

## **Washington Inpatient Atlas Project (WIAP)**

Concerns about the increasing cost of health care have led to questions about the appropriate quality, accessibility, and utilization of healthcare resources. The most comprehensive research to date on the geographic variation of healthcare, the Dartmouth Atlas of Health Care, revealed substantial differences in the access to and usage of healthcare resources, both across the country and even within single cities, including wide variation in the use of many major medical procedures. The substantial geographic variation in the use of medical treatments and hospital resources suggests that decisions about health care are not always based on solid scientific evidence. They may be based on the availability of resources, as well as regional trends and consensus.

### **Research Brief Series**

Following an introductory document, there is a series of research briefs, each of which could be read as a stand-alone document. Each of these describes the geographic and historical variation in the usage rate of a specific inpatient surgical procedure in Washington State. Each brief includes four charts:

- the statewide rates by sex and age bracket over the period 1990-2005,
- the statewide rates for each year from 1990-2005 adjusted for age and sex with confidence intervals,
- the regional rates adjusted for age and sex in 2005 with confidence intervals, and
- the regional rates adjusted for age and sex for each year in the period 1990-2005.

There are many possible explanations for the observed variations. These studies do not make any conclusions as to why the variations exist. The purpose is to display them and hopefully to stimulate discussion.

### **Appendices**

- Appendix A: Introduction and Background of the Washington Inpatient Atlas Project (WIAP)
- Appendix B: WIAP Coronary Artery Bypass Graft (CABG): 1990-2005
- Appendix C: WIAP Percutaneous Transluminal Coronary Angioplasty (PTCA): 1990-2005
- Appendix D: WIAP Total Knee Replacement: 1990-2005
- Appendix E: WIAP Total Hip Replacement: 1990-2005
- Appendix F: WIAP Cholecystectomy (Gallbladder Removal): 1990-2005
- Appendix G: WIAP Hysterectomy: 1990-2005
- Appendix H: WIAP Appendectomy: 1990-2005
- Appendix I: WIAP Tonsillectomy: 1990-2005
- Appendix J: Summary of Findings for Eight Surgical Procedures in Washington State: 1990-2005

## WASHINGTON INPATIENT ATLAS PROJECT

Research Brief No. 44A  
February 2007

## Introduction and Background of the Washington Inpatient Atlas Project

*By The WIAP Team<sup>i</sup>*

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Concerns about the increasing cost of health care have led to questions about the appropriate quality, accessibility, and utilization of health care resources. The most comprehensive research to date on the geographic variation of healthcare, the Dartmouth Atlas of Health Care, revealed substantial differences in the access to and usage of healthcare resources, both across the country and even within single cities, including wide variation in the use of many major medical procedures.<sup>1</sup> The substantial geographic variation in the use of medical treatments and hospital resources suggests that decisions about healthcare are not always based on solid scientific evidence. They may be based on the availability of resources, as well as regional trends and consensus.

Previous research found significant variation in the rates of surgical procedures, hospitalizations for chronic illnesses, and overall hospital utilizations across geographic areas – even after adjusting for the age and sex structure of the population. For example, researchers at the University of Michigan found regional variations in the treatment of pediatric asthma among children enrolled in the Michigan Medicaid health plan.<sup>2</sup> Studies also show substantial geographic variation in the use of post-acute care, hospitalizations for chronic illnesses, the use of breast-conserving surgery in breast cancer treatment, ICU utilization by patients with chronic obstructive pulmonary disease, hospice use among cancer patients, and more.<sup>3</sup> Several of these previous studies suggest that where there are differences in usage, there may be opportunities to improve the quality of health care. There are many possible explanations for the observed variations. These studies do not make any conclusions as to why the variations exist. The purpose is to display them and hopefully to stimulate discussion.

### Research Brief Series

Following this introductory document is a series of research briefs, each of which could be read as a stand-alone document. Each of these describes the geographic and historical variation in the usage rate of a specific inpatient surgical procedure in Washington State. Each brief includes four charts:

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<sup>i</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson. By using these data the user agrees that the Washington State Office of Financial Management shall not be liable for any activity involving these data with regard to lost profits or savings or any other consequential damages; or the fitness for use of the data for a particular purpose; or the installation of the data, its use, or results obtained.

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The rates are based on data from the Department of Health's Comprehensive Hospital Abstract Reporting System (CHARS) database on hospital inpatient discharges and county populations by age, race and sex from the Office of Financial Management. The CHARS database includes information on the procedures performed on individual patients during the hospital stay and the patient's age, sex, and zip code of residence (patients are not identified in the file). Outpatient procedures are not included in the CHARS database. CHARS records also do not include procedures performed in military or Veterans Administration facilities.

## **Inpatient Surgical Procedures**

The surgical procedures selected for study in the following research briefs include: Coronary Artery Bypass Graft (CABG), Percutaneous Transluminal Coronary Angioplasty (PTCA), Total Knee Replacement, Total Hip Replacement, Cholecystectomy (gallbladder removal), Hysterectomy, Appendectomy, and Tonsillectomy. Most of these inpatient procedures are fairly common and involve short stays in the hospital. The procedures vary in terms of how much discretion physicians have in performing them; appendectomies, for example, are normally performed in response to acute appendicitis, while knee and hip replacements are often more elective in nature. The two heart surgery procedures, CABG and PTCA, are alternatives for surgically treating coronary artery disease. Among all eight procedures, appendectomies are expected to vary the least geographically (there are few alternatives to treating acute appendicitis and there is little reason to expect appendicitis to vary geographically), and is therefore used as a "benchmark" procedure against which to compare the variation seen in the use of the other procedures.

The procedures were identified in the CHARS data with *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) procedure codes. The CHARS database includes up to six procedure code fields; discharge records were selected if the procedure codes of interest occurred in any of the six fields. Several ICD-9-CM procedure codes were revised during the period of study (1990 to 2005). These code revisions were noted and the processing of the hospital discharge data was adjusted accordingly for each year. The ICD-9-CM codes used to identify each procedure are noted in the first footnote of each research brief.

## **Geography**

An ideal choice of geographic sub-unit of the state for this analysis would be the county. This study, however, is based on the regions used for the State Population Survey (SPS). There are three main reasons for choosing the SPS regions.

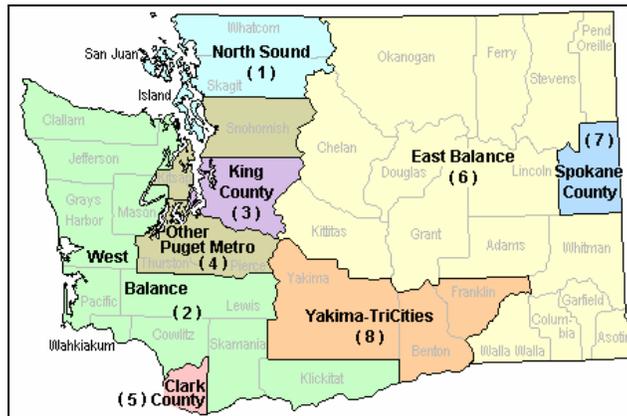
The CHARS data identifies the zip code of residence of each patient. The zip code generally identifies an SPS region and, with a few exceptions, identifies a state resident. Some zip codes, however, are spread across county boundaries, and in two instances, a zip code spans two regions. Zip code 99026 spans Spokane County and Stevens County, which also means it spans the Spokane region and the East Balance Region. For these briefs, all 99026 records are counted as in the East Balance region. Zip code 98304 spans Lewis County and Pierce County. Lewis County is in the West Balance Region, and Pierce County is in the Other Puget Sound Metro Region. For these briefs, all 98304 records are counted as in the Other Puget Sound Metro Region. Using the SPS region as the geographic scale in this study minimizes the zip-code related problems, including the additional problem of changing zip code boundaries over time.

Population size is the second reason for using SPS regions. Some Washington counties are small enough that the estimated usage rates would have unacceptably wide confidence intervals. Since several larger counties serve as SPS regions (King, Spokane, and Clark), not much is sacrificed by using SPS regions for the analysis.

Lastly, the SPS provides data on income, health insurance status and education levels, which are not available at the county level. The availability of regional social and economic data may help in understanding the context behind regional differences in surgical procedure rates. Key characteristics of the SPS regions are displayed below.

### Washington State Population Survey Regions

Results from the Washington State Population Survey are available for Washington State and for eight regions within Washington. The regions, either single counties or groups of counties, are shown at right.



### Highest Level of School Completed (2004)

	NORTH PUGET	WEST BALANCE	KING COUNTY	PUGET METRO	CLARK COUNTY	EAST BALANCE	SPOKANE CNTY	TRI- CITIES
Less than 9 Grade	1.9%	1.9%	1.0%	0.7%	1.4%	4.0%	1.3%	7.6%
9 - 12, No GED	9.0%	11.7%	6.6%	10.2%	9.7%	13.0%	9.8%	12.9%
High School Grad	26.1%	30.2%	19.0%	27.2%	27.5%	28.2%	25.4%	27.1%
GED	2.1%	2.6%	1.2%	1.6%	2.2%	1.8%	1.1%	3.7%
Vocational	3.0%	3.6%	2.2%	3.0%	2.8%	3.5%	3.1%	3.3%
Some College, No Degree	20.3%	21.0%	16.1%	18.6%	18.6%	17.6%	21.0%	14.9%
Associate Degree	7.6%	9.8%	8.0%	11.2%	10.4%	7.5%	11.1%	7.3%
Bachelor's Degree	19.2%	12.4%	30.0%	19.3%	18.7%	14.8%	17.3%	14.4%
Master's Degree	7.9%	5.1%	12.0%	6.4%	6.7%	6.8%	6.9%	6.4%
Professional Degree	1.1%	0.5%	1.8%	0.9%	0.6%	1.3%	1.5%	1.1%
Doctorate Degree	1.9%	1.1%	2.1%	1.1%	1.5%	1.5%	1.4%	1.3%
<b>TOTAL</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Source: OFM State Population Survey, 2004. <http://www.ofm.wa.gov/sps/default.asp>.

**Health Insurance Status by SPS Region (2004)**

<b>SPS REGION</b>	<b>Insured</b>	<b>Not Insured</b>	<b>Total</b>	<b>% Insured</b>	<b>% Not Insured</b>
NORTH PUGET	332,584	43,354	375,938	88.47%	11.53%
WEST BALANCE	387,094	45,772	432,866	89.43%	10.57%
KING COUNTY	1,637,012	151,766	1,788,778	91.52%	8.48%
PUGET METRO	1,667,871	179,013	1,846,884	90.31%	9.69%
CLARK COUNTY	344,069	39,327	383,396	89.74%	10.26%
EAST BALANCE	402,074	66,748	468,822	85.76%	14.24%
SPOKANE CNTY	385,604	46,394	431,998	89.26%	10.74%
TRI-CITIES	401,336	38,059	439,395	91.34%	8.66%
<b>STATE TOTAL</b>	<b>5,557,644</b>	<b>610,433</b>	<b>6,168,077</b>	<b>90.10%</b>	<b>9.90%</b>

Source: OFM State Population Survey, 2004. (Version 4) <http://www.ofm.wa.gov/sps/default.asp>.

**Household Income by SPS Region (2003)**

<b>SPS Region</b>	<b>Median</b>	<b>Mean</b>
NORTH PUGET	45,000	56,186
WEST BALANCE	36,130	44,912
KING COUNTY	57,520	73,377
PUGET METRO	50,000	63,449
CLARK COUNTY	48,600	61,091
EAST BALANCE	32,400	44,183
SPOKANE CNTY	40,300	52,674
TRI-CITIES	45,900	58,478
<b>STATE TOTAL</b>	<b>48,200</b>	<b>61,994</b>

Source: OFM State Population Survey, 2004.  
<http://www.ofm.wa.gov/sps/default.asp>.

### Family Income as Percent of Federal Poverty Line (2003)

SPS Region	0-99%	100-199%	200-299%	300-399%	400%+	Total
NORTH PUGET	16.83%	17.02%	16.63%	15.58%	33.94%	100.00%
WEST BALANCE	19.91%	18.06%	19.44%	12.56%	30.04%	100.00%
KING COUNTY	12.51%	12.64%	12.27%	13.59%	49.00%	100.00%
PUGET METRO	15.57%	14.36%	15.80%	12.76%	41.51%	100.00%
CLARK COUNTY	12.31%	17.20%	18.24%	15.11%	37.14%	100.00%
EAST BALANCE	21.94%	23.72%	16.10%	13.33%	24.91%	100.00%
SPOKANE CNTY	17.11%	15.59%	22.92%	13.31%	31.07%	100.00%
TRI-CITIES	21.51%	17.17%	17.09%	14.06%	30.16%	100.00%
<b>STATE TOTAL</b>	<b>15.88%</b>	<b>15.46%</b>	<b>15.85%</b>	<b>13.48%</b>	<b>39.34%</b>	<b>100.00%</b>

Source: OFM State Population Survey, 2004. (Version 4) <http://www.ofm.wa.gov/sps/default.asp>.

### Total Hospital Beds per 10,000 Residents by Region (2004)

SPS Region	Total Hospital Beds	Population	Beds per 10,000 Population
NORTH PUGET	596	383,200	15.55
WEST BALANCE	1,179	438,600	26.88
KING COUNTY	5,055	1,808,300	27.95
PUGET METRO	4,182	1,876,200	22.29
CLARK COUNTY	355	391,500	9.07
EAST BALANCE	1,498	474,400	31.58
SPOKANE CNTY	1,883	436,300	43.16
TRI-CITIES	969	447,900	21.63
<b>STATE TOTAL</b>	<b>15,717</b>	<b>6,256,400</b>	<b>25.12</b>

Source: Department of Health (2004). 2005 Population Estimates.

### Additional Note on Clark County

These data include only procedures performed on Washington State residents in hospitals located in Washington. They do not include non-residents who had procedures done in Washington or Washington residents that have had procedures out of state. This explains why the Clark Region generally has the lowest procedure rates, since some Clark residents likely travel out of state, to Portland, Oregon, for inpatient treatment.

### Methods

The rates presented in the following briefs are in terms of numbers of surgical discharges (the numerator) per 10,000 residents (the denominator). Note that it is possible for one patient to receive more than one procedure within a year and therefore be counted for multiple events. All rates have been adjusted for the varying age-sex structure of the population. Since the age-sex structure of the population changes both geographically and over time, age and sex adjustments are necessary for each year. Otherwise, some of the variation which would appear in unadjusted rates would be the result of the variation in demographics over time and between the regional populations in any given year.

