

## Poor Hemorrhagic Stroke Outcomes During the COVID-19 Pandemic Are Driven by Socioeconomic Disparities: Analysis of Nationally Representative Data

### Supplemental Methods

Segmented logistic regression model is expressed as follows:

$$\text{logit}(p) = \beta_0 + \beta_1 \text{time}_t + \beta_2 \text{post-pandemic}_t + \beta_3 \text{time\_post}_t + \beta_4 X_4 + \dots + \beta_n X_n + \varepsilon_t$$

Where:

- $p$  = probability of mortality and  $\text{logit}(p) = \log\left(\frac{p}{1-p}\right)$ ;
- “time” is the the number of month elapsed from January 2016 (time = 1) to December 2020 (time =60). We used month as our unit of analysis because segmented regression requires a sufficient number (at least 10) of time points before and after the pandemic.
- “Post-pandemic” is a variable that is set to be equals to 0 for pre-pandemic months (January 2016 – February 2020) and 1 for post-pandemic months (March 2020 – December 2020);
- “time\_post” is a variable that is set to be equals to 0 for pre-pandemic months; otherwise, time-post equals the number months since the start of the post-pandemic period (with march 2020 = 1 and December 2020 = 10).
- “time\_post” can be calculated as follows:  $\text{time\_post} = \text{post\_pandemic} (1,0) \times (\text{time} - \text{post-pandemic period start time [i.e. time variable for March 2020 = 51]} + 1)$ .
- $\beta_1$  represents the change in the log-odds of in-hospital mortality per unit increase in time (per month) during the pre-pandemic period.
- $\beta_2$  is the change in the log-odds of mortality just after March 2020 (the start of the post-pandemic period).
- $\beta_3$  is the difference in the log-odds of mortality (per unit time) between the pre-pandemic periods and post-pandemic periods. In other words,  $\beta_3$  measures the acceleration/deceleration of the mortality rate during the post-pandemic period.
- Using Stata’s Lincom command we calculated the post-pandemic slope as  $\beta_1 + \beta_3$ .
- $\beta_4 - \beta_n$  represent the coefficients for the confounders adjusted in the model.

