Clinical Outcomes of Atrial Fibrillation in Aortic Aneurysm Patients: Insights from the National Inpatient Sample

Analysis for RCOP NIS Cardio13

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## Preamble:

* **Reference Papers:**
  + [Kumi et al. 2024](https://doi.org/10.1136/bmjopen-2023-077839)
* **Study Objective**: Examine the impact of atrial fibrillation on in-hospital mortality and length of stay among inpatient admissions with a principal diagnosis of aortic aneurysm (AA).
* **Data Source**: Cross-sectional analysis of the National Inpatient Sample (NIS) from 2018 to 2020.
* **Patient Selection**: Included all inpatient admissions with a principal diagnosis of AA.
* **Aortic Aneurysm + Atrial Fibrillation Categories**:
  + Aortic Aneurysm with Atrial Fibrillation
  + Aortic Aneurysm without Atrial Fibrillation
* **Primary Outcomes**:
  + In-hospital all-cause mortality
  + Total hospital length of stay (days)
  + Total charge, inflation adjusted to 2020 ($)
* **Secondary Outcomes**:
  + Ischemic Stroke
  + Transient Ischemic Attack
  + Acute Myocardial Infarction
  + Major Bleeding
  + Bleeding Requiring Transfusion
  + Arterial Embolism
* **Statistical Analysis**: Multiple logistic and linear regression to determine the independent association of atrial fibrillation with in-hospital mortality and length of stay, respectively, adjusted for:
  + Demographics: Age, sex, race, residential income, insurance, hospital region, hospital bedsize, hospital location, and teaching status.
  + Medical History: Aneurysm type, Ruptured/Unruptured, Hypertension, cerebrovascular disease, heart failure, diabetes mellitus, chronic kidney disease, chronic obstructive pulmonary disease, and HIV/AIDS.
  + Comorbidities: Charlson comorbidity index.
* **Software:** All analyses were performed using R Version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria)

