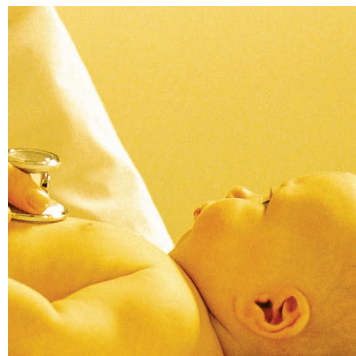
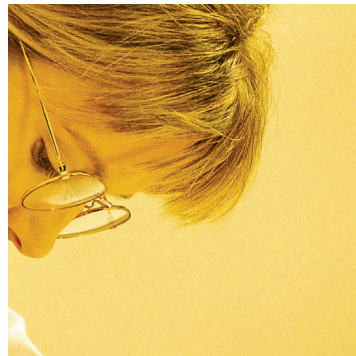


**PEDIATRIC REGIONAL CRITICAL CARE HOSPITALS**

# White Paper on Evidence and Improvement Opportunities in New York

New York State Emergency Medical Services for Children Advisory Committee

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White Paper on  
Evidence and Improvement Opportunities In New York

New York State  
Emergency Medical Services for Children  
Advisory Committee

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Members of the New York State Emergency Medical Services for  
Children Advisory Committee, 2007

**Robert Amler, M.D. FAAP, FACPM**

Dean and Professor  
School of Public Health, Ste 322  
New York Medical College  
Valhalla, New York 10595  
(914) 594-4531

**Susan Brillhart, MS, RN, CPNP**

Borough of Manhattan Community  
College  
Dept. of Nursing  
199 Chambers Street  
New York, New York 10037  
(212) 220-8244

**Richard M. Cantor, M.D.,  
FAAP,FACEP**

Associate Professor of Emergency  
Medicine  
And Pediatrics  
SUNY Upstate Medical University,  
Department of Emergency Medicine  
750 East Adams Street  
Syracuse, New York 13210  
(315) 464-4363

**Sharon Chiumento, BSN, EMT-P**

23 Donna Marie Circle  
Rochester, New York 14606  
585-507-1964

**Arthur Cooper, M.D. MS**

Director of Pediatric Surgical  
Services  
Harlem Hospital Center  
506 Lenox Avenue  
New York, New York 10037  
(212) 939-4003

**Ann Fitton, EMT-P**

Paramedic Deputy Chief of  
Operations  
Fire Dept. of the City of New  
York  
420B Weaver Avenue  
Fort Totten, New York 11359  
(718) 281-3387

**Jonathan S. Halpert, M.D., FACEP,  
REMT-P**

Medical Director, Prime Care  
Urgent Care Center  
Prime Care Physicians PLLC  
400 Patroon Creek Boulevard,  
Suite 100  
Albany, New York 12206-5041  
(518) 445-4444

**Robert Kanter, M.D.**

Professor, Dept. of Pediatrics  
Director, Critical Care and  
Inpatient Pediatrics  
SUNY Upstate Medical University  
750 East Adams St.  
Syracuse, NY 13210  
(315) 464-5800

**Kathleen Lillis, M.D.**

Division of Emergency Medicine  
Women and Children's Hospital of  
Buffalo  
219 Bryant Street  
Buffalo, New York 14222  
(716) 878-7109

**Rita Molloy, RN**

Mary G. Clarkson School Nurse  
1415 East Third Avenue  
Bay Shore, New York 11706  
(631) 968-1202

**Janice Rogers, MS, RN, CS, CPNP**

Univ. of Rochester Medical Ctr.  
Emergency Department  
601 Elmwood Avenue, Box 655  
Rochester, New York 14642  
(585) 275-4707

**Robert C. Smath, EMT-P**

Wycoff Heights Medical Center  
348 Stanhope St.  
Brooklyn, NY 11237  
(718) 302- 8407

Members of the New York State Emergency Medical Services for  
Children Advisory Committee, 2008 (continued)

**Elise van der Jagt, M.D., MPH**

Professor of Pediatrics and  
Critical Care  
Children's Hospital at Strong  
601 Elmwood Avenue, Box 667  
Rochester, New York 14642  
(585) 275-8138

