NSQIP-P for the comparative analysis of resource utilization and disease-specific outcomes:

Implications for Benchmarking and Collaborative Quality Improvement

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NSQIP-P for the comparative analysis of resource utilization and disease-specific outcomes

Outline:

• Justification for expanding the platform
• Appendicitis as a model pilot disease
• Estimating the potential of QI through administrative data
• Implications for value-based collaborative QI
• Challenges & next steps
Why should NSQIP-P capture disease-specific resource utilization and outcome measures?

Events are relatively rare in children and may not always be “actionable”...

(2011 NSQIP-P data, n=46,281)
Why should NSQIP-P capture disease-specific resource utilization and outcome measures?

Because we can’t afford not to...
Why focus on appendicitis as a model disease for the NSQIP-P pilot expansion?

• Most common abdominal surgical emergency in children
• Approximately 80,000 cases/year in the United States
• Relatively high treatment-associated resource utilization due to case volume and morbidity of perforated disease
• Evidence-base remains poor and variation in care extreme
Reported cost of the most expensive surgical procedures performed at 42 Childrens Hospitals (2010)

(PHIS Database, 2010, Child Health Care Association)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Cumulative Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsal and dorsolumbar fusion, posterior technique</td>
<td>$157,088,942</td>
</tr>
<tr>
<td>Laparoscopic &amp; open appendectomy</td>
<td>$147,678,876</td>
</tr>
<tr>
<td>Tonsillectomy with adenoidectomy</td>
<td>$132,041,546</td>
</tr>
<tr>
<td>Temporary tracheostomy</td>
<td>$126,344,955</td>
</tr>
<tr>
<td>Other partial resection of small intestine</td>
<td>$126,339,728</td>
</tr>
<tr>
<td>Heart transplantation</td>
<td>$98,280,627</td>
</tr>
<tr>
<td>Other excision or destruction of lesion or tissue of brain</td>
<td>$90,175,197</td>
</tr>
<tr>
<td>Myringotomy with insertion of tube</td>
<td>$89,597,410</td>
</tr>
<tr>
<td>Ventriculostomy</td>
<td>$72,351,661</td>
</tr>
</tbody>
</table>
Where is the greatest variation in practice for patients treated with appendicitis at children’s hospitals?

- Advanced diagnostic imaging (ER)
- Postoperative resource utilization (complicated disease)
  - Advanced diagnostic imaging
  - PICC line utilization
  - TPN utilization
  - Laboratory utilization
- Readmission rates
Why focus on preventable readmissions following treatment for pediatric appendicitis?
Comparative analysis of readmission rates:
Study Design

• 5 year retrospective cohort review (1/2006 to 9/2011)
  – 30 day all-cause readmission rates following discharge from index encounter
  – Source: PHIS database (38 freestanding Children’s Hospitals)

• Calculation of standardized 30-day readmission rates
  – Hierarchical modeling through General Estimating Equations adjusting for disease severity, age, insurance, race, gender & hospital effect

• Performance-based Comparative analysis
  – Descriptive statistics to compare the relative proportions of hospitals by performance-based outlier status before and after risk-adjustment
PHIS-based Clinical Classification:

Uncomplicated appendicitis
- Cohort definition: Post-op LOS ≤2 days (n=31,820) - 31% of entire cohort

Complicated appendicitis
- Cohort definition: Post-op LOS ≥3 days ≥3 days of antibiotics (n=16,046) - 8% of entire cohort (unclassified)

Any ICD-9-CM Dx: 540.1, 540.0, 540.9 - 61% of entire cohort
Variation in standardized readmission rates for patients treated with appendicitis at 38 children’s hospitals

12 (32%) low-performing outliers

10 (26%) high-performing outliers

Rice-Townsend et al, Ann Surg, In press
Variation in standardized readmission rates for patients treated with complicated appendicitis (Complicated disease)

- 7 (18%) low-performing outliers
- 11 (29%) high-performing outliers

Rice-Townsend et al., Ann Surg, In press
CBS HEALTHWATCH

TO SCAN OR NOT TO SCAN?

NEW STUDIES SHOW INCREASED CANCER RISK
Comparative analysis of diagnostic imaging rates: Study Design

- PHIS database (40 children’s hospitals)

- 1/2009-6/2011, ages 3-18, ICD-9-CM Px for non-interval appendectomy

- Multivariable hierarchical regression using GEEs to evaluate influence of independent variables on imaging utilization (CT and US)
  - Age, gender, race, insurance status, chronic health conditions, median household income & hospital-level effect
Variation in standardized diagnostic imaging rates for appendicitis at 40 children’s hospitals

(n=28,043)

Overall imaging rate: 50.8%

12 (30%) high-utilization outliers

10 (25%) low-utilization outliers
Relationship between CT & US utilization at 40 children’s hospitals

- Overall CT rate: 23.7%
- Overall US rate: 31.8%
Compliance with American College of Radiology guidelines for children with suspected appendicitis at 40 children’s hospitals

Overall compliance rate: 47.6%
What about postoperative resource utilization in children with complicated disease?