## Baseline Table:

| **Characteristic** | **Aortic Aneurysm without Atrial Fibrillation** N = 123,590 | **Aortic Aneurysm with Atrial Fibrillation** N = 28,055 | **p-value***1* | **Overall** N = 151,645 |
| --- | --- | --- | --- | --- |
| Age, y, Mean (SD) | 71 (11) | 74 (10) | <0.001 | 71 (11) |
| Sex, n (%) |  |  | 0.91 |  |
| Female | 33,420 (27) | 7,565 (27) |  | 40,985 (27) |
| Male | 90,170 (73) | 20,490 (73) |  | 110,660 (73) |
| Race, n (%) |  |  | <0.001 |  |
| White | 98,700 (82) | 23,395 (86) |  | 122,095 (83) |
| Asian or Pacific Islander | 2,605 (2.2) | 680 (2.5) |  | 3,285 (2.2) |
| Black | 9,750 (8.1) | 1,385 (5.1) |  | 11,135 (7.5) |
| Hispanic | 5,845 (4.9) | 1,145 (4.2) |  | 6,990 (4.7) |
| Native American | 480 (0.4) | 90 (0.3) |  | 570 (0.4) |
| Other | 2,820 (2.3) | 590 (2.2) |  | 3,410 (2.3) |
| Charlson comorbidity index, Mean (SD) | 2.54 (1.64) | 3.00 (1.80) | <0.001 | 2.63 (1.68) |
| Residential income, n (%) |  |  | <0.001 |  |
| $1 - $51,999 | 33,540 (28) | 6,475 (23) |  | 40,015 (27) |
| $52,000 - $65,999 | 33,995 (28) | 7,270 (26) |  | 41,265 (28) |
| $66,000 - $87,999 | 29,965 (25) | 7,445 (27) |  | 37,410 (25) |
| $88,000 or more | 23,990 (20) | 6,400 (23) |  | 30,390 (20) |
| Expected primary payer, n (%) |  |  | <0.001 |  |
| Private | 26,255 (21) | 5,035 (18) |  | 31,290 (21) |
| Medicaid | 5,655 (4.6) | 905 (3.2) |  | 6,560 (4.3) |
| Medicare | 88,135 (71) | 21,435 (76) |  | 109,570 (72) |
| Other | 3,430 (2.8) | 660 (2.4) |  | 4,090 (2.7) |
| Hospital region, n (%) |  |  | <0.001 |  |
| Midwest | 31,050 (25) | 7,260 (26) |  | 38,310 (25) |
| Northeast | 22,060 (18) | 5,085 (18) |  | 27,145 (18) |
| South | 49,330 (40) | 10,355 (37) |  | 59,685 (39) |
| West | 21,150 (17) | 5,355 (19) |  | 26,505 (17) |
| Hospital bedsize, n (%) |  |  | <0.001 |  |
| Large | 77,590 (63) | 18,455 (66) |  | 96,045 (63) |
| Medium | 30,595 (25) | 6,520 (23) |  | 37,115 (24) |
| Small | 15,405 (12) | 3,080 (11) |  | 18,485 (12) |
| Hospital location and teaching status, n (%) |  |  | <0.001 |  |
| Rural | 4,560 (3.7) | 720 (2.6) |  | 5,280 (3.5) |
| Urban, non-teaching | 15,865 (13) | 3,010 (11) |  | 18,875 (12) |
| Urban, teaching | 103,165 (83) | 24,325 (87) |  | 127,490 (84) |
| Aneurysm location, n (%) |  |  | <0.001 |  |
| Abdominal | 95,475 (77) | 16,390 (58) |  | 111,865 (74) |
| Thoracic | 22,385 (18) | 10,220 (36) |  | 32,605 (22) |
| Thoracoabdominal | 5,205 (4.2) | 1,350 (4.8) |  | 6,555 (4.3) |
| Unspecified | 525 (0.4) | 95 (0.3) |  | 620 (0.4) |
| Ruptured aortic aneurysm, n (%) |  |  | <0.001 |  |
| Unruptured | 112,365 (91) | 25,025 (89) |  | 137,390 (91) |
| Ruptured | 11,225 (9.1) | 3,030 (11) |  | 14,255 (9.4) |
| Hypertension, n (%) | 99,840 (81) | 24,280 (87) | <0.001 | 124,120 (82) |
| Cerebrovascular disease, n (%) | 8,415 (6.8) | 2,595 (9.2) | <0.001 | 11,010 (7.3) |
| Heart failure, n (%) | 16,845 (14) | 9,185 (33) | <0.001 | 26,030 (17) |
| Diabetes mellitus, n (%) | 23,190 (19) | 5,555 (20) | 0.076 | 28,745 (19) |
| Chronic kidney disease, n (%) | 23,315 (19) | 7,215 (26) | <0.001 | 30,530 (20) |
| Chronic obstructive pulmonary disease, n (%) | 40,225 (33) | 9,660 (34) | 0.008 | 49,885 (33) |
| HIV/AIDS, n (%) | 805 (0.7) | 205 (0.7) | 0.50 | 1,010 (0.7) |
| *1*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | |

## Outcomes Table:

| **Characteristic** | **Aortic Aneurysm without Atrial Fibrillation** N = 123,590 | **Aortic Aneurysm with Atrial Fibrillation** N = 28,055 | **p-value***1* | **Overall** N = 151,645 |
| --- | --- | --- | --- | --- |
| Died during hospitalization, n (%) | 5,340 (4.3) | 1,570 (5.6) | <0.001 | 6,910 (4.6) |
| Length of stay (days), Median (IQR) | 2.0 (1.0 – 5.0) | 5.0 (1.0 – 8.0) | <0.001 | 2.0 (1.0 – 6.0) |
| Inflation-adjusted total charge ($), Median (IQR) | 129,791 (83,517 – 203,051) | 160,821 (98,478 – 264,390) | <0.001 | 134,796 (85,443 – 213,558) |
| Ischemic stroke, n (%) | 1,295 (1.0) | 700 (2.5) | <0.001 | 1,995 (1.3) |
| Transient ischemic attack, n (%) | 180 (0.1) | 100 (0.4) | 0.001 | 280 (0.2) |
| Acute myocardial infarction, n (%) | 1,650 (1.3) | 640 (2.3) | <0.001 | 2,290 (1.5) |
| Arterial embolism, n (%) | 7,285 (5.9) | 1,500 (5.3) | 0.11 | 8,785 (5.8) |
| Major Bleeding, n (%) | 9,200 (7.4) | 2,715 (9.7) | <0.001 | 11,915 (7.9) |
| Bleeding Requiring Transfusion, n (%) | 17,390 (14) | 5,850 (21) | <0.001 | 23,240 (15) |
| *1*Pearson's X^2: Rao & Scott adjustment; Design-based KruskalWallis test | | | | |

