

# TRENDS

## Twenty-Year Trends In Regional Variations In The U.S. Physician Workforce

Variations in physician supply have persisted for decades, but their effects on Americans' health are still being investigated.

by David C. Goodman

**ABSTRACT:** Large differences in the regional supply of physicians have challenged traditional methods of determining the “right” workforce rate. With continued growth expected in the number of U.S. physicians per capita, this study examines changes in regional variation over time to provide perspective on where future physicians are likely to locate. There was a slight reduction in workforce variation during the past twenty years as the aggregate supply per capita grew more than 50 percent. Most physicians located in regions with an already large supply. Given these persistent patterns, the population benefits of further growth in the physician workforce are uncertain.

**D**URING 1980–2000 the total number of physicians in the United States increased from 467,679 to 813,770, while the physician-to-population ratio grew from 207 to 296 per 100,000 people.<sup>1</sup> This remarkable growth in the workforce will continue for a number of years with current rates of physician training. Continuing workforce expansion has sharpened the policy debate: Some analysts warn of a physician excess, while others propose even higher training rates to care for an aging population.<sup>2</sup> These disagreements about the need for more physicians come at a time of pressing need and interest in reforming the health care system to achieve improved efficiency, greater effectiveness, and more active patient participation in decisions about care.<sup>3</sup>

Ignored in the statistics is the persistent variation in physician supply across locales. While low supply in remote rural areas and inner cities is widely acknowledged to represent

“maldistribution,” recent studies have shown that workforce variation is two- to threefold even across regions where supply is apparently adequate.<sup>4</sup> For example, White Plains, New York, has 2.3 times the specialists per capita as Minneapolis, Minnesota.<sup>5</sup>

Current workforce policies let physicians' preferences dictate their location while subsidizing providers who care for underserved populations. Policy discussions of regional workforce variations have generally taken the view that labor-market forces, supplemented by rural and inner-city practice incentives, will gradually ameliorate supply disparities as the aggregate number of physicians rises.<sup>6</sup> In higher-supply areas, physicians face lower incomes and fewer practice opportunities, and when supply reaches a high level, jobs will be less available. Physicians will then begin to look to locations where incomes are higher and working conditions are more physician-centric. Several studies provide evi-

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dence that diffusion from high- to low-supply regions has improved access in rural areas.<sup>7</sup> However, little is known about the magnitude of physician flow in relation to the increase in overall supply.

Some analysts have begun to call for expanded physician training through additional Medicare graduate medical education (GME) funding and enlarged U.S. medical schools.<sup>8</sup> Amid such calls, an understanding of the relationship between past workforce growth and changes in regional variation would provide insights into where additional physicians are likely to locate. This paper answers three specific questions. (1) Between 1979 and 1999, as the per capita supply increased, did physicians become more evenly distributed across regions? (2) Did areas with high supply in 1979 regress toward the national mean by 1999? (3) Is diffusion of physicians from higher- to lower-supply regions reasonably efficient?

## Study Data And Methods

■ **Physicians and populations.** The ZIP code locations of federal and nonfederal physicians were obtained from the American Medical Association (AMA) and the American Osteopathic Association (AOA) Masterfiles for 1979 and 1999. Excluded from analyses were physicians in GME, medical teaching, administration, or research or those working fewer than twenty hours per week. This resulted in 132.4 physicians per 100,000 in 1979 and 199.9 per 100,000 in 1999. We aggregated the 406 self-designated specialties used by the associations into thirty-eight specialty groups and then further grouped them into either specialists (with subgroups of medical, surgical, and other specialists) or generalists (including family practice, general internal medicine, and general pediatrics). We adjusted area estimates of physicians for patient travel across regional boundaries and for differences in age and sex of the populations.<sup>9</sup> Age-sex specific population counts for 1980, 1990, and 1999 were obtained from Claritas Corporation in Arlington, Virginia. Physician supply is reported by hospital referral regions (HRRs; N = 306), as developed for the *Dartmouth Atlas of*

*Health Care*.<sup>10</sup>

■ **Statistical analyses.** We measured the degree of variation among regions by the interquartile ratio (defined as the ratio of the 75 percent HRR physician-to-population ratio to the 25 percent HRR ratio after ordering regions from the lowest to highest ratio), extremal quotient (ratio of minimum to maximum physician-to-population ratio HRR), and the coefficient of variation (the standard deviation of the physician-to-population HRR ratios divided by the mean).

