The Dartmouth Atlas of Health Care in Virginia

The Center for the Evaluative Clinical Sciences
Dartmouth Medical School

The Maine Medical Assessment Foundation

VIRGINIA HOSPITAL & HEALTHCARE ASSOCIATION
An alliance of hospitals and health delivery systems

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The Dartmouth Atlas of Health Care in Virginia Working Group

From the Center for the Evaluative Clinical Sciences

Kristen K. Bronner, M.A.
Megan McAndrew Cooper, M.B.A., M.S., *Editor*
John E. Wennberg, M.D., M.P.H., *Director and Series Editor*

From the Maine Medical Assessment Foundation

Robert B. Keller, M.D., Executive Director
Anne Marie Largay, M.S., M.P.H.
Ellen Jane Schneiter, M.H.S.A.
David E. Wennberg, M.D., M.P.H.

Atlas design and print production

Jonathan Sa'adah and Elizabeth Adams
Intermedia Communications

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The Center for the Evaluative Clinical Sciences
Dartmouth Medical School
Hanover, New Hampshire 03756
(603) 650-1820
http://www.dartmouth.edu/~atlas/

The Maine Medical Assessment Foundation
P.O. Box 249
Manchester, Maine 04351-0249
(207) 622-9342
MMAF@mmaf.org

Virginia Hospital & Healthcare Association
P.O. Box 31394
Richmond, Virginia 23294-1394
(804) 965-1208

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CHAPTER ONE

Variations in the Use of Acute Care Hospital Services

Variations in the Use of Acute Care Hospital Services

The Dartmouth Atlas of Health Care in Virginia, a part of the Dartmouth Atlas of Health Care series of publications, demonstrates again that the way health care resources are distributed and used, at the local level, challenges the conventional wisdom that illness determines the use of medical care, and the assumption that the supply of medical care arises in response to the demand for it.

To some degree, the conventional wisdom is correct: people who are very sick more often seek and receive care than those who are less sick. But there is little relationship between how much care people with a given level of illness living in one community receive and how much care equally-sick people in another community are likely to get. The amounts of care provided to equally-sick people (those with, for example, diabetes, chronic obstructive pulmonary disease, heart disease, or prostate disease) who live in different communities are not the same. In some communities, for example, people with heart disease are more likely to be treated with surgery; in other communities, people with the same disease profiles are treated with less invasive methods, such as oral medications.

Moreover, differences in the amount of care provided to members of different communities are not closely related to differences in illness rates. In some inner cities, for example, rates of hospitalization, per capita supplies of hospital beds, and expenditures for hospital-based care are very high. In other, demographically similar cities, rates of medical resources and utilization are relatively low. The difference lies not in population health characteristics, but in the characteristics of the local supply of resources. Patterns of medical care are more closely related to the amount of available resources and to the practice patterns of physicians who prescribe care than to the relative illness rates of populations. Most simply put, geography is destiny: where you live determines whether you are relatively likely or unlikely to receive certain medical interventions for your illness. This is as true for residents of Virginia as it is for people living elsewhere in the United States.

Small Area Analysis

Differences in the per capita supply of medical resources among local and regional markets have been identified through the methodology called small area analysis. Small area analysis begins with patient origin studies, which link patients' ZIP Codes of residence to the hospitals where they receive care (using the hospitals' unique identifier numbers). Each ZIP Code is assigned to a hospital service area based on where the plurality of patients living in the ZIP Code who received hospital-based care were hospitalized. Once such hospital service areas — clusters of contiguous ZIP Codes — are defined, it is possible to accurately estimate the resources allocated to residents on a per capita basis — for example, the number of acute care hospital beds per 1,000 residents of a particular hospital service area, or the number of physicians per 100,000 residents of the area. Further, the per capita rates of utilization of specific kinds of medical interventions, such as the rates of hospitalization for medical conditions per 1,000 residents or the number of heart bypass procedures per 1,000 residents, can be estimated using these methods. Finally, the relationship between the supply of resources available and the likelihood of their use — for example, the relationship between the supply of hospital beds per 1,000 residents of a hospital service area and the rates at which residents of the area are hospitalized for specific conditions such as pneumonia, congestive heart failure, or care at the end of life — can be examined.

The patterns of variation and the associations between hospital resources and hospitalization explain why, in health care markets, geography is destiny: why the supply of resources and the practice patterns of physicians, rather than illness rates, are the major factors explaining the differences in rates of care among communities and regions.

The Surgical Signature

The patterns of variation in use of elective surgery illustrate the importance of physician practice style in determining how surgical resources are allocated to patient populations. There are striking differences among Virginia hospital service areas in the likelihood of undergoing common surgical procedures such as prostate operations, back surgery, and coronary artery bypass grafting. The "surgical signature" of a particular community is the pattern that describes the relative likelihood that someone living in that community will undergo a specific procedure, compared to the chances that a resident of a different community who has the same set of symptoms will undergo the procedure.

Absent the information presented in the Dartmouth Atlas of Health Care series, one might expect that communities would have fairly standard surgical rates — that areas with high rates of one kind of surgery would have high rates of other kinds of surgical procedures as well. Interestingly, this is not the case; communities' surgical signatures generally have idiosyncratic patterns. It is typical for a community to be high in the use of one procedure, low in the use of another, and average in the use of a third. Even when the overall rates of surgery — the measure of the total number of surgical cases per thousand residents — are similar from community to community, the elements that make up those rates (for example, back surgery, prostate surgery, open heart surgery) are often very different.

The rates of ten common surgical procedures in the eight largest Virginia hospital service areas — Alexandria, Arlington, Falls Church, Newport News, Norfolk, Richmond, Roanoke, and Virginia Beach — are illustrated in Figure 1.1. Note that the aggregate rates of surgery in these communities are largely the same, but that the rates of specific procedures are quite different, and that none of the communities has uniformly high or uniformly low rates of the different surgical procedures.

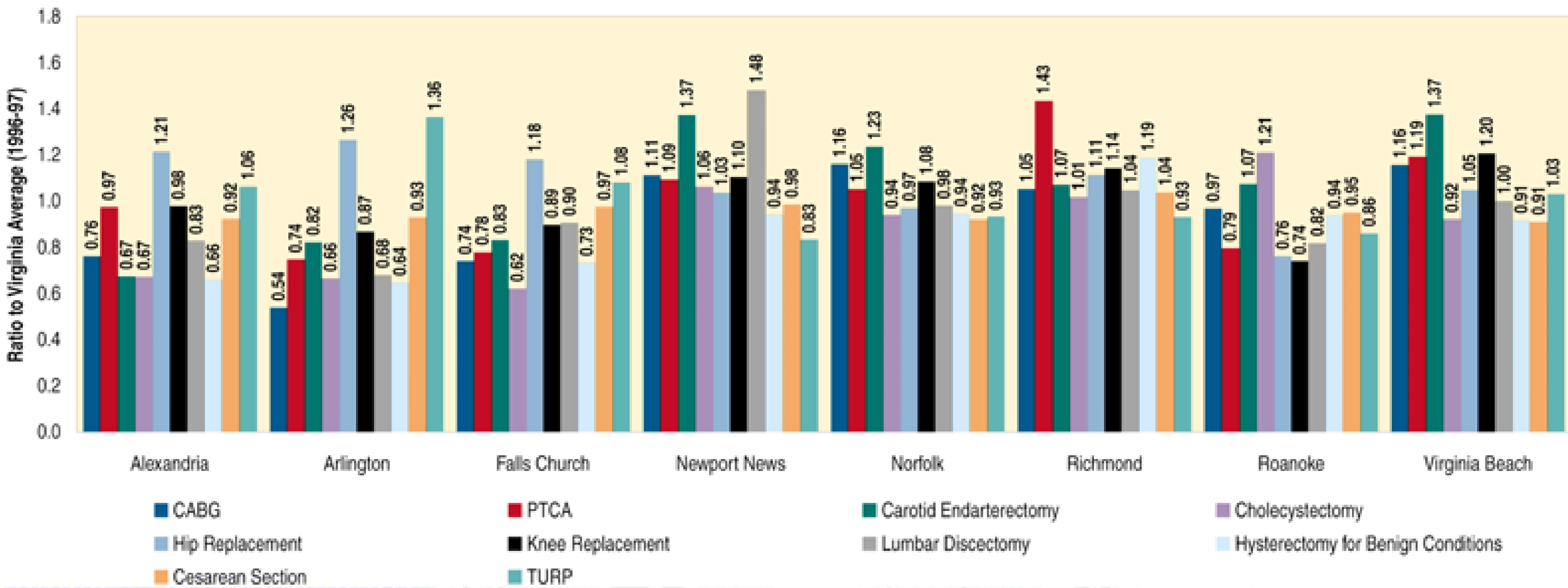


Figure 1.1. The Surgical Signatures of Eight Virginia Hospital Service Areas (1996-97)

Rates of particular kinds of surgery are highly variable between communities. For example, residents of the Newport News hospital service area are 48% more likely to undergo lumbar discectomy than the state average, while residents of the Arlington hospital service area are 32% less likely than the average to have the procedure. Residents of Newport News and Virginia Beach are 37% more likely than the state average to undergo carotid endarterectomy; residents of Alexandria are 33% less likely, and residents of Arlington 18% less likely, to undergo the procedure than the average. Interestingly, patterns of surgery are not uniformly high or low in any community; areas with high rates of one kind of surgery often have low rates of another. For example, although rates of lumbar discectomy and carotid endarterectomy are higher than average in Newport News, male residents of Newport News are 17% less likely than the state average to undergo transurethral prostatectomy, and women in Newport News who have children are 2% less likely than the state average to have their babies by cesarean section.

The Medical Signature

The patterns of variation in discharge rates for medical (non-surgical) conditions have their own recognizable “signatures,” but medical signatures are generally unlike surgical signatures. Within a given community, there is likely to be a strong and consistent pattern of high, average, or low rates of hospitalization for a variety of medical conditions, such as pneumonia, heart failure and gastroenteritis, as well as consistent patterns of hospitalizations for related illnesses such as cancers.

Figure 1.2 illustrates the medical signature of common conditions among residents of the Alexandria, Arlington, Falls Church, Newport News, Norfolk, Richmond, Roanoke, and Virginia Beach hospital service areas. There is more within-area consistency in the patterns of utilization in these communities than in the patterns of variation in surgery illustrated in Figure 1.1. Rates of hospitalization for medical conditions were relatively consistent in these communities, with certain striking exceptions such as the rate of discharges for arrythmia in the Virginia Beach hospital service area.

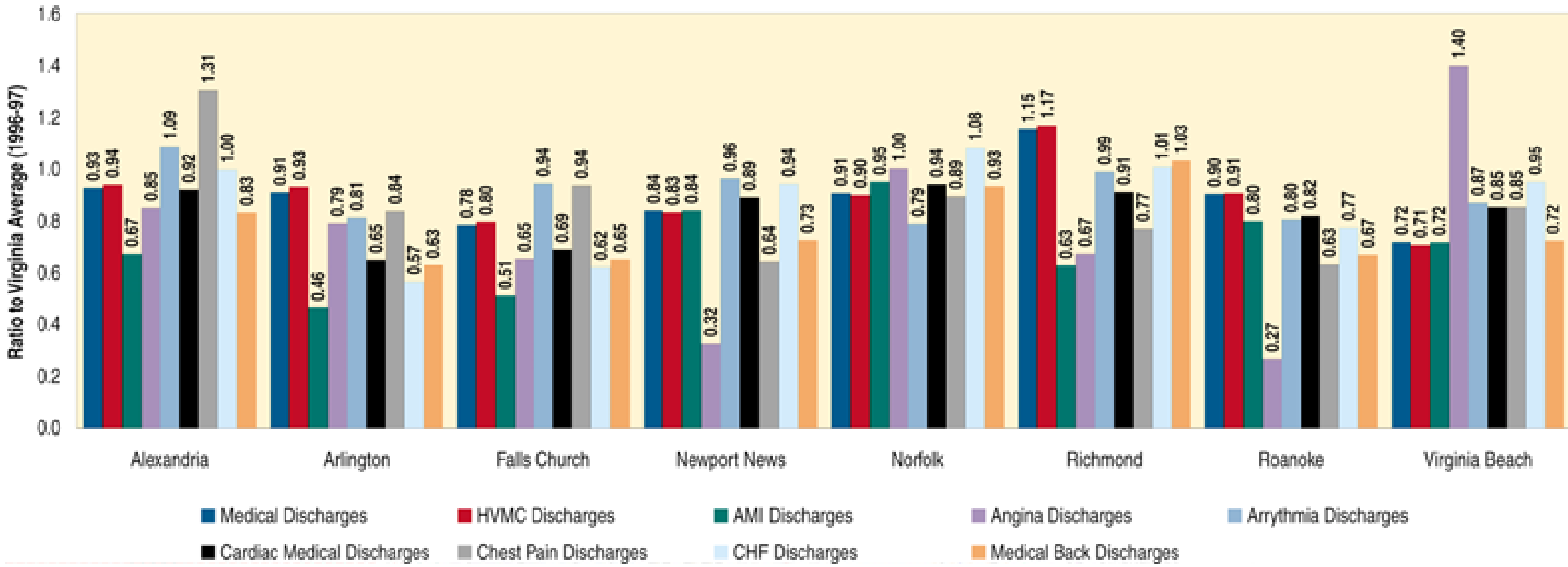


Figure 1.2. The Medical Signature of Eight Virginia Hospital Service Areas (1996-97)

Compared to surgical signature, areas' medical signatures tend to be uniformly high, low, or average. For example, rates of admission for common medical conditions are from 7% to 54% lower than the state average among residents of the Arlington hospital service area; no medical discharge rate is higher than the state average. Rates of medical admissions in Norfolk are consistently higher than in Arlington; no rate is more than 21% below the state average. There are certain exceptions, such as the rate of discharges of discharges for angina in the Roanoke hospital service area, which was substantially lower than for other medical discharge rates in the hospital service area, and rates of angina discharges in Virginia Beach, which were 40% higher than the state average although other rates in the hospital service area were below the state average.

Sources of Variation

Figures 1.3, 1.4, and 1.5 show the correlations between hospital capacity in Virginia hospital service areas and utilization for adult medical conditions, pediatric medical conditions and surgical conditions. There is a strong correlation between the per capita supply of hospital beds and the rates of hospitalizations for medical conditions (R^2 = .37), suggesting that almost 40% of the variation is related to bed supply. There is less correlation (R^2 = .33) between surgical hospitalizations and the local supplies of hospital beds (Figure 1.4); and much less correlation (R^2 = .17) between hospital beds and pediatric medical discharges (Figure 1.5).

Figure 1.3. The Association Between Hospital Beds and Hospitalization Rates for Medical Conditions in Virginia (1996-97)

Almost 40% of the variation in rates of adult hospitalizations for medical conditions was explained by local differences in the number of hospital beds per 1,000 residents, after adjustment for differences in population age, sex and race (R^2 = .37). Note that this relationship would be stronger (R^2 = .55) if the Lebanon, Grundy, Norton, Clintwood, Richlands, Hot Springs and Low Moor hospital service areas — the "outliers" on the graph — were excluded from the analysis.

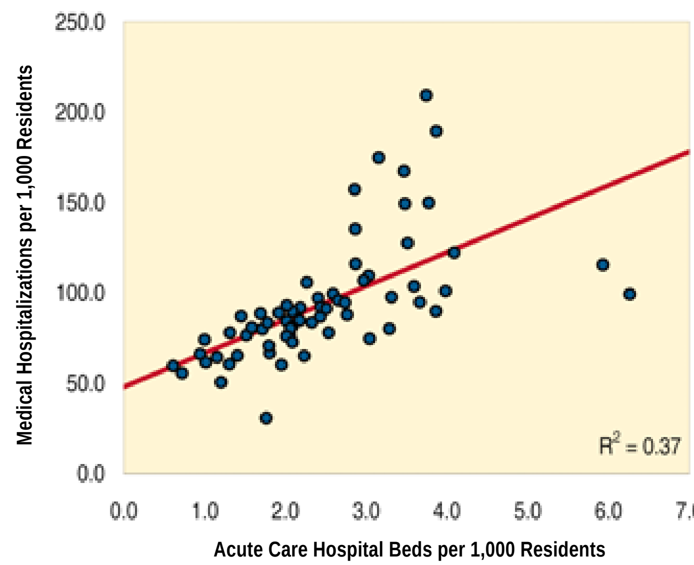
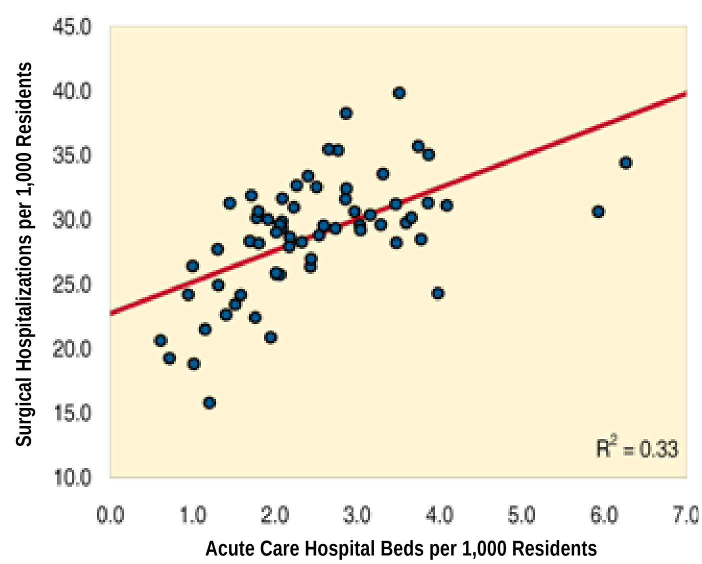


Figure 1.4. The Association Between Hospital Beds and Hospitalization Rates for Surgical Procedures in Virginia (1996-97)

About 30% of the variation in rates of adult hospitalizations for surgical conditions was explained by local differences in the number of hospital beds per 1,000 residents, after adjustment for differences in population age, sex and race (R^2 = .33). Exclusion of the Clintwood, Grundy, Hot Springs, Low Moor, Norton and Richlands hospital service areas (the "outliers" on the graph) from this analysis changes the correlation only slightly, to R^2 = .34.



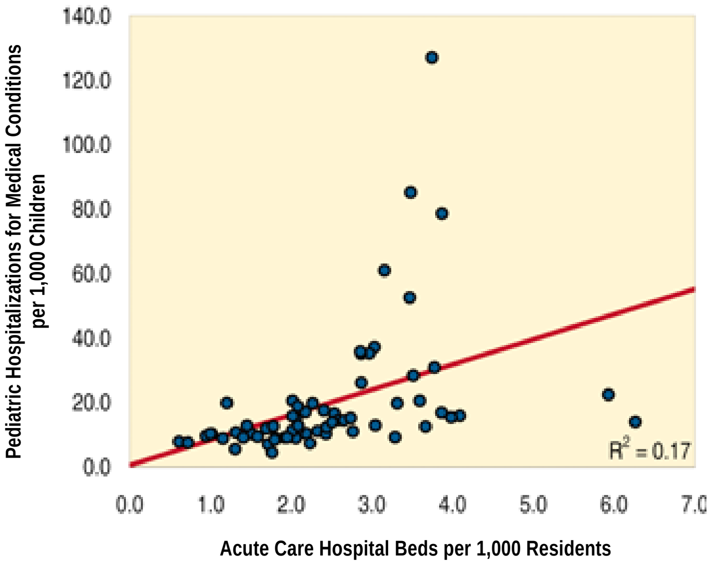


Figure 1.5. The Association Between Hospital Beds and Rates of Pediatric Medical Conditions in Virginia (1996-97)

Less than 20% of the variation in rates of pediatric hospitalizations for medical conditions was explained by local differences in the number of hospital beds per 1,000 residents, after adjustment for differences in population age, sex and race (R^2 = .17). Exclusion of the Clintwood, Grundy, Hot Springs, Low Moor, Norton and Richlands hospital service areas (the "outliers" on the graph) from this analysis changes the correlation only slightly, to R^2 = .23.

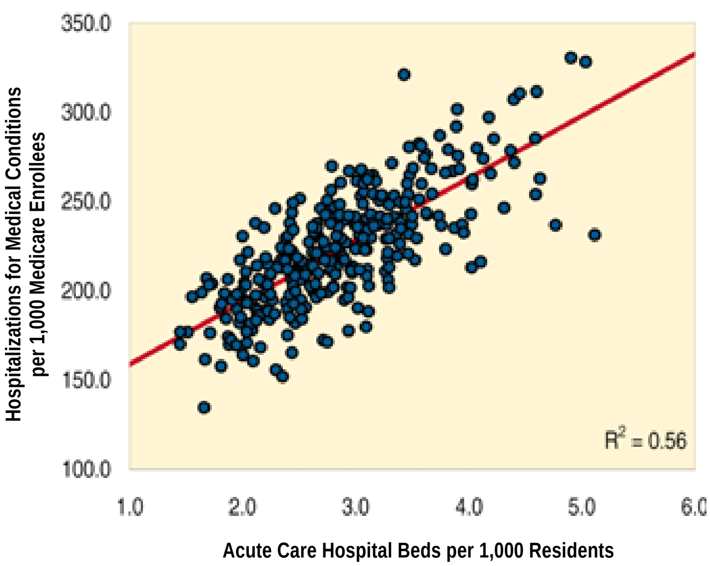


Figure 1.6. The Association Between Hospital Beds and Rates of Hospitalizations for Medical Conditions in the Medicare Population in the United States (1995-96)

Nationally, more than half of the variation in rates of hospitalization for medical conditions in the Medicare population could be attributed to differences in local supplies of acute care hospital beds (R^2 = .56).

The association between beds and medical hospitalizations in Virginia is not unusual; it can be seen throughout the United States. The Dartmouth Atlas of Health Care 1999 (Figure 1.6) reported that in the Medicare population, the supply of hospital beds explained more than half the variation in the rate of hospitalization for medical conditions (R^2 = .56). In the Medicare population, as in the population at large, the supply of hospital beds influences the probability of hospitalization for a wide spectrum of acute illnesses. For example, communities with more beds per 1,000 residents treat terminal illnesses much more aggressively, on average, than communities with fewer beds per capita. This more-aggressive approach to end of life care can be measured by the average number of days Medicare enrollees spend in hospitals during the last six months of life, the likelihood of being admitted to intensive care, and the amount of money that is spent on hospital services (Chapter Six).

The association between hospital beds per capita and the use of hospitals for the treatment of adult medical conditions is not well-recognized by practicing physicians. Some part of this phenomenon is explained by the ingrained assumption that more is better — and that making more resources available to a sick person will result in a better outcome. When sick patients are reasonable candidates for hospitalization (for example in the case of a patient with pneumonia, congestive heart failure, or chronic obstructive pulmonary disease), and the local supply of hospital beds is such that using a bed for the treatment of such a patient will not deny the use of the bed to a patient who cannot live without it, it is common for the attending physician to assume that it is better for the patient to be treated in the inpatient environment. In the hospital, all the power of modern medicine is at hand, and care is better organized and more intense than it is in other settings (in the patient's home, through hospice, or in a nursing home, for example).

Figures 1.3 through 1.6 demonstrate the relationship between supply of hospital beds and medical hospitalization rates in adults, surgical procedure rates in adults, and pediatric admissions for medical conditions. The four kinds of admissions have different relationships with the local supply of hospital beds. In spite of recent efforts of managed care companies and others to reduce hospital admissions and lengths of stay, admissions for adult medical conditions are strongly correlated with the supply of hospital beds. Rates of surgery among adults are less related to the supply of beds than to differences in practice patterns of surgeons. Patterns of pediatric hospitalizations for medical conditions are markedly different from patterns of medical conditions in adults. In common diseases of children, including asthma, bronchitis, pneumonia, gastroenteritis and otitis media, there is a much weaker correlation between admission rates and hospital bed capacity. Decisions to hospitalize children with these conditions is dependent on the practice patterns and beliefs of the pediatricians and family practitioners who treat children, in much the same way that surgical procedures tend to be driven by differences between surgeons about preferred approaches to treating common conditions.

This Atlas examines the variations in the supply of hospital resources and spending (Chapter Two); the physician workforce (Chapter Three); the surgical treatment of common conditions (Chapter Four); the quality of care as reflected in the use of recommended preventive services (Chapter Five); and the experience of death in Virginia (Chapter Six). Questions of what is the “right” rate, what is fair, and how inequalities in the current distribution and utilization of resources can be corrected, are addressed in Chapter Seven.

Readers wishing to know more about the methodology underlying the analyses in this Atlas are referred to the Appendix on Methods. The Endnote provides a list of other publications by member of the Dartmouth Atlas Working Group and other publications of interest to students of small area analysis and health services policy and research.

Notes on the Data

In this Atlas, most measures of health care resources and utilization are reported on the basis of hospital service areas, using data prepared for the Virginia Hospital Research and Education Foundation by HCIA. There are some exceptions. In some cases, such as mastectomy for breast cancer, the number of observed procedures in most hospital service areas would be too small to achieve statistical significance, and might in some cases result in compromised confidentiality of patient records. When necessary, the problem of small numbers in the VHREF database was compensated for by using larger units of analysis — hospital referral regions, which are aggregations of hospital service areas that represent naturally-occurring markets for tertiary care services (including such procedures as coronary artery bypass grafting and neurosurgery). Using hospital referral regions results in less precision about local rates but offers greater statistical stability.

In Chapter Five, the Quality of Care, and Chapter Six, The Experience of Death, only Medicare claims data were used to calculate rates of such measures as rates of colorectal cancer screening and days in hospitals during the last six months of life. These data are available only from the Medicare database, and were used to answer certain questions about the likelihood of particular kinds of preventive services and medical interventions for residents of the state during the last six months of their lives. The information reiterates data used in the Dartmouth Atlas of Health Care 1999, but is reported for Virginia only.

Hospital service areas vary in size, both geographically and in terms of their populations. Some areas, such as Alexandria and Arlington, have large populations that provide enough observed and expected events for all measures (such as surgical procedures) so that both statistical stability and confidentiality are assured. Other areas have smaller populations, and fewer surgical events. Some areas import or export patients for health care services across state boundaries. Various methods have been used to compensate for these situations. In the text, certain areas, although they might lie at either extreme of the distribution, are excluded from discussion because their populations are small. In the data tables, areas where there are questions of statistical stability or significance have been noted.

It is the philosophy of the Dartmouth Atlas of Health Care Working Group that, in illustrating interesting aspects of the data in the text accompanying tables, figures, and maps, attention should be focused on hospital service areas large enough and populous enough that the variations are not due to such complex and intractable problems as the supply of beds in areas with small rural hospitals. In general, areas with small total populations are not mentioned in the text, although they are included in the maps and figures and are reported in the data tables.

For more detailed information about the methodology used to create this Atlas and other publications in the Dartmouth Atlas of Health Care series, please see the Appendix on Methods.

For a ZIP-to-HSA crosswalk file in electronic form, please contact ESRI, in Redlands, California (www.phelm@esri.com), which distributes this file free of charge.

The Geography of Health Care in Virginia

The use of medical resources in Virginia, like their use in the United States as a whole, is highly localized. Most Virginians use the services of physicians whose practices are nearby. Physicians, in turn, are usually affiliated with hospitals that are near their practices. As a result, when patients are admitted to hospitals, the admissions generally take place within a relatively short distance of where the patients live. Although the distances from homes to hospitals vary with geography — people who live in rural areas travel farther than those who live in cities — in general most patients are admitted to a hospital which provides an appropriate level of care close to where they live.

The Medicare program maintains exhaustive records of hospitalizations. These files provide a reliable basis for determining the geographic patterns of health care use, because research shows that the migration patterns of patients in the Medicare program are similar to those for younger patients (see the Endnote).

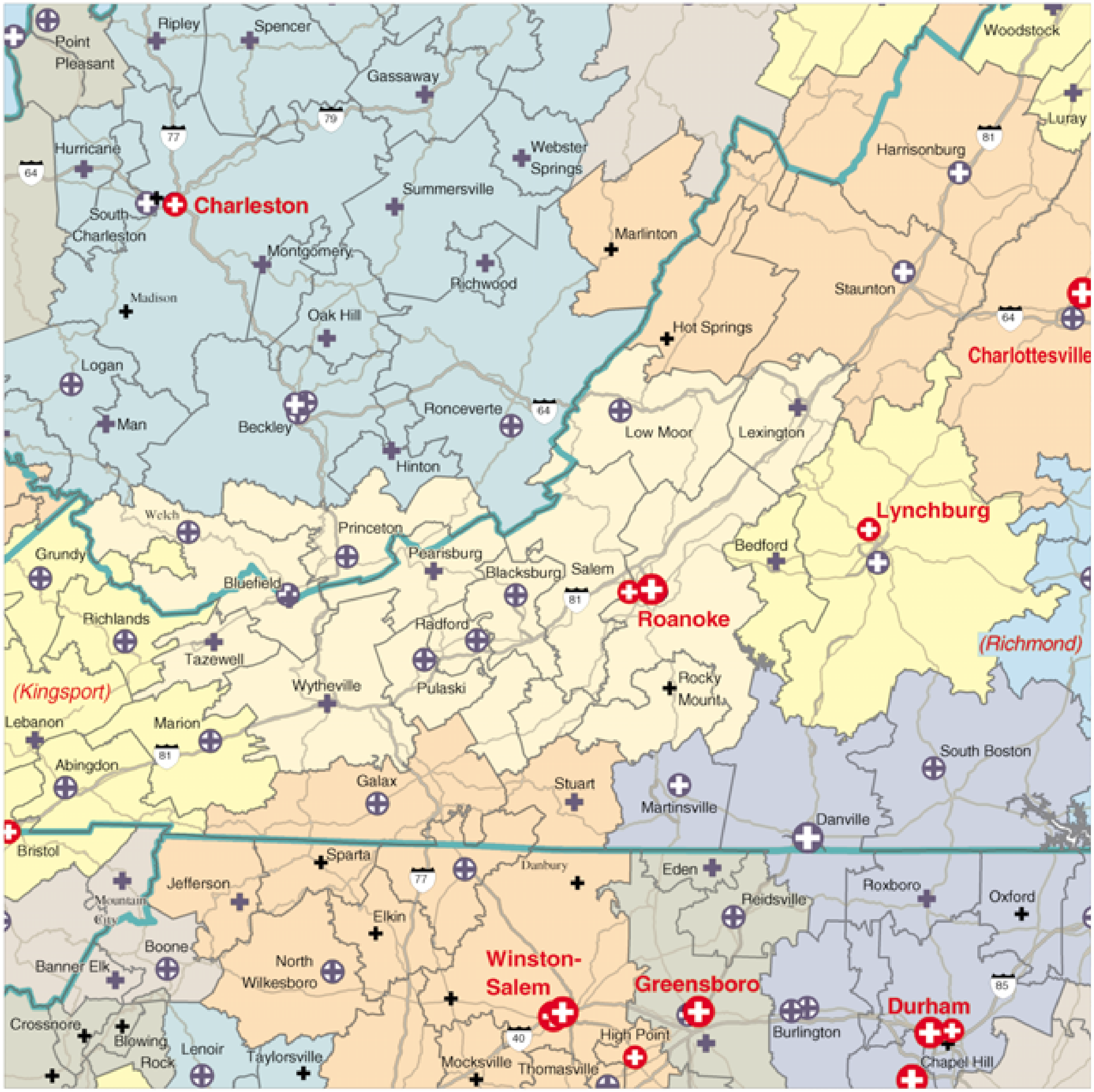
Medicare records of hospitalizations were used to define 65 geographically distinct hospital service areas in Virginia. In each hospital service area, most of the care received by the population is provided by hospitals within the area. The maps in this section show the location of each of these areas. Hospital service areas have been further aggregated into hospital referral regions, based on the patterns of use of cardiac surgery and neurosurgery. The maps also show the hospital referral regions to which the hospital service areas belong.

In every state except Alaska and Hawaii, some people seeking medical services do so at hospitals which are outside their state of residence, generally because these hospitals are geographically closer than in-state hospitals that provide similar services. In the thematic maps in this Atlas, it will be noted that in some western Virginia hospital service areas, the numbers of Virginia residents receiving particular services were too small to include in the analysis.

A detailed description of how hospital service areas and hospital referral regions were defined is included in the Appendix on Methods.

Map 1.1 Hospital Service Areas Assigned to the Johnson City and Kingsport, TN Hospital Referral Regions

Map 1.2 Hospital Service Areas Assigned to the Lynchburg and Roanoke, VA Hospital Referral Regions



Acute Care Hospital Beds

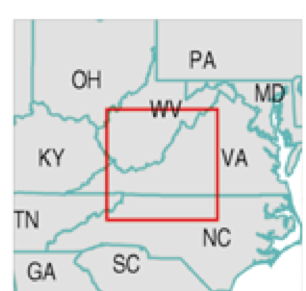
- Less than 50
- 50 to 100
- 100 to 250
- 250 to 500
- More than 500

Symbols for hospitals performing major cardiovascular surgery are red.

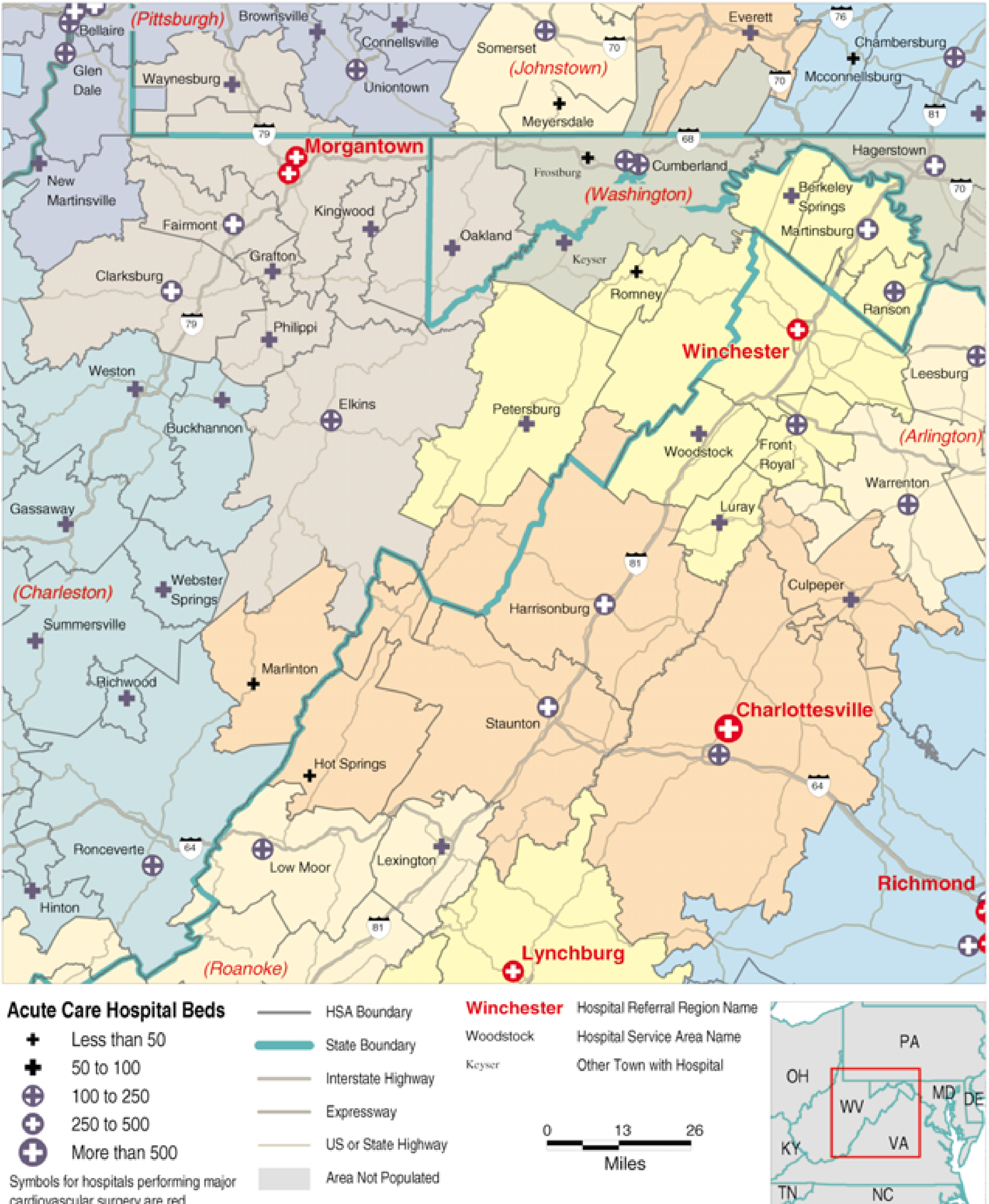
- HSA Boundary
- State Boundary
- Interstate Highway
- Expressway
- US or State Highway
- Area Not Populated

Roanoke — Hospital Referral Region Name
Blacksburg — Hospital Service Area Name
Madison — Other Town with Hospital

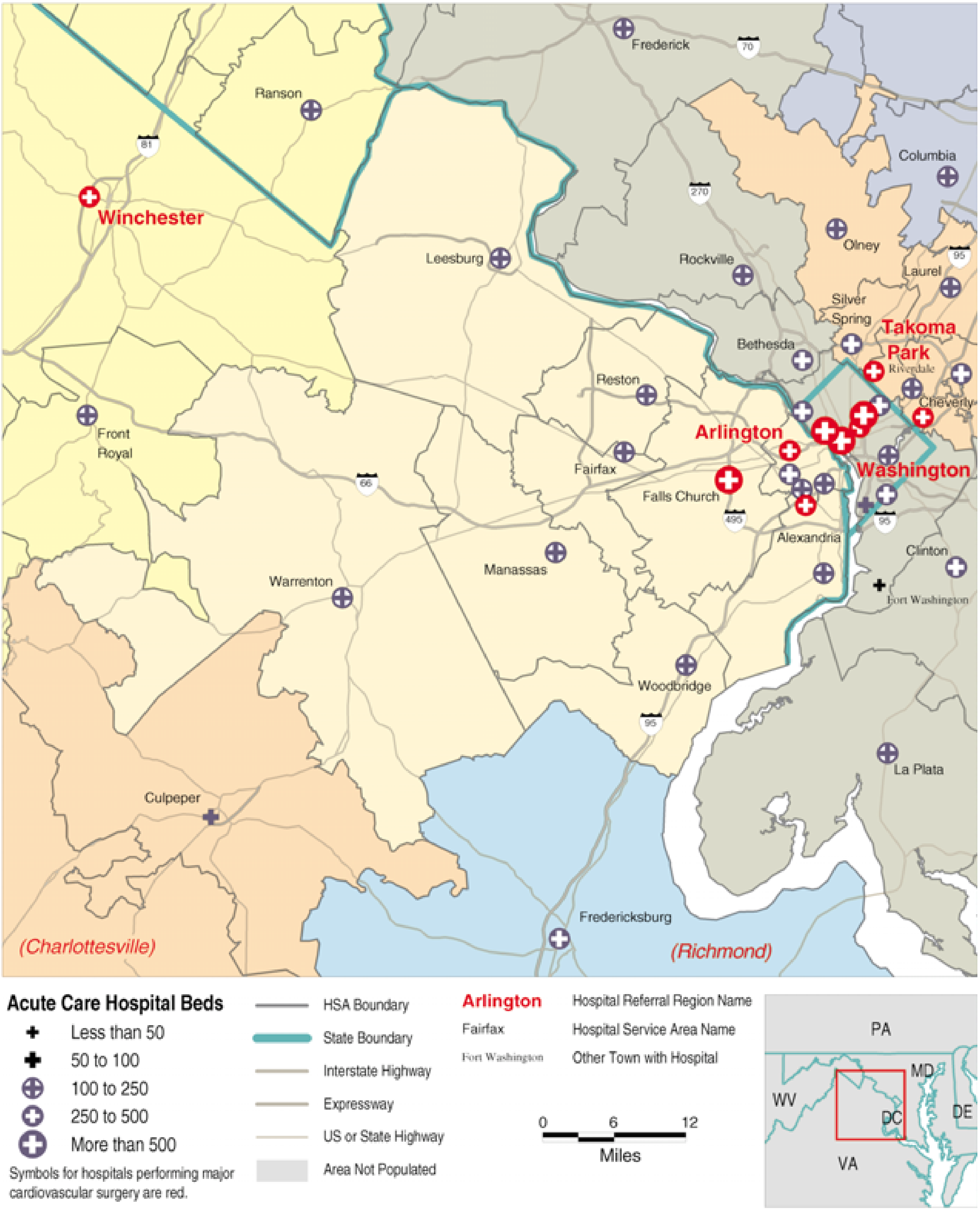
0 15 30
Miles



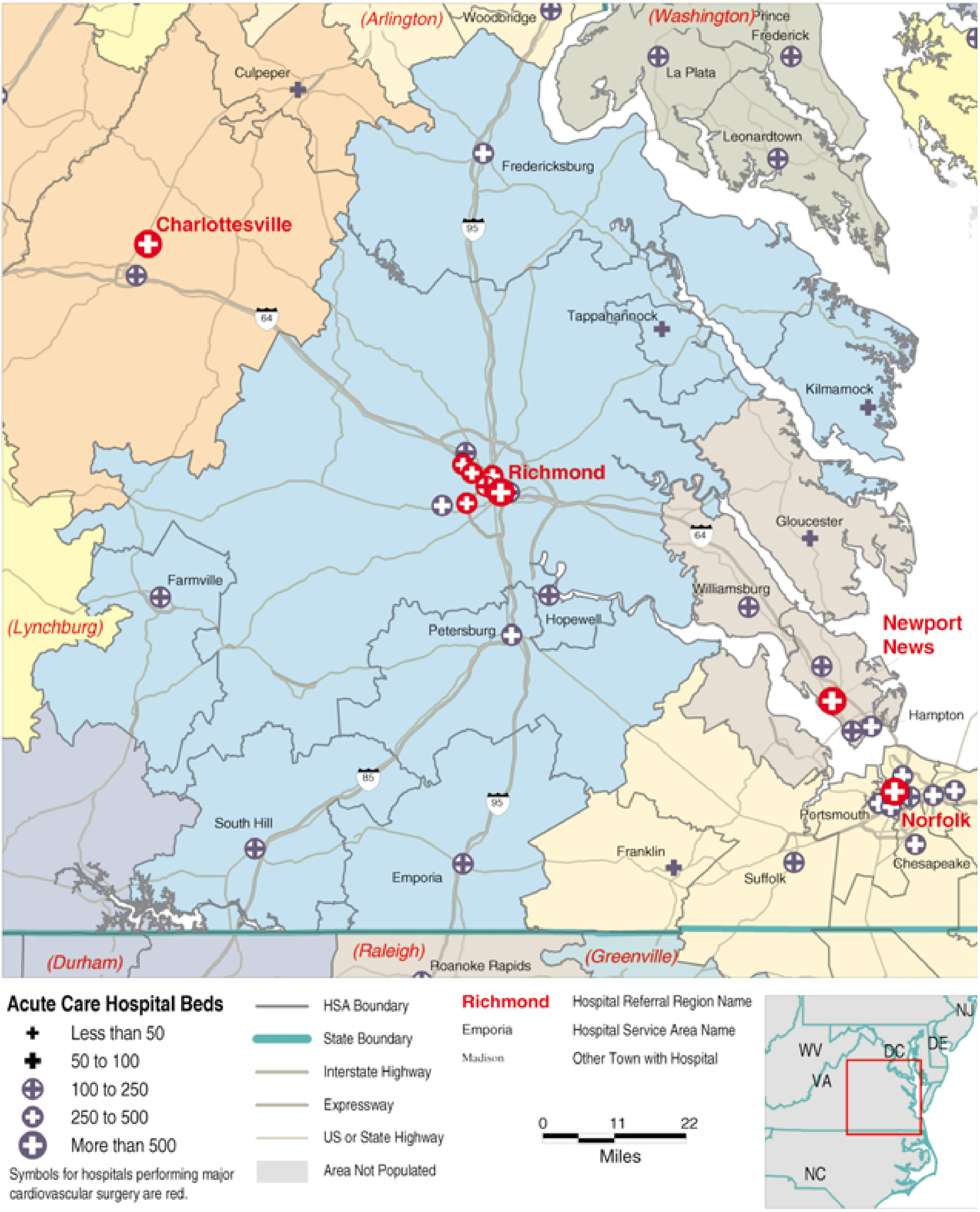
Map 1.3 Hospital Service Areas Assigned to the Charlottesville and Winchester, VA and Morgantown, WV Hospital Referral Regions



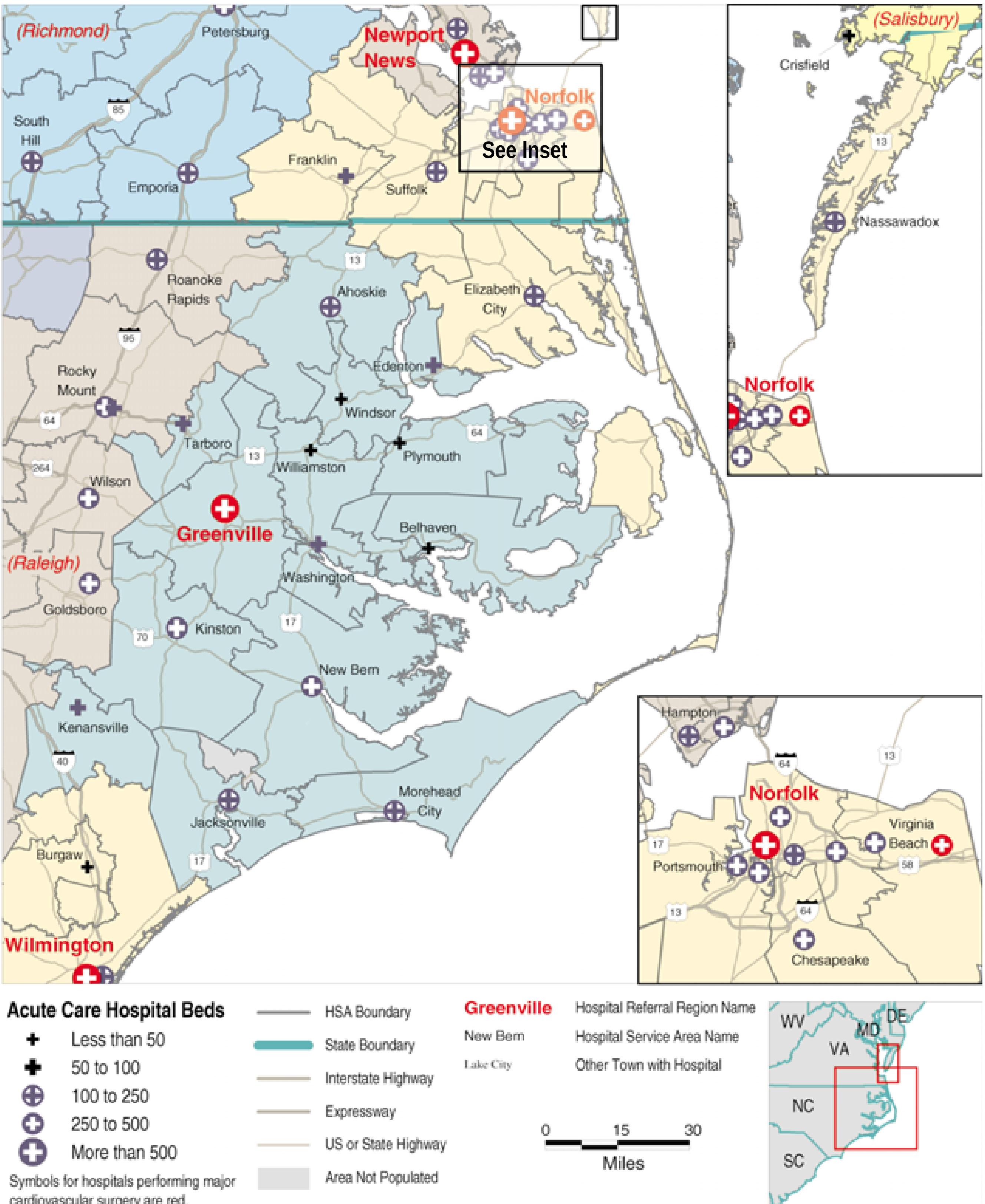
Map 1.4 Hospital Service Areas Assigned to the Arlington, VA Hospital Referral Region



Map 1.5 Hospital Service Areas Assigned to the Newport News and Richmond, VA Hospital Referral Regions



Map 1.6 Hospital Service Areas Assigned to the Norfolk, VA and Greenville, NC Hospital Referral Regions



Chapter One Table Note

Hospital Discharge Data for VA residents was obtained for calendar years 1996-7 from the Virginia Hospital and Healthcare Association. Data for Virginia residents discharged from Tennessee, North Carolina, Maryland and Washington D.C. during 1996-7 were obtained for the same years from the respective states. All data files were maintained by HCIA and passed to the MMAF for processing.

CHAPTER ONE TABLE

Discharges for Medical Conditions by Hospital Service Area (1996-97)

Virginia HSA City	Resident Population (1996-97)	Medical Discharges per 1,000 Residents (1996-97)	Surgical Discharges per 1,000 Residents (1996-97)	Pediatric Medical Discharges per 1,000 Children (1996-97)	Discharges for High Variation Medical Conditions per 1,000 Residents (1996-97)	Acute Myocardial Infarction per 1,000 Residents (1996-97)	Angina per 1,000 Residents (1996-97)	Arrhythmia per 1,000 Residents (1996-97)	Cardiac Medical Discharges per 1,000 Residents (1996-97)	Chest Pain per 1,000 Residents (1996-97)	Congestive Heart Failure per 1,000 Residents (1996-97)	Medical Back Discharges per 1,000 Residents (1996-97)
Abingdon	68,316	91.5	28.6	10.4	83.5	3.0	1.0	1.8	16.5	3.8	3.6	0.6
Alexandria	545,874	77.7	24.9	10.6	73.6	1.1	0.5	1.6	12.1	2.7	3.0	0.5
Arlington	424,062	76.4	23.4	10.1	72.9	0.8	0.4	1.2	8.5	1.7	1.7	0.3
Bedford	45,310	77.7	28.8	16.4	70.8	2.3	0.4	1.1	12.0	1.9	2.2	0.4
Big Stone Gap	32,914	149.1	28.2	85.1	139.5	3.9	(1.8)	1.8	19.8	3.9	4.4	(1.3)
Blacksburg	138,572	80.6	24.1	9.3	75.0	2.0	0.4	1.7	13.5	1.3	3.0	0.4
Charlottesville	394,832	88.3	28.3	11.8	82.5	1.6	0.2	1.4	13.1	1.5	3.1	0.6
Chesapeake	274,272	79.8	31.8	7.0	73.7	2.0	0.7	1.6	14.7	2.4	3.2	0.5
Clintwood	29,258	189.3	35.0	78.5	178.3	4.1	(4.0)	2.6	33.7	7.8	8.2	(3.4)
Culpeper	65,706	89.5	29.8	11.6	81.9	2.6	0.4	2.0	14.8	2.2	3.0	0.5
Danville	217,418	83.2	30.1	12.5	76.0	2.5	0.1	1.0	14.3	0.9	2.9	0.2
Emporia	61,550	109.2	29.5	37.0	100.8	3.0	1.8	2.4	18.9	5.0	3.6	0.5
Fairfax	192,316	59.2	20.6	7.7	55.9	1.2	0.7	1.4	10.0	2.2	2.2	0.3
Falls Church	1,003,552	65.8	24.2	9.5	62.3	0.8	0.3	1.4	9.1	1.9	1.9	0.4
Farmville	56,344	106.6	30.6	35.1	100.2	2.0	1.2	2.3	14.9	3.2	3.0	0.5
Franklin	50,568	97.3	33.5	19.6	89.7	2.2	0.5	2.1	14.9	1.7	4.2	0.6
Fredericksburg	411,444	86.7	31.3	12.7	81.6	1.2	0.5	1.6	12.9	2.5	3.0	0.5
Front Royal	63,248	83.4	28.2	11.0	77.9	2.0	0.4	1.7	14.7	2.6	3.0	0.5
Galax	89,248	84.4	27.9	16.9	77.6	2.1	0.5	1.4	14.1	1.8	2.6	0.5
Gloucester	91,648	64.7	30.9	7.2	58.5	1.9	0.2	1.3	11.4	0.9	2.8	0.4
Grundy	60,756	174.7	30.3	60.9	166.3	3.5	5.5	2.0	35.6	7.3	8.8	2.0
Hampton	180,858	66.4	28.1	8.9	61.3	1.6	0.3	1.8	13.1	1.4	3.0	0.4
Harrisonburg	240,644	84.0	25.8	20.5	77.8	2.2	0.3	1.6	13.0	1.9	2.8	0.6
Hopewell	68,676	135.2	38.2	35.0	126.8	2.9	1.3	2.2	22.6	2.9	5.0	0.9
Hot Springs	10,810	115.2	30.6	22.3	106.9	4.3	(1.5)	(2.1)	22.2	4.1	4.3	(0.9)
Kilmarnock	52,456	30.5	22.4	4.4	28.5	0.5	0.1	0.6	4.8	0.3	0.7	0.3
Lebanon	65,096	157.1	31.6	35.7	147.0	3.8	2.1	2.6	26.2	5.3	5.8	1.4
Leesburg	154,674	64.1	21.4	8.8	60.8	1.3	0.9	1.3	8.3	1.8	1.3	0.4
Lexington	60,304	74.4	29.2	12.8	67.6	2.6	0.8	0.9	13.9	3.6	2.5	0.4
Low Moor	51,268	99.0	34.4	13.9	90.7	3.3	0.4	2.1	18.3	2.1	3.4	0.5
Luray	33,976	122.0	31.1	15.8	113.8	2.3	(1.0)	1.7	20.7	2.5	7.5	(1.2)
Lynchburg	395,204	81.0	29.3	18.8	75.4	1.0	0.2	1.2	11.2	2.1	2.8	0.5
Manassas	229,556	61.3	18.8	10.2	57.6	1.4	0.7	1.2	9.5	2.1	2.2	0.4
Marion	68,934	89.7	31.3	16.7	80.7	3.5	0.6	1.4	15.0	2.1	3.2	0.5
Martinsville	148,524	88.6	30.0	9.0	82.2	2.1	0.5	1.8	15.9	1.8	3.6	0.6
Nassawadox	68,320	103.4	29.7	20.5	97.0	2.4	0.5	1.5	14.8	1.5	4.0	0.9
Newport News	624,128	70.5	30.6	8.3	65.2	1.4	0.2	1.4	11.7	1.3	2.8	0.4
Norfolk	756,728	76.1	29.5	8.8	70.4	1.6	0.5	1.2	12.3	1.8	3.3	0.5
Norton	57,848	209.1	35.7	126.9	196.2	5.2	2.8	3.2	34.7	6.2	8.1	2.2

	Resident Population (1996-97)	Medical Discharges per 1,000 Residents (1996-97)	Surgical Discharges per 1,000 Residents (1996-97)	Pediatric Medical Discharges per 1,000 Children (1996-97)	Discharges for High Variation Medical Conditions per 1,000 Residents (1996-97)	Acute Myocardial Infarction per 1,000 Residents (1996-97)	Angina per 1,000 Residents (1996-97)	Arrhythmia per 1,000 Residents (1996-97)	Cardiac Medical Discharges per 1,000 Residents (1996-97)	Chest Pain per 1,000 Residents (1996-97)	Congestive Heart Failure per 1,000 Residents (1996-97)	Medical Back Discharges per 1,000 Residents (1996-97)
Pearisburg	37,496	86.6	26.3	10.2	79.2	2.4	0.3	1.6	15.3	1.6	3.5	0.2
Pennington Gap	36,256	149.6	28.4	30.8	139.0	4.8	(1.1)	3.2	25.1	4.1	3.9	1.8
Petersburg	231,704	115.7	32.4	26.0	108.2	2.2	0.7	1.5	17.2	2.1	4.3	0.7
Portsmouth	338,700	87.6	35.4	10.9	80.9	1.9	0.5	1.5	15.9	3.0	3.3	0.6
Pulaski	37,422	100.8	24.3	15.3	94.1	2.5	0.9	1.9	16.7	3.1	2.6	0.5
Radford	79,254	80.1	25.7	14.8	73.5	2.2	0.4	1.8	14.9	1.6	3.3	0.4
Reston	315,028	55.3	19.2	7.5	51.7	1.4	0.5	1.1	8.4	1.5	1.7	0.3
Richlands	60,622	167.2	31.2	52.4	158.7	2.7	2.0	1.8	29.0	5.2	7.2	1.7
Richmond	1,728,086	96.8	33.4	17.4	91.5	1.0	0.4	1.5	11.9	1.6	3.0	0.6
Roanoke	467,290	75.8	25.8	11.2	71.0	1.3	0.1	1.2	10.8	1.3	2.3	0.4
Rocky Mount	52,264	92.7	29.0	15.6	86.3	2.3	0.5	1.8	17.1	2.1	3.2	0.6
Salem	96,178	59.8	20.8	9.0	56.2	1.0	0.2	0.9	8.0	0.9	2.0	0.3
South Boston	112,534	99.1	29.5	14.4	91.8	2.1	2.0	1.6	15.5	4.0	2.6	1.4
South Hill	55,694	127.3	39.8	28.2	118.3	3.5	3.5	2.8	22.8	6.1	4.5	1.1
Staunton	201,660	105.5	32.6	19.6	96.0	3.6	0.3	1.5	16.8	1.4	3.4	0.8
Stuart	26,120	91.9	26.9	12.2	85.8	2.2	(1.8)	2.5	16.7	3.6	2.7	(0.7)
Suffolk	128,566	95.5	35.4	14.4	88.5	2.7	0.4	1.8	16.5	1.8	3.7	0.9
Tappahannock	47,626	79.9	29.6	9.1	74.1	1.5	0.3	2.2	13.6	0.9	3.1	0.5
Tazewell	24,898	50.3	15.8	19.7	48.3	0.7	(0.4)	0.4	6.5	1.2	1.0	(0.5)
Virginia Beach	598,368	60.3	27.7	5.5	55.5	1.2	0.7	1.3	11.2	1.7	2.9	0.4
Warrenton	109,290	65.0	22.6	9.0	60.2	1.4	0.3	1.2	10.6	1.7	2.7	0.7
Williamsburg	127,246	72.5	31.6	12.7	67.4	1.5	0.3	1.8	13.2	1.7	3.0	0.6
Winchester	229,200	91.0	32.5	13.8	85.7	1.3	0.6	1.6	16.1	3.5	3.6	1.0
Woodbridge	333,384	73.9	26.4	10.2	69.6	1.4	0.5	1.4	13.0	2.4	3.2	0.4
Woodstock	41,242	94.6	30.1	12.4	87.0	2.2	0.7	1.7	16.7	2.3	4.0	0.9
Wytheville	64,198	94.4	29.3	15.1	85.4	3.6	0.3	1.3	14.7	0.8	2.9	0.4
Virginia	**13,165,538**	**84.0**	**28.8**	**13.7**	**78.4**	**1.7**	**0.5**	**1.5**	**13.1**	**2.0**	**3.0**	**0.5**

CHAPTER TWO

Acute Care Hospital Resources and Medicare Expenditures in Virginia

Acute Care Hospital Resources and Medicare Expenditures in Virginia

This chapter provides measures of the allocation of hospital resources to the populations living in hospital service areas in Virginia, and measures of Medicare reimbursements for enrollees.