**Table S1: Characteristics of ICH patients Pre- and Post-Covid.**

|                                   | Overall (n= 309965) | Pre-Covid (n=259535) | Post-Covid (n=50430) | OR (95% CI)            |
|-----------------------------------|---------------------|----------------------|----------------------|------------------------|
| Age, median (IQR)                 | 70 (58 – 80)        | 70 (58 – 80)         | 69 (57 – 79)         | 1.00 (0.99 – 1.00) *** |
| Female                            | 145740 (47.02)      | 122785 (47.31)       | 22955 (45.53)        | 0.93 (0.89 – 0.97) **  |
| Race                              |                     |                      |                      |                        |
| Non-Hispanic White                | 183845 (61.50)      | 154725 (61.81)       | 29120 (59.90)        | Reference              |
| Non-Hispanic Black                | 54770 (18.32)       | 45630 (18.23)        | 9140 (18.80)         | 1.06 (0.96 – 1.18)     |
| Hispanic                          | 31380 (10.50)       | 25965 (10.37)        | 5415 (11.14)         | 1.11 (0.98 – 1.26)     |
| Asian                             | 16330 (5.46)        | 13560 (5.42)         | 2770 (5.70)          | 1.09 (0.92 – 1.28)     |
| Other                             | 12610 (4.22)        | 10440 (4.17)         | 2170 (4.46)          | 1.10 (0.95 – 1.28)     |
| Income                            |                     |                      |                      |                        |
| Quartile 1                        | 92280 (30.30)       | 77080 (30.24)        | 15200 (30.61)        | Reference              |
| Quartile 2                        | 77335 (25.40)       | 64340 (25.25)        | 12995 (26.17)        | 1.02 (0.94 – 1.11)     |
| Quartile 3                        | 71845 (23.59)       | 60630 (23.79)        | 11215 (22.58)        | 0.94 (0.85 – 1.04)     |
| Quartile 4                        | 63055 (20.71)       | 52805 (20.72)        | 10250 (20.64)        | 0.98 (0.87 – 1.11)     |
| Insurance                         |                     |                      |                      |                        |
| Medicare                          | 185395 (59.92)      | 156535 (60.43)       | 28860 (57.28)        | Reference              |
| Medicaid                          | 37925 (12.26)       | 30905 (11.93)        | 7020 (13.93)         | 1.23 (1.14 – 1.33) *** |
| Private                           | 60995 (19.71)       | 50860 (19.63)        | 10135 (20.12)        | 1.08 (1.01 – 1.15) *   |
| Self-pay                          | 16110 (5.21)        | 13415 (5.18)         | 2695 (5.35)          | 1.09 (0.96 – 1.24)     |
| No charge                         | 1130 (0.37)         | 895 (0.35)           | 235 (0.47)           | 1.42 (0.96 – 2.11)     |
| Other                             | 7860 (2.54)         | 6420 (2.48)          | 1440 (2.86)          | 1.22 (1.05 – 1.41) **  |
| Hospital Bed Size                 | 0 (0.00)            | 0 (0.00)             | 0 (0.00)             |                        |
| Small                             | 29500 (9.52)        | 23945 (9.23)         | 5555 (11.02)         | Reference              |
| Medium                            | 79030 (25.50)       | 66505 (25.62)        | 12525 (24.84)        | 0.81 (0.68 – 0.97) *   |
| Large                             | 201435 (64.99)      | 169085 (65.15)       | 32350 (64.15)        | 0.82 (0.70 – 0.97) *   |
| Hospital Location/Teaching Status |                     |                      |                      |                        |
| Rural                             | 8970 (2.89)         | 7605 (2.93)          | 1365 (2.71)          | Reference              |
| Urban Non-teaching                | 39400 (12.71)       | 33810 (13.03)        | 5590 (11.08)         | 0.92 (0.68 – 1.25)     |
| Urban Teaching                    | 261595 (84.39)      | 218120 (84.04)       | 43475 (86.21)        | 1.11 (0.85 – 1.46)     |
| Hospital Region                   |                     |                      |                      |                        |
| Northeast                         | 52525 (16.95)       | 43875 (16.91)        | 8650 (17.15)         | Reference              |
| Midwest                           | 63115 (20.36)       | 53535 (20.63)        | 9580 (19.00)         | 0.91 (0.77 – 1.07)     |
| South                             | 126250 (40.73)      | 105445 (40.63)       | 20805 (41.26)        | 1.00 (0.86 – 1.16)     |
| West                              | 68075 (21.96)       | 56680 (21.84)        | 11395 (22.60)        | 1.02 (0.87 – 1.20)     |
| Charlson Index Quartiles          |                     |                      |                      |                        |
| Quartile 1                        | 117905 (38.04)      | 100065 (38.56)       | 17840 (35.38)        | Reference              |
| Quartile 2                        | 64885 (20.93)       | 54280 (20.91)        | 10605 (21.03)        | 1.10 (1.03 – 1.16) **  |
| Quartile 3                        | 45835 (14.79)       | 38125 (14.69)        | 7710 (15.29)         | 1.13 (1.06 – 1.22) *** |
| Quartile 4                        | 81340 (26.24)       | 67065 (25.84)        | 14275 (28.31)        | 1.19 (1.12 – 1.27) *** |

|                            |                |                |               |                        |
|----------------------------|----------------|----------------|---------------|------------------------|
| Hypertension               | 271960 (87.74) | 227670 (87.72) | 44290 (87.82) | 1.01 (0.93 – 1.09)     |
| Diabetes                   | 93160 (30.06)  | 77715 (29.94)  | 15445 (30.63) | 1.03 (0.98 – 1.08)     |
| Heart Failure              | 40935 (13.21)  | 33685 (12.98)  | 7250 (14.38)  | 1.13 (1.06 – 1.20) *** |
| Obesity                    | 38890 (12.55)  | 31270 (12.05)  | 7620 (15.11)  | 1.30 (1.21 – 1.39) *** |
| Renal Failure              | 53090 (17.13)  | 44060 (16.98)  | 9030 (17.91)  | 1.07 (1.01 – 1.13) *   |
| APRDRG Severity of Illness |                |                |               |                        |
| Minor Loss of Function     | 15495 (5.00)   | 12960 (4.99)   | 2535 (5.03)   | Reference              |
| Moderate Loss of Function  | 77025 (24.85)  | 64355 (24.80)  | 12670 (25.12) | 1.01 (0.91 – 1.12)     |
| Major Loss of Function     | 100300 (32.36) | 84070 (32.39)  | 16230 (32.18) | 0.99 (0.89 – 1.10)     |
| Extreme Loss of Function   | 117145 (37.79) | 98150 (37.82)  | 18995 (37.67) | 0.99 (0.89 – 1.10)     |
| NIHSS Available            | 64125 (20.69)  | 48560 (18.71)  | 15565 (30.86) | 1.94 (1.79 – 2.11) *** |
| NIHSS, Mean (SD)           | 8 (2 – 18)     | 8 (2 – 18)     | 8 (3 – 8)     | 1.00 (1.00 – 1.00)     |
| ICH Type                   |                |                |               |                        |
| Subcortical                | 55910 (18.04)  | 44605 (17.19)  | 11305 (22.42) | 1.39 (1.30 – 1.49) *** |
| Cortical                   | 61075 (19.70)  | 50390 (19.42)  | 10685 (21.19) | 1.12 (1.05 – 1.18) *** |
| Unknown / Unspecified      | 5705 (1.84)    | 4975 (1.92)    | 730 (1.45)    | 0.75 (0.62 – 0.90) **  |
| Brainstem                  | 18445 (5.95)   | 15165 (5.84)   | 3280 (6.50)   | 1.12 (1.03 – 1.22) *   |
| Cerebellum                 | 25555 (8.24)   | 21385 (8.24)   | 4170 (8.27)   | 1.00 (0.93 – 1.08)     |
| Intraventricular           | 73470 (23.70)  | 60405 (23.27)  | 13065 (25.91) | 1.15 (1.09 – 1.22) *** |
| Multiple Localized         | 2820 (0.91)    | 2380 (0.92)    | 440 (0.87)    | 0.95 (0.75 – 1.21)     |
| Other                      | 51575 (16.64)  | 44055 (16.97)  | 7520 (14.91)  | 0.86 (0.80 – 0.92) *** |
| Unspecified                | 56905 (18.36)  | 49220 (18.96)  | 7685 (15.24)  | 0.77 (0.71 – 0.83) *** |
| Mortality                  | 68755 (22.19)  | 58120 (22.41)  | 10635 (21.10) | 0.93 (0.88 – 0.98) **  |
| Home Discharge             | 58180 (24.14)  | 48975 (24.33)  | 9205 (23.14)  | 0.94 (0.88 – 1.00) *   |
| Craniotomy                 | 43565 (14.06)  | 36225 (13.96)  | 7340 (14.58)  | 1.05 (0.98 – 1.13)     |

\* - p-value < 0.05; \*\* - p-value < 0.01; \*\*\* - p-value < 0.001

**Table S2: Comparison of ICH patients, with and without COVID-19, Admitted between April to December 2020 and ICH Patients Admitted during The Same Period in 2019**