## Results

■ **Changes in overall workforce.** Over the twenty-year study period, the number of clinically active physicians per 100,000 people in the United States grew 51 percent. The rate of growth differed by specialty (Exhibit 1), with generalists increasing 45 percent. Most of the generalist physician growth occurred among general internists and general pediatricians. Family practice increased only 18 percent, despite an effort by policymakers and medical educators to encourage entrance into the specialty. Medical specialists increased by 118 percent, with all but allergy and dermatology experiencing more than 100 percent increases. Surgical specialties grew more slowly. Growth among surgeons was highest for plastic/reconstructive surgery, obstetrics/gynecology, and orthopedics, while general surgery actually declined.

■ **Changes in workforce variation across HRRs.** The physician workforce varied markedly across regions in 1979 (Exhibits 1–3), and while the distribution shifted upward during the twenty years, the 1999 variation in physician supply remained large. San Francisco (113 per 100,000); White Plains (106); and Royal Oaks, Michigan (105), had the highest generalist workforce per 100,000 people in 1999. McAllen, Texas (39); El Paso, Texas (40); and Aurora, Illinois (41), had the lowest. Even as the workforce grew substantially in low-supply regions in terms of percentage change, in absolute terms high-supply regions expanded at a greater pace. In McAllen, Texas, for example, the generalist supply increased 53

**EXHIBIT 1**  
**Changes In Physicians Per 100,000 People And In The Variation In Workforce Across Hospital Referral Regions (HRRs), 1979 And 1999**

	U.S. rate (per 100,000)			Ratio of 75% HRR to 25% HRR (interquartile ratio)		
	1979	1999	Percent change	1979	1999	Percent change
All physicians	132.4	199.9	51	1.36	1.26	-7.0
Generalists	49.2	71.1	45	1.30	1.22	-6.1
Family practitioners	25.8	30.4	18	1.41	1.49	5.5
General internists	15.4	26.6	73	1.78	1.56	-12.3
General pediatricians	7.9	14.1	78	1.62	1.60	-1.2
Medical specialists	15.8	34.4	118	1.79	1.45	-19.0
Allergy/immunology	0.9	1.3	37	2.58	1.78	-31.1
Cardiology	3.0	6.4	109	2.18	1.57	-28.3
Dermatology	2.0	3.0	53	1.75	1.61	-7.9
Gastroenterology	1.2	3.3	183	2.37	1.52	-35.9
Hematology/oncology	1.0	2.6	162	2.99	1.59	-46.8
Neurology	1.5	3.4	121	2.35	1.53	-35.0
Pulmonary	1.0	2.1	115	2.84	1.64	-42.1
Rheumatology	0.4	1.1	154	6.81	1.79	-73.7
Surgical specialists	37.6	45.6	21	1.32	1.24	-6.1
General surgery	10.2	8.7	-15	1.31	1.34	2.4
Neurological surgery	1.1	1.4	26	1.63	1.43	-12.0
Obstetrics/gynecology	8.8	12.3	40	1.45	1.36	-6.3
Ophthalmology	4.6	5.8	26	1.51	1.36	-9.3
Orthopedic surgery	4.9	6.7	38	1.56	1.32	-15.7
Otolaryngology	2.4	2.8	17	1.46	1.36	-6.8
Plastic, reconstructive surgery	1.1	2.0	86	2.28	1.73	-24.1
Urology	2.8	3.2	13	1.37	1.31	-4.3
Other specialists	28.0	47.4	69	1.43	1.27	-11.2
Anesthesiology	5.7	11.1	95	1.81	1.39	-23.2
Emergency medicine	2.5	7.1	183	2.16	1.54	-28.3
Pathology	3.9	4.8	22	1.48	1.45	-2.1
Psychiatry	9.8	13.2	35	2.32	1.85	-19.9
Radiology	7.0	9.2	33	1.43	1.29	-10.1

