Predictors of Palliative Care in Colorectal Cancer Patients: A National Inpatient Sample Analysis

Analysis for RCOP NIS-Apr-IM12

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## Preamble:

* **Reference Papers:**
  + [Mojtahedi et al. 2021](https://pmc.ncbi.nlm.nih.gov/articles/PMC8496534/#s0002)
* **Study Objective**: To characterize the demographic, clinical, and hospital-level factors associated with utilization of palliative care among patients with colorectal cancer.
* **Data Source**: Cross-sectional analysis of the National Inpatient Sample (NIS) from 2018 to 2020. The NIS is part of the Healthcare Cost and Utilization Project (HCUP) and provides a stratified sample of inpatient discharges from U.S. community hospitals across all payers.
* **Cohort Definition:** Patients were included if they met the following criteria
  + Age ≥18 years
  + Diagnosis of colorectal cancer
  + Non-missing data for palliative care consultation status
* **Outcome of Interest:** Receipt of palliative care consultation, defined by ICD-10-CM code Z51.5 (“Encounter for palliative care”) in any diagnosis field.
* **Covariates for Adjustment:** All models adjusted for
  + **Demographic Factors:** Age, sex, race/ethnicity
  + **Socioeconomic Factors:** Primary payer, ZIP code–level income quartile
  + **Clinical Factors:** Elixhauser comorbidity index (aggregate score), APR-DRG risk of mortality
  + **Hospital-Level Factors:** Hospital region, bed size, teaching status, and urban/rural location
* **Statistical Methods:**
  + **Descriptive Analysis:**
    - Patient and hospital characteristics were compared between those who did and did not receive palliative care consultation.
    - Categorical variables: Compared using Pearson’s chi-square test with Rao & Scott adjustment
    - Continuous variables: Analyzed using the design-based Kruskal–Wallis test, a non-parametric alternative suitable for survey-weighted data
  + **Multivariable Analysis:**
    - Predictors of palliative care consultation were assessed using survey-weighted logistic regression with the quasibinomial family.
    - Results were reported as adjusted odds ratios (aORs) with 95% confidence intervals.
* **Software:** All statistical analyses were performed using the R Statistical Language (Version 4.5.0; R Foundation for Statistical Computing, Vienna, Austria), incorporating survey-weighted procedures via the *survey* package to account for the complex sampling design of NIS.

## Baseline Table:

| **Characteristic** | **Overall** N = 746,240*1* | **No** N = 670,335*1* | **Yes** N = 75,905*1* | **p-value***2* |
| --- | --- | --- | --- | --- |
| Age, y |  |  |  | <0.001 |
| <30 | 5,580 (0.7%) | 4,970 (0.7%) | 610 (0.8%) |  |
| >89 | 25,220 (3.4%) | 19,770 (2.9%) | 5,450 (7.2%) |  |
| 30-39 | 22,170 (3.0%) | 19,940 (3.0%) | 2,230 (2.9%) |  |
| 40-49 | 64,510 (8.6%) | 58,875 (8.8%) | 5,635 (7.4%) |  |
| 50-59 | 146,000 (20%) | 133,270 (20%) | 12,730 (17%) |  |
| 60-69 | 196,135 (26%) | 178,260 (27%) | 17,875 (24%) |  |
| 70-79 | 177,870 (24%) | 160,180 (24%) | 17,690 (23%) |  |
| 80-89 | 108,755 (15%) | 95,070 (14%) | 13,685 (18%) |  |
| Sex |  |  |  | <0.001 |
| Female | 345,695 (46%) | 309,240 (46%) | 36,455 (48%) |  |
| Male | 400,525 (54%) | 361,075 (54%) | 39,450 (52%) |  |
| Race |  |  |  | <0.001 |
| White | 510,820 (70%) | 461,270 (70%) | 49,550 (66%) |  |
| Asian or Pacific Islander | 26,235 (3.6%) | 23,400 (3.6%) | 2,835 (3.8%) |  |
| Black | 96,695 (13%) | 84,530 (13%) | 12,165 (16%) |  |
| Hispanic | 70,965 (9.7%) | 63,510 (9.7%) | 7,455 (10%) |  |
| Native American | 4,000 (0.5%) | 3,605 (0.6%) | 395 (0.5%) |  |
| Other | 20,590 (2.8%) | 18,470 (2.8%) | 2,120 (2.8%) |  |
| Insurance payer |  |  |  | <0.001 |
| Private | 238,460 (32%) | 219,145 (33%) | 19,315 (25%) |  |
| Medicaid | 83,535 (11%) | 74,065 (11%) | 9,470 (12%) |  |
| Medicare | 405,680 (54%) | 361,900 (54%) | 43,780 (58%) |  |
| Other | 17,770 (2.4%) | 14,535 (2.2%) | 3,235 (4.3%) |  |
| Income quartile |  |  |  | 0.13 |
| $1 - $51,999 | 206,025 (28%) | 184,950 (28%) | 21,075 (28%) |  |
| $52,000 - $65,999 | 195,345 (27%) | 176,135 (27%) | 19,210 (26%) |  |
| $66,000 - $87,999 | 175,985 (24%) | 157,810 (24%) | 18,175 (24%) |  |
| $88,000 or more | 156,545 (21%) | 140,400 (21%) | 16,145 (22%) |  |
| Hospital region |  |  |  | 0.028 |
| Midwest | 163,740 (22%) | 147,075 (22%) | 16,665 (22%) |  |
| Northeast | 139,250 (19%) | 124,305 (19%) | 14,945 (20%) |  |
| South | 296,070 (40%) | 267,000 (40%) | 29,070 (38%) |  |
| West | 147,180 (20%) | 131,955 (20%) | 15,225 (20%) |  |
| Hospital bedsize |  |  |  | >0.9 |
| Large | 392,670 (53%) | 352,635 (53%) | 40,035 (53%) |  |
| Medium | 209,890 (28%) | 188,545 (28%) | 21,345 (28%) |  |
| Small | 143,680 (19%) | 129,155 (19%) | 14,525 (19%) |  |
| Hospital location/teaching status |  |  |  | <0.001 |
| Rural | 60,345 (8.1%) | 55,610 (8.3%) | 4,735 (6.2%) |  |
| Urban, non-teaching | 126,950 (17%) | 114,910 (17%) | 12,040 (16%) |  |
| Urban, teaching | 558,945 (75%) | 499,815 (75%) | 59,130 (78%) |  |
| APR-DRG risk of mortality |  |  |  | <0.001 |
| Extreme | 89,180 (12%) | 64,660 (9.6%) | 24,520 (32%) |  |
| Major | 244,620 (33%) | 207,010 (31%) | 37,610 (50%) |  |
| Minor | 138,105 (19%) | 137,375 (20%) | 730 (1.0%) |  |
| Moderate | 274,330 (37%) | 261,290 (39%) | 13,040 (17%) |  |
| None specified | 5 (<0.1%) | 0 (0%) | 5 (<0.1%) |  |
| No. of comorbidities |  |  |  | <0.001 |
| No comorbidities | 695 (<0.1%) | 690 (0.1%) | 5 (<0.1%) |  |
| One comorbidity | 530 (<0.1%) | 510 (<0.1%) | 20 (<0.1%) |  |
| Two or more comorbidities | 745,015 (100%) | 669,135 (100%) | 75,880 (100%) |  |
| *1*n (%) | | | | |
| *2*Pearson's X^2: Rao & Scott adjustment | | | | |

## Multivariable logistic regression:

### Palliative care consultation:

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Age, y |  |  |  |
| <30 | — | — |  |
| >89 | 1.90 | 1.51, 2.39 | <0.001 |
| 30-39 | 0.97 | 0.77, 1.23 | 0.8 |
| 40-49 | 0.85 | 0.68, 1.05 | 0.14 |
| 50-59 | 0.82 | 0.66, 1.02 | 0.069 |
| 60-69 | 0.80 | 0.64, 0.99 | 0.040 |
| 70-79 | 0.82 | 0.66, 1.02 | 0.078 |
| 80-89 | 1.01 | 0.81, 1.25 | >0.9 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 0.86 | 0.83, 0.89 | <0.001 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 1.13 | 1.02, 1.26 | 0.020 |
| Black | 1.20 | 1.13, 1.27 | <0.001 |
| Hispanic | 1.11 | 1.03, 1.20 | 0.005 |
| Native American | 1.05 | 0.80, 1.36 | 0.7 |
| Other | 1.09 | 0.95, 1.26 | 0.2 |
| Insurance payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.13 | 1.06, 1.21 | <0.001 |
| Medicare | 0.87 | 0.82, 0.92 | <0.001 |
| Other | 2.26 | 2.01, 2.54 | <0.001 |
| Income quartile |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.00 | 0.95, 1.06 | >0.9 |
| $66,000 - $87,999 | 1.05 | 1.00, 1.11 | 0.065 |
| $88,000 or more | 1.05 | 0.99, 1.12 | 0.10 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 1.03 | 0.94, 1.12 | 0.6 |
| South | 0.97 | 0.91, 1.03 | 0.3 |
| West | 0.98 | 0.91, 1.05 | 0.5 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.98 | 0.93, 1.03 | 0.4 |
| Small | 0.98 | 0.91, 1.05 | 0.5 |
| Hospital location/teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.11 | 1.00, 1.22 | 0.046 |
| Urban, teaching | 1.28 | 1.18, 1.40 | <0.001 |
| APR-DRG risk of mortality |  |  |  |
| Extreme | — | — |  |
| Major | 0.48 | 0.46, 0.50 | <0.001 |
| Minor | 0.01 | 0.01, 0.02 | <0.001 |
| Moderate | 0.14 | 0.13, 0.14 | <0.001 |
| None specified | 32,140 | 4,518, 228,609 | <0.001 |
| Elixhauser comorbidity index | 1.02 | 1.01, 1.03 | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |