



Trends and Regional Variations in Abdominal Aortic Aneurysm Repair

Dartmouth - CMS - FDA collaborative
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Background

The Dartmouth Atlas Project provides ongoing population-based monitoring of the rates of use of medical and surgical services in the fee-for-service Medicare population. This report focuses on trends and regional variations in abdominal aortic aneurysm (AAA) repair.

Until the late 1990s, repair of abdominal aneurysms required a major intra-abdominal procedure that carried substantial risks of death and complications. On September 28, 1999, the Food and Drug Administration approved for widespread use an endovascular stent-graft that made it possible to carry out some AAA repairs without an open procedure. Initial randomized trials demonstrated that the endovascular approach -- at least in the setting of the clinical trials -- carried substantially lower short-term risks than the open procedure. Many observers hypothesized that the introduction of the lower-risk procedure would lead to a substantial increase in the overall number of procedures performed, as surgeons would be able to offer the new procedure to patients with aneurysms in need of repair who were felt to face unjustifiably high risks from the open procedure.

This report is the first of a series of studies that will examine the impact of the introduction of endovascular AAA repair on utilization and outcomes. The data are drawn from Medicare inpatient hospital discharge records (MedPAR files) and the Medicare Denominator Files from 1992 through 2003. The primary analyses are based on the standard analytic files that are made available on an annual basis, generally about six to nine months after the end of the calendar year.



National Trends in Utilization and Spending

Figure 1 presents national trends in the overall rate of AAA repair and the rates of open and endovascular procedures. Overall, utilization rates of AAA repair have been relatively stable throughout the decade, peaking in 1997. Even before the introduction of the endovascular procedure, rates of the open procedure had begun to fall. The introduction of endovascular repair at the end of 1999 was followed by a rapid increase in the use of the procedure in 2000 and 2001, with a rapid decline in population-based rates of open repair. The combined effect was a modest increase in overall rates of AAA repair in 2001, followed by a modest decline back to a level similar of the mid-1990s.

Figure 2 presents national trends in Medicare Part A inpatient payments for AAA repair. The introduction of the endovascular approach has not been associated with an increase in spending on AAA repair. Rather, since 2001, per-capita inpatient spending on AAA repair has fallen modestly.

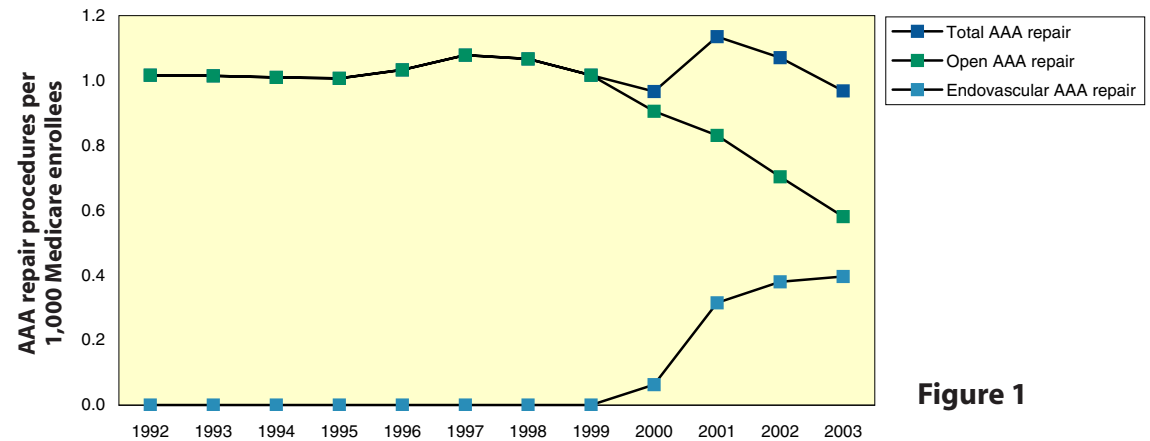


Figure 1

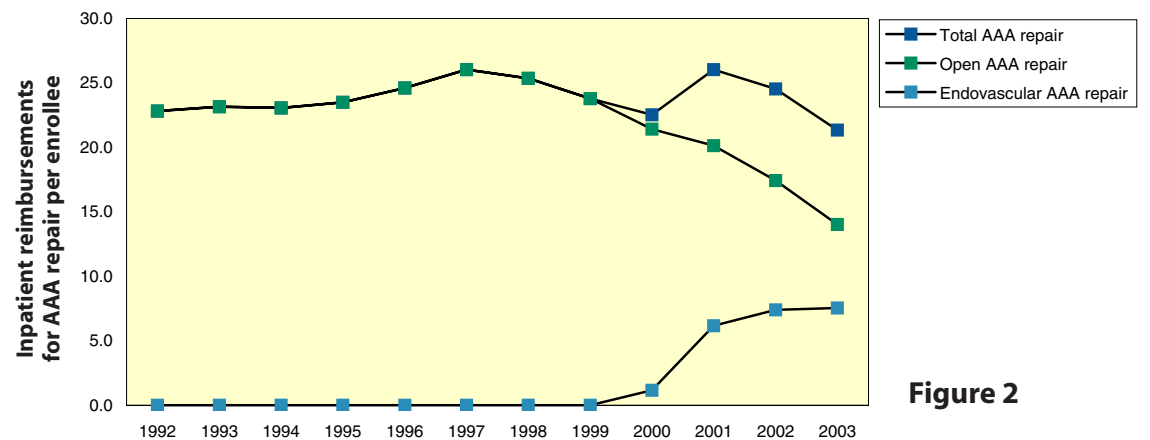
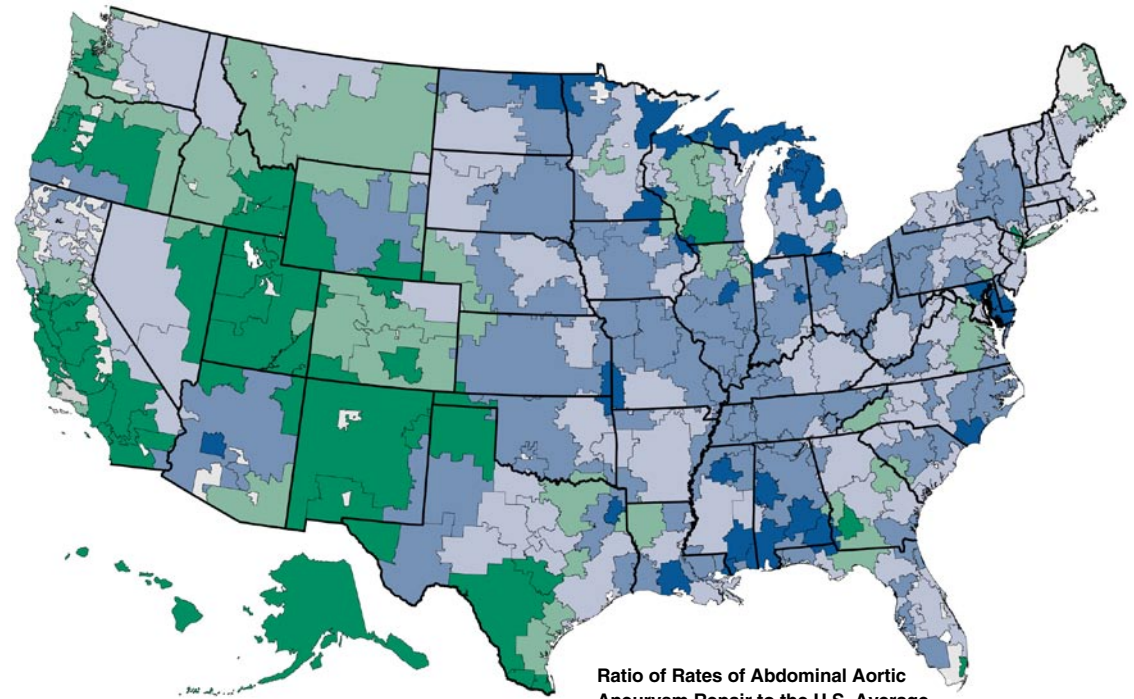


Figure 2







Regional Variations in Rates of Abdominal Aortic Aneurysm Repair

The following figures and maps present data on regional variations in the rates of AAA repair procedures. Because rates are relatively low overall, many hospital referral regions have rates that are either below the threshold for suppression required to protect the privacy of Medicare beneficiaries or are statistically too imprecise to include. We therefore combined two years of data when describing these rates at the regional level.

