
Variation in Quality by Hospital Characteristics: True or False?

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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 hospital**
 - 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

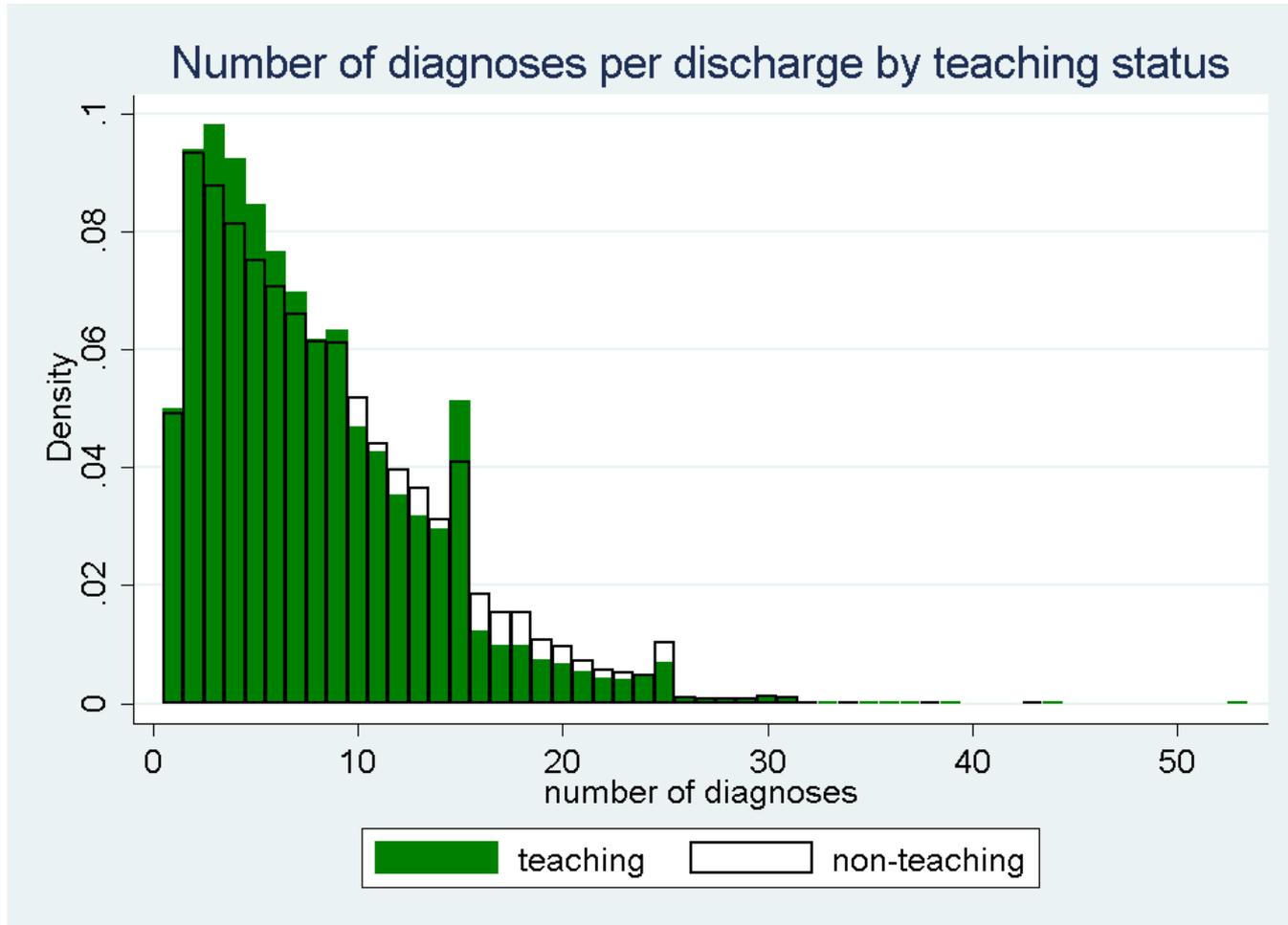
Exploratory Data Analysis: Methods

- **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