|                                   | Overall (n = 92440) | 2019 (n= 47100) | 2020 - No covid (n= 44405) | 2020-Covid (n = 935) | OR (95% CI) - 2020 With COVID vs 2019 (Model group 1) | OR (95% CI) - 2020 Without COVID (Model group 2) |
|-----------------------------------|---------------------|-----------------|----------------------------|----------------------|-------------------------------------------------------|--------------------------------------------------|
| Age                               | 69 (57 – 80)        | 70 (58 – 80)    | 69 (57 – 79)               | 65 (55 – 77)         | 0.98 (0.98 – 0.99) **                                 | 0.99 (0.98 – 1.00) *                             |
| Female                            | 42505 (45.99)       | 21915 (46.53)   | 20250 (45.61)              | 340 (36.56)          | 0.66 (0.48 – 0.91) *                                  | 0.69 (0.50 – 0.95) *                             |
| Race                              |                     |                 |                            |                      |                                                       |                                                  |
| Non-Hispanic White                | 54180 (60.64)       | 28030 (61.46)   | 25805 (60.24)              | 345 (38.33)          | Reference                                             | Reference                                        |
| Non-Hispanic Black                | 16785 (18.79)       | 8555 (18.76)    | 8010 (18.70)               | 220 (24.44)          | 2.09 (1.40 – 3.11) ***                                | 2.05 (1.40 – 3.02) ***                           |
| Hispanic                          | 9555 (10.69)        | 4665 (10.23)    | 4690 (10.95)               | 200 (22.22)          | 3.48 (2.30 – 5.28) ***                                | 3.19 (2.15 – 4.73) ***                           |
| Asian                             | 4985 (5.58)         | 2515 (5.51)     | 2430 (5.67)                | 40 (4.44)            | 1.29 (0.56 – 2.96)                                    | 1.23 (0.54 – 2.79)                               |
| Other                             | 3845 (4.30)         | 1845 (4.05)     | 1905 (4.45)                | 95 (10.56)           | 4.18 (2.54 – 6.90) ***                                | 3.73 (2.31 – 6.04) ***                           |
| Income                            |                     |                 |                            |                      |                                                       |                                                  |
| Quartile 1                        | 27730 (30.49)       | 14135 (30.52)   | 13190 (30.18)              | 405 (44.02)          | Reference                                             | Reference                                        |
| Quartile 2                        | 23050 (25.34)       | 11335 (24.47)   | 11525 (26.37)              | 190 (20.65)          | 0.59 (0.39 – 0.87) **                                 | 0.54 (0.36 – 0.79) **                            |
| Quartile 3                        | 21370 (23.50)       | 11215 (24.21)   | 9950 (22.76)               | 205 (22.28)          | 0.64 (0.43 – 0.94) *                                  | 0.67 (0.46 – 0.98) *                             |
| Quartile 4                        | 18795 (20.67)       | 9630 (20.79)    | 9045 (20.69)               | 120 (13.04)          | 0.43 (0.27 – 0.71) **                                 | 0.43 (0.27 – 0.69) ***                           |
| Insurance                         |                     |                 |                            |                      |                                                       |                                                  |
| Medicare                          | 54320 (58.86)       | 28495 (60.64)   | 25325 (57.08)              | 500 (53.76)          | Reference                                             | Reference                                        |
| Medicaid                          | 12115 (13.13)       | 5795 (12.33)    | 6150 (13.86)               | 170 (18.28)          | 1.67 (1.14 – 2.44) **                                 | 1.40 (0.96 – 2.04)                               |
| Private                           | 18240 (19.76)       | 9040 (19.24)    | 9015 (20.32)               | 185 (19.89)          | 1.17 (0.79 – 1.72)                                    | 1.04 (0.71 – 1.53)                               |
| Selfpay                           | 4815 (5.22)         | 2370 (5.04)     | 2385 (5.38)                | 60 (6.45)            | 1.44 (0.76 – 2.73)                                    | 1.27 (0.68 – 2.38)                               |
| Nocharge                          | 410 (0.44)          | 200 (0.43)      | 205 (0.46)                 | 5 (0.54)             | 1.42 (0.19 – 10.57)                                   | 1.24 (0.17 – 9.20)                               |
| Other                             | 2385 (2.58)         | 1090 (2.32)     | 1285 (2.90)                | 10 (1.08)            | 0.52 (0.13 – 2.15)                                    | 0.39 (0.10 – 1.62)                               |
| Hospital Bed Size                 |                     |                 |                            |                      |                                                       |                                                  |
| Small                             | 9785 (10.59)        | 4745 (10.07)    | 4950 (11.15)               | 90 (9.63)            | Reference                                             | Reference                                        |
| Medium                            | 23320 (25.23)       | 12070 (25.63)   | 11005 (24.78)              | 245 (26.20)          | 1.07 (0.59 – 1.93)                                    | 1.22 (0.70 – 2.14)                               |
| Large                             | 59335 (64.19)       | 30285 (64.30)   | 28450 (64.07)              | 600 (64.17)          | 1.04 (0.60 – 1.81)                                    | 1.16 (0.68 – 1.97)                               |
| Hospital Location/Teaching Status |                     |                 |                            |                      |                                                       |                                                  |
| Rural                             | 2605 (2.82)         | 1380 (2.93)     | 1205 (2.71)                | 20 (2.14)            | Reference                                             | Reference                                        |
| Urban Non-teaching                | 9885 (10.69)        | 4975 (10.56)    | 4840 (10.90)               | 70 (7.49)            | 0.97 (0.30 – 3.10)                                    | 0.87 (0.28 – 2.72)                               |
| Urban Teaching                    | 79950 (86.49)       | 40745 (86.51)   | 38360 (86.39)              | 845 (90.37)          | 1.43 (0.51 – 4.00)                                    | 1.33 (0.48 – 3.67)                               |
| Hospital Region                   | 0 (0.00)            | 0 (0.00)        | 0 (0.00)                   | 0 (0.00)             |                                                       |                                                  |
| Northeast                         | 15750 (17.04)       | 7870 (16.71)    | 7665 (17.26)               | 215 (22.99)          |                                                       | Reference                                        |
| Midwest                           | 18145 (19.63)       | 9575 (20.33)    | 8415 (18.95)               | 155 (16.58)          | 0.59 (0.35 – 1.01)                                    | 0.66 (0.40 – 1.09)                               |
| South                             | 37860 (40.96)       | 19170 (40.70)   | 18265 (41.13)              | 425 (45.45)          | 0.81 (0.53 – 1.25)                                    | 0.83 (0.55 – 1.24)                               |
| West                              | 20685 (22.38)       | 10485 (22.26)   | 10060 (22.66)              | 140 (14.97)          | 0.49 (0.29 – 0.82) **                                 | 0.50 (0.30 – 0.81) **                            |
| Charlson Index Quartiles          |                     |                 |                            |                      |                                                       |                                                  |

|                            |               |               |               |             |                       |                        |
|----------------------------|---------------|---------------|---------------|-------------|-----------------------|------------------------|
| Quartile 1                 | 33025 (35.73) | 17105 (36.32) | 15620 (35.18) | 300 (32.09) | Reference             | Reference              |
| Quartile 2                 | 19475 (21.07) | 9855 (20.92)  | 9430 (21.24)  | 190 (20.32) | 1.10 (0.72 – 1.69)    | 1.05 (0.68 – 1.61)     |
| Quartile 3                 | 13745 (14.87) | 6880 (14.61)  | 6715 (15.12)  | 150 (16.04) | 1.24 (0.77 – 2.01)    | 1.16 (0.72 – 1.87)     |
| Quartile 4                 | 26195 (28.34) | 13260 (28.15) | 12640 (28.47) | 295 (31.55) | 1.27 (0.85 – 1.90)    | 1.22 (0.81 – 1.82)     |
| Hypertension               | 81645 (88.32) | 41825 (88.80) | 39020 (87.87) | 800 (85.56) | 0.75 (0.49 – 1.13)    | 0.82 (0.54 – 1.23)     |
| Diabetes                   | 28180 (30.48) | 14260 (30.28) | 13590 (30.60) | 330 (35.29) | 1.26 (0.90 – 1.75)    | 1.24 (0.89 – 1.72)     |
| Heart Failure              | 13340 (14.43) | 6875 (14.60)  | 6285 (14.15)  | 180 (19.25) | 1.39 (0.96 – 2.03)    | 1.45 (0.99 – 2.11)     |
| Obesity                    | 13120 (14.19) | 6220 (13.21)  | 6720 (15.13)  | 180 (19.25) | 1.57 (1.07 – 2.30) *  | 1.34 (0.91 – 1.96)     |
| Renal Failure              | 16840 (18.22) | 8640 (18.34)  | 8030 (18.08)  | 170 (18.18) | 0.99 (0.67 – 1.46)    | 1.01 (0.69 – 1.48)     |
| APRDRG Severity of Illness |               |               |               |             |                       |                        |
| Minor Loss of Function     | 4965 (5.37)   | 2785 (5.91)   | 2180 (4.91)   | 0 (0.00)    |                       |                        |
| Moderate Loss of Function  | 24290 (26.28) | 12955 (27.51) | 11285 (25.41) | 50 (5.35)   |                       |                        |
| Major Loss of Function     | 29070 (31.45) | 14275 (30.31) | 14445 (32.53) | 350 (37.43) |                       |                        |
| Extreme Loss of Function   | 34115 (36.91) | 17085 (36.27) | 16495 (37.15) | 535 (57.22) |                       |                        |
| NIHSS Available            | 28115 (30.41) | 14140 (30.02) | 13730 (30.92) | 245 (26.20) | 0.83 (0.59 – 1.17)    | 0.79 (0.57 – 1.10)     |
| NIHSS, Mean (SD)           | 8 (2 – 18)    | 8 (2 – 18)    | 8 (2 – 18)    | 10 (2 – 18) |                       |                        |
| ICH Type                   |               |               |               |             |                       |                        |
| Hemisphere (Subcortical)   | 20115 (21.76) | 9900 (21.02)  | 10005 (22.53) | 210 (22.46) | 1.09 (0.77 – 1.53)    | 1.00 (0.71 – 1.40)     |
| Hemisphere (Cortical)      | 19320 (20.90) | 9650 (20.49)  | 9470 (21.33)  | 200 (21.39) | 1.06 (0.74 – 1.51)    | 1.00 (0.71 – 1.43)     |
| Hemisphere (Unspecified)   | 1480 (1.60)   | 830 (1.76)    | 650 (1.46)    | 0 (0.00)    |                       |                        |
| Brainstem                  | 6085 (6.58)   | 3110 (6.60)   | 2935 (6.61)   | 40 (4.28)   | 0.63 (0.32 – 1.24)    | 0.63 (0.32 – 1.23)     |
| Cerebellum                 | 7350 (7.95)   | 3675 (7.80)   | 3625 (8.16)   | 50 (5.35)   | 0.67 (0.36 – 1.25)    | 0.64 (0.34 – 1.19)     |
| Intraventricular           | 23795 (25.74) | 11975 (25.42) | 11560 (26.03) | 260 (27.81) | 1.13 (0.81 – 1.58)    | 1.09 (0.79 – 1.52)     |
| Multiple Localized         | 710 (0.77)    | 325 (0.69)    | 375 (0.84)    | 10 (1.07)   | 1.56 (0.38 – 6.45)    | 1.27 (0.31 – 5.12)     |
| Other                      | 13655 (14.77) | 6910 (14.67)  | 6610 (14.89)  | 135 (14.44) | 0.98 (0.65 – 1.48)    | 0.96 (0.64 – 1.46)     |
| Unspecified                | 14880 (16.10) | 8065 (17.12)  | 6645 (14.96)  | 170 (18.18) | 1.08 (0.74 – 1.57)    | 1.26 (0.87 – 1.83)     |
| Mortality                  | 19650 (21.27) | 10090 (21.43) | 9265 (20.87)  | 295 (31.55) | 1.69 (1.25 – 2.28) ** | 1.75 (1.30 – 2.35) *** |
| Home Discharge             | 17360 (23.86) | 9070 (24.52)  | 8110 (23.09)  | 180 (28.13) | 1.20 (0.80 – 1.81)    | 1.30 (0.87 – 1.96)     |
| Craniotomy                 | 13350 (14.46) | 6610 (14.04)  | 6560 (14.79)  | 180 (19.25) | 1.46 (1.00 – 2.12) *  | 1.37 (0.95 – 1.99)     |

\* - p-value < 0.05; \*\* - p-value < 0.01; \*\*\* - p-value < 0.001

**Table S3: Comparison of SAH patients, with and without COVID-19, Admitted between April to December 2020 and ICH Patients Admitted during The Same Period in 2019**

|                                   | Overall (n = 33780) | 2019 (n= 17180) | 2020 - No covid (n= 16205) | 2020-Covid (n = 395) | OR (95% CI) - 2020 With COVID vs 2019 (Model group 1) | OR (95% CI) - 2020 With COVID vs 2020 Without COVID (Model group 2) |
|-----------------------------------|---------------------|-----------------|----------------------------|----------------------|-------------------------------------------------------|---------------------------------------------------------------------|
| Age(sd)                           | 60 (50 – 71)        | 61 (50 – 72)    | 60 (50 – 71)               | 55 (47 – 69)         | 0.99 (0.97 – 1.00)                                    | 0.99 (0.97 – 1.00)                                                  |
| Female                            | 20475 (60.61)       | 10535 (61.32)   | 9710 (59.92)               | 230 (58.23)          | 0.88 (0.57 – 1.36)                                    | 0.93 (0.61 – 1.44)                                                  |
| Race                              |                     |                 |                            |                      |                                                       |                                                                     |
| Non-Hispanic White                | 19695 (60.94)       | 9925 (60.50)    | 9610 (61.88)               | 160 (41.56)          | Reference                                             | Reference                                                           |
| Non-Hispanic Black                | 5445 (16.85)        | 2795 (17.04)    | 2605 (16.77)               | 45 (11.69)           | 1.00 (0.47 – 2.13)                                    | 1.04 (0.49 – 2.21)                                                  |
| Hispanic                          | 4175 (12.92)        | 2030 (12.37)    | 1970 (12.69)               | 175 (45.45)          | 5.35 (3.36 – 8.51) ***                                | 5.34 (3.39 – 8.39) ***                                              |
| Asian                             | 1470 (4.55)         | 810 (4.94)      | 660 (4.25)                 | 0 (0.00)             |                                                       |                                                                     |
| Other                             | 1535 (4.75)         | 845 (5.15)      | 685 (4.41)                 | 5 (1.30)             | 0.37 (0.05 – 2.72)                                    | 0.44 (0.06 – 3.25)                                                  |
| Income                            |                     |                 |                            |                      |                                                       |                                                                     |
| Quartile 1                        | 10075 (30.33)       | 4915 (29.09)    | 4995 (31.31)               | 165 (44.59)          | Reference                                             | Reference                                                           |
| Quartile 2                        | 8325 (25.06)        | 4125 (24.42)    | 4115 (25.79)               | 85 (22.97)           | 0.61 (0.34 – 1.11)                                    | 0.63 (0.35 – 1.13)                                                  |
| Quartile 3                        | 7780 (23.42)        | 4120 (24.39)    | 3580 (22.44)               | 80 (21.62)           | 0.58 (0.30 – 1.10)                                    | 0.68 (0.36 – 1.27)                                                  |
| Quartile 4                        | 7040 (21.19)        | 3735 (22.11)    | 3265 (20.46)               | 40 (10.81)           | 0.32 (0.15 – 0.70) **                                 | 0.37 (0.17 – 0.79) *                                                |
| Insurance                         |                     |                 |                            |                      |                                                       |                                                                     |
| Medicare                          | 13125 (38.92)       | 6740 (39.29)    | 6270 (38.76)               | 115 (29.11)          | Reference                                             | Reference                                                           |
| Medicaid                          | 5540 (16.43)        | 2795 (16.29)    | 2620 (16.20)               | 125 (31.65)          | 2.62 (1.50 – 4.57) **                                 | 2.60 (1.51 – 4.49) **                                               |
| Private                           | 11430 (33.89)       | 5845 (34.07)    | 5485 (33.91)               | 100 (25.32)          | 1.00 (0.56 – 1.81)                                    | 0.99 (0.55 – 1.79)                                                  |
| Selfpay                           | 2480 (7.35)         | 1195 (6.97)     | 1255 (7.76)                | 30 (7.59)            | 1.47 (0.57 – 3.82)                                    | 1.30 (0.53 – 3.18)                                                  |
| Nocharge                          | 175 (0.52)          | 60 (0.35)       | 105 (0.65)                 | 10 (2.53)            | 9.77 (2.05 – 46.59) **                                | 5.19 (1.08 – 24.92) *                                               |
| Other                             | 975 (2.89)          | 520 (3.03)      | 440 (2.72)                 | 15 (3.80)            | 1.69 (0.47 – 6.05)                                    | 1.86 (0.53 – 6.57)                                                  |
| Hospital Bed Size                 |                     |                 |                            |                      |                                                       |                                                                     |
| Small                             | 2565 (7.59)         | 1285 (7.48)     | 1240 (7.65)                | 40 (10.13)           | Reference                                             | Reference                                                           |
| Medium                            | 6990 (20.69)        | 3715 (21.62)    | 3205 (19.78)               | 70 (17.72)           | 0.61 (0.24 – 1.54)                                    | 0.68 (0.28 – 1.66)                                                  |
| Large                             | 24225 (71.71)       | 12180 (70.90)   | 11760 (72.57)              | 285 (72.15)          | 0.75 (0.34 – 1.66)                                    | 0.75 (0.36 – 1.59)                                                  |
| Hospital Location/Teaching Status |                     |                 |                            |                      |                                                       |                                                                     |
| Rural                             | 610 (1.81)          | 305 (1.78)      | 305 (1.88)                 | 0 (0.00)             | Reference                                             | Reference                                                           |
| Urban Non-teaching                | 2495 (7.39)         | 1275 (7.42)     | 1175 (7.25)                | 45 (11.39)           | 1.57 (0.73 – 3.37)                                    | 1.61 (0.83 – 3.11)                                                  |
| Urban Teaching                    | 30675 (90.81)       | 15600 (90.80)   | 14725 (90.87)              | 350 (88.61)          | Omitted                                               | Omitted                                                             |
| Hospital Region                   |                     |                 |                            |                      |                                                       |                                                                     |
| Northeast                         | 5635 (16.68)        | 2960 (17.23)    | 2610 (16.11)               | 65 (16.46)           |                                                       | Reference                                                           |
| Midwest                           | 6790 (20.10)        | 3430 (19.97)    | 3310 (20.43)               | 50 (12.66)           | 0.66 (0.24 – 1.81)                                    | 0.61 (0.23 – 1.60)                                                  |

|                               |               |               |               |             |                        |                        |
|-------------------------------|---------------|---------------|---------------|-------------|------------------------|------------------------|
| South                         | 13455 (39.83) | 6650 (38.71)  | 6605 (40.76)  | 200 (50.63) | 1.37 (0.59 – 3.19)     | 1.22 (0.54 – 2.74)     |
| West                          | 7900 (23.39)  | 4140 (24.10)  | 3680 (22.71)  | 80 (20.25)  | 0.88 (0.34 – 2.25)     | 0.87 (0.35 – 2.17)     |
| Charlson Index<br>Quartiles   |               |               |               |             |                        |                        |
| Quartile 1                    | 18295 (54.16) | 9530 (55.47)  | 8560 (52.82)  | 205 (51.90) | Reference              | Reference              |
| Quartile 2                    | 6635 (19.64)  | 3270 (19.03)  | 3290 (20.30)  | 75 (18.99)  | 1.07 (0.60 – 1.89)     | 0.95 (0.54 – 1.69)     |
| Quartile 3                    | 3885 (11.50)  | 1890 (11.00)  | 1945 (12.00)  | 50 (12.66)  | 1.23 (0.60 – 2.51)     | 1.07 (0.52 – 2.20)     |
| Quartile 4                    | 4965 (14.70)  | 2490 (14.49)  | 2410 (14.87)  | 65 (16.46)  | 1.21 (0.64 – 2.29)     | 1.13 (0.60 – 2.11)     |
| Hypertension                  | 25295 (74.88) | 12875 (74.94) | 12095 (74.64) | 325 (82.28) | 1.55 (0.92 – 2.63)     | 1.58 (0.94 – 2.65)     |
| Diabetes                      | 6335 (18.75)  | 3195 (18.60)  | 3040 (18.76)  | 100 (25.32) | 1.48 (0.89 – 2.47)     | 1.47 (0.88 – 2.44)     |
| Heart Failure                 | 3395 (10.05)  | 1630 (9.49)   | 1730 (10.68)  | 35 (8.86)   | 0.93 (0.42 – 2.05)     | 0.81 (0.37 – 1.78)     |
| Obesity                       | 4915 (14.55)  | 2415 (14.06)  | 2415 (14.90)  | 85 (21.52)  | 1.68 (0.98 – 2.85)     | 1.57 (0.93 – 2.63)     |
| Renal Failure                 | 2790 (8.26)   | 1370 (7.97)   | 1375 (8.49)   | 45 (11.39)  | 1.48 (0.73 – 3.03)     | 1.39 (0.68 – 2.82)     |
| APRDRG Severity of<br>Illness |               |               |               |             |                        |                        |
| Minor Loss of<br>Function     | 595 (1.76)    | 305 (1.78)    | 290 (1.79)    | 0 (0.00)    |                        |                        |
| Moderate Loss of<br>Function  | 2040 (6.04)   | 1055 (6.14)   | 985 (6.08)    | 0 (0.00)    |                        |                        |
| Major Loss of<br>Function     | 16635 (49.25) | 8670 (50.47)  | 7855 (48.47)  | 110 (27.85) |                        |                        |
| Extreme Loss of<br>Function   | 14510 (42.95) | 7150 (41.62)  | 7075 (43.66)  | 285 (72.15) |                        |                        |
| NIHSS Available               | 5425 (16.06)  | 2660 (15.48)  | 2720 (16.78)  | 45 (11.39)  | 0.70 (0.33 – 1.48)     | 0.64 (0.31 – 1.33)     |
| NIHSS, Mean (SD)              | 3 (0 – 17)    | 3 (0 – 16)    | 4 (0 – 19)    | 8 (6 – 21)  |                        |                        |
| Mortality                     | 6565 (19.44)  | 3210 (18.70)  | 3210 (19.81)  | 145 (36.71) | 2.52 (1.60 – 3.99) *** | 2.35 (1.48 – 3.72) *** |
| Home Discharge                | 12965 (47.67) | 6660 (47.71)  | 6185 (47.61)  | 120 (48.00) | 1.01 (0.57 – 1.79)     | 1.02 (0.57 – 1.80)     |
| Coiling                       | 11120 (32.92) | 5730 (33.35)  | 5270 (32.52)  | 120 (30.38) | 0.87 (0.54 – 1.41)     | 0.91 (0.56 – 1.46)     |
| Clipping                      | 3040 (9.00)   | 1680 (9.78)   | 1335 (8.24)   | 25 (6.33)   | 0.62 (0.25 – 1.56)     | 0.75 (0.30 – 1.88)     |

\* - p-value < 0.05; \*\* - p-value < 0.01; \*\*\* - p-value < 0.001