## Multivariable Logistic Regression:

### All-Cause Mortality:

| **Characteristic** | **OR** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 0.95 (0.81 to 1.12) | 0.53 |
| Age, y | 1.03 (1.03 to 1.04) | <0.001 |
| Sex |  |  |
| Female | — |  |
| Male | 0.61 (0.53 to 0.71) | <0.001 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 1.01 (0.66 to 1.55) | 0.96 |
| Black | 0.84 (0.64 to 1.10) | 0.21 |
| Hispanic | 0.99 (0.73 to 1.35) | 0.96 |
| Native American | 0.58 (0.16 to 2.17) | 0.42 |
| Other | 1.23 (0.87 to 1.76) | 0.25 |
| Charlson comorbidity index | 1.20 (1.10 to 1.31) | <0.001 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | 0.89 (0.74 to 1.06) | 0.19 |
| $66,000 - $87,999 | 1.00 (0.84 to 1.19) | >0.99 |
| $88,000 or more | 0.79 (0.64 to 0.98) | 0.031 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 1.10 (0.75 to 1.62) | 0.61 |
| Medicare | 0.87 (0.72 to 1.06) | 0.18 |
| Other | 1.02 (0.65 to 1.60) | 0.92 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 1.20 (0.98 to 1.48) | 0.082 |
| South | 1.08 (0.90 to 1.29) | 0.41 |
| West | 1.04 (0.84 to 1.30) | 0.72 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | 1.19 (1.02 to 1.39) | 0.029 |
| Small | 1.19 (0.97 to 1.46) | 0.095 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 0.98 (0.69 to 1.39) | 0.90 |
| Urban, teaching | 0.84 (0.62 to 1.15) | 0.27 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 1.26 (1.05 to 1.50) | 0.011 |
| Thoracoabdominal | 3.22 (2.43 to 4.26) | <0.001 |
| Unspecified | 1.26 (0.46 to 3.45) | 0.66 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 23.4 (20.6 to 26.6) | <0.001 |
| Hypertension |  |  |
| No | — |  |
| Yes | 0.49 (0.42 to 0.56) | <0.001 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 1.60 (1.26 to 2.03) | <0.001 |
| Heart failure |  |  |
| No | — |  |
| Yes | 1.47 (1.22 to 1.77) | <0.001 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | 0.71 (0.57 to 0.88) | 0.002 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | 0.78 (0.61 to 1.01) | 0.058 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | 0.77 (0.65 to 0.91) | 0.003 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | 0.33 (0.14 to 0.77) | 0.011 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | |

### Ischemic Stroke

| **Characteristic** | **OR** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 1.59 (1.19 to 2.14) | 0.002 |
| Age, y | 1.00 (0.98 to 1.01) | 0.58 |
| Sex |  |  |
| Female | — |  |
| Male | 0.73 (0.55 to 0.96) | 0.022 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 1.22 (0.62 to 2.42) | 0.56 |
| Black | 0.86 (0.53 to 1.41) | 0.55 |
| Hispanic | 1.93 (1.09 to 3.41) | 0.024 |
| Native American | 0.00 (0.00 to 0.00) | <0.001 |
| Other | 1.25 (0.60 to 2.62) | 0.55 |
| Charlson comorbidity index | 1.95 (1.68 to 2.27) | <0.001 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | 1.11 (0.79 to 1.56) | 0.55 |
| $66,000 - $87,999 | 0.97 (0.65 to 1.42) | 0.86 |
| $88,000 or more | 0.92 (0.60 to 1.39) | 0.68 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 1.17 (0.65 to 2.11) | 0.60 |
| Medicare | 0.62 (0.43 to 0.89) | 0.010 |
| Other | 1.73 (0.78 to 3.83) | 0.17 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 1.18 (0.77 to 1.80) | 0.46 |
| South | 1.09 (0.77 to 1.56) | 0.61 |
| West | 0.99 (0.64 to 1.52) | 0.95 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | 0.75 (0.54 to 1.06) | 0.10 |
| Small | 0.85 (0.52 to 1.39) | 0.52 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 3.90 (1.07 to 14.3) | 0.040 |
| Urban, teaching | 4.09 (1.17 to 14.2) | 0.027 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 5.37 (4.03 to 7.17) | <0.001 |
| Thoracoabdominal | 5.03 (3.14 to 8.06) | <0.001 |
| Unspecified | 0.00 (0.00 to 0.00) | <0.001 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 2.89 (1.96 to 4.25) | <0.001 |
| Hypertension |  |  |
| No | — |  |
| Yes | 0.40 (0.28 to 0.56) | <0.001 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 1,773,999,515 (1,449,752,225 to 2,170,766,995) | <0.001 |
| Heart failure |  |  |
| No | — |  |
| Yes | 0.60 (0.41 to 0.85) | 0.005 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | 0.35 (0.23 to 0.53) | <0.001 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | 0.26 (0.17 to 0.42) | <0.001 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | 0.39 (0.28 to 0.55) | <0.001 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | 0.04 (0.01 to 0.19) | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | |

### Transient Ischemic Attack

| **Characteristic** | **OR** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 1.64 (0.88 to 3.07) | 0.12 |
| Age, y | 0.99 (0.97 to 1.02) | 0.60 |
| Sex |  |  |
| Female | — |  |
| Male | 1.12 (0.61 to 2.05) | 0.72 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 0.00 (0.00 to 0.00) | <0.001 |
| Black | 1.06 (0.40 to 2.82) | 0.90 |
| Hispanic | 0.97 (0.28 to 3.32) | 0.96 |
| Native American | 0.00 (0.00 to 0.00) | <0.001 |
| Other | 1.30 (0.28 to 6.01) | 0.74 |
| Charlson comorbidity index | 0.83 (0.56 to 1.24) | 0.36 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | 0.82 (0.38 to 1.78) | 0.62 |
| $66,000 - $87,999 | 0.92 (0.42 to 2.02) | 0.84 |
| $88,000 or more | 0.80 (0.33 to 1.92) | 0.61 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 0.77 (0.20 to 2.93) | 0.70 |
| Medicare | 0.79 (0.41 to 1.51) | 0.47 |
| Other | 0.00 (0.00 to 0.00) | <0.001 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 0.61 (0.22 to 1.71) | 0.35 |
| South | 1.26 (0.60 to 2.65) | 0.54 |
| West | 1.32 (0.53 to 3.32) | 0.55 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | 1.03 (0.52 to 2.06) | 0.93 |
| Small | 0.78 (0.26 to 2.31) | 0.65 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 1.27 (0.25 to 6.56) | 0.77 |
| Urban, teaching | 0.63 (0.14 to 2.92) | 0.56 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 2.86 (1.64 to 5.00) | <0.001 |
| Thoracoabdominal | 1.03 (0.24 to 4.45) | 0.97 |
| Unspecified | 0.00 (0.00 to 0.00) | <0.001 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 0.26 (0.06 to 1.13) | 0.073 |
| Hypertension |  |  |
| No | — |  |
| Yes | 0.52 (0.25 to 1.07) | 0.075 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 1,394,909,569 (774,181,101 to 2,513,330,155) | <0.001 |
| Heart failure |  |  |
| No | — |  |
| Yes | 1.11 (0.47 to 2.64) | 0.81 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | 1.51 (0.66 to 3.47) | 0.33 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | 2.64 (0.94 to 7.38) | 0.064 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | 1.13 (0.52 to 2.49) | 0.75 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | 12.8 (0.55 to 299) | 0.11 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | |

### Acute Myocardial Infarction

| **Characteristic** | **OR** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 1.36 (1.07 to 1.72) | 0.012 |
| Age, y | 1.00 (0.99 to 1.01) | >0.99 |
| Sex |  |  |
| Female | — |  |
| Male | 0.94 (0.75 to 1.19) | 0.63 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 1.57 (0.85 to 2.91) | 0.15 |
| Black | 0.79 (0.51 to 1.21) | 0.28 |
| Hispanic | 1.36 (0.88 to 2.09) | 0.16 |
| Native American | 1.55 (0.38 to 6.44) | 0.54 |
| Other | 1.57 (0.89 to 2.76) | 0.12 |
| Charlson comorbidity index | 2.37 (2.21 to 2.55) | <0.001 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | 0.80 (0.60 to 1.07) | 0.13 |
| $66,000 - $87,999 | 0.84 (0.63 to 1.11) | 0.22 |
| $88,000 or more | 0.83 (0.61 to 1.14) | 0.26 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 0.71 (0.41 to 1.24) | 0.23 |
| Medicare | 0.75 (0.56 to 1.00) | 0.050 |
| Other | 0.89 (0.44 to 1.80) | 0.75 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 1.06 (0.77 to 1.45) | 0.72 |
| South | 0.94 (0.72 to 1.23) | 0.66 |
| West | 1.02 (0.74 to 1.40) | 0.91 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | 0.99 (0.76 to 1.29) | 0.95 |
| Small | 1.07 (0.78 to 1.49) | 0.67 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 1.27 (0.59 to 2.76) | 0.54 |
| Urban, teaching | 1.47 (0.73 to 2.97) | 0.28 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 0.98 (0.75 to 1.28) | 0.86 |
| Thoracoabdominal | 1.05 (0.63 to 1.73) | 0.86 |
| Unspecified | 1.28 (0.24 to 6.73) | 0.77 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 4.32 (3.45 to 5.42) | <0.001 |
| Hypertension |  |  |
| No | — |  |
| Yes | 0.72 (0.56 to 0.94) | 0.015 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 0.63 (0.45 to 0.88) | 0.007 |
| Heart failure |  |  |
| No | — |  |
| Yes | 1.12 (0.88 to 1.44) | 0.35 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | 0.22 (0.16 to 0.30) | <0.001 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | 0.23 (0.17 to 0.31) | <0.001 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | 0.40 (0.32 to 0.51) | <0.001 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | 0.01 (0.00 to 0.02) | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | |

### Major Bleeding

| **Characteristic** | **OR** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 1.17 (1.04 to 1.32) | 0.008 |
| Age, y | 1.00 (1.00 to 1.01) | 0.39 |
| Sex |  |  |
| Female | — |  |
| Male | 0.85 (0.77 to 0.95) | 0.003 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 1.25 (0.93 to 1.68) | 0.14 |
| Black | 1.42 (1.21 to 1.66) | <0.001 |
| Hispanic | 1.53 (1.25 to 1.87) | <0.001 |
| Native American | 0.88 (0.44 to 1.79) | 0.73 |
| Other | 1.02 (0.75 to 1.38) | 0.92 |
| Charlson comorbidity index | 1.33 (1.26 to 1.41) | <0.001 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | 1.04 (0.92 to 1.18) | 0.52 |
| $66,000 - $87,999 | 0.99 (0.87 to 1.12) | 0.83 |
| $88,000 or more | 1.01 (0.88 to 1.17) | 0.86 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 1.08 (0.85 to 1.38) | 0.51 |
| Medicare | 1.06 (0.92 to 1.22) | 0.41 |
| Other | 0.98 (0.72 to 1.33) | 0.89 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 1.03 (0.88 to 1.19) | 0.74 |
| South | 1.05 (0.93 to 1.18) | 0.43 |
| West | 1.13 (0.98 to 1.31) | 0.094 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | 0.99 (0.88 to 1.11) | 0.86 |
| Small | 1.07 (0.92 to 1.24) | 0.37 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 1.04 (0.75 to 1.45) | 0.80 |
| Urban, teaching | 1.14 (0.84 to 1.55) | 0.40 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 0.91 (0.81 to 1.03) | 0.16 |
| Thoracoabdominal | 1.11 (0.90 to 1.37) | 0.32 |
| Unspecified | 1.02 (0.51 to 2.07) | 0.95 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 1.67 (1.46 to 1.92) | <0.001 |
| Hypertension |  |  |
| No | — |  |
| Yes | 0.94 (0.82 to 1.07) | 0.34 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 6.81 (5.99 to 7.73) | <0.001 |
| Heart failure |  |  |
| No | — |  |
| Yes | 0.90 (0.78 to 1.03) | 0.12 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | 0.62 (0.53 to 0.71) | <0.001 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | 0.67 (0.57 to 0.79) | <0.001 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | 0.87 (0.78 to 0.98) | 0.017 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | 0.35 (0.20 to 0.60) | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | |

### Bleeding Requiring Transfusion

| **Characteristic** | **OR** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 1.41 (1.29 to 1.53) | <0.001 |
| Age, y | 1.00 (0.99 to 1.00) | 0.024 |
| Sex |  |  |
| Female | — |  |
| Male | 0.75 (0.70 to 0.82) | <0.001 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 1.72 (1.40 to 2.11) | <0.001 |
| Black | 1.44 (1.27 to 1.64) | <0.001 |
| Hispanic | 1.56 (1.34 to 1.81) | <0.001 |
| Native American | 0.90 (0.53 to 1.55) | 0.71 |
| Other | 1.22 (0.96 to 1.54) | 0.11 |
| Charlson comorbidity index | 1.23 (1.18 to 1.29) | <0.001 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | 0.94 (0.85 to 1.03) | 0.20 |
| $66,000 - $87,999 | 1.01 (0.91 to 1.12) | 0.81 |
| $88,000 or more | 1.16 (1.04 to 1.30) | 0.009 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 1.00 (0.84 to 1.19) | 0.98 |
| Medicare | 1.01 (0.91 to 1.12) | 0.83 |
| Other | 0.96 (0.76 to 1.22) | 0.75 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 1.52 (1.32 to 1.75) | <0.001 |
| South | 1.39 (1.22 to 1.58) | <0.001 |
| West | 1.40 (1.22 to 1.61) | <0.001 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | 0.98 (0.87 to 1.10) | 0.71 |
| Small | 1.05 (0.90 to 1.21) | 0.55 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 0.89 (0.70 to 1.13) | 0.36 |
| Urban, teaching | 1.01 (0.81 to 1.25) | 0.95 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 1.19 (1.08 to 1.31) | <0.001 |
| Thoracoabdominal | 1.68 (1.41 to 2.00) | <0.001 |
| Unspecified | 0.57 (0.30 to 1.08) | 0.085 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 3.30 (2.98 to 3.65) | <0.001 |
| Hypertension |  |  |
| No | — |  |
| Yes | 1.00 (0.91 to 1.10) | 0.97 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 4.05 (3.62 to 4.53) | <0.001 |
| Heart failure |  |  |
| No | — |  |
| Yes | 1.06 (0.95 to 1.18) | 0.31 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | 0.72 (0.64 to 0.80) | <0.001 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | 0.84 (0.74 to 0.95) | 0.007 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | 0.88 (0.80 to 0.96) | 0.004 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | 0.34 (0.21 to 0.54) | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | |

### Arterial Embolism

| **Characteristic** | **OR** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 1.05 (0.91 to 1.21) | 0.54 |
| Age, y | 0.98 (0.98 to 0.99) | <0.001 |
| Sex |  |  |
| Female | — |  |
| Male | 0.60 (0.54 to 0.68) | <0.001 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 0.88 (0.60 to 1.30) | 0.53 |
| Black | 0.96 (0.79 to 1.16) | 0.65 |
| Hispanic | 1.32 (1.07 to 1.63) | 0.009 |
| Native American | 1.13 (0.53 to 2.41) | 0.75 |
| Other | 1.22 (0.89 to 1.67) | 0.21 |
| Charlson comorbidity index | 1.10 (1.03 to 1.17) | 0.003 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | 0.91 (0.79 to 1.04) | 0.17 |
| $66,000 - $87,999 | 1.03 (0.89 to 1.18) | 0.72 |
| $88,000 or more | 0.85 (0.73 to 1.00) | 0.049 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 1.09 (0.84 to 1.41) | 0.54 |
| Medicare | 1.06 (0.91 to 1.24) | 0.44 |
| Other | 1.18 (0.86 to 1.63) | 0.30 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 0.98 (0.83 to 1.16) | 0.81 |
| South | 0.99 (0.86 to 1.14) | 0.89 |
| West | 1.12 (0.95 to 1.31) | 0.17 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | 0.93 (0.83 to 1.06) | 0.29 |
| Small | 0.82 (0.69 to 0.97) | 0.018 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 0.84 (0.60 to 1.17) | 0.31 |
| Urban, teaching | 1.11 (0.82 to 1.49) | 0.50 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 0.28 (0.23 to 0.34) | <0.001 |
| Thoracoabdominal | 1.19 (0.96 to 1.46) | 0.11 |
| Unspecified | 0.66 (0.29 to 1.54) | 0.34 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 1.81 (1.57 to 2.09) | <0.001 |
| Hypertension |  |  |
| No | — |  |
| Yes | 0.90 (0.79 to 1.02) | 0.10 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 1.37 (1.13 to 1.65) | 0.001 |
| Heart failure |  |  |
| No | — |  |
| Yes | 0.96 (0.83 to 1.13) | 0.64 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | 0.73 (0.62 to 0.86) | <0.001 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | 1.05 (0.87 to 1.28) | 0.59 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | 1.07 (0.94 to 1.21) | 0.31 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | 0.49 (0.23 to 1.04) | 0.064 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | |

## Multivariable Linear Regression:

### Length of Stay:

| **Characteristic** | **Beta** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 1.5 (1.2 to 1.7) | <0.001 |
| Age, y | -0.05 (-0.06 to -0.04) | <0.001 |
| Sex |  |  |
| Female | — |  |
| Male | -0.48 (-0.67 to -0.30) | <0.001 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 1.1 (0.47 to 1.7) | <0.001 |
| Black | 0.93 (0.55 to 1.3) | <0.001 |
| Hispanic | 1.0 (0.60 to 1.4) | <0.001 |
| Native American | -0.21 (-0.99 to 0.57) | 0.59 |
| Other | 0.01 (-0.41 to 0.43) | 0.95 |
| Charlson comorbidity index | 0.70 (0.55 to 0.84) | <0.001 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | -0.05 (-0.24 to 0.14) | 0.61 |
| $66,000 - $87,999 | 0.06 (-0.16 to 0.28) | 0.60 |
| $88,000 or more | -0.11 (-0.33 to 0.11) | 0.33 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 1.3 (0.72 to 1.9) | <0.001 |
| Medicare | 0.22 (-0.01 to 0.45) | 0.056 |
| Other | 0.66 (0.07 to 1.2) | 0.028 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 0.66 (0.38 to 0.95) | <0.001 |
| South | 0.40 (0.19 to 0.61) | <0.001 |
| West | 0.22 (-0.02 to 0.46) | 0.075 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | -0.64 (-0.81 to -0.46) | <0.001 |
| Small | -0.83 (-1.0 to -0.64) | <0.001 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 0.44 (0.11 to 0.76) | 0.008 |
| Urban, teaching | 1.3 (0.98 to 1.6) | <0.001 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 2.8 (2.6 to 3.0) | <0.001 |
| Thoracoabdominal | 4.4 (3.8 to 5.0) | <0.001 |
| Unspecified | -0.33 (-1.0 to 0.36) | 0.35 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 3.6 (3.2 to 4.0) | <0.001 |
| Hypertension |  |  |
| No | — |  |
| Yes | -0.67 (-0.90 to -0.43) | <0.001 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 1.6 (1.2 to 2.1) | <0.001 |
| Heart failure |  |  |
| No | — |  |
| Yes | 0.96 (0.63 to 1.3) | <0.001 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | -1.2 (-1.4 to -0.88) | <0.001 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | -0.25 (-0.62 to 0.11) | 0.18 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | -0.39 (-0.62 to -0.17) | <0.001 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | -3.9 (-5.2 to -2.5) | <0.001 |
| Abbreviation: CI = Confidence Interval | | |