Maps 1 through 3 present the population-based rates of AAA repair in all U.S. hospital referral regions. The relationship between rates of open AAA repair and endovascular AAA repair is not at all obvious in the maps.



Ratio of Rates of Abdominal Aortic Aneurysm Repair to the U.S. Average
by Hospital Referral Region (2002-03)

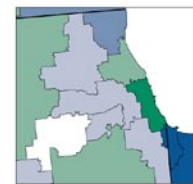
	1.30 to 1.68	(27)
	1.10 to < 1.30	(85)
	0.90 to < 0.90	(108)
	0.75 to < 0.75	(42)
	0.38 to < 0.38	(44)
	Not Populated	

Map 1 Ratio of Rates of Abdominal Aortic Aneurysm Repair (Open plus Endovascular) to the U.S. Average (2002-03)

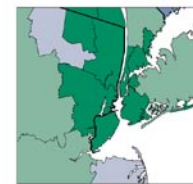
In 27 hospital referral regions, rates of AAA repair were at least 30% higher than the United States average of 1.0 per 1,000 Medicare enrollees. In 44 hospital referral regions, rates were more than 25% lower than the national average. Among the regions with the highest rates per 1,000 Medicare enrollees were Petoskey, Michigan (1.7); Wilmington, North Carolina (1.7); Marquette, Michigan (1.7); Traverse City, Michigan (1.6); and Montgomery, Alabama (1.6). Among the regions with the lowest rates per 1,000 Medicare enrollees were Ogden, Utah (0.4); Honolulu (0.4); McAllen, Texas (0.5); Boulder, Colorado (0.5); and Harlingen, Texas (0.5).



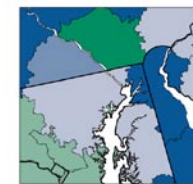
San Francisco



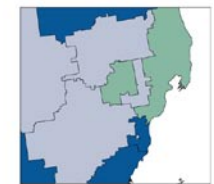
Chicago



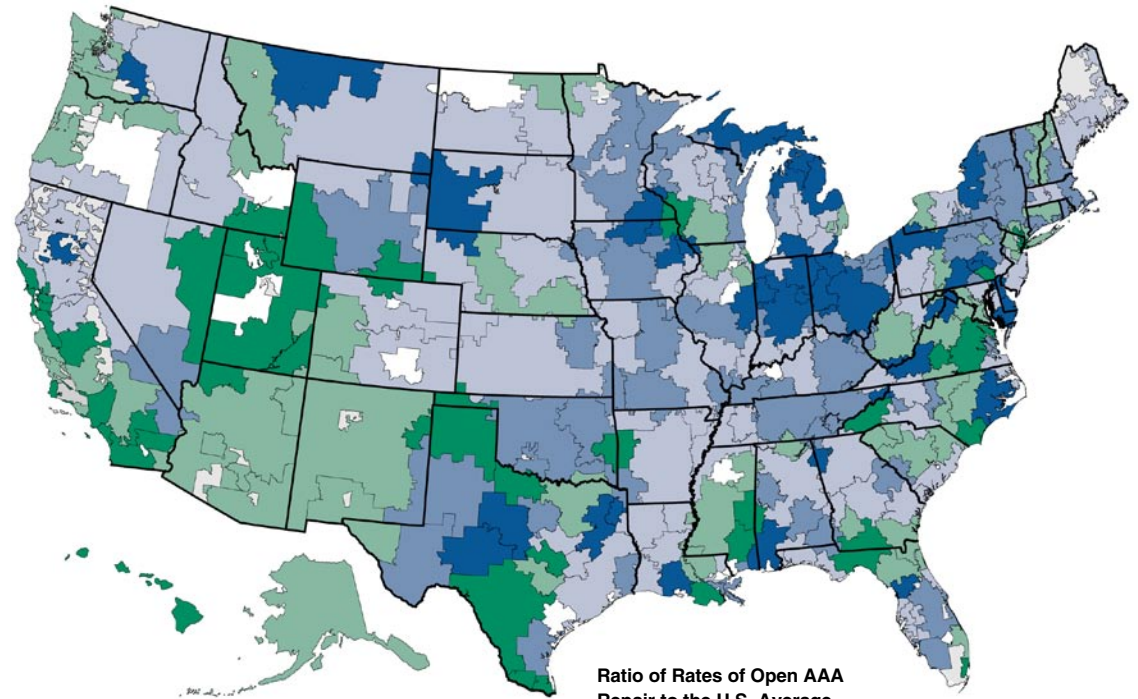
New York



Washington-Baltimore



Detroit



Ratio of Rates of Open AAA Repair to the U.S. Average
by Hospital Referral Region (2002-03)

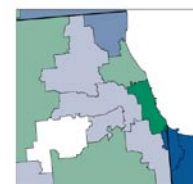
1.30 to 2.30	(44)
1.10 to < 1.30	(62)
0.90 to < 1.10	(89)
0.75 to < 0.90	(56)
0.34 to < 0.75	(40)
Insufficient data	(15)
Not Populated	

Map 2 Ratio of Rates of Open Abdominal Aortic Aneurysm Repair to the U.S. Average (2002-03)

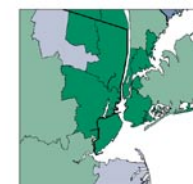
In 44 hospital referral regions, rates of open AAA repair were at least 30% higher than the United States average of 0.6 per 1,000 Medicare enrollees. In 40 hospital referral regions, rates were more than 25% lower than the national average. Among the regions with the highest rates of open procedures per 1,000 Medicare enrollees were Traverse City, Michigan (1.5); Petoskey, Michigan (1.4); Muncie, Indiana (1.2); Marquette, Michigan (1.1); and Longview, Texas (1.1). Among the regions with the lowest rates per 1,000 Medicare enrollees were Manhattan (0.2); McAllen, Texas (0.2); Palm Springs – Rancho Mirage, California (0.3); Harlingen, Texas (0.3); and San Jose, California (0.3).



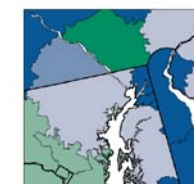
San Francisco



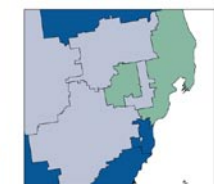
Chicago



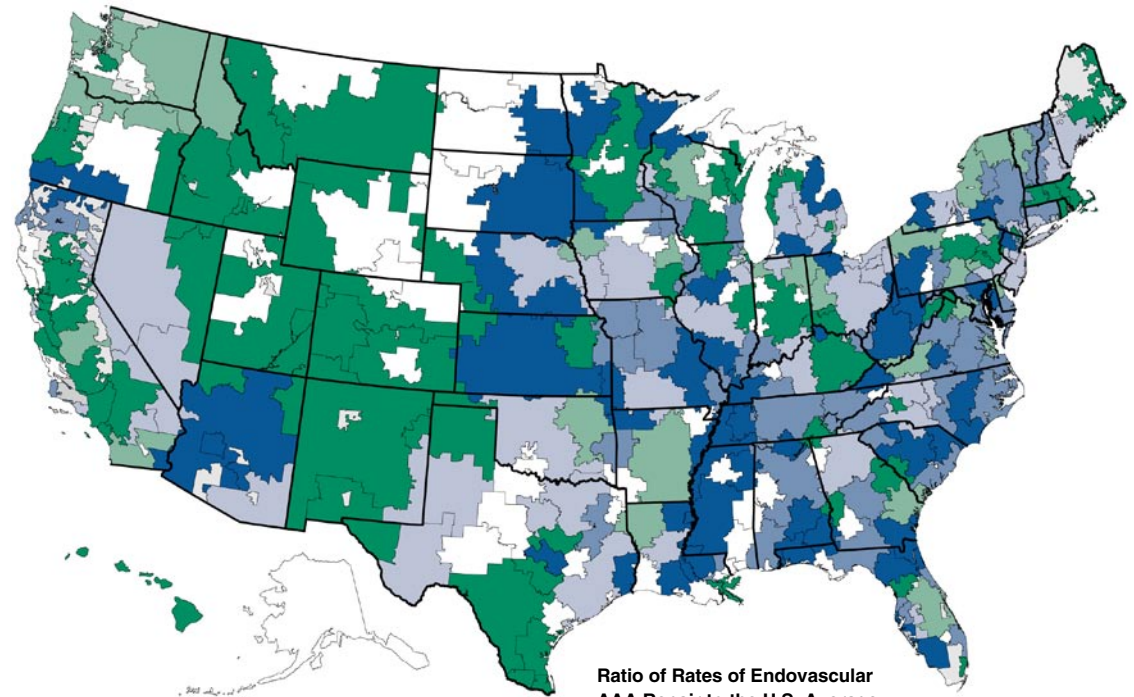
New York



Washington-Baltimore



Detroit



Map 3 Ratio of Rates of Endovascular Abdominal Aortic Aneurysm Repair to the U.S. Average (2002-03)

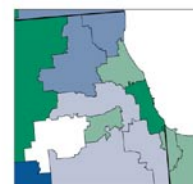
In 51 hospital referral regions, rates of endovascular AAA repair were at least 30% higher than the United States average of 0.4 per 1,000 Medicare enrollees. In 65 hospital referral regions, rates were more than 25% lower than the national average. Among the regions with the highest rates of endovascular procedures were Wilmington, North Carolina (1.3); Montgomery, Alabama (0.9); Sun City, Arizona (0.8); Mesa, Arizona (0.8); and Huntsville, Alabama (0.8). Among the regions with the lowest rates of endovascular procedures were Honolulu (0.1); Modesto, California (0.1); Corpus Christi, Texas (0.1); Dearborn, Michigan (0.1); and Traverse City, Michigan (0.1).

Ratio of Rates of Endovascular AAA Repair to the U.S. Average by Hospital Referral Region (2002-03)

■ 1.30 to 3.25	(51)
■ 1.10 to < 1.30	(44)
■ 0.90 to < 1.10	(51)
■ 0.75 to < 0.90	(33)
■ 0.19 to < 0.75	(65)
□ Insufficient data	(62)
■ Not Populated	



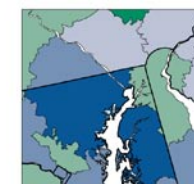
San Francisco



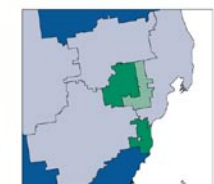
Chicago



New York



Washington-Baltimore



Detroit



In fact, as shown in Figure 3, there was virtually no correlation between rates of open and endovascular AAA repair in 2002-03 ($R^2 = 0.01$). However, as shown in Figure 4, there was a strong relationship between the overall rates of AAA repair in 1996-97 and in 2002-03 ($R^2 = 0.42$). Regions that had high rates of AAA repair overall in 1996-97 continued to have high rates in 2002-03.

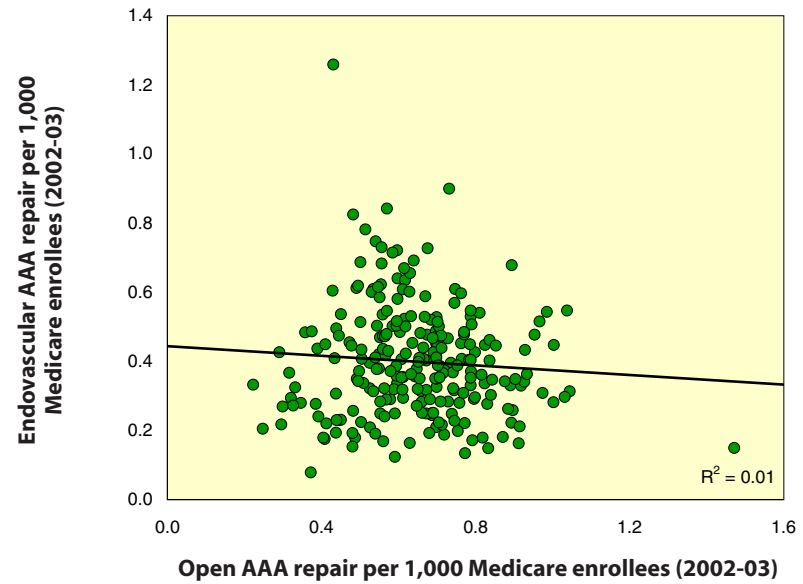


Figure 3

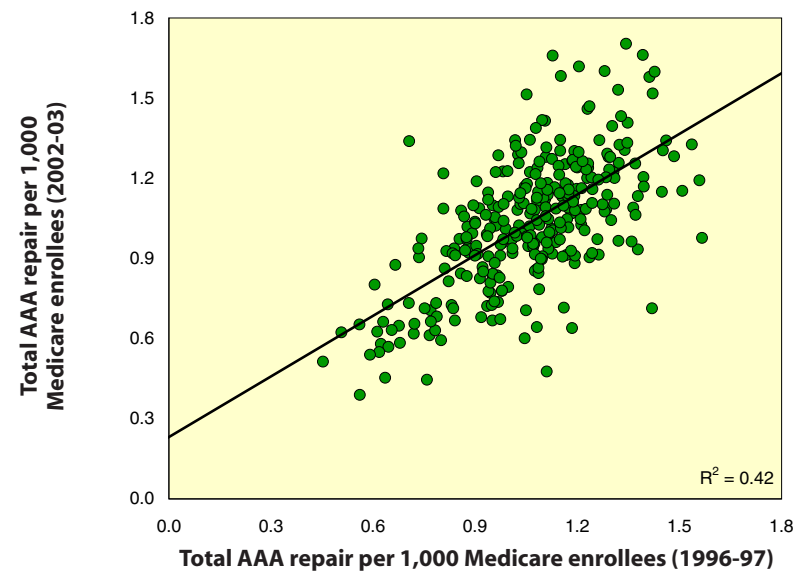


Figure 4



The next two figures, however, provide further insight into how the introduction of the endovascular repair occurred. Regions that had high rates of AAA repair in 1996-97 (all of which were open procedures), continued, in general, to have high rates of open repairs in 2002-03 ($R^2 = 0.30$). When one looks at changes in the rates of the open procedure between 1996-97 and 2002-03 (Figure 6), however, one sees that in general the regions with the greatest declines in rates of the open procedure (shown on the horizontal axis as a greater positive number when the decline was greater) were also the regions that tended to have the greatest increase in use of the endovascular procedure (shown on the vertical axis).

These data are consistent with the national data shown in Figure 1. In general, endovascular repair appears to have been introduced as a substitute for the open procedure. First, areas with high rates of AAA repair continued to have high overall rates of the two procedures (Figure 4). And having a high rate of procedures in 1996-97 predicted not only continued high rates of the open procedure in 2002-03 (Figure 5), but also predicted relatively high rates of the endovascular procedure ($R^2 = 0.14$).

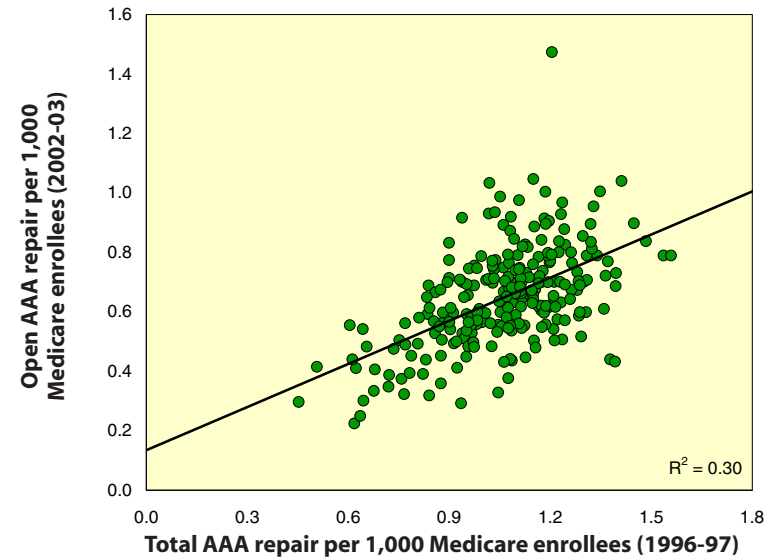


Figure 5

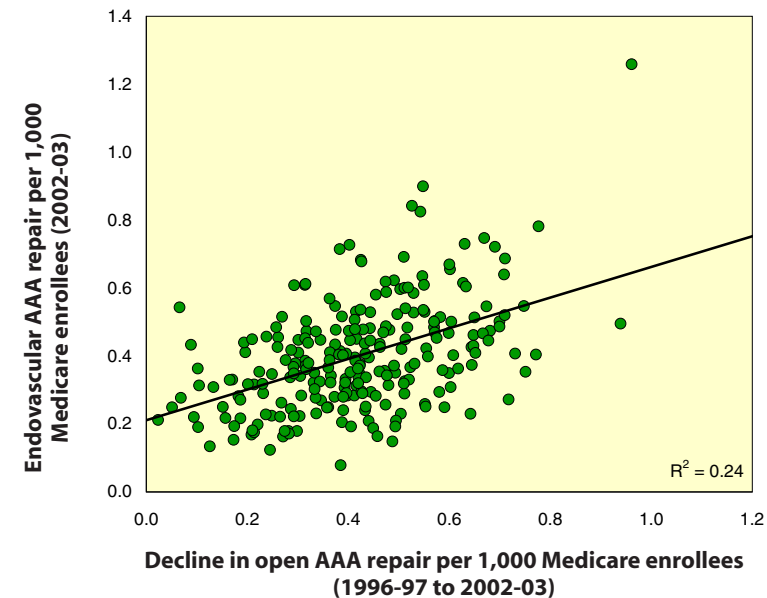


Figure 6

Variations in utilization rates, however, persist. Figure 7 shows how rates of utilization of these procedures have changed over time and suggests an additional important insight: introduction of the endovascular procedure has increased the variability in procedure rates. This is consistent with the hypothesis that broadening of the indications (perhaps to patients at higher underlying risk from major surgery) has led to greater variability in clinical decision-making for this procedure.

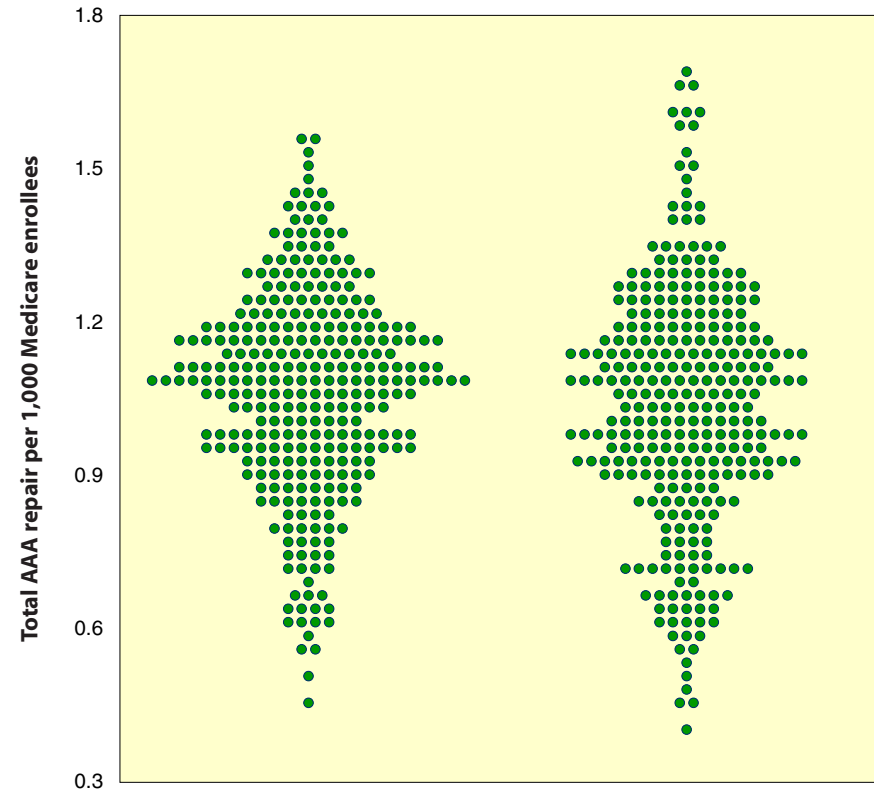


Figure 7

	1996-97	2002-03
U.S. average	1.06	1.02
Interquartile ratio	1.27	1.31
Extremal ratio	3.46	4.38
SCV	36.1	54.8



Methods Overview

A hospital service area (HSA) is a collection of Zip codes whose residents receive most of their hospitalizations from the hospitals within that area. Hospital referral regions (HRRs) are aggregations of HSAs and represent regional health care markets for tertiary medical care; each HRR contains at least one hospital that performs major cardiovascular procedures and neurosurgery.

The Medicare population in an area that was used as the denominator for the rates in these studies included those alive, age 65 to 99, and not enrolled in a risk bearing HMO. The numerator for the surgical rates presented was based on all individuals meeting these eligibility criteria who underwent the specified procedure during an inpatient stay within the given year, based on the ICD-9-CM procedure codes shown in the table. The numerator for Part A expenditures was based on the actual payments made by the Medicare program, including disproportionate share, medical education, and outlier payments.

Rates based on a count of fewer than 11 observed counts are not displayed for reasons of patient confidentiality. Rates with fewer than 26 expected events are reported in parentheses to indicate lack of statistical precision; the margin of error is greater than 20%. Rates were adjusted to the age, sex and race distribution of the national Medicare population as follows. The national event rate for each age-sex-race category was computed. These rates were then applied to the HSA and HRR populations to produce the expected number of events in the HSA or HRR; that is, the number of events that would have occurred in the HSA if its rate had been the same as the national event rate.

PROCEDURE	CODES
Total AAA repair	Procedure codes 38.44, 39.25, 39.71 and/or Diagnosis codes 441.3-441.9
Open AAA repair	Procedure codes 38.44, 39.25 and/or Diagnosis codes 441.3-441.9
Endovascular AAA repair	Procedure code 39.71 and/or Diagnosis codes 441.3-441.9



Appendix Table: Age-sex-race adjusted rates per 1000 Medicare beneficiaries in U.S. Hospital Referral Regions

Notes: When rates were based on observed counts of 11 or fewer individuals in the HRR, the rates are fully suppressed and the cell in this table is empty. When a rate is based on fewer than 26 expected events, and might lack statistical stability, the rate is presented in parentheses.

GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
1	AL-Birmingham	515,217	1.16	1.16	495,492	1.13	0.67	0.48
2	AL-Dothan	92,173	1.06	1.06	96,221	1.34	0.75	0.61
5	AL-Huntsville	113,556	1.29	1.29	129,527	1.28	0.52	0.78
6	AL-Mobile	157,000	1.35	1.35	163,074	1.41	1.00	0.45
7	AL-Montgomery	98,719	1.28	1.28	100,427	1.60	0.73	0.90
9	AL-Tuscaloosa	57,379	1.11	1.11	59,069	1.41	0.74	(0.70)
10	AK-Anchorage	58,368	0.56	0.56	74,463	0.65	0.55	
11	AZ-Mesa	99,636	1.03	1.03	120,686	1.29	0.48	0.82
12	AZ-Phoenix	347,259	1.05	1.05	416,741	1.17	0.56	0.62
14	AZ-Sun City	89,273	1.10	1.10	89,315	1.42	0.57	0.84
15	AZ-Tucson	134,972	0.94	0.94	187,823	0.91	0.53	0.39
16	AR-Fort Smith	87,893	1.38	1.38	90,321	0.93	0.44	0.49
18	AR-Jonesboro	61,883	0.94	0.94	61,318	0.99	0.69	(0.29)
19	AR-Little Rock	379,180	1.21	1.21	392,567	1.03	0.70	0.32
21	AR-Springdale	96,379	1.05	1.05	102,631	1.18	0.60	0.58
22	AR-Texarkana	69,461	1.51	1.51	67,393	1.15	0.80	(0.37)
23	CA-Orange County	259,689	0.72	0.72	323,041	0.62	0.35	0.28
25	CA-Bakersfield	107,253	0.77	0.77	119,642	0.70	0.56	0.17



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
31	CA-Chico	68,552	1.18	1.18	79,031	1.07	0.91	0.16
33	CA-Contra Costa County	99,625	0.95	0.95	109,401	0.67	0.45	0.23
43	CA-Fresno	137,279	0.83	0.83	148,954	0.72	0.44	0.31
56	CA-Los Angeles	894,862	0.62	0.62	965,877	0.58	0.41	0.17
58	CA-Modesto	99,167	0.84	0.84	115,837	0.71	0.59	0.12
62	CA-Napa	65,227	0.95	0.95	62,174	0.77	0.59	(0.19)
65	CA-Alameda County	162,754	0.79	0.79	149,099	0.68	0.45	0.23
69	CA-Palm Spa/Rancho Mir	56,444	0.94	0.94	68,213	0.72	0.29	0.43
73	CA-Redding	85,086	1.17	1.17	91,068	1.09	0.60	0.48
77	CA-Sacramento	289,155	0.95	0.95	304,113	0.83	0.59	0.25
78	CA-Salinas	61,961	0.75	0.75	72,505	0.71	0.50	0.22
79	CA-San Bernardino	158,054	0.97	0.97	197,907	0.73	0.53	0.21
80	CA-San Diego	304,796	0.77	0.77	359,537	0.61	0.32	0.29
81	CA-San Francisco	195,456	0.51	0.51	194,899	0.62	0.41	0.22
82	CA-San Jose	153,563	0.65	0.65	165,026	0.57	0.30	0.27
83	CA-San Luis Obispo	39,604	1.19	1.19	54,080	0.64	0.54	
85	CA-San Mateo County	93,648	0.84	0.84	107,014	0.67	0.32	0.37
86	CA-Santa Barbara	59,016	0.74	0.74	74,734	0.90	0.47	0.45
87	CA-Santa Cruz	39,698	0.63	0.63	39,446	0.66	(0.39)	(0.27)
89	CA-Santa Rosa	64,534	0.74	0.74	66,715	0.97	0.44	(0.53)
91	CA-Stockton	64,408	1.05	1.05	70,032	0.71	0.61	
96	CA-Ventura	80,961	0.92	0.92	108,568	0.82	0.49	0.35



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
101	CO-Boulder	26,623	1.11	1.11	31,018	0.48	(0.38)	
102	CO-Colorado Springs	107,098	0.97	0.97	126,647	0.91	0.69	0.24
103	CO-Denver	260,521	0.81	0.81	270,920	0.86	0.58	0.29
104	CO-Fort Collins	50,529	0.95	0.95	54,899	0.73	0.43	(0.29)
105	CO-Grand Junction	63,169	0.61	0.61	70,591	0.80	0.55	0.25
106	CO-Greeley	59,218	0.73	0.73	61,034	0.94	0.66	(0.31)
107	CO-Pueblo	31,772	0.79	0.79	36,073	0.73	(0.50)	
109	CT-Bridgeport	158,870	1.03	1.03	144,930	1.08	0.71	0.38
110	CT-Hartford	360,740	1.12	1.12	373,560	1.01	0.55	0.47
111	CT-New Haven	328,984	1.18	1.18	336,918	1.12	0.74	0.39
112	DE-Wilmington	141,677	1.06	1.06	161,697	1.22	0.89	0.33
113	DC-Washington	411,112	0.88	0.88	472,092	1.02	0.56	0.47
115	FL-Bradenton	91,252	1.31	1.31	97,362	1.22	0.60	0.64
116	FL-Clearwater	154,760	1.17	1.17	146,476	1.25	0.62	0.63
118	FL-Fort Lauderdale	571,919	1.12	1.12	581,798	1.05	0.54	0.50
119	FL-Fort Myers	316,682	1.34	1.34	367,628	1.31	0.79	0.53
120	FL-Gainesville	98,506	0.81	0.81	118,724	1.08	0.49	0.61
122	FL-Hudson	141,400	1.29	1.29	135,831	1.08	0.59	0.50
123	FL-Jacksonville	210,676	1.21	1.21	272,311	1.26	0.54	0.75
124	FL-Lakeland	85,213	1.28	1.28	88,645	1.07	0.67	0.40
127	FL-Miami	379,849	0.72	0.72	341,948	0.65	0.39	0.28
129	FL-Ocala	167,595	1.45	1.45	210,357	1.15	0.90	0.26



