Racial and Ethnic Disparities in Management and Outcomes of Gastrointestinal Bleeding Complicating Acute Myocardial Infarction

Analysis for RCOP NIS Gastro3

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## Preamble:

* **Reference Papers:**
  1. [Subramaniam et al. (2021)](https://www.ahajournals.org/doi/10.1161/JAHA.120.019907)
  2. [Albeiruti et al. (2019)](https://www.ajconline.org/article/S0002-9149(19)30514-4/abstract)
* **Study Objective**: This study aims to evaluate racial and ethnic disparities in the management and outcomes of gastrointestinal (GI) bleeding complicating acute myocardial infarction (AMI).
* **Data Source**: Cross-sectional analysis of the National Inpatient Sample (NIS) from 2018 to 2020.
* **Patient Selection**: Included all inpatient admissions with a primary diagnosis of acute myocardial infarction and a secondary diagnosis of gastrointestinal bleeding. GI bleeding was defined as any ICD-10 code corresponding to upper or lower gastrointestinal hemorrhage.
* **Outcomes**:
  + In-hospital all-cause mortality
  + Total hospital length of stay (days)
  + Total charge, inflation adjusted to 2020 ($)
  + Esophagogastroduodenoscopy
  + Colonoscopy
  + Mechanical Ventilation
  + Acute Kidney Injury
  + Acute Kidney Injury requiring Dialysis
  + Blood Transfusion
  + Acute Ischemic Stroke
  + Acute Respiratory Failure
* **Statistical Analysis**: Multiple logistic and linear regression models were used to assess the independent associations of race and ethnicity with the outcomes of interest. Models were adjusted for the following confounders:
  + Demographics: Age, sex, residential income, and insurance payer.
  + Hospital Characteristics: Hospital region, bed size, location, and teaching status.
  + Comorbidities and Clinical Variables: Charlson comorbidity index, hypertension, diabetes mellitus, chronic pulmonary disease, chronic kidney disease, peripheral vascular disease, atrial fibrillation, anemia, and obesity.
* **Software:** All analyses were performed using R Version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria)