The direct adjustment method for sex and age consists of the following steps. First, a statewide or regional rate for each sex and age bracket combination in each year from 1990 to 2005 is computed.<sup>ii</sup> Each of these age-sex specific rates is then applied to the 1990 statewide population by sex and age bracket (the standard population). The resulting number of procedures for each age-sex bracket can be thought of as the number that would have been performed in the state in 1990 if the state's age-specific rates were the same as the region's for the given year; that is, the region's counts of the procedure have been standardized to the state's population structure in 1990. The standardized number of procedures for each sex and age bracket are then summed for each year and divided by the total state population in 1990 to calculate the sex and age adjusted rate for each year. This method is known as direct age and sex adjustment and is widely used in studies involving population-based comparisons across areas or across time.<sup>iii</sup>

### **Intended Use of this Inpatient Atlas Research Brief Series**

This research brief series is intended to stimulate discussion among Washington's medical, public health, and health policy professionals. The briefs are by no means exhaustive studies into the origins and/or causes of regional disparities in surgery rates, but are meant only to serve as a beginning point for identifying and quantifying regional health care disparities. The series was inspired, in part, by the findings of the Dartmouth Atlas of Health Care (produced by the Center for the Evaluative Clinical Sciences, Dartmouth Medical School). Reasonable efforts were made to sufficiently review relevant literature and consult with medical professionals in the design of the study (including the definition of the surgical procedures), but given the specialized knowledge needed to fully implement a scientifically rigorous design, some errors or omissions may remain. It should be noted that only ICD-9-CM procedure codes were used to define surgical procedures described in the series; diagnosis codes were not taken into consideration in order to qualify discharge records for inclusion or exclusion. The WIAP team welcomes comments or feedback regarding these research briefs.

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<sup>ii</sup> Unless otherwise specified, 18 age brackets were used: five year brackets from 0-4 to 80-84 and over 85.

<sup>iii</sup> Sex and age-adjusted rates and confidence intervals (alpha = .05) were computed using the method recommended in Washington State Department of Health - Guidelines for using confidence intervals for public health assessments. 2002. Available on-line at [http://www.doh.wa.gov/Data/Guidelines/WordDocs/CI\\_guidelines.pdf](http://www.doh.wa.gov/Data/Guidelines/WordDocs/CI_guidelines.pdf).

**Notes:**

<sup>1</sup> Wennberg JE & Cooper MM, eds. The quality of medical care in the United States: A report on the Medicare program, *Dartmouth Atlas of Health Care in the United States 1999*, 2003. Available on-line at <http://www.dartmouthatlas.org/atlas/99Atlas.pdf>.

<sup>2</sup> Dombkowski KJ, Cabana MD, Cohn LM, Gebremarian A, Clark SJ. Geographic variation of asthma quality measures within and between health plans. *The American Journal of Managed Care*. 2005; 11:765-772.

<sup>3</sup> Kane RL, Lin W, Blewett LA. Geographic variation in the use of post-acute care. *Health Services Research*. 2002; 37:667.

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WASHINGTON INPATIENT  
ATLAS PROJECT

Research Brief No. 44B  
February 2007

Coronary Artery Bypass Graft (CABG):  
1990-2005

By The WIAP Team<sup>i</sup>

The first brief in the series on geographic variation in the use of surgical procedures analyzes Coronary Artery Bypass Graft (CABG) rates across Washington. Being first developed in the 1960s, CABGs are now commonly performed to relieve angina and to reduce the effects of coronary artery disease. The methodology used in this series of research briefs is detailed in the overview brief.<sup>1</sup>

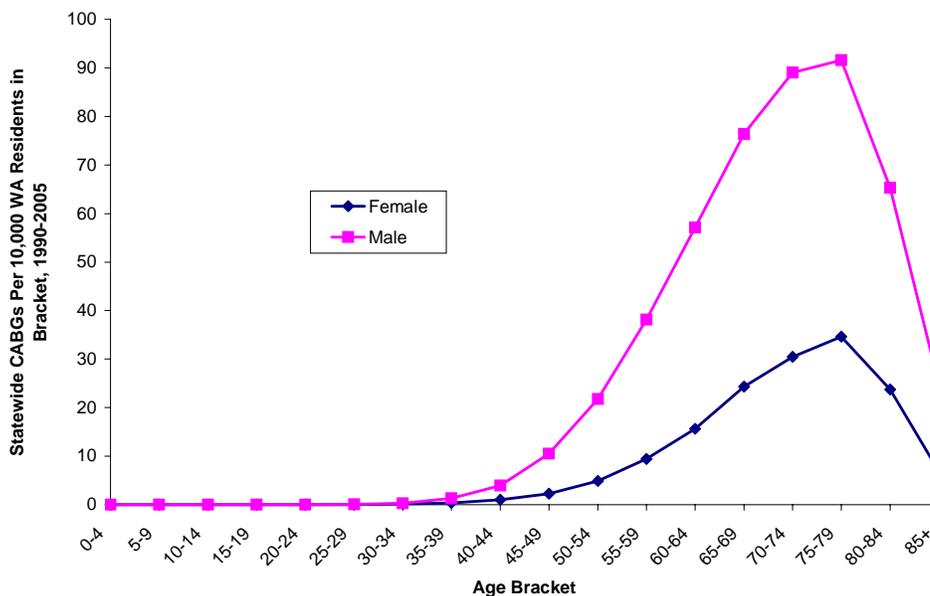
Coronary Artery Bypass Grafts described in this research brief include ICD-9-CM procedure codes 36.10 to 36.19. Codes 36.20 to 36.39 were also suggested for inclusion, however, a literature review indicated these codes are not ordinarily included in studies of CABG. The effect of omitting these codes is negligible. Including them would have added 207 cases, or less than 0.25 percent of total cases.

**Findings**

The CABG rates described in this brief are adjusted for age and sex and refer to the number of surgery discharges per 10,000 Washington residents. As indicated in Figure 1, bypass surgery is most commonly performed on patients in the senior and elderly age groups. In Washington during the period 1990 to 2005, men received the bypasses 2.8 times as often as women.

**Figure 1: CABG Rates by Age and Sex, 1990 – 2005**

Universe: Washington residents discharged from hospitals located in Washington



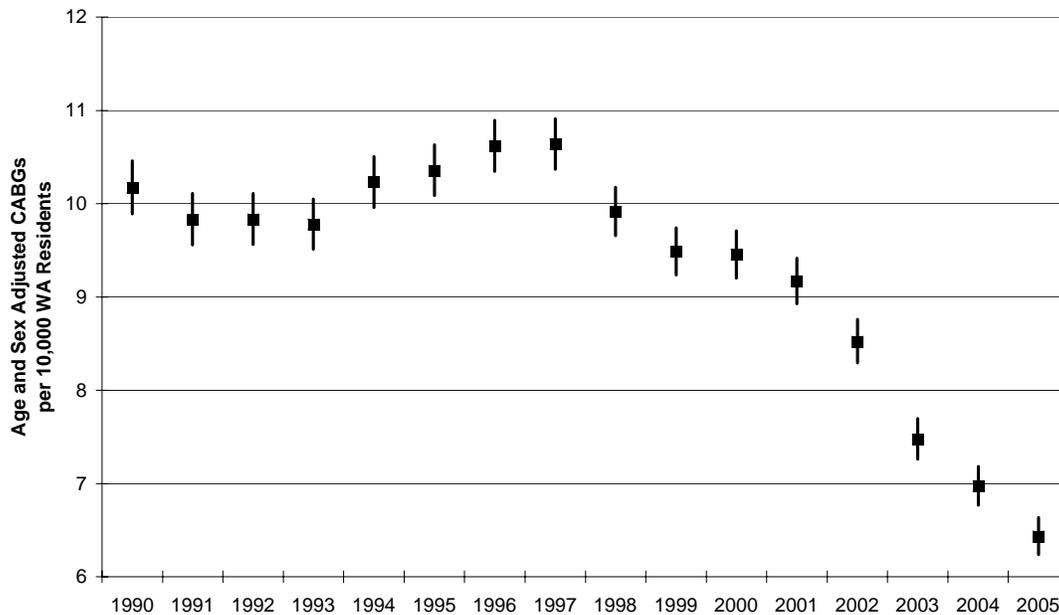
Source: Authors' calculations using CHARS data, 1990 to 2005.

<sup>i</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson. By using these data the user agrees that the Washington State Office of Financial Management shall not be liable for any activity involving these data with regard to lost profits or savings or any other consequential damages; or the fitness for use of the data for a particular purpose; or the installation of the data, its use, or results obtained.

Between 1990 and 2005, about 85,000 bypass surgeries were performed in Washington. Since the mid-1990s, however, the rate has declined by 40 percent, from 10.6 CABGs per 10,000 residents in 1997 to just 6.4 in 2005 (Figure 2). Part of the decline, which was also observed nationally during the period (Center for the Evaluative Clinical Sciences, 2005), can likely be explained by growing use of angioplasty<sup>2</sup> as a less invasive and less risky alternative to bypass surgery.

### Figure 2: Age and Sex Adjusted Statewide CABG Rates: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARs data, 1990 to 2005.

Rates are directly adjusted to the age and sex distribution of Washington's population in 1990. 95% confidence intervals are shown.

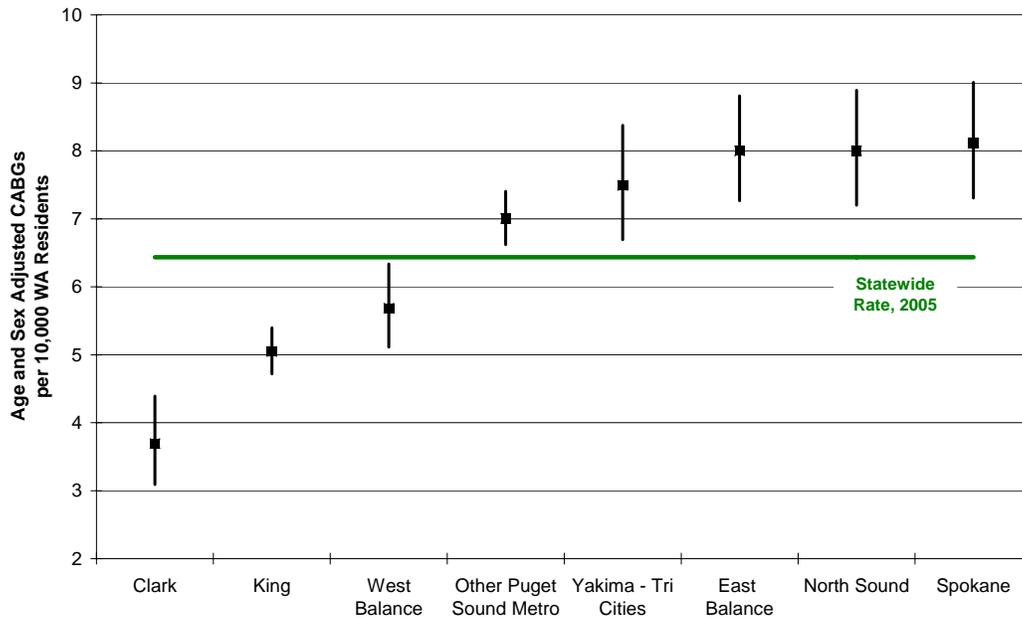
### Regional Variation

Coronary bypass rates varied significantly across the eight Washington State Population Survey (WSPS) regions in 2005.<sup>3</sup> The statewide CABG rate in 2005 was 6.4 per 10,000 residents. As shown in Figure 3, bypass surgery was least commonly performed in Clark (3.7) and King (5.0), and most commonly performed in North Sound (8.0), Spokane (8.0), and East Balance (8.1). All of these regions varied significantly from the statewide rate in 2005, suggesting that the likelihood of patients undergoing bypass surgery at least in part depended on where patients lived. The very low figure for Clark may be due to many of Clark's heart patients opting to have bypass surgery performed at a hospital located in nearby Portland.

Figure 4 illustrates that the statewide decline in bypass surgeries since the mid-1990s was also apparent in each of the WSPS regions. The largest regional decline during that period, 56 percent, was seen in King, where the rate fell from 11.4 in 1996 to 5.0 in 2005.

### Figure 3: Age and Sex Adjusted CABG Rates By Region: 2005

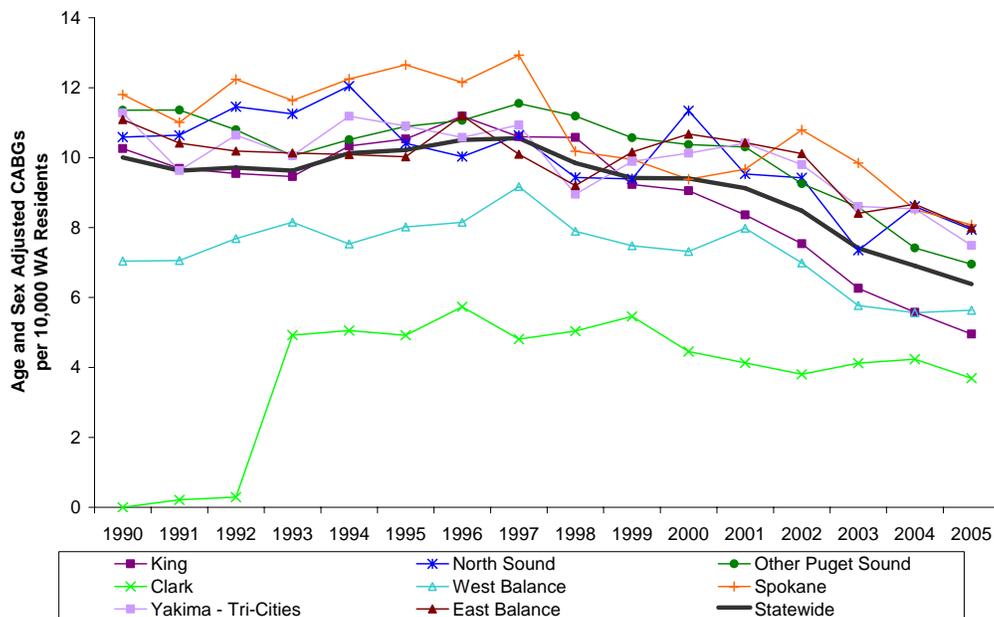
Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.  
 95% confidence intervals are shown.

### Figure 4: Age and Sex Adjusted CABG Rates By Region: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

## Notes

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
2. Angioplasty most commonly refers to Percutaneous Transluminal Coronary Angioplasty (PTCA). The second brief in this research series describes the geographic variation of PTCA in Washington.
3. The Washington State Population Survey (WSPS) regions are defined as follows:
  - North Puget (Island, San Juan, Skagit, Whatcom)
  - West Balance (Clallam, Cowlitz, Grays Harbor, Jefferson, Klickitat, Lewis, Mason, Pacific Skamania, Wahkiakum)
  - King (King)
  - Puget Metro (Kitsap, Pierce, Snohomish, Thurston)
  - Clark (Clark)
  - East Balance (Adams, Asotin, Chelan, Columbia, Douglas, Ferry Garfield, Grant, Kittitas, Lincoln, Okanogan, Pend Oreille, Stevens, Walla Walla, Whitman)
  - Spokane (Spokane)
  - Yakima - Tri Cities (Benton, Franklin, Yakima)

## References

Center for the Evaluative Clinical Sciences, 2005. Dartmouth Atlas of Health Care: Studies in Surgical Variation, Cardiac Surgery Report. Lebanon, NH. Obtained online from [http://www.dartmouthatlas.org/atlas/Cardiac\\_report\\_2005.pdf](http://www.dartmouthatlas.org/atlas/Cardiac_report_2005.pdf) , on January 25, 2007.