**SOURCE:** American Medical Association and American Osteopathic Association Masterfiles.

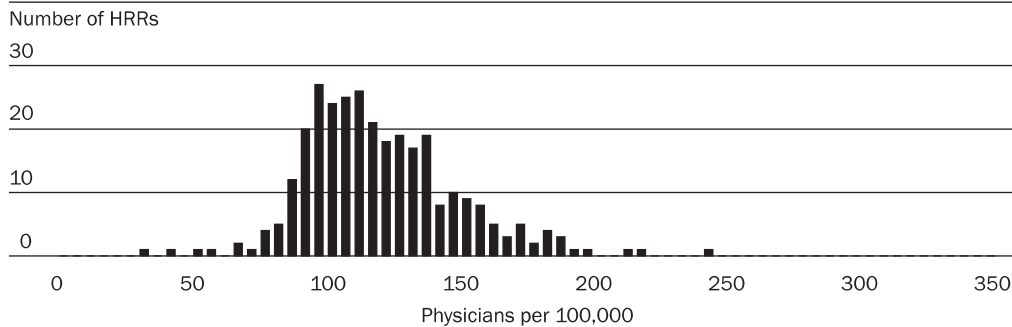
percent as San Francisco grew 21 percent, while the McAllen physician-to-population ratio grew by 13 per 100,000, compared with 19 in San Francisco. Comparing relative changes in supply over time is deceiving when the regions begin with highly different physician-to-population ratios.

Washington, D.C., and Manhattan, New York (68 per 100,000), led the nation in the supply of medical specialists, compared with Lawton, Oklahoma (12), and McAllen (13). By 1999 the workforce of these low-supply regions rose 7 and 10 per 100,000, respectively, from their 1979 levels, while Washington, D.C., medical specialists grew by 43 and Manhattan

specialists, by 39.

Variation across regions decreased slightly during the twenty-year study period (Exhibits 1-3). Interquartile ratios (the ratio of the 75 percent HRR to the 25 percent HRR), for example, fell 7 percent for physicians overall. This indicates that the difference between the seventy-fifth and twenty-fifth percentiles decreased and clustered more closely around the median HRR. The decrease in variation was greatest for medical specialists (19 percent) compared with surgical (6 percent) and other (11 percent) specialists. Variation decreased least for generalists (6 percent). By individual specialty, regional variation in supply in-

## EXHIBIT 2 Physicians Per 100,000 People Across Hospital Referral Regions (HRRs), 1979



**SOURCES:** American Medical Association and American Osteopathic Association Masterfiles.

**NOTES:** The median HRR had 116 physicians per 100,000. The interquartile ratio was 1.36; extremal ratio, 7.50; coefficient of variation, 23.9.

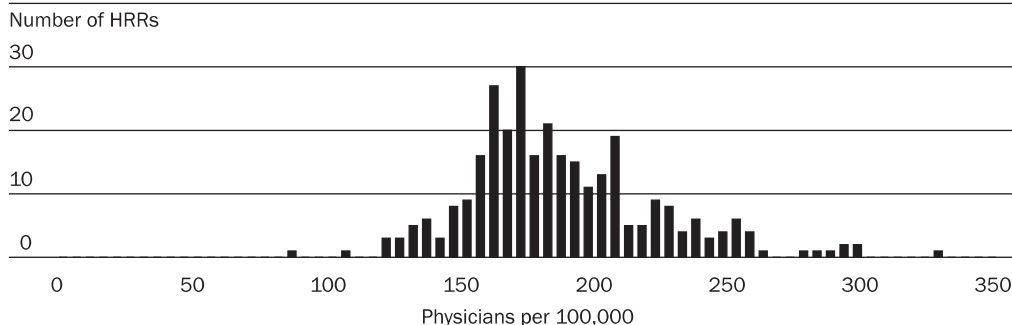
creased only for family physicians (6 percent) and general surgery (2 percent).

■ **Changes in the relative rankings of HRRs.** There was no evidence of a regression to the mean in areas with extremely high or low supply in 1979. The ranking of HRRs in that year was highly associated with the relative rank in 1999. For generalists, the  $R^2$  was .54 ( $p < .001$ ); that is, 54 percent of the supply level in 1999 is explained by the supply level in 1979. The  $R^2$  was .69 ( $p < .001$ ) for medical specialists, .51 ( $p < .001$ ) for surgical specialists, and .75 ( $p < .001$ ) for other specialists.

■ **Efficiency of workforce diffusion.** Although a reduction in workforce regional variation, regardless of how small, is a welcome

trend and indicates that net diffusion of the workforce has occurred, the high rates of workforce growth during the twenty-year period raises questions about the efficiency of this process. In Exhibit 4, regions are ordered from lowest supply to highest supply per 100,000 people for all physicians, generalists, and specialists (includes medical, surgical, and other specialists) and then divided into groups of equal population. Although physicians per 100,000 grew much faster in the low- than in the high-quartile supply regions, there was a greater increase in the absolute number of physicians entering the high-quartile regions. Generalists, for example, had a net increase of 20,565 physicians in the low-quartile regions,

## EXHIBIT 3 Physicians Per 100,000 People Across Hospital Referral Regions (HRRs), 1999



**SOURCES:** American Medical Association and American Osteopathic Association Masterfiles.

**NOTES:** The median HRR had 180 physicians per 100,000. The interquartile ratio was 1.26; extremal ratio, 3.60; coefficient of variation, 18.9.

**EXHIBIT 4**  
**Comparison Of Change In Per Capita Physicians And The Number Of Physicians,**  
**Stratified By 1979 Population Quartiles, 1979–1999**

	1979 per capita workforce in HRRs, population quartile (lowest to highest)			
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
<b>All physicians</b>				
Number of HRRs	119	74	72	41
Population	56,462,585	56,505,781	56,575,595	56,953,941
Physicians per 100,000 in median HRR, 1979	97.2	116.6	136.5	166.7
Physicians per 100,000 in median HRR, 1999	162.9	177.0	203.2	245.3
Change in physicians per 100,000	65.7	60.4	66.7	78.5
Percent change, 1979–1999 <sup>a</sup>	67.5%	51.8%	48.9%	47.1%
Change in number of physicians	55,938	58,367	64,991	69,158
Percent of total physician increase	22.5%	23.5%	26.2%	27.8%
<b>Generalists</b>				
Number of HRRs	98	88	65	55
Population	54,258,775	58,016,805	56,417,622	57,804,700
Physicians per 100,000 in median HRR, 1979	37.9	44.7	51.8	59.3
Physicians per 100,000 in median HRR, 1999	61.5	65.2	72.0	81.1
Change in physicians per 100,000	23.6	20.5	20.2	21.8
Percent change, 1979–1999 <sup>a</sup>	62.3%	45.9%	39.0%	36.7%
Change in number of physicians	20,565	19,054	21,630	22,425
Percent of total physician increase	24.6%	22.8%	25.9%	26.8%
<b>Specialists</b>				
Number of HRRs	117	83	63	43
Population	55,381,013	57,111,668	56,766,978	57,238,243
Physicians per 100,000 in median HRR, 1979	55.7	69.2	84.2	106.8
Physicians per 100,000 in median HRR, 1999	101.8	111.1	128.0	157.8
Change in physicians per 100,000	46.1	41.9	43.8	51.0
Percent change, 1979–1999 <sup>a</sup>	82.8%	60.6%	52.0%	47.8%
Change in number of physicians	34,595	39,911	41,079	47,551
Percent of total physician increase	21.2%	24.5%	25.2%	29.1%

**SOURCE:** American Medical Association and American Osteopathic Association Masterfiles.

**NOTE:** HRR is hospital referral region.

<sup>a</sup> Calculated as the 1999–1979 difference in median HRR within each quartile.

while the high-quartile regions gained 22,425. In the lowest-quartile regions of specialists per 100,000, the net increase was 34,595 compared with a 47,551 increase in the quartile with the highest supply. These results demonstrate that as regions with lower workforce rates gained slightly on higher regions, the majority of additional physician labor located in areas with an already large supply.

### Discussion

These analyses demonstrate that regional variation in the physician workforce declined

slightly during the twenty years 1979–1999 as the overall physician workforce increased more than 50 percent. Growth in the workforce was robust for nearly all specialties, but improvement in the relative distribution of physicians was modest for generalists and specialists despite long-standing public policies, particularly directed toward reducing inequities in primary care availability. Areas with a high supply in 1979 generally maintained a relatively high supply in 1999; similarly, low-supply areas tended to retain a low ranking even as their per capita rate increased. Diffu-

sion as a means to add workforce to low-supply regions is costly, as the majority of physicians still entered areas with high supply.

