Eastern Association for the Surgery of Trauma

28th Annual Scientific Assembly

Sunrise Session 2
National Data Sources for Acute Care Surgery
Pearls and Pitfalls for Researchers and Readers

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MAYO CLINIC

National Data Sources for Acute Care Surgery: Pearls and Pitfalls for Researchers and Readers

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Agenda

- Introduction to Secondary Data Analysis
- National Data Sources for Acute Care Surgery
- Choosing a Data Source for Your Question
- A Surgeon's Perspective

What is Secondary Data Analysis?

Secondary Data Definitions

- Primary data:
  Data collected directly by the user for a specific purpose
- Secondary data:
  Data collected by someone other than the user, for some other purpose
- Primary data → Secondary data

National Sources of Secondary Data

Administrative (Billing, "Claims") Data

- Nationwide Inpatient Sample (NIS)
  - KID Database
- Private Payer Administrative Data
  - United, Blue Cross Blue Shield, Kaiser
  - Optum Labs
  - MMSI
- Medicare
  - Medicare-Linked Data
    - SEER-Medicare

National Sources of Secondary Data

- Cancer Registries or Data
  - Surveillance, Epidemiology, and End Results (SEER)
  - California Cancer Registry
  - National Cancer Database (NCDB)
- Surgery-Specific Data
  - Society of Thoracic Surgery (STS)
  - American College Surgeons National Surgical Quality Improvement Program (ACS-NSQIP)
- Other Clinical Sources
  - National Trauma Database
  - Trauma Quality Improvement Program (TQIP)
  - Vascular Quality Initiative (VQI)
  - … and others

+ Advantages to secondary data analysis

- Saves time
- Inexpensive
- No additional respondent burden
- Often more data available
- Cross-sectional
- Longitudinal

- Disadvantages to secondary data analysis

- Lack of control
- Population
- Sample design
- Measures
- Data availability/outdated data
- Level of observation
- Quality of documentation
- Data quality control
- “Scoopable”

+/- Primary vs. Secondary data

- Not either/or question
- Secondary data analysis can be a good place to start
- Generate publication record
- Provide preliminary data for grant application

Benefits and Limitations of Secondary Data Research

Limitations

- Potential for selection bias
- Need to justify methods and data to reviewers
- Existing variables may not include those of interest
- Delay in studying new procedures
- Lack of control
- Outdated data
- "Scoopable"

Benefits

- Cross Sectional or Longitudinal
- Study effects that would be impossible or possibly unethical to study in RCTs
- Identify nationwide trends
- Inclusion of disadvantaged populations
- Often publicly available
- Study rare conditions
- No additional respondent burden
- Lower costs

Administrative data

- Billing information
- Can be enhanced with registry/other data in certain datasets (NTDB)

National Data Sources for Acute Care Surgery

- NIS
  - KID
- NSQIP
  - Must participate
- NTDB
  - TQIP for Level I and II

NIS

- HCUP Data
- Samples 20% US hospitals
  - Every patient in sampled hospital
- Based on state inpatient data files
- Can be weighted→ population data
- Multiple ICD-9 diagnosis and procedure codes
- Elixhauser comorbidity
- No follow-up

NSQIP

- ACS data
- Opt-in participation
- Cycled sampling
- Vascular and general surgery
- Only one diagnosis code, multiple CPT codes
- Comorbidities and complications
- 30 day follow-up

NTDB

- ACS trauma data
- All verification levels
- Patient level inclusion (injury ICD-9 codes)
- Comorbidities and complications
- Certain ICD-9 codes are collected, varies by center

Choosing a Data Source for Your Question

Patient/Case Identification

Inclusion Criteria for Data

NIS/KID: All US hospitalizations

*Multiple ICD-9 diagnosis and procedure codes

NTDB: ISS 9+ (TQIP Level I or II center only)

NSQIP: Participating center, general and vascular surgical procedures (no trauma, cardiac)