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**WASHINGTON INPATIENT  
ATLAS PROJECT**

Research Brief No. 44C  
February 2007

**Percutaneous Transluminal Coronary  
Angioplasty (PTCA):  
1990-2005**

By WIAP Team<sup>i</sup>

The second brief in the series on geographic variation in the use of surgical procedures analyzes Percutaneous Transluminal Coronary Angioplasty (PTCA, hereafter “angioplasty”) rates across Washington. Coronary angioplasty uses a catheter to open up blocked coronary arteries and restore blood flow to the heart in order to relieve angina and reduce the effects of coronary artery disease. The procedure is much less invasive, usually less expensive, and faster to perform than coronary artery bypass graft surgery (or CABG, see the first brief of this series, Research Brief No. 44B). The methodology used in this series of research briefs is detailed in the overview brief.<sup>1</sup>

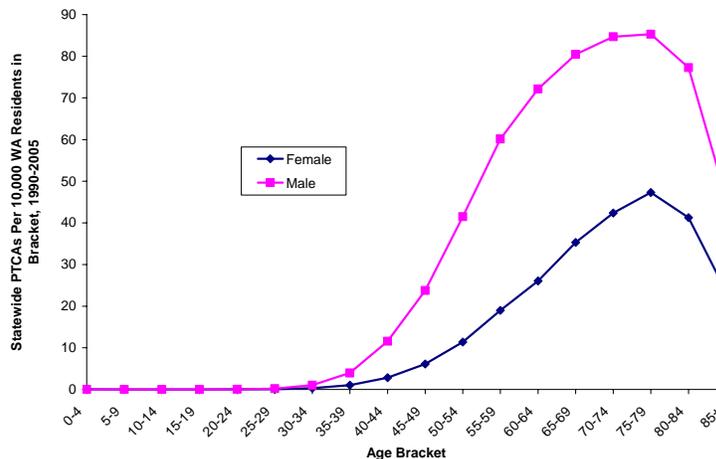
Percutaneous Transluminal Coronary Angioplasty, as described in this research brief, includes ICD-9-CM procedure codes 36.01, 36.02, 36.05, and 00.66 (the revised code beginning in 2005). A literature review indicated that these are ordinarily the codes used to define PTCA.

**Findings**

The PTCA rates described in this brief are adjusted for age and sex and refer to the number of surgery discharges per 10,000 Washington residents. As indicated in Figure 1, coronary angioplasty is most commonly performed on patients in the senior and elderly age groups. In Washington during the period 1990 to 2005, men received coronary angioplasty about twice as often as women.

**Figure 1: PTCA Rates by Age and Sex, 1990 – 2005**

Universe: Washington residents discharged from hospitals located in Washington



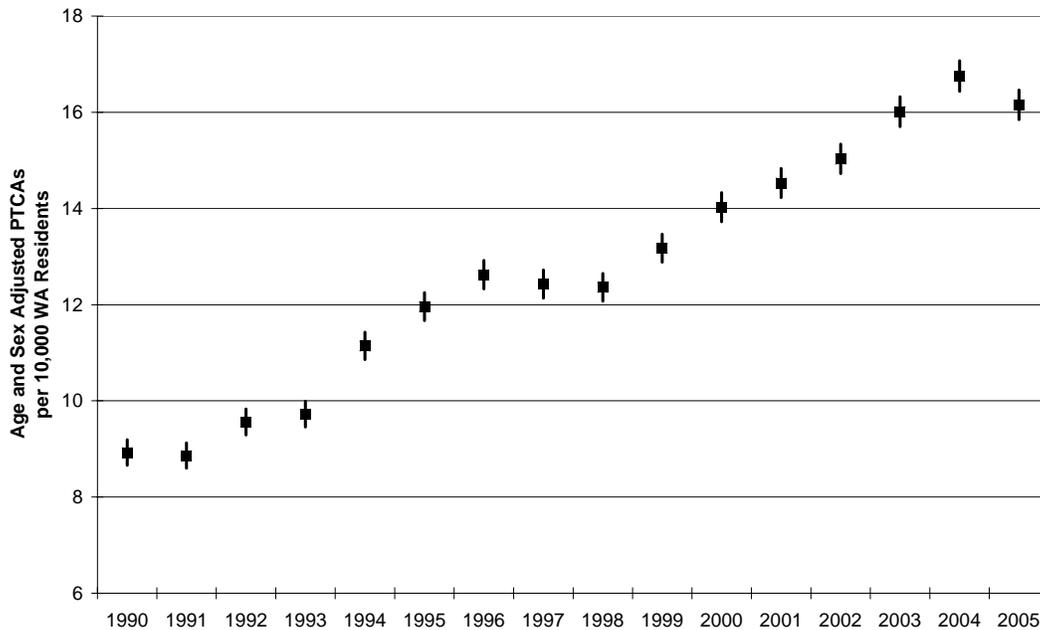
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Between 1990 and 2005, over 122,000 coronary angioplasty procedures were performed in Washington. Statewide, the age and sex adjusted rate for coronary angioplasties grew fairly steadily from 8.9 per 10,000 residents in 1990 to 16.2 in 2005, or by 81 percent (Figure 2). The growth of the use of coronary angioplasty also occurred nationally during the same period (Center for the Evaluative Clinical Sciences, 2005).

### Figure 2: Age and Sex Adjusted Statewide PTCA Rates: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.

Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

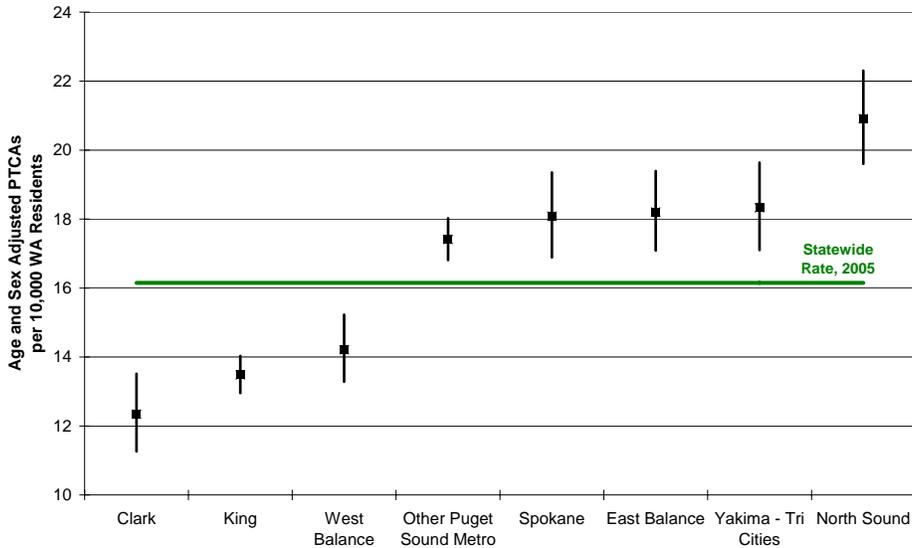
95% confidence intervals are shown.

### Regional Variation

Coronary angioplasty rates varied significantly across the eight Washington State Population Survey (WSPS) regions in 2005.<sup>2</sup> The statewide PTCA rate in 2005 was 16.2 per 10,000 residents. As shown in Figure 3, coronary angioplasty was least commonly performed in Clark (12.3) and King (13.5), and most commonly performed in North Sound (21.0). All of the regions varied significantly from the statewide rate in 2005, suggesting that the likelihood of patients undergoing coronary angioplasty at least in part depended on where patients lived. The very low figure for Clark may be due to many of Clark's heart patients opting to have the procedure performed at a hospital located in nearby Portland.

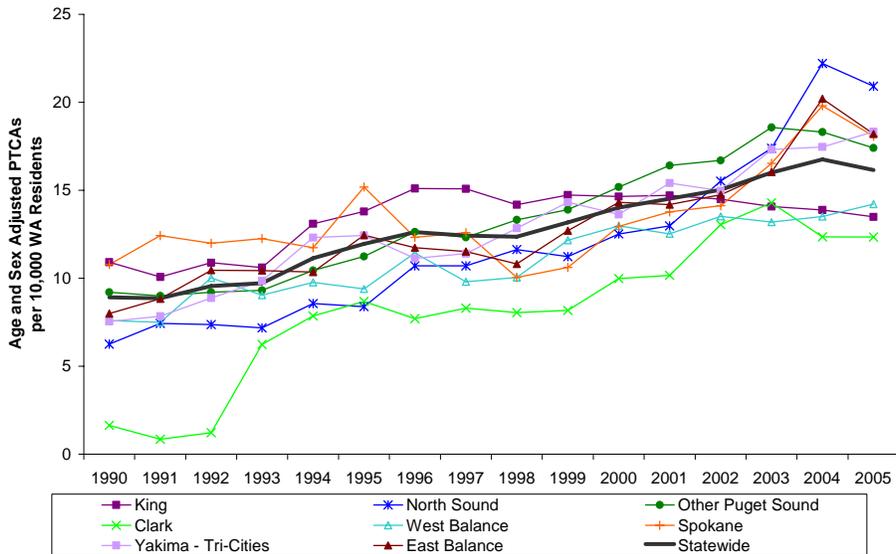
Figure 4 illustrates that the statewide growth in PTCAs from 1990 to 2005 was also apparent in each of the WSPS regions, however, growth was clearly faster in some regions than others. The largest regional increase during the period was seen in North Sound, where the rate more than tripled from 6.3 per 10,000 residents in 1990 to 21.0 in 2005. The slowest growth in the use of the procedure was in King, where the rate grew by only 24 percent, from 10.9 in 1990 to 13.5 in 2005.

**Figure 3: Age and Sex Adjusted PTCA Rates By Region: 2005**  
 Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.  
 95% confidence intervals are shown.

**Figure 4: Age and Sex Adjusted PTCA Rates By Region: 1990-2005**  
 Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

## Notes

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
2. The Washington State Population Survey (WSPS) regions are defined as follows:
  - North Puget (Island, San Juan, Skagit, Whatcom)
  - West Balance (Clallam, Cowlitz, Grays Harbor, Jefferson, Klickitat, Lewis, Mason, Pacific Skamania, Wahkiakum)
  - King (King)
  - Puget Metro (Kitsap, Pierce, Snohomish, Thurston)
  - Clark (Clark)
  - East Balance (Adams, Asotin, Chelan, Columbia, Douglas, Ferry Garfield, Grant, Kittitas, Lincoln, Okanogan, Pend Oreille, Stevens, Walla Walla, Whitman)
  - Spokane (Spokane)
  - Yakima - Tri Cities (Benton, Franklin, Yakima)

## References

Center for the Evaluative Clinical Sciences, 2005. Dartmouth Atlas of Health Care: Studies in Surgical Variation, Cardiac Surgery Report. Lebanon, NH. Obtained online from [http://www.dartmouthatlas.org/atlas/Cardiac\\_report\\_2005.pdf](http://www.dartmouthatlas.org/atlas/Cardiac_report_2005.pdf) , on January 25, 2007.

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**WASHINGTON INPATIENT  
ATLAS PROJECT**

Research Brief No. 44D  
February 2007

**Total Knee Replacement:  
1990-2005**

*By The WIAP Team<sup>i</sup>*

The third brief in the series on geographic variation in the use of surgical procedures analyzes total knee replacement (hereafter “knee replacement”) rates across Washington. A commonly performed procedure, knee replacements relieve the pain and reduce the physical disability due to arthritis of the knee joint. The surgery often dramatically improves patients’ mobility and quality of life. The methodology used in this series of research briefs is detailed in the overview brief.<sup>1</sup>

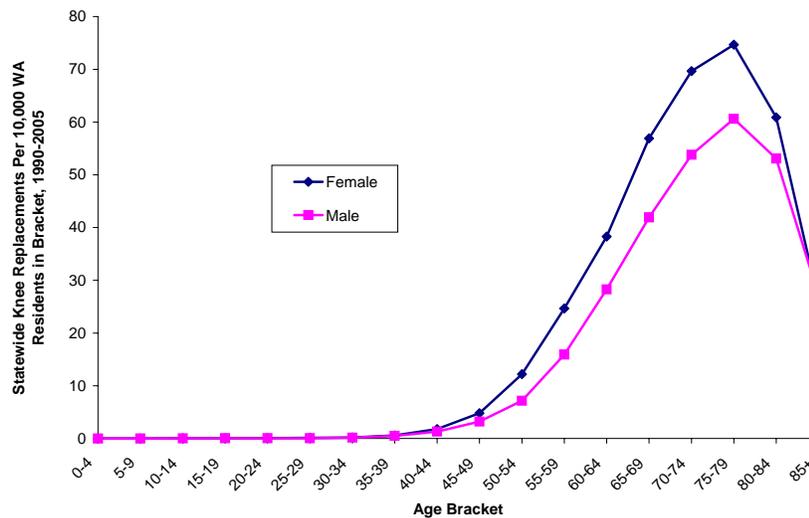
Total knee replacements, as described in this research brief, include ICD-9-CM procedure code 81.54. Codes 81.55 (revision of knee replacement) and 81.41 – 81.47 (knee ligament surgery and repairs) were also reviewed for inclusion. Other studies tend to use only 81.54. Knee repair has generally declined over the past decade. Inclusion of these omitted codes would slightly change the age distribution of recipients, but would not alter the relative geographic variation in rates. Inclusion of the omitted codes would have added 24,000 cases, or 22 percent of total cases.

**Findings**

The knee replacement rates described in this brief are adjusted for age and sex and refer to the number of surgery discharges per 10,000 Washington residents. As indicated in Figure 1, knee replacements are most commonly performed on patients in the senior and elderly age groups. In Washington during the period 1990 to 2005, women received knee replacements about 50 percent more often than men.

**Figure 1: Total Knee Replacement Rates by Age and Sex, 1990 – 2005**

Universe: Washington residents discharged from hospitals located in Washington



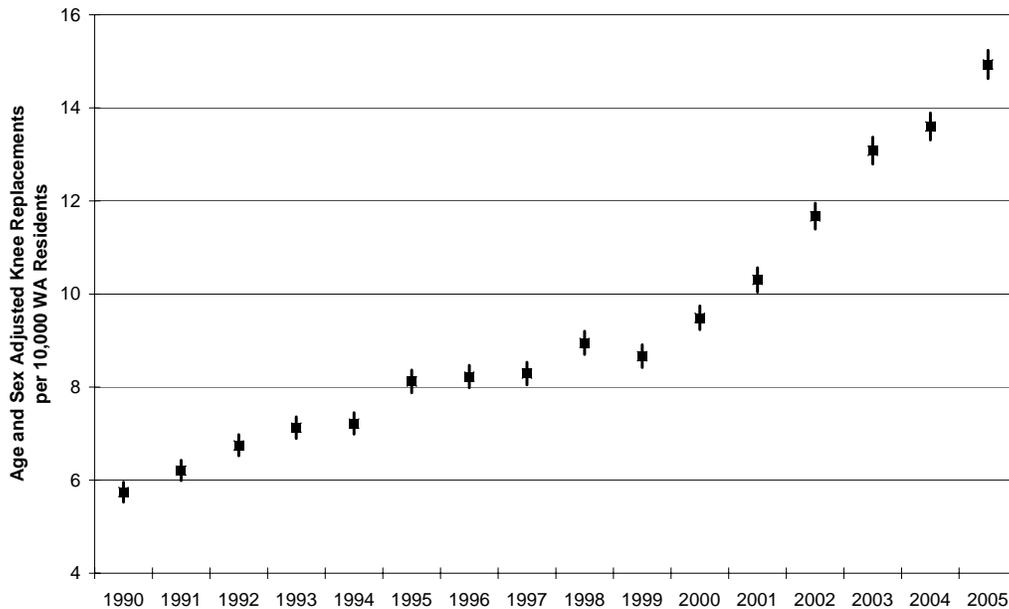
Source: Authors’ calculations using CHARS data, 1990 to 2005.

<sup>i</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson. By using these data the user agrees that the Washington State Office of Financial Management shall not be liable for any activity involving these data with regard to lost profits or savings or any other consequential damages; or the fitness for use of the data for a particular purpose; or the installation of the data, its use, or results obtained.

Between 1990 and 2005, over 86,000 knee replacement procedures were performed in Washington. Statewide, the age and sex adjusted rate for knee replacements grew steadily from 5.7 per 10,000 residents in 1990 to 14.9 in 2005, or by over 160 percent (Figure 2).

## Figure 2: Age and Sex Adjusted Statewide Knee Replacement Rates: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.

Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

95% confidence intervals are shown.

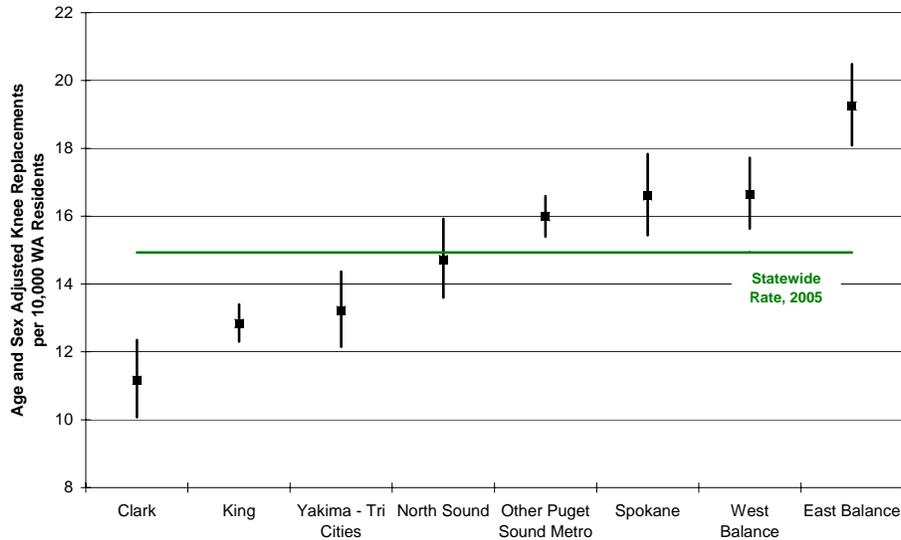
## Regional Variation

Knee replacement rates varied significantly across the eight Washington State Population Survey (WSPS) regions in 2005.<sup>2</sup> As shown in Figure 3, knee replacements were least commonly performed in Clark (11.2) and King (12.8), and most commonly performed in East Balance (19.2). Several of the regions varied significantly from the statewide rate in 2005, suggesting that the likelihood of patients receiving knee replacements at least in part depended on where they lived. The very low figure for Clark may be due to many of Clark's knee replacement patients opting to have the procedure performed at a hospital located in nearby Portland.

Figure 4 illustrates that the statewide growth in knee replacements from 1990 to 2005 was also apparent in each of the WSPS regions, however, growth was clearly faster in some regions than others. The largest regional increase during the period was seen in West Balance, where the rate more than tripled from 5.3 per 10,000 residents in 1990 to 16.6 in 2005. The slowest growth in the use of the procedure was in King and North Sound, however, even in each of these regions the knee replacement rate more than doubled during the period.

### Figure 3: Age and Sex Adjusted Knee Replacement Rates By Region: 2005

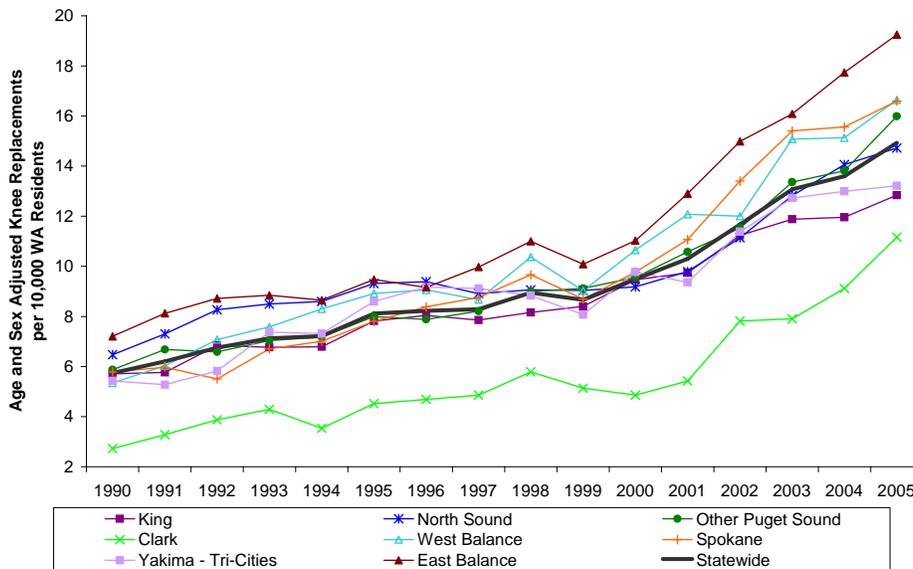
Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005. Rates are directly adjusted to the age and sex distribution of Washington's population in 1990. 95% confidence intervals are shown.

### Figure 4: Age and Sex Adjusted Knee Replacement Rates By Region: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005. Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

## Notes

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
2. The Washington State Population Survey (WSPS) regions are defined as follows:
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WASHINGTON INPATIENT  
ATLAS PROJECT

Research Brief No. 44E  
February 2007

Total Hip Replacement:  
1990-2005

By The WIAP Team<sup>i</sup>

The fourth brief in the series on geographic variation in the use of surgical procedures analyzes total hip replacement rates across Washington. A commonly performed procedure, hip replacements relieve the pain and reduce the physical disability due to arthritis of the hip joint. The surgery often significantly improves patients' mobility and quality of life. The methodology used in this series of research briefs is detailed in the overview brief.<sup>1</sup>

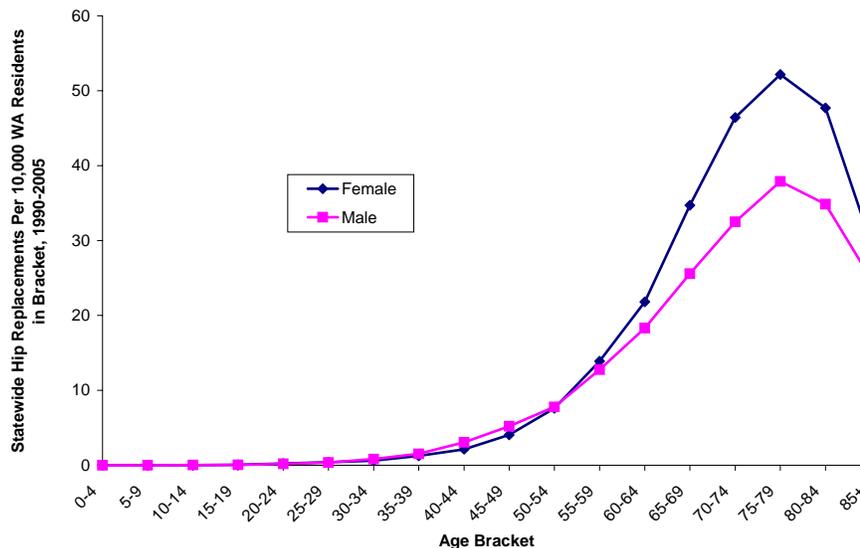
Total hip replacements, as described in this research brief, include ICD-9-CM procedure code 81.51. Codes 81.52 (partial hip replacement) and 81.53 (revision of hip replacement) were also reviewed for inclusion. Other studies tend to use only 81.51. Inclusion of these omitted codes would have increased the number of elderly recipients, but would not have altered the relative geographic variation in rates. Inclusion of the omitted codes would have added 41,000 cases, or 40 percent of total cases.

Findings

The hip replacement rates described in this brief are adjusted for age and sex and refer to the number of surgery discharges per 10,000 Washington residents. As indicated in Figure 1, hip replacements are most commonly performed on patients in the senior and elderly age groups. In Washington during the period 1990 to 2005, women received hip replacements about 40 percent more often than men.

Figure 1: Total Hip Replacement Rates by Age and Sex, 1990 – 2005

Universe: Washington residents discharged from hospitals located in Washington



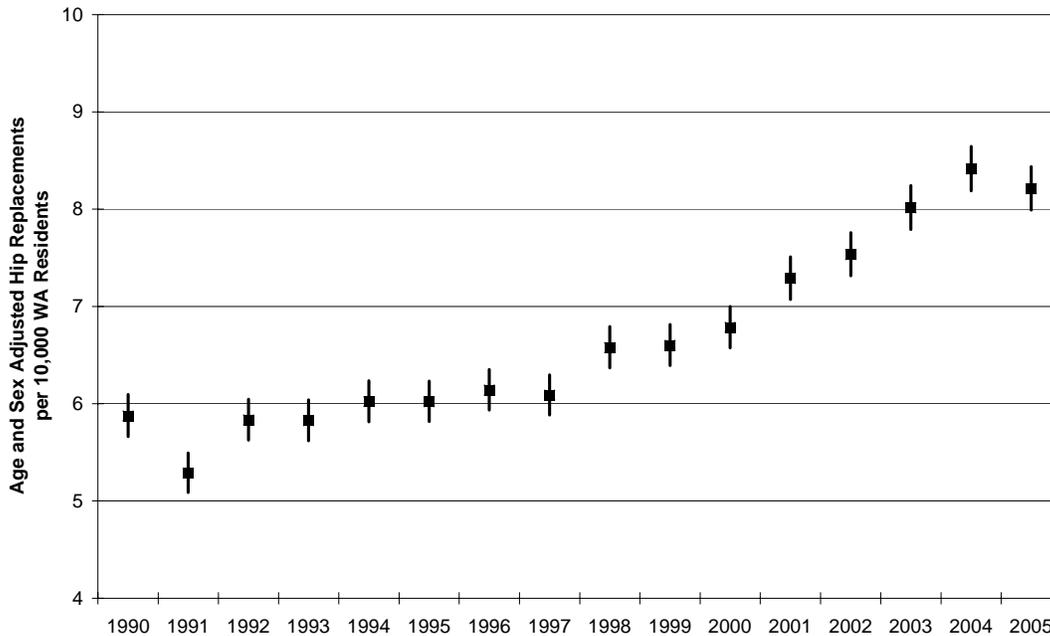
Source: Authors' calculations using CHARS data, 1990 to 2005.

<sup>i</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson. By using these data the user agrees that the Washington State Office of Financial Management shall not be liable for any activity involving these data with regard to lost profits or savings or any other consequential damages; or the fitness for use of the data for a particular purpose; or the installation of the data, its use, or results obtained.

Between 1990 and 2005, over 62,000 hip replacement procedures were performed in Washington. Statewide, the age and sex adjusted rate for hip replacements grew slowly from 5.9 per 10,000 residents in 1990 to 8.2 in 2005, or by about 40 percent (Figure 2).

## Figure 2: Age and Sex Adjusted Statewide Hip Replacement Rates: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.

Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

95% confidence intervals are shown.

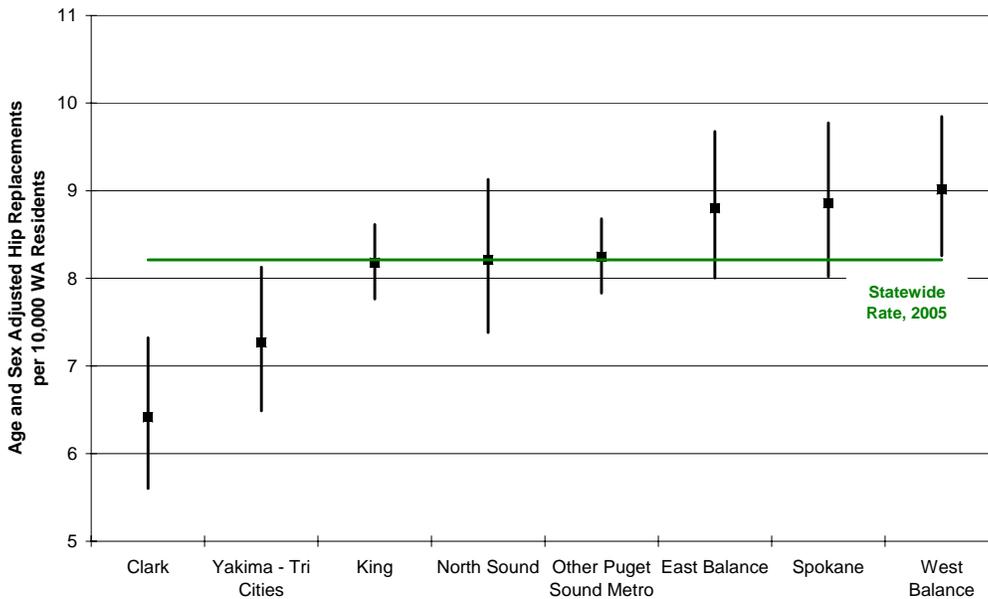
## Regional Variation

Hip replacement rates did not vary significantly across the eight Washington State Population Survey (WSPS) regions in 2005.<sup>2</sup> As shown in Figure 3, most regions' rates were close to the state average, suggesting that the likelihood of patients receiving hip replacements was independent of where they lived. The very low figure for Clark may be due to many of Clark's hip replacement patients opting to have the procedure performed at a hospital located in nearby Portland.

Figure 4 illustrates that the statewide growth in hip replacements from 1990 to 2005 was also apparent in each of the WSPS regions, with most regions' growth patterns following the state average.

### Figure 3: Age and Sex Adjusted Hip Replacement Rates By Region: 2005

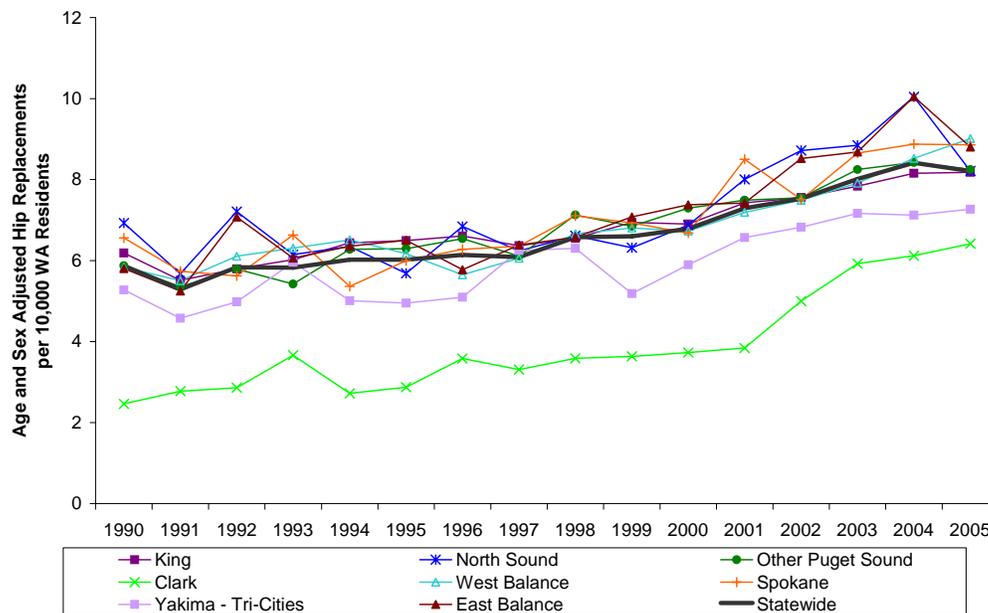
Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.  
 95% confidence intervals are shown.

### Figure 4: Age and Sex Adjusted Hip Replacement Rates By Region: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

## Notes

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
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**WASHINGTON INPATIENT  
ATLAS PROJECT**

Research Brief No. 44F  
February 2007

**Cholecystectomy  
(Gallbladder Removal):  
1990-2005**

By The WIAP Team<sup>i</sup>

The fifth brief in the series on geographic variation in the use of surgical procedures analyzes cholecystectomy (removal of the gallbladder) rates across Washington. Gallbladder removal surgery is most often performed to treat gallbladder disease, gallstones, or gallbladder cancer. The methodology used in this series of research briefs is detailed in the overview brief.<sup>1</sup>

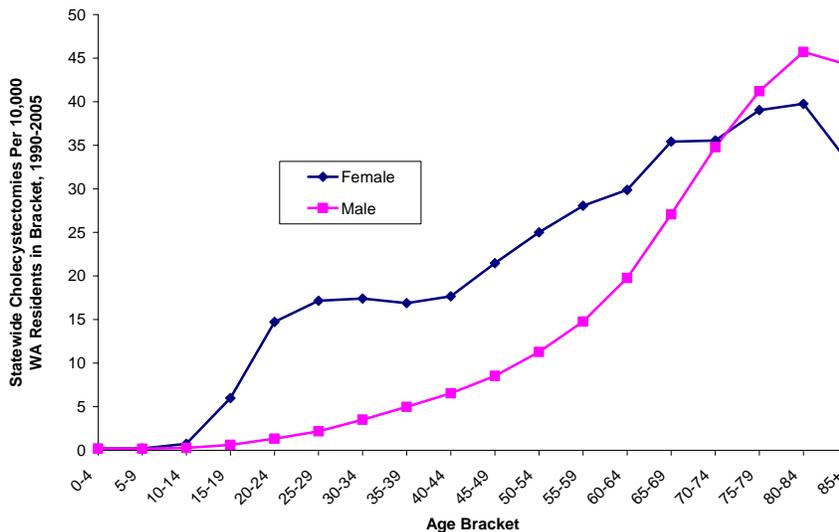
Cholecystectomies, as described in this research brief, include ICD-9-CM procedure codes 51.21 to 51.24. These procedure codes include both open and laparoscopic gallbladder removals. Codes 51.41 to 51.59 (exploratory surgeries and removal of bile duct obstructions) were considered for inclusion, but studies of cholecystectomy rates ordinarily use only 51.21 to 51.24. The effect of including the omitted codes would be negligible. Inclusion of the omitted codes would have added 977 cases, or less than one percent of total cases.

**Findings**

The cholecystectomy rates described in this brief are adjusted for age and sex and refer to the number of surgery discharges per 10,000 Washington residents. As indicated in Figure 1, gallbladder removal surgery is much more likely to be performed on women, particularly those in younger age brackets, than men. However, the likelihood for men steadily increases as they age. In Washington during the period 1990 to 2005, women overall received cholecystectomies about twice as often as men.

**Figure 1: Gallbladder Removal Rates by Age and Sex, 1990 – 2005**

Universe: Washington residents discharged from hospitals located in Washington



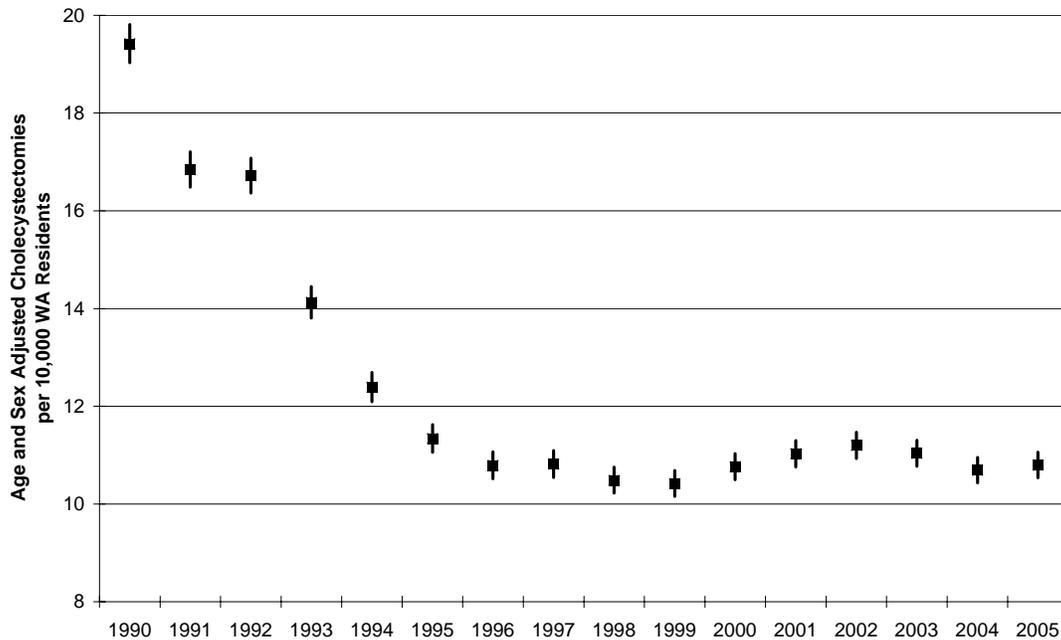
Source: Authors' calculations using CHARS data, 1990 to 2005.

<sup>i</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson. By using these data the user agrees that the Washington State Office of Financial Management shall not be liable for any activity involving these data with regard to lost profits or savings or any other consequential damages; or the fitness for use of the data for a particular purpose; or the installation of the data, its use, or results obtained.

Between 1990 and 2005, over 112,000 gallbladder removal procedures were performed in Washington. Statewide, the age and sex adjusted rate for gallbladder removal fell sharply from 19.4 per 10,000 residents in 1990 to 10.8 in 1996, or by over 40 percent. Since that time, the rate has remained relatively stable (Figure 2).

## Figure 2: Age and Sex Adjusted Statewide Gallbladder Removal Rates: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.

Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

95% confidence intervals are shown.

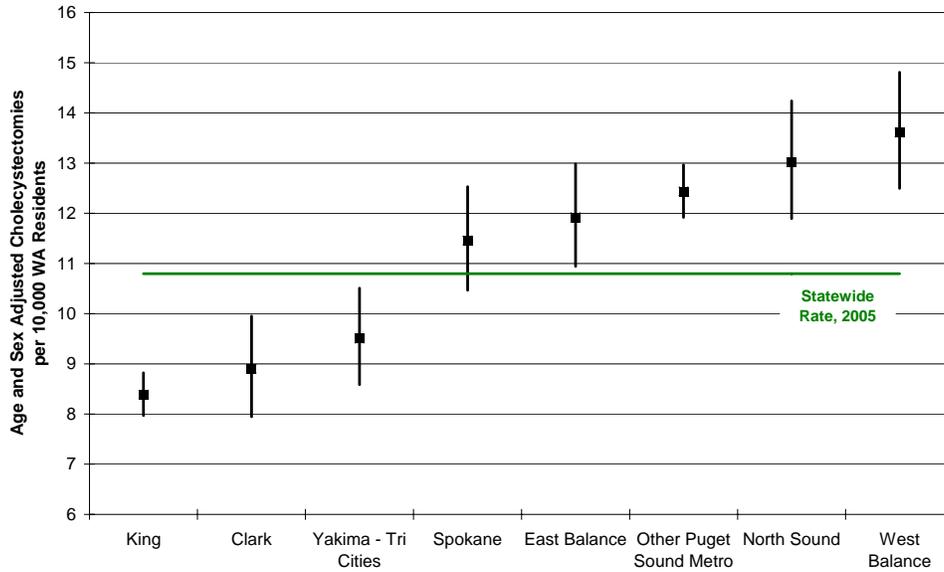
## Regional Variation

Gallbladder removal rates varied significantly across the eight Washington State Population Survey (WSPS) regions in 2005.<sup>2</sup> As shown in Figure 3, gallbladder removals were least commonly performed in King (8.4) and most commonly performed in North Sound (13.0) and West Balance (13.6). Several of the regions varied significantly from the statewide rate in 2005, suggesting that the likelihood of patients having gallbladders removed at least in part depended on where they lived. The very low figure for Clark may be due to many of Clark's gallbladder patients opting to have the procedure performed at a hospital located in nearby Portland.

Figure 4 illustrates that the statewide decline in gallbladder removals from 1990 to 2005 was also apparent in each of the WSPS regions, with most regions' growth patterns following the state average, particularly since that late-1990s.

### Figure 3: Age and Sex Adjusted Gallbladder Removal Rates By Region: 2005

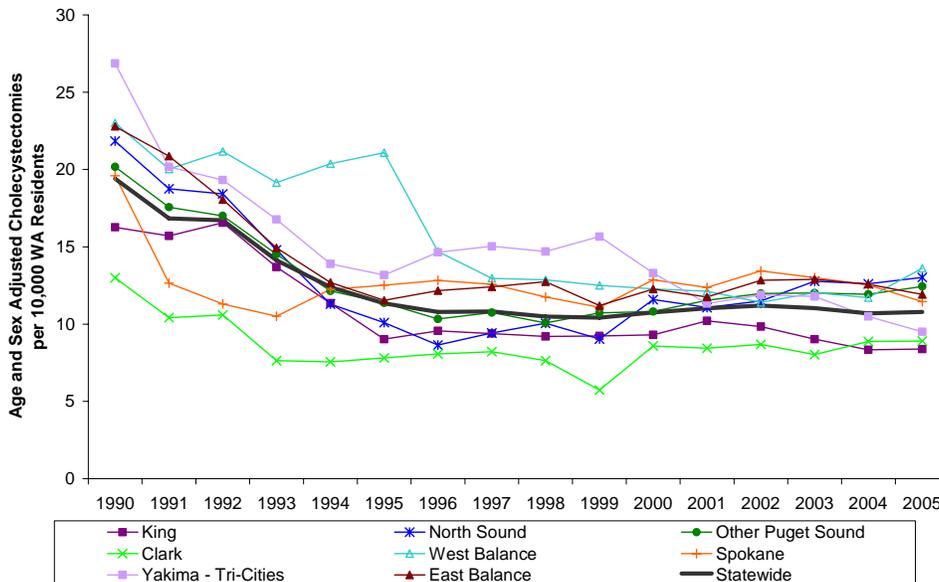
Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.  
 95% confidence intervals are shown.

### Figure 4: Age and Sex Adjusted Gallbladder Removal Rates By Region: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

## Notes

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
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**WASHINGTON INPATIENT  
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Research Brief No. 44G  
February 2007

**Hysterectomy:  
1990-2005**

*By The WIAP Team<sup>1</sup>*

The sixth brief in the series on geographic variation in the use of surgical procedures analyzes hysterectomy rates across Washington. Hysterectomies consist of the removal of all or part of the uterus and may also include removal of related reproductive organs. The procedure is often undertaken for treatment of tumors or cancer. The methodology used in this series of research briefs is detailed in the overview brief.<sup>1</sup>

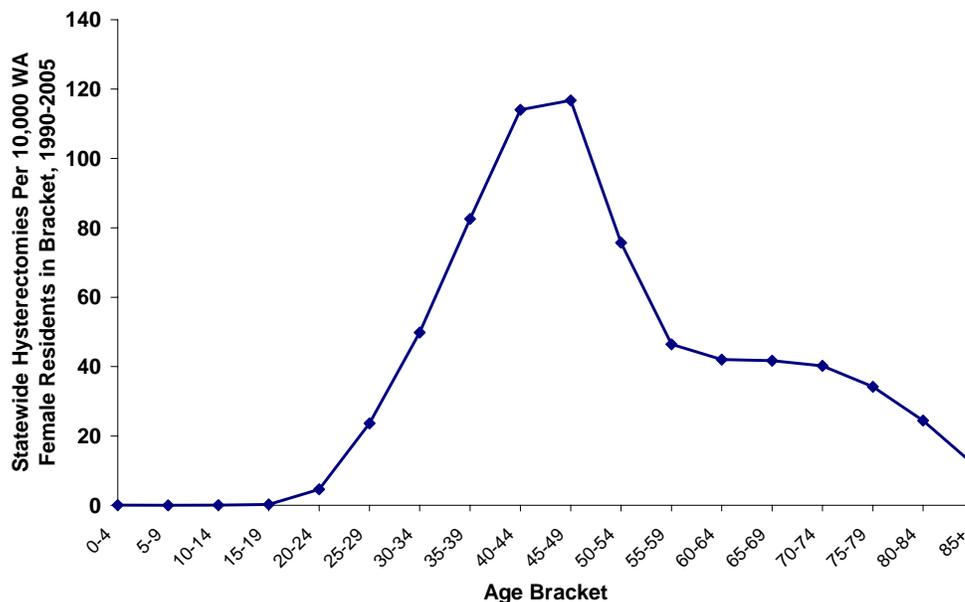
Hysterectomies, as described in this research brief, include ICD-9-CM procedure codes 68.30 -- 68.39, 68.40 -- 68.49, 68.50 -- 68.59, 68.60 -- 68.69, 68.70 -- 68.79, and 68.90 -- 68.99. Codes 68.80 -- 68.89 (pelvic evisceration) were considered but not included. The effect of including the omitted codes would be negligible. Inclusion of the omitted codes would have added 412 cases, or less than 0.25 percent of total cases, and would not have altered the age distribution or regional variation.

**Findings**

The hysterectomy rates described in this brief are adjusted for age and refer to the number of total surgery discharges per 10,000 Washington female residents. As indicated in Figure 1, hysterectomies are most likely to be performed on patients in the middle-aged brackets.

**Figure 1: Hysterectomy Rates by Age, 1990 – 2005**

Universe: Washington residents discharged from hospitals located in Washington



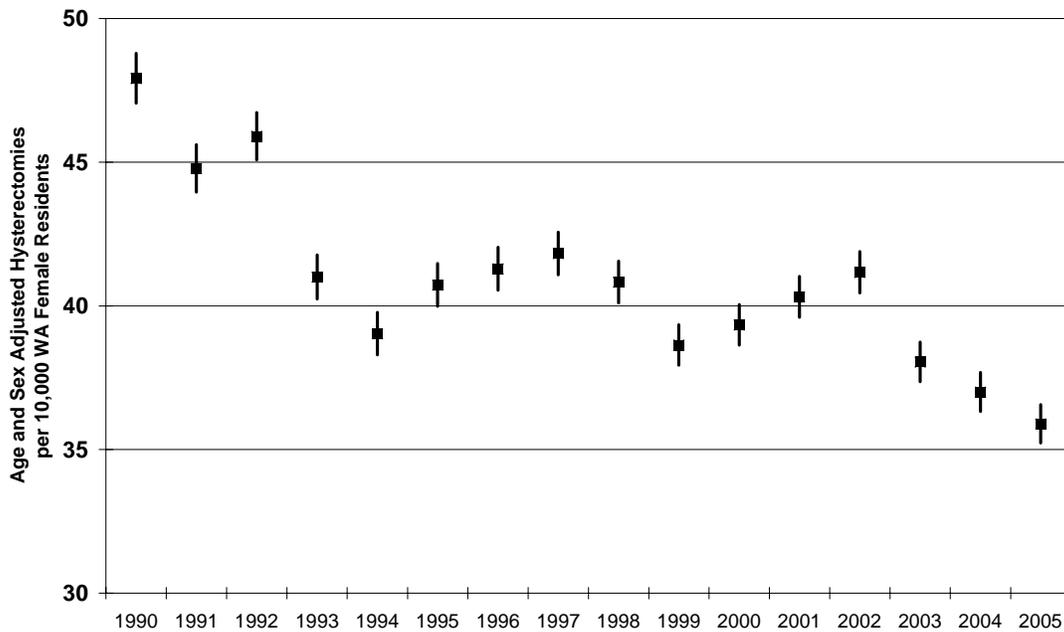
Source: Authors' calculations using CHARS data, 1990 to 2005.

<sup>1</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson. By using these data the user agrees that the Washington State Office of Financial Management shall not be liable for any activity involving these data with regard to lost profits or savings or any other consequential damages; or the fitness for use of the data for a particular purpose; or the installation of the data, its use, or results obtained.

Between 1990 and 2005, over 190,000 hysterectomies were performed in Washington. Statewide, the age adjusted rate for hysterectomies declined from 47.9 per 10,000 female residents in 1990 to 35.9 in 2005. The most recent few years suggest a renewed decline in the hysterectomy rate may be underway, following the period of relative stability in the rate from the mid-1990s to 2002 (Figure 2).

## Figure 2: Age Adjusted Statewide Hysterectomy Rates: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.

Rates are directly adjusted to the age distribution of Washington's female population in 1990.

95% confidence intervals are shown.

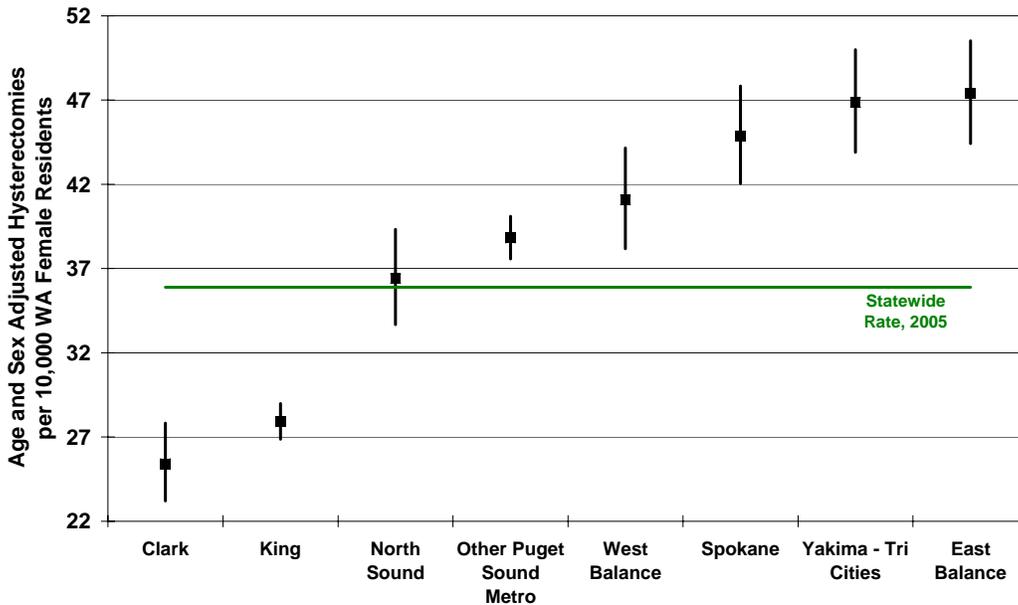
## Regional Variation

Hysterectomy rates varied significantly across the eight Washington State Population Survey (WSPS) regions in 2005.<sup>2</sup> As shown in Figure 3, hysterectomies were least commonly performed in Clark (25.4) and King (27.9) and most commonly performed in Yakima – Tri Cities (46.9) and East Balance (47.4). Most of the regions varied significantly from the statewide rate in 2005, suggesting that the likelihood of patients having hysterectomies at least in part depended on where they lived. The very low figure for Clark may be due to many of Clark's hysterectomy patients opting to have the procedure performed at a hospital located in nearby Portland.

Figure 4 illustrates that the statewide decline in hysterectomies from 1990 to 2005 was also apparent in each of the WSPS regions, with most regions' growth patterns roughly following the state average and maintaining their relative position with respect to the state average during the period.

### Figure 3: Age Adjusted Hysterectomy Rates By Region: 2005

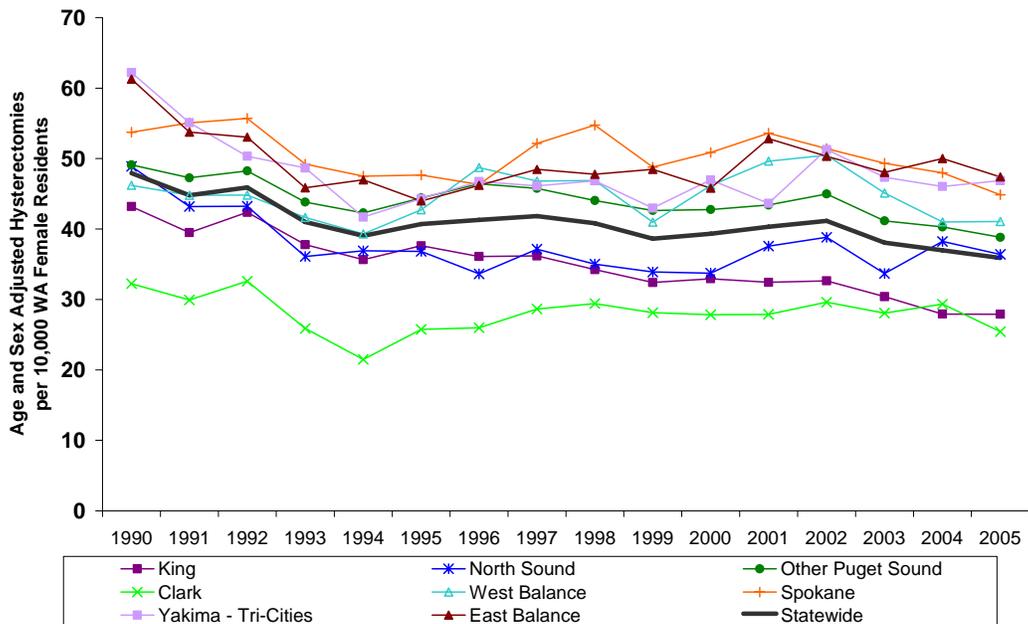
Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age distribution of Washington's female population in 1990.  
 95% confidence intervals are shown.

### Figure 4: Age Adjusted Hysterectomy Rates By Region: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age distribution of Washington's female population in 1990.

## Notes

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
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# WASHINGTON INPATIENT ATLAS PROJECT

Research Brief No. 44H  
February 2007

## Appendectomy: 1990-2005

By The WIAP Team<sup>1</sup>

The seventh brief in the series on geographic variation in the use of surgical procedures analyzes appendectomy rates across Washington. An appendectomy consists of the removal of the appendix and is usually performed as an emergency response to acute appendicitis or incidentally to a primary surgical procedure. The methodology used in this series of research briefs is detailed in the overview brief.<sup>1</sup>

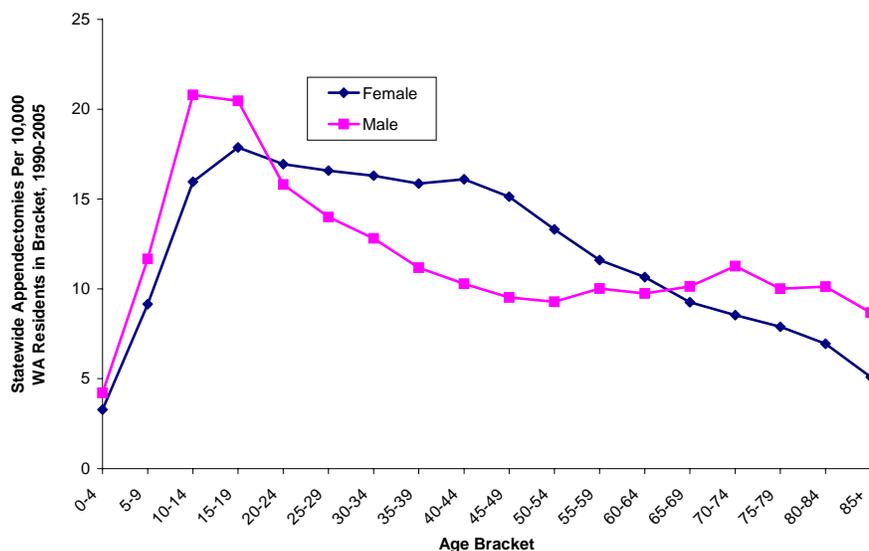
Appendectomies, as described in this research brief, include ICD-9-CM procedure codes 47.0 – 47.09 (open appendectomies and laparoscopic removals) and 47.1 – 47.19 (incidental appendectomies). The inclusion of incidental appendectomies added 22,466 cases, or about 20 percent of total cases reported here. Including codes 47.1 to 47.19 increased the rate for women in the middle age brackets and slightly increased the degree of regional variation; if they were excluded, the age distribution for females would have been nearly identical to that shown below for males.

### Findings

The appendectomy rates described in this brief are adjusted for age and sex and refer to the number of surgery discharges per 10,000 Washington residents. As indicated in Figure 1, appendectomies are more likely to be performed on females as males, except for during the teenage or elderly years. After adolescence, the appendectomy rate generally falls with age.

**Figure 1: Appendectomy Rates by Age and Sex, 1990 – 2005**

Universe: Washington residents discharged from hospitals located in Washington



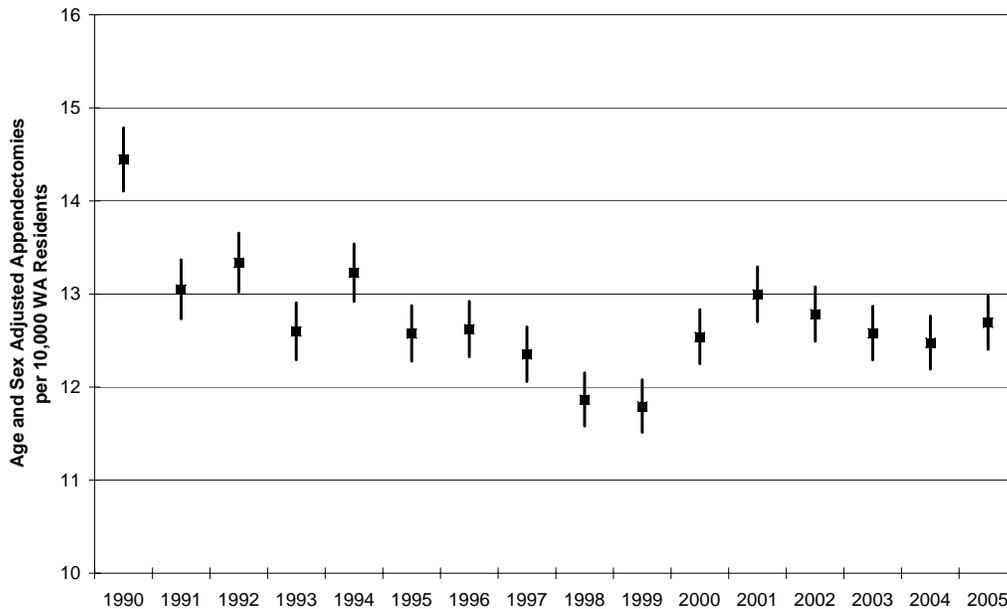
Source: Authors' calculations using CHARS data, 1990 to 2005.

<sup>1</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson. By using these data the user agrees that the Washington State Office of Financial Management shall not be liable for any activity involving these data with regard to lost profits or savings or any other consequential damages; or the fitness for use of the data for a particular purpose; or the installation of the data, its use, or results obtained.

Between 1990 and 2005, over 115,000 appendectomies were performed in Washington. Statewide, the age and sex adjusted rate for appendectomies has remained relatively stable since 1991, at around 12 to 13 appendectomies per 10,000 Washington residents (Figure 2).

## Figure 2: Age and Sex Adjusted Statewide Appendectomy Rates: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.

Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

95% confidence intervals are shown.

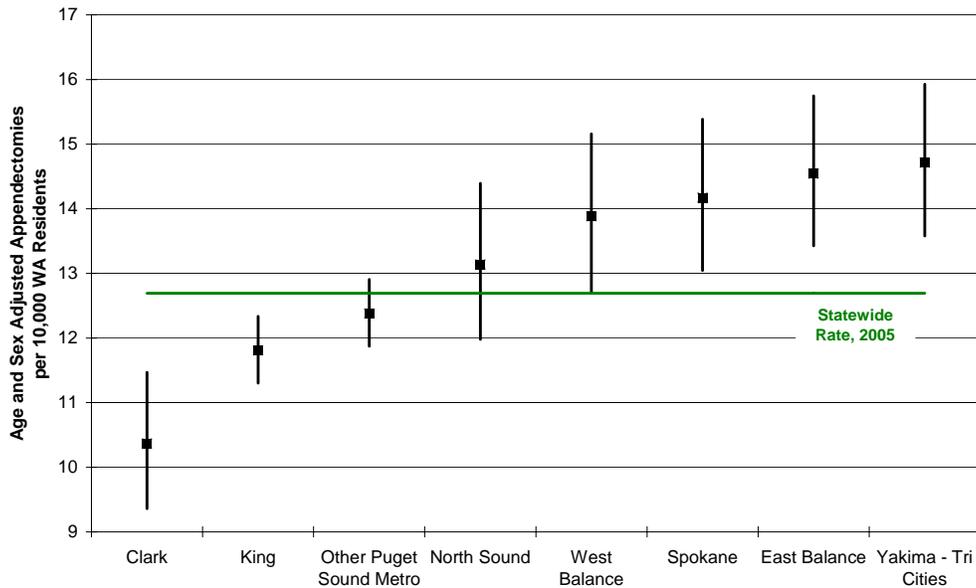
## Regional Variation

Appendectomy rates did not vary greatly across the eight Washington State Population Survey (WSPS) regions in 2005.<sup>4</sup> As shown in Figure 3, most regions' rates were very close to the state average, suggesting that the likelihood of patients having appendectomies was mostly independent of where they lived. East Balance and Yakima-Tri Cities registered significantly higher rates than King. The very low figure for Clark may be due to many of Clark's appendicitis patients opting to have the procedure performed at a hospital located in nearby Portland.

Figure 4 illustrates that the WSPS regions' rates mostly followed the statewide average from 1990 to 2005. Yakima's was the only rate that was detectably higher than the state average in 2005, a position that it maintained throughout the period.

