carolina	148.2	150.9	154.3	1.3	4.0
Virginia	210.2	227.6	257.7	8.1	22.4
West Virginia	169.3	173.5	201.1	2.4	18.3
East South Central	161.2	167.5	186.6	3.7	15.5
Alabama	147.5	154.6	170.7	4.7	15.6
Kentucky	166.5	170.8	192.5	2.4	15.6
Mississippi	132.3	138.3	154.0	4.5	15.9
Tennessee	184.6	191.4	212.4	3.3	14.6
West South Central	165.3	173.1	178.6	4.2	7.9
Arkansas	146.8	149.3	158.6	1.4	7.5
Louisiana	176.7	183.4	196.1	3.4	10.8
Oklahoma	149.0	158.1	178.3	6.0	19.5
Texas	168.2	176.9	177.1	4.8	4.8
West	228.1	235.6	245.3	3.1	7.5
Mountain	188.2	180.2	171.2	-4.2	-8.9
Arizona	187.3	173.7	149.7	-6.8	-19.7
Colorado	230.7	227.7	224.5	-1.2	-2.5
Idaho	134.1	127.0	132.5	-5.1	-0.6
Montana	161.3	163.0	182.8	0.6	13.0
Nevada	158.5	141.1	119.9	-10.6	-23.9
New Mexico	186.5	208.4	243.0	11.3	30.0
Utah	185.6	170.1	156.6	-8.0	-15.5
Wyoming	141.2	115.6	104.9	-17.6	-25.4

Table 10-5—Number of Professionally Active MDs Per 100,000 Residents by Region and State: Estimated 1986 and Projected 1990 and 2000—Continued

	MDs per 100,000 residents			Percent change	
	1986	1990	2000	1986-1990	1986-2000
Pacific	242.7	258.4	280.5	6.2	15.2
Alaska	160.5	203.0	244.6	26.2	12.3
California	250.9	273.8	300.5	8.8	19.5
Hawaii	239.9	250.8	270.0	4.2	12.5
Oregon	222.3	204.1	209.3	-8.0	-5.7
Washington	215.7	217.1	231.0	0.5	7.0
U.S. possessions	185.2	216.8	275.3	16.7	48.6

[a] Includes MDs in patient care, research, administration, and teaching, and MDs in Federal service. 1986 figures include approximately 90 percent of those MDs not classified according to activity status by the American Medical Association.
[b] Includes MDs in the U.S. possessions.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report to the President and Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-90-1, (Rockville MD: HRSA, June 1990), table VI-A-16.

Table 10-6-Enrollments and Graduates of Allopathic (MD) and Osteopathic (DO) Medical Schools: 1981-82,1986-87, and Projected 1991-92

				Percent change	
	1981-82	1986-87	1991-92	1981-82 to 1986-87	1986-87 to 1991-92
MD					
First-year enrollments	17,871	17,156	16,677	-4.0	-2.8
Graduates	15,985	15,836	16,169	0.9	2.1
DO					
First-year enrollments	1,582	1,724	1,692	9.0	-1.9
Graduates	1,017	1,587	1,512	6.0	-4.7
Total					
First-year enrollments	19,453	18,880	18,369	-2.9	-2.7
Graduates	17,002	17,481	17,681	2.8	1.1

NOTE: For allopathic and osteopathic schools, first-year enrollments are actual for 1981-82 and 1986-87 and are projected for 1991-92; graduates are actual for 1981-82 and 1986-87 and are projected for 1991-92. MD first-year enrollments include students transferring from 2-year schools, other degree programs, and foreign medical schools. DO first-year enrollments and graduates for 1986-87 are preliminary estimates.

SOURCE: U.S. Department of Health & Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report to the President & Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-90-1 (Rockville, MD: HRSA, June 1990), table VI-A-11.

lowest ratio (161) and New England had the highest (283) (673).[12] Although most States may expect an increase in coming years, substantial decreases are projected for some (e.g., Colorado, Nevada, and Wyoming) (673).

Doctors of osteopathy (DOs) represent a small but increasing proportion of total active physicians in the United States (table 10-2) (673). Their growth in importance is expected to continue into the next century, even though enrollments in both osteopathic and allopathic schools are projected to decrease (table 10-6) (673). The number of osteopathic medical schools increased from 5 in 1968 to 15 in 1989 (148).[13] As of September 1, 1989,

[12] See app. F for a list of States included in each census region and division.

[13] The increase in the number of osteopathic medical schools in recent years, and the consequent increase in numbers of graduates, has not been matched by an increase in the number of osteopathic residency training programs. As a result, approximately one-half of osteopathic graduates seeking residency training are now entering allopathic residency training programs (*148*).

there were *27,627* active DOS in the United States (711).

Distribution by Specialty: Primary v. Nonprimary Care

Growth in physician supply has been accompanied by a trend towards more specialized practice. The period 1970 to 1988 saw a 68 percent increase in the total number of professionally active MDs, but the number of MDs in general/family practice increased by only 20 percent during this time (table 10-7) (39,671). Specialties experiencing the greatest increases in absolute number during this period included radiology,[14] plastic surgery, gastroenterology, neurology, pulmonary and cardiovascular specialties, and anesthesiology (39,671).

This trend towards specialization has widened the gap between supplies of primary and nonprimary care physicians.[15] Between 1981 and 1988, MD-to-population ratios increased more quickly for nonprimary care specialists than for primary care physicians (table 10-8) (39,672). Furthermore, ratios for family/general practitioners showed the smallest increase (8 percent) of the three primary care specialties for which information is available (table 10-8). The slower rates of increase for primary care MDs in general, and for family and general practitioners in particular, are projected to continue through the year 2020 (table 10-9) (673). The AMA predicts that, unlike the supply of other physicians, the supply of general and family practitioners and general surgeons will not keep pace with growth in the demand for their services (table 10-10) (369).

A recent study examined data from the 1983 and 1987 Association of American Medical Colleges Graduation Questionnaire to determine trends in evolution of specialty choice among allopathic medical school seniors. During this period, the number of seniors indicating a choice for any primary care specialty decreased, with the most dramatic decrease occurring in general internal medicine (65). Specialties showing the greatest increases among male seniors included the pediatric and internal medicine subspecialties, rehabilitation medicine, and public health (65).

Primary care physicians are almost twice as likely as nonprimary care physicians to practice in rural areas. In 1988, 15.9 percent of all professionally active primary care physicians (MDs and DOS) were in rural areas, compared with 8.0 percent of active nonprimary care physicians (MDs only) (686).[16] The trend towards nonprimary care will thus have a disproportionately negative effect on rural areas.

The proportion of primary care MDs who are office-based has declined as more of these physicians enter research, administration, teaching, and hospital-based positions (68). Rural areas have suffered more than urban areas from this trend. From 1963 to 1986, the ratio of office-based primary care MDs to area residents increased by 2 percent in urban areas but decreased by 8 percent in rural areas (68).

Trends in the Supply of General and Family Practitioners

The "classic" primary care physician is the family practitioner (FP). This specialty was first recognized in 1969 with the establishment of the American Board of Family Practice (11). The predecessors of board-certified FPs were general practitioners (GPs), who received no specialty training and typically went into practice after 1 year of graduate internship. GPs still make a significant contribution to the primary care work force, but their numbers have been decreasing. In 1963 there were over 73,000 GPs in the United States. By 1986, there were only slightly more than 25,000 GPs, and most (60 percent) were over the age of 55 (11,68). In 1940, approximately 75 percent of physicians in patient care were GPs (37). By 1970, general and family practitioners (combined) represented only 19 per-

[14] Includes diagnostic radiology, therapeutic radiology, radiation oncology, and nuclear medicine.

[15] There is some debate over which specialties should be included as "primary care specialties." While all internists and pediatricians were once considered primary care specialists, increasing subspecialization in both fields has led researchers and policymakers to exclude subspecialists from the definition of "primary care." Some definitions of primary care physicians include obstetrics/gynecology and general surgery, since these specialists often provide substantial amounts of primary care, especially when there is a lack of other primary care providers. The Bureau of Health Professions and the Bureau of Health Care Delivery and Assistance currently include family/general practice, general internal medicine, general pediatrics, and obstetrics/gynecology in their definition of primary care physicians for purposes of shortage area designation (see ch. 11). The definition of primary care specialties used in this report varies depending on the source of information.

[16] Primary care here includes MDs in general/family practice, general internal medicine, general pediatrics, and obstetrics/gynecology, and all DOs in patient care.

Table 10-7-Supply of Active MDs in the United States by Specialty, 1970, 1980, and 19888 b—Continued

	Active MDs						
	1970		1980		1988		
	Number	Rate per 100,000 residents [c]	Number	Rate per 100,000 residents [c]	Number	Rate per 100,000 residents [c]	Percent change in number, 1970-1988
Physical medicine and rehabilitation. . , ...	1,479	0.7	2,146	0.9	3,729	1.5	152.1
Psychiatry.	21,146	10.2	27,481	11.9	33,679	13.6	59.3
Public health	3,833	1.8	3,126	1.4	3,050	1.2	-20.4
Radiology[h].	3,360	6.4	20,282	8.8	26,833	10.8	698.6
Other and unspecified.	19,415	9.3	23,798	10.3	24,779	10.0	27.6

[a] Includes Federal MDs and MDs in U.S. possessions. Data for 1988 are as of Jan. 1. Data for 1970 and 1980 are as of Dec. 31.

[b] In its publication of 1981 data, the American Medical Association (AMA) began differentiating additional subspecialists in internal medicine, pediatrics and surgery. Separate estimates were made available for internal medicine subspecialties of allergy and immunology, diabetes, endocrinology, geriatrics, hematology, immunology, infectious diseases, nephrology, nutrition, oncology and rheumatology. Separate estimates in pediatrics were provided for the subspecialties of adolescent medicine, neonatal-perinatal medicine, peiatric endocrinology, pediatric hematology/oncology, and pediatric nephrology. Separate estimates for surgical subspecialties were made available for abdominal surgery, cardiovascular surgery, hand surgery, head and neck surgery, pediatric surgery and traumatic surgery. In this table, these subspecialties were formerly included in AMA published data under internal medicine, pediatrics and general surgery. When excluded from these categories, the total number of general internists, general pediatricians, and general surgeons presented for 1988 decrease to 72,038, 34,669, and 32,339, respectively.

[c] Ratios are based on total population plus civilian population in U.S. possessions. 1987 population estimates were used to calculate 1988 MD ratios.

[d] Adjusted to include MDs whose addresses were unknown or who were not classified according to specialty.

[e] Excludes MDs who were inactive, not classified according to specialty, or whose addresses were unknown.

[f] Includes forensic pathology.

[g] Includes general preventive medicine.

[h] Includes diagnostic and therapeutic radiology, radiation oncology, and nuclear medicine.

[i] Includes emergency medicine.

SOURCES: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to the President & Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 3-3; American Medical Association, unpublished data, provided by staff at the U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Rockville, MD, in 1990.

Table 10-7—Supply of Active MDs in the United States by Specialty, 1970, 1980, and 1988[a b]

	Active MDs						
	1970		1980		1988		
	umb	Rate per 100,000 residents[c]	Number	1[oo,ooo] residents[c]	Number	Rate per 100,000 residents[c]	Percent change in in number, 1970-1988
Estimated active[d]	314,196	150.0	440,357	190.4	536.185	216.6	70.7
Professionally active[e]	310,845	149·4	414,916	179.4	521.328	210·6	67.7
General and family practice	57,948	27.8	60,049	26 o	69,339	28 o	19.7
Medical Specialties	77,214	37.1	125,755	54.4	170,502	68.9	120.8
Allergy	1,719	0.8	1,518	0.7	1,471	0.6	-14.4
Cardiovascular diseas	6,476	3.1	9,823	4.2	15,132	6.1	133.7
Dermatology	4,003	1.9	5,660	2.4	7,041	2.8	75.9
Gastroenterology	2,010	1.0	4,046	1.7	6,868	2.8	241.7
Internal medicine	<1,872	20.1	71,531	30.9	94,674	38.3	126.1
Pediatrics allergy	391	0.2	461	0.2	378	0.2	-3.3
Pediatric cardiology	487	.2	59	.	931	.4	91.2
	17,941	0.6	28,[2]42	10.3	38,231	10·4	113.1
Pulmonary diseases	2,315	8.1	3,[o]1	2.3	5,776	5·3	149.5
Surgical specialties	86,042	41.3	110,775	47.9	132,409	58.5	53.9
General surgery	29,761	14.3	34,034	14.7	37,792	15.3	27.0
Neurological surgery	2,578	1.2	3,341	1.4	4,217	1.7	63.6
Obstetrics and gynecology	18,876	9.1	26,305	11.4	32,278	13.0	71.0
Ophthalmology	9,927	4.8	12,974	5.6	15,581	6.3	57.0
Orthopedic surgery	9,620	4.6	13,996	6.1	18,234	7.4	89.5
Otolarynology	5,409	2.6	6,553	2.8	7,182	3.2	44.4
Plastic surgery	1,600	0.8	2,980	1.3	4,356	1.8	172.3
Colon and rectal surgery	667	0.3	719	.	860	0.3	28.9
Thoracic surgery	1,809	0.9	2,133	0.3	2,124	0.9	17.4
Urology	5,795	2.8	7,743	0.9	9,155	3.7	58.0
Other specialties	89,641	43.1	110 334	51.2	149,078	60.2	66.3
Aerospace medicin	1,188	0.6	587	0.3	685	0.3	-42.3
Anesthesiology	10,860	5.2	15 958	6.9	24,258	9.8	123.4
Child psychiatry	2,090	1.0	3 271	1.4	4,107	1.7	96.5
Neurology	3,074	1.5	5 685	2.5	8,663	3.5	181.8
Occupational medicin	2,713	1.3	2 358	1·0	2,701	1.1	-0·4
Pathology[f]	10,483	5·0	13, 642	5·9	16,594	6.7	58·3

(continued on next page)

Table 10-7-Supply of Active MDs in the United States by Specialty, 1970, 1980, and 1988a b—Continued

	Active MDs						
	1970		1980		1988		
	Number	Rate per 100,000 residents c	Number	Rate per 100,000 residents c	Number	Rate per 100,000 residents	Percent change in in number, 1970-1988
Physical medicine and rehabilitation	1,479	0.7	2,146	0.9	3,729	1.5	152.1
Psychiatry	21,146	10.2	27,481	11.9	33,679	13.6	59.3
Public health	3,833	1.8	3,126	1.4	3,050	1.2	-20.4
Radiology[f]	3,360	6.4	20,282	8.8	26,833	10.8	698.6
Other and unspecified	19,415	9.3	23,798	10.3	24,779	10.0	27.6

[a] Includes Federal MDs and MDs in U.S. possessions. Data for 1988 are as of Jan. 1. Data for 1970 and 1980 are as of Dec. 31.

[b] In its publication of 1981 data, the American Medical Association (AMA) began differentiating additional subspecialists in internal medicine, pediatrics and surgery. Separate estimates were made available for internal medicine subspecialties of allergy and immunology, diabetes, endocrinology, geriatrics, hematology, immunology, infectious diseases, nephrology, nutrition, oncology and rheumatology. Separate estimates in pediatrics were provided for the subspecialties of adolescent medicine, neonatal-perinatal medicine, peiatric endocrinology, pediatric hematology/oncology, and pediatric nephrology. Separate estimates for surgical subspecialties were made available for abdominal surgery, cardiovascular surgery, hand surgery, head and neck surgery, pediatric surgery and traumatic surgery. In this table, these subspecialties were formerly included in AMA published data under internal medicine, pediatrics and general surgery. When excluded from these categories, the total number of general internists, general pediatricians, and general surgeons presented for 1988 decrease to 72,038, 34,669, and 32,339, respectively.

[c] Ratios are based on total population plus civilian population in U.S. possessions. 1987 population estimates were used to calculate 1988 MD ratios.

[d] Adjusted to include MDs whose addresses were unknown or who were not classified according to specialty.

[e] Excludes MDs who were inactive, not classified according to specialty, or whose addresses were unknown.

[f] Includes forensic pathology.

[g] Includes general preventive medicine.

[h] Includes diagnostic and therapeutic radiology, radiation oncology, and nuclear medicine.

[i] Includes emergency medicine.

SOURCES: Us. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to the President & Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 3-3; American Medical Association, unpublished data, provided by staff at the U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health professions, Rockville, MD, in 1990.

Table 10-8—Professionally Active MDs in Primary Care: Rate Per 100,000 Residents and Distribution by Specialty, 1981 and 1988[a]

	1981	1988	Percent change 1981 to 1988
Rate per 100,000 residents:[b]			
All active	184.5	210.6	14.1%
primary care	63.7	71.1	11.6
Family/general practice	26.0	28.0	7.7
General internal medicine	25.8	29.1	12.8
General pediatrics	12.0	14.0	16.7
Nonprimary care	120.8	139.5	15.5
Percent Distribution			
All active	100.0	100.0	
Primary care	34.5	33.8	
Family/general practice	14.1	13.3	
General internal medicine	14.0	13.8	
General pediatrics	6.5	6.7	
Nonprimary care	65.5	66.2	

[a]Data for 1988 are as of Jan. 1. Data for 1986 are as of Dec. 31.
[b]1987 population estimates were used to calculate 1988 MD ratios. Prior to 1988, population estimates used were for the same year as MD data.
[c]Includes MDs in patient care, research, administration, and teaching. Excludes inactive, not classified, and address unknown categories.

SOURCE: U.S. Department of Health & Human Services, Health Resources and Services Administration, Bureau of Health Professions, Division of Medicine, Council on Graduate Medical Education: First Report of the Council, vol. 2 (Rockville, MD: July 1, 1988), table 6; American Medical Association, unpublished data, provided by staff at the U.S. Department of Health and Human Services, **Health Resources and Services Administration, Bureau of Health Professions, Rockville, MD, 1990.**

cent of all professionally active physicians; by 1988, they represented only 13.3 percent (39).

The continuing attrition of GPs, and the fact that there has not been a significant increase in recent years in the number of FPs, raises concern about the adequacy of the future supply of these key primary care providers. One indicator of declining interest in family practice is the 1988 decrease in the percent of available first-year family practice residency positions in the National Residency Match Program that had been filled. The "fill rate,''which had consistently been greater than 80 percent, fell to 73 percent in 1988 (94). Similar declines were seen in the fill rates for other primary care fields, including general internal medicine and pediatrics (94).

Urban areas compete heavily with rural areas for FPs. A recent survey of hospitals (both rural and urban) in five geographic regions showed that FPs are in the greatest demand (514). The American Academy of Family Physicians (AAFP) anticipates that the continued growth of managed care systems such as health maintenance organizations (HMOs)--which are disproportionately located in urban areas--will result in a strong demand for FPs (11). Such systems seek FPs and other primary care providers because they offer a broad range of services, can act as "gatekeepers" and thereby control referrals to more expensive specialists, and are generally seen as efficient utilizers of resources. At present, of the 94 percent of FPs in patient care, an estimated 23 percent were employed by HMOs, 12 percent were in independent practice associations, and 15 percent were in preferred provider organizations(n).

In contrast to the United States, Canada has resisted the trend towards specialized medical practice. Although it has 19 percent fewer MDs per capita than does the United States, Canada, in 1985, had a general/family practitioner-to-population ratio of 89 compared with the U.S. ratio of 28 (table 10-11) (129). Approximately 50 percent of all practicing physicians in Canada are in general or family practice (3a), compared with 13 percent of physicians[17] in the United States (table 10-8)(39).

Other Characteristics of the MD Population

Female physicians are an increasing proportion of all physicians. Between 1980 and 2000, the percentage of physicians who are female is projected to more than double, from 11 percent to 23 percent (figure 10-1) (671). The implications of this trend for health personnel policy may be significant, since studies have shown that women physicians see fewer patients and work fewer hours than their male counterparts (95,308,481). Female physicians are more likely than their male counterparts to choose salaried positions (378) and are less likely to practice in rural areas (184).

The proportion of MDs who are graduates of foreign medical schools (FMGs) nearly doubled

[17]MDs only.

Table 10-9—Number of Professionally Active MDs in Primary Care and Nonprimary Care: Estimated 1986 and Projected 2000 and 2020[a]

Specialty	1986	2000	2020	Percent change 1986-2020
primary care	182,110	223,920	262,010	43.9
General/family practice	71,320	82,780	97,520	36.7
General internal medicine	76,260	94,280	111,130	45.7
General pediatrics	34,530	46,860	53,360	54.5
Primary care with obstetrics/gynecology	215,540	268,040	314,530	**45.9**
Other medical specialties	60,700	99,170	115,820	**90.8**
Surgical specialties	134,440	165,550	182,770	**35.9**
Other specialties	144,530	193,240	228,710	**58.2**
Total	521,780	681,890	789,300	**51.3%**

NOTE: Figures may not add to totals due to rounding.

[a]Includes MDs in patient care, research, administration, and teaching, and MDs in Federal service. 1986 figures include approximately 90 percent of the physicians who are not classified according to activity status by the American Medical Association and whose addresses are unknown.

[b]Figures may not add to totals due to rounding.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report to the President & Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-90-1 (Rockville, MD: HRSA, June 1990), table VI-A-14.

Table 1O-1O--American Medical Association (AMA) Projected Changes in Physician Supply and Utilization by Specialty, 1985-2000

	Percent growth, 1985-2000		Difference between growth in utilization and Supply[b]
	Supply[a]	Utilization[a]	
All MDs[c]	**23.8%**	**14.5%**	**9.3%**
General/family practice	9.9	13.0	-3.1
Internal medicine	36.6	24.0	12.6
General internal medicine	27.0	24.6	2.4
Medical subspecialties	51.8	23.4	28.4
All surgical specialties	13.1	17.0	-3.9
General surgery	0.5	16.5	-16.0
Surgical subspecialties	19.9	17.1	2.8
Pediatrics	38.8	7.0	31.8
Obstetrics/gynecology	24.3	2.8	21.5
Psychiatry	14.0	19.4	-5.4
Emergency medicine	69.4	6.2	63.2

[a]Supply growth estimates based on the projected number of active physicians. Utilization growth estimates based on the number of of physician contacts (excluding telephone contacts) as reported in the National Health Interview Survey and the National Medical Care Utilization and Expenditure Survey.

[b]This represents the percent growth in utilization (column 2) subtracted from the the Percent growth in supply (column 1).

[c]The AMA predicts a 61.1) percent increase in the supply of osteopathic physicians (DOs) between 1986 and 2000. In 1986, DOS represented 4.2 percent of all physicians--the proportion is expected to increase to 5.5 percent by the year 2000 (table 10-2).

SOURCE: W.D. Marder, P.R. Kletke, A.B. Silberger, et al., physician Supply and Utilization by Specialty: Trends and Projections (Chicago, IL: American Medical Association, 1988), table 8-2.

Table 10-11—Comparison of Canadian and American Physician Supply for Selected Specialties, 1985

	Canada		United States	
	Active civilian physicians, Dec. 31, 1985	Physicians per 100,000 residents	Active Federal and non-Federal physicians Dec. 31, 1985	Physicians per 100,000 residents
Primary care (including subspecialties)	28,538	111	220,036	92
Primary care with obstetrics/gynecology	30,007	117	250,903	104
General/family practice	22,789	89	67,051	28
Internal medicine and subspecialties[a]	4,141	16	116,146	48
Pediatrics and subspecialties[b]	1,608	6	36,839	15
Obstetrics/gynecology	1,469	6	30,867	13
Nonprimary care	15,692	61	291,054	121
Total	44,230	173	511,090	213

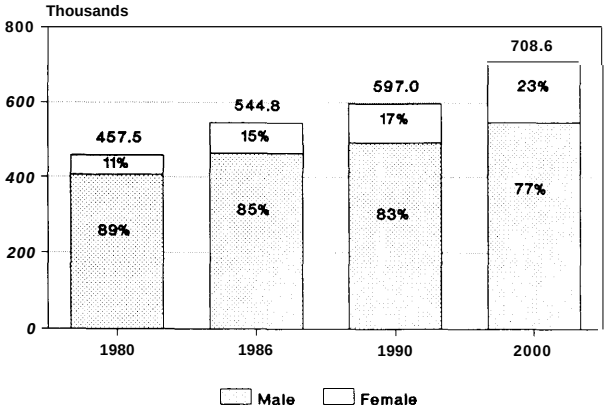
NOTE: As of Jan. 1, 1986, the Canadian population was 25,625,000, and the U.S. population was 240,468,000. Canadian and American population data are from the Bureau of the Census World Population Profile, 1986.

[a]Canadian data for the category "internal medicine and subspecialties" are directly from their category of the same name. American data for this category are the sum of the American Medical Association's (AMA's) category for internal medicine, allergy, cardiovascular disease, gastroenterology, and pulmonary disease.

[b]Canadian data for the category 'pediatrics and subspecialties" are from their category "pediatrics." American data for this category are the sum of the AMA's categories for pediatrics, pediatric allergy, and pediatric cardiology.

SOURCE: Adapted from F.L. Clare, E. Spratley, P. Schwab, et al., "Trends in Health Personnel," Health Affairs vol. 6, No. 4, winter 1987, pp. 90-103.

Figure 10-1—Supply of Physicians (MD and DO) by Sex: Estimated 1980 and 1986, Projected 1990 and 2000a



[a]Includes all professionally active physicians. Estimates of MDs adjusted to include approximately 90 percent of physicians who are not classified according to activity status by the Ameriian Medical Association and whose addresses are unknown.

SOURCE: Office of Technology Assessment, 1990. Data from U.S. Department ofHealthandHuman Services, Health Resources and Services Administration, Bureau of Health Professions, *Sixth Report to the President and Congress on the Status of Health Personnel in the United States,* DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 3-46.

between 1963 and 1983, increasing from 13 to 23 percent of all U.S. physicians, but it has since declined slightly (to 21.7 percent in 1988)(39,671). This proportion may decrease further if Federal policies restricting the number of FMGs allowed to practice in the United States are implemented (388).