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
130	FL-Orlando	680,082	1.31	1.31	794,583	1.10	0.79	0.33
131	FL-Ormond Beach	89,432	1.21	1.21	100,183	1.08	0.64	0.45
133	FL-Panama City	46,757	1.17	1.17	52,571	1.05	0.60	(0.44)
134	FL-Pensacola	159,289	1.29	1.29	180,258	1.29	0.60	0.72
137	FL-Sarasota	183,479	1.30	1.30	196,323	1.04	0.70	0.35
139	FL-St. Petersburg	115,250	1.23	1.23	106,090	1.20	0.70	0.53
140	FL-Tallahassee	147,457	1.13	1.13	155,407	0.92	0.45	0.47
141	FL-Tampa	164,273	1.17	1.17	188,021	1.17	0.70	0.49
142	GA-Albany	44,567	1.42	1.42	44,643	0.71	0.51	
144	GA-Atlanta	713,297	1.12	1.12	769,673	0.99	0.64	0.36
145	GA-Augusta	128,215	1.17	1.17	136,911	0.91	0.72	0.19
146	GA-Columbus	68,768	1.19	1.19	69,883	0.88	0.70	0.21
147	GA-Macon	146,862	0.91	0.91	152,150	1.09	0.60	0.50
148	GA-Rome	62,048	1.32	1.32	65,197	1.26	0.89	(0.38)
149	GA-Savannah	146,366	1.14	1.14	160,111	0.96	0.66	0.31
150	HI-Honolulu	187,128	0.76	0.76	267,648	0.44	0.37	0.08
151	ID-Boise	143,108	1.09	1.09	142,307	0.78	0.63	0.16
152	ID-Idaho Falls	34,545	0.71	0.71	38,914	0.73	(0.33)	(0.42)
154	IL-Aurora	32,966	0.94	0.94	32,883	0.78	(0.57)	
155	IL-Blue Island	180,094	1.06	1.06	197,371	1.07	0.67	0.41
156	IL-Chicago	426,308	0.78	0.78	415,550	0.63	0.39	0.24
158	IL-Elgin	85,198	1.12	1.12	106,521	1.15	0.70	0.45



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
161	IL-Evanston	218,450	0.86	0.86	243,066	0.84	0.53	0.32
163	IL-Hinsdale	63,259	0.88	0.88	76,272	0.92	0.60	0.34
164	IL-Joliet	100,465	1.24	1.24	117,637	0.90	0.51	0.41
166	IL-Melrose Park	253,174	0.99	0.99	262,621	1.01	0.61	0.41
170	IL-Peoria	189,683	1.23	1.23	178,446	1.24	0.63	0.65
171	IL-Rockford	173,703	1.00	1.00	177,387	0.79	0.56	0.24
172	IL-Springfield	256,506	1.20	1.20	249,634	1.16	0.77	0.41
173	IL-Urbana	113,165	1.19	1.19	101,887	1.26	1.00	0.28
175	IL-Bloomington	38,868	1.42	1.42	35,991	1.52	(0.53)	(0.99)
179	IN-Evansville	197,041	0.94	0.94	193,565	1.15	0.70	0.46
180	IN-Fort Wayne	199,459	1.08	1.08	207,877	1.24	0.92	0.33
181	IN-Gary	114,196	1.15	1.15	119,143	1.34	1.05	0.31
183	IN-Indianapolis	579,628	1.15	1.15	607,303	1.15	0.89	0.26
184	IN-Lafayette	46,173	1.06	1.06	46,479	1.02	0.90	
185	IN-Muncie	46,019	1.46	1.46	44,797	1.34	1.18	
186	IN-Munster	79,167	1.23	1.23	76,413	1.25	0.93	0.34
187	IN-South Bend	168,401	1.03	1.03	167,772	1.02	0.70	0.35
188	IN-Terre Haute	53,276	1.00	1.00	49,566	1.13	0.77	(0.36)
190	IA-Cedar Rapids	71,715	1.11	1.11	74,544	1.28	0.97	0.31
191	IA-Davenport	139,570	1.11	1.11	139,730	1.12	0.70	0.45
192	IA-Des Moines	280,157	1.10	1.10	276,768	1.15	0.79	0.37
193	IA-Dubuque	44,182	0.71	0.71	45,816	1.34	0.96	(0.38)



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
194	IA-Iowa City	84,399	0.84	0.84	81,124	0.94	0.69	0.25
195	IA-Mason City	53,210	1.38	1.38	51,018	1.13	0.93	(0.20)
196	IA-Sioux City	79,868	1.25	1.25	76,083	1.16	0.82	0.34
197	IA-Waterloo	63,641	0.98	0.98	62,352	0.96	0.71	(0.25)
200	KS-Topeka	111,599	1.04	1.04	113,516	0.99	0.77	0.22
201	KS-Wichita	351,519	1.11	1.11	343,085	1.14	0.62	0.52
203	KY-Covington	65,983	0.91	0.91	67,787	1.19	0.61	0.61
204	KY-Lexington	308,067	0.98	0.98	323,202	0.95	0.75	0.20
205	KY-Louisville	367,214	1.18	1.18	382,822	1.01	0.62	0.42
207	KY-Owensboro	36,562	1.19	1.19	37,242	1.30	(0.82)	(0.54)
208	KY-Paducah	113,387	1.33	1.33	111,574	1.32	0.81	0.54
209	LA-Alexandria	67,370	1.08	1.08	68,408	1.11	0.70	0.41
210	LA-Baton Rouge	107,447	0.98	0.98	128,304	1.23	0.56	0.68
212	LA-Houma	41,169	0.89	0.89	51,023	0.99	0.35	(0.68)
213	LA-Lafayette	120,048	1.41	1.41	120,173	1.58	1.04	0.55
214	LA-Lake Charles	52,590	1.45	1.45	60,685	1.30	0.68	(0.64)
216	LA-Metairie	75,740	1.10	1.10	72,630	1.12	0.66	0.48
217	LA-Monroe	68,088	1.40	1.40	67,499	1.20	0.69	0.52
218	LA-New Orleans	138,249	0.90	0.90	102,765	0.93	0.71	0.22
219	LA-Shreveport	164,515	1.19	1.19	167,171	0.91	0.61	0.29
220	LA-Slidell	30,570	1.23	1.23	32,704	1.46	(0.74)	(0.72)
221	ME-Bangor	112,084	1.26	1.26	117,819	0.91	0.67	0.25



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
222	ME-Portland	262,812	1.08	1.08	275,154	0.96	0.61	0.35
223	MD-Baltimore	496,799	1.08	1.08	550,017	1.39	0.68	0.73
225	MD-Salisbury	99,426	1.33	1.33	124,266	1.43	0.95	0.48
226	MD-Takoma Park	125,983	0.95	0.95	146,773	0.81	0.51	0.34
227	MA-Boston	989,083	1.13	1.13	938,221	1.00	0.73	0.28
230	MA-Springfield	182,441	1.12	1.12	158,084	0.94	0.66	0.28
231	MA-Worcester	121,622	1.24	1.24	97,965	0.92	0.69	0.25
232	MI-Ann Arbor	264,770	0.96	0.96	276,714	1.05	0.66	0.41
233	MI-Dearborn	141,409	1.32	1.32	130,664	0.97	0.83	0.15
234	MI-Detroit	446,389	1.06	1.06	421,249	0.94	0.55	0.42
235	MI-Flint	118,308	1.26	1.26	120,842	0.97	0.64	0.36
236	MI-Grand Rapids	230,265	0.95	0.95	245,128	1.10	0.69	0.43
238	MI-Kalamazoo	156,551	1.32	1.32	161,854	1.53	0.89	0.68
239	MI-Lansing	127,677	1.18	1.18	155,004	0.93	0.60	0.36
240	MI-Marquette	65,510	1.13	1.13	64,654	1.66	1.10	(0.57)
242	MI-Muskegon	69,867	0.90	0.90	70,746	1.04	0.83	0.28
243	MI-Petoskey	51,190	1.34	1.34	55,304	1.70	1.44	(0.27)
244	MI-Pontiac	74,324	1.08	1.08	83,429	0.86	0.57	0.29
245	MI-Royal Oak	163,236	1.10	1.10	168,581	0.91	0.59	0.32
246	MI-Saginaw	192,668	1.05	1.05	190,958	1.51	0.99	0.54
248	MI-St. Joseph	39,797	1.37	1.37	39,578	1.25	(0.46)	(0.79)
249	MI-Traverse City	65,238	1.21	1.21	73,724	1.62	1.47	0.15



