



# Hospital and Physician Capacity Update

A Dartmouth Atlas Project Brief Report

A Brief Report from the Dartmouth Atlas of Health Care

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*Regional variation in hospital and physician capacity reveals the irrational distribution of valuable and expensive health care resources. Better planning of future growth in capacity can help build a more effective and affordable health care system.*

## Health care costs continue to rise as quality lags— where is the money spent?

Reform of the U.S. health care system is often portrayed as an unattractive choice between quality and affordability. Health care costs continue to rise at a faster pace than either the Gross Domestic Product or inflation, straining public budgets and eroding workplace insurance coverage. Over 45 million have no insurance at all. Our national strengths in biomedical innovation have produced remarkable and often beneficial interventions, but they are too often used in situations where the benefits are unproven or nonexistent. Meanwhile, patients frequently fail to receive care that has been proven to be effective.

We all know that health care is expensive, but there is less discussion about where the money is spent. Some costs are easy to identify. Patients are often shocked at the price of a brand name prescription drug, a night in the hospital, or an outpatient surgical procedure. Discussions about containing costs often center on reducing the price for a particular service, ignoring the even more important factor of the volume of care provided. Strategies to reduce the volume of ineffective and unnecessary services can be misunderstood as attempts to ration beneficial care, and have generally failed to slow the increases in costs.

A useful alternative view of health care costs is to examine *health care capacity*. Capacity represents the capital investments and labor that permit the delivery of medical services. Two types of capacity determine the majority of health care costs. The first is hospital capacity, including the number of general and intensive care beds, imaging devices, and procedure suites like operating rooms and cardiac catheterization labs. Health care labor is the second and related component of capacity, and includes the physicians, nurses, allied health professionals and administrative staff who work in hospitals and physician practices. Managing our national investment in capacity may seem more abstract than lowering the price of a new and expensive drug, but it offers an important opportunity for freeing money that could be better invested in providing the effective care that patients need and want.

This report examines changes in hospital and physician capacity over a decade, and also reveals the substantial unwarranted variation in capacity across regions. The regional variation in capacity is idiosyncratic, that is, not reflecting patient wants or needs. And research conducted over the last 30 years shows that lower capacity is compatible with high quality and comparable outcomes. Better planning of hospital and physician capacity is an essential part of reforming the health care system toward improved outcomes and affordability.

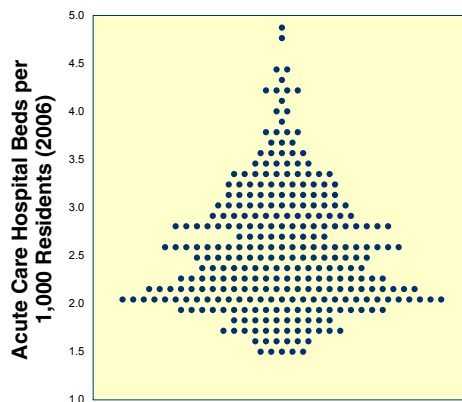
## Changes in U.S. hospital capacity

The hospital bed supply per capita contracted from 1996 to 2006 while the numbers of hospital-based employees and registered nurses grew. The number of staffed acute care beds declined from 2.82 to 2.46 per 1,000 U.S. residents, reflecting a 12.9% decrease. This change in bed capacity is part of a 20-year shift of medical care to outpatient settings, including hospital-based clinics and outpatient surgery units.

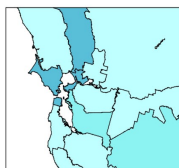
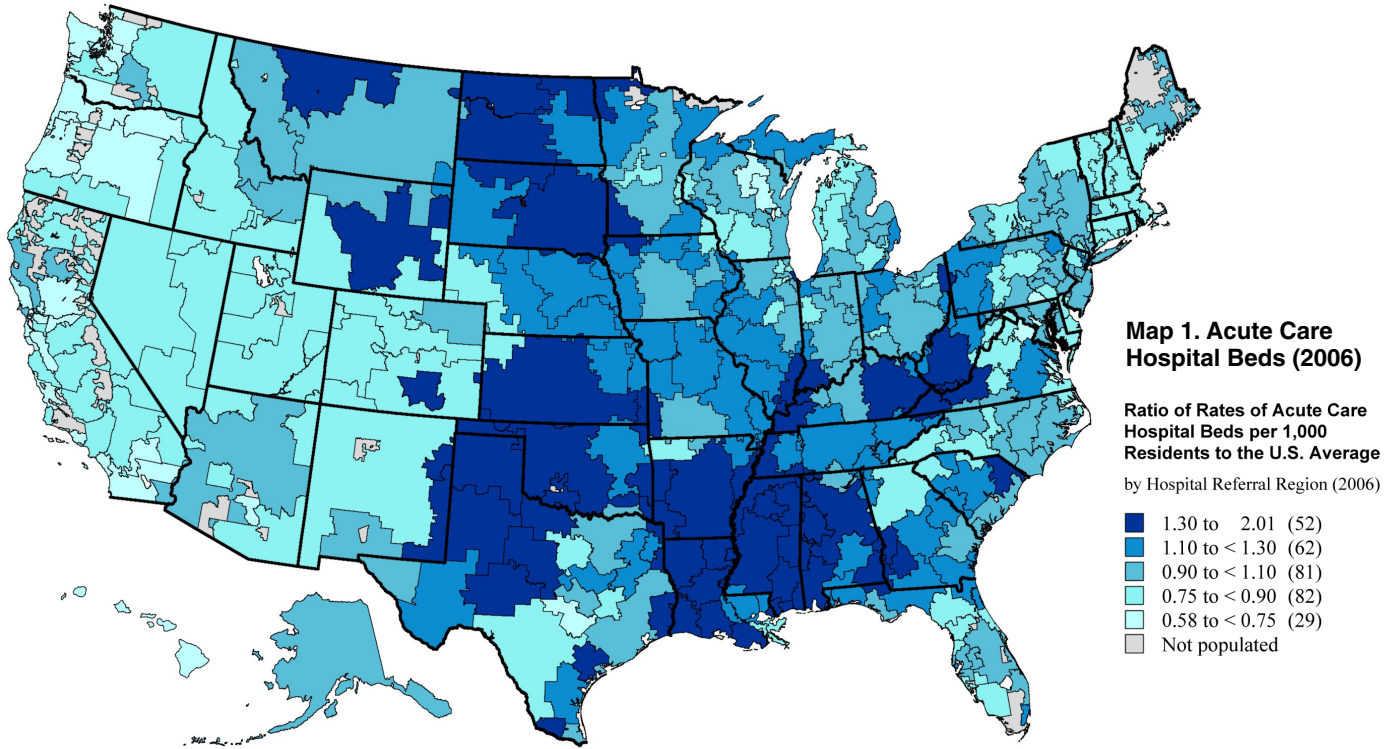
Despite fewer beds, overall hospital staffing increased, reflecting the continuing importance of the hospital in health care delivery, including providing ambulatory services such as outpatient surgery, diagnostic tests, and physician visits. Hospital-based employment rose from 13.2 to 14.1 FTEs per 1,000 residents (6.2% increase) and the supply of hospital-based registered nurses increased from 3.3 to 3.7 FTEs per 1,000 residents (14.1% increase).