- TPN utilization
- PICC-lines
- Advanced diagnostic imaging (CT or US)
Variation in the utilization of PICC lines
(Complicated disease, 2009-2011)
Variation in the utilization of postoperative TPN
(Complicated disease, 2009-2011)
Variation in the utilization of postoperative advanced diagnostic imaging (abdominal US or CT) (Complicated disease, 2009-2011)
But how does variation in care relate to meaningful outcomes in this cohort children?

• Negative (non-diagnostic) appendectomy rate?
• Delayed/missed diagnosis rate?
• Readmission rate for treatment failure?
Applying the concept of value in health care:

\[
\text{VALUE} = \frac{\text{Quality}}{\text{Cost}}
\]

“How many negative CT scans are worth preventing one negative appendectomy?”

“How many PICC lines are worth preventing one readmission due to antibiotic treatment failure?”
Relationship between advanced diagnostic imaging rate and negative appendectomy rate

(PHIS, 2009-2011, n=40 hospitals)
Relationship between advanced diagnostic imaging rate and negative appendectomy rate

(PhiS, 2009-2011, n=40 hospitals)

The scatter plot illustrates the relationship between the advanced diagnostic imaging rate and the non-diagnostic appendectomy rate. The median value is indicated by a blue line. Hospitals are categorized into "Higher-performers" and "Lower-performers" based on their performance metrics.
How can we define “quality” with respect to cost-effective postoperative care?
How can we define “quality” with respect to cost-effective postoperative care?

“Higher performers”
## Relationship between hospital-specific resource utilization, case volume & outcomes

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Spearman’s Correlation [rho (p-value)]</th>
<th>Weighted Kappa (Quartile rankings) [k (95%CI)]</th>
<th>Strength of Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Negative Appendectomy Rate vs.:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case volume</td>
<td>-0.342 (0.042)</td>
<td>0.034 (-0.233-0.301)</td>
<td>Very Weak</td>
</tr>
<tr>
<td>Resource utilization measure:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Rate of advanced diagnostic imaging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in the Emergency Department</td>
<td></td>
<td>-0.288 (-0.462 to -0.115)</td>
<td>Weak</td>
</tr>
<tr>
<td>Number of laboratory tests ordered in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the Emergency Department</td>
<td></td>
<td>N/A</td>
<td>Very Weak</td>
</tr>
<tr>
<td><strong>Readmission Rate vs.:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case volume</td>
<td>-0.461 (0.009)</td>
<td>-0.221 (-0.443-0.002)</td>
<td>Very Weak</td>
</tr>
<tr>
<td>Resource utilization measure:</td>
<td></td>
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<td></td>
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<tr>
<td>Rate of parenteral nutrition</td>
<td>0.162 (0.375)</td>
<td>0.075 (-0.192-0.342)</td>
<td>Very Weak</td>
</tr>
<tr>
<td>utilization during the postoperative</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>period</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Rate of advanced diagnostic imaging</td>
<td>0.097 (0.596)</td>
<td>-0.025 (-0.269-0.219)</td>
<td>Very Weak</td>
</tr>
<tr>
<td>during the postoperative period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of central venous access</td>
<td>0.232 (0.201)</td>
<td>0.111 (-0.159-0.391)</td>
<td>Very Weak</td>
</tr>
<tr>
<td>procedures during the postoperative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>period</td>
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<tr>
<td>Number of laboratory tests ordered</td>
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<tr>
<td>during the postoperative period</td>
<td></td>
<td>N/A</td>
<td>Very Weak</td>
</tr>
<tr>
<td>Postoperative length of stay (days)</td>
<td></td>
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</tbody>
</table>
Conclusions from administrative modeling

• Wide variation in practice exists across all aspects of care for patients treated with appendicitis at children’s hospitals

• Wide variation exists between children’s hospitals for non-diagnostic appendectomy and readmission rates

• There is poor correlation between resource utilization, hospital volume, disease severity and outcomes
Preliminary quality and resource utilization metrics for the P-NSQIP appendicitis pilot project

• Diagnostic work-up
  – Utilization: Advanced diagnostic imaging rates
  – Outcomes: Negative appendectomy, treatment delay & ACR compliance rates

• Postoperative management (30 day window)
  – Utilization: TPN, PICC line & advanced diagnostic imaging rates, total hospital days
  – Outcomes: Readmission to ED and inpatient setting, postoperative drainage
What could we accomplish from a p-NSQIP collaborative surrounding utilization/outcomes data?

• Identification and dissemination of strategies from exemplar centers to:
  – Increase the availability & diagnostic yield of preoperative US
  – Optimize the use of targeted diagnostic imaging for early postoperative detection of intra-abdominal abscesses
  – Reduce preventable readmissions

• Establishing which, if any, patients may benefit from postop TPN

• Establishing which, if any, patients may benefit from the use of PICC lines for prolonged IV antibiotic therapy

• And potentially much, much more......
Challenges and next steps...

- Establishing consensus definitions for outcomes/severity
- Appropriate risk-adjustment for severity and other factors
- Sampling and power issues
- Non-operative therapy & interval appendectomy??
- FTE balance for increased data collection effort
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