*Pediatric NSQIP separate

*Only one ICD-9 diagnosis code

Demographics and Disparities

Utilization

Outcomes

Benchmarking and Institutional Comparisons

Demographics and Disparities

Age, gender, race, ethnicity, payer status in most data sources

Utilization

Outcomes

Benchmarking and Institutional Comparisons

ORIGINAL ARTICLES

Primary Payer Status Affects Mortality for Major Surgical Operations

Damien J. LaPar, MD,* Castigliano M. Bhamidipati, DO,* Carlos M. Mery, MD, MPH,* George J. Stukenborg, PhD,† David R. Jones, MD,* Bruce D. Schirmer, MD,* Irving L. Kron, MD,* and Gorav Ailawadi, MD*

ORIGINAL ARTICLE

Insurance Status and Hospital Discharge Disposition After Trauma: Inequities in Access to Postacute Care

Greg D. Sacks, BA, Caterina Hill, MSc, and Selwyn O. Rogers, Jr., MD, MPH

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Demographics and Disparities

Utilization

Specific operation or treatment

Cost/charges

Outcomes

Benchmarking and Institutional Comparisons

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Morbid Obesity and Diverticulitis: Results from the ACS NSQIP Dataset

Matthew B Bailey, MD, Daniel I. Davenport, PhD, Levi Procter, MD, Shaun McKenzie, MD, H David Vargas, MD, FACS

BACKGROUND: We examined the relationship between morbid obesity, clinical presentation, and perioperative outcomes in patients offered surgery for diverticulitis.

STUDY DESIGN: We queried the ACS NSQIP dataset from 2005 to 2010 for patients undergoing surgery for nonhemorrhaging diverticulitis. Univariate comparisons were made between normal weight (NL) and morbidly obese (MO) patients in terms of demographics, clinical presentation, and perioperative and postoperative outcomes variables using chi-square or rank tests. Multivariable regression was used to adjust for age in assessing the impact of MO on the likelihood of emergent surgery (ES), ostomy creation, open surgery, and undergoing procedures without an anastomosis.

RESULTS: We identified 10,952 patients undergoing surgery for diverticulitis: morbidly obese (body mass index [BMI] $\geq$ 40 kg/m^2, n = 592, 5.7%), normal weight (BMI 18.5 to 25 kg/m^2, n = 2,530, 24.2%). Morbidly obese patients were younger than NL patients by an average of 9.4 years ($p < 0.001$). Morbidly obese patients underwent ES more frequently than NL patients (19.3% vs 15.4%; $p = 0.025$). Multivariable regression identified morbid obesity as an independent risk factor for ES (odds ratio [OR] 1.75, 95% CI 1.37 to 2.24, $p < 0.001$), ostomy creation (OR 1.67, 95% CI 1.34 to 2.08, $p < 0.001$), undergoing procedures without an anastomosis (OR 1.78, 95% CI 1.42 to 2.24, $p < 0.001$), and open surgery (OR 2.09, 95% CI 1.72 to 2.53, $p < 0.001$). Morbidly obese patients undergoing ES had more preoperative systemic inflammatory response syndrome/sepsis/septic shock than NL patients (72.8% vs 57.7%, $p = 0.004$).

CONCLUSIONS: Morbidly obese patients undergoing surgery for diverticulitis are nearly 10 years younger than NL patients and are more likely to require ES, ostomy creation, open surgery, and to undergo procedures without an anastomosis. Morbidly obese patients undergoing ES also have more preoperative systemic inflammatory response syndrome/sepsis/septic shock. (J Am Coll Surg

Cost-efficiency and outcomes in the treatment of perforated peptic ulcer disease: Laparoscopic versus open approach

G. Paul Wright, MD,[a,b] Alan T. Davis, PhD,[b,c] Tracy J. Koehler, MA,[c] and David E. Scheeres, MD, FACS,[a,b,d] *Grand Rapids, MI*

Purpose. *Laparoscopic treatment of perforated peptic ulcer disease (perfPUD) has demonstrated comparable operative outcomes with an open approach though the cost-efficiency of this method has not been studied.*

Table IV. Multivariate mortality

	OR (95% CI)	P value
Charlson-Deyo score	2.79 (1.81–4.29)	<.001
Age	1.04 (1.04–1.05)	<.001
Septicemia*	4.47 (3.42–5.83)	<.001
Shock*	3.54 (2.63–4.78)	<.001
Laparoscopic approach		.459

*At time of admission to the hospital.
Nonsignificant variables include sex, hospital size, and hospital type.
CI, Confidence interval; OR, odds ratio.

Table V. Multivariate total charges

	Beta coefficient	P value
Age	0.008	<.001
Charlson-Deyo score	0.193	.002
Septicemia*	0.741	<.001
Shock*	0.248	<.001
Hospital size†	0.090	<.001
Hospital‡	0.116	<.001
Laparoscopic approach		.683

*At time of admission to the hospital.
†Hospital size = small, medium, and large.
‡Hospital type = urban teaching, urban nonteaching, rural.
Nonsignificant variables included sex.

- NIS
- ICD-9 codes to identify perforated PUD
- Outcomes: LOS, mortality, charges

"The HCUP NIS, SID, and KID **contain data on total charges for each hospital** in the databases. This charge information represents **the amount that hospitals billed for services**, but **does not reflect how much hospital services actually cost or the specific amounts that hospitals received in payment**. In some cases, users may be interested in seeing how hospital charges translate into actual costs.

The HCUP Cost-to-Charge Ratio Files enable this conversion. Each file contains **hospital-specific cost-to-charge ratios based on all-payer inpatient cost for nearly every hospital in the corresponding NIS, SID, or KID databases**. Cost information was obtained from the hospital accounting reports collected by the Centers for Medicare and Medicaid Services (CMS). Some **imputations for missing values** were necessary.

Users can merge the data elements on the appropriate file to the corresponding NIS, SID, or KID databases by the data element hospital identification number (HOSPID). Using the merged data elements from the cost-to-charge ratio files and the total charges reported in the NIS, SID, or KID databases, **users may convert the hospital total charge data to cost estimates by simply multiplying total charges with the appropriate cost-to-charge ratio.**

HCUP Cost-to-Charge Ratio Files are designed to be used exclusively with the HCUP NIS, SID, or KID. These files are **unique by year."**

Demographics and Disparities

Utilization

Outcomes

- Complications
- Length of Stay
- Mortality
- Readmission

Benchmarking and Institutional Comparisons

- NIS
  - Complications by ICD-9 diagnosis or procedure code, no standard definition
  - In-hospital mortality and complications only, no post-discharge follow-up
- NTDB
  - Standard complication definitions
  - In-hospital mortality and complications only, no post-discharge follow-up
- NSQIP
  - Standard complication definitions
  - 30 day follow-up
    - Readmission
    - Reoperation
    - Mortality

ORIGINAL ARTICLE

Outcomes of Cholecystectomy in US Heart Transplant Recipients

Arman Kilic, MD, Amy Sheer, MPH,* Ashish S. Shah, MD,* Stuart D. Russell, MD,† Christine G. Gourin, MD,‡ and Anne O. Lidor, MD, MPH**

Objective: The aim of this study was to evaluate outcomes and predictors of in-hospital mortality after cholecystectomy in heart transplant (HTx) recipients.

Background: There is a paucity of data on outcomes after cholecystectomy in HTx recipients.