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
250	MN-Duluth	108,464	1.27	1.27	103,879	1.34	0.76	0.60
251	MN-Minneapolis	568,924	1.01	1.01	614,096	0.92	0.71	0.22
253	MN-Rochester	111,648	1.02	1.02	114,303	1.34	0.93	0.43
254	MN-St. Cloud	52,073	0.67	0.67	56,087	0.87	0.69	(0.20)
256	MN-St. Paul	150,772	0.90	0.90	165,762	1.10	0.70	0.41
257	MS-Gulfport	39,505	0.81	0.81	41,076	1.22	0.78	(0.43)
258	MS-Hattiesburg	64,551	1.43	1.43	66,579	1.60	0.42	(1.20)
259	MS-Jackson	238,915	1.11	1.11	236,757	1.09	0.56	0.53
260	MS-Meridian	53,495	0.96	0.96	52,435	1.02	0.37	(0.66)
261	MS-Oxford	34,486	1.15	1.15	35,686	1.58	(0.89)	(0.69)
262	MS-Tupelo	91,127	1.19	1.19	91,856	1.27	0.56	0.73
263	MO-Cape Girardeau	76,041	1.13	1.13	74,614	1.27	0.83	0.45
264	MO-Columbia	178,036	1.08	1.08	177,226	1.21	0.76	0.45
267	MO-Joplin	103,908	1.54	1.54	100,429	1.33	0.79	0.55
268	MO-Kansas City	448,915	1.17	1.17	439,899	1.16	0.70	0.47
270	MO-Springfield	218,484	1.14	1.14	209,935	1.09	0.71	0.38
273	MO-St. Louis	743,480	1.11	1.11	667,593	1.18	0.67	0.53
274	MT-Billings	126,617	1.10	1.10	133,588	0.90	0.66	0.25
275	MT-Great Falls	40,748	1.57	1.57	41,074	0.98	0.84	
276	MT-Missoula	86,939	0.97	0.97	93,317	0.84	0.55	0.28
277	NE-Lincoln	157,906	1.09	1.09	155,150	1.15	0.54	0.61
278	NE-Omaha	295,471	0.94	0.94	293,024	1.01	0.65	0.38



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		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
279	NV-Las Vegas	158,502	1.37	1.37	210,354	1.09	0.72	0.37
280	NV-Reno	114,178	1.15	1.15	130,294	0.97	0.66	0.35
281	NH-Lebanon	109,438	0.88	0.88	113,635	0.94	0.50	0.43
282	NH-Manchester	165,519	1.03	1.03	185,223	1.10	0.74	0.37
283	NJ-Camden	631,653	1.01	1.01	672,165	0.97	0.59	0.38
284	NJ-Hackensack	293,274	0.82	0.82	283,215	0.81	0.39	0.44
285	NJ-Morristown	205,346	0.97	0.97	214,332	1.09	0.50	0.62
288	NJ-New Brunswick	182,862	0.90	0.90	198,676	0.95	0.54	0.41
289	NJ-Newark	322,299	0.88	0.88	287,446	0.83	0.36	0.48
291	NJ-Paterson	76,841	0.86	0.86	76,914	1.08	0.67	0.44
292	NJ-Ridgewood	82,981	1.05	1.05	89,680	0.60	0.33	0.27
293	NM-Albuquerque	221,600	0.77	0.77	256,967	0.66	0.49	0.18
295	NY-Albany	462,476	1.31	1.31	437,057	1.20	0.71	0.50
296	NY-Binghamton	106,015	1.11	1.11	110,818	1.32	0.75	0.57
297	NY-Bronx	176,978	0.68	0.68	147,667	0.65	0.33	0.32
299	NY-Buffalo	385,667	1.04	1.04	278,843	1.10	0.53	0.60
300	NY-Elmira	108,669	1.20	1.20	102,584	1.24	0.77	0.48
301	NY-East Long Island	865,153	0.92	0.92	861,960	0.87	0.50	0.37
303	NY-Manhattan	809,119	0.62	0.62	694,252	0.55	0.22	0.33
304	NY-Rochester	282,992	1.21	1.21	236,277	1.05	0.65	0.40
307	NY-Syracuse	269,660	1.24	1.24	268,345	1.20	0.88	0.34
308	NY-White Plains	228,408	0.85	0.85	232,842	0.97	0.57	0.42



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		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
309	NC-Asheville	187,907	1.08	1.08	200,957	0.85	0.38	0.49
311	NC-Charlotte	394,629	1.07	1.07	419,449	0.94	0.58	0.37
312	NC-Durham	294,478	1.02	1.02	300,941	0.98	0.56	0.44
313	NC-Greensboro	128,238	1.19	1.19	120,142	1.13	0.79	0.35
314	NC-Greenville	171,267	1.49	1.49	188,454	1.28	0.84	0.46
315	NC-Hickory	64,442	1.02	1.02	68,985	1.00	0.71	0.28
318	NC-Raleigh	276,593	1.08	1.08	302,037	1.13	0.55	0.58
319	NC-Wilmington	86,208	1.39	1.39	98,945	1.66	0.43	1.26
320	NC-Winston-Salem	241,159	1.36	1.36	221,435	0.96	0.61	0.35
321	ND-Bismarck	63,094	1.09	1.09	63,347	1.02	0.69	(0.35)
322	ND-Fargo/Moorhead MN	144,465	0.97	0.97	143,094	1.28	0.59	0.71
323	ND-Grand Forks	48,299	1.30	1.30	46,273	1.39	0.54	(0.87)
324	ND-Minot	39,199	1.18	1.18	37,987	1.13	(0.58)	(0.54)
325	OH-Akron	164,333	1.17	1.17	137,111	1.18	0.78	0.40
326	OH-Canton	166,895	1.08	1.08	143,631	1.08	0.72	0.37
327	OH-Cincinnati	336,964	1.10	1.10	311,293	0.98	0.74	0.25
328	OH-Cleveland	511,943	1.13	1.13	495,696	1.17	0.82	0.36
329	OH-Columbus	584,040	1.23	1.23	583,366	1.23	0.84	0.40
330	OH-Dayton	268,277	1.20	1.20	257,084	1.24	0.90	0.35
331	OH-Elyria	57,185	1.28	1.28	56,013	1.10	0.77	(0.33)
332	OH-Kettering	87,849	1.19	1.19	88,504	1.10	0.89	0.22
334	OH-Toledo	236,441	1.24	1.24	215,053	1.47	0.97	0.51



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
335	OH-Youngstown	209,730	1.04	1.04	167,001	1.30	0.93	0.36
336	OK-Lawton	48,933	1.29	1.29	48,507	1.23	0.80	(0.45)
339	OK-Oklahoma City	398,743	1.03	1.03	399,506	1.13	0.75	0.39
340	OK-Tulsa	276,167	0.96	0.96	265,170	1.05	0.75	0.32
341	OR-Bend	41,964	1.16	1.16	36,986	0.71	(0.67)	
342	OR-Eugene	156,369	0.96	0.96	171,505	0.74	0.48	0.26
343	OR-Medford	114,553	1.15	1.15	135,760	1.30	0.64	0.69
344	OR-Portland	290,270	0.95	0.95	298,821	0.84	0.54	0.31
345	OR-Salem	51,287	0.80	0.80	35,064	0.59	(0.41)	
346	PA-Allentown	280,477	1.19	1.19	287,551	1.08	0.80	0.29
347	PA-Altoona	83,223	1.22	1.22	69,702	1.00	0.57	0.43
350	PA-Danville	122,589	1.12	1.12	135,084	1.00	0.82	0.18
351	PA-Erie	211,515	1.02	1.02	192,587	1.32	1.03	0.30
352	PA-Harrisburg	237,979	1.17	1.17	252,281	1.14	0.84	0.30
354	PA-Johnstown	77,976	0.96	0.96	54,194	1.22	0.63	(0.61)
355	PA-Lancaster	131,497	1.09	1.09	148,864	0.84	0.43	0.41
356	PA-Philadelphia	774,647	1.05	1.05	653,970	0.98	0.63	0.36
357	PA-Pittsburgh	856,553	1.29	1.29	627,308	1.20	0.70	0.51
358	PA-Reading	145,826	1.08	1.08	144,214	1.04	0.87	0.18
359	PA-Sayre	53,040	0.94	0.94	55,940	0.98	0.76	(0.22)
360	PA-Scranton	100,923	1.23	1.23	96,532	1.08	0.80	0.30
362	PA-Wilkes-Barre	81,393	0.87	0.87	82,244	0.93	0.55	0.38