Table 10-12 shows changes in the distribution of MDs across various professional activities over the past two decades. Fluctuations from year to year in the proportion of MDs who were not classified according to activity status or whose addresses were unknown prevent determination of any consistent trends. Nevertheless, a slow but steady **increase in** the proportion of MDs who are in research, a recent decrease in the proportion who are in office-based patient care, and an increase in the proportion who are inactive (i.e., retired) can be detected (39,671).

Doctors of Osteopathy

DOs are considerably more likely than are MDs to be primary care physicians. Of board-certified DOs

Table 10-12—Distribution of MDs by Major Professional Activity, Selected Years, 1970-88[a,b]

Activity	1970	1975	1980	1983	1985	1988
	Percent distribution					
Patient care	83.4	79.2	80.5	81.5	81.2	81.7
Office-based	57.6	54.7	58.2	59.7	59.7	57.8
Hospital-based	25.8	24.5	22.3	21.8	21.5	23.9
Residents	15.3	14.7	13.3	14.1	13.6	15.4
Staff	10.4	9.8	9.1	7.7	7.8	8.4
Nonpatient care	9.7	7.2	8.2	8.4	8.7	7.3
Medical teaching	1.7	1.6	1.7	1.5	1.4	1.4
Administration	3.6	2.8	2.6	2.7	2.5	2.5
Research	3.6	2.0	3.3	3.6	4.2	2.8
Other	0.8	0.7	0.6	0.6	0.6	0.6
Not classified or address unknown	1.1	**8.1**	**5.8**	3.0	3.0	2.8
Inactive	5.9	5.4	5.5	7.1	7.0	8.2
Total[c]	100.0	100.0	100.0	100.0	100.0	100.0

[a]Data for 1988 are as of Jan. 1. Prior data are as of Dec. 31.
[b]Includes MDs in Federal service.
[c]Percentages may not add to 100 due to rounding.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to the President and Congress on the Status of Health Personnel in The United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 3-5; American Medical Association, unpublished data, provided by staff at the U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Rockville, MD, 1990.

in 1986,[18] 39 percent were in general practice,[19] and an additional 21 percent were in internal medicine, obstetrics/gynecology, or pediatrics (table 10-13) (671). However, the percentage of DOs in general practice decreased slightly from 1982 to 1986, from 41 to 39 percent (671), raising the question of whether osteopathic graduates are following allopaths' trends in preferring specialized to general practice.[20] The distribution of DOs by State is rather uneven, with the highest concentrations in States where osteopathic schools are located (table 10-14) (e.g., Michigan, Pennsylvania, and Ohio) (671).

Rural Supply

Prevalence of Rural Physicians

The number of professionally active physicians (MDs and DOs) per l00,000 residents was more than twice as high in urban as in rural areas in 1988 (table 10-15)[21] (686). For primary care physicians, urban-rural differences are less dramatic but still pronounced (table 10-15). Within rural counties,[22] physician-to-population ratios are related to county

[18]Only 27 percent of all DOs are board-certified specialists (*711*).

[19]The American Osteopathic Association does not recognize the term "family practice." In the osteopathic physician community, "general practice" describes physicians who have completed a residency in general practice or whose practice is of a general rather than a specialized nature (*711*).

[20]For purposes of data analysis, the Federal Bureau of Health Professions regards all DOs wo provide patient care as primary care physicians, regardless of board certification and specialty (*570*).

[21]In table lo-15 and other subsequent tables, physician distribution and supply are shown by county size and classification. In 1987, the total U.S. population (as estimated for the purposesof the Area Resource File database) was 243,398,300. Distribution of that population was as follows: metro-188,261,600(77%); nonmetro-55,136,700 (23%); nonmetro counties with50,0000rmoreresidents—18,937,200 (7.7%); nonmetro counties with 25,000-49,999 residents-17,930,700 (7.3%); nonmetro counties with 10,000-24,999 residents— 14,294,900 (5.8%); nonmetro counties with 5,000-9,999residents-3,132,500 (1.3%} nonmetro counties with 2,500-4,999residents-681,400 (0.3%] nonmetro counties with fewer than 2,500 residents-160,000 (<0.5%). Within nonmetro counties of fewer than 10,000 residents, the total population in counties with 6 or fewer persons per square mile was 1,308,000 (0.5910 of the total U.S. population), and the total population all other counties was 2,695,600 (1.1% of the total U.S. population) (686).

[22]Here and elsewhere in this Chapter, "rural counties" and "urban counties" refer to nonmetro and metro counties, respectively.

Table 10-13—Board-Certified Osteopathic Physicians (DOS) by Specialty, 1986[a]

Certification board	Number of DOS, 1986	Percent of board-certified DOS
Anesthesiology	227	3.5
Dermatology	58	0.9
Emergency medicine	108	1.6
General practice	2,582	39.3
Internal medicine	1,020	15.5
Neurology/psychiatry	139	2.1
Nuclear medicine	80	1.2
Obstetrics/gynecology	180	2.7
Opthamology/otorhinolaryngology	330	5.0
Pathology	226	3.4
Pediatrics	170	2.6
Proctology	72	1.1
Public health/preventive medicine	64	1.0
Radiology	452	6.9
Rehabilitation medicine	82	1.2
General surgery	398	6.1
Necrologic surgery	17	0.3
Orthopedic surgery	193	2.9
Plastic & reconstructive surgery	3	0.0
Thoracic surgery	32	0.5
Urologic surgery	59	0.9
Other	85	1.3
Total	6,566	100.0

[a]Only 26 percent of all DOs were board-certified in 1986.

SOURCE: U.S. Department of Health & Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to The President & Congress on The Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 3-13.

Photo credit: Peter Beeson

Primary care physicians make up the majority of physicians in rural areas.

size,[23] with the smallest rural counties having fewer than one-half as many primary care physicians and approximately one-ninth as many nonprimary care physicians per capita as the largest rural counties.

The supply of different types of primary care specialists (MDs only) likewise varies considerably by county size (table 10-16) (686). General/family practitioners are by far the most evenly distributed across all county types and sizes, although even these physicians are much less common in very small counties. Other primary care specialists are less evenly distributed. Rural counties have fewer than one-third as many general internists, approximately one-fourth as many general pediatricians, and slightly more than one-fifth as many obstetrician/gynecologists per capita **as** urban counties have (686).

Wide variations in rural physician supply exist among States and regions (table 10-17) (511). The South consistently has rural physician-to-population ratios below the national rural average for all MDs, DOs, and primary care MDs. Numbers of primary care MDs per 100,000 residents in rural areas range from 41.7 in Alabama to 99.1 in New Hampshire (table 10-17) (511). An in-depth study of physician supply in small (fewer than 10,000 residents) rural counties also found considerable regional and State

[23]Unless otherwise indicated, county size in this chapter refers to population rather than geographic size of county.

Table 10-14-Distribution of Osteopathic Physicians (DOS) by Geographic Region and State, 1986[a]

	Number of DOS	Percent of DOs[b]
Northeast	6,194	24.3
Connecticut	58	0.2
Maine[c]	309	1.2
Massachusetts	171	0.7
New Hampshire	19	0.1
Hew Jersey[c]	1,444	5.7
New YorkC	799	3.1
Pennsylvania[c]	3,252	12.8
Rhode Island	110	0.4
Vermont	32	0.1
Midwest	9,752	38.2
Illinois[c]	802	3.1
Indiana	300	1.2
Imp	672	2.6
Kansas	320	1.3
Michigan[c]	3,555	14.0
Minnesota	83	0.3
Missouri[c]	1,521	6.0
Nebraska	27	0.1
North Dakota	10	*
Ohio[c]	2,141	8.4
South Dakota	34	0.1
Wisconsin	287	1.1
south	5,275	20.7
Alabama	48	0.2
Arkansas	48	0.2
Delaware	92	0.4
District of Columbia	19	0.1
FloridaC	1,638	6.4
Georgia	222	0.9
Kentucky	75	0.3
Louisiana	28	0.1
Maryland	68	0.3
Mississippi	50	0.2
North Carolina	67	0.3
Oklahoma[c]	878	3.4
South Carolina	34	0.1
Tennessee	102	0.4
Texas[c]	1,586	6.2
Virginia	104	0.4
west Virginia	216	0.8
West	2,791	11.1
Alaska	29	0.1
Arizona	717	2.8
California[c]	727	2.9
Colorado	396	1.6
Hawaii	42	0.2
Idaho	40	0.2
Montana	34	0.1
Nevada	63	0.2
New Mexico	154	0.6
Oregon	254	1.0
Utah	22	0.1
Washington	298	1.2
Wyoming	15	0.1
Public Health Service	116	0.4
U.S. Total	24,128	100.0

NOTE: * = less than 0.5 percent of the total number of 00s.

[a] Includes residents and interns (12.0 percent of total), retired and inactive DOs (5.7 percent); DOs in research, education, administration, and other nonpatient care fields (2.0 percent); and DOS whose professional activity was unknown (20.3 percent). Excludes DOs in U.S. possessions and in military service.

[b] percentages may not add to totals due to rounding.

[c] estates with colleges of osteopathic ❑edicine.

SOURCE: U.S. Department of Health and Human Services, Health Resources end Services Administration, Bureau of Health Professions, Sixth Annual Report to The President & Congress on The Status of Health Personnel in The United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 3-16.

Table 1O-15--Supply of Professionally Active Physicians[a] in Primary Care and Nonprimary Care by Type of County, 1979 and 1988[b]

county classification and county size	All active[c]					Primary care[c]					Nonprimary care[d]				
	1979		1988		Percent change in rate 1979-88	1979		1988		Percent change in rate, 1979-88	1979		1988		Percent change in rate, 1979-88
	Number	Rate per 100,000 population	Number	Rate per 100,000 population		Number	Rate per 100,000 population	Number	Rate per 100,000 population		Number	Rate per 100,000 population	Number	Rate per 100,000 population	
Metro	312,529	181.7	424,192	225.3	24.0	128,520	74.7	161,349	86.8	16.1	184,009	107.0	262,843	138.5	29.5
Nonmetro	41,002	78.0	53,338	96.7	24.1	24,070	45.8	30,461	55.3	20.8	16,932	32.2	22,877	41.4	28.7
50,000 and over	17,950	101.8	24,249	128.0	25.8	8,987	51.0	11,691	61.8	21.4	8,963	50.8	12,558	66.2	30.3
25,000 to 49,999	13,261	77.5	17,153	95.7	23.4	7,846	45.9	10,059	56.1	22.4	5,415	31.7	7,094	39.5	24.9
10,000 to 24,999	7,924	57.2	9,766	68.3	19.3	5,691	41.1	6,936	48.5	18.1	2,233	16.1	2,830	19.8	22.6
5,000 to 9,999	1,510	47.9	1,759	56.2	17.1	1,244	39.5	1,438	45.9	16.2	266	8.4	321	10.2	21.3
2,500 to 4,999	311	44.5	359	52.7	18.4	264	37.8	296	43.4	15.0	47	6.7	63	9.2	37.5
Fewer than 2,500	46	28.2	52	32.5	15.2	38	23.3	41	25.6	9.9	8	4.9	11	6.9	40.1
Population < 10,000:															
<= 6 persons/ square mile	620	47.0	783	59.9	27.4	495	37.5	620	47.4	26.4	125	9.5	163	12.5	31.5
>6 persons/ square mile	1,257	46.2	1,408	52.2	13.0	1,057	38.9	1,167	43.3	11.4	200	7.4	241	8.9	21.6
U.S. total	353,531	157.4	477,530	196.2	24.6	152,590	67.9	191,810	79.7	17.2	200,941	89.5	285,720	116.5	30.2

[a] Includes American Medical Association and American osteopathic Association data. Includes physicians in research, administration, and teaching, and physicians in federal service.
[b] 1988 MD data as of Jan. 1. Data for 1979 as of Dec. 31.
[c] Includes general/family practice, internal medicine, pediatrics, obstetrics/gynecology, and 1987 DO patient care.
[d] MDs only.
[e] 1987 population estimates were used to calculate 1988 HO and 1987 DO ratios. 1979 population estimates were used to calculate 1979 MD and DO ratios.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Office of Data Analysis and Management, Rockville, MO, unpublished data from the Area Resource File System provided to OTA in 1989 and 1990.

Table 10-16—Supply of Primary Care MDs by Specialty and Type of County, 1975 and 1988[a]

	General/family practice					General internal medicine				
	1975		1988		Percent change in rate 1975-88	1975		1988		Percent change in rate 1975-88
	Number	Rate per 100,000 residents[b]	Number	Rate per 100,000 residents[b]		Number	Rate per 100,000 residents[b]	Number	Rate per 100,000 residents[b]	
Metro	37,916	22.5	47,771	25.4	12.9	45,157	24.7	74,624	39.6	60.3
Nonmetro	13,595	27.0	16,251	29.5	9.1	2,855	5.5	6,207	11.3	104.5
50,000 and over	3,981	23.8	5,021	26.5	11.6	1,546	8.9	3 147	-6.6	86.7
25,000 to 49,999	4,495	27.4	5,304	29.6	7.8	906	5.4	2,020	-1.3	107.1
10,000 to 24,999	3,934	29.7	4,591	32.1	8.2	355	@a.6	914	6.4	144.3
5,000 to 9,999	931	30.	1,070	34.2	12.7	41	.2	108	3.4	177.9
2,500 to 4,999	218	31·mm	235	34.5	11.4	7	Ado"0	4	2.1	105·7
Fewer than 2,500	36	N2·oo	30	18.8	-14.7	0	"0	14	2·5	0·0
Population < 10,000:										
<= 6 persons/sq. mile	427	32.8	484	37.0	12.9	16	1.2	48	3.7	218.1
6+ persons/sq. mile	761	28·6	857	31.8	11·2	32	1·1	81	3·0	165.6
U.S. total	51,511	23.5	64,022	26.3	11 8	48.o12	2o 3	8o 831	33 2	63 9

	1975		1988		Percent change in rate 1975-88	Obstetrics/gynecology 1975		1988		Percent change in rate 1975-88
	Number	Rate per 100,000 residents[b]	Number	Rate per 100,000 residents[b]		Number	Rate per 100,000 residents[b]	Number	Rate per 100,000 residents[b]	
Metro	18.651	1o 3	3o.615	16 3	58 5	18.654	1o 8	26.993	1< 3	32.6
Nonmetro	1,351	2.6	2,646	5.8	81.7	1.653	c.2	2,908	5.3	2.4
50,000 and over	783	4.6	1,446	8.6	65.6	949	.6	1,581	8.3	8.4
25,000 to 49,999	436	2.6	893	5.0	89.4	554	3.4	993	5.5	4.8
10,000 to 24,999	123	0.9	278	1.9	117.9	139	1.0	303	2.1	10.7
5,000 to 9,999	7	0.2	23	0.7	221.2	11	0.4	20	0.6	17.
2,500 to 4,999	2	0.3	6	0·9	208·6	0	0.0	9	1.3	7
Fewer than 2,500	0	0.0	0	0·0	0·0	0	0.0	2	1·3	0.mm
Population < 10,000:										
<= 6 persons/sq. mile	3	o.2	14	1.1	363.m	2	o.2	18	1.4	794.7
6+ persons/sq. mile	6	o.2	15	0·6	145·m	9	o.3	14	0·5	53.0
U.S. total	20,002	8.5	33,261	13.7	61.0	20,307	9.1	29,901	12.3	35.7

[a]1988 MD data as of Jan. 1. Data for 1979 as of Dec. 31.
[b]1987 population estimates were used to calculate 1988 MD ratios Prior to 1988, population estimates used were for the same year as MD data

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Office of Data Analysis and Management, unpublished data from the Area Resource File System provided to OTA in 1989 and 1990.

Table 10-17-Professionally Active MDs, Primary Care MDs, and DOS per 100,000 Residents in Metropolitan and Nonmetropolitan Areas by Region and State, 1987/1988a

	Total active MDs[b] per 100,000 residents, 1988		Total active DOs[c] per 100,000 residents. 1987		Primary care MDs[d] per 100,000 residents, 1988	
	Metro	Nonmetro	Metro	Nonmetro	Metro	Nonmetro
United States,	243.1	**94.7**	10.3	**6.6**	98.5	**56.2**
Northeast	284.1	**137.0**	12.2	7.8	112.9	**67.3**
New England	291.8	**182.0**	4.4	8.6	102.7	**85.1**
Connecticut[e]	291.3	**0.0**	1.8	0.0	102.4	**0.0**
Maine	195.9	**140.1**	26.5	16.7	101.9	**84.5**
Massachusetts	328.2	**171.5**	2.6	2.3	106.8	**73.9**
New Hampshire	151.0	**274.3**	1.7	2.7	64.7	**99.1**
Rhode Island	242.7	NA	10.3	NA	104.4	NA
Vermont	396.1	174.4	2,9	6.1	138.9	82.7
Middle Atlantic	281.6	118.5	14.8	7.4	116.3	59.9
New Jersey[f]	233.3	NA	18.0	NA	107.1	NA
New York	326.6	122.0	4.5	2.0	120.0	56.7
Pennsylvania	246.4	115.2	28.6	12.5	117.4	63.0
Midwest	226.6	82.5	17.1	10.7	102.1	57.4
East North Central	217.0	85.2	18.0	8.8	100.3	54.3
Illinois	234.3	88.8	7.4	3.5	99.5	53.6
Indiana	184.1	78.8	5.6	3.9	78.1	47.5
Michigan	204.7	81.2	39.6	20.2	114.2	60.0
Ohio	220.6	80.4	20.7	12.2	103.0	52.5
Wisconsin	222.8	98.9	6.9	2.9	89.7	58.6
West North Central	258.2	79.1	14.3	13.1	108.1	61.1
Iowa	233.6	77.0	34.4	11.6	115.6	56.4
Kansas	237.0	93.3	13.9	10.0	97.1	65.1
Minnesota	278.3	82.7	1.5	2.2	106.5	58.3
Missouri	257.7	58.1	22.0	36.3	113.8	68.6
Nebraska	258.6	84.1	2.1	0.8	97.6	54.5
North Dakota	274.9	95.9	3.1	2.4	105.9	59.7
South Dakota	249.3	92.2	2.5	5.9	102.3	61.1
south	230.2	88.7	7.4	3.9	89.9	50.8
South Atlantic	251.3	105.2	6.7	3.2	95.6	54.0
Delaware	226.2	122.3	16.9	5.5	101.2	51.6
District of Columbia.	583.1	NA	5.1	NA	191.8	NA
Florida	211.4	104.5	12.8	5.9	87.6	50.9
Georgia	205.9	91.7	5.0	2.6	78.5	48.8
Maryland	391.5	147.3	2.6	1.6	134.1	65.1
North Carolina	235.0	102.8	1.8	0.8	86.5	52.8
South Carolina	197.0	86.5	1.3	1.5	78.8	50.0
Virginia	233.5	108.5	2.8	1.3	89.5	56.1
West Virginia	210.3	138.2	9.6	11.8	88.8	68.7
East South Central	225.6	79.2	2.0	2.4	86.0	47.1
Alabama	197.5	66.3	2.0	1.6	79.3	41.7
Kentucky	244.2	88.3	2.3	2.1	89.5	50.8
Mississippi	205.4	88.3	2.3	2.4	79.7	49.5
Tennessee	243.3	69.3	1.8	3.6	91.1	44.5
West South Central	198.4	73.1	10.7	6.4	82.5	49.5
Arkansas	229.2	86.5	1.6	2.3	84.3	53.5
Louisiana	233.3	68.2	0.9	0.7	80.8	42.3
Oklahoma	191.8	74.3	31.5	16.1	104.6	57.7
Texas	189.3	68.6	10.6	6.5	79.6	47.2

(continued on next page)

Table 10-17-Professionally Active MDs, Primary Care MDs, and DOS per 100,000 Residents in Metropolitan and Nonmetropolitan Areas by Region and State, 1987/1988a-Continued

	Total active MDs[b] per 100,000 residents, 1988		Total active DOs[c] per 100,000 residents, 1987		Primary care MDs[d] per 100,000 residents, 1988	
	Metro	Nonmetro	Metro	Nonmetro	Metro	Nonmetro
West	233.5	114.6	5.8	5.6	**91.6**	**63.9**
Mountain	213.1	104.8	12.5	6.6	**88.1**	**61.6**
Arizona	220.7	93.1	22.6	9.1	**101.6**	**59.0**
Colorado	219.0	112.1	11.8	13.4	**91.2**	**72.0**
Idaho	172.7	106.4	4.1	4.0	**66.9**	**56.3**
Montana	202.9	131.9	2.0	4.6	**60.1**	**71.1**
Nevada	169.2	107.7	7.5	4.7	**67.8**	**61.3**
New Mexico	250.8	94.6	12.3	7.6	**96.1**	**59.2**
Utah	203.2	86.4	1.4	1.6	**70.9**	**49.5**
Wyoming	189.2	108.9	0.7	3.2	**87.9**	**64.1**
Pacific	238.8	128.7	4.1	4.2	**92.5**	**67.2**
Alaska[e]	131.0	NA	7.0	NA	**69.5**	NA
California	244.2	129.5	3.1	2.8	**93.0**	64.8
Hawaii	226.1	169.1	6.7	4.0	**99.2**	88.5
Oregon	229.4	124.8	10.2	4.9	**94,4**	66.3
Washington	223.1	119.9	7.4	5.5	**90.0**	65.2

NOTE: NA = not applicable (see footnote e).
[a]Population estimates are for 1987.
[b]Includes MDs of all specialties in patient care, research, administration, and teaching. American Medical Association data as of Jan. 1, 1988.
[c]Includes DOS of all specialties in patient care, research, administration, and teaching. American Osteopathic Association data as of 1987.
'Includes MD family practitioners, general practitioners, general pediatricians, general internists, and obstetrician/gynecologists .
[e]For the purposes of this analysis, Rhode Island and New Jersey were considered to have no nonmetro counties, and Alaska was considered all one "county" (so the entire population is listed under the "metro" column).
SOURCE: T.C. Ricketts, Rural Health Research Center, University of North Carolina, Chapel Hill, NC. Analysis of unpublished data (provided by the Health Resources and Services Administration) conducted under contract with the Office of Technology Assessment, 1989.

variations (table 10-18) (.318). The number of physicians (MDs and DOs) per 100,000 residents in small rural counties ranged from 39 in the East South Central Region to 75 in the Pacific region, and from 31 in Georgia to 86 in California (318).

Rural hospitals have fewer than one-half the medical staff of urban hospitals with a comparable number of beds (see table 5-7) (625).[24] Rural hospitals with fewer than 50 beds have roughly one-third the medical staff of their urban counterparts. Among rural hospitals, frontier hospitals have particularly small medical staffs (625). Table 10-19 presents rural-urban differences by hospital size category for each physician specialty.[25]

Travel Times to Physicians in Rural Areas

Rural residents travel for longer periods of time to receive medical care than do their urban counterparts. In a 1985 survey, 22 percent of rural residents reported that they had to travel outside of their community to receive any kind of medical care (303). Rural residents have longer average travel times to every type of physician (table 10-20)(644). Differences are least for travel to primary care physicians, especially general practitioners, and greatest for secondary care physician specialists. On average, for example, a rural resident must travel twice as long as does an urban resident to visit a neurologist (644).

Among rural residents, those living on farms generally have relatively greater travel times to physicians (table 10-20) (644). With few exceptions, poor rural residents also have slightly longer travel times to physicians than do residents with higher incomes (table 10-21) (644). The exceptions maybe due to physical or financial constraints upon poor

[24]Includes both board-certified and nonboard-certified medical staff(MDsandDOs).
[25]Physician specialty as reported by each hospital.

Table 10-18—Physician-To-Population Ratios (1985), Percentage of DOS (1985), and Percent Change in Ratios (1975-85) in Small Nonmetropolitan Counties, by Region and State

Region and State[a]	Number of small nonmetro counties[b]	Physicians per 100,000 residents (1985)	Percent DOS (1985)[c]	Percent change in physician-to-population ratio, 1975-85
Northeast	0	0.0	0.0%	0.0%
Midwest	**291**	**58.4**	**21.7**	**16.5**
East North Central	**33**	**47.2**	**7.2**	**14.0**
Illinois	**13**	**33.3**	**6.7**	**-11.4**
Indiana	**5**	**31.5**	**16.7**	**10.5**
Michigan	**10**	**70.5**	**5.6**	**36.9**
Wisconsin	**5**	**49.2**	**6.7**	**20.0**
West North Central	**258**	**60.2**	**23.5**	**17.9**
Iowa	**15**	**53.3**	**45.5**	**-4.3**
Kansas	**61**	**76.3**	**24.7**	**28.7**
Minnesota	**12**	**56.6**	**18.2**	**7.0**
Missouri	**26**	**58.1**	**73.7**	**-0.3**
Nebraska	**61**	**51.5**	**1.3**	**15.8**
North Dakota	**36**	**52.8**	**6.5**	**39.3**
South Dakota	**47**	**61.0**	**7.3**	**39.3**
south	**244**	**43.1**	**11.2**	**16.0**
East South Central	**46**	**38.7**	**5.9**	**9.2**
Kentucky	**24**	**40.5**	**2.7**	**17.7**
Mississippi	**8**	**35.6**	**11.1**	**1.4**
Tennessee	**14**	**35.6**	**11.1**	**1.4**
West South Central	**110**	**49.1**	**18.1**	**5.1**
Arkansas	**8**	**34.6**	**4.3**	**18.9**
Oklahoma	**15**	**56.3**	**36.4**	**-0.3**
Texas	**87**	**49.7**	**14.8**	**-3.3**
South Atlantic	**88**	**40.0**	**6.3**	**26.6**
Florida	**8**	**41.9**	**12.0**	**41.1**
Georgia	**47**	**31.3**	**10.0**	**11.4**
North Carolina	**8**	**45.8**	**0.0**	**24.5**
Virginia	**16**	**53.6**	**1.7**	**52.3**
West Virginia	**9**	**49.3**	**4.9**	**3.8**
west	**140**	**63.9**	**7.5**	**25.9**
Mountain	**120**	**60.8**	**8.7**	**14.9**
Colorado	**31**	**53.2**	**3.9**	**-9.8**
Idaho	**20**	**52.0**	**10.5**	**30.3**
Montana	**34**	**68.7**	**12.0**	**33.9**
New Mexico	**9**	**56.1**	**12.0**	**10.4**
Nevada	**7**	**56.6**	**18.2**	**7.0**
Utah	**11**	**65.3**	**0.0**	**20.3**
Wyoming	**8**	**77.5**	**11.6**	**26.6**
Pacific	**20**	**75.0**	**3.4**	**36.7**
California	**4**	**86.2**	**5.3**	**85.0**
Oregon	**8**	**68.0**	**3.3**	**17.4**
Washington	**8**	**76.0**	**2.6**	**7.6**
All nonmetro counties with fewer than 10,000 residents	53.0	15.3	14.2	
Entire United Stated	164.8	5.1	33.6	

[a]Only includes the 32 States with nonmetro counties having fewer than 10,000 residents.
[b]Number of nonmetro counties with fewer than 10,000 residents in each State. No States in the Northeast region had nonmetro counties with fewer than 10,000 residents.
[c]Doctors of Osteopathy.
[d]Includes all metro and nonmetro counties.

