Healthcare Workforce and Regionalization of Services: *Lung Cancer Resections*

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AHRQ 9/10/08

Disclosures

Are Surgical Outcomes for Lung Cancer Resections Improved at Teaching Hospitals?

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Thoracic Surgery Directors Association (TSDA) Resident Research Award.

Background. Defining centers of excellence for complex surgical procedures, including pulmonary resection, reveals lower mortality at high-volume centers. We postulate that short-term outcome after lung cancer resection is better at teaching hospitals (TH) compared with non-teaching hospitals (non-TH), independent of volume.

Methods. Lung cancer resections in the Nationwide Inpatient Sample (NIS) dataset from 1998 to 2004 were stratified by resection type (segmentectomy, lobectomy, and pneumonectomy). The TH identified in the NIS include those with Accreditation Council for Graduate Medical Education-approved general surgery (GSTH) and thoracic surgery (TSTH) residency programs. The association of hospital teaching status with in-hospital mortality was assessed by multivariate logistic regression, adjusting for patient demographics and comorbidities.

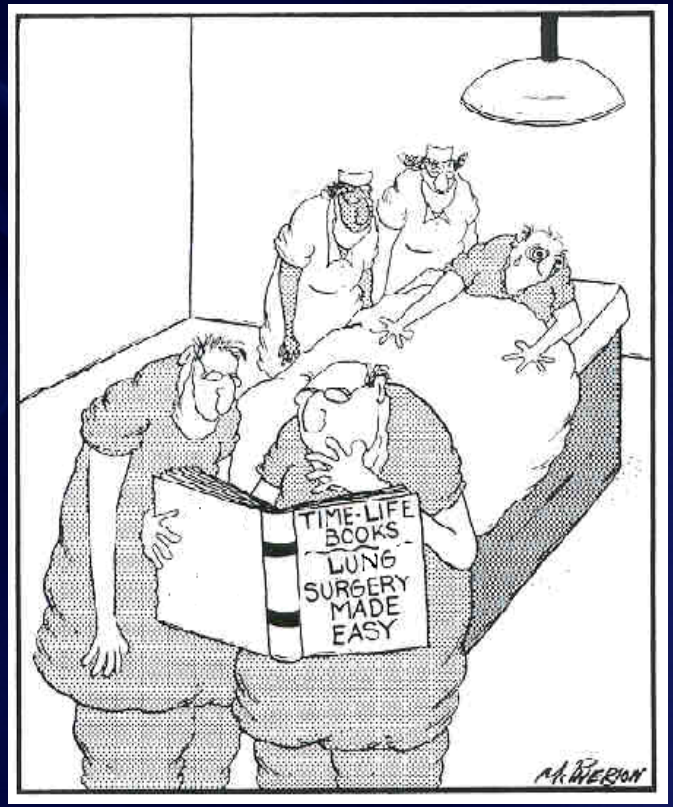
Results. Of 46,951 lung resections (5,651 segmentectomies, 37,027 lobectomies, 4,273 pneumonectomies), 56% were performed at TH. Overall mortality was significantly lower at TH versus non-TH (3.2% vs 4.0%; $p < 0.001$). Subgroup analysis for GSTH and TSTH confirmed this decrease. On multivariate regression, overall odds of death was independently reduced by 17% at TH versus non-TH (95% confidence interval: 0.73 to 0.93; $p = 0.002$). At TH, odds of death for pneumonectomy and lobectomy were significantly reduced independent of surgical volume, except for the latter at the highest hospital volume strata.

Conclusions. In-hospital mortality is reduced for patients undergoing lung cancer resections at teaching hospitals, with results prominent at all but the highest volume institutions. Lower mortality rates persisted at GSTH and TSTH. Understanding and disseminating the processes of care associated with these settings may improve quality of care for lung cancer patients, and decrease patient bias against teaching hospitals.

(Ann Thorac Surg 2008;85:1015–25)

Overview

- Incidence of lung cancer
- Study background/methods
- Result:
  - Teaching vs non-teaching
  - General surgery residency
  - Thoracic surgery residency
- AHRQ Implications

