Racial Disparities in Women Undergoing Coronary Artery Bypass Graft Surgery

Analysis for RCOP NIS group

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## Preamble:

* **Study Objective**: To investigate racial disparities in in-hospital outcomes among female patients undergoing coronary artery bypass graft (CABG) surgery.
* **Data Source**: Cross-sectional analysis of the National Inpatient Sample (NIS) from 2018 to 2020.
* **Population**: Female inpatient admissions with CABG surgery as the principal procedure were included in the analysis.
* **Outcomes**:
  + In-hospital mortality
  + Cardiogenic shock
  + Major bleeding
  + Venous thromboembolism
  + Acute kidney injury
  + Total hospital charges
  + Length of stay
* **Statistical Analysis**: Descriptive statistics for variables of interest are present as frequency and percentage of total admissions. Comparative statistics between patient groups was performed. Multiple logistic and linear regression was performed to identify variables independently associated with outcomes in women undergoing CABG surgery, respectively, adjusted for:
  + Demographics: Age, sex, race, residential income, insurance, hospital region, hospital bedsize, hospital location, and teaching status.
  + Medical History: Hypertension, diabetes mellitus, fluid/electrolytes imbalance, coronary artery disease, liver disease, peripheral vascular disease, heart failure, chronic kidney disease, chronic obstructive pulmonary disease, anemia, obesity, tobacco use disorde, prior PCI, prior stroke, prior MI, prior cardiac surgery.
  + Comorbidities: Charlson comorbidity index.
* **Software:** All analyses were performed using R Version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria)