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363	PA-York	91,349	1.40	1.40	106,675	1.17	0.73	0.47
364	RI-Providence	277,119	1.08	1.08	206,633	0.96	0.79	0.17
365	SC-Charleston	170,928	1.19	1.19	203,886	1.11	0.62	0.50
366	SC-Columbia	226,301	1.18	1.18	244,745	1.16	0.55	0.61
367	SC-Florence	79,717	1.21	1.21	81,425	1.16	0.50	0.69
368	SC-Greenville	180,319	0.90	0.90	198,045	1.03	0.57	0.47
369	SC-Spartanburg	86,156	1.15	1.15	89,987	1.01	0.50	0.51
370	SD-Rapid City	46,929	0.87	0.87	51,355	1.06	0.91	
371	SD-Sioux Falls	234,173	1.05	1.05	227,804	1.16	0.63	0.53
373	TN-Chattanooga	153,643	1.15	1.15	157,376	1.03	0.76	0.28
374	TN-Jackson	92,908	1.15	1.15	91,636	1.25	0.67	0.59
375	TN-Johnson City	63,107	1.09	1.09	61,807	1.26	0.83	(0.46)
376	TN-Kingsport	135,290	0.98	0.98	119,629	1.10	0.60	0.52
377	TN-Knoxville	312,147	1.11	1.11	308,483	1.16	0.71	0.47
379	TN-Memphis	367,301	1.22	1.22	360,267	1.26	0.62	0.67
380	TN-Nashville	489,286	1.03	1.03	490,194	1.14	0.71	0.44
382	TX-Abilene	88,337	1.01	1.01	86,347	0.94	0.85	
383	TX-Amarillo	105,573	1.08	1.08	105,460	0.64	0.44	0.23
385	TX-Austin	160,464	0.64	0.64	197,978	0.73	0.54	0.19
386	TX-Beaumont	106,426	1.20	1.20	109,116	1.30	0.79	0.51
388	TX-Bryan	38,185	0.91	0.91	41,522	0.92	0.69	
390	TX-Corpus Christi	95,273	0.90	0.90	102,259	0.91	0.77	0.13



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		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
391	TX-Dallas	545,577	1.08	1.08	619,812	0.91	0.54	0.38
393	TX-El Paso	171,010	0.66	0.66	197,212	0.63	0.48	0.15
394	TX-Fort Worth	227,983	0.93	0.93	270,314	1.06	0.71	0.35
396	TX-Harlingen	86,250	0.45	0.45	93,843	0.51	0.30	0.22
397	TX-Houston	617,766	1.07	1.07	802,483	1.08	0.70	0.39
399	TX-Longview	47,790	1.35	1.35	50,014	1.33	1.09	(0.23)
400	TX-Lubbock	154,862	1.26	1.26	155,913	1.19	0.80	0.43
402	TX-McAllen	72,603	0.64	0.64	84,322	0.45	0.25	0.20
406	TX-Odessa	67,019	1.56	1.56	71,148	1.19	0.79	0.40
411	TX-San Angelo	42,872	0.82	0.82	42,678	0.93	0.84	
412	TX-San Antonio	331,039	0.61	0.61	388,982	0.62	0.44	0.19
413	TX-Temple	66,253	0.88	0.88	75,649	0.97	0.45	0.54
416	TX-Tyler	139,367	1.30	1.30	146,284	1.28	0.85	0.44
417	TX-Victoria	39,191	0.98	0.98	40,308	0.78	(0.61)	
418	TX-Waco	84,696	0.84	0.84	83,616	0.92	0.65	0.27
420	TX-Wichita Falls	57,618	1.16	1.16	56,156	1.10	0.44	(0.66)
421	UT-Ogden	55,746	0.56	0.56	67,284	0.39	0.33	
422	UT-Provo	51,259	0.59	0.59	62,172	0.54		(0.43)
423	UT-Salt Lake City	260,109	0.68	0.68	309,447	0.58	0.41	0.18
424	VT-Burlington	142,671	1.11	1.11	150,459	1.06	0.74	0.32
426	VA-Arlington	216,313	0.97	0.97	264,747	0.83	0.50	0.34
427	VA-Charlottesville	120,755	0.98	0.98	133,801	1.04	0.57	0.48



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428	VA-Lynchburg	63,697	1.06	1.06	70,075	0.99	0.43	0.60
429	VA-Newport News	102,094	1.37	1.37	120,321	1.06	0.77	0.31
430	VA-Norfolk	221,979	1.29	1.29	247,442	1.14	0.69	0.47
431	VA-Richmond	312,261	1.16	1.16	341,919	0.91	0.48	0.44
432	VA-Roanoke	192,901	1.09	1.09	193,552	1.18	0.84	0.35
435	VA-Winchester	82,355	0.94	0.94	91,732	1.12	0.92	0.21
437	WA-Everett	71,882	0.88	0.88	85,396	0.98	0.67	0.32
438	WA-Olympia	61,092	0.92	0.92	64,354	0.68	0.52	(0.17)
439	WA-Seattle	384,342	0.96	0.96	411,951	0.88	0.56	0.32
440	WA-Spokane	272,880	1.07	1.07	327,046	0.95	0.65	0.32
441	WA-Tacoma	103,629	1.09	1.09	111,862	0.86	0.68	0.19
442	WA-Yakima	56,902	1.05	1.05	57,972	0.98	0.89	
443	WV-Charleston	254,162	1.25	1.25	251,544	1.11	0.57	0.55
444	WV-Huntington	100,764	1.03	1.03	101,358	1.26	0.77	0.48
445	WV-Morgantown	111,932	1.15	1.15	106,765	1.21	0.63	0.60
446	WI-Appleton	78,054	1.11	1.11	80,578	0.96	0.68	0.29
447	WI-Green Bay	132,808	0.98	0.98	134,184	0.97	0.75	0.23
448	WI-La Crosse	96,405	0.92	0.92	82,266	0.85	0.41	0.45
449	WI-Madison	229,602	0.97	0.97	237,984	0.67	0.48	0.19
450	WI-Marshfield	109,321	0.84	0.84	108,171	0.91	0.61	0.32
451	WI-Milwaukee	561,456	1.00	1.00	572,521	1.23	0.79	0.45
452	WI-Neenah	61,212	0.98	0.98	62,683	0.78	0.58	(0.20)



GEOID	GEONAME	1996-97			2002-03			
		Medicare enrollees	Total AAA repair	Open AAA repair	Medicare enrollees	Total AAA repair	Open AAA repair	Endovascular AAA repair
456	WI-Wausau	54,620	1.09	1.09	55,605	0.90	0.63	(0.27)
457	WY-Casper	45,140	1.15	1.15	47,317	1.14	0.82	(0.41)
999	US-United States	55,338,599	1.06	1.06	56,935,617	1.02	0.64	0.39