## Regional variation in hospital capacity

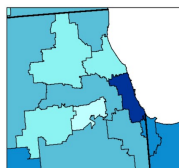
In 2006, there was a greater than twofold variation in acute hospital beds per 1,000 across hospital referral regions, even after adjustment for differences in age and sex. Four regions in Mississippi had particularly high bed capacity, including Jackson (4.44 beds per 1,000), Gulfport (4.44), Oxford (4.28) and Meridian (4.27). Four regions in California had low capacity, including San Mateo County (1.45), San Luis Obispo (1.45), Sacramento (1.52) and San Jose (1.57).



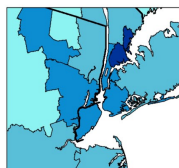
**Figure 1. Acute Care Hospital Beds Allocated to Hospital Referral Regions (2006)**



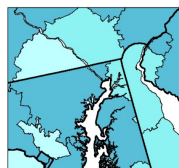
San Francisco



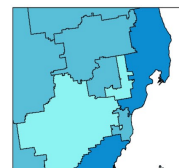
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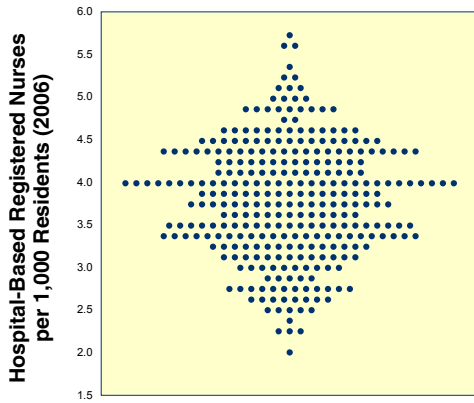
New York



Washington-Baltimore

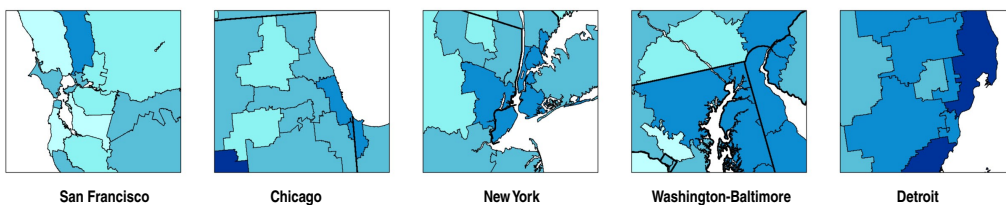
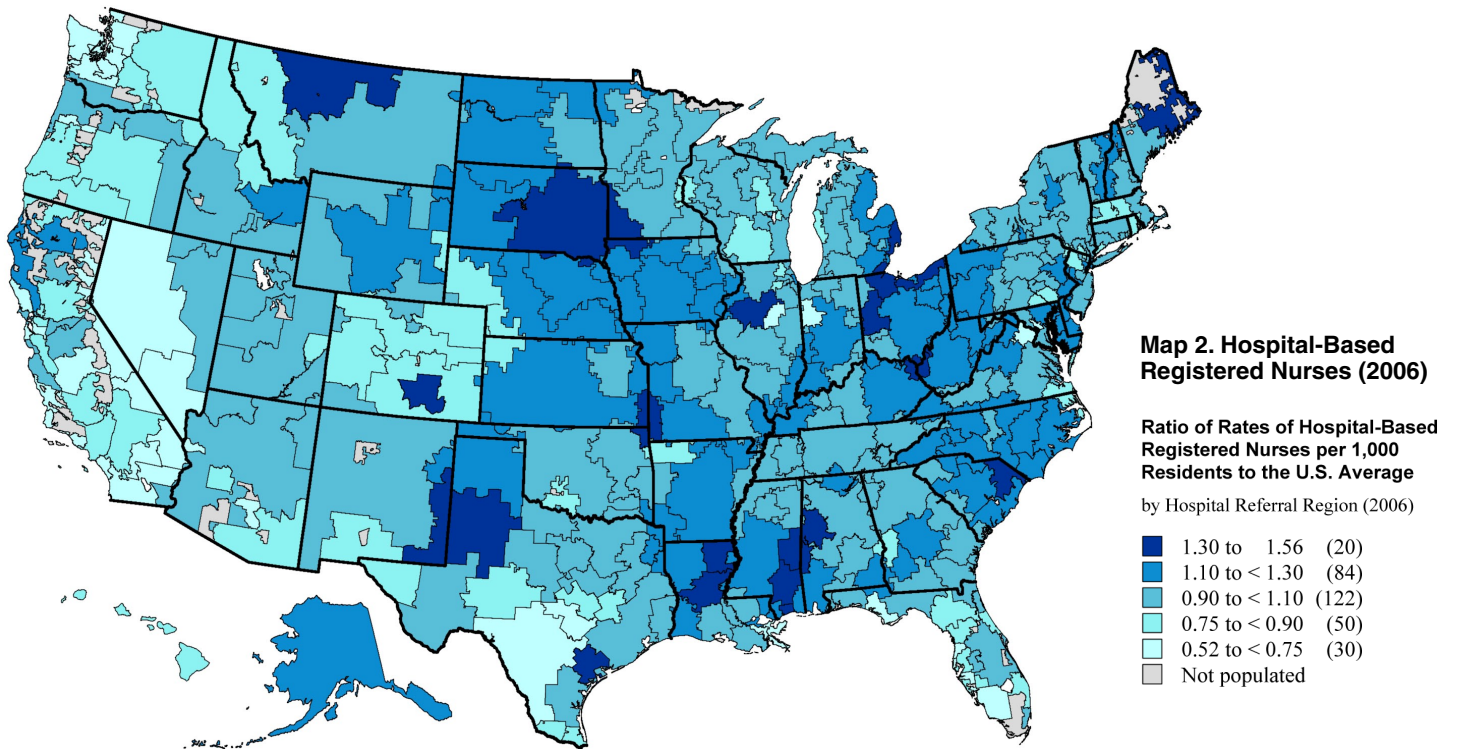


Detroit

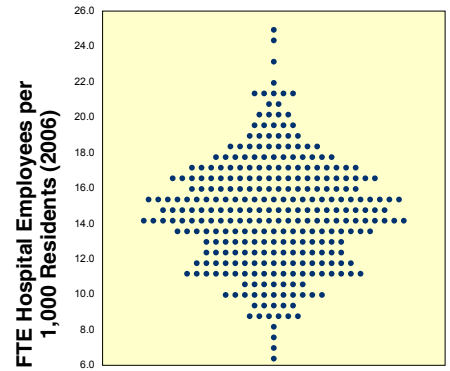


A similarly high degree of regional variation was observed for overall hospital employment and for hospital-based registered nurses (RNs). RN supply varied from less than 2.5 per 1,000 residents in San Luis Obispo, California (1.94), Clearwater, Florida (2.28) and Mesa, Arizona (2.49) to more than 5.5 per 1,000 in Monroe, Louisiana (5.79), Detroit (5.66) and Gulfport, Mississippi (5.58).