The quantity of care provided in hospital service areas is generally limited only by supply. Judgments about how much health care is enough must be grounded in an understanding of the relationship between health care capacity and its utilization — on how available resources are used. Decisions about how much is enough must also focus on global outcomes. In the case of the supply of acute care hospital resources, the primary focus should be on the marginal effects of resources and spending on the health outcomes of populations.

In general, the nation is moving to reduce acute care hospital inpatient capacity. The nature of the relationship between hospital supply and utilization, and the failure to find evidence that more care results in better outcomes, are indications of the validity of using areas with relatively low supplies of resources and relatively low utilization to define reasonable limits.

If the resources now spent on acute hospital care in areas with higher levels of resources were reduced, money could be made available for other sectors of care — providing ambulatory care to the underserved, for example. This reallocation of health care spending appears to make sense — if we accept the thesis that more care is better. Do patients who live in areas with lower acute care hospital capacity receive adequate levels of care? Could constraints on supply be harmful to patients? Or is less care enough? We can answer these questions by asking whether people who live in regions with fewer health care resources, less utilization, and less spending are somehow harmed by receiving less care than those who live in areas with high capacity, spending, and utilization.

Research conducted in conjunction with the national editions of the Dartmouth Atlas of Health Care confirms a pattern common to all hospital referral regions in the United States: areas with greater acute care hospital capacity, and with more inpatient days per capita, do not have lower mortality rates, even after controlling for a wide variety of health indicators which might influence the need for care. In other words, the United States might be on the "flat of the curve" in terms of mortality, and, if so, a reduction in overall acute care hospital bed capacity would not be expected to affect life expectancy. It could well be both safe and in the public interest simply to reduce the rates of resources, spending, and utilization in areas that are substantially higher than average.

Data from the American Hospital Association and the Virginia Hospital Research and Education Foundation (VHREF) were used to estimate the numbers of staffed hospital beds, full time equivalent hospital employees, and registered nurses employed in acute care hospitals. Data from the 1996 Medicare claims database were used for measures of reimbursements for various segments of care (e.g., inpatient, laboratory, home health) in order to make comparisons between Virginia rates and rates in other parts of the United States. The population count is from the 1990 United States census, updated with Claritas™ adjustment. The allocation method adjusts for patient migration to hospitals outside of the hospital service area where the patient resides (see the Appendix on Methods).

Acute Care Hospital Beds

The number of acute care hospital beds per 1,000 residents of hospital service areas in Virginia in 1996, after adjusting for differences in population age and sex, averaged 1.9, ranging from fewer than 0.7 to more than 6.0. The United States average in 1996 was 2.8.

Among the large hospital service areas in Virginia with higher than average supplies of hospital beds were Low Moor (6.3); Luray (4.1); Pulaski (4.0); Clintwood (3.9) and Marion (3.9).

Hospital service areas with relatively low numbers of hospital beds per 1,000 residents included Fairfax (0.6); Reston (0.7); Falls Church (0.9); Woodbridge (1.0) and Manassas (1.0).

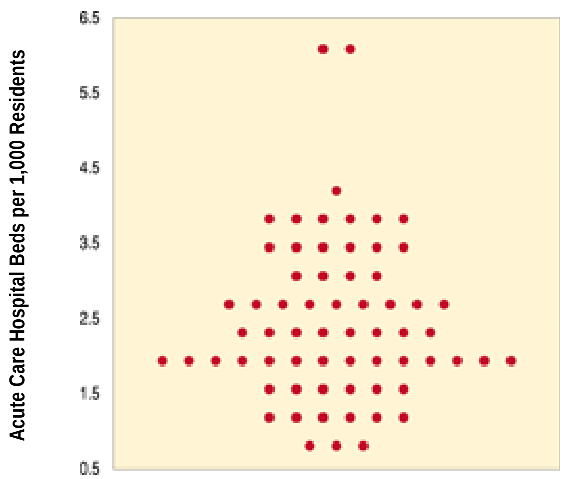
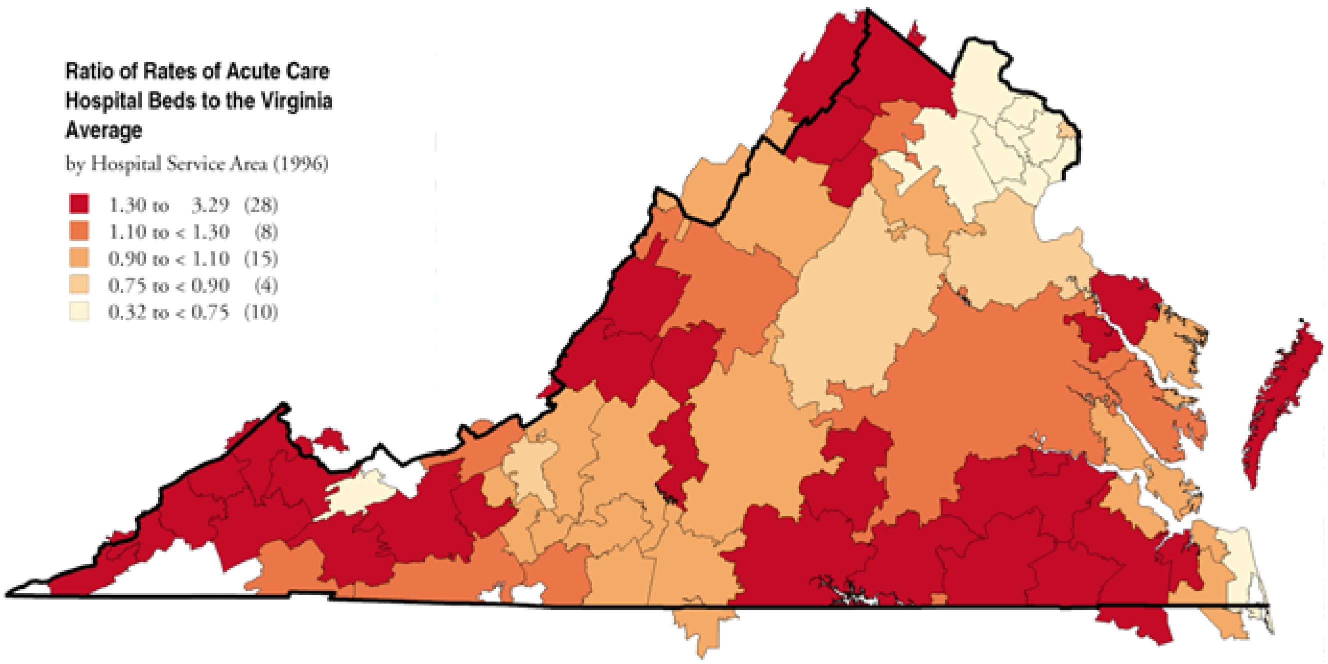


Figure 2.1. Acute Care Hospital Beds (1996)

The number of acute care hospital beds per 1,000 residents ranged from fewer than 1.0 to more than 6.0, after adjusting for differences in age and sex of local populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 2.1. Acute Care Hospital Beds (1996)

Twenty-eight hospital service areas had rates of acute care hospital beds per 1,000 residents at least 30% higher than the state average. Ten areas had rates more than 25% below the average.

Acute Care Hospital Employees

There were more than 3.56 million workers employed in acute care hospitals in the United States in 1996, an average of 13.2 per 1,000 residents. In Virginia in 1996, the numbers of full time equivalent hospital employees per 1,000 residents, after adjusting for differences in population age and sex, averaged 8.3, ranging from fewer than 3.0 to 19.2.

Among the larger hospital service areas, the numbers of full time equivalent hospital employees allocated to local populations were substantially higher than the state and national averages in Franklin (17.0); Clintwood (16.8); Norton (16.7); South Hill (16.6) and Luray (16.2).

In other hospital service areas, the numbers of hospital employees per 1,000 residents were substantially lower than the state average, including Fairfax (3.0); Reston (3.3); Tazewell (4.2); Falls Church (4.3) and Woodbridge (4.4).

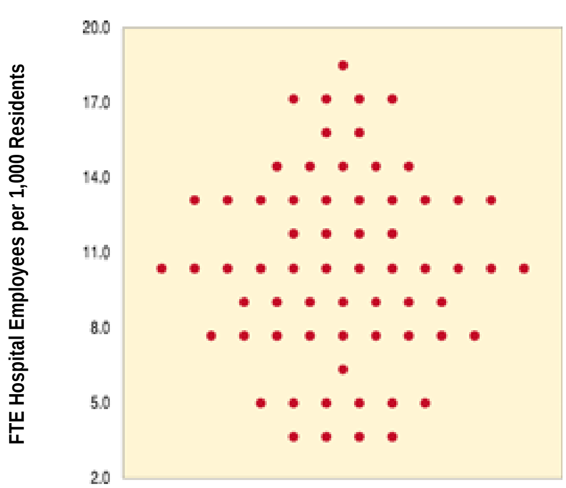
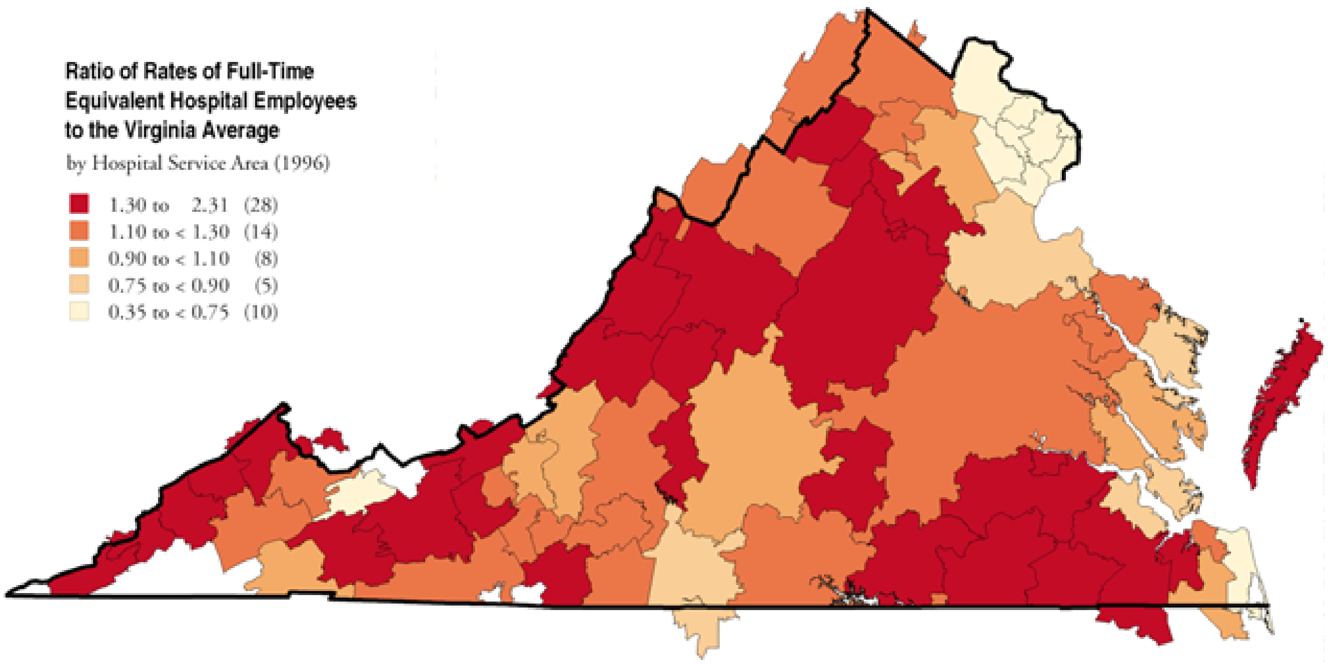


Figure 2.2. Hospital Employees (1996)
The number of full time equivalent hospital employees per 1,000 residents, after adjusting for differences in the age and sex of local populations, ranged from 3.0 to more than 19.0. Each point represents one of the 65 hospital service areas in Virginia.



Map 2.2. Hospital Employees (1996)

Twenty-eight hospital service areas had rates of hospital employees per 1,000 residents at least 30% higher than the state average of 8.3. Ten areas had rates more than 25% below the average.

Registered Nurses Employed in Acute Care Hospitals

There were more than 877,900 full-time equivalent registered nurses employed in acute care hospitals in the United States in 1996, an average of 3.3 per 1,000 residents. In Virginia in 1996, the number of full time equivalent hospital-employed registered nurses per 1,000 residents, after adjusting for differences in population age and sex, averaged 2.3; the supply varied by a factor of more than five, from fewer than 1.0 to 5.5.

The numbers of full time equivalent hospital-based registered nurses per 1,000 residents were higher than the state average in the hospital service areas in Luray (4.4); Pulaski (4.4); Clintwood (4.0); Norton (3.9) and South Hill (3.9).

In other hospital service areas, the numbers of allocated registered nurses were substantially lower than the Virginia average, including Fairfax (0.9); Tazewell (1.0); Reston (1.0); Woodbridge (1.2) and Falls Church (1.3).

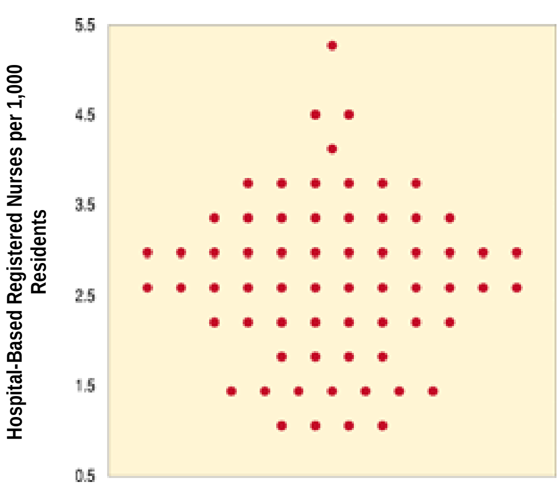
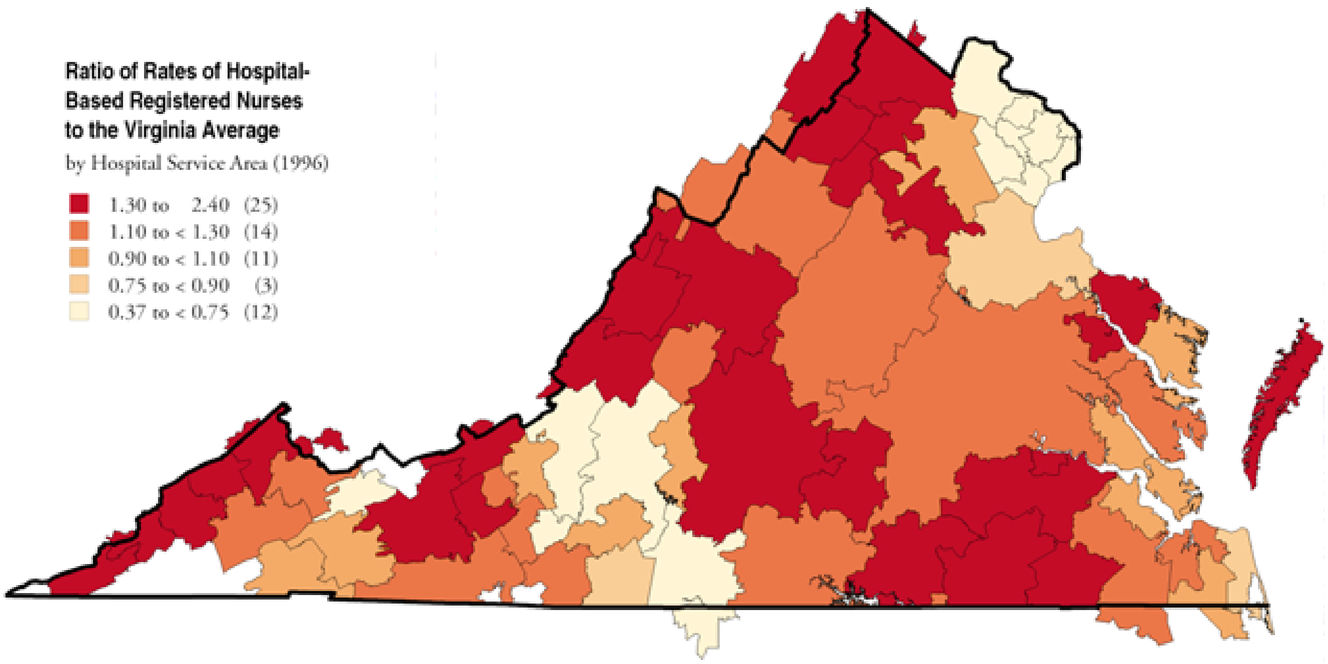


Figure 2.3. Registered Nurses Employed in Acute Care Hospitals (1996)
The numbers of registered nurses per 1,000 residents ranged from fewer than 1.0 to 5.5, after adjusting for differences in age and sex of local populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 2.3. Registered Nurses Employed in Acute Care Hospitals (1996)

Twenty-five hospital service areas had rates at least 30% higher than the state average of 2.3 registered nurses per 1,000 residents. Twelve areas had rates more than 25% below the average.

Medicare Spending

Most Americans over the age of 65 are enrolled in the Medicare program. In 1996, most residents of Virginia enrolled in the Medicare program received their care from "traditional" Medicare — that is, from providers who charged on a fee-for-service basis, either as independent practitioners or as members of health maintenance organizations that were not capitated. In 1996, according to HCFA records, $138.3 billion— or 87.8% of Medicare outlays for people over 65 —was reimbursed on a fee-for-service basis.

There were large differences in the level of these reimbursements among hospital service areas in Virginia. The uneven distribution of reimbursements raises the question of whether areas with lower levels of acute care hospital services might have been achieving their inpatient savings by substituting outpatient care, hospice care, or home health services. However, research shows very little evidence of substitution; the opposite is often the case. Regions with higher reimbursements for acute care hospital services tended also to have higher reimbursements for hospital-based outpatient care, as well as higher reimbursements for physician services and for home health services.

Nationally, differences in Medicare spending have been shown to relate to differences in the supply of resources and differences in physicians' practice styles. Illness rates explain only a small portion of the differences in spending among regions. Differences in spending also are not explained by differences in regional prices.

Estimates of Medicare reimbursements in this section of the chapter are based on a 5% sample of the Medicare population as recorded in the Continuous Medicare History File. Fee-for-service reimbursements have been price adjusted to take into account differences in the costs of living among hospital service areas.

Medicare Reimbursements for Noncapitated Medicare

In 1996, Medicare payments for all services reimbursed on a fee-for-service basis (including non-risk-bearing health maintenance organizations) averaged $4,993. In Virginia, the average per-enrollee Medicare payment for all services was $4,274, varying from $2,425 to $9,197.

Among the large hospital service areas in Virginia with per capita Medicare reimbursements for all services higher than the state average were Staunton ($5,443); Charlottesville ($4,819); Winchester ($4,509); Danville ($4,509) and Norfolk ($4,410).

Among the large hospital service areas with lower than average price adjusted Medicare reimbursements per enrollee were Lynchburg ($3,137); Falls Church ($3,542); Roanoke ($3,749) and Fredericksburg ($3,755).

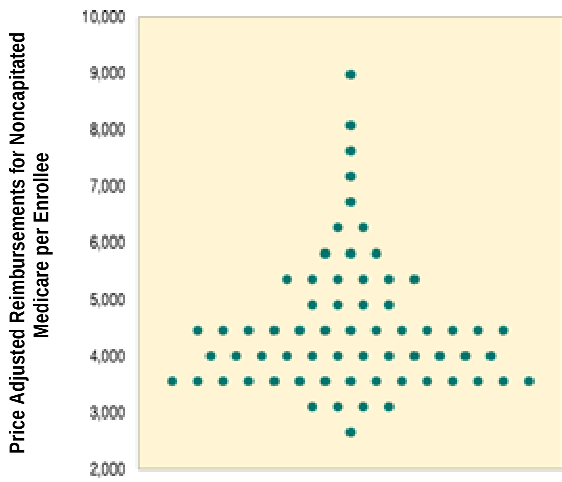
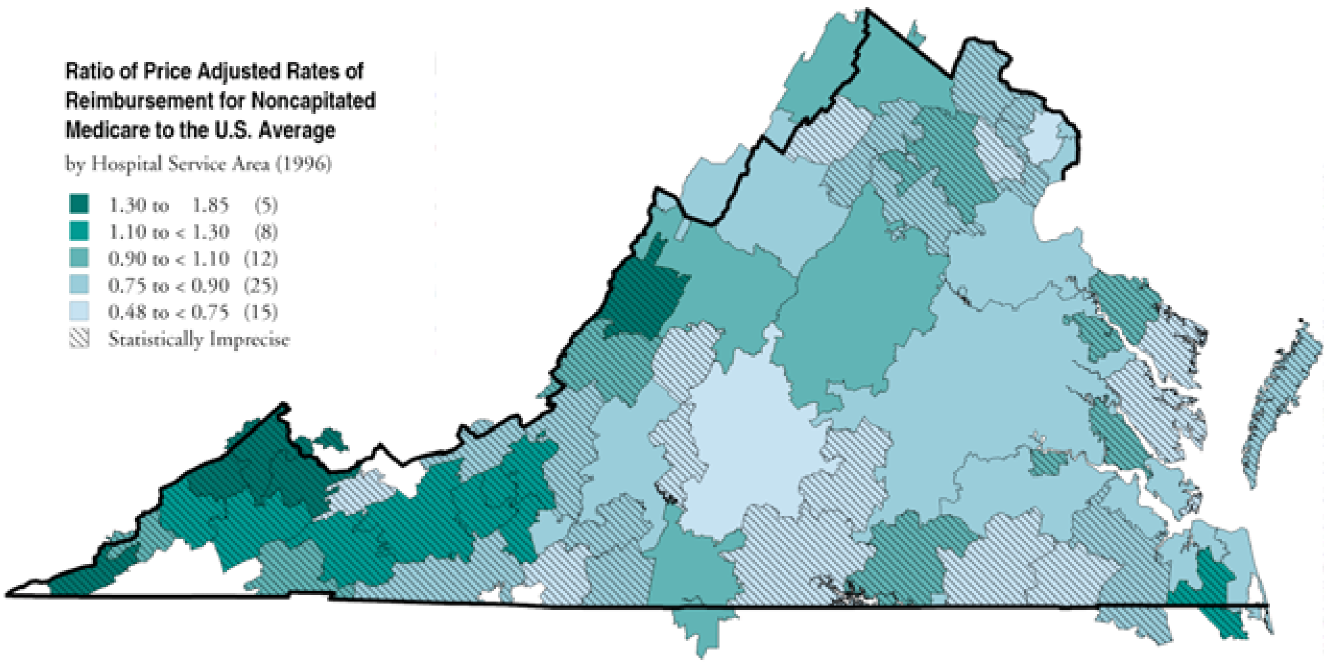


Figure 2.4. Reimbursements for Noncapitated Services (1996)
Total per enrollee reimbursements for noncapitated Medicare ranged from less than $2,500 to more than $9,000, after adjusting for differences in age, sex and race of local populations and regional differences in prices. Each point represents one of the 65 hospital services areas in Virginia.



Map 2.4. Price Adjusted Reimbursements for Noncapitated Services (1996)

Five hospital service areas had per enrollee reimbursements at least 30% higher than the United States average of $4,993. Fifteen areas had rates more than 25% below the average.

Medicare Reimbursements for Inpatient Services

In 1996, Medicare payments for inpatient hospital services paid for on a fee-for-service basis averaged $2,450. Among Virginia hospital service areas, such reimbursements averaged $2,202, varying from less than $1,100 to more than $5,000.

Among the large hospital service areas in Virginia with per enrollee Medicare reimbursements for inpatient services higher than the state average were Staunton ($3,144); Danville ($2,567); Petersburg ($2,446); Winchester ($2,437) and Charlottesville ($2,323).

Among the large hospital service areas with lower than average price adjusted inpatient reimbursements per enrollee were Falls Church ($1,584); Lynchburg ($1,640); Arlington ($1,807); Fredericksburg ($1,811) and Roanoke ($1,930).

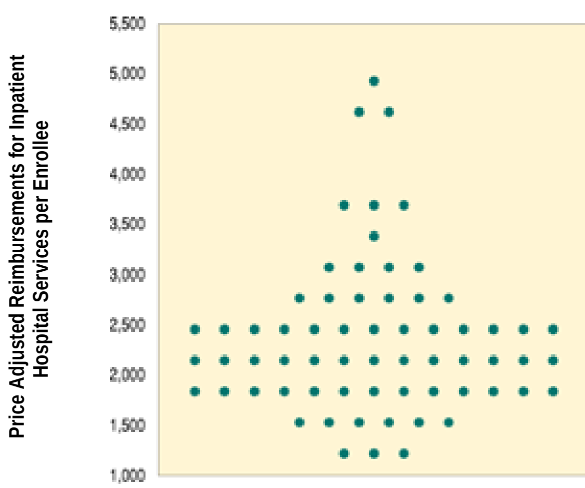
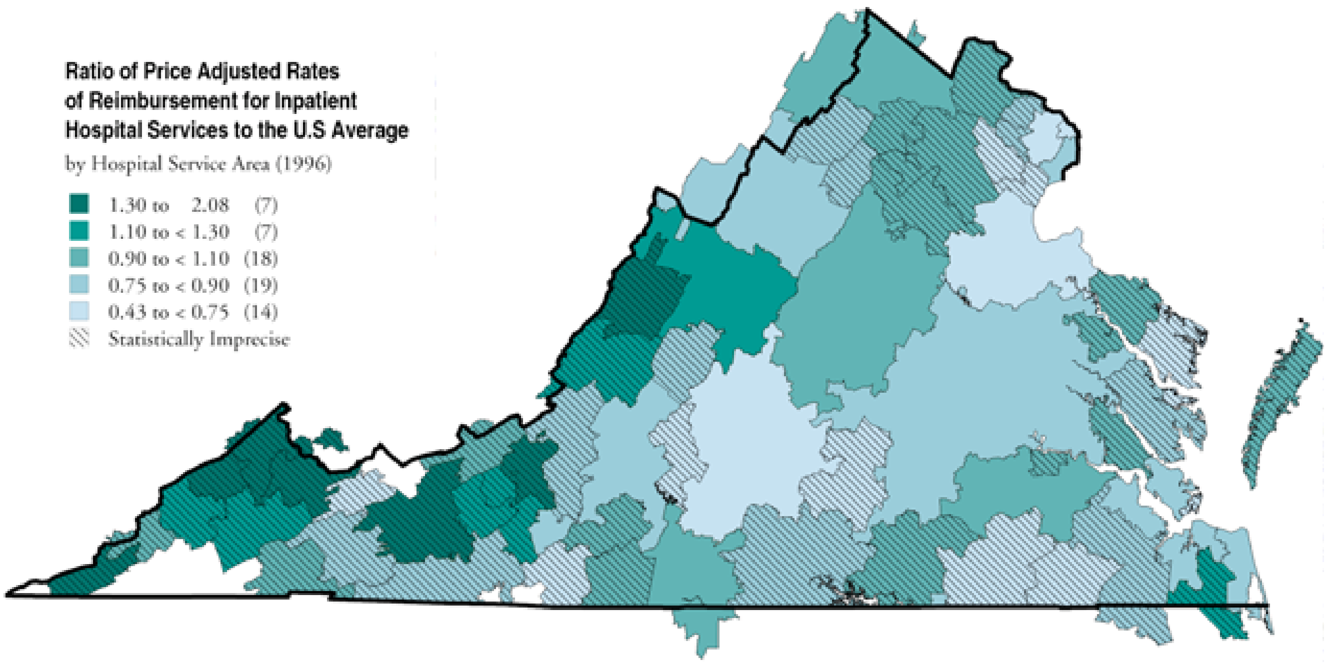


Figure 2.5. Medicare Reimbursements for Inpatient Hospital Services (1996)
Per capita Medicare reimbursements for inpatient hospital services ranged from $1,062 to over $5,000, after adjustment for differences in age, sex and race of local populations and regional differences in prices. Each point represents one of 65 hospital service areas in Virginia.



Map 2.5. Medicare Reimbursements for Inpatient Hospital Services (1996)

Seven hospital service areas had rates of reimbursement at least 30% higher than the United States average of $2,450 per enrollee. Fourteen areas had rates more than 25% below the average.

Medicare Reimbursements for Outpatient Services

In 1996, Medicare payments for outpatient services reimbursed on a fee-for-service basis averaged $444. Among Virginia hospital service areas, such reimbursements averaged $393, varying from less than $220 to more than $1,250.

Among the large hospital service areas in Virginia with per capita Medicare reimbursements for outpatient services higher than the state average were Charlottesville ($587); Harrisonburg ($498); Staunton ($483); Danville ($434) and Norfolk ($433).

Among the large hospital service areas with lower than average outpatient reimbursements per enrollee were Winchester ($224); Petersburg ($260); Fredericksburg ($295); Falls Church ($301) and Roanoke ($316).

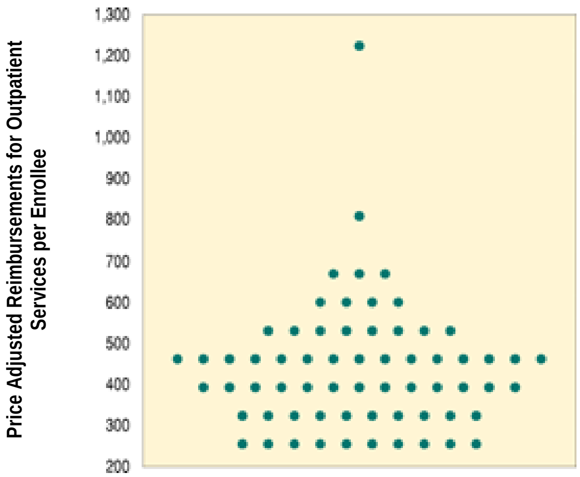
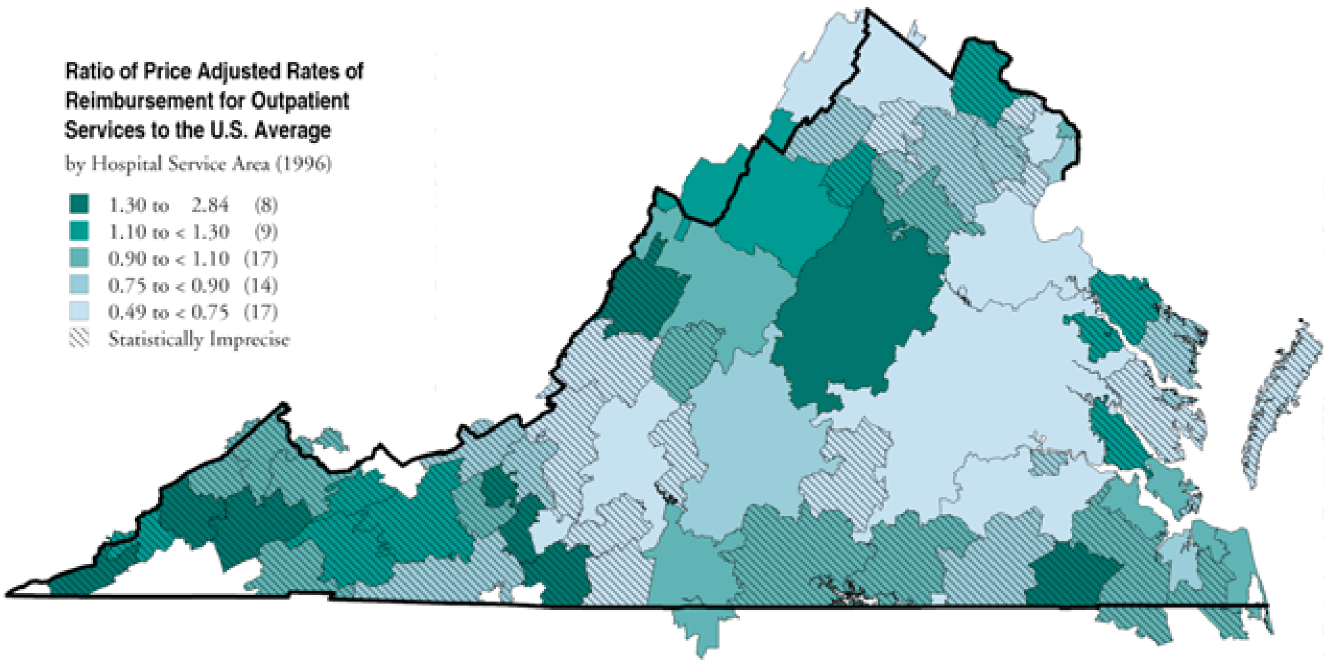


Figure 2.6. Medicare Reimbursements for Outpatient Services (1996)
Per enrollee reimbursements for outpatient services ranged from less than $220 to more than $1,200, after adjusting for differences in age, sex and race of local populations and regional differences in prices. Each point represents one of the 65 hospital services areas in Virginia.



Map 2.6. Medicare Reimbursements for Outpatient Services (1996)

Eight hospital service areas had average per enrollee reimbursements at least 30% higher than the United States average of $444. Seventeen areas had rates more than 25% below the average.

Medicare Reimbursements for Professional and Laboratory Services

In 1996, Medicare payments for professional and laboratory services reimbursed on a fee-for-service basis (including non-risk-bearing health maintenance organizations) averaged $1,015. Among Virginia hospital service areas, such reimbursements averaged $899, varying from less than $440 to $1,197.

Among the large hospital service areas where reimbursements for professional and laboratory services were higher than the national average were Portsmouth ($1,115); Alexandria ($1,095); Virginia Beach ($1,084) and Newport News ($1,042).

Among the large hospital service areas where reimbursements were lower than the state and national averages were Lynchburg ($703); Charlottesville ($767); Roanoke ($771); Harrisonburg ($788) and Winchester ($859).

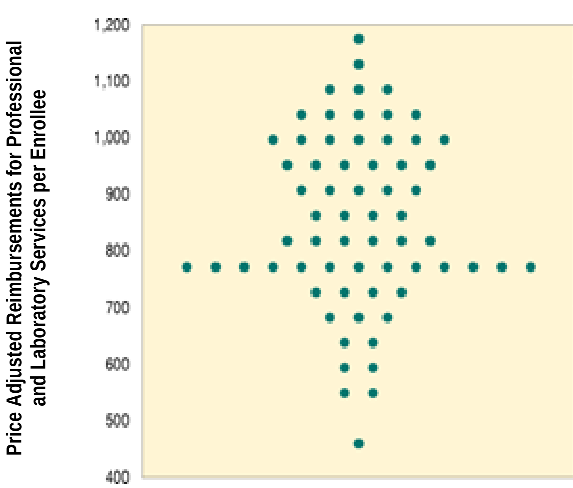
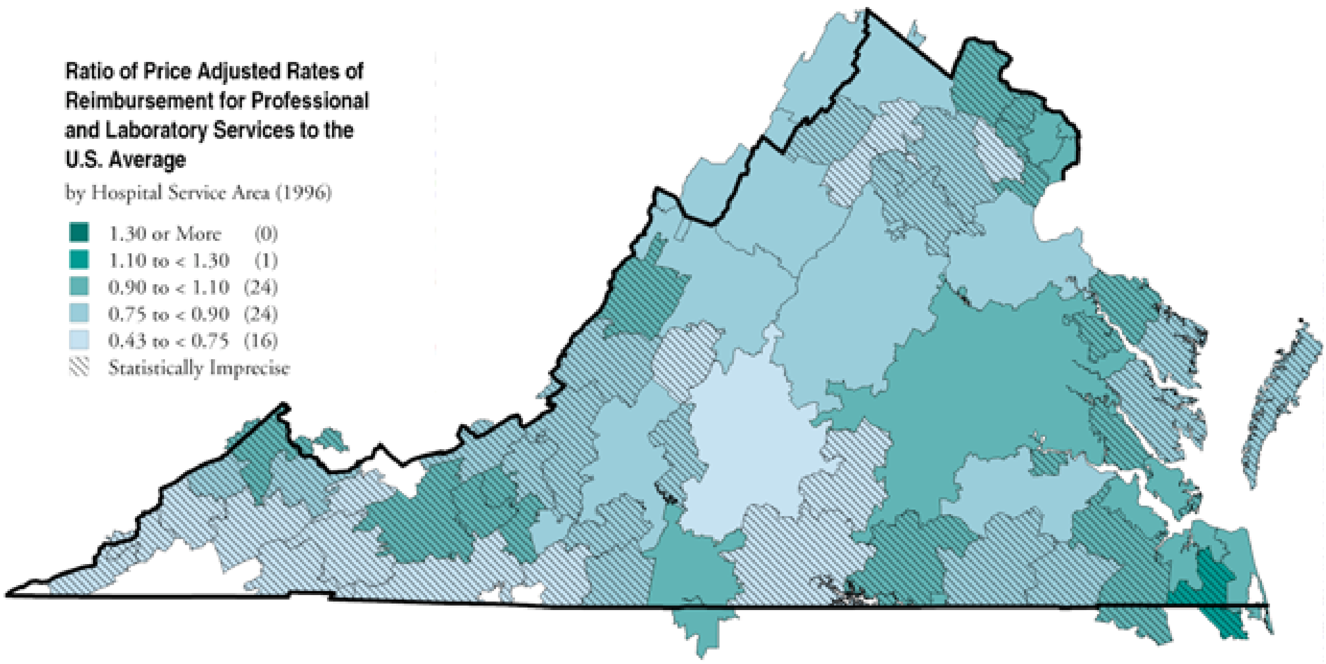


Figure 2.7. Medicare Reimbursements for Professional and Laboratory Services (1996)
Per enrollee reimbursements for professional and laboratory services ranged from less than $450 to almost $1,200, after adjusting for differences in age, sex and race of local populations and regional differences in prices. Each point represents one of the 65 hospital service areas in Virginia.



Map 2.7. Medicare Reimbursements for Professional and Laboratory Services (1996)

No hospital service area had a rate more than 30% higher than the United States average of $1,015 per enrollee. Sixteen areas had rates more than 25% below the average.

Medicare Reimbursements for Home Health Services

In 1996, Medicare payments for home health services reimbursed on a fee-for-service basis (including non-risk-bearing health maintenance organizations) averaged $532. Among Virginia hospital service areas, such reimbursements averaged $396, varying from $85 to more than $2,000.

The large hospital service areas in Virginia where per enrollee reimbursements for home health services were higher than the state average were Winchester ($565) and Staunton ($422).

Among the large hospital service areas with lower than average price adjusted Medicare reimbursements per capita were Lynchburg ($146); Danville ($191); Falls Church ($267); Petersburg ($278) and Virginia Beach ($278).

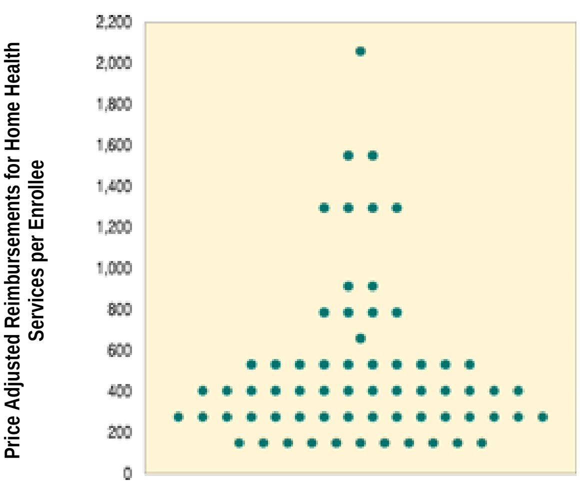
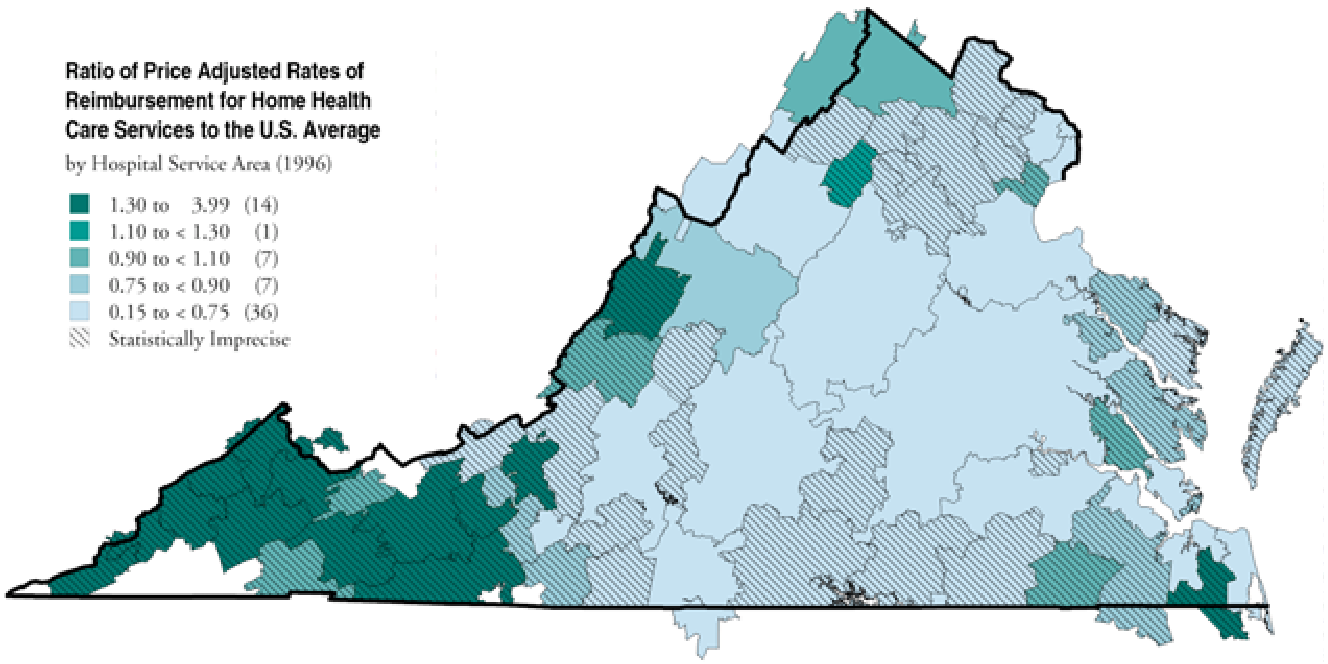


Figure 2.8 Medicare Reimbursements for Home Health Care Services (1996)
Per capita Medicare reimbursements for home health care ranged from $85 to $2,122, after adjusting for differences in age, sex and race of local populations and regional differences in prices. Each point represents one of the 65 hospital service areas in Virginia.



Map 2.8. Medicare Reimbursements for Home Health Care Services (1996)

Fourteen hospital service areas had rates at least 30% higher than the United States average of $532 per enrollee. Thirty-six areas had rates more than 25% below the average.

Chapter Two
Table Note

All measures of allocated hospital resources are expressed as rates per 1,000 residents. Reimbursements are expressed as rates per Medicare enrollee, and are adjusted for regional differences in age, sex, race and prices. Estimates of allocated hospital employees and registered nurses are expressed as full time equivalents (FTEs). Medicare data exclude enrollees who were members of risk-bearing health maintenance organizations.

Estimates of Medicare reimbursements are based on a 5% sample of the Medicare population as recorded in the Continuous Medicare History File.

See the Appendix on Methods for details on the methods used for allocating resources, estimating populations and adjusting rates, and for other details concerning the rates in this table.

Numbers in parentheses in the table are statistically imprecise because there are fewer than 12,000 Medicare enrollees in the hospital service areas.

CHAPTER TWO TABLE

Acute Care Hospital Resources and Medicare Reimbursements (1996)

Virginia HSA City	Resident Population (1996)	Medicare Enrollees (1996)	Acute Care Hospital Beds per 1,000 Residents (1996)	FTE Hospital Employees per 1,000 Residents (1996)	Hospital-Based Registered Nurses per 1,000 Residents (1996)	Price Adjusted Total Reimbursements for Noncapitated Medicare per Enrollee (1996)	Price Adjusted Medicare Reimbursements for Inpatient Hospital Services per Enrollee (1996)	Price Adjusted Medicare Reimbursements for Outpatient Services per Enrollee (1996)	Price Adjusted Medicare Reimbursements for Professional and Laboratory Services per Enrollee (1996)	Price Adjusted Medicare Reimbursements for Home Health Care Services per Enrollee (1996)
Abingdon	34,158	5,440	2.2	8.0	2.1	(4,821)	(2,413)	(486)	(739)	(558)
Alexandria	272,937	20,040	1.3	5.2	1.5	4,085	1,969	357	1,095	312
Arlington	212,031	16,640	1.5	5.2	1.4	3,761	1,807	417	988	283
Bedford	22,655	4,020	2.5	13.6	2.3	(2,982)	(1,655)	(219)	(808)	(165)
Big Stone Gap	16,457	2,320	3.5	14.1	3.0	(5,174)	(2,658)	(560)	(691)	(885)
Blacksburg	69,286	5,180	1.6	7.8	2.1	(5,938)	(3,361)	(346)	(841)	(765)
Charlottesville	197,416	23,060	1.7	11.0	2.9	4,819	2,323	587	767	320
Chesapeake	137,136	9,500	1.7	8.3	2.5	(6,128)	(3,115)	(469)	(1,197)	(803)
Clintwood	14,629	1,500	3.9	16.8	4.0	(6,809)	(3,576)	(487)	(832)	(1,236)
Culpeper	32,853	4,480	2.1	12.4	3.5	(4,170)	(2,530)	(476)	(802)	(141)
Danville	108,709	16,860	1.8	7.3	1.7	4,509	2,567	434	1,026	191
Emporia	30,775	4,080	3.0	12.9	3.4	(3,121)	(1,613)	(394)	(784)	(85)
Fairfax	96,158	2,520	0.6	3.0	0.9	(3,854)	(1,864)	(378)	(1,032)	(165)
Falls Church	501,776	35,160	0.9	4.3	1.3	3,542	1,584	301	994	267
Farmville	28,172	4,340	3.0	12.3	3.5	(2,425)	(1,279)	(241)	(615)	(147)
Franklin	25,284	3,360	3.3	17.0	3.2	(3,488)	(1,292)	(602)	(771)	(483)
Fredericksburg	205,722	16,020	1.5	7.2	1.9	3,755	1,811	295	886	327
Front Royal	31,624	3,360	2.3	10.3	3.1	(3,763)	(2,247)	(268)	(670)	(253)
Galax	44,624	7,600	2.2	9.8	2.6	(4,460)	(2,058)	(394)	(760)	(951)
Gloucester	45,824	6,640	2.2	8.2	2.5	(3,646)	(1,863)	(231)	(816)	(413)
Grundy	30,378	3,080	3.2	10.8	3.0	(9,197)	(4,754)	(475)	(1,042)	(2,122)
Hampton	90,429	7,920	1.8	7.5	2.1	(3,619)	(1,603)	(361)	(931)	(449)
Harrisonburg	120,322	15,200	2.0	10.0	2.6	4,090	2,130	498	788	348
Hopewell	34,338	4,080	2.9	12.6	3.0	(4,619)	(2,453)	(347)	(972)	(397)
Hot Springs	5,405	800	5.9	19.2	5.5	(8,087)	(5,083)	(645)	(953)	(705)
Kilmarnock	26,228	7,000	1.8	7.0	2.2	(3,664)	(1,745)	(367)	(852)	(316)
Lebanon	32,548	4,320	2.9	10.0	2.6	(5,736)	(2,828)	(683)	(709)	(1,325)
Leesburg	77,337	4,840	1.2	5.2	1.4	(4,093)	(2,276)	(509)	(942)	(97)
Lexington	30,152	4,780	3.0	13.7	2.7	(3,424)	(1,883)	(475)	(641)	(132)
Low Moor	25,634	4,680	6.3	15.4	3.7	(5,270)	(3,128)	(285)	(791)	(543)
Luray	16,988	2,380	4.1	16.2	4.4	(4,445)	(2,201)	(516)	(570)	(590)
Lynchburg	197,602	26,440	2.1	9.0	3.2	3,137	1,640	358	703	146
Manassas	114,778	5,340	1.0	5.2	1.3	(3,635)	(1,702)	(399)	(739)	(379)
Marion	34,467	5,340	3.9	11.4	2.2	(5,518)	(2,179)	(501)	(759)	(1,502)
Martinsville	74,262	11,500	1.9	9.3	2.0	(4,218)	(2,366)	(319)	(763)	(332)
Nassawadox	34,160	6,440	3.6	13.4	3.7	(4,371)	(2,590)	(326)	(798)	(286)
Newport News	312,064	27,960	1.8	7.4	2.1	4,363	2,183	430	1,042	389
Norfolk	378,364	30,580	2.1	9.2	2.6	4,410	2,204	433	996	361
Norton	28,924	4,620	3.7	16.7	3.9	(5,522)	(2,803)	(637)	(644)	(1,234)

HSA City	Resident Population (1996)	Medicare Enrollees (1996)	Acute Care Hospital Beds per 1,000 Residents (1996)	FTE Hospital Employees per 1,000 Residents (1996)	Hospital-Based Registered Nurses per 1,000 Residents (1996)	Price Adjusted Total Reimbursements for Noncapitated Medicare per Enrollee (1996)	Price Adjusted Medicare Reimbursements for Inpatient Hospital Services per Enrollee (1996)	Price Adjusted Medicare Reimbursements for Outpatient Services per Enrollee (1996)	Price Adjusted Medicare Reimbursements for Professional and Laboratory Services per Enrollee (1996)	Price Adjusted Medicare Reimbursements for Home Health Care Services per Enrollee (1996)
Pearisburg	18,748	3,120	2.4	14.0	3.5	(4,320)	(2,628)	(386)	(790)	(276)
Pennington Gap	18,128	2,300	3.8	14.5	3.1	(7,389)	(3,631)	(1,258)	(591)	(1,588)
Petersburg	115,852	13,440	2.9	12.6	3.0	4,203	2,446	260	910	278
Portsmouth	169,350	17,880	2.8	11.4	2.7	4,325	2,145	369	1,115	341
Pulaski	18,711	3,520	4.0	14.9	4.4	(5,605)	(2,766)	(483)	(996)	(780)
Radford	39,627	4,180	2.1	10.2	2.9	(5,541)	(3,044)	(827)	(949)	(467)
Reston	157,514	6,300	0.7	3.3	1.0	(4,051)	(2,122)	(220)	(1,001)	(222)
Richlands	30,311	3,700	3.5	10.6	2.6	(7,531)	(4,683)	(450)	(837)	(1,307)
Richmond	864,043	95,580	2.4	9.5	2.8	4,162	2,199	327	925	373
Roanoke	233,645	32,180	2.0	9.5	1.5	3,749	1,930	316	771	344
Rocky Mount	26,132	3,720	2.0	10.5	2.4	(4,114)	(2,531)	(286)	(781)	(172)
Salem	48,089	8,300	2.0	8.0	1.5	(3,762)	(1,943)	(327)	(782)	(304)
South Boston	56,267	9,520	2.6	10.2	2.5	(3,697)	(1,956)	(474)	(726)	(256)
South Hill	27,847	5,040	3.5	16.6	3.9	(4,575)	(2,519)	(485)	(955)	(282)
Staunton	100,830	15,160	2.3	13.2	3.6	5,443	3,144	483	860	422
Stuart	13,060	2,000	2.4	12.8	2.8	(3,408)	(1,518)	(626)	(535)	(463)
Suffolk	64,283	7,400	2.7	12.5	2.9	(4,123)	(2,085)	(412)	(994)	(406)
Tappahannock	23,813	3,900	3.3	10.5	3.2	(5,065)	(2,612)	(547)	(1,044)	(424)
Tazewell	12,449	1,980	1.2	4.2	1.0	(2,906)	(1,062)	(530)	(437)	(568)
Virginia Beach	299,184	20,040	1.3	5.5	1.7	4,307	2,014	429	1,084	278
Warrenton	54,645	4,260	1.4	8.4	2.2	(4,586)	(2,598)	(377)	(884)	(192)
Williamsburg	63,623	8,720	2.1	9.0	2.5	(4,872)	(2,488)	(572)	(1,068)	(485)
Winchester	114,600	12,920	2.5	10.5	3.4	4,509	2,437	224	859	565
Woodbridge	166,692	5,040	1.0	4.4	1.2	(4,095)	(1,785)	(260)	(1,010)	(495)
Woodstock	20,621	3,100	3.7	14.1	3.9	(3,578)	(1,966)	(368)	(782)	(296)
Wytheville	32,099	4,180	2.7	11.2	3.3	(6,246)	(3,646)	(503)	(921)	(787)
Virginia	6,582,769	666,900	1.9	8.3	2.3	4,274	2,202	393	899	396
United States		27,691,820				4,993	2,450	444	1,015	532

CHAPTER THREE

The Physician Workforce in Virginia

The Physician Workforce in Virginia

The size of the physician workforce in the United States has been determined by factors that have little to do with patient demand for health care, and much to do with federal policy on funding physician training and the needs of the training institutions as they are currently structured. As a result, from 1970 to 1996, the per capita supply of clinically active physicians in the United States grew by about 67%, from 113.1 per 100,000 residents to 188.9. About 66% of the physician workforce in 1996 were specialists. In Virginia in 1996, there were 169.8 physicians per 100,000 residents, slightly fewer than the national average.