### Inflation Adjusted Total Charge:

| **Characteristic** | **Beta** **(95% CI)** | **p-value** |
| --- | --- | --- |
| Atrial fibrillation categories |  |  |
| Aortic Aneurysm without Atrial Fibrillation | — |  |
| Aortic Aneurysm with Atrial Fibrillation | 24,072 (17,298 to 30,847) | <0.001 |
| Age, y | -1,472 (-1,793 to -1,151) | <0.001 |
| Sex |  |  |
| Female | — |  |
| Male | 8,469 (2,596 to 14,342) | 0.005 |
| Race |  |  |
| White | — |  |
| Asian or Pacific Islander | 25,495 (5,180 to 45,810) | 0.014 |
| Black | 13,089 (2,004 to 24,174) | 0.021 |
| Hispanic | 35,919 (22,599 to 49,239) | <0.001 |
| Native American | -14,354 (-35,297 to 6,589) | 0.18 |
| Other | 22,554 (1,251 to 43,857) | 0.038 |
| Charlson comorbidity index | 9,601 (6,077 to 13,126) | <0.001 |
| Residential income |  |  |
| $1 - $51,999 | — |  |
| $52,000 - $65,999 | 5,569 (59 to 11,078) | 0.048 |
| $66,000 - $87,999 | 7,266 (164 to 14,367) | 0.045 |
| $88,000 or more | 12,412 (3,746 to 21,079) | 0.005 |
| Expected primary payer |  |  |
| Private | — |  |
| Medicaid | 14,087 (-742 to 28,915) | 0.063 |
| Medicare | 11,320 (4,053 to 18,587) | 0.002 |
| Other | 20,990 (4,826 to 37,155) | 0.011 |
| Hospital region |  |  |
| Midwest | — |  |
| Northeast | 24,875 (12,703 to 37,046) | <0.001 |
| South | 29,411 (22,724 to 36,098) | <0.001 |
| West | 84,726 (66,667 to 102,785) | <0.001 |
| Hospital bedsize |  |  |
| Large | — |  |
| Medium | -15,975 (-24,009 to -7,940) | <0.001 |
| Small | -20,832 (-30,827 to -10,836) | <0.001 |
| Hospital location and teaching status |  |  |
| Rural | — |  |
| Urban, non-teaching | 41,677 (31,610 to 51,743) | <0.001 |
| Urban, teaching | 53,906 (45,504 to 62,308) | <0.001 |
| Aneurysm location |  |  |
| Abdominal | — |  |
| Thoracic | 51,539 (42,467 to 60,610) | <0.001 |
| Thoracoabdominal | 113,917 (93,223 to 134,611) | <0.001 |
| Unspecified | -45,512 (-68,315 to -22,708) | <0.001 |
| Ruptured aortic aneurysm |  |  |
| Unruptured | — |  |
| Ruptured | 72,397 (62,128 to 82,666) | <0.001 |
| Hypertension |  |  |
| No | — |  |
| Yes | -19,574 (-27,249 to -11,898) | <0.001 |
| Cerebrovascular disease |  |  |
| No | — |  |
| Yes | 43,250 (31,887 to 54,613) | <0.001 |
| Heart failure |  |  |
| No | — |  |
| Yes | 30,546 (19,417 to 41,675) | <0.001 |
| Diabetes mellitus |  |  |
| No | — |  |
| Yes | -13,004 (-20,610 to -5,397) | <0.001 |
| Chronic kidney disease |  |  |
| No | — |  |
| Yes | -348 (-11,590 to 10,894) | 0.95 |
| Chronic obstructive pulmonary disease |  |  |
| No | — |  |
| Yes | -9,224 (-15,430 to -3,018) | 0.004 |
| HIV/AIDS |  |  |
| No | — |  |
| Yes | -72,010 (-107,562 to -36,457) | <0.001 |
| Abbreviation: CI = Confidence Interval | | |