## Descriptive analysis

### Baseline Characteristics:

| **Characteristic** | **White** N = 101,215*1* | **Overall** N = 136,110*1* | **Asian or Pacific Islander** N = 4,115*1* | **Black** N = 15,405*1* | **Hispanic** N = 10,895*1* | **Native American** N = 940*1* | **Other** N = 3,540*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Age, y | 69 (61, 75) | 68 (60, 74) | 67 (60, 73) | 64 (57, 71) | 67 (58, 72) | 64 (57, 72) | 67 (60, 73) | <0.001 |
| Residential income |  |  |  |  |  |  |  | <0.001 |
| $1 - $51,999 | 29,060 (29%) | 43,450 (32%) | 540 (13%) | 8,255 (54%) | 4,305 (40%) | 410 (46%) | 880 (25%) |  |
| $52,000 - $65,999 | 30,010 (30%) | 38,250 (29%) | 820 (20%) | 3,370 (22%) | 2,895 (27%) | 235 (27%) | 920 (26%) |  |
| $66,000 - $87,999 | 24,435 (25%) | 31,000 (23%) | 1,115 (27%) | 2,260 (15%) | 2,190 (20%) | 150 (17%) | 850 (24%) |  |
| $88,000 or more | 16,220 (16%) | 21,335 (16%) | 1,580 (39%) | 1,270 (8.4%) | 1,340 (12%) | 90 (10%) | 835 (24%) |  |
| Expected primary payer |  |  |  |  |  |  |  | <0.001 |
| Private | 25,990 (26%) | 36,010 (26%) | 1,315 (32%) | 4,455 (29%) | 2,980 (27%) | 230 (24%) | 1,040 (29%) |  |
| Medicaid | 7,030 (7.0%) | 12,260 (9.0%) | 640 (16%) | 2,115 (14%) | 1,755 (16%) | 115 (12%) | 605 (17%) |  |
| Medicare | 66,590 (66%) | 85,620 (63%) | 2,050 (50%) | 8,560 (56%) | 6,015 (55%) | 550 (59%) | 1,855 (52%) |  |
| Other | 1,510 (1.5%) | 2,105 (1.5%) | 110 (2.7%) | 260 (1.7%) | 145 (1.3%) | 45 (4.8%) | 35 (1.0%) |  |
| Hospital region |  |  |  |  |  |  |  | <0.001 |
| Midwest | 26,145 (26%) | 30,760 (23%) | 465 (11%) | 2,805 (18%) | 740 (6.8%) | 210 (22%) | 395 (11%) |  |
| Northeast | 16,235 (16%) | 21,570 (16%) | 625 (15%) | 1,995 (13%) | 1,610 (15%) | 45 (4.8%) | 1,060 (30%) |  |
| South | 45,515 (45%) | 62,790 (46%) | 825 (20%) | 9,695 (63%) | 5,000 (46%) | 375 (40%) | 1,380 (39%) |  |
| West | 13,320 (13%) | 20,990 (15%) | 2,200 (53%) | 910 (5.9%) | 3,545 (33%) | 310 (33%) | 705 (20%) |  |
| Hospital bedsize |  |  |  |  |  |  |  | 0.038 |
| Large | 61,440 (61%) | 83,130 (61%) | 2,685 (65%) | 9,630 (63%) | 6,665 (61%) | 490 (52%) | 2,220 (63%) |  |
| Medium | 26,990 (27%) | 36,405 (27%) | 1,060 (26%) | 4,165 (27%) | 3,005 (28%) | 240 (26%) | 945 (27%) |  |
| Small | 12,785 (13%) | 16,575 (12%) | 370 (9.0%) | 1,610 (10%) | 1,225 (11%) | 210 (22%) | 375 (11%) |  |
| Hospital location and teaching status |  |  |  |  |  |  |  | <0.001 |
| Rural | 3,370 (3.3%) | 3,895 (2.9%) | 10 (0.2%) | 395 (2.6%) | 45 (0.4%) | 70 (7.4%) | 5 (0.1%) |  |
| Urban, non-teaching | 13,750 (14%) | 18,230 (13%) | 600 (15%) | 1,655 (11%) | 1,660 (15%) | 130 (14%) | 435 (12%) |  |
| Urban, teaching | 84,095 (83%) | 113,985 (84%) | 3,505 (85%) | 13,355 (87%) | 9,190 (84%) | 740 (79%) | 3,100 (88%) |  |
| Hypertension | 89,055 (88%) | 121,370 (89%) | 3,810 (93%) | 14,300 (93%) | 10,090 (93%) | 875 (93%) | 3,240 (92%) | <0.001 |
| Diabetes mellitus | 50,470 (50%) | 73,905 (54%) | 2,815 (68%) | 9,770 (63%) | 7,970 (73%) | 635 (68%) | 2,245 (63%) | <0.001 |
| Fluid/electrolytes imbalance | 41,755 (41%) | 57,260 (42%) | 1,980 (48%) | 6,785 (44%) | 4,775 (44%) | 415 (44%) | 1,550 (44%) | <0.001 |
| Liver disease | 4,685 (4.6%) | 6,450 (4.7%) | 240 (5.8%) | 720 (4.7%) | 525 (4.8%) | 40 (4.3%) | 240 (6.8%) | 0.10 |
| Coronary artery disease | 96,970 (96%) | 130,375 (96%) | 4,005 (97%) | 14,695 (95%) | 10,440 (96%) | 895 (95%) | 3,370 (95%) | 0.3 |
| Peripheral vascular disease | 15,740 (16%) | 20,540 (15%) | 615 (15%) | 2,100 (14%) | 1,425 (13%) | 165 (18%) | 495 (14%) | 0.012 |
| Heart failure | 40,585 (40%) | 56,975 (42%) | 1,790 (43%) | 7,575 (49%) | 4,965 (46%) | 430 (46%) | 1,630 (46%) | <0.001 |
| Chronic kidney disease | 20,170 (20%) | 30,290 (22%) | 1,145 (28%) | 4,860 (32%) | 3,050 (28%) | 280 (30%) | 785 (22%) | <0.001 |
| Chronic obstructive pulmonary disease | 29,305 (29%) | 37,250 (27%) | 580 (14%) | 4,075 (26%) | 2,300 (21%) | 225 (24%) | 765 (22%) | <0.001 |
| Anemia | 4,390 (4.3%) | 6,495 (4.8%) | 230 (5.6%) | 945 (6.1%) | 665 (6.1%) | 75 (8.0%) | 190 (5.4%) | <0.001 |
| Obesity | 35,285 (35%) | 47,355 (35%) | 715 (17%) | 6,060 (39%) | 3,850 (35%) | 320 (34%) | 1,125 (32%) | <0.001 |
| Tobbacco use disorder | 820 (0.8%) | 1,085 (0.8%) | 10 (0.2%) | 150 (1.0%) | 95 (0.9%) | 0 (0%) | 10 (0.3%) | 0.2 |
| Prior PCI | 13,920 (14%) | 18,590 (14%) | 360 (8.7%) | 2,365 (15%) | 1,415 (13%) | 160 (17%) | 370 (10%) | <0.001 |
| Prior myocardial inafarction | 16,580 (16%) | 22,455 (16%) | 610 (15%) | 2,730 (18%) | 1,930 (18%) | 165 (18%) | 440 (12%) | 0.010 |
| Prior stroke | 9,850 (9.7%) | 13,895 (10%) | 425 (10%) | 2,070 (13%) | 1,145 (11%) | 120 (13%) | 285 (8.1%) | <0.001 |
| Prior cardiac surgery | 3,230 (3.2%) | 4,265 (3.1%) | 80 (1.9%) | 440 (2.9%) | 405 (3.7%) | 15 (1.6%) | 95 (2.7%) | 0.11 |
| Charlson comorbidity index | 2.00 (1.00, 4.00) | 3.00 (1.00, 4.00) | 3.00 (1.00, 5.00) | 3.00 (2.00, 5.00) | 3.00 (2.00, 5.00) | 3.00 (2.00, 5.00) | 3.00 (2.00, 4.00) | <0.001 |
| *1*Median (Q1, Q3); n (%) | | | | | | | | |
| *2*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | | | | | |

### Outcomes Table:

| **Characteristic** | **White** N = 101,215*1* | **Overall** N = 136,110*1* | **Asian or Pacific Islander** N = 4,115*1* | **Black** N = 15,405*1* | **Hispanic** N = 10,895*1* | **Native American** N = 940*1* | **Other** N = 3,540*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Died during hospitalization | 3,720 (3.7%) | 5,235 (3.8%) | 175 (4.3%) | 695 (4.5%) | 470 (4.3%) | 55 (5.9%) | 120 (3.4%) | 0.10 |
| Length of stay (days) | 9 (6, 12) | 9 (6, 13) | 9 (6, 13) | 10 (7, 15) | 10 (7, 13) | 9 (6, 12) | 10 (7, 14) | <0.001 |
| Inflation-adjusted total charge ($) | 189,014 (131,780, 288,174) | 199,525 (137,404, 308,242) | 254,881 (166,781, 399,227) | 209,884 (146,881, 328,386) | 265,084 (181,392, 400,569) | 171,448 (123,669, 277,475) | 246,181 (166,553, 384,068) | <0.001 |
| Major bleeding | 7,570 (7.5%) | 10,700 (7.9%) | 310 (7.5%) | 1,435 (9.3%) | 960 (8.8%) | 70 (7.4%) | 355 (10%) | 0.001 |
| Acute ischemic stroke | 4,875 (4.8%) | 7,550 (5.5%) | 250 (6.1%) | 1,380 (9.0%) | 805 (7.4%) | 45 (4.8%) | 195 (5.5%) | <0.001 |
| Acute kidney failure | 21,795 (22%) | 31,400 (23%) | 1,030 (25%) | 4,520 (29%) | 2,925 (27%) | 215 (23%) | 915 (26%) | <0.001 |
| Cardiogenic shock | 9,020 (8.9%) | 12,930 (9.5%) | 435 (11%) | 1,625 (11%) | 1,295 (12%) | 110 (12%) | 445 (13%) | <0.001 |
| Venous thromboembolism | 1,820 (1.8%) | 2,695 (2.0%) | 60 (1.5%) | 440 (2.9%) | 235 (2.2%) | 20 (2.1%) | 120 (3.4%) | <0.001 |
| *1*n (%); Median (Q1, Q3) | | | | | | | | |
| *2*Pearson's X^2: Rao & Scott adjustment; Design-based KruskalWallis test | | | | | | | | |

