The Volume-Outcome Relationship Revisited: Practice Indeed Makes Perfect

PHS 6040 Journal Club

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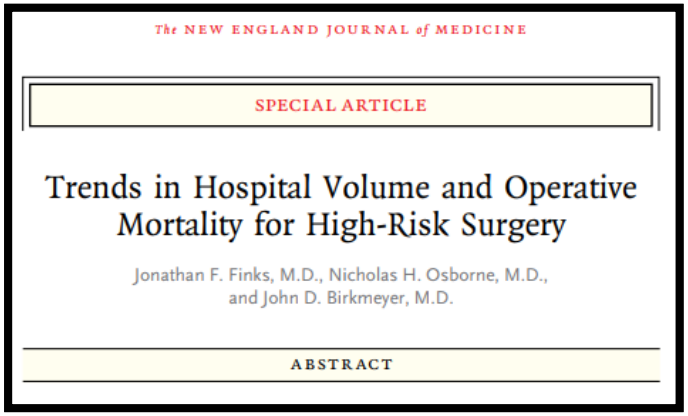
RESEARCH ARTICLE

The Volume–Outcome Relationship Revisited: Practice Indeed Makes Perfect

Corinna Hentschker and Roman Mennicken

Objective. To examine the causal effect of a hospital's experience with treating hip fractures (volume) on patient treatment outcomes.
Data Sources. We use a full sample of administrative data from German hospitals for 2007. The data provide detailed information on patients and hospitals. We also reference the hospitals' addresses and the zip codes of patients' place of residence.
Study Design. We apply an instrumental variable approach to address endogeneity concerns due to reverse causality and unobserved patient heterogeneity. As instruments for case volume, we use the number of potential patients and number of other hospitals in the region surrounding each hospital.
Principal Findings. Our results indicate that after applying an instrumental variables (IV) regression of volume on outcome, volume significantly increases quality.
Conclusions. We provide evidence for the practice-makes-perfect hypothesis by showing that volume is a driving factor for quality.
Key Words. Volume, hospital quality, mortality, instrumental variables



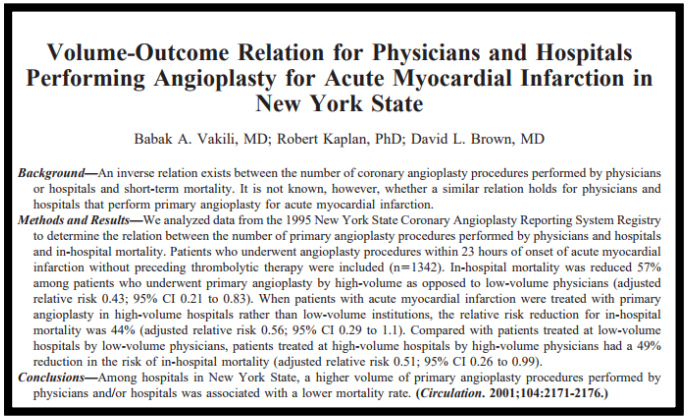
The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL ARTICLE

Trends in Hospital Volume and Operative Mortality for High-Risk Surgery

Jonathan F. Finks, M.D., Nicholas H. Osborne, M.D., and John D. Birkmeyer, M.D.

ABSTRACT



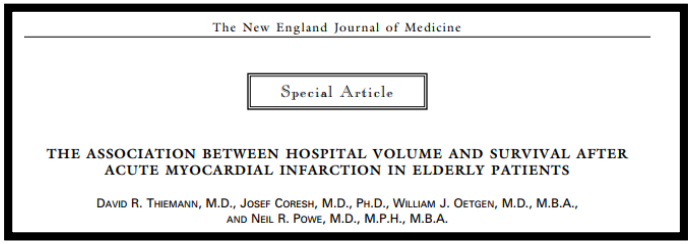
Volume-Outcome Relation for Physicians and Hospitals Performing Angioplasty for Acute Myocardial Infarction in New York State

Babak A. Vakili, MD; Robert Kaplan, PhD; David L. Brown, MD

Background—An inverse relation exists between the number of coronary angioplasty procedures performed by physicians or hospitals and short-term mortality. It is not known, however, whether a similar relation holds for physicians and hospitals that perform primary angioplasty for acute myocardial infarction.

Methods and Results—We analyzed data from the 1995 New York State Coronary Angioplasty Reporting System Registry to determine the relation between the number of primary angioplasty procedures performed by physicians and hospitals and in-hospital mortality. Patients who underwent angioplasty procedures within 23 hours of onset of acute myocardial infarction without preceding thrombolytic therapy were included (n=1342). In-hospital mortality was reduced 57% among patients who underwent primary angioplasty by high-volume as opposed to low-volume physicians (adjusted relative risk 0.43; 95% CI 0.21 to 0.83). When patients with acute myocardial infarction were treated with primary angioplasty in high-volume hospitals rather than low-volume institutions, the relative risk reduction for in-hospital mortality was 44% (adjusted relative risk 0.56; 95% CI 0.29 to 1.1). Compared with patients treated at low-volume hospitals by low-volume physicians, patients treated at high-volume hospitals by high-volume physicians had a 49% reduction in the risk of in-hospital mortality (adjusted relative risk 0.51; 95% CI 0.26 to 0.99).

Conclusions—Among hospitals in New York State, a higher volume of primary angioplasty procedures performed by physicians and/or hospitals was associated with a lower mortality rate. **(*Circulation*. 2001;104:2171-2176.)**

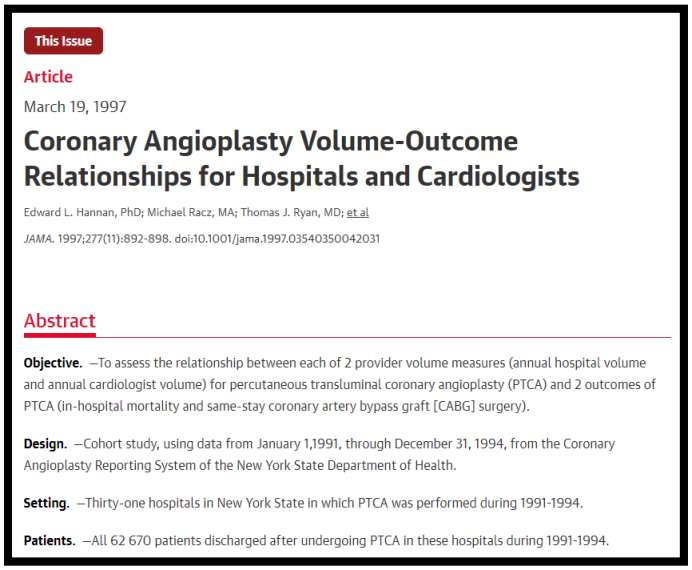


The New England Journal of Medicine

Special Article

THE ASSOCIATION BETWEEN HOSPITAL VOLUME AND SURVIVAL AFTER ACUTE MYOCARDIAL INFARCTION IN ELDERLY PATIENTS

David R. Thiemann, M.D., Josef Coresh, M.D., Ph.D., William J. Oetgen, M.D., M.B.A., and Neil R. Powe, M.D., M.P.H., M.B.A.



This Issue

Article

March 19, 1997

Coronary Angioplasty Volume-Outcome Relationships for Hospitals and Cardiologists

Edward L. Hannan, PhD; Michael Racz, MA; Thomas J. Ryan, MD; et al

JAMA. 1997;277(11):892-898. doi:10.1001/jama.1997.03540350042031

Abstract

Objective. —To assess the relationship between each of 2 provider volume measures (annual hospital volume and annual cardiologist volume) for percutaneous transluminal coronary angioplasty (PTCA) and 2 outcomes of PTCA (in-hospital mortality and same-stay coronary artery bypass graft [CABG] surgery).

Design. —Cohort study, using data from January 1,1991, through December 31, 1994, from the Coronary Angioplasty Reporting System of the New York State Department of Health.

Setting. —Thirty-one hospitals in New York State in which PTCA was performed during 1991-1994.

Patients. —All 62 670 patients discharged after undergoing PTCA in these hospitals during 1991-1994.

Definitions

- Hospital volume:

the number of patients treated within the hospital

- Outcome of the patient:

mortality, quality of care, …

Two classical hypotheses

- Practice-makes-perfect hypothesis (volume → outcome)

- Selective-referral hypothesis (outcome → volume): High-quality healthcare providers are able to attract more patients

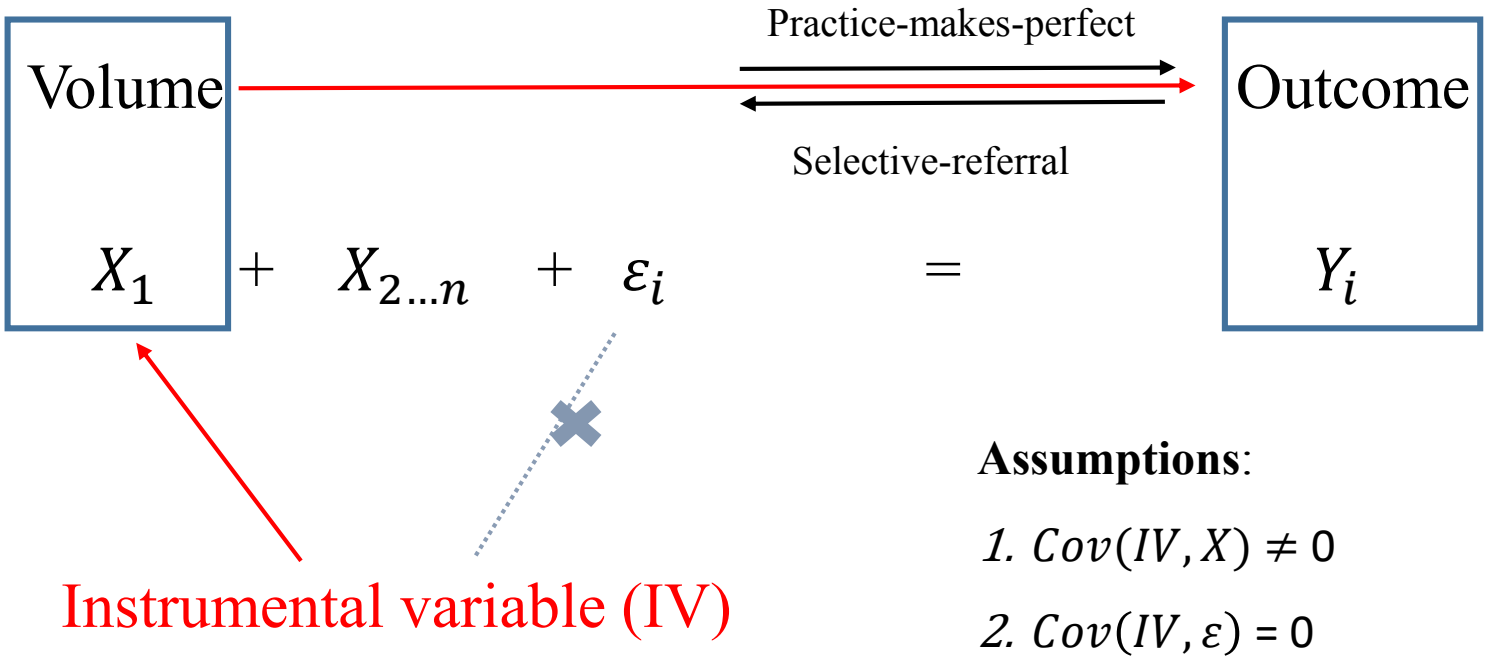
Endogeneity

- Endogeneity: explanatory variable is correlated with the error term.
- Endogeneity → biased estimate

- Sources of endogeity:

