

THRESHOLD ANALYSIS OF THE VOLUME-OUTCOMES RELATIONSHIP IN TOTAL KNEE ARTHROPLASTY

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Financial Disclosures

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No financial conflicts to disclose

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The Volume-Outcomes Relationship

- Studies have associated higher surgeon volumes with better outcomes for many procedures, including total knee arthroplasty (TKA).
- Unfortunately, current approaches for volume stratification are arbitrary, resulting in variable definitions.
 - Definitions of “low volume” TKA surgeons range from <3 to <52 TKAs/year.
 - Definitions of “high volume” surgeons range from >5 to >70 TKAs/year.
- The clinical utility of volume-outcomes research requires a more rigorous statistical approach to volume stratification.

A Different Approach: SSLR

- Stratum Specific Likelihood Ratio (SSLR) analysis has been used in diagnostic testing research and in a heart transplant volume-outcomes study for risk stratification.
- SSLR offers a more rigorous statistical approach to volume stratification in volume-outcomes studies.

Hypothesis / Research Questions

SSLR analysis can identify multiple surgeon volume thresholds using 2-year revision rates in patients undergoing a unilateral, primary TKA.

1. What surgeon volume thresholds are most predictive of 2-year revision risks?
2. What are the associations between SSLR-generated volume strata and the risks of 2-year revision, 90-day complications, and 90-day mortality?

Study Design

Cohort Selection (N=233,859)

New York State SPARCS
Administrative Database

Primary, Unilateral TKA, 1997-2009
NY state resident (n=233,859)

SSLR Analysis and Volume Stratification

2-Year Revision Rates

Multivariable / Sensitivity Analyses

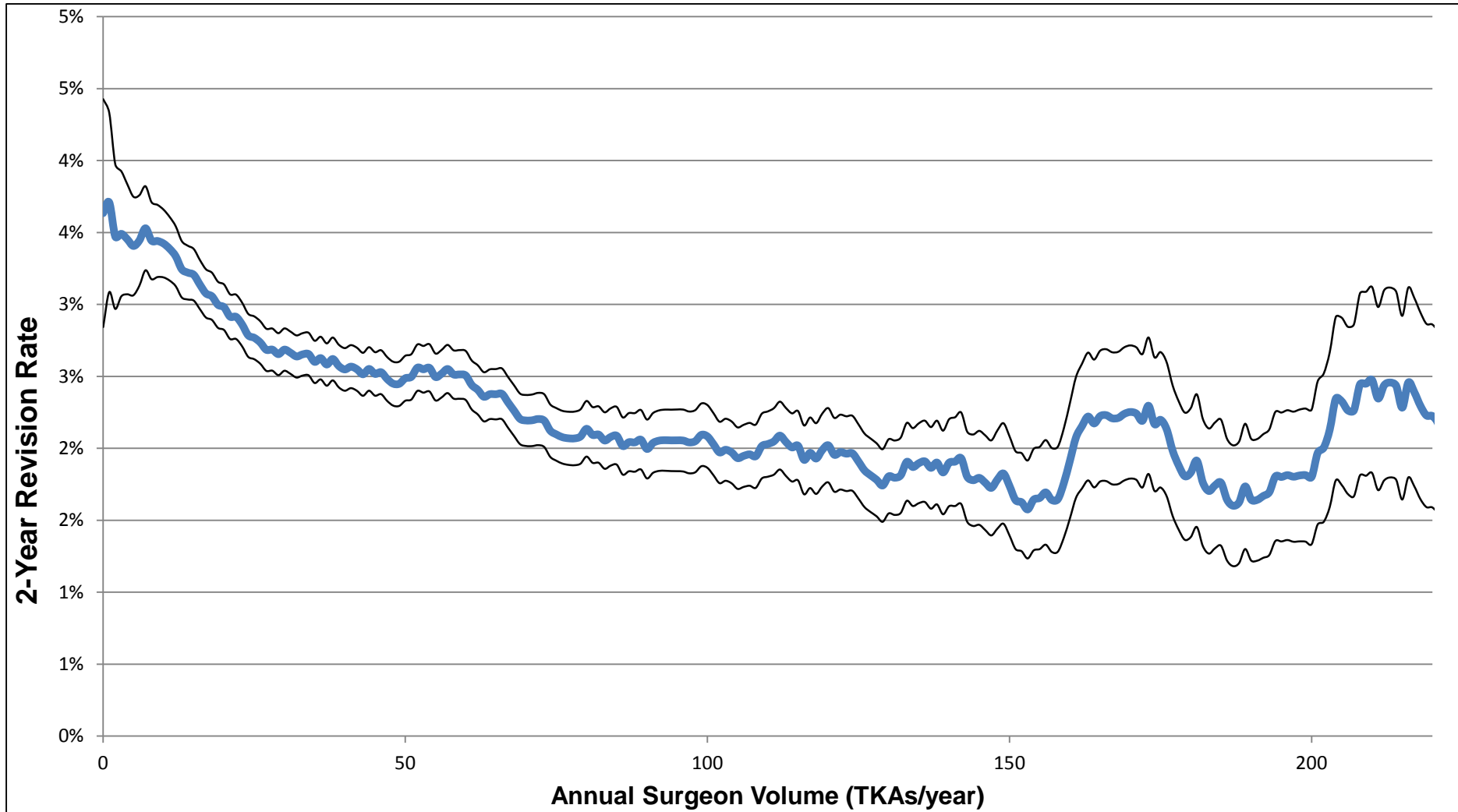
Hazard ratios of 2-year revision
Odds Ratios of 90-day complication, 90-day mortality

90-Day Complications

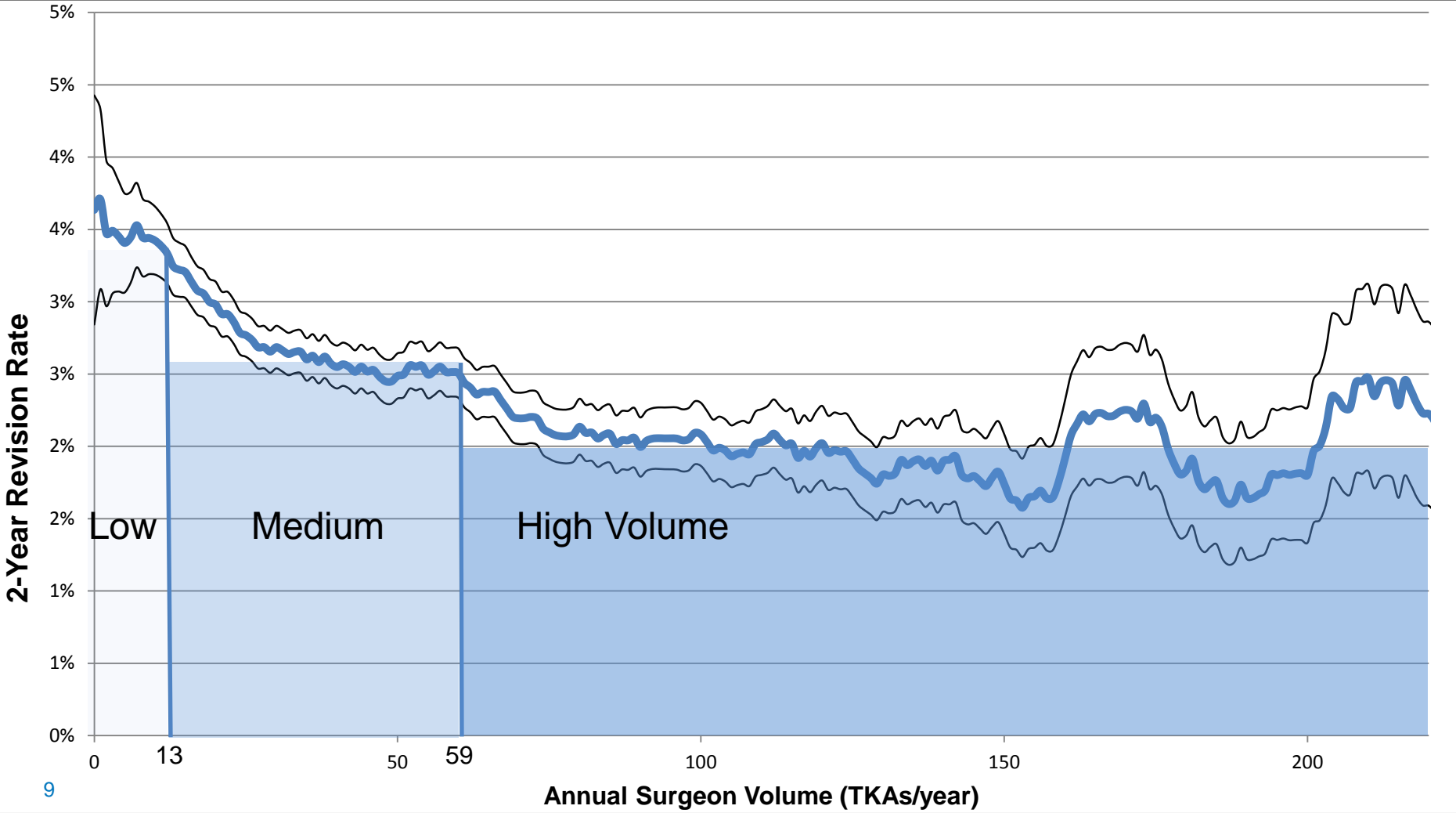
Acute Myocardial Infarction
Stroke
Mechanical Complication
Pulmonary Embolism / Deep Vein Thrombosis
Sepsis / Septicemia / Shock
Major bleed
Hip / Knee dislocation
Hip / Knee fracture
Intracranial Injury
Burns
Retained Foreign Object
Air Embolism
Blood Incompatibility