SOURCE: D.A. Kindig and H. Movassaghi, "The Adequacy of Physician Supply in Small Rural Counties," Health Affairs vol. 8, No. 2, 1989, pp. 63-76, exhibits 4 and 5.

Table 10-19 Average Number of Hospital Medical Staff[a] in Selected Specialties by Hospital Bed Size and Metropolitan/Nonmetropolitan Status: United States, 1987

Medical specialty	Hospital bed size: 6-24									
	Percent with none[b]	Mean number per hospital	Percent with none[b]	Mean number per hospital	Percent with none[b]	Mean number per hospital	Percent with none[b]	Mean number per hospital	Percent with none[b]	Mean number per hospital
General/family practice										
Nonmetro	3.0	2.7	21.6	4.21	1.2	6.36	0.7	9.29	2.2	12.53
Metro	12.1	3.96	3.5	6.57	1.6	10.31	2.4	17.69	3.2	22.45
General internal medicine										
Nonmetro	83.0	1.47	59.4	1.73	27.1	2.96	9.1	5.65	1.5	10.14
Metro	83.9	11.60*	25.2	4.92	4.7	7.00	2.1	14.60	.7	26.16
Pediatrics[c]										
Nonmetro	97.0	1.17*	85.7	1.30	50.3	1.70	21.9	3.01	5.2	4.96
Metro	93.5	6.00*	62.9	2.57	30.4	3.27	12.4	6.44	6.8	11.83
Other medical specialties[c]										
Nonmetro	95.0	all.90	84.5	1.89	72.1	2.80	49.7	4.44	19.3	7.54
Metro	90.3	.67*	60.1	7.14	37.9	7.59	13.4	14.59	7.0	25.30
Obstetrics/gynecology										
Nonmetro	99.5	1.38	81.5	1.39	46.4	1.96	18.2	3.32	4.4	5.42
Metro	100.3	4.00*	51.0	3.00	17.8	4.09	3.6	7.76	1.5	12.63
Ophthalmology										
Nonmetro	90.5	2.37	91.1	1.47	64.8	1.41	26.7	2.21	8.1	3.26
Metro	74.2	9.38*	67.8	3.22	34.9	2.52	8.1	4.44	1.3	6.94
Orthopedic surgery										
Nonmetro	93.0	1.43	82.6	1.59	54.5	1.79	23.0	2.73	4.4	3.91
Metro	74.2	2.63*	54.5	2.80	19.9	3.66	3.4	6.22	1.3	9.42
astic surgery										
Nonmetro	99.5	1.00*	98.8	1.20	94.7	1.11	83.7	1.[illegible]0	60.7	4.55
Metro	83.9	1.80*	79.7	2.93	63.7	2.26	30.3	2.[illegible]8	13.5	4.[illegible].75
General surgery										
Nonmetro	65.5	1.52	36.4	1.55	15.6	2.1[illegible]	6.[illegible]	3.46	0.7	5.43
Metro	58.1	2.31	20.3	3.34	3.7	4.5[illegible]	1.[illegible]	8.03	0.7	12.59
Thoracic surgery										
Nonmetro	98.5	1.0[illegible]*	97.3	1.14	94.5	1.29	80.5	1.50	54.1	1.82
Metro	93.5	2.5[illegible]*	85.3	2.62	75.4	2.41	34.8	2.87	15.5	3.75
Other surgical specialties[c]										
Nonmetro	84.5	1.29	80.4	1.96	55.0	2.39	26.9	4.19	5.9	6.88
Metro	64.5	2.00	56.6	6.74	19.4	6.42	6.5	12.12	3.7	18.34

Table 10-19—Average Number of Hospital Medical Staff[a] in Selected Specialties by Hospital Bed Size and Metropolitan/Nonmetropolitan Status, 1987—Continued

Medical specialty	Hospital bed size: 6-24 Percent with none[b]	6-24 Mean number per hospital	25-49 Percent with none[b]	25-49 Mean number per hospital	50-99 Percent with none[b]	50-99 Mean number per hospital	100-199 Percent with none[b]	100-199 Mean number per hospital	200-299 Percent with none[b]	200-299 Mean number per hospital
Anesthesiology										
Nonmetro	92.0	2.13	89.8	1.39	67.7	1.56	30.6	2.35	8.9	3.63
Metro	71.0	5.33*	54.5	3.05	26.5	3.12	3.8	4.74	1.5	6.92
Dermatology										
Nonmetro	100.0	--	98.5	1.33	95.4	1.10	77.0	1.25	47.4	1.69
Metro	93.5	1.50*	86.7	1.42	81.3	1.84	47.0	1.99	22.5	2.77
Emergency medicine										
Nonmetro	97.5	2.60*	91.1	3.86	69.4	2.97	43.8	3.51	16.3	4.32
Metro	93.5	4.50*	74.8	4.08	40.5	3.55	18.9	5.11	10.8	5.84
Nuclear medicine										
Nonmetro	100.0	--	99.3	1.67*	97.5	1.92	91.7	1.73	78.5	1.66
Metro	100.0	--	93.7	1.78*	89.7	2.07	76.2	2.17	61.5	2.82
Pathology[c]										
Nonmetro	79.0	1.98	71.7	2.07	47.7	1.56	19.7	1.74	3.7	2.37
Metro	71.0	2.00*	49.0	1.97	20.6	2.05	4.0	2.46	1.0	3.44
Psychiatry										
Nonmetro	99.0	1.00*	96.3	1.37	85.5	1.38	57.9	1.88	24.4	2.00
Metro	90.3	2.67*	84.6	3.55	66.7	2.74	29.9	4.27	13.2	4.28
Radiology[c]										
Nonmetro	75.0	2.06	59.7	1.74	28.2	1.75	12.0	2.58	3.0	4.14
Metro	71.0	2.44*	35.7	2.16	11.0	2.66	2.0	4.51	0.8	6.40
Other specialties										
Nonmetro	70.5	3.49	71.0	5.49	67.1	5.81	67.7	5.65	57.0	6.03
Metro	48.4	5.25	63.6	7.56	54.3	8.99	50.5	9.07	49.0	11.26

NOTE: "*" indicates mean is based on fewer than 10 cases.

[a]Includes all active an associate medical staff, board-certified and nonboard-certified. Excludes courtesy, consulting, honorary, provisional, or other medical staff.

[b]Percentage of hospitals within each be[redacted]ry reporting no medical staff in that particular specialty.

[c]"Pediatrics" includes pediatrics, ped[redacted]y, and pediatric cardiology; "Other medical specialties" includes allergy, physical medicine and rehabilitation, cardi[redacted]seases, gastroenterology, pulmonary diseases, nephrology, neurology, and child psychiatry; "Other surgical specialti[redacted] neurological surgery, otolaryngology, colon and rectal surgery, urology, oral and maxillofacial surgery; "Pathology" inc[redacted]gy and forensic pathology; "Radiology" includes radiology, diagnostic radiology, and therapeutic radiology; "Other special[redacted] aerospace medicine, occupational medicine, general preventive medicine, and public health.

SOURCE: U.S. Congress, Office of Technology Assessment, analysis of dat[redacted] from American Hospita[redacted] ssociation 1987 Survey o[redacted] Hospitals performed for Rural Health Care report (see app. C).

Table 10-20--Average Travel Time to Physicians for Metropolitan and Nonmetropolitan Residents, 1983

Type of physician	Mean travel time (minutes)			
		Nonmetro		
	Metro	All	Nonfarm	Farm
All physicians	20	**25**	24	35
All primary care physicians	18	**20**	20	26
General practitioners	17	**18**	18	23
Internists	21	**32**	32	36
Pediatricians	17	**23**	23	31
Obstetrician/ gynecologists	19	**24**	23	36
Family practitioners.	16	**20**	20	*
Osteopaths.	14	**16**	16	17
All secondary care specialists	24	**37**	36	57
Surgeons	23	**25**	25	22
Orthopedists	24	**36**	35	46
Ophthalmologists.	25	**41**	39	70
Neurologists	28	**58**	58	*
Radiologists/oncologists..	30	**58**	48	86
Urologists	23	**38**	36	59
Dermatologists.	20	**34**	34	27
Proctologists	22	**54**	54	*
Otolaryngologists.	24	**37**	37	31
Psychiatrists	24	**33**	33	*
Anesthesiologists/ pathologists	20	**73**	73	*
Other specialists	29	**40**	40	60

NOTE: Not all metro areas are included. Sample sizes in some cases may be very small. Statistical significance of differences in times cannot be calculated. Asterisks ("*") indicate that no one in the sample met the specifications for that entry.

SOURCE: U.S. Department of Health and Human Services, Centers for Disease Control, National Center for Health Statistics, Hyattsville, MD, unpublished travel time data from the 1983 National Health Interview Survey provided by E. Parsons, May 1989.

rural residents to visit the physician closest to their homes.

Counties With No Physicians

In 1988, 111 rural counties (with an aggregate resident population of 325,100) had no physician at all (table 10-22) (511). These counties are concentrated in the West North Central, South Atlantic, West South Central, and Mountain census divisions.

More detailed data are available for MDs alone.In 1988, 176 counties (with a total resident population of 713,700) had no primary care MD (table 10-23) (686). All of these were rural counties with fewer than 25,000 residents, and 166 were counties with fewer than 10,000 residents. Well over one-half were frontier counties. Among MDs, general/family practitioners are the most ubiquitous specialists; they were present in all but 205 rural counties and all but 2 urban counties (figure 10-2)(686).

Changes in Rural and Urban Physician Supply

Federal policies regarding health personnel have been influenced not only by GMENAC's projections of increases in supply but also by three RAND Corp. studies conducted in the early 1980s which suggested that overall growth in physician supply would in time solve the problem of geographic maldistribution of physicians.

All three studies examined changes in the supply of physicians in towns with populations of 2,500 and more during the 1960s and 1970s. The first study (550) found that the number of board-certified specialists per capita increased more in smaller towns than in larger towns. The second (436) found that by 1979, nearly every town of more than 2,500 residents had ready access to a physician. The third (727) found that 96 percent of towns with a population of at least 2,500 were fewer than 10 miles away from a physician and that 98 percent of the U.S. population lived within 25 miles of a general or family practitioner. These three studies, however, had some limitations: they excluded towns with fewer than 2,500 residents, the results were dominated by findings in towns with more than 10,000 residents, and they excluded DOS and Federal physicians (318).

From these three studies policymakers concluded that market forces play a significant role in the distribution pattern of physicians, and that a greater supply of physicians in a particular specialty will lead to a greater diffusion of those specialists into rural areas. In the wake of RAND and GMENAC studies, Federal efforts to improve the geographic distribution of health personnel decreased significantly (68,318,462). However, more recent State and national studies have found that increases in national supply have not consistently produced corresponding increases in rural supply, particularly in small or isolated rural areas, and that rural/urban disparities in overall physician supply have actually widened during the past two decades. Summaries of the studies follow.

Table 10-21-Average Travel Time to Physicians for Nonmetropolitan Residents by Incomes Above or Below the Federal Poverty Level, 1983

Type of physician	Mean travel time (minutes) All nonmetro	Above Poverty Level	Below Poverty Level	Income Unknown
All physicians	25	24	25	29
All primary care physicians	20	20	22	21
General practitioners	18	17	22	18
Internists	32	31	35	42
Pediatricians	23	22	28	26
Obstetrician/gynecologists	24	25	15	33
Family practitioners	20	20	*	20
Osteopaths	16	17	15	2
All secondary care specialists	37	36	39	46
Surgeons	25	24	32	30
Orthopedists	36	36	38	28
Ophthalmologists	41	38	53	70
Neurologists	58	65	46	27
Radiologists/oncologists	58	57	25	64
Urologists	38	35	45	62
Dermatologists	34	33	30	40
Proctologists	54	54	*	*
Otolaryngologists	37	35	51	44
Psychiatrists	33	35	43	14
Anesthesiologists/pathologists	73	25	*	120
Other specialists	40	41	13	47

NOTE: **Sample sizes in some cases may be very small.** Statistical significance of differences in times cannot be calculated. Asterisks (I'*") indicate that no one in the sample met the **specifications for that entry.**

SOURCE: U.S. Department of Health and Human Services, Centers for Disease Control, National Center for Health Statistics, Hyattsville, MD, unpublished travel time data from the 1983 National Health Interview Survey provided by E. Parsons, May 1989.

National Studies Examining Change in Rural Physician Supply—A Bureau of Health Professions (BHPr) study found that during the 1970s, the greatest improvement in the number of patient care and office-based primary care physicians per capita occurred in large (more than 25,000 residents) rural counties and small urban counties, with the smaller rural counties experiencing comparatively small increases (683). A study of physician distribution trends between 1950 and 1978 singled out those counties with the smallest populations and the poorest physician-to-population ratios as those with the least improvement in supply (205). A study of changes in physician supply in individual rural communities between 1971 and 1981 found that a large number of these communities did not experience increases in physician supply, and that some even experienced decreases (738).

A study of young physicians settling in rural areas between 1975 and 1979 (332) found that 60 percent of all rural counties had either not attracted any new young physicians or had lost some. The Northern and Western regions had the most success attracting young physicians, while the Central region had the least success. A later study found that in 1983,31 percent of the least populated as compared with 92 percent of the most populated rural counties had gained at least one young graduate (334). This study concluded that physicians tend to locate in larger, more attractive rural communities, and that less attractive communities have difficulty attracting physicians without special targeted efforts.

More recent BHPr data indicate that relatively slow increases in physician supply in small rural counties have continued through the 1980s. From 1979 to 1988, the number of office-based MDs per 100,000 residents rose 18 percent in rural counties of fewer than 10,000 residents compared with 23 percent in all rural counties and 25 percent in urban counties; the corresponding increases for all patient care MDs were 17, 24, and 24 percent (table 10-24) (686). In 1988, the incidence of patient-care MDs in

Table 10-22—Number and Resident Population of Nonmetropolitan[a] Counties Without a Professionally Active Physician (MD or DO), 1988[a,b]

	Number of nonmetro[a] counties	Resident population of counties[d]
United States	111	325,100
Northeast	1	4,900
New England	0	0
Middle Atlantic	1	4,900
New York	1	4,900
Midwest	49	138,600
East North Central	2	7,300
Indiana	1	5,400
Michigan	1	1,900
West North Central	47	131,300
Kansas	1	2,200
Missouri	2	16,100
Nebraska	19	40,700
North Dakota	10	32,100
South Dakota	15	40,200
South	37	137,200
South Atlantic	14	66,500
Florida	1	6,800
Georgia	10	37,200
North Carolina	1	9,700
Virginia	2	12,800
East South Central	6	36,000
Mississippi	3	19,200
Tennessee	3	16,800
West South Central	17	34,700
Texas	17	34,700
West	24	44,400
Mountain	22	40,700
Colorado	4	7,400
Idaho	3	12,400
Montana	9	12,200
Nevada	2	3,200
New Mexico	1	1,000
Utah	3	4,500
Pacific	2	3,700
Oregon	2	3,700

[a]There were n. metro counties without an active MD or DO in 1988.
[b]Includes physicians Of all specialties in patient care, research, administration, and teaching. This is a listing of counties that have no professionally active MD and no professionally active DO.
[c]Data from the American Medical Association as of Jan. 1, 1988. Data from the American Osteopathic Association as of 1987.
[d]Resident population is only for those counties included in the listing. Resident population estimates are for 1987.

SOURCE: T.C. Ricketts, Rural Health Research Center, University of North Carolina, Chapel Hill, NC. Analysis of unpublished data (provided by the Health Resources and Services Administration) conducted under contract with the Office of Technology Assessment, 1989.

Table 10-23—Number and Resident Population of Counties Without a Primary Care MD[a,b] by Type of County, 1988[c]

	Number of counties	Resident population
Metro	0	0
Nonmetro	176	713,700
50,000 and over	0	0
25,000 to 49,999	0	0
10,000 to 24,999	10	119,500
5,000 to 9,999	47	327,800
2,500 to 4,999	45	160,300
Fewer than 2,500	74	106,100
Population <10,000:		
<=6 persons/square mile	112	267,900
>6 persons/square mile	54	326,300
U.S. total	176	713,700

[a]Excludes Federal MDs and MDs in the Us. possessions.
[b]Includes general/family practice, general internal medicine, general pediatrics, and obstetrics/gynecology.
[c]American Medical Association data as of Jan. 1, 1988.

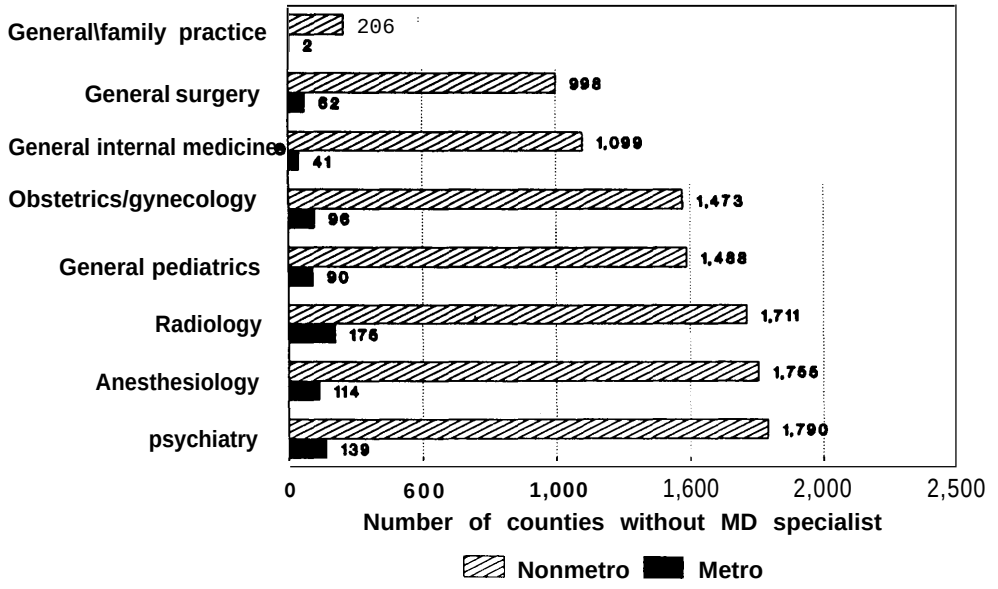
SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Office of Data Analysis and Management, Rockville, MD, unpublished data from the Area Resource File System provided to OTA in 1989 and 1990.

urban counties was more than twice as high as in all rural counties and more than 4 times as high as in rural counties of fewer than 10,000 residents (table 10-24)(686).

A characteristic of these trend data (and most detailed trend data on rural health personnel in this chapter) is that the underlying counties in each category can change dramatically over time as counties gain or lose population. As a result, changes in practitioner-to-population ratios—particularly in categories with only a small number of counties—can be abrupt, making trends more difficult to interpret.

As the RAND studies predicted, specialties with the greatest growth rates (i.e., the nonprimary care specialties) appear to be diffusing to small rural counties at a faster rate than that for primary care physicians. For primary care physicians (MDs and DOs), increases in supply were actually greater in the larger rural counties than in urban counties (table 10-15) (686). Within rural counties, however, in-

Figure 10-2—Number of Counties Without Selected MD Specialties by Metropolitan/Nonmetropolitan Status, 1988[a]



[a]Excludes Federal physicians and physicians in the U.S. possessions.

SOURCE: Office of Technology Assessment, 1990. Data from U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Office of Data Analysis and Management, unpublished 1988 data from the Area Resource File data system.

creases in primary care physician supply were directly proportional to county size, with the smallest counties (fewer than 2,500 residents) experiencing less than half the increase of the largest counties (25,000 or more residents). For nonprimary care physicians, the pattern was essentially the reverse: large rural counties had slightly greater increases than did urban counties, but increases in nonprimary care physician supply *within rural* counties were *inversely* proportional to county size (table 10-15). Within counties of fewer than 10,000 residents, counties with 6 or fewer persons per square mile had substantially greater increases of primary care and nonprimary care physicians than counties with higher population densities (table 10-15) (686). Some of these data may be misleading; in 1975 and 1979 there were so few nonprimary care physicians in the smallest rural counties that their ratios were remarkably sensitive to the addition of a small number of physicians (table 10-16) (686).

Within the primary care specialties, the supply of general/family practitioners increased more slowly from 1975 to 1988 in rural counties (9.1 percent) than in urban counties (12.9 percent), and actually decreased in rural counties with fewer than 2,500 residents (-14.7 percent) (table 10-16) (686). In contrast, the supply of general internists, general pediatricians, and obstetrician/gynecologists increased more in rural than in urban counties during this period (table 10-16) (686).

Kindig and Movassaghi undertook a detailed examination of physician availability in the 684 rural counties having fewer than 10,000 residents in both 1975 and 1985 (318). This study included all active Federal and non-Federal MDs and DOS, but excluded interns and residents.) They found that from 1975 to 1985, the mean level of physician availability increased by 34 percent in the United States as a whole but by only 14 percent in small rural counties (table 10-1 8). Percent change in physician-to-population ratios during the period ranged from 5 percent in the West South Central region to 37 percent in the Pacific region, and from 85 percent in California to -11 percent in Illinois (table 10-18). Primary care[26] physician availability increased more rapidly in all rural counties (42

[26]"Primary care" physicians here include MDs in general/family practice, general internal medicine, general pediatrics, and obstetrics/gynecology.

Table 10-24-Total MDs, Patient Care MDs, and Office-Based MDs Per 100,000 Residents by Type of County, 1979 and 1988[a]

County classification and county population	1979	1988	Percent change, 1975-88
	Total MDs per 100.000 residents		
Metro	219.3	262.6	19.7
Nonmetro	87.2	108.5	24.4
50,000 and over	116.3	146.7	26.1
25,000-49,999	86.8	106.2	22.4
10,000-24, 999	62.0	74.7	20.5
0-9,999	48.6	58.2	19.6
U.S. total	188.4	227.7	20.9
	Patient care MDs per 100,000 residents[b]		
Metro	174.3	215.6	23.7
Nonmetro	73.3	90.5	23.5
50,000 and over	97.5	122.2	25.3
25,000-49,999	73.3	89.9	22.6
10,000-24,999	52.0	61.3	17.9
0-9,999	40.5	47.5	17.4
U.S. total	150.7	187.2	24.3
	Office-based MDs per 100,000 residents[b]		
Metro	123.5	153.8	24.5
Nonmetro	65.6	80.6	22.9
50,000 and over	85.9	107.0	24.6
25,000-49,999	66.4	81.3	22.3
10,000-24,999	46.7	54.9	17.5
0-9,999	37.4	44.1	17.7
U.S. total	110.0	137.2	24.8

[a]MD data for 1988 are as of Jan. 1. Prior to 1988, data are as of Dec. 31.
[b]1987 population estimates were used to calculate 1988 MD ratios. Prior to 1988, population estimates used were for the same year as MD data.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Office of Data Analysis and Management, Rockville, MD, unpublished data from the Area Resource File system provided to OTA in 1989 and 1990.

percent) than in all urban counties (27 percent), but increased very little (9 percent)[27] in small rural counties (table 10-25) (318).

State Studies Examining Changes in Rural Physician Supply—Several State studies lend support to the findings of the national studies mentioned above:

- In Pennsylvania, overall physician-to-population ratios increased by 25 percent in rural and 32 percent in urban counties from 1970 to 1980.[28] Ratios for general and family practitioners actually dropped during this period for rural and urban counties alike (145).[29]
- *In Minnesota*, the primary care[30] physician-to-population ratio increased by 63 percent in urban counties from 1965 to 1985, but actually decreased by 2 percent in rural counties. The ratios of other specialists increased in smaller communities, however, and these physicians may actually be providing a substantial amount of primary care (164).
- In Georgia, physician-to-population ratios increased slightly more in rural areas (28 percent) than in urban areas (24 percent) between 1968

[27]Increase was 8.7 percent with MDs only, and 9.4 percent when DOs were included.

[28]This analysis included MDs and DOs.

[29]This analysis did not include DOs.

[30]In this study, "primary care" included general/family practice, pediatrics (including subspecialties), and internal medicine (including subspecialties).

Table 10-25-Supply of Primary Care Physicians in Metropolitan, Nonmetropolitan, and Small Nonmetropolitan Counties, 1975 and 1985[a]

	1975		1985		Percent change in number of primary care physicians per 100,000 residents, 1975-88
	Primary care physicians per 100,000 residents	Percent of all patient care physicians	Primary care physicians per 100,000 residents	Percent of all patient care physicians	
Metro counties (MDs only).	59.5	43.8	75.5	43.2	27
Nonmetro counties (MDs only). . . .	38.1	58,4	53.9	55.0	41
Nonmetro counties with fewer than 10,000 residents:					
MDs only.	32.2	81.0	35.0	77.9	9
MDs and DOS.	37.3	80.7	40.8	77.0	9
U.S. total (MDs only).	53.9	46.0	70.4	44.9	31

[a]Excludes medical residents and fellows; includes general practice, family practice, general internal medicine, general pediatrics, and obstetrics/gynecology.

