Variation in Quality by Hospital Characteristics: True or False?

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Eric Schone

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Quality Indicators Overview

- The AHRQ QI are a set of more than 90 quantitative indicators of health care quality
- The area level indicators characterize quality of care for ambulatory care sensitive conditions by portion of the country, e.g., by county
- The provider level indicators characterize quality of hospital care
- The indicators are calculated using hospital inpatient administrative data
- See www.qualityindicators.ahrq.gov

Four Modules

- **Prevention Quality Indicators (PQI)**
  - Potentially avoidable hospital admissions – by area
- **Inpatient Quality Indicators (IQI)**
  - Reflect care inside hospitals and by area
  - Mortality for medical conditions and surgical procedures
- **Patient Safety Indicators (PSI)**
  - Reflect care inside the hospital
  - Potentially avoidable complications and iatrogenic events
- **Pediatric Quality Indicators (PDI)**
  - Reflect care inside the hospital and by area
  - Specific to children and neonates

Software Updates and QI Types

- **Software updated frequently**
  - Fiscal year coding updates
  - Changes to reference population
  - Changes to numerator and denominator
  - Changes to statistical methods
  - Currently Version 4.5
- **Three types of indicators**
  - Count and Volume Indicators
  - Area-Level Rate Indicators
  - Provider- (Hospital-) Level Rate Indicators

Focus on Provider-Level Rate Indicators

- **Numerator is count of records that match QI specification**
  - **E.g., hip replacement mortality rate; pressure ulcer rate**
- **Denominator is count of persons at risk in the <u>hospital</u>**
  - **E.g., persons who had hip replacement surgery**

Provider-Level Rate Indicators - Methods

- Risk adjusted using several types of covariates (customized model for each QI)
- Outcome or risk factor might be present on admission (POA); POA sometimes missing and imputed
- Smooth rates using shrinkage estimator
  - Weighted average of risk-adjusted rate from hospital and nationwide reference population rate
  - Weights are calculated using signal variance and noise variance

Hospital Characteristics and Hospital Indicators

- Indicators of hospital quality are used in a number of high-profile, high-stakes programs to compare hospital quality on a national scale across a variety of hospital types.
- The use of the indicators in comparative reporting has been critiqued in the popular press and academic literature.
  - Use of administrative data
  - Quality indicator specifications
  - Methods used to calculate the rates

Example of the Critique – Teaching Status

- Rates for many indicators differ on average between hospitals that provide medical education and those that do not.
- Critics argue that teaching hospital rates for some measures differ for reasons not related to quality.
- What can explain differences in rates by teaching status?
  - Differences in coding, data sources, and so on
  - Unaccounted for differences in patient risk
  - Relationship with volume
  - Quality

Exploratory Data Analysis: Data

- **Research focused on IQI, PSI, and PDI individual and composite measures**
- **Data source – State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality**
- **12 states*, ~ 1,500 hospitals**
- **All inpatient hospital discharges for 2009 and 2010**
- **Hospital characteristics – American Hospital Association (AHA) 2010**
- **AHRQ QI software v4.4**

* We would like to thank the HCUP Partners from the following states: AR, AZ, CA, FL, IA, KY, MA, MD, NE, NJ, NY, WA (http://www.hcup-us.ahrq.gov/partners.jsp)

Exploratory Data Analysis: Hospital Characteristics

- **Structural characteristics**
  - Bed size
  - Teaching status
- **Aggregate patient characteristics**
  - DSH status
  - Race
- **Market characteristics**
  - Urban
  - Median income

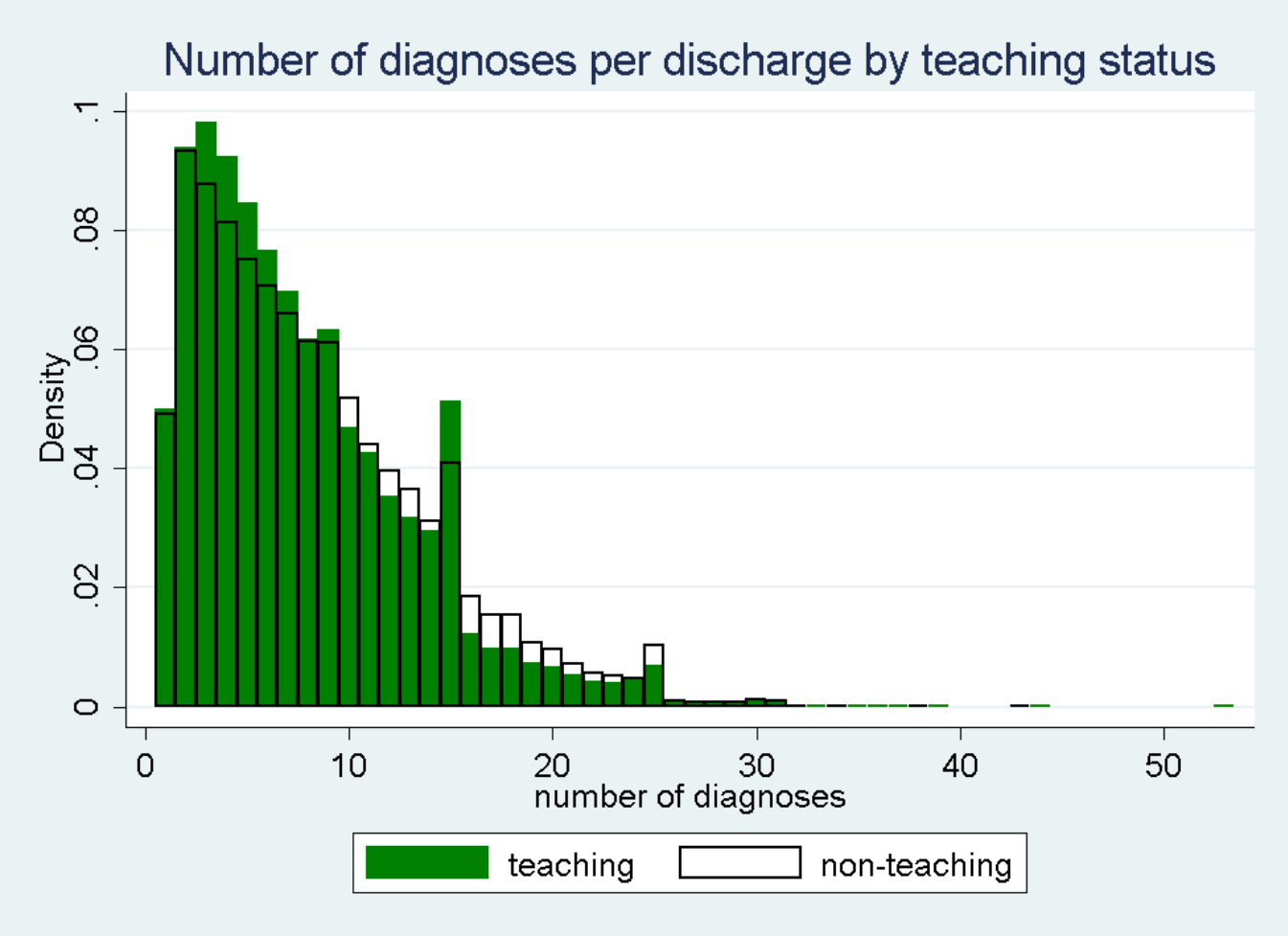
Exploratory Data Analysis: Methods

- **Analysis of differences by hospital characteristics**
  - Comparison of means and overall distribution
  - In raw, risk-adjusted, and smoothed rates
  - In coding frequencies
  - In risk
- **Differences in relation to volume**
  - Reliability weights
  - Classification and Regression Tree (CART)
  - Multivariate regression