## Multivariable Logistic Regression:

### In-hospital mortality:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.11 | 0.77, 1.60 | 0.6 |
| Black | 1.41 | 1.14, 1.75 | 0.002 |
| Hispanic | 1.32 | 1.02, 1.70 | 0.034 |
| Native American | 1.84 | 0.97, 3.48 | 0.062 |
| Other | 0.85 | 0.55, 1.32 | 0.5 |
| Age, y | 1.03 | 1.02, 1.05 | <0.001 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.97 | 0.81, 1.16 | 0.7 |
| $66,000 - $87,999 | 0.90 | 0.75, 1.09 | 0.3 |
| $88,000 or more | 0.88 | 0.71, 1.09 | 0.2 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.39 | 1.02, 1.91 | 0.039 |
| Medicare | 1.44 | 1.16, 1.80 | 0.001 |
| Other | 2.00 | 1.21, 3.30 | 0.007 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.21 | 0.86, 1.71 | 0.3 |
| South | 1.16 | 0.89, 1.52 | 0.3 |
| West | 1.36 | 1.03, 1.78 | 0.028 |
| HOSP\_DIVISION |  |  |  |
| East North Central | — | — |  |
| East South Central | 1.10 | 0.82, 1.49 | 0.5 |
| Middle Atlantic | 0.99 | 0.69, 1.43 | >0.9 |
| Mountain | 0.71 | 0.49, 1.04 | 0.078 |
| South Atlantic | 0.84 | 0.65, 1.09 | 0.2 |
| West North Central | 1.21 | 0.89, 1.66 | 0.2 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 1.10 | 0.93, 1.31 | 0.3 |
| Small | 1.31 | 1.04, 1.65 | 0.020 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.73 | 0.47, 1.12 | 0.2 |
| Urban, teaching | 0.60 | 0.40, 0.90 | 0.014 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.66 | 0.54, 0.81 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.68 | 0.57, 0.80 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.22 | 0.18, 0.27 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.97 | 1.67, 2.32 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 1.17 | 0.95, 1.44 | 0.14 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.96 | 0.81, 1.14 | 0.7 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 1.60 | 1.34, 1.91 | <0.001 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 5.36 | 4.47, 6.42 | <0.001 |
| Fluid/electrolytes imbalance |  |  |  |
| No | — | — |  |
| Yes | 2.67 | 2.30, 3.09 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 0.80 | 0.59, 1.09 | 0.2 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.81 | 0.69, 0.95 | 0.008 |
| Tobbacco use disorder |  |  |  |
| No | — | — |  |
| Yes | 0.48 | 0.16, 1.47 | 0.2 |
| Prior PCI |  |  |  |
| No | — | — |  |
| Yes | 0.93 | 0.73, 1.19 | 0.6 |
| Prior myocardial inafarction |  |  |  |
| No | — | — |  |
| Yes | 0.67 | 0.53, 0.84 | <0.001 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 0.77 | 0.60, 0.99 | 0.041 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 1.75 | 1.26, 2.43 | <0.001 |
| Charlson comorbidity index | 1.06 | 1.00, 1.13 | 0.054 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Major bleeding:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 0.96 | 0.71, 1.30 | 0.8 |
| Black | 1.16 | 1.00, 1.34 | 0.054 |
| Hispanic | 1.23 | 1.03, 1.46 | 0.023 |
| Native American | 1.05 | 0.61, 1.82 | 0.9 |
| Other | 1.48 | 1.15, 1.90 | 0.003 |
| Age, y | 1.00 | 1.00, 1.01 | 0.12 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.06 | 0.94, 1.20 | 0.3 |
| $66,000 - $87,999 | 1.07 | 0.94, 1.23 | 0.3 |
| $88,000 or more | 1.16 | 0.99, 1.35 | 0.064 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.14 | 0.94, 1.39 | 0.2 |
| Medicare | 1.40 | 1.22, 1.60 | <0.001 |
| Other | 1.11 | 0.73, 1.66 | 0.6 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.91 | 0.68, 1.20 | 0.5 |
| South | 0.83 | 0.69, 0.99 | 0.042 |
| West | 0.84 | 0.68, 1.03 | 0.089 |
| HOSP\_DIVISION |  |  |  |
| East North Central | — | — |  |
| East South Central | 1.05 | 0.84, 1.30 | 0.7 |
| Middle Atlantic | 1.00 | 0.75, 1.33 | >0.9 |
| Mountain | 0.97 | 0.71, 1.34 | 0.9 |
| South Atlantic | 1.17 | 0.98, 1.38 | 0.082 |
| West North Central | 0.76 | 0.60, 0.97 | 0.028 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.98 | 0.88, 1.10 | 0.8 |
| Small | 0.78 | 0.65, 0.94 | 0.008 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.83 | 0.60, 1.15 | 0.3 |
| Urban, teaching | 0.96 | 0.71, 1.29 | 0.8 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.97 | 0.82, 1.14 | 0.7 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.45 | 0.39, 0.50 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.59 | 0.49, 0.72 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 0.71 | 0.63, 0.79 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 0.41 | 0.35, 0.47 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.66 | 0.59, 0.74 | <0.001 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 0.61 | 0.54, 0.70 | <0.001 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 1.47 | 1.24, 1.74 | <0.001 |
| Fluid/electrolytes imbalance |  |  |  |
| No | — | — |  |
| Yes | 1.20 | 1.09, 1.32 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 1.89 | 1.58, 2.26 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.91 | 0.81, 1.01 | 0.068 |
| Tobbacco use disorder |  |  |  |
| No | — | — |  |
| Yes | 0.94 | 0.56, 1.58 | 0.8 |
| Prior PCI |  |  |  |
| No | — | — |  |
| Yes | 0.82 | 0.70, 0.95 | 0.010 |
| Prior myocardial inafarction |  |  |  |
| No | — | — |  |
| Yes | 0.80 | 0.70, 0.91 | <0.001 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 5.19 | 4.67, 5.76 | <0.001 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 0.90 | 0.69, 1.19 | 0.5 |
| Charlson comorbidity index | 1.56 | 1.50, 1.63 | <0.001 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Acute ischemic stroke:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.15 | 0.84, 1.57 | 0.4 |
| Black | 1.62 | 1.40, 1.88 | <0.001 |
| Hispanic | 1.36 | 1.12, 1.65 | 0.002 |
| Native American | 0.76 | 0.37, 1.57 | 0.5 |
| Other | 1.04 | 0.74, 1.45 | 0.8 |
| Age, y | 0.99 | 0.99, 1.00 | 0.037 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.96 | 0.84, 1.11 | 0.6 |
| $66,000 - $87,999 | 0.99 | 0.85, 1.15 | >0.9 |
| $88,000 or more | 1.02 | 0.85, 1.21 | 0.8 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.34 | 1.10, 1.62 | 0.003 |
| Medicare | 1.03 | 0.89, 1.19 | 0.7 |
| Other | 0.62 | 0.36, 1.07 | 0.089 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.76 | 0.55, 1.06 | 0.11 |
| South | 1.12 | 0.92, 1.36 | 0.3 |
| West | 0.87 | 0.70, 1.08 | 0.2 |
| HOSP\_DIVISION |  |  |  |
| East North Central | — | — |  |
| East South Central | 0.68 | 0.52, 0.89 | 0.004 |
| Middle Atlantic | 1.07 | 0.76, 1.51 | 0.7 |
| Mountain | 1.11 | 0.83, 1.49 | 0.5 |
| South Atlantic | 0.87 | 0.72, 1.05 | 0.14 |
| West North Central | 0.95 | 0.74, 1.22 | 0.7 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 1.13 | 1.00, 1.29 | 0.051 |
| Small | 1.06 | 0.87, 1.28 | 0.6 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.99 | 0.62, 1.58 | >0.9 |
| Urban, teaching | 1.22 | 0.79, 1.90 | 0.4 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 1.61 | 1.30, 2.01 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.68 | 0.60, 0.78 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.90 | 0.70, 1.15 | 0.4 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.14 | 1.01, 1.29 | 0.036 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 0.69 | 0.59, 0.81 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.70 | 0.62, 0.80 | <0.001 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 0.96 | 0.82, 1.11 | 0.6 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 0.87 | 0.68, 1.10 | 0.2 |
| Fluid/electrolytes imbalance |  |  |  |
| No | — | — |  |
| Yes | 1.23 | 1.10, 1.38 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 1.27 | 1.02, 1.58 | 0.030 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 1.22 | 1.09, 1.36 | <0.001 |
| Tobbacco use disorder |  |  |  |
| No | — | — |  |
| Yes | 0.76 | 0.40, 1.45 | 0.4 |
| Prior PCI |  |  |  |
| No | — | — |  |
| Yes | 0.69 | 0.57, 0.83 | <0.001 |
| Prior myocardial inafarction |  |  |  |
| No | — | — |  |
| Yes | 0.76 | 0.65, 0.90 | 0.001 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 0.86 | 0.72, 1.04 | 0.11 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 0.86 | 0.62, 1.20 | 0.4 |
| Charlson comorbidity index | 1.29 | 1.24, 1.35 | <0.001 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Cardiogenic shock:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 0.99 | 0.78, 1.27 | >0.9 |
| Black | 1.16 | 1.01, 1.34 | 0.033 |
| Hispanic | 1.23 | 1.04, 1.45 | 0.017 |
| Native American | 1.18 | 0.72, 1.92 | 0.5 |
| Other | 1.36 | 1.05, 1.76 | 0.020 |
| Age, y | 1.01 | 1.00, 1.01 | 0.004 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.01 | 0.90, 1.13 | 0.9 |
| $66,000 - $87,999 | 0.92 | 0.81, 1.05 | 0.2 |
| $88,000 or more | 1.18 | 1.03, 1.36 | 0.020 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.04 | 0.88, 1.24 | 0.6 |
| Medicare | 0.94 | 0.83, 1.06 | 0.3 |
| Other | 1.04 | 0.73, 1.47 | 0.8 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.07 | 0.81, 1.40 | 0.6 |
| South | 1.47 | 1.19, 1.80 | <0.001 |
| West | 1.12 | 0.91, 1.39 | 0.3 |
| HOSP\_DIVISION |  |  |  |
| East North Central | — | — |  |
| East South Central | 0.50 | 0.40, 0.64 | <0.001 |
| Middle Atlantic | 0.66 | 0.50, 0.87 | 0.003 |
| Mountain | 0.98 | 0.76, 1.26 | 0.9 |
| South Atlantic | 0.62 | 0.51, 0.75 | <0.001 |
| West North Central | 1.07 | 0.81, 1.41 | 0.6 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.83 | 0.73, 0.95 | 0.005 |
| Small | 0.76 | 0.63, 0.93 | 0.007 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.33 | 0.91, 1.96 | 0.14 |
| Urban, teaching | 1.61 | 1.12, 2.30 | 0.010 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.64 | 0.56, 0.73 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.72 | 0.64, 0.81 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.44 | 0.38, 0.52 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 2.84 | 2.55, 3.16 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 0.73 | 0.63, 0.84 | <0.001 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.84 | 0.75, 0.94 | 0.003 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 1.09 | 0.97, 1.24 | 0.2 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 2.14 | 1.84, 2.48 | <0.001 |
| Fluid/electrolytes imbalance |  |  |  |
| No | — | — |  |
| Yes | 2.13 | 1.93, 2.35 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 0.97 | 0.80, 1.17 | 0.7 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.86 | 0.78, 0.94 | 0.001 |
| Tobbacco use disorder |  |  |  |
| No | — | — |  |
| Yes | 0.81 | 0.45, 1.45 | 0.5 |
| Prior PCI |  |  |  |
| No | — | — |  |
| Yes | 0.86 | 0.74, 1.00 | 0.057 |
| Prior myocardial inafarction |  |  |  |
| No | — | — |  |
| Yes | 0.68 | 0.59, 0.78 | <0.001 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 0.71 | 0.60, 0.84 | <0.001 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 1.25 | 0.98, 1.58 | 0.069 |
| Charlson comorbidity index | 1.15 | 1.10, 1.20 | <0.001 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Venous thromboembolism:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 0.70 | 0.39, 1.24 | 0.2 |
| Black | 1.41 | 1.10, 1.79 | 0.006 |
| Hispanic | 1.15 | 0.82, 1.60 | 0.4 |
| Native American | 1.17 | 0.44, 3.15 | 0.8 |
| Other | 1.85 | 1.19, 2.86 | 0.006 |
| Age, y | 1.00 | 0.99, 1.01 | 0.8 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.89 | 0.71, 1.13 | 0.3 |
| $66,000 - $87,999 | 1.01 | 0.79, 1.29 | >0.9 |
| $88,000 or more | 1.12 | 0.85, 1.48 | 0.4 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.09 | 0.76, 1.57 | 0.6 |
| Medicare | 1.18 | 0.90, 1.55 | 0.2 |
| Other | 1.22 | 0.60, 2.51 | 0.6 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.72 | 0.40, 1.29 | 0.3 |
| South | 1.10 | 0.80, 1.52 | 0.5 |
| West | 1.02 | 0.71, 1.46 | >0.9 |
| HOSP\_DIVISION |  |  |  |
| East North Central | — | — |  |
| East South Central | 0.71 | 0.46, 1.09 | 0.12 |
| Middle Atlantic | 1.04 | 0.57, 1.91 | 0.9 |
| Mountain | 1.21 | 0.75, 1.93 | 0.4 |
| South Atlantic | 0.98 | 0.73, 1.32 | 0.9 |
| West North Central | 1.09 | 0.74, 1.61 | 0.7 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.76 | 0.61, 0.94 | 0.014 |
| Small | 0.63 | 0.46, 0.86 | 0.004 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.21 | 0.57, 2.56 | 0.6 |
| Urban, teaching | 1.47 | 0.72, 3.00 | 0.3 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.66 | 0.51, 0.85 | 0.002 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.67 | 0.54, 0.84 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | 0.41 | 0.31, 0.54 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.69 | 1.37, 2.08 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | 1.13 | 0.84, 1.51 | 0.4 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 0.88 | 0.72, 1.09 | 0.2 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | 1.00 | 0.78, 1.27 | >0.9 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 1.42 | 1.05, 1.91 | 0.021 |
| Fluid/electrolytes imbalance |  |  |  |
| No | — | — |  |
| Yes | 1.96 | 1.63, 2.37 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 0.92 | 0.62, 1.36 | 0.7 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.84 | 0.69, 1.03 | 0.093 |
| Tobbacco use disorder |  |  |  |
| No | — | — |  |
| Yes | 1.77 | 0.77, 4.11 | 0.2 |
| Prior PCI |  |  |  |
| No | — | — |  |
| Yes | 0.72 | 0.52, 0.99 | 0.043 |
| Prior myocardial inafarction |  |  |  |
| No | — | — |  |
| Yes | 0.79 | 0.60, 1.03 | 0.083 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | 1.03 | 0.78, 1.36 | 0.9 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 0.44 | 0.21, 0.94 | 0.033 |
| Charlson comorbidity index | 1.15 | 1.06, 1.25 | <0.001 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

## Multivariable Linear Regression:

### Length of stay:

| **Characteristic** | **Beta** | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 0.83 | 0.23, 1.4 | 0.007 |
| Black | 1.6 | 1.2, 2.0 | <0.001 |
| Hispanic | 0.60 | 0.20, 1.0 | 0.003 |
| Native American | -0.46 | -1.6, 0.68 | 0.4 |
| Other | 0.54 | -0.05, 1.1 | 0.072 |
| Age, y | 0.04 | 0.03, 0.06 | <0.001 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | -0.04 | -0.29, 0.21 | 0.8 |
| $66,000 - $87,999 | -0.09 | -0.39, 0.22 | 0.6 |
| $88,000 or more | -0.34 | -0.68, -0.01 | 0.047 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.6 | 1.0, 2.1 | <0.001 |
| Medicare | 0.07 | -0.21, 0.34 | 0.6 |
| Other | 0.00 | -0.63, 0.63 | >0.9 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.73 | 0.11, 1.3 | 0.021 |
| South | 0.38 | 0.00, 0.75 | 0.052 |
| West | 0.00 | -0.43, 0.42 | >0.9 |
| HOSP\_DIVISION |  |  |  |
| East North Central | — | — |  |
| East South Central | -0.07 | -0.57, 0.42 | 0.8 |
| Middle Atlantic | -0.30 | -1.0, 0.41 | 0.4 |
| Mountain | 0.04 | -0.53, 0.62 | 0.9 |
| South Atlantic | 0.30 | -0.11, 0.71 | 0.2 |
| West North Central | -0.26 | -0.74, 0.22 | 0.3 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | -0.46 | -0.73, -0.18 | 0.001 |
| Small | -0.75 | -1.1, -0.42 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.33 | -0.28, 0.94 | 0.3 |
| Urban, teaching | 0.88 | 0.30, 1.5 | 0.003 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | -1.4 | -1.8, -0.94 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | -1.6 | -1.9, -1.3 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | -6.6 | -7.8, -5.5 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 2.0 | 1.7, 2.2 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | -0.69 | -1.2, -0.20 | 0.006 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | -0.70 | -1.0, -0.39 | <0.001 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | -1.1 | -1.4, -0.72 | <0.001 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 1.8 | 1.1, 2.5 | <0.001 |
| Fluid/electrolytes imbalance |  |  |  |
| No | — | — |  |
| Yes | 2.6 | 2.4, 2.8 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 1.0 | 0.54, 1.5 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | -0.26 | -0.45, -0.07 | 0.008 |
| Tobbacco use disorder |  |  |  |
| No | — | — |  |
| Yes | -0.72 | -1.5, 0.03 | 0.061 |
| Prior PCI |  |  |  |
| No | — | — |  |
| Yes | -0.23 | -0.47, 0.01 | 0.064 |
| Prior myocardial inafarction |  |  |  |
| No | — | — |  |
| Yes | -1.7 | -1.9, -1.4 | <0.001 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | -0.32 | -0.60, -0.04 | 0.024 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | -0.42 | -0.92, 0.07 | 0.092 |
| Charlson comorbidity index | 1.2 | 0.99, 1.3 | <0.001 |
| *1*CI = Confidence Interval | | | |

### Inflation Adjusted Total Charge:

| **Characteristic** | **Beta** | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 33,604 | 8,468, 58,739 | 0.009 |
| Black | 29,893 | 18,331, 41,455 | <0.001 |
| Hispanic | 49,197 | 34,222, 64,172 | <0.001 |
| Native American | -38,986 | -66,502, -11,470 | 0.006 |
| Other | 46,036 | 21,142, 70,931 | <0.001 |
| Age, y | 322 | -72, 715 | 0.11 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | -686 | -8,417, 7,044 | 0.9 |
| $66,000 - $87,999 | -4,866 | -13,567, 3,834 | 0.3 |
| $88,000 or more | 5,674 | -7,256, 18,604 | 0.4 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 15,008 | 3,806, 26,210 | 0.009 |
| Medicare | 9,819 | 2,035, 17,602 | 0.013 |
| Other | 1,905 | -16,271, 20,081 | 0.8 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | -27,439 | -47,892, -6,986 | 0.009 |
| South | 36,214 | 20,832, 51,596 | <0.001 |
| West | 159,147 | 131,850, 186,444 | <0.001 |
| HOSP\_DIVISION |  |  |  |
| East North Central | — | — |  |
| East South Central | -22,793 | -51,194, 5,608 | 0.12 |
| Middle Atlantic | 83,886 | 57,864, 109,909 | <0.001 |
| Mountain | -68,127 | -104,367, -31,886 | <0.001 |
| South Atlantic | 14,022 | -4,082, 32,126 | 0.13 |
| West North Central | -13,723 | -27,097, -349 | 0.044 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 6,763 | -6,729, 20,256 | 0.3 |
| Small | 6,841 | -9,860, 23,543 | 0.4 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 36,779 | 12,947, 60,612 | 0.003 |
| Urban, teaching | 28,663 | 8,370, 48,955 | 0.006 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | -33,893 | -46,562, -21,224 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | -30,226 | -38,018, -22,433 | <0.001 |
| Coronary artery disease |  |  |  |
| No | — | — |  |
| Yes | -191,335 | -224,621, -158,049 | <0.001 |
| Heart failure |  |  |  |
| No | — | — |  |
| Yes | 58,688 | 50,607, 66,768 | <0.001 |
| Chronic kidney disease |  |  |  |
| No | — | — |  |
| Yes | -7,225 | -19,972, 5,523 | 0.3 |
| Chronic obstructive pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | -7,482 | -15,826, 862 | 0.079 |
| Peripheral vascular disease |  |  |  |
| No | — | — |  |
| Yes | -6,048 | -15,760, 3,665 | 0.2 |
| Liver disease |  |  |  |
| No | — | — |  |
| Yes | 110,185 | 87,085, 133,284 | <0.001 |
| Fluid/electrolytes imbalance |  |  |  |
| No | — | — |  |
| Yes | 64,662 | 58,016, 71,307 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 12,642 | -1,247, 26,530 | 0.074 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | -3,733 | -9,218, 1,752 | 0.2 |
| Tobbacco use disorder |  |  |  |
| No | — | — |  |
| Yes | -12,332 | -36,869, 12,205 | 0.3 |
| Prior PCI |  |  |  |
| No | — | — |  |
| Yes | -7,288 | -13,208, -1,369 | 0.016 |
| Prior myocardial inafarction |  |  |  |
| No | — | — |  |
| Yes | -41,744 | -48,570, -34,917 | <0.001 |
| Prior stroke |  |  |  |
| No | — | — |  |
| Yes | -3,252 | -11,941, 5,438 | 0.5 |
| Prior cardiac surgery |  |  |  |
| No | — | — |  |
| Yes | 38,353 | 20,729, 55,978 | <0.001 |
| Charlson comorbidity index | 16,384 | 12,326, 20,442 | <0.001 |
| *1*CI = Confidence Interval | | | |