SOURCE: D.A. Kindig and H. Movassaghi, "The Adequacy of Physician Supply in Small Rural Counties," Health Affairs, vol. 8, No. 2, 1989, pp. 63-76, exhibit 3.

and 1983, but wide variation in percent change existed within both urban and rural areas. In 1983, physician-to-population ratios in Georgia were still twice as high in urban as in rural areas (740).

Who Are Rural Physicians?

Rural areas rely much more heavily than urban areas on primary care physicians and DOS. Some rural areas also rely heavily on FMGs. Rural physicians are also older than their urban counterparts.

Primary Care Physicians--In 1988, primary care physicians accounted for 81 percent of all professionally active physicians in rural counties with fewer than 10,000 residents and 57 percent in all rural counties, compared with 38 percent in all urban counties and 40 percent in the United States as a whole (686).31

Doctors of Osteopathy—In 1985, DOs made up 15.3 percent of all patient care physicians in small rural counties compared with 5.1 percent for the United States as a whole (table 10-18) (318). The distribution of DOs by State is highly uneven. DOS constituted as much as 74 percent of all patient care physicians in Missouri's small rural counties, but were entirely absent in small rural counties in Utah and North Carolina (table 10-18)(318).

Foreign Medical Graduates--Although they are disproportionately located in urban areas, FMGs nonetheless play a significant role in health care in some rural areas. In Georgia in 1986, for example, FMGs were actually more common in rural areas: they accounted for 17 percent of physicians in rural counties but only 13 percent in urban counties (167). In 1985, FMGs accounted for 22 percent of patient care physicians in the United States as a whole, compared with 15 percent in rural counties with fewer than l0,000 residents (table 10-26) (316). The proportion of patient care physicians who were FMGs, however, increased much more quickly from 1975 to 1985 in small rural counties than in the country as a whole (table 10-26) (316), indicating that FMGs play an increasingly important role in health care in small rural counties.

The Age Distribution of Rural Physicians—The proportion of physicians who are young (under age 35) increased substantially in both urban and rural areas from 1975 to 1985, but rural physicians on the average are still older than their urban counterparts (table 10-27) (686). Physicians age 65 and over made up 13 percent of the rural physician population, compared with 9 percent in urban areas (table 10-27) (686). Elderly physicians make up an even

[31]Includes MDs and DOs. Primary care here includes MDs in general/family practice, general internal medicine, general pediatrics, obstetrics/gynecology, and all DOs in patient care.

Table 10-28-Foreign Medical Graduate (FMG) Physician Supply in Small U.S. Nonmetropolitan Counties, 1975 and 1985

	1975		1985		Percent change in proportion of all patient care physicians who were FMGs[a], 1975-85
	Number of FMGs	As a percent of all patient care physicians	Number of FMGs	As a percent of all patient care physicians	
All nonmetro counties with fewer than 10,000 residents. .	174	10	325	15	50
5,000-10,000.	135	10	251	15	50
2,500-4, 999.	35	12	68	20	67
Fewer than 2,500.	4	10	6	14	40
Population < 10,000:					
<= 6 persons/square mile. .	71	12	119	17	42
>6 persons/square mile. . . .	103	9	206	15	67
U.S. total	46,165[c]	18.6	82,525	22.1	19

[a]Includes MDs and DOs.
[b]Includes all metro and nonmetro counties.
[c]1976 figure.

SOURCE: D.A. Kindig and H. Movassaghi, "Trends in Physician Supply and Characteristics in Small Rural Counties of the United States 1975-1985," National Rural Health Association, Kansas City, MO, July 1987.

Table 10-27—Distribution of Primary Care MDs by Age in Metropolitan and Nonmetropolitan Counties, 1975 and 1985

Age	1975		1985	
	Metro	Nonmetro	Metro	Nonmetro
<35.	27%	11%	33x	21%
35-44.	22	23	27	30
45-54.	23	29	16	18
55-64.	16	22	14	19
65+.	11	15	9	13
Total	100	100	100	100

[a]Excludes Federal physicians and physicians in the U.s. possessions. Includes physicians in general/family practice, general internal medicine, general pediatrics, and obstetrics/gynecology.
[b]percentages may not add to 100 due to rounding.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Office of Data Analysis and Management, Rockville, MD, unpublished data from the Area Resource File system provided to OTA in 1989 and 1990.

larger percentage (16 percent) of patient care physicians in small (fewer than 10,000 residents) rural counties (316).

Future Supply of Rural Physicians

Stability of Rural Physician Practices-Many physicians practicing in small rural counties reportedly view their counties as lacking sufficient health personnel. In a 1988 survey of physicians in these areas,[32] 32 percent of the respondents indicated that there were too few physicians in their counties. Based on these responses, researchers estimated a need for a 50 percent increase relative to the current supply of physicians in these counties (405). Twenty-six percent indicated that they would be leaving their respective communities within 5 years; of this group, about one-half were underage 45 (405).[33] Of the 510 respondents, 55 percent were in solo practice. Although this particular study offered no comparable data for urban physicians, a recent survey of Minnesota physicians found differences between rural and urban practitioners. Only 64 percent of rural physicians surveyed reported that it was "very likely" they would continue to practice

[32]Data based on a 50 percent random sample mail survey of all MDs and DOs practicing in small rural counties in 1988. The survey response rate was 50 percent.

[33]Physicians were not asked whether they planned to relocate to an urban or to another rural community.

Table 10-28-Practice Location Preferences of Allopathic Medical School Seniors, 1979 and 1989[a]

Setting where student would most like to practice upon completion of medical training[b]	Percent of seniors 1979	1989
Large and moderate sized cities and suburbs	**59.1**	**79.5**
Large city (more than 500,000 residents)	**17.2**	**23.7**
Suburb of large city	**10.1**	**17.4**
City of moderate size (50,000 to 500,000 residents)	**25.4**	**29.9**
Suburb of moderate size city	**6.4**	**8.5**
Small city or town (not a suburb)	26.6	12.0
Small city (10,000 to 50,000 residents--other than suburb)	18.5	9.1
Town (2,500 to 10,000 residents--other than suburb)	8.1	2.9
Small town or rural area	3.2	1.5
Small town (fewer than 2,500 residents)	1.8	0.7
Rural/unincorporated area	1.4	0.8
Undecided or no preference	8.6	**6.5**
Other	1.0	**NA**
No response	1.5	**0.4**
Total[c]	100.0	**100.0**

NOTE: NA =not applicable.

[a]Reflects preferences indicated by allopathic medical school seniors on a graduation questionnaire. In 1979, 8,382 seniors (or 55 percent of all final year students) completed the questionnaire. In 1989, 11,175 students (or 72 percent of all final year students) completed the questionnaire.

[b]Does not reflect metro or nonmetro status of area.

[c]Percentages may not add to 100 due to rounding.

SOURCES: Association of American Medical Colleges, 1979 Medical Student Graduation Questionnaire Survey: Summary Revert for All Schools (Washington, DC: Association of American Medical Colleges, 1979); Association of American Medical Colleges 1989 Graduate Questionnaire Results: All School Summary (Washington, DC: Association of American Medical Colleges, 1989).

medicine in their current geographic area during the next few years, compared with 74 percent of physicians Statewide and 79 percent of physicians in the Twin Cities metro area (173).

Location Choices of New Medical Graduates— Allopathic medical school graduates are increasingly expressing a reluctance to choose rural practice. In 1979, 27 percent of allopathic medical school seniors preferred to practice in a small city or larger town, and 3 percent preferred small towns or rural areas (table 10-28) (58). By 1989, these proportions had dropped to 12 percent and 1.5 percent, respectively (table 10-28) (61). Osteopathic physicians seem to have a markedly greater inclination towards rural practice than do allopaths. In 1988,21 percent of senior osteopathic medical students reported that they intended to practice in communities of l0,000 to 50,000 people, and 9 percent intended to practice in communities of fewer than l0,000 people (21).

MIDLEVEL PRACTITIONERS

Nurse practitioners (NPs), certified nurse-midwives (CNMs), and physician assistants (PAs) (see box 10-B) have played valuable roles in providing primary health care services traditionally provided by physicians. Often referred to collectively as "midlevel practitioners" (MLPs), these three professional groups have developed rapidly since the 1960s in response to concerns over geographic maldistribution of primary care providers. Although MLPs can substitute for physicians in many instances in the delivery of primary medical care, their scope of practice is more limited. State medical and nurse practice laws that regulate these professions require some degree of physician supervision or collaboration. Within their areas of competence, MLPs provide care whose quality is equivalent to that of care provided by physicians, and they often do so at a comparatively low cost (617). NPs and, to a lesser extent, PAs see fewer patients and spend more time with each patient than do physicians, presumably because NPs provide nonmedical services such as counseling and health education during a patient visit (617). Notwithstanding the quality and cost-effectiveness of MLP care, lack of direct third-party coverage for MLP services has

Box 10-B—Provider Profiles: Midlevel Practitioners

Nurse Practitioners (NPs)

The NP profession developed during the 1960s in response to concerns over a shortage of physicians (617). NPs are registered nurses who have completed advanced training programs in primary health care delivery. These programs grant either certificates or master's degrees and involve from 9 months to 2 years of full-time study. Functions performed by NPs include health assessment, physical examinations, management of minor acute and chronic illnesses, development of plans of care, patient education and counseling, health promotion and disease prevention activities, and coordination of health care services. In some States they have the authority to prescribe medication. NPs can manage patients independently of physicians, but they do so within the context of a system that allows for professional consultation, collaborative management, and, when appropriate, referral (617).

Physician Assistants (PAs)

The PA profession also developed during the 1960s in response to concerns over a shortage of physicians (617,671). PAs work with or under the supervision of physicians, providing diagnostic and therapeutic patient care. They take patient histories, perform physical examinations and basic diagnostic tests, develop treatment plans, counsel patients on preventive health behavior, and facilitate referrals to other health or social service facilities (671). In some States, they have the authority to prescribe certain medications (192). PA training programs provide an average of 50 weeks education in the basic medical sciences and another 52 weeks in various clinical disciplines, including approximately 34 weeks of supervised primary care clinical experience and approximately 19 weeks in the nonprimary care specialties. Most PA programs grant either bachelor's or associate degrees, depending on the program structure and the educational background of the student (192). A small but increasing number of PA programs are now granting master's degrees ((67.3). While NPs and CNMs perform both nursing and primary medical care tasks, PAs perform medical tasks exclusively (192).

Certified Nurse-Midwives (CNMs)

Trained nurse-midwives were introduced into the United States with the establishment of the Frontier Nursing Service in rural Kentucky in 1925. The first formal training program opened in 1931 (24). A CNM is educated in the two disciplines of nursing and midwifery. CNMs provide gynecological care, family planning, and prenatal care. They also deliver babies, co-manage high-risk pregnancies with physicians, and care for mothers and infants after pregnancy (24,617). Programs preparing CNMs offer either certificates or master's degrees (24). Like NPs, CNMs can practice independently of physicians, but only within a context that provides for consultation, collaborative management, and referral (24).

Certified Registered Nurse Anesthetists (CRNAs)

CRNAs are baccalaureate-prepared registered nurses who have completed an additional 24 to 36 months training in anesthesiology in an accredited program and have passed a national certification examination in the specialty (522). CRNAs substitute for anesthesiologists across States and across a wide range of procedures. Licensure and certification laws require that CRNAs work under physician supervision, but direct supervision by an anesthesiologist is generally not required (522).

resulted in these practitioners' not being used to their fullest potential (617).

This section examines the supply and geographic distribution of each type of MLP. Also included are supply and distributional data for certified registered nurse anesthetists (CRNAs), who often substitute for anesthesiologists in rural facilities (see box 10-B). Studies comparing anesthesia outcomes by provider type have found no significant differences between CRNA and MD anesthesiologist-administered services (75,200,211).

Nurse Practitioners

National Supply

In 1988, there were in the United States an estimated 56,043 RNs who had completed formal training as NPs (511). Only 20,649 RNs, however, were employed with the *position title* of nurse practitioner, including 2,318 who had *not* completed formal training (511). NPs are employed primarily in ambulatory care settings (about 33 percent) and community and public health settings (about 30

percent) (673). Another 27 percent are in hospitals (673).[34]

The future supply of NPs is influenced by the availability of eligible applicants as well as by the availability of slots in training programs. Most programs preparing NPs today are master's level (86 percent of federally funded programs in 1986), in contrast to 1973 when most programs were at the certificate level (671). Many NP training programs require a baccalaureate degree in nursing. This may affect the ability of rural RNs, who are less likely to have a baccalaureate degree (317), to obtain advanced degrees. In 1984, there were 208 NP training programs in the United States, and almost one-half (91) received some degree of Federal support (671). Anecdotal reports suggest that there are roughly four jobs available for every new NP graduate (603). The geographic distribution of NPs is directly related to the geographic distribution of NP training programs (586).

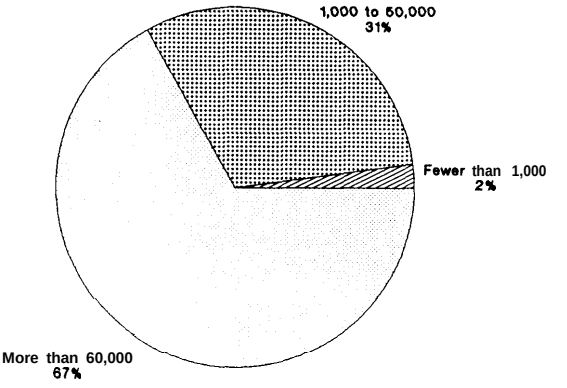
Rural Supply

The proportion of NPs in rural areas decreased slightly between 1984 and 1988. Of the 20,649 RNs employed as NPs in 1988, 15.8 percent were in rural areas (511). In 1984, approximately 18 percent were in rural areas (671).[35] Preliminary data from the American Academy of Nurse Practitioners' (AANPs') 1988 National Nurse Practitioner Survey indicate that 30 percent of all NPs are practicing in communities of 1,000 to 50,000 residents, and 2 percent are practicing in communities of fewer than 1,000 residents (figure 10-3) (13).[36]

Some State data on the rural-urban distribution of NPs are available. For example:

- *In Texas, in* 1986, approximately 12 percent of the State's 1,046 board-approved NPs were practicing in rural counties (708).
- In ***Arizona, in 1987, the*** NP-to-100,000 population ratio was 12 in rural counties as compared with 15 in urban counties.[37] Among Arizona's 13 rural counties, NP-to-100,000 population ratios ranged from O to 26 (220).

Figure 10-3--Distribution of Nurse Practitioners by Community Size, 1988[a]



[a]Community size does not reflect metro/nonmetro status. Data based on 5,987 responses to a national random sample survey of nurse practitioners. Excludes 210 respondents who did not indicate the size of their community.

SOURCE: Office of Technology Assessment, 1990. Data from American Academy of Nurses Practitioners, Lowell, MA, unpublished data from the 1988 National Nurse Practitioner Survey.

- In *Georgia, in* 1983, 32 percent of NPs were working in rural areas (535).
- In Utah, in 1986, slightly more than 10 percent of the State's 252 licensed NPs were practicing in rural counties (158).

In the 1960s, many NPs practiced independently in rural satellite clinics under supervision of physicians in neighboring communities, but this mode of NP practice has become less common as demand for NPs in a variety of other nonrural settings has grown (617). Table 10-29 examines selected characteristics of NPs practicing in communities of fewer than 1,000 residents, communities of 1,000 to 50,000 residents, and communities of 50,000 or more residents (13).[38] Compared with NPs in the largest communities, NPs in smaller communities are more likely to specialize in family health and to have hospital and nursing home privileges. NPs in the smallest communities are most likely to be employed in freestanding primary care clinics; NPs in communities of 1,000 to 50,000 residents are found mostly in private practices or in public health clinics;

[34]Data on employment *setting* include approximately 2,900 RNs employed with the position title of nurse-midwife (673).

[35]Because 1984 distributional data included RNs employed with the position title of nurse-midwife, 1984 and 1988 data are not entirely comparable. However, nurse-midwives were only a small proportion (12 percent) of RNs employed as nurse-midwives or NPs in 1984.

[36]Community size does not reflect urban or rural status. Smaller communities maybe in urban areas, and larger communities maybe in rural areas.

[37]These ratios are based on the total 488 board-certified NPs residing in Arizona in 1987 and may be overestimates of actual supply since the activity status of these NPs was not examined.

[38]See footnote 36.

Table 10-29—Characteristics of Practicing Nurses Practitioners (NPs) by Community Population Size, 1988[a]

	Community population		
	Fewer than 1,000 residents [N = 1,22]	1,000 to 50,000 residents [N = 1,771]	More than 50,000 residents [N = 3,884]
	Percent of NPs:		
Specialty:			
Family health	59.8	32.8	20.1
Adult health	3.3	10.8	17.4
Pediatric health	12.3	18.8	18.1
Gerontologic health	3.3	1.9	3.3
School/college health	2.5	4.4	4.3
Women's health	5.7	19.3	18.0
Psychiatric/mental health	0.0	1.9	2.9
Other	13.1	10.1	15.9
Total	100.0	100.0	100.0
Education:			
Masters degree or greater	33.8	33.2	52.4
Other	66.2	66.8	47.6
Total	100.0	100.0	100.0
Employment setting:			
Private practice (with & without a physician)	**9.2**	20.8	14.5
HMO	**0.8**	3.0	10.4
Freestanding primary care clinic	47.5	16.8	11.7
Hospital outpatient clinic	3.3	4.5	13.7
Public health clinic	7.5	18.1	7.9
Hospital inpatient unit	2.5	6.5	8.6
Extended care facility	2.5	1.5	1.7
School/college	5.0	11.7	11.7
Occupational health	2.5	2.9	2.8
Other	18.3	13.6	16.2
Total	100.0	100.0	100.0
Other characteristics:			
Percent of NPs having hospital privileges	27.5	26.1	26.0
Percent of NPs having nursing home privileges	9.8	8.6	3.9
Percent of NPs caring for patients over age 65	76.9	56.4	50.1

[a]Community population size was self-reported and self-defined. It does not reflect metro or nonmetro location.

SOURCE: American Academy of Nurse Practitioners, Lowell, MA, unpublished data from the 1988 Nurse Practitioner Survey.

and NPs in the largest communities are more likely to be found in private practices or hospital outpatient clinics. Approximately one-third of NPs in the smaller communities have a master's or doctoral degree, compared with over one-half of those in the largest communities (l3).

Physician Assistants

National Supply

In 1987, there were an estimated 19,446 PAs licensed to practice in the United States, an increase of 15 percent over only 2 years earlier (671). Approximately 80 percent of these PAs were involved inpatient care (671). The distribution of PAs by State is closely linked to the presence of PA training programs (table 10-30)(62,671). Dramatic differences in estimated PA population exist among States, ranging from 2,508 PAs in California to only ***35 in*** Delaware. The East South Central had the lowest regional PA population (648 PAs) in 1987, while the Middle Atlantic had the highest (3,793 PAs) (62,671). PA distribution may also be influenced by State laws and regulations regarding PAs' scope of practice. In some States, PAs are required

Table 10-30-Number of Physician Assistants (PAs), 1987, and Number of PA Training Programs, 1989, by Region and State

	Number of PA training programs, 1989[a]	Estimated number of PAs, 1987[b]
United States	51	19,446
Northeast	14	5,082
New England	2	1,289
Connecticut	1	408
Maine	0	192
Massachusetts	1	455
New Hampshire	0	105
Rhode Island	O	69
Vermont	0	60
Middle Atlantic	12	3,793
New Jersey	1	232
New York	7	2,465
Pennsylvania	4	1,096
Midwest	13	3,367
East North Central	7	2,129
Illinois	1	229
Indiana	0	147
Michigan	2	700
Ohio	3	698
Wisconsin	1	355
West North Central	6	1,238
Iowa	2	236
Kansas	1	228
Minnesota	0	177
Missouri	1	178
Nebraska	1	175
North Dakota	1	127
South Dakota	0	117
south	17	6,234
South Atlantic	9	4,062
Delaware	0	35
District of Columbia	2	106
Florida	1	846
Georgia	2	666
Maryland	1	751
North Carolina	2	905
South Carolina	0	202
Virginia	0	348
West Virginia	1	203
East South Central	3	648
Alabama	1	169
Kentucky	1	209
Mississippi	0	32
Tennessee	1	238
West South Central	5	1,524
Arkansas	0	48
Louisiana	0	105
Oklahoma	1	335
Texas	4	1,036
Waft	7	4,640
Mountain	2	1,255
Arizona	0	277
Colorado	1	392
Idaho	0	54
Montana	0	41
Nevada	0	82
New Mexico	0	247
Utah	1	120
Wyoming	0	42
Pacific	5	3,385
Alaska	0	169
California	4	2,508
Hawaii	0	70
Oregon	0	146
Washington	1	492

[a] Programs must be accredited in order to graduate PAs. As of November 1989, four additional PA training programs were awaiting accreditation.
[b] Includes PAs not involved in patient care.

SOURCES: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Pro-fessions, Sixth Report to The President & Congress on The Status of Health Personnel in The United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 4-3; Association of Physician Assis-tant Programs, Physician Assistant Programs National Directory 1989-~ (Alexandria, VA: APAP, 1989).

to practice under the direct personal supervision of a physician (16) (see ch. 12).

The percentage of PAs in primary care practice is large but decreasing. In 1986, only 65 percent of all PAs were in family practice, compared with 74 percent in 1978 (table 10-31) (671). Conversely, the percentage of PAs in the medical and surgical subspecialties has increased significantly (671). This trend parallels that in the physician population, possibly because of the close relationship between PA and physician practice.

Pronounced changes in the distribution of PAs by practice setting have also been occurring. From 1981 to 1984, the proportion of patient care PAs in solo office-based practice decreased from 18 to 15 percent, while the proportion of PAs practicing in hospitals, HMOs, office-based group practice, and prisons increased (671). The increase in hospital-based PAs is likely to be further influenced by the recent broadening in 1986 (Public Law 99-509) of Medicare reimbursement policies for PA services provided in hospitals, skilled nursing facilities, and intermediate care facilities. According to the American Academy of Physician Assistants (AAPA) and

Table 10-31—Distribution of Physician Assistants by Specialty, 1978 and 1986[a]

Specialty	1978 (N= 3, 416)	1986 (N=8,330)
Primary care specialties	**74.2%**	**65.1%**
Family practice	52.0	**37.3**
General internal medicine	12.0	**13.5**
Emergency medicine	4.9	**4.3**
General pediatrics	3.3	**5.8**
Obstetrics/gynecology	2.o	**4.2**
Medical subspecialties	**6.3**	**5.4**
Surgical specialties	**11.7**	**19.2**
Other specialties	**7.8**	**10.3[b]**
Total[c]	100.0	**100.0**

[a]Data are based on two national sample surveys of PAs.
[b]Includes 1.9 percent industrial medicine and 1.5 percent psychiatry.
[c]Percentages may not add to 100 due to rounding.

SOURCE: U.S. Department of Health & Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to the President & Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 4-6.

others, there has recently been an increased demand for PAs to fill hospita1 surgical resident house staff positions, where they are believed to improve quality of care as well as to help minimize costs (47(9,671). A threefold increase in the demand for PAs in Federal prisons is anticipated as the size and number of prisons expand (192). Increased demand for PAs in these settings, along with the trend away from primary care specialty practice, is likely to have a significant impact on the future supply of PAs in rural areas.

Approximately 1,200 new graduates are added annually to the PA pool, and approximately 90 percent of these enter active clinical practice (671). The BHPr projects that the total number of PAs could more than double by the year 2020 (671). Nonetheless, PA programs reported an average of more than seven available jobs per graduate for the 1988 class (18).[39]

Rural Supply

Little is known about the rural supply of PAs. PAs are slightly more likely (39 percent—figure 10-4) to practice in communities with fewer than 50,000 residents than are NPs (32 percent-figure 10-3) (13,17). Recent evidence suggests that the proportion of PAs practicing in very small communities has decreased and will continue to do so. In 1981,27 percent of all professionally active PAs were practicing in communities of fewer than 10,000 residents (671} In 1989,only 20 percent were practicing in communities of this size; an additional 19 percent were in communities of 10,000 to 49,999 residents, and the remainder (61 percent) were in larger communities (figure 10-4) (17).[40] The 36 PA training programs that received Federal funds in 1986 reported that approximately one-third of their graduates were practicing in primary care HMSAs (671), with recent data indicating a trend toward PAs practicing in the urban as opposed to the rural shortage areas (721).

Data from selected States indicate a substantial proportion of PAs in rural practice.

- *In Arizona, in 1987,* approximately 30 percent of the State's licensed PAs were located in rural counties, making their PA-to-population ratio higher than that of urban counties (8 v. 6 per 100,000 residents) (220).
- In Texas, in 1986, 66 percent of the State's 412 PAs were practicing in rural counties (708).
- *In Utah, in 1986, 37 percent of the* 75 PAs were practicing in rural counties (l58).
- *In Oklahoma, in* 1987, the distribution of PAs showed a somewhat different pattern. Twenty-eight percent of all PAs were located in rural counties, but the PA-to-100,000 population ratio was almost twice as high in urban counties (7.4) as in rural counties (4.0) (451).

Table 10-32 describes selected characteristics of PAs by size of community in 1989. The specialty distribution of PAs differed greatly by community size, with PAs in small communities (fewer than 10,000 residents) and small cities (10,000-250,000 residents) employed mostly in family practice, and

[39]Based on a survey of PA program directors conducted in February 1988. Directors were asked: 1) of how many PA job positions they had been made aware over the past 12 months and 2) how many new PA graduates they had in 1988. From these data, AAPA calculated for each program the ratio of available positions to PA graduates. The unweighed average of all ratios was 7.5:1 All programs reported a ratio equal to or greater than 2: 1. When asked the subjective question, "Do you feel there is a shortage of PAs?," all programs responded "yes" (*18,192*).

