Access to High Pediatric-Readiness Emergency Care in the United States

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Objective To determine the geographic accessibility of emergency departments (EDs) with high pediatric readiness by assessing the percentage of US children living within a 30-minute drive time of an ED with high pediatric readiness, as defined by collaboratively developed published guidelines.

Study design In this cross-sectional analysis, we examined geographic access to an ED with high pediatric readiness among US children. Pediatric readiness was assessed using the weighted pediatric readiness score (WPRS) of US hospitals based on the 2013 National Pediatric Readiness Project (NPRP) survey. A WPRS of 100 indicates that the ED meets the essential guidelines for pediatric readiness. Using estimated drive time from ZIP code centroids, we determined the proportions of US children living within a 30-minute drive time of an ED with a WPRS of 100 (maximum), 94.3 (90th percentile), and 83.6 (75th percentile).

Results Although 93.7% of children could travel to any ED within 30 minutes, only 33.7% of children could travel to an ED with a WPRS of 100, 55.3% could travel to an ED with a WPRS at or above the 90th percentile, and 70.2% could travel to an ED with a WPRS at or above the 75th percentile. Among children within a 30-minute drive of an ED with the maximum WPRS, 90.9% lived closer to at least 1 alternative ED with a WPRS below the maximum. Access varied across census divisions, ranging from 14.9% of children in the East South Center to 56.2% in the Mid-Atlantic for EDs scoring a maximum WPRS.

Conclusion A significant proportion of US children do not have timely access to EDs with high pediatric readiness. *(J Pediatr 2017;■■:■■-■■).*

When medical emergencies occur, children require timely access to care that is prepared for their unique needs.[1] As outlined in guidelines collaboratively developed and sponsored by the American Academy of Pediatrics, American College of Emergency Physicians, and Emergency Nurses Association,[2,3] these needs include pediatric-specific equipment, medication, and supplies; staff with pediatric expertise; and pediatric-specific policies, procedures, and protocols. However, in previous studies, only 59% of emergency departments (EDs) nationally were aware of pediatric guidelines,[4] only 53.5% had a written transfer agreement with a hospital with pediatric intensive care services,[5] and only 23% had a pediatric emergency physician on staff.[6] Such findings have prompted efforts to improve the pediatric emergency care system over the last decade.[7,8]

To understand the current pediatric readiness of EDs, the 2013 National Pediatric Readiness Project (NPRP) assessment surveyed all US EDs on individual components of the published guidelines and developed a weighted pediatric readiness score (WPRS) to reflect the availability of pediatric-specific equipment, personnel, and processes.[9] A WPRS of 100 indicates meeting the essential elements for pediatric readiness, and as such is the target score for all EDs. In the 2013 NPRP assessment, the median WPRS for EDs nationally was 68.9,[9] indicating that the majority of EDs in the US are still not fully compliant with published guidelines. More than 70% of pediatric emergency visits occur in community hospitals, not pediatric hospitals,[5] including the majority of visits by infants and by children with medical complexities,[10] underscoring the importance of assessing and improving pediatric readiness across all EDs.

Although these findings highlight the potential for further improvements in pediatric readiness, they do not address the degree to which pediatric-ready

AHA	American Hospital Association
ED	Emergency department
EMSC	Emergency Medical Services for Children
GIS	Geographic information systems
ICU	Intensive care unit
NPRP	National Pediatric Readiness Project
WPRS	Weighted pediatric readiness score

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emergency care is geographically accessible for the nation's children. Thus, a pressing question remains: when emergencies occur, will parents and families be able to quickly travel to an ED with high pediatric readiness? The goal of the present study was to address this knowledge gap by examining the distribution of EDs with high pediatric readiness relative to the pediatric population to evaluate the accessibility of pediatric-ready EDs for children both nationally and regionally.

Methods

We performed a cross-sectional analysis of geographic access to pediatric-ready EDs for the US pediatric population in 2013, the most recent year of available data. We defined geographic access as living within a 30-minute drive time of an ED meeting specified thresholds of the WPRS. We used a 30-minute drive time based on previous work reporting that adults with children in the household were willing to spend up to 30 minutes traveling for urgent concerns,[11] and that <4% of children arrive to the ED by ambulance.[12] We examined access nationally and in the 9 US Census divisions.

