Total Hip Arthroplasty (THA): Practice Makes Perfect – Operative Time Indicative of Surgeon Skill ^{135th} Annual Meeting of APHA, November 3-7, 2007

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

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

Contact: <u>sxirasagar@sc.edu</u> 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 selfreferral 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

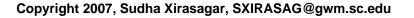
- THA cost variation driven by healing course and LOS
- Early rehab and complication prevention
 - Prompt post-surgical healing
 - Optimum implant biomechanics
 - Minimal (surgical) tissue damage
 - ALL a function of surgeon's skill.



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

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

Log₁₀ 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
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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	_	_	-	O 1

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	_	-	- Š	1. 2 73

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	- SOUTH CAROLLNA

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	– ŠOU	HCROUN

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.

