Patterns and Predictors of Palliative Care Use in Acute Heart Failure Hospitalizations

NIS Analysis for the RCOP Match Mentorship Program

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## Preamble:

* **Reference Studies:**
  + [Kavalieratos et al., 2017](https://doi.org/10.1016/j.jacc.2017.08.036)
  + [Webb et al., 2025](https://doi.org/10.1016/j.cardfail.2024.06.005)
* **Study Objective:** To characterize the demographic, clinical, and hospital-level factors associated with receipt of palliative care consultation among patients hospitalized with acute decompensated heart failure, using a nationally representative U.S. inpatient database.
* **Data Source:** Retrospective 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
  + Hospitalization flagged as involving acute decompensated heart failure, identified using ICD-10-CM diagnosis codes (principal diagnosis)
  + Non-missing data for palliative care consultation status
* **Outcome of Interest:** Receipt of palliative care consultation, defined by the presence of ICD-10-CM code Z51.5 (“Encounter for palliative care”) in any diagnosis position.
* **ICD-10 Code Definitions:**
  + **Heart Failure (inclusion diagnosis):**
    - ICD-10-CM:
      * I50.\* (Heart failure)
      * I0981, I110, I130, I132 (Hypertensive and rheumatic HF-related conditions)
      * I97130, I97131 (Postprocedural cardiac dysfunction)
      * O29121, O29122, O29123, O29129 (Pregnancy-related cardiac disease)
      * Z95811, Z95812 (Presence of heart assist devices or heart transplant status)
  + **Palliative Care Consultation:**
    - ICD-10-CM:
      * Z51.5\* (“Encounter for palliative care”)
* **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 = 3,655,265*1* | **No** N = 3,470,325*1* | **Yes** N = 184,940*1* | **p-value***2* |
| --- | --- | --- | --- | --- |
| Age, y | 71 (14) | 71 (14) | 78 (12) | <0.001 |
| Sex |  |  |  | <0.001 |
| Female | 1,727,015 (47%) | 1,633,885 (47%) | 93,130 (50%) |  |
| Male | 1,928,105 (53%) | 1,836,300 (53%) | 91,805 (50%) |  |
| Race |  |  |  | <0.001 |
| White | 2,324,455 (65%) | 2,187,070 (64%) | 137,385 (76%) |  |
| Asian or Pacific Islander | 78,725 (2.2%) | 75,105 (2.2%) | 3,620 (2.0%) |  |
| Black | 775,265 (22%) | 750,490 (22%) | 24,775 (14%) |  |
| Hispanic | 305,485 (8.5%) | 294,210 (8.6%) | 11,275 (6.2%) |  |
| Other | 101,805 (2.8%) | 97,755 (2.9%) | 4,050 (2.2%) |  |
| Insurance payer |  |  |  | <0.001 |
| Medicaid | 410,265 (11%) | 400,485 (12%) | 9,780 (5.3%) |  |
| Medicare | 2,639,675 (72%) | 2,488,140 (72%) | 151,535 (82%) |  |
| Other | 186,690 (5.1%) | 179,520 (5.2%) | 7,170 (3.9%) |  |
| Private | 415,065 (11%) | 398,775 (12%) | 16,290 (8.8%) |  |
| Income quartile |  |  |  | <0.001 |
| $1 - $51,999 | 1,215,355 (34%) | 1,168,280 (34%) | 47,075 (26%) |  |
| $52,000 - $65,999 | 966,405 (27%) | 916,690 (27%) | 49,715 (27%) |  |
| $66,000 - $87,999 | 802,395 (22%) | 756,280 (22%) | 46,115 (25%) |  |
| $88,000 or more | 604,945 (17%) | 565,400 (17%) | 39,545 (22%) |  |
| Hospital region |  |  |  | <0.001 |
| Midwest | 840,355 (23%) | 791,720 (23%) | 48,635 (26%) |  |
| Northeast | 666,465 (18%) | 631,385 (18%) | 35,080 (19%) |  |
| South | 1,512,105 (41%) | 1,444,260 (42%) | 67,845 (37%) |  |
| West | 636,340 (17%) | 602,960 (17%) | 33,380 (18%) |  |
| Hospital bedsize |  |  |  | <0.001 |
| Large | 1,721,030 (47%) | 1,626,425 (47%) | 94,605 (51%) |  |
| Medium | 1,080,100 (30%) | 1,027,075 (30%) | 53,025 (29%) |  |
| Small | 854,135 (23%) | 816,825 (24%) | 37,310 (20%) |  |
| Hospital location/teaching status |  |  |  | <0.001 |
| Rural | 378,755 (10%) | 364,930 (11%) | 13,825 (7.5%) |  |
| Urban, non-teaching | 739,455 (20%) | 706,870 (20%) | 32,585 (18%) |  |
| Urban, teaching | 2,537,055 (69%) | 2,398,525 (69%) | 138,530 (75%) |  |
| APR-DRG risk of mortality |  |  |  | <0.001 |
| Extreme | 729,665 (20%) | 643,515 (19%) | 86,150 (47%) |  |
| Major | 1,629,075 (45%) | 1,552,005 (45%) | 77,070 (42%) |  |
| Minor | 256,475 (7.0%) | 255,055 (7.3%) | 1,420 (0.8%) |  |
| Moderate | 1,040,050 (28%) | 1,019,750 (29%) | 20,300 (11%) |  |
| No. of comorbidities |  |  |  | <0.001 |
| No comorbidities | 10 (<0.1%) | 10 (<0.1%) | 0 (0%) |  |
| One comorbidity | 319,740 (8.7%) | 309,140 (8.9%) | 10,600 (5.7%) |  |
| Two or more comorbidities | 3,335,515 (91%) | 3,161,175 (91%) | 174,340 (94%) |  |
| *1*Mean (SD); n (%) | | | | |
| *2*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | |

## Multivariable logistic regression:

### Palliative care consultation:

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Age, y | 1.05 | 1.05, 1.05 | <0.001 |
| Sex |  |  |  |
| Female | — | — |  |
| Male | 1.02 | 0.99, 1.04 | 0.2 |
| Race |  |  |  |
| White | — | — |  |
| Asian or Pacific Islander | 0.74 | 0.68, 0.80 | <0.001 |
| Black | 0.83 | 0.80, 0.87 | <0.001 |
| Hispanic | 0.76 | 0.72, 0.81 | <0.001 |
| Other | 0.78 | 0.72, 0.85 | <0.001 |
| Insurance payer |  |  |  |
| Medicaid | — | — |  |
| Medicare | 0.72 | 0.67, 0.76 | <0.001 |
| Other | 1.15 | 1.05, 1.26 | 0.002 |
| Private | 0.94 | 0.88, 1.01 | 0.10 |
| Income quartile |  |  |  |
| $1 - $51,999 | — | — |  |
| $52,000 - $65,999 | 1.13 | 1.09, 1.17 | <0.001 |
| $66,000 - $87,999 | 1.14 | 1.10, 1.19 | <0.001 |
| $88,000 or more | 1.18 | 1.13, 1.24 | <0.001 |
| Hospital region |  |  |  |
| Midwest | — | — |  |
| Northeast | 0.88 | 0.82, 0.95 | <0.001 |
| South | 0.93 | 0.88, 0.99 | 0.016 |
| West | 0.91 | 0.85, 0.97 | 0.002 |
| Hospital bedsize |  |  |  |
| Large | — | — |  |
| Medium | 0.85 | 0.80, 0.89 | <0.001 |
| Small | 0.74 | 0.70, 0.78 | <0.001 |
| Hospital location/teaching status |  |  |  |
| Rural | — | — |  |
| Urban, non-teaching | 1.11 | 1.01, 1.22 | 0.023 |
| Urban, teaching | 1.48 | 1.36, 1.61 | <0.001 |
| APR-DRG risk of mortality |  |  |  |
| Extreme | — | — |  |
| Major | 0.40 | 0.39, 0.41 | <0.001 |
| Minor | 0.09 | 0.08, 0.11 | <0.001 |
| Moderate | 0.18 | 0.17, 0.19 | <0.001 |
| Elixhauser comorbidity index | 1.10 | 1.09, 1.11 | <0.001 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |