

Resources for Improving Pediatric Readiness and Quality of Care in Rural Communities and Emergency Departments

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Objectives: To share the process and products of an 8-year, federally funded grant from the Health Resources and Services Administration Emergency Medical Services for Children program to increase pediatric emergency readiness and quality of care provided in rural communities located within 2 underserved local emergency medical services agencies (LEMSAs) in Northern California.

Methods: In 2 multicounty LEMSAs with 24 receiving hospital emergency departments, we conducted focus groups and interviews with patients and parents, first responders, receiving hospital personnel, and other community stakeholders. From this, we (a regional, urban children's hospital) provided a variety of resources for improving the regionalization and quality of pediatric emergency care provided by prehospital providers and healthcare staff at receiving hospitals in these rural LEMSAs.

Results: From this project, we provided resources that included regularly scheduled pediatric-specific training and education programs, pediatric-specific quality improvement initiatives, expansion of telemedicine services, and cultural competency training. We also enhanced community engagement and investment in pediatric readiness.

Conclusions: The resources we provided from our regional, urban children's hospital to 2 rural LEMSAs facilitated improvements in a regionalized system of care for critically ill and injured children. Our shared resources framework can be adapted by other regional children's hospitals to increase readiness and quality of pediatric emergency care in rural and underserved communities and LEMSAs.

Key Words: quality improvement, patient safety, telemedicine, culturally competent care, regionalization

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Each year, there are more than 30 million emergency department (ED) visits by children in the United States.¹ Although most of these patients can be managed effectively in community EDs, children with special healthcare needs and those with serious illnesses require access to pediatric specialists. For children living in rural and underserved communities, access to specialized pediatric care is often lacking.^{1,2} Prehospital providers, such as emergency medical services (EMS) responders and receiving hospitals in rural communities, are generally less prepared to handle pediatric emergencies compared

with tertiary centers with pediatric specialists.^{3–5} As a result, lower quality of care may be provided to some of these children.^{2,6–10}

To help address these disparities, the Health Resources and Services Administration's Emergency Medical Services for Children (EMSC) program joined with the American Academy of Pediatrics, the American College of Emergency Physicians, and the to update pediatric readiness guidelines and establish the National Pediatric Readiness Project (NPRP), an ED quality improvement (QI) initiative.¹¹ The 2009 “Guidelines for Care of Children in the Emergency Department,” which were revised and updated in 2018, improve the quality of pediatric emergency care and improve standardization across prehospital providers and receiving hospitals.^{12–20} The NPRP assessment, conducted in 2013, was a cross-sectional investigation to gather baseline data, using a nationally representative sample of EDs to examine the extent to which EDs met the pediatric readiness guidelines, using weighted pediatric readiness score.¹⁶ In many states, pediatric ready designations are given to EDs that commit to preparation to receive and care for seriously ill and injured children using specific standards.²¹ Pediatric medical recognition programs are based on compliance with the current published pediatric emergency and trauma care guidelines and contribute to the development of an organized system of care that assists hospitals in determining their capacity and readiness to effectively deliver pediatric emergency, trauma, and specialty care.¹¹ One such designation in California is the Emergency Departments Approved for Pediatrics (EDAP). The EDAP hospitals and/or facilities that receive 911 ambulance traffic for pediatric patients must have pediatric equipment, ongoing physician and nurse pediatric training, pediatric specific QI efforts, a pediatric-designated liaison nurse (PdLN), and a physician director.²²

In recognition of these guidelines and the importance of pediatric readiness, the federal EMSC program funded the State Partnership Regionalization of Care (SPROC) grant program in 2012. The purpose of this program is to implement projects to develop systems of care that increase access to emergency medical services for children in United States rural, territorial, insular and/or tribal communities. The University of California Davis received a grant to create the Transport of Acutely Ill and Injured Children to Institutions of Higher Care from Allied Localities

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(TACTICAL) project to address the identified gaps in pediatric emergency services in our expansive service regions.^{23–25} The goals of this project focused on the implementation, improvement, and sustainability of multicounty rural EMS agencies with multiple EDs to improve care for acutely ill and injured children, including children with special healthcare needs. In this article, we summarize our processes, lessons learned, and final resources that we developed to improve quality and readiness of care for EMS systems in rural communities. We also summarize the project's framework, which other regional children's hospitals and academic medical centers across the country can customize and replicate to increase readiness and quality of care for pediatric emergencies in affiliate sites with similar needs.

METHODS

EMS Regions Served

University of California (UC) Davis Children's Hospital is an academic regional children's hospital located in Sacramento with a pediatric ED and level I pediatric trauma center. Its referral region encompasses a 65,000 square mile area comprising 33 counties in Northern California. During the first 4 years of the TACTICAL project (TACTICAL I: 2012–2016), we partnered with North Coast EMS (NCEMS) local emergency medical services agency (LEMSA), which serves 3 rural and remote counties (approximately 6000 square miles) with 7 receiving hospital EDs. During the second grant cycle (TACTICAL II: 2016–2020), we expanded our partnership and service region to include Sierra-Sacramento Valley EMS (S-SVEMS) and added 10 mostly rural and remote counties (>19,000 square miles) with 17 receiving hospital EDs.

Planning and Implementation

We performed outreach and focus groups with community stakeholders. These stakeholders included representatives from the LEMSAs, public health department, law enforcement, first responders (including local paramedics, emergency medical technicians and fire fighters), receiving hospital personnel, and patients and parents, including parents of children with special healthcare needs in the represented communities. During these focus groups, local approaches to planning EMS care for children were shared, as well as the strengths of existing services, opportunities for improvement, and specific recommendations to improve EMS for children in these rural regions of the State. The ultimate goal was to improve the care provided to children in emergency situations. In addition to the focus groups, we sent a survey to all prehospital providers in NCEMS to assess comfort and gaps in knowledge related to treating pediatric patients. Collectively, the teams used the themes identified during these focus group meetings and the surveys to develop the TACTICAL shared resources framework and

implementation plan to best optimize regional readiness to care for critically ill and injured children.

TACTICAL II was an extension of the TACTICAL I efforts from the first 4 years. During this second 4-year period, we leveraged the TACTICAL framework used in the NCEMS region in the first 4 years and expanded these efforts toward the S-SVEMS region. Efforts continued to focus on training, education, and EDAP recognition and renewal for the NCEMS sites, as well as implementation of telemedicine access and sustained ongoing pediatric-specific QI processes. During TACTICAL II, there was a greater variety and number of prehospital providers and agencies, as well as receiving hospital providers and EDs. Therefore, we continued to modify and improve our approach to outreach, education, training, and preparedness to better reach a broad range of providers. The institutional review board at the University of California, Davis reviewed this study and deemed it not related to human subject research.

RESULTS

The priorities identified during focus group meetings with TACTICAL stakeholders included: pediatric-specific training and educational programs for prehospital and hospital providers; the implementation and strengthening of the EDAP program for pediatric receiving facility designation; pediatric-specific QI initiatives; cultural competency education; local and regional need-based pediatric-specific training programs for prehospital responders and volunteers in the community; support for establishing, improving, and expanding telemedicine services; and local, regional, and state-level collaborations. Ultimately, these themes and opportunities led to the development of 3 goals and associated objectives for TACTICAL (Table 1).

Pediatric-Specific Training and Education Programs

We provided 3 primary modes of training and education directed at both prehospital and receiving hospital clinicians related to pediatric EMS. First, a standard lecture series was provided in 4- to 6-hour sessions that were conducted locally at each of the LEMSAs. Educational champions from the LEMSAs assisted in the coordination of a regularly scheduled region-specific lecture-based training series. Speakers and facilitators were recruited locally, including from UC Davis and regionally from across California as needed for specific expertise. Second, UC Davis provided biannual team-based simulation trainings for both prehospital responders and pediatric champions (PdLNs) from receiving hospitals at the UC Davis Center for Virtual Care with task/procedure-based and team scenario-based skill stations. These training sessions focused on both prehospital and clinician skills for managing common region-specific pediatric injuries and illnesses as seen in Table 2. Third, to expand our reach and audience,

TABLE 1. Goals and Objectives of the TACTICAL Project

Goal	Objective
(1) To provide pediatric education and training to prehospital and hospital providers in the management of acutely ill and injured children.	Development of both prehospital and receiving hospital education and training curriculum, as well as team-based simulation training through the UC Davis Center for Virtual Care.
(2) To implement, improve, and sustain EDAP recognition with a focus on continuous pediatric-specific QI and the recognition of ED specific PdLNs.	Implement the EDAP facility recognition program and checklist, implement modifiable pediatric EMSC QI processes using evidence-based and quality-centered processes, and provide training and support for recognized ED PdLNs.
(3) To improve the availability of pediatric expertise to the NCEMS and S-SVEMS regions in the care of acutely ill and injured children.	Implementation and expansion of telemedicine to the NCEMS and S-SVEMS regions to help improve facility pediatric readiness.

TABLE 2. Team-Based Simulation Training for Rural/Underserved LEMSAs

Team-based simulation training
Task-training stations
–Airway management
–Vascular access
–Pneumothorax—chest tube placement
–Ultrasound and eFAST
–Central venous access
Scenario-based stations
–Pediatric respiratory distress
–Pediatric advanced life support—arrhythmias, sepsis
–Toxicology
–Anaphylaxis
–Traumatic Injury
–Postpartum hemorrhage
–Precipitous delivery
–Medically fragile children/special healthcare needs
–Epilepsy
–Near drowning
–Neonatal emergencies

eFAST indicates Extended Focused Assessment with Sonography for Trauma.

we also implemented quarterly remote continuing medical education courses called Pediatric Acute Care Education Sessions.

Implementation and Support of EDAP Recognition Program

Key EDAP program components included the designation of qualified administrators, physicians and nurses (including a PdLN or pediatric emergency care coordinator), pediatric inclusive continuous QI plans and policies, and the presence of pediatric-specific policies, procedures and protocols for common pediatric emergency situations. While 1 LEMSA had a preexisting EDAP program (NCEMS), the other did not (S-SVEMS). We therefore provided support to continue and bolster the NCEMS program, while taking lessons learned from TACTICAL I to specifically focus on implementing the QI and PdLN components of the EDAP program in the S-SVEMS LEMSA for TACTICAL II.

Establishing PdLNs

For both LEMSAs, we supported the creation and identification of PdLNs at each receiving facility and provided job descriptions, duties, and expectations associated with each of the positions. The PdLN needed to be acknowledged by physician leadership as well as in administrative leadership in both the ED and hospital. The PdLN serves as the in-house pediatric resource, the main contact for pediatric QI efforts, and the resource for staff training for pediatric emergency care. We maintained continuous communication between UC Davis and each PdLN and conducted regular trainings, site visits, and resource sharing.

In addition, we assisted all receiving hospital EDs in conducting inventories of the recommended EDAP pediatric equipment and helped each facility acquire a complete inventory. Some examples of equipment provided included age-appropriate blood pressure cuffs, as well as training equipment including infant trainers and obstetric mannequins with simulation units and leg mannequins for intrasosseous vascular access training. Finally, as an EDAP recommendation

to support interfacility transfer of children, we also ensured the implementation of written transfer agreements and memoranda of understanding between all receiving hospitals.

Pediatric-Specific QI Initiatives

We provided various patient safety resources, as well as pediatric-specific QI opportunities. Many of these resources were shared from the EMSC Innovation and Improvement Center, national resource center for all EMSC grantees and collaborators which provides guidance, education and tools necessary to increase pediatric readiness of the nation's EMS systems.²⁶ Patient safety resources included car seat certification and recertification courses, a pediatric ED bedside binder with a list of emergency equipment and medications for all pediatric weight ranges, and pediatric drug dosing resources, such as UC Davis Children's Hospital's drug dosing cards. Utilizing a train-the-trainer model and collaborative support to disperse QI knowledge, PdLNs implemented QI efforts, and interventions at their local hospitals. These interventions targeted key gaps in care identified by the NPRP, this includes: documentation of the child's weight in kilograms (kg), abnormal pediatric vital signs recognition and when to notify providers, pediatric-specific interfacility transfer guidelines development, and pediatric population considerations in disaster plan development.