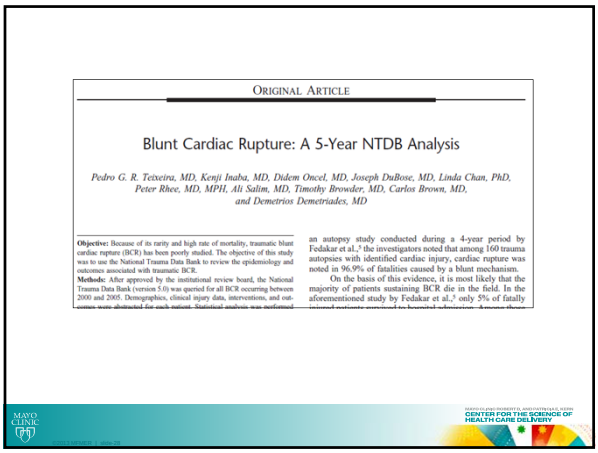
Methods: The Nationwide Inpatient Sample (NIS) database was used to identify HTx recipients who underwent cholecystectomy between 1998 and 2008. Multivariate logistic regression analysis was constructed using clinically relevant covariates (age, gender, Charlson comorbidity index, race, admission acuity, complicated gallstone disease, hospital teaching status, and open vertient population remains controversial. Moreover, in the general population, cholecystectomy is generally recommended for symptomatic cholelithiasis or complications of gallstones, such as acute cholecystitis or gallstone pancreatitis. With regard to HTx recipients, some groups have recommended that patients with asymptomatic, uncomplicated cholelithiasis also undergo cholecystectomy, given increased risks of morbidity and mortality, should a complication develop in this patient cohort.[4] Other centers have recommended similar management to the general population in terms of reserving cholecystectomy for symptomatic or complicated cases.[5] A major limitation of previous investigations has been the limited number of patients.

TABLE 1. ICD-9 Codes for Diagnosis

Diagnosis	ICD-9 Codes
Acute cholecystitis	574.0, 574.00, 574.01, 574.1, 574.10, 575.0, 575.12, 575.10, 574.11, 574.10
Chronic cholecystitis	575.11
Acute or chronic pancreatitis	577.0, 577.1
Choledocholelithiasis	574.3, 574.4, 574.5, 574.6x, 574.7x, 574.8x, 574.9x, 574.5x, 576.x
Calculus of the gallbladder without cholecystitis	574.2, 574.20
Other related diagnoses	575.2, 575.3, 575.4, 575.5, 575.6, 575.8, 575.9, 576.4, 576.8, 576.9, 576.3

TABLE 2. ICD-9 Codes For Complications After Cholecystectomy

Complication	ICD-9 Codes
Respiratory failure	518.81, 518.82, 518.84, 518.4, 518.5
Pneumonia	481, 482.0–482.9, 483, 484, 485, 507.0
Myocardial infarction	410.00–410.91
Deep venous thrombosis	451.11, 451.19, 451.2, 451.81, 453.8
Pulmonary embolism	415.1, 415.11, 415.19
Acute renal failure	584
Postoperative hemorrhage	998.1, 530.82, 531.00–531.21, 531.40, 531.41, 531.60, 531.61, 532.00–532.21, 532.40, 532.41, 532.60, 532.61, 533.00–533.21, 533.40, 533.41, 533.60, 533.61, 534.00–534.21, 534.40, 534.41, 534.60, 534.61, 535.01, 535.11, 535.21, 535.31, 535.41, 535.51, 535.61, 578.9
Surgical site infection	958.3, 998.5, 998.59, 998.51



ORIGINAL ARTICLE

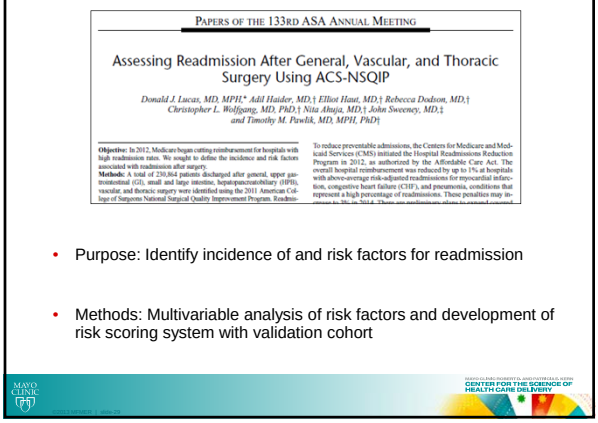
Blunt Cardiac Rupture: A 5-Year NTDB Analysis

Pedro G. R. Teixeira, MD, Kenji Inaba, MD, Didem Oncel, MD, Joseph DuBose, MD, Linda Chan, PhD, Peter Rhee, MD, MPH, Ali Salim, MD, Timothy Browder, MD, Carlos Brown, MD, and Demetrios Demetriades, MD

Objective: Because of its rarity and high rate of mortality, traumatic blunt cardiac rupture (BCR) has been poorly studied. The objective of this study was to use the National Trauma Data Bank to review the epidemiology and outcomes associated with traumatic BCR.
Methods: After approved by the institutional review board, the National Trauma Data Bank (version 5.0) was queried for all BCR occurring between 2000 and 2005. Demographics, clinical injury data, interventions, and outcomes were abstracted for each patient. Statistical analysis was performed

an autopsy study conducted during a 4-year period by Fedakar et al,[3] the investigators noted that among 160 trauma autopsies with identified cardiac injury, cardiac rupture was noted in 96.9% of fatalities caused by a blunt mechanism.

On the basis of this evidence, it is most likely that the majority of patients sustaining BCR die in the field. In the aforementioned study by Fedakar et al,[3] only 5% of fatally injured patients survived to hospital admission. Among those



PAPERS OF THE 133RD ASA ANNUAL MEETING

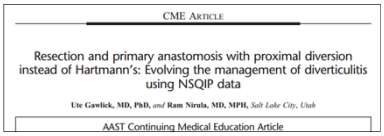
Assessing Readmission After General, Vascular, and Thoracic Surgery Using ACS-NSQIP

Donald J. Lucas, MD, MPH, Adil Haider, MD,† Elliot Haut, MD,† Rebecca Dodson, MD,† Christopher L. Wolfgang, MD, PhD,† Nita Ahuja, MD,† John Sweeney, MD,‡ and Timothy M. Pawlik, MD, MPH, PhD†*

Objective: In 2012, Medicare began cutting reimbursement for hospitals with high readmission rates. We sought to define the incidence and risk factors associated with readmission after surgery.
Methods: A total of 230,864 patients discharged after general, upper gastrointestinal (GI), small and large intestine, hepatopancreatobiliary (HPB), vascular, and thoracic surgery were identified using the 2011 American College of Surgeons National Surgical Quality Improvement Program. Readmis-

To reduce preventable admissions, the Centers for Medicare and Medicaid Services (CMS) initiated the Hospital Readmissions Reduction Program in 2012, as authorized by the Affordable Care Act. The overall hospital reimbursement was reduced by up to 1% at hospitals with above-average risk-adjusted readmissions for myocardial infarction, congestive heart failure (CHF), and pneumonia, conditions that represent a high percentage of readmissions. These penalties may in-

- Purpose: Identify incidence of and risk factors for readmission
- Methods: Multivariable analysis of risk factors and development of risk scoring system with validation cohort



CME ARTICLE

Resection and primary anastomosis with proximal diversion instead of Hartmann's: Evolving the management of diverticulitis using NSQIP data

Ute Gawlick, MD, PhD, *and* **Ram Nirula, MD, MPH,** *Salt Lake City, Utah*

AAST Continuing Medical Education Article

- NSQIP
- Patients with diverticulitis who underwent associated procedure
- Compared outcomes between two techniques

NSQIP specific variables

- ASA class
- Operative times
- Transfusion volume
- Resident involvement

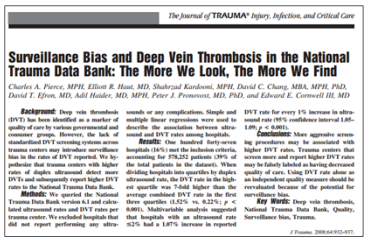
Demographics and Disparities

Utilization

Outcomes

Benchmarking and Institutional Comparisons

- NIS
  - Institutional identifiers and surgeon identifiers
  - Institutional characteristics
- NTDB
  - Institutional identifiers
  - Institutional characteristics (ACS verification, state verification, others)
- NSQIP
  - No institutional identifiers or characteristics