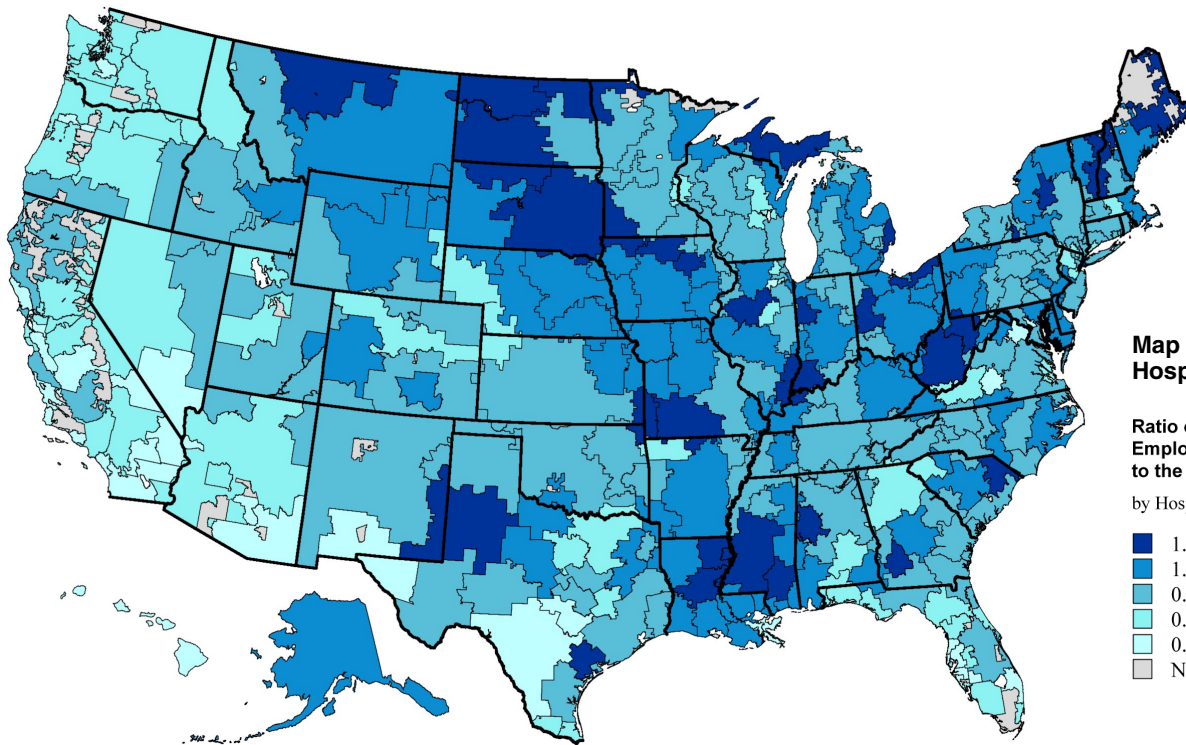
**Figure 2. Hospital-Based Registered Nurses Allocated to Hospital Referral Regions (2006)**







**Figure 3. Hospital Employees Allocated to Hospital Referral Regions (2006)**

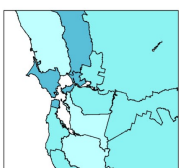


**Map 3. Acute Care Hospital Employees (2006)**

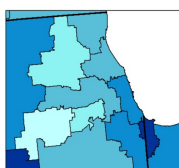
Ratio of Rates of FTE Hospital Employees per 1,000 Residents to the U.S. Average

by Hospital Referral Region (2006)

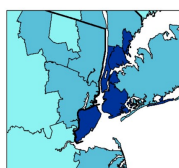
- 1.30 to 1.80 (33)
- 1.10 to < 1.30 (81)
- 0.90 to < 1.10 (109)
- 0.75 to < 0.90 (53)
- 0.43 to < 0.75 (30)
- Not populated