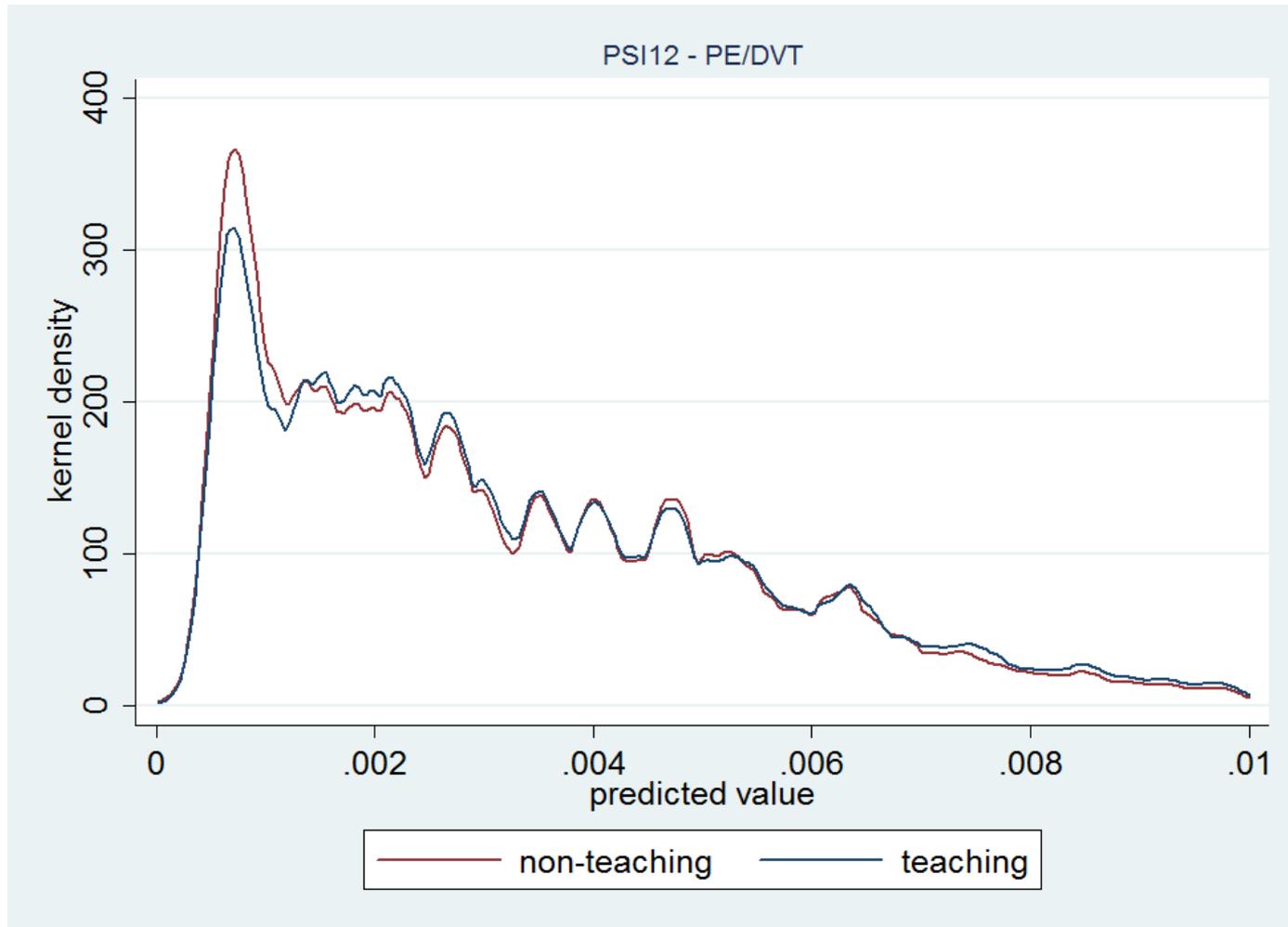
- **PSI 12: Post-operative Pulmonary Embolism/Deep Vein Thrombosis**
 - Risk-adjusted and smoothed rates of teaching hospitals significantly worse than those of non-teaching hospitals, raw rates no different
- **IQI 20: Pneumonia mortality**
 - Risk-adjusted and smoothed rates of teaching hospitals significantly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

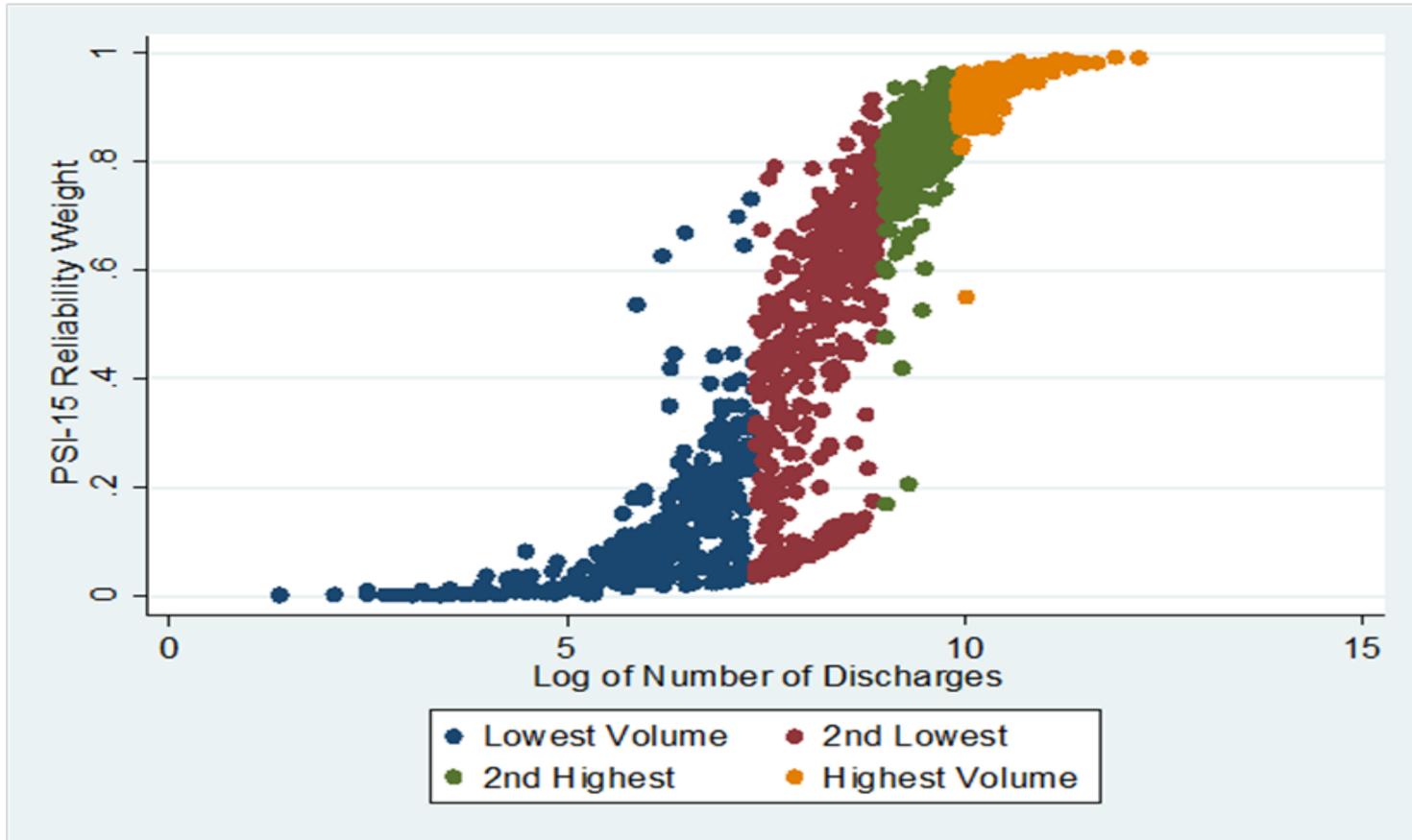
Do Teaching Hospitals Have Riskier Patients?