How many physicians are really needed? Workforce requirements have often been forecast on the basis of needs or demand planning, both of which models are flawed. Needs-based planning relies on "experts" to estimate the correct number of physicians to meet need and produce optimal outcomes. The uncertainties inherent in clinical medicine, rapid changes in technology, and the failure of outcomes research to keep up with innovation all mean that these experts are, in practice, unable to accurately predict the need for physicians.

Demand-based planning assumes that the utilization of care is driven by patient demand; the trends in prevailing rates of service are therefore assumed to be the right rates and are used to project future needs for physicians. Since the supply of resources and provider preferences have been shown to influence the rates of use of care for discretionary services, this method is also problematic for projecting workforce requirements.

Benchmarking offers a pragmatic alternative for estimating the requirements for a reasonably-sized workforce. Benchmarks are based on the actual deployment of the workforce. Further, there is little evidence that patients are harmed because they live in regions with fewer physicians per 100,000 residents. Finally, since it is unclear that spending more for physicians' services results in better outcomes, common sense argues against maintaining the status quo — continuing to produce physicians at a rate which increases the nation's per capita supply.

This chapter examines the physician workforce in the 65 hospital service areas in Virginia. The data come from two sources. For most of the medical and surgical specialties, the workforce is calculated from the state's hospital discharge database.

The allocation methodology used in this Atlas makes possible an accurate analysis of the actual utilization of the services of both local and out of area doctors by the residents of Virginia hospital service areas. The work of each physician providing services to residents of Virginia was allocated to hospital service areas according to the proportion of his or her services provided to residents of those hospital service areas. For example, a primary care physician who spent 20% of her time treating residents of the Wytheville hospital service area, 70% of her time treating residents of the Pulaski hospital service area and 10% of her time treating residents of the Galax hospital service area would be allocated proportionately: 20% of a full-time equivalent primary care physician to the residents of Wytheville, 70% of a full-time equivalent to the residents of Pulaski, and 10% of a full-time equivalent to the residents of Galax.

The obverse is also true: the amount of out-of-area physicians' time spent treating residents of a particular hospital service area is allocated back to the hospital service area of residence of the patient. For example, if residents of the Galax hospital service area use 5% of the services of a cardiologist whose offices are in Roanoke, then 5% of a full-time equivalent cardiologist is allocated to the Galax hospital service area. These rules apply to all residents of Virginia hospital service areas and all physicians providing services to residents of Virginia hospital service areas.

In the case of specialists who do not actually admit or discharge patients from hospitals (such as radiologists) data from the American Medical Association and the American Osteopathic Association were used to calculate the numbers of physicians allocated to specific populations.

In order to make comparisons between areas, and in order to be consistent with the national editions of the Dartmouth Atlas, the physician supply is always expressed as a rate: the number of physicians per 100,000 persons. The use of a consistent rate reveals the relative level of supply available to the residents of a defined area. For example, we can look at one area with a rate of 10 surgeons per 100,000 residents and another area with a rate of 15 surgeons per 100,000 residents and ask what effect the additional capacity has on those populations: is there more surgery in the area with higher supply? Are more people going without necessary surgical procedures in the area with lower supply?

Physicians were identified by specialties based on a profile of discharge diagnoses. In order to be counted as a specialist, the physician must have had a minimum of 20 discharges with specialty-specific diagnoses.

The methodology used to allocate the physician workforce is described in detail in the Appendix on Methods. The estimates have been adjusted for differences in the age and sex of the populations in each hospital service area.

In a number of Virginia hospital service areas, a significant proportion of residents receive care at hospitals in bordering states, and residents of bordering states receive care in Virginia hospitals. Data concerning Virginia residents who received care in bordering states were obtained and incorporated in the estimates. Where estimates are based on too little data to receive a statistically significant number, or where confidentiality might be compromised, the maps are shaded and colored to indicate that data have either been suppressed because of small numbers or because of statistical instability.

The Physician Workforce Active in Patient Care

In 1996, there were 188.9 physicians per 100,000 residents of the United States. In Virginia in 1996, the supply of physicians varied by a factor of three, from about 80 per 100,000 residents to almost 250; the state average was 169.8.

Among the large hospital service areas with physician workforces higher than the U.S. average of 188.9 were Kilmarnock (247.4) and Williamsburg (196.9). Arlington (179.9); Charlottesville (178.4) and Gloucester (175.6) were slightly higher than the state average.

Other hospital service areas had allocated supplies of physicians substantially lower than the Virginia average, including Grundy (81.4); Hampton (90.1); Lebanon (90.8); Manassas (94.3) and Galax (97.1).

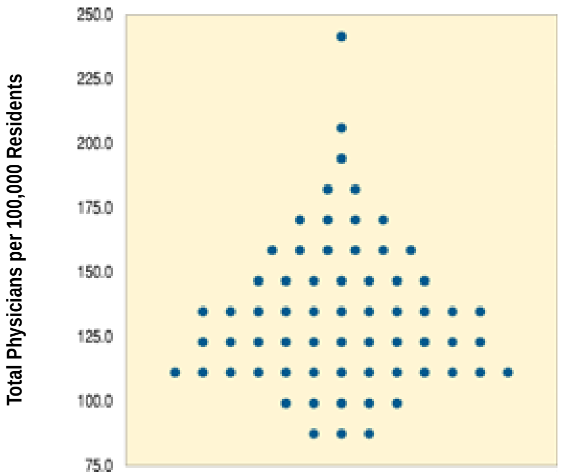
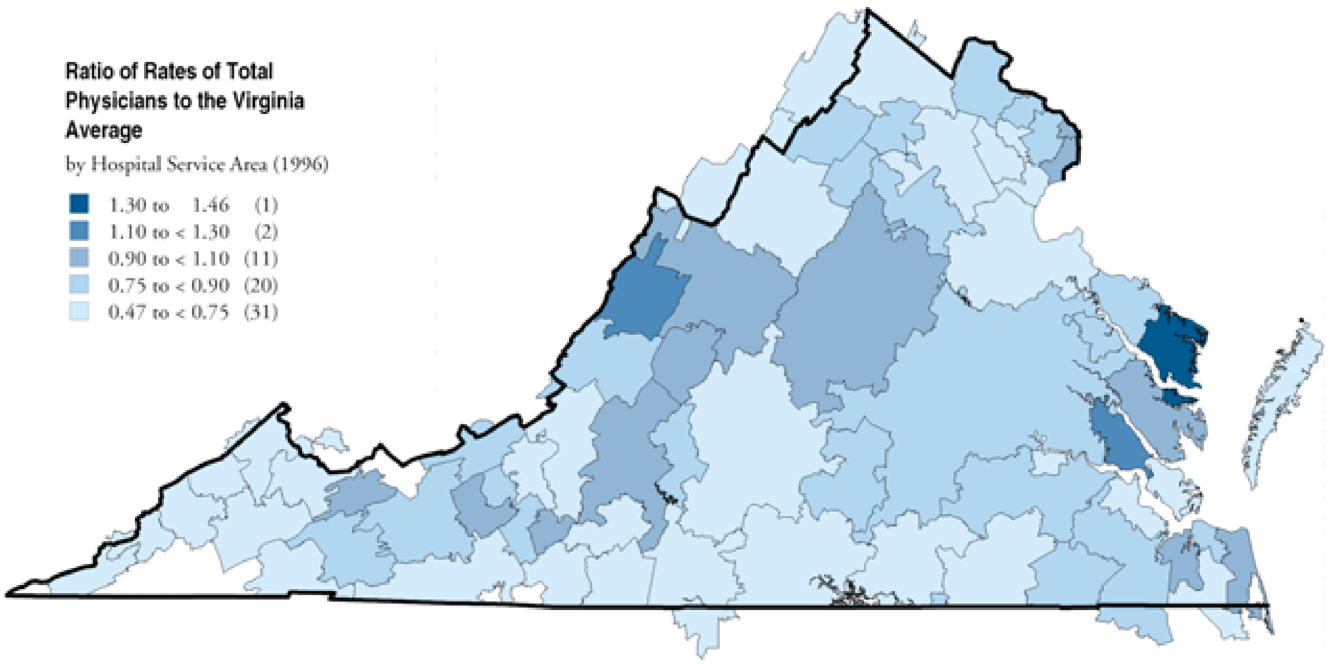


Figure 3.1. The Physician Workforce (1996)
The number of physicians per 100,000 residents varied from 80 to almost 250, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.1. The Physician Workforce (1996)

One hospital service area had a physician workforce at least 30% higher than the Virginia average of 170 per 100,000 residents. Thirty-one areas had workforces more than 25% below the average.

Physicians in Primary Care

In 1996, there were 65.0 physicians in primary care per 100,000 residents of the United States. The numbers of primary care physicians in active practice per 100,000 residents of Virginia hospital service areas in 1996 varied by a factor of four, from about 30 to more than 120; there were 58.9 physicians in primary care per 100,000 residents of the state.

Among the hospital service areas with supplies of primary care physicians higher than the U.S. average of 65.0 were Kilmarnock (121.5); Lexington (76.9); Tazewell (73.9); Pearisburg (73.2) and Gloucester (72.9).

Other hospital service areas had fewer primary care physicians per 100,000 residents than the state average, including Danville (30.4); Martinsville (30.7); Winchester (31.6); Hampton (32.0) and Manassas (35.1).

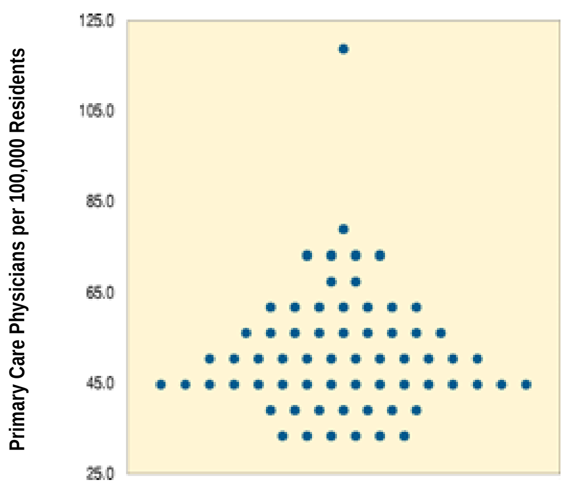
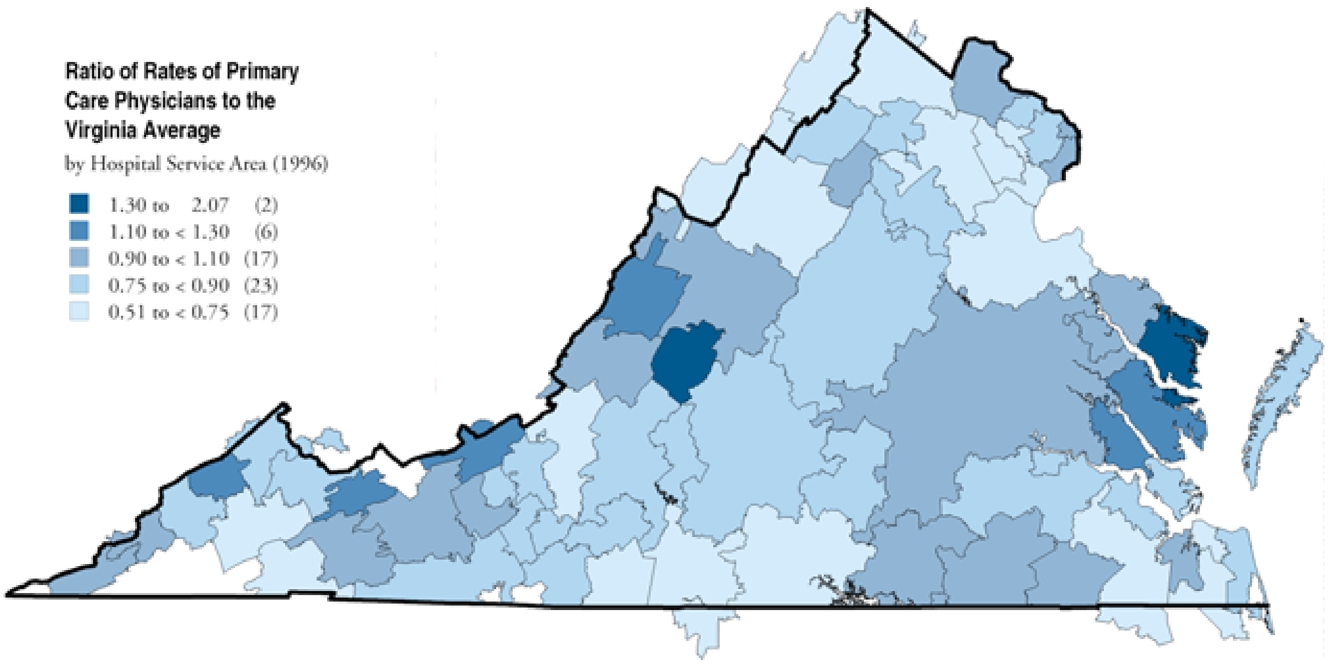


Figure 3.2. The Primary Care Physician Workforce (1996)
The number of primary care physicians per 100,000 residents varied from 30 to 120, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.2. The Primary Care Physician Workforce (1996)

Two hospital service areas had primary care physician workforces at least 30% higher than the Virginia average of 58.9 per 100,000 residents. Seventeen areas had primary care workforces more than 25% below the average.

Specialist Physicians

The number of specialists per 100,000 residents in Virginia hospital service areas in 1996 varied by a factor of 3.7, from 35 to 130; there were 110.4 specialists per 100,000 residents of the state.

Among the hospital service areas with average numbers of specialist physicians higher than the U.S. average of 122.9 were Williamsburg (128.2); Charlottesville (127.6); Kilmarnock (126.5) and Arlington (123.9).

The numbers of specialist physicians allocated to residents of hospital service areas in Grundy (35.0); Clintwood (45.0); Lebanon (46.8); Pennington Gap (50.5) and Galax (50.5) were substantially lower than the Virginia average.

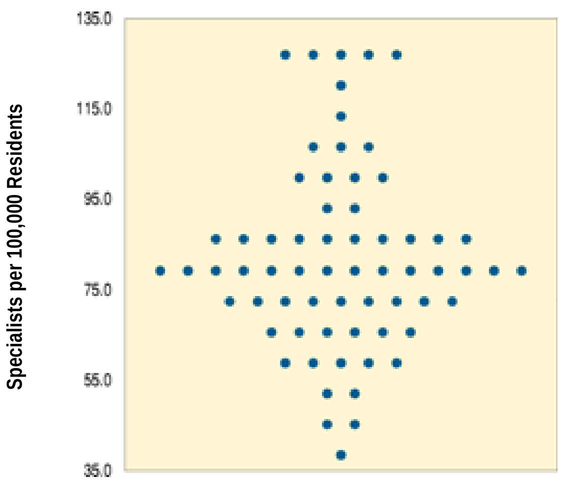
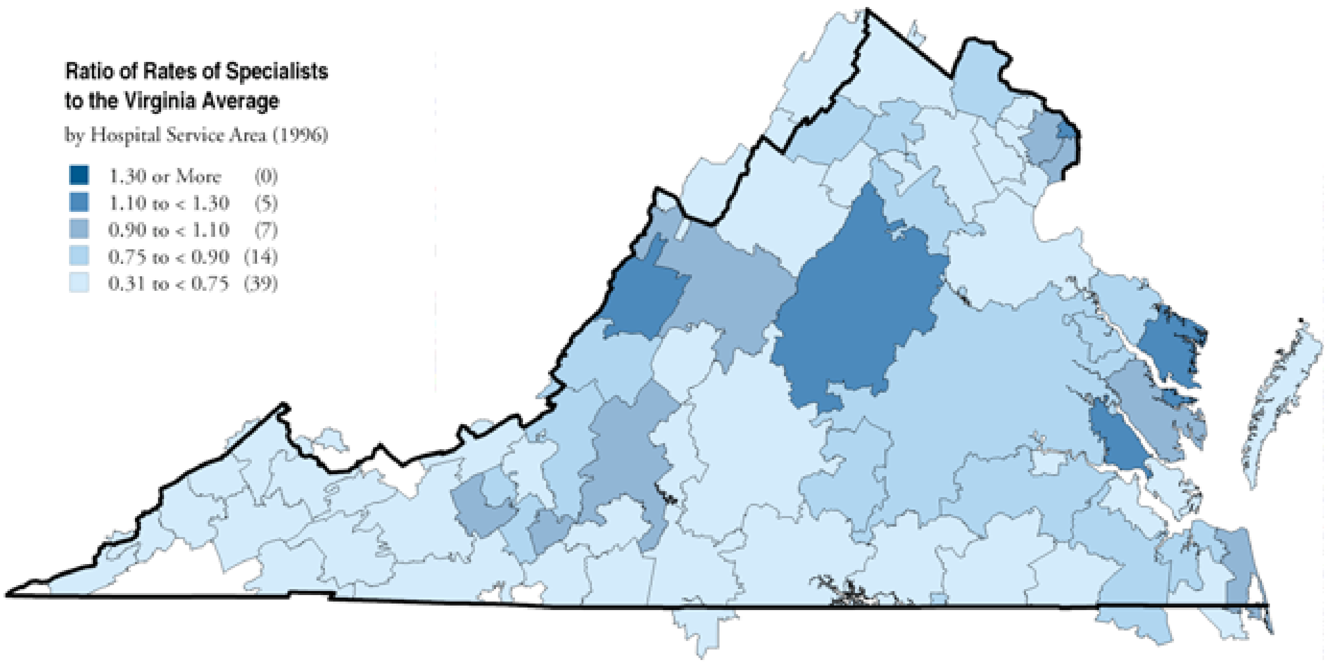


Figure 3.3. The Specialist Workforce (1996)
The number of specialist physicians per 100,000 residents varied from 35 to 130, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.3. The Specialist Workforce (1996)

No hospital service area had a specialist workforce at least 30% higher than the Virginia average of 110 per 100,000 residents. Thirty-nine areas had specialist workforces more than 25% below the average.

Cardiologists

In 1996, there were 5.9 cardiologists per 100,000 residents of the United States. In Virginia in 1996, the supply of cardiologists allocated to local populations varied from fewer than 0.1 to almost 13; there were 5.7 cardiologists per 100,000 residents of the state.

Among the hospital service areas with numbers of cardiologists higher than the U.S. average of 5.9 were Danville (12.9); Hopewell (12.5); Petersburg (11.3); Kilmarnock (11.1) and Suffolk (10.7).

The numbers of cardiologists allocated to residents of the hospital service areas in Big Stone Gap (0.04); Norton (0.06); Abingdon (0.2); Clintwood (0.5) and Marion (0.6) were substantially lower than the Virginia average.

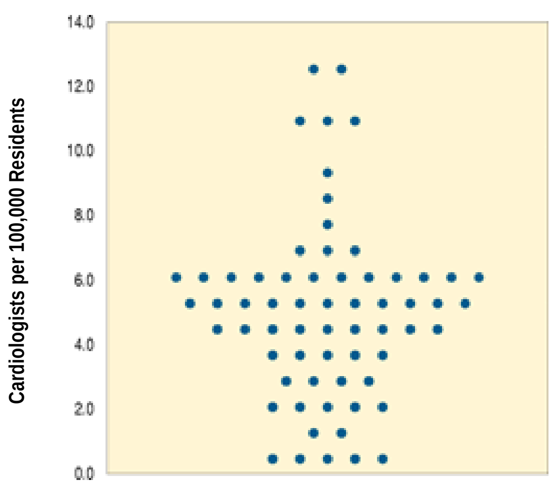
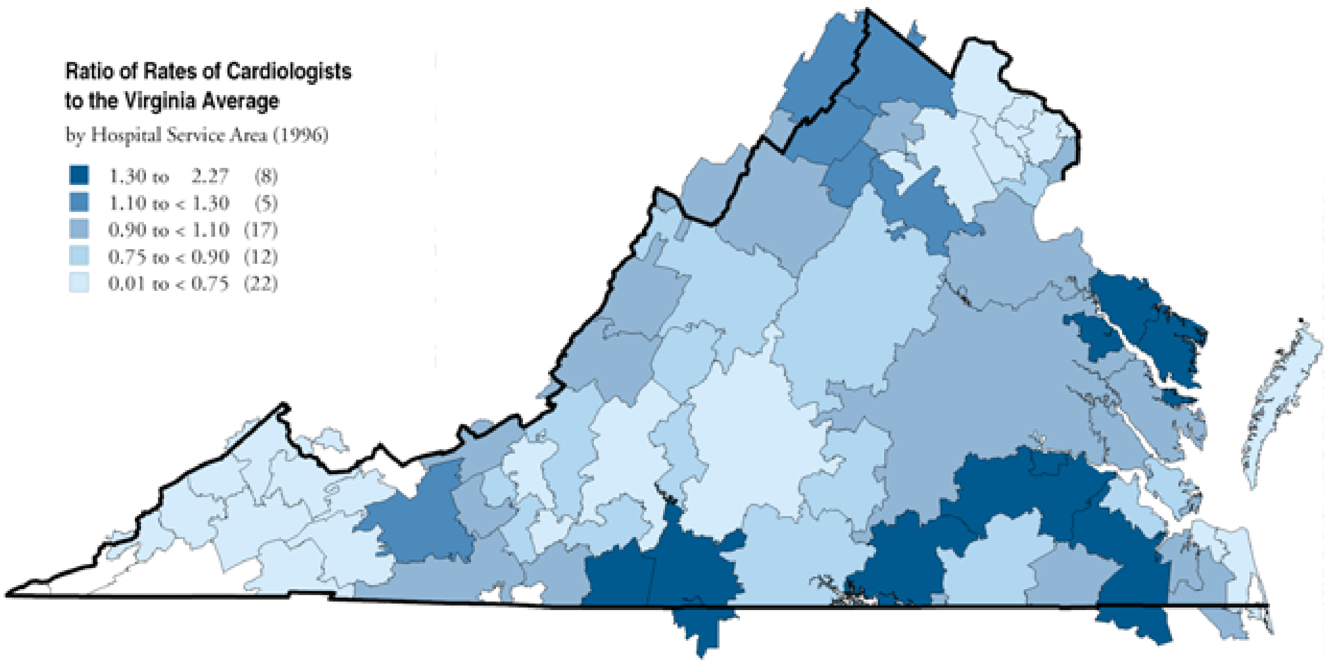


Figure 3.4. The Cardiology Workforce (1996)

The number of cardiologists per 100,000 residents varied from fewer than 1 to almost 13, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.4. The Cardiology Workforce (1996)

Eight hospital service areas had cardiologist workforces at least 30% higher than the Virginia average of 5.7 per 100,000 residents. Twenty-two areas had cardiologist workforces more than 25% below the average.

Cardiothoracic Surgeons

In 1996, there were 1.6 cardiothoracic surgeons per 100,000 residents of the United States. In Virginia in 1996, the supply of cardiothoracic surgeons allocated to local populations varied from 0.0 to 3.8; there were 1.1 per 100,000 residents of the state.

Four hospital service areas had allocated cardiovascular surgery workforces larger than the U.S. average of 1.6: Bedford (3.8), South Hill (3.5), Williamsburg (2.0), and Gloucester (1.7). Residents of the hospital service area in Kilmarnock (1.5) also had a higher than average workforce.

The Pennington Gap, Norton, Abingdon, Lebanon, and Danville hospital service areas all had fewer than 0.03 allocated cardiothoracic surgeons per 100,000 residents.

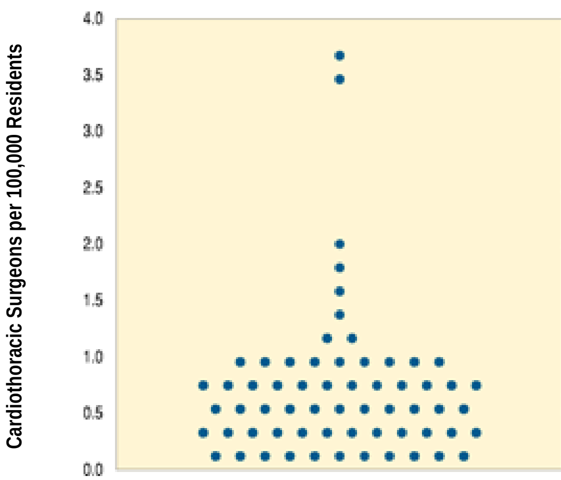
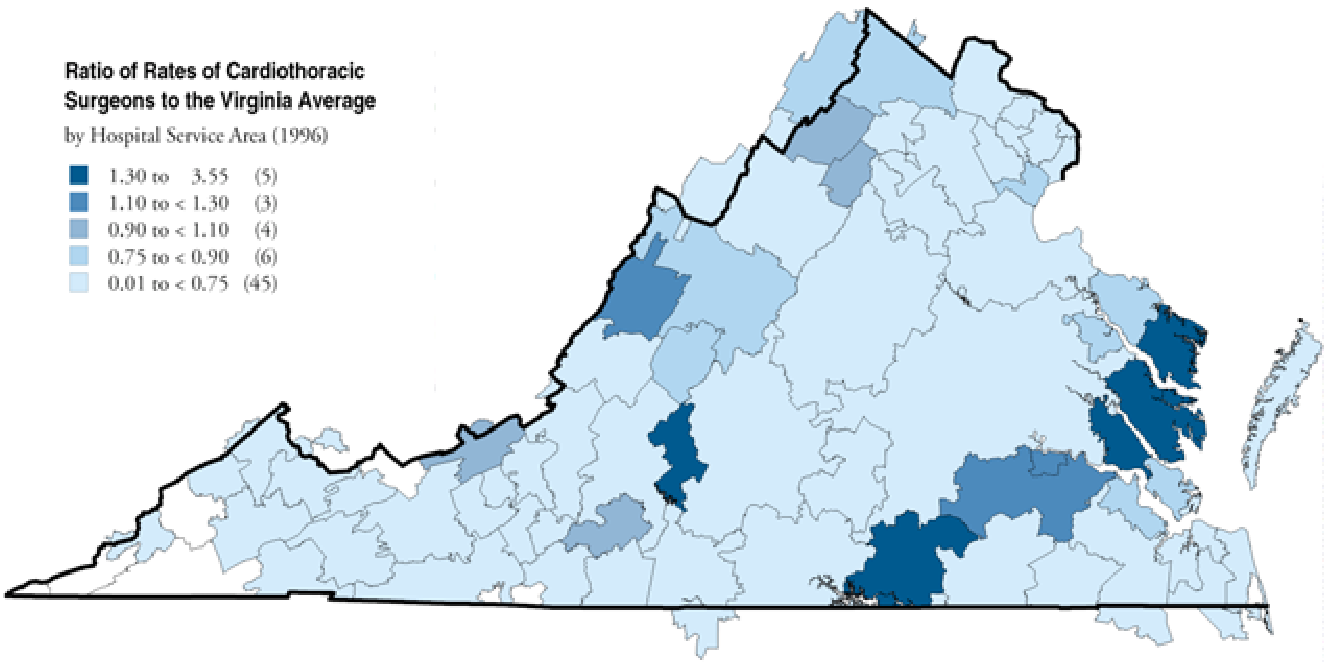


Figure 3.5. The Cardiothoracic Surgery Workforce (1996)
The number of cardiothoracic surgeons per 100,000 residents varied from 0 to 3.8, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.5. The Cardiothoracic Surgery Workforce (1996)

Five hospital referral regions had cardiothoracic surgery workforces at least 30% higher than the Virginia average of 1.1 per 100,000 residents. Forty-five regions had cardiothoracic workforces more than 25% below the average.

General Surgeons

In 1996, there were 8.9 general surgeons per 100,000 residents of the United States. In Virginia in 1996, the supply of general surgeons allocated to local populations varied by a factor of 7.6, from 3.3 to 25.2; the state average was 7.9.

Residents of some hospital service areas had general surgery workforces that substantially exceeded the U.S. average of 8.9, including Tazewell (17.2); Pearisburg (16.5); Big Stone Gap (16.1); Marion (15.4) and Bedford (13.1).

In other hospital service areas, the numbers of general surgeons per 100,000 residents were lower than the average, including Fairfax (3.3); Reston (3.8); Hampton (3.9); Woodbridge (4.2) and Lebanon (4.4).

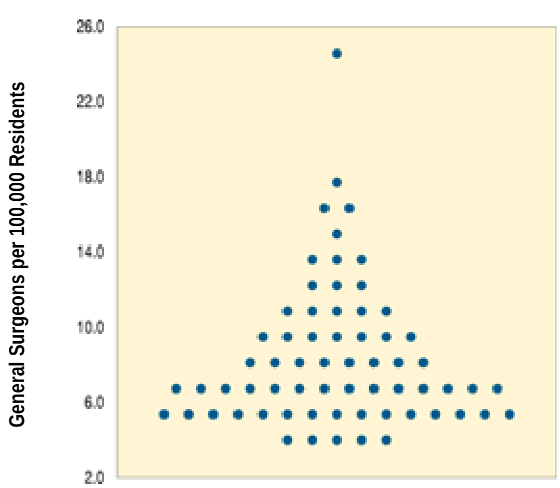
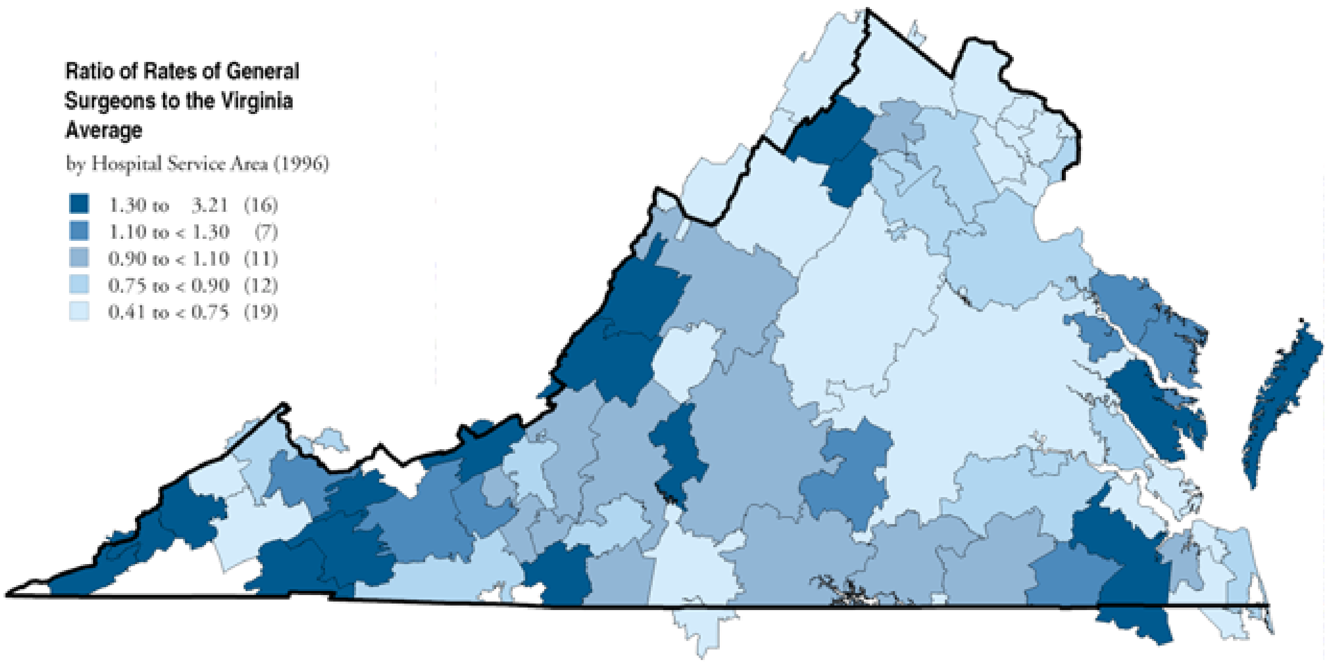


Figure 3.6. The General Surgery Workforce (1996)
The number of general surgeons per 100,000 residents varied from 3.3 to 25.2, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.6. The General Surgery Workforce (1996)

Sixteen hospital service areas had general surgery workforces at least 30% higher than the Virginia average of 7.9 per 100,000 residents. Nineteen areas had general surgery workforces more than 25% below the average.

Obstetrician/Gynecologists

In 1996, there were 12.0 obstetrician/gynecologists per 100,000 residents of the United States. In Virginia in 1996, the supply of obstetrician/ gynecologists allocated to local populations varied by a factor of almost four, from 4.3 to 16.0; there were 11.9 per 100,000 residents of the state.

The numbers of obstetrician/gynecologists allocated to the residents of the Bedford (16.0); Hopewell (14.7); Pearisburg (14.6); Low Moor (14.2) and Leesburg (14.1) hospital service areas were higher than the U.S. average of 12.0.

Other Virginia hospital service areas had many fewer allocated obstetrician/gynecologists than the Virginia average, including Kilmarnock (4.3); Stuart (5.1); Tazewell (5.2); Danville (6.1) and Grundy (6.2).

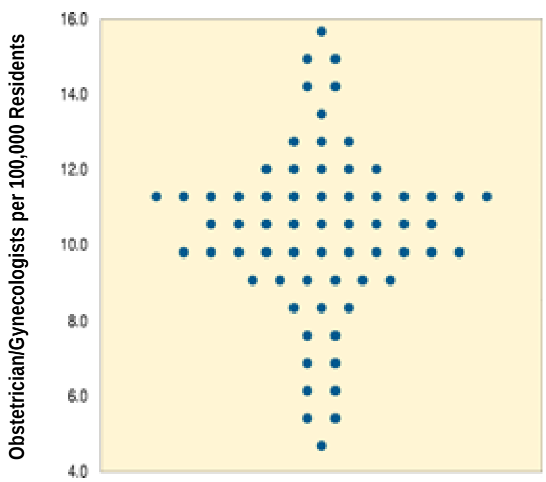
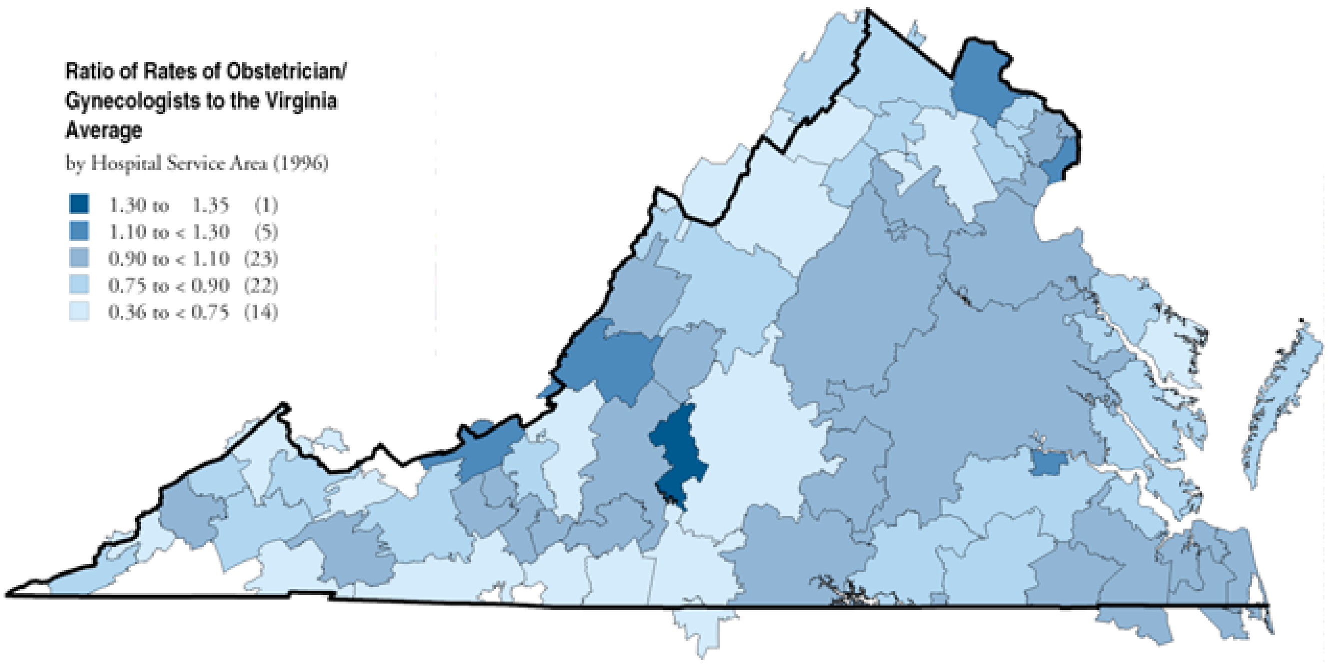


Figure 3.7. The Obstetrician/Gynecologist Workforce (1996)
The number of obstetrician/gynecologists per 100,000 residents varied from 4.3 to 16.0, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.7. The Obstetrician/Gynecologist Workforce (1996)

One hospital service area had an obstetrics/gynecology workforce at least 30% higher than the Virginia average of 11.9 per 100,000 residents. Fourteen areas had obstetrics/gynecology workforces more than 25% below the average.

Orthopedic Surgeons

In 1996, there were 7.1 orthopedic surgeons per 100,000 residents of the United States. In Virginia in 1996, the supply of orthopedic surgeons allocated to local populations varied by a factor of more than eight, from 1.6 to 13.0; there were 6.4 per 100,000 residents of the state.

The numbers of orthopedic surgeons allocated to the Pennington Gap (13.0); Farmville (8.4); Williamsburg (8.3); Staunton (8.1) and Grundy (8.1) hospital service areas were higher than the U.S. average of 7.1.

Among the Virginia hospital service areas where the numbers of allocated orthopedic surgeons were less than half the Virginia average were Big Stone Gap (1.6); Tazewell (2.0); Fairfax (2.1); Norton (2.8) and Emporia (2.9).

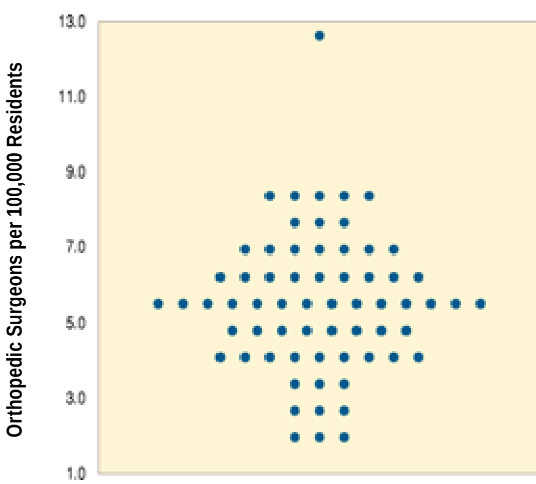
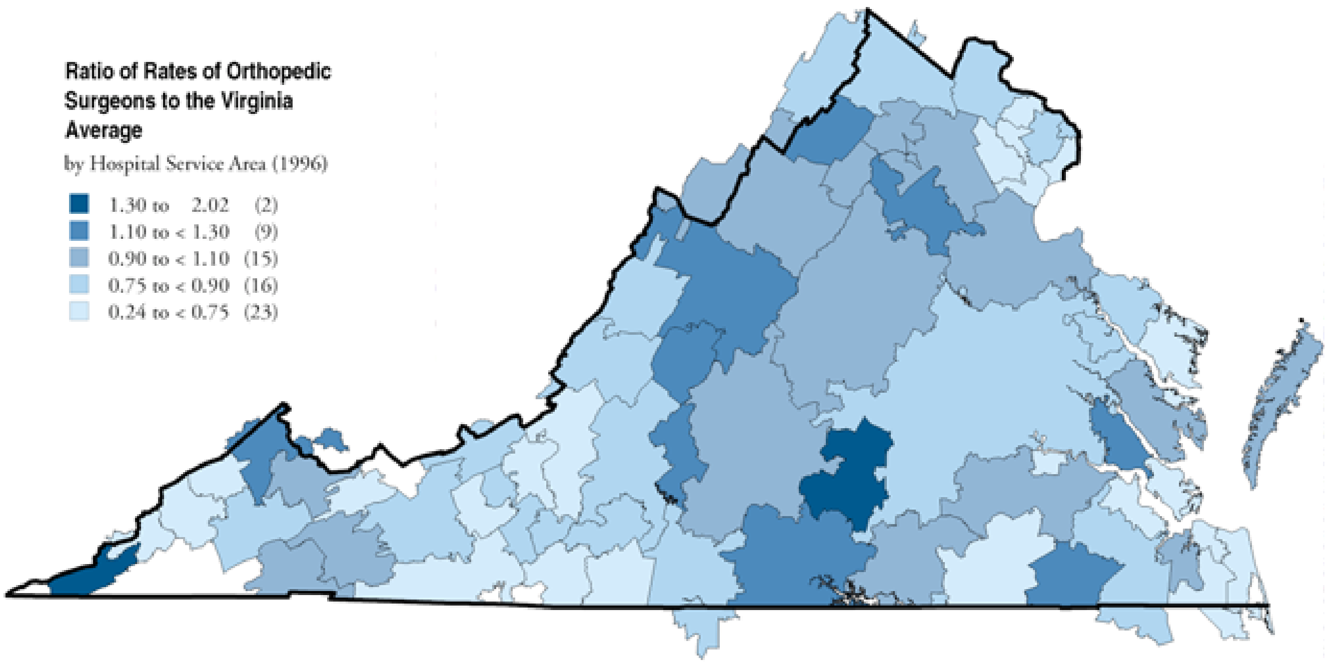


Figure 3.8. The Orthopedic Surgery Workforce (1996)
The number of orthopedic surgeons per 100,000 residents varied from 1.6 to 13.0, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.8. The Orthopedic Surgery Workforce (1996)

Two hospital service areas had orthopedic surgery workforces at least 30% higher than the Virginia average of 6.4 per 100,000 residents. Twenty-three areas had orthopedic surgery workforces more than 25% below the average.

Radiologists

In 1996, there were 8.8 radiologists per 100,000 residents of the United States. In Virginia in 1996, the supply of radiologists allocated to local populations varied by a factor of 7.8, from 2.2 to 17.1; there were 8.0 per 100,000 residents of the state.

The numbers of radiologists allocated to residents of the Tazewell (17.0); Kilmarnock (15.1); Pulaski (14.7); Charlottesville (11.6) and Staunton (10.2) hospital service areas were substantially higher than the U.S. average of 8.8.

The numbers of radiologists allocated to residents of the Grundy (2.2); Hampton (3.1); Clintwood (3.1); Abingdon (3.4) and Nassawadox (3.6) hospital service areas were less than half the Virginia average.

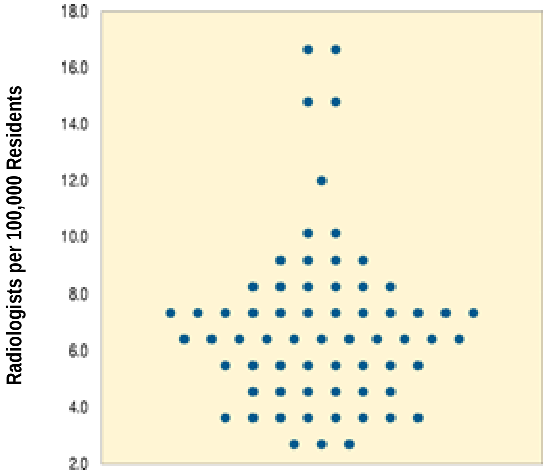
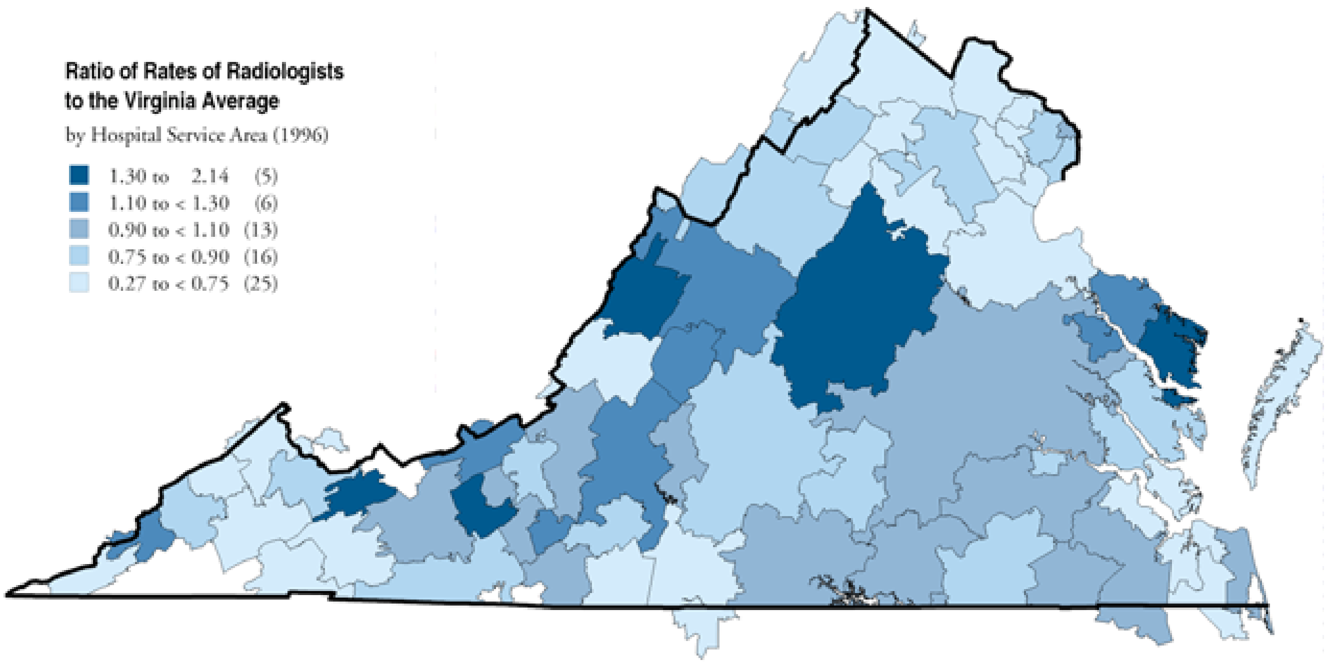


Figure 3.9. The Radiology Workforce (1996)
The number of radiologists per 100,000 residents varied from 2 to 17, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.9. The Radiology Workforce (1996)

Five hospital service areas had radiology workforces at least 30% higher than the Virginia average of 8.0 per 100,000 residents. Twenty-five areas had radiology workforces more than 25% below the average.

Urologists

In 1996, there were 3.2 urologists per 100,000 residents of the United States. In Virginia in 1996, the supply of urologists allocated to local populations varied by a factor of 11.3, from 0.6 to 6.8; there were 3.4 per 100,000 residents of the state.

The numbers of urologists allocated to residents of the Tappahannock (6.8); Pulaski (6.3); Martinsville (6.1); Low Moor (5.7) and Bedford (5.7) hospital service areas were substantially higher than the U.S. average of 3.2.

The numbers of urologists allocated to residents of the Grundy (0.6); Tazewell (1.1); Fairfax (1.4); Reston (1.7) and Chesapeake (1.7) hospital service areas were less than half the state average.

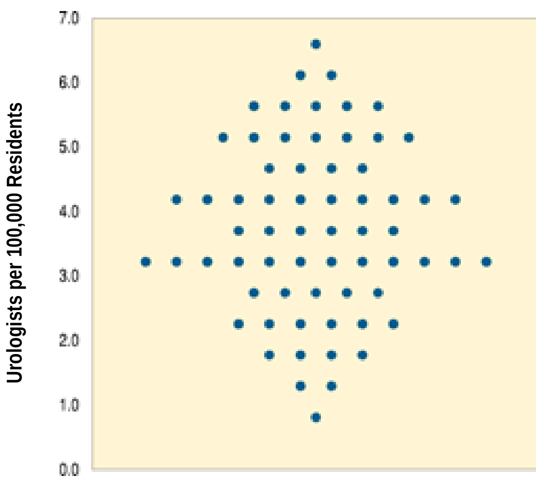
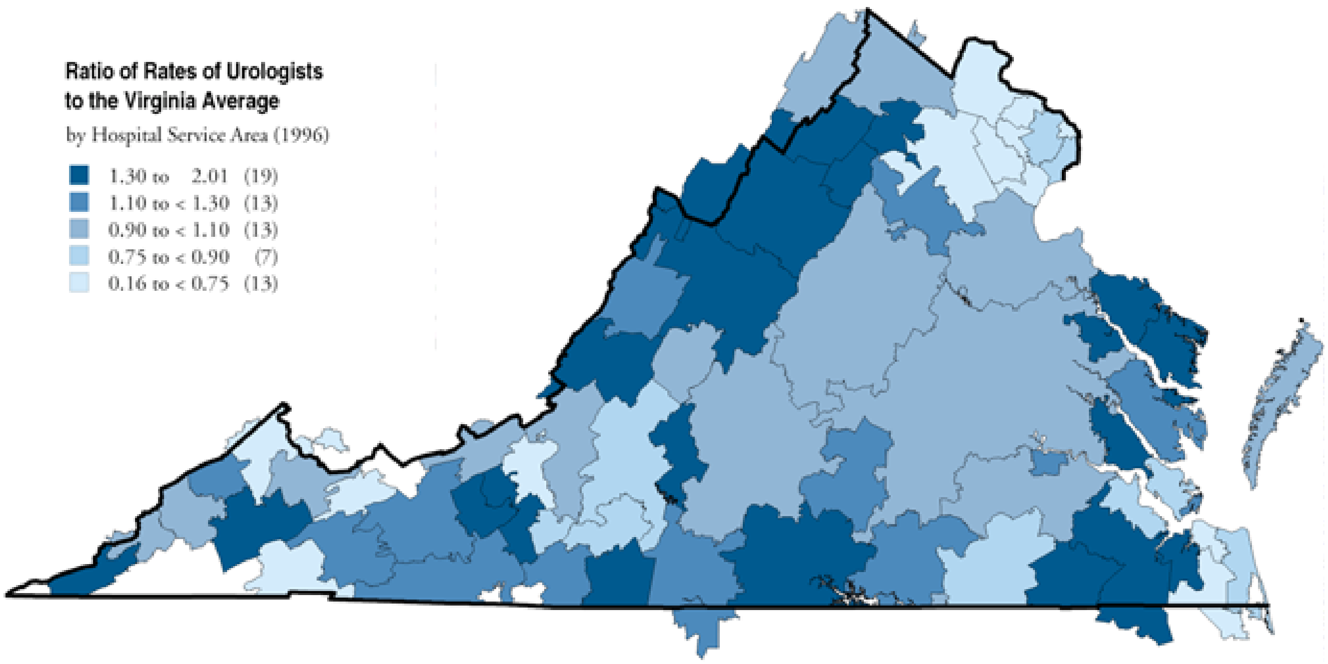


Figure 3.10. The Urology Workforce (1996)
The number of urologists per 100,000 residents varied from 0.6 to almost 7, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.10. The Urology Workforce (1996)

Nineteen hospital service areas had urology workforces at least 30% higher than the Virginia average of 3.4 per 100,000 residents. Thirteen areas had urology workforces more than 25% below the average.

Physicians in Residency Training Programs

In 1996, there were 38.1 physicians in residency training programs per 100,000 residents of the United States. In Virginia in 1996, the supply allocated to local populations varied from 2.3 to 121.7; there were 32.3 per 100,000 residents of the state.

The number of physicians in residency training programs allocated to residents of the Charlottesville hospital service area was more than 3.7 times higher than the Virginia average. The numbers allocated to the Arlington (68.1); Richmond (39.3); Culpeper (35.6) and Staunton (34.0) hospital service areas were also higher than the Virginia average of 32.3.

There were only about one-tenth the average number of physicians in residency training programs allocated to the residents of the Abingdon (2.3); Danville (2.5); Pennington Gap (2.7); Lebanon (2.9) and Norton (3.2) hospital service areas.