To identify US hospital-based EDs, we used the comprehensive list of hospitals developed for the 2013 NPRP assessment. Details on the development and deployment of the 55 question Web-based survey are available elsewhere.[9] In brief, the NPRP survey was designed to assess adherence to guidelines for pediatric readiness. The NPRP national steering committee identified hospitals in each state from the 2009 American Hospital Association database, and then requested that Emergency Medical Services for Children (EMSC) program managers in all states review and finalize the list to ensure inclusion of all hospitals with EDs open continuously, excluding federal and prison hospitals. The survey focused on these EDs because the guidelines were intended to apply to hospital-based EDs with 24/7 staffing. With assistance of multiple professional organizations at national and local levels and EMSC state managers, the NPRP survey was distributed to nurse managers at 5017 identified hospitals across the US and US territories.

Hospitals were surveyed between January 1 to August 23, 2013, with each hospital given 3 months to complete the survey. Among the 5017 surveyed hospitals, 4959 were within the nonterritorial US. Of these, 4090 (82%) responded to the survey. To explore the characteristics of responding and nonresponding hospitals, we linked NPRP survey data with 2011 American Hospital Association (AHA) data using hospital name, state, county, and zip code. Among the 869 nonresponders, 79 could not be matched to an AHA-identified hospital, even after manual review, with many representing healthcare facilities that either had closed or did not appear to meet original inclusion criteria. These 79 hospitals, representing 1.6% of the original sample, were dropped from further analysis. The final cohort comprised the 790 matched nonresponders and the 4090 responders.

We used the WPRS to determine pediatric readiness for each ED. The WPRS was developed through expert panel review and an initial pilot, ultimately weighting 24 of 55 questions. A WPRS of 100 indicates that the ED meets the essential guidelines for pediatric readiness. In addition to examining total WPRS, we separated scored items into 3 subscores, maintaining the same weighting for each item as in the total WPRS: equipment (33 points, including equipment, supplies, and medications), personnel (29 points, including staffing and physician and nurse coordinators), and processes (38 points, including quality improvement, safety, processes, policies, and procedures).

For the 4090 hospitals that responded to the survey, we determined total WPRS and 3 subscores from survey responses. For the 790 nonresponding hospitals, we performed multiple imputation[13,14] of the 3 subscores (personnel, equipment, and processes). Multiple imputation generates multiple simulated datasets, each containing plausible values for missing data, which are then analyzed and pooled.[13,14] To perform the imputation, we first evaluated hospital characteristics associated with nonresponse and with WPRS based on AHA linkage. The goal of this step was to evaluate the degree to which nonresponse was associated with measured variables. We then developed a regression model for each WPRS subscore in which the model covariates included ED characteristics (pediatric ED, trauma center level, total volume, triage system), hospital characteristics (bed size, inpatient pediatric ward, pediatric intensive care unit [ICU], neonatal ICU, pediatric cardiology, computed tomography scanner, magnetic resonance imaging), accreditations (The Joint Commission, Accreditation Council for Graduate Medical Education), and geographic characteristics (rural/urban status, state). We then used the univariate conditional probability distributions from these models to create 10 multiply imputed datasets with 3 imputed subscores and a summed total WPRS.

We dichotomized the WPRS and the 3 subscores in each of the 10 multiply imputed datasets to reflect whether each ED met a high level of pediatric readiness. For our primary analysis, we used a cut point of 100 WPRS, the maximal readiness score. Because only a small number of EDs received a score of 100, we repeated our analysis using cut points at the 75th percentile (83.6) and the 90th percentile (94.3), recognizing that many hospitals not achieving a maximal score still have pediatric readiness approaching the maximal score.

We obtained data on the population age 14 years and younger and 17 years and younger in each ZIP code from 2013 US Census data. Recognizing variation in the definition of "pediatric patients," we used these cut points to focus our primary analysis on a cohort recognized as "pediatric" by the vast majority of EDs (0-14 years, recognized as pediatric by 83% of EDs), and also performing a sensitivity analysis with a more inclusive definition of pediatric (0-17 years, recognized as pediatric by 71% of EDs).[4]

Statistical Analyses

We used descriptive statistics to compare hospital characteristics between responders and nonresponders, using the χ^2 test to test significant differences for categorical variables. We performed each subsequent analysis separately using each imputed dataset and then combined the results using standard methodology.[15]

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