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

What Is the Relationship Between Volume and QI Rates?

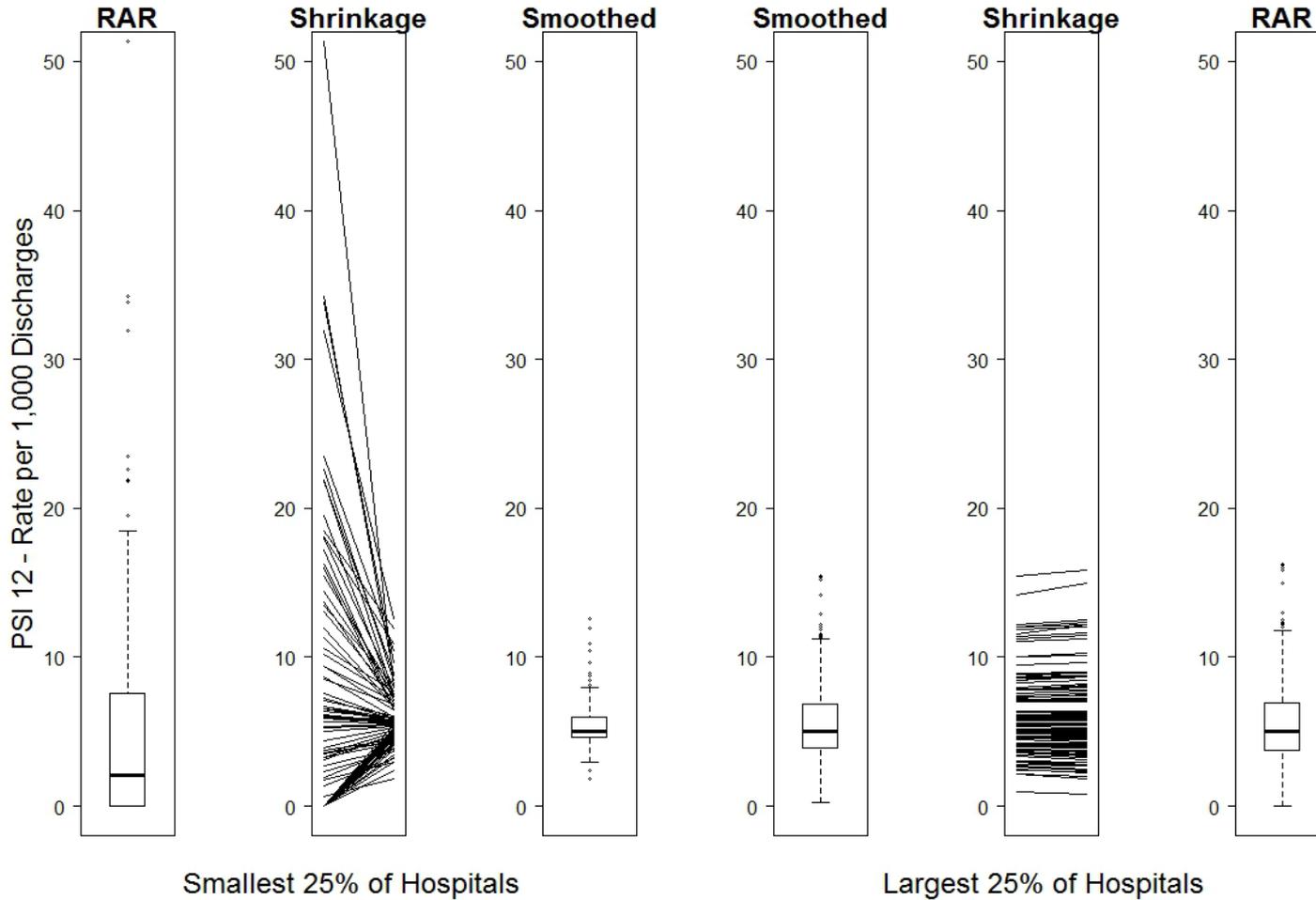
Relationship with Volume: Reliability Weights