**Ruth Walden**

Parent Representative, CSHCNs  
2610 US 20  
Nassau, New York 12123  
(518) 474-2001

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## Executive Summary

Critical care is a vital component of emergency medical services for children. Successful care for children with life threatening illness and injury depends on a continuum from rapid emergency medical responses at any location, and stabilization at widely distributed emergency departments. For those with the highest-risk complex conditions, regional pediatric hospitals provide critical care in pediatric intensive care units (PICUs) as well as comprehensive pediatric expertise and equipment for medical, surgical, and nursing care. Outcomes are optimized by an orderly transition back to the community-based medical home after recovery from severe disorders.

Evidence on quality of care for patients with life threatening conditions is especially important because suboptimal care, or barriers to access, lead to preventable death or disability. The high cost of providing specialized services should be justified by evidence. In many fields, outcome from complex high-risk conditions is better when patients receive specialized care in high volume regional centers. Children with life threatening illness and injury are particularly vulnerable because fewer pediatric critical care hospitals are available than such facilities for adults.

This White Paper reports an evaluation of pediatric critical care services undertaken by the New York State

Emergency Medical Services for Children Advisory Committee. We summarize published research regarding outcomes at high volume pediatric regional critical care hospitals versus other facilities. Potential barriers interfering with access to pediatric critical care facilities in New York are described. We suggest approaches that should be considered for improvement of critical care services for children in New York.

Published evidence indicates higher quality of care at high volume pediatric regional critical care hospitals than other hospitals when treating children with a broad range of severe medical and surgical conditions, including cardiac surgery and trauma. New York State has many hospitals able to provide high quality care to children with complex high-risk conditions. However, evidence shows that the utilization of such facilities is incomplete and varies among regions of the state. Rates of potentially preventable deaths resulting from barriers to access have been estimated.

Professional organizations have formulated standards necessary for high quality and accessible pediatric critical care. Some states have accredited pediatric critical care hospitals, indicating the hospital's capability to provide specified services. Others have designated pediatric critical care hospitals, with requirements to use such facilities for specified conditions. Evidence indicates that such designation increases the use of pediatric critical

care hospital resources. One state pays higher rates of reimbursement from public health insurance coverage to hospitals meeting criteria for pediatric critical care services, providing a tangible incentive for the use of these facilities. While New York State has recognized the importance of hospital designation for a number of complex high-risk conditions, pediatric critical care hospitals have not been formally accredited or designated in New York.

Based on evidence regarding best practices and possible barriers to access in New York, the EMSCAC recommends that the New York State Department of Health consider the following approaches to improving pediatric critical care services.

1. Stimulate discussion among stakeholders regarding quality and access to pediatric critical care services in New York State. Stakeholders include health care providers and representative professional organizations, hospitals and emergency care organizations, community representatives of families and patients including children with special health care needs, payers, and regulators.

2. Specify standards and levels of pediatric critical care services, including personnel qualifications, equipment, communications, procedures, and patient criteria for consultation or referral. Responsibilities of regional



pediatric critical care centers and other hospitals should be defined.

3. Develop a process for the ongoing accreditation of pediatric critical care facilities. Accreditation indicates that services at a specified level are available at a hospital.

4. Create the authority and a process necessary to designate facilities appropriate for pediatric critical care. Designation implies that certain facilities SHOULD be used for patients meeting specified criteria. Mechanisms to enforce accountability are warranted.

5. Determine the optimal number and distribution of pediatric critical care centers, based on regional needs, to facilitate access as well as efficient use of resources.

6. Promote a process of ongoing monitoring and continuing improvement of regional services, in which comprehensive pediatric regional critical care centers serve as an educational and coordinating resource to other facilities and agencies throughout a region.

7. Provide public information about relative quality of care by evaluating and publicizing risk-adjusted outcomes for pediatric critical care at individual hospitals.

8. Authorize higher reimbursement at hospitals that are designated to provide specified pediatric critical care resources and services.

9. Authorize higher reimbursement at hospitals that have the best risk-adjusted outcomes for pediatric critical care.

## Introduction

Evidence on quality of care for patients with life threatening conditions is especially important because suboptimal care, or barriers to access, lead to preventable death and disability. The cost of caring for such patients is high and difficult decisions must be made regarding allocation of finite health care resources. In many fields, outcome from complex high-risk conditions is better when patients receive specialized care in high volume hospitals [Mackenzie 2006, Hannan 2005, Berkmeyer 2002, 2003, Epstein 2002]. Children with life threatening illness and injury are particularly vulnerable because fewer pediatric critical care hospitals are available, and their distribution is uneven geographically, compared with such facilities for adults [Randolph 2004].

This White Paper reports an evaluation of pediatric critical care services undertaken by the New York State Emergency Medical Services for Children Advisory Committee. We summarize published research comparing outcomes at high volume pediatric regional critical care hospitals versus other facilities, describe potential barriers interfering with access to pediatric critical care facilities in New York, and suggest approaches to improving regional and statewide critical care for children.

When fully developed, regionalized emergency and hospital care for children involves a continuum: 1) rapid

responses to crises at any location by emergency medical service providers; 2) stabilization of critically ill or injured children at widely distributed emergency departments; 3) hospital care close to home for common, low-risk conditions; 4) care of high-risk, complex disorders at regional pediatric hospitals that provide pediatric intensive care units (PICUs) as well as comprehensive pediatric expertise and equipment for medical, surgical, and nursing care; 5) the transition from hospital care to rehabilitation and back to the community-based medical home after recovery from severe illness [AAP 1995, AAP 2000 a, Thompson 1994].

#### Evidence on quality of care at pediatric critical care hospitals

In this review of published evidence, the following classification system is used to describe the level of evidence contained in each cited study. Studies conducted by methods at levels 1-3 provide the strongest evidence of a relationship between treatments and outcomes, with controls for patient characteristics in each of these study designs. Study designs at levels 4-5 describe clinical experience without controlled comparisons. Reports of professional opinion are classified as evidence level 6.

Level 1- Randomized clinical trials

- Level 2- Prospective, controlled, nonrandomized  
comparison of health care processes / outcome
- Level 3- Retrospective, nonrandomized, controlled  
cohort or case-control comparison of processes /  
outcome
- Level 4- Retrospective data on processes or outcome,  
control group lacking
- Level 5- Questionnaire, interview, control group  
lacking
- Level 6- Expert professional opinion

Critical Care:

A study performed in 16 PICUs evaluated the relationship between clinical volume and outcome [Tilford 2000; evidence level 3, analysis of ICU registry data]. The risk adjusted mortality rate across severe medical and surgical disorders was lower in units with higher patient volume. Each increase of one hundred annual admissions was associated with a reduction in relative risk by 5% (95% CI = 1-9%). PICU patient volume varied from 147 to 1378 per year (mean = 863). Mortality rate varied from 1.8% to 9.1% (mean 4.6%).

Another study evaluated intensive care of children in Oregon, to determine the relative quality of care at hospitals with PICU services versus other hospitals [Pollack 1991, evidence level 3, analysis of clinical data in hospital records]. The study population included children

with head trauma or respiratory failure. For patients with the most severe conditions, the risk-adjusted mortality was worse at non-pediatric hospitals (odds ratio = 7.7; 95% CI = 1.4-42.1).

Cardiac surgery:

Risk adjusted mortality rates were found to be lower at hospitals performing large volumes of pediatric cardiac surgery in the states of California, Massachusetts, and New York [Jenkins 1995, evidence level 3, analysis of hospital administrative data; Hannan 1998; evidence level 3, analysis of a cardiac surgery registry]. Independent effects of high surgeon and institutional volume were evident [Hannan 1998].

For a single procedure whose outcome is highly dependent on the quality of postoperative care, institutional volume appeared to be more closely associated with mortality than surgeon volume [Checchia 2005, evidence level 3, analysis of proprietary hospital data]. One hospital with modest numbers of pediatric heart surgery procedures evaluated outcomes before and after shifting referrals away to higher volume facilities. Compared with an historical control period when these procedures were done locally, referral to high volume centers significantly reduced risk adjusted mortality rates [Allen 2003, evidence level 3, analysis of clinical data].

Trauma:

Children hospitalized with traumatic injuries have better risk adjusted survival at hospitals verified to meet American College of Surgeons trauma center criteria than at other hospitals (odds ratio = 0.75; 95% CI = 0.58-0.97) [Osler 2001; evidence level 3, analysis of trauma registry data].

In another study, risk adjusted outcomes from severe trauma in children 10 years and younger were significantly better at children's hospitals than adult hospitals. [Densmore 2006, evidence level 3, analysis of federal Agency for Healthcare Research and Quality Kid's Inpatient Database sampled from hospital administrative discharge data].

In a study comparing outcomes stratified for child injury severity, survival in designated trauma centers tended to exceed that in non-trauma center hospitals [Cooper 1993; evidence level 3, analysis of hospital administrative data from NY State and the National Pediatric Trauma Registry].

In a study of functional recovery among survivors at the time of hospital discharge, greater improvement was seen in some patient subgroups at pediatric trauma centers compared with other types of hospitals [Potoka 2001, evidence level 3, analysis of trauma registry data].

Risk adjusted survival for children with blunt traumatic injuries was better at one designated pediatric trauma center than at adult centers ( $p < .05$ ), although

outcomes were similar for penetrating trauma [Hall 1996; evidence level 3, analysis of trauma registry data].

Adherence to American Pediatric Surgical Association guidelines for nonoperative care of blunt spleen injuries was better at trauma centers than nontrauma center hospitals [Stylianos 2006, evidence level 3, analysis of hospital administrative data].

While trauma center accreditation appears to be an important determinant of quality of care, the benefit of pediatric-specific versus adult trauma center care for severely injured children has not been clearly demonstrated. Trauma center criteria include a commitment to the care of children, regardless of the availability of a stand-alone pediatric hospital. For children with severe injuries, survival was more likely at a pediatric trauma center, or an adult trauma center with added qualifications for pediatric care, than at trauma centers lacking added qualifications for pediatric care ( $p < .05$ ) [Potoka 2000; evidence level 3, analysis of trauma registry data]. However, outcomes were similar at pediatric and adult trauma centers with added qualification to treat children.

In other studies, risk adjusted outcomes were similar in comparisons of pediatric and adult trauma centers [Nakayama 1992, Osler 2001, Farrell 2004; all evidence level 3, analysis of trauma registry data].

Taken together, these studies demonstrate that adult trauma surgeons provide appropriate care for pediatric



trauma patients when a pediatric trauma center is not accessible. What is most critical in pediatric trauma care is proper emphasis on the special needs of pediatric patients throughout all phases of care.

National evidence on barriers to access of pediatric critical care services

In a national ecological study, child trauma mortality rates were significantly higher in counties lacking a hospital with a PICU than in counties served by a PICU, even after controlling for rural/urban location, county socioeconomic indicators, and availability of adult critical care services [Odetola 2005; evidence level 3, analysis of National Center for Health Statistics and Census data].

At hospitals providing care to small numbers of high-risk children, attempts to create and maintain pediatric intensive care units often fail. At small hospitals clinical revenue is inadequate to support such services and it is difficult to recruit the teams of specialists necessary to provide critical care [Odetola 2006, evidence level 5, analysis of interviews with hospital administrators].

The national geographical distribution of hospitals with PICUs is uneven [Randolph 2004, evidence level 5, analysis of questionnaire data]. As a result, families' travel distance tends to be greater for children than for adults who die in a hospital [Feudtner 2006, evidence level

3, analysis of state death certificate information]. Although a child's death far from home is difficult for families, parents are more likely to choose care at a distant pediatric regional critical care hospital for a condition having a high mortality risk, compared with low-risk conditions [Chang 2004, evidence level 5, analysis of interviews], in hopes of obtaining better lifesaving care. Thus, availability of regional critical care at a distant facility is not perceived by families to be a barrier to access.