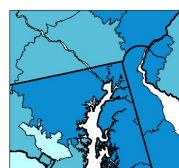
San Francisco



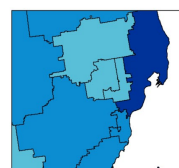
Chicago



New York



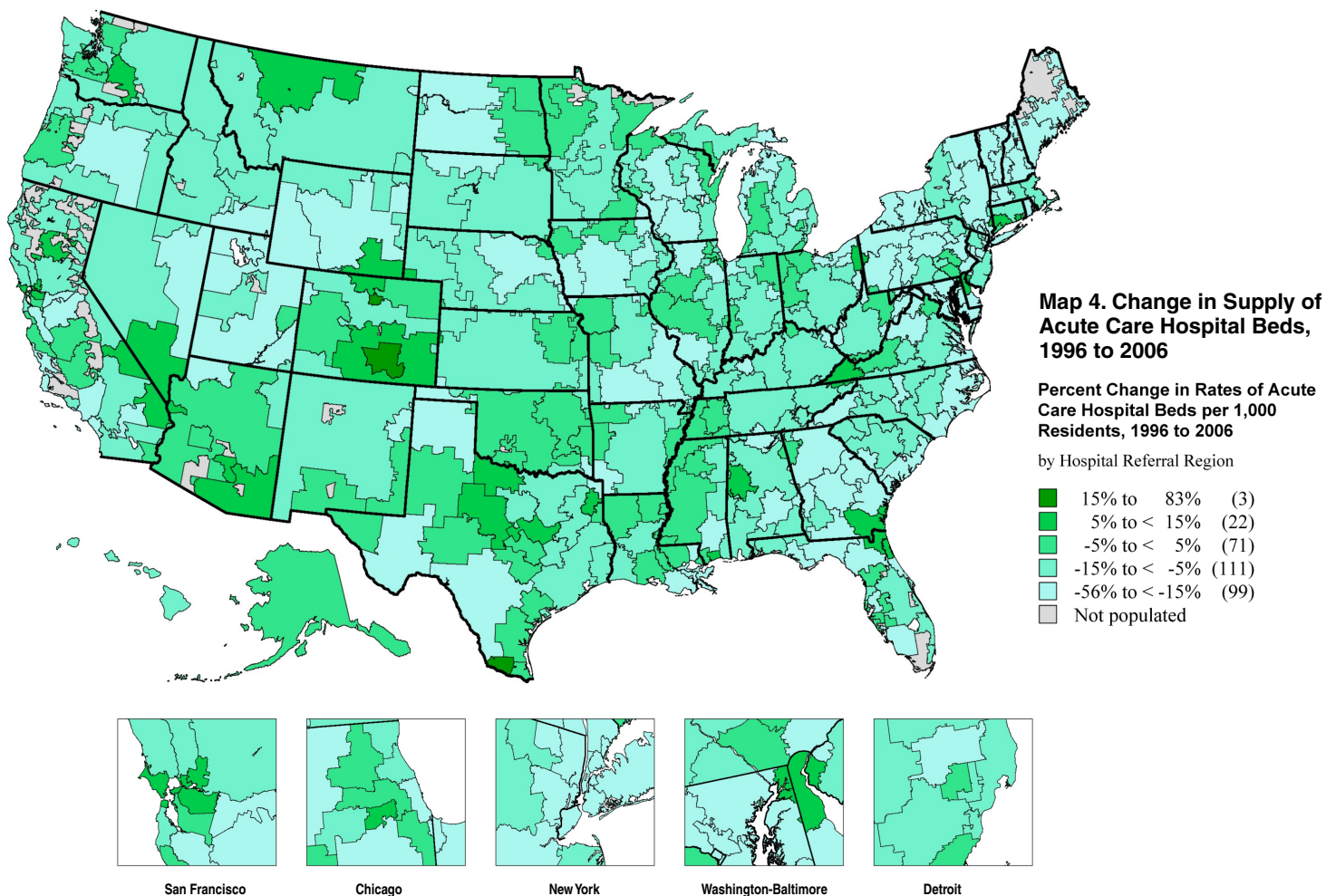
Washington-Baltimore



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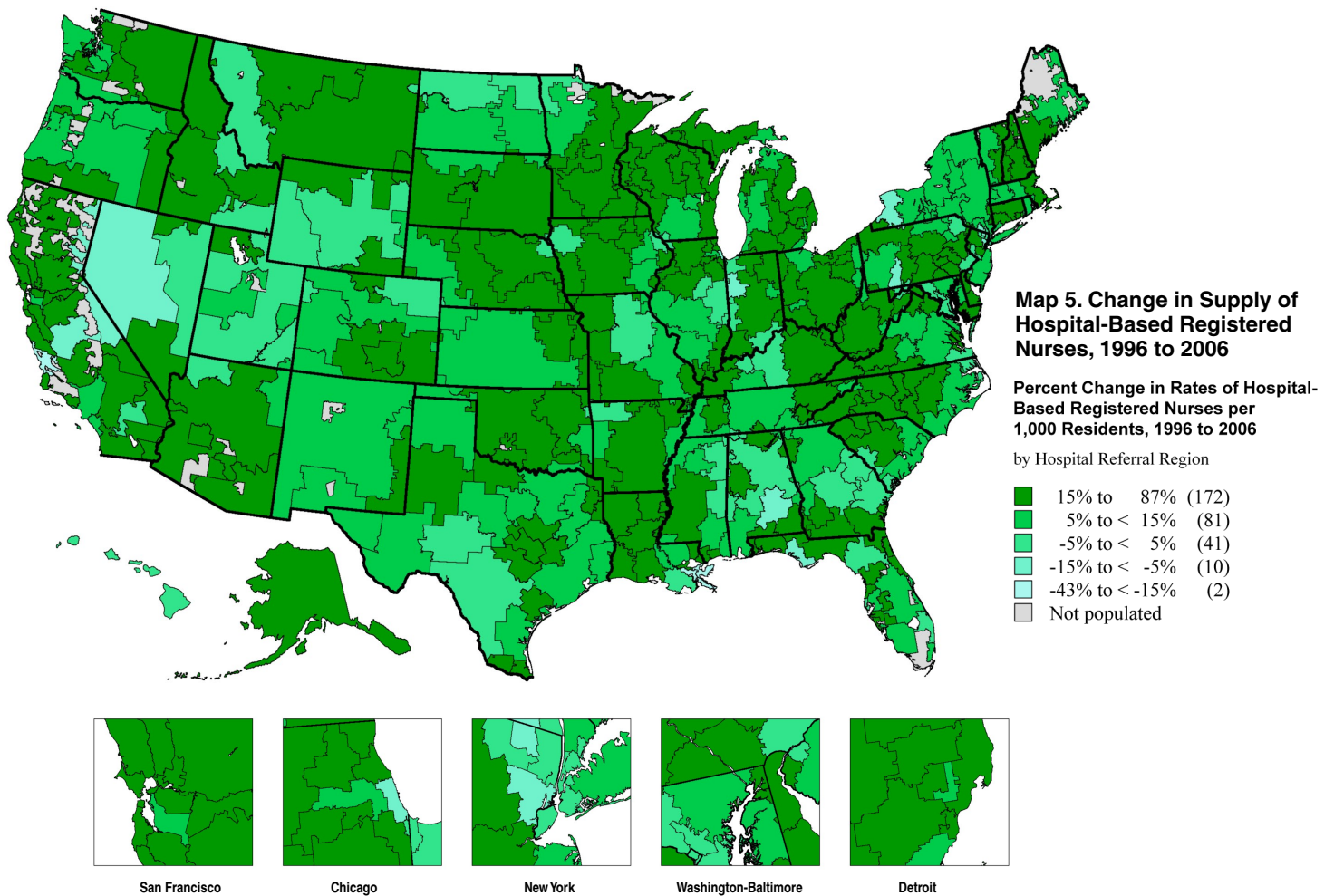
## Growth in capacity by region

The change in hospital bed supply varied markedly across regions. While bed supply decreased in most regions, the decline was particularly large in Newport News, Virginia (-37.1%), Newark, New Jersey (-36.6%) and Wilkes-Barre, Pennsylvania (-35.6%).<sup>i</sup> In a few regions, the supply increased, including Pueblo, Colorado (+82.8%), McAllen, Texas (+40.2%) and Boulder, Colorado (+19.2%).

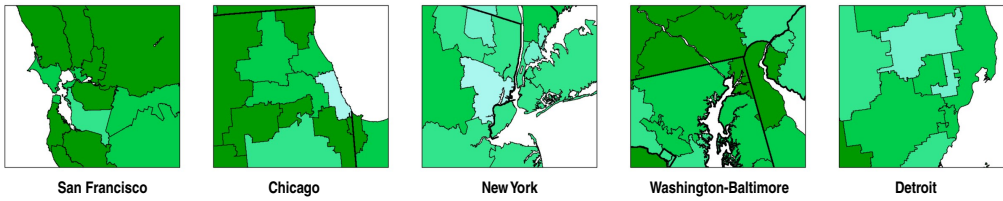
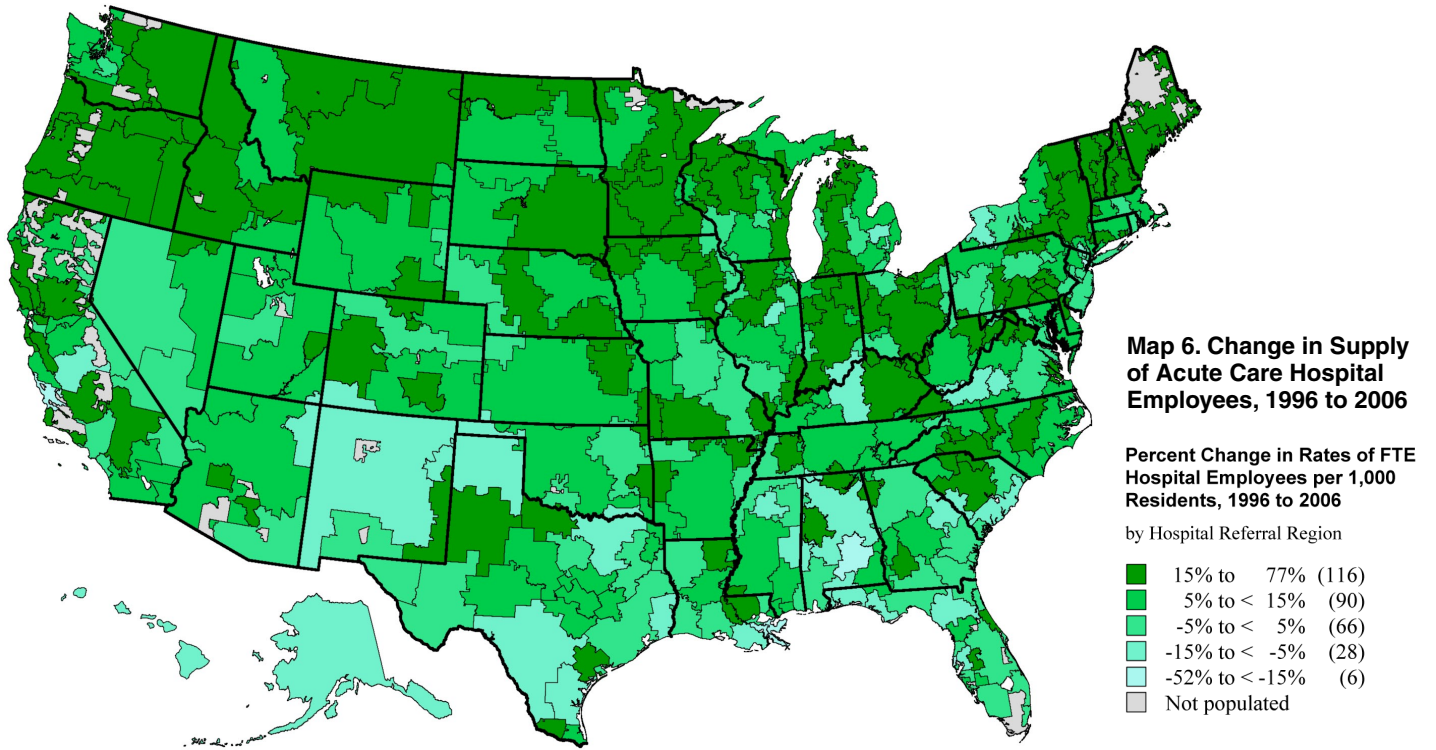


<sup>i</sup> The most dramatic decline in the supply of acute care hospital beds, employees and registered nurses occurred in New Orleans. Because much of this decline was almost certainly due to Hurricane Katrina in 2005, rather than factors endogenous to the region's health care system, we have chosen not to emphasize this decline in this report.

In contrast to hospital beds, most regions experienced growth in hospital staff, including registered nurses and total employment. Regions that experienced particularly large increases in both nurses and overall employment included Contra Costa County, California (RNs, +86.4%: total employees, +76.7%), Santa Cruz, California (RNs, +85.1%: total employees, +46.7%) and Wilmington, Delaware (RNs, +65.1%: total employees, +48.3%). In a few regions of the country, hospital employment declined. These included San Luis Obispo, California (RNs, -21.5%: total employees, -18.3%), Newark (RNs, -11.5%: total employees, -25.1%) and Chicago (RNs, -10.2%: total employees, -20.0%).









### Areas with high bed supply in 1996 maintained high supply in 2006

Regions with relatively high capacity in 1996 continued to be high in 2006, revealing the stability of regional capacity (Figure 4). Seventy-three percent of the regional variation in supply in 2006 could be explained by the 1996 supply.

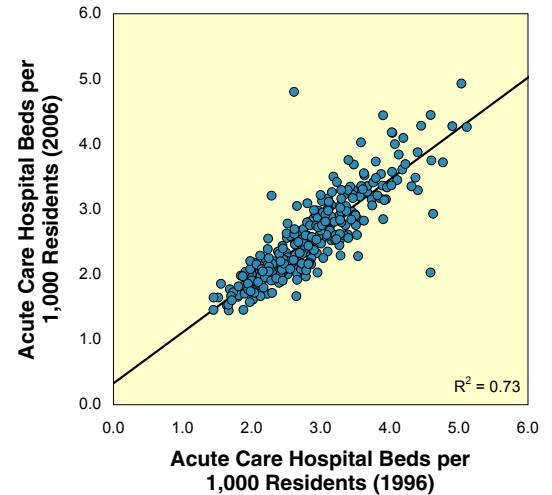


Figure 4. The Relationship between the Supply of Acute Care Hospital Beds in 1996 and 2006

### Areas with high bed supply had high levels of hospital-based employees

The per capita supply of hospital beds was strongly correlated with hospital-based employment, including registered nurses and overall employment. Even with the shift to outpatient care, the capital investment in inpatient capacity is linked to the overall size of the hospital labor force.

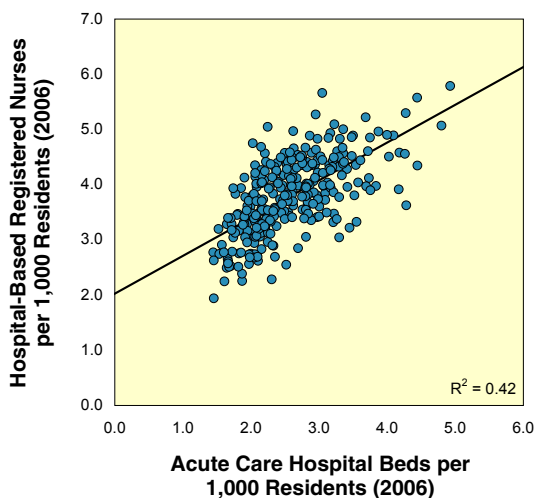


Figure 5. The Relationship between the Supply of Acute Care Hospital Beds and Hospital-Based Registered Nurses (2006)

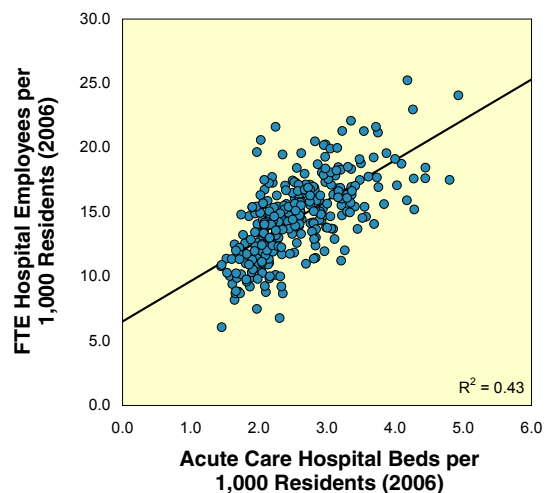
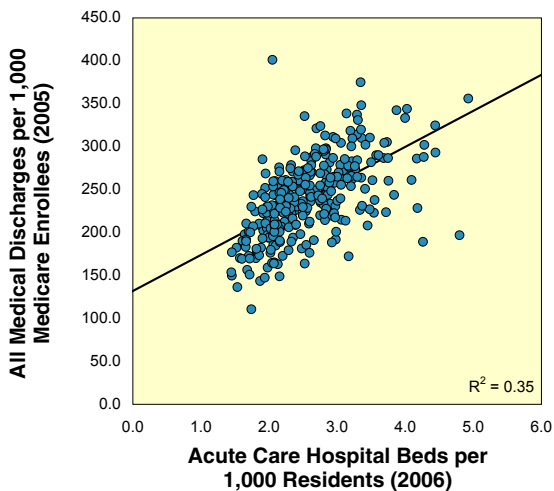


Figure 6. The Relationship between the Supply of Acute Care Hospital Beds and Hospital Employees (2006)



**Figure 7. The Relationship between the Supply of Acute Care Hospital Beds (2006) and Medical Discharge Rates (2005)**

### Bed supply is associated with medical discharge rates

As long ago as the 1960s, Milton Roemer described the phenomenon that a built bed was a filled bed.<sup>1</sup> Numerous studies since then have found that higher bed supply is associated with more hospital use for conditions where outpatient care is a viable alternative.<sup>1-6</sup> This includes most medical causes of hospitalization. In 2006, bed supply remained an important determinant of medical discharges.

### Hospital capacity 2006: Interpreting the data

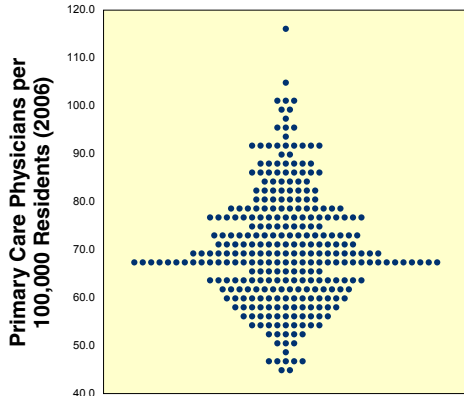
The powerful effects of hospital capacity on the local practice of medicine have been known for almost 50 years.<sup>1</sup> The number and size of hospitals grew rapidly after the Second World War, but by the 1970s there were widespread concerns about costs associated with excess hospital capacity and high rates of hospitalization. Since then, hospitals have reduced bed capacity while growing services that can be provided without an overnight stay. Although hospital bed supply has decreased, the overall size and dominance of hospitals in health care delivery has grown.

Unfortunately, the distribution of hospital capacity fails to reflect the regional need for hospital care, either for beds or for hospital staff. Even after controlling for differences in age and sex, some regions had more than twice the number of beds per capita than other regions. More beds means that patients are more likely to receive their care during a hospital admission, with greater costs, and a higher likelihood of hospital-acquired infections and medical errors.

Anticipation of aging baby boomers has again raised concerns about the adequacy of hospital capacity.<sup>7</sup> The Medicare Payment Advisory Commission (MedPAC) notes that hospital capital investment is increasing, particularly for entirely new facilities and expansion of existing hospitals.<sup>8</sup> While population changes are often cited as the root cause, robust growth in capacity is planned in counties with and without strong population increases. The recent economic downturn has dampened some of these construction plans, but this is likely to only be a pause in the pace of investments.

## Changes in physician capacity

Physician supply continues to expand modestly, in both the overall numbers and the number per capita. Over the decade ending in 2006, the U.S. added almost 110,000 practicing physicians, including about 45,000 primary care and 60,000 specialty physicians. These increases exceeded population growth, and, as a result, the workforce per 100,000 grew by 7% overall, 11% for primary care physicians, and 4% for specialists. Specialties that grew at a particularly fast pace included critical care (198%), infectious disease (51%) and nephrology (43%). Specialties that declined include cardiothoracic surgery (-17%), pulmonology (-18%) and general surgery (-19%).

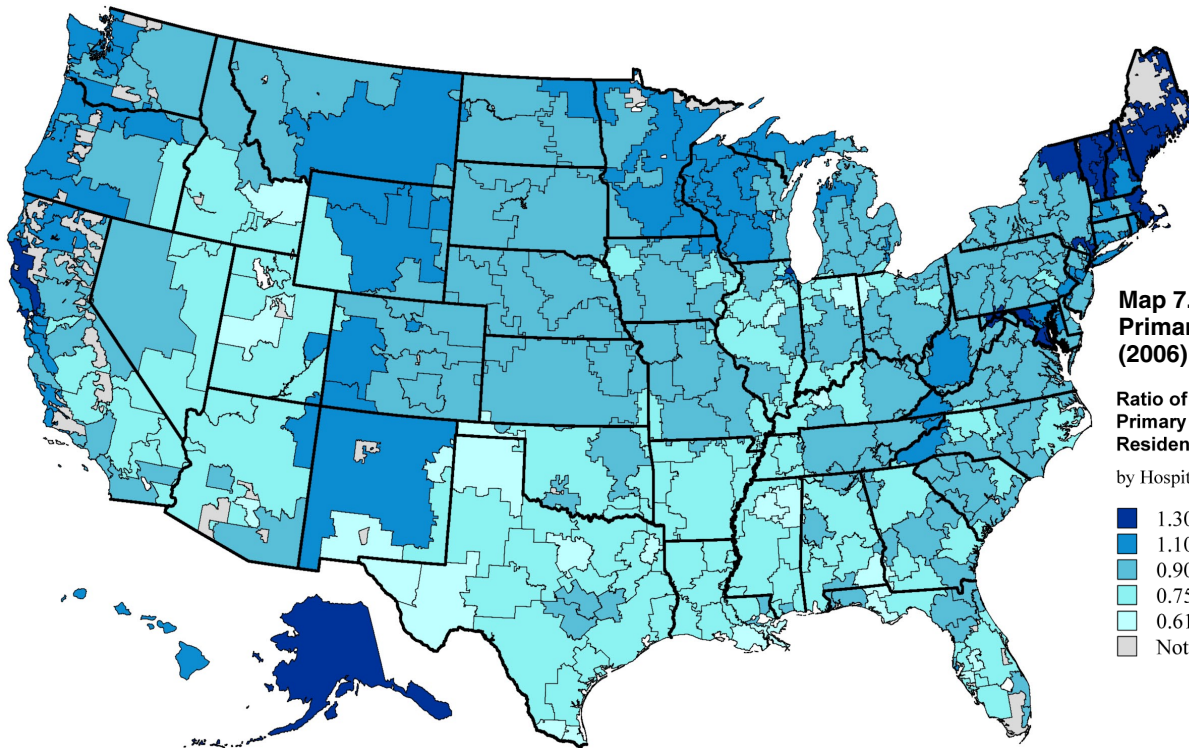


**Figure 8. Clinically Active Primary Care Physicians Allocated to Hospital Referral Regions (2006)**

### Regional variation in the physician workforce

Marked regional variation in the physician workforce was observed for all specialties. Primary care physicians per capita varied by a factor of more than 2.5, and specialist physicians more than threefold across hospital referral regions, after adjusting for age and sex population differences. High physician levels were found in both highly and less urbanized regions.

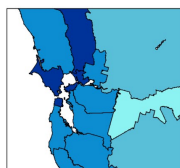
Regions with more than 100 primary care physicians per 100,000 residents included San Francisco (117.0), Lebanon, New Hampshire (105.5), Washington, D.C. (102.0), White Plains, New York (101.4) and Anchorage, Alaska (100.5). Five regions in Texas had fewer than 50 primary care physicians per 100,000, including Odessa (43.9), McAllen (45.1), El Paso (47.2), Longview (47.6) and Harlingen (47.7).



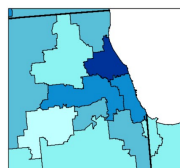
**Map 7. Clinically Active Primary Care Physicians (2006)**

Ratio of Rates of Clinically Active Primary Care Physicians per 100,000 Residents to the U.S. Average by Hospital Referral Region (2006)

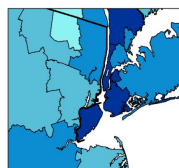
- 1.30 to 1.63 (12)
- 1.10 to < 1.30 (53)
- 0.90 to < 1.10 (141)
- 0.75 to < 0.90 (78)
- 0.61 to < 0.75 (22)
- Not populated



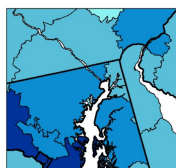
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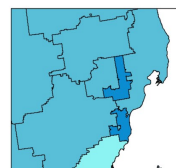
Chicago