Pressure Ulcer
Catheter-associated Urinary Tract Infection
Vascular Catheter-associated Infection
Ileus
Pneumonia
Other complications, including
Nervous System Complications
Peripheral Vascular Complications
Respiratory Complications
Digestive System Complications
Urinary Complications

2-year Revision Rate by Surgeon Volume



SSLR-Generated Volume Categories



SSLR-Generated Volume Categories

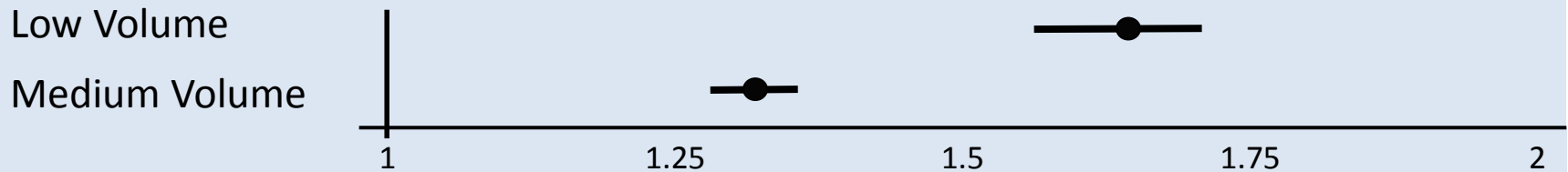
Surgeon Volume Categories	TKAs/ Year	2-year Revision Rate (%)	90-day Complication Rate (%)	90-day Mortality Rate (%)
Low	<13	3.3	10.4	0.51
Medium	13-59	2.6	8.7	0.29
High	60+	2.0	7.1	0.21

Multivariable Analyses

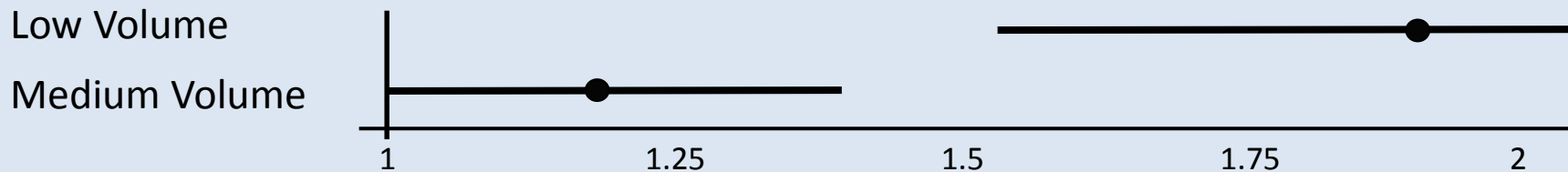
Hazard Ratios for 2-year revision by volume (High volume as reference)



Odds Ratios for 90-day complications by volume (High volume as reference)



Odds Ratios for 90-day mortality by volume (High volume as reference)



*The above analyses controlled for age, sex, race, indication for surgery (OA, IA, AVN, fracture), hospital volume (TKAs/year), insurance type, comorbidities (Elixhauser), and surgeon experience (years in practice).

Conclusion

- SSLR analysis of TKA revision rates established meaningful surgeon volume thresholds at 13 and 60 TKAs per year.
- Higher surgeon volume strata were associated with lower risks of 2-year revision, 90-day complication, and 90-day mortality after TKA when compared to lower volume strata.
- Our findings reinforce existing evidence of the surgeon volume effect in TKA surgery and support SSLR analysis as a more refined and rigorous statistical approach to volume stratification.

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