Differences by Teaching Status: Examples

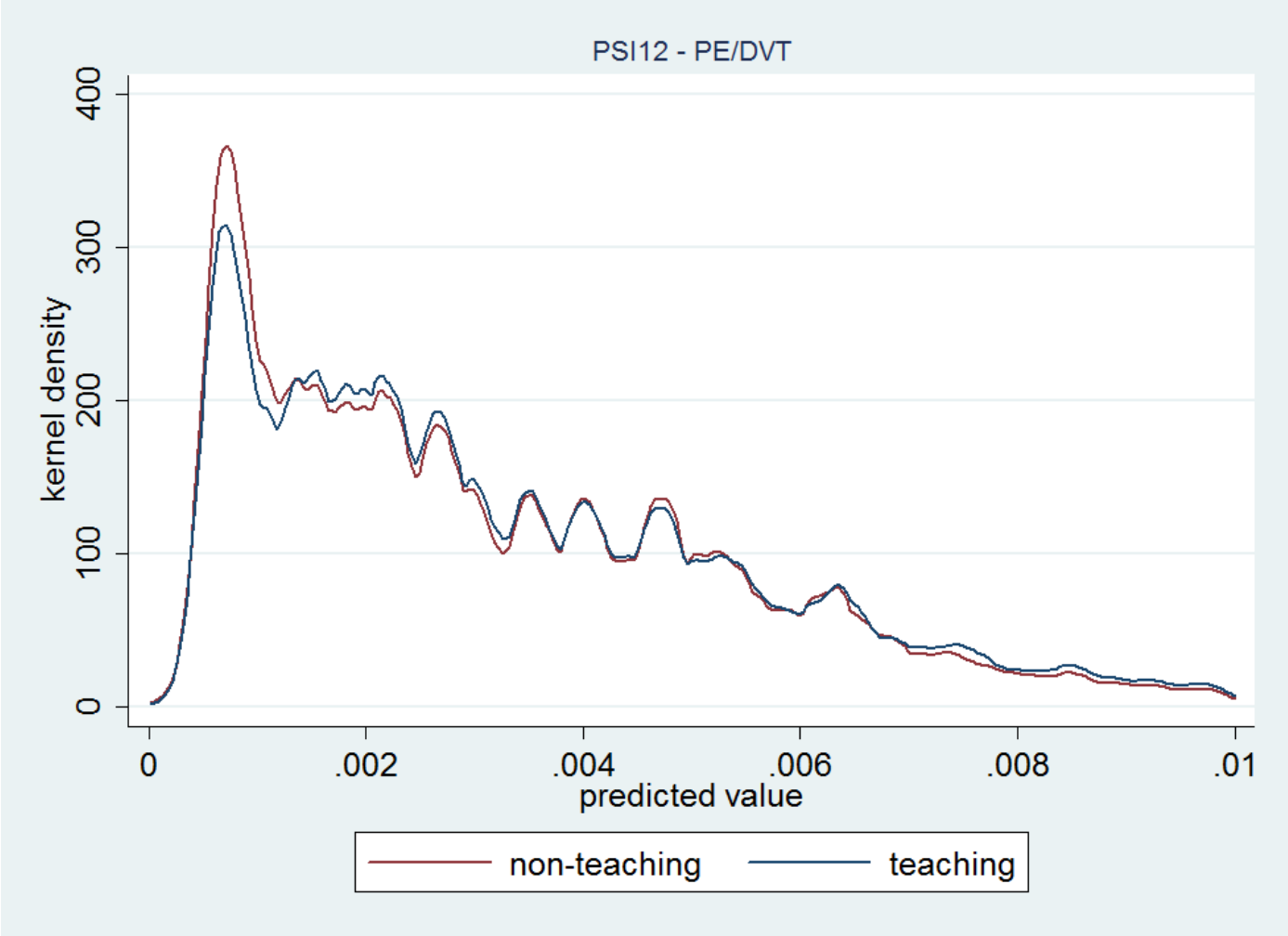
- **PSI 12: Post-operative Pulmonary Embolism/Deep Vein Thrombosis**
  - **Risk-adjusted and smoothed rates of teaching hospitals significantly worse than those of non-teaching hospitals, raw rates no different**
- **IQI 20: Pneumonia mortality**
  - **Risk-adjusted and smoothed rates of teaching hospitals significantly better than those of non-teaching hospitals, raw rates no different**

Do Teaching Hospitals List More Codes on Administrative Data Sources?



Source: HCUP, SID 2009–2010, AHA 2010.