[40]See footnote 36. Communities with fewer than 50,000 residents may be in either rural or urban areas.

Table 10-32--Characteristics of Practicing Physician Assistants by Community Population Size, 1989[a]

	Community population[b]		
	Fewer than 10,000 residents	10,000 to 250,000 residents	More than 250,000 residents
Primary specialty:			
Family/general practice	67	36	24
Emergency medicine	8	6	5
Internal medicine	5	9	11
General pediatrics	3	4	3
Orthopedics	3	7	6
Industrial/occupational medicine	2	3	5
Geriatrics	2	1	3
General surgery	2	5	6
Obstetrics/gynecology	1	5	6
Other	8	24	31
Total[c]	100	100	100
Practice Setting:			
Group office	17	27	19
Solo office	20	13	9
Nursing home	1	1	2
Public hospital	7	13	12
Private hospital	4	10	17
Public clinic	4	6	6
Private clinic	7	9	9
Rural clinic	21	1	*
Inner city clinic	0	1	4
Other clinic	14	12	7
HMO	1	7	14
Prison/jail	4	2	1
Other nonclinic	1	1	1
Total[c]	100	100	100
Number of years in currant practice setting:			
Less than 1 year	19	24	23
1 to 3 years	26	30	37
4 to 6 years	21	18	21
7 to 9 years	15	12	13
10 years or more	20	15	7
Unknown	0	*	0
Total[c]	100	100	100
Academic Degree:			
Certificate	14	9	4
Bachelor's	66	68	74
Master's	7	12	13
Associate	14	10	8
Doctorate	0	1	1
None stated	1	0	*
Total[c]	100	100	100
sex:			
Male	71	63	55
Female	29	37	45
Total[c]	100	100	100
Average Age (in years)	40.7	38.5	37.4

NOTE: * = less than 0.5 percent of total.

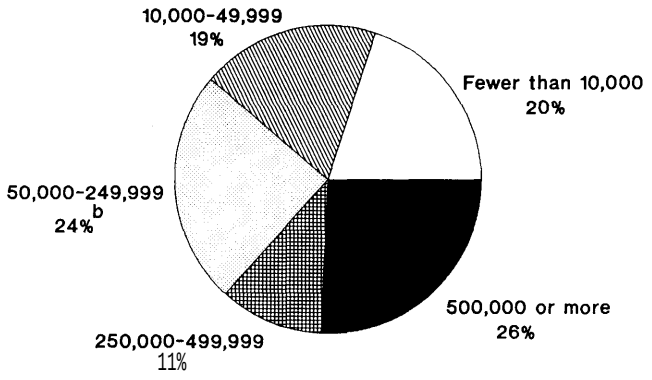
[a]This information is derived from the American Academy of Physician Assistants' 1989 prescriptive practice Survey and is statistically representative of member and nonmember physician assistants in communities of all sizes.

[b]Community population size was self-reported and self-defined. It does not reflect metro or nonmetro location.

[c]Percentages may not add to 100 due to rounding.

SOURCE: American Academy of Physician Assistants, Alexandria, VA, unpublished data from the 1989 PA Prescriptive Practice Survey provided to OTA in 1989.

Figure 10-4-Distribution of Physician Assistants by Community Size, 1989a



[a]Represents location of PAs' major practice setting. Based on 1,588 responses to a 1989 sample survey of PAs. Community size was self-defined and self-reported, and does not reflect metro/nonmetro location.
[b]The actual percentage (24.62) was rounded to 24 percent for the purpose of this figure.

SOURCE: Office of Technology Assessment, 1990. Data from American Academy of Physician Assistants, Alexandria, VA, unpublished data from the 1989 PA Prescriptive Practice Survey.

PAs in large cities (more than 250,000 residents) employed mostly in other medical and surgical subspecialties (17). More small community and small city PAs than large city PAs were in solo practice settings, and fewer were in group practice, hospital, and HMO settings. PAs in small communities were considerably older, were more likely to be male, had lower salaries, and tended to have been in their current employment setting much longer than PAs in small and large cities. Small community PAs were also less likely than PAs in small and large cities to have at least a bachelor's degree (17).

Certified Nurse-Midwives

National Supply

As of January 1990, 4,260 nurse-midwives had been certified by the American College of Nurse-Midwives (ACNM) (27), a 67 percent increase over the number in 1982 (2,550) (23a) .41 Seventy-one percent of all CNMs responding to a 1988 ACNM survey were practicing nurse-midwifery (342). The Division of Nursing estimates that there were some 2,886 practicing nurse-midwives in the United States in 1988, but it does not distinguish between those who were certified by the ACNM and those who were not (681). Almost one-fourth of CNMs responding to the 1988 ACNM survey were employed by hospitals (342). Seventeen percent were employed by physicians, and 9 percent were employed by other CNMs or were in private practice (342). Twenty-five nurse-midwifery education programs were in operation in the United States at the end of 1987 (24).

Studies have shown that CNMs can manage normal pregnancies at least as well as physicians (169,359,502,504,565). Numerous factors, including lack of physician acceptance, liability coverage costs and availability, and reimbursement coverage, have influenced the characteristics and location of CNM practice.

Rural Supply

Although no information regarding the national rural/urban distribution of CNMs is available, survey data show that the proportion of CNMs in smaller communities has decreased in recent years. The proportion of active CNMs practicing in communities of fewer than 50,000 residents decreased by over 10 percentage points in both small (fewer than 10,000 residents) and mid-sized (10,000 to 49,999 residents) communities between 1982 and 1987 (table 10-33) *(23a,26).*[42]

State data indicate that the distribution and activity of CNMs vary considerably between rural and urban areas.

- *In Arizona, in 1987,* although only one-half of CNMs in urban counties were practicing midwifery, all of the 21 CNMs in rural counties were delivering babies. CNMs attended 4 percent of all deliveries in Arizona in 1985, and in some rural counties they delivered more than 50 percent of the total county births (220).[43]
- *In Texas, in 1986,22* percent of the 79 CNMs practicing nurse-midwifery were practicing in rural counties (708).
- *In Utah, in 1986, only* 1 of the 42 known employed CNMs was practicing in a rural county. Only one rural hospital in Utah granted delivery privileges to nurse-midwives in 1987,

[41]Data on the geographic distribution and characteristics of CNMs were available for 1982, 1987, and 1988, based on surveys conducted by the ACNM. The ACNM is the only national certifying body for nurse-midwives.

[42]See footnote 36.

[43]Most CNMs delivering babies in rural Arizona counties work on Indian reservation and are employed by the Indian Health Service (*221*).

Table 10-33-Distribution of Practicing Certified Nurse-Midwives (CNMs) by Community Population Size, 1982 and 1987[a,b]

Community population	1982 (N=l,065)	1987 (N=l,526)
Fewer than 10,000	8 .7%	7 .9%
10,000 to 49,999	14.5	13.7
50,000 to 199,999	17.4	20.0
200,000 to 499,999	13.2	10.6
500,000 or more	40.6	39.0
Total[d]	100.0	100.0

[a]Represents community population size of CNMs primary work site.
[b]Data are based on the 1982 and 1987 American College of Nurse-Midwives (ACNM) Surveys and only reflect characteristics of nurse-midwives who are certified according to the requirements of the ACNM. Data for 1982 are based on responses from 1,684 CNMs (66% of all CNMs in 1982). Data for 1987 are based on responses from 2,278 CNMs (57% of all CNMs in 1987). CNMs who were residing outside of the United States, were not practicing nurse-midwifery, or did not indicate the size of their primary worksite are excluded.
[c]Does not reflect metro or nometro location.
[d]Percentages may not add to 100 due to rounding.

SOURCE: American College of Nurse-Midwives, Nurse-Midwifery in the United States: 1982 (Washington, DC: ACNM, 1984); American College of Nurse-Midwives, Washington, DC, unpublished data from the 1987 five-year survey provided to OTA in 1990.

Table 10-34--Number of Nurse Anesthetist Training Programs and Graduates, 1976-90

Year	Total number of graduates	Total number of programs
1976	1,094	194
1977	1,029	166
1978	1,063	172
1979	1,078	163
1980	1,023	161
1981	1,055	148
1982	1,107	142
1983	985	137
1984	953	127
1985	722	112
1986	722	104
1987	720	99
1988	574	84
1989	636	80[b]
1990	693[a]	

[a]Projected.
[b]Number of programs as of Apr. 1, 1990.

SOURCE: American Association of Nurse Anesthetists, Chicago, IL, unpublished data provided to OTA in April 1990.

and CNMs in the State do not participate in home deliveries (158).

Certified Registered Nurse Anesthetists(CRNAs)

In 1986, there were 22,500 CRNAs and 19,000 anesthesiologists in the United States, but the number of anesthesiologists has increased much more quickly than that of CRNAs over the past two decades (116 v. 68 percent) (522).[44] The number of graduates from nurse anesthetist training programs dropped by a precipitous 44 percent from 1980 to 1988, due to a 48 percent reduction in the number of nurse anesthetist training programs (table 10-34) (22). Reasons for program closure may include withdrawal of anesthesiologist support and concerns within hospitals over program costs (522). The number of graduates has increased since 1988, reaching a projected 693 in 1990, but it is still far below the peak level of 1982 (table 10-34)(22).

The distribution of CRNAs and anesthesiologists by State is shown in table 10-35, which ranks the States by their CRNA-to-population ratio. The seven States with average rates at or above the national median for both providers all have both large anesthesiology residency programs and nurse anesthetist training programs (522). The eight States with rates below the national median for both providers all have large rural areas and below-average hospital bed-to-population ratios (522).

Hospitals that lack the services of MD anesthesiologists may rely on CRNAs as the sole providers of anesthesia during surgical procedures. CRNAs administer nearly 70 percent of all anesthetics given in the United States (122).[45] In 1982, 34 percent of

[44]These figures represent the number of members in the American Association of Nurse Anesthetists and in the American Society of Anesthesiologists, but they exclude nurse anesthesia students andanesthesiologyresidents (522).

[45]According to an anesthesia practice survey conducted by the Center for Health Economics Research (*122*), 19 percent of anesthesia services mtionwide are provided byCRNAsalone,48 percent by anesthesiologists and CRNAs together, and 33 percent by anesthesiologists alone. when anesthesiologists and CRNAs work together, it is usually the CRNA who actually administers the anesthesia (*601*).

[46]Excluded from this analysis were hospitals in the U.S. territories, long-term care and Federal hospitals, specialty hospitals not meeting the Health Care FinancingAdministration's defiitionofcommunityhospital, and hospitals not providing surgical services.

Table 10-35--Supply of Certified Registered Nurse Anesthetists (CRNAs) and MD Anesthesiologists by State, 1986, Ranked by CRNAs and MD Anesthesiologists Per 100,000 Residents

State	CRNAs			Anesthesiologists			Anesthesia providers (CRNAs plus MD anesthesiologists) per 100,000 residents
	Number[a]	Per 100,000 residents	Rank[c]	Number[d]	Per 100,0o0 residents	Rank[e]	
Alabama	562	14.0	7	175	4.4	46	18.4
Alaska	34	6.5	41.5	21	4.0	48	10.5
Arizona	140	4.4	47	263	8.3	7	12.7
Arkansas	243	10.3	16	105	4.5	44	14.8
California	957	3.6	50	2,025	7.7	10	11.3
Colorado	181	5.6	44	233	7.2	12.5	12.8
Connecticut	287	9.0	24	280	8.8	5	17.8
Delaware	78	12.5	11	37	5.9	30.5	18.4
District of Columbia	61	9.7	21	48	7.7	10	17.4
Florida	86o	7.6	33	822	7.2	12.5	14.8
Georgia	546	9.1	23	367	6.1	27	15.2
Hawaii	104	9.9	19	61	5.8	32.5	15.7
Idaho	99	9.9	19	31	3.1	50	13.0
Illinois	810	7.0	39	709	6.1	27	13.1
Indiana	119	2.2	51	374	6.8	17	9.0
Iowa	208	7.2	36	160	5.5	34.5	12.7
Kansas	326	13.3	9	126	5.1	39	18.4
Kentucky	301	8.1	29.5	199	5.3	36.5	13.4
Louisiana	723	16.1	4	216	4.8	42	20.9
Maine	125	10.7	15	69	5.9	30.5	16.6
Maryland	310	7.1	37.5	404	9.2	2.5	16.3
Massachusetts	456	7.8	31	582	10.0	1	17.8
Michigan	992	10.9	14	502	5.5	34.5	16.4
Minnesota	774	18.5	3	267	6.4	21	24.9
Mississippi	263	10.1	17	87	3.3	49	13.4
Missouri	611	12.1	12	291	5.8	32.5	17.9
Montana	59	7.1	37.5	51	6.2	24	13.3
Nebraska	193	12.0	13	83	5.2	38	17.2
Nevada	38	4.1	49	81	8.7	6	12.8
New Hampshire	84	8.4	27	53	5.3	36.5	13.7
New Jersey	347	4.6	45	511	6.8	17	11.4
New Mexico	117	8.1	29.5	87	6.0	29	14.1
New York	800	4.5	46	1,461	8.2	8	12.7
North Carolina	863	13.8	8	283	4.5	44	18.3
North Dakota	129	18.8	2	31	4.5	44	23.3
Ohio	946	8.8	25	765	7.1	14	15.9
Oklahoma	244	7.4	34	164	5.0	40	12.4
Oregon	168	6.3	43	208	7.7	10	14.0
Pennsylvania	1,772	14.9	5	824	7.0	15	21.9
Rhode Island	81	8.4	27	60	6.2	24	14.6
South Carolina	333	9.9	19	140	4.2	47	14.1
South Dakota	141	19.9	1	19	2.7	51	22.6
Tennessee	625	13.1	10	309	6.5	19.5	19.6
Texas	1,382	8.4	27	1,065	6.5	19.5	14.9
Utah	71	4.3	48	152	9.2	2.5	13.5
Vermont	41	7.7	32	33	6.2	24	13.9
Virginia	525	9.2	22	358	6.3	22	15.5
Washington	286	6.5	41.5	394	8.9	4	15.4
West Virginia	279	14.4	6	95	4.9	41	19.3
Wisconsin	350	7.3	35	326	6.8	17	14.1
Wyoming	34	6.7	40	31	6.1	27	12.8
U.S. total		8.4			6.1		14.5

[a] Active members in the American Association of Nurse Anesthetists, as of August 1986.
[b] Based on 1985 population.
[c] Ranked by CRNAs per capita.
[d] Active members in the American Society of Anesthesiologists, as of Dec. 31, 1986.
[e] Ranked by MD anesthesiologists per capita.

SOURCE: Adapted from M.L. Rosenbach and J. Cromwell, "A Profile of Anesthesia Practice Patterns," Health Affairs, vol. 7, No. 4, Fall 1988, pp. 118-131, exhibit 3.

Box 10-C—Provider Profiles: Nurses

Registered Nurses (RNs)

Although all RNs take the same licensure examination, basic nursing education is provided in a number of different settings (673). Programs vary in length and type of degree provided. Diploma programs, usually located in hospitals, are typically 3 years in length. Associate degree programs, typically located in community colleges, are generally 2 years long. Bachelor's degree programs are located in colleges and universities and require a total of 4 years of undergraduate education for degree completion. In recent years, there has been a trend away from the diploma and toward the bachelor's degree or associate degree as the route of entry into the RN work force. Associate degree programs are still producing the majority of RNs (673). Many advanced nursing degree programs, such as those preparing NPs, CNMs, and CRNAs, require a previous bachelor's degree (673), and some States have initiated plans to require a bachelor's degree for RN professional practice (671). The total employed RN population includes RNs with advanced training (e.g., NPs, CNMs, CRNAs, clinical nurse specialists) who are either in clinical practice or are employed in research, teaching, or administration (673).

Licensed Practical/Vocational Nurses (LP/VNs)

LP/VNs must complete a training program in practical nursing (typically 12 months long) before taking a national licensure examination (671). In California and Texas, the licensing laws refer to vocational nurses rather than practical nurses (671). LP/VNs are not considered professional nurses because their skills and training are not equivalent to those of RNs (69). LP/VNs are responsible to RN supervisors under State nurse practice acts (69).

hospitals[%] relied solely on CRNAs for anesthesia service provision (123);[47] 85 percent of these hospitals were located in rural areas (123). In isolated areas, a single CRNA may provide services in as many as four hospitals (699).

The high proportion of rural anesthesia services provided by CRNAs suggests a concentration of these professionals in rural areas, but recent decreases in the number of programs and graduates may disproportionately affect rural areas. A survey of rural and urban hospitals in Texas found that the vacancy rate for CRNAs was 10 percent in rural hospitals, compared with 2 percent in urban hospitals (595).

NURSES

The U.S. health care system employs over 3 million nursing personnel at a wide range of professional levels and in a wide range of settings (671). Reports from nurse employers suggest a recent serious national shortage of nurses (698). The nature and extent of this shortage have been the subject of numerous studies at the national, State, and local levels. These studies have focused primarily on registered nurses (RNs) employed in hospitals. The impact of the national nursing shortage-in rural areas is difficult to determine due to the limitations of these studies and their data sources, but available data suggest that rural areas are suffering at least as much as urban areas. Smaller rural facilities are more sensitive to the loss of a single nurse, because such a loss can critically affect their ability to deliver health services.

This section describes the national and rural supply of registered nurses (RNs) and licensed practical/vocational nurses (LP/VNs) (see box 10-C).

National Supply[48]

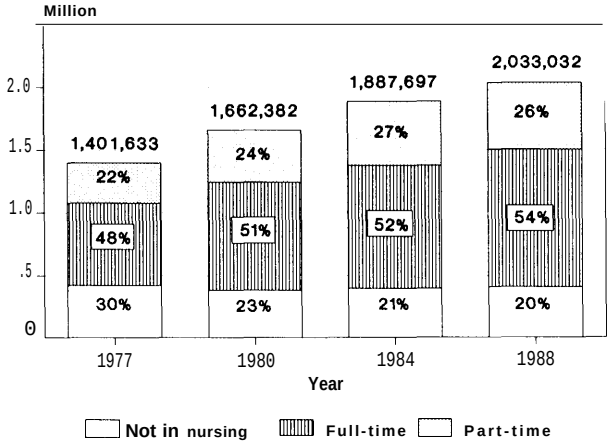
Current Supply

As of March 1988, there were just over 2 million RNs licensed to practice in the United States, representing an increase of approximately 45 percent over the 1977 RN population (figure 10-5) (673). From 1984 to 1988, however, total RN population increased by only 8 percent. The estimated total number of RNs *employed in* nursing in

[47] Seventeen percent used anesthesiologists only, and 45 percent used both anesthesiologists and CRNAs. The remainder used other providers (e.g., RNs, other physician specialists).

[48] A substantial number of nurses (46 percent of RNs in 1988) are employed part-time (*673*). BHPr adjusted for the percentage of RNs employed part-time in 1988 to produce estimates of full-time equivalent (FTE) RN and LP/VN supply. In 1988, when the total employed RN supply was 1.63 million, the estimated FTE supply was only 83 percent of that, or 1.36 million (673). In 1983, FTE LP/VN supply was 87 percent of the estimated total number of LP/VNs (*671*). The percentage of both RNs and LP/VNs who are employed full-time varies somewhat by region and State (*671,673*).

Figure 10-5-Employment Status of Registered Nurses in the United States, Selected Years, 1977-1988



SOURCE: Office of Technology Assessment, 1990. Data from U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, *Seventh Report to the President and Congress on the Status of Health Personnel in the United States,* DHHS Pub. No. HRS-P-OD-90-1(Rockville, MD: HRSA, June 1990), table VIII-2.

1988 was approximately 1.6 million, or roughly 80 percent of all licensed RNs (673). Both the proportion of licensed RNs who are practicing and the proportion employed full-time have increased in recent years (figure 10-5) (673). There were 668 employed RNs per 100,000 residents in the United States as a whole in 1988-a 19 percent increase over the 1980 ratio (table 10-36) (404,673). The number of RNs employed in hospital settings has increased dramatically in recent years (table 10-37) (671,698).

In 1983, the most recent year for which data are available, there were in the United States an estimated 781,506 LP/VNs, with 69 percent of these actually employed in practical nursing. Approximately 5 percent of all LP/VNs were also licensed to practice as RNs, and almost 12 percent of the LP/VNs who were not employed in practical nursing in 1983 were employed as RNs (678). The number of LP/VNs employed in hospitals decreased substantially between 1981 and 1988 (table 10-37) (671,698).

Considerable State and regional variations in estimated RN supply exist (figure 10-6, table 10-36) (404,673). In 1988, for example, New England had more than twice as many employed RNs per 100,000 residents as the West South Central region (table 10-36) (673). Ratios in the States ranged from a low of 442 in Louisiana to a high of 1,167 in Massachusetts. Employed-RN-to-population ratios increased in all States between 1980 and 1988, although the rate of increase varied considerably, and a few States experienced decreases during the latter part of that period. Regions with the lowest ratios experienced the highest rates of increase (table 10-36) (404,673).

Regional variations are less pronounced for LP/VNs (table 10-38). The national ratio of LP/VNs per 100,000 residents was 231 in 1983. The only regions with ratios well below this average were the Mountain (173) and Pacific (176) regions (671). Interestingly, the two regions with the lowest relative RN-to-population ratios in 1984 (East South Central and West South Central) (table 10-36) had high relative LP/VN-to-population ratios in 1983 (278 and 274, respectively) (404)671).

Over two-thirds of RNs employed in nursing (in 1988) and over one-half of employed LP/VNs (in 1983) worked in hospitals (table 10-39) (671,681). Other major employment settings for RNs were nursing homes, ambulatory care settings, and public health settings. Other major employment settings for LP/VNs were nursing homes and physicians' or dentists' offices. RN employment in ambulatory care settings (e.g., group practice physician offices, HMOs, freestanding clinics) increased by 29 percent from 1984 to 1988, but it changed little in public health settings (673).

Future Supply

The main cause for concern regarding future supply of nurses is the recent downward trend in enrollments in and graduations from nursing programs. Total enrollments in basic RN nursing education programs decreased in all but three years between academic years 1975-76 and 1987, then increased slightly in 1988 (671,673). In 1989-90, first-time student enrollments in 4-year RN programs increased by 6 percent over the previous year-the first increase in 5 years (20). Enrollments in practical nursing programs peaked in 1982-83, and they have since declined significantly (671).

The number of graduates from RN programs, after nearly a decade of increase, dropped significant.ly in 1985-86 and has continued to decline (table 10-40)

Table 10-36—Estimated Supply of Registered Nurses (RNs) Employed in Nursing by Region and State, 1980, 1984, and 1988[a]

	Number of RNs	Rate per 100,000 residents	Number of RNs	Rate per 100,000 residents	Number of RNs	Rate per 100,000 residents	Percent change in rate per 100,000 residents 1980-84	Percent change in rate per 100,000 residents 1984-88
United States	1,272,851	560	1,485,725	629	1,627,035	668	12	6
Northeast								
New England	109,116	882	129,914	953	130,915	1,020	8	7
Connecticut	26,083	838	6,407	837	29,367	916	>-0.5	9
Maine	7,583	673	8,453	731	9,639	809	9	11
Massachusetts	7,052	993	63,540	1,096	68,255	1,167	10	6
New Hampshire	7,368	798	8,024	821	10.015	946	3	15
Rhode Island	7,025	740	8,851	920	9.149	933	24	1
Vermont	4,005	782	4,639	875	4.490	821	12	-6
Middle Atlantic	252,751	686	277,040	746	293.961	785	9	5
New Jersey	46,768	634	52,493	699	53.239	693	10	-1
New York	12,184	695	133,310	752	142,899	802	8	7
Pennsylvania	83,769	705	91,238	767	97,823	819	9	7
Midwest								
East North Central	231,557	555	277,280	667	295,202	705	20	6
Illinois	66,997	586	80,564	700	84,779	734	19	5
Indiana	25,379	462	32,240	586	35,527	642	27	10
Michigan	48,427	523	56,449	622	60,463	658	19	6
Ohio	61,841	573	75,676	704	80,095	743	23	6
Wisconsin	28,913	612	32,351	679	34,338	714	11	5
West North Central	111,206	646	125,639	717	135,464	768	11	7
Iowa	19,600	673	23,704	815	22,770	805	21	-1
Kansas	14,574	616	15,943	664	16,863	683	8	3
Minnesota	32,184	788	32,229	774	33,911	798	-2	3
Missouri	25,635	521	31,866	636	38,277	751	22	18
Nebraska	10,325	657	11,094	691	11,627	728	5	5
North Dakota	4,264	652	5,637	822	6,239	923	26	12
South Dakota	4,623	670	5,164	731	5,777	818	9	12
outh								
South Atlantic	186,480	502	227,724	577	259.671	623	15	8
Delaware	3 832	643	4,423	722	5 661	885	12	23
District of Columbia	8'462	1.328	9,465	1,519	10·279	1,656	14	9
Florida	49,245	499	67,722	617	80.319	668	24	8
Georgia	24,756	452	29,365	503	33.860	545	11	8
Maryland	24'639	583	31,565	726	32·207	710	25	-2
North Carolina	27'536	468	32,460	527	37·568	586	13	11
South Carolina	12·537	401	13,761	417	15·180	444	4	6
Virginia	26,138	487	28,477	505	33.500	567	4	12
West Virginia	9 336	479	10,485	537	11.097	585	12	9

(continued on next page)

Table 10-36—Estimated Supply of Registered Nurses (RNs) Employed in Nursing by Region and State, 1980, 1984, and 1988[a]—Continued

	1980						Percent change in rate per 100,000 residents	
	Number of RNs	Rate per 100,000 residents	Number of RNs	Rate per 100,000 residents	Number of RNs	Rate per 100,000 residents	1980-84	1984-88
South (continued):								
East South Central.....	62,411	425	72,429	482	82,644	540	1[c]	12
Alabama.....	16,026	411	19,750	495	22,113	541	2[c]	9
Kentucky.....	16,972	463	16,799	451	19,495	523	—	16
Mississippi.....	9,052	359	10,577	407	12,147	461	13	13
Tennessee.....	20,360	443	25,302	536	28,889	595	23	11
West South Central.....	87,476	366	113,518	435	125,470	466	11	7
Arkansas.....	8,405	366	10,258	437	11,292	473	19	8
Louisiana.....	14,556	345	17,372	389	19,685	442	19	14
Oklahoma.....	10,509	346	13,569	411	15,036	458	13	11
Texas.....	54,0[6]	377	72,320	452	79,457	474	29	5
West							0	
Mountain.....	61,214	536	72,448	577	81,838	623	8	8
Arizona.....	16,685	611	19,015	623	23,191	685	2	10
Colorado.....	17,820	614	21,212	667	23,459	713	9	7
Idaho.....	4,062	429	5,039	503	4,963	501	17	<0.5
Montana.....	4,824	612	5,260	638	5,275	655	4	3
Nevada.....	3,950	489	4,849	532	6,367	636	9	20
New Mexico.....	5,478	420	7,255	509	7,489	500	21	-2
Utah.....	6,045	411	7,151	433	8,397	500	5	15
Wyoming.....	2,350	495	2,667	522	2,697	551	5	6
Pacific.....	170,672	535	199,734	584	221,869	607		4
Alaska.....	1,948	483	3,256	651	3,351	648	3	<0.5
California.....	122,176	514	141,834	554	159,808	575	9	4
Hawaii.....	4,763	492	6,462	622	5,923	545	25	-12
Oregon.....	1,208	652	18,081	676	20,466	753	8	11
Washington.....	2[4],576	592	30,100	692	33,121	729	16	5
							[4]7	

[a]Data for 1980 and 1984 as of November; data for 1988 as of March.

