Optimal Resources for Children’s Surgical Care

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Objectives

- Examine the relationship between resources available and outcomes for children’s surgical care in 2015.
- Provide a vision and a specific plan to prospectively match clinical resources with the needs of individual children receiving surgical care in the United States.
- No financial conflict; ACS Medical Director
1. Much of children’s surgery is done today in a nonspecialized environment.

2009 US (KID) Data

- 87,110/189,977 children’s general and thoracic inpatient procedures done in general hospitals...45.9%


Where are surgical neonates definitively treated in U.S.? (KIDS 2009 Data)

<table>
<thead>
<tr>
<th></th>
<th>Free Standing Children's Hospital</th>
<th>Children's Unit within a Hospital</th>
<th>General Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%), Preliminary data/unpublished</td>
<td>20.57%</td>
<td>34.33%</td>
<td>45.1%</td>
</tr>
</tbody>
</table>

- Free Standing Children's Hospital
- Children's Unit within a Hospital
- General Hospital
### Table 2. Complex neonatal procedures by hospital type for 2009

<table>
<thead>
<tr>
<th>Procedure</th>
<th>All Hospital Types*</th>
<th>Children's Hospital &amp; Children's unit†</th>
<th>General Hospital†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weighted Frequency</td>
<td>Weighted Frequency Per 10,000 (95% CI)</td>
<td>Weighted Frequency Per 10,000 (95% CI)</td>
</tr>
<tr>
<td>Operation for malrotation</td>
<td>1,176</td>
<td>760 (9.7, 7.6 - 11.8)</td>
<td>278 (6.8)</td>
</tr>
<tr>
<td>Repair esophageal atresia</td>
<td>1,077</td>
<td>816 (9.7, 7.6 - 11.8)</td>
<td>156 (13.1)</td>
</tr>
<tr>
<td>Lung biopsy</td>
<td>899</td>
<td>612 (7.3, 5.6 - 8.9)</td>
<td>141 (10.8)</td>
</tr>
<tr>
<td>Pull through for Hirschsprung</td>
<td>675</td>
<td>503 (6.0, 4.7 - 7.3)</td>
<td>77 (16.4)</td>
</tr>
<tr>
<td>Repair diaphragmatic hernia</td>
<td>475</td>
<td>340 (4.5, 3.1 - 4.9)</td>
<td>66 (12.8)</td>
</tr>
</tbody>
</table>

†Rao Scott χ² test for difference in surgical volume rates between hospital types were all p<.0001 following Bonferroni adjustment for multiple test.
‡Procedural volume per 10,000 surgical admissions excluding circumcision.


Results - Trend by Comorbidity Profile

Conclusion

2015-

Substantial volumes of children's surgery, including relatively simple procedures, but also neonates and other high risk patients with complex procedures, are performed in nonspecialized environments.

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Top 10

1. Much of children's surgery is done in a nonspecialized environment today.
2. Specialized environment is associated with better outcomes for some procedures. This is most readily demonstrable for complex procedures in high risk patients.

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Congenital Heart Surgery 2013

- Cochrane Response Rapid Review
- 28 analyses; 248,164 patients
- Specialization(volume)....positive correlation with better outcome
- 19/28(68%)+ ; 0/28 - ; 8/28(29%) NS
  1 unclear
“Generally effective for reduction in mortality”

O/E Mortality for Surgical Neonates with Intrinsic Risk of Mortality >5%

<table>
<thead>
<tr>
<th>O/E ratio for hospital category</th>
<th>Statistical trend line</th>
</tr>
</thead>
<tbody>
<tr>
<td>General hospitals</td>
<td>Low</td>
</tr>
<tr>
<td>Children's units in general hospitals</td>
<td>Medium</td>
</tr>
<tr>
<td>Children's general hospitals</td>
<td>High</td>
</tr>
</tbody>
</table>

Preliminary data/unpublished

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3. Specialized pediatric anesthesia is critical for safe, contemporary children’s surgery.

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Background

Studies over the last 50 years have demonstrated:

- Higher mortality in infants undergoing anesthesia and surgery
- Highest mortality in neonates (< 1 month)
- Reduced morbidity when infants are cared for by pediatric anesthesiologists


Perioperative Mortality Differences

- Infants (< 1 year) have 4 x greater mortality risk than older children
- Neonates (< 1 month) have a 6 x greater mortality risk than infants > 1 month and < 1 year
- Neonates have an almost 25 x higher risk of mortality than older children undergoing surgery

Figure 1: Effect of absence of specialized pediatric anesthesiologist on PMAE-OR by type of surgery (P for interaction = 0.0482)
Surgeons and anesthesiologists should not undertake occasional paediatric practice.

Anaesthesia services for children require specially trained clinical staff together with equipment, facilities and environment.

The service should be led at all times by consultants who regularly anaesthetise children.

Relationship between Complications of Pediatric Anesthesia and Volume of Pediatric Anesthetics

A significant inverse correlation was shown between volume and complication rate in pediatric anesthesia.

<table>
<thead>
<tr>
<th>Annual number of anesthetics</th>
<th>Number of complications per 1000 anesthetics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-100</td>
<td>7.0 ± 24.8</td>
</tr>
<tr>
<td>100-200</td>
<td>2.8 ± 10.1</td>
</tr>
<tr>
<td>&gt;200</td>
<td>1.3 ± 4.3</td>
</tr>
</tbody>
</table>


“...we recommend that a minimum case load of 200 pediatric anesthetics per year is necessary to reduce the incidence of complications and improve the level of safety in pediatric practice.”
"The annual minimum case volume required to maintain clinical competence in each patient care category should be determined by facility’s Department of Anesthesia."

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4. **A comprehensive (Level III or IV) NICU is essential for optimal surgical care of neonates.**
Levels of Neonatal Care

Provision of risk appropriate care for newborn infants and mothers was first proposed in 1976. This updated policy statement provides a review of data supporting evidence for a tiered provision of care and reaffirms the need for uniform, nationally applicable definitions and consistent standards of service for public health to improve neonatal outcomes.

Facilities that provide hospital care for newborn infants should be classified on the basis of functional capabilities, and these facilities should be organized within a regionalized system of perinatal care. Pediatrics 2012;130:587-597.

Level III NICU

- Provides comprehensive care for infants born 25-31 months gestational age and weighing 800-1750 grams at birth with critical illness.
- Provides prompt and readily available access to a full range of pediatric medical subspecialists, pediatric surgeons, pediatric anesthesiologists, and pediatric ophthalmologists.
- Provides a full range of respiratory support.
- Performs advanced imaging with interpretation on an urgent basis.

Level IV Regional NICU

- Level IV regional NICU is capable of performing complex organ transplants or surgical repairs.
- Maintains a full range of pediatric medical subspecialists, pediatric surgical subspecialists, and pediatricians on obstetricians at the site.

Survival for Very Low Birth Weight Infants

- JAMA 2010;304[9]:992-1000
- Survival for Very Low Birth Weight Infants
- Table 1: Survival for Various Categories of Very Low Birth Weight Infants
- Figure 1: Survival Rate by Gestational Age and Birth Weight
- Figure 2: Survival Rate by Birth Weight and Gestational Age

- Pediatrics September 1, 2012 vol. 130 no. 3
- DOI: 10.1542/peds.2012-1999
Hospitals with higher neonatal surgery volume have better patient outcomes.


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5. A multidisciplinary PICU is necessary for comprehensive contemporary perioperative care of children and pediatric trauma patients.

<table>
<thead>
<tr>
<th>Trent</th>
<th>1014</th>
<th>74</th>
<th>42.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>1194</td>
<td>50</td>
<td>90.0</td>
</tr>
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The Lancet
Should paediatric intensive care be centralised? Trent Versus Victoria

**Interpretation**

If Trent is representative of the whole country, there are 453 (200-720) excess deaths a year in the UK that are probably due to suboptimal results from paediatric intensive care.

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In January 2000, a pediatric-specific task force assembled by the American Academy of Pediatrics (AAP) and the Society of Critical Care Medicine (SCCM) concluded that evidence supporting regionalized care for critically ill children was sufficiently strong to recommend its implementation.

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6. Specialized environment is likely important for (relatively) simple pediatric surgical problems.
   - Pediatric Hospitals: more severe disease
   - Non-Pediatric vs Pediatric Hospitals
     - Bowel resection more common, 59% vs 33%; Postop complications more common (OR 2.83, p<0.001)
   - Bowel resection age 0-4
     - Pediatric vs Non-Pediatric (OR 0.20, p<0.001)
     (McAteer JP, J Am Coll Surgeons. 2013 Aug 217(2))

Rural vs Urban Hospitals
- Pyloromyotomy ...fewer surgical & fewer anesthesia related complications (Urban H)
  (Anesthesia OR=0.12, 95%CI 0.05-0.29)
- Appendectomy ...fewer postop complications & fewer anesthesia related complications, especially age<5 (Urban H)
  (Anesthesia OR=0.75, 95%CI 0.59-0.96)

Differential Outcomes

(Intussusception)
Differential Outcomes
Rural vs Urban Hospitals

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7. A simple vision.
Vision

Every child in need of surgical care in North America today will receive care in an environment with resources appropriate to his/her individual need...furthermore this will become a model applicable elsewhere.