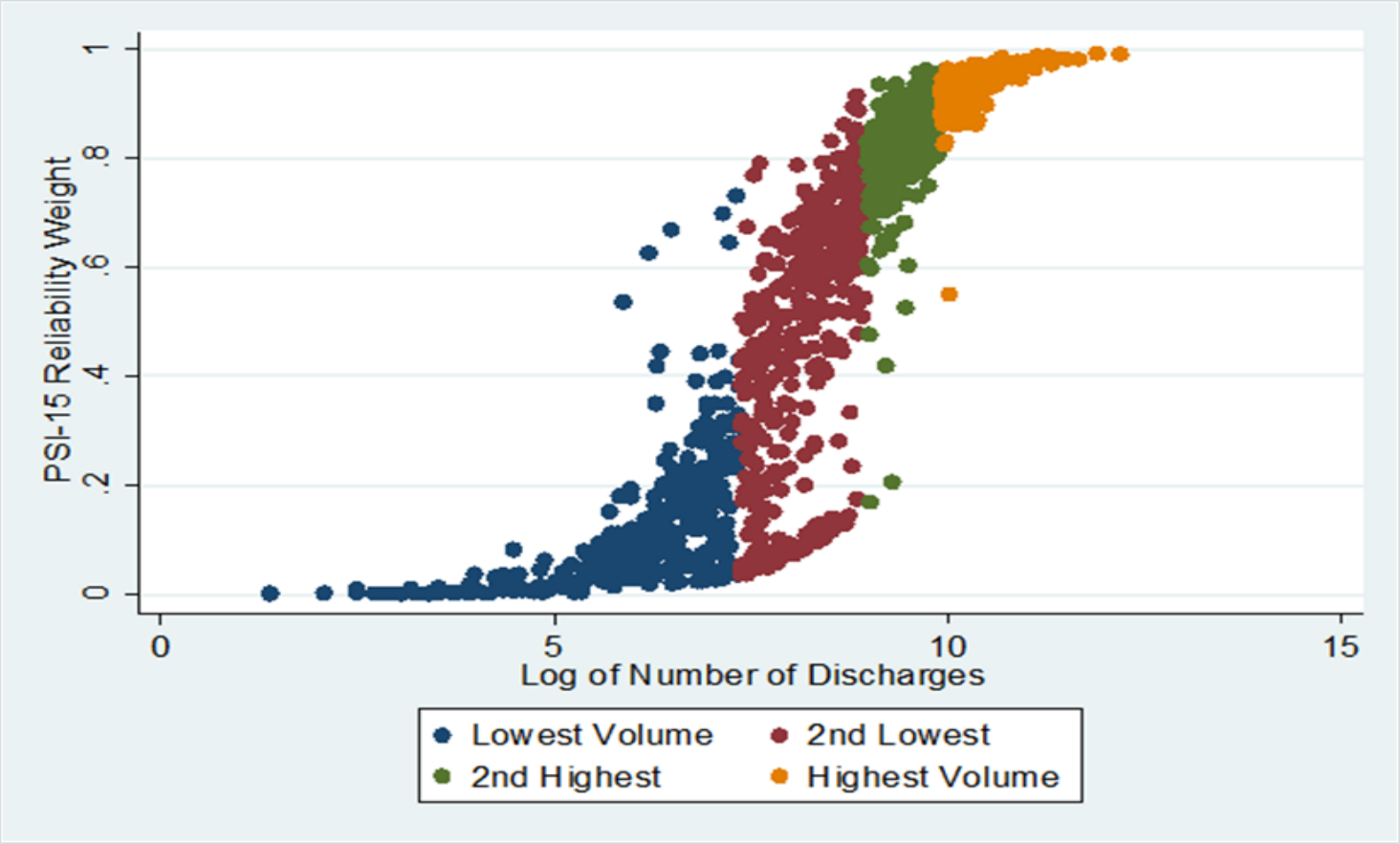
Do Teaching Hospitals Have Riskier Patients?



Source: HCUP, SID 2009–2010, AHA 2010.

What Is the Relationship Between Volume and QI Rates?

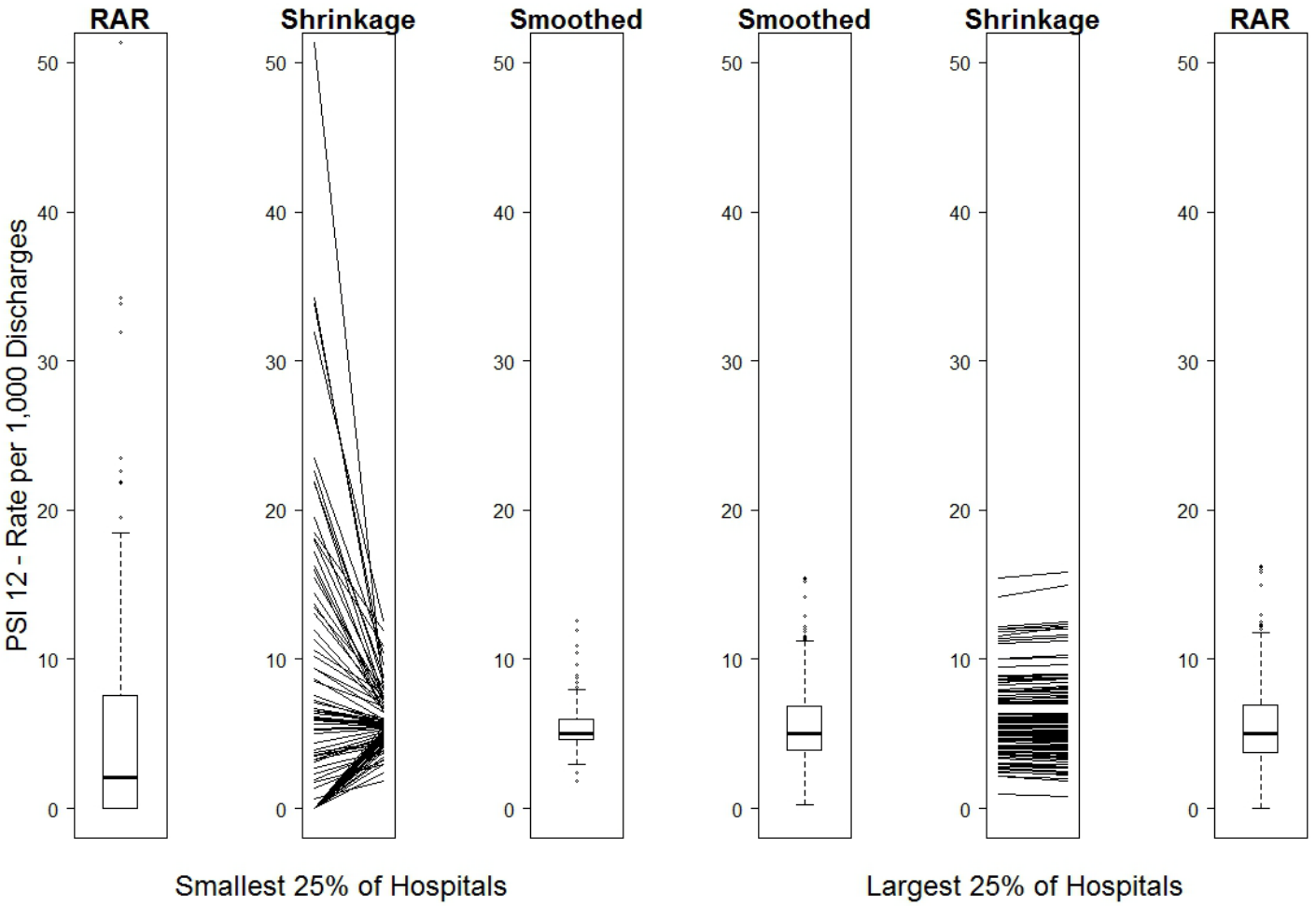
Relationship with Volume: Reliability Weights



Source: HCUP, SID 2009–2010, AHA 2010.

What Is the Relationship Between Volume and QI Rates?

