

Pediatric Care in Rural Hospital Emergency Departments

Final Report No. 97

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EXECUTIVE SUMMARY

Background

Concern about inadequate emergency care for children was raised in 1984 when researchers in Los Angeles County reported higher death rates from trauma among children in the field and at the hospital. In the years that followed, the U.S. Department of Health and Human Services instituted the Emergency Medical Services for Children (EMSC) program, and the American College of Emergency Physicians (ACEP) and American Academy of Pediatrics (AAP) jointly issued guidelines for pediatric emergency department (ED) care.

Optimal emergency care for children may be difficult for rural hospitals to provide. Rural hospitals have less access to pediatric and emergency medicine trained physicians and a low volume of pediatric ED patients makes it difficult for staff to maintain pediatric care skills. In addition, rural hospitals may be far from a hospital that admits critically ill children, requiring that the rural hospital receive and stabilize pediatric emergency cases prior to transfer. Previous studies have only partially investigated potential rural disparities in pediatric emergency care.

In this study, we analyzed data from the Emergency Pediatric Services and Equipment Supplement (EPSES) to the National Hospital Ambulatory Medicare Care Survey to compare rural and urban hospitals' responses on various dimensions of pediatric ED care. In addition, we surveyed 65 ED directors at rural hospitals in a separate process to explore rural pediatric ED care in more detail and to obtain the opinion of rural ED administrators regarding ways to assure quality emergency care for children. For our study, hospitals in the EPSES sample and in the interview survey sample were classified as rural if they were located in a nonmetropolitan county or in a metropolitan county with a Rural-Urban Commuting Area (RUCA) code of four or higher. Use of RUCA codes to determine rurality captures those hospitals that are located outside of urbanized areas of metropolitan counties, hospitals whose characteristics are more likely to resemble those of other rural hospitals than those of urban hospitals.

Results

Findings from the analysis of the EPSES data include the following:

- Rural hospitals had a lower ED visit volume and were less likely to be teaching hospitals or to have a children's hospital in their county. They were also less likely to be Level I (highest) or Level II Trauma Centers.
- All rural hospitals reported admitting pediatric patients, but few had an inpatient unit specifically for children.
- Almost all rural hospitals would send children needing intensive care to another hospital compared to three-quarters of urban hospitals. A written transfer agreement for care that was not available locally was available at only one-half of hospitals regardless of geography.
- Rural hospitals had less access to physicians specially trained in emergency medicine or in pediatrics or both.

- Rural hospitals had a lower overall pediatric supply score than urban hospitals and lower scores in four categories (of six categories queried): vascular access supplies, airway management supplies, pediatric trays, and miscellaneous supplies. However, the percent of all supplies that were available in rural hospitals was only 5.1 percentage points less than the percent available in urban hospitals.

Hospitals in our survey of ED directors were similar to those in the rural panel in the EPSES data. Findings include the following:

- Almost all admit pediatric patients, but few have a separate pediatric inpatient unit.
- ED staff in every hospital had access to a medication chart for pediatric dosages and most had a special pediatric crash cart. Few, however, had a special room in their ED for pediatric care.
- The availability of board-certified pediatricians and emergency medicine physicians was higher than in the EPSES rural sample. Most ED physicians or mid-level providers had Advanced Cardiac Life Support (ACLS) training and most hospitals reported that all of their ED physicians or mid-levels had Pediatric Advanced Life Support (PALS) training.
- Most rural hospitals reported that some or all ED nurses had PALS training. Many reported that all or some nurses had completed the Emergency Nursing Pediatric Course and most had some nurses with Trauma Nursing Core Curriculum training.
- Staff training was the most common need reported. Money to pay for training was the biggest barrier but lack of training opportunities and staffing were also cited, particularly personnel to cover when other staff is at training. One in five of those without a special pediatric emergency cart would like to get one.

Discussion

The organization of pediatric care, including emergency care, and availability of pediatric emergency expertise differs between rural and urban hospitals. Several areas merit further discussion.

Trauma System Development - Most rural hospitals would not qualify as Level III or higher trauma centers because they lack the specialized staff and equipment to meet the needs of trauma patients. However, in states with trauma designations that include Level IV (ability to provide advanced trauma life support before a patient is transferred) some rural hospitals could meet the qualifications for this level of care. Obtaining a trauma level designation requires a good working relationship with a Level I, II, or III trauma center and the preparation and cooperation required to obtain and maintain a trauma center designation could, in turn, strengthen these relationships in addition to strengthening trauma care overall.

Pediatric and Trauma Care Expertise - The training of clinical staff in emergency procedures, both initial training and skill refreshers, was a concern identified by respondents. An emergency medicine trained physician in every rural hospital may not be a realistic goal. Emergency medicine training in the form of special courses or certification is important for family medicine and internal medicine physicians and for mid-level providers who often staff rural hospitals. Completion of the Rural Trauma Team Development Course (RTTDC) was reported by few respondents. The RTTDC, taught at the rural hospital by instructors from Level I or Level II

trauma centers, can strengthen the relationships between rural hospitals and those larger hospitals to which they transfer critically ill or injured patients.

Continuing Education - Low patient volume in any area of health care challenges retention of skills. Creative solutions to improve staff training are needed, including a funding mechanism to support the costs of out-of-town training and temporary replacement staff if needed. Medical simulation has been used for training to allow repetition of skills. Medical simulation suites are more likely to be available in teaching hospitals and would need to be available to rural providers either by bringing providers to the training hospital or taking the technology to rural areas. Videoconference instruction is another evolving technology that could be valuable in providing education with minimal disruption of staff availability in rural areas. ED Learning Units (self-directed instructional packets) have been developed at one hospital to promote on-site learning and continuing education.

Supplies and Equipment - Rural hospitals had a higher percent of pediatric supply/equipment items than might be expected given the few pediatric emergencies they are likely to treat. All hospitals in our smaller study of rural EDs had a medication chart or tape to calculate pediatric dosages and most had a special emergency cart for pediatric care, frequently a Broselow cart or other color-coded pediatric cart. The availability of the supplies that are included in such carts may be a reasonable compromise for specific categories of supplies recommended by the AAP/ACEP when funding limits the ability of an ED to stock all supplies.

Summary

Rural hospital administrators are aware of the special concerns for pediatric care in the ED and have taken steps to assure optimal care. Some needs, such as better availability of pediatricians, emergency medicine physicians, and pediatric emergency medicine physicians, will be difficult to meet given the low pediatric patient volume in rural areas and the competing incentives for practice in a larger area. Emergency and trauma training is available for physicians, mid-levels, and nurses but requires the resources to take advantage of training opportunities. Programs to support training, either in the form of funding for stipends or temporary staff to fill in for trainees, would be valuable. Innovative educational programs exist but emergency department administrators in isolated rural areas may not always be aware of them. Programs that collect and catalogue training opportunities and disseminate this information to rural areas, combined with funding sources to allow hospitals to take advantage of the opportunities, could improve the skills of rural emergency department providers as they serve children. Finally, programs to support acquisition of pediatric sized equipment including a specialized pediatric emergency cart such as a Broselow cart would only require limited, short-term investment that would improve the likelihood of appropriate care in pediatric emergencies.

INTRODUCTION

Concern about inadequate emergency care for children was raised by Seidel and colleagues in 1984 when they reported that the death rate in the field from trauma was higher for children than for adults in Los Angeles County.¹ They also found that 12% of children arriving at the emergency room with trauma injuries died, compared to 7% of adults. In addition, almost one-quarter (22%) of children who were transported to the emergency department (ED) required secondary transport to another hospital for care.

In the years that followed, the U.S. Department of Health and Human Services instituted the Emergency Medical Services for Children (EMSC) program that provides grants, technical assistance, and research to improve pediatric emergency care through partnerships with states and private organizations. Joint American College of Emergency Physicians (ACEP) and American Academy of Pediatrics (AAP) guidelines for ED care issued in 2000 included qualifications and responsibilities for ED physicians, nursing pediatric coordinators, and other ED staff, as well as guidelines for quality improvement, policies, procedures, protocols, support services, and equipment, supplies, and medication for children.²⁻³

Three subsequent studies have examined hospital ED adherence to all or part of the ACEP/AAP guidelines.⁴⁻⁷ A 2001 study using the 1997 National Electronic Injury Surveillance System (NEISS) found that while hospitals without specialized pediatric units still admitted critically ill or injured children, few had protocols to obtain pediatric consultation for pediatric emergencies, and pediatric-sized emergency equipment was less likely to be available than was adult-sized equipment.⁴

In 2002-2003, the National Hospital Ambulatory Medicare Care Survey (NHAMCS) included an Emergency Pediatric Services and Equipment Supplement (EPSES).⁵ This supplemental survey found that only 23% of hospitals used pediatric emergency medicine attending physicians, 9% had a pediatrician in the ED at all times, and 26% had a written protocol for when to call in a pediatrician. On the other hand, among hospitals without specific pediatric units capable of caring for children needing trauma or intensive care, 91% would transfer trauma cases and 98% would transfer intensive care cases to another hospital for definitive care. Hospitals had most of the recommended supplies and equipment for pediatric care.

Particular aspects of emergency care for children may be especially difficult for rural hospitals to meet. Rural hospitals have less access to pediatric and emergency medicine trained physicians. A low volume of pediatric ED patients makes it difficult for emergency care staff to maintain skills for treating this population.⁸ Compared to hospitals in urban areas, rural hospitals may be farther from a children's hospital or a teaching hospital that admits critically ill children, necessitating that rural hospitals receive and stabilize pediatric emergency cases prior to transfer. Previous studies have only partially investigated potential rural disparities in pediatric emergency care. They have used limited definition of rural^{5,7} or provided little detail regarding the specific limitations of rural EDs regarding pediatric care.⁷

In a further analysis of the EPSES data, nonmetropolitan hospital EDs were less likely to have either a board-certified emergency medicine or a board-certified pediatric emergency medicine

physician and the percentage of pediatric supplies they had was less likely to be higher than the median percentage for all hospitals.⁶ Calculation of the odds of meeting pediatric preparedness criteria that controlled for multiple factors associated with ED care found that rural hospitals had a lower pediatric supply score than urban hospitals but they did not differ significantly in the other three categories of preparedness, i.e., pediatric intensive care unit (PICU) services, trauma services, or expertise.

Gausche-Hill and colleagues surveyed all hospital ED medical directors using an instrument developed from the ACEP/AAP guidelines that assigned a preparedness score for each hospital based on the various components of ideal ED pediatric care.⁷ The median preparedness score for all hospitals was 55, indicating room for improvement for most hospitals. A median score of 53 for rural hospitals was close to the overall median but remote hospitals were significantly less prepared with a median score of 43. The areas in which rural or remote hospitals were deficient were not described.

In this study, we reanalyze the EPSES data using a more current and comprehensive definition of rural to compare rural and urban hospitals on the various dimensions of pediatric ED care queried in the survey. In addition, we surveyed a sample of rural hospitals in a separate process to explore aspects of rural pediatric ED care in more detail and to obtain the opinion of rural ED administrators regarding ways to assure quality emergency care for children.

METHODS

Analysis of EPSES Data - Data from the 2002 and 2003 EPSES survey were analyzed to assess the availability of pediatric emergency expertise and pediatric equipment in rural hospitals compared to urban hospitals. Details about the NHAMCS and EPSES survey design can be found at <http://www.cdc.gov/nchs/ahcd.htm>. For our study, hospitals in the EPSES sample were classified as rural if they were located in a nonmetropolitan county or in a metropolitan county with a Rural-Urban Commuting Area (RUCA) code of four or higher. Use of RUCA codes to determine rurality captures those hospitals that are located outside of urbanized areas of metropolitan counties, hospitals whose characteristics are more likely to resemble those of other rural hospitals than those of urban hospitals.

Data were weighted and analyzed using SUDAAN to account for the complex survey design. The total weighted sample represents 4,672 hospitals (2,091 rural and 2,581 urban). Differences between rural and urban ED responses were compared using the chi-square test for categorical variables. The test for trends was used for summary supply scores created for each of six categories of pediatric supplies. Differences between rural and urban hospitals were considered statistically significant if $p \leq 0.01$.

The restricted-use EPSES dataset was accessed through the National Center for Health Statistics (NCHS) Research Data Center (RDC). The RDC appended geographic indicators in order to classify rural hospitals using RUCA definitions. Differences between some services provided at rural and urban hospitals could not be analyzed because of small sample size in the EPSES and RDC access restrictions.

Survey of Rural Hospital ED Directors - Additional data were collected from a sample of rural hospital ED administrators who we surveyed about care for children in their emergency department. One hundred and forty-four (144) hospitals with emergency departments were chosen randomly from the Online Survey, Certification, and Reporting (OSCAR) Provider of Services (POS) system database for the 1st Quarter of 2007. Hospitals were considered to be rural if they met the RUCA code definition described above. The survey instrument was developed in-house and included some questions from the EPSES survey and others that were written to capture more detailed information about rural ED care. Fielding of the survey was completed in 2008, by telephone when possible, with the majority of respondents mailing in their responses. Sixty-five (65) usable surveys were received for a response rate of 45.5% (one hospital was ineligible). Surveys were received from 31 states and from all U.S. Census Divisions. Closed-ended questions focused on training of ED personnel, structure of the ED, e.g., specific room for pediatrics, and availability of a pediatric crash cart. In open-ended questions, ED Directors discussed how they thought they could better serve children in their ED and their perceived barriers to changes in care.

RESULTS

Analysis of EPSES Data

Data from the EPSES analysis describing hospital location and characteristics are presented in Table 1. Rural hospitals had a lower ED visit volume than urban hospitals. Rural hospitals were more likely to be government hospitals and less likely to be proprietary, less likely to be teaching hospitals, and none had a children’s hospital in their county.

Table 1: Percent of Hospitals by Location and Hospital Characteristics – EPSES Data

	All Hospitals N=4,672 %	Rural Hospitals N=2,091 %	Urban Hospitals N=2,581 %	p value
Number of overall ED visits per year				
Less than 4,000	12.0	19.9	5.3	.0000
4,000-10,000	20.7	38.9	5.6	
More than 10,000	67.3	41.2	89.1	
Ownership				
Voluntary	63.0	66.2	60.4	.0083
Government	12.4	17.3	8.4	
Proprietary	24.6	16.5	31.1	
Geographic region				
Northeast	15.3	10.7	19.1	.0011
Midwest	29.8	38.3	22.6	
South	38.6	38.3	38.8	
West	16.4	12.7	19.4	
Teaching hospital	21.5	5.7	33.8	.0000
Trauma center levels:				
Level I (highest)	9.7	6.5	12.2	.0015
Level II	26.3	16.3	34.2	
Level III	17.6	21.2	14.8	
Other/unknown	14.5	24.0	7.0	
Missing	31.9	32.1	31.8	
Children’s hospital in same county	17.9	0.0	32.8	.0000

Rural hospitals were more likely to be in the Midwest and less likely to be in the Northeast or West. Fewer rural hospitals were Level I (the highest level) or Level II Trauma Centers. Rural hospitals were three times as likely as urban hospitals to have an “other” trauma center designation (most likely Level IV – see Table 5 below) or an unknown designation.

The availability of pediatric inpatient care units and transfer agreements was queried (Table 2).

Table 2: Percent of Hospitals with Specialized Pediatric Services or Transfer Agreements for Pediatric Care – EPSES Data

	All Hospitals N=4,672 %	Rural Hospitals N=2,091 %	Urban Hospitals N=2,581 %	p value
Admits pediatric patients to hospital	90.2	98.2	83.5	.0000
Has a pediatric ward or department	38.5	17.1	57.4	.0000
Has a pediatric 23-hr observation unit	16.7	9.0	23.2	.0004
Would send patients needing PICU care to another hospital	84.8	97.1	74.6	.0000
Has a written transfer agreement with a hospital with PICU	52.4	51.5	53.1	.7717
Has a pediatric trauma service	14.2	9.1	18.6	.0709
Has a written transfer agreement with a hospital with a pediatric trauma service (among hospitals with no pediatric trauma service)	56.1	52.1	59.6	.1678

As shown in Table 2, virtually all rural hospitals reported that they admit pediatric patients to their hospital compared to 83.5% of urban hospitals. Fewer rural hospitals, however, had an inpatient unit specifically for children. Few hospitals, regardless of location, had a pediatric trauma service. Almost all rural hospitals would send children needing PICU care to another hospital compared to three-quarters of urban hospitals. The presence of a written agreement for transfer of children for PICU or trauma care did not differ between rural and urban hospitals but only one-half of all hospitals had these written agreements.

Rural hospitals were less likely to have 24/7 access to physicians specially trained in emergency medicine or pediatrics (Table 3.)

Table 3: Percent of Hospitals with Physicians Trained in Emergency Medicine or in Pediatrics – EPSES Data

	All Hospitals N=4,672 %	Rural Hospitals N=2,091 %	Urban Hospitals N=2,581 %	p value
ED has 24/7 access to the following board certified attending physicians:				
Emergency Medicine	72.1	51.9	88.7	.0000
Pediatric Emergency Medicine	23.5	14.6	30.9	.0012
Pediatrician	63.1	46.6	77.0	.0001
Has written protocol for when to call a pediatrician to the ED (among hospitals without a pediatrician 24/7)	28.9	22.3	34.6	.0389

The percent of rural hospitals with emergency medicine physicians was slightly more than the percent with pediatricians. Physicians trained in pediatric emergency medicine are rare in rural areas and not widely available in urban areas. There was no significant difference between rural and urban hospitals in the percent of hospitals with a written protocol for when to call in a pediatrician. The percent of all hospitals with this type of protocol was considerably less than the percent with written agreements for transfer (Table 2).

The EPSES survey includes a list of 131 pediatric-sized supplies or equipment in six categories that the ACEP/AAP guidelines recommend be available in every emergency department (see the Appendix for a comprehensive list of supplies queried). Because most hospitals did not have all the supplies in any category, weighted summary scores for each category of supplies and an overall supply score were created for each hospital as part of the EPSES dataset. A weighted summary score accounts for the number of items in the category. For example, a hospital with six of the 12 monitoring supply items would have a score of 50% for that category. To obtain a score of 50% for the airway management supplies would require a hospital to have 37 of the 74 items in that category. The average supply score across hospitals for each category of supplies and the overall supply score are presented comparing rural hospitals to urban ones (Table 4). We also calculated the availability of each individual supply or piece of equipment but do not present those results here; results for individual items will be used, however, to explain the differences for specific categories when statistically significant differences in category scores were found.

Table 4: Average Supply Scores for Supply Categories – EPSES Data

	All Hospitals N=4,672 %	Rural Hospitals N=2,091 %	Urban Hospitals N=2,581 %	p value
Monitoring supplies (12 items)	94.3	91.5	96.7	.0202
Vascular access supplies (19 items)	76.3	71.8	79.9	.0013
Airway management supplies (74 items)	77.7	71.2	83.1	.0000
Pediatric trays (13 items)	80.0	75.4	83.9	.0069
Fracture management supplies (4 items)	78.6	78.6	78.6	.9963
Miscellaneous supplies (8 items)	88.8	85.2	91.9	.0007
Overall supply score	85.0	82.2	87.3	.0046
Percent of hospitals with a medication tape for pediatric dosage (single item)	98.7	99.5	97.9	.2614

The percent of supplies available at all hospitals ranged from 94.3% of monitoring supplies to 76.3% of vascular access supplies. Rural hospitals had a statistically significant lower overall supply score and lower scores in four of six categories: vascular access supplies (8.1 percentage points difference), airway management supplies (11.9 percentage points difference), pediatric trays (8.5 percentage points difference), and miscellaneous supplies (6.7 percentage points difference.)

Overall, hospitals stocked 85.0% of all supplies on average. The percent of all supplies that were available in rural hospitals was 5.1 percentage points less than the percent available in urban hospitals (82.2% vs. 87.3%).

Survey of Rural Hospital ED Directors

The analysis of the EPSES data was augmented by a survey we conducted with rural hospital ED Directors. Fifty-eight percent (58%) of respondent hospitals were critical access hospitals. The median number of beds was 25 (range: 5-238) and the median average daily census was 14 (range: 1-165). Pediatric and emergency care services available at the rural hospitals are described in Table 5.

Table 5: Characteristics of Pediatric Services and Emergency Care in Rural Hospitals Surveyed (N=65)

Admits pediatric patients to the hospital	95.4%
Has a separate pediatric inpatient unit	13.8%
Has a pediatric 23 hour observation unit	3.1%
Hospital Trauma Center Designation*:	
None	57.1%
Level II	7.9%
Level III	11.1%
Level IV	23.8%
Median number of all ED visits per month (range)	825 (55-3250)
ED has a medication chart or tape for pediatric dosages	100.0%
ED has a pediatric emergency cart	81.5%
ED has a special room for pediatrics	21.5%

*Trauma Center Level I is the highest level of trauma center care.

Hospitals in the interview group were similar to those in the rural panel in the EPSES data. Almost all of them admit pediatric patients to their hospital but few have a separate pediatric inpatient unit and fewer still have a 23-hour observation unit for children. Fewer than half reported a trauma center designation for their hospital. We included Level IV as an option in our question regarding trauma center designation although the EPSES survey did not. Level IV designation requires that a hospital provide advanced trauma life support before a patient is transferred to a higher level of care. Level IV trauma centers are recognized by the American College of Surgeons but are not part of the classification scheme in all states. In our survey of rural hospitals, Level IV was the most frequently reported level among those hospitals reporting a trauma center level.

ED staff in every hospital in this sample of rural hospitals had access to a medication chart for pediatric dosages and most had a special pediatric emergency cart available. Few hospitals, however, had a special room in their ED for pediatric care.

We also asked about ED staffing in our survey of rural hospitals. In addition to asking about the availability of certain specialty physicians, we asked about specific emergency medicine training for ED physicians, mid-level providers, and nurses.

The availability of specialty trained physicians was higher in this sample of hospitals than in the EPSES rural sample with about 60% of hospitals reporting 24/7 access to board certified emergency medicine physicians and pediatricians (Table 6). Emergency medicine (EM) trained physicians were more likely to be available in-house while pediatricians were more likely to be available on-call.

Table 6: ED Staff Training in Rural Hospitals Surveyed (N=65)

	% of hospitals
ED Physician Training	
ED has 24/7 Access to board-certified pediatrician	60.0
ED has 24/7 Access to board-certified EM physician	63.1
ED has 24/7 Access to board-certified pediatric EM physician	14.1
All ED Physicians or Mid-Levels have the following:	
Advanced Cardiac Life Support (ACLS) training	95.3
Pediatric Advanced Life Support (PALS) training	78.7
Advanced Trauma Life Support (ATLS) training	45.8
Rural Trauma Team Development Course (RTTDC)*	3.9
ED Nurse Training	
All ED Nurses have the following:	
Advanced Cardiac Life Support (ACLS) training	90.6
Pediatric Advanced Life Support (PALS) training	61.9
Emergency Nursing Pediatric Course (ENPC)	12.9
Trauma Nursing Core Curriculum (TNCC)	35.4

*>10% of responses were missing

Most ED physicians or mid-levels had Advanced Cardiac Life Support (ACLS) training and more than three-quarters of hospitals reported that all of their ED physicians or mid-levels had PALS training. Few hospitals, however, reported that their physicians or mid-levels had participated in the Rural Trauma Team Development Course (RTTDC).

Almost two-thirds of rural hospitals reported that all ED nurses had Pediatric Advanced Life Support (PALS) training and most of the others reported that some ED nurses had this training. Similarly, although only 12.9% of hospitals reported that all nurses had completed the Emergency Nursing Pediatric Course (ENPC), another 56% reported that some had completed

the course. One-third of hospitals reported that all nurses had Trauma Nursing Core Curriculum (TNCC) training and 60% of hospitals had some nurses with TNCC training.

In open-ended questions, survey respondents reported what they thought would improve care for children in their ED and the barriers to making those changes. The most common responses focused on ED training, facilities and equipment, and the overall need for staff with pediatric expertise.

Staff training was the most common need and was reported by 40% of respondents. Training needs ranged from the desire for more mock codes and drills to specific pediatric emergency training courses such as PALS and ENPC. Money to pay for training was the biggest barrier but staffing was also cited, particularly the lack of personnel to cover when other staff is at training. A lack of training opportunities was also reported.

Twenty-two percent (22%) of those that do not already have a separate room in their ED for pediatric cases would like to have one. Almost all of them cited lack of space as a barrier. Funding was also a barrier.

Seventeen percent (17%) of those without a special pediatric emergency cart would like to get one. Others listed pediatric equipment in general or special equipment such as a mannequin for training purposes as a need for their ED. Low pediatric volume was listed as a barrier as well as budget constraints.

Fourteen percent (14%) of respondents would like to have a pediatrician on staff or better access to available pediatricians or other physicians trained in pediatric care.

DISCUSSION

The organization of pediatric care, including emergency care, differs between many rural and urban hospitals. Rural hospitals are less likely than urban hospitals to have an inpatient pediatric unit but they are more likely to admit children to the hospital, reflecting, in part, the lack of children's hospitals in rural areas. Rural hospitals are just as likely as urban hospitals to have written transfer agreements with other hospitals for children needing PICU or trauma center care, but only about half of all hospitals (rural and urban) had these agreements. Even though a hospital may have a well-established relationship with another hospital, written transfer agreements can clearly spell out the conditions for which a child will be transferred and the roles and responsibilities of the transferring hospital and the receiving hospital.

Trauma System Development

Many rural hospitals in both data sources (EPSES and our survey) did not have a trauma level designation. The American College of Surgeons (ACS) has disseminated guidelines and standards for trauma level designation, and certifies hospitals that meet their standards. Official designations, however, are granted by the state. Many rural hospitals do not qualify as Level III or higher trauma centers because they lack the specialized staff and equipment to meet the needs

of trauma patients beyond stabilization and transfer. However, in states with trauma designations that include Level IV, some rural hospitals could meet the qualifications for this level of care that requires that they provide advanced trauma life support before a patient is transferred to a higher level of care. Obtaining a trauma level designation requires a good working relationship with a Level I, II, or III trauma center and the preparation and cooperation required to obtain and maintain a trauma center designation could, in turn, strengthen these relationships as well as strengthening trauma care overall. A trauma center designation also provides a clear indication to pre-hospital emergency care providers of a hospital's capacity to provide trauma care.

Pediatric and Trauma Care Expertise

The training of clinical staff in emergency procedures, both initial training and skill refreshers, were frequent concerns of the individuals who responded to our survey. A review of the literature and specific suggestions by respondents provided a number of ideas and examples about how these concerns could be addressed if resources were available.

