

SUPPLEMENTAL MATERIAL

Title: Cerebral aneurysm treatment trends in National Inpatient

Sample 2007-2016: endovascular therapies favored over

surgery

Table 1S. ICD-10-CM Codes

ICD-10-CM	Description
Unruptured Aneurysms	
I67.1	Cerebral aneurysm, nonruptured
Ruptured Aneurysms	
I60.00	NT SAH from unspecified carotid siphon and bifurcation
I60.01	NT SAH from right carotid siphon and bifurcation
I60.02	NT SAH from left carotid siphon and bifurcation
I60.10	NT SAH from unspecified middle cerebral artery
I60.11	NT SAH from right middle cerebral artery
I60.12	NT SAH from left middle cerebral artery
I60.20	NT SAH from anterior communicating artery
I60.21	NT SAH from right anterior communicating artery
I60.22	NT SAH from left anterior communicating artery
I60.30	NT SAH from unspecified posterior communicating
I60.31	NT SAH from right posterior communicating artery
I60.32	NT SAH from left posterior communicating artery
I60.4	NT SAH from basilar artery
I60.50	NT SAH from unspecified vertebral artery
I60.51	NT SAH from right vertebral artery
I60.52	NT SAH from left vertebral artery
I60.6	NT SAH from other intracranial arteries
I60.7	NT SAH from unspecified intracranial artery
I60.8	Other NT SAH
I60.9	NT SAH, unspecified
I61.0	NT ICH in hemisphere, subcortical
I61.1	NT ICH in hemisphere, cortical
I61.2	NT ICH in hemisphere, unspecified
I61.3	NT ICH in brain stem
I61.4	NT ICH in cerebellum
I61.5	NT ICH, intraventricular
I61.6	NT ICH, multiple localized
I61.8	Other NT ICH
I61.9	NT ICH, unspecified

Abbreviations: ICD-10-CM, International Classification of Diseases, Tenth Revision, Clinical Modification; NT, nontraumatic; SAH, subarachnoid hemorrhage; ICH, intracerebral hemorrhage

Table 2S. ICD-10-PCS Codes

ICD-10-PCS	Description
Surgical Clipping	
03VG0CZ	Restriction of Intracranial artery with ED, OA
03LG0CZ	Occlusion of Intracranial artery with ED, OA
03VK0CZ	Restriction of Right Internal Carotid Artery with ED, OA
03LK0CZ	Occlusion of Right Internal Carotid Artery with ED, OA
03VL0CZ	Restriction of Left Internal Carotid Artery with ED, OA
03LL0CZ	Occlusion of Left Internal Carotid Artery with ED, OA
03VP0CZ	Restriction of Right Vertebral Artery with ED, OA
03LP0CZ	Occlusion of Right Vertebral Artery with ED, OA
03VQ0CZ	Restriction of Left Vertebral Artery with ED, OA
03LQ0CZ	Occlusion of Left Vertebral Artery with ED, OA
Endovascular Therapy	
03VG3DZ	Restriction of Intracranial Artery with ID, PA
03LG3DZ	Occlusion of Intracranial Artery with ID, PA
03VG3BZ	Restriction of Intracranial Artery with Bioactive ID, PA
03LG3BZ	Occlusion of Intracranial Artery with Bioactive ID, PA
03VK3DZ	Restriction of Right Internal Carotid Artery with ID, PA
03LK3DZ	Occlusion of Right Internal Carotid Artery with ID, PA
03VK3BZ	Restriction of Right Internal Carotid Artery with Bioactive ID, PA
03LK3BZ	Occlusion of Right Internal Carotid Artery with Bioactive ID, PA
03VL3DZ	Restriction of Left Internal Carotid Artery with ID, PA
03LL3DZ	Occlusion of Left Internal Carotid Artery with ID, PA
03VL3BZ	Restriction of Left Internal Carotid Artery with Bioactive ID, PA
03LL3BZ	Occlusion of Left Internal Carotid Artery with Bioactive ID, PA
03VP3DZ	Restriction of Right Vertebral Artery with ID, PA
03LP3DZ	Occlusion of Right Vertebral Artery with ID, PA
03VP3BZ	Restriction of Right Vertebral Artery with Bioactive ID, PA
03LP3BZ	Occlusion of Right Vertebral Artery with Bioactive ID, PA
03VQ3DZ	Restriction of Left Vertebral Artery with ID, PA
03LQ3DZ	Occlusion of Left Vertebral Artery with ID, PA
03VQ3BZ	Restriction of Left Vertebral Artery with Bioactive ID, PA
03LQ3BZ	Occlusion of Left Vertebral Artery with Bioactive ID, PA

Abbreviations: : ICD-10-PCS, International Classification of Diseases, Tenth Revision, Procedure Coding System; ED, extraluminal device; OA, open approach; ID, intraluminal device; PA, percutaneous approach.

