Total Hip Arthroplasty (THA): Practice Makes Perfect – Operative Time Indicative of Surgeon Skill

135th Annual Meeting of APHA, November 3-7, 2007
Washington DC
Session 5183.0
Health Services Research: Cost Analysis
November 7, 2006

Sudha Xirasagar, MBBS, PhD (P.I.)
University of South Carolina

Herng-Ching Lin, PhD
Taipei Medical University, Taipei, Taiwan

Contact: sxirasagar@sc.edu
Ph: (803) 576 6093

Volume Versus Outcomes

- Surgeon/hospital volume correlate with better outcomes
- Hospital CABG volume and mortality
- Surgeon/hospital THA volume and 90-day mortality, dislocation, revision THA
- Liver transplantation, gastrointestinal surgery, etc.

Caveats in conclusions

- Hospital, or surgeon volume, or both important?
- "Practice makes perfect" or "selective patient self-referral to reputed hospitals?"
- Confounding due to case severity and co-morbidity?
- Selection bias: Limited hospital/surgeon/insurer panels are used
- Mortality - limited indicator of surgical or care quality
- Need for variables mediating hospital/surgeon volume impacts on outcomes (Katz et al 2001)

Study Setting

- National Health Insurance claims database of Taiwan
- Universal coverage, single comprehensive benefit package, low co-pays, single payer system
- Well dispersed public, for profit and NFP providers
- Patient choice of any hospital or physician
- Most doctors affiliated with only ONE hospital

Operative time – Proxy for Surgical quality

- Not documented as measure of surgery quality impacting outcomes
- Silber et al – Operative time to assess care disparities (race) in academic medical centers (Acad. Health 2006)
- Operative time exclusively driven by surgeon skill (no role of patient compliance) – Silber et al 2006.

Theoretical Background

- **THA cost variation driven by healing course and LOS**
- **Early rehab and complication prevention**
  - **Prompt post-surgical healing**
  - **Optimum implant biomechanics**
  - **Minimal (surgical) tissue damage**
  - **ALL a function of surgeon's skill.**

Why THA Operative Time Impacts Cost and Course

- Less skilled surgeon – longer operating time
- Longer operative time – higher infection propensity
- Less skilled organ and implant manipulation – delay in getting implant right
- More tissue handling – delayed local healing, longer post surgical pain
- Delayed rehab to functional status to discharge
- Increased medications, antibiotics, LOS

Data and variables

- Population-based, universal sample
- 23,309 claims for primary THA (ICD 8151) during 2000-2004 (5 years)
- Exclusions: THA for Traumatic and Pathological fractures, Revision THA

Physician Volume Categories

- Low ≤28 cases
- Medium 29-69
- High 70-156
- Very High ≥157 (reference group)

Hospital Volume Categories

- Low ≤91 cases
- Medium 92-295
- High 296-684
- Very High ≥ 685 (reference group)

Study hypotheses

- ***H1: Increasing physician THA volume (but not hospital volume) predicts reduced operative time***
- ***H2: Increasing physician volume associated with lower costs (total inpatient costs) and length of stay, LOS) and lower mortality***
- ***H3: Increasing operative time mediates the inpatient cost – volume association***

Statistical Analysis

- **Hierarchical regressions (linear and logistic)**
- **Key Indep. variables: Physician vol., Hospital vol.**
- **Dep. variables: Anesthesia cost (proxy for operative time), Total cost, Other cost, LOS (all near normal distributions), and mortality**
- **Controls: Patient and physician demographics, hospital ownership and level, clinical severity (Charlson Comorbidity Index, Renal and liver dysfunction, hypertension, diabetes, joint pathology)**
- **Random effects Hospital/ Physician**

Testing Volume vs. Resource Use and Operative time (H1 & H2)

- Inpatient cost = Phy. (/Hosp) volume + Controls (Surgeon, patient demographics, clinical variables) + Hosp./ Phy. random effect
- LOS = Physician volume + Controls + Hospital random effect
- Anesth. cost = Phy. (/Hosp.) volume + Controls + Hospital random effect
- Inpatient mortality= Phy. (/Hosp.) volume + Controls + Hospital random effect

Operative time mediates volume-cost association (H3)

- Other cost = Anesth cost + Phy. (/Hosp) volume + Controls (Surgeon, patient demographics, clinical variables) + Hosp./ Phy. random effect
  - Other cost = Inpatient cost – Anesth cost

Dependent variables (NT$)

	Mean	Median	Mode
Inpatient cost	117,279	115,588	113,117
Anesthesia cost	6,163	5,865	2,550
Other cost	111,116	5,865	2,550

Log_{10} transformed variables (no better than raw variables)

	Mean	Median	Mode	
Inpatient cost	5.06	5.06	5.05	
Anesthesia cost	3.73	3.77	3.40	
Other cost	5.04	5.04	5.03	

Adjusted Assns of Physician Volume with Cost/Outcome

Volume	Inpatient Cost	Anesthesia cost	LOS	Mort. OR
≤28	6,148***	666***	1.62**	1.00
29-69	4,846***	632***	0.88**	0.80
70-156	1,581	15	0.30**	0.48
≥157	-	-	-	0.51

Adjusted Assns of Hospital Volume with Cost/Outcome

Volume	Inpatient Cost	Anesthesia cost	LOS	Mort. OR
≤91	7,275*	24	0.73	1.00
92-295	5,247	140	0.41	1.03
296-684	3,816	708**	0.08	0.91
≥685	-	-	-	1.773

Does Operative Time predict Inpatient (Other) Cost? (Adjusted)

	Other cost
Anesthesia cost	4.92***
Surgeon THA Volume ≤28	2,307**
29-69	919
70-156	1,423
≥157	-

Does Operative Time predict Inpatient (Other) Cost? (Adjusted)

	Other cost
Anesthesia cost	5.04***
Hospital THA Volume ≤28	5,131
29-69	7,504
70-156	898
≥157	-

Conclusion

- THA Operative time is a function of surgeon volume, but not hospital volume
- LOS and inpatient cost are associated with surgeon volume but not hospital volume
- Operative time mediates the associations between surgeon volume and inpatient cost
- Professional and payer initiatives to address THA by low volume or novice surgeons needed.