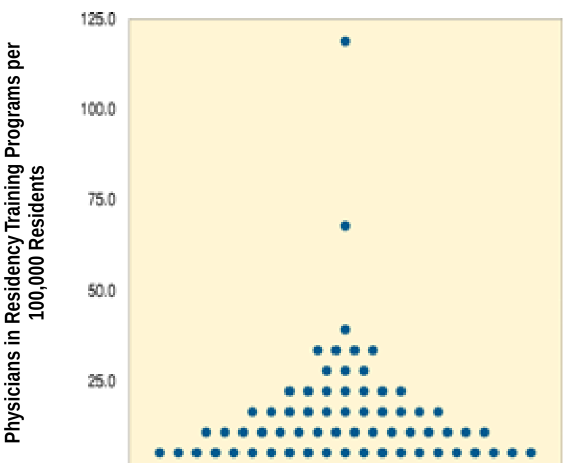
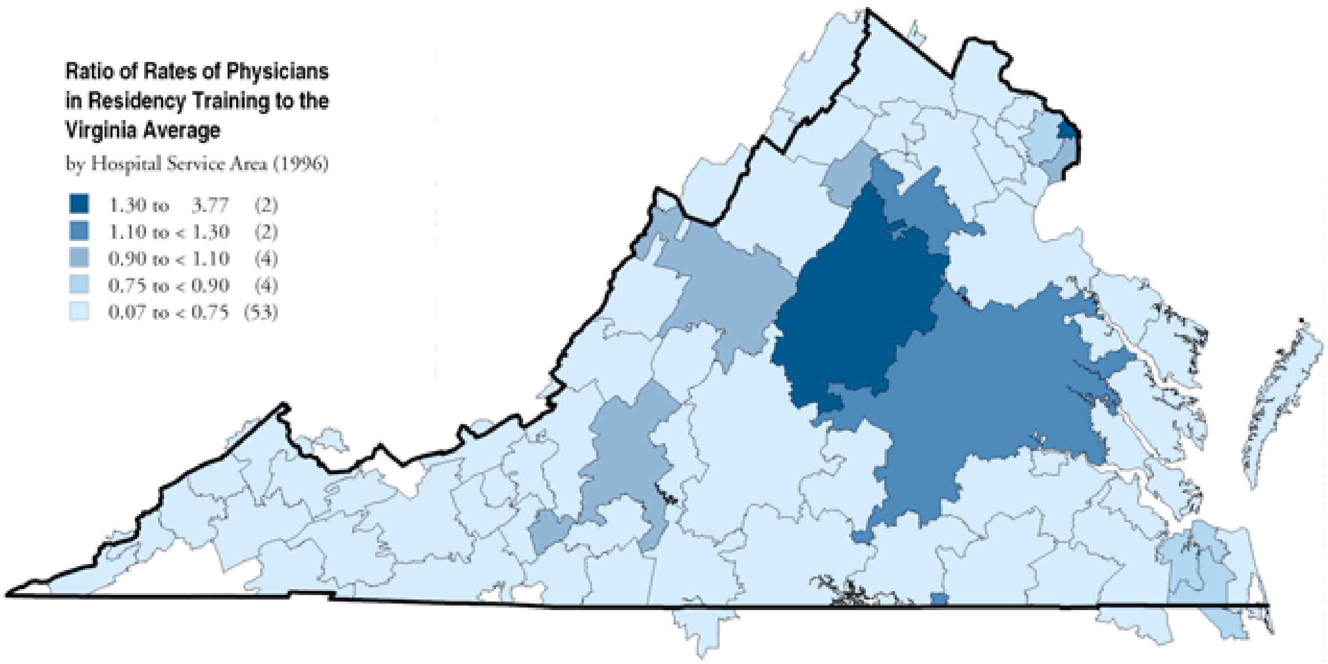


Figure 3.11. Physicians in Residency Training Programs (1996)
The number of physicians in residency training programs per 100,000 residents varied from 2.3 to more than 120, after adjustment for differences in population age and sex. Each point represents one of the 65 hospital service areas in Virginia.



Map 3.11. Physicians in Residency Training Programs (1996)

Two hospital service areas had supplies of physicians in residency training programs at least 30% higher than the Virginia average of 32.3 per 100,000 residents. Fifty-three areas had residency workforces more than 25% below the average.

Chapter Three Table Note

The physician supply is expressed in rates per 100,000 residents. Rates are adjusted for differences in the age and sex composition of the population and corrected for out of area use. Physicians in residency training programs, regardless of specialty area, are grouped together. The count of primary care physicians added to the count of specialist physicians does not equal the count of all physicians; the difference is attributable to the count of those whose specialty areas were identified as “unspecified.”

See the Appendix on Methods for details on the methods used for allocating the physician workforce, identifying physician specialties, and for other details concerning the rates in this table.

CHAPTER THREE TABLE

The Physician Workforce

Virginia HSA City	Resident Population (1996)	Total Physicians per 100,000 Residents (1996)	Primary Care Physicians per 100,000 Residents (1996)	Specialists per 100,000 Residents (1996)	Cardiologists per 100,000 Residents (1996)	Cardiothoracic Surgeons per 100,000 Residents (1996)	General Surgeons per 100,000 Residents (1996)	Obstetrician/ Gynecologists per 100,000 Residents (1996)	Orthopedic Surgeons per 100,000 Residents (1996)	Radiologists per 100,000 Residents (1996)	Urologists per 100,000 Residents (1996)	Physicians in Residency Training per 100,000 Residents (1996)
Abingdon	34,158	105.3	36.0	68.1	0.16	0.01	10.3	7.0	6.5	3.4	2.4	2.3
Alexandria	272,937	164.4	53.9	110.0	5.28	0.54	6.5	13.3	3.6	6.8	3.0	32.9
Arlington	212,031	179.9	56.2	123.9	3.12	0.73	4.8	12.5	5.4	8.1	2.4	68.1
Bedford	22,655	128.2	48.2	80.1	4.84	3.77	13.1	16.0	7.2	7.3	5.7	14.7
Big Stone Gap	16,457	114.0	56.2	58.1	0.04	0.03	16.1	7.3	1.6	9.3	3.2	4.9
Blacksburg	69,286	117.3	45.1	71.5	2.10	0.46	6.6	9.7	4.2	7.2	2.1	5.5
Charlottesville	197,416	178.4	50.1	127.6	4.91	0.65	5.0	10.8	6.1	11.6	3.1	121.7
Chesapeake	137,136	110.5	43.5	66.8	5.57	0.25	5.5	11.0	4.6	3.6	1.7	24.6
Clintwood	14,629	109.8	64.9	45.0	0.54	0.03	5.5	10.2	3.0	3.1	4.1	3.4
Culpeper	32,853	144.9	50.6	94.3	6.35	0.63	6.8	10.9	8.0	5.0	3.8	35.6
Danville	108,709	102.1	30.4	71.9	12.94	0.02	4.7	6.1	5.4	5.5	4.1	2.5
Emporia	30,775	121.4	64.5	57.1	5.09	0.77	8.0	9.8	2.9	6.2	3.0	13.6
Fairfax	96,158	109.6	39.4	70.2	1.72	0.33	3.3	10.4	2.1	4.5	1.4	13.2
Falls Church	501,776	151.3	48.5	102.8	3.13	0.69	5.5	11.0	5.0	6.7	2.6	24.7
Farmville	28,172	138.7	52.1	86.7	4.52	0.46	9.5	11.4	8.4	7.1	4.2	17.9
Franklin	25,284	141.1	63.5	77.7	6.27	0.24	9.1	11.5	7.1	8.2	5.6	13.0
Fredericksburg	205,722	111.9	37.3	74.3	6.12	0.46	6.4	12.2	5.9	5.0	3.1	10.0
Front Royal	31,624	132.1	46.6	85.7	5.47	0.77	7.5	9.6	5.8	3.6	5.3	8.7
Galax	44,624	97.1	46.9	50.5	6.26	0.19	6.5	7.6	3.9	6.3	4.3	4.6
Gloucester	45,824	175.6	72.9	103.0	6.18	1.70	10.3	10.1	6.9	7.0	4.0	13.0
Grundy	30,378	81.4	46.1	35.0	1.51	0.05	7.1	6.2	8.1	2.2	0.6	4.8
Hampton	90,429	90.1	32.0	58.2	5.90	0.65	3.9	9.8	4.8	3.1	4.1	9.4
Harrisonburg	120,322	115.1	43.2	72.0	5.56	0.60	5.7	8.8	6.5	6.8	4.6	16.0
Hopewell	34,338	113.7	46.5	67.2	12.52	1.21	6.1	14.7	4.3	6.2	4.2	13.4
Hot Springs	5,405	205.0	74.9	130.3	6.22	1.27	25.2	12.4	5.6	17.1	4.2	23.7
Kilmarnock	26,228	247.4	121.5	126.5	11.08	1.49	8.8	4.3	4.3	15.1	5.1	23.6
Lebanon	32,548	90.8	43.5	46.8	1.12	0.01	4.4	10.6	5.5	4.8	4.6	2.9
Leesburg	77,337	144.8	55.7	89.2	2.27	0.41	5.4	14.1	5.2	3.6	2.2	13.9
Lexington	30,152	153.0	76.9	76.4	4.84	0.88	5.0	11.8	7.5	9.3	3.3	23.8
Low Moor	25,634	150.7	59.2	91.6	6.19	0.73	11.5	14.2	5.6	3.9	5.7	18.3
Luray	16,988	141.3	58.9	82.5	7.13	0.97	13.0	9.2	6.7	5.9	5.0	29.3
Lynchburg	197,602	125.6	47.4	78.1	3.27	0.66	7.1	8.7	6.5	6.3	3.4	14.6
Manassas	114,778	94.3	35.1	58.9	2.46	0.42	4.8	9.3	3.4	3.8	1.8	6.9
Marion	34,467	131.9	53.2	78.8	0.57	0.08	15.4	11.8	6.6	5.8	3.8	3.3
Martinsville	74,262	98.8	30.7	68.3	7.97	0.31	7.5	8.9	4.5	5.7	6.1	5.6
Nassawadox	34,160	126.9	52.4	74.6	2.74	0.20	12.6	10.6	6.6	3.6	3.4	9.2
Newport News	312,064	127.0	46.3	80.9	4.83	0.95	4.9	10.4	4.4	4.4	2.7	14.9
Norfolk	378,364	129.0	41.8	86.4	3.36	0.18	5.7	11.5	4.0	5.1	2.2	26.6
Norton	28,924	115.2	50.7	64.8	0.06		10.3	11.3	2.8	6.6	3.3	3.2

Virginia HSA City	Resident Population (1996)	Total Physicians per 100,000 Residents (1996)	Primary Care Physicians per 100,000 Residents (1996)	Specialists per 100,000 Residents (1996)	Cardiologists per 100,000 Residents (1996)	Cardiothoracic Surgeons per 100,000 Residents (1996)	General Surgeons per 100,000 Residents (1996)	Obstetrician/ Gynecologists per 100,000 Residents (1996)	Orthopedic Surgeons per 100,000 Residents (1996)	Radiologists per 100,000 Residents (1996)	Urologists per 100,000 Residents (1996)	Physicians in Residency Training per 100,000 Residents (1996)
Pearisburg	18,748	151.4	73.2	78.1	5.25	1.01	16.5	14.6	5.2	9.6	3.6	13.0
Pennington Gap	18,128	103.5	53.4	50.5			13.0	10.4	13.0	5.7	5.6	2.7
Petersburg	115,852	140.1	53.0	86.7	11.28	1.35	6.7	10.7	6.7	7.6	3.5	14.3
Portsmouth	169,350	159.8	60.4	99.0	5.21	0.63	8.5	10.9	6.6	4.9	5.3	26.3
Pulaski	18,711	167.8	61.6	106.4	5.78	0.64	9.5	11.6	3.9	14.7	6.3	8.7
Radford	39,627	129.0	45.2	83.9	4.59	0.66	8.4	10.9	4.9	7.7	5.1	7.3
Reston	157,514	129.2	48.1	81.0	2.14	0.41	3.8	9.7	3.5	4.8	1.7	12.3
Richlands	30,311	118.4	46.4	70.5	3.49	0.11	9.8	9.4	6.4	6.1	3.4	5.2
Richmond	864,043	152.6	54.2	98.3	5.91	0.69	5.9	12.4	5.4	8.4	3.7	39.3
Roanoke	233,645	153.7	44.3	109.4	3.91	0.68	8.1	11.0	5.6	9.2	3.0	31.2
Rocky Mount	26,132	125.5	48.5	77.2	5.10	0.96	6.2	11.5	5.3	7.2	2.6	17.5
Salem	48,089	125.5	37.7	87.8	4.62	0.31	7.7	8.6	4.8	8.7	3.1	18.6
South Boston	56,267	114.2	40.9	73.5	4.77	0.26	8.5	10.9	7.4	7.5	4.7	4.4
South Hill	27,847	126.3	59.1	67.4	9.05	3.46	7.3	9.9	6.9	7.7	4.0	13.8
Staunton	100,830	175.3	56.8	117.8	4.93	0.95	7.4	10.1	8.1	10.2	5.1	34.0
Stuart	13,060	105.6	47.4	58.4	5.40	0.38	12.6	5.1	3.9	7.6	4.1	6.1
Suffolk	64,283	129.7	41.8	87.9	10.74	0.29	10.7	12.2	5.5	7.3	4.7	13.2
Tappahannock	23,813	139.4	54.4	85.1	8.76	0.90	9.4	9.7	5.1	10.0	6.8	21.1
Tazewell	12,449	154.3	73.9	80.3	2.65	0.55	17.2	5.2	2.0	17.0	1.1	6.6
Virginia Beach	299,184	153.3	47.3	105.8	4.03	0.34	5.9	11.0	4.7	7.8	2.7	20.8
Warrenton	54,645	118.1	39.8	78.4	4.18	0.57	7.0	7.0	6.2	7.1	1.9	7.3
Williamsburg	63,623	196.9	68.1	128.2	6.26	2.03	6.7	10.4	8.3	6.9	5.3	10.4
Winchester	114,600	113.4	31.6	82.0	6.92	0.94	5.6	10.2	5.2	5.0	3.1	5.2
Woodbridge	166,692	110.9	39.0	71.5	4.40	0.81	4.2	12.6	4.0	3.6	2.2	12.0
Woodstock	20,621	135.7	52.6	83.4	7.11	1.01	11.3	8.1	7.8	6.1	5.6	9.9
Wytheville	32,099	134.8	54.9	80.2	6.34	0.57	9.0	9.4	5.3	8.5	3.8	7.7
Virginia	6,582,769	169.8	58.9	110.4	5.71	1.06	7.9	11.9	6.4	8.0	3.4	32.3
United States (1996)	262,306,124	188.9	65.0	122.9	5.92	1.56	8.9	12.0	7.1	8.8	3.2	38.1

CHAPTER FOUR

The Surgical Treatment of Common Diseases

The Surgical Treatment of Common Diseases

While geographic variation in the use of surgery has long been recognized, not all surgical procedures are equally variable. For example, there is little variation in rates of colon resection (colectomy). Other procedures, such as coronary artery bypass grafting, are highly variable.

What distinguishes low variation from high variation surgery? In general, low variation procedures are non-discretionary; they are used to treat clinical conditions for which physicians agree on the most appropriate treatment strategy. In addition, patient and physician preferences are aligned — that is, both parties have the same goals.

Conversely, high variation procedures involve physician discretion; the variability reflects underlying choices in medical decision making that occur either because of inadequate science or the failure to take patient preferences into account.

Sometimes, medical science is inadequate to provide definitive information on which treatment is likely to provide the best outcome for a given patient. In these cases, procedure rates vary because physicians disagree about the effectiveness of surgery. Sometimes, the scientific evidence regarding outcomes is adequate, but the available treatments have different risks and benefits, which only the patient can assess. The fact that patient preferences are unevenly incorporated into treatment decisions results in large variations in rates of these procedures.

These two factors are important to consider when evaluating variation in surgical procedures. For example, a colectomy is the only recognized approach to cure cancer of the colon or rectum, and the only alternative for attempting to extend life expectancy. The status of science in these cases is, by and large, quite good. The dilemma of patient choice is virtually a non-issue.

This can be contrasted with treatment for coronary artery disease, where there are multiple approaches to treating the disease, including surgical intervention. The status of science in making decisions about whether to perform coronary artery bypass grafting surgery is imperfect. For the majority of patients, there is no scientific evidence that this surgery prolongs life or reduces the long-term risks of myocardial infarction. The variation in rates among regions suggests that physicians differ in their propensity to recommend surgery.

Another example is the treatment of breast cancer, where the status of science is good. Clinical trials have demonstrated the value of early screening in reducing mortality in women who are over 50. Once diagnosed, surgery is universally recommended for the treatment of breast cancer. There are, however, two principal surgical approaches: breast-sparing surgery (lumpectomy followed by radiation therapy) and mastectomy (complete removal of the breast). Clinical trials have shown that these two approaches have nearly identical effect on life expectancy. Therefore, the dilemma of choice concerns preferences, not science. The tradeoffs involve factors that only patients can evaluate. The wide variations in surgical rates for early stage breast cancer suggest that physician, rather than patient, preferences are the deciding factor in most cases. Since there is scientific evidence that the survival rates are the same for patients who have breast sparing surgery with adjuvant therapy and for those who have total mastectomy, patient preferences should be determining which treatment is chosen.

This chapter examines differences in rates of surgery for a variety of conditions. It is clear that in Virginia, as in the country as a whole, rates of surgery vary by factors of two, five, and even more than ten, among hospital service areas. In some cases, hospital referral regions (aggregations of hospital service areas) are used as the units of analysis due to the relatively small numbers of procedures performed on an annual basis.

Colectomy

In Virginia in 1996-97, rates of colectomy varied by a factor of 2.5, from 0.2 procedures per 1,000 residents to 0.5; the state average was 0.4.

Rates of colectomy were higher than the state average among residents of the hospital service areas in Tappahannock (0.5); Norton (0.5); Danville (0.5); Fairfax (0.5) and Winchester (0.5).

Colectomy rates were lower than the Virginia average among residents of the Emporia (0.2); Salem (0.3); Wytheville (0.3); Kilmarnock (0.3) and Lebanon (0.3) hospital service areas.

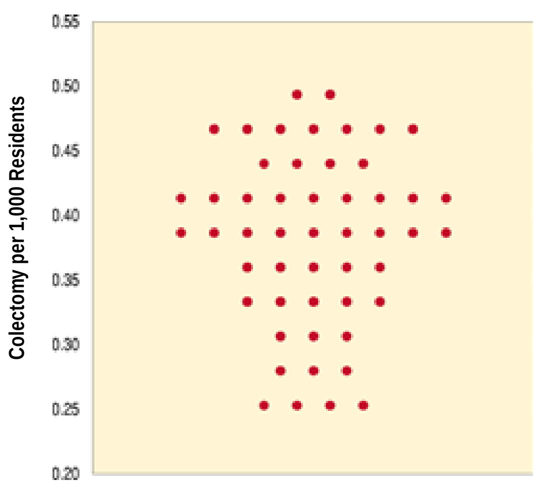
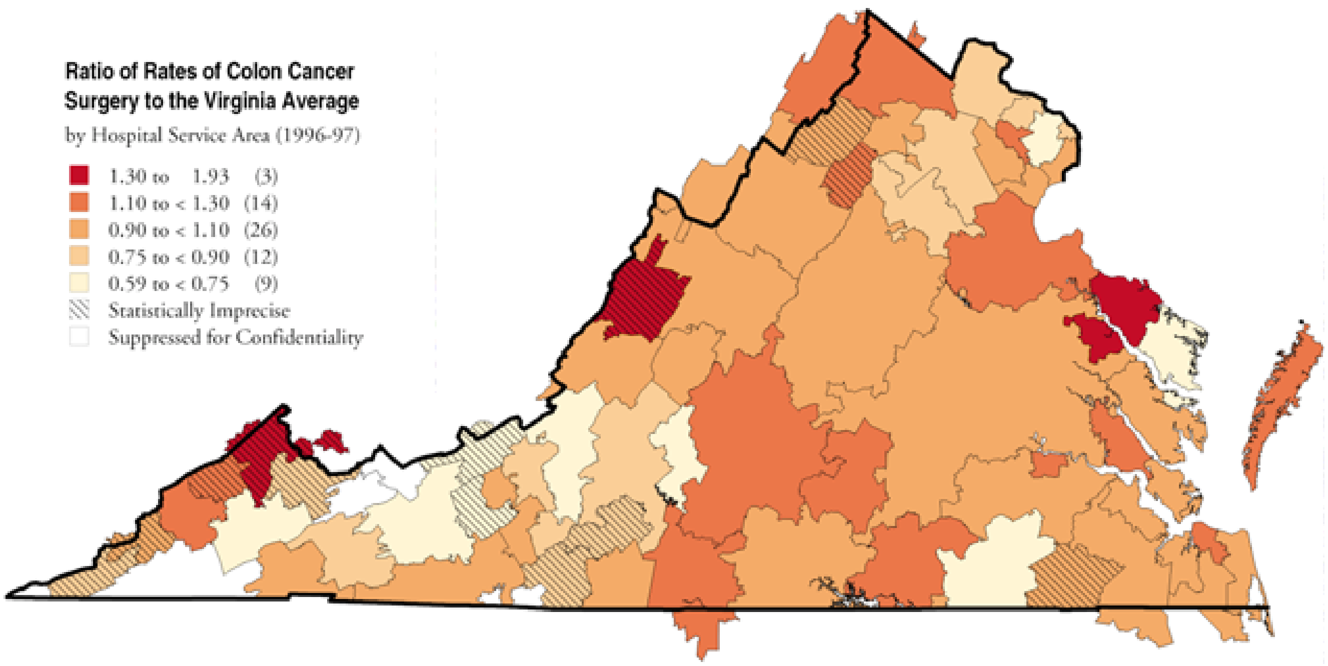


Figure 4.1. Colectomy for Colon Cancer (1996-97)
Rates of colectomy per 1,000 residents ranged from 0.2 to 0.5, after adjusting for differences in age, sex and race of local populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.1. Colectomy (1996-97)

Only three hospital service areas had rates of colectomy at least 30% higher than the Virginia average of 0.4. Nine areas had rates more than 25% lower than the average.

Coronary Artery Bypass Grafting

In Virginia in 1996-97, rates of coronary artery bypass grafting varied by a factor of three, from fewer than 0.7 procedures per 1,000 residents to about 2.1; the state average was 1.2.

Residents of the Lynchburg (1.5); Clintwood (1.4); Blacksburg (1.3) and Richmond (1.3) hospital service areas had rates of bypass surgery higher than the state average. Residents of the Nassawadox (1.1); Galax (1.1); Stuart (1.2); Martinsville (1.2) and Roanoke (1.2) hospital service area had rates near the state average.

Coronary artery bypass grafting rates were lower than the Virginia average among residents of the Arlington (0.7); Reston (0.8); Alexandria (0.9) and Falls Church (0.9) hospital service areas.

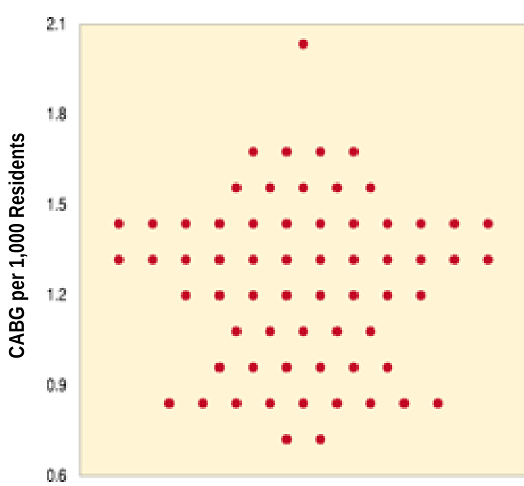
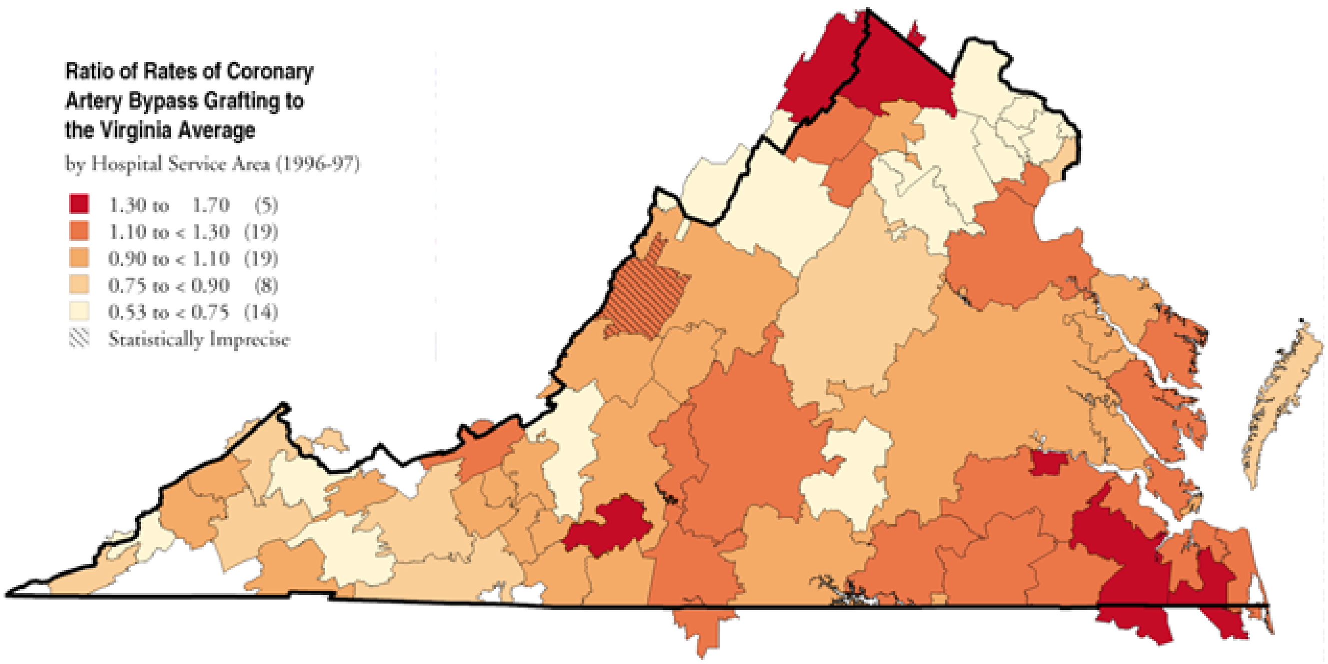


Figure 4.2. Coronary Artery Bypass Grafting (1996-97)

Rates of coronary bypass surgery per 1,000 residents ranged from fewer than 0.7 to more than 2.0, after adjusting for differences in age, sex and race of local populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.2. Coronary Artery Bypass Grafting (1996-97)

Five hospital service areas had rates of coronary artery bypass at least 30% higher than the Virginia average of 1.2 per 1,000 residents. Fourteen areas had rates more than 25% lower than the average.

Percutaneous Transluminal Coronary Angioplasty

In Virginia in 1996-97, the average rate of coronary angioplasty was 1.6 per 1,000 residents. Rates varied by a factor of more than three, from less than 1.0 to almost 3.0.

Rates of angioplasty were higher than the state average among residents of the Petersburg (1.9); Farmville (1.8); Front Royal (1.7); Newport News (1.7) and Norfolk (1.7) hospital service areas.

Rates of angioplasty were lower than the average among residents of the Manassas (0.8); Fairfax (0.9); Blacksburg (1.0); and Abingdon (1.1) hospital service areas.

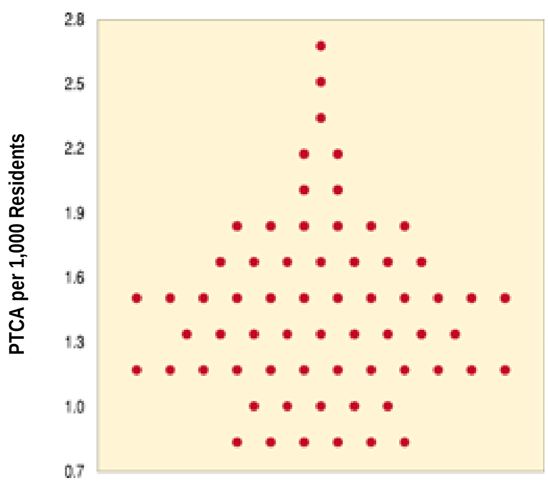
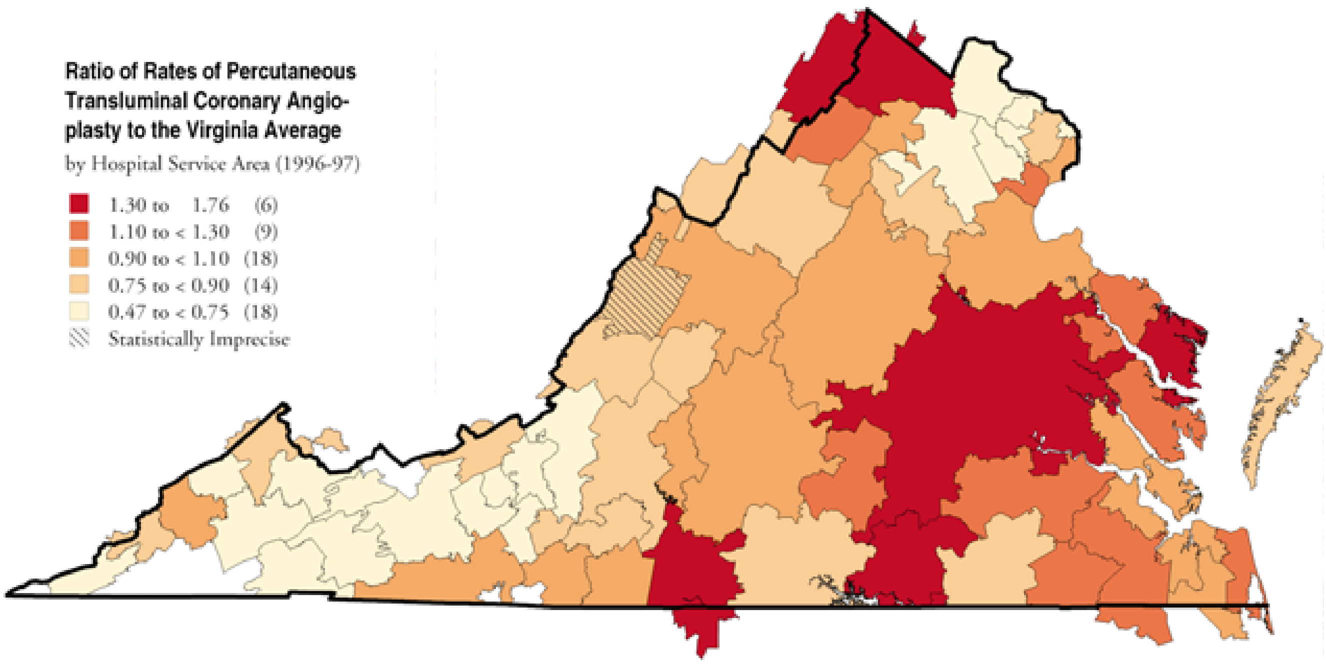


Figure 4.3. Percutaneous Transluminal Coronary Angioplasty (1996-97)
Rates of angioplasty varied from less than 1.0 per 1,000 residents to almost 3.0, after adjusting for differences in age, sex and race of local populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.3. Percutaneous Transluminal Coronary Angioplasty (1996-97)

Six hospital service areas had rates of angioplasty at least 30% higher than the state average of 1.6 per 1,000 residents. Eighteen areas had rates more than 25% below the average.

Carotid Endarterectomy

In Virginia in 1996-97, the average rate of carotid endarterectomy was 0.4 per 1,000 residents. Rates varied by a factor of almost six, from 0.1 to 0.8.

Rates of carotid endarterectomy were higher than the state average among residents of the Newport News (0.6); Abingdon (0.6); Low Moor (0.5) and Lexington (0.5) hospital service areas.

Rates of carotid endarterectomy were lower than the state average among residents of the hospital service areas in Galax (0.1); Harrisonburg (0.2); Leesburg (0.3) and Alexandria (0.3).

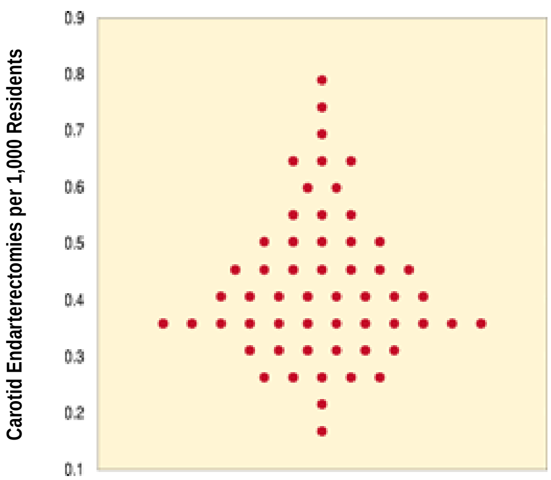
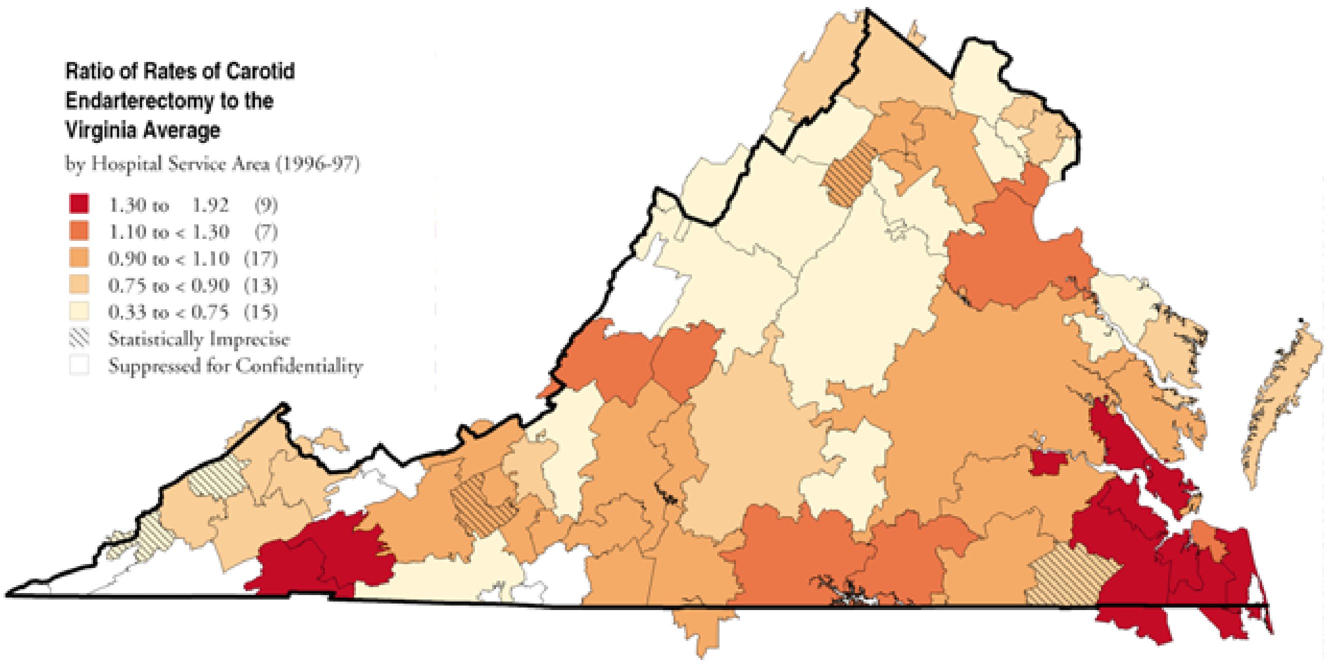


Figure 4.4. Carotid Endarterectomy (1996-97)
Rates of carotid endarterectomy varied from 0.1 to 0.8, after adjusting for differences in population age, sex and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.4. Carotid Endarterectomy (1996-97)

Nine hospital service areas had rates of carotid endarterectomy at least 30% higher than the state average of 0.4 per 1,000 residents. Fifteen areas had rates more than 25% below the average.

Cholecystectomy

Rates of cholecystectomy (both open and closed procedures) among residents of Virginia varied by a factor of six, from 0.6 to 3.7 per 1,000 residents.

Rates of cholecystectomy were higher than the average among residents of the South Hill (3.7); Hopewell (2.7); Rocky Mount (2.7); Portsmouth (2.6) and Lebanon (2.5) hospital service areas.

Rates of cholecystectomy were lower than average among residents of the Kilmarnock (0.7); Reston (0.7); Manassas (0.7); Fairfax (0.7) and Warrenton (0.8) hospital service areas.

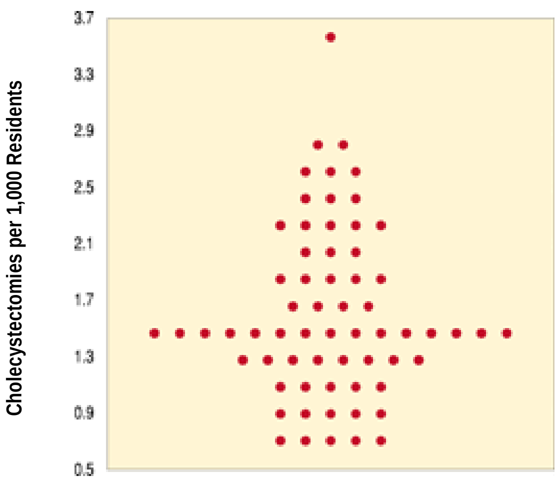
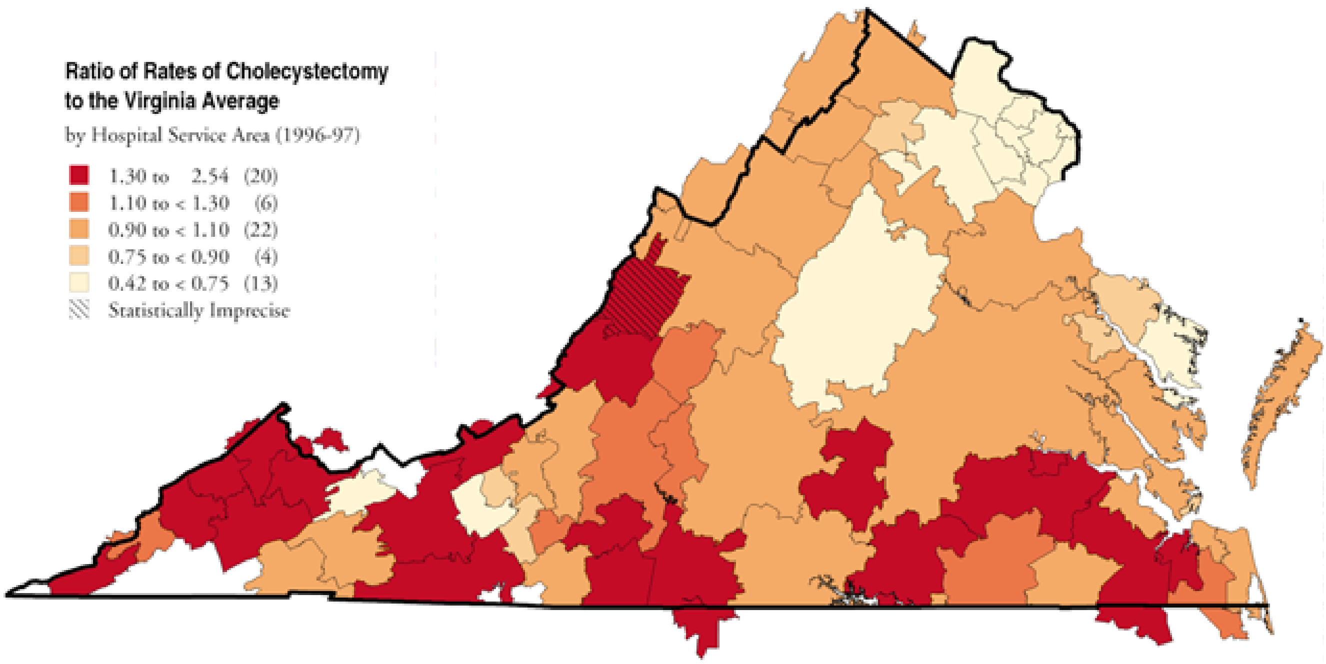


Figure 4.5. Cholecystectomy (1996-97)

Rates of cholecystectomy ranged from 0.6 to 3.7 per 1,000 residents, after adjustment for differences in population age, sex and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.5. Cholecystectomy (1996-97)

Twenty hospital service areas had rates of cholecystectomy at least 30% higher than the state average of 1.4 per 1,000 residents. Thirteen areas had rates more than 25% below the average.

Primary Hip Replacement

Rates of primary hip replacement among residents of Virginia varied by a factor of three, from 0.2 to 0.6 per 1,000 residents.

Rates of hip replacements were higher than the Virginia average of 0.4 per 1,000 residents in the Williamsburg (0.6); Emporia (0.6); Lexington (0.5); Arlington (0.5) and Alexandria (0.5) hospital service areas.

Residents of the Nassawadox (0.2); Kilmarnock (0.2); Salem (0.3); Richlands (0.3) and Fairfax (0.3) hospital service areas had rates of hip replacement lower than the Virginia average.

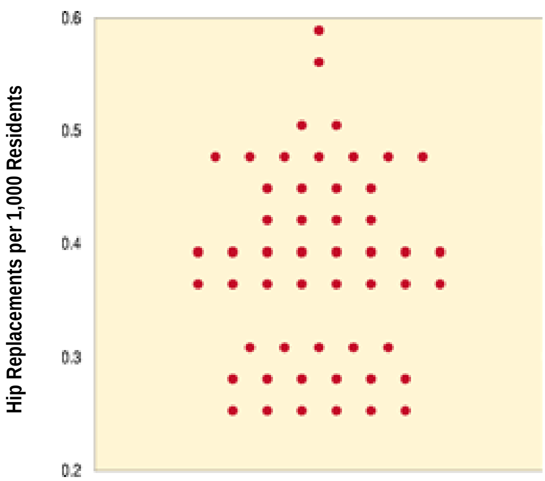
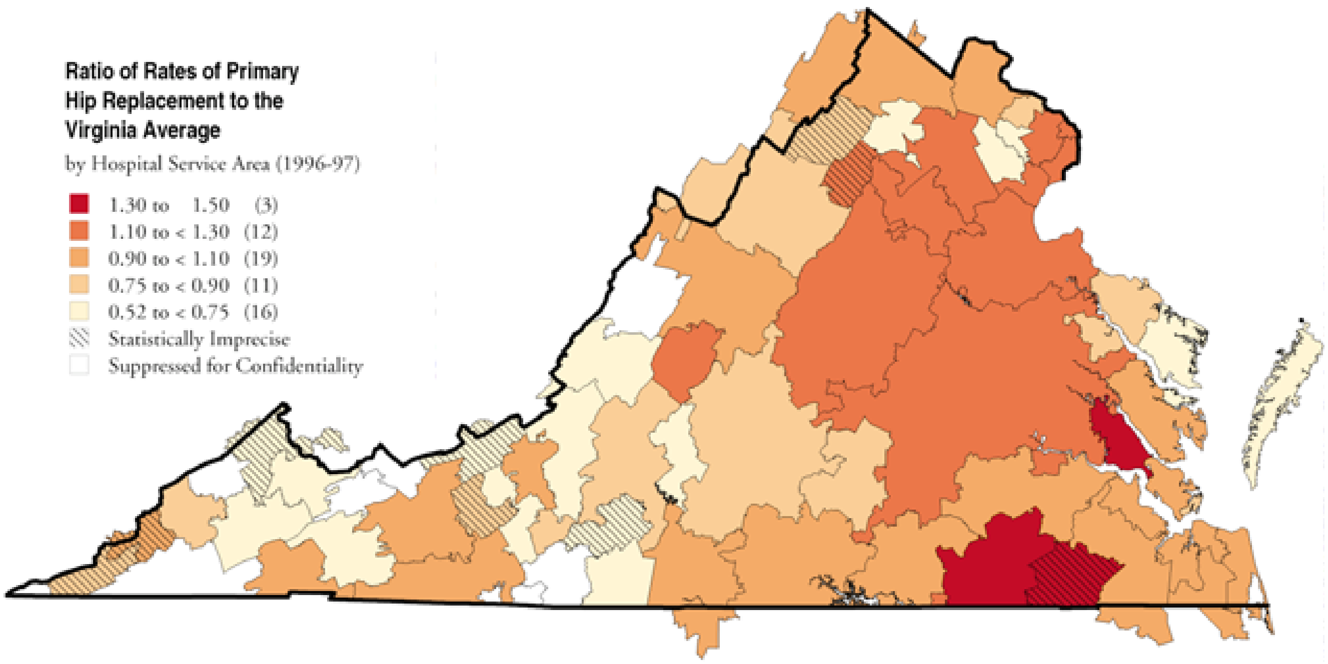


Figure 4.6. Primary Hip Replacement (1996-97)
Rates of hip replacement varied from 0.2 to 0.6 per 1,000 residents, after adjustment for differences in population age, sex and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.6. Primary Hip Replacement (1996-97)

Three hospital service areas had rates of primary hip replacement at least 30% higher than the state average of 0.4 per 1,000 residents. Sixteen areas had rates more than 25% below the average.

Primary Knee Replacement

Rates of primary knee replacement among all residents of Virginia varied by a factor of six, from 0.3 to 1.8 per 1,000 residents.

Rates of knee replacement were higher than the Virginia average of 0.7 per 1,000 residents in the Franklin (1.8); Emporia (1.1); Winchester (1.0); Gloucester (0.9) and Staunton (0.9) hospital service areas.

Residents of the Grundy (0.3); Norton (0.4); Salem (0.4); Manassas (0.4) and Richlands (0.5) hospital service areas had rates of knee replacement lower than the Virginia average.

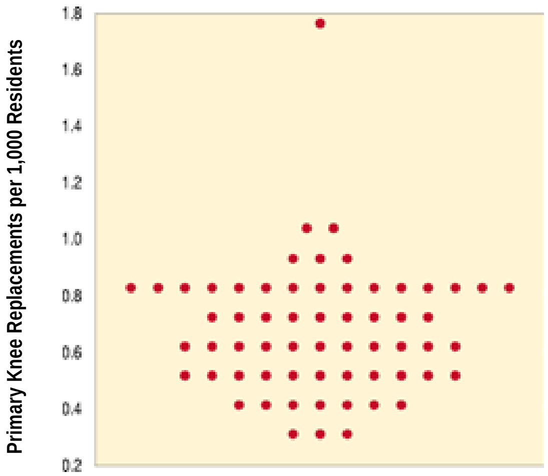
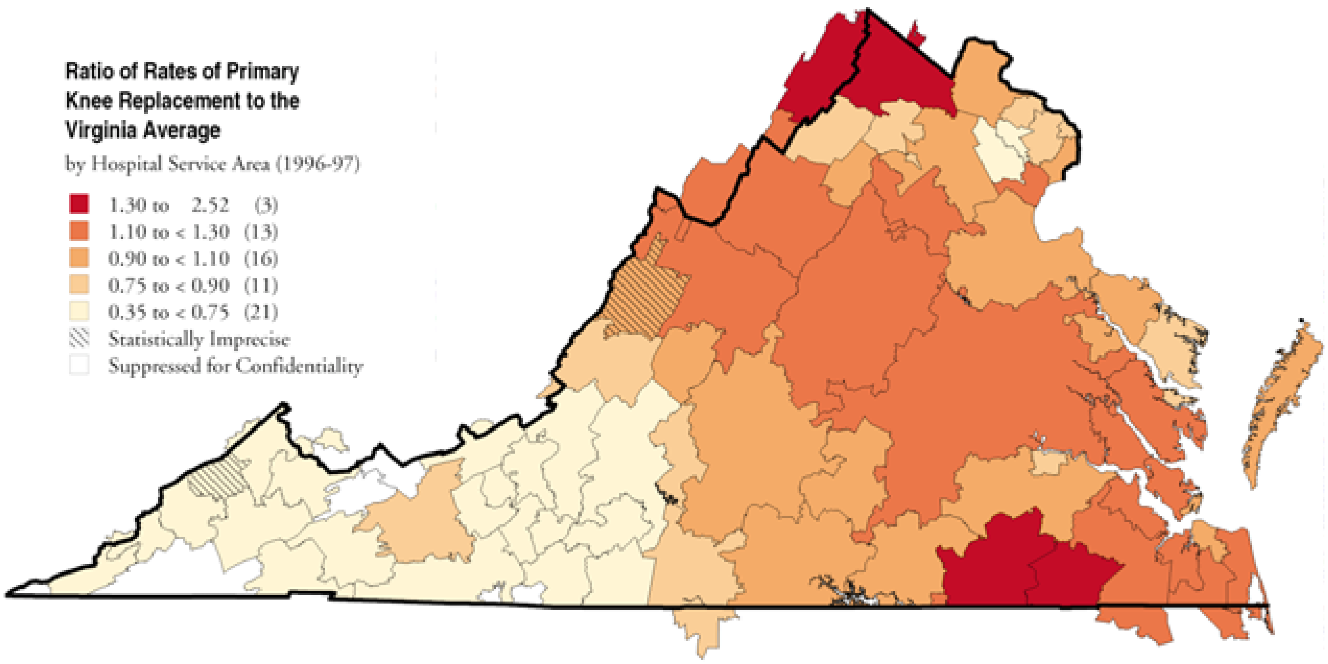


Figure 4.7. Primary Knee Replacement (1996-97)
Rates of primary knee replacement varied from 0.3 to 1.8 per 1,000 residents, after adjustment for differences in population age, sex and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.7. Primary Knee Replacement (1996-97)

Three hospital service areas had rates of primary hip replacement at least 30% higher than the state average of 0.7 per 1,000 residents. Twenty-one areas had rates more than 25% below the average.

Lumbar Discectomy

Rates of lumbar discectomy among residents of Virginia varied by a factor of more than three, from 0.6 to 2.1 per 1,000 residents.

Rates of lumbar discectomy were higher than the Virginia average of 1.1 per 1,000 residents in the Suffolk (2.1); Hampton (2.0); Franklin (1.7); Newport News (1.6) and Williamsburg (1.6) hospital service areas.

Residents of the Galax (0.6); Manassas (0.7); Salem (0.7); Arlington (0.7) and Lebanon (0.7) hospital service areas had rates of lumbar discectomy substantially lower than the Virginia average.

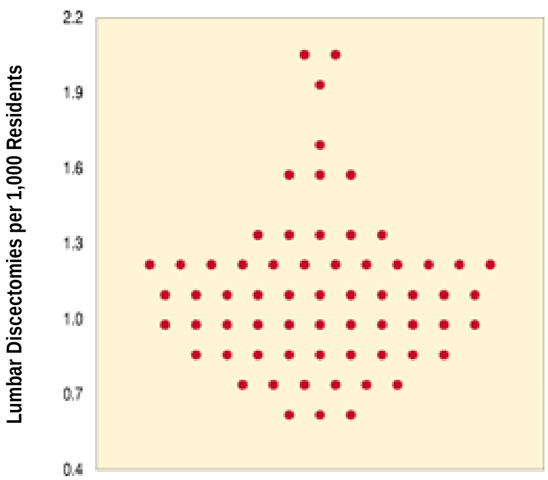
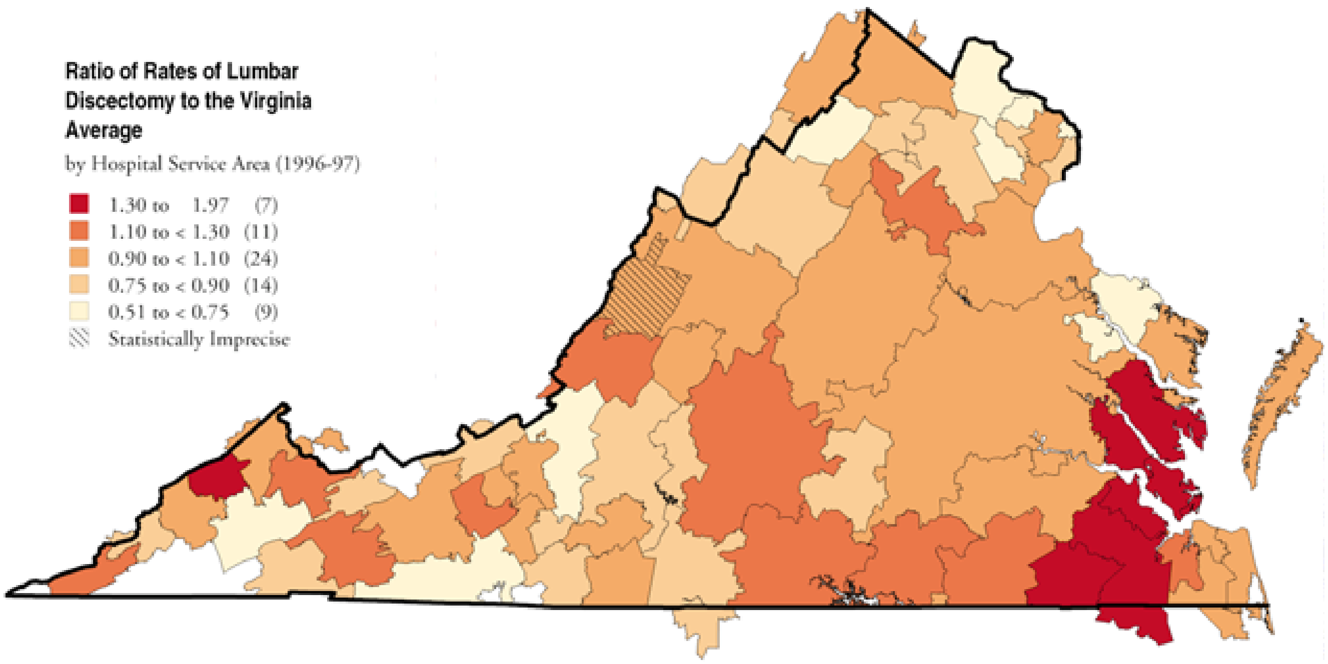


Figure 4.8. Lumbar Discectomy (1996-97)
Rates of lumbar discectomy varied from 0.6 to 2.1 per 1,000 residents, after adjustment for differences in population age, sex and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.8. Lumbar Discectomy (1996-97)

Seven hospital service areas had rates of lumbar discectomy at least 30% higher than the state average of 1.1 per 1,000 residents. Nine areas had rates more than 25% below the average.

Mastectomy for Breast Cancer

Nationally, the proportion of women who underwent total mastectomy for the treatment of early stage breast cancer in 1995 was 76.6%, indicating that slightly more than 20% of women were treated with partial mastectomy and adjuvant therapy. The proportion of Medicare women in Virginia who were treated for early stage breast cancer with total mastectomy in 1996-97 varied from 71.2% to 85.4%.

Women in the Norfolk (85.4%), Arlington (79.4%) and Newport News (78.6%) hospital referral regions were more likely than the state average of 77.8% to undergo total mastectomy.

The proportions of Medicare women undergoing total mastectomy in the Winchester (71.2%), Richmond (72.2%) and Lynchburg (73.1%) hospital referral regions were somewhat lower than the state average.