Rural hospitals in these analyses are less likely than urban hospitals to have access to physicians trained in either emergency medicine or in pediatrics, a finding consistent with other studies.^{6,10} Although some rural hospitals contract with an emergency medicine physician group for ED coverage, many rely on community physicians or their own hospital primary care staff for coverage. Given limitations in the supply of emergency medicine trained physicians and the incentive for those physicians to practice in larger hospitals, an emergency medicine trained physician in every rural hospital may not be a realistic goal. Emergency medicine training in the form of special courses or certification is important for the family medicine and internal medicine physicians as well as mid-level providers who often staff rural hospitals.

The Rural Trauma Team Development Course has been developed by the American College of Surgeons to help rural hospitals develop trauma teams and, thus, improve the quality of care in their hospital. We asked specifically about RTTDC in our survey of a sample of rural hospitals, and although RTTDC courses have been conducted in 25 states¹¹, less than 10% of those we surveyed reported that the physicians or mid-levels in their hospital had taken the course. Almost 20% did not know if the course had been taken, indicating that they may not be aware of the course and its benefits.

The RTTDC 8-hour curriculum is taught at the rural hospital by instructors from Level I or Level II trauma centers for a nominal fee. Hospitals wishing to obtain this training put together 3-person trauma teams (generally a physician, a nurse, and one other staff member) and provide space for the training. RTTDC training requires cooperation between the smaller rural hospital and the larger hospital. This training program should be promoted to both groups of hospitals, and would be another way that hospitals within networks, including critical access hospitals, could strengthen their relationships with other hospitals including those to whom they transfer critically ill or injured patients.

Most hospitals in our sample had some ED nursing staff with advanced pediatric emergency training such as PALS, ENPC, or TNCC. Certification in these critical care programs was not

universal, however, and training was the most frequently identified need cited by respondents. ED directors reported having neither the time nor the money to get the training that their staff needed. Rural hospitals that struggle to maintain staff in locations where there is limited availability of physicians and nurses, especially those with emergency medicine training, may have few options to provide training for their staff. Funds may not be available to send personnel for training, particularly if the training costs involve travel and housing expenses in addition to the cost of the conference or course. Even if funds are available, hospitals may not be able to provide time off for training if staffing is already stretched thin or temporary staff is not available. Creative solutions to improve staff training are needed including a funding mechanism to support the costs of out-of-town training and temporary replacement staff if needed.

Continuing Education

Low patient volume in any area of health care challenges retention of skills and several respondents to our small study noted that low pediatric emergency patient volume was a concern for them. Some respondents specifically suggested more mock codes or drills to maintain skills. Medical simulation has been used for training when the patient volume is not adequate to allow repetition of skills. This method for training physicians in emergency care for children shows promise in a review of the literature by Eppich and colleagues.¹² Medical simulation suites are more likely to be available in teaching hospitals, however, and would need to be available to rural providers either by bringing providers to the training hospital or taking the technology to rural areas.

Even with advancements in technology, some training options will not be available at the local level. The opportunity for rural nurses to observe and work periodically in busier urban EDs was suggested by a survey respondent as a valuable experience. Similarly, for hospitals with network relationships, cross-training of staff could maximize the value of these relationships.

Videoconference instruction as a method for ED staff training was explored by Weeks and Molsberry.¹³ In a randomized trial of PALS retraining using either videoconferencing or face-to-face instruction, they found no difference in trainee results in the areas of psychomotor skills, knowledge, and confidence at the end of the training and also found no difference in skills after one year, although both groups showed degradation of skills. Psychomotor skills of the trainees at the videoconference site were observed in person and the ability to assess these skills via videoconference remains to be demonstrated. The ease of using videoconferencing for retraining would facilitate retraining at more frequent intervals for those whose skills deteriorate when rarely used.

One children's hospital has developed ED Learning Units (EDLUs), i.e., self-directed instructional packets, which cover more than 50 critical care topics. These learning modules can be completed by nurses on their own when they have the time. The EDLUs have been positively received by the nurses and have been reported to be valuable as part of a new nurse's orientation and as refreshers for nurses with more experience.¹³ Learning Units that require hands-on practice do require supervision and limited supervisory staff in a rural ED may limit their usefulness in that setting. In addition, rural hospitals may need EDLUs specific to rural care.

Supplies and Equipment

Rural hospitals in our analysis of EPSES data had a higher percent of pediatric supply and equipment items than might be expected given the few pediatric emergencies they are likely to treat. The difference in overall supply scores for rural hospitals and urban hospitals was statistically significant but was not remarkable (82% vs. 87%). This extensive list of items is ideal but may not be realistic for a small rural hospital that rarely receives trauma patients when the likelihood of needing the equipment is weighed against the cost of maintaining all sizes of all items. All hospitals in our small study of rural EDs had a medication chart or tape to calculate pediatric dosages. In addition, 80% reported that they had a special emergency cart for pediatric care, frequently identifying their cart as a Broselow cart or a color-coded pediatric cart. A color-coded pediatric emergency cart based on the Broselow tape was easier to use, led to faster location of specific supplies and the provision of correct supplies, and was preferred by subjects in a study of the use of the color-coded cart versus a standard pediatric cart in a mock code situation.¹⁵ The availability of the pediatric supplies that are included in such carts may be a reasonable compromise for specific categories of supplies recommended by the AAP/ACEP when funding limits the ability of an ED to stock all supplies.

SUMMARY

Rural hospital ED administrators are aware of the special concerns for pediatric care in the emergency department and have taken steps to assure optimal care. Some needs such as better availability of pediatricians, emergency medicine physicians, and pediatric emergency medicine physicians, will be difficult to meet given the pediatric patient volume in rural areas and the competing incentives for practice in a larger area.

Emergency and trauma training is available for physicians, mid-level providers, and nurses but requires the resources to take advantage of training opportunities. Programs to support training either in the form of funding for stipends or temporary staff to fill in for trainees would be valuable. Innovative educational programs exist but emergency department administrators in isolated rural areas may not always be aware of them. Programs that collect and catalogue training opportunities and disseminate this information to rural areas combined with funding sources to allow hospitals to take advantage of the opportunities could be helpful in improving the skills of rural emergency department providers as they serve children.

Finally, programs to support acquisition of pediatric sized equipment including a specialized pediatric emergency cart such as a Broselow cart would only require limited, short-term investment that would improve the likelihood of appropriate care in pediatric emergencies.

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APPENDIX

List of Supplies Included in the EPSES Questionnaire

Monitoring Supplies (12 items)

Cardiorespiratory monitor	Thermometer / rectal probe
Defibrillator	Doppler blood pressure device
Pediatric monitor electrodes	Blood pressure cuffs (neonatal, infant, child, small adult)
Pulse oximeter w/newborn sensor	Monitor for ET tube and placement
Pulse oximeter w/child sensor	

Vascular Access Supplies (19 items)

Butterfly needles (19, 21, 23, 25ga)	Tubing for infusion device
Catheter over needles (16, 18, 20, 22, 24 short, 24ga long)	Intraosseous needles (16, 18ga)
Infusion device	Umbilical vein catheters (3.5, 5Fr)
	Seldinger vascular access kits (3, 4, 5Fr)

Airway Management Supplies (74 items)

Oxygen masks (preterm/neonate, infant, child)	Stylets (infant, pediatric)
Nonbreathing masks (infant, child)	Laryngoscope handle - pediatric
Oralpharyngeal airways (sizes 00, 0, 1, 2, 3)	Curved laryngoscope blades (sizes 2, 3)
Nasopharyngeal airway (10, 12, 14, 16, 20, 24, 28Fr)	Straight laryngoscope blades (sizes 0, 1, 2, 3)
Bag-valve-mask resuscitator	Magil forceps - pediatric
Nasal cannulae (infant, child)	Nasogastric tubes (5, 6, 8, 10, 12, 14Fr)
Uncuffed endotracheal tubes (sizes 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5)	Flexible suction catheters (5/6, 8, 10, 12Fr)
Cuffed endotracheal tubes (sizes 5.5, 6.0, 6.5, 7.0, 7.5)	Chest tubes (8, 10, 12, 14, 16, 18, 20, 22, 24, 26Fr)
	Tracheostomy tubes (sizes 00, 0, 1, 2, 3, 4, 5, 6)

Specialized Pediatric Trays (13 items)

Thoracotomy tube w/water seal	Umbilical vein catheterization
Lumbar puncture trays (20, 22, 25ga)	Meconium aspirator
Pediatric Foley Catheters (5/6, 8, 10, 12Fr)	Venous cutdown
Obstetric pack	Surgical airway

Fracture Management Supplies (4 items)

Cervical immobilization (infant, child)	Femur split - child
Extremity splints	

Miscellaneous Supplies (8 items)

Infant scales	Pediatric restraining devices
Infant formula	Resuscitation board
Oral rehydrating solutions	Sterile linen for burn care
Heating source, isolette	Medical photography capability