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

What Is the Relationship Between Volume and QI Rates?

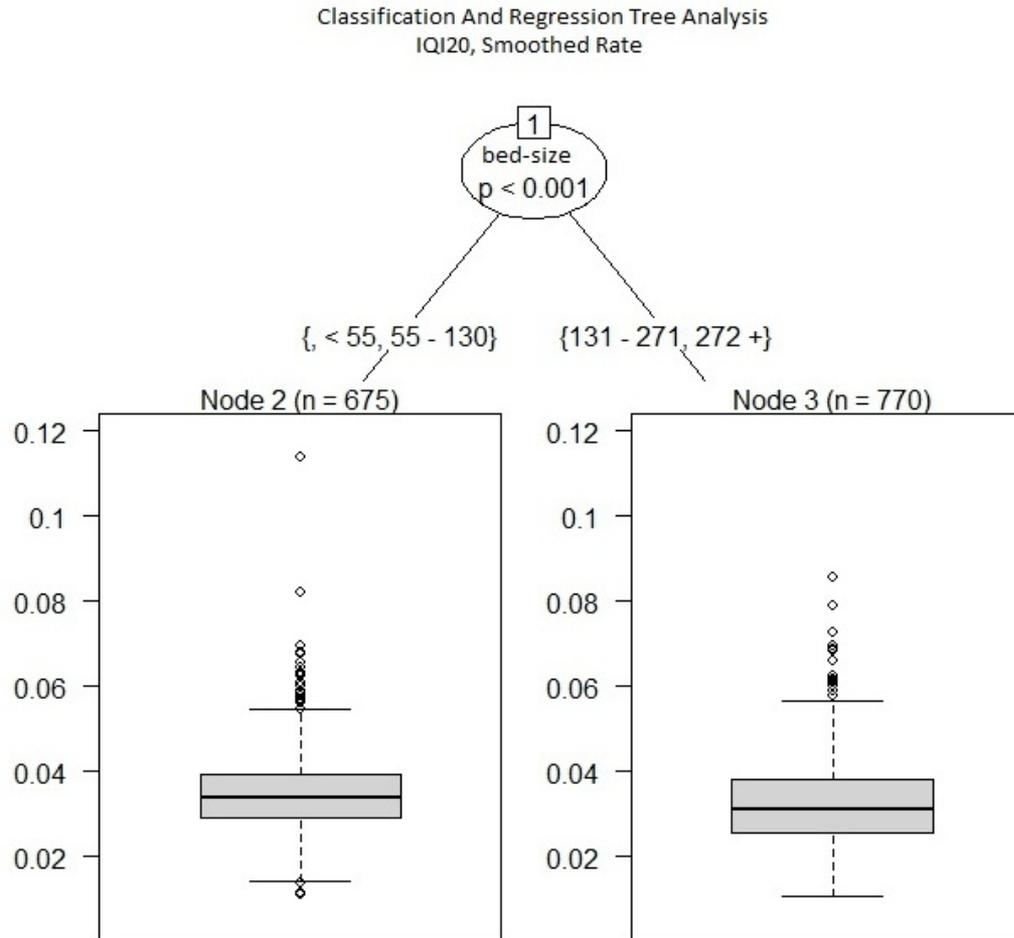
■ Degree of smoothing, by hospital size



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

What Is the Relationship Between Volume and QI Rates?