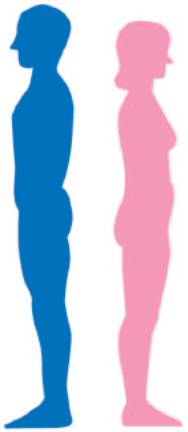



It Looks Just As Stupid When You Do It.
Minnesota Department of Health

The High Incidence of Lung Cancer

Estimated New Cases*

Males			Females		
Prostate	234,460	33%	Breast	212,920	31%
Lung and Bronchus	**92,700**	**13%**	**Lung and Bronchus**	**81,770**	**12%**
Colon and Rectum	72,800	10%	Colon and Rectum	75,810	11%
Urinary Bladder	44,690	6%	Uterine Corpus	41,200	6%
Melanoma of the Skin	34,260	5%	Non-Hodgkin Lymphoma	28,190	4%
Non-Hodgkin Lymphoma	30,680	4%	Melanoma of the Skin	27,930	4%
Kidney and Renal Pelvis	24,650	3%	Thyroid	22,590	3%
Oral Cavity and Pharynx	20,180	3%	Ovary	20,180	3%
Leukemia	20,000	3%	Urinary Bladder	16,730	2%
Pancreas	17,150	2%	Pancreas	16,580	2%
All Sites	**720,280**	**100%**	**All Sites**	**679,510**	**100%**



Estimated Deaths

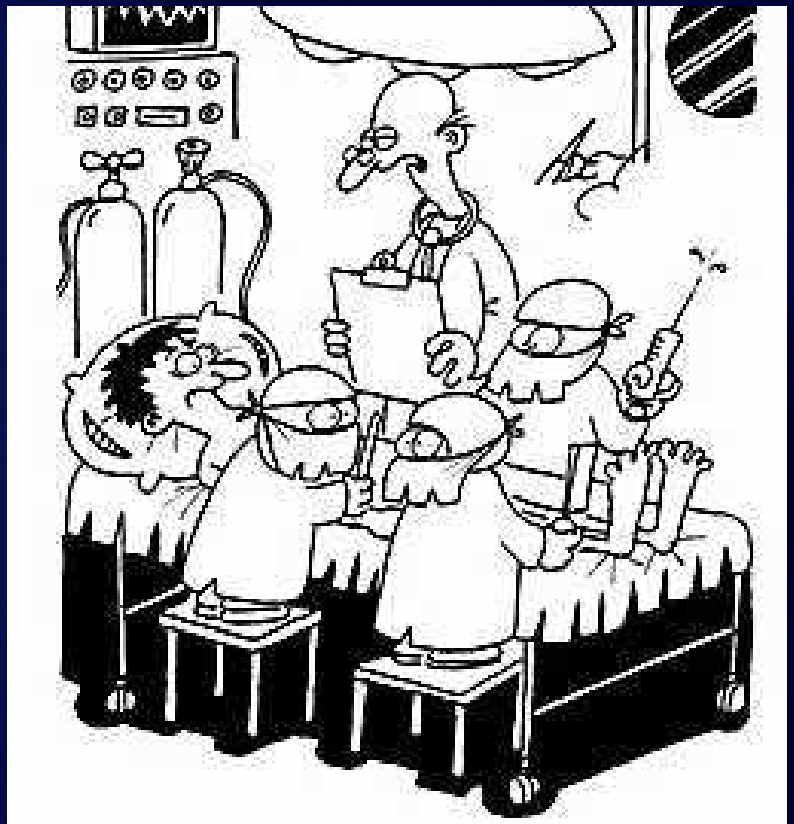
Males			Females		
Lung and Bronchus	**90,330**	**31%**	**Lung and Bronchus**	**73,130**	**36%**
Colon and Rectum	27,870	10%	Breast	40,970	15%
Prostate	27,350	9%	Colon and Rectum	27,300	10%
Pancreas	16,090	6%	Pancreas	16,210	6%
Leukemia	12,470	4%	Ovary	15,310	6%
Liver and Intrahepatic Bile Duct	10,840	4%	Leukemia	9,810	4%
Esophagus	10,730	4%	Non-Hodgkin Lymphoma	8,840	3%
Non-Hodgkin Lymphoma	10,000	3%	Uterine Corpus	7,350	3%
Urinary Bladder	8,990	3%	Multiple Myeloma	5,630	2%
Kidney and Renal Pelvis	8,130	3%	Brain and Other Nervous System	5,560	2%
All Sites	**291,270**	**100%**	**All Sites**	**273,560**	**100%**

* Jemal et al, CA 2006

Prior Studies Examining Surgical Outcomes

- Surgeon volume
- Hospital volume
  - Pulmonary resection
  - Esophageal resection
  - Coronary artery bypass
  - Carotid endarterectomy
  - Other complex cancer surgery
- Hospital characteristics associated with improved outcomes poorly defined

Origin of the Study



"Try not to worry Mr Thomas. It's just a minor operation."

Teaching Hospitals

- Teaching hospitals
  - Fellows, residents, medical and nursing students
  - Surrogate of higher levels of tertiary care and services
  - Public perception: “dangerous”
- Published studies:
  - Benefit of teaching hospitals is due to increased volume

Thoracic vs. General Surgeons

- Lung resections traditionally performed by general surgeons as well as specialty-trained thoracic surgeons
- Debate persists over whether thoracic surgeons should preferentially perform lung (and esophageal) resections
- Few large, nationwide studies have examined this issue

Benefit of Teaching Hospitals

- Unclear whether perioperative outcomes are improved at teaching hospitals due to volume or environment

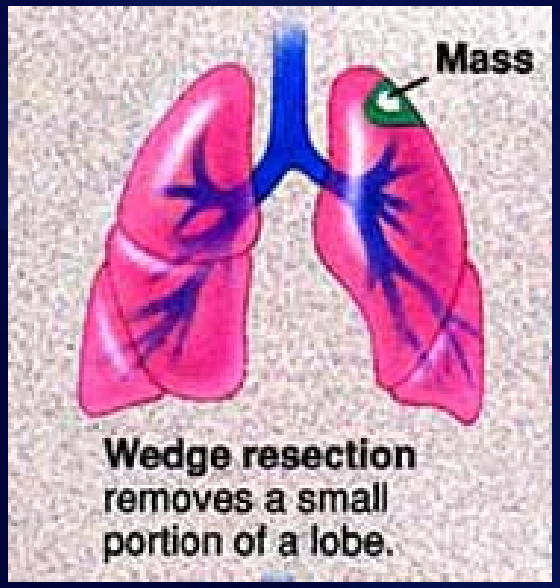
- Hypothesis:

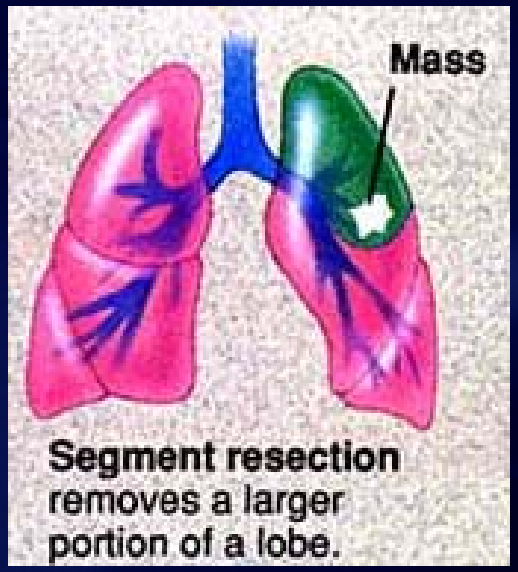
"In-hospital mortality after lung cancer resection at teaching hospitals is low and improved at thoracic teaching programs, while independent of hospital procedure volume."

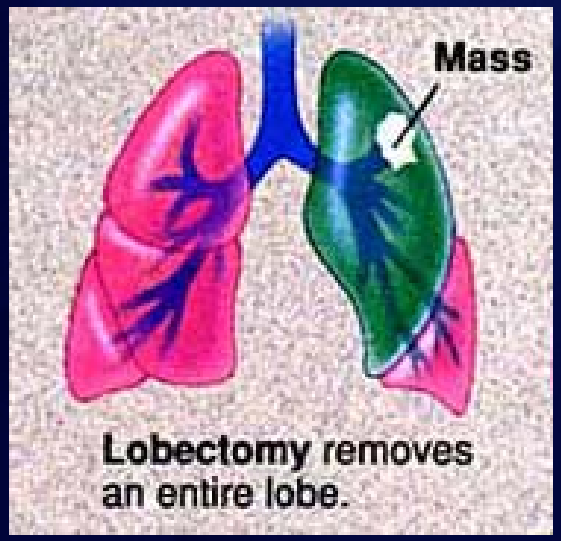
Methods - 1

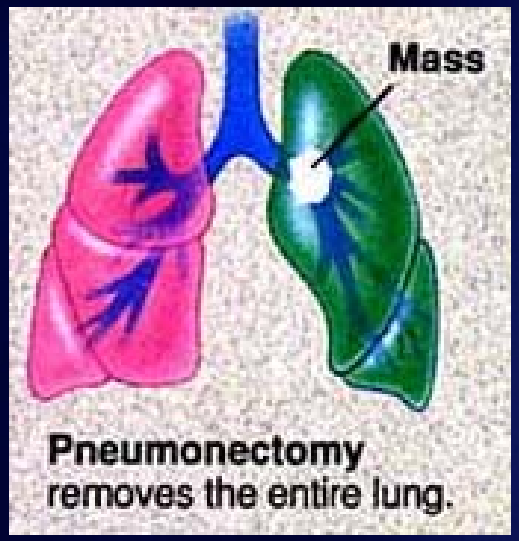
- **Study Design:** Retrospective analysis using Nationwide Inpatient Sample (HCUP/AHRQ)
  - 1998-2003
  - Combined with ACGME to identify general and thoracic surgery residency programs
  - Primary lung cancer
  - Segmentectomy, lobectomy, pneumonectomy

Definitions: *Lung Cancer Operations*









Methods - 2

- **Variables:**
  - Age, gender, race
  - Charlson Index of comorbidities
  - Annual hospital procedure volumes
  - Teaching hospital status

Definitions

Teaching Hospitals (NIS):

- **At least 1 residency program (not necessarily surgery)**
- **Member of Council of Teaching Hospitals**
- **Maximum 4:1 beds:residents**

Academic Hospitals:

- **University affiliation**
- **Faculty: university-based, engage in research**

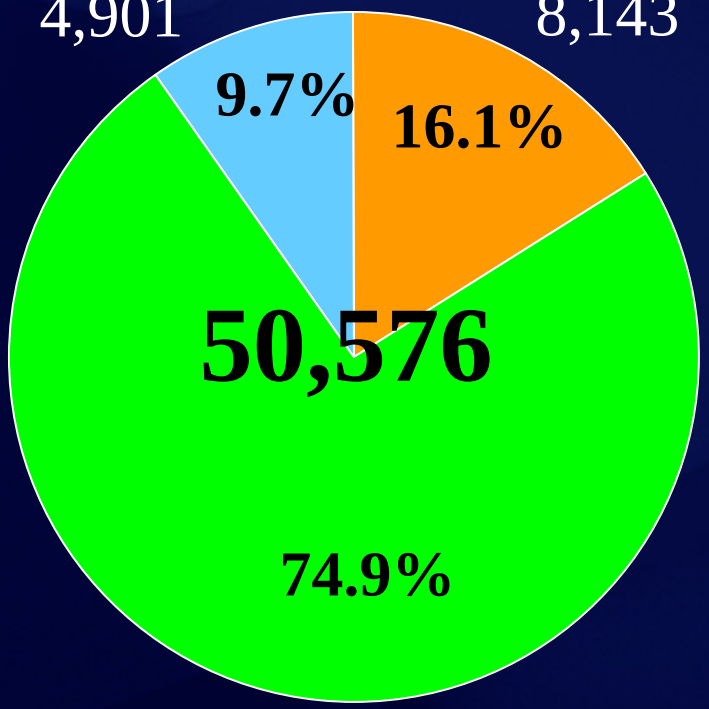
Outcome Analysis

- **Outcome:**
  - In-hospital death from any cause as end result based on discharge summary (not usual 30-day mortality)

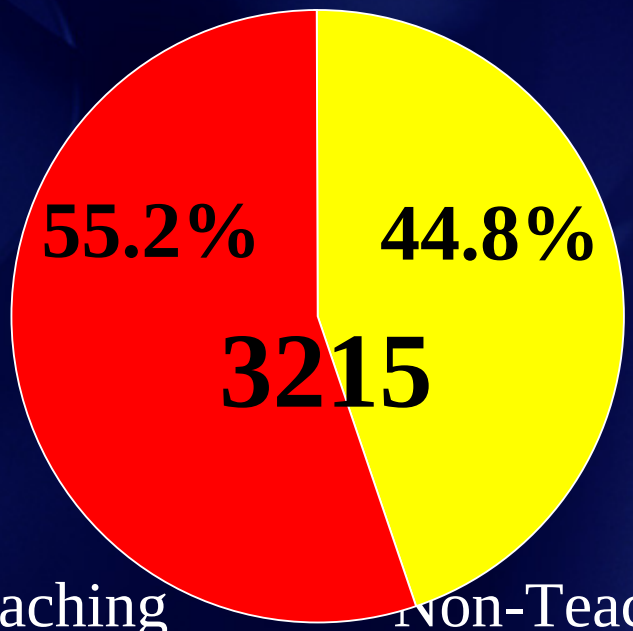
- **Analyzed Statistics:**
  - Multivariate logistic regression analysis

Surgical and Hospital Demographics

Overall Resections



Overall Hospital Status



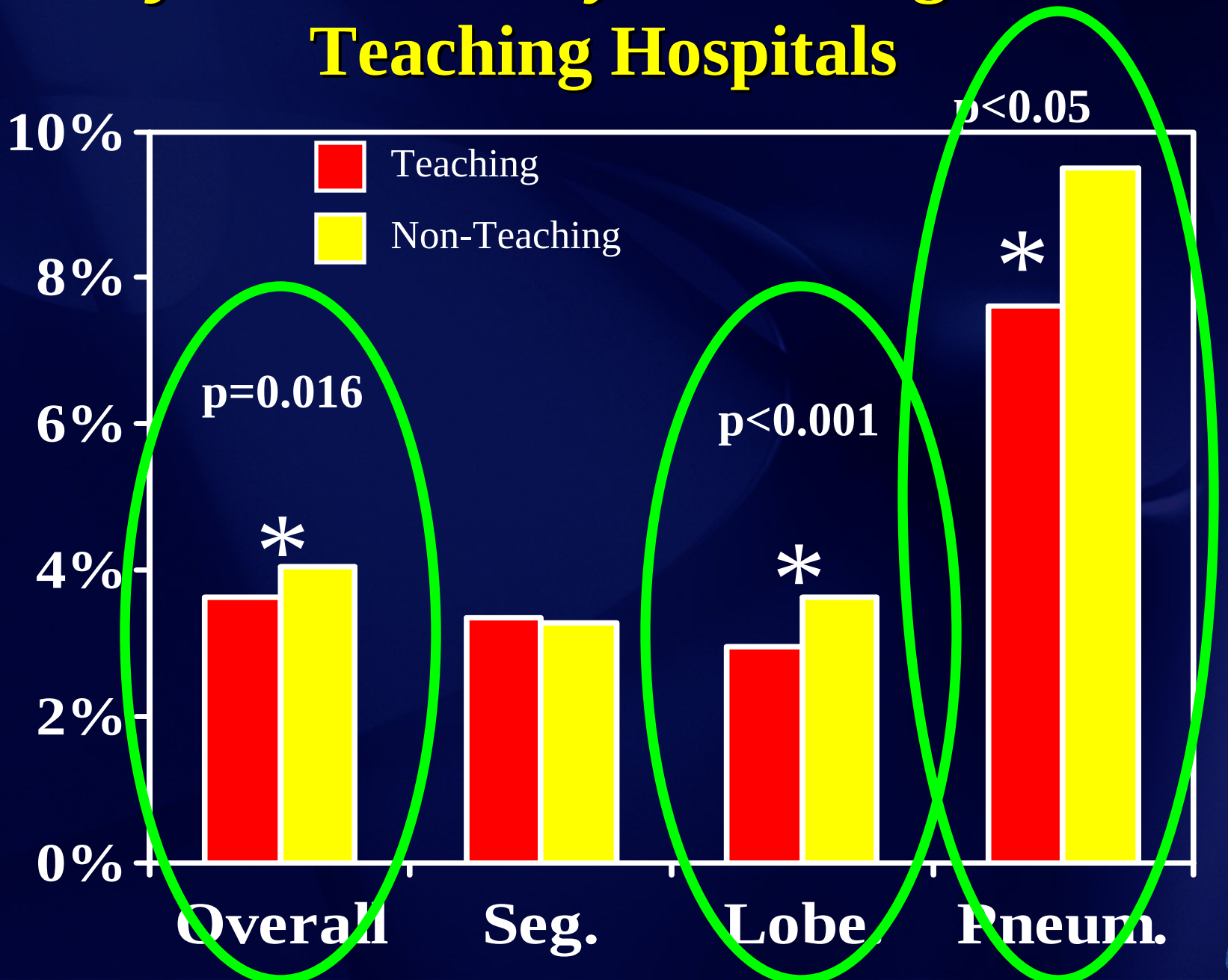
Resection Demographics

	Teaching	Non-Teaching
Hospitals	1095 (34.1%)	2115 (65.9%)
Total Resections	28,101	22,780
Segmentectomy	4,383 (15.7%)	3,753 (16.5%)
Lobectomy	20,740 (73.8%)	17,110 (75.1%)
Pneumonectomy	2,978 (10.6%)	1,917 (8.4%)

Patient Demographics

	Teaching	Non-Teaching
Median Age	66 years	67 years
Female	46.8%	45.6%
Median Charlson Index	**3**	**3**
Median Hospital Stay	**7**	**7**

Unadjusted Mortality: Teaching vs. Non-Teaching Hospitals

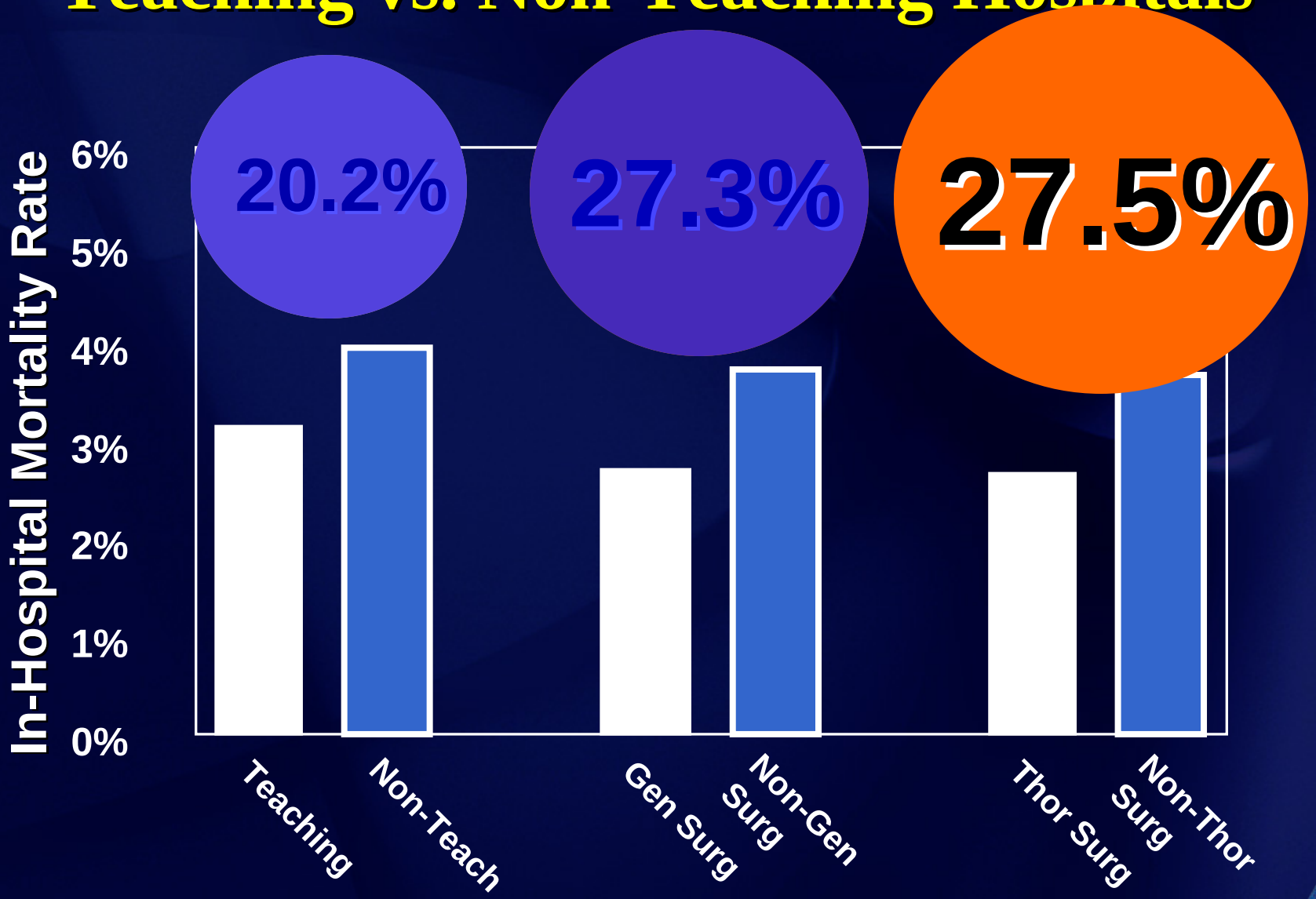


Multivariate Analysis of Lobectomies at Teaching vs. Non-Teaching

	Odds Ratio*	95% CI	P-value
Overall	***0.81***	**19% Reduction in Mortality**	
Sub-Groups:			
Volume ≤ 5	0.83	0.70 - 0.97	0.023
Volume ≤ 10	0.83	0.70 - 0.98	0.026
Volume ≥ 10	0.83	0.70 - 0.98	0.026
Volume ≥ 20	0.84	0.71 - 0.98	0.031

*** Adjusted for Age, Gender, Race, Comorbidities, Volume**

Unadjusted Overall Mortality: Teaching vs. Non-Teaching Hospitals



Summary

Statistically significant difference in mortality rate for lobectomies at teaching vs. non-teaching hospitals (2.94% vs. 3.62%)

19% improvement in post-operative survival for lobectomy at teaching hospital

(95% CI: 0.69 - 0.96)

These findings are independent of hospital volume

Teaching Hospitals: *Process of Care*

- Subspecialty trained surgeons
  - Thoracic vs. General surgeons
- In-house resident / fellow care
- Dedicated SICU directed by intensive care specialists
- Thoracic anesthesiology
- Physical / Respiratory therapists
- Interdisciplinary team management of lung cancer patients
- Pathway protocols for post-operative care

Study Limitations

- Retrospective database design
- Definition of teaching hospital in NIS
- Inability to account for differences in surgical specialty training
- Unable to examine other post-op outcomes
- Inability to further delineate what differences exist between teaching & non-teaching hospitals

Conclusions

- These data suggest that post-operative mortality is improved for patients undergoing lobectomy at teaching hospitals.

- More research is needed to define the influence of hospital status and the process of care on post-operative outcomes for high-risk operations.

Conclusions

- Our data refute the fears of patients seeking surgical care at teaching hospitals
- Information regarding these processes of care could be disseminated to improve patient care and outcomes nationally.
- Critical steps in the process of care should be identified for the benefit of patients undergoing resection for lung cancer independent of hospital volume and teaching status.

Application of NIS/HCUP/AHRQ

- Limitations: patient level data (staging, specific complications, etc)
- Applicability of NIS increased by combining with other datasets (ACGME in this study)
- Specialty Datasets: Society of Thoracic Surgeons database in adult cardiac, general thoracic and pediatric cardiac surgery

Policy Implications

- If data is taken at face value, AHRQ could propose national clinical practice guidelines (i.e. beta-blockers for MI) to have complex procedures performed at teaching hospitals
- If conclusions are extrapolated, and the "processes of care" are felt to be essential for improved outcomes, policy makers could make these mandatory services for these procedures

Thank You

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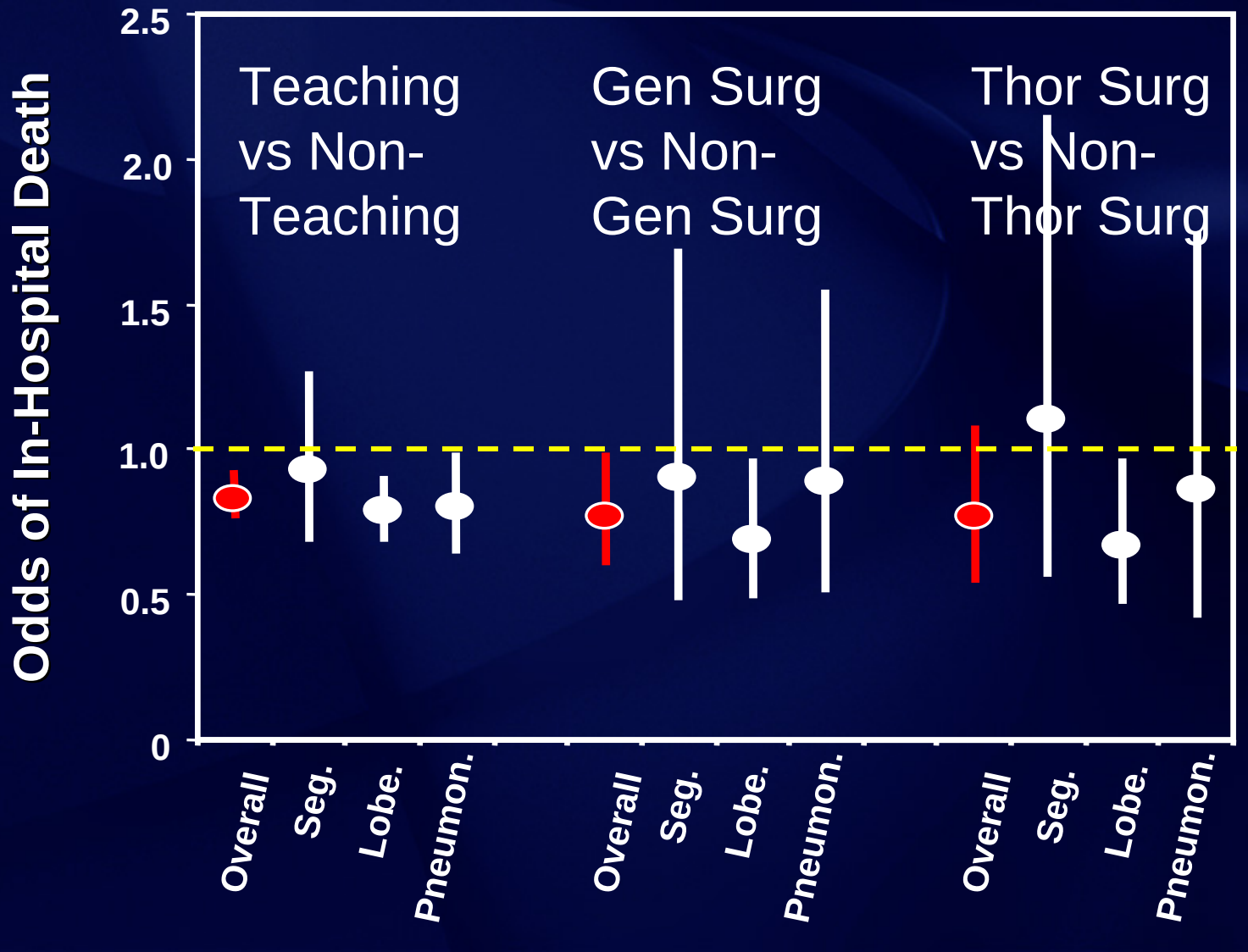
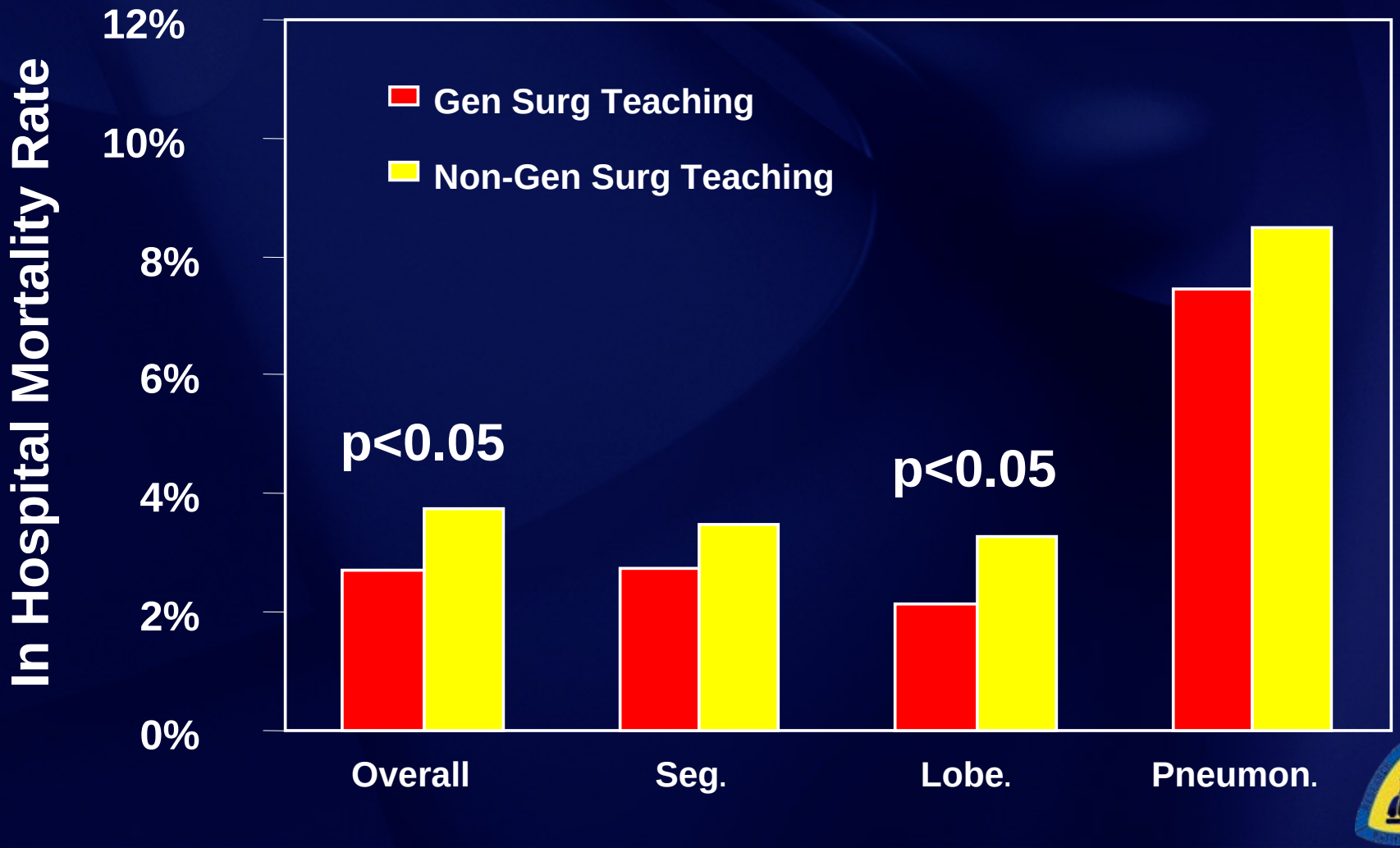
Adjusted Odds Ratio of In-Hospital Death after Lung Resection



Hypotheses:

- *Post-Operative mortality after lung resection is reduced at teaching hospitals*
- *This reduction is independent of volume*
- *Mortality outcomes for Thoracic Surgeons are improved over General Surgeons*

Unadjusted Mortality: General Surgery Teaching vs. Non-Gen Surg Teaching Hospitals



Unadjusted Mortality: Thoracic Surgery Teaching vs. Non-Thor Surg Teaching Hospitals