## Baseline Table:

| **Characteristic** | **White** N = 26,580*1* | **Black** N = 4,660*1* | **Hispanic** N = 3,380*1* | **Other** N = 2,650*1* | **p-value***2* | **Overall** N = 37,270*1* |
| --- | --- | --- | --- | --- | --- | --- |
| Age, y | 72 (12) | 67 (13) | 69 (13) | 70 (12) | <0.001 | 71 (12) |
| Sex |  |  |  |  | <0.001 |  |
| Female | 10,390 (39%) | 2,150 (46%) | 1,300 (38%) | 935 (35%) |  | 14,775 (40%) |
| Male | 16,190 (61%) | 2,510 (54%) | 2,080 (62%) | 1,715 (65%) |  | 22,495 (60%) |
| Residential income |  |  |  |  | <0.001 |  |
| $1 - $51,999 | 7,260 (28%) | 2,470 (54%) | 1,335 (40%) | 560 (22%) |  | 11,625 (32%) |
| $52,000 - $65,999 | 7,645 (29%) | 975 (21%) | 860 (26%) | 565 (22%) |  | 10,045 (27%) |
| $66,000 - $87,999 | 6,455 (25%) | 685 (15%) | 645 (19%) | 700 (27%) |  | 8,485 (23%) |
| $88,000 or more | 4,770 (18%) | 460 (10%) | 470 (14%) | 725 (28%) |  | 6,425 (18%) |
| Expected primary payer |  |  |  |  | <0.001 |  |
| Medicaid | 1,735 (6.5%) | 660 (14%) | 525 (16%) | 395 (15%) |  | 3,315 (8.9%) |
| Medicare | 19,440 (73%) | 2,985 (64%) | 1,985 (59%) | 1,640 (62%) |  | 26,050 (70%) |
| Other | 660 (2.5%) | 120 (2.6%) | 85 (2.5%) | 40 (1.5%) |  | 905 (2.4%) |
| Private | 4,730 (18%) | 880 (19%) | 785 (23%) | 570 (22%) |  | 6,965 (19%) |
| Hospital region |  |  |  |  | <0.001 |  |
| Midwest | 6,505 (24%) | 1,095 (23%) | 225 (6.7%) | 260 (9.8%) |  | 8,085 (22%) |
| Northeast | 4,820 (18%) | 685 (15%) | 485 (14%) | 460 (17%) |  | 6,450 (17%) |
| South | 10,875 (41%) | 2,370 (51%) | 1,480 (44%) | 760 (29%) |  | 15,485 (42%) |
| West | 4,380 (16%) | 510 (11%) | 1,190 (35%) | 1,170 (44%) |  | 7,250 (19%) |
| Hospital bed size |  |  |  |  | 0.011 |  |
| Large | 13,635 (51%) | 2,490 (53%) | 1,570 (46%) | 1,355 (51%) |  | 19,050 (51%) |
| Medium | 8,050 (30%) | 1,260 (27%) | 1,265 (37%) | 865 (33%) |  | 11,440 (31%) |
| Small | 4,895 (18%) | 910 (20%) | 545 (16%) | 430 (16%) |  | 6,780 (18%) |
| Hospital location and teaching status |  |  |  |  | <0.001 |  |
| Rural | 2,185 (8.2%) | 145 (3.1%) | 30 (0.9%) | 65 (2.5%) |  | 2,425 (6.5%) |
| Urban, non-teaching | 4,930 (19%) | 610 (13%) | 570 (17%) | 505 (19%) |  | 6,615 (18%) |
| Urban, teaching | 19,465 (73%) | 3,905 (84%) | 2,780 (82%) | 2,080 (78%) |  | 28,230 (76%) |
| Charlson Comorbidity Index | 4.37 (2.21) | 4.73 (2.38) | 4.84 (2.37) | 4.63 (2.29) | <0.001 | 4.48 (2.26) |
| Hypertension | 11,770 (44%) | 1,840 (39%) | 1,470 (43%) | 1,085 (41%) | 0.032 | 16,165 (43%) |
| Diabetes mellitus | 11,145 (42%) | 2,405 (52%) | 2,125 (63%) | 1,540 (58%) | <0.001 | 17,215 (46%) |
| Chronic Pulmonary Disease | 8,210 (31%) | 1,105 (24%) | 610 (18%) | 555 (21%) | <0.001 | 10,480 (28%) |
| Chronic Kidney Disease | 9,625 (36%) | 2,250 (48%) | 1,525 (45%) | 1,170 (44%) | <0.001 | 14,570 (39%) |
| Peripheral Vascular Disease | 4,580 (17%) | 840 (18%) | 510 (15%) | 295 (11%) | 0.001 | 6,225 (17%) |
| Atrial Fibrillation | 9,070 (34%) | 1,060 (23%) | 820 (24%) | 730 (28%) | <0.001 | 11,680 (31%) |
| Anemia | 17,965 (68%) | 3,260 (70%) | 2,440 (72%) | 1,920 (72%) | 0.014 | 25,585 (69%) |
| Obesity | 4,380 (16%) | 755 (16%) | 515 (15%) | 325 (12%) | 0.10 | 5,975 (16%) |
| *1*Mean (SD); n (%) | | | | | | |
| *2*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | | | |

## Outcomes Table:

| **Characteristic** | **White** N = 26,580*1* | **Black** N = 4,660*1* | **Hispanic** N = 3,380*1* | **Other** N = 2,650*1* | **p-value***2* | **Overall** N = 37,270*1* |
| --- | --- | --- | --- | --- | --- | --- |
| Died during hospitalization | 4,355 (16%) | 770 (17%) | 550 (16%) | 625 (24%) | <0.001 | 6,300 (17%) |
| Length of stay (days) | 6 (3, 12) | 6 (3, 12) | 7 (4, 13) | 7 (3, 13) | 0.043 | 6 (3, 12) |
| Inflation-adjusted total charge ($) | 103,045 (48,143, 211,161) | 101,594 (53,131, 213,173) | 143,649 (76,979, 299,762) | 137,999 (63,678, 306,557) | <0.001 | 107,845 (51,646, 225,115) |
| Esophagogastroduodenoscopy | 4,985 (19%) | 915 (20%) | 745 (22%) | 505 (19%) | 0.2 | 7,150 (19%) |
| Colonoscopy | 1,175 (4.4%) | 215 (4.6%) | 190 (5.6%) | 135 (5.1%) | 0.5 | 1,715 (4.6%) |
| Mechanical Ventilation | 5,550 (21%) | 1,215 (26%) | 845 (25%) | 755 (28%) | <0.001 | 8,365 (22%) |
| Acute Kidney Injury | 12,145 (46%) | 2,105 (45%) | 1,625 (48%) | 1,265 (48%) | 0.5 | 17,140 (46%) |
| Acute Kidney Injury requiring Dialysis | 1,330 (5.0%) | 280 (6.0%) | 280 (8.3%) | 230 (8.7%) | <0.001 | 2,120 (5.7%) |
| Blood Transfusion | 6,650 (25%) | 1,120 (24%) | 970 (29%) | 895 (34%) | <0.001 | 9,635 (26%) |
| Acute Ischemic Stroke | 860 (3.2%) | 210 (4.5%) | 125 (3.7%) | 115 (4.3%) | 0.2 | 1,310 (3.5%) |
| Acute Respiratory Failure | 8,070 (30%) | 1,295 (28%) | 1,060 (31%) | 910 (34%) | 0.074 | 11,335 (30%) |
| *1*n (%); Median (Q1, Q3) | | | | | | |
| *2*Pearson's X^2: Rao & Scott adjustment; Design-based KruskalWallis test | | | | | | |

## Multivariable Logistic Regression:

### All-Cause Mortality:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 1.11 | 0.91, 1.35 | 0.3 |
| Hispanic | 1.04 | 0.82, 1.32 | 0.7 |
| Other | 1.62 | 1.28, 2.05 | <0.001 |
| Age, y | 1.01 | 1.01, 1.02 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.00 | 0.88, 1.14 | >0.9 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.92 | 0.78, 1.10 | 0.4 |
| $66,000 - $87,999 | 1.05 | 0.88, 1.26 | 0.6 |
| $88,000 or more | 1.06 | 0.86, 1.29 | 0.6 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 0.67 | 0.53, 0.86 | 0.001 |
| Other | 0.76 | 0.49, 1.20 | 0.2 |
| Private | 0.80 | 0.63, 1.02 | 0.071 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.87 | 0.71, 1.07 | 0.2 |
| South | 1.00 | 0.84, 1.19 | >0.9 |
| West | 0.97 | 0.79, 1.19 | 0.8 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.89 | 0.76, 1.03 | 0.11 |
| Small | 0.79 | 0.66, 0.95 | 0.012 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.49 | 1.07, 2.08 | 0.019 |
| Urban, teaching | 1.57 | 1.16, 2.14 | 0.004 |
| Charlson Comorbidity Index | 1.03 | 0.98, 1.07 | 0.3 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.48 | 0.40, 0.57 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.87 | 0.74, 1.01 | 0.069 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 0.91 | 0.79, 1.06 | 0.2 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 0.57 | 0.47, 0.69 | <0.001 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 1.16 | 0.98, 1.36 | 0.090 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 1.32 | 1.15, 1.52 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 0.74 | 0.65, 0.85 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.64 | 0.53, 0.79 | <0.001 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Esophagogastroduodenoscopy:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 0.96 | 0.80, 1.17 | 0.7 |
| Hispanic | 1.14 | 0.92, 1.42 | 0.2 |
| Other | 0.99 | 0.78, 1.26 | >0.9 |
| Age, y | 0.99 | 0.98, 1.0 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.06 | 0.93, 1.20 | 0.4 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.00 | 0.85, 1.16 | >0.9 |
| $66,000 - $87,999 | 0.91 | 0.77, 1.08 | 0.3 |
| $88,000 or more | 1.04 | 0.86, 1.25 | 0.7 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 1.12 | 0.88, 1.42 | 0.4 |
| Other | 1.65 | 1.08, 2.51 | 0.020 |
| Private | 1.00 | 0.77, 1.29 | >0.9 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.80 | 0.65, 0.98 | 0.032 |
| South | 0.85 | 0.72, 1.00 | 0.048 |
| West | 0.85 | 0.70, 1.04 | 0.12 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.87 | 0.75, 1.00 | 0.052 |
| Small | 0.65 | 0.55, 0.78 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.76 | 1.25, 2.49 | 0.001 |
| Urban, teaching | 2.22 | 1.61, 3.06 | <0.001 |
| Charlson Comorbidity Index | 1.11 | 1.07, 1.15 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 1.22 | 1.03, 1.44 | 0.024 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.88 | 0.76, 1.02 | 0.087 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 0.89 | 0.77, 1.02 | 0.090 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 0.75 | 0.62, 0.91 | 0.004 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 0.92 | 0.78, 1.08 | 0.3 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 1.09 | 0.96, 1.24 | 0.2 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 3.16 | 2.68, 3.73 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 1.08 | 0.92, 1.27 | 0.3 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Colonoscopy:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 0.90 | 0.63, 1.28 | 0.6 |
| Hispanic | 1.14 | 0.78, 1.67 | 0.5 |
| Other | 1.15 | 0.75, 1.75 | 0.5 |
| Age, y | 1.00 | 0.99, 1.01 | 0.8 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.85 | 0.68, 1.07 | 0.2 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.88 | 0.66, 1.17 | 0.4 |
| $66,000 - $87,999 | 0.89 | 0.65, 1.21 | 0.4 |
| $88,000 or more | 0.71 | 0.50, 1.02 | 0.068 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 0.80 | 0.52, 1.24 | 0.3 |
| Other | 1.03 | 0.47, 2.25 | >0.9 |
| Private | 1.03 | 0.66, 1.60 | >0.9 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.08 | 0.75, 1.55 | 0.7 |
| South | 1.04 | 0.77, 1.41 | 0.8 |
| West | 0.88 | 0.60, 1.28 | 0.5 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.86 | 0.66, 1.11 | 0.2 |
| Small | 0.91 | 0.67, 1.23 | 0.5 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.57 | 0.89, 2.77 | 0.12 |
| Urban, teaching | 1.59 | 0.95, 2.69 | 0.079 |
| Charlson Comorbidity Index | 0.97 | 0.89, 1.05 | 0.5 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 1.33 | 0.95, 1.86 | 0.094 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 1.20 | 0.90, 1.60 | 0.2 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 1.00 | 0.77, 1.29 | >0.9 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 1.39 | 0.95, 2.04 | 0.091 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 1.08 | 0.79, 1.48 | 0.6 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 0.97 | 0.76, 1.24 | 0.8 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 3.15 | 2.28, 4.36 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 1.13 | 0.85, 1.50 | 0.4 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Mechanical Ventilation:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 1.34 | 1.12, 1.60 | 0.002 |
| Hispanic | 1.32 | 1.08, 1.61 | 0.008 |
| Other | 1.50 | 1.20, 1.88 | <0.001 |
| Age, y | 0.98 | 0.97, 0.98 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.12 | 0.99, 1.27 | 0.065 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.15 | 0.98, 1.35 | 0.081 |
| $66,000 - $87,999 | 1.24 | 1.05, 1.46 | 0.010 |
| $88,000 or more | 1.49 | 1.24, 1.78 | <0.001 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 0.84 | 0.68, 1.05 | 0.12 |
| Other | 1.03 | 0.69, 1.53 | 0.9 |
| Private | 0.97 | 0.78, 1.20 | 0.8 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.80 | 0.65, 0.97 | 0.024 |
| South | 0.92 | 0.78, 1.08 | 0.3 |
| West | 0.84 | 0.69, 1.02 | 0.078 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.83 | 0.72, 0.96 | 0.009 |
| Small | 0.67 | 0.57, 0.80 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 2.07 | 1.46, 2.92 | <0.001 |
| Urban, teaching | 2.48 | 1.79, 3.42 | <0.001 |
| Charlson Comorbidity Index | 1.00 | 0.96, 1.04 | >0.9 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.48 | 0.41, 0.55 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.92 | 0.80, 1.05 | 0.2 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 1.07 | 0.94, 1.23 | 0.3 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 0.51 | 0.43, 0.61 | <0.001 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 1.07 | 0.92, 1.25 | 0.4 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 1.49 | 1.31, 1.70 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 1.01 | 0.88, 1.15 | >0.9 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.89 | 0.76, 1.05 | 0.2 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Acute Kidney Injury:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 0.90 | 0.77, 1.05 | 0.2 |
| Hispanic | 1.04 | 0.88, 1.25 | 0.6 |
| Other | 1.02 | 0.84, 1.24 | 0.8 |
| Age, y | 1.00 | 1.00, 1.01 | 0.075 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.19 | 1.07, 1.31 | <0.001 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.06 | 0.93, 1.20 | 0.4 |
| $66,000 - $87,999 | 1.14 | 0.99, 1.31 | 0.066 |
| $88,000 or more | 1.16 | 0.99, 1.35 | 0.061 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 0.79 | 0.65, 0.96 | 0.017 |
| Other | 0.79 | 0.56, 1.13 | 0.2 |
| Private | 0.85 | 0.70, 1.03 | 0.11 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.94 | 0.80, 1.11 | 0.5 |
| South | 1.05 | 0.92, 1.21 | 0.4 |
| West | 0.82 | 0.70, 0.97 | 0.022 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.87 | 0.78, 0.98 | 0.021 |
| Small | 0.75 | 0.66, 0.86 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.66 | 1.31, 2.11 | <0.001 |
| Urban, teaching | 1.98 | 1.59, 2.46 | <0.001 |
| Charlson Comorbidity Index | 1.07 | 1.03, 1.11 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.47 | 0.42, 0.54 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.91 | 0.81, 1.02 | 0.12 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 0.88 | 0.79, 0.99 | 0.035 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 1.25 | 1.07, 1.47 | 0.006 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 0.86 | 0.75, 0.98 | 0.026 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 1.29 | 1.16, 1.43 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 1.08 | 0.97, 1.20 | 0.2 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 1.00 | 0.87, 1.15 | >0.9 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Acute Kidney Injury requiring Dialysis:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 0.97 | 0.70, 1.33 | 0.8 |
| Hispanic | 1.53 | 1.11, 2.13 | 0.011 |
| Other | 1.62 | 1.13, 2.31 | 0.008 |
| Age, y | 0.98 | 0.97, 0.99 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.10 | 0.88, 1.37 | 0.4 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.98 | 0.74, 1.30 | 0.9 |
| $66,000 - $87,999 | 1.08 | 0.81, 1.43 | 0.6 |
| $88,000 or more | 1.20 | 0.89, 1.63 | 0.2 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 0.96 | 0.65, 1.40 | 0.8 |
| Other | 1.28 | 0.65, 2.48 | 0.5 |
| Private | 1.12 | 0.75, 1.67 | 0.6 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.76 | 0.52, 1.11 | 0.2 |
| South | 0.94 | 0.69, 1.26 | 0.7 |
| West | 0.76 | 0.53, 1.09 | 0.14 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.64 | 0.49, 0.84 | 0.001 |
| Small | 0.82 | 0.62, 1.08 | 0.2 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 3.16 | 1.44, 6.93 | 0.004 |
| Urban, teaching | 4.42 | 2.10, 9.28 | <0.001 |
| Charlson Comorbidity Index | 1.01 | 0.95, 1.08 | 0.7 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.33 | 0.24, 0.46 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 1.02 | 0.79, 1.32 | 0.9 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 0.76 | 0.58, 0.98 | 0.036 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 1.25 | 0.91, 1.71 | 0.2 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 0.80 | 0.60, 1.07 | 0.13 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 1.62 | 1.29, 2.03 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 1.29 | 1.00, 1.66 | 0.047 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 1.18 | 0.90, 1.55 | 0.2 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Blood Transfusion:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 0.98 | 0.82, 1.19 | 0.9 |
| Hispanic | 1.15 | 0.93, 1.41 | 0.2 |
| Other | 1.41 | 1.14, 1.75 | 0.001 |
| Age, y | 1.00 | 1.00, 1.01 | 0.3 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.96 | 0.85, 1.07 | 0.4 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.04 | 0.89, 1.21 | 0.6 |
| $66,000 - $87,999 | 1.05 | 0.89, 1.24 | 0.6 |
| $88,000 or more | 1.27 | 1.05, 1.53 | 0.012 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 1.00 | 0.79, 1.27 | >0.9 |
| Other | 0.90 | 0.59, 1.37 | 0.6 |
| Private | 1.06 | 0.83, 1.35 | 0.6 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 2.15 | 1.72, 2.70 | <0.001 |
| South | 1.57 | 1.29, 1.91 | <0.001 |
| West | 1.54 | 1.23, 1.93 | <0.001 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.96 | 0.82, 1.12 | 0.6 |
| Small | 1.07 | 0.89, 1.28 | 0.5 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.67 | 0.50, 0.90 | 0.008 |
| Urban, teaching | 0.65 | 0.50, 0.85 | 0.001 |
| Charlson Comorbidity Index | 1.07 | 1.03, 1.11 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.97 | 0.82, 1.14 | 0.7 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 1.02 | 0.89, 1.17 | 0.8 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 1.04 | 0.91, 1.18 | 0.6 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 0.93 | 0.78, 1.12 | 0.5 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 1.14 | 0.98, 1.32 | 0.10 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 1.10 | 0.98, 1.25 | 0.11 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 5.70 | 4.83, 6.73 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.90 | 0.77, 1.06 | 0.2 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Acute Ischemic Stroke:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 1.33 | 0.90, 1.96 | 0.2 |
| Hispanic | 1.03 | 0.65, 1.65 | 0.9 |
| Other | 1.24 | 0.78, 1.98 | 0.4 |
| Age, y | 0.98 | 0.97, 1.00 | 0.016 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.80 | 0.60, 1.05 | 0.11 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.40 | 0.98, 1.99 | 0.063 |
| $66,000 - $87,999 | 0.93 | 0.63, 1.38 | 0.7 |
| $88,000 or more | 1.77 | 1.19, 2.64 | 0.005 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 0.73 | 0.46, 1.17 | 0.2 |
| Other | 1.44 | 0.66, 3.11 | 0.4 |
| Private | 0.84 | 0.52, 1.34 | 0.5 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.93 | 0.59, 1.46 | 0.8 |
| South | 1.04 | 0.72, 1.48 | 0.9 |
| West | 1.19 | 0.79, 1.79 | 0.4 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.87 | 0.64, 1.17 | 0.4 |
| Small | 0.73 | 0.50, 1.07 | 0.10 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.48 | 0.70, 3.13 | 0.3 |
| Urban, teaching | 1.65 | 0.83, 3.30 | 0.2 |
| Charlson Comorbidity Index | 1.53 | 1.46, 1.61 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.56 | 0.40, 0.78 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.48 | 0.36, 0.65 | <0.001 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 0.61 | 0.45, 0.84 | 0.002 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 0.22 | 0.15, 0.32 | <0.001 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 0.70 | 0.49, 1.00 | 0.048 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 1.15 | 0.85, 1.54 | 0.4 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 0.99 | 0.73, 1.33 | >0.9 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.89 | 0.60, 1.31 | 0.6 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

### Acute Respiratory Failure:

| **Characteristic** | **OR***1* | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 0.85 | 0.72, 1.01 | 0.064 |
| Hispanic | 1.04 | 0.85, 1.26 | 0.7 |
| Other | 1.14 | 0.93, 1.40 | 0.2 |
| Age, y | 0.99 | 0.98, 0.99 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.06 | 0.95, 1.18 | 0.3 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.03 | 0.89, 1.18 | 0.7 |
| $66,000 - $87,999 | 1.11 | 0.95, 1.28 | 0.2 |
| $88,000 or more | 1.26 | 1.07, 1.48 | 0.007 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 0.95 | 0.77, 1.17 | 0.6 |
| Other | 1.15 | 0.80, 1.65 | 0.4 |
| Private | 1.14 | 0.93, 1.40 | 0.2 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.68 | 0.57, 0.81 | <0.001 |
| South | 0.88 | 0.76, 1.01 | 0.074 |
| West | 0.87 | 0.73, 1.03 | 0.10 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | 0.86 | 0.76, 0.97 | 0.015 |
| Small | 0.71 | 0.61, 0.82 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 2.03 | 1.54, 2.67 | <0.001 |
| Urban, teaching | 2.35 | 1.82, 3.03 | <0.001 |
| Charlson Comorbidity Index | 1.07 | 1.03, 1.10 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 0.49 | 0.42, 0.56 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | 0.88 | 0.78, 1.00 | 0.049 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | 0.95 | 0.84, 1.07 | 0.4 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | 0.51 | 0.44, 0.61 | <0.001 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | 0.90 | 0.78, 1.04 | 0.14 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 1.42 | 1.27, 1.59 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 1.08 | 0.96, 1.21 | 0.2 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.90 | 0.78, 1.04 | 0.2 |
| *1*OR = Odds Ratio, CI = Confidence Interval | | | |

## Multivariable Linear Regression:

### Length of Stay:

| **Characteristic** | **Beta** | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | 0.29 | -0.64, 1.2 | 0.5 |
| Hispanic | 0.79 | -0.15, 1.7 | 0.10 |
| Other | 0.86 | -0.17, 1.9 | 0.10 |
| Age, y | -0.09 | -0.12, -0.06 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.04 | -0.47, 0.54 | 0.9 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.32 | -0.30, 0.95 | 0.3 |
| $66,000 - $87,999 | 0.50 | -0.26, 1.3 | 0.2 |
| $88,000 or more | 1.1 | 0.28, 1.8 | 0.008 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | -0.52 | -1.8, 0.79 | 0.4 |
| Other | -0.27 | -2.2, 1.6 | 0.8 |
| Private | -1.0 | -2.3, 0.18 | 0.10 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 2.1 | 0.96, 3.2 | <0.001 |
| South | 0.94 | 0.33, 1.6 | 0.002 |
| West | -0.55 | -1.3, 0.21 | 0.2 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | -1.7 | -2.3, -1.1 | <0.001 |
| Small | -3.2 | -3.8, -2.6 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 2.1 | 1.3, 3.0 | <0.001 |
| Urban, teaching | 4.2 | 3.5, 4.9 | <0.001 |
| Charlson Comorbidity Index | 0.79 | 0.62, 0.97 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | -3.6 | -4.4, -2.8 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | -1.4 | -2.1, -0.78 | <0.001 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | -0.71 | -1.3, -0.16 | 0.011 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | -3.6 | -4.6, -2.6 | <0.001 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | -1.2 | -1.8, -0.55 | <0.001 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 2.1 | 1.6, 2.6 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 3.0 | 2.5, 3.5 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | -0.72 | -1.3, -0.13 | 0.017 |
| *1*CI = Confidence Interval | | | |

### Inflation Adjusted Total Charge:

| **Characteristic** | **Beta** | **95% CI***1* | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Black | -2,654 | -27,915, 22,606 | 0.8 |
| Hispanic | 29,164 | 2,410, 55,918 | 0.033 |
| Other | 53,859 | 17,978, 89,740 | 0.003 |
| Age, y | -3,616 | -4,451, -2,781 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 15,930 | 3,332, 28,529 | 0.013 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 4,202 | -13,326, 21,730 | 0.6 |
| $66,000 - $87,999 | 13,455 | -6,035, 32,944 | 0.2 |
| $88,000 or more | 43,120 | 18,690, 67,549 | <0.001 |
| Expected primary payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 17,866 | -14,585, 50,317 | 0.3 |
| Other | 22,192 | -28,225, 72,609 | 0.4 |
| Private | 30,786 | -1,969, 63,541 | 0.065 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 32,907 | 9,597, 56,217 | 0.006 |
| South | 44,006 | 27,447, 60,564 | <0.001 |
| West | 81,547 | 51,789, 111,305 | <0.001 |
| Hospital bed size |  |  |  |
| Large | — | — |  |
| Medium | -44,986 | -63,165, -26,808 | <0.001 |
| Small | -81,070 | -99,777, -62,364 | <0.001 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 68,743 | 48,935, 88,551 | <0.001 |
| Urban, teaching | 118,522 | 101,869, 135,174 | <0.001 |
| Charlson Comorbidity Index | 13,167 | 6,624, 19,709 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | -102,401 | -126,529, -78,273 | <0.001 |
| Diabetes mellitus |  |  |  |
| No | — | — |  |
| Yes | -23,807 | -42,838, -4,777 | 0.014 |
| Chronic Pulmonary Disease |  |  |  |
| No | — | — |  |
| Yes | -27,531 | -43,024, -12,037 | <0.001 |
| Chronic Kidney Disease |  |  |  |
| No | — | — |  |
| Yes | -115,387 | -147,637, -83,137 | <0.001 |
| Peripheral Vascular Disease |  |  |  |
| No | — | — |  |
| Yes | -24,079 | -42,017, -6,142 | 0.009 |
| Atrial Fibrillation |  |  |  |
| No | — | — |  |
| Yes | 53,326 | 38,158, 68,495 | <0.001 |
| Anemia |  |  |  |
| No | — | — |  |
| Yes | 69,717 | 56,141, 83,293 | <0.001 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | -13,977 | -30,860, 2,905 | 0.10 |
| *1*CI = Confidence Interval | | | |