Racial Disparities in Utilization and Outcomes of Robotic-Assisted Colectomy Among Patients with Colon Cancer

Analysis for RCOP NIS Surgery21

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## Preamble:

* **Reference Papers:**
  + [Sheetz et al. 2019](https://jamanetwork.com/journals/jamasurgery/fullarticle/2752567)
  + [Salman et al. 2025](https://doi.org/10.1097/MCA.0000000000001479)
* **Study Objective**: To examine the association between patient race and the utilization of robotic-assisted colectomy (RAC) versus non-robotic approaches (laparoscopic or open) among adults undergoing elective colectomy for colon cancer in the United States, and to assess postoperative outcomes specifically among those who underwent robotic-assisted colectomy.
* **Data Source**: Cross-sectional analysis using the National Inpatient Sample (NIS) database from 2018 to 2020, a representative sample of all-payer inpatient hospitalizations in the U.S.
* **Patient Selection**: The study population included adult patients (aged 18 years or older) who were hospitalized with a diagnosis of colon cancer and underwent colectomy during an elective admission. Colon cancer was identified using ICD-10-CM codes (C18.0–C18.9), and colectomy procedures were identified using ICD-10-PCS codes. Surgical approach was classified as robotic-assisted, laparoscopic, or open, based on procedure codes. Patients with missing race/ethnicity information were excluded.
* **Outcomes of Interest**:
  + **Among all elective colectomy patients**:
    - Utilization of Robotic-Assisted Colectomy (vs non-robotic approach)
  + **Among robotic-assisted colectomy patients only**:
    - Length of Stay (LOS) in days
    - Inflation-adjusted Total Charges (converted to 2020 U.S. dollars using Consumer Price Index data)
    - Favorable Discharge (defined as discharge to home or with home health care)
    - Any Postoperative Complication — defined as the presence of one or more of the following:
      * Postoperative infection
      * Postoperative wound complications
      * Postoperative bleeding
      * Acute kidney injury
      * Postoperative ileus
      * Venous thromboembolism
      * Acute myocardial infarction
* **Statistical Analysis**: Univariable and multivariable analyses were conducted to assess the association between race and the outcomes of interest:
  + **Univariable Analysis:**
    - Continuous variables: Design-based Kruskal-Wallis test.
    - Categorical variables: Pearson’s X² test with Rao & Scott adjustment to account for survey design.
  + **Multivariable Analysis:**
    - Logistic regression for binary outcomes (e.g., robotic utilization, complications).
    - Linear regression for continuous outcomes (e.g., length of stay, total charges).
  + **Adjustments:** Models controlled for the following covariates:
    - **Demographics and Socioeconomic Factors**: Age, Sex, Race, Residential income, Expected primary payer.
    - **Clinical Factors:** A summary measure of comorbidity (Elixhauser comorbidity index).
    - **Hospital-Level Factors:** Hospital region, Hospital bedsize, Hospital location and teaching status.
* **Software:** All statistical analyses were performed using R Statistical Language (Version 4.5.0; R Foundation for Statistical Computing, Vienna, Austria), incorporating survey-weighted procedures via the *survey* package to account for the complex sampling design of NIS.

## Baseline Characteristics: All Elective Colectomy Patients with Colon Cancer:

| **Characteristic** | **Overall** N = 138,955*1* | **White** N = 105,320*1* | **Asian or Pacific Islander** N = 4,525*1* | **Black** N = 14,615*1* | **Hispanic** N = 10,440*1* | **Other** N = 4,055*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Age, y | 67 (13) | 68 (13) | 65 (13) | 63 (12) | 63 (13) | 64 (13) | <0.001 |
| Sex |  |  |  |  |  |  | 0.005 |
| Female | 69,410 (50%) | 52,450 (50%) | 2,100 (46%) | 7,700 (53%) | 5,110 (49%) | 2,050 (51%) |  |
| Male | 69,540 (50%) | 52,870 (50%) | 2,425 (54%) | 6,915 (47%) | 5,325 (51%) | 2,005 (49%) |  |
| Residential income |  |  |  |  |  |  | <0.001 |
| $1 - $51,999 | 33,735 (25%) | 22,455 (22%) | 445 (9.9%) | 6,755 (47%) | 3,195 (31%) | 885 (23%) |  |
| $52,000 - $65,999 | 36,450 (27%) | 29,030 (28%) | 685 (15%) | 3,200 (22%) | 2,715 (26%) | 820 (21%) |  |
| $66,000 - $87,999 | 34,495 (25%) | 27,045 (26%) | 1,155 (26%) | 2,700 (19%) | 2,575 (25%) | 1,020 (26%) |  |
| $88,000 or more | 32,440 (24%) | 25,500 (25%) | 2,190 (49%) | 1,765 (12%) | 1,785 (17%) | 1,200 (31%) |  |
| Expected primary payer |  |  |  |  |  |  | <0.001 |
| Private | 47,200 (34%) | 34,515 (33%) | 1,985 (44%) | 5,250 (36%) | 3,935 (38%) | 1,515 (37%) |  |
| Medicaid | 8,310 (6.0%) | 4,390 (4.2%) | 475 (10%) | 1,620 (11%) | 1,390 (13%) | 435 (11%) |  |
| Medicare | 78,745 (57%) | 63,555 (60%) | 1,895 (42%) | 6,995 (48%) | 4,445 (43%) | 1,855 (46%) |  |
| Other | 4,605 (3.3%) | 2,790 (2.7%) | 170 (3.8%) | 730 (5.0%) | 670 (6.4%) | 245 (6.0%) |  |
| Hospital region |  |  |  |  |  |  | <0.001 |
| Midwest | 31,420 (23%) | 27,320 (26%) | 355 (7.8%) | 2,615 (18%) | 635 (6.1%) | 495 (12%) |  |
| Northeast | 25,370 (18%) | 19,855 (19%) | 855 (19%) | 2,080 (14%) | 1,550 (15%) | 1,030 (25%) |  |
| South | 54,760 (39%) | 39,300 (37%) | 945 (21%) | 8,670 (59%) | 4,255 (41%) | 1,590 (39%) |  |
| West | 27,405 (20%) | 18,845 (18%) | 2,370 (52%) | 1,250 (8.6%) | 4,000 (38%) | 940 (23%) |  |
| Hospital bedsize |  |  |  |  |  |  | 0.11 |
| Large | 73,195 (53%) | 55,105 (52%) | 2,520 (56%) | 7,845 (54%) | 5,485 (53%) | 2,240 (55%) |  |
| Medium | 39,475 (28%) | 29,725 (28%) | 1,365 (30%) | 4,260 (29%) | 3,045 (29%) | 1,080 (27%) |  |
| Small | 26,285 (19%) | 20,490 (19%) | 640 (14%) | 2,510 (17%) | 1,910 (18%) | 735 (18%) |  |
| Hospital location and teaching status |  |  |  |  |  |  | <0.001 |
| Rural | 12,040 (8.7%) | 10,655 (10%) | 60 (1.3%) | 925 (6.3%) | 225 (2.2%) | 175 (4.3%) |  |
| Urban, non-teaching | 23,310 (17%) | 18,310 (17%) | 710 (16%) | 1,765 (12%) | 1,825 (17%) | 700 (17%) |  |
| Urban, teaching | 103,605 (75%) | 76,355 (72%) | 3,755 (83%) | 11,925 (82%) | 8,390 (80%) | 3,180 (78%) |  |
| Charlson Comorbidity Index | 3.89 (2.11) | 3.88 (2.11) | 3.90 (2.11) | 4.05 (2.17) | 3.76 (2.06) | 3.79 (2.06) | <0.001 |
| Metastatic Cancer | 31,170 (22%) | 23,185 (22%) | 1,210 (27%) | 3,545 (24%) | 2,250 (22%) | 980 (24%) | 0.001 |
| Diabetes Mellitus | 34,295 (25%) | 24,430 (23%) | 1,160 (26%) | 4,480 (31%) | 3,215 (31%) | 1,010 (25%) | <0.001 |
| Congestive Heart Failure | 11,080 (8.0%) | 9,030 (8.6%) | 180 (4.0%) | 1,165 (8.0%) | 490 (4.7%) | 215 (5.3%) | <0.001 |
| Chronic Pulmonary Disease | 21,415 (15%) | 17,445 (17%) | 365 (8.1%) | 1,990 (14%) | 1,105 (11%) | 510 (13%) | <0.001 |
| Renal Failure | 14,265 (10%) | 10,885 (10%) | 390 (8.6%) | 1,830 (13%) | 865 (8.3%) | 295 (7.3%) | <0.001 |
| Coagulopathy | 3,875 (2.8%) | 3,005 (2.9%) | 70 (1.5%) | 285 (2.0%) | 335 (3.2%) | 180 (4.4%) | <0.001 |
| Obesity | 27,205 (20%) | 20,415 (19%) | 360 (8.0%) | 3,555 (24%) | 2,210 (21%) | 665 (16%) | <0.001 |
| Hypertension | 82,510 (59%) | 61,880 (59%) | 2,465 (54%) | 10,285 (70%) | 5,790 (55%) | 2,090 (52%) | <0.001 |
| Liver Disease | 6,860 (4.9%) | 5,015 (4.8%) | 340 (7.5%) | 695 (4.8%) | 620 (5.9%) | 190 (4.7%) | <0.001 |
| Deficiency Anemia | 11,130 (8.0%) | 8,300 (7.9%) | 335 (7.4%) | 1,315 (9.0%) | 800 (7.7%) | 380 (9.4%) | 0.15 |
| Fluid and Electrolyte Disorders | 22,695 (16%) | 17,275 (16%) | 560 (12%) | 2,565 (18%) | 1,615 (15%) | 680 (17%) | 0.007 |
| Peripheral Vascular Disease | 7,175 (5.2%) | 5,770 (5.5%) | 205 (4.5%) | 665 (4.6%) | 395 (3.8%) | 140 (3.5%) | 0.001 |
| *1*Mean (SD); n (%) | | | | | | | |
| *2*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | | | | |

## Univariable Analysis:

### Outcomes Among All Elective Colectomy Patients:

| **Characteristic** | **Overall** N = 138,955*1* | **White** N = 105,320*1* | **Asian or Pacific Islander** N = 4,525*1* | **Black** N = 14,615*1* | **Hispanic** N = 10,440*1* | **Other** N = 4,055*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Route of Colectomy |  |  |  |  |  |  | <0.001 |
| Laparoscopic | 44,980 (32%) | 33,620 (32%) | 1,690 (37%) | 4,680 (32%) | 3,600 (34%) | 1,390 (34%) |  |
| Open | 64,085 (46%) | 49,180 (47%) | 1,800 (40%) | 6,920 (47%) | 4,475 (43%) | 1,710 (42%) |  |
| Robotic | 29,890 (22%) | 22,520 (21%) | 1,035 (23%) | 3,015 (21%) | 2,365 (23%) | 955 (24%) |  |
| *1*n (%) | | | | | | | |
| *2*Pearson's X^2: Rao & Scott adjustment | | | | | | | |

### Outcomes Among Robotic-Assisted Colectomy Patients Only:

| **Characteristic** | **Overall** N = 29,890*1* | **White** N = 22,520*1* | **Asian or Pacific Islander** N = 1,035*1* | **Black** N = 3,015*1* | **Hispanic** N = 2,365*1* | **Other** N = 955*1* | **p-value***2* |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Length of Stay (days) | 3.00 (2.00, 4.00) | 3.00 (2.00, 4.00) | 3.00 (2.00, 4.00) | 3.00 (2.00, 5.00) | 3.00 (2.00, 4.00) | 3.00 (2.00, 5.00) | 0.016 |
| Inflation-Adjusted Total Charges ($) | 80,777 (55,921, 122,360) | 78,828 (55,217, 116,965) | 80,966 (54,653, 129,704) | 78,536 (56,480, 128,010) | 103,408 (71,180, 144,613) | 90,512 (57,730, 141,844) | <0.001 |
| Favorable Discharge | 28,285 (95%) | 21,175 (94%) | 1,020 (99%) | 2,875 (95%) | 2,310 (98%) | 905 (95%) | <0.001 |
| Any Postoperative Complication | 2,520 (8.4%) | 1,880 (8.3%) | 55 (5.3%) | 380 (13%) | 155 (6.6%) | 50 (5.2%) | <0.001 |
| Postoperative Infection | 230 (0.8%) | 165 (0.7%) | 0 (0%) | 25 (0.8%) | 30 (1.3%) | 10 (1.0%) | 0.5 |
| Postoperative Wound Complication | 120 (0.4%) | 70 (0.3%) | 0 (0%) | 20 (0.7%) | 30 (1.3%) | 0 (0%) | 0.024 |
| Postoperative Bleeding | 345 (1.2%) | 245 (1.1%) | 5 (0.5%) | 55 (1.8%) | 35 (1.5%) | 5 (0.5%) | 0.3 |
| Acute Kidney Injury | 1,755 (5.9%) | 1,315 (5.8%) | 50 (4.8%) | 280 (9.3%) | 65 (2.7%) | 45 (4.7%) | <0.001 |
| Postoperative Ileus | 105 (0.4%) | 85 (0.4%) | 0 (0%) | 5 (0.2%) | 15 (0.6%) | 0 (0%) | 0.6 |
| Venous Thromboembolism | 255 (0.9%) | 215 (1.0%) | 0 (0%) | 25 (0.8%) | 10 (0.4%) | 5 (0.5%) | 0.5 |
| Acute Myocardial Infarction | 100 (0.3%) | 75 (0.3%) | 0 (0%) | 20 (0.7%) | 5 (0.2%) | 0 (0%) | 0.5 |
| *1*Median (Q1, Q3); n (%) | | | | | | | |
| *2*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | | | | |

## Multivariable Logistic Regression:

### Likelihood of Robotic Use (All Elective Colectomy Patients):

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 0.94 | 0.78, 1.13 | 0.5 |
| Black | 0.92 | 0.82, 1.03 | 0.14 |
| Hispanic | 0.98 | 0.86, 1.11 | 0.7 |
| Other | 1.06 | 0.89, 1.27 | 0.5 |
| Age, y | 0.99 | 0.99, 1.00 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.08 | 1.02, 1.15 | 0.008 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.96 | 0.88, 1.06 | 0.4 |
| $66,000 - $87,999 | 1.04 | 0.94, 1.14 | 0.5 |
| $88,000 or more | 1.13 | 1.01, 1.27 | 0.028 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 0.82 | 0.72, 0.95 | 0.006 |
| Medicare | 1.01 | 0.92, 1.10 | 0.8 |
| Other | 0.79 | 0.65, 0.95 | 0.013 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.88 | 0.73, 1.07 | 0.2 |
| South | 1.05 | 0.93, 1.20 | 0.4 |
| West | 1.09 | 0.94, 1.27 | 0.3 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.94 | 0.83, 1.05 | 0.3 |
| Small | 0.87 | 0.76, 1.00 | 0.043 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 2.48 | 1.90, 3.22 | <0.001 |
| Urban, teaching | 2.87 | 2.24, 3.68 | <0.001 |
| Elixhauser comorbidity index | 0.97 | 0.96, 0.99 | 0.003 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |

### Favorable Discharge (Robotic-Assisted Patients):

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 2.25 | 0.73, 6.87 | 0.2 |
| Black | 1.00 | 0.64, 1.55 | >0.9 |
| Hispanic | 1.61 | 0.86, 3.01 | 0.13 |
| Other | 0.84 | 0.42, 1.69 | 0.6 |
| Age, y | 0.93 | 0.91, 0.95 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.05 | 0.83, 1.35 | 0.7 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.17 | 0.85, 1.63 | 0.3 |
| $66,000 - $87,999 | 1.34 | 0.96, 1.88 | 0.082 |
| $88,000 or more | 1.43 | 0.98, 2.09 | 0.063 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 0.69 | 0.22, 2.15 | 0.5 |
| Medicare | 0.43 | 0.25, 0.72 | 0.001 |
| Other | 0.30 | 0.12, 0.79 | 0.014 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.19 | 0.80, 1.77 | 0.4 |
| South | 1.52 | 1.12, 2.07 | 0.007 |
| West | 1.85 | 1.26, 2.71 | 0.002 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.92 | 0.70, 1.22 | 0.6 |
| Small | 0.92 | 0.64, 1.33 | 0.7 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.78 | 0.40, 1.54 | 0.5 |
| Urban, teaching | 0.91 | 0.48, 1.70 | 0.8 |
| Elixhauser comorbidity index | 0.74 | 0.71, 0.78 | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |

### Any Postoperative Complication (Robotic-Assisted Patients):

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 0.89 | 0.47, 1.66 | 0.7 |
| Black | 1.78 | 1.33, 2.39 | <0.001 |
| Hispanic | 0.98 | 0.63, 1.51 | >0.9 |
| Other | 0.70 | 0.35, 1.38 | 0.3 |
| Age, y | 1.01 | 1.00, 1.02 | 0.033 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.44 | 1.19, 1.75 | <0.001 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.87 | 0.66, 1.17 | 0.4 |
| $66,000 - $87,999 | 1.20 | 0.90, 1.59 | 0.2 |
| $88,000 or more | 1.18 | 0.87, 1.59 | 0.3 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.35 | 0.77, 2.36 | 0.3 |
| Medicare | 1.16 | 0.87, 1.54 | 0.3 |
| Other | 1.05 | 0.53, 2.05 | 0.9 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.90 | 0.65, 1.25 | 0.5 |
| South | 0.85 | 0.65, 1.10 | 0.2 |
| West | 0.90 | 0.66, 1.23 | 0.5 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 1.01 | 0.80, 1.27 | >0.9 |
| Small | 1.00 | 0.75, 1.32 | >0.9 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.13 | 0.63, 2.02 | 0.7 |
| Urban, teaching | 1.04 | 0.60, 1.81 | 0.9 |
| Elixhauser comorbidity index | 1.44 | 1.38, 1.51 | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |

## Multivariable Linear Regression:

### Length of Stay (Robotic-Assisted Patients):

| **Characteristic** | **Beta** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | -0.16 | -0.45, 0.12 | 0.3 |
| Black | 0.70 | 0.20, 1.2 | 0.006 |
| Hispanic | 0.21 | -0.13, 0.56 | 0.2 |
| Other | 0.60 | -0.11, 1.3 | 0.10 |
| Age, y | 0.02 | 0.01, 0.03 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.32 | 0.12, 0.51 | 0.002 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 0.01 | -0.33, 0.35 | >0.9 |
| $66,000 - $87,999 | -0.27 | -0.59, 0.05 | 0.10 |
| $88,000 or more | -0.04 | -0.41, 0.33 | 0.8 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.0 | 0.35, 1.7 | 0.003 |
| Medicare | 0.18 | -0.10, 0.46 | 0.2 |
| Other | 0.65 | 0.06, 1.2 | 0.031 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.33 | -0.04, 0.70 | 0.085 |
| South | 0.14 | -0.18, 0.45 | 0.4 |
| West | -0.17 | -0.47, 0.14 | 0.3 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | -0.20 | -0.45, 0.06 | 0.13 |
| Small | -0.38 | -0.65, -0.11 | 0.005 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 0.24 | -0.24, 0.72 | 0.3 |
| Urban, teaching | 0.04 | -0.38, 0.46 | 0.8 |
| Elixhauser comorbidity index | 0.43 | 0.36, 0.50 | <0.001 |
| Abbreviation: CI = Confidence Interval | | | |

### Inflation-adjusted Total Charge (Robotic-Assisted Patients):

| **Characteristic** | **Beta** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | -4,428 | -15,473, 6,617 | 0.4 |
| Black | 9,240 | -727, 19,207 | 0.069 |
| Hispanic | 12,462 | 3,847, 21,077 | 0.005 |
| Other | 14,921 | 883, 28,960 | 0.037 |
| Age, y | -32 | -284, 220 | 0.8 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 7,176 | 3,105, 11,248 | <0.001 |
| Residential income |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | -1,164 | -8,183, 5,856 | 0.7 |
| $66,000 - $87,999 | -6,604 | -13,477, 268 | 0.060 |
| $88,000 or more | -211 | -8,386, 7,964 | >0.9 |
| Expected primary payer |  |  |  |
| Private | — | — |  |
| Medicaid | 15,391 | 1,503, 29,280 | 0.030 |
| Medicare | 4,667 | -1,421, 10,756 | 0.13 |
| Other | -2,426 | -13,496, 8,644 | 0.7 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 10,562 | 1,380, 19,745 | 0.024 |
| South | 22,533 | 15,416, 29,650 | <0.001 |
| West | 50,930 | 42,148, 59,711 | <0.001 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | -3,947 | -10,992, 3,097 | 0.3 |
| Small | -8,104 | -15,858, -350 | 0.041 |
| Hospital location and teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 41,349 | 28,051, 54,647 | <0.001 |
| Urban, teaching | 29,039 | 17,826, 40,251 | <0.001 |
| Elixhauser comorbidity index | 7,759 | 6,339, 9,179 | <0.001 |
| Abbreviation: CI = Confidence Interval | | | |