Interhospital transfers of sick patients from community hospitals to a critical care center may be necessary to gain access to the highest level of regional resources. Evidence indicates that specialized pediatric transport staff can perform such transfers safely [Edge 1994; evidence level 3, analysis of clinical data]. Thus interhospital transport does not introduce substantial safety barriers to obtaining pediatric critical care at a distant regional center.

#### Recommendations on pediatric regional critical care by national organizations

The following professional organizations have made recommendations for criteria necessary to achieve high standards of pediatric critical care.

<u>Organization &amp; reference</u>	<u>Standards for pediatric services</u>
AAP 1995, 2000b	Pediatric emergency care
Am Col Surgeons 1996, 2006	Care of the injured patient
AAP 2000a	Pediatric critical care regionalization
AAP 2004	Pediatric ICUs
Institute of Medicine 2006	Pediatric emergency care
AAP 1999a	Intensive care admission criteria

A regionalized system of pediatric critical care, as outlined by the national organizations above, includes the following essential elements. Planning, communication, and coordination across professions and across institutions are essential. Hospital accreditation implies that quality and access to specified services is verified by an independent organization, often the state, or an independent private organization on behalf of the state. Hospital designation implies a more explicit regulatory action. Designation indicates that providers for high-risk patients meeting certain criteria SHOULD consult with, or SHOULD refer those patients to specified hospitals having the most appropriate resources for those patients. Regional boundaries and critical care facilities are chosen to promote access and efficiency. Triage, consultation, and referral criteria are defined. Standards of personnel training and qualifications, equipment, procedures, and communications are necessary for prehospital, emergency department, interhospital transport, hospital and intensive care, and rehabilitation phases of care. Particular attention must be given to planning for

children with special health care needs [Dosa 2001, AAP 1999b].

In a well-developed regional system, much is expected of community hospitals to recognize and stabilize critically ill and injured children. At the same time, smaller community hospitals should receive considerable support from regional centers. In addition to assistance in care of individual patients, regional centers should provide continuing professional education, design of clinical protocols, and clinical improvement programs guided by regional performance data. Formal commitments and familiarity with roles and responsibilities of participating organizations will contribute to effective performance.

Regionalization takes into account the wide variation in local characteristics of each region. The distinct needs of rural, suburban, and metropolitan regions may be met by appropriate distributions of hospitals providing a range of services from basic to comprehensive pediatric emergency and critical care [AAP 1995, AAP 2004]. Private hospitals are increasingly affiliated in commercial networks in some regions. The considerable resources of proprietary hospital organizations may contribute to effective solutions, or may create new barriers to access [Green]. Access to the most basic health care services may be difficult in low-density rural regions, and stabilization in a nearby non-pediatric hospital may be essential, due to the long distance to the nearest regional pediatric hospital. Health information

technology may provide improvement opportunities across the continuum of care for all regions.

In addition, The Leap Frog Group, a national organization representing large private employers who bear a substantial proportion of the costs of health care, recommends evidence-based hospital referral. Particular attention to the qualifications of critical care physicians is recommended to improve safety as well as reduce the costs of critical care [Leapfrog Group 2005].

Other states' actions to promote pediatric regional critical care services

Hospital accreditation implies that quality and access to specified services is verified by an independent organization, often a state. Pediatric Critical Care Centers are accredited in Illinois [IL Department of Public Health 2005]. Hospital designation implies a more explicit regulatory action. Designation indicates that providers for high-risk patients meeting certain criteria SHOULD consult with, or SHOULD refer those patients to specified hospitals having the most appropriate resources for those patients. Pediatric critical care centers have been designated in California, with tangible incentive to use these resources. Higher rates of reimbursement are paid from public health insurance to designated hospitals [California Children's Services 1999].

During 1987-1991 a statewide regionalization of trauma care was implemented in Oregon. Availability of the trauma system was associated with lower risk adjusted odds of death for seriously injured children than simultaneous observations in the state of Washington, which had not yet regionalized trauma care [Hulka 1997, evidence level 3, analysis of hospital discharge data].