Table 3S. Total Number of Cases by Year and Treatment Modality for Single-Treated Unruptured Cerebral Aneurysms

Single-Treated Unruptured Cerebral Aneurysms			
Year	Surgical Clipping	Endovascular Therapies	Total Number of Cases
2007	719	932	1,651
2008	875	1,499	2,374
2009	751	1,261	2,012
2010	931	905	1,836
2011	961	1,005	1,966
2012	728	1,098	1,826
2013	789	1,181	1,970
2014	725	1,214	1,939
2015	692	1,596	2,288
2016	676	2,106	2,782

Table 4S. Total Number of Cases by Year and Treatment Modality for Single-Treated Ruptured Cerebral Aneurysms

Single-Treated Ruptured Cerebral Aneurysms			
Year	Surgical Clipping	Endovascular Therapies	Total Number of Cases
2007	962	966	1,928
2008	972	1,347	2,319
2009	872	1,199	2,071
2010	1,013	974	1,987
2011	928	786	1,714
2012	725	786	1,511
2013	713	861	1,574
2014	705	887	1,592
2015	637	1,128	1,765
2016	581	1,596	2,177

Table 5S. Mean Number of Single-Treated Unruptured Aneurysms and Single-Treated Ruptured Aneurysms, 2007-2011 vs. 2012-2016

	2007-2011			2012-2016			
	Mean ± SD			Mean ± SD			p value
Unruptured Aneurysms	1,967.8 ± 266.8			2,161.0 ± 387.2			0.39
	Surgical Clipping	Endovascular Therapies		Surgical Clipping	Endovascular Therapies		
	Mean ± SD	Mean ± SD	p value	Mean ± SD	Mean ± SD	p value	
	847.4 ± 107.7	1,120.4 ± 254.1	0.21	722.0 ± 43.4	1,439.0 ± 419.2	<0.001	
	Mean ± SD			Mean ± SD			p value
Ruptured Aneurysms	2,003.8 ± 220.2			1,723.8 ± 270.3			0.11
	Surgical Clipping	Endovascular Therapies		Surgical Clipping	Endovascular Therapies		
	Mean ± SD	Mean ± SD	p value	Mean ± SD	Mean ± SD	p value	
	949.4 ± 52.8	1,054.4 ± 219.6	0.85	672.2 ± 61.4	1,051.6 ± 330.2	0.02	

Abbreviations: SD, standard deviation

Table 6S. Patient and Hospital Characteristics for Single-Treated Unruptured Aneurysms, 2007-2011 vs. 2012-2016

	2007-2011			2012-2016		
	Surgical (n = 4,237)	Endovascular (n = 5,602)	p value	Surgical (n = 3,610)	Endovascular (n = 7,195)	p value
Age, mean \pm SD, years	54.7 \pm 11.8	57.2 \pm 13.1	<0.001	55.9 \pm 11.6	58.3 \pm 13.0	<0.001
Sex, No. (%)						
Female	3,141 (74.4)	4,249 (76.4)	0.02	2,655 (73.5)	5,478 (76.2)	0.003
Male	1,083 (25.6)	1,311 (23.6)		955 (26.5)	1,715 (23.8)	
Race, No. (%)						
White	2,514 (73.8)	3,201 (72.3)	0.001	2,351 (69.0)	4,725 (69.3)	0.01
Black	357 (10.5)	429 (9.7)		479 (14.1)	893 (13.1)	
Hispanic	324 (9.5)	484 (10.9)		362 (10.6)	695 (10.2)	
Asian or Pacific Islander	69 (2.0)	109 (2.5)		64 (1.9)	196 (2.9)	
Native American	34 (1.0)	20 (0.5)		29 (0.9)	37 (0.5)	
Other	109 (3.2)	184 (4.2)		124 (3.6)	270 (4.0)	
Healthcare coverage, No. (%)						
Private insurance	2,248 (53.1)	2,622 (46.9)	<0.001	1,630 (45.2)	2,947 (41.0)	<0.001
Medicaid	508 (12.0)	576 (10.3)		563 (15.6)	925 (12.9)	
Medicare	1,102 (26.1)	1,978 (35.4)		1,139 (31.6)	2,820 (39.3)	
Self-pay	145 (3.4)	168 (3.0)		121 (3.4)	190 (2.6)	
No charge	27 (0.6)	24 (0.4)		19 (0.5)	36 (0.5)	
Other	200 (4.7)	226 (4.0)		134 (3.7)	266 (3.7)	
Income quartile, No. (%)						
0 to 25th percentile	989 (23.9)	1,325 (24.1)	0.03	963 (27.3)	1,931 (27.4)	0.002
26th to 50th percentile	1,135 (27.4)	1,417 (25.8)		932 (26.4)	1,729 (24.5)	
51st to 75th percentile	1,072 (25.9)	1,365 (24.9)		893 (25.3)	1,693 (24.0)	
76th to 100th percentile	946 (22.8)	1,383 (25.2)		738 (20.9)	1,697 (24.1)	
Admission type, No. (%)						
Non-elective admission	621 (14.7)	1,231 (22.0)	<0.001	467 (13.0)	1,526 (21.3)	<0.001
Elective admission	3,613 (85.3)	4,352 (78.0)		3,131 (87.0)	5,637 (78.7)	
Elixhauser comorbidity score, mean \pm SD, points ^a	1.22 \pm 3.95	1.03 \pm 3.74	0.02	1.37 \pm 4.54	1.03 \pm 4.09	0.001
Hospital region, mean \pm SD, No.						
Northeast	154.2 \pm 27.7	208.4 \pm 103.7	>0.99	153.8 \pm 17.8	290.0 \pm 94.2	0.03
Midwest	204.0 \pm 28.9	265.6 \pm 81.1	>0.99	184.6 \pm 15.1	318.4 \pm 81.6	0.03
West	206.4 \pm 33.9	272.8 \pm 105.1	0.95	149.4 \pm 9.7	242.8 \pm 92.6	0.3
South	282.8 \pm 70.3	373.6 \pm 51.6	0.33	234.2 \pm 7.2	587.8 \pm 152.5	<0.001
Location/teaching status of hospital, mean \pm SD, No.						
Rural	16.4 \pm 15.3	11.4 \pm 11.3	>0.99	3.0 \pm 3.0	3.0 \pm 2.5	>0.99
Urban nonteaching	68.6 \pm 10.3	107.6 \pm 43.9	>0.99	40.8 \pm 18.8	116.4 \pm 30.7	>0.99
Urban teaching	749.8 \pm 108.8	989.4 \pm 272.0	0.08	678.2 \pm 27.7	1,319.6 \pm 412.4	<0.001

Hospital bedsize, mean \pm SD, No.						
Small	47.8 \pm 28.6	40.8 \pm 35.7	>0.99	48.4 \pm 8.6	56.0 \pm 15.1	>0.99
Medium	107.0 \pm 11.4	138.4 \pm 38.4	>0.99	109.8 \pm 11.8	239.4 \pm 71.0	0.75
Large	680.0 \pm 117.3	929.2 \pm 263.1	0.025	563.8 \pm 37.3	1,143.6 \pm 336.0	<0.001
In-hospital mortality rate, mean \pm SD, %	0.5 \pm 0.4	0.4 \pm 0.3	>0.99	0.3 \pm 0.2	0.4 \pm 0.3	>0.99
Length of stay, mean \pm SD, days	6.1 \pm 6.0	3.0 \pm 6.3	<0.001	5.5 \pm 5.6	2.6 \pm 4.7	<0.001
Total charges, mean \pm SD, US dollars	\$95,653.53 \pm \$82,114.70	\$90,988.03 \pm \$70,786.42	0.003	\$123,023.45 \pm \$95,974.99	\$121,982.31 \pm \$101,479.78	0.61

Abbreviations: SD, standard deviation; No., number.