The most stringent federal definition of primary care underservice is more than 3,000 people per generalist physician within a “rational service area.”<sup>11</sup> An obvious benefit of workforce growth is that all eleven regions (2.4 million population) with a regional undersupply of generalists in 1979 (more than 3,000 people per generalist physician) were lifted above this level by 1999.

The region with the lowest workforce in 1999 was McAllen, Texas (2,500 per generalist physician). However, one should not conclude from this that local workforce shortages have been entirely eliminated. These analyses provide measures at a regional level; workforce rates in smaller geographic units such as Health Professional Shortage Areas or Primary Care Service Areas show that underservice persists.<sup>12</sup> At the same time, it should be noted that regions with very high supply, such as San Francisco (893 per generalist), still have underserved populations.

Even as growth in physician supply benefited low-supply regions, the efficiency of the diffusion of physicians appears low. Lower-supply regions saw their workforces grow, but most physicians still entered regions with higher-than-median supply. Miami, Florida, is a case in point. The region was in the top decile in supply of medical specialists in both 1979 and 1999 with a twenty-year absolute increase in supply of 21 per 100,000. In 1999 there were thirty-three HRRs with per capita medical specialist supply lower than the twenty-year increase in Miami. That is, the net rise in Miami’s supply per capita was larger than the total 1999 supply observed in more than 10 percent of HRRs in 1999. Is this growth in supply to be envied? A large supply of medical specialists in Miami and other regions is associated with similarly high intensity of Medicare use and costs. Unfortunately, high intensity of

medical treatment is not associated with better quality or access to care, or with slower declines in functional health status or lower mortality.<sup>13</sup>

Could differences in population needs explain regional workforce variations? In this case, we might expect more physicians to be working in areas with higher socioeconomic risk and poorer health status. This study adjusted for differences in the age and sex distribution of the population across regions, but

other important differences persist. For example, the age-adjusted mortality of Medicare beneficiaries ranged from 3.7 percent to 6.2 percent per year, and median household income ranged from \$17,000 to \$58,000. In fact, higher rates of physicians per capita are associated with higher regional incomes and lower mortality rates.<sup>14</sup>

One can argue that regional differences in physician supply are the reasonable results of a market-based health economy and no more consequential than regional differences in wealth. If the population of Miami desires and pays for more physicians and their services, why should this be of public concern? This argument ignores the subsidization of health care, including public funding of medical education, tax subsidies for employer-based health benefits, and government-funded medical care, which constitutes almost half of total health care reimbursements. Medicare pays more than twice as much for health care per beneficiary in Miami than in Minneapolis, even after adjustment for patients’ health status.<sup>15</sup> As the public funding of health care increases, it is reasonable to expect accountability in the effectiveness, efficiency, and equity of health care delivery. All three are now lacking in the uneven physician workforce landscape.

■ **Study limitations.** These analyses have several limitations. First, this work is not intended to identify populations with inadequate access to basic medical services. The difficulties faced by many inner-city and rural

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populations are well documented by analytic methods that use smaller geographic units and also consider barriers of distance, costs, culture, and language.

Second, there is no agreement regarding the amount of work that constitutes a full-time clinician. AMA and AOA data are “head counts,” which represent a heterogeneous labor effort. There has been a slight decline in the patients seen per year by physicians over the twenty years studied here, although these differences are not large enough to greatly alter these findings.<sup>16</sup>

Third, the saliency of using large regions to measure physician specialties that provide care in smaller markets (for example, generalists) could be questioned. We reanalyzed generalist physician supply using Primary Care Service Areas (N = 6,104) as the unit of analysis, with similar results.

**S**TUDYING REGIONAL variation in workforce levels offers an important perspective on the perennial debate about future workforce requirements. It has been suggested that the U.S. specialist workforce will be 20 percent short of “need” by 2020 if training rates are not increased.<sup>17</sup> This assessment rests upon the assumption that the current deployment of physicians is aligned with the needs of the U.S. population, contradicting studies that examine the relationship between physician workforce levels and population health outcomes. A 20 percent difference in supply appears slight compared with the 300 percent differences already present across U.S. regions. Committing additional public funding to a further expansion of the physician workforce is likely to cause high-supply regions to grow even more, without improving the quality of care or patient outcomes.

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## NOTES

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