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EMERGENCY CARE FOR CHILDREