Burden and predictors of 30-day readmission in patients with aortic dissection

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## Preamble:

* **Reference Studies:**
  + [Carroll et al., 2023](https://pubmed.ncbi.nlm.nih.gov/31839347/)
* **Study Objective:**
* To identify patient- and hospital-level predictors of 30-day all-cause hospital readmission among adults hospitalized for aortic dissection using a nationally representative dataset. This study also evaluates the clinical and economic burden of readmission in this high-risk population, including its associations with in-hospital mortality, length of stay (LOS), and hospital charges.
* **Data Source:**
* A retrospective cohort study using the 2016–2017 Nationwide Readmissions Database (NRD), developed by the Healthcare Cost and Utilization Project (HCUP). The NRD enables tracking of individual patients across hospitalizations within a given year via synthetic identifiers, capturing discharges from U.S. community hospitals and supporting survey-weighted national estimates through complex sampling design.
* **Cohort Definition:**
* Index hospitalizations were included if they met all of the following criteria:
  + Adults aged ≥18 years
  + Principal diagnosis of thoracic or thoracoabdominal aortic dissection, identified using ICD-10-CM codes: I7101 and I7103
  + Non-elective admission
  + Index discharge by the end of November to allow for a complete 30-day follow-up period
  + Complete data on NRD\_DAYSTOEVENT, required to compute discharge dates
* **Outcomes of Interest:**
  + Primary Outcomes:
    - Predictors of 30-day readmission
  + Secondary Outcomes:
    - In-hospital mortality (binary)
    - Length of stay (LOS, in days)
    - Total hospitalization charges (inflation-adjusted to 2017 USD)
* **Outcome Definitions:**
  + Readmission:
    - Defined using NRD’s linkage variables. Readmissions were identified only among patients with qualifying index events.
    - Trauma-related hospitalizations were excluded only from the readmission pool to avoid injury-related returns unrelated to aortic dissection care.
* **Covariates:**
  + Demographic & Socioeconomic Factors:
    - Age (categorized: 18–49, 50–64, 65–79, 80+)
    - Sex (FEMALE; ref = Male)
    - Primary expected payer (PAY1; Medicare, Medicaid, Private, Other)
    - ZIP-based median income quartile
  + Clinical Characteristics:
    - Hypertension
    - Diabetes
    - Hyperlipidemia
    - Chronic Kidney Disease
    - Congestive heart failure
    - Valvular disease
    - Chronic pulmonary disease
    - Renal failure
    - Coagulopathy
    - Obesity
    - Fluid and electrolyte imbalance
    - Drug abuse
  + Hospital Characteristics:
    - Hospital bed size (Small, Medium, Large)
    - Admission day (Weekend vs Weekday)
  + Disposition and Severity:
    - Discharge disposition
    - Number of comorbidities
* **Statistical Methods:**
  + Survey Design and Weighting:
    - All analyses incorporated NRD’s complex sampling design via the survey and srvyr packages.
  + Descriptive Statistics:
    - Weighted baseline characteristics of index hospitalizations were summarized and stratified by 30-day readmission status to compare patients who were readmitted versus those who were not.
    - Stratification was performed using a derived binary variable, which categorized patients as:
      * With 30-day readmission
      * Without readmission
    - P-values from statistical tests (Rao–Scott adjusted chi-square for categorical variables; Kruskal–Wallis test for continuous variables).
  + Multivariable Regression:
    - A survey-weighted logistic regression modeled predictors of 30-day readmission.
    - The model included demographic, clinical, hospital-level, and index-stay factors.
    - Results were exponentiated to yield odds ratios (ORs) with 95% confidence intervals.
  + The ten most common principle diagnoses for readmission were reported according to decreasing prevalence
* **Software:** All analyses were conducted in R Statistical Language (Version 4.5.0; R Foundation for Statistical Computing, Vienna, Austria).

## Descriptive Statistics:

### Readmission Rate:

Index hospitalizations resulted in:

1. Readmission (n): 3156
2. Readmission Rate (%): 11.92%
3. Readmission Rate (95% CI): 11.31% to 12.53%

### In-Hospital Mortality by Readmission Status:

Index hospitalizations resulted in:

1. Deaths (n): 3360
2. Death Rate (%): 12.7%
3. Death Rate (95% CI): 11.93% to 13.47%

Readmission hospitalizations resulted in:

1. Deaths (n): 89
2. Death Rate (%): 2.86%
3. Death Rate (95% CI): 2.02% to 3.71%

### LOS and Cost by Readmission Status:

Index hospitalizations resulted in:

1. Mean Length of Stay (days): 9.53
2. Mean Length of Stay (95% CI): 9.26 to 9.8
3. Mean Charge ($): 231509
4. Mean Charge (95% CI): 217524 to 245494

Readmission hospitalizations resulted in:

1. Mean Length of Stay (days): 6.21
2. Mean Length of Stay (95% CI): 5.81 to 6.6
3. Mean Charge ($): 98918
4. Mean Charge (95% CI): 89158 to 108679

## Baseline Characteristics

| **Characteristic** | **Overall** N = 26,477*1* | **Without Readmission** N = 23,321*1* | **With 30-day readmission** N = 3,157*1* | **p-value***2* |
| --- | --- | --- | --- | --- |
| Age (years) | 64 (15) | 64 (15) | 62 (14) | 0.003 |
| Sex |  |  |  | 0.3 |
| Male | 16,556 (63%) | 14,546 (62%) | 2,010 (64%) |  |
| Female | 9,921 (37%) | 8,775 (38%) | 1,147 (36%) |  |
| Primary Expected Payer |  |  |  | 0.008 |
| Private | 7,127 (27%) | 6,355 (27%) | 773 (25%) |  |
| Medicaid | 3,336 (13%) | 2,861 (12%) | 476 (15%) |  |
| Medicare | 13,451 (51%) | 11,867 (51%) | 1,584 (50%) |  |
| Other | 2,507 (9.5%) | 2,192 (9.4%) | 314 (10.0%) |  |
| Median Household Income Quartile |  |  |  | 0.2 |
| 0-25th percentile | 7,925 (30%) | 6,913 (30%) | 1,012 (33%) |  |
| 26th to 50th percentile | 6,814 (26%) | 6,009 (26%) | 805 (26%) |  |
| 51st to 75th percentile | 6,345 (24%) | 5,605 (24%) | 741 (24%) |  |
| 76th to 100th percentile | 4,964 (19%) | 4,410 (19%) | 554 (18%) |  |
| Admission Day |  |  |  | 0.091 |
| Monday-Friday | 20,380 (77%) | 18,003 (77%) | 2,377 (75%) |  |
| Saturday-Sunday | 6,097 (23%) | 5,317 (23%) | 780 (25%) |  |
| Hospital Bed Size |  |  |  | 0.5 |
| Small | 1,297 (4.9%) | 1,124 (4.8%) | 173 (5.5%) |  |
| Large | 20,570 (78%) | 18,115 (78%) | 2,455 (78%) |  |
| Medium | 4,610 (17%) | 4,082 (18%) | 528 (17%) |  |
| Number of comorbidities |  |  |  | <0.001 |
| One comorbidity | 9,517 (36%) | 8,503 (36%) | 1,015 (32%) |  |
| Two or more comorbidities | 16,960 (64%) | 14,818 (64%) | 2,142 (68%) |  |
| Congestive heart failure | 2,417 (9.1%) | 2,118 (9.1%) | 299 (9.5%) | 0.6 |
| Valvular Disease | 5,730 (22%) | 5,076 (22%) | 655 (21%) | 0.4 |
| Coagulopathy | 6,064 (23%) | 5,361 (23%) | 703 (22%) | 0.5 |
| Obesity | 4,664 (18%) | 4,081 (17%) | 583 (18%) | 0.4 |
| Fluid and electrolyte disorders | 10,835 (41%) | 9,544 (41%) | 1,291 (41%) | >0.9 |
| Chronic pulmonary disease | 5,642 (21%) | 4,842 (21%) | 801 (25%) | <0.001 |
| Renal failure | 5,493 (21%) | 4,690 (20%) | 803 (25%) | <0.001 |
| Hypertension | 21,573 (81%) | 18,969 (81%) | 2,604 (82%) | 0.3 |
| Diabetes | 3,081 (12%) | 2,677 (11%) | 404 (13%) | 0.15 |
| Hyperlipidemia | 10,215 (39%) | 9,000 (39%) | 1,215 (38%) | >0.9 |
| Drug abuse | 1,828 (6.9%) | 1,558 (6.7%) | 270 (8.5%) | 0.005 |
| *1*Mean (SD); n (%) | | | | |
| *2*Design-based KruskalWallis test; Pearson's X^2: Rao & Scott adjustment | | | | |