The Journal of TRAUMA® Injury, Infection, and Critical Care

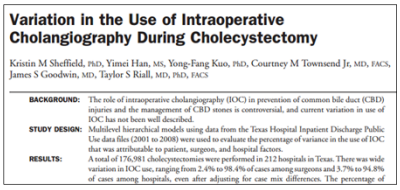
Surveillance Bias and Deep Vein Thrombosis in the National Trauma Data Bank: The More We Look, The More We Find

Charles A. Pierce, MPH, Elliott R. Haut, MD, Shahrzad Kardooni, MPH, David C. Chang, MBA, MPH, PhD, David T. Efron, MD, Adil Haider, MD, MPH, Peter J. Pronovost, MD, PhD, and Edward E. Cornwell III, MD

Background: Deep vein thrombosis (DVT) has been identified as a marker of quality of care by various governmental and consumer groups. However, the lack of standardized DVT screening systems across trauma centers may introduce surveillance bias in the rates of DVT reported. We hypothesize that trauma centers with higher rates of duplex ultrasound detect more DVTs and subsequently report higher DVT rates to the National Trauma Data Bank. **Methods:** We queried the National Trauma Data Bank version 6.1 and calculated ultrasound rates and DVT rates per trauma center. We excluded hospitals that did not report performing any ultrasounds or any complications. Simple and multiple linear regressions were used to describe the association between ultrasound and DVT rates among hospitals. **Results:** One hundred forty-seven hospitals (16%) met the inclusion criteria, accounting for 578,252 patients (39% of the total patients in the dataset). When dividing hospitals into quartiles by duplex ultrasound rate, the DVT rate in the highest quartile was 7-fold higher than the average combined DVT rate in the first three quartiles (1.52% vs. 0.22%; $p < 0.001$). Multivariable analysis suggested that hospitals with an ultrasound rate ≤2% had a 1.07% increase in reported DVT rate for every 1% increase in ultrasound rate (95% confidence interval 1.05–1.09; $p < 0.001$). **Conclusions:** More aggressive screening procedures may be associated with higher DVT rates. Trauma centers that screen more and report higher DVT rates may be falsely labeled as having decreased quality of care. Using DVT rate alone as an independent quality measure should be reevaluated because of the potential for surveillance bias. **Key Words:** Deep vein thrombosis, National Trauma Data Bank, Quality, Surveillance bias, Trauma.

J Trauma. 2008;64:932–937.

- NTDB
- Determined ultrasound and DVT rates per center
- Multivariable analysis



Variation in the Use of Intraoperative Cholangiography During Cholecystectomy

Kristin M Sheffield, PhD, Yimei Han, MS, Yong-Fang Kuo, PhD, Courtney M Townsend Jr, MD, FACS, James S Goodwin, MD, Taylor S Riall, MD, PhD, FACS

BACKGROUND: The role of intraoperative cholangiography (IOC) in prevention of common bile duct (CBD) injuries and the management of CBD stones is controversial, and current variation in use of IOC has not been well described.

STUDY DESIGN: Multilevel hierarchical models using data from the Texas Hospital Inpatient Discharge Public Use data files (2001 to 2008) were used to evaluate the percentage of variance in the use of IOC that was attributable to patient, surgeon, and hospital factors.

RESULTS: A total of 176,981 cholecystectomies were performed in 212 hospitals in Texas. There was wide variation in IOC use, ranging from 2.4% to 98.4% of cases among surgeons and 3.7% to 94.8% of cases among hospitals, even after adjusting for case mix differences. The percentage of

- State inpatient file
- Used institution and surgeon IDs to determine intraoperative cholangiogram rates
- IOC use more reflective of surgeon and institution ID than patient characteristics

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Questions & Discussion

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