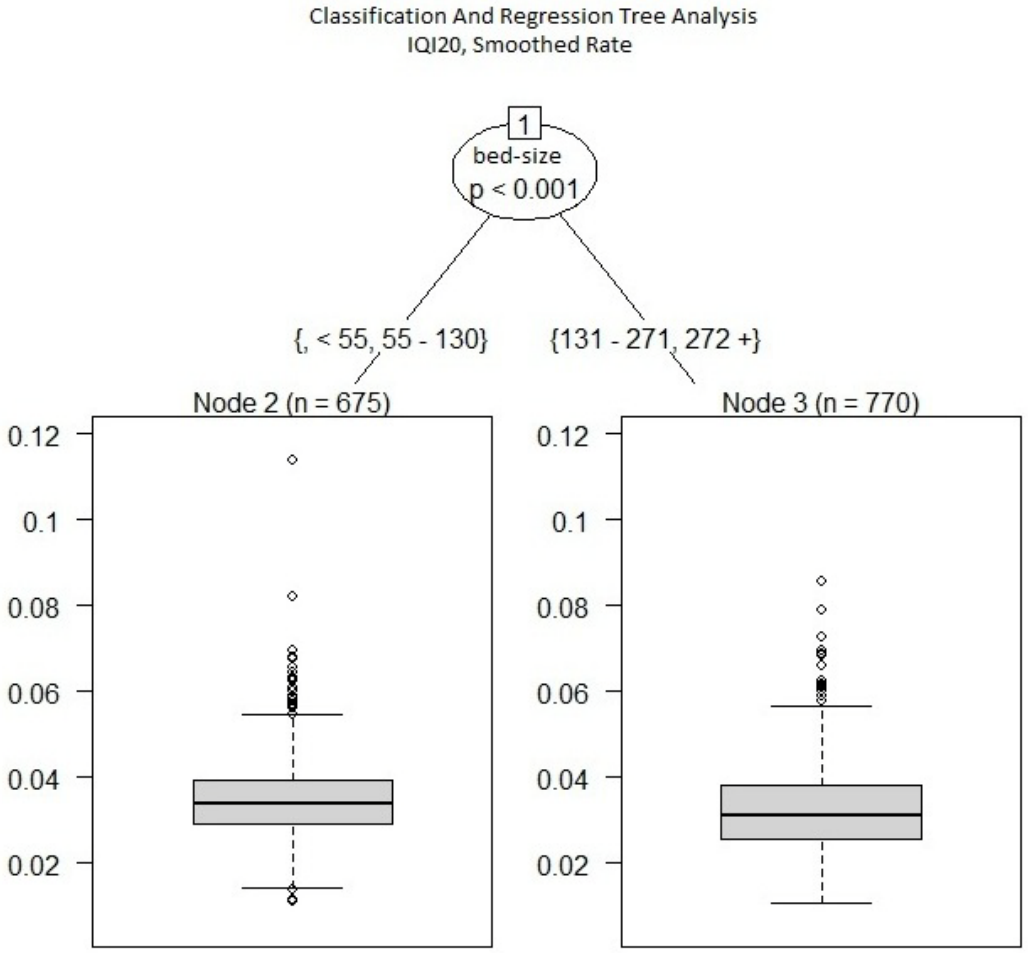
- **Degree of smoothing, by hospital size**



Source: HCUP, SID 2009–2010, AHA 2010.

What Is the Relationship Between Volume and QI Rates?

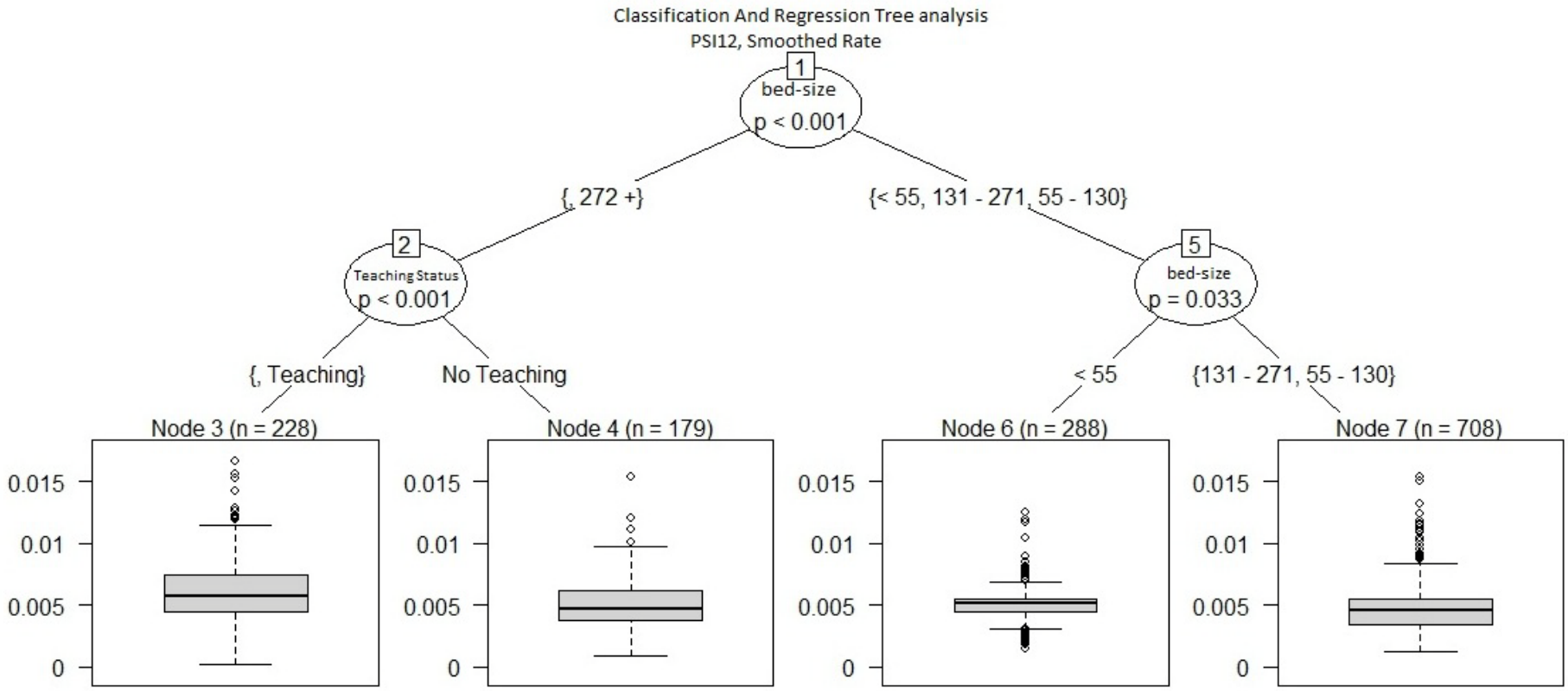
- **Rates grouped by bed size in CART analysis**



Source: HCUP, SID 2009–2010, AHA 2010.

What Is the Relationship Between Volume and QI Rates?

- **Rates by teaching status, stratified by volume**



Source: HCUP, SID 2009–2010, AHA 2010.

What Is the Relationship Between Volume and QI Rates?

- **Multivariate model with bed size and teaching status**

Hospital Characteristic	IQI 20 – Coefficients (standard errors)	PSI 12 – Coefficients (standard errors)
Bed Size (< 55 omitted)		
55 to 130	- 0.11 (0.08)	- 0.39 (0.15) **
131 to 271	- 0.35 (0.09) ***	0.38 (0.16) **
272 or more	- 0.21 (0.08) ***	- 0.43 (0.15) ***
Teaching Hospital	- 0.06 (0.08)	0.51 (0.14) ***

* Significantly different from zero at the 0.10 level, two-tailed test.
** Significantly different from zero at the 0.05 level, two-tailed test.
*** Significantly different from zero at the 0.01 level, two-tailed test.
Source: HCUP, SID 2009–2010, AHA 2010.

Quality

- It is difficult to distinguish other factors that influence variation by teaching status versus variation due to factors we seek to estimate – quality.

- Ongoing analyses
  - Matching analysis by discharge characteristics
  - Simulations of patient populations with known characteristics
  - IV analysis using travel time and distance to hospitals