1. Omitted variables,
2. Measurement error,
3. Simultaneous causality

Simultaneous causality in this case



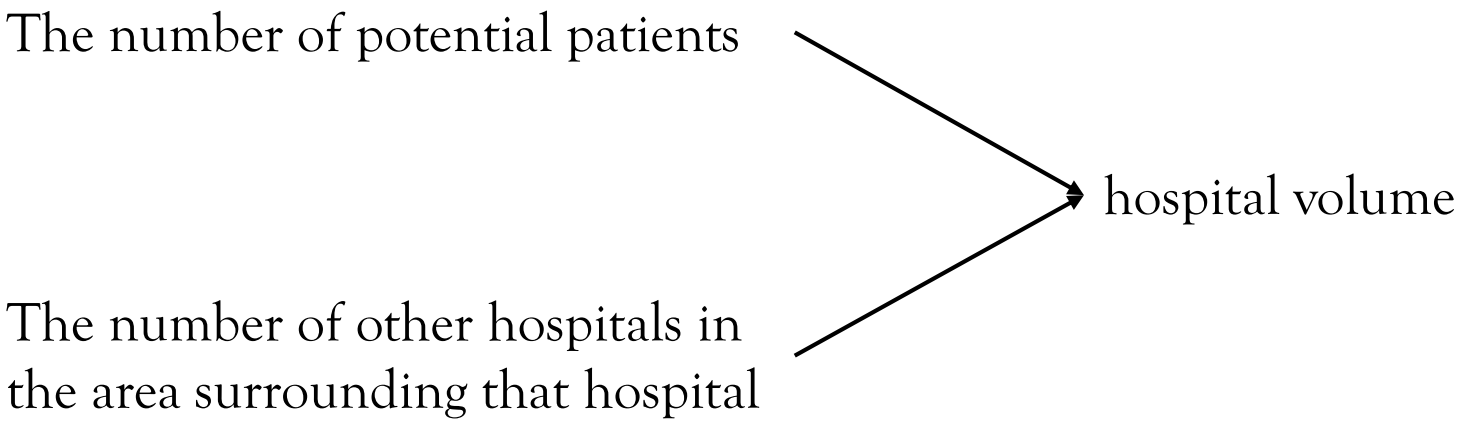
Assumptions:

