A Hub and Spoke Model for Pediatric Critical Care

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Faculty Disclosure Information

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Title of Presentation: A Hub and Spoke Model for Pediatric Critical Care

I have no financial relationships to disclose.
Learning Objectives

- Define challenges in the optimal care of critically ill children in rural areas
- Understand the factors driving the regionalization of pediatric care
- Describe how a spoke and hub operating model applies to care coordination and delivery for critically ill children
- Delineate the roles and obligations of healthcare providers in delivering the best care possible for critically ill children

Why this guy?
Challenges on the Navajo Nation

- 166,826 residents (50% under age 18yo)
- Total area: 27,413 sq mi
- Density: 6.3 persons/sq mi

Going the distance

Given difficult weather, ground transport was often used.

Given the distances and crosswinds, rotor flights were unrealistic and dangerous.

Fixed-wing flight to PHX, including ground transport, took 3+ hrs.
But now I live in Kentucky

• Quick review of Kentucky History:

Clinical Correlation

• 9mo female with severe bronchopulmonary dysplasia from 27wk premature birth
• On NG feeds at home because of failure to thrive issues
• Aspiration event in the home with respiratory arrest. EMS unable to intubate, had difficulty with BVM.
Clinical Correlation

• At community ED, intubated with a 2.5 uncuffed ETT
• Child had cardiopulmonary arrest 15 min later. pCO2 found to be >130 directly prior to arrest.
• Spontaneous circulation reestablished with 15 minutes of CPR and three doses of epinephrine
• Upon arrival, the pediatric transport team replaced the ETT with a 4.0 cuffed ETT.

What happened?

• Rural community, 90 minutes from UK
• Family lived 20 minutes from the ED
• ED was staffed by an internal medicine physician that night
• The ED does not use a Broselow tape
• Limited pediatric specific equipment
• Pediatric transport not immediately available
Not all that uncommon

- EDs with all essential pediatric supplies: 6%
- EDs with 85% of the supplies: 50%
- Nationally, limited pediatric specific training and continuing education for EMTs

Emergency Care for Children: Growing Pains
http://www.nap.edu/catalog/11655.html

Let’s really take a look at Kentucky
Population density

Value for Kentucky (No. of people per square mile): 109.9

Starting small, getting smaller

KENTUCKY - 2010 Census Results
Percent Change in Population by County: 2000 to 2010

Source: U.S. Census Bureau, Census 2010 and © Census Publishing & Data Center Inc.
Population under 18yo

Value for Kentucky (Percent): 23.1%
(US: 24%)
Health Factors 2016

The failed war of poverty . . .
Socioeconomic distress

Kentucky Childhood (1-17 years of age) Death Rate by County, 2002-2012*

*2009-2012 data are preliminary and numbers may change.
Data Sources: 2002-2012: Kentucky Vital Statistics Files, Death Certificates; Denominator data: Kentucky State Data Center, Child Population Estimates by County 2002-2012.
Disproportionate access

Over 2M Kentuckians live within the three metropolitan areas. 47% of the state has direct access to expert pediatric care. That means 53% are far from specialty care in low density population regions.

Drivers of change: cost

Dataset: "National Health Expenditures by Type of Service and Source of Funds, Calendar Years 1980-2014." U.S. Department of Health & Human Services, Centers for Medicare and Medicaid Services, November 5, 2015
Healthcare Costs

- American healthcare expenditures have grown untenably
- The Affordable Care Act requires reining in of overall costs with increased emphasis on preventive health
- The rise of accountable care organizations will reintroduce capitation in healthcare delivery
- Emphasis on quality and value

Drivers of change: resources

Map 1.3. Active Primary Care Physicians per 100,000 Population, 2014

Source: July 1, 2014; population estimates are from the U.S. Census Bureau (Release date: December, 2014). Physician data are from the 2013 AMA Physician Masterfile (December 31, 2014).
## Resources

- Nationally, there are ongoing shortages of physicians and nurses
- 30 counties in Kentucky do not have pediatricians
- 22% of Kentucky physicians are international medical graduates (indicator of domestic shortfalls)

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## Implications of poor resources

- Only 46% of KY EDs require ED physicians to be BC/BE
- Fewer than half require PALS certification
- 16% of facilities only required a KY license and one year of training
Our pediatric trauma referrals show the “shape” of things

A good resource

The regionalization of pediatric health care: a state of the art review

Scott A. Lorch, MD, MSCE1,2,3,4,5, Sage Myers, MD1, and Brendan Carr, MD2,5


Regionalization improves patient outcomes through two primary mechanisms (Table 2): improved outcomes at high volume, high specialty centers; and improved coordination of care within a given geographic area. Regionalization may take several forms (Figure 1). Models such as the spoke-and-hub system and the web system are characterized by a specialized center that manages the most complex patients within a geographic area, supported by less specialized hospitals. The degree of coordination between hospitals helps distinguish the two systems. The “mini-hub” model is a less coordinated, “de-regionalized” system that may develop depending on financial incentives, hospital and geographic characteristics, patient preferences, and lack of coordination between centers (Figure 2).
Hub and spoke is more than a shape

- Several organizational models can be applied to limited resource services
- Hub and spoke models have been applied to neonatal and pediatric trauma models with good success


Hub and spoke

- Movement of patients from primary sites to tertiary and quaternary care hubs offloads the primary sites while ensuring best care for the patients
- This flow of patients can be reinforced by treatment agreements formed between referring hospitals and tertiary care centers in the form of networks
Variations on a theme

- True hub and spoke organizations can be difficult to sustain because of various logistic and financial issues
- “Mini-hub” models have arisen in areas where there may be financial incentives in retaining critical patients, thus affecting outcomes

Teamwork and limited resources

- As resources and dollars become more limited, healthcare providers need to work together
- The older model of full-services available at all outlets has proven wasteful and expensive with little impact to patient outcomes
My backyard

Building partnerships
National Support

- Emergency Medical Services for Children (EMSC) was formed in the 1980s to support the improvement of pediatric specific emergency care
- It is contemporaneous with the formalization of Pediatric Emergency Medicine and Pediatric Critical Care Medicine

About EMSC

- Formed in 1985
- Supports state-based programs for care integration in pediatric emergency services
- Oversaw creation and funding of Pediatric Emergency Care Applied Research Network (PECARN)
IOM Report 2006

IOM Report: The Future of Emergency Care in the United States Health System

Paying Attention to Children

Finally, as these various improvements are made to the nation’s emergency care system, it will be important to keep pediatric patients in mind in all aspects of emergency care. The needs of pediatric patients should be taken into account in developing standards and protocols for triage and transport of patients; in developing disaster plans; in training emergency care workers, to assure that they are competent and comfortable providing emergency care to children.

IOM 2007 – Growing Pains

Regionalization

Because not all hospitals within a community have the personnel and resources to support the delivery of high-level emergency care, critically ill and injured patients should be directed specifically to those facilities with such capabilities. That is the goal of regionalization. There is substantial evidence that the use of regionalization of services to direct such patients to designated hospitals with greater experience and resources improves outcomes and reduces costs across a range of high-risk conditions and procedures. A few states have taken steps to regionalize pediatric emergency care, allowing advanced life support ambulances to bring such patients only to hospitals designated as having pediatric capabilities. However, a state-by-state analysis shows that many states still have not formally regionalized pediatric intensive or trauma care. Concerted, cooperative efforts at all levels of government—federal, state, regional, local—and the private sector are necessary to finally break through and achieve optimum emergency care.
EMS: Challenges

TABLE 4-1  Recommended Pediatric Education in the Current U.S.  
Department of Transportation National Standard Curricula  

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<th>Content</th>
<th>Recommended Minimum Hours</th>
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<tr>
<td>First Responder (1995)</td>
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<tr>
<td>Practical Lab: Children and Childbirth</td>
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<tr>
<td>Evaluation: Children and Childbirth</td>
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<td>Emergency Medical Technician-Basic (1994)</td>
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<td>Practical Skills Lab: Infants and Children</td>
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<td>Neonatal Resuscitation</td>
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</table>

What about community pediatricians?

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT
Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine

The Role of the Pediatrician in Rural Emergency Medical Services for Children

PEDIATRICS Vol. 116 No. 6 December 2005 1553
What will it take?

- Collaboration of stakeholders
  - State-level coordination with empowerment of local services
- Coordination of resources
- Investment is EMS resources and education
- Formation of standards and designations
- Investment/adopter of improved communications modalities

What are we doing in Kentucky?

- Annual stakeholder summit
- Strengthening Kentucky EMS-C direction
- Coordination and agreement of specialists at the two pediatric specialty hospitals
- Development of ED and EMS categories/designations with regard to pediatric care capabilities (similar to trauma)
- Development of standardized education
What needs to be better

- Rural EMS access to pediatric specific training
- Incorporation of high fidelity simulation
- Real-time video assessment of patients (use of encrypted, HIPPA compliant mobile communications)
- Sharing of evidenced-based/expert opinion care protocols

Helpful educational resources

- Pediatric Advanced Life Support (AHA)
- Pediatric Emergency Assessment and Stabilization (AHA)
- Acute Pediatric Life Support (AAP and ACEP)
- Pediatric Education for Prehospital Professionals (AAP)
- Pediatric Fundamental Critical Care Stabilization (SCCM)
Are you ready for some advocacy?

Summary

- Pediatric specific emergency care is a limited resource with maldistribution
- Limited resources and funding call for coordination of healthcare entities to provide best care for all children
- The hub and spoke model can apply to such situations
Summary

• Building such care models involves coordination of public and private entities at the federal, state, and local levels.

• Education of providers is essential and many options exist.

• Development of good care models requires the commitment and advocacy of those who care critically ill children.