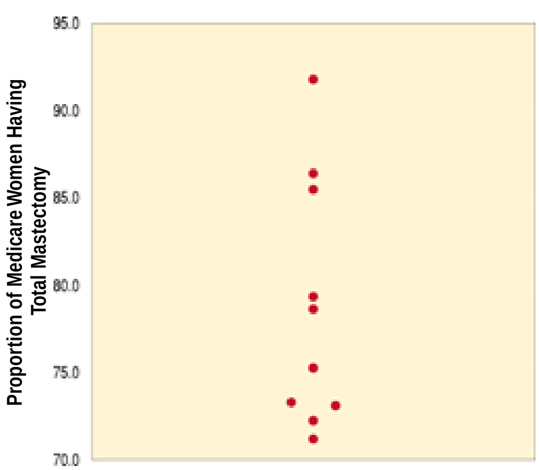
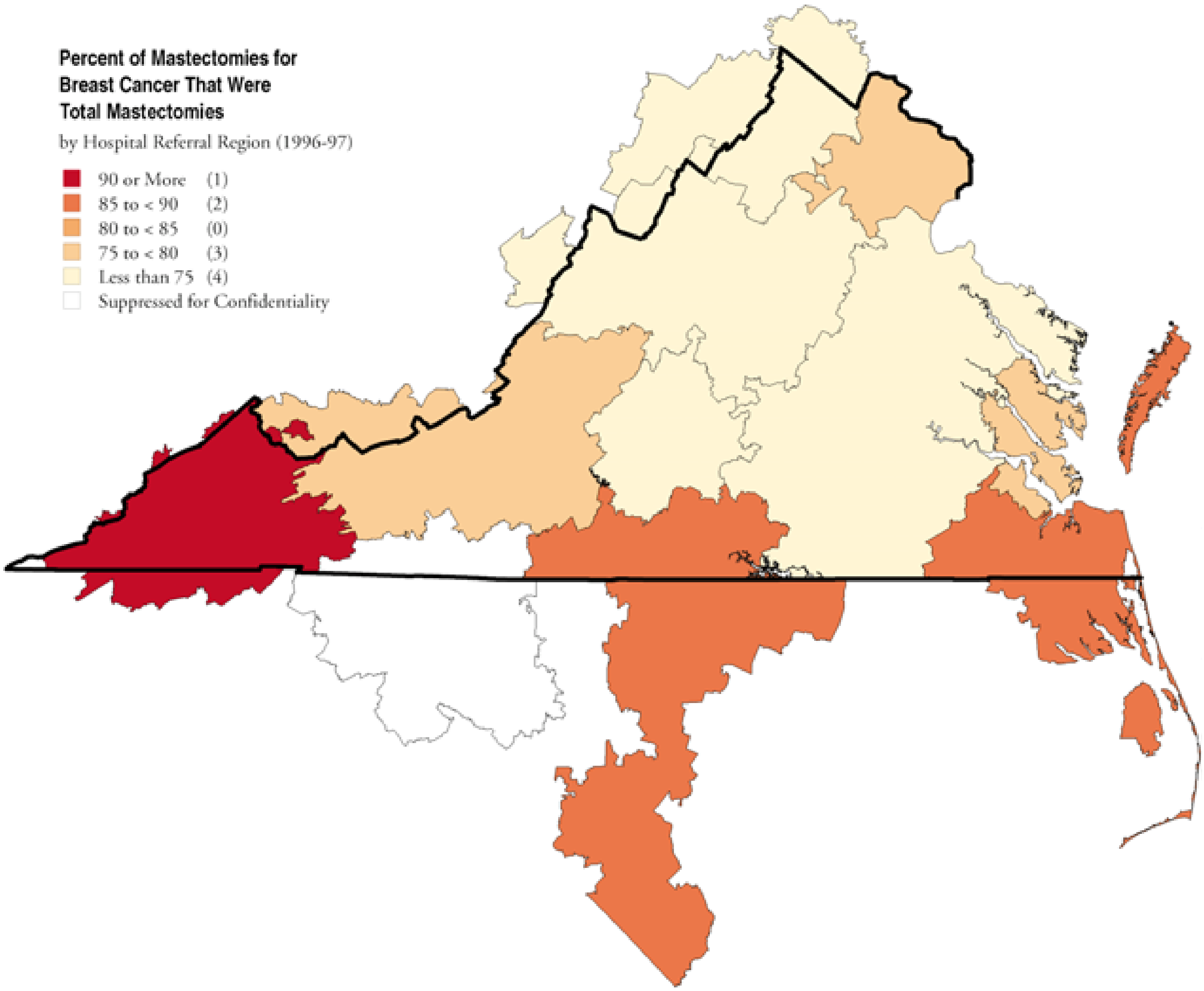


Figure 4.9. Mastectomy for Breast Cancer in Medicare Women (1996-97)
Proportion of surgeries for breast cancer that were total mastectomies varied from 71% to 85% in Virginia hospital referral regions. Each point represents one of the eight hospital referral regions in Virginia.



Map 4.9. Mastectomy for Breast Cancer in Medicare Women (1996-97)

In the Kingsport, Tennessee hospital referral region (where some residents of Virginia receive care), the proportion of total mastectomy for breast cancer among female residents of Virginia was over 90%. In two Virginia hospital referral regions, the rate was at least 85%. In four hospital referral regions, the rate was less than 75%.

Hysterectomy for Benign Conditions of the Uterus

Rates of hysterectomy for benign conditions of the uterus among female residents of Virginia varied by a factor of more than five, from 1.5 to 7.9 per 1,000 women.

Rates of hysterectomy for benign conditions of the uterus were substantially higher than the state average of 3.0 per 1,000 women among residents of the Marion (7.9); Richlands (7.6); Abingdon (6.0); Wytheville (5.4) and Grundy (5.1) hospital service areas.

Residents of Fairfax (1.5); Reston (1.6); Warrenton (1.6); Leesburg (1.6) and Manassas (1.8) hospital service areas had rates of hysterectomy for non-cancer conditions lower than the Virginia average.

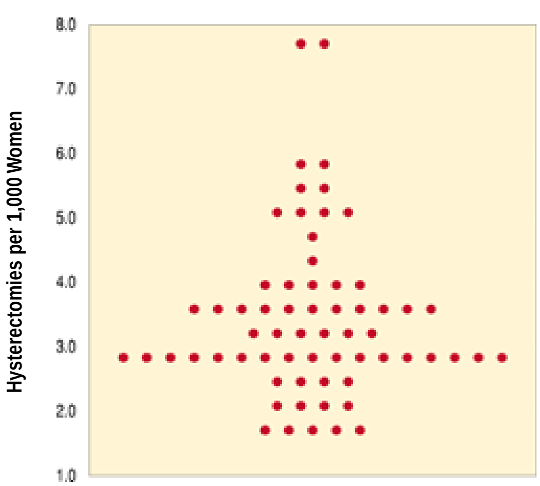
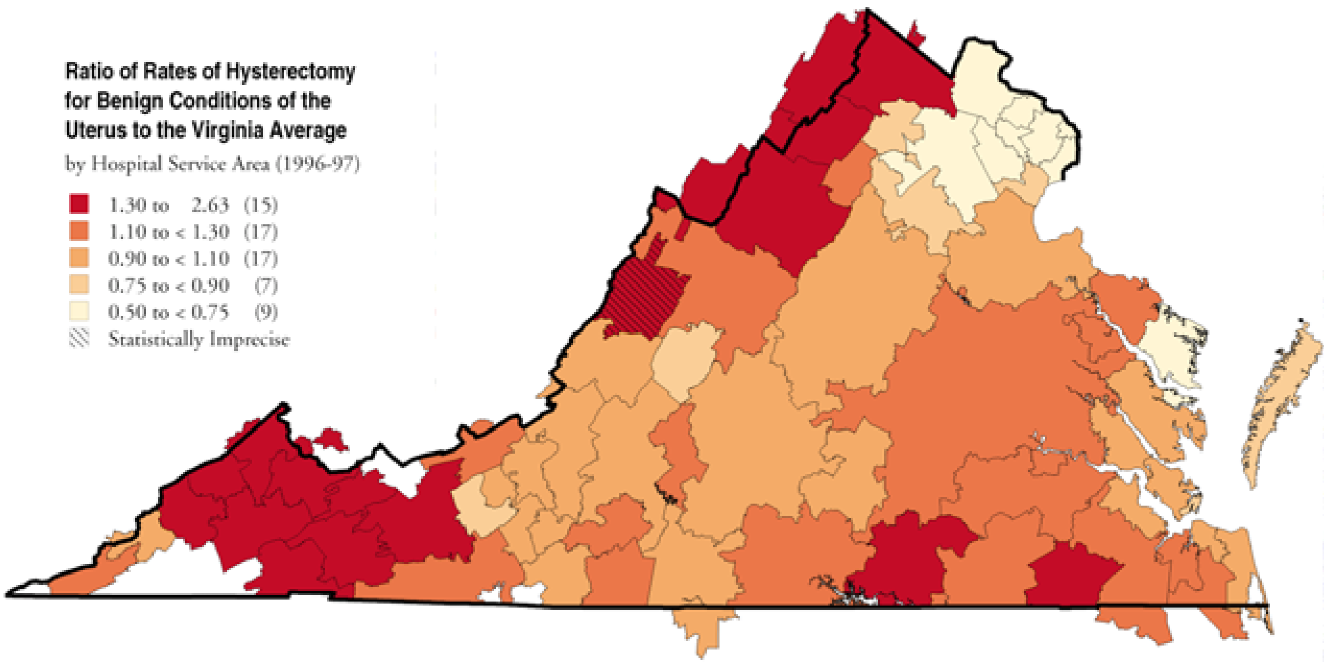


Figure 4.10. Hysterectomy for Benign Conditions of the Uterus (1996-97)
Rates of hysterectomy varied from 1.5 to 7.9 per 1,000 women, after adjustment for differences in population age and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.10. Hysterectomy for Benign Conditions of the Uterus (1996-97)

Fifteen hospital service areas had rates of hysterectomy at least 30% higher than the state average of 3.0 per 1,000 female residents. Nine areas had rates more than 25% below the average.

Births

Birth rates (rates of deliveries) among female residents of Virginia varied by a factor of about four, from 8.3 to 32.2 per 1,000 women.

Rates of births were higher than the Virginia average of 23.9 per 1,000 women in the Nassawadox (32.2); Leesburg (30.0); Suffolk (29.1); South Boston (28.7) and Hopewell (28.0) hospital service areas.

Residents of the Kilmarnock (8.3); Radford (13.8); Blacksburg (15.3); Grundy (15.8) and Salem (16.6) hospital service areas had birth rates lower than the Virginia average.

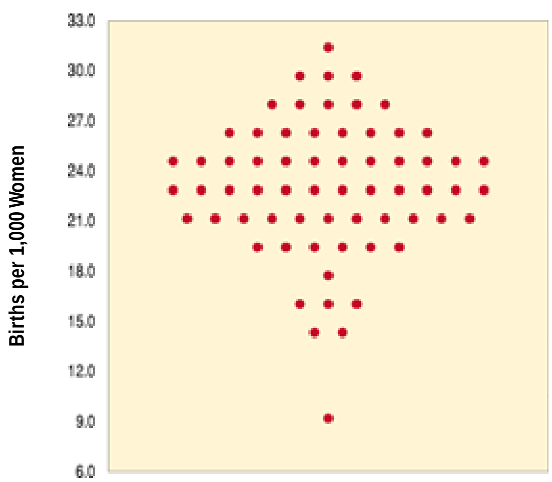
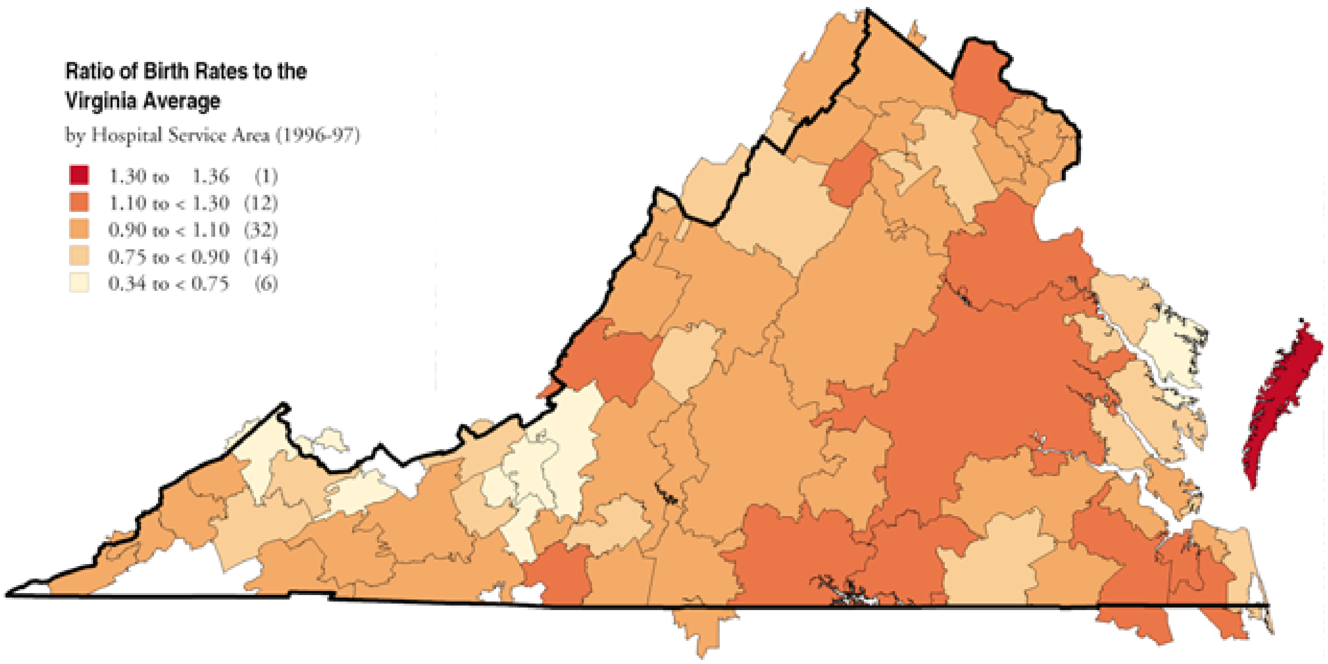


Figure 4.11. Births (1996-97)

Rates of births varied from 8.3 to 32.2 per 1,000 women, after adjusting for differences in population age and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.11. Births (1996-97)

One hospital service area had a rate of births at least 30% higher than the state average of 23.9 per 1,000 female residents. Six areas had rates more than 25% below the average.

Cesarean Sections

Cesarean section rates among female residents of Virginia varied by a factor of 1.8, from 176.1 to 326.4 per 1,000 births.

Rates of cesarean sections were higher than the Virginia average of 215.0 per 1,000 births in the Wytheville (326.4); Grundy (318.2); Martinsville (314.4); Low Moor (308.8) and Nassawadox (287.1) hospital service areas.

Hospital service areas with lower than average rates of cesarean section included Hampton (176.1); Manassas (176.7); Woodbridge (182.7); Gloucester (187.3) and Petersburg (187.4).

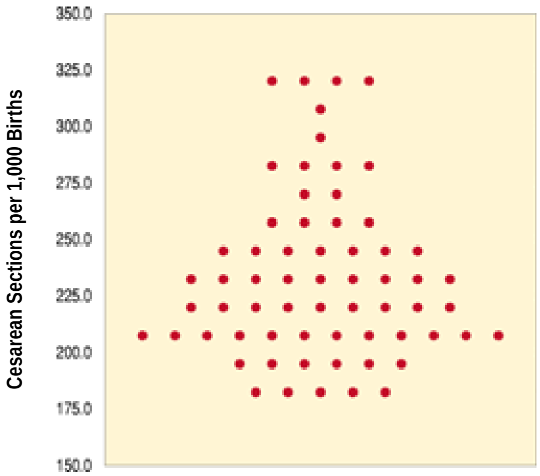
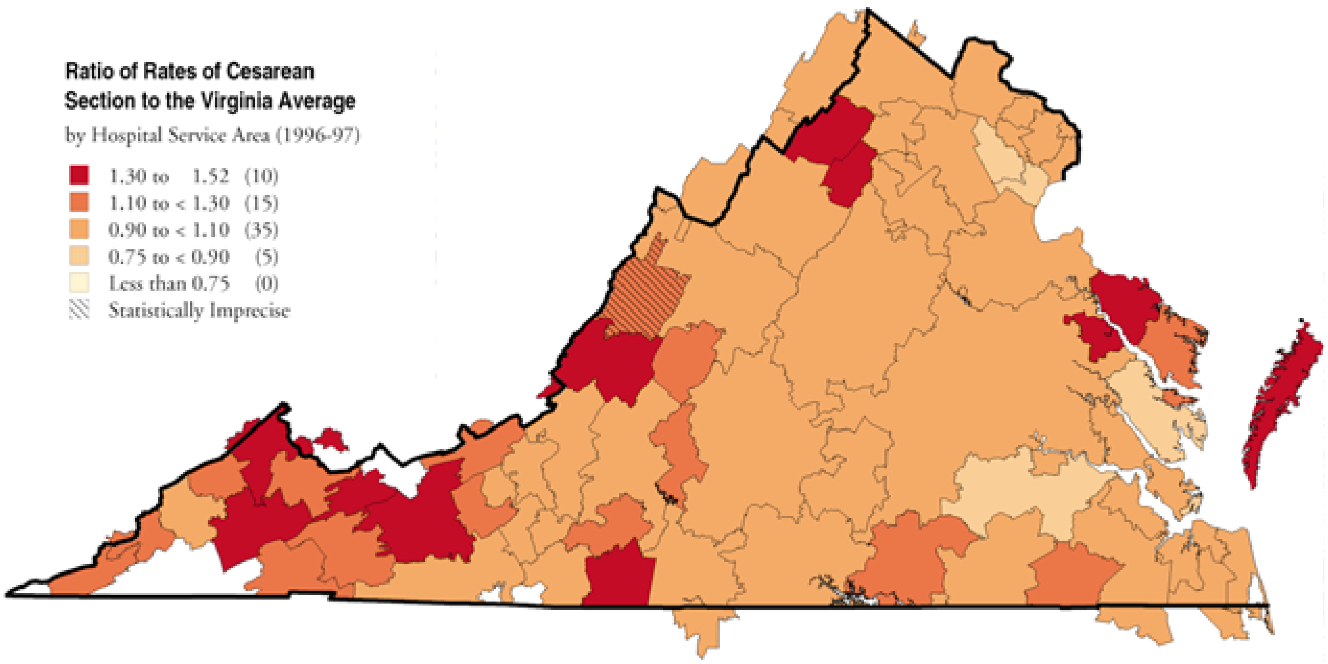


Figure 4.12. Cesarean Sections (1996-97)

Rates of cesarean sections varied from 176.1 to 326.4 per 1,000 births, after adjustment for differences in age and race of populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.12. Cesarean Sections (1996-97)

Ten hospital service areas had rates of cesarean sections at least 30% higher than the state average of 215 per 1,000 births. No area had a rate more than 25% below the average.

Vaginal Birth After Cesarean Section

Vaginal birth after cesarean section rates in Virginia hospital service areas varied by a factor of more than three, from 147.9 to 498.5 per 1,000 women who had previously had a baby by cesarean section. (Data on a number of Virginia hospital service areas were excluded from this analysis and the data tables due to the small numbers involved.)

Rates of VBAC were higher than the Virginia average of 392.9 per 1,000 births to women with previous cesarean sections in the Virginia Beach (498.5); Norfolk (493.7); Roanoke (492.9); Woodbridge (472.5) and Arlington (448.2) hospital service areas.

Rates of VBAC were lower than the Virginia average in the Martinsville (311.9); Danville (322.8); Winchester (326.7); Richmond (332.9) and Williamsburg (333.6) hospital service areas.

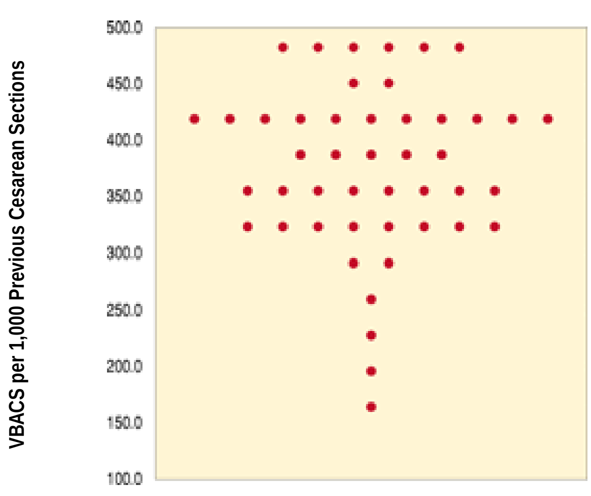
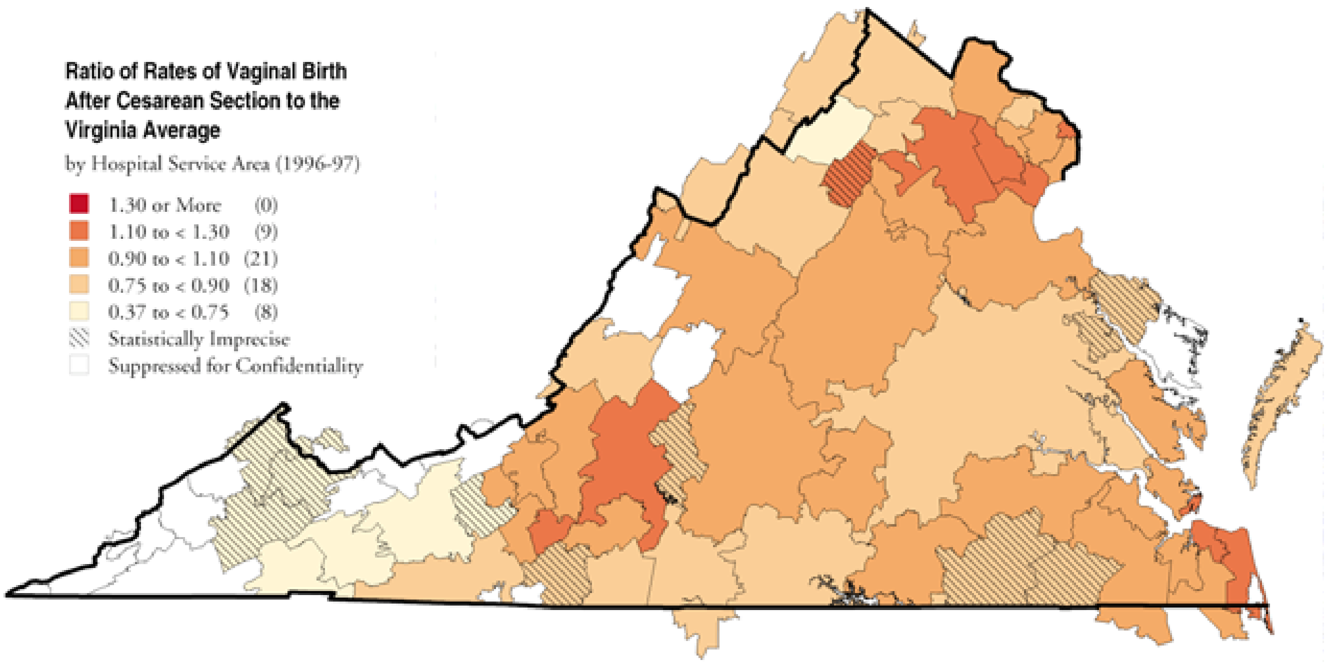


Figure 4.13. Vaginal Birth After Cesarean Section (1996-97)
Rates of VBAC varied from less than 150 to almost 500 per 1,000 women with previous cesarean sections, after adjustment for differences in population age and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.13. Vaginal Birth After Cesarean Section (1996-97)

No hospital service area had a rate of VBAC at least 30% higher than the state average of 392.9 per 1,000 births to women with previous Cesarean sections. Eight areas had rates more than 25% below the average.

Transurethral Prostatectomy

Transurethral prostatectomy rates in Virginia hospital service areas varied by a factor of ten, from about 0.2 to 2.0 per 1,000 male residents.

Rates of transurethral prostatectomy were higher than the Virginia average of 0.6 per 1,000 males in the Marion (2.0); Williamsburg (1.2); Galax (1.1); Wytheville (1.0) and Woodbridge (0.9) hospital service areas.

Rates of transurethral prostatectomy were lower than the Virginia average in the Salem (0.2); Leesburg (0.3); Harrisonburg (0.4); Winchester (0.4) and Petersburg (0.4) hospital service areas.

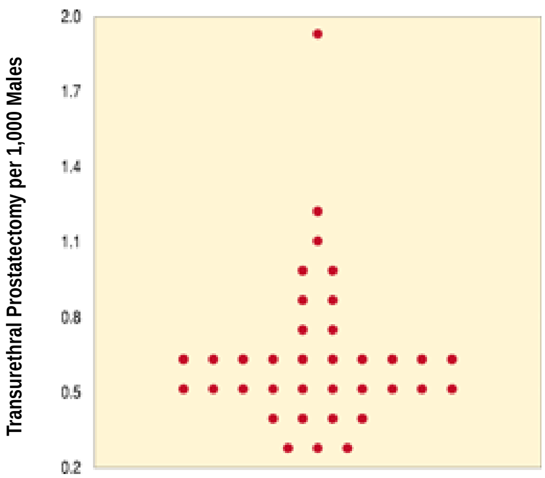
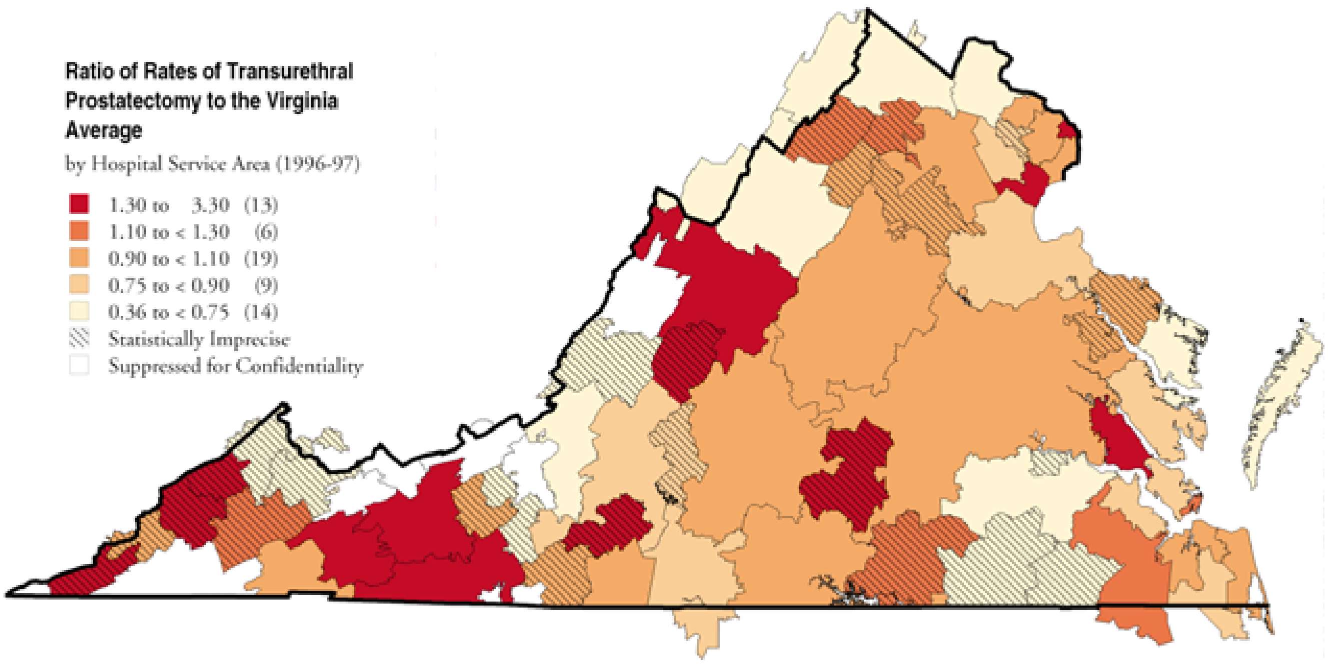


Figure 4.14. Transurethral Prostatectomy (1996-97)
Rates of transurethral prostatectomy varied from 0.2 to 2.0 per 1,000 male residents, after adjustment for differences in population age and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 4.14. Transurethral Prostatectomy (1996-97)

Thirteen hospital service areas had rates of transurethral prostatectomy at least 30% higher than the state average of 0.6 per 1,000 males. Fourteen areas had rates more than 25% below the average.

Radical Prostatectomy

Radical prostatectomy rates in Virginia hospital referral regions varied by a factor of 1.9, from less than 0.3 to 0.5 per 1,000 male residents.

Rates of radical prostatectomy were higher than the state average of 0.4 per 1,000 males among residents of the Newport News (0.5) and Richmond (0.5) hospital referral regions.

Rates of radical prostatectomy were lower than the Virginia average among male residents of the Norfolk (0.3), Winchester (0.3) and Roanoke (0.3) hospital referral regions.

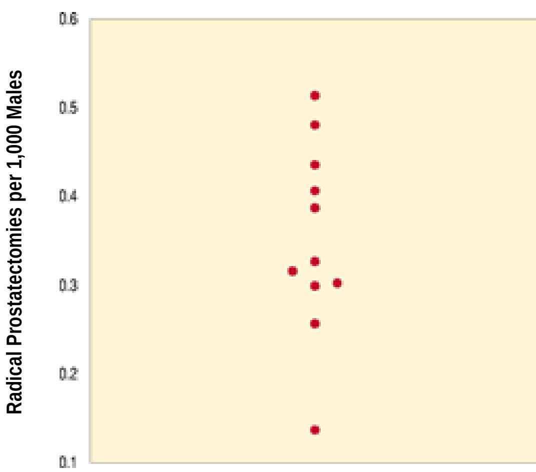
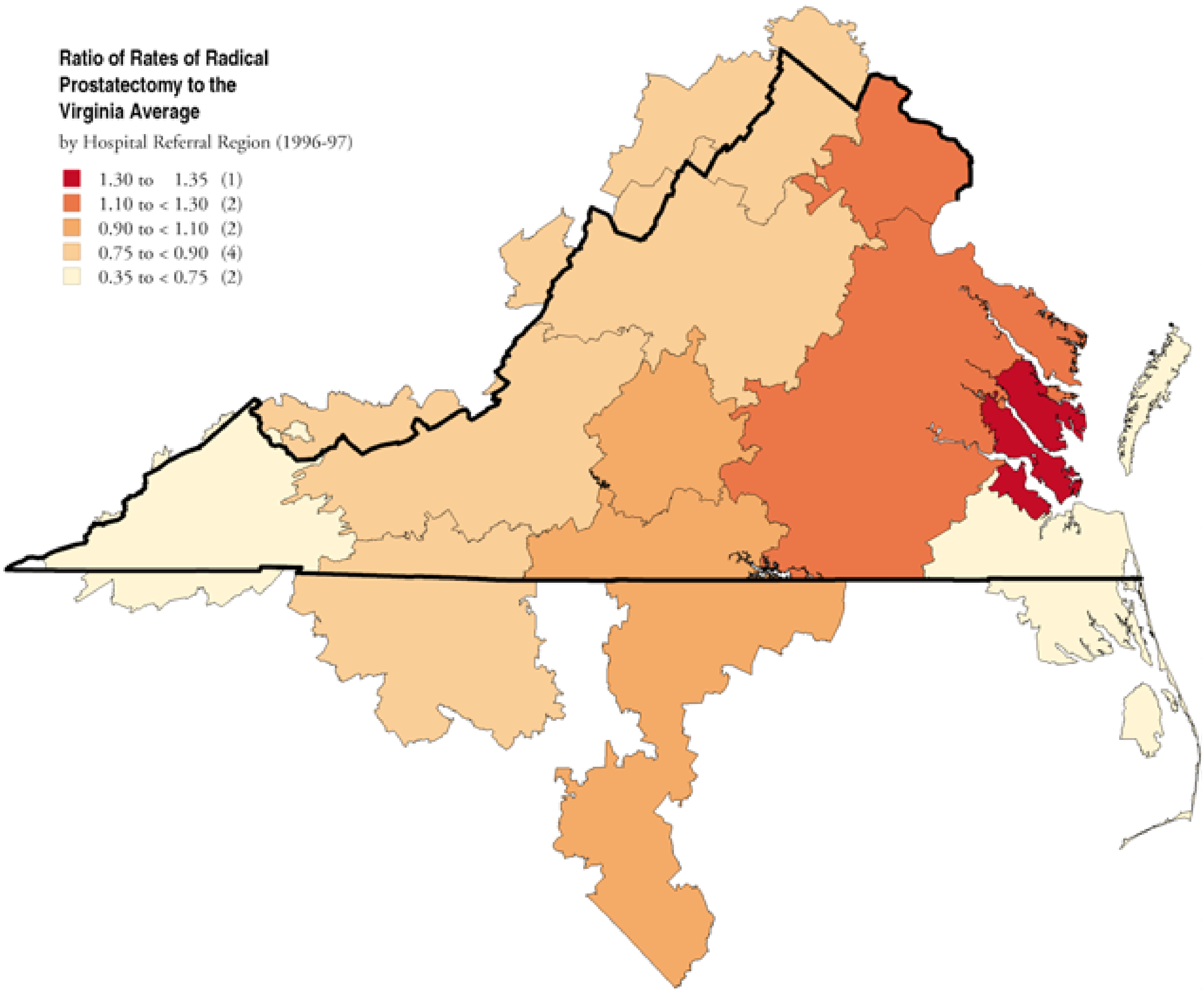


Figure 4.15. Radical Prostatectomy (1996-97)

Rates of radical prostatectomy varied from 0.3 to 0.5 per 1,000 males, after adjustment for differences in population age and race. Each point represents one of the eight hospital referral regions in Virginia.



Map 4.15. Radical Prostatectomy (1996-97)

One hospital referral region had a rate of radical prostatectomy at least 30% higher than the state average of 0.4 per 1,000 male residents. Two regions had rates more than 25% below the average.

Chapter Four Table Notes

All rates are age, sex, and race adjusted. Surgical rates in the general population are for 1996-97. Rates for births, mastectomy, and prostate procedures are sex-specific.

CABG = coronary artery bypass grafting
PTCA = percutaneous transluminal coronary angioplasty
TURP for BPH = transurethral resection of the prostate for benign prostatic hyperplasia

Specific codes used to define the numerators for rates, and methods of age, sex, and race adjustment are included in the Appendix on Methods.

CHAPTER FOUR TABLE A

Rates of Surgical Treatment of Common Medical Conditions by Hospital Service Areas (1996-97)

Virginia HSA City	Resident Population (1996-97)	Colon Cancer Surgery per 1,000 Residents (1996-97)	CABG per 1,000 Residents (1996-97)	PTCA per 1,000 Residents (1996-97)	Carotid Endarterectomy per 1,000 Residents (1996-97)	Cholecystectomy per 1,000 Residents (1996-97)	Primary Hip Replacement per 1,000 Residents (1996-97)	Primary Knee Replacement per 1,000 Residents (1996-97)	Lumbar Discectomy per 1,000 Residents (1996-97)	Hysterectomy for Benign Conditions per 1,000 Women (1996-97)	Births per 1,000 Women (1996-97)	Cesarean Sections per 1,000 Births (1996-97)	Vaginal Births per 1,000 Women with Previous C-Sections (1996-97)	TURP per 1,000 Men (1996-97)
Abingdon	68,316	0.4	1.2	1.1	0.6	1.5	0.4	0.5	0.9	6.0	22.8	247.6	232.9	0.7
Alexandria	545,874	0.4	0.9	1.5	0.3	1.0	0.5	0.7	0.9	2.0	24.6	198.1	424.1	0.6
Arlington	424,062	0.3	0.7	1.2	0.3	1.0	0.5	0.6	0.7	1.9	25.0	199.2	448.2	0.8
Bedford	45,310	0.3	1.4	1.5	0.4	1.8	0.3	0.6	0.8	3.4	23.8	267.4	(332.5)	(0.5)
Big Stone Gap	32,914	(0.4)	0.8	1.3	(0.3)	1.8	(0.4)	0.4	0.9	3.3	23.1	244.3		(0.6)
Blacksburg	138,572	0.3	1.3	1.0	0.4	1.5	0.4	0.5	1.0	2.7	15.3	200.3	399.2	
Charlottesville	394,832	0.4	1.1	1.4	0.3	1.1	0.5	0.8	1.0	2.8	22.3	210.4	387.9	0.6
Chesapeake	274,272	0.4	1.6	1.6	0.7	1.6	0.4	0.9	1.2	3.6	26.7	225.5	427.6	0.5
Clintwood	29,258	(0.4)	1.4	1.1	(0.3)	2.3		(0.5)	1.9	6.0	23.2	254.0		(1.4)
Culpeper	65,706	0.3	0.9	1.2	0.3	1.4	0.5	0.9	1.3	2.6	24.6	224.6	378.0	(0.6)
Danville	217,418	0.5	1.5	2.2	0.4	1.9	0.4	0.6	0.9	2.7	25.5	228.0	322.8	0.5
Emporia	61,550	0.2	1.4	1.3	0.4	1.6	0.6	1.1	1.4	3.8	20.5	213.0	(302.0)	(0.4)
Fairfax	192,316	0.5	0.8	0.9	0.3	0.7	0.3	0.5	1.0	1.5	22.5	218.6	407.4	(0.5)
Falls Church	1,003,552	0.3	0.9	1.2	0.4	0.9	0.5	0.6	1.0	2.2	24.8	209.2	406.5	0.7
Farmville	56,344	0.4	0.9	1.8	0.2	2.3	0.3	0.7	0.9	2.9	21.6	194.8	408.5	(1.1)
Franklin	50,568	(0.4)	1.5	1.7	(0.3)	1.4	(0.6)	1.8	1.7	5.3	24.6	245.8	(304.2)	(0.4)
Fredericksburg	411,444	0.4	1.5	1.5	0.5	1.5	0.5	0.8	1.2	3.2	27.5	225.3	403.1	0.5
Front Royal	63,248	0.4	1.3	1.7	0.4	1.2	0.3	0.6	0.9	2.5	26.1	235.0	340.0	(0.8)
Galax	89,248	0.4	1.1	1.6	0.1	2.2	0.4	0.5	0.6	3.8	25.3	212.3	297.7	1.1
Gloucester	91,648	0.4	1.5	1.9	0.4	1.4	0.4	0.9	1.6	2.8	20.6	187.3	420.6	0.5
Grundy	60,756	(0.5)	1.1	1.4	0.3	2.4	(0.2)	0.3	1.1	5.1	15.8	318.2	(187.6)	(0.4)
Hampton	180,858	0.4	1.4	1.6	0.5	1.1	0.3	0.8	2.0	2.7	19.3	176.1	467.6	0.7
Harrisonburg	240,644	0.4	0.9	1.2	0.2	1.3	0.4	0.9	0.8	4.0	21.4	223.4	340.4	0.4
Hopewell	68,676	0.5	2.1	2.8	0.6	2.7	0.5	0.6	1.1	3.4	28.0	232.2	304.2	(0.3)
Hot Springs	10,810	(0.7)	(1.5)	(1.2)		(2.2)		(0.8)	(1.0)	(4.1)	21.7	(263.5)		
Kilmarnock	52,456	0.3	1.4	2.1	0.4	0.7	0.2	0.6	1.2	2.1	8.3	246.9		0.2
Lebanon	65,096	0.3	1.0	1.1	0.4	2.5	0.3	0.5	0.7	4.9	21.1	286.8	(171.6)	(0.7)
Leesburg	154,674	0.3	0.7	0.9	0.3	0.9	0.4	0.7	0.7	1.6	30.0	208.2	379.2	0.3
Lexington	60,304	0.4	1.3	1.4	0.5	1.8	0.5	0.7	1.2	2.7	21.0	262.3		(0.9)
Low Moor	51,268	0.4	1.1	1.4	0.5	2.5	0.3	0.6	1.3	2.8	26.6	308.8	336.0	(0.3)
Luray	33,976	(0.5)	1.4	1.6	(0.4)	1.6	(0.5)	0.8	1.0	3.6	27.1	287.8	(442.9)	(0.6)
Lynchburg	395,204	0.5	1.5	1.5	0.4	1.5	0.4	0.7	1.2	3.0	24.8	202.2	362.4	0.6
Manassas	229,556	0.4	0.8	0.8	0.2	0.7	0.3	0.4	0.7	1.8	22.1	176.7	468.7	0.5
Marion	68,934	0.3	0.8	0.8	0.6	1.6	0.3	0.5	1.2	7.9	23.6	257.5	268.6	2.0
Martinsville	148,524	0.4	1.2	1.4	0.4	2.0	0.3	0.5	1.1	3.6	23.1	314.4	311.9	0.6
Nassawadox	68,320	0.5	1.1	1.4	0.4	1.4	0.2	0.7	1.1	2.4	32.2	287.1	309.1	0.4
Newport News	624,128	0.4	1.4	1.7	0.6	1.5	0.4	0.8	1.6	2.8	23.4	211.4	425.2	0.5
Norfolk	756,728	0.5	1.4	1.7	0.5	1.4	0.4	0.8	1.1	2.8	22.4	197.4	493.7	0.6
Norton	57,848	0.5	1.2	1.5	0.4	2.5	0.4	0.4	1.1	5.1	24.5	217.4		(1.5)

	Resident Population (1996-97)	Colon Cancer Surgery per 1,000 Residents (1996-97)	CABG per 1,000 Residents (1996-97)	PTCA per 1,000 Residents (1996-97)	Carotid Endarterectomy per 1,000 Residents (1996-97)	Cholecystectomy per 1,000 Residents (1996-97)	Primary Hip Replacement per 1,000 Residents (1996-97)	Primary Knee Replacement per 1,000 Residents (1996-97)	Lumbar Discectomy per 1,000 Residents (1996-97)	Hysterectomy for Benign Conditions per 1,000 Women (1996-97)	Births per 1,000 Women (1996-97)	Cesarean Sections per 1,000 Births (1996-97)	Vaginal Births per 1,000 Women with Previous C-Sections (1996-97)	TURP per 1,000 Men (1996-97)
Pearisburg	37,496	(0.2)	1.4	1.2	0.4	2.2	(0.3)	0.4	0.9	3.4	20.2	248.2		
Pennington Gap	36,256	(0.3)	1.0	1.1		2.7	(0.3)	0.3	1.3	3.3	26.2	248.3		(1.4)
Petersburg	231,704	0.4	1.5	1.9	0.4	2.0	0.4	0.8	1.0	3.6	25.1	187.4	365.6	0.4
Portsmouth	338,700	0.4	1.6	1.6	0.8	2.6	0.4	0.8	1.2	3.5	27.1	233.5	423.4	0.6
Pulaski	37,422	(0.3)	1.2	0.9	(0.5)	1.0	(0.4)	0.4	1.3	2.4	19.9	238.6	(282.5)	(0.6)
Radford	79,254	0.4	1.3	1.1	0.4	1.3	0.3	0.5	1.1	2.8	13.8	220.7	402.9	(0.3)
Reston	315,028	0.3	0.8	0.8	0.4	0.7	0.4	0.6	0.8	1.6	22.1	210.3	350.3	0.6
Richlands	60,622	(0.3)	0.9	0.9	0.3	2.3	0.3	0.5	1.2	7.6	20.5	267.8	(251.3)	(0.4)
Richmond	1,728,086	0.4	1.3	2.3	0.5	1.5	0.4	0.8	1.1	3.6	26.7	222.6	332.9	0.6
Roanoke	467,290	0.3	1.2	1.2	0.5	1.7	0.3	0.5	0.9	2.8	21.8	204.0	492.9	0.5
Rocky Mount	52,264	(0.3)	1.7	1.3	0.5	2.7	(0.2)	0.5	1.0	3.4	19.3	255.7	357.5	(0.9)
Salem	96,178	0.3	0.9	1.0	0.3	1.4	0.3	0.4	0.7	2.8	16.6	216.6	422.1	0.2
South Boston	112,534	0.4	1.3	1.3	0.5	1.3	0.4	0.7	1.3	3.7	28.7	211.3	334.6	0.6
South Hill	55,694	0.4	1.6	2.5	0.5	3.7	0.4	0.8	1.3	5.2	30.5	242.5	395.1	(0.7)
Staunton	201,660	0.4	1.3	1.5	0.3	1.5	0.4	0.9	1.1	3.4	24.0	234.2	366.0	0.8
Stuart	26,120	(0.3)	1.2	1.7		1.5		0.4	0.9	3.0	27.9	228.0	(350.1)	(0.6)
Suffolk	128,566	0.4	1.7	2.0	0.7	2.0	0.4	0.9	2.1	3.8	29.1	230.9	368.2	0.7
Tappahannock	47,626	0.5	1.2	1.8	0.3	1.3	0.3	0.7	0.8	3.7	19.0	279.7	(353.1)	(0.7)
Tazewell	24,898		1.3	1.2		0.6			0.8	4.4	14.2	315.8		
Virginia Beach	598,368	0.4	1.4	1.9	0.6	1.3	0.4	0.9	1.1	2.8	20.6	195.1	498.5	0.6
Warrenton	109,290	0.3	0.8	0.8	0.4	0.8	0.5	0.8	0.9	1.6	20.2	204.8	460.0	0.6
Williamsburg	127,246	0.4	1.3	1.6	0.7	1.3	0.6	0.8	1.6	2.8	18.1	204.8	333.6	1.2
Winchester	229,200	0.5	1.7	2.3	0.4	1.5	0.4	1.0	1.0	4.1	23.4	228.5	326.7	0.4
Woodbridge	333,384	0.4	1.4	1.8	0.5	1.1	0.5	0.9	1.2	2.4	25.4	182.7	472.5	0.9
Woodstock	41,242	(0.4)	1.5	1.7	0.3	1.4	(0.3)	0.6	0.6	4.7	25.8	298.5	203.8	(0.7)
Wytheville	64,198	0.3	1.1	1.1	0.4	1.9	0.4	0.6	1.2	5.4	21.9	326.4	147.9	1.0
Virginia	13,165,538	0.4	1.2	1.6	0.4	1.4	0.4	0.7	1.1	3.0	23.9	215.0	392.9	0.6

CHAPTER FOUR TABLE B

Mastectomy and Prostatectomy by Hospital Referral Region (1996-97)

HRR City	Female Population (1996-97)	Male Population (1996-97)	Percent of Mastectomies for Breast Cancer That Were Radical Mastectomies (1996-97)	Radical Prostatectomy per 1,000 Men (1996-97)
Arlington	1,657,712	1,650,024	79.4	0.43
Charlottesville	468,720	444,932	73.3	0.33
Lynchburg	230,068	210,446	73.1	0.39
Newport News	523,650	500,230	78.6	0.51
Norfolk	1,101,536	1,113,986	85.4	0.26
Richmond	1,402,158	1,311,422	72.2	0.48
Roanoke	569,236	539,908	75.3	0.30
Winchester	186,184	181,482	71.2	0.30
Durham, NC	250,694	227,782	86.4	0.41
Winston-Salem, NC	59,166	56,202		0.32
Kingsport, TN	246,864	233,136	91.8	0.14
Virginia	6,695,988	6,469,550	77.8	0.38

CHAPTER FIVE

Quality of Care: The Use of Preventive Services

The Use of Preventive Services

Primary prevention (the prevention of harm from disease through early detection and the prevention of complications of established disease) are among the most important goals of medicine. The quality of preventive services for Medicare enrollees is examined in this chapter, which looks at immunization and screening rates, treatment and management intended to prevent further complications or progression of established disease, and preventive care to avoid unnecessary hospitalizations.

The quality of ambulatory care in Virginia was highly variable in 1995-96:

- The rate at which Medicare enrollees received vaccinations for pneumococcal pneumonia varied by a factor of three.

- The rate at which female Medicare enrollees received annual mammograms varied by a factor of 2.4.

- The rate at which Medicare enrollees received fecal occult blood tests or sigmoidoscopy examinations varied by a factor of more than six.

- The rate at which diabetic Medicare enrollees received annual eye examinations varied by a factor of 2.5; the rate at which they received routine monitoring of HgbA1c, a marker of glucose, varied by a factor of 4.8, and the rate at which diabetics were tested for blood lipid levels varied by a factor of 4.4.

Immunizations and Screening Examinations

The United States Preventive Services Task Force (1996) used an evidence-based approach to arrive at recommendations for immunizations and screening tests. In order to recommend immunizations, the Task Force required evidence of biological effectiveness — that is, in order to be recommended, immunizations must reduce or eliminate the diseases they are designed to prevent. The Task Force had three major requirements for screening tests. First, they had to accurately detect conditions earlier than would be possible without screening. Second, there had to be effective treatments available for the diseases being detected. Third, treatments had to be more effective when used at the preclinical stages of disease than after disease becomes clinically apparent.

This section examines the quality of preventive care in Virginia as measured by the frequency of use of preventive services recommended by the Task Force for routine use among Medicare enrollees:

- Immunization to reduce the risk of pneumococcal pneumonia
- Mammography to detect early stage breast cancer
- Eye examinations, blood glucose monitoring, and blood lipid testing for diabetics

Vaccination for Pneumococcal Pneumonia

The United States Preventive Services Task Force recommended that people over age 65 be vaccinated against pneumococcal pneumonia because of the high mortality and morbidity associated with the infection in older people. In the judgment of the Task Force, the vaccination's effectiveness has been established by a number of clinical trials, and there is little evidence of serious side effects. The protection provided by the vaccine is, moreover, becoming increasingly important as antibiotic-resistant strains of the bacteria emerge.

The Task Force did not make a specific recommendation on the frequency of vaccination. The duration of protection is unknown, but there is evidence that protection lasts at least five years, and perhaps as many as ten.

Immunization rates among Medicare enrollees were higher than the state average of 9.9% in the Staunton (18.4%); Charlottesville (17.0%); Galax (16.1%); Suffolk (13.5%) and Virginia Beach (13.1%) hospital service areas.

The frequency of immunization was lower than the national average of 8.9% in the hospital service areas in Lebanon (6.0%); Hampton (6.0%); Newport News (7.1%); Petersburg (7.2%) and South Boston (7.8%).

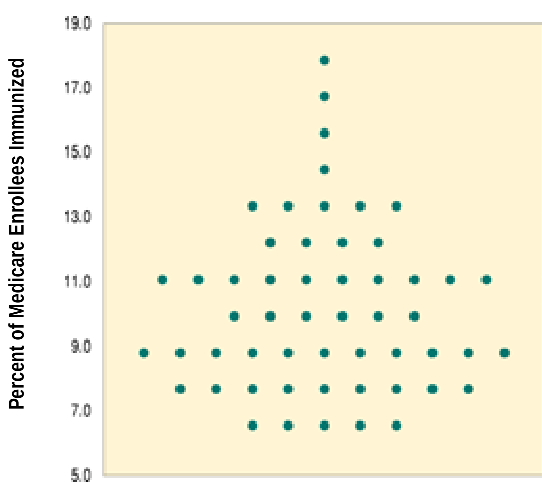
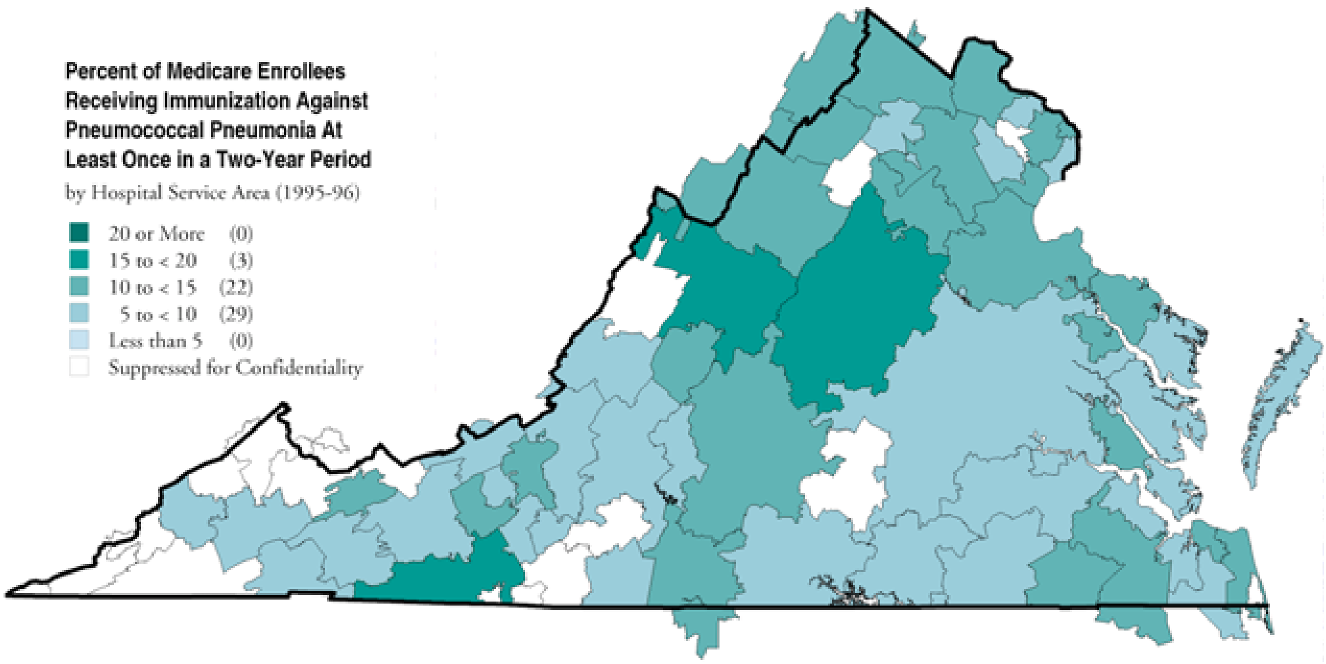


Figure 5.1. Percent of Medicare Enrollees Who Received Immunization Against Pneumococcal Pneumonia (1995-96)
The target immunization rate of the U.S. Preventive Services Task Force is 10-20% in each two-year period; actual rates ranged from 6.0% to 18.4%. Each point represents one of the 65 hospital service areas in Virginia.



Map 5.1. Immunization Against Pneumococcal Pneumonia (1995-96)

No hospital service area had a rate of immunization of more 20%. No hospital service area had a rate of less than 5%.

Screening for Breast Cancer

The United States Preventive Services Task Force recommends routine mammographic screening every one or two years for women age 50 to 69. Clinical trials provide convincing evidence of the effectiveness of this screening in reducing mortality from breast cancer. The Task Force found that there was not enough evidence to recommend universal screening for women over age 69, but opined that healthy women age 70 and over might benefit from routine mammography.

The frequency of mammography among female Medicare enrollees between 65 and 69 fell considerably short of the Task Force's recommendation in 1995-96. The average rate of mammography in the United States was 49.0%; in Virginia, the rate varied by a factor of 2.4, from 25.7% to 60.9%.

The mammography rate was higher than the national average in the Petersburg (60.9%); Virginia Beach (57.0%); Charlottesville (57.0%); Chesapeake (56.9%) and Arlington (55.0%) hospital service areas.

In other hospital service areas, screening rates were lower than the national average, including Danville (34.8%); Staunton (36.6%); Fredericksburg (37.6%) and Winchester (38.9%).

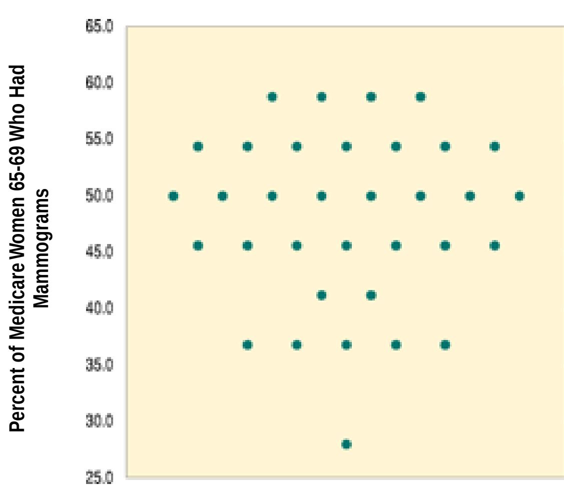
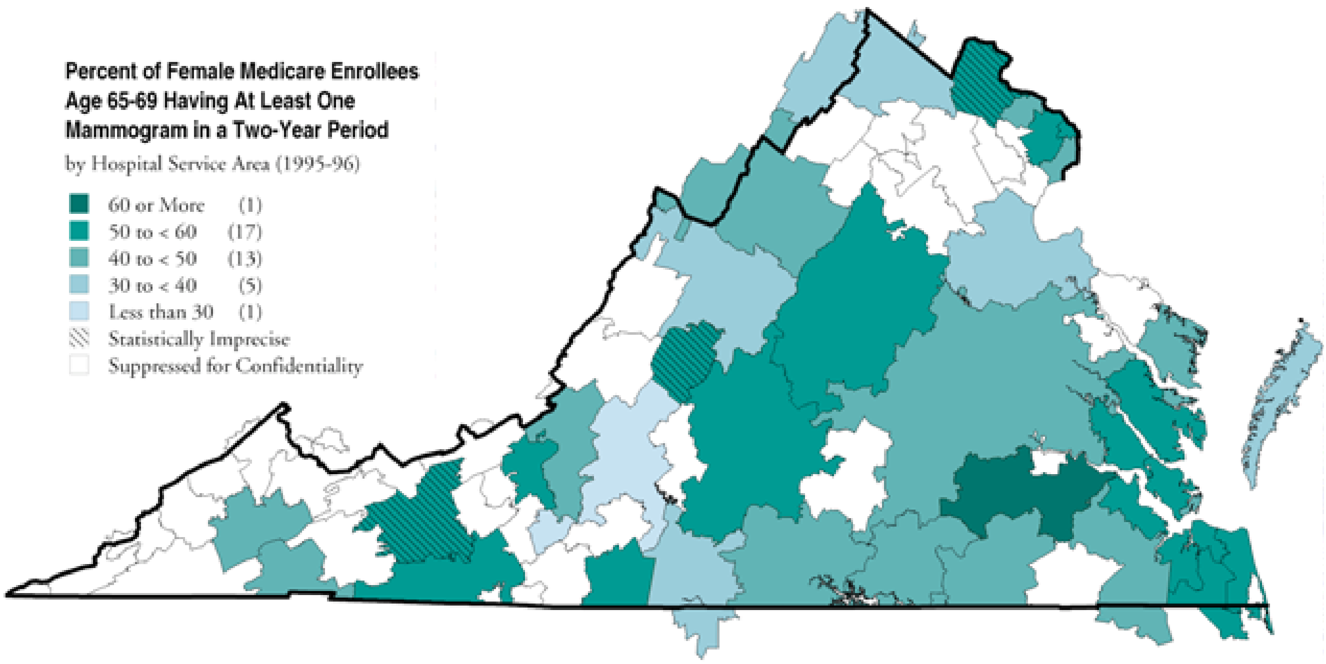


Figure 5.2. Percent of Medicare Women in Virginia Age 65-69 Who Had Mammograms (1995-96)
The target screening rate of the U.S. Preventive Services Task Force is one mammogram every one to two years for women between 65 and 69. Actual rates of screening ranged from 25.7% to 60.9%. Each point represents one of the 65 hospital service areas in Virginia.



Map 5.2. Percent of Medicare Women in Virginia Who Had Mammograms (1995-96)

One hospital service area had a rate of mammographic screening higher than 60%.

One hospital service area had a rate lower than 30%.

Screening for Colorectal Cancer

The United States Preventive Services Task Force recommends annual fecal occult blood testing or sigmoidoscopy for all Americans over age 50. The fecal occult blood screening recommendation is based on the outcomes of randomized clinical trials, and the recommendation for sigmoidoscopy arose from the results of carefully conducted case-control studies. Both screening tests have demonstrated effectiveness in reducing mortality from colorectal cancer (although the Medicare program did not pay for these screening tests until 1997). Compliance with the colorectal cancer screening guideline varied by a factor of 6.5, from 2.9% to 19.1%.

Annual screening for colorectal cancer was more common than the national average of 12.3% among residents of the hospital service areas in Arlington (19.1%); Fairfax (18.3%); Falls Church (18.2%); Reston (15.7%) and Portsmouth (15.1%).

The two screening procedures were used less than half as frequently as the state average of 8.7% among residents of the Bedford (2.9%); South Hill (3.5%); Norton (3.7%); Grundy (4.0%) and Lebanon (4.3%) hospital service areas.

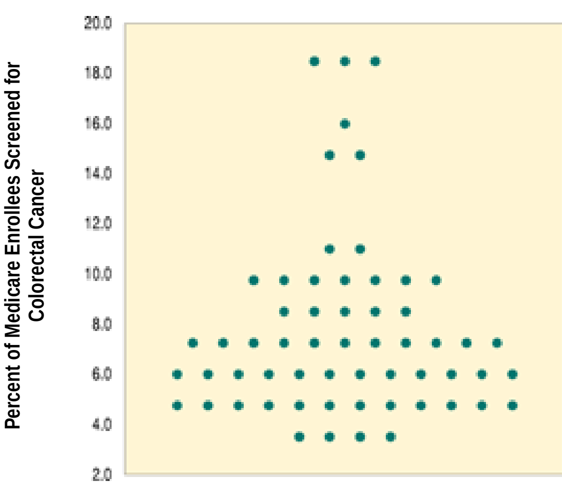
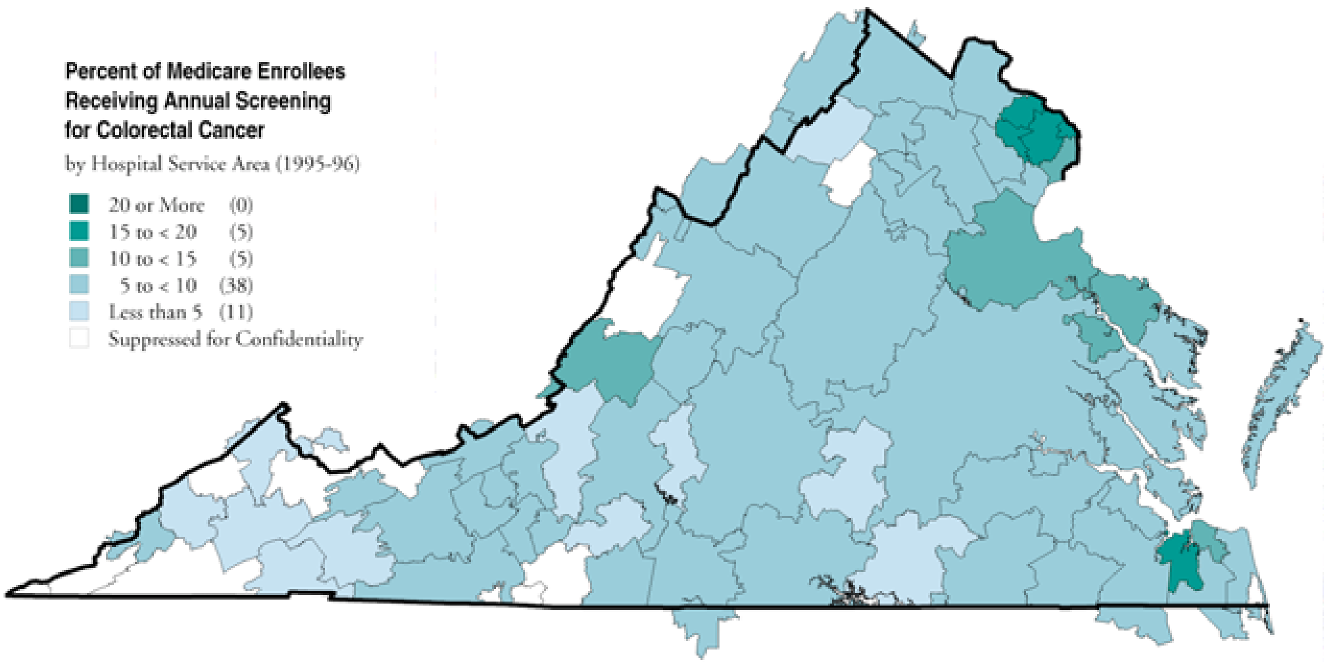


Figure 5.3. Percent of Virginia Medicare Enrollees Receiving Annual Screening for Colorectal Cancer (1995-96)

The U.S. Preventive Services Task Force recommends annual screening for colorectal cancer for Medicare enrollees. Compliance with the guideline ranged from 2.9% to 19.1%. Each point represents one of the 65 hospital service areas in Virginia.



Map 5.3. Percent of Virginia Medicare Enrollees Receiving Annual Screening for Colorectal Cancer (1995-96)

No hospital service area had a rate of screening of 20% or more. Eleven areas had rates of less than 5%.

Secondary Prevention Services for Diabetics

Concern over the quality of secondary preventive services in managed care organizations has led to the wide adoption of practice guidelines for such services, as well as the development of performance measures to evaluate adherence to the guidelines. Recognizing the serious risk of complications associated with diabetes, and the fact that several studies have suggested that the care of diabetic patients in the United States is sub-optimal, a coalition of private and public organizations sponsored the Diabetes Quality Improvement Project. Members included the American Diabetes Foundation, the American College of Physicians, the American Academy of Family Physicians, the Department of Veterans Affairs, the Health Care Financing Administration, the Foundation for Accountability, and the National Center for Quality Assurance.

Diabetes is a chronic illness that effects over 16 million Americans. There are two basic types of diabetes: insulin dependent and non-insulin dependent. Patients with insulin-dependent diabetes have lost their ability to make insulin, the major regulatory hormone for glucose control. Patients with non-insulin-dependent diabetes, the most common form of the disease among Medicare enrollees, have developed resistance to insulin.

People with both forms of diabetes are at significant risk of morbidity and mortality, including retinal disease that can lead to blindness and kidney disease that can lead to renal failure. Diabetics also develop coronary artery disease at a much higher rate than non-diabetics. Recent randomized trials have shown that improving glucose control in people with insulin-dependent diabetes can decrease the risk of these complications. These findings have been extrapolated to people with non-insulin-dependent diabetes; several studies are now underway to directly assess this relationship.

The Diabetes Quality Improvement Project recommends annual eye examinations, annual measurement of glucose control, and semiannual measurement of blood lipid levels. The Project also developed a set of diabetes-specific performance measures with which individual physicians, plans and systems can be evaluated. In this section we report on the care of Medicare diabetics in Virginia, using three quality measures (the proportion of diabetics receiving the test): dilated eye exam, measurement of long term glucose control, and measurement of lipid levels.

Annual Eye Examinations for Diabetics

In people with both insulin-dependent and non-insulin-dependent diabetes, randomized trials have confirmed that yearly retinal exams and treatment of eye disease reduce the risk of blindness. The Diabetes Quality Improvement Project recommends annual eye exams. In 1995-96, all hospital service areas in Virginia fell well short of the guideline recommendation for annual eye examinations for Medicare enrollees who were diabetics. Compliance with the guideline varied by a factor of more than two, from 22.8% to 58.0%.

Among the hospital service areas with rates of annual eye examinations for diabetic Medicare enrollees higher than the national average of 45.3% were Lebanon (58.0%); Lynchburg (57.8%); Rocky Mount (55.9%); Wytheville (55.6%) and Harrisonburg (54.5%).

Among the hospital service areas with lower rates of annual eye exams for diabetic Medicare enrollees than the state average of 43.6% were Low Moor (22.8%); Culpeper (25.0%); Woodbridge (25.0%); Winchester (26.9%) and Abingdon (29.9%).

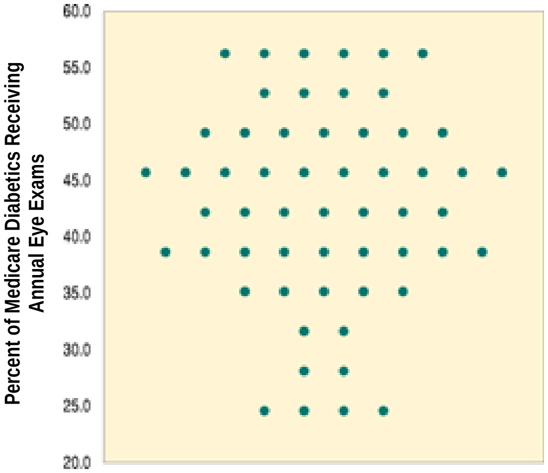
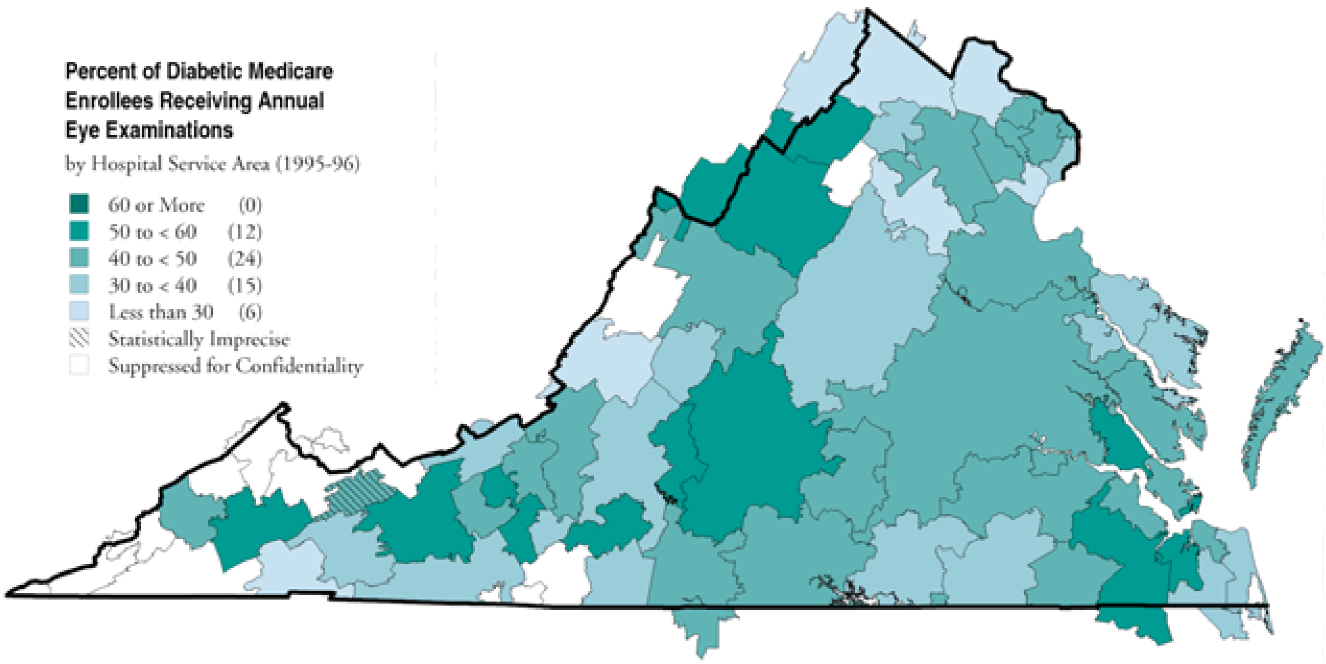


Figure 5.4. Percent of Diabetic Medicare Enrollees in Virginia Receiving Annual Eye Examinations (1995-96)
The Diabetes Quality Improvement Project recommends annual eye exams for all diabetics. Actual rates of compliance with the guideline ranged from 22.8% to 58.0%. Each point represents one of the 65 hospital service areas in Virginia.



Map 5.4. Percent of Diabetic Medicare Enrollees Receiving Annual Eye Examinations (1995-96)

No hospital service area had a rate of annual eye exams of 60% or more. Six areas had rates of less than 30%.

Annual HgbA1c Monitoring for Diabetics

The Diabetes Quality Improvement Project recommends routine monitoring of HgbA1c, a marker of glucose; tight control of glucose levels results in decreased complications. While definitive results have not been found for patients with non-insulin-dependent diabetes, the Project has expanded this recommendation to all diabetics. Overall, compliance with this guideline fell far short of the recommendation, varying from 14.6% of eligible Medicare enrollees to 69.6%.

Among the hospital service areas in Virginia where annual HgbA1c testing was substantially higher than the national average of 35.6% were Warrenton (69.6%); Rocky Mount (66.1%); Fredericksburg (60.8%); Falls Church (57.4%) and Alexandria (53.1%).

Among the hospital service areas where Medicare enrollees with diabetes were less likely than the state average of 39.3% to receive annual glucose testing were Marion (14.6%); Nassawadox (17.8%); Petersburg (18.6%); Martinsville (19.5%) and Low Moor (22.8%).

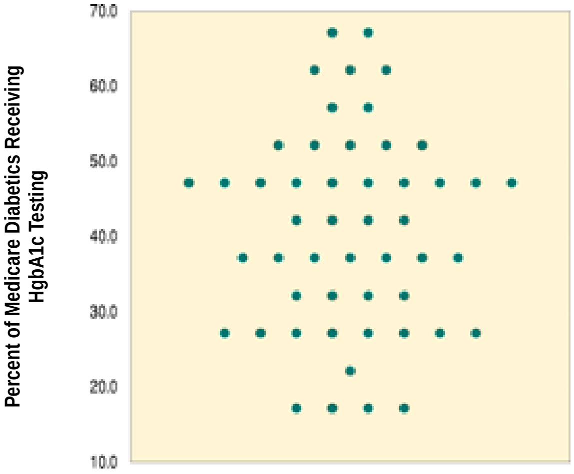
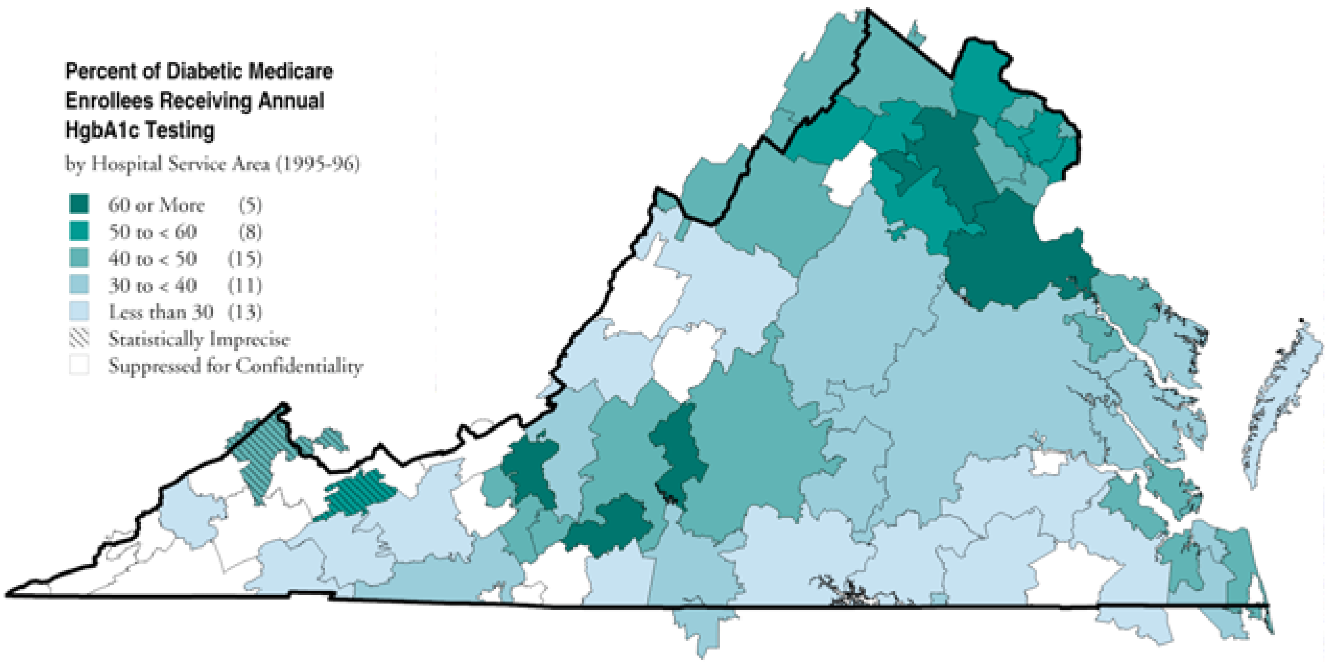


Figure 5.5. Percent of Diabetic Medicare Enrollees in Virginia Receiving Annual HgbA1c Testing (1995-96)

The Diabetes Quality Improvement Project recommends annual HgbA1c testing for all diabetics. Compliance with the guideline ranged from less than 15% to almost 70%. Each point represents one of the 65 hospital service areas in Virginia.



Map 5.5. Percent of Diabetic Medicare Enrollees in Virginia Receiving Annual HgbA1c Testing (1995-96)

Five hospital service areas had rates of glucose monitoring of 60% or more. Thirteen areas had rates of less than 30%.

Blood Lipids Testing for Diabetics

Cardiac disease occurs at a much higher rate in diabetics than in the non-diabetic population, and the most common cause of death in diabetics is cardiovascular disease. Some, although not all, of this excess incidence is related to lipid abnormalities. Because of this excess risk, the Diabetes Quality Improvement Project recommends aggressive management of lipid abnormalities in diabetics, including monitoring of blood lipids. Compliance with the guideline fell short of this recommendation; the percent of diabetic enrollees who received one or more tests in 1995-96 varied by a factor of more than four, from 14.6% to 64.3%.

Among the hospital service areas where rates of blood lipids testing for Medicare diabetics were higher than the United States average of 33.1% were Warrenton (64.3%); Woodstock (57.1%); Falls Church (55.5%); Culpeper (53.6%) and Harrisonburg (53.2%).

Among the hospital service areas where Medicare enrollees with diabetes were less likely than the state average of 36.0% to receive blood lipids testing were Marion (14.6%); Nassawadox (16.4%); Martinsville (22.8%); Gloucester (23.3%) and Salem (24.5%).

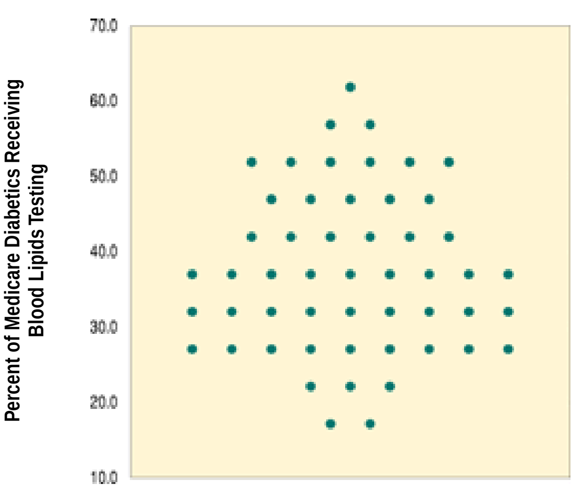
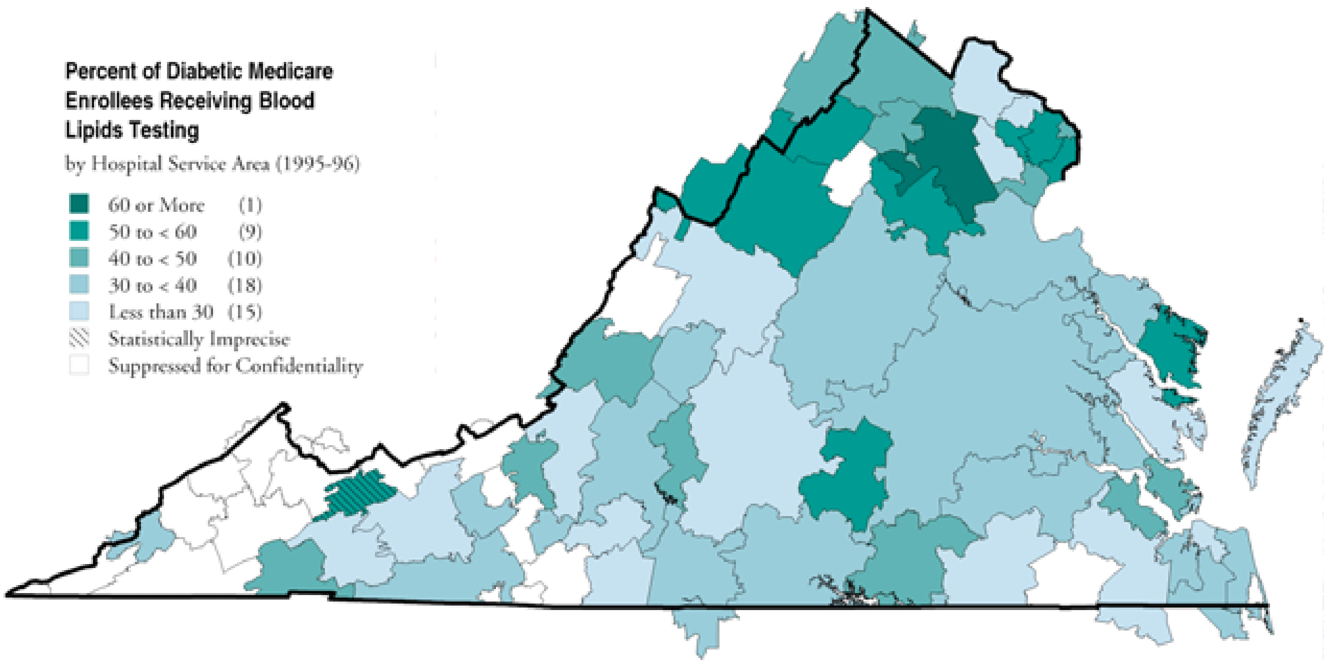


Figure 5.6. Percent of Diabetic Medicare Enrollees Receiving One or More Blood Lipids Tests (1995-96)

The Diabetes Quality Improvement Project recommends blood lipids testing for all diabetics at least once every two years. The percent of Medicare diabetics in Virginia who had a test ranged from less than 15% to almost 65%. Each point represents one of the 65 hospital service areas in Virginia.



Map 5.6. Percent of Diabetic Medicare Enrollees Receiving One or More Blood Lipids Tests (1995-96)

One hospital service area had a rate of blood lipids testing of more than 60%. Fifteen areas had rates of less than 30%.

The Preventive Care Profiles of Hospital Referral Regions

If measures of the use of immunizations, screening tests, and preventive care reflect the overall performance of health care delivery systems, there should be an association between the rates of use of services. For example, areas with high-quality care would be expected to have higher than average rates for all quality of care measures. But in reality, the patterns of provision of screening and preventive services are essentially unrelated to one another. Nationally in 1995-96, there was no association between the use of mammograms and pneumococcal vaccine (R^2 = 08); and very little association between the frequency of mammograms and diabetic eye exams (R^2 = .07), or between the likelihood that Medicare enrollees would receive pneumococcal vaccinations and that diabetic enrollees would receive annual eye examinations (R^2 = .00) (Table 5.1).

TABLE 5.1. THE RELATIONSHIPS BETWEEN THE USE OF SELECTED PREVENTIVE SERVICES (R^2 VALUES) (1995-96)

	Immunization for Pneumococcal Pneumonia	Screening for Breast Cancer (Age 65-69)	Screening for Colorectal Cancer	Eye Examination (Diabetics)	HgbA1c Testing (Diabetics)	Blood Lipids Testing (Diabetics)
Immunization for Pneumococcal Pneumonia	1.00					
Screening for Breast Cancer (Age 65-69)	0.08	1.00				
Screening for Colorectal Cancer	0.01	0.21	1.00			
Eye Examination (Diabetics)	0.00	0.07	0.07	1.00		
HgbA1c Testing (Diabetics)	0.00	0.03	0.01	0.05	1.00	
Blood Lipids Testing (Diabetics)	0.01*	0.01	0.18	0.07	0.23	1.00

**Indicates inverse association (negative correlation coefficient)*

There was little relationship between receiving any given recommended preventive service and the likelihood of receiving any other. For example, although diabetics who received one of the recommended tests were slightly more likely to have the other diabetic screenings and to be screened for colon cancer, there were virtually no other correlations among preventive services.

Moreover, profiles of the propensity of given regions to use appropriate and recommended screening and diagnostic tests illustrate the idiosyncratic, non-systematic patterns of delivery of preventive services. A region that does well with regard to use of one service might do very poorly with regard to another, although some hospital service areas did (relatively) well on all measures.

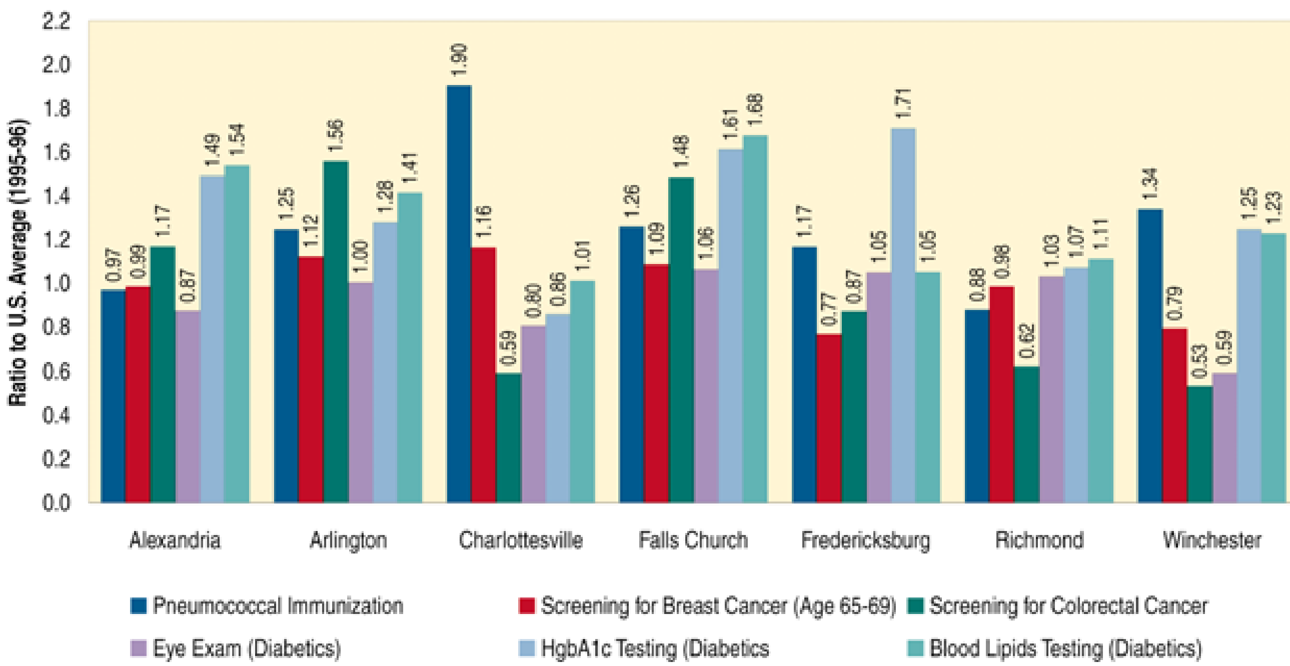


Figure 5.7. The Preventive Services Signatures of Seven Hospital Service Areas (1995-96)

These seven Virginia hospital service areas had distinctly different preventive services profiles. Medicare enrollees in Charlottesville, for example, were 90% more likely than the national average to receive the pneumococcal pneumonia vaccine, but residents were 41% less likely than the national average to receive screening for colorectal cancers. By contrast, enrollees in Alexandria were 3% less likely than the national average to receive the pneumonia vaccine, but were 17% more likely than the national average to receive screening for colorectal cancers. Women age 65-69 in Charlottesville were 16% more likely than the national average to have mammograms; women of the same age are Fredericksburg were 23% less likely than the national average to receive this cancer screening test.

Hospitalizations for Ambulatory Care-Sensitive Conditions

Health care researchers have used the incidence of hospitalization for certain conditions as an indicator of the quality of ambulatory care. The theory is that when the access to or the quality of ambulatory care are poor, patients with diseases such as asthma, pneumonia, chronic pulmonary obstructive disease and congestive heart failure are inadequately treated in the clinic or outpatient department; this sub-optimal care results in higher rates of hospitalization compared to similar patients with higher quality care. Several researchers have suggested that the regions with high rates of hospitalization for these "ambulatory care-sensitive conditions" should be targeted for special interventions to improve the quality of primary care.

Rates of admissions for ambulatory care-sensitive conditions among Virginia hospital service areas varied by a factor of 17, from fewer than 4.0 per 1,000 residents to 65.4.

Among the hospital service areas where residents were more likely to be admitted to hospitals for ambulatory care-sensitive conditions than the state average of 15.0 per 1,000 residents were Grundy (65.4); Norton (60.5); Clintwood (58.8); Richlands (49.8) and Lebanon (45.3).

In other hospital service areas, residents were much less likely to be admitted for ambulatory care-sensitive conditions, including those in Kilmarnock (3.8); Reston (8.4); Salem (8.5); Fairfax (8.8) and Falls Church (9.0).

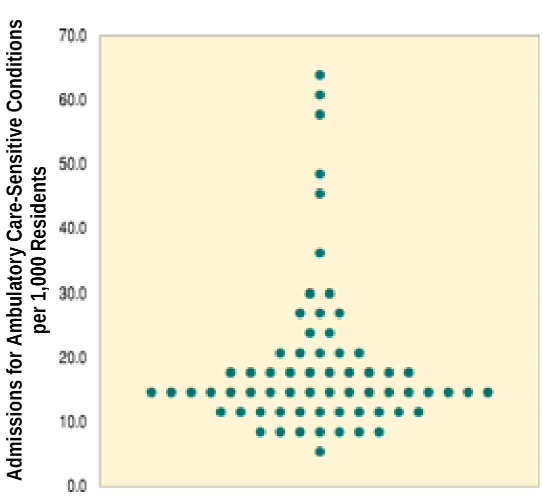
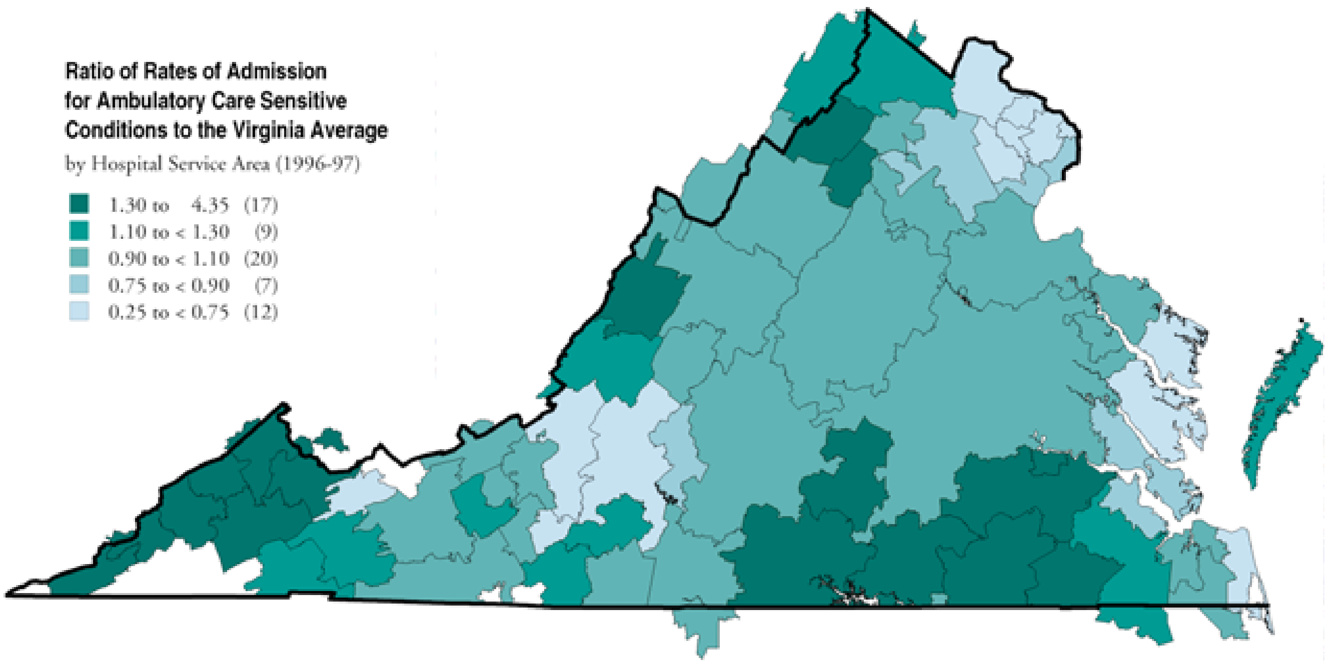


Figure 5.8. Admissions for Ambulatory Care-Sensitive Conditions (1996-97)

Rates of admissions for ambulatory care-sensitive conditions varied from 3.8 per 1,000 residents to more than 65, after adjustment for differences in population age, sex, and race. Each point represents one of the 65 hospital service areas in Virginia.



Map 5.7. Admissions for Ambulatory Care-Sensitive Conditions (1996-97)

In 17 hospital service areas, rates of admissions for ambulatory care-sensitive conditions were at least 30% higher than the state average. In 12 hospital service areas, rates were more than 25% below the average.

Supply of Resources, Access to Care, and Hospitalizations for Ambulatory Care-Sensitive Conditions

Is there an association between the capacity of local health care systems and rates of discharges for ambulatory care-sensitive conditions? Do hospital service areas with fewer physicians have higher rates of admissions for ambulatory care-sensitive conditions? Do communities with fewer primary care physicians or specialists have higher rates of such admissions? Does better access to care help avoid preventable hospitalizations?

Apparently not. Rates of discharges for ambulatory care-sensitive conditions were not related to the supply of primary care physicians per 100,000 residents (Figure 5.9); there was essentially no correlation between the two (R^2 = .00).

There was an inverse relationship (R^2 = .24) between the supply of specialists in Virginia's hospital service areas and the rates at which residents were admitted to hospitals for ambulatory care-sensitive conditions.

The local supply of hospital beds had a stronger correlation to the rates at which Virginia residents were admitted to hospitals for ambulatory care-sensitive conditions (R^2 = .29) than either the supply of primary care physicians or the supply of specialists.

It appears that ambulatory care-sensitive conditions are not "special case" conditions. Rather, a particular aspect of the local health care system, the supply of hospital beds, has the same influence on general medical admissions and on admissions for ambulatory care-sensitive conditions. The capacity of the acute care hospital system has a dominating influence on rates of hospitalizations for all medical conditions, and discharges for ambulatory care-sensitive conditions appear to be, at least in part, a measure of hospital bed capacity, not the quality of ambulatory care or the illness of the population.

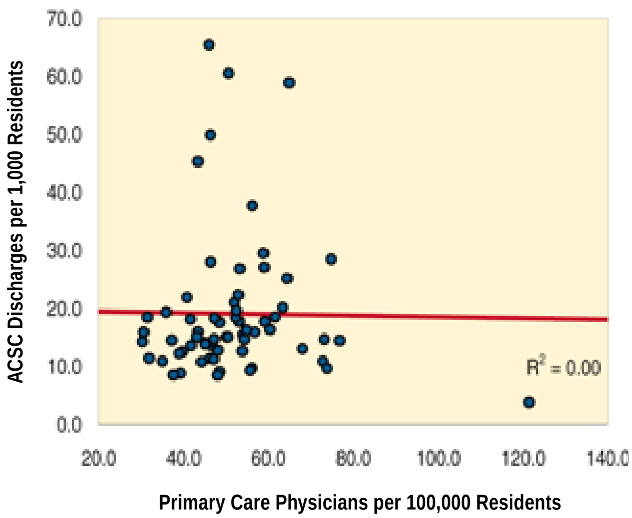


Figure 5.9. The Association Between Allocated Primary Care Physicians and Rates of Discharges for Ambulatory Care-Sensitive Conditions (1996)

There was no relationship between the supply of primary care physicians and rates of discharges for ambulatory care-sensitive conditions; more primary care physicians in a given community did not result in fewer "preventable" hospitalizaitons.

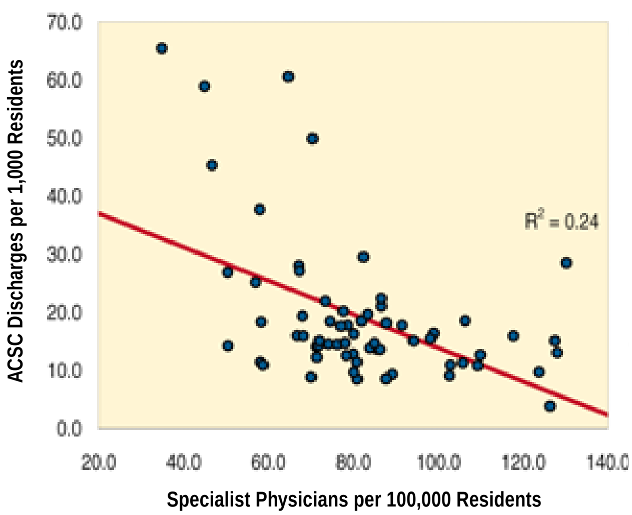


Figure 5.10. The Association Between Allocated Specialist Physicians and Rates of Discharges for Ambulatory Care-Sensitive Conditions (1996)

There was an inverse relationship between the supply of specialist physicians and rates of discharges for ambulatory care-sensitive conditions; more specialists in a given community resulted in fewer ambulatory care-sensitive conditions.

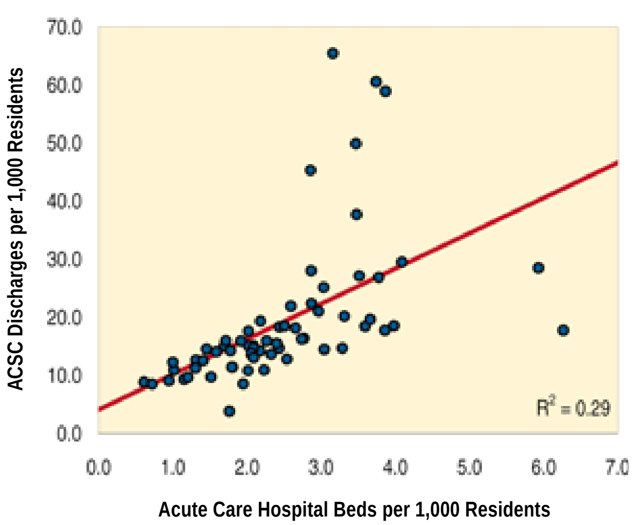


Figure 5.11. The Association Between Acute Care Hospital Beds and Rates of Discharges for Ambulatory Care-Sensitive Conditions (1996)

The acute care hospital bed supply explained about one-third of the variation in rates of admissions for ambulatory care-sensitive conditions. Residents of hospital service areas with more beds per 1,000 residents were more likely to be hospitalized for conditions such as pneumonia, congestive heart failure, and chronic obstructive pulmonary disease; residents of hospital service areas with lower supplies of hospital beds per 1,000 residents were more likely to be treated for these conditions in another setting.

Chapter Five Table Notes

All measures of screening are expressed as percents of Medicare enrollees receiving the preventive service. Percents are calculated using a two-year "person-year" denominator, which varies according to the specific measure; e.g., all Medicare enrollees, women between the ages of 65 and 69, and diabetic Medicare enrollees. Data exclude Medicare enrollees who were members of risk-bearing health maintenance organizations. The measures in columns 1 and 2 are two-year rates — e.g., the number of persons having one test in the two-year period.

Specific codes used to define the numerators for rates, and methods of age, sex, race and illness adjustment are included in the Appendix on Methods.

CHAPTER FIVE TABLE

Preventive Services Among Virginia Medicare Enrollees (1995-96)

Virginia HSA City	Percent of Medicare Enrollees Receiving Immunization Against Pneumococcal Pneumonia At Least Once in a Two-Year Period (1995-96)	Percent of Female Medicare Enrollees Age 65-69 Having At Least One Mammogram in a Two-Year Period (1995-96)	Percent of Medicare Enrollees Receiving Annual Screening for Colorectal Cancer (1995-96)	Percent of Diabetic Medicare Enrollees Receiving Annual Eye Examinations (1995-96)	Percent of Diabetic Medicare Enrollees Receiving Annual HgbA1c Testing (1995-96)	Percent of Diabetic Medicare Enrollees Receiving Annual Blood Lipids Testing (1995-96)	Admission for Ambulatory Care Sensitive Conditions per 1,000 Residents (1996-97)
Abingdon	8.5	43.8	4.3	29.9	26.9	49.3	19.3
Alexandria	8.7	48.3	14.3	39.6	53.1	51.0	12.6
Arlington	11.1	55.0	19.1	45.5	45.5	46.9	9.7
Bedford	8.9		2.9	56.1	63.4	43.9	12.7
Big Stone Gap			6.6			34.4	37.6
Blacksburg	10.7	52.9	6.6	45.2	64.3	45.2	14.0
Charlottesville	17.0	57.0	7.3	36.4	30.5	33.5	15.0
Chesapeake	9.1	56.9	9.2	36.7	38.5	32.5	15.9
Clintwood							58.8
Culpeper	12.4		6.3	25.0	51.8	53.6	15.0
Danville	12.4	34.8	7.0	46.4	35.4	39.2	14.2
Emporia	6.6	44.4	5.9	39.1	29.0	24.6	25.1
Fairfax			18.3	43.8	59.4	50.0	8.8
Falls Church	11.3	53.3	18.2	48.2	57.4	55.5	9.0
Farmville			4.9	48.5	34.8	51.5	21.0
Franklin	11.3		7.2	46.8			20.1
Fredericksburg	10.4	37.6	10.7	47.5	60.8	34.8	14.5
Front Royal	9.5		5.8	37.0	50.0	43.5	13.6
Galax	16.1	54.5	7.3	31.8	33.6	30.8	14.2
Gloucester	8.0	51.3	5.1	48.9	31.1	23.3	10.9
Grundy			4.0		(48.0)		65.4
Hampton	6.0	47.7	7.1	51.8	44.6	34.8	11.4
Harrisonburg	10.5	48.6	7.6	54.5	49.1	53.2	15.0
Hopewell	9.2		7.4	41.9		39.5	28.0
Hot Springs							28.4
Kilmarnock	9.3	48.1	9.3	39.1	30.4	50.7	3.8
Lebanon	6.0	41.7	4.3	58.0			45.3
Leesburg	11.1	(57.1)	8.8	26.1	54.3	28.3	9.3
Lexington	11.3	(50.0)	6.8	36.7		36.7	14.4
Low Moor	8.7		10.4	22.8	22.8	42.4	17.7
Luray							29.5
Lynchburg	11.0	50.4	5.1	57.8	46.8	26.9	14.7
Manassas	9.7		6.7	44.9	47.8	27.5	10.9
Marion	6.6		4.4	30.5	14.6	14.6	17.7
Martinsville	9.3	56.5	7.2	39.6	19.5	22.8	15.9
Nassawadox	9.7	38.7	5.1	42.5	17.8	16.4	18.4
Newport News	7.1	53.5	8.2	45.8	49.1	43.0	11.3
Norfolk	10.8	51.3	10.1	44.9	37.0	28.0	13.5
Norton	7.7		3.7	42.6	27.7		60.5
Pearisburg	7.9		5.1	36.2			14.6

	Percent of Medicare Enrollees Receiving Immunization Against Pneumococcal Pneumonia At Least Once in a Two-Year Period (1995-96)	Percent of Female Medicare Enrollees Age 65-69 Having At Least One Mammogram in a Two-Year Period (1995-96)	Percent of Medicare Enrollees Receiving Annual Screening for Colorectal Cancer (1995-96)	Percent of Diabetic Medicare Enrollees Receiving Annual Eye Examinations (1995-96)	Percent of Diabetic Medicare Enrollees Receiving Annual HgbA1c Testing (1995-96)	Percent of Diabetic Medicare Enrollees Receiving Annual Blood Lipids Testing (1995-96)	Admission for Ambulatory Care Sensitive Conditions per 1,000 Residents (1996-97)
Pennington Gap							26.8
Petersburg	7.2	60.9	5.8	40.3	18.6	34.2	22.3
Portsmouth	8.7	51.8	15.1	51.7	40.2	30.1	16.3
Pulaski	10.2		8.4	43.8		33.3	18.5
Radford	8.2		6.4	53.2	42.6		13.8
Reston	9.9	46.9	15.7	49.1	49.1	29.1	8.4
Richlands							49.8
Richmond	7.8	48.3	7.6	46.6	38.1	36.8	15.4
Roanoke	8.4	25.7	6.5	38.8	47.4	32.5	10.8
Rocky Mount			4.4	55.9	66.1	27.1	17.6
Salem	8.4	40.7	4.8	43.6	35.1	24.5	8.5
South Boston	7.8	46.7	5.2	42.5	25.2	38.6	21.9
South Hill	7.4	45.5	3.5	37.3	28.4	49.3	27.0
Staunton	18.4	36.6	7.9	44.2	26.2	25.6	15.9
Stuart							18.3
Suffolk	13.5	44.7	9.4	50.8	25.0	29.2	18.1
Tappahannock	12.8		10.3	34.7	42.9	36.7	14.6
Tazewell	13.5		5.9	(48.0)	(52.0)	(52.0)	9.6
Virginia Beach	13.1	57.0	9.8	38.9	47.7	35.2	11.2
Warrenton	13.1		6.3	44.6	69.6	64.3	12.5
Williamsburg	12.7	54.8	9.9	53.6	36.9	39.3	13.0
Winchester	12.0	38.9	6.5	26.9	44.4	40.6	18.4
Woodbridge	10.5		8.1	25.0	46.9	45.3	12.2
Woodstock	14.9		4.4	50.8	50.8	57.1	19.6
Wytheville	7.1	(56.5)	5.4	55.6	29.6	29.6	16.2
Virginia	9.9	46.4	8.7	43.6	39.3	36.0	15.0
United States	**8.9**	**49.0**	**12.3**	**45.3**	**35.6**	**33.1**	

CHAPTER SIX

The Experience of Death in Virginia

The Experience of Death in Virginia

Modern technology has vastly extended the ability to intervene in the lives of patients, most dramatically so when life itself is at stake. But the capability to intervene is not uniformly deployed, and health care providers do not share a uniform propensity to hospitalize dying patients or to use technology at the end of life. The experience of death for residents of Virginia varied remarkably from one community to another in 1995-96. For example:

- The chance that when death occurred, it occurred in a hospital, ranged from 20% to 50%. Nationally, the chance of an in-hospital death was 33%.

- The average number of days Medicare enrollees spent in hospitals during the last six months of life varied by a factor more than two, from 7.3 to 17.3.

- The chance of being in an intensive care unit one or more times during the last six months of life varied by a factor of more than four, from less than 12% to almost 50%.

- The likelihood that a Medicare enrollee would spend seven or more days in an intensive care unit during the last six months of life varied by a factor of more than of two, from 6.6% to more than 15%.

- Price adjusted reimbursements by the Medicare program for hospital (inpatient) care during the last six months of life varied by a factor of two, from about $6,700 to more than $13,500.

Like other medical decisions, end of life decisions about the use of resources are usually influenced by the available supply. The amount of acute care hospital resources allocated to residents of hospital service areas had a strong influence on the experience of death in Virginia.

Data in this chapter are drawn from the Medicare claims database, and apply to the Medicare population. In some cases, hospital referral regions (aggregations of hospital service areas) are used as the unit of analysis due to the relatively small numbers of procedures performed on an annual basis.

The Likelihood That Death Will Occur in a Hospital, Rather Than Elsewhere

In 1995-96, one-third of Medicare enrollees in the United States who died were hospital inpatients at the time of death. In Virginia, the likelihood of a Medicare enrollee's being in a hospital at time of death averaged 34.8%, varying from 20.6% to more than 50%.

Among the hospital service areas in Virginia where the likelihood of death occurring in a hospital was higher than the national average were Lebanon (52.0%); Norton (49.3%); Abingdon (49.0%); Pulaski (47.6%) and South Hill (46.1%)

Residents of the hospital service areas in Culpeper (20.6%); Stuart (21.6%); Lexington (23.2%); Reston (23.5%); Woodbridge (23.6%) and Falls Church (26.3%) were less likely to die as inpatients than the national average.

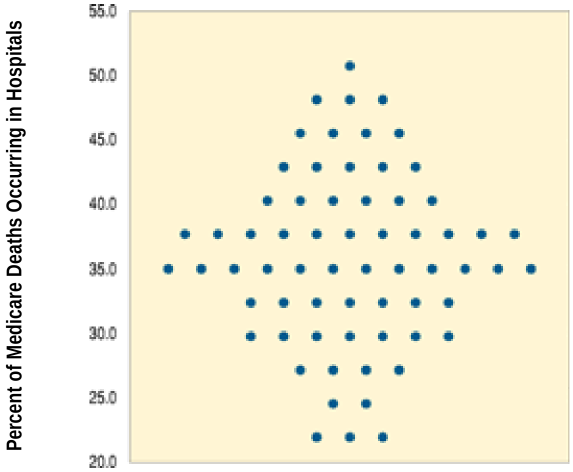
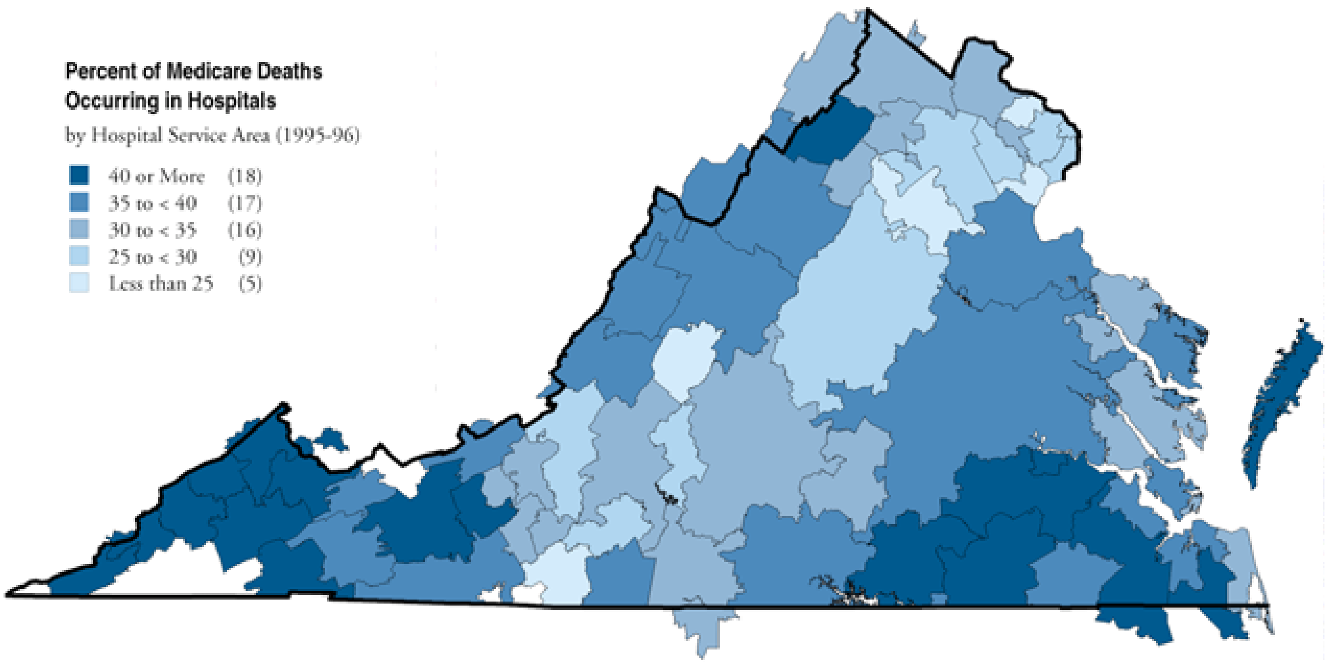


Figure 6.1. Percent of Medicare Deaths Occurring in Hospitals (1995-96)
The percent of hospitalized deaths varied from about 20% to more than 50%, after adjustment for differences in the age, sex and race of populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 6.1. Percent of Medicare Deaths Occurring in Hospitals (1995-96)

In 18 hospital service areas, the percent of hospitalized deaths was 40% or more. In five hospital service areas, less than 25% of deaths occurred in hospitals.