1. $Cov(IV, X) \neq 0$
2. $Cov(IV, \varepsilon) = 0$

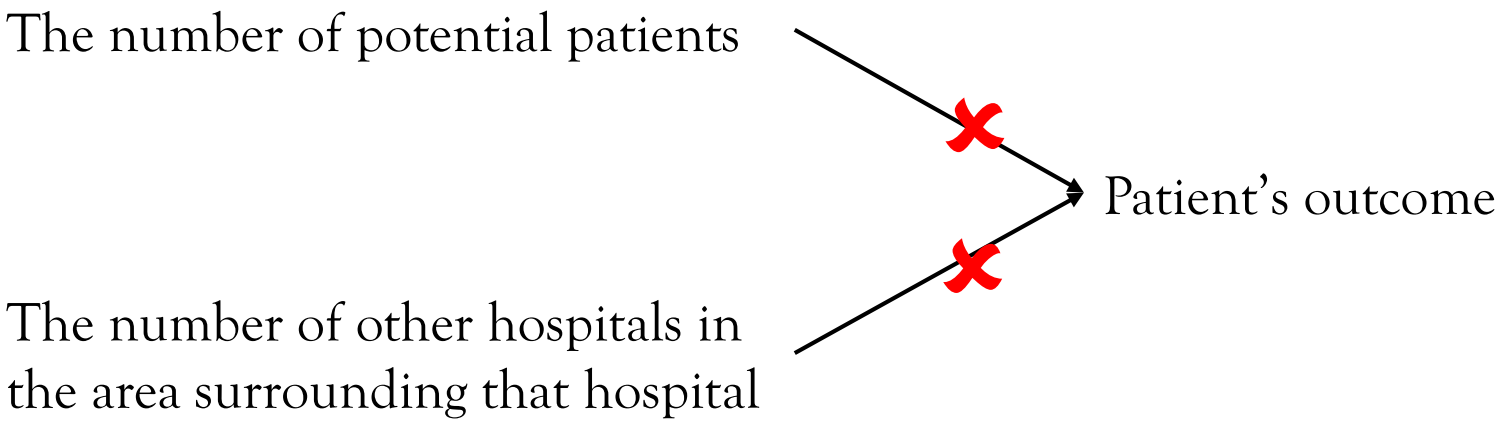
IVs used in this study

1. The number of potential patients
2. The number of other hospitals in the area surrounding that hospital

Assumption 1: $Cov(IV, X) = 0$



Assumption 2: $Cov(IV, \varepsilon) \neq 0$



Two stage regression

- First stage: IVs → volume (linear regression)
- Second stage: $\widehat{\text{volume}}$ + covariates → outcome (logistic/probit regression)

Data and sample

- Full sample of all inpatients in Germany in 2007
- 89541 patients with hip fractures from 1262 hospitals
- Crude mortality rate of 6.3%

Results

(c) IV-Probit; Instrument: Number of Potential Patients per Hospital in the Regional Area

	(11)	(12)	(13)	(14)	(15)
Ln case volume	−0.0138***	−0.0176***	−0.0217***	−0.0280***	−0.0259***
	(0.0037)	(0.0041)	(0.0060)	(0.0066)	(0.0071)
Patient characteristics	No	Yes	No	Yes	Yes
Hospital charcteristics	No	No	Yes	Yes	Yes
Socioeconomic indicators	No	No	No	No	Yes
Settlement structure indicators	No	No	No	No	Yes
First-stage *F*-statistic	186.7512	189.1469	130.9806	130.7457	119.6255
Test for endogeneity (*p*-value)	0.0930	0.0372	0.0557	0.0175	0.0299
Observations	89,541	89,541	89,541	89,541	89,541
Number of hospitals	1,262	1,262	1,262	1,262	1,262

Note. Clustered standard errors (at the hospital level) in parentheses.
*$p < .10$, **$p < .05$, ***$p < .01$.

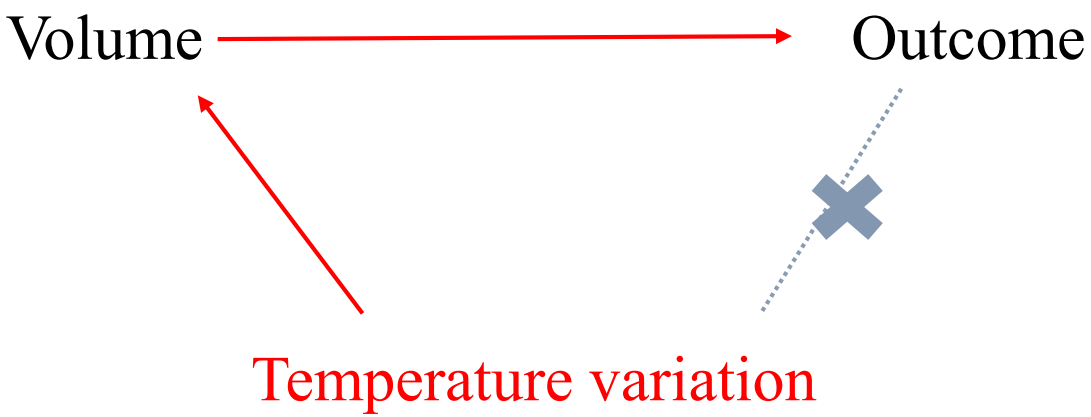
Conclusions

- Minimum-volume regulation policies.
- Driving very-low-volume providers out of the market.

Problems

1. The balance between minimum-volume policy & accessibility
2. Is hospital volume higher better?
   - High-volume → case overloading
   - high concentration → lower competition

My innovations on the IV estimator



This project focuses on the cardiovascular disease patients.

Q & A?