[b]Population data based on provisional estimates of resident population as of July 1, 1984 in the publication of U.S. Department of Commerce, Bureau of the Census, State Population Estimates, by Age and Components of Change: 1980 to 1984, Series P-25, No. 970, issued June 1985.

[c]Population data based on provisional estimates of resident population as of July 1, 1984 in the publication of U.S. Department of Commerce, Bureau of the Census, State Population and Household Estimates, with Age, Sex and Components of Change: 1981-1987, Series P-25, No. 1024, Issued May 1988.

SOURCES: E. B. Moses, The Registered Nurse Population: Findings from the National Sample Survey of Registered Nurses, November 1984, DHHS Pub. No. HRP-0906938 (Rockville, MD: HRSA, 1986); and U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report to the President and Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-90-1 (Rockville, MD: HRSA, June 1990), table VIII-A-3.

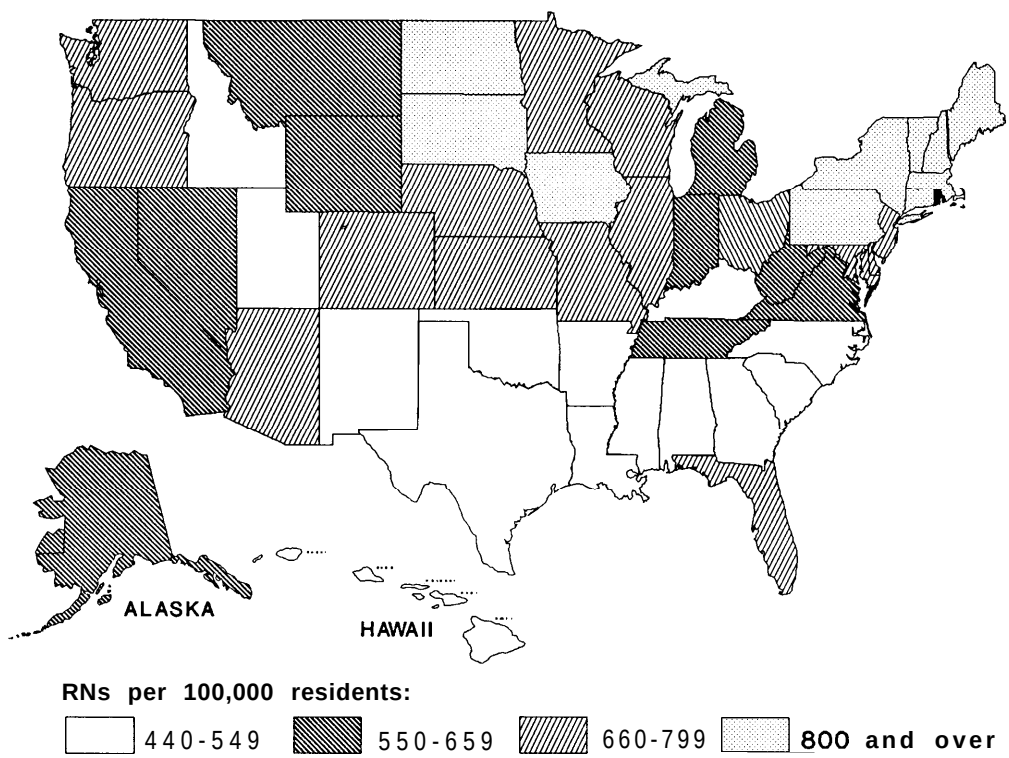
Table 10-37-Registered Nurse (RN) and Licensed Practical/Vocational Nurse (LP/VP) Supply in U.S. Community Hospitals,[a] 1981-88

	1981	1982	1983	1984	1985	1986	1987	1988
RNs:								
Total FTEs[b] (1,000s)	629	672	698	698	709	736	759	771
FTEs per 100 patients[c]	72.1	76.5	80.8	85.1	91.3	95.6	97.8	97.9
Vacancy rate	7.6	5.3	4.4	4.6	6.3	11.0	11.3	NA
LP/VNs :								
Total FTEs[b] (l,OOOs)	234	238	230	205	187	174	170	171
FTEs per 100 patients	26.8	27.1	26.6	25.0	24.1	22.6	21.9	21.7
Vacancy rate	5.5	3.4	2.8	3.3	NA	NA	NA	NA

NOTE: NA = not available.
[a] defined by the American Hospital Association.
[b] Full-time equivalent.
[c] Includes inpatients plus outpatient visits converted to inpatient equivalents.

SOURCE: American Hospital Association, Hospital Statistics, 1982-1990 eds. (Chicago, IL: AHA, 1982-1990); U.S. Department of Health and Human Services, Secretary's Commission on Nursing, Secretary's Commission on Nursing Final Report, Volume I (Washington, DC: December 1988), figure 1; U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to the President and Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 10-12.

Figure 10-6-Employed Registered Nurses (RNs) Per 100,000 Residents in the United States by State, March 1988



SOURCE: Office of Technology Assessment 1990. Based on data from U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report *to the President and Congress on the Status of Health Personnel in* the *United States,* DHHS Pub. No. HRS-P-OD-90-1 (Rockville, MD: HRSA, June 1990), figure VIII-6.

Table 10-38-Estimated Supply of Licensed Practical/ Vocational Nurses (LP/VNs) by Region, 1983[a]

	Number	Rate per 100,000 residents
United States	539,463	231
New England	33,004	264
Middle Atlantic	82,885	224
South Atlantic	86,872	224
East South Central	41,598	278
West South Central	70,671	274
East North Central	94,979	229
West North Central	48,729	280
Mountain	21,386	173
Pacific	59,339	176

[a]Includes only nurses actually employed as LP/VNs.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to the President and Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 10-7.

Table 10-39-Registered Nurses (RNs) Employed in Nursing, 1988, and Employed Licensed Practical/ Vocational Nurses (LP/VNs), 1983, by Primary Employment Setting

Employment setting	Number	Percent
Estimated RNs employed in nursing, 1988		
Hospital	1,104,978	67.9
Nursing home/extended care facility	107,805	6.6
Nursing education	30,005	1.8
Community/public health	110,886	6.8
Student health service	47,792	2.9
Occupational health	21,857	1.3
Ambulatory care	125,813	7.7
Private duty nursing	19,988	1.2
Self-employed	13,203	0.8
Other	43,321	2.7
Unknown	1,386	0.1
Total	1,627,035	100.0
Estimated LP/VNs employed as LP/VNs, 1983		
Hospital	310,842	57.6
Nursing home	121,398	22.5
Public/community health	13,574	2.5
Student health	4,200	0.8
Occupational health	6,056	1.1
Physicians or dentists office	48,969	9.1
Private duty	19,959	3.7
Other	6,237	1.2
Not known	8,229	1.5
Total	539,465	100.0

[a]Percentages may not add to 100 due to rounding.

SOURCES: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Division of Nursing, Rockville, MD, unpublished data from the 1988 National Sample Survey of Registered Nurses provided to OTA in 1989; U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to the President and Congress on the Status of Health Personnel in the United States, DHHS Pub. No.HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 10-11.

(421)[49] Similarly, the number of graduates from LP/VN programs increased until 1984-85 but has since dramatically declined, dropping by almost 20,000 between 1984-85 and 1987-88 (table 10-40()). While the number of programs preparing RNs has increased slightly in recent years, the number of LP/VN programs has decreased (table 10-40)(421)). BHPr projects a continuing decline in graduates from all basic nurSing education programs through the year 2020 (673). Between 1990 and 2020, the total supply of employed RNs is projected to decrease by 2.6 percent (from 1,687,100 to l,642,900), while the supply of employed RNs relative to population is projected to decrease by 17 percent (from 674 to 558 per 100,000 residents) (673). The total number of LP/VNs per 100,000 residents is projected to peak in 2004 and to subsequently experience a slow but steady decline (671).

The pool of potential nursing students also seems to be shrinking. An ongoing study of career interests of first-time freshmen college students conducted by the University of CaliFornia (Los Angeles) shows a marked decrease in the numbers indicating an interest in nursing (63).

The 1980s Nursing Shortage--Although in the future there is likely to be a shortage of nurses due to lack of nursing graduates, the shortage of RNs in the 1980s was primarily due to an increase in demand (698). Demand factors included:

[49]These figures include graduates of all RN programs. Recent data from the American Association of Colleges of Nursing (AACN) indicate that t number of first-time student graduates from 4-year programs (excluding students who were already RNs but were upgrading to a baccalaureate degree) continues to decrease—by 16 percent between 1987 and 1988, and by 11 percent between 1988 and 1989 (*19*). Enrollments in baccalaureate RN progr also continue to decrease, although more slowly during the past 2 years when compared with previous years (*20*).

Table 10-40-Number of Programs Preparing Registered Nurses (RNs) and Licensed Practical/ Vocational Nurses (LP/VNs) and Number of Graduates: 1976-77 and 1981-82 through 1988-89

Year	Number of programs	Number of graduates
RNs :		
1976 -77	1,358	77,755
1981 -82	1,401	74,052
1982-83	1,432	77,408
1983-84	1,466	80,312
1984-85	1,477	82,075
1985-86	1,473	77,027
1986-87	1,469	70,561
1987-88	1,465	64,839
1988-89	1,442	NA
LP/VNs:		
1976-77	**1,318**	46,614
1981-82	**1,309**	43,299
1982-83	**1,295**	45,174
1983-84	**1,297**	44,654
1984-85	**1,254**	36,955
1985-86	**1,165**	29,599
1986-87	**1,087**	27,285
1987-88	**1,068**	26,912
1988-89	**1,095**	NA

NOTE: NA= not available.

SOURCE: National League for Nursing, New York, NY, unpublished data provided by staff at the U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Rockville, MD, 1990.

- increasing demand for RNs in hospitals due to advances in medical technology, shorter hospital stays, and increased severity of illness of hospital patients, which results in intensification of required RN services, and reduction in hospitals' ancillary nursing staff, which increases the range of tasks that must be performed by RNs;
- increasing demand for RNs in nonhospital settings (e.g., ambulatory care and home health care); and
- increasing opportunities for RN employment outside of traditional medical settings (628).

Increase in demand for RNs in the hospital sector is evidenced by increases in both RN employment and vacancy rates. Although the average number of full-time equivalent (FTE)RNs per l00 patients in community hospitals increased by 21 percent from 1983 to 1987 (from 80.0 to 97.8) (figure 10-7),RN vacancy rates in these hospitals increased from 4.4 percent to 11.3 percent during the same period (table 10-37) (698).[50] As the number of RNs in hospitals has increased, both the number of LP/VNs and reportedly/VNvacancyrates have decreased (figure 10-7, table 10-37) (671,698). Nursing homes, which employed almost 7 percent of RNs in 1988 (673), reported an RN vacancy rate of 8 percent in 1987 (462). The number of RNs employed in nursing homes may increase in the near future due to new requirements for greater RN staffing in Medicare- and Medicaid-certified nursing homes (Public Law 100-203)(462,673).

Rural Supply

The proportion of RNs who work in rural areas has decreased in recent years, but it is not clear whether this is the result of decreased demand in rural settings or decreased supply of nurses willing to locate there. In 1988, 17 percent of all RNs employed in nursing in the United States were employed in rura1 areas, compared with 20 percent in 1980 (table 10-41)(681). The rural/urban distribution of RNs varies considerably by region. The West North Central and East South Central regions had the highest proportions of their nurses in rural areas in 1988 (31 percent and 30 percent, respectively) (681). The distribution of RNs across rural and urban areas in 1988 cannot be fully explained by the distribution of U.S. registered hospital beds, 21 percent of which were located in rural areas in 1988 (178).[51]

Rural RNs are concentrated in the most populated counties. According to a recent analysis of 1988 data, only 8.7 percent of all RNs employed in nursing were located in counties of fewer than 50,000 residents (table 10-42) (317). Most of these were in counties of more than 25,000 residents (table 10-42) (317).[52]

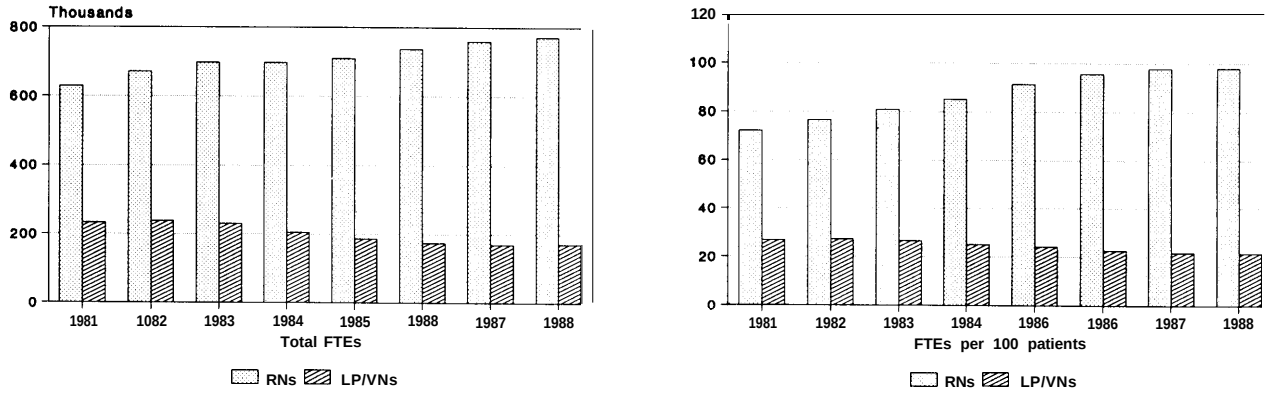
Compared with RNs in larger counties, RNs in small counties (50,000 or fewer residents) axe older, more likely to work full-time, more likely to work in

[50]Evidence of the nursing shortage is typically expressed in terms of budgeted staff vacancy rates at institutions which employ nurses. Budgeted vacancy rates may not be a true reflection of unfilled positions, however, due to use of temporsry nursing staff, and due to the tendency of administrators to use budgeted vacancies as a tool to retain discretionary funds for staff development (462).

[51]Declining occupancy rates in rural hospitals in recent years (see ch. 5) may help to explain the shift of RNs from rural to urban areas.

[52]In this analysis, some of the larger counties (more than 50,000 residents) are nonmetro counties.

Figure 10-7—Registered Nurses (RNs) and Licensed Practical/Vocational Nurses (LP/VNs) in U.S. Community Hospitals:[a] Total FTEs[b] and FTEs per 100 Patients,' 1981-88



[a]As defined by the American Hospital Association.
[b]Full-time equivalent.
[c]Includes inpatients plus outpatient visits converted to inpatient equivalents.

SOURCE: Office of Technology Assessment, 1990. Data from American Hospital Association, *Hospital Statistics* (Chicago, IL: AHA, 1982-1989 eds).

Table 10-41—Metropolitan/Nonmetropolitan Distribution of Registered Nurses (RNs) Employed in Nursing in the United States by Region, 1980 and 1988[a]

	Employed RNs, 1980				Employed RNs, 1988			
	Total[b]	Metro		Nonmetro	Total[b]	Metro		Nonmetro
United States	1,268,170	1,010,934	(80%)	257,936 (20%)	1,626,026	1,344,143	(83%)	281,883 (17%)
New England	106,027	80,297	(76%)	25,730 (24%)	130,838	106,908	(82%)	23,930 (18%)
Middle Atlantic	252,435	220,639	(87%)	31,796 (13%)	293,961	262,474	(89%)	31,487 (11%)
East North Central	231,324	186,148	(80%)	45,176 (20%)	294,850	248,730	(84%)	46,120 (16%)
West North Central	111,206	71,463	(64%)	39,743 (36%)	135,382	93,432	(69%)	41,950 (31%)
South Atlantic	186,355	141,746	(76%)	44,609 (24%)	259,502	207,568	(80%)	51,934 (20%)
East South Central	62,382	44,854	(72%)	17,528 (28%)	82,594	58,182	(70%)	24,412 (30%)
West South Central	87,375	71,199	(81%)	16,176 (19%)	125,307	104,866	(84%)	20,441 (16%)
Mountain	61,154	42,744	(70%)	18,410 (30%)	81,828	61,403	(75%)	20,425 (25%)
Pacific	170,612	151,844	(89%)	18,768 (11%)	221,765	200,581	(90%)	21,184 (10%)

[a]1980 data as of November; 1988 data as of March.
[b]Total excludes RNs whose metro or nonmetro location was not known.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Division of Nursing, Rockville, MD, unpublished data from the 1980 and 1988 National Sample Surveys of Registered Nurses.

nursing home or public health settings, less likely to work in hospitals, and less likely to have a baccalaureate degree (table 10-43) (317). RNs in small counties are also more likely to work in administrative or supervisory positions. Most of these characteristics are most pronounced in the smallest counties; for example, RNs in the smallest counties are more than three times as likely as RNs in the largest counties to work in a nursing home or extended care facility. Oddly enough, within the smaller counties, the percentage of RNs with a baccalaureate degree as their highest degree in nursing is highest in the smallest counties (table 10-43) (317). This finding may be indicative of a more pressing need for well-trained RNs in the smallest, most remote facilities.

Rural RNs are less likely than urban RNs to be employed in nursing (77 v. 81 percent in 1988) (681). Analysis of 1984 national survey data revealed that 14 percent of RNs who resided in rural areas commuted to urban areas to work, while only

Table 10-42—Estimated Number and Distribution of Registered Nurses Employed in Nursing by County Population Size, *1988*

county population size[a]	Estimated number of RNs	Percent distribution[b]
All U.S. counties.	1,627,035	100.0
More than 50,000	1,485,999	91.3
50,000 or fewer	140,057	8.7
25,001 to 50,000: . . .	79,117	4.8
10,001 to 25,000. . . .	46,955	2.9
10,000 or fewer.. . . .	13,986	0.9

[a]County population size does not necessarily reflect metro or nonmetro status.
[b]Percentages may not add to 100 due to rounding.

SOURCE: D.A. Kindig, University of Wisconsin, Madison, WI, and H. Movassaghi, Ithaca College, Ithaca, NY, unpublished analysis of data from the 1988 National Sample Survey of Registered Nurses (provided by the Division of Nursing, Bureau of Health Professions) conducted under contract with the University of North Dakota Rural Health Research Center, Grand Forks, ND, 1989.

2 percent of RNs residing in urban areas commuted to rural practice sites (699).

Data from selected States indicate substantial rural/urban differences in RN and LP/VN distribution. For example:

- In Texas, in 1986, the number of employed RNs per 100,000 residents was 228 in rural counties, compared with 460 in urban counties (708).
- ***In Arizona, in*** 1987, the total number of RNs per 100,000 residents was also much lower in rural than in urban counties (477 v. 850). LP/VN availability was also lower in rural than in urban counties (186 v. 238 per 100,000) (220).
- In Oklahoma, in 1987, the total number of RNs per 100,000 residents was again much lower in rural than in urban counties (397v. 686), but the ratio of LP/VNs to 100,000 residents was actually higher in rural than in urban counties (387 v. 286) (451).

These differences may be explained to some extent by rural/urban distribution of hospitals, where most RNs and LP/VNs are employed. In Texas, in 1986, for example, only 19 percent of the State's hospital beds were located in rural counties, and 42 of the 43 Texas counties without a hospital were rural (708). A recent study found that vacancy rates for RNs, LP/VNs, and critical care RNs in this State were only slightly higher in rural than in urban hospitals (595).

Nurse Supply In Rural and Urban Hospitals

Rural hospitals have markedly fewer RNs and distinctly lower RN-to-LP/VN ratios than their urban counterparts (table 10-44) (625). Among rural hospitals, hospitals in frontier areas have especially few FTE RNs--as little as one-fifth as many FTE RNs as nonfrontier rural hospitals of comparable size. Medicare-certified sole community hospitals tend to have slightly larger FTE RN staffs than those of other rural hospitals (625).

In contrast, rural hospitals of any given size generally have slightly more FTE LP/VNs than their urban counterparts (table 10-44). Again, however, frontier hospitals have the fewest FTE LP/VNs (625).

Urban hospitals have up to two times as many FTE RNs per FTE LP/VN as do rural hospitals of comparable size (table 10-44) (625), reflecting a greater reliance on nurses with less training and lower salaries in rural hospitals. It is unclear whether the greater representation of LP/VNs in rural hospitals is due to the hospitals' inability to pay the higher RN salaries, their inability to recruit qualified RNs from the larger national pool, or a lower demand for RNs in these hospitals.

Eighteen percent of large urban hospitals and 9.5 percent of rural hospitals reported closing beds in 1987 due to shortage of nursing staff (699). Although a larger proportion of rural than urban hospitals report no vacant RN positions, high RN vacancy rates (over 15 percent) are more common in rural than in urban hospitals (699). Because most rural hospitals are small and employ relatively few RNs, they may be subject to extreme shifts in vacancy rates, and they may be more sensitive to the loss of a single nursing employee.

Data are scarce regarding the extent of the nursing shortage in ambulatory and other nonhospital, nonnursing home health care settings, which employ approximately 25 percent of all RNs and 22 percent of all LP/VNs (table 10-39) (671,681). Lack of such data hinders accurate assessment of the extent of the nursing shortage. This limitation is particularly troubling given the recent increase in RN employment in ambulatory care settings (673) and given the relatively large proportion of RNs in small rural

Table 10-43-Characteristics of Registered Nurses (RNs) Employed in Nursing by County Population Size,[a] 1988

	All Us. counties	County population size: more than 50,000 residents	50,000 or fewer residents	25,001 to 50,000 residents	10,001 to 25,000 residents	10,000 or fewer residents
	Percent of RNs:					
Basic nursing education:						
Diploma	44.6	44.5	45.6	43.8	47.1	50.9
Associate degree	31.5	30.9	38.6	40.5	37.2	32.4
Baccalaureate, masters or doctoral degree	23.5	24.2	15.5	15.4	15.5	16.7
Unknown	0.4	0.4	0.2	0.3	0.2	*
Total[b]	100.0	100.0	100.0	100.0	100.0	100.0
Highest nursing degree:						
Diploma	36.5	36.1	41.1	39.5	42.7	44.5
Associate degree	28.0	27.2	36.2	38.5	34.2	29.1
Baccaluareate degree	28.7	29.5	20.1	18.8	21.1	24.3
Masters or doctoral degree	6.3	6.7	2.5	2.9	1.8	2.1
Unknown	0.4	0.4	0.2	0.3	0.2	*
Total[b]	100.0	100.0	100.0	100.0	100.0	100.0
Received degree/certificate from nurse practitioner/midwife program:						
Yes	3.4	3.5	2.3	2.8	1.6	1.9
No	96.1	96.0	97.4	96.9	98.2	98.1
Unknown	0.5	0.5	0.2	0.3	0.2	*
Total[b]	100.0	100.0	100.0	100.0	100.0	100.0
Age:						
<25	4.7	4.8	3.4	3.7	2.7	4.0
25-34	33.3	33.6	30.4	30.4	31.1	27.7
35-44	31.7	31.6	31.2	31.8	31.6	25.8
45-5.4	19.2	19.0	21.4	20.4	21.2	27.5
>55	10.7	10.4	13.6	13.5	13.2	14.7
Unknown	0.5	0.5	0.2	0.2	0.2	0.2
Total[b]	100.0	100.0	100.0	100.0	100.0	100.0
Employment status:						
Full-time	67.6	67.4	69.5	71.1	67.1	68.0
Part-time	32.4	32.5	30.5	28.9	32.9	32.0
Full-time/part-time	0.1	0.1	*	*	*	*
Total	100.0	100.0	100.0	100.0	100.0	100.0
Field of employment:						
Hospital	67.9	68.9	57.8	60.4	54.7	53.7
Nursing home/extended care	6.6	6.0	13.5	11.8	14.5	19.8
Nursing education	1.8	1.8	1.8	2.4	0.9	1.2
Public/community health	6.8	6.3	11.8	10.5	13.4	14.4
Ambulatory care	7.7	7.7	7.7	7.8	8.2	5.7
Other[c]	8.9	9.2	7.3	7.1	8.2	5.4
Unknown	0.1	0.1	0.0	*	0.1	*
Total[b]	100.0	100.0	100.0	100.0	100.0	100.0

counties who work in these settings (table 10-43) (317).

OTHER HEALTH PROFESSIONALS

Dentists

National Supply

In 1986, there were 143,000 practicing dentists in the United States--a 40 percent increase in absolute numbers since 1970, and a 20 percent increase in the active dentist-to-population ratio (table 10-45)(671). Of these dentists, 85 percent were in general practice, but this proportion is declining (671). From 1981 to 1987, the general and pediatric dentist-to-population ratio increased by only l.4 percent, while the dental specialist-to-population ratio increased by 35 percent (table 10-46) (686). The trend towards specialty practice in dentistry is slight compared with that seen in medicine, but it maybe cause for concern in the future if overall supply decreases (table 10-47) (673).

Table 10-43--Characteristics of Registered Nurses (RNs) Employed in Nursing by County Population Size[a], 1988-Continued

	All U.S. counties	County population size: more than 50,000 residents	50,000 or fewer residents	25,001 to 50,000 residents	10,001 to 25,000 residents	10,000 or fewer residents
	Percent of RNs:					
Title of position:						
Administrator/Assistant						
administrator	6.0	5.6	10.5	8.4	11.4	19.6
Supervisor	5.6	5.2	9.9	10.1	10.0	8.3
Instructor	3.8	3.8	4.0	4.7	3.3	2.6
Staff/general duty nurse	66.9	67.3	62.5	62.6	63.2	59.6
Practitioner/midwife	1.4	1.4	1.4	1.7	1.1	1.2
Clinical specialist	1.8	1.9	0.7	0.7	0.7	0.4
Certified nurse anesthetist	1.0	1.0	1.4	1.3	1.5	1.5
Other	13.0	13.2	9.3	10.2	8.7	6.9
Unknown	0.4	0.4	0.2	0.3	0.1	*
Total	100.0	100.0	100.0	100.0	100.0	100.0

NOTE: * = less than 0.05 percent of total.
[a]County population size does not necessarily reflect metro or nonmetro status.
[b]Percentages may not add to 100 due to rounding.
[c]"Other" includes the following: student health, occupational health, private duty, self-employment, and other.
[d]"Other" includes the following: consultant, head nurse/assistant head nurse, nurse clinician, research, private duty, and other.

SOURCE: D.A. Kindig, University of Wisconsin, Madison, WI, and H. Movassaghi, Ithaca College, Ithaca, NY, unpublished analysis of data from the 1988 National Sample Survey of Registered Nurses (provided by the Division of Nursing, Bureau of Health Professions) conducted under contract with the University of North Dakota Rural Health Research Center, Grand Forks, ND, 1989.

Box 10-D—Provider Profile: Dentists

Dentists undergo 4 years of post-baccalaureate undergraduate training in general and some specialty dentistry (671). Graduates of these programs may enter dental residency programs to receive training in orthodontics, oral and maxillofacial surgery, periodontics, pedodontics, endodontics, prosthodontics, public health dentistry, or oral pathology (671).

Variations inactive dentist supply amonggeographic regions and States areas great as for other health professions. In 1986, the ratio of dentists to 100,000 residents in the United States was 57.3. Ratios in the States ranged from a high of 76.2 in Connecticut to a low of 35.2 in Mississippi (671). Regionally, ratios in the Northeast were well above the national average, while the South fell well below (671). These patterns show little difference from those existing in 1970 (671), suggesting that increased national supply has had little effect on State and regional distribution.

In 1988, there were 793 designated dental HMSAs in the United States, with a resident population of almost 16 million. An estimated 1,729 dentists would be needed to remove these designations. Over 70 percent of all dental HMSAs are in rural areas.[53]

Trends in the number of dental students suggest a leveling off in future supply. For example:

- the number of applicants to dental schools decreased by nearly two-thirds between 1975 and 1986, from 15,734 to 5,724;
- the number of first-year enrollments decreased by 27 percent from 1978-79 to 1986-87; and
- the number of graduates decreased by 14 percent from 1982-83 to 1985-86(671).

Rural Supply

The distribution of dentists across urban and rural areas is very similar to that of physicians. For all

[53]See ch. 11, table 11-5.

Table 10-44-Estimated Supply of Registered Nurses (RNs) and Licensed Practical Vocational Nurses (LP/VNs) in U.S. Registered Community Hospitals by Metropolitan/Nonmetropolitan, Frontier, and Sole Community Hospital Status, 1987

	Mean number of estimated FTE[a] RNs, by hospital bed size:				
	6-24	25-49	50-99	100-199	200-299
All U.S. community hospitals[b]	7.6	15.4	37.3	90.5	186.8
Metro	9.5	22.6	48.8	105.2	197.6
Nonmetro	7.3	14.2	31.8	69.9	138.9
Within nonmetro:					
Frontier	6.7	9.8	16.3	32.5*	26.0*
Not frontier	7.5	15.0	33.4	70.8	139.8
Sole community hospital[d]	8.1	15.4	36.2	81.7	132.9*
Not sole community hospital	7.1	14.0	31.3	68.7	139.6

	Mean number of estimated FTE[a] LP/VNs, by hospital bed size:				
	6-24	25-49	50-99	100-199	200-299
All U.S. community hospitals[b]	3.5	7.4	15.2	27.8	45.3
Metro	2.6	7.5	15.7	27.0	43.0
Nonmetro	3.6	7.4	14.9	28.9	55.5
Within nonmetro:					
Frontier	3.0	4.3	6.9	6.9*	18.0*
Not frontier	3.9	8.0	15.7	29.5	55.8
Sole community hospital[d]	2.7	6.4	13.3	29.5	45.5*
Not sole community hospital	3.9	7,6	15.1	28.9	56.5

	Estimated FTE[a] RN-to-LP/VN ratio[c], by hospital bed size category:				
	6-24	25-49	50-99	100-199	200-299
All U.S. community hospitals[b,d]	2.88	3.11	3.81	5.70	8.74
Metro	3.82*	4.25	4.57	6.69	9.75
Nonmetro	2.75	2.91	3.45	4.33	4.28

NOTE: "*" indicates that the figure is based on fewer than 30 cases.
[a]Full-time equivalent.
[b]The definition of "community hospital" used by OTA in this analysis differs slightly from that used by the American Hospital Association (see app. C)
[c]Ratios were calculated using nonrounded figures.
[d]130 hospitals without any LP/VNs, were dropped from the analysis.

SOURCE: U.S. Congress, Office of Technology Assessment, analysis of data from American Hospital Association 1987 Survey of Hospitals, performed for Rural Health Care report (see app. C).

dentists, office-based dentists, and general practice and pediatric dentists, ratios per 100,000 residents were much lower in rural than in urban counties in 1987 (table 10-48) (686). Within rural counties, ratios were directly related to county size, with the smallest counties (fewer than 2,500 residents) having fewer than one-half as many dentists per capita as the largest counties. Interestingly, the greatest increases in both general and specialist dentist supply between 1981 and 1987 occurred in the smaller rural counties (table 10-46)(686). However, in 1987, 183 counties in the United States still had no general practice or pediatric dentist (table 10-48) *(686).* All but two of these counties were rural counties of fewer than 25,000 residents, and most of these were counties of low population density.

Data on the age distribution of dentists show no notable rural/urban differences, but the proportion of dentists who are young decreased substantially in all areas between 1981 and 1987 (686). This trend reflects the decreasing number of new graduates in recent years. As older dentists retire, rural areas will have to compete with urban areas for an increasingly limited supply of new dentists.

Table 10-45-Supply and Distribution of Active Dentists by General and Specialty Practice, 1970,1980, and 1986[a]

Specialty	1970 Number	1970 Percent[c]	1970 Dentists per 100,000 people[b]	1980 Number	1980 Percent[c]	1980 Dentists per 100,000 people[b]	1986 Number	1986 Percent[c]	1986 Dentists per 100,000 people[b]
All active	102,200	100.0	49.5	126,200	100.0	55.2	143,000	100.0	58.9
General practice	92,880	90.9	45.0	109,050	86.4	47.7	121,700	85.1	50.2
All specialties	9,320	9.1	4.5	17,150	13.6	7.5	21,300	14.9	8.8
Orthodontics	3,900	3.8	1.9	6,560	5.2	2.9	7,150	5.0	2.9
Oral & maxillo-facial surgery	2,190	2.1	1.1	3,960	3.1	1.7	4,730	3.3	1.9
Periodontics	930	0.9	0.5	2,240	1.8	1.0	3,030	2.1	1.2
Pedodontics	1,070	1.0	0.5	2,060	1.6	0.9	2,600	1.8	1.1
Endodontics	460	0.5	0.2	1,170	0.9	0.5	1,900	1.3	0.8
Prosthodontics	590	0.6	0.3	950	0.8	0.4	1,560	1.1	0.6
Public health dentistry	90	0.1	*	110	0.1	0.1	170	0.1	0.1
Oral pathology	90	0.1	*	100	0.1	*	160	0.1	0.1

NOTE: "*" = fewer than 0.05 dentists per 100,000 people.
[a]Includes dentists in Federal service.
[b]All ratios are based on total population.
[c]Percentages may not add to 100 due to rounding.

SOURCE: U.S. Department of Health & Human Services, Health Resources and Services Administration, Bureau of Health Professions, Sixth Report to The President & Congress on The Status of Health Personnel in The United States, DHHS Pub. No. HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 5-4.

Table 1046-Number of General Practice and Pediatric Dentists and Other Specialty Dentists Per 1OO,OOO Residents by Type of County, 1981 and 1987

	General practice and pediatric dentists[a]			Other specialties		
	Rate per 100,000 residents		Percent change,	Rate per 100.000 residents		Percent change,
	1981	1987	1981-87	1981	1987	1981-87
Metro	45.7	46.2	1.2	7.0	9.3	32.6
Nonmetro	31.2	31.6	1.2	2.0	3.0	49.9
50,000 or more	34.2	34.0	-0.7	3.8	5.5	43.5
25,000 to 49,999	31.8	32.2	1.2	1.7	2.7	52.6
10,000 to 24,999	28.2	29.1	3.0	0.5	0.8	67.6
5,000 to 9,999	25.8	27.1	5.1	0.2	0.4	103.5
2,500 to 4,999	25.5	25.5	0.1	0.1	0.7	420.5
fewer than 2,500	13.2	14.4	8.7	0.0	0.0	0.0
Population < 10,000:						
<=6 persons/square mile	27.7	28.7	3.7	0.1	0.5	520.6
>6 persons/square mile	23.9	25.0	4.7	0.2	0.4	86.3
U.S. total	42.3	42.9	1.4	5.8	7.9	34.7

[a]Includes both full-time and part-time dentists. Part-time dentists are counted as full-time dentists.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Office of Data Analysis and Management, Rockville, MD, unpublished data from the Area Resource File system provided to OTA in 1989 and 1990.

Table 10-47-Supply of Active Dentists in the United States: Estimated 1988 and Projected 1990-2020

Year	Number of active dentists	Active dentists per 100,000 people[a]
1988	146,800	59.4
1990	149,700	59.8
2000	154,600	57.6
2010	151,200	53.5
2020	140,700	47.8

[a]Ratios are based on total population, including Armed Forces overseas as of July 1 for 1990 and succeeding years.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report to the President and Congress on the Status of Health Personnel in the United States, DHHS Pub. No. HRS-P-OD-90-1 (Rockville, MD: HRSA, June 1990), table VII-A-5.

Box 10-E—Provider Profile: Pharmacists

In order to obtain a license, pharmacists must complete either a 5-year baccalaureate education program or a 6-year doctoral program (671). The amount of preprofessional college study required by these programs varies from O to 2 years. The number of entry-level doctoral pharmacy programs and degrees awarded has increased in recent years, and this increase is projected to continue. The major dimensions of pharmacy practice include: general management and administration of the pharmacy; activities related to processing the prescription; drug-related decisionmaking and patient care functions; drug preparation, distribution, and control; and education of health care professionals and patients (671).

Table 10-48--Number of Dentists Per 100,000 Residents and Number of CountiesWithout General Practice or Pediatric Dentists by Typeof County, 1987

	Number of dentists[a] per 100,000 residents			Counties without general practice or pediatric dentists, 1987	
	Total	Office-based	General practice and pediatric	Number of counties	Resident population
Metro	57.7	55.5	46.2	2	15,400
Nonmetro	35.3	34.6	31.6	181	731,500
50,000 or more	40.4	39.5	34.0	0	0
25,000 to 49,999	35.5	34.8	32.2	0	0
10,000 to 24,999	30.4	29.8	29.1	11	141,200
5,000 to 9,999	28.1	27.5	27.1	41	291,700
2,500 to 4,999	26.6	26.3	25.5	48	178,300
fewer than 2,500	15.0	14.4	14.4	81	120,300
Population < 10,000:					
<=6 persons/square mile	29.7	29.2	28.7	115	272,600
>6 persons/square mile	26.0	25.4	25.0	57	333,100
U.S. total	52.7	50.8	42.9	183	746,900

[a]Includes both full-time and part-time dentists.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Office of Data Analysis and Management, Rockville, MD, unpublished data from the Area Resource File system provided to OTA in 1989 and 1990.

Pharmacists

NationalSupply

There were an estimated 157,800 practicing pharmacists in the United States in 1988 (673). Paralleling the pattern in dentist supply, the absolute number of pharmacists increased by 40 percent and the pharmacist-to-population ratio increased by 17 percent from 1970 to 1988 (table 10-49) (673). Significant trends in the pharmacy profession include:

- an increase in the proportion of pharmacists who are female (from 4 percent of the active workforce in 1950 to 26 percent in 1988)(673);
- an increase in the percentage of minority pharmacists (from 8.9 percent in 1980 to 10.5

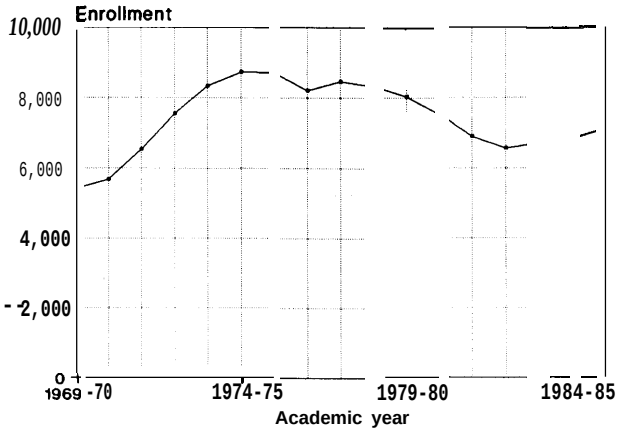
Table 10-49-Supply of Professionally Active Pharmacists, Selected Years: Estimated 1970-1988, and Projected 1990-202@

Year	Number of active pharmacists	Active pharmacists per 100,000 people[b]
1970	112,600	54.5
1980	142,400	62.2
1988	157,800	63.8
1990	161,600	64.5
2000	181,400	67.6
2010	200,500	71.0
2020	213,800	72.6
Percent change, 1970-1988	40.1	17.1
Percent change, 1988-2020	35.5	13.8

[a]Includes pharmacists in Federal service.
[b]Ratios based on total population, including Armed Forces overseas, as of July 1.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report to The President & Congress on The Status of Health Personnel in The United States, DHHS Pub. No. HRS-P-OD-90-1 (Rockville, MD: HRSA, June 1990), table XII-1.

Figure10-8--First Year Enrollment in U.S. Schools of Pharmacy, Academic Years 1969-70 Through 1985-86"



[a]Includes students in the first of 3 years of professional pharmacy education. Excludes students in pre-pharmacy education.

SOURCE: Office of Technology Assessment, 1990. Data from U.S. Department ofHealthandHuman Services, Health Resources and Services Administration, Bureau of Health Professions, *Sixth Report to ThePresident and Congress on The Status of Health Personnel in The United States,* DHHS Pub. No. HRS-P-OD-88-1(Rockville, MD:HRSA, June 1988), table 8-3.

percent in 1988)(67.?); and

- a change in professional focus from merely distributing drugs to providing a wider range of services, including quality assurance, patient education, patient care activities, and monitoring in order to reduce adverse drug effects (671).

After decreasing for a number of years, enrollments in U.S. schools of pharmacy have recently increased slightly, although they are still well below the peak level reached in 1974-75 (figure 10-8) (671). As of 1988, there were 74 colleges of pharmacy in the United States (466).

The National Association of Boards of Pharmacy reported that 68 percent of all active pharmacists in 1986 were in community pharmacies, with the great majority in chain store pharmacies (671). Only 8 percent were in independent establishments. Just over 20 percent were working in hospital settings, and the remaining 12 percent were employed in manufacturing, wholesale practice, teaching, government agencies, and other areas (671). The Federal Government at one time designated pharmacy HMSAs but no longer does so (see ch. 11).

BHPr projects continuing increases in both the number of active pharmacists and the pharmacist-to-population ratio over the next three decades (table 10-49) (673). The increasing number of female pharmacists in the work force may lower the overall number of FTE pharmacists, since female pharmacists tend to work fewer hours than their male counterparts (673). Despite recent increases in supply, however, demand is outpacing supply, and many employers have reported difficulty in recruiting for vacant pharmacist positions (673). Taking into account recent trends in the output of the pharmaceutical industry, as well as the expanded clinical role played by pharmacists, future requirements may continue to exceed supply.

Rural Supply

Current information on the national rural/urban distribution of pharmacists is scarce. No national census of pharmacists has been conducted since the 1970s, and no information on the rural/urban distribution of pharmacists is available from that census

(466).[54] State studies that examined the rural/urban distribution of pharmacists during the 1980s suggest there are a few areas with shortages but little overall reason for concern.

- ***In Georgia, in*** 1983, only one county lacked a licensed pharmacist, and the pharmacist-to-100,000 population ratio was only slightly lower in rural than in urban counties (81 v. 88) (740).
- ***In Texas, in*** 1988, 14 rural counties had no pharmacist (575).
- ***In Arizona, in*** 1987, the average pharrnacist-to-100,000 population ratio in the 13 rural counties was 47 (range 18-58) as compared with 78 in the 2 urban counties (220).
- ***In Oklahoma, in*** 1987, the pharmacist-to-100,000 population ratio in rural counties was 67 compared with 72 in urban counties (451).
- ***In Nebraska, in 1981, 52*** percent of all active pharmacists were located in the State's 4 urban counties (429). This distribution closely parallels that of Nebraska's resident population, 53 percent of whom resided in urban counties in 1986 (631).

Optometrists

National Supply

The active optometrist-to-100,000 population ratio increased from 8.9 in 1970 to 10.6 in 1988. BHPr projects that the ratio will increase to 14.2 active optometrists per 100,000 residents by 2020 (table 10-50) (673).

The number of applicants to schools and colleges of optometry peaked in 1975-1976 and has declined continuously since then (671). Enrollments increased until 1985-86 but have since leveled off (671,673); the number of graduates increased until 1983-84, declined slightly in 1984-85, and has remained relatively stable since that time (671,673).

The American Optometric Association (AOA) estimates that nearly three-fourths of the 25,400 practicing optometrists in the United States in 1989 were in independent practice, with the remainder employed by HMOs, ophthalmologists, optical chains, the Armed Forces, and other employers (56). The average age of optometrists is decreasing: from *1980* to 1988, the median age fell from 49 to 41 years (673). The proportion of all optometrists who are women is expected to increase from 11.5 percent in 1988 to 28.4 percent in the year 2000 (673). As for pharmacists, the Federal Government has ceased to designate HMSAs for vision care providers (see ch. 11).

Box 10-F—Provider Profile: Optometrists

Optometrists examine, diagnose, and treat problems of the eyes and vision system (673). Optometry students must complete from 2 to 3 years of preoptometry higher education before entering a 4-year program in optometry. On completion of undergraduate training, some optometrists enter specialized residency programs in fields such as family practice, primary care, geriatric, pediatric, and rehabilitative optometry (671).

Table 10-50-Supply of Professionally Active Optometrists, Selected Years: Estimated 1970-1988, and Projected 1990-2020[a]

Year	Number of active optometrists[a]	Active optometrists per 100,000 people[b]
1970	18,400	8.9
1980	22,200	9.7
1988	26,100	10.6
1990	27,100	10.8
2000	33,100	12.3
2010	38,800	13.7
2020	41,700	14.2

[a]Includes optometrists in Federal service.
[b]Ratios based on total population, including Armed Forces overseas, as of July 1.

SOURCE: U.S. Department of Health & Human Services, Health Resources and Services Administration, Bureau of Health Professions, Seventh Report to The President & Congress on The Status of Health Personnel in The United States, DHHS Pub. No. HRS-P-OD-90-1 (Rockville, MD: HRSA, June 1990), table XI-A-1.

Rural Supply

Optometrists are important providers of primary eye and vision care in areas that lack ophthalmologists. An analysis of 1983 registries of optometrists and ophthalmologists conducted by the AOA found

[54]The American Association of Colleges of Pharmacy, in cooperation with the National Association of Boards of Pharmacy, is currently preparing to conduct another census. Rural/urban distributional information will be available from this census, but not for another 2 years (46@.

that optometrists were practicing in 6,612 communities[55] in the United States and in 4,153 were the only providers of primary eye/vision care (table 10-51) (56). It is not known whether optometrists are more or less likely than ophthalmologists to practice in rural areas, because available data are neither comparable nor consistent. Over one-third of optometrists practice in communities of fewer than 25,000 residents (table 10-52) (42).[56] Twenty-one percent of ophthalmologists[57] surveyed in 1988 were practicing in large (more than 10,000 residents) "rural' '[58] areas, and 2 percent in small (fewer than 10,000 residents) "rural" areas (49). However, data from the AMA show only 4.7 percent of all ophthalmologists practicing in rural counties in 1988 (686).

Data from two States suggest that the urban/rural distribution of optometrists is more even than that of many other health professionals.

- ***In Arizona, in 1987, the*** optometrist-to-lOO,OOO population ratio was 8 in rural counties compared with 10 in urban counties (220).
- ***In Oklahoma, in*** 1987, the optometrist-to-100,000 population ratio was higher in rural than in urban counties (13.6 v. 9.8) (451).

Allied Health Professionals

The term "allied health" has no set definition. The vagueness of the term is due in part to the continuing and rapid evolution of the numerous health fields it includes, and the lack of a set definition may be one reason why the allied health professions have historically received relatively little attention from researchers and policymakers. Allied health professionals (AHPs) are a diverse group of practitioners who makeup the majority of the health care work force, have education varying from on-the-job training to advanced college degrees, and are employed in all types of health care settings. Table 10-53 lists some of the many professions in this category.

National Supply

Between 1970 and 1986, the total estimated number of AHPs employed in the United States almost doubled, reaching 1.3 million[59] in 1986 (table 10-53) (671). This rapid growth is largely attributable to increasing need to delegate tasks formerly performed by other health professionals, and the rapid evolution of medical technologies that require skilled personnel (288). Occupations with the greatest rates of growth between 1975 and 1986 were dietetic technicians, medical technologists, and medical laboratory technicians (table 10-53) (671).

Despite this growth, concerns have mounted in recent years over a shortage of certain AHPs. The paucity of information regarding the demand for and supply of AHPs prevents an accurate determination of the degree of shortage.[60] However, available data and anecdotal evidence suggest that shortages may reach critical proportions during the next two decades if current downward trends in enrollment in AHP training programs continue.

Characteristics of the AHP Labor Market-In a 1989 report on allied health services, the Institute of Medicine (IOM) found that the AHP labor market is characterized by:

- a predominantly female work force;
- technically competent workers;
- highly regulated professions and work environments;
- educational programs that have difficulty capturing limited resources and recruiting enough students; and
- a rapidly changing work environment where employers must make decisions as to the hiring and compensation of a wide range of health

[55]"Communities" include cities and towns in the United States, which are listed by State in directories published by the American Optometric Association (*41*) and the American Academy of Ophthalmology (*14*).

[56]Data do not distinguish between rural and urban location.

[57]Includes only ophthalmologists belonging to the American Academy of Ophthalmology.

[58]Does not reflect metro/nonmetro location. Some smaller communities may be in metro areas. Size of community was determined by survey analysts, who looked up the name of each community and placed it in one of four size categories, the two smallest of which were termed "rural" (50).

[59]This somewhat restrictive estimate, which recognizes only specific groups of AHPs who have received professional training at the post-secondary level, is less than one-half of a recent estimate made by the American Society of Allied Health Professionals (ASAHP). Using a broader definition, ASAHP estimates a supply of over 3 million AHPs (462).

[60]The Bureau of Labor Statistics (BLS) collects information on certain categories of licensed, employed AHPs, but these data are limited because many AHPs lack formal training or licensure. For example, the BLS estimated that there were 57,000 employed speech-language pathologists and audiologists in 1986 (table 10-53). The American Speech-Language-Hearing Association (ASHA), however, estimated that approximately 86,700 speech-language pathologists and audiologists (both licensed and nonlicensed) were active in the work force in 1987 (288).

Table 10-51—Number of Cities With Optometrists and Ophthalmologists by State, 1983

State	Cities with optometrists	Cities with ophthalmologists	Difference[a]
Alabama	101	27	74
Alaska	14	5	9
Arizona	55	23	32
Arkansas	92	24	68
California	505	254	251
Colorado	73	27	46
Connecticut	104	55	49
Delaware	11	7	4
District of Columbia	1	1	0
Florida	207	116	91
Georgia	146	50	96
Hawaii	24	8	16
Idaho	49	13	36
Illinois	326	117	209
Indiana	176	51	125
Iowa	145	30	115
Kansas	119	27	92
Kentucky	116	32	84
Louisiana	88	34	54
Maine	67	23	44
Maryland	103	52	51
Massachusetts	218	97	121
Michigan	253	94	159
Minnesota	166	49	117
Mississippi	81	26	55
Missouri	152	35	117
Montana	49	11	38
Nebraska	74	13	61
Nevada	16	6	10
New Hampshire	38	22	16
New Jersey	292	148	144
New Mexico	39	16	23
New York	400	212	188
North Carolina	176	59	117
North Dakota	42	7	35
Ohio	313	91	222
Oklahoma	105	24	81
Oregon	95	29	66
Pennsylvania	407	162	245
Rhode Island	30	12	18
South Carolina	91	27	64
South Dakota	48	8	40
Tennessee	124	36	88
Texas	273	95	178
Utah	37	11	26
Vermont	28	16	12
Virginia	119	52	67
Washington	117	43	74
West Virginia	80	22	58
Wisconsin	202	52	150
Wyoming	25	8	17
Total cities in U.S.	6,612	2,459	4,153

NOTE: Only communities with either an optometrist or an ophthalmologist are included in the count.