*Elixhauser comorbidity scores were not calculated from October 1, 2015 to December 31, 2016 because NIS databases did not provide the 29 Elixhauser comorbidity indicators.

Table 7S. Patient and Hospital Characteristics for Single-Treated Ruptured Aneurysms, 2007-2011 vs. 2012-2016

	2007-2011		p value	2012-2016		p value
	Surgical (n = 4,747)	Endovascular (n = 5,272)		Surgical (n = 3,361)	Endovascular (n = 5,258)	
Age, mean \pm SD, years	53.2 \pm 13.28	54.6 \pm 15.8	<0.001	54.4 \pm 13.6	54.9 \pm 16.1	0.085
Sex, No. (%)						
Female	3,275 (69.0)	3,465 (65.9)	0.001	2,322 (69.1)	3,376 (64.2)	<0.001
Male	1,470 (31.0)	1,794 (34.1)		1,039 (30.9)	1,880 (35.8)	
Race, No. (%)						
White	2,174 (57.0)	2,543 (60.8)	0.001	1,791 (57.6)	2,899 (58.9)	0.091
Black	601 (15.8)	639 (15.3)		552 (17.7)	819 (16.6)	
Hispanic	619 (16.2)	588 (14.0)		438 (14.1)	672 (13.7)	
Asian or Pacific Islander	179 (4.7)	215 (5.1)		136 (4.4)	247 (5.0)	
Native American	26 (0.7)	20 (0.5)		28 (0.9)	23 (0.5)	
Other	215 (5.6)	181 (4.3)		165 (5.3)	262 (5.3)	
Healthcare coverage, No. (%)						
Private insurance	2,111 (44.5)	2,279 (43.4)	<0.001	1,371 (40.8)	2,089 (39.8)	<0.001
Medicaid	818 (17.3)	803 (15.3)		689 (20.5)	948 (18.1)	
Medicare	943 (19.9)	1,413 (26.9)		838 (25.0)	1,552 (29.6)	
Self-pay	564 (11.9)	463 (8.8)		326 (9.7)	422 (8.0)	
No charge	55 (1.2)	71 (1.4)		17 (0.5)	47 (0.9)	
Other	248 (5.2)	228 (4.3)		116 (3.5)	187 (3.6)	
Income quartile, No. (%)						
0 to 25th percentile	1,362 (29.6)	1,423 (27.7)	0.010	1,031 (31.3)	1,539 (30.0)	0.002
26th to 50th percentile	1,199 (26.0)	1,346 (26.2)		859 (26.1)	1,275 (24.9)	
51st to 75th percentile	1,116 (24.2)	1,202 (23.4)		793 (24.1)	1,180 (23.0)	
76th to 100th percentile	932 (20.2)	1,173 (22.8)		611 (18.5)	1,131 (22.1)	
Admission type, No. (%)						
Non-elective admission	4,296 (90.8)	4,684 (89.0)	0.004	3,061 (91.3)	4,744 (90.4)	0.18
Elective admission	436 (9.2)	577 (11.0)		292 (8.7)	502 (9.6)	
Elixhauser comorbidity score, mean \pm SD, points*	3.80 \pm 5.76	4.09 \pm 5.94	0.02	4.46 \pm 6.28	5.04 \pm 6.76	0.001
Hospital region, mean \pm SD, No.						
Northeast	143.6 \pm 23.7	194.6 \pm 122.1	>0.99	107.8 \pm 16.7	200.0 \pm 60.6	0.17
Midwest	213.0 \pm 36.3	228.8 \pm 74.3	>0.99	151.6 \pm 20.9	213.2 \pm 62.0	0.84
West	263.8 \pm 45.9	263.2 \pm 63.0	>0.99	170.6 \pm 23.1	219.6 \pm 81.0	>0.99
South	329.0 \pm 42.6	367.8 \pm 74.5	>0.99	242.2 \pm 10.9	418.8 \pm 129.1	<0.001
Location/teaching status of hospital, mean \pm SD, No.						
Rural	12.6 \pm 11.6	10.8 \pm 8.7	>0.99	2.8 \pm 2.5	4.2 \pm 3.6	>0.99