The Likelihood of Hospitalization During the Last Six Months of Life

In 1995-96, more than two-thirds of Medicare enrollees were admitted to hospitals one or more times during the last six months of their lives. In Virginia, the likelihood of a Medicare enrollee's admission to a hospital during the last six months of life averaged 68.1%, varying from 55% to more than 80%.

Among the hospital service areas in Virginia where the likelihood of being admitted to a hospital at least once during the last six months of life was higher than the national average were Norton (81.4%); Lebanon (81.2%); Clintwood (81.0%); Richlands (80.7%) and Pulaski (80.1%).

Residents of the Lexington (55.1%); Culpeper (59.2%); Woodbridge (60.2%); Falls Church (60.8%) and Salem (61.5%) hospital service areas were less likely to be admitted to hospitals during the last six months of their lives than the national average.

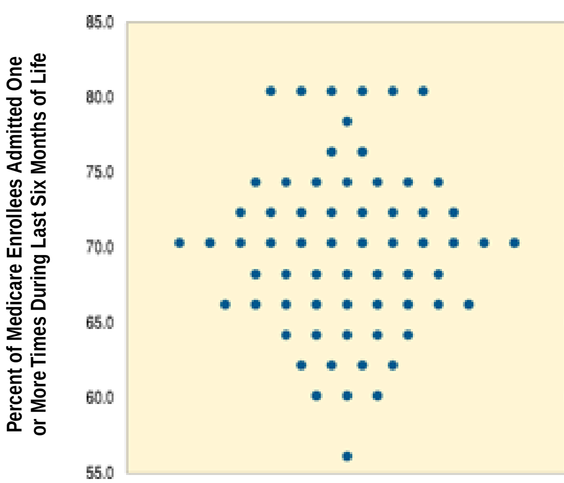
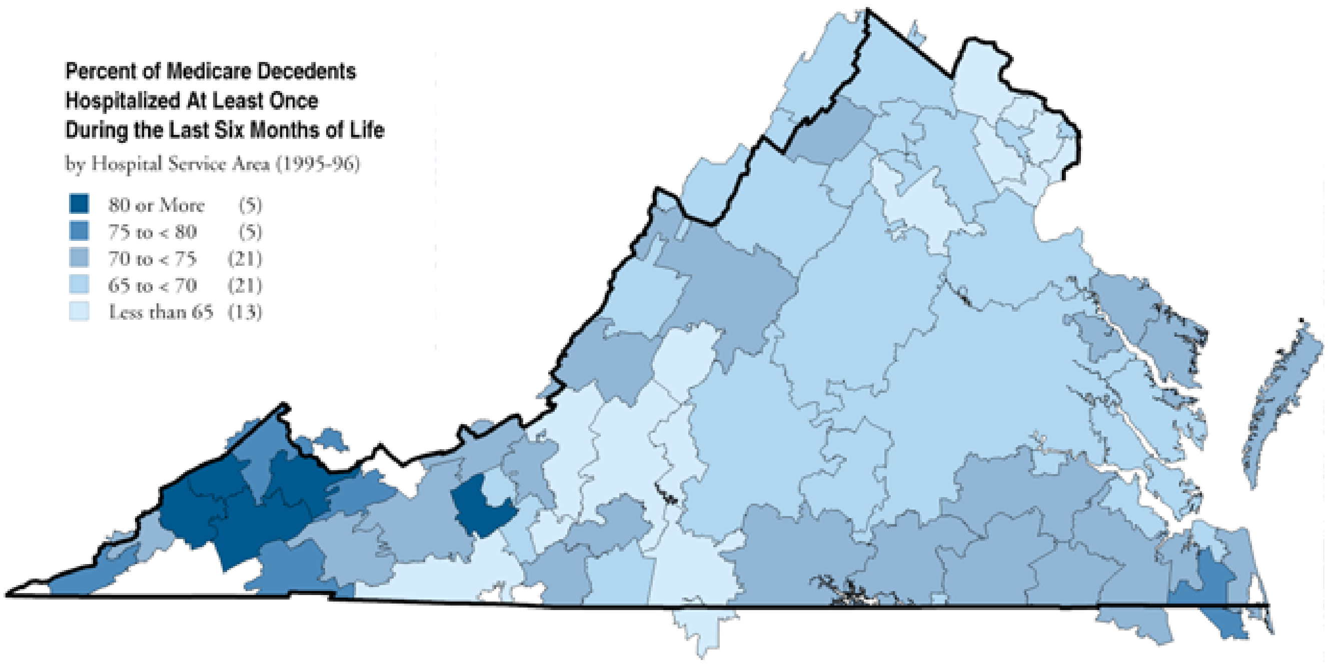


Figure 6.2. Percent of Medicare Enrollees Admitted to Hospitals One or More Times During the Last Six Months of Life (1995-96)
The likelihood that a Medicare enrollee would be admitted to a hospital at least once during the last six months of life varied from 55% to more than 80%. Each point represents one of the 65 hospital service areas in Virginia.



Map 6.2. Percent of Medicare Enrollees Admitted to Hospitals One or More Times During the Last Six Months of Life (1995-96)

In five hospital service areas, rates of admissions to hospitals during the last six months of life averaged at least 80%. In thirteen hospital service areas, the likelihood of admission was less than 65%.

Days in Hospitals During the Last Six Months of Life

In 1995-96, Medicare enrollees in the United States spent an average of 10.6 days in hospitals during the last six months of their lives. In Virginia, the number of days Medicare enrollees spent in hospitals during their last six months of life averaged 10.5, varying by a factor of more than two, from 7.3 to 17.3.

Residents of the Grundy (17.3); Lebanon (16.8); Richlands (16.7); Norton (16.3) and Pennington Gap (16.1) hospital service areas spent substantially more of their last days in hospitals than the state and national averages.

Residents of the Culpeper (7.3); Lexington (7.3); Manassas (8.0); Charlottesville (8.1) and Reston (8.4) hospital service areas spent fewer than average numbers of days in hospitals during their last six months of life.

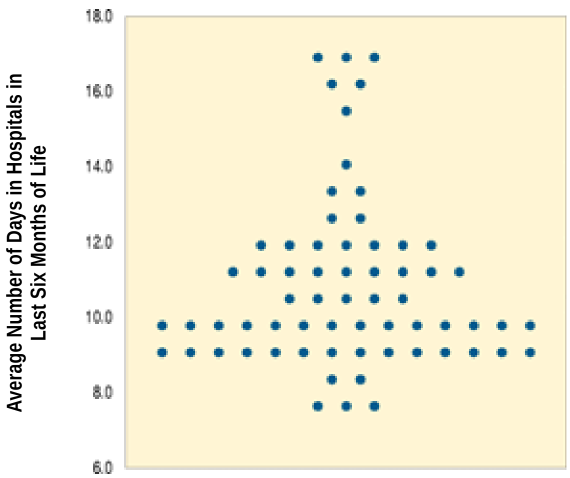
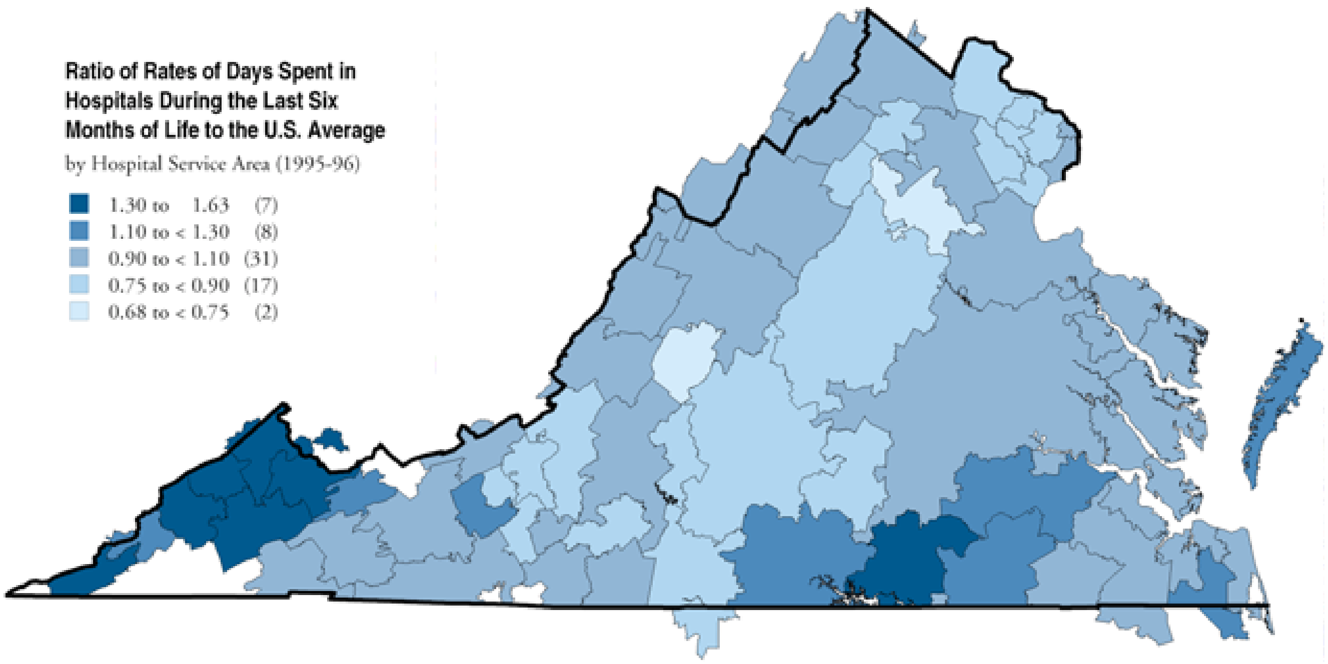


Figure 6.3. Average Number of Days Spent in Hospitals During the Last Six Months of Life (1995-96)

The average number of days Medicare enrollees in Virginia spent in hospitals during their last six months of life ranged from 7.3 to 17.3, after adjustment for differences in the age, sex and race of populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 6.3. Average Number of Days Spent in Hospitals During the Last Six Months of Life (1995-96)

In seven hospital service areas, Medicare enrollees spent at least 30% more days in hospitals during their last six months of life than the national average. In two hospital service areas, enrollees spent more than 25% fewer days in hospitals than the average.

The Likelihood of Admission to Intensive Care During the Last Six Months of Life

In 1995-96, almost one-third of Medicare enrollees in the United States were admitted to intensive care units one or more times during the last six months of their lives. In Virginia, the likelihood of a Medicare enrollee's admission to an intensive care unit during the last six months of life averaged 31.4%, varying from less than 12% to almost 50%.

The likelihood of being admitted to an intensive care unit at least once during the last six months of life was higher than the national average among residents of the Norton (49.4%); Suffolk (41.9%); Clintwood (41.4%); Virginia Beach (41.3%) and South Hill (40.7%) hospital service areas.

Residents of the Luray (11.8%); Manassas (19.2%); Danville (21.9%); Culpeper (22.8%) and Winchester (23.4%) hospital service areas were less likely to be admitted to intensive care units during the last six months of their lives than the national average.

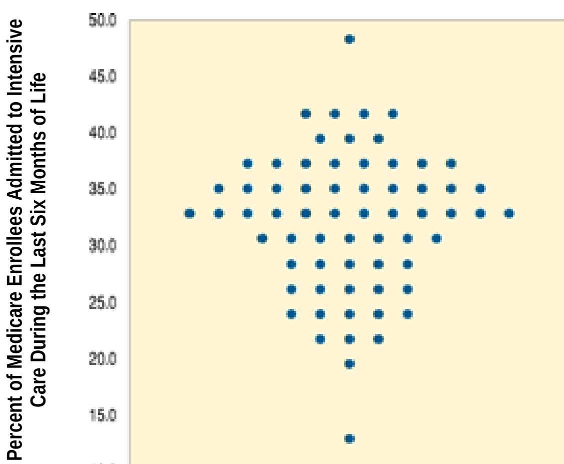
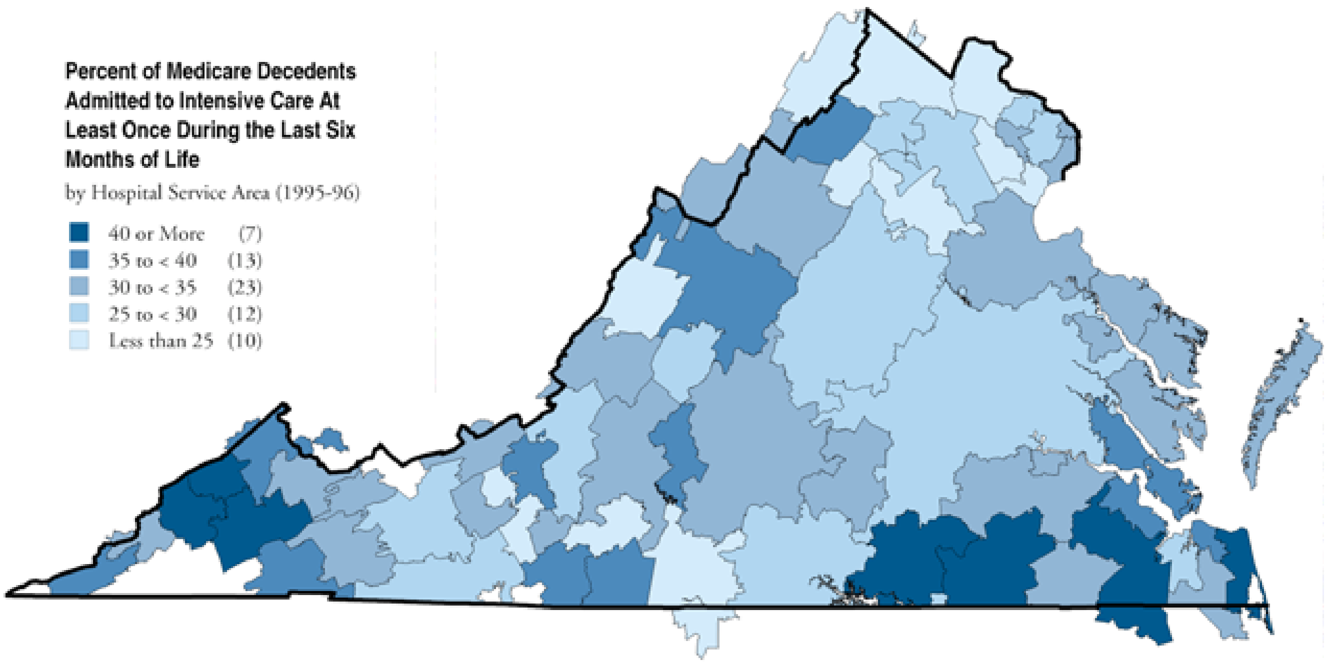


Figure 6.4. Percent of Virginia Medicare Enrollees Admitted to Intensive Care One or More Times During the Last Six Months of Life (1995-96)
The likelihood of being admitted to an intensive care unit at least once during the last six months of life varied from less than 12% to almost 50%, after adjustment for differences in the age, sex and race of populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 6.4. Percent of Virginia Medicare Enrollees Admitted to Intensive Care One or More Times During the Last Six Months of Life (1995-96)

In seven hospital service areas, 40% or more of Medicare enrollees were admitted to intensive care units at least once during their last six months of life. In ten hospital service areas, the likelihood of such admissions was less than 25%.

The Likelihood of Spending Seven or More Days in Intensive Care During the Last Six Months of Life

In 1995-96, 11.0% of Medicare enrollees spent seven or more days in intensive care during their last six months of life. The Virginia average was slightly higher (11.4%). The percent of decedents who spent at least a week in intensive care varied by a factor of more than two, from 6.6% to 15.3%.

Residents of the Norfolk (15.3%), Newport News (14.8%) and Lynchburg (12.7%) hospital referral regions were more likely than Medicare enrollees elsewhere to spend at least seven days in intensive care during their last six months of life.

Residents of the Winchester (6.6%), Arlington (9.0%) and Charlottesville (9.8%) hospital referral regions were less likely than decedents elsewhere to spend at least a week in intensive care.

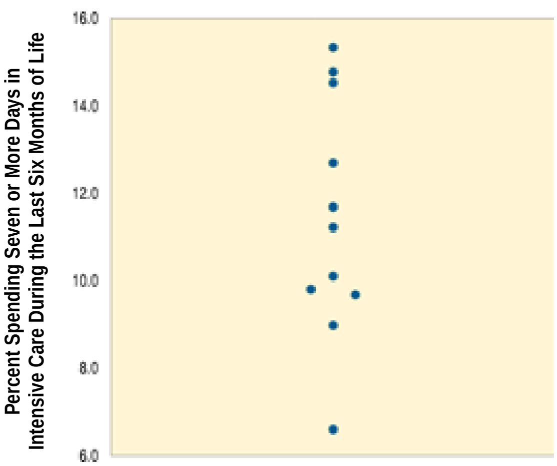
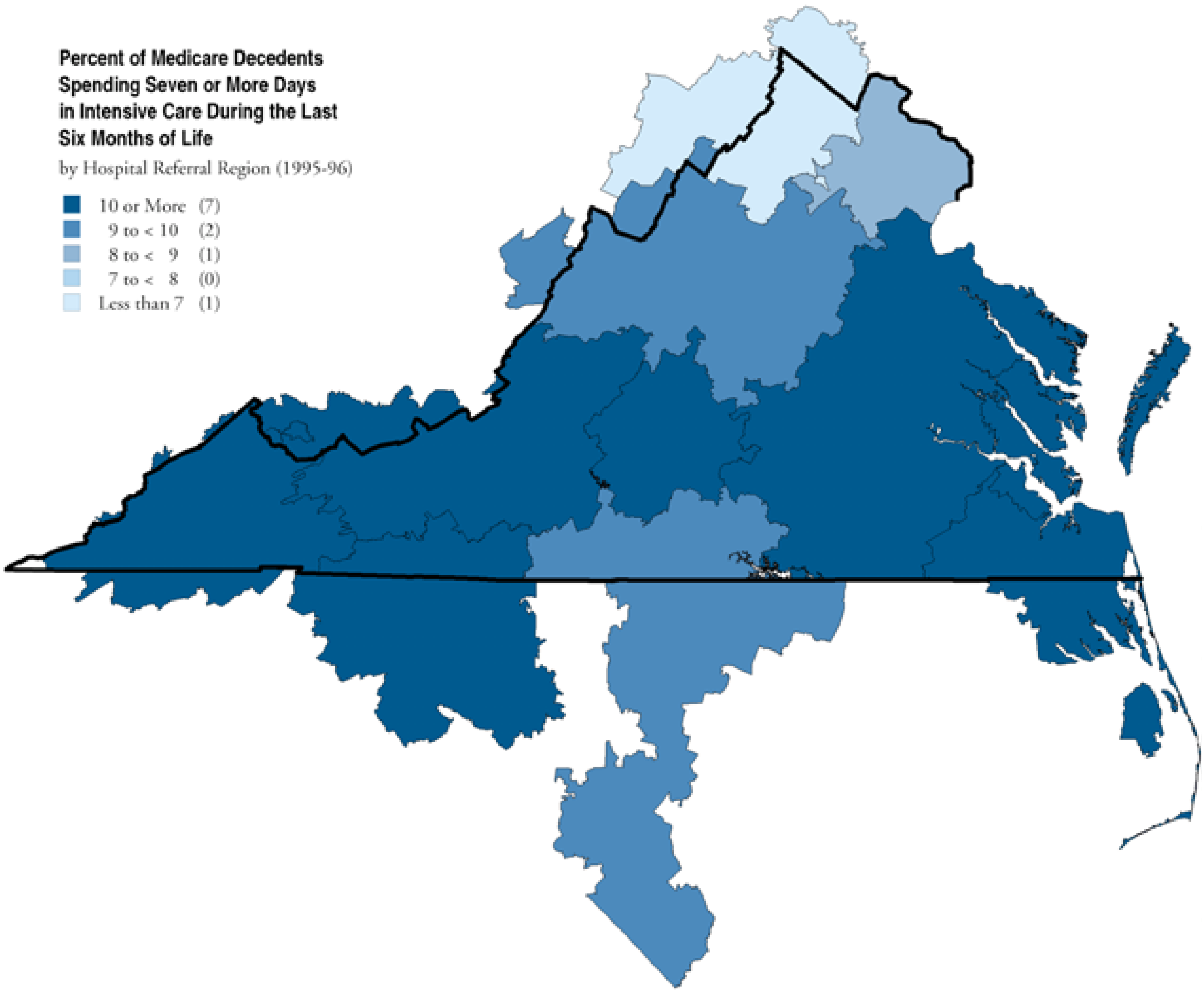


Figure 6.5. Percent Spending Seven or More Days in Intensive Care During the Last Six Months of Life (1995-96)

The likelihood of spending at least seven days in intensive care at the end of life varied from 6.6% to 15.3%. Each point represents one of the hospital referral regions in Virginia.



Map 6.5. Percent Spending Seven or More Days in Intensive Care During the Last Six Months of Life (1995-96)

In seven hospital referral regions, 10% or more of Medicare decedents spent at least seven days in intensive care units during their last six months of life. There was one region in which fewer than 8% of Medicare enrollees who died had spent at least a week in intensive care in the previous six months.

The Likelihood of Admission to Intensive Care During the Terminal Hospitalization

In 1995-96, an average of 16.9% of Medicare enrollees who died had been admitted to an intensive care unit during the terminal hospitalization (hospitalization in which the enrollee died). The average was slightly higher in Virginia (17.3%). Among Virginia hospital service areas, the likelihood of admission to intensive care during the terminal hospitalization varied from less than 6% to more than 25%.

Among the hospital service areas in which admissions to intensive care during terminal hospitalizations were higher than the state and national averages were Norton (27.2%); South Hill (25.1%); Suffolk (24.9%); Emporia (23.8%) and Hampton (23.2%).

In other hospital service areas, rates of admission to intensive care units at the time of death were substantially lower than the state average, including Luray (5.9%); Manassas (10.7%); Culpeper (11.5%); Winchester (12.1%) and Woodbridge (12.2%).

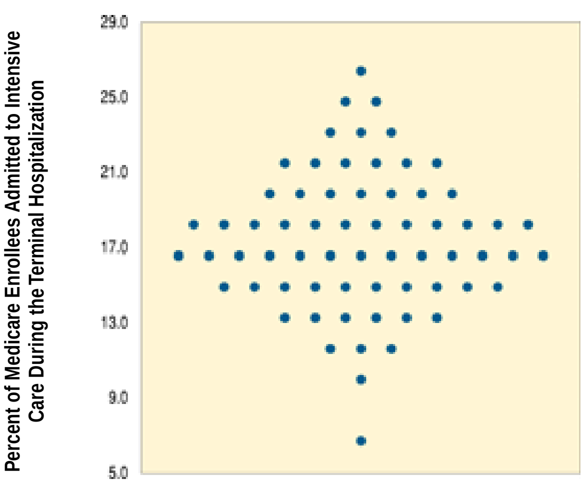
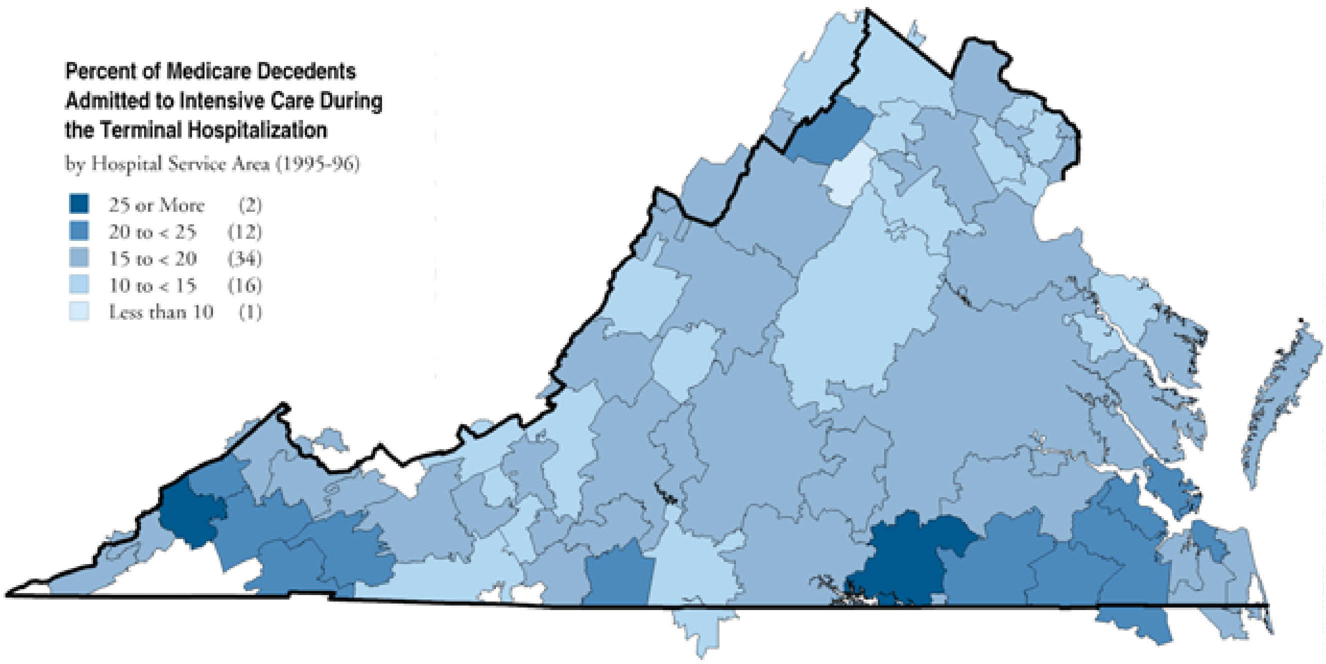


Figure 6.6. Percent of Medicare Decedents Admitted to Intensive Care During the Terminal Hospitalization (1995-96)

The likelihood that a hospitalized death would include an admission to an intensive care unit varied from less than 6% to more than 25%, after adjustment for differences in the age, sex and race of populations. Each point represents one of the 65 hospital service areas in Virginia.



Map 6.6. Percent of Medicare Decedents Admitted to Intensive Care During the Terminal Hospitalization (1995-96)

In two hospital service areas, 25% or more of Medicare decedents who died in hospitals had been admitted to intensive care. In one hospital service area, less than 10% of decedents were admitted to intensive care.

Reimbursements for Inpatient Care During the Last Six Months of Life

In 1995-96, the amount reimbursed by the federal government for the inpatient hospital care of Medicare enrollees during their last six months of life averaged $9,943. Medicare reimbursements for residents of Virginia during the last six months of life averaged $8,778, varying by a factor of two, from about $6,700 to more than $13,500.

Reimbursements for inpatient care at the end of life were higher than the national average for residents of the Lebanon ($13,736); Grundy ($13,645); Richlands ($13,452); Pennington Gap ($13,282) and Norton ($12,334) hospital service areas.

Reimbursements for residents of the Manassas ($6,684); Woodbridge ($6,827); Fairfax ($6,882); Culpeper ($7,018) and Bedford ($7,155) hospital service areas were lower than the national average.

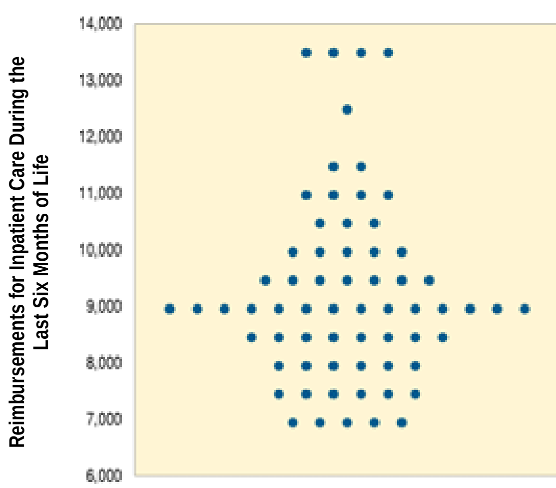
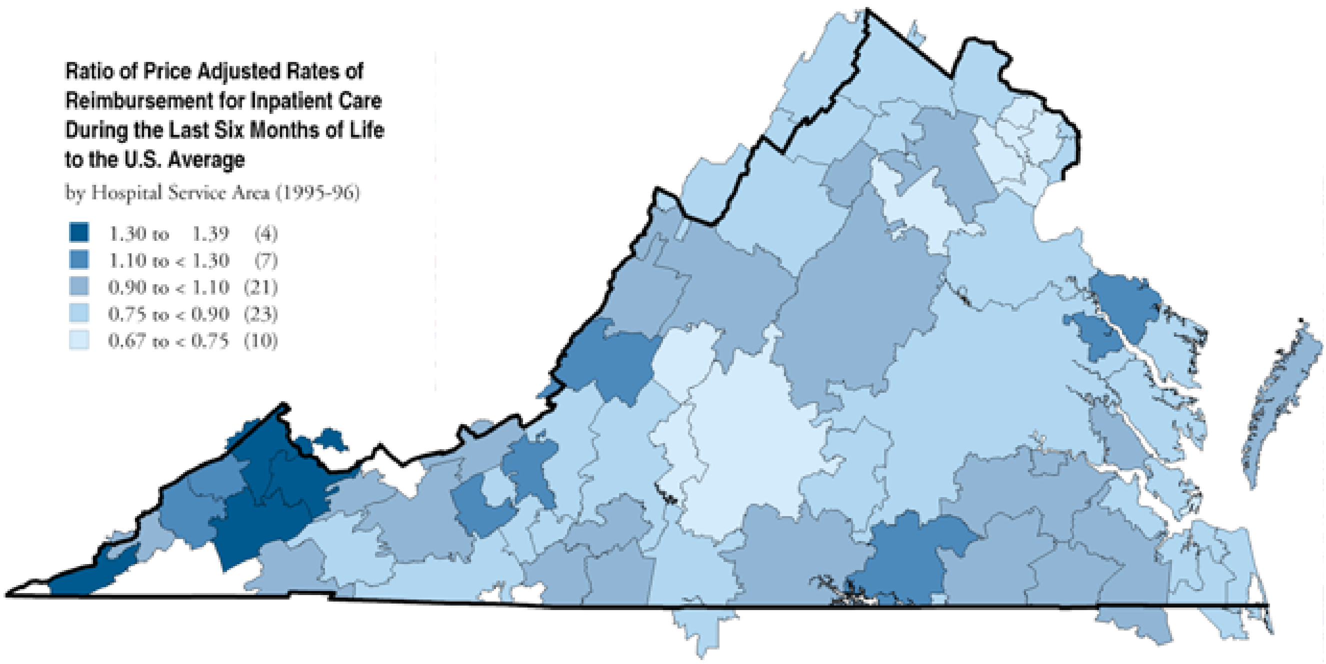


Figure 6.7. Reimbursements for Inpatient Care During the Last Six Months of Life (1995-96)

Rates of reimbursement for inpatient care at the end of life varied from less than $6,700 to more than $13,700, after adjustment for differences in population age, sex and race, and regional differences in prices. Each point represents one of the 65 hospital service areas in Virginia.



Map 6.7. Reimbursements for Inpatient Care During the Last Six Months of Life (1995-96)

Four hospital service areas had rates of reimbursements at least 30% higher than the national average of $9,943. Ten hospital service areas had rates more than 25% below the average.

Reimbursements for Intensive Care During the Last Six Months of Life

In 1995-96, the amount reimbursed by the federal government for the intensive care of Medicare enrollees during their last six months of life averaged $2,492. Medicare reimbursements for residents of Virginia, at $1,971, were lower than the national average. Average reimbursements varied by a factor of more than 4.5, from $736 to $3,439.

Reimbursements for intensive care at the end of life were higher than the national average for residents of the Norton ($3,439); Martinsville ($2,888); Emporia ($2,876); Newport News ($2,866) and Williamsburg ($2,855) hospital service areas.

Reimbursements for residents of the Reston ($852); Manassas ($865); Danville ($1,007); Woodbridge ($1,035) and Winchester ($1,036) hospital service areas were lower than the national average.

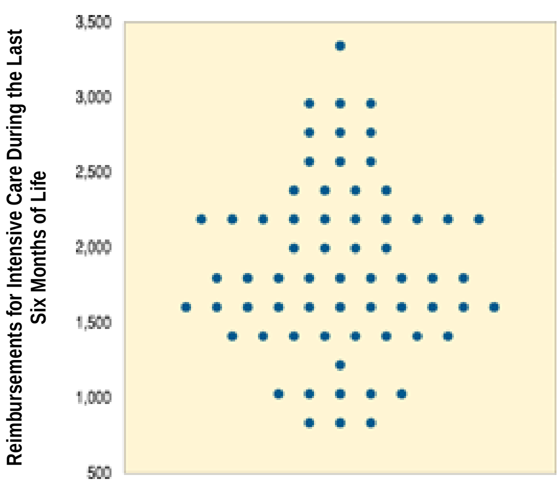
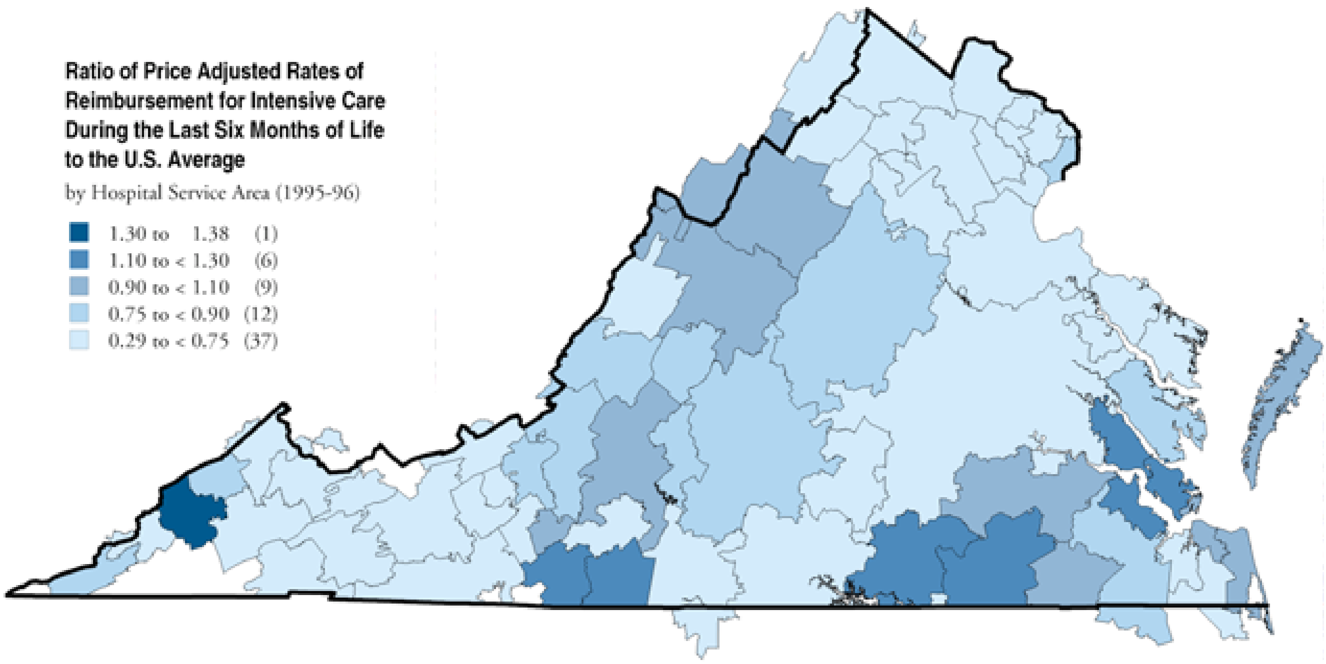


Figure 6.8. Reimbursements for Intensive Care During the Last Six Months of Life (1995-96)

Average reimbursements for intensive care varied from $736 to $3,439, after adjustment for differences in population age, sex and race, and regional differences in prices. Each point represents one of the 65 hospital service areas in Virginia



Map 6.8. Average Price Adjusted Reimbursements for Intensive Care During the Last Six Months of Life (1995-96)

One hospital service area had a reimbursement rate at least 30% higher than the United States average of $2,492. Thirty-seven hospital service areas had rates more than 25% below the average.

Chapter Six Table Notes

All hospitalization and utilization rates are based on Medicare deaths occurring during the period July 1, 1995 — December 31, 1996, and are expressed as rates per person (per decedent). Rates are age, sex, and race adjusted and reimbursements are also adjusted for differences in prices. Data exclude Medicare enrollees who were members of risk-bearing health maintenance organizations.

See the Appendix on Methods for details on the methods used for allocating resources, estimating populations, measuring utilization and adjusting rates, and for other details concerning the rates in this table.

CHAPTER SIX TABLE

The Experience of Death in Virginia (1995-96)

Virginia HSA City	Medicare Deaths (1995-96)	Percent of Medicare Deaths Occurring in Hospitals (1995-96)	Percent of Medicare Decedents Hospitalized During the Last Six Months of Life (1995-96)	Average Hospital Days per Decedent During the Last Six Months of Life (1995-96)	Percent of Medicare Decedents Admitted to Intensive Care During the Last Six Months of Life (1995-96)	Percent of Medicare Decedents Admitted to Intensive Care During the Terminal Hospitalization (1995-96)	Price Adjusted Medicare Reimbursements for Inpatient Care During the Last Six Months of Life per Decedent (1996)	Price Adjusted Medicare Reimbursements for Intensive Care During the Last Six Months of Life per Decedent (1996)
Abingdon	461	49.0	75.1	10.9	35.9	20.5	8,994	1,797
Alexandria	1,481	27.4	63.0	10.8	32.3	16.4	8,095	2,130
Arlington	1,354	29.3	66.4	10.7	31.0	17.1	8,799	1,780
Bedford	319	28.3	64.5	9.3	37.5	16.3	7,155	2,107
Big Stone Gap	211	45.7	74.1	13.2	33.8	19.6	9,668	1,588
Blacksburg	422	34.2	74.6	9.2	37.4	17.0	11,211	2,148
Charlottesville	1,870	27.2	66.5	8.1	25.3	13.5	9,228	2,098
Chesapeake	857	41.0	76.3	12.2	31.7	18.5	8,918	1,769
Clintwood	131	42.6	81.0	15.4	41.4	20.7	11,032	1,990
Culpeper	324	20.6	59.2	7.3	22.8	11.5	7,018	1,320
Danville	1,353	34.4	63.8	8.8	21.9	13.8	8,044	1,007
Emporia	378	41.1	71.4	11.7	40.5	23.8	9,357	2,876
Fairfax	210	31.4	66.3	8.8	32.3	17.4	6,882	1,476
Falls Church	2,400	26.3	60.8	9.1	26.4	14.6	7,452	1,638
Farmville	385	32.4	68.7	8.9	32.5	19.8	8,626	1,838
Franklin	326	39.6	73.4	11.2	34.8	20.0	10,023	2,450
Fredericksburg	1,208	36.3	68.9	11.6	32.6	17.5	8,109	1,411
Front Royal	266	33.4	70.0	9.1	28.8	13.0	7,693	1,296
Galax	620	35.5	64.4	9.5	25.9	14.6	8,374	1,527
Gloucester	468	31.4	66.8	10.1	30.9	17.4	8,150	2,154
Grundy	253	45.3	78.8	17.3	35.0	16.7	13,645	1,642
Hampton	682	34.9	65.8	9.7	37.0	23.2	7,341	2,661
Harrisonburg	1,108	37.1	65.5	10.0	32.4	18.1	8,596	2,561
Hopewell	350	40.5	69.8	11.0	30.5	16.7	9,012	1,065
Hot Springs	93	35.0	68.3	11.3	22.0	13.3	10,165	736
Kilmarnock	519	36.4	70.3	9.7	34.1	17.9	8,847	1,636
Lebanon	323	52.0	81.2	16.8	40.3	22.5	13,736	1,686
Leesburg	374	30.8	63.3	8.7	24.7	15.4	8,632	1,496
Lexington	337	23.2	55.1	7.3	28.1	14.9	7,409	2,088
Low Moor	425	36.4	73.9	11.4	33.3	16.6	10,969	1,926
Luray	203	34.6	70.0	8.9	11.8	5.9	9,465	1,119
Lynchburg	2,211	32.6	66.1	9.0	34.4	17.6	7,200	1,960
Manassas	509	28.9	63.1	8.0	19.2	10.7	6,684	865
Marion	466	36.6	70.4	10.0	34.8	21.4	8,867	1,663
Martinsville	886	37.8	68.3	10.1	38.1	21.5	9,244	2,888
Nassawadox	527	40.9	72.4	13.6	34.1	18.5	9,172	2,277
Newport News	2,156	36.4	69.8	10.4	37.8	21.6	8,416	2,866
Norfolk	2,576	36.7	68.9	10.0	37.3	21.8	8,725	2,360
Norton	353	49.3	81.4	16.3	49.4	27.2	12,334	3,439
Pearisburg	234	38.6	72.6	9.8	32.6	14.5	10,125	1,388

	Medicare Deaths (1995-96)	Percent of Medicare Deaths Occurring in Hospitals (1995-96)	Percent of Medicare Decedents Hospitalized During the Last Six Months of Life (1995-96)	Average Hospital Days per Decedent During the Last Six Months of Life (1995-96)	Percent of Medicare Decedents Admitted to Intensive Care During the Last Six Months of Life (1995-96)	Percent of Medicare Decedents Admitted to Intensive Care During the Terminal Hospitalization (1995-96)	Price Adjusted Medicare Reimbursements for Inpatient Care During the Last Six Months of Life per Decedent (1996)	Price Adjusted Medicare Reimbursements for Intensive Care During the Last Six Months of Life per Decedent (1996)
Pennington Gap	244	46.0	76.6	16.1	37.2	19.9	13,282	2,222
Petersburg	1,195	42.0	70.6	11.9	33.9	19.5	9,112	2,456
Portsmouth	1,513	38.1	71.2	11.3	28.4	17.7	8,788	1,558
Pulaski	291	47.6	80.1	12.4	32.2	17.9	11,516	1,491
Radford	371	32.9	69.4	9.0	25.0	12.6	8,541	1,347
Reston	454	23.5	62.6	8.4	26.5	13.0	7,209	852
Richlands	315	41.0	80.7	16.7	33.3	16.4	13,452	1,862
Richmond	7,851	35.0	67.6	11.1	27.5	15.1	8,795	1,862
Roanoke	2,694	34.2	64.0	9.9	30.6	17.5	7,993	2,250
Rocky Mount	249	30.0	71.8	8.9	24.8	15.6	9,057	1,807
Salem	650	29.6	61.5	9.2	25.2	14.2	7,663	1,920
South Boston	807	38.5	71.0	11.7	29.7	19.4	10,322	1,686
South Hill	390	46.1	71.6	14.4	40.7	25.1	11,098	2,819
Staunton	1,118	35.2	72.8	9.7	35.6	16.4	10,177	2,445
Stuart	173	21.6	73.5	9.8	38.1	17.3	10,556	2,766
Suffolk	661	42.7	71.9	11.6	41.9	24.9	8,999	2,232
Tappahannock	349	34.8	74.8	10.9	34.3	14.3	11,457	1,710
Tazewell	193	38.9	79.5	12.5	31.8	16.5	10,677	1,471
Virginia Beach	1,479	33.4	70.3	10.0	41.3	18.9	8,841	2,625
Warrenton	405	29.3	65.9	10.1	27.6	15.6	9,336	1,616
Williamsburg	513	34.6	68.9	10.1	36.1	17.8	9,277	2,855
Winchester	1,024	30.4	66.0	10.4	23.4	12.1	8,614	1,036
Woodbridge	394	23.6	60.2	8.8	24.5	12.2	6,827	1,035
Woodstock	273	43.5	72.6	11.2	38.4	21.7	8,564	1,860
Wytheville	424	43.2	70.6	11.6	29.9	17.2	10,069	1,617
Virginia	53,659	34.8	68.1	10.5	31.4	17.3	8,778	1,971
United States	2,278,277	33.0	68.4	10.6	31.4	16.9	9,943	2,492

CHAPTER SEVEN

Which Rate is Right? How Much is Enough? and What is Fair?

Which Rate is Right? How Much is Enough? and What is Fair?

Ideally, the use of health care services by a given population would depend on local levels of illness, and would comprise an efficient mix of preventive, acute and chronic care. Resource allocation decisions would be guided at the patient level by need and knowledge of outcomes, and by the tradeoffs patients made between the costs, risks and benefits of care. At the population level, resource allocation decisions would be made based on society's beliefs about cost-effectiveness and social justice. Ideally, spending by the Medicare program would also reflect the goals of efficiency and equity.

Unfortunately, the Dartmouth Atlas series provides little evidence that these ideals are being achieved — that the quantities of health services and resources consumed by Americans are determined by patient needs and preferences, or by knowledge about the outcomes of care, much less by consensus about society's needs and priorities. On the contrary, the Dartmouth Atlas series, including the Dartmouth Atlas of Health Care in Virginia, demonstrates that:

- There is wide variation in health care spending, and in the supply of acute care hospital resources and physicians among the nation's, and Virginia's, hospital service areas.

- Hospital capacity has a dominating influence on hospital utilization rates, particularly for medical conditions.

- There is wide variation in the intensity of hospital care that Medicare residents, including those who live in Virginia, receive during the last six months of their lives, and the variation is closely associated with local supplies of hospital resources.

- Discretionary surgical procedures have idiosyncratic patterns which result in local "surgical signatures," a phenomenon which can be traced to scientific uncertainty about what works and the failure to involve patients in a meaningful way in the surgical decision making process.

The reality of health care in the United States, and in Virginia, is that geography is destiny. The amount of care consumed depends more on where people live — the local supply of resources and the prevailing practice style — than on their needs or preferences.

Practice variations challenge basic assumptions about the nature of the health care economy and theories as to how it should be reformed. While it is beyond the scope of the Atlas series to consider the question of how policies for addressing variations in health care delivery might be specifically designed or implemented, the Atlas can help frame the debate over what should be done.

Surgical variations point to the need for better science at the patient level and the need to bring the patient into the decision process through shared decision making. Through the diligent application of outcomes research, much can be learned about what works in medicine, particularly in those kinds of care where a discrete intervention, such as a drug or a surgical procedure, is hypothesized to improve outcomes in specific ways. By bringing patients into the decision process through shared decision making, health care markets can be improved so that the use of care reflects the preferences of patients, rather than the preferences of providers or payers. Part I of this chapter addresses these opportunities for improving health care delivery.

The struggle for rationality at the patient level of care is both never-ending and fated to only partial success. New medical ideas and technologies will constantly challenge, and often outstrip, our best efforts to evaluate the end results of care. Moreover, much of clinical decision making is not driven by discrete, testable hypotheses, but by the need to help solve the myriad and complex sets of problems patients bring to physicians. When problem solving decisions are made under the assumption that more is always better, as is common in the United States, the supply of medical resources will always be used up to the point of exhaustion, regardless of how much is available. Rational reform requires a policy for setting limits.

Part II of this chapter considers the problem of variation in hospital capacity and the inevitable association between having more resources and providing more services. How should the debate over whether more is better be framed? The first step is to understand the impact of increased supply on population-based utilization and outcomes. Most of the marginal resources in the acute care hospital sector appear to be invested in admitting patients to medical wards in the hope of reducing mortality. The most important outcome question, then, is population mortality: Do patient populations destined to receive more care in hospitals on the basis of their residence live longer than their counterparts in regions with fewer resources who receive less?

Part III of this chapter discusses the necessity, when setting limits on health care capacity, of addressing the issue of the physician workforce. The impact of an increase in physician supply on rates of delivery of specific services depends on the physicians' specialties, their incentives to work, and, ultimately, on the idiosyncratic nature of the individual physician's "practice style." The complexities of the impact of physician supply on utilization make it impossible to base workforce planning on either patient level need and outcomes or on patient demand. In making decisions about supporting subsidies to medical education, or recruiting physicians into a system of care, it is helpful to use a method of benchmarking (described in the Dartmouth Atlas of Health Care 1998) that allows planners to compare workforce levels between communities to arrive at rational estimates of how many physicians are needed and what the effect is likely to be of increasing the local workforce through recruitment. Benchmarking allows communities, health systems, and providers to compare specific regional workforces to other workforces and to health plans that have been successful in competitive markets, are low cost, and where global outcomes, measured at the population level, are satisfactory.

Part IV of this chapter is a summary statement that focuses the debate on the fundamental issue of value in health care, and how to involve patients in medical decision making.

I. Islands of Rationality

The tradition of decision making based on professional paternalism does not deal well with the complex tradeoffs created by modern technology. Rates of elective surgery and other discretionary interventions, which now are determined in large part by practice style and geographic variations in resources, should be determined by the choices informed patients make. To accomplish this "right rate," patients must participate in the decision making process; to do so, patients must understand what is known, as well as what is not known, about the outcomes that matter to them. Further, patients must be enabled to choose according to their own preferences, even if they ultimately decide to let their doctors decide for them.

This reform will require a new model of clinical decision making. Fortunately, the time is ripe; the escalation in medical spending over the past three decades has created an environment in which it has become possible for patients to challenge the paternalistic role of physicians as agents and sole decision makers. Employers, as payers, have promoted the growth of managed care, which challenges the autonomy of physicians, imposes rules on clinical medicine, and substitutes the managed care company as the decision maker. This transfer of agency power to third parties — payers, insurance companies, and health maintenance organizations — has opened a national debate about the role of the patient in the choice of medical care.

A new model of the doctor-patient relationship is emerging. Shared decision making recognizes the complex tradeoffs that patients must make in the choice of medical care, and addresses the ethical requirement to fully inform patients about the risks and benefits of treatments as well as the need to insure that patients' values and preferences play a prominent role in medical decision making.

The shared decision making model holds promise for establishing health care markets in which the right rate of service is determined by the choices made by informed and empowered patients. Shared decision making has been implemented in several clinical studies. The studies provide evidence about both patients' willingness to participate in decisions about their own care, and the rates at which patients choose certain procedures when they are fully informed about the risks and benefits of their choices. Most patients willingly participate in shared decision making, even when, as in the case of early stage prostate cancer, decisions are complicated and difficult because medical science provides no clear evidence that invasive treatment extends life expectancy. The studies of shared decision making also provide initial benchmarks for addressing the question, Which rate is right? The preliminary evidence indicates that the amount of discretionary invasive care now prescribed in the United States might substantially exceed the amount that informed patients actually want.

II. Setting Limits on Hospital Capacity

While shared decision making and patient-level outcomes research hold promise for creating more rational approaches to making choices among available treatments, those strategies do not effectively address global variations in the supply of resources and medical spending. Much of medicine is not driven by well-articulated medical theories that are (at least conceptually) testable by randomized clinical trials or other forms of outcomes research. Hospitalization is often an effort — sometimes a desperate effort — to hold the tide against the inevitable. The quantity of care provided under these circumstances is often limited only by supply. Judgments about how much care is enough must be grounded in an understanding of the relationship between health care capacity and utilization — on how available resources are used. Decisions about how much is enough must also focus on global outcomes. In the case of the supply of acute care hospital resources, the size of the physician workforce, and the level of health care spending, the primary focus should be on the marginal effects of resources and spending on the health outcomes of populations.

The nation is already moving to reduce hospital capacity, although the reduction is happening at a faster rate in areas where resources are already low (such as California) than in areas where resources are high (such as large urban areas on the East Coast). The nature of the relationship between hospital supply and utilization, and the failure to find evidence that more is better, are indications of the validity of using low-resource, low-utilization areas to define reasonable limits. Using such areas as benchmarks, it is possible to estimate the magnitude of potential savings, which could be realized, if high-resource, high-utilization regions were constrained to the level of low-resource, low-utilization regions.

The Dartmouth Atlas web site will allow analysts to use the existing databases, including Medicare claims and the Virginia claims database, to ask these kinds of "What if?" questions. What if resources and utilization in higher-rate areas were reduced to the level of similar, but lower-rate areas? How many hospital beds would need to be closed? How many doctors would be required in the workforce? How many more (or fewer) procedures would be performed? The Atlas raises these questions. The upcoming internet site will make it possible to query the data in additional ways, allowing the analyst to create scenarios for change and to examine the possible repercussions.

III. Setting Limits on the Physician Workforce

The size of the physician workforce in the United States has been determined by factors that have little to do with patient demand for health care, and much to do with federal policy and the needs of training institutions as they are currently structured. In the late 1970s it was widely assumed that the United States faced a physician shortage, which led to policies which encouraged an increase in the number of medical schools and the enlargement of medical school class sizes.

The federal government, through the Medicare program, is the primary source of funding for the training of physicians in residency programs, providing an estimated $70,000 for every resident in training in 1992. The number of specialty residency positions, however, has been determined by the training institutions themselves, aided by an accreditation process that focuses on academic standards, not the numbers of specialists needed by the populations served by the training institutions.

From 1970 to 1996, the supply of clinically active physicians in the United States grew by about 67%, from 113.1 per 100,000 residents to 188.9. During this period, the number of specialists almost doubled, increasing from 63 specialists per 100,000 residents of the United States to 123 per 100,000. The supply of generalist physicians increased from 49 to 65 per 100,000 residents. By 1996, about 66% of the physician workforce were specialists. In Virginia in 1996-97, the numbers of physicians per 100,000 residents ranged from fewer than 100 per 100,000 to almost 250. The average number of physicians in the total physician workforce in Virginia was 170 per 100,000 residents of the state, about 10% lower than the national average.

But how many physicians are really needed? Traditionally, workforce requirements have been focused on the basis of either needs-based or demand-based planning models, both of which are seriously flawed.

Needs-based planning relies on experts to estimate the correct number of physicians to meet need and produce optimal outcomes. Unfortunately, the uncertainties inherent in clinical medicine, rapid changes in technology, and the inevitable failure of outcomes research to keep up with innovation mean that even "experts" are unable to accurately predict the need for physicians.

Demand-based planning assumes that the utilization of care is driven by patient demand; the trends in prevailing rates of service are therefore assumed to be the right rates and are used to project the need for physicians. The evidence that the supply of resources and provider preferences influence the rates of use of care for discretionary services is evidence of the futility of using utilization as a measure of patient demand, and consequently its failure as a method by which to project workforce requirements.

Benchmarking — comparing the workforces in different markets to each other and calculating the excess or deficit in the numbers using a selected area as standard — provides a pragmatic alternative for estimating the requirements for a reasonably-sized workforce. The Atlas series has argued that the hiring practices of large, stable, staff-model health maintenance organizations or the population-based physician supply in regions with efficient delivery systems (such as Minneapolis) should be used as benchmarks for estimating the needed and rational physician workforce for a given area. Benchmarks provide a useful measure of the level of need for several reasons:

- Benchmarks provide working examples of the actual deployment of the workforce, realistic guidelines drawn from successful health care plans or regions. In the case of staff-model health maintenance organizations, workforce configurations have succeeded in competition with fee-for-service markets, often in places such as San Francisco where the numbers of physicians per 100,000 residents serving the fee-for-service market is among the highest in the nation. Regions with efficient health care markets are also useful as benchmarks because their workforce configurations serve entire populations, not just the part of the population enrolled in health maintenance organizations.

- There is little or no evidence that patients are harmed because they are served by health plans or systems with constrained workforces, or live in regions with fewer physicians per capita. Indeed, there is some evidence that the current surgical workforce is more than sufficient to meet patient demand for discretionary surgery.

- Finally, while studies of the global impact of marginal increases in the physician supply on population mortality have not been done and should be encouraged, when it is unclear that spending more is beneficial, common sense argues against the status quo (continuing to produce physicians at a rate which increases the nation's per capita supply), particularly when the trend in the market is toward managed care.

The Dartmouth Atlas web site will provide analysts with the capacity to compare the physician workforce in Virginia's hospital service areas to workforces in other areas of the United States, such as Minneapolis, and to make internal comparisons between hospital service areas in Virginia. Such benchmarking can inform the debate over the current supply of physicians — specialists, by specialty, generalists, and the total workforce — and help policy makers and providers assess the current deployment of physicians in Virginia and plan for future workforce requirements.

IV. Focusing the Debate: A Summary Statement

Health care markets in Virginia are characterized by wide variations in the supply of hospital beds and physicians, in price adjusted spending, in rates of hospitalization and surgery, and in the intensity of care during the last six months of life. Practice variations challenge basic assumptions about the nature of the health care economy and theories about how it should be reformed. For decades, the health care debate has taken place against the background assumption that more is better, and that constraint leads inevitably to the rationing of efficacious health care. It is time to re-frame the debate over health care reform to address the fundamental issue of value itself: Which rate is right? How much is enough? and What is fair?

The Dartmouth Atlas series of publications, including the Dartmouth Atlas of Health Care in Virginia, suggests certain conclusions and important hypotheses that bear on the debate:

- Patients should be fully informed about what is known and what is not known about the outcomes of available treatment options, and should be encouraged to choose among those options according to their own preferences.

- Outcomes research should become part of the everyday practice of medicine, and routine follow up of patients according to treatment choice should be incorporated into strategies to improve the scientific basis for clinical decision making.

- It is both safe for patients and in the public interest to adopt the level of acute hospital capacity, physician supply, and Medicare spending of efficient benchmarks such as New Haven and Minneapolis.

■ In order to achieve fairness, spending among regions should be equalized on a price adjusted basis.

The impact on the health care economy of reform along these lines would be considerable. When informed patients actively participate in the choice of treatment, there is evidence that patients express less demand for invasive treatments than the amount now being provided.

Extrapolations into the future show that if Medicare spending in regions with higher rates than Minneapolis were brought down to that benchmark, the depletion of Medicare trust funds would be avoided or substantially delayed. Indeed, the Minneapolis configuration of resources suggests a level of health care spending for populations of all ages that is far less than the current average for the United States. Within the savings generated by the judicious reduction of resources and spending to the level of such benchmarks, the nation can find the resources to provide access to health care for all Americans.

Virginia, as a cluster of health care markets, has very much the same patterns of variation observed nationally in other editions of the Dartmouth Atlas series. The use of data prepared for the Virginia Hospital Research and Education Foundation by HCIA to construct this edition of the Atlas demonstrates that variations in Virginia reflect a nationwide phenomenon, and that many of the same remedies could be applied: a "right rate" established for the deployment of resources and workforces; the implementation of shared decision making among Virginia citizens faced with choices between alternative medical interventions, most likely resulting in reduced demand for such services as open heart and prostate surgery, and a more fair and equal distribution of spending for basic health care needs among all residents of the state. This Atlas provides a platform on which analysts, providers, policy makers, employers, payers, and patients can begin a discussion of how to address these important questions.

Appendix on Methods

Appendix on Methods

1. The Geography of Health Care in Virginia

1.1 Files Used in the Atlas

The Atlas depends on the integrated use of databases provided by the Virginia Hospital and Health Care Association (VHHA), the American Hospital Association (AHA), the American Medical Association, the American Osteopathic Association, and several federal agencies, including the Agency for Health Care Policy and Research, the Bureau of the Census, the Health Care Financing Administration, the National Center for Health Statistics, and the Department of Veterans Affairs. Table 1 lists these files and provides a short description of the uses made of them in the Atlas.

TABLE 1. DATA FILES USED IN ANALYSIS

File	Year Used (Sample)	Source / Provider	Description and Use in Analyses
Data Files			
Virginia Discharge Dataset	1996-7	Virginia Hospital and Healthcare Association	One record for each hospital admission in Virginia hospitals. Includes data on dates of admission/discharge, age, sex, race, residence (ZIP Code), procedure, and diagnosis codes. Used to define numerators for procedure rates. Data for Virginia residents discharged from TN, NC, MD, and Washington DC during 1996-7 were obtained from the respective states. All data files maintained by HCIA and passed to Maine Medical Assessment Foundation for processing.
Denominator File	1994 & 1995 (100%)	HCFA	Contains one record for each Medicare beneficiary, and includes demographic information (age, sex, race), residence (ZIP Code), program eligibility and mortality. Used to determine denominators for utilization rates and to determine mortality.
MEDPAR File	1994 & 1995 (100%)	HCFA	One record for each hospital stay by Medicare beneficiaries. Includes data on dates of admission / discharge, diagnoses, procedures and Medicare reimbursements to the hospital. Used for (1) allocation of acute care resources and physicians and (2) numerators for utilization rates.
Continuous Medicare History Sample File	1995 (5%)	HCFA	Includes a record for each beneficiary in a 5% sample for each year. Includes summary expenditure data. Used to estimate Medicare spending by program component.
Medicare Provider of Services File	1995	HCFA	Includes a record for each hospital eligible to provide inpatient care through Medicare. Includes location and resource data. Used in measuring acute care resource investments.
Medicare Cost Reports	1994	HCFA	Includes a record for each hospital and provides detailed accounting data for the specified year. Used in measuring acute care resource investments.

TABLE 1. (CONTINUED)

File	Year Used	Source/Provider	Description and Use in Analyses
Resource Files			
American Hospital Association Annual Survey of Hospitals	1995	American Hospital Association	Includes a record for each hospital registered with the AHA. Used in measuring acute care resources (beds, personnel).
Physician File	1995	American Medical Association	Includes one record for each allopathic physician with practice ZIP Code, self-designated specialty, major professional activities, and federal / non-federal status. Used to determine specialty-specific counts of physicians in each health care market.
Osteopath File	1995	American Osteopathic Association	Includes one record for each osteopathic physician with practice ZIP Code, self-designated specialty, major professional activities, and federal / non-federal status. Used to determine specialty-specific counts of physicians in each health care market.
Federal hospital utilization and resources	1993-1994	U.S. Medicine Directory 1993-94 ISSN 0890-6637	Provides location, counts and occupancy rates of federal hospital beds.
Other Files			
Geographic Practice Cost Index	1993	HCFA	Records for each MSA and non-MSA area of each state. Records include area-level values for each of the components of the GPCI (physician work, practice cost, mal-practice) and summary index value. Used for price adjustment.
National Hospital Discharge Survey	1989	NTIS	Provides age-sex specific hospital discharge rates for the U.S. as a whole, which were used as the basis for the age-sex adjustment of acute care resources.
National Ambulatory Medical Care Survey (NAMCS)	1989-1994	NTIS	Ambulatory services from samples of patient records selected from a national sample of office-based physicians. Allows estimation of age-sex specific use rates by specialty. Used for age-sex adjustment of physician workforce.
Population files	1995	Claritas, Inc., Arlington, VA	1990 STF3 data from the U.S. Bureau of the Census was adapted by Claritas, Inc. to 1995 ZIP Code geography; includes 1995 age-sex specific estimated counts of residents in the ZIP Code. Used (1) for age-sex adjustment, (2) as denominator for rates of allocated and adjusted resources.
ZIP Code boundary files	1995	Geographic Data Technology, Lebanon, NH	Includes records for each ZIP Code with the coordinates of the boundary precisely specified. Used as basis for mapping HSAs and HRRs and for assigning ZIP Codes appropriately.

1.2 Defining Hospital Service Areas

Hospital Service Areas (HSAs) represent local health care markets for community-based inpatient care. HSAs were originally defined in three steps using 1993 provider files and 1992-93 utilization data. First, all acute care hospitals in the 50 states and the District of Columbia were identified from the American Hospital Association Annual Survey of Hospitals and the Medicare Provider of Services files and assigned to a location within a town or city. The list of towns or cities with at least one acute care hospital (N=3,953) defined the maximum number of possible HSAs. Second, all 1992 and 1993 acute care hospitalizations of the Medicare population were analyzed according to ZIP Code to determine the proportion of residents' hospital stays that occurred in each of the 3,953 candidate HSAs. ZIP Codes were initially assigned to the HSA where the greatest proportion (plurality) of residents were hospitalized. Approximately 500 of the candidate HSAs did not qualify as independent HSAs because the plurality of patients resident in those HSAs were hospitalized in other HSAs.

The third step required visual examination of the ZIP Codes used to define each HSA. Maps of ZIP Code boundaries were made using files obtained from Geographic Data Technologies (GDT) and each HSA's component ZIP Codes were examined. In order to achieve contiguity of the component ZIP Codes for each HSA, "island" ZIP Codes were reassigned to the enclosing HSA, and/or HSAs were grouped into larger HSAs. Certain ZIP Codes used in the Medicare files were restricted in their use to specific institutions (e.g., nursing homes) or post offices. These "point ZIPs" were assigned to their enclosing ZIP Code based on the ZIP Code boundary map.

This process resulted in the identification of 3,436 HSAs. In most HSAs, the majority of Medicare hospitalizations occurred in a hospital or hospitals located within the HSA.

1.3 Defining Hospital Referral Regions

Hospital referral regions (HRRs) represent health care markets for tertiary medical care. Each HRR contained at least one HSA that had a hospital or hospitals that performed major cardiovascular procedures and neurosurgery in 1992-93. Three steps were taken to define HRRs.

First, the candidate hospitals and HRRs were identified. A total of 862 hospitals performed at least 10 major cardiovascular procedures (DRGs 103-107) on Medicare enrollees in both years. These hospitals were located within 458 HSAs, thereby defining the maximum number of possible HRRs. Further checks verified that all 458 HSAs included at least one hospital performing the specified major neurosurgical procedures (DRGs 1-3 and 484).

Second, we calculated in each of the 3,436 HSAs in the United States the proportion of major cardiovascular procedures performed in each of the 458 candidate HRRs in 1992-93. Each HSA was then assigned provisionally to the candidate HRR where most patients went for these services.

Third, HSAs were reassigned or further grouped to achieve (a) geographic contiguity, unless major travel routes (e.g., interstate highways) justified separation (which did not occur in Virginia); (b) a minimum population size of 120,000; and (c) a high localization index.

The process resulted in the definition of 306 hospital referral regions which ranged in total 1995 population from 124,656 (Minot, North Dakota) to 9,230,785 (Los Angeles) in the 1998 edition of the Atlas.

1.4 Populations of HSAs and HRRs

Total population counts were estimated for residents of all ages in each HSA using 1995 ZIP Code level files obtained from Claritas, Inc. The Claritas file is based on the latest U.S. Census STF3B ZIP Code file, updated to account for changes in ZIP Code definitions. Population counts for HRRs are the sum of the counts of the constituent HSAs. These serve as denominators for estimating rates for hospital resource and physician workforce allocations.

For rates that apply to the Medicare population for the years 1995-96, enrollee counts were obtained from the Medicare Denominator file. The 1995 and 1996 Medicare enrollee population included those alive and age 65 to age 99 on June 30, 1995 and 1996, respectively, and were summed to give person-years. For Medicare reimbursement rates, the enrollee counts are based on a 5% sample of 1996 enrollees (selected on the basis of Social Security numbers) who were enrolled in both Part A and Part B of the Medicare program. For all rates presented in the Atlas, the numerator and the denominator counts exclude those who were enrolled in risk bearing HMOs on June 30.

2. Variations in Hospital Resources

Acute care hospital resources consist of hospital beds and personnel. Three tasks were required to estimate rates. First, the resources for each hospital were determined; second, resources were allocated to populations, proportionate to their rates of use; third, rates were computed and adjusted to take into account differences in age and sex among regions.

2.1 Measuring Hospital Resources

Hospitals were eligible for inclusion if they were located within the 50 states or the District of Columbia and were classified either by Medicare or the AHA as short term general medical and surgical hospitals (AHA service code = 10), specialty hospitals listed as obstetrics and gynecology (code 44), eye, ear, nose and throat (code 45), orthopedic (code 47), or other specialty (code 49); and children's hospitals (codes 50, 59). For inclusion in this study, hospitals must have been open on June 30, 1995. Certain specialty hospitals were excluded if additional information gathered from external sources (e.g., telephone calls) indicated they did not meet the inclusion criteria, or if they fell into the following categories: Shriners' hospitals, crippled children's hospitals, hospital units of institutions (prisons, colleges, etc.), institutions for mental retardation, psychiatric facilities, rehabilitation or chronic disease facilities, addiction treatment facilities, communication disorders facilities, podiatry facilities, small surgery centers, obstetrics and gynecology clinics, and hospices. Department of Veterans' Affairs hospitals were excluded because of the non-comparability of expenditure and personnel data.

The American Hospital Association Annual Survey file and the Medicare Provider file were searched to identify all non-federal hospitals (AHA control code = 12-33) and federal PHS Indian Service hospitals (control code = 47) that met the criteria for inclusion. Short term general hospitals (N= 5,004), children's hospitals (N=47), and specialty hospitals (N=56) located in the 50 states or the District of Columbia as of June 30, 1995 were identified.

The resources for each hospital were determined as follows:

Hospital beds were ascertained primarily from the AHA file. The field selected was "hospital beds (including cribs, pediatric and neonatal bassinets) that were set up and staffed at the end of the reporting period." Our measure of intensive care beds included both "medical/surgical intensive care" and "cardiac intensive care" beds. For the hospitals completely lacking AHA data, and for hospitals that were non-reporting in 1995, we used data from the Medicare Cost Reports for "total beds available in the hospital" and "intensive care" plus "coronary care beds" as the measure of intensive care beds.

Full time equivalent hospital personnel were defined as the sum of full time employees and 1/2 of the part time employees. Hospital employees do not include medical or dental interns or residents or trainees. For the hospitals lacking AHA data completely and for hospitals that were non-reporting in 1995, the Medicare Cost Report value for "average number of employees, hospital total" was used to estimate hospital personnel at these hospitals.

Full time equivalent registered nurses were defined as the sum of full time nurses and 1/2 of the part time nurses. For the hospitals lacking AHA data completely and for hospitals that were non-reporting for 1995, the Medicare Provider of Services file count of "licensed registered nurses" was used to estimate the number of registered nurses at these hospitals.

2.2 Allocation of Hospital Resources

In order to account for the use of care by patients who live in one HSA but obtain care in another, hospital resources for acute care short-term hospitals have been allocated to the HSAs in proportion to the actual patterns of use. This was accomplished using the proportion of all Medicare patient days (1995-96) provided by each specific hospital to each HSA. For example, if 60% of total Medicare inpatient days at a hospital were used by residents of the HSA where the hospital was located, then 60% of that hospital's resources would be assigned to its HSA. If 20% of the Medicare patient days provided by that hospital were used by a neighboring HSA, 20% of the hospital's resources would be assigned to that neighboring HSA.

Once each of the hospital resources had been allocated to HSAs, the allocated resources were summed. For example, the allocated beds of each HSA were equal to the sum of allocated acute short-term beds and allocated specialty/children's beds. For the HSAs located in a given HRR, resources were further summed to obtain the total for the HRR. Crude rates were then calculated for HRRs using the 1995 population for all ages described in Section 1.4.

2.3 Calculation of Adjusted Per Capita Hospital Resource Rates

The resource allocation rates were adjusted for differences in age and sex using the indirect method and the 1995 U.S. population as the standard (Breslow and Day, 1987). Since indirectly standardized rates cannot be "rolled up" from HSAs to HRRs, we computed observed and expected counts at the HSA level and summed these to the HRR levels. The expected counts within HSAs are weighted averages of the stratum-specific crude rates in the standard population. These observed and expected counts were then used to compute HRR-level indirectly standardized rates.

Since the national age-sex specific bed supply rates are not available, these were estimated using the national age and sex specific patient day rates obtained from the 1989 National Hospital Discharge Survey. These estimates were used to calculate the expected bed supply in each HRR. Under the assumption that employee allocations across age and sex groups are also proportionate to patient days, a similar strategy was used to adjust employees.

3. Medicare Program Reimbursement Rates

The numerators for Medicare reimbursement rates are from the 1996 Continuous Medicare History Sample (CMHS), which documents reimbursements by calendar year for each component of the Medicare program. The data are for a 5% sample of Medicare enrollees selected on the basis of the terminal digits in the Social Security number. The denominator for rates is the corresponding 5% sample of the enrollment file (see Section 1.4).

3.1 Categories of Medicare Reimbursement

Categories of Medicare reimbursement are listed in Table 2 (next page) with their definitions from the CMHS file.

TABLE 2. DEFINITIONS FOR CATEGORIES OF REIMBURSEMENT

Category of Reimbursement	For each service, the specified components were selected from the file and summed as indicated. All fields refer to packed-decimal, variable length, EBCDIC, mainframe record layout locations.
All Services	Sum of Individual Services
Professional and Laboratory Services	File: Payment trailer 1. Total Reimb., cols. 11-13 2. Medical line items, cols. 14-15 (TOS=1, 3, Y, Z) 3. Medical Reimb., cols. 19-21 4. Surgical line items, cols. 22-23 (TOS=2, 8) 5. Surgical Reimb., cols. 27-29 6. Lab/X-ray line items, cols. 30-31 (TOS=4, 5) 7. Lab/X-ray Reimb., cols. 35-37 Professional and Lab. reimb. = 3+5+7
Acute Care Hospital Services	File: Short Stay trailer Stays, cols. 6-7 LOS, cols. 10-11 Reimbursement, cols. 20-23 Passthrough amount, cols. 64-67
Outpatient Hospital Services	Outpatient trailer Total bills, cols. 6-7 Total Reimb., cols. 11-13 Outpatient POS bills, cols. 14-15 Outpatient POS Reimb., cols. 19-21 Inpatient POS bills, cols. 22-23 Inpatient POS Reimb., cols. 27-29 Total Reimb. = Outpatient POS Reimb. + Inpatient POS Reimb.
Home Health Care Services	HHA trailer Part A Reimb., cols. 11-13 Part B Reimb., cols. 19-21 Total Reimb. = Part A + Part B

3.2 Calculation of Adjusted Medicare Program Reimbursement Rates

Rates were adjusted using the indirect method for the following strata: sex, race (black, non-black) and age (65-69, 70-74, 75-79, 80-84, 85-99), with the 1996 Medicare population as the standard, as described in Section 2.3.

Medicare program rates were further adjusted to account for regional differences in price. Two different price adjustors were used, depending on the category of Medicare spending: the Dartmouth Price Index and the HCFA Part B Index, both of which are based on the Geographic Practice Cost Index (GPCI) developed by Pope, Welch, Zuckerman, and Henderson (1989). These price indexes are described below.

The Dartmouth (Modified GPCI) Price Index. Seeking to avoid a price adjustment that depended on physician or hospital market conditions, we focused on cost of living indices using non-medical regional price measures. We relied on the Geographic Practice Cost Index (GPCI), which uses the weighted sum of three components: the relative cost of non-physician professional labor across areas, the relative cost of physician practice inputs (principally rents and wages to office employees) and the relative cost of malpractice. The weights are based on the national proportions of these costs in physician services. We re-weighted the index, excluding the malpractice costs. We also used the full professional labor component in our revised index (HCFA used only one-quarter of the professional labor component). While not perfectly exogenous to health care (as it includes physician office expenses), this modified GPCI index is available at the level of geographic analysis needed in this study, and is preferable to the major alternative, Medicare's hospital wage index. (The hospital wage index is based on actual wages paid to hospital employees in each area and is thus distorted by differences in occupational mix and market conditions. Hospitals that hire more highly paid staff have those costs reflected in the wage index.) The Dartmouth index was available for each metropolitan statistical area (MSA) and for non-MSA areas of each state. The values for the area-specific modified GPCI were assigned to each HSA according to the location of the principal city or town of each HSA.

HCFA Part B Index. Because Medicare Part B payments compensate for only one-quarter of the difference in professional wage adjustments across areas and include an adjustment for malpractice insurance costs, these adjustments were made in reverse to recover the original value of the Part B billings.

For both indexes, HRR-level modified GPCIs were calculated as weighted sums of the HSA-specific indexes, using the number of Medicare enrollees in the HSA as the weight. The Dartmouth Price Index was used to adjust all components of Medicare expenditures except professional and laboratory services. This latter component was adjusted using the HCFA Part B regional price measure.

To implement the adjustment, each component of the Medicare program was first age sex and race adjusted at the HSA level. Observed and expected dollars were then summed to the HRR level and indirectly standardized rates were computed. HRR-specific Medicare expenditures were then divided by the index for that HRR to adjust for regional differences in price. Total noncapitated Medicare reimbursement rates were computed as the sum of the component rates.

4. Physician Workforce Rates

The methods for allocating and estimating the per capita rates of physicians serving HSAs and HRRs are analogous to the methods used for estimating and allocating hospital resources described in Sections 2.2 and 2.3. The sources of information on physicians are the American Medical Association (AMA; January 1, 1996) and the American Osteopathic Association (AOA; June 1, 1996) Physician Masterfiles. These files have been used extensively to study physician supply and are the only comprehensive data available on physician location, specialty and level of effort devoted to clinical practice. Both the AMA and the AOA physician files classify physicians according to self-reported level of effort devoted to clinical practice. In this study, we excluded physicians who reported that they worked the majority of the time in medical teaching, administration or research, and part time physicians working fewer than 20 hours a week in clinical practice. Both files also list ZIP

Code fields indicating the physician's primary place of practice, which was complete in more than 90% of records. When this information was not available, we used the physician's preferred professional address to indicate location. Based on these criteria, 495,510 physicians resident in the 50 states and District of Columbia constituted the clinically active physician workforce for 1996. There were also 99,972 physicians in residency or fellowship programs. See the Appendix on the Physician Workforce in the United States, in the 1998 edition of the national Atlas, for more details.

4.1 Physician Specialties

The AMA and AOA physician files include the physician's primary self-designated specialty from a list of 243 specialties. We grouped these into the categories in Table 3A on the following two pages.

TABLE 3A. CATEGORIES OF CLINICALLY ACTIVE PHYSICIANS

Classification of physician specialties and type of utilization used for allocation and age adjustment

Dartmouth Specialty	AMA or AOA Specialty	AMA/AOA Code	Age Adjustment
All Physicians	All except Unspecified (Codes US, T)		
Primary Physicians	Adolescent Medicine-GP	AGP	Family Practice
	Family Practice	FP	
	Geriatrics Medicine (Family Practice)	FPG	
		FSM	
	General Practice	GP	
	Internal Medicine	IM	
	Internal Medicine-Pediatrics	IPD	
	Pediatrics	PD	Pediatrics
Specialty Physicians	All except Primary Physicians and Unspecified (Codes US, T)		
Anesthesiology	Anesthesiology	AN	Surgery
	Cardiothoracic Anesthesiology	CAN	
	Obstetrics Anesthesiology	OBA	
	Pediatric Anesthesiology	PAN	
Cardiology	Cardiology	C	Cardiology
	Cardiovascular Diseases	CD	
		CVD	
	Cardiac Electrophysiology	ICE	
General Surgery	Abdominal Surgery	AS	General Surgery
	Colon and Rectal Surgery	CRS	
	General Surgery	GS	
	Surgery-General	S	
Obstetrics/ Gynecology	Gynecological Oncology	GO	Ob/Gyn
	Gynecological Surgery	GS	
	Gynecology	GYN	
	Maternal & Fetal Medicine	MFM	
	Obstetrics & Gynecology	OBG	
	Obstetrics	OBS	
	Obstetrics/Gynecology Surgery	OGS	
	Reproductive Endocrinology	RE	
	Reproductive Endocrinology	REN	
Ophthalmology	Ophthalmology	OPH	Ophthalmology

TABLE 3A. (CONTINUED)

Dartmouth Specialty	AMA or AOA Specialty	AMA/AOA Code
Orthopedic Surgery	Hand Surgery (Ortho Surgery)	HSO
	Adult Reconstructive Orthopedics	OAR
	Pediatric Orthopedics	OP
	Orthopedics	OR
	Orthopedic Surgery	ORS
	Sports Medicine (Orthopedic Surgery)	OSM
	Orthopedic Surgery - Spine	OSS
	Orthopedic Trauma	OTR
Psychiatry	Child Psychiatry	CHP
	Psychiatry	P
	Pediatric Psychiatry	PDP
	Psychoanalysis	PYA
	Geriatric Psychiatry	PYG
	Psychosomatic Medicine	PYM
Radiology	Angiography/Interventional Radiology	ANG
	Diagnostic Radiology	DR
	Diagnostic Ultrasound	DUS
	Nuclear Medicine	NM
	Nuclear Radiology	NR
	Neuroradiology	NRA
	Pediatric Radiology	PDR
	Radiology	R
	Diagnostic Roentgenology	RTD
Urology	Urological Surgery	U
	Urology	URS

4.2 Allocation of Clinically Active Physicians

Clinically active physicians were assigned to the HSA of their primary place of practice or preferred professional address. Since physicians, like hospitals, provide services to patients residing outside of the HSA in which their practices are located, the physician workforce was allocated to adjust for patient migration. Unfortunately, allocations could not be based on information about the travel patterns of the patients of individual physicians or information about the use of care outside acute hospitals. For clinically active non-federal physicians (N = 26,730), the adjustments are closely analogous to the method used for hospital resources, with an important exception. Since the hospital affiliations of the physicians were not determined, the physicians were allocated on the basis of the patterns of inpatient care of all the hospitals located in their HSAs. The Virginia records selected for allocation, which depended on the physician's specialty, are given in Table 3B. For example, primary physicians were allocated on the basis of medical DRGs. If an HSA had 4 primary care physicians and if 25% of the medical DRG patient days at the local hospital(s) in 1996 were for residents of a neighboring HSA, then the four primary physicians would be estimated to contribute 1.0 FTE primary care physician to the neighboring HSA.

The workforce analysis uses two methods to identify physicians in the workforce.

Identification of the Specialty and Location of Physicians

I) For the specialties of cardiology, obstetrics/gynecology, urology and orthopedics we used to identify the physicians' specialties and where physicians were located using the following algorithm.

1.Using the attending physician's license number, we identified all discharges in which the attending physicians performed specialty-relevant surgical procedures or deliveries, or admitted patients with cardiac diagnoses (see table 3.A for the relevant DRGs or surgical procedures used to identify and/or allocate physicians).

2. Once the relevant discharges were identified, we used the following decision rules to classify a physician as a full time equivalent:

a) Cardiologist: any physician with at least 10 discharges in which a percutaneous transluminal coronary angioplasty or coronary angiography were performed (excluding those discharges with a concurrent open-heart procedure); or, any physician with at least 20 medical discharges and 60% of these discharges had to have been in a cardiology DRG (see next page). The later was used to separate non-invasive cardiologists from internists and family practitioners.

b) Orthopedist: any physician with at least 10 discharges in an orthopedic surgery DRG (see next page).

c) Urologist: any physician with at least 10 discharges in a urologic surgery DRG (see below).

d) Obstetrician/Gynecologist: any physician with at least 10 discharges in gynecologic surgery DRG (see next page); or any physician with at least 20 deliveries and fewer than 20 non-gynecologic oncology medical discharges (the latter was used to separate family physicians who perform deliveries from obstetricians).

3) The physician's practice was "located" in the HSA from which the majority of their patients came.

II) For all other specialties, we used the American Medical Association's and American Osteopathic Association's annual surveys to identify a physician's specialty and location of practice.

TABLE 3B. DRGS USED FOR ALLOCATION

Cardiology	DRG = (115 - 118) OR ICD-9 = (37.22, 37.23, 88.55, 88.56, 88.57, 36.01, 36.02, 36.05, 36.09)
Obstetrics/Gynecology	DRG = (370 - 384) OR (353 - 365)
Cardiothoracic Surgery	DRG = 103 - 108
General Surgery	DRG = (146 – 171) OR (191 – 201) OR (257 – 270) OR (285) OR (287 - 293) OR (493 - 494)
Orthopedic Surgery	DRG = (209 - 213) OR (216 - 234) OR (471) OR (485) OR (491)
Neurosurgery	DRG = (001 - 004) OR (007 - 008) OR (214 - 215) OR (484)
Urology	DRG = (302 - 315) OR (334 - 335)
Pediatric Medicine	DRG = (026) or (070) or (081) or (091) or (098) or (137) or (184) or (279) or (298) or (417) or (422) or (448)
All other surgical specialties as well as **Anesthesiology**	DRG = (1-8, 36-42, 49-63, 75-77, 103-120, 146-171, 191-201, 209-234, 257-270, 285-293, 302-345, 353-365, 370,371,377, 392-394, 400-402, 406-408, 415,424, 439-443, 458,459,461 468, 471-472, 476-486, 488,491,493,494)
Internal Medicine, Family Practice, General Practice and all **medicine sub-specialties**	Any DRG not in SURGICAL and not in MDC = (14, 15, 19, 20) and age >18.
Radiology and Pathology	Total Discharges

5. The Distribution Graph

The distribution graphs used in the Atlas provide a simple way to show the dispersion in particular rates of health care resources and utilization. For example, Figure 2.1 shows the distribution of acute care hospital beds per 1,000 residents for each of the 65 hospital service areas in Virginia. The vertical axis shows the rate of hospital beds per 1,000 residents. Low Moor, which has 6.3 acute care beds per 1,000 residents, and Hot Springs, which has 5.9, are represented by the two highest points on the graph. (Some areas which do not have exactly the same number of hospital beds per 1,000 residents are arrayed on a single line because their rates fall into a "bin" between two values.)

This chart summarizes two features of the data. The first is a measure of dispersion; if the number of employees per 1,000 (or whatever measure is on the vertical axis) for the highest hospital service area is two or three times higher than the number of employees per 1,000 for the lowest hospital service area, it suggests substantial variation in health care resources. Second, the distribution graph shows whether the variation is caused by just a few outliers — hospital service areas that for various reasons are very different from the rest of the country — or whether the variation is pervasive and widespread.

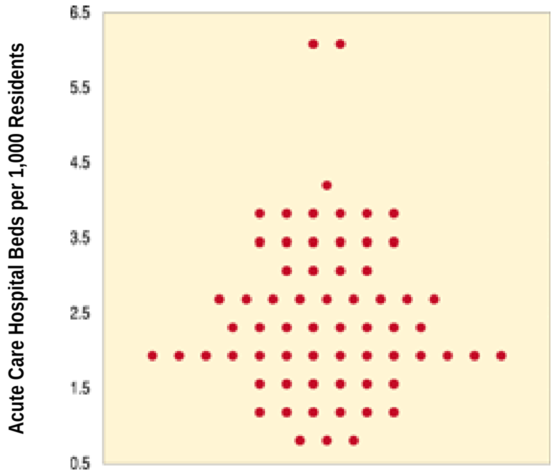


Figure 2.1. Acute Care Hospital Beds (1996)
The number of acute care hospital beds per 1,000 residents ranged from fewer than 1.0 to more than 6.0, after adjusting for differences in age and sex of local populations. Each point represents one of the 65 hospital service areas in Virginia.

6. All-Payor Hospitalization Rates

Hospitalization rates represent counts of the number of discharges that occurred in a defined time period (the numerator) for a specific population (the denominator). population files, as appropriate.

6.1 Procedures and Conditions Examined in the Atlas

The specific procedures and conditions, or "numerator events," and the codes used to identify the event in the file are given in Tables 4 and 5.

TABLE 4. CONDITION AND PROCEDURE CODES

Condition	Codes used to define condition
Pediatric Medicine	DRG = (26, 70, 81, 91, 98, 137, 184, 279, 298, 417, 422, 448) and (Age <= 18)
Pediatric Asthma	Any ICD-9 Diagnosis = 493.xx and (Age <= 18)
Oncology Chemotherapy	DRG = '410'
Major Bowel	DRG = (146 - 149)
Carotid Endarterectomy	Any procedure where ICD-9 = 38.12
Cholecystectomy	Any procedure where ICD-9 =(51.22 or 51.23)
Open Cholecystectomy	Any procedure where ICD-9 = 51.22
Closed Cholecystectomy	Any procedure = 51.23
Cardiac Catheterizations	Any procedure where ICD-9 = (37.22, 37.23,85.55, 85.56, 85.57)
CABG	Any procedure where ICD-9 = (36.03, 36.1x, 36.2x)
PTCA	Any procedure where ICD-9 = (36.01, 36.02, 36.05, 36.09)
Cardiac Medical	Any DRG = 121-145
AMI	Any DRG = 121 - 123
CHF	DRG = 127
Angina	DRG = 140
Arrythmia	DRG = 138 - 139
Chest Pain	DRG = 140 or 143
Revascularization	Any procedure where ICD-9 = (36.03, 36.1x, 36.2x, 36.01, 36.02, 36.05, 36.09)
Pediatric Cancer	Any diagnosis where ICD-9 = 140 - 239 AND Age <= 18
Medical Back Problems	DRG = 243
Lumbar Fusion	No trauma diagnosis codes and: any procedure ICD-9 = 81.06,81.07,81.08 or [[ANY ICD-9 procedure = 81.0,81.00 and any ICD-9 diagnosis = 721.3,721.42,722.10,722.52,722.73,722.83,722.93,724.02,724.4,756.11, 738.4,756.12,722.1)]]

Cervical Procedures	No trauma diagnosis codes and no Lumbar fusion and: any ICD-9 procedure = 81.02, 81.03 or [[any ICD-9 procedure = 03.09, 80.50, 80.51, 80.52, 80.59) and ICD-9 diagnosis = 722.0, 723.0, 723.4, 721.1, 722.4, 722.71, 722.91, 721.0]]
Lumbar Discectomy	No trauma diagnosis codes and no Lumbar fusion and no cervical procedures and: any ICD-9 procedure = 03.09, 80.50, 80.51, 80.52, 80.59) and any ICD-9 diagnosis = 721.3, 721.42, 722.10, 722.52, 722.73, 722.83, 722.93, 724.02, 724.4, 756.11, 738.4, 756.12, 722.1)
Total Hip Primary	Any procedure where ICD-9 = 81.51 and ICD-9 diagnosis not equal (820.xx, 996.xx, 821.xx)
Total Hip Revision	Any procedure where ICD-9 = 81.53
Total Knee Primary	Any procedure where ICD-9 = 81.54
Total Knee Revision	Any procedure where ICD-9 = 81.55
Hip Fracture	Any diagnosis where ICD-9 = 820.xx
Radical Prostatectomy	Any procedure where ICD-9 = 60.5x and sex = male
TURP	Any procedure where ICD-9 = 60.2x and any diagnosis where ICD-9 = (600.xx, 601.xx, 601.0x, 601.1x, 601.2x, 601.3x, 601.4x, 601.8x, 602.xx, 602.0x, 602.1x, 602.3x, 602.8x, 602.9x)
Hysterectomy —Cancer	Any procedure where ICD-9 = (68.3x, 68.4x, 68.5x) and diagnosis ICD-9 = (179.xx, 180.xx, 181.xx, 182.xx, 183.xx, 184.xx) and sex = female
Hysterectomy Non-Cancer	Any procedure where ICD-9 = (68.3x, 68.4x, 68.5x) and any ICD=9 diagnosis NOT EQUAL to (179.xx, 180.xx, 181.xx, 182.xx, 183.xx, 184.xx) and sex = female
Deliveries	DRG in (370 - 375) and sex = female
Cesarean Deliveries	DRG in (370, 371) and sex = female
VBAC	DRG in 372 - 375 and any diagnosis where ICD-9 = 654.2
Partial Mastectomy	Principal procedure where ICD-9 = (85.20, 85.21, 85.22, 85.23) and any diagnosis where ICD-9 = 174.xx
Radical Mastectomy	Principal procedure where ICD-9 = (85.42, 85.44, 85.46, 85.48, 85.41, 85.43, 85.45, 85.47) and any diagnosis where ICD-9 = 174.xx
High Variation Medical Conditions	DRG = (9-13, 15-35, 43-48, 64-74, 78-102, 124-145, 172-173, 176-190, 202-208, 235-256, 271-284, 294-301, 316-333, 346-352, 366-369, 378-391, 395-399, 403-405, 409-414, 416-423, 425-437, 444-457, 462-467, 372, 373, 376, 473, 475, 487, 489, 490, 492)
Medical and Surgical Discharges	SURGICAL: any DRG = (1-8, 36-42, 49-63, 75-77, 103-120, 146-171, 191-201, 209-234, 257-270, 285-293, 302-345, 353-365, 370,371,377, 392-394, 400-402, 406-408, 415,424, 439-443, 458,459,461 468, 471-472, 476-486, 488,491,493,494). MEDICAL: any DRG not in SURGICAL and not in MDC = (14, 15, 19, 20)

TABLE 5. AMBULATORY CARE-SENSITIVE CONDITIONS

CONDITION	ICD – 9 – CM CODES
Convulsions	780.3
Chronic obstructive pulmonary disease	491, 492, 494, 496, 466.0 Acute bronchitis (466.0) only with secondary diagnosis of 491, 492, 494, 496
Bacterial pneumonia	481, 482.2, 482.3, 482.9, 483, 485, 486 Excluding cases with secondary diagnosis of sickle cell (282.6)
Asthma	493
Congestive heart failure	428, 402.01, 402.11, 402.91, 518.4 Excluding cases with the following surgical procedures: 36.01, 36.02, 36.05, 36.1, 37.5, or 37.7
Hypertension	401.0, 401.9, 402.00, 402.10, 402.90 Excluding cases with the following surgical procedures: 36.01, 36.02, 36.05, 36.1, 37.5, or 37.7
Angina	411.1, 411.8, 413 Excluding cases with a surgical procedure (01-86.99)
Cellulitis	681, 682, 683, 686 Excluding cases with a surgical procedure (01-86.99), except incision of skin and subcutaneous tissue (86.0) where it is the only listed surgical procedure
Diabetes	250.0 250.1, 250.2, 250.3, 250.8, 250.9
Gastroenteritis	558.9
Kidney/urinary infection	590, 599.0, 599.9
Dehydration – volume depletion	276.5

6.2 Adjusted Utilization Rates

Rates were adjusted using the indirect method for the following strata: sex, race (black, non-black) and age (0-4, 5-9 etc., up to 85-99), with the 1996 "core" population as the standard, as described in Section 2.3. For Medicare-specific utilization, only records of Medicare enrollees age 65 and older were used. Although the majority of events occurred at most once per person during the study period, we included multiple events to the same person to allow the rates to reflect total health care utilization.

Although standard errors of the rates were not reported, these estimates are, for the most part, precisely determined. Rates are reported as statistically stable only for areas with expected counts of 25 or more. For an event rate of 5 per 1,000, rates would be reported as stable only for HSAs with 5,000 or more person-years.

6.4 Measures of Association (R^2 and Regression Lines)

In this Atlas, we often suggest that some factors may be related in a systematic way to other factors. For example, we hypothesize that regions with high rates of beds per 1,000 residents also have high rates of hospitalization for medical conditions. To capture the degree and extent of the association between hospital beds and medical hospitalizations, in Figure 1.3 we put hospital beds per 1,000 residents on the horizontal axis and hospitalization rates per 1,000 residents on the vertical axis, and placed a point on the graph for each of the 127 hospital service areas in Pennsylvania. If hospital beds and hospitalization rates were negatively correlated, so that regions with higher beds per 1,000 residents had lower per capita hospitalizations, then we might expect to see the cloud of points tilted downward, running from northwest to southeast. Conversely, if they were positively correlated — as they in fact are — the cloud of points would run from southwest to northeast on the graph, as seen in Figure 1.3.

It is sometimes difficult to discern from this cloud of points the relationship between two variables. A linear regression line provides the best fit of the data and summarizes the relationships between them. A measure of the "goodness of fit" or the extent to which hospital beds per 1,000 residents predicts hospitalizations per 1,000 enrollees is the R^2, which is defined as the proportion of total variation in the vertical axis (hospitalizations) that is explained by variation in the horizontal axis (beds). It can range between 0 and 1, where 1 is perfect correlation and 0 means that the two variables are completely unrelated. In Figure 1.3, the R^2 for the relationship between medical hospitalizations and hospital beds is 0.53, which means that the two are closely related — that 53% of the variation in medical hospitalizations per 1,000 residents is related to the bed supply.

The regression lines and R^2 statistics given in the text are not weighted for the size of the population. Weighted and unweighted R^2 statistics were similar.

In general, if we denote the event rate as p and the population size as N, the standard error is (p/N)^0.5 and the precision, expressed as a percent of the true rate, is (se (p)/p)*100%.

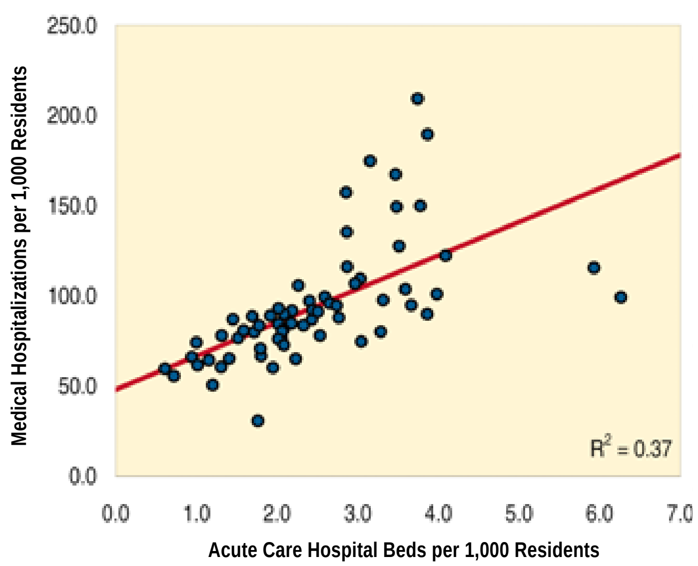


Figure 1.3. The Association Between Hospital Beds and Hospitalization Rates for Medical Conditions in Virginia (1996-97)

Almost 40% of the variation in rates of adult hospitalizations for medical conditions was explained by local differences in the number of hospital beds per 1,000 residents, after adjustment for differences in population age, sex and race (R^2 = .37). Note that this relationship would be stronger (R^2 = .55) if the Lebanon, Grundy, Norton, Clintwood, Richlands, Hot Springs and Low Moor hospital service areas — the "outliers" on the graph — were excluded from the analysis.

7. The Experience of Death

The percent of Medicare deaths occurring in hospitals was computed similarly to the method used for Medicare hospitalization rates described in Section 6. In this case, however, the denominator was the Medicare enrollee population who died in 1995 or 1996 (see Section 1.4), and the "numerator event" was death in a hospital (discharge status = 'B' in MEDPAR file). Rates were age, sex and race adjusted as described in Section 6.2 and were expressed as a percentage of deaths.

For all rates pertaining to the last six months of life, the denominator was the 18 month 1995-96 deceased Medicare population, computed as the sum of one half the 1995 deaths and all the 1996 deaths, using the same criteria as above. For the percent of Medicare deaths who were admitted to the ICU in the last 6 months of life, the "numerator event" was death in a hospital between 7/1/95 and 12/31/96 with admission to an ICU within 6 months of the death date, determined by using the MEDPAR files.

Average days in the hospital, average days in the ICU and average reimbursements for inpatient care per capita were computed using only the portion of the event (hospital stay or ICU stay) falling within the 6 month period (182 days) prior to death. Rates were age, sex and race adjusted as described in Section 6.2. Inpatient reimbursement rates were also price adjusted as described in Section 3.2.

8. Surgical Procedure Rates and Medical Conditions

The rates of inpatient surgery in Chapter Four are based on the Virginia for 1996-97. To ensure that the population included in the numerator corresponded to the denominator population, restrictions were applied to exclude the following records: where race, age, or sex were missing;

8.1 Procedures and Medical Conditions Examined in Chapter Four

The procedure codes used are listed in Table 4. The procedure codes are based on the International Classification of Disease, ICD-9-CM. Selection of procedure codes was based on review of the literature and/or consultation with clinical experts. No rate was based on a count of fewer than 20 expected events for reasons of statistical precision.

9. Preventive Services and Continuity of Care

Preventive service rates are counts of Medicare enrollees receiving at least one medical service of a particular type divided by the target Medicare population. The data were derived from Medicare part B physician claims files for 1995-96 for a 5% sample of Medicare enrollees . Mammography rates were computed for women age 65 to 69; eye examinations, HgbA1c and LDL blood lipid monitoring were computed for diabetics. Diabetics were defined as enrollees with two outpatient evaluation and management visits or one inpatient visit, with a diagnosis of diabetes (see the Endnote in the Dartmouth Atlas of Health Care 1999). We counted the number of people obtaining these services at least once in any year and then computed the average annual rate after combining years. The preventive services are defined in Table 6 and are based on HEDIS recommendations (see the Endnote in the Dartmouth Atlas of Health Care 1999).

TABLE 6. PREVENTIVE SERVICES / CPT CODES

Service	CPT Codes
Pneumococcal Immunization	90732
Mammogram	76090-76092
Occult Blood Test	82270
Sigmoidoscopy	45300-45320,45330-45336,45338-45339
Eye Exam	92002,92004,92012,92014,92018,92019,9222,92226,92235,92250
HgbAlc	83036
Blood Lipids	83715-83721,80061

Endnote

For further information on small area variation:

Baron JA, Karagas M, Barrett J, Kniffin W, Malenka D, Mayor M, Keller RB. Basic epidemiology of fractures of the upper and lower limb among Americans over 65 years of age. Epidemiology. 1996;7:612-618.

Wennberg J, Gittelsohn A. Small area variations in health care delivery: a population-based health information system can guide planning and regulatory decision-making. Science. 1973;182:1102-1108.

Wennberg JE, McPherson K, Caper P. Will payment based upon diagnosis-related groups control hospital costs? N Eng J Med. 1984;311:295-300.

Wennberg JE. Small area analysis and the medical care outcome problem. In: Research Methodology: Strengthening Causal Interpretations of Nonexperimental Data. Agency for Health Care Policy and Research #PB90-101387, Rockville, MD, 1990;177-206.

Wennberg J, Gittelsohn A. Variations in medical care among small areas. Sci Amer. 1982; 246(4):120-134.

Wennberg JE, Cooper MM, editors, The Dartmouth Atlas of Health Care. American Hospital Publishing, Inc., Chicago, IL 1996;72-73.

For further examples of the surgical signature phenomenon:

Roos NP, Roos LL. High and low surgical rates: risk factors for area residents. Am J Publ Health. 1981;71:591-600.

Wennberg JE. Small area analysis and the medical care outcome problem. In: Research Methodology: Strengthening Causal Interpretations of Nonexperimental Data. Agency for Health Care Policy and Research #PB90-101387, Rockville, MD, 1990;177-206.

For further information on the role of capacity in influencing care in the last six months of life:

Mor V, Hiris J. Determinants of site of death among hospice cancer patients. J Health and Social Behav. 1983;24:375-385.

Moinpour C, Polissar L. Factors affecting place of death of hospice and non-hospice cancer patients. Am J Public Health. 1989;79(11):1549-1551.

For a discussion of the flaws in the professional agency role that result in practice variations:

Wennberg JE, Barnes B, Zubkoff M. Professional uncertainty and the problem of supplier-induced demand. Soc Sci and Med. 1982;16:811-824.

The failure of population illness to explain small area variations is discussed in:

Wennberg JE: Small area analysis and the medical care outcome problem. In: Research Methodology: Strengthening Causal Interpretations of Nonexperimental Data. Agency for Health Care Policy and Research #PB90-101387, Rockville, MD, 1990;177-206.

The correlation between states with high Medicare spending and those with poor self-reported health is discussed in:

Ashby J, Fisher K, Gage B, Guertman BS, Kelley D, Lynch AM, Pettengill J. State variation in the resource costs of treating aged Medicare beneficiaries. Prospective Payment Assessment Commission Intramural Report. June 1996;I-96-01.

Trials of shared decision making programs are discussed in:

Barry MJ, Fowler FJ, Mulley AG, Henderson JV, Wennberg JE. Patient reactions to a program designed to facilitate patient participation in treatment decisions for benign prostatic hyperplasia. Med Care. 1995;33:771-782.

Wagner EH, Barrett P, Barry MJ, Barlow W, Fowler FJ. The effect of a shared decision making program on rates of surgery for benign prostatic hyperplasia: pilot results. Med Care. 1995;33:765-770.

Barry MJ, Cherkin DC, Chang YC, Fowler FJ, Skates S. A randomized trial of a multimedia shared decision making program for men facing a treatment decision for benign prostatic hyper-plasia. Disease Management and Clinical Outcomes. 1997;1:5-114.

Morgan MW, Deber RB, Llewellyn-Thomas HA, Gladstone P, Cusimano RJ, O'Rourke K, Detsky AS. A randomized trial of the ischemic heart disease shared decision making program: an evaluation of a decision aid. The Toronto Hospital, University of Toronto, Toronto, Ontario. Journal of Gen Intern Med. April 1997 (supp.);12:62.

Abstract presented at Society of General Internal Medicine 20th Annual Meeting, Washington, DC, May 1-3, 1997.

For a broader discussion of the role of outcomes research and shared decision making in resolving surgical practice variations for benign prostatic hyperplasia and prostate cancer see:

Prostate Disease Patient Outcomes Research Team (PORT) Final Report. Agency for Health Care Policy and Research (AHCPR) Pub. No. 95-N010; July 1995:1-59.

Flood AB, Wennberg JE, Nease RF Jr, Fowler FJ, Ding J, Hynes LM, and Members of the Prostate PORT. The importance of patient preference in the decision to screen for prostate cancer. J General Internal Medicine. 1996;11:342-349.

Onel E, Hammond CS, Wasson JH, Berlin BB et al. An assessment of the feasibility and impact of shared decision making in prostate cancer. Urology. in press.

For more information about the comparative use of data to determine "right" rates (benchmarking):

Fisher ES, Wennberg JE, Stukel TA, Sharp SM. Hospital readmission rates for cohorts of Medicare beneficiaries in Boston and New Haven. N Eng J Med. 1994;331(15):989-95.

Goodman DC, Fisher ES, Bubolz TA, Mohr JE, Poage JF, Wennberg JE. Benchmarking the U.S. physician workforce: an alternative to needs or demand based planning. JAMA. 1996;276:1811-1817.

Wennberg JE. Dealing with medical practice variations: a proposal for action. Health Affairs. 1984;3(2):6-32.

Wennberg JE, Freeman JL, Culp WJ. Are hospital services rationed in New Haven or over-utilized in Boston? Lancet. 1987;1(8543):1185-1188.

Wennberg JE, Freeman JL, Culp WJ. Are hospital services rationed in New Haven or over-utilized in Boston? Lancet. 1987;1(8543):1185-1188.

Wennberg JE, Freeman JL, Shelton RM, Bubolz TA. Hospital use and mortality among Medicare beneficiaries in Boston and New Haven. N Eng J Med. 1989;321:1168-1173.

Wennberg JE, Freeman JL, Shelton RM, Bubolz TA. Hospital use and mortality among Medicare beneficiaries in Boston and New Haven. N Eng J Med. 1989;321:1168-1173.

Wennberg JE, Cooper MM, editors, The Dartmouth Atlas of Health Care 1998, American Hospital Publishing, Inc., Chicago IL 1997; 270-300.

For a discussion of the implications of reducing hospital capacity for health care rationing and further discussion of the implications of transfer payments for efficiency and equity in health care markets:

Fisher ES, Welch HG, Wennberg JE. Prioritizing Oregon's hospital resources: an example based on variations in discretionary medical admission rates. JAMA. 1992;267:1925-1931.

Skinner J, Fisher E. Regional disparities in Medicare expenditures: an opportunity for reform, National Tax Journal, September 1997.

Wennberg JE. Should the cost of insurance reflect the cost of use in local hospital markets? N Eng J Med. 1982;307:1374-1381.

Appendix on Methods

Radany MH, Luft HS. Estimating hospital admission patterns using Medicare data. Social Science and Medicine. 1993;37(12):1431-9.

Pope GC, Welch WP, Zuckerman S, Henderson MG. Cost of practice and geographic variation in Medicare fees. Health Affairs. 1989;8(3):117-28.

Breslow NE, Day NE. Statistical Methods in Cancer Research. Volume II - The Design and Analysis of Cohort Studies. Lyon: IARC, 1987.

HCFA. Medicare Current Beneficiary Survey Public Use Documentation. In: Health Care Financing Administration, 1992.

Naylor CD, DeBoer DP. Coronary artery bypass grafting, variations in selected surgical procedures and medical diagnoses by year and region. In Goel V, Williams JI, Anderson GM, Blackstien-Hirsch P, Fooks C, Naylor CD, editors. Patterns of Health Care in Ontario. The ICES Practice Atlas. 2nd Edition. Canadian Medical Association, Ottawa, Ontario, Canada 1996;99-103.

Wennberg JE, Cooper MM, editors, The Dartmouth Atlas of Health Care 1998, American Hospital Publishing, Inc., Chicago IL 1997; 217-300.

Keller RB, Wennberg DE, Soule DN. Changing physician behavior: The Maine Medical Assessment Foundation. Quality Management in Health Care, 1997; 5(4): 1-11.

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The American Hospital Association
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Map and map databases were generated using
MapInfo® software
Highway map coordinates from MapInfo®
ZIP Code map coordinates from GDT®
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