Cultural Competency Training and Resources

Cultural competence promotes healthy relationships between health care providers and local cultural and tribal communities, as well as improves communication and prevents misunderstandings regarding specific cultural practices.¹⁸ We conducted a cultural awareness training series for law enforcement, fire, and EMS personnel, as well as receiving hospital staff and healthcare providers. We also created and distributed cultural sensitivity pocketbooks with information about verbal and nonverbal communication, spiritual healing modalities, and conceptions of health respective of the diverse communities of the region, which included American Indian/Alaskan Native, Hmong, Latinx, and East Indian communities.^{27,28}

Local and Regional Need-Based Training

In addition to the 3-pronged approach to providing education and training, we provided additional training for cardiopulmonary resuscitation (CPR). We provided this additional training based on feedback from our focus groups and community assessments. Front-line providers noted the need for more accessible on-site public safety, first responder and emergency medical responder training programs at the local and community level. As a result of this feedback, we provided CPR and first aid training to volunteer medical responders in the local rural communities. In the remote areas, we used a train-the-trainer model to train local instructors so that they could provide instruction to other prehospital responders and make first responder training more accessible. We also provided support for first responder training programs with emergency medical responder training in each LEMSA.

Support in Setting Up, Improving, and Expanding Telemedicine Services

The UC Davis has a well-established telemedicine program offering a variety of telehealth services. The UC Davis Pediatric Telehealth Program provides subspecialty consultations with neonatologists, pediatric critical care physicians, and pediatric hospitalists to more than 25 regional EDs and is considered one of the largest pediatric tele-emergency programs in the country.²⁹ Regional EDs have 24-7 availability to access pediatric specialty

consultations over telemedicine. During TACTICAL, we expanded telemedicine capacity to sites that previously did not have telemedicine in 4 NCEMS EDs and 6 of the S-SVEMS EDs, such that by the end of the grant, all 7 of NCEMS EDs and 14 of the 17 S-SVEMS EDs had access to pediatric telemedicine. Previous research suggests that such consultations can improve parent/guardian and referring provider satisfaction, improve quality of care, reduce the frequency of medication errors, and result in more appropriate triage decisions and potentially reduce unnecessary transfers.^{30–35} To support and sustain these telemedicine services, we conducted kick-off events for new telemedicine sites and conducted bi-weekly virtual test calls from UC Davis Children's Hospital providers to assess established telemedicine connections and conduct training for both day- and night-shift providers.

Additional Community Outreach, Engagement, and Investment

Throughout the TACTICAL project, we conducted community needs and outcomes assessments to provide region-specific solutions to specific community needs, elicit feedback for further improvement and determine when to end specific interventions. One such example is the development and distribution of family transport packets and family transport bags. Families of children with special healthcare needs or who had experience being transferred to UC Davis Children's Hospital or another regional children's hospitals in Northern California expressed the difficulty in traveling to and navigating less familiar cities far from home. With their feedback, we created transport packets specific to each children's hospital that included regional maps, directions, information on available lodging and dining options, parking, as well as hospital and unit specific information for families. We also created and distributed family transport bags to all receiving EDs that were provided to families of patients transferred out of the ED and included personal hygiene supplies, such as travel toothbrush, toothpaste, razors, shampoo and body wash, and note pads and pens. Last, we strove to identify cultural liaisons from each of the diverse communities to provide representation and help bridge cultural gaps in EMS for children.

Integration Into Local, Regional, and State Collaborations

We kept a perspective on how our efforts fit in with local, regional, state, and national infrastructures. We established collaborations and continuous engagement with local community stakeholders, local Indian Health Services (IHS) representatives, regional LEMSA representatives, state EMSC officials, public health nurses, and California IHS nurse consultants. Finally, we worked with the State of California's Emergency Medical Services Authority and the EMSC Innovation and Improvement Center to bolster regional awareness of state and national EMSC resources.

DISCUSSION

As 1 of the 6 original SPROC grant recipients, UC Davis in partnership with LEMSA and regional hospital partners developed a protocolized approach for providing resources to improve the regionalization of pediatric emergency care in rural and underserved regions. We believe that other academic medical centers and children's hospitals can use our TACTICAL processes, resources, and outcomes as a framework to improve pediatric medical care. It is our expectation that this program can be replicated in other counties, LEMSAs, and states where regional children's hospitals can partner with rural and underserved communities to work to improve the level of EMS care delivered to children. Although not all of our interventions may be applicable to some

communities, regions, or LEMSAs, it is our intent to report the successes, as well as lessons from our program.

Over the 8-year period of TACTICAL, the project produced a wide range of resources that are summarized in Supplemental Table 3, <http://links.lww.com/PEC/A882>. These resources include the following: lecture-based education and team-based simulation training programs; pediatric-specific QI processes; procedures for implementing PdLNs in rural EDs; and cultural competence resources. In addition, the project supported technical assistance in the form of pediatric equipment, telemedicine support, community engagement, community investment, and the establishment of local, regional and state-level collaborations. The new collaborations allowed for better monitoring and sustainability of these efforts and helped ensure that the NCEMS and S-SVEMS prehospital and receiving hospital providers, cultural communities, and families are better prepared to care for and transport critically ill and injured children.

We believe that our approach of first engaging the community and rural LEMSAs to identify needs, working on an ongoing basis with all types of providers from prehospital to receiving hospital settings, as well as offering diverse solutions as part of the TACTICAL toolbox helped to raise the level of coordination and quality of care provided to children. Positive outcomes included strengthened relationships and collaborations with partnering EMS agencies and regional hospitals in NCEMS and S-SVEMS, partnerships with local and regional cultural communities and the Indian Health Services, and a protocolized approach for implementing region-specific solutions to specific community needs in terms of education, training, and other resources.

Other SPROC grant recipients achieved similarly positive outcomes with their regionalization efforts, although the approaches and primary focus areas differed from ours.^{14,18} We believe that the SPROC goals and objectives are still relevant and can be integrated into pediatric preparedness, reflected through the EMSC State Partnership Performance Measures, including the goal to create a hospital recognition program for pediatric emergencies.²¹ These efforts are consistent with state and national approaches to designate pediatric receiving hospitals by state or local EMS agencies. The findings and outcomes from SPROC recipients and other medical centers over the past several years provide a realistic outlook on what can be accomplished and demonstrate the challenges faced by rural communities with unique geographic, socioeconomic, and cultural disparities. These findings should be taken into consideration for a national facility recognition program development and a framework for providing resources to each state's communities and geographic regions.

With each of these efforts, there were often challenges and variability in how effective the interventions were. For example, challenges faced in providing educational resources primarily revolved around a lack of response rates and engagement between the local and regional EMS agencies and the small rural hospitals. This was complicated by the large project area and variable educational preferences (some learners preferred on-site or local education while others preferred off-site education at the regionalized center). As a result, we provided tailored education and training to providers both on-site in the rural communities, as well as off-site, on the UC Davis campus.

With regard to the EDAP recognition program, although most receiving hospital EDs were amenable to working toward the EDAP designation, some hesitated and expressed concerns regarding the resources required to meet all of the EDAP criteria. For example, some hospital administrators questioned the financial support needed for the nonclinical time necessary to develop and implement pediatric-specific QI processes and pediatric-specific policies and protocols. Finally, only 1 of the 2 LEMSAs

had a formal EDAP recognition program to allow for routing of pediatric EMS cases to specific EDs. As a result, some hospital EDs were motivated to ensure EDAP recognition while others were not. Encouraging the enforcement of EDAP or similar recognition programs could be difficult if the LEMSA is unable to mandate where pediatric EMS patients should be routed.

Since initiation of this project, the California EMSC Program has built on this and other local pediatric readiness efforts to implement EMSC regulations that include EDAP-type criteria. Because these are voluntary and largely unfunded, only a small number of LEMSAs have been able to implement or continue these EMSC programs. Hospitals for the most part must, therefore, elect to maintain pediatric readiness when there are other state mandated licensure or national accreditation review processes without pediatric readiness considerations that may take priority.²² Having national and/or state-wide pediatric facility recognition programs and the inclusion of pediatric readiness in national accreditation review processes would help facilitate ongoing improvements in regionalization of services and hospital preparedness for managing pediatric emergencies.

CONCLUSIONS

TACTICAL demonstrates that a well-developed, protocolized approach to advancing EMSC can be implemented with important benefits for children and family services, rural EMS providers, and the supporting, regional pediatric referral institution. The collective resources provided in this article can be used to help facilitate the implementation of regionalized systems of pediatric emergency care and to expand the inclusion of communities that are dependent on these systems, most notably tribal, territorial, insular and rural communities.²⁶ Our shared resources framework can be adapted by regional pediatric specialty centers to increase readiness and quality of pediatric emergency care in rural and nonurban communities. This article provides suggestions and a framework for the approach, opportunities, and resources needed to improve the regionalization of pediatric emergency care in rural and underserved regions. In this way, other academic medical centers and children's hospitals can improve the quality of EMSC services with their community partners.

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