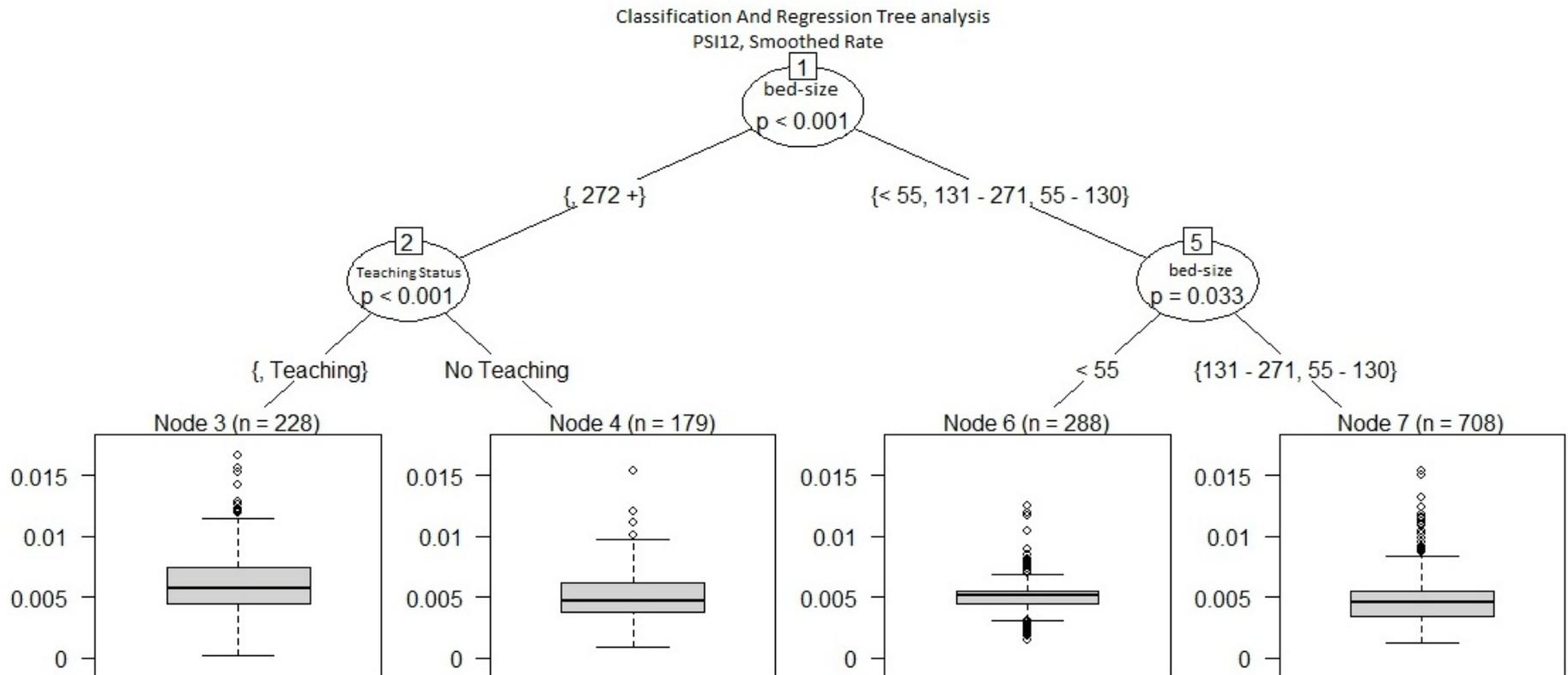
- Rates grouped by bed size in CART analysis



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**