### Figure 3: Age and Sex Adjusted Appendectomy Rates By Region: 2005

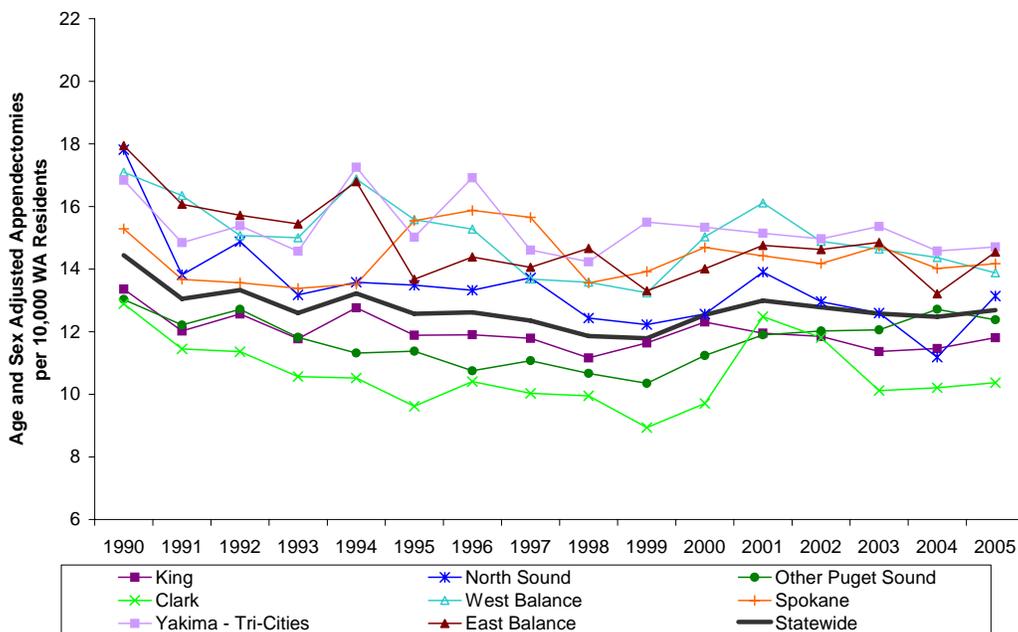
Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005. Rates are directly adjusted to the age and sex distribution of Washington's population in 1990. 95% confidence intervals are shown.

### Figure 4: Age and Sex Adjusted Appendectomy Rates By Region: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005. Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

**Notes**

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
  2. The Washington State Population Survey (WSPS) regions are defined as follows:
    - North Puget (Island, San Juan, Skagit, Whatcom)
    - West Balance (Clallam, Cowlitz, Grays Harbor, Jefferson, Klickitat, Lewis, Mason, Pacific Skamania, Wahkiakum)
    - King (King)
    - Puget Metro (Kitsap, Pierce, Snohomish, Thurston)
    - Clark (Clark)
    - East Balance (Adams, Asotin, Chelan, Columbia, Douglas, Ferry Garfield, Grant, Kittitas, Lincoln, Okanogan, Pend Oreille, Stevens, Walla Walla, Whitman)
    - Spokane (Spokane)
    - Yakima - Tri Cities (Benton, Franklin, Yakima)
- 

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**WASHINGTON INPATIENT  
ATLAS PROJECT**

Research Brief No. 44I  
February 2007

**Tonsillectomy:  
1990-2005**

*By The WIAP Team<sup>1</sup>*

The eighth brief in the series on geographic variation in the use of surgical procedures analyzes tonsillectomy rates across Washington. A tonsillectomy consists of the removal of the tonsils and sometimes includes the removal of the adenoids (lymphatic tissue closely related to the tonsils). Ordinarily tonsils are removed in patients who suffer from frequent tonsillitis, sleep apnea, or several other conditions. The methodology used in this series of research briefs is detailed in the overview brief.<sup>1</sup>

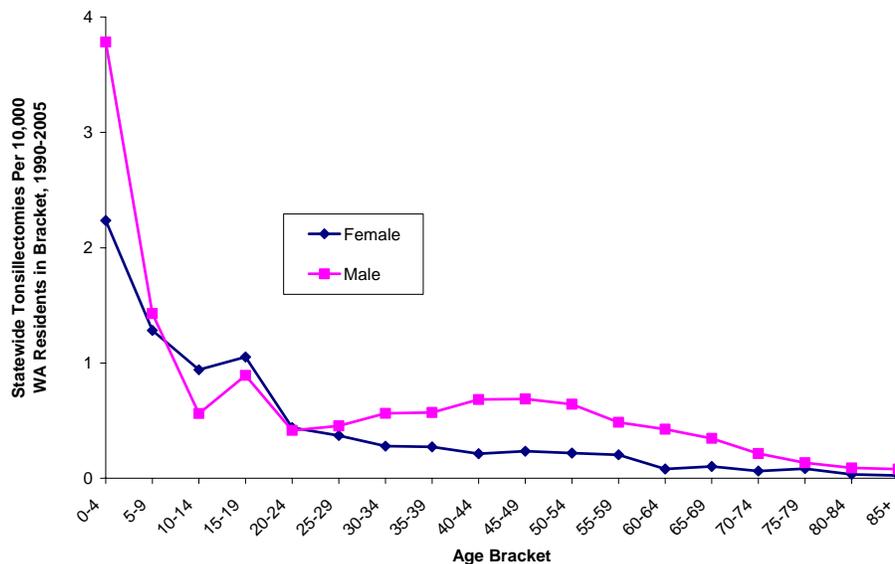
Tonsillectomies, as described in this research brief, include ICD-9-CM procedure codes 28.2 and 28.3. Adenoidectomies without removal of the tonsils are not included (28.6). The effect of including the omitted codes would be negligible. Inclusion of the omitted codes would have added 305 cases, or less than 5 percent of total cases, and would not have changed the age distribution or regional variation.

**Findings**

The tonsillectomy rates described in this brief are adjusted for age and sex and refer to the number of surgery discharges per 10,000 Washington residents. As indicated in Figure 1, tonsillectomies are one of the more rarely performed surgical procedures and are about equally likely to be performed on males as on females. The tonsillectomy rate falls dramatically with age.

**Figure 1: Tonsillectomy Rates by Age and Sex, 1990 – 2005**

Universe: Washington residents discharged from hospitals located in Washington



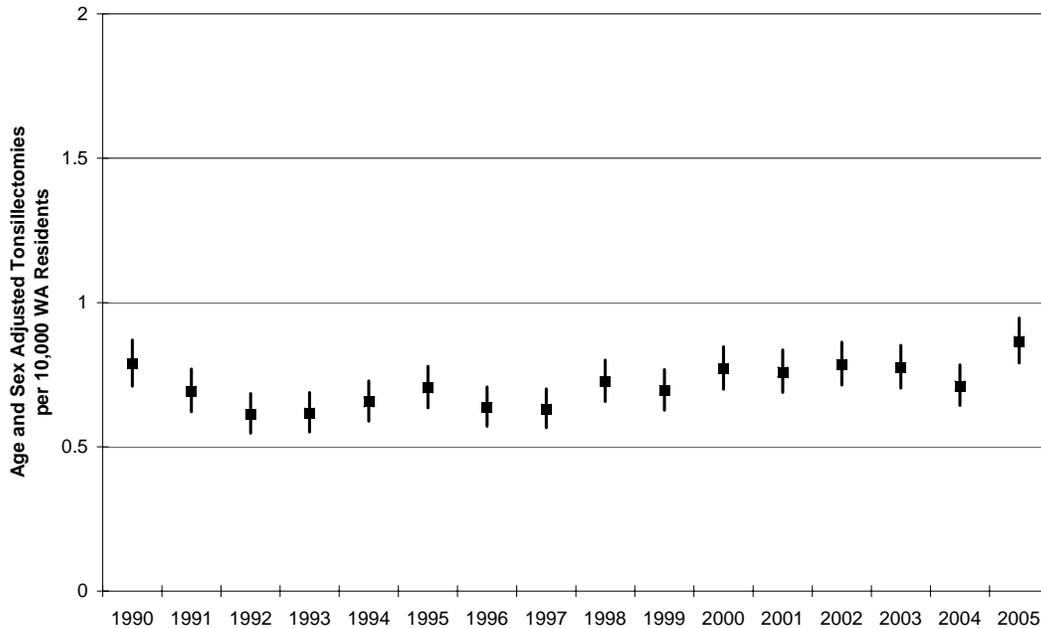
Source: Authors' calculations using CHARS data, 1990 to 2005.

<sup>1</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson. By using these data the user agrees that the Washington State Office of Financial Management shall not be liable for any activity involving these data with regard to lost profits or savings or any other consequential damages; or the fitness for use of the data for a particular purpose; or the installation of the data, its use, or results obtained.

Between 1990 and 2005, only 6,300 tonsillectomies were performed in Washington. Statewide, the age and sex adjusted rate for tonsillectomies has remained very stable since 1990, at around 7.5 tonsillectomies per 100,000 Washington residents (Figure 2).

## Figure 2: Age and Sex Adjusted Statewide Tonsillectomy Rates: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.

Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

95% confidence intervals are shown.

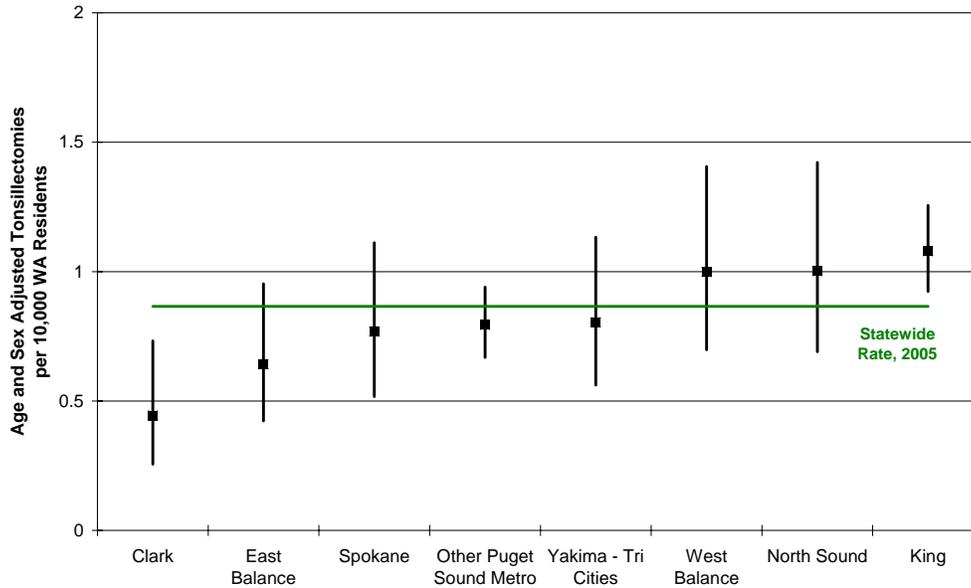
## Regional Variation

Tonsillectomy rates did not vary significantly across the eight Washington State Population Survey (WSPS) regions in 2005.<sup>2</sup> As shown in Figure 3, most regions' rates were very close to the state average, suggesting that the likelihood of patients having tonsillectomies was independent of where they lived. The very low figure for Clark may be due to many of Clark's tonsillectomy patients opting to have the procedure performed at a hospital located in nearby Portland.

Figure 4 illustrates that the WSPS regions' rates mostly followed the statewide average from 1990 to 2005.

### Figure 3: Age and Sex Adjusted Tonsillectomy Rates By Region: 2005

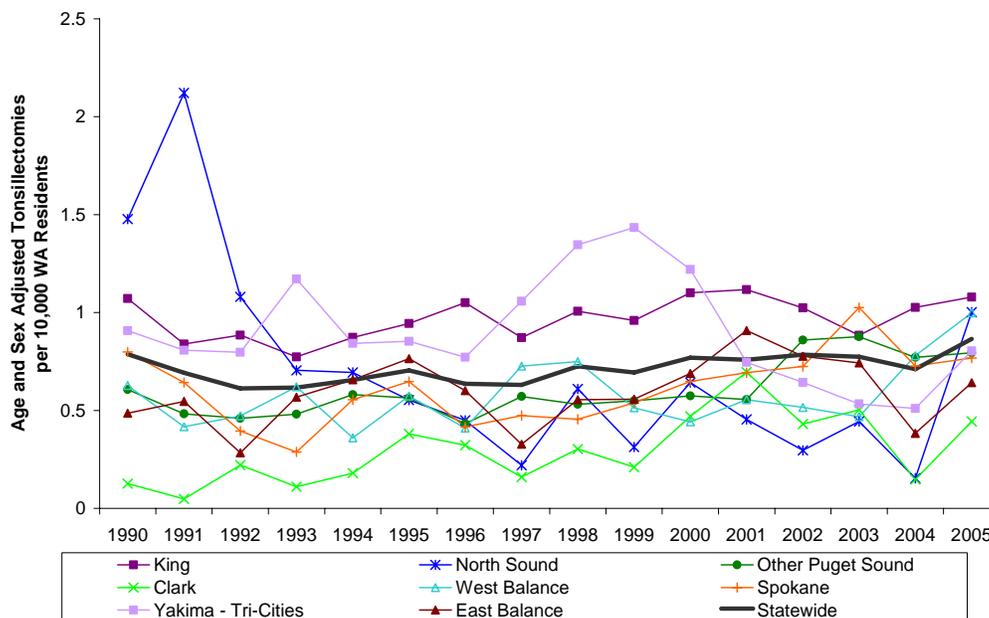
Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.  
 95% confidence intervals are shown.

### Figure 4: Age and Sex Adjusted Tonsillectomy Rates By Region: 1990-2005

Universe: Washington residents discharged from hospitals located in Washington



Source: Authors' calculations using CHARS data, 1990 to 2005.  
 Rates are directly adjusted to the age and sex distribution of Washington's population in 1990.

## Notes

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
  2. The Washington State Population Survey (WSPS) regions are defined as follows:
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- 

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# WASHINGTON INPATIENT ATLAS PROJECT

Research Brief No. 44J  
March 2007

## Summary of Findings for Eight Surgical Procedures in Washington State:

1990 - 2005

By The WIAP Team<sup>i</sup>

This brief summarizes the findings of eight Washington Inpatient Atlas Project Research Briefs (numbers 44B through 44I) describing regional disparities in the rates of surgical procedures in Washington State. As noted in the introductory brief to the series (Research Brief 44A), a number of studies have shown wide variation in the use of major surgical procedures and medical treatments, both across the country and within smaller regions. Geographic disparities in surgical procedures underline a number of concerns about uneven accessibility, the uneven use of evidence-based practices, and the possible inefficient utilization of healthcare resources.

The intention of the WIAP is to highlight potential regional disparities in surgery rates in Washington. The goal is to encourage policy discussions and, if warranted, further research. The methodology used in these briefs is detailed in the series introduction (Research Brief 44A). The ICD-9-CM codes used to define each procedure can be found in each of the Research Briefs.<sup>1</sup>

The eight surgical procedures studied in the series are listed in Table 1, along with several key characteristics. In Table 1, "Total Charges" reflect the total charges for the hospital stays of Washington residents in Washington hospitals that involved the given procedure. Hospital stays

**Table 1: Characteristics of Selected Surgical Procedures, 2005**

<b>Procedure</b>	<b>Total Charges</b>	<b>Discharges</b>	<b>Average Charges</b>	<b>Average Stay (Days)</b>
Coronary Artery Bypass Graft	\$ 427,981,613	4,339	\$ 98,636	8.2
Coronary Angioplasty	559,296,796	11,310	49,452	2.7
Knee Replacment	313,333,960	9,922	31,580	3.5
Hip Replacement	199,781,768	5,568	35,880	3.7
Gallbladder Removal	201,124,819	7,059	28,492	4.5
Hysterectomy	194,120,100	12,049	16,111	2.4
Appendectomy	163,275,543	7,929	20,592	3.4
Tonsillectomy	6,430,439	507	12,683	2.0
All Other Procedures	9,256,103,853	537,287	17,227	4.1
All Surgery Discharges	11,290,807,042	595,463	18,961	4.0

Source: CHARS, 2005.

Note: Eight procedures are not unduplicated, therefore amounts will not sum to All Surgery Discharges.

in some cases involved more than one procedure; however, in most cases the procedure listed in Table 1 was the primary procedure, or essentially the primary reason for the hospital admission. In 2005, there were nearly 600,000 surgeries performed on Washington residents in the state's hospitals, with total patient charges amounting to over 11 billion dollars.

<sup>i</sup> The Washington Inpatient Atlas Project (WIAP) Team members are: Deron Ferguson, Tomas Mosquera, Thea Mounts, Harold Nelson (Supervisor) and Karen Sampson.

Hospital stays involving the two heart surgery procedures, or 2.6 percent of all surgeries, amounted to nearly one billion dollars, or about 8.6 percent of all surgery charges, underlining the fact that these are expensive procedures. Coronary angioplasty is often chosen, when possible, over coronary artery bypass by many patients, given that on average it costs about half as much and requires a much shorter hospital stay.

### Regional Variation

Substantial regional variation was apparent for five of the eight surgical procedures (Table 2), with “substantial” being defined as more than six of the regions’ rates varying significantly (statistically) from the state average.<sup>2</sup> Clark County had the lowest rates for seven of the eight procedures, which was likely due to many of Clark’s residents going to nearby Portland hospitals for surgery. In the summary of regional variation that follows, Clark’s rates are excluded from the interregional comparisons.

For surgery procedures with substantial regional variation in 2005, the age-sex adjusted rates in the highest-rate regions were 50 to 70 percent higher than in the lowest rate regions. King County often had the lowest rates. Regions with the highest rates included Spokane, North Sound, East Balance and West Balance. Residents of Spokane experienced the highest age-sex adjusted rates of coronary artery bypass surgery (8.1 surgeries per 10,000 residents), while residents of North Sound had the highest rates of coronary angioplasty (20.9). The highest ratio of extreme rates was for hysterectomy (1.70), in which East Balance’s rate (47.4) was 70 percent higher than King’s (27.9).

**Table 2: Summary of Regional Variation of Selected Surgical Procedures (2005)**

Procedure	2005 Number of Discharges	Substantial Variation	Low Rate	High Rate	Ratio* High:Low	Low Region	High Region
Coronary Artery Bypass	4,339	YES	5.0	8.1	1.61	King	Spokane
Coronary Angioplasty	11,310	YES	13.5	20.9	1.55	King	North Sound
Total Knee Replacement	9,922	YES	12.8	19.2	1.50	King	East Balance
Total Hip Replacement	5,568	NO	7.3	9.0	1.24	Yakima	West Balance
Cholecystectomy	7,059	YES	8.4	13.6	1.62	King	West Balance
Hysterectomy	12,049	YES	27.9	47.4	1.70	King	East Balance
Appendectomy	7,929	Marginal	11.8	14.7	1.25	King	Yakima
Tonsillectomy	507	NO	0.6	1.1	1.68	East Balance	King

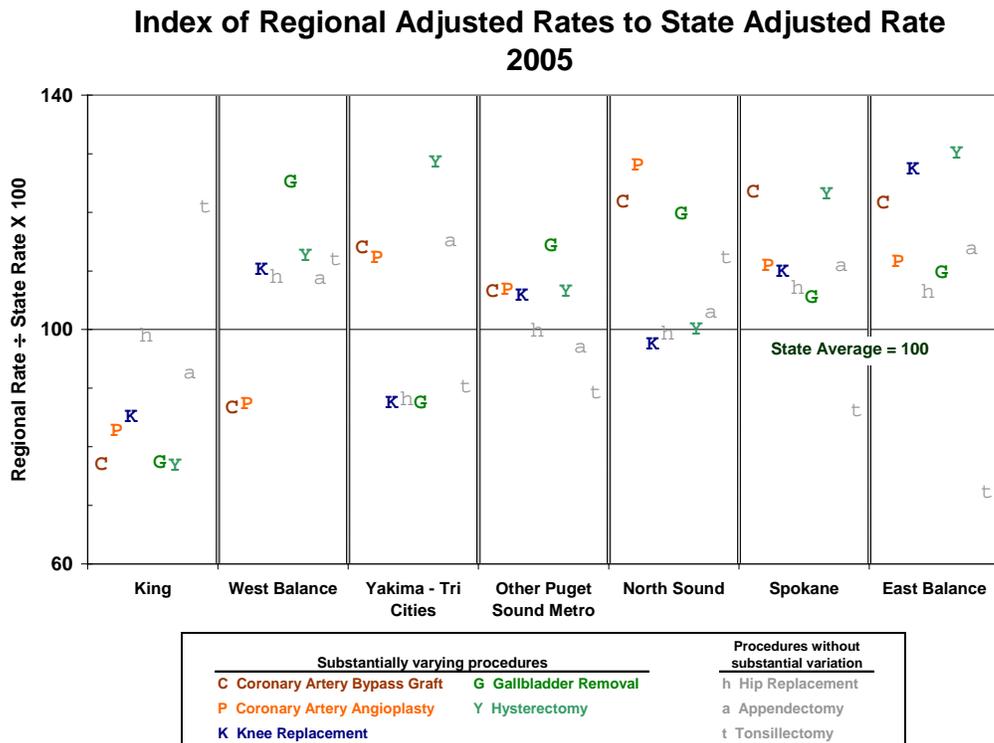
\* Ratio of the highest rate to the lowest excludes Clark County  
Rates are age-sex adjusted to 1990 Washington population, per 10,000 residents

Source: OFM Research Briefs 44B – 44I. <http://www.ofm.wa.gov/healthcare/WIAP/default.asp>

While the ratio of extreme rates for tonsillectomies was high (1.68, calculated using unrounded rates), this was mainly an artifact of that procedure having a very low minimum (0.6). Most regions’ tonsillectomy rates were not significantly different from the state average (see Research Brief 44I). King County had the highest rates for tonsillectomies in 2005 (1.1) (as it did throughout the period from 1990 to 2005), however further analysis showed that this was because Children’s Hospital in Seattle accounted for fully 30 percent of all tonsillectomies in the state that year (28 percent for the period), which is not unexpected given its focus on treating children.

The overall distribution of rates for 2005 is depicted in Chart 1, where indexes of regional rates to the state average for each procedure are plotted. The indexes are calculated by dividing the age-sex adjusted rate for each procedure by the state rate, and then multiplying by 100. The state average in Chart 1 is thus represented as “100.” The regions are ordered from that having the lowest indexes, on average (King County), to that with the highest (East Balance). For the five substantially varying procedures in 2005, King tended to have the lowest indexes (with all rates below the state average), while Spokane and East Balance tended to have the highest indexes (all rates above the state average).

**Chart 1: Pattern of Regional Variation of Selected Surgical Procedures (2005)**



Note: Rates are age-sex adjusted to 1990 state population. A larger version of this chart appears at the end of this Research Brief.

The two regions with consistently high rates, Spokane and East Balance, are located in Eastern Washington. Other Puget Sound Metro (comprised of Pierce, Snohomish, Kitsap, and Thurston counties) also had rates consistently greater than the regional average, although generally of lesser magnitude than the eastern regions.

King’s consistently low rates warrant further investigation, especially since King, being the most populous county, strongly influences the state averages. If it is found that King’s rates are biased downward due of data coding or other systematic issues, the findings of significant regional variation could be called into question, because the effect of correcting for such bias would probably increase state average rates, thereby reducing the departure of the high-rate regions from the state rates for each procedure.

## Further Research

The regional differences summarized in this Research Brief only begin to explore the geography of inpatient care in Washington. The regional variation found in this study corresponds to a wider literature documenting such variation in other parts of the country. There are a number of possibilities for further research. First, a closer examination of King may shed light on whether its surgery rates are uniformly low or whether there is some source of systematic bias in reporting surgery discharges.<sup>3</sup>

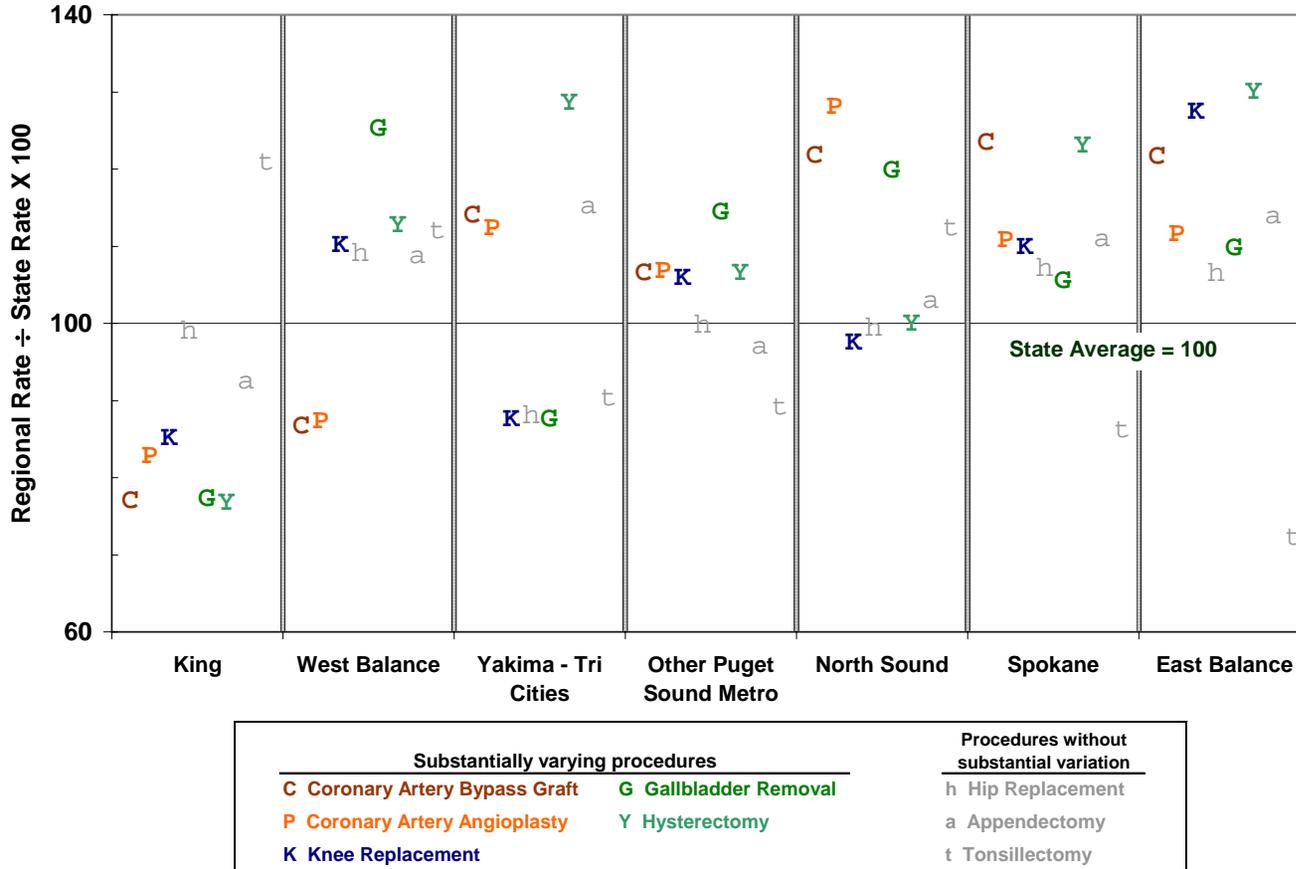
Second, a consistent and statistically valid method should be developed for comparing and ranking the degree of regional variation in surgical rates. This area of epidemiological research is known as “Small Area Analysis,” and as yet there is little consensus on how to compare or rank the regional variation of surgical procedures.<sup>4</sup> One approach may be to apply multivariate regression techniques to estimate or predict the odds of receiving a given surgery within a region, after accounting for a time trend, age, and sex.

A third area of needed research is to determine an appropriate geographic scale for studying differences in surgical rates, and to identify appropriate ways to group zip codes into such areas. Because Washington’s hospital discharge (CHARS) data is available with only zip code level geographic detail, area groupings should be aggregates of zip codes. A concordance of postal zip codes to census zip code tabulation areas (ZCTAs) should be developed in order to relate area characteristics, drawn from decennial census data, to surgical rates. Previous research indicates this must be done with care.<sup>5</sup>

Finally, substantive questions surrounding regional disparities in inpatient care would ideally be generated by stakeholders in Washington’s health care system. The WIAP welcomes feedback and input with respect to asking such questions.

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**Chart 1: Pattern of Regional Variation of Selected Surgical Procedures (2005)**  
**Index of Regional Adjusted Rates to State Adjusted Rate**  
**2005**



Notes: Surgery rates are age-sex adjusted to 1990 state population. The symbols indicate age-sex adjusted surgery rates in each region indexed to (divided by) the state adjusted rate. For example, the cluster of symbols for King County indicates that rates of each of the substantially varying procedures were within 70 to 90 percent of the state average, or between 10 to 30 percent below the state average. The symbols for Spokane and East Balance indicate that the substantially varying surgery rates were all above the state average in those regions in 2005.

Source: CHARS, 2005. Surgeries include Washington residents discharged from Washington hospitals (non residents and residents leaving the state for surgery is not included).

**Notes:**

1. Surgical procedures were tabulated using data from the Comprehensive Hospital Abstract Reporting System (CHARS). The CHARS database contains hospital patient discharge data. The purpose of the database is to facilitate improvements in the quality and cost effectiveness of health care for people in the state of Washington. It can be used in research to identify trends related to patients' hospitalizations and to quantify issues related to health care access, quality, and cost containment. For more information about CHARS, readers can consult the Department of Health website at <http://www.doh.wa.gov/EHSPHL/hospdata/Chars.htm>.
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  - Yakima - Tri Cities (Benton, Franklin, Yakima)
3. Preliminary discussions have suggested that hospitals in King County for various reasons may perform a greater number of surgeries on an outpatient basis than hospitals in other areas, with the result that such surgeries would not be included in the CHARS database. If true, this could bias the surgery rates for King County in a downward direction.
4. For example, see Diehr et al, 1990, "What is Too Much Variation? The Null Hypothesis in Small-Area Analysis," *Health Services Research*, 24:741-71.
5. See Grubestic, T and Matisziw, T, 2006, "On the Use of ZIP Codes and ZIP Code Tabulation Areas (ZCTAs) for the Spatial Analysis of Epidemiological Data," *International Journal of Health Geographics*, 5:58.

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