Urban nonteaching	106.0 ± 20.5	100.2 ± 31.3	>0.99	48.6 ± 16.4	89.0 ± 23.2	>0.99
Urban teaching	806.0 ± 78.2	926.6 ± 225.7	0.67	620.8 ± 47.7	958.4 ± 323.6	<0.001
Hospital bedsize, mean ± SD, No.						
Small	30.0 ± 18.4	44.6 ± 41.2	>0.99	32.6 ± 11.5	42.0 ± 19.4	>0.99
Medium	123.0 ± 11.7	110.4 ± 39.6	>0.99	104.2 ± 16.3	170.8 ± 58.6	>0.99
Large	771.6 ± 67.6	882.6 ± 211.7	0.56	535.4 ± 46.8	838.8 ± 256.9	<0.001
In-hospital mortality rate, mean ± SD, %	11.1% ± 0.6%	13.1% ± 2.0%	0.04	11.4% ± 0.8%	12.7% ± 1.2%	0.25
Length of stay, mean ± SD, days	19.3 ± 14.7	17.8 ± 15.0	<0.001	19.0 ± 13.3	18.0 ± 14.6	0.002
Total charges, mean ± SD, US dollars	\$253,541.6 ± \$199,904.56	\$258,872.45 ± \$207,041.73	0.20	\$365,488.68 ± \$290,898.37	\$363,106.69 ± \$291,714.04	0.71

Abbreviations: SD, standard deviation; No., number.

*Elixhauser comorbidity scores were not calculated from October 1, 2015 to December 31, 2016 because NIS databases did not provide the 29 Elixhauser comorbidity indicators.

Table 8Sa. In-Hospital Mortality Rate for Single-Treated Cerebral Aneurysms based on Hospital Size and Location/Teaching Status, 2007-2016

		2007-2016				2007-2016			
		Small	Medium	Large	p value	Rural	Urban Nonteaching	Urban Teaching	p value
Unruptured Aneurysms	mean ± SD	0.3% ± 0.6%	0.5% ± 0.4%	0.4% ± 0.2%	0.87	0.0% ± 0.0%	0.4% ± 0.5%	0.4% ± 0.1%	0.70
Ruptured Aneurysms	mean ± SD	11.6% ± 4.2%	13.1% ± 3.9%	12.1% ± 1.0%	0.10	21.1% ± 24.5%	17.6% ± 4.4%	11.5% ± 1.2%	<0.001

Abbreviations: SD, standard deviation.

Bonferroni multiple comparison tests showed from 2007-2016, for ruptured aneurysms only, regardless of treatment modality, significantly lower in-hospital mortality rate was seen at urban teaching hospitals as compared to rural hospitals (p=0.03; higher p value due to a greater SD in rural hospitals (24.5%)) and as compared to urban nonteaching hospitals (p<0.001).

Table 8Sb. In-Hospital Mortality Rate for Single-Treated Cerebral Aneurysms based on Hospital Size and Location/Teaching Status, 2007-2011 vs. 2012-2016

	2007-2011				2012-2016			
	mean ± SD				mean ± SD			
	Small	Medium	Large	p value	Small	Medium	Large	p value
Unruptured Aneurysms	0.3% ± 0.7%	0.6% ± 0.4%	0.4% ± 0.2%	0.40	0.3% ± 0.5%	0.3% ± 0.3%	0.4% ± 0.2%	0.88
Ruptured Aneurysms	12.7% ± 5.3%	12.2% ± 4.7%	12.2% ± 1.2%	0.63	10.5% ± 2.9%	14.0% ± 3.2%	11.9% ± 0.9%	0.06
	mean ± SD				mean ± SD			
	Rural	Urban Nonteaching	Urban Teaching	p value	Rural	Urban Nonteaching	Urban Teaching	p value

Unruptured Aneurysms	0.0% ± 0.0%	0.6% ± 0.6%	0.4% ± 0.1%	0.59	0.0% ± 0.0%	0.2% ± 0.4%	0.4% ± 0.2%	0.84
Ruptured Aneurysms	30.6% ± 29.0%	19.3% ± 4.6%	11.3% ± 1.5%	<0.001	11.5% ± 16.9%	16.4% ± 4.2%	11.8% ± 1.0%	0.002

Abbreviations: SD, standard deviation.