Subsequently, the state of Washington instituted a statewide trauma system designating certain hospitals as pediatric trauma centers in 1994. Admissions of injured children at pediatric hospitals after designation increased by 12% (95% CI = 4-20%), compared with the expected trend. Admission of injured children to designated adult trauma hospitals did not change, while admissions at hospitals lacking any trauma designation fell by 11% (95% CI = -4 to -18%) [Vavilala 2004, evidence level 3, analysis of hospital administrative data]. The studies in Oregon and Washington both suggest that government regulation was successful in influencing use of designated hospitals, with resulting mortality reduction demonstrated in Oregon.

#### Pediatric critical care in New York State- The evidence on potential barriers to access

Pediatric hospitals and intensive care units are widely distributed throughout New York State [Randolph 2004, evidence level 5, analysis of questionnaire data; Kanter

2005, evidence level 4, analysis of hospital administrative discharge data]. Thus, a better foundation of existing resources for effective regionalization of pediatric critical care services is available in New York than in some other states.

However, evidence demonstrates that existing resources are not always utilized effectively in New York. In a study of hospital inpatient deaths of children in New York State, significant regional variation was observed in rates of deaths in hospitals lacking pediatric ICUs [Kanter 2002, evidence level 4, analysis of hospital administrative discharge data]. Although the deaths of some children in hospitals lacking a pediatric ICU are expected, the significant regional variation in these deaths suggests that some local barriers may interfere with access to existing critical care resources. If referral practices to pediatric ICUs were more uniform across the state, it was estimated that 5% of child hospital deaths would be potentially preventable in some regions [Kanter 2002].

Pediatric trauma centers are only readily accessible in Western NY and Metropolitan New York City [NYS DOH 2006]. One third of all high-risk pediatric trauma victims in New York receive care in hospitals that do not provide a pediatric intensive care unit [Farrell 2004, evidence level 3, analysis of trauma registry data].

In order to improve the standard and access to quality of care, New York State designates centers to provide

services for some complex high-risk conditions (AIDS, Burns, Perinatal, Poisoning, Sexual Assault Forensic Examiners, Stroke, and Trauma) [NYS DOH 2006]. However, pediatric critical care hospitals are not currently accredited or designated in New York. Apparent barriers to access for pediatric critical care services in New York, successful actions taken by other states to improve pediatric critical care access, and successful action in New York to promote other specialized services all suggest that there are opportunities for pediatric critical care improvement in New York.

### Recommendations

Based on evidence regarding current best practices summarized above, the EMSCAC recommends that the New York State Department of Health consider the following approaches to improving quality and access to pediatric critical care services in New York.

1. Stimulate discussion among stakeholders regarding quality and access to pediatric critical care services in New York State. Stakeholders include health care providers and representative professional organizations, hospitals and emergency care organizations, community representatives of families and patients including children with special health care needs, payers, and regulators.



2. Specify standards and levels of pediatric critical care services, including personnel qualifications, equipment, communications, procedures, and patient criteria for consultation or referral. Responsibilities of regional pediatric critical care centers and other hospitals should be defined.

3. Develop a process for the ongoing accreditation of pediatric critical care facilities. Accreditation indicates that services at a specified level are available at a hospital.

4. Create the authority and a process necessary to designate facilities appropriate for pediatric critical care. Designation implies that certain facilities SHOULD be used for patients meeting specified criteria. Mechanisms to enforce accountability are warranted.

5. Determine the optimal number and distribution of pediatric critical care centers, based on regional needs, to facilitate access as well as efficient use of resources.

6. Promote a process of ongoing monitoring and continuing improvement of regional services, in which comprehensive pediatric regional critical care centers serve as an

educational and coordinating resource to other facilities and agencies throughout a region.

7. Provide public information about relative quality of care by evaluating and publicizing risk-adjusted outcomes for pediatric critical care at individual hospitals.

8. Authorize higher reimbursement at hospitals that are designated to provide specified pediatric critical care resources and services.

9. Authorize higher reimbursement at hospitals that have the best risk-adjusted outcomes for pediatric critical care.

## Acknowledgment

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