Socioeconomic and Insurance-Based Disparities in Stroke Management and Outcomes Among Patients with Atrial Fibrillation

Analysis for RCOP group 2025April-NIS-1 Cardiology

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## Preamble:

* **Study Objective**: Examine the impact of household income and insurance status on stroke management and outcomes among inpatient admissions with atrial fibrillation.
* **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 Stroke.
* **Outcomes**:
  + In-hospital all-cause mortality
  + Utilization of endovascular thrombectomy
  + Intracranial hemorrhage
  + Sepsis
  + Total hospital length of stay (days)
  + Total charge, inflation adjusted to 2020 ($)
* **Covariates for Adjustment:** All models adjusted for the following
  + Demographics: Age, sex, race, residential income, insurance, hospital region, hospital bedsize, hospital location, and teaching status.
  + Medical History: Hypertension, diabetes mellitus, hyperlipidemia, coronary artery disease, peripheral vascular disease, heart failure, cancer, chronic kidney disease, chronic obstructive pulmonary disease, dementia, liver disease, fluid/electrolyte imbalance, obesity, prior stroke, prior cardiac surgery, presence of pacemaker/defibrillator.
  + Comorbidities: Charlson comorbidity index.
* **Statistical Methods:**
  + **Univariable Analysis:**
    - Categorical variables: Compared using Pearson’s chi-square test with Rao & Scott adjustment
    - Continuous variables: Analyzed using the design-based Kruskal–Wallis test, a non-parametric alternative suitable for survey-weighted data
  + **Multivariable Analysis:**
    - Binary outcomes (e.g., mortality): Survey-weighted logistic regression using the quasibinomial family
    - Continuous outcomes (e.g., LOS, hospital charges): Survey-weighted linear regression using the gaussian family
    - Results reported as adjusted odds ratios (aORs) or beta coefficients with 95% confidence intervals
* **Software:** All statistical analyses were performed using the R Statistical Language (Version 4.5.0; R Foundation for Statistical Computing, Vienna, Austria), incorporating survey-weighted procedures via the *survey* package to account for the complex sampling design of NIS.