## Multivariable Regression

### 30-Day Readmission:

| **Characteristic** | **OR** | **95% CI** | **p-value** |
| --- | --- | --- | --- |
| Age (years) | 0.99 | 0.99, 1.00 | 0.002 |
| Sex |  |  |  |
| Male | — | — |  |
| Female | 0.96 | 0.85, 1.08 | 0.5 |
| Primary Expected Payer |  |  |  |
| Private | — | — |  |
| Medicaid | 1.23 | 1.02, 1.49 | 0.029 |
| Medicare | 1.20 | 1.01, 1.43 | 0.042 |
| Other | 1.09 | 0.88, 1.34 | 0.4 |
| Median Household Income Quartile |  |  |  |
| 0-25th percentile | — | — |  |
| 26th to 50th percentile | 0.96 | 0.82, 1.11 | 0.6 |
| 51st to 75th percentile | 0.98 | 0.84, 1.13 | 0.7 |
| 76th to 100th percentile | 0.95 | 0.82, 1.12 | 0.6 |
| Admission Day |  |  |  |
| Monday-Friday | — | — |  |
| Saturday-Sunday | 1.10 | 0.97, 1.25 | 0.13 |
| Hospital Bed Size |  |  |  |
| Small | — | — |  |
| Large | 0.87 | 0.66, 1.14 | 0.3 |
| Medium | 0.85 | 0.63, 1.14 | 0.3 |
| Congestive heart failure |  |  |  |
| No | — | — |  |
| Yes | 1.00 | 0.83, 1.21 | >0.9 |
| Valvular Disease |  |  |  |
| No | — | — |  |
| Yes | 0.94 | 0.81, 1.09 | 0.4 |
| Coagulopathy |  |  |  |
| No | — | — |  |
| Yes | 0.95 | 0.83, 1.09 | 0.5 |
| Obesity |  |  |  |
| No | — | — |  |
| Yes | 0.99 | 0.85, 1.15 | 0.9 |
| Fluid and electrolyte disorders |  |  |  |
| No | — | — |  |
| Yes | 0.95 | 0.85, 1.06 | 0.4 |
| Chronic pulmonary disease |  |  |  |
| No | — | — |  |
| Yes | 1.29 | 1.12, 1.48 | <0.001 |
| Renal failure |  |  |  |
| No | — | — |  |
| Yes | 1.36 | 1.18, 1.56 | <0.001 |
| Hypertension |  |  |  |
| No | — | — |  |
| Yes | 1.06 | 0.92, 1.22 | 0.4 |
| Diabetes |  |  |  |
| No | — | — |  |
| Yes | 1.13 | 0.95, 1.34 | 0.2 |
| Hyperlipidemia |  |  |  |
| No | — | — |  |
| Yes | 1.00 | 0.89, 1.13 | >0.9 |
| Drug abuse |  |  |  |
| No | — | — |  |
| Yes | 1.13 | 0.93, 1.37 | 0.2 |
| Abbreviations: CI = Confidence Interval, OR = Odds Ratio | | | |