New York



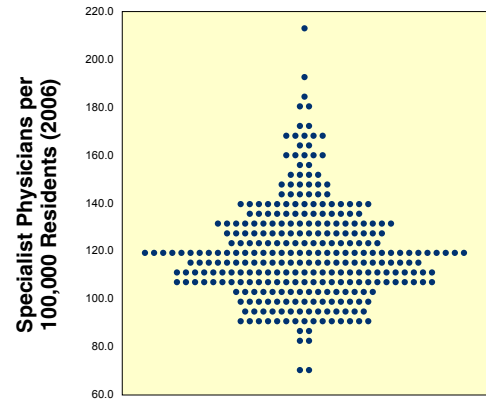
Washington-Baltimore



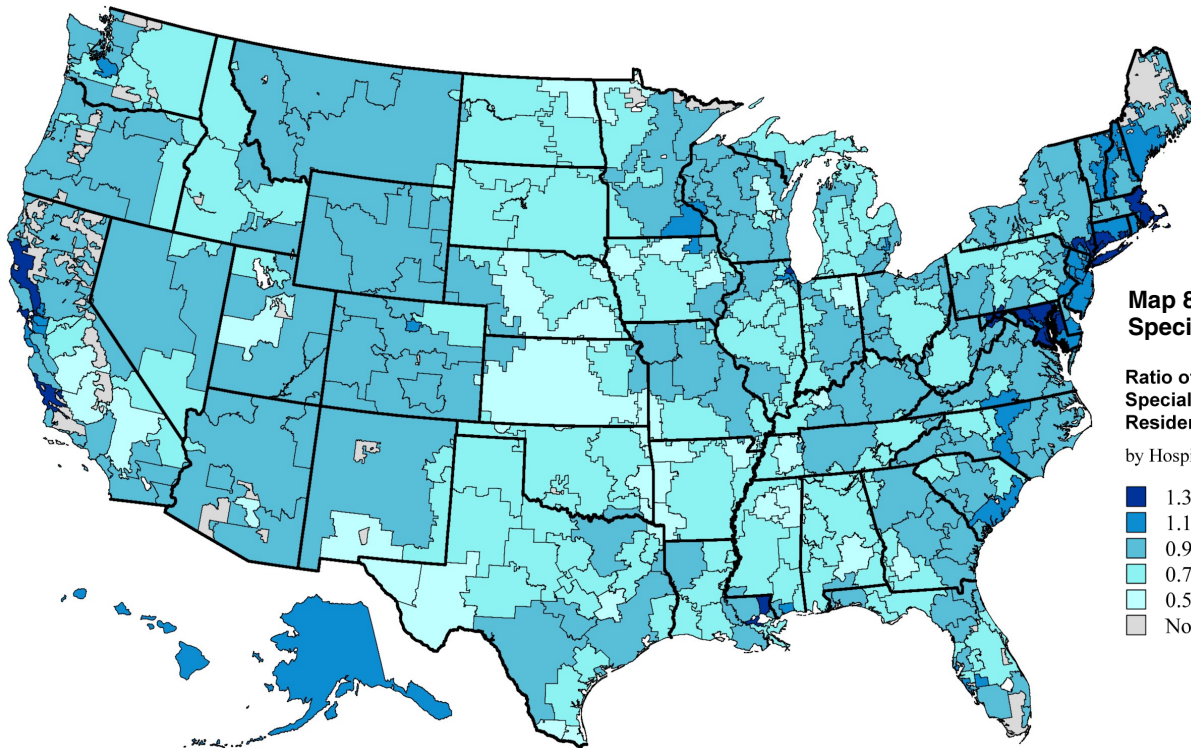
Detroit



Regions with particularly high specialist workforce levels included White Plains, New York (215.0 per 100,000), Washington, D.C. (194.7), Manhattan (185.9), San Francisco (180.7) and Boston (179.8). Regions with particularly low specialist workforce levels included McAllen, Texas (68.3), Harlingen, Texas (72.0), Tupelo, Mississippi (83.5), Sioux City, Iowa (84.1) and Aurora, Illinois (88.2).



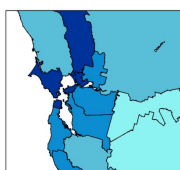
**Figure 9. Clinically Active Specialists Allocated to Hospital Referral Regions (2006)**



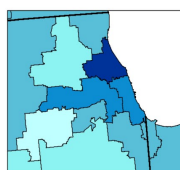
**Map 8. Clinically Active Specialists (2006)**

Ratio of Rates of Clinically Active Specialist Physicians per 100,000 Residents to the U.S. Average by Hospital Referral Region (2006)

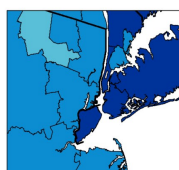
- 1.30 to 1.69 (13)
- 1.10 to < 1.30 (31)
- 0.90 to < 1.10 (127)
- 0.75 to < 0.90 (105)
- 0.53 to < 0.75 (30)
- Not populated



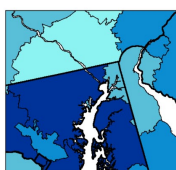
San Francisco



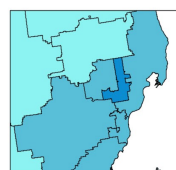
Chicago



New York

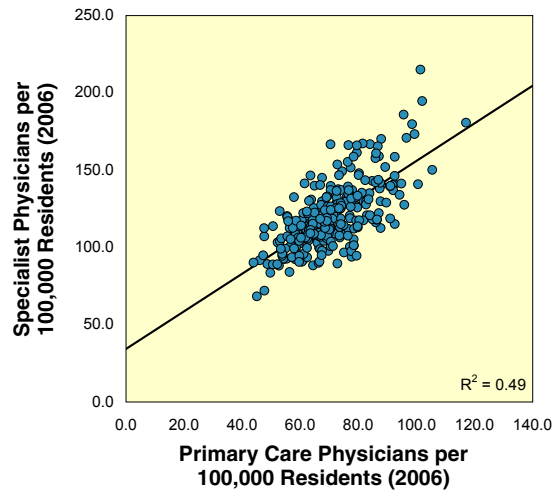


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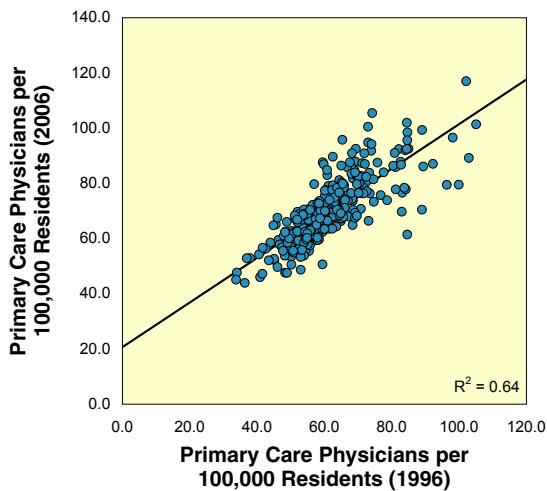
There was little substitution regionally in the primary care and specialist workforce. Regions that had a high supply of one generally had a high supply of the other, as reflected in the strong positive correlation across hospital referral regions.



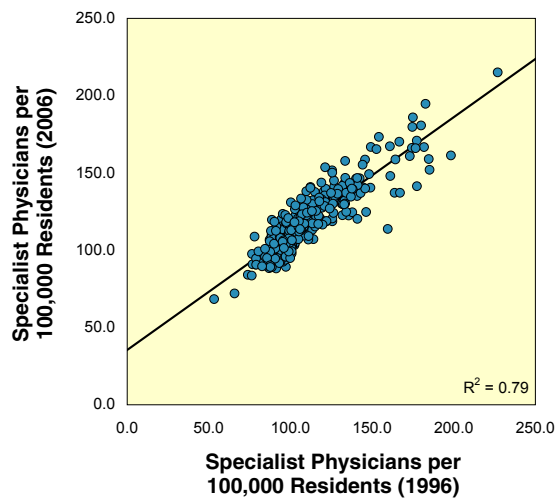
**Figure 10. The Relationship between the Supply of Primary Care and Specialist Physicians (2006)**

The striking variation in the physician workforce cannot be explained by differing patient needs.<sup>9-11</sup> Instead, previous research has shown that physicians have a strong preference to settle in more affluent communities and close to the teaching hospitals where they trained.

Workforce variation is remarkably durable over time. Regions with high numbers of physicians per capita in 1996 are usually the same regions with high supply in 2006 (Figures 11 and 12). Overall growth in the workforce, therefore, does not lead to a meaningful decrease in regional variation. Previous studies have shown that for every physician that settles in a low supply region, four physicians settle in a region with high supply.<sup>10</sup>



**Figure 11. The Relationship between the Supply of Clinically Active Primary Care Physicians in 1996 and 2006**



**Figure 12. The Relationship between the Supply of Clinically Active Specialists in 1996 and 2006**

## **Are more physicians associated with better patient outcomes?**

Every day physicians improve the health and well being of patients. It would seem to follow that more physicians in a region would lead to better outcomes for populations. The remarkable finding from two decades of studies at Dartmouth and other research centers is that higher physician supply *per se* offers little benefit in population health or in patients' satisfaction with access and with the care received.<sup>12-15</sup> While it is true that a *very low* supply of doctors is associated with higher hospitalization rates and mortality, only a small proportion of the country's population resides in such areas. Populations living in regions with a very high supply of physicians have no better mortality rates than those in regions with low or medium supply.

If greater physician supply is not very important in improving patients' health, then what is? Patients clearly do better when physicians provide evidence-based medicine in preventive services and in the care of patients with chronic illness. Consensus is emerging that the problems of care fragmentation, poor care coordination, and the uneven safety and reliability of medical care can best be addressed through a strategy that supports the development of integrated delivery systems more widely throughout the United States.<sup>16-18</sup>

## **Better management of capacity is an essential tool in health care reform**

The problems of quality and affordability have reached the critical stage, where many believe that substantive health care reform is not only possible, but inevitable. Proposals have been advanced for dependable insurance coverage, shifting reimbursements away from procedures and subspecialty care and toward primary care and the medical home, and better coordination of care through electronic medical records and integrated delivery systems. There has been less attention to the powerful effects that existing and future hospital and physician capacity will have on these initiatives.

Our legacy of hospital and physician capacity will challenge forces seeking health system change. In many regions of the country, hospitals and physicians have already invested in high numbers of intensive care unit beds, cardiac catheterization suites, and ambulatory surgery centers. Current expansion plans assume a continuation of reimbursement models that favor these medical services. Sustainable reform will require changes in capital investment that reflect our vision of better health care.

The physician workforce is shaped by a different set of forces than hospital capacity. While the current relative value unit reimbursement system draws medical students to medical and surgical subspecialties, teaching hospitals are equally powerful in their influence on training decisions. Physician workforce planning today consists of the decisions of hundreds of teaching hospitals regarding the size of residency



programs. Public funding of graduate medical education is approaching \$10 billion per annum. While legislation in 1997 limited further increases in GME funding, teaching hospitals have continued to expand training positions, largely in subspecialties, while ignoring a greater need for additional primary care residencies.

Two broad strategies deserve serious consideration.

**A regulatory approach:** Directly manage the future growth of capacity.

*Hospital capacity.* To manage the future growth of hospital capacity and reduce unwarranted variations in supply, Congress could require the Centers for Medicare and Medicaid Services to use its capital payment policies to limit the further growth of hospital capacity in markets that are already over-invested. Although Certificate of Need programs have generally not been effective, strengthening CON programs or statewide prospective hospital budgeting processes could be used to more wisely target future hospital growth. Neither of these approaches, however, would help reduce capacity in regions that already have an oversupply.

*Physician workforce.* With the large public investments in physician training, workforce planning needs a process with broader public input than can be found in today's narrowly focused and fragmented federal bodies. A national workforce commission with representation from the clinical professions, public health, health care purchasers, and patients would provide badly needed analyses and research to better direct funds for health workforce training and for provision of care to the underserved. This commission would take an outcomes-oriented approach; that is, explicitly define the desirable outcomes of workforce policy and then recommend investments that have a higher likelihood of achieving these ends.<sup>19</sup>

**A more market-oriented approach.** An alternative approach builds on the model proposed by John Wennberg<sup>17,20</sup> and would focus on fostering the growth of more organized systems of care and implementing fundamental payment reform. Consensus is emerging that integrated delivery systems that provide strong clinical support to clinicians and team-based care management for patients offer great promise for improving quality and lowering costs. Most physicians already practice within local referral networks around one or more hospitals, which could form local integrated delivery systems with little disruption of practice. Policymakers would need to remove legal barriers to collaboration and provide incentives—such as larger payment updates or subsidies for implementing electronic health records—to providers who were willing to establish real or virtual accountable care systems. Our volume-based payment systems could then be changed to incorporate partial capitation, bundled payments, or shared savings, thereby fostering accountability for overall costs and quality of care. Under global shared savings payment models, organized systems would have the appropriate incentives to right-size their hospitals and realign their physician workforces with the needs of the populations they serve.

## A Note on Methods

The measures of hospital and physician capacity presented in this report have been previously published in peer-reviewed journals and in editions of the Dartmouth Atlas of Health Care. A detailed discussion of the methods and the data can be found at the Dartmouth Atlas web site ([www.dartmouthatlas.org](http://www.dartmouthatlas.org)).

### Measuring hospital capacity

A set of acute care hospitals was developed from the linkage of the 2006 American Hospital Association (AHA) hospital survey, the CMS Provider of Services file, and the CMS Cost Reports. Hospitals that failed to link were examined and included if they appeared to provide care in 2006. In addition to acute care general hospitals, the set included children's hospitals and other specialty hospitals. Mental health facilities, skilled nursing facilities, and long-term hospitals were excluded.

The AHA survey was used as the primary source for measurement of beds and employment. While the AHA file has several different fields that report beds, we used staffed beds as the best indicator of the hospital's capacity to admit patients. When a hospital did not report to the AHA, we used the CMS Cost Report, then the CMS Provider of Services file. In the unusual situation that none of these sources provided measures of beds and employment, we used the AHA survey estimates.

These methods are similar to the methods used in 1996 except for the order of the data sources. In 1996, the AHA survey was used as the primary source of data, followed by the CMS Cost Report file. When a hospital did not report data for either of these files, the AHA estimate was used before the CMS Provider of Services file. This difference in methods may result in small differences in capacity rates in some regions.

### Measuring physician capacity

The counts of physicians were derived from the 1996 and 2006 American Medical Association (AMA) Master Files. In 1996, the American Osteopathic Association (AOA) file was also used. The 2006 AMA Master File includes a record for nearly every allopathic and osteopathic physician in the U.S. with information about physician location and self-reported specialty. We grouped the hundreds of Master File specialties into 39 categories and then further grouped these into primary care physicians and specialists. Primary care included family and general practitioners, general pediatricians, and general internists. Almost all other physicians were categorized as specialists. There is a small residual group that is not reported here. We limited our physicians to those who have completed post-graduate medical education (residency) and work for more than 20 hours a week in an office or hospital-based practice. Residents are reported separately. The age of physicians was limited to 26 to 65.

### **Calculating rates**

The above measures of capacity provided the numerators for rate calculation. The denominators are regional population estimates developed using data from Claritas. All rates were adjusted for regional border crossing of patients and for differences in population age and sex using the indirect method.

### **Defining hospital referral regions**

The Dartmouth Atlas presents most of its regional findings using hospital service areas (N = 3,436) and hospital referral regions (N = 306). Hospital service areas are geographic representations of the market for hospitalization among Medicare beneficiaries. These areas are further aggregated to hospital referral regions based upon beneficiaries' travel for tertiary care, in particular cardiovascular surgery and neurosurgery.

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