[a]Minimum number of cities where one or more optometrists were practicing in 1983, but where no ophthalmologists were practicing in 1983.

SOURCE: F. Aron, Manager of Information and Data, American Optometric Association, St. Louis, MO, personal communication, 1989. Data were collected by hand counts of optometrists from American Optometric Association, The Blue Book of Optometrists. 1984, 37th ed. (Chicago, IL: Professional Press, Inc., 1983) and of ophthalmologists from American Academy of Ophthalmology, The Red Book of Ophthalmology, 1983, 35th ed. (Chicago, IL: Professional Press, Inc., 1983).

Table 10-52—Distribution of Optometrists by Community Population Size, 1989a

Community population size[b]	Percent of optometrists[c]
"Urban" (total)	40.7
500,000 or more	13.2
100,000-500,000	12.9
25,000-100,000	14.6
"Suburban" (total)	24.8
500,000 or more	2.9
100,000-500,000	6.0
25,000-100,000	15.9
Under 25,000	34.4
Total	100.0

[a]Data based on approximately 1,100 replies to the 1989 American Optometric Association (AOA) Economic Survey, which was sent to a random sample of AOA members. The AOA membership represents approximately 75 percent of all practicing optometrists in the United States.
[b]Community population size was self-reported. It does not necessarily reflect metro or nonmetro location.
[c]Percentages may not add to 100 due to rounding.

SOURCE: American Optometric Association, St. Louis, MO, unpublished data from the 1989 AOA Economic Survey provided to OTA in 1989.

professionals in the absence of adequate information (288).

Selected information on the educational preparation, employment, role, and regulatory environment of practitioners unselected AHP fields is summarized in box 10-G.

Trends in the Supply of AHPs--An adequate future supply of AHPs will depend on changes in health care financing policies, technology, educational programs, and the regulatory environments that affect each type of AHP. Of the l0 professions studiedly IOM, physical therapists were most often reported as being in short supply (288). The IOM concluded that, "barring major economic or health care financing contractions, the growth of the number of jobs for allied health workers will substantially exceed the nation's average rate of growth for all jobs". The growth rate is expected to be highest for physical therapists and medical records specialists. In the fields of physical therapy, radiologic technology, occupational therapy, and medical record services, IOM indicated a potential for serious future imbalances in supply and demand. In most other allied health fields--clinical laboratory technology, dental hygiene, speech-language pathology and audiology, respiratory therapy, and dietetic technology-supply and demand were expected to remain fairly well balanced through the year 2000, provided that downward trends in the number of graduates in certain professions are halted and that improvements are made in salary and working conditions (288).

Recent and projected trends in allied health fields include:

- A *35* percent decrease in the number of graduates from clinical laboratory technologist programs from 1982 to 1988, and a 25 percent decrease in the number of graduates from clinical laboratory technician programs from 1982 to 1987 (673). A recent national survey indicated a 54 percent undersupply of technologists and a 38 percent undersupply of technicians.[61] Other reports also indicate a marked undersupply of these professionals in most employment settings (288).
- Increased demand for occupational therapists (OTs) during the past several decades (288,673), and a projected 52 percent increase in the number of OT jobs from 1986 to 2000 (288). Short supply is linked to the limited number of training programs and the inability of those programs to recruit faculty (288). IOM predicts a future shortage of OTs unless these conditions change (288). The number of OT graduates did increase by 18 percent from 1982 to 1988 (673).
- A projected 87 percent increase in the number of jobs for physical therapists (PTs) from 1986 to 2000 (288). Although the number of new PT graduates has increased substantially during the 1980s (673), supply may still not be able to keep pace with demand.
- A 24 percent decline in the number of dental hygiene graduates from 1980 to 1985 (the number increased slightly in 1986) (288). Strengthening entry requirements and increasing the length of training required may place further limits on the pool of interested students. Some areas have reported acute shortages of dental hygienists (288).
- A projected 45 percent increase in the number of jobs for radiologic personnel from 1986 to

[61]Based on an informal survey of constituent societies conducted by the American Society for Medical Technology (*288*).

Table 10-53-Estimated Supply of Selected Allied Health Personnel Employed in the United States: 1970, 1975, 1980, and 1986, and Percent Change, 1975-86[a b]

Occupation	1970	1975	1980	1986	Percent change, 1975-86
Total allied health personnel	673,000	899,000	1,100,000	1,330,000	47
Dental hygienist	15,000	27,000	38,000	48,000	77
Dental assistant	112,000	134,000	156,000	175,000	31
Dental laboratory technician	31,000	42,000	53,000	63,000	50
Dietitian	17,000	23,000	32,000	41,000	78
Dietetic technician	2,000	3,000	4,000	7,000	133
Medical record administrator	10,000	12,000	13,000	16,000	33
Medical record technician	42,000	53,000	64,000	76,000	43
Medical laboratory personnel:	135,000	191,000	249,000	293,000	53
Medical technologist	57,000	93,000	138,000	174,000	87
Cytotechnologists	3,000	6,000	7,000	9,000	50
Medical laboratory technician	1,000	8,000	13,000	16,000	100
Other laboratory personnel	74,000	84,000	91,000	94,000	11
Occupational therapist	6,000	21,000	25,000	32,000	52
Physical therapist	30,000	38,000	50,000	63,000	65
Radiologic service worker	87,000	97,000	116,000	143,000	47
Respiratory therapist	30,000	43,000	56,000	65,000	51
Speech pathologist/audiologist	19,000	32,000	42,000	57,000	78
Other allied health personnel	135,000	183,000	212,000	251,000	37

[a] All numbers are rounded to the nearest thousand. Some numbers may differ from those that appear elsewhere due to revisions and independent estimations.

[b] Includes only those personnel who have received certification/formal training in their particular allied health field. Does not include on-the-job trained, noncertified personnel who may be employed in nonregulated health care settings.

[c] Includes, but is not limited to: dietetic assistants, general assistants, operating room technicians, ophthalmic medical assistants, optometric assistants and technicians, orthopedic and prosthetic technologists, pharmacy assistants, podiatric assistants, vocational rehabilitation counselors, other rehabilitation services personnel, and other social and mental health services personnel.

SOURCE: U.S. Department of Health and Human Services, Health Resources and Services Administration. Bureau of Health Professions, Sixth Report to the President and Congress on the Status of Health Personnel in the United States, DHHS Pub. No.HRS-P-OD-88-1 (Rockville, MD: HRSA, June 1988), table 12-1.

1990 (288). Severe shortages are likely to occur if the current downward trend in graduates is not reversed. The number of graduates from radiography programs decreased by 24 percent from 1981 to 1988, and the number of graduates in nuclear medicine technology decreased by 44 percent from 1984 to 1988 (673).

- An increased demand for emergency medical technician (EMT) paramedics in hospital emergency departments due to the recent nursing shortage (288). Estimating current supply and predicting future supply of EMTs of all levels of training are difficult, since most EMTs are volunteers and no national data on the number of graduates of training programs are available.[62]
- A projected 75 percent increase in demand for certified medical record technicians from 1986 to 2000, due to the increasing complexity of the tasks these personnel must perform (288). After changes in Medicare hospital payment methods in 1983, hospitals reported substantially higher growth rates unemployment of medical record technicians and administrators than had been seen in previous years. Demand for medical records personnel in nonhospital settings is expected to increase as well (288).

A national survey of hospitals conducted by the American Hospital Association found that personnel vacancy rates were highest for PTs (16 percent) and OTs (15 percent) (673). A 1986 survey of 167 Veterans' Administration facilities found high vacancy rates for PTs (23 percent), respiratory thera-

[62] For more information on rural emergency medical personnel, see OTA's Special Report on Rural Emergency Medical Services (623).

Box 10-G—Provider Profiles: Allied Health Professionals (AHPs)

Clinical Laboratory Technologists/Technicians (CLTs)

CLT fields include generalist medical technology, blood bank technology, cytotechnology, hematology, histology, microbiology, and clinical chemistry (288). CLTs perform a wide array of tests used to help prevent, detect, diagnose, and treat diseases (673). Technologists are baccalaureate-prepared; technicians are associate-degree or certificate-prepared (288). Six States require technologists to be licensed (67.3); remaining States require only registration (288). Many CLT tasks are performed by nonlicensed, nonregistered individuals in unregulated environments (e.g., private physician offices) (288). The Bureau of Labor Statistics estimates that, in 1988, 71 percent of CLTs were employed in hospitals (673).

Physical Therapists (PTs)

PTs must graduate from an accredited program before taking their licensure examination (288). Three types of programs exist: baccalaureate programs, certificate programs for those with baccalaureate degrees in another field, and 2-year master's degree programs (288). PTs plan and administer treatment to relieve pain, improve functional mobility, maintain cardiopulmonary functioning, and limit the disability of people suffering from disabling injuries or diseases (67.3). All States require licensure for PT practice (673). In 1986,38 States allowed PTs to evaluate patients without physician referral, and 14 States allowed PTs to treat patients without physician referral (288). In 1986,40 percent of PTs worked in hospitals and 15 percent in independent or group practice (288).

Occupational Therapists (OTs)

OTs are trained through baccalaureate programs, post-baccalaureate certificate programs, or masters' programs (673). OTs work with disabled individuals to help them learn the skills necessary to perform daily tasks, diminish or correct problems, and promote and maintain health. In 1989, 35 States and the District of Columbia required licensure, 3 States required registration and had competency standards, and 4 States required certification for OT practice (673). In 1986, 35 percent of OTs worked in hospitals, 17 percent in schools, 10 percent in rehabilitative facilities, and the remainder in long-term care and home health settings (288).

Respiratory Therapists (RTs)

Accredited RT programs, which have grown in number in recent years, provide 2 years of training and grant either associate or baccalaureate degrees, depending on the student's previous educational background (673). RTs provide services ranging from emergency care for stroke, drowning, heart failure, and shock to temporary relief for respiratory disorders. They also treat patients after surgery to prevent respiratory illness (288,673). Certification is voluntary (673). In 1987, 18 States licensed respiratory care personnel, and licensure bills had been introduced in 10 others (288). In 1986, almost 90 percent of RTs worked in hospital settings, and the remainder were employed in nursing and home health facilities. Forty percent of RTs are men—a larger proportion than in many other allied health fields (288).

Dental Hygienists

Accredited hygienist programs include associate degree programs requiring 2 or more years of training and baccalaureate degree programs requiring 4 years of training (288). Dental hygienists remove stains and deposits from patients' teeth, take and develop x-ray films, apply fluoride, and make impressions of teeth. In some States, they may apply sealants to teeth, administer local anesthesia, and perform periodontal therapy. Licensure is required in all States. In most States, hygienists are required to work under the supervision of a dentist. The profession has been striving for greater autonomy, and legislation recently passed in Colorado allows dental hygienists to practice independently (288). In 1986, 99 percent of dental hygienists were women and over 90 percent were under age 44 (673). Ninety-five percent were employed in private dentists' offices (673).

Dietitians

Dietitians are baccalaureate-prepared professionals who have completed special courses in nutrition and have completed the practical training required by the American Dietetic Association for registration (288). Dietitians assess the nutritional needs of hospital patients and implement special diets. They also provide dietary counseling to groups and individuals. All certified dietitians must pass a national registration exam and participate in continuing education programs in order to maintain certification (288). Eight States require licensure, 5 require certification,

continued on next page

Box 10-G—Provider Profiles: Allied Health Professionals (AHPs)--Continued

and 3 require registration for the practice of dietetics (673). Most dietitians are employed in hospitals and nursing and personal care facilities (288).

Radiologic Technicians

The field of radiologic technology includes three distinct types of personnel. **Radiographers** receive **2** to **3 years** of training in operation of x-ray equipment. They are licensed in 18 States (288). **Radiation therapists** receive **2** to **4 years** of training and work primarily in oncology, preparing patients and administering ionizing radiation therapy. Fifteen States licensed these personnel in 1987, and another 10 States had enabling legislation but no licensure requirement. **Nuclear medicine technologists** receive 1 year of technical training in the use of radiopharmaceuticals in diagnosis and treatment. Seven States licensed these professionals in 1987, and another 10 had enabling legislation but no licensure requirement. In 1986, 60 percent of all radiologic personnel worked in hospitals, but employment in freestanding diagnostic centers is expected to increase in the coming years (288).

Emergency Medical Technicians (EMTs)

There are three levels of EMTs, distinguished from one another by the extent of training involved (288). All programs are certificate-granting, and they are offered by police, fire, and health departments as well as by medical schools, colleges, and universities. All 50 States have some type of certification procedure for EMTs, and 24 require national registration for one or more of the 3 levels of EMT practice (288). There were an estimated 65,200 paid EMTs in 1986, working in private ambulance services, hospitals, and police and fire departments (288). However, roughly two-thirds of EMTs are volunteers who work for rescue squads and local fire departments (288). In rural areas, an even larger proportion of EMTs are volunteers (623).

Medical Records Personnel

Medical records administrator programs are bachelor degree-granting and are based in colleges and universities (288). Medical records technicians typically hold associate degrees from community college-based programs. Many lower-level medical records personnel are trained on the job. No mandatory registration exists, although medical records administrators may choose to take a national registry exam. Three-fourths of all medical records personnel are employed by hospitals; others work in HMOs, nursing homes, and medical group practices (288).

Speech-Language Pathology and Audiology Personnel

To be certified, speech-language pathologists and audiologists must have completed a master's degrees in their field, although many States permit non-certified, baccalaureate-prepared practitioners to work in public school settings (288). Speech-language pathologists diagnose and treat speech or language disorders, and audiologists diagnose and correct hearing disorders. Increasing numbers of practitioners are entering independent private practice (288). Thirty-seven States require licensure for private practice in clinics or other nonschool settings (673). Over one-half of employed speech-language pathologists and audiologists in 1986 worked in schools, colleges, and universities, with the remainder in health care settings (288).

pists (16 percent) and radiation therapy technologists and technicians (15 percent) (673):

Surveys of AHP supply in a wider range of settings were conducted in North Carolina in 1986 (445). The highest vacancy rate reported was for OTs (21.5 percent). The vacancy rate for PTs increased from 8.7 percent in 1981 to 19 percent in 1986, and trends away from hospital employment and towards self-employment were noted. The vacancy rate for respiratory care personnel, 98 percent of whom were employed by hospitals in 1986, doubled from 1981 to 1986, from 9 to 18 percent. The vacancy rate for medical technology staff (medical technologists, medical technicians, phlebotomists, and laboratory assistants) was 16.5 perrcent, an increase over 4.6 percent in 1981. Ninety-four percent of all medical technology staff vacancies reported were in hospitals. The vacancy rate for medical records personnel was 11.9 percent, and the lowest reported vacancy rate (8 percent) was for radiologic personnel (445).

Multiskilled AHPs--AHPs became increasingly specialized during the 1960s and 1970s due to rapid technological advancements in the health care field. During the 1970s, however, concern about the supply of health professionals in rural areas led to an increased emphasis on the need for AHPs with skills in more than one field. Surveys have found that

Table 10-54-Provider-to-Population Ratios for Selected Allied Health Professions by Metropolitan/Nonmetropolitan Area, 1980

Occupation	Number per 100,000 residents		Nonmetro ratio as a percentage of metro ratio
	Metro	Nonmetro	
Dietitian	30.9	26.0	84%
Speech therapist	19.5	14.4	74
Health aide (excludes nursing aides)	138.5	99.9	72
Inhalation therapist	23.1	16.6	72
Dental assistant	75.2	53.2	71
Health record technician	7.2	5.0	69
Radiologic technician	46.3	31.0	67
Physical therapist	21.1	12.7	60
Clinical laboratory technician	120.5	68.9	57
Dental hygienist	23.1	12.3	53
Occupational therapist	9.3	3.5	38

SOURCE: Adapted from Institute of Medicine, Allied Health Services: Avoiding Crises (Washington, DC: National Academy Press, 1989), table 6-4.

many hospitals use multiskilled AHPs (130,358a,424), and that many more would do so if they were available (424). Training for multiskilled AHPs ranges from formal training programs that offer dual certification eligibility to informal on-the-job training. The range of skill combinations reported by hospitals that use multiskilled workers is great, but the three most common combinations are:

1. Respiratory therapist or technician and electroencephalography or electrocardiography technician;
2. Radiologic technologist and ultrasound technician; and
3. Laboratory technologist or technician and radiographer (424).

No national data on the supply of multiskilled AHPs are available. Survey data indicate that most multiskilled AHPs are employed in small not-for-profit and small non-Federal government hospitals (424). A recent study identified only 75 programs in the United States offering formal cross-training, but informal training for multiskilled AHPs has most likely been occuring for some time (424).

Rural Supply

Information regarding the national rural/urban distribution of AHPs is similarly scarce, and the available national data are noncurrent. Table 10-54 shows the rural/urban distribution of selected AHPs in 1980. Personnel-to-population ratios were lower in rural areas in every AHP category and were especially low for PTs, OTs, clinical laboratory technicians, and dental hygienists (288). The greater concentration of health care facilities in urban areas may explain some of the differences, but some disparities--e.g., those among OTs--are too great to be explained so simply. The reportedly wide use of noncertified personnel to perform AHP tasks in nonregulated environments (e.g., private physicians' offices) further confuses assessment of true AHP availability and distribution. Anecdotal evidence suggests that the most severe shortages of AHPs in rural health care facilities nationally are for PTs and OTs (162,462,473), although individual rural facilities report shortages for a wide array of AHPs.

A 1989 survey of small rural hospitals in Florida (572) found high vacancy rates for general radiographers (20 percent), laboratory supervisors (16 percent), laboratory technologists (13 percent), and respiratory therapists (8.6 percent). A large proportion of hospitals reported difficulties recruiting these personnel; PTs and physical therapy technicians were also often difficult to recruit. Rural hospitals had sharply higher vacancy rates than did their urban counterparts for laboratory and radiology personnel, but they had slightly lower rates for respiratory therapists (572).

Rural facilities often cannot support highly specialized AHPs on a full-time basis due to small population bases and low patient volume (see chs. 7 and 12). Precarious financial conditions make it difficult for some rural health facilities to compete for AHPs in the national labor market by raising

salaries and offering other incentives. Strategies that have been suggested to overcome some of these barriers and ensure the adequate supply of AHPs in rural areas include:

- encouraging the development of multiskilled AHPs through training and increased flexibility of licensure laws for rural facilities,
- increased recruitment of students from rural areas who may be more likely to return to those areas to practice,
- increased opportunities for training at rural sites, and
- employer-initiated cooperative hiring of AHP staff by several health care facilities ***(288).***

SUMMARY OF FINDINGS

Physicians

Overall physician supply has increased substantially over the past two decades. The number of MDs relative to the U.S. population more than doubled between 1963 and 1988—from 146 to 237 per 100,000 residents. ***The primary care specialties (particularly general and family practice) have seen the lowest increases.*** From 1979 to 1988, the number of primary care physicians per capita increased by 17.2 percent, compared with 30.2 percent for nonprimary care physicians.

Primary care physicians are twice as likely as nonprimary care physicians to practice in rural areas, but this may change due to recent increases in demand for primary care physicians in urban settings. Rural areas rely heavily on primary care physicians. In rural counties with fewer than 10,000 residents, for example, primary care physicians constitute 81 percent of all professionally active physicians. ***Future national shortages of primary care specialists are therefore likely to have a disproportionately negative effect on rural areas.***

The increasing supply of physicians has resulted in greater physician availability in counties of all sizes. However, overall increases in physician-to-population ratios have been lowest in the least populated counties. In 1988, rural counties still had fewer than one-half as many patient care MDs per capita as had urban counties. Rural counties with fewer than 10,000 residents had fewer than one-fourth as many patient care MDs per capita as urban counties. Rural residents travel for longer periods of time than do their urban counterparts to obtain medical care from physicians.

In 1988, all of the 111 counties (with a total resident population of 325,100) with no MD or DO were rural. In 1988, 29 percent of all rural residents were living in federally designated primary care HMSAs, compared with only 9.2 percent of urban residents (see ch. 11). Over ***4,000*** primary care physicians would be needed to eliminate shortages in these urban and rural HMSAs.

Despite increases in the proportion of physicians who are young (under age 35) in both rural and urban areas, rural physicians are still older than their urban counterparts. Most physicians in small rural counties are in solo practice.

Some rural areas rely heavily on DOS. Although they made up only 9.4 percent of the total U.S. physician population in 1986, DOS makeup as much as 74 percent of total physician supply in some States' small rural counties.

Evidence suggests that the current supply of physicians in small rural counties is unstable. New medical graduates are increasingly indicating a preference for practice in large cities and suburbs, with fewer indicating a preference for small town and rural practice sites.

Midlevel Practitioners

Midlevel practitioners can provide primary medical care services in areas where no physician is available. NPs are about as likely as primary care physicians to practice in rural areas. The proportion of NPs who are in rural areas seems to be decreasing.

The belief that PAs are more likely than physicians to locate in rural areas cannot be confirmed because data on the rural/urban distribution of PAs are not available. The limited data available, however, suggest that the proportion of PAs practicing in small communities (under 10,000 residents) is decreasing. This is also true for CNMs. This shift may be due to an increased demand for these providers in urban settings.

On the national level, evidence suggests that current demand for NPs and PAs exceeds current supply.

CRNAs, who provide nearly 70 percent of anesthesia services in rural areas, are crucial members of the rural health care team in many hospital settings,

but their supply is in danger. Precipitous decreases in the number of programs preparing CRNAs and the number of new CRNA graduates will adversely affect the future supply of CRNAs both nationally and in rural areas.

Nurses

RN- and LP/VN-to-population ratios are projected to decrease in coming years. The number of graduates from nursing programs has already begun to decrease, and this trend is expected to continue. RN-to-population ratios are the lowest in the South, Mountain, and Pacific regions. Furthermore, the proportion of employed RNs working in rural areas has decreased in recent years, and rural health care facilities may have increasing difficulty competing with urban facilities in RN recruitment.

While the number of RNs employed in hospitals has been increasing, the number of LP/VNs has been decreasing. Rural hospitals have markedly fewer RNs and higher RN-to-LP/VN ratios than do their urban counterparts. Analysis of regional nurse-to-population ratios shows that the regions with lowest RN availability are those with highest LP/VN availability, indicating that LP/VNs may be substituting for nurse positions that would otherwise be filled by RN.

Data on RN shortages (e.g., vacancy rates) are limited to the hospital and nursing home sector. RNs in smaller counties are more likely than RNs in large counties to be employed in nonhospital settings, yet little is known about the adequacy of RN supply in such settings.

Other Health Professionals

Numbers of practitioners in all other health professions examined in this report have increased over the past two decades. Recent data on rural/urban distribution are unavailable for most of these professions. For some professions, even national supply estimates are difficult or impossible to obtain due to lack of data collection.

Dentists

The distribution of dentists parallels that of physicians. Rural counties have substantially fewer dentists per capita than urban counties (35 v. 58 per 100,000 residents in 1987). Within rural counties, ratios decreased with county size, with the smallest rural counties (fewer than 2,500 residents) having only 15 office-based dentists per 100,000 residents.

The relative supply of general and pediatric dentists increased more in rural than in urban areas during the 1980s. However, future constraints on national supply due to recent and continuing decreases in the number of dental graduates may change this trend. There is a slight trend away from generalist and towards specialist practice among dentists; however, most dentists are still generalists. In 1987, 85 percent of dentists were in general practice, compared with 91 percent in 1970.

In 1988,183 counties had no general or pediatric dentist. Of these, 181 were rural counties of fewer than 25,000 residents. An estimated 1,729 dentists are needed to eliminate shortages in almost 800 designated dental HMSAs, 72 percent of which are in rural areas. Over 8 million people resided in rural dental HMSAs in 1988.

Pharmacists

There are no data on U.S. rural pharmacist supply. State studies suggest that although some rural areas have few pharmacists, rural/urban differences in pharmacist distribution may not be as dramatic as those for other health professionals. An increase in the number of pharmacists relative to population is expected over the next three decades, but growth in demand for pharmacists may exceed growth in the national supply.

Optometrists

In many communities, optometrists are the only providers of primary vision/eye care. Their rural/urban distribution is not known, but a substantial proportion (34 percent) practice in communities of 25,000 or fewer residents. Although the number of applicants to schools of optometry has declined in recent years, enrollments have remained stable. The supply of optometrists relative to population is projected to increase over the next two decades.

Allied Health Professionals

Physical therapists are in short supply nationally, and the potential for serious future shortages exists in the fields of physical therapy, radiologic technology, occupational therapy, and medical record services. In most other allied health fields studied, downward trends in the number of training programs and graduates will need to be reversed to avoid future shortages.

Although no recent national data are available on the rural/urban distribution of AHPs, selected State data and anecdotal evidence suggest that rural settings currently have a disproportionately small share of AHPs, and they are likely to suffer more than urban settings in the face of future shortages. Evidence from these sources further suggests that some rural facilities are facing critical shortages of physical and occupational therapists. Radiologic and laboratory personnel are also in very short supply in some rural areas.

Multiskilled AHPs may be especially appropriate for small rural facilities. Although a small number of formal training programs exist, no national data on the supply of multiskilled AHPs are available.