Bonferroni multiple comparison tests showed from 2007-2011, for ruptured aneurysms only, significantly lower in-hospital mortality rate was seen at urban teaching hospitals as compared to urban nonteaching hospitals ($p < 0.001$) but not compared to rural hospitals ($p = 0.19$; higher p value due to a greater SD in rural hospitals (29.0%)). From 2012-2016, similar trends were observed (urban teaching vs. urban nonteaching, $p = 0.009$; urban teaching vs. rural, $p = 0.14$).

Table 9Sa. In-Hospital Mortality Rate for Single-Treated Cerebral Aneurysms based on Treatment Modality, Hospital Size and Location/Teaching Status, 2007-2016

		2007-2016				2007-2016			
		Small	Medium	Large	p value	Rural	Urban Nonteaching	Urban Teaching	p value
UA SC	mean ± SD	0.2% ± 0.6%	0.5% ± 0.9%	0.4% ± 0.3%	0.75	0.0% ± 0.0%	0.3% ± 0.6%	0.4% ± 0.3%	0.79
UA EVT	mean ± SD	0.4% ± 0.7%	0.5% ± 0.5%	0.4% ± 0.3%	0.53	0.0% ± 0.0%	0.5% ± 0.7%	0.4% ± 0.3%	0.78
RA SC	mean ± SD	9.6% ± 6.4%	12.6% ± 6.0%	11.1% ± 1.0%	0.21	15.7% ± 20.4%	19.9% ± 4.1%	10.4% ± 1.0%	<0.001
RA EVT	mean ± SD	20.8% ± 28.1%	13.7% ± 4.1%	12.9% ± 1.6%	0.36	22.6% ± 31.3%	16.2% ± 4.6%	12.5% ± 1.5%	<0.001

Abbreviations: UA, unruptured aneurysms; RA, ruptured aneurysms; SC, surgical clipping; EVT, endovascular therapy; SD, standard deviation.

Bonferroni multiple comparison tests showed from 2007-2016, for ruptured aneurysms treated with surgical clipping, significantly lower in-hospital mortality rate was seen at urban teaching hospitals as compared to urban nonteaching hospitals ($p < 0.001$) but not compared to rural hospitals ($p = 1.0$). However, for ruptured aneurysms treated with endovascular therapies,

significantly lower in-hospital mortality rate was seen at urban teaching hospitals as compared to rural hospitals ($p=0.011$) and as compared to urban nonteaching hospitals ($p=0.014$).

Table 9Sb. In-Hospital Mortality Rate for Single-Treated Cerebral Aneurysms based on Treatment Modality, Hospital Size and Location/Teaching Status, 2007-2011 vs. 2012-2016

	2007-2011				2012-2016			
	mean \pm SD				mean \pm SD			
	Small	Medium	Large	p value	Small	Medium	Large	p value
UA SC	0.4% \pm 0.8%	0.7% \pm 1.1%	0.5% \pm 0.4%	0.74	0.0% \pm 0.0%	0.2% \pm 0.5%	0.4% \pm 0.2%	0.54
UA EVT	0.3% \pm 0.6%	0.5% \pm 0.5%	0.4% \pm 0.3%	0.48	0.6% \pm 0.9%	0.4% \pm 0.5%	0.4% \pm 0.2%	0.63
RA SC	9.7% \pm 8.5%	11.9% \pm 8.3%	11.0% \pm 1.0%	0.67	9.4% \pm 4.7%	13.3% \pm 3.4%	11.2% \pm 1.2%	0.20
RA EVT	30.0% \pm 39.4%	13.1% \pm 4.4%	13.3% \pm 1.9%	0.37	11.5% \pm 2.9%	14.4% \pm 4.0%	12.5% \pm 1.3%	0.24
	mean \pm SD				mean \pm SD			
	Rural	Urban Nonteaching	Urban Teaching	p value	Rural	Urban Nonteaching	Urban Teaching	p value
UA SC	0.0% \pm 0.0%	0.6% \pm 0.8%	0.5% \pm 0.4%	0.80	0.0% \pm 0.0%	0.0% \pm 0.0%	0.3% \pm 0.2%	0.70
UA EVT	0.0% \pm 0.0%	0.7% \pm 0.8%	0.4% \pm 0.4%	0.61	0.0% \pm 0.0%	0.3% \pm 0.6%	0.4% \pm 0.2%	0.96
RA SC	25.7% \pm 22.9%	20.6% \pm 4.3%	9.9% \pm 0.9%	<0.001	5.7% \pm 12.8%	19.2% \pm 4.4%	10.8% \pm 1.0%	<0.001
RA EVT	30.5% \pm 40.1%	17.6% \pm 5.3%	12.5% \pm 1.9%	0.002	14.6% \pm 20.8%	14.8% \pm 4.0%	12.4% \pm 1.2%	0.06