Regionalization -2015

1. Informed consumer/patient decisions
2. Data driven professional decisions
3. Market (Health System) consolidation
4. Standards verified externally
5. Designation by central authority
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9. A specific proposal to define optimal resources for children's surgical care…eAPSA.org

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<table>
<thead>
<tr>
<th>LEVEL I</th>
<th>LEVEL II</th>
<th>LEVEL III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Any</td>
<td>&gt; 6 months</td>
</tr>
<tr>
<td>ASA</td>
<td>≥ 5</td>
<td>≥ 2</td>
</tr>
<tr>
<td>Co-morbidities</td>
<td>All – complex</td>
<td>Typically single specialty management</td>
</tr>
<tr>
<td>Operations</td>
<td>All – complex diseases, multi-specialty care</td>
<td>Common anomalies, single specialty centric</td>
</tr>
<tr>
<td>Ambulatory</td>
<td>ASA ≥ 3, guidelines for post anesthesia monitoring</td>
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</table>

**Overriding Principle: Tiered Care**

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Key details: Ambulatory Centers

- Board Cert. Ped Surgery and Anesthesia medical directors
- Pediatric Anesthesia expertise to care for youngest children
- Child appropriate pre, post, intra op environment
- Demonstrated provisions for social / emotional needs
- Pediatric equipment and devices
- PALS certified staff present at all times

Creating a National Framework for SYSTEMS of Children’s Surgical Care

- Promotion and participation in systems of care required for verification
- Level I centers have leadership “obligation”
- All centers have “obligation” for seamless coordination and patient transfer
- System leaders will care for all children regardless of ability to pay
- ACS Children’s Surgery will provide support and consultation for state and regional systems

Optimal Resources: DATA Consensus Statements from Task Force

- Accurate data are the proven backbone of verification
- Data platform must be uniform and unified
- Data systems must be able to serve multiple accreditation programs
- NSQIP-Pediatric is the most robust and relevant program
- Safety data must complement NSQIP outcome data
- ACS is committed to work with other organizations
Safety Events: to be collected at all centers

- Cardiac or respiratory arrest within 72 hrs
- Unplanned reintubation
- Major anesthetic event
- Joint Commission Sentinel Event
- Unplanned return to OR, admission, or transfer
- Pressure ulcer or VTE within 30 days
- Death from any cause within 30 days

Optimal Resources: Other relevant standards

- Framework for continuous performance improvement
- Outreach and educational programs
- Peer review, corrective action, loop closure
- Research and Scholarship
- Ethical standards

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8. Models exist for optimal resources/verification to improve patient outcomes — eg. Trauma/Cancer/Bariatric.
9. A specific proposal to define optimal resources for children's surgical care.
10. Where are we? Where are we going?
April, 2015

Optimal Resources for Children’s Surgical Care

- April 28th, 2015 – 1st meeting of Task Force for Children’s Surgical Care
- May, 2015 – ACS board approval
- June 2, 2015 – 1st meeting of Task Force for Children’s Surgical Care
- June 8, 2015 – ACS board approval
- July 11, 2015 – Site Visit/Task Force approval
- July 18, 2015 – Planning meeting for the verification process within ACS
- October, 2015 – AAP board presentation
- October, 2015 – Support from all of the AAP surgical and anesthesia sections
- October, 2015 – Verification process development meeting with ACS leadership
- March 2016 – Annals of Surgery publication
- April 28th, 2016 – 2nd Meeting of Pediatric Neurosurgery, American Association of Neurological Surgeons/Congress of Neurological Surgeons approval
- May 28th, 2016 – 3rd meeting of Task Force for Children’s Surgical Care
- September 26, 2016 – “Final” standards document
- October 2016 – 5th Annual Meeting of ACS verification process at ACS and CHA meetings
- ACS Verification Committee
- February 2015 – Endorsement by American Academy of Pediatrics
- April/April, 2015 – Begin 6 pilot verification visits (concluding June 1, 2015) by ACS

IMPLEMENTATION

- WHO – administered by the Amer Coll Surgeons
- WHAT – voluntary verification program for children’s surgical centers in USA
- WHEN – pilot site visits early 2015
- WHERE – all institutions are eligible
- WHY – because it’s the right thing to do for kids