## Baseline Table:

| **Characteristic** | **Overall** N = 340,835*1* | **$1 - $51,999** N = 91,090*1* | **$52,000 - $65,999** N = 91,400*1* | **$66,000 - $87,999** N = 84,215*1* | **$88,000 or more** N = 74,130*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- |
| Age, y | 77 (11) | 75 (12) | 77 (11) | 77 (11) | 78 (11) | <0.001 |
| Sex |  |  |  |  |  | 0.2 |
| Female | 177,730 (52%) | 47,905 (53%) | 47,885 (52%) | 43,720 (52%) | 38,220 (52%) |  |
| Male | 163,100 (48%) | 43,185 (47%) | 43,510 (48%) | 40,495 (48%) | 35,910 (48%) |  |
| Race |  |  |  |  |  | <0.001 |
| White | 252,980 (76%) | 58,770 (66%) | 70,465 (80%) | 65,670 (80%) | 58,075 (80%) |  |
| Asian or Pacific Islander | 10,450 (3.1%) | 1,070 (1.2%) | 1,815 (2.1%) | 2,830 (3.4%) | 4,735 (6.5%) |  |
| Black | 37,190 (11%) | 18,450 (21%) | 8,315 (9.4%) | 6,265 (7.6%) | 4,160 (5.7%) |  |
| Hispanic | 22,335 (6.7%) | 7,980 (9.0%) | 5,710 (6.5%) | 5,250 (6.4%) | 3,395 (4.7%) |  |
| Native American | 925 (0.3%) | 375 (0.4%) | 270 (0.3%) | 175 (0.2%) | 105 (0.1%) |  |
| Other | 8,225 (2.5%) | 2,095 (2.4%) | 1,815 (2.1%) | 2,025 (2.5%) | 2,290 (3.1%) |  |
| Charlson comorbidity index | 4.16 (2.18) | 4.28 (2.18) | 4.18 (2.17) | 4.14 (2.18) | 4.03 (2.19) | <0.001 |
| Hospital region |  |  |  |  |  | <0.001 |
| Midwest | 76,105 (22%) | 18,730 (21%) | 24,710 (27%) | 20,490 (24%) | 12,175 (16%) |  |
| Northeast | 64,405 (19%) | 10,150 (11%) | 14,330 (16%) | 17,125 (20%) | 22,800 (31%) |  |
| South | 132,510 (39%) | 50,965 (56%) | 36,845 (40%) | 26,890 (32%) | 17,810 (24%) |  |
| West | 67,815 (20%) | 11,245 (12%) | 15,515 (17%) | 19,710 (23%) | 21,345 (29%) |  |
| Hospital bedsize |  |  |  |  |  | <0.001 |
| Large | 185,185 (54%) | 53,165 (58%) | 50,190 (55%) | 45,920 (55%) | 35,910 (48%) |  |
| Medium | 97,255 (29%) | 25,030 (27%) | 25,445 (28%) | 23,135 (27%) | 23,645 (32%) |  |
| Small | 58,395 (17%) | 12,895 (14%) | 15,765 (17%) | 15,160 (18%) | 14,575 (20%) |  |
| Hospital location and teaching status |  |  |  |  |  | <0.001 |
| Rural | 22,565 (6.6%) | 11,365 (12%) | 8,300 (9.1%) | 2,405 (2.9%) | 495 (0.7%) |  |
| Urban, non-teaching | 56,145 (16%) | 12,165 (13%) | 15,650 (17%) | 15,570 (18%) | 12,760 (17%) |  |
| Urban, teaching | 262,125 (77%) | 67,560 (74%) | 67,450 (74%) | 66,240 (79%) | 60,875 (82%) |  |
| Hypertension | 302,020 (89%) | 81,550 (90%) | 81,135 (89%) | 74,320 (88%) | 65,015 (88%) | <0.001 |
| Diabetes mellitus | 124,195 (36%) | 37,375 (41%) | 33,695 (37%) | 29,680 (35%) | 23,445 (32%) | <0.001 |
| Heart failure | 114,110 (33%) | 32,680 (36%) | 30,965 (34%) | 27,375 (33%) | 23,090 (31%) | <0.001 |
| Hyperlipidemia | 210,820 (62%) | 53,875 (59%) | 56,490 (62%) | 53,190 (63%) | 47,265 (64%) | <0.001 |
| Coronary artery disease | 109,570 (32%) | 30,280 (33%) | 30,125 (33%) | 26,490 (31%) | 22,675 (31%) | <0.001 |
| Peripheral vascular disease | 40,460 (12%) | 10,390 (11%) | 10,680 (12%) | 10,020 (12%) | 9,370 (13%) | 0.011 |
| Chronic kidney disease | 81,930 (24%) | 22,000 (24%) | 22,080 (24%) | 20,890 (25%) | 16,960 (23%) | 0.002 |
| Cancer | 12,070 (3.5%) | 2,900 (3.2%) | 3,130 (3.4%) | 2,955 (3.5%) | 3,085 (4.2%) | <0.001 |
| Chronic obstructive pulmonary disease | 63,265 (19%) | 19,130 (21%) | 17,710 (19%) | 14,800 (18%) | 11,625 (16%) | <0.001 |
| Dementia | 53,580 (16%) | 13,410 (15%) | 14,090 (15%) | 13,345 (16%) | 12,735 (17%) | <0.001 |
| Liver disease | 6,850 (2.0%) | 1,840 (2.0%) | 1,835 (2.0%) | 1,690 (2.0%) | 1,485 (2.0%) | >0.9 |
| Obesity | 47,355 (14%) | 14,070 (15%) | 13,030 (14%) | 11,600 (14%) | 8,655 (12%) | <0.001 |
| Prior stroke | 91,160 (27%) | 25,630 (28%) | 23,545 (26%) | 22,625 (27%) | 19,360 (26%) | <0.001 |
| Prior cardiac surgery | 38,125 (11%) | 10,000 (11%) | 10,510 (11%) | 9,390 (11%) | 8,225 (11%) | 0.5 |
| Pacemaker/ICD | 33,685 (9.9%) | 9,270 (10%) | 9,415 (10%) | 7,860 (9.3%) | 7,140 (9.6%) | 0.007 |
| Fluid disorders | 95,300 (28%) | 26,585 (29%) | 25,295 (28%) | 23,125 (27%) | 20,295 (27%) | <0.001 |
| *1*Mean (SD); n (%) | | | | | | |
| *2*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | | | |

| **Characteristic** | **Overall** N = 340,835*1* | **Private** N = 45,845*1* | **Medicaid** N = 15,285*1* | **Medicare** N = 273,415*1* | **Other** N = 6,290*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- |
| Age, y | 77 (11) | 66 (13) | 61 (12) | 80 (9) | 73 (12) | <0.001 |
| Sex |  |  |  |  |  | <0.001 |
| Female | 177,730 (52%) | 18,085 (39%) | 6,405 (42%) | 151,635 (55%) | 1,605 (26%) |  |
| Male | 163,100 (48%) | 27,755 (61%) | 8,880 (58%) | 121,780 (45%) | 4,685 (74%) |  |
| Race |  |  |  |  |  | <0.001 |
| White | 252,980 (76%) | 31,450 (71%) | 6,635 (45%) | 210,100 (79%) | 4,795 (78%) |  |
| Asian or Pacific Islander | 10,450 (3.1%) | 1,640 (3.7%) | 1,045 (7.0%) | 7,630 (2.9%) | 135 (2.2%) |  |
| Black | 37,190 (11%) | 6,810 (15%) | 3,780 (25%) | 25,875 (9.7%) | 725 (12%) |  |
| Hispanic | 22,335 (6.7%) | 3,255 (7.3%) | 2,570 (17%) | 16,220 (6.1%) | 290 (4.7%) |  |
| Native American | 925 (0.3%) | 100 (0.2%) | 120 (0.8%) | 680 (0.3%) | 25 (0.4%) |  |
| Other | 8,225 (2.5%) | 1,280 (2.9%) | 720 (4.8%) | 6,075 (2.3%) | 150 (2.5%) |  |
| Charlson comorbidity index | 4.16 (2.18) | 3.73 (2.10) | 4.19 (2.08) | 4.24 (2.19) | 4.21 (2.28) | <0.001 |
| Hospital region |  |  |  |  |  | <0.001 |
| Midwest | 76,105 (22%) | 8,690 (19%) | 3,020 (20%) | 63,155 (23%) | 1,240 (20%) |  |
| Northeast | 64,405 (19%) | 9,120 (20%) | 2,890 (19%) | 51,645 (19%) | 750 (12%) |  |
| South | 132,510 (39%) | 20,265 (44%) | 4,900 (32%) | 104,390 (38%) | 2,955 (47%) |  |
| West | 67,815 (20%) | 7,770 (17%) | 4,475 (29%) | 54,225 (20%) | 1,345 (21%) |  |
| Hospital bedsize |  |  |  |  |  | <0.001 |
| Large | 185,185 (54%) | 25,495 (56%) | 8,995 (59%) | 147,180 (54%) | 3,515 (56%) |  |
| Medium | 97,255 (29%) | 13,030 (28%) | 4,060 (27%) | 78,440 (29%) | 1,725 (27%) |  |
| Small | 58,395 (17%) | 7,320 (16%) | 2,230 (15%) | 47,795 (17%) | 1,050 (17%) |  |
| Hospital location and teaching status |  |  |  |  |  | <0.001 |
| Rural | 22,565 (6.6%) | 2,230 (4.9%) | 510 (3.3%) | 19,265 (7.0%) | 560 (8.9%) |  |
| Urban, non-teaching | 56,145 (16%) | 6,910 (15%) | 2,165 (14%) | 46,005 (17%) | 1,065 (17%) |  |
| Urban, teaching | 262,125 (77%) | 36,705 (80%) | 12,610 (82%) | 208,145 (76%) | 4,665 (74%) |  |
| Hypertension | 302,020 (89%) | 38,855 (85%) | 13,295 (87%) | 244,370 (89%) | 5,500 (87%) | <0.001 |
| Diabetes mellitus | 124,195 (36%) | 16,495 (36%) | 6,735 (44%) | 98,485 (36%) | 2,480 (39%) | <0.001 |
| Heart failure | 114,110 (33%) | 13,570 (30%) | 5,995 (39%) | 92,420 (34%) | 2,125 (34%) | <0.001 |
| Hyperlipidemia | 210,820 (62%) | 27,055 (59%) | 8,280 (54%) | 171,735 (63%) | 3,750 (60%) | <0.001 |
| Coronary artery disease | 109,570 (32%) | 11,520 (25%) | 4,175 (27%) | 91,860 (34%) | 2,015 (32%) | <0.001 |
| Peripheral vascular disease | 40,460 (12%) | 4,510 (9.8%) | 1,610 (11%) | 33,585 (12%) | 755 (12%) | <0.001 |
| Chronic kidney disease | 81,930 (24%) | 7,825 (17%) | 2,800 (18%) | 69,855 (26%) | 1,450 (23%) | <0.001 |
| Cancer | 12,070 (3.5%) | 1,250 (2.7%) | 320 (2.1%) | 10,275 (3.8%) | 225 (3.6%) | <0.001 |
| Chronic obstructive pulmonary disease | 63,265 (19%) | 6,850 (15%) | 3,260 (21%) | 51,795 (19%) | 1,360 (22%) | <0.001 |
| Dementia | 53,580 (16%) | 3,095 (6.8%) | 850 (5.6%) | 48,880 (18%) | 755 (12%) | <0.001 |
| Liver disease | 6,850 (2.0%) | 1,110 (2.4%) | 730 (4.8%) | 4,785 (1.8%) | 225 (3.6%) | <0.001 |
| Obesity | 47,355 (14%) | 9,660 (21%) | 3,205 (21%) | 33,415 (12%) | 1,075 (17%) | <0.001 |
| Prior stroke | 91,160 (27%) | 10,310 (22%) | 4,345 (28%) | 74,755 (27%) | 1,750 (28%) | <0.001 |
| Prior cardiac surgery | 38,125 (11%) | 4,125 (9.0%) | 1,220 (8.0%) | 32,065 (12%) | 715 (11%) | <0.001 |
| Pacemaker/ICD | 33,685 (9.9%) | 2,945 (6.4%) | 1,050 (6.9%) | 29,200 (11%) | 490 (7.8%) | <0.001 |
| Fluid disorders | 95,300 (28%) | 11,770 (26%) | 4,660 (30%) | 77,200 (28%) | 1,670 (27%) | <0.001 |
| *1*Mean (SD); n (%) | | | | | | |
| *2*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | | | |

## Outcomes Table:

| **Characteristic** | **Overall** N = 340,835*1* | **$1 - $51,999** N = 91,090*1* | **$52,000 - $65,999** N = 91,400*1* | **$66,000 - $87,999** N = 84,215*1* | **$88,000 or more** N = 74,130*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- |
| Died during hospitalization | 22,535 (6.6%) | 6,415 (7.0%) | 6,005 (6.6%) | 5,295 (6.3%) | 4,820 (6.5%) | 0.045 |
| Length of stay (days) | 5.6 (6.9) | 6.1 (7.7) | 5.5 (6.4) | 5.5 (6.9) | 5.4 (6.2) | <0.001 |
| Inflation-adjusted total charge ($) | 82,503 (108,472) | 83,270 (107,568) | 77,086 (101,847) | 82,038 (109,177) | 88,758 (116,076) | <0.001 |
| Utilization of mechanical thrombectomy | 19,080 (5.6%) | 4,935 (5.4%) | 5,080 (5.6%) | 4,775 (5.7%) | 4,290 (5.8%) | 0.6 |
| Intracranial hemorrhage | 30,880 (9.1%) | 8,285 (9.1%) | 7,880 (8.6%) | 7,755 (9.2%) | 6,960 (9.4%) | 0.11 |
| Sepsis | 9,595 (2.8%) | 3,025 (3.3%) | 2,410 (2.6%) | 2,145 (2.5%) | 2,015 (2.7%) | <0.001 |
| *1*n (%); Mean (SD) | | | | | | |
| *2*Pearson's X^2: Rao & Scott adjustment; Design-based KruskalWallis test | | | | | | |

| **Characteristic** | **Overall** N = 340,835*1* | **Private** N = 45,845*1* | **Medicaid** N = 15,285*1* | **Medicare** N = 273,415*1* | **Other** N = 6,290*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- |
| Died during hospitalization | 22,535 (6.6%) | 2,785 (6.1%) | 875 (5.7%) | 18,120 (6.6%) | 755 (12%) | <0.001 |
| Length of stay (days) | 5.6 (6.9) | 5.8 (7.5) | 8.9 (16.7) | 5.4 (5.6) | 5.6 (7.6) | <0.001 |
| Inflation-adjusted total charge ($) | 82,503 (108,472) | 89,435 (117,445) | 129,738 (222,158) | 78,829 (95,947) | 77,100 (104,074) | <0.001 |
| Utilization of mechanical thrombectomy | 19,080 (5.6%) | 3,230 (7.0%) | 955 (6.2%) | 14,540 (5.3%) | 355 (5.6%) | <0.001 |
| Intracranial hemorrhage | 30,880 (9.1%) | 4,560 (9.9%) | 1,670 (11%) | 24,095 (8.8%) | 555 (8.8%) | <0.001 |
| Sepsis | 9,595 (2.8%) | 1,165 (2.5%) | 705 (4.6%) | 7,520 (2.8%) | 205 (3.3%) | <0.001 |
| *1*n (%); Mean (SD) | | | | | | |
| *2*Pearson's X^2: Rao & Scott adjustment; Design-based KruskalWallis test | | | | | | |

## Multivariable Logistic Regression:

### All-Cause Mortality:

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.86 | 0.79, 0.94 | 0.001 |
| $66,000 - $87,999 | 0.80 | 0.72, 0.88 | <0.001 |
| $88,000 or more | 0.78 | 0.70, 0.86 | <0.001 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 0.93 | 0.77, 1.12 | 0.4 |
| Medicare | 0.71 | 0.63, 0.79 | <0.001 |
| Other | 1.71 | 1.38, 2.11 | <0.001 |
| Age, y | 1.04 | 1.03, 1.04 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.98 | 0.92, 1.05 | 0.6 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.14 | 0.96, 1.36 | 0.14 |
| Black | 0.79 | 0.70, 0.89 | <0.001 |
| Hispanic | 0.97 | 0.85, 1.11 | 0.7 |
| Native American | 0.56 | 0.26, 1.23 | 0.2 |
| Other | 1.10 | 0.91, 1.33 | 0.3 |
| Charlson comorbidity index | 1.18 | 1.16, 1.20 | <0.001 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.15 | 1.03, 1.29 | 0.012 |
| South | 0.90 | 0.81, 0.99 | 0.029 |
| West | 1.13 | 1.01, 1.26 | 0.027 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.85 | 0.78, 0.93 | <0.001 |
| Small | 0.72 | 0.65, 0.79 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.73 | 0.62, 0.85 | <0.001 |
| Urban, teaching | 1.08 | 0.94, 1.23 | 0.3 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.69 | 0.63, 0.76 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.85 | 0.79, 0.91 | <0.001 |
| Hyperlipidemia |  |  |  |
| No | — | — |  |
| Yes | 0.61 | 0.57, 0.65 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.96 | 0.89, 1.03 | 0.3 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 0.90 | 0.81, 1.00 | 0.046 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.17 | 1.08, 1.25 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 0.72 | 0.66, 0.78 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.92 | 0.85, 1.00 | 0.047 |
| Dementia |  |  |  |
| No | — | — |  |
| Yes | 0.78 | 0.71, 0.85 | <0.001 |
| Cancer |  |  |  |
| No | — | — |  |
| Yes | 0.82 | 0.70, 0.97 | 0.020 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 1.57 | 1.31, 1.87 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.74 | 0.66, 0.82 | <0.001 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 0.86 | 0.79, 0.93 | <0.001 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 0.89 | 0.79, 1.00 | 0.046 |
| Pacemaker/ICD |  |  |  |
| No | — | — |  |
| Yes | 0.79 | 0.70, 0.88 | <0.001 |
| Fluid\_disorders |  |  |  |
| No | — | — |  |
| Yes | 1.87 | 1.75, 1.99 | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |

### Utilization of Endovascular Thrombectomy:

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.03 | 0.93, 1.13 | 0.6 |
| $66,000 - $87,999 | 1.01 | 0.92, 1.12 | 0.8 |
| $88,000 or more | 1.06 | 0.95, 1.19 | 0.3 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 0.84 | 0.71, 0.99 | 0.032 |
| Medicare | 0.89 | 0.81, 0.99 | 0.029 |
| Other | 0.88 | 0.68, 1.15 | 0.4 |
| Age, y | 0.99 | 0.99, 1.00 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.81 | 0.76, 0.87 | <0.001 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.18 | 0.97, 1.43 | 0.10 |
| Black | 0.87 | 0.78, 0.98 | 0.022 |
| Hispanic | 1.05 | 0.90, 1.21 | 0.5 |
| Native American | 0.64 | 0.30, 1.34 | 0.2 |
| Other | 1.26 | 1.04, 1.52 | 0.019 |
| Charlson comorbidity index | 1.28 | 1.26, 1.30 | <0.001 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.82 | 0.70, 0.97 | 0.021 |
| South | 1.24 | 1.09, 1.41 | 0.001 |
| West | 1.21 | 1.04, 1.40 | 0.016 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.53 | 0.47, 0.60 | <0.001 |
| Small | 0.26 | 0.21, 0.31 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 9.03 | 4.08, 20.0 | <0.001 |
| Urban, teaching | 28.0 | 12.9, 60.5 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.92 | 0.84, 1.02 | 0.11 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.57 | 0.52, 0.61 | <0.001 |
| Hyperlipidemia |  |  |  |
| No | — | — |  |
| Yes | 0.97 | 0.91, 1.04 | 0.4 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.87 | 0.81, 0.94 | <0.001 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 0.71 | 0.64, 0.79 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 0.85 | 0.80, 0.92 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 0.43 | 0.39, 0.47 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.66 | 0.60, 0.72 | <0.001 |
| Dementia |  |  |  |
| No | — | — |  |
| Yes | 0.44 | 0.39, 0.50 | <0.001 |
| Cancer |  |  |  |
| No | — | — |  |
| Yes | 0.56 | 0.46, 0.67 | <0.001 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 0.58 | 0.46, 0.74 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 1.06 | 0.96, 1.17 | 0.2 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 0.77 | 0.70, 0.84 | <0.001 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 0.93 | 0.83, 1.05 | 0.2 |
| Pacemaker/ICD |  |  |  |
| No | — | — |  |
| Yes | 1.07 | 0.96, 1.20 | 0.2 |
| Fluid\_disorders |  |  |  |
| No | — | — |  |
| Yes | 1.20 | 1.12, 1.29 | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |

### Intracranial Hemorrhage:

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.94 | 0.87, 1.02 | 0.14 |
| $66,000 - $87,999 | 0.96 | 0.88, 1.04 | 0.3 |
| $88,000 or more | 0.95 | 0.87, 1.03 | 0.2 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 0.99 | 0.86, 1.13 | 0.9 |
| Medicare | 1.02 | 0.93, 1.11 | 0.7 |
| Other | 1.00 | 0.81, 1.24 | >0.9 |
| Age, y | 1.00 | 1.00, 1.00 | >0.9 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.11 | 1.05, 1.17 | <0.001 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.75 | 1.54, 2.01 | <0.001 |
| Black | 0.96 | 0.88, 1.05 | 0.4 |
| Hispanic | 1.35 | 1.22, 1.50 | <0.001 |
| Native American | 0.64 | 0.33, 1.25 | 0.2 |
| Other | 1.37 | 1.17, 1.60 | <0.001 |
| Charlson comorbidity index | 1.12 | 1.11, 1.14 | <0.001 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.17 | 1.06, 1.29 | 0.002 |
| South | 0.97 | 0.89, 1.06 | 0.5 |
| West | 1.01 | 0.91, 1.11 | 0.9 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.69 | 0.64, 0.74 | <0.001 |
| Small | 0.50 | 0.46, 0.56 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.62 | 1.31, 2.00 | <0.001 |
| Urban, teaching | 3.05 | 2.51, 3.69 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.95 | 0.88, 1.04 | 0.3 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.91 | 0.85, 0.97 | 0.006 |
| Hyperlipidemia |  |  |  |
| No | — | — |  |
| Yes | 0.89 | 0.84, 0.94 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.88 | 0.82, 0.94 | <0.001 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 0.84 | 0.77, 0.92 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.00 | 0.94, 1.07 | >0.9 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 0.61 | 0.57, 0.66 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.71 | 0.66, 0.77 | <0.001 |
| Dementia |  |  |  |
| No | — | — |  |
| Yes | 0.70 | 0.64, 0.77 | <0.001 |
| Cancer |  |  |  |
| No | — | — |  |
| Yes | 0.70 | 0.60, 0.81 | <0.001 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 0.81 | 0.67, 0.98 | 0.027 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.97 | 0.90, 1.06 | 0.5 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 0.79 | 0.74, 0.85 | <0.001 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 0.88 | 0.79, 0.98 | 0.016 |
| Pacemaker/ICD |  |  |  |
| No | — | — |  |
| Yes | 0.66 | 0.59, 0.74 | <0.001 |
| Fluid\_disorders |  |  |  |
| No | — | — |  |
| Yes | 1.56 | 1.48, 1.66 | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |

### Sepsis:

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.84 | 0.74, 0.96 | 0.009 |
| $66,000 - $87,999 | 0.81 | 0.70, 0.93 | 0.003 |
| $88,000 or more | 0.85 | 0.74, 0.99 | 0.035 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.42 | 1.14, 1.79 | 0.002 |
| Medicare | 1.21 | 1.03, 1.42 | 0.024 |
| Other | 1.30 | 0.91, 1.85 | 0.14 |
| Age, y | 1.00 | 0.99, 1.00 | 0.3 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.23 | 1.11, 1.37 | <0.001 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.56 | 1.23, 1.99 | <0.001 |
| Black | 1.14 | 0.98, 1.32 | 0.089 |
| Hispanic | 1.19 | 1.00, 1.43 | 0.050 |
| Native American | 1.06 | 0.42, 2.68 | >0.9 |
| Other | 1.34 | 1.02, 1.74 | 0.033 |
| Charlson comorbidity index | 1.11 | 1.08, 1.14 | <0.001 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.01 | 0.86, 1.19 | 0.9 |
| South | 1.12 | 0.97, 1.28 | 0.12 |
| West | 1.15 | 0.98, 1.35 | 0.080 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.90 | 0.80, 1.01 | 0.064 |
| Small | 0.83 | 0.71, 0.96 | 0.011 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.38 | 1.03, 1.84 | 0.030 |
| Urban, teaching | 1.84 | 1.42, 2.38 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.58 | 0.51, 0.66 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 1.01 | 0.90, 1.13 | 0.9 |
| Hyperlipidemia |  |  |  |
| No | — | — |  |
| Yes | 0.73 | 0.66, 0.80 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.89 | 0.79, 1.00 | 0.049 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 0.85 | 0.72, 1.00 | 0.053 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.42 | 1.28, 1.58 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 0.82 | 0.71, 0.93 | 0.003 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.99 | 0.87, 1.11 | 0.8 |
| Dementia |  |  |  |
| No | — | — |  |
| Yes | 0.90 | 0.78, 1.03 | 0.12 |
| Cancer |  |  |  |
| No | — | — |  |
| Yes | 1.15 | 0.91, 1.45 | 0.2 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 2.55 | 2.11, 3.10 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.89 | 0.77, 1.04 | 0.14 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 0.77 | 0.69, 0.87 | <0.001 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 0.92 | 0.77, 1.11 | 0.4 |
| Pacemaker/ICD |  |  |  |
| No | — | — |  |
| Yes | 0.51 | 0.42, 0.64 | <0.001 |
| Fluid\_disorders |  |  |  |
| No | — | — |  |
| Yes | 4.96 | 4.47, 5.50 | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |

## Multivariable Linear Regression:

### Length of Stay:

| **Characteristic** | **Beta** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | -0.28 | -0.43, -0.14 | <0.001 |
| $66,000 - $87,999 | -0.24 | -0.40, -0.08 | 0.003 |
| $88,000 or more | -0.34 | -0.51, -0.17 | <0.001 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 2.4 | 1.8, 3.0 | <0.001 |
| Medicare | -0.08 | -0.26, 0.10 | 0.4 |
| Other | -0.12 | -0.57, 0.34 | 0.6 |
| Age, y | -0.02 | -0.02, -0.01 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.16 | 0.05, 0.27 | 0.004 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 0.87 | 0.51, 1.2 | <0.001 |
| Black | 1.1 | 0.92, 1.4 | <0.001 |
| Hispanic | 0.88 | 0.63, 1.1 | <0.001 |
| Native American | 0.33 | -0.59, 1.2 | 0.5 |
| Other | 1.1 | 0.57, 1.6 | <0.001 |
| Charlson comorbidity index | 0.41 | 0.37, 0.45 | <0.001 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.61 | 0.43, 0.78 | <0.001 |
| South | 0.31 | 0.17, 0.46 | <0.001 |
| West | -0.08 | -0.26, 0.10 | 0.4 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | -0.59 | -0.73, -0.45 | <0.001 |
| Small | -1.2 | -1.3, -1.1 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.32 | 0.11, 0.53 | 0.003 |
| Urban, teaching | 1.2 | 1.0, 1.4 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | -0.34 | -0.54, -0.14 | 0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | -0.35 | -0.47, -0.22 | <0.001 |
| Hyperlipidemia |  |  |  |
| No | — | — |  |
| Yes | -0.41 | -0.53, -0.30 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | -0.17 | -0.28, -0.05 | 0.004 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | -0.17 | -0.33, 0.00 | 0.044 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 0.48 | 0.34, 0.61 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | -0.89 | -1.1, -0.73 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | -0.40 | -0.53, -0.27 | <0.001 |
| Dementia |  |  |  |
| No | — | — |  |
| Yes | 0.23 | 0.09, 0.38 | 0.002 |
| Cancer |  |  |  |
| No | — | — |  |
| Yes | -0.56 | -0.81, -0.32 | <0.001 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 0.43 | -0.07, 0.94 | 0.093 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.07 | -0.08, 0.22 | 0.4 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | -0.12 | -0.23, 0.00 | 0.053 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | -0.40 | -0.53, -0.26 | <0.001 |
| Pacemaker/ICD |  |  |  |
| No | — | — |  |
| Yes | -0.71 | -0.84, -0.59 | <0.001 |
| Fluid\_disorders |  |  |  |
| No | — | — |  |
| Yes | 3.2 | 3.0, 3.3 | <0.001 |
| Abbreviation: CI = Confidence Interval | | | |

### Inflation Adjusted Total Charge:

| **Characteristic** | **Beta** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | -2,394 | -4,903, 115 | 0.061 |
| $66,000 - $87,999 | -1,332 | -4,234, 1,571 | 0.4 |
| $88,000 or more | 3,056 | -881, 6,993 | 0.13 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 23,542 | 15,300, 31,785 | <0.001 |
| Medicare | 1,321 | -1,702, 4,344 | 0.4 |
| Other | -5,918 | -12,317, 480 | 0.070 |
| Age, y | -566 | -672, -461 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 2,009 | 387, 3,630 | 0.015 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 23,376 | 13,834, 32,919 | <0.001 |
| Black | 8,819 | 5,179, 12,458 | <0.001 |
| Hispanic | 34,736 | 28,626, 40,846 | <0.001 |
| Native American | -19,342 | -28,158, -10,526 | <0.001 |
| Other | 33,703 | 24,855, 42,551 | <0.001 |
| Charlson comorbidity index | 7,862 | 7,193, 8,530 | <0.001 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 19,856 | 15,307, 24,405 | <0.001 |
| South | 16,860 | 13,689, 20,031 | <0.001 |
| West | 39,736 | 34,820, 44,651 | <0.001 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | -12,408 | -16,145, -8,670 | <0.001 |
| Small | -23,895 | -27,891, -19,900 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 29,421 | 25,438, 33,404 | <0.001 |
| Urban, teaching | 42,946 | 40,270, 45,621 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | -8,160 | -11,379, -4,941 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | -9,400 | -11,486, -7,313 | <0.001 |
| Hyperlipidemia |  |  |  |
| No | — | — |  |
| Yes | -3,360 | -5,211, -1,509 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | -1,629 | -3,552, 293 | 0.10 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | -4,381 | -7,177, -1,585 | 0.002 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 2,297 | 253, 4,342 | 0.028 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | -23,379 | -25,902, -20,856 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | -8,230 | -10,291, -6,169 | <0.001 |
| Dementia |  |  |  |
| No | — | — |  |
| Yes | -14,782 | -16,758, -12,806 | <0.001 |
| Cancer |  |  |  |
| No | — | — |  |
| Yes | -13,774 | -17,858, -9,690 | <0.001 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 11,839 | 2,179, 21,500 | 0.016 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 3,450 | 966, 5,935 | 0.006 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | -5,316 | -7,225, -3,407 | <0.001 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | -5,467 | -7,938, -2,996 | <0.001 |
| Pacemaker/ICD |  |  |  |
| No | — | — |  |
| Yes | -9,775 | -11,893, -7,657 | <0.001 |
| Fluid\_disorders |  |  |  |
| No | — | — |  |
| Yes | 43,443 | 40,813, 46,073 | <0.001 |
| Abbreviation: CI = Confidence Interval | | | |