Abbreviations: UA, unruptured aneurysms; RA, ruptured aneurysms; SC, surgical clipping; EVT, endovascular therapy; SD, standard deviation.

Bonferroni multiple comparison tests showed from 2007-2011, for ruptured aneurysms treated with surgical clipping, significantly lower in-hospital mortality rate was seen at urban teaching hospitals as compared to urban nonteaching hospitals ($p<0.001$) but not compared to rural hospitals ($p=1.0$; higher p value due to a greater SD in rural hospitals (22.9%)). From 2012-2016, similar trends were observed (urban teaching vs. urban nonteaching, $p<0.001$; urban teaching vs. rural, $p=1.0$). As for ruptured aneurysms treated with endovascular therapies from 2007-2011, significantly lower in-hospital mortality rate was seen at urban teaching hospitals as compared to urban nonteaching hospitals ($p=0.008$) but not compared to rural hospitals ($p=0.124$; higher p value due to a greater SD in rural hospitals (40.1%)). However, these relationships disappeared from 2012-2016 (urban teaching vs. urban nonteaching, $p=1.0$; urban teaching vs. rural, $p=0.085$).

Table 10Sa. Total Number (%) of Unruptured Aneurysms Treated in Different Location/Teaching Statuses of Hospital across the United States, 2012-2016

	2012-2016		
	Location/teaching status of hospital		
Hospital Region	Urban nonteaching	Urban teaching	Total
Northeast	43 (1.94%)	2,165 (97.57%)	2,219
Midwest	148 (5.88%)	2,358 (93.76%)	2,515
West	190 (9.69%)	1,770 (90.26%)	1,961
South	405 (9.85%)	3,696 (89.93%)	4,110

Data from rural hospitals were analyzed but not shown because HCUP prohibits the publication of cell table with $n < 10$.

Table 10Sb. Total Number (%) of Ruptured Aneurysms Treated in Different Location/Teaching Statuses of Hospital across the United States, 2012-2016

	2012-2016		
	Location/teaching status of hospital		
Hospital Region	Urban nonteaching	Urban teaching	Total
Northeast	32 (2.08%)	1,493 (97.01%)	1,539
Midwest	90 (4.93%)	1,724 (94.52%)	1,824
West	240 (12.30%)	1,709 (87.60%)	1,951
South	326 (9.86%)	2,970 (89.86%)	3,305

Data from rural hospitals were analyzed but not shown because HCUP prohibits the publication of cell table with n<10.

Table 11Sa. Total Number (%) of Unruptured Aneurysms Treated in Different Hospital Bedsizes across the United States, 2012-2016

	2012-2016			
	Hospital bedsize			
Hospital Region	Small	Medium	Large	Total
Northeast	37 (1.67%)	347 (15.64%)	1,835 (82.69%)	2,219
Midwest	104 (4.14%)	322 (12.80%)	2,089 (83.06%)	2,515
West	149 (7.60%)	248 (12.65%)	1,564 (79.76%)	1,961
South	232 (5.64%)	829 (20.17%)	3,049 (74.18%)	4,110

Table 11Sb. Total Number (%) of Ruptured Aneurysms Treated in Different Hospital Bedsizes across the United States, 2012-2016

	2012-2016			
	Hospital bedsize			
Hospital Region	Small	Medium	Large	Total
Northeast	26 (1.69%)	211 (13.71%)	1,302 (84.60%)	1,539
Midwest	73 (4.00%)	238 (13.05%)	1,513 (82.95%)	1,824
West	125 (6.41%)	230 (11.79%)	1,596 (81.80%)	1,951
South	149 (4.51%)	696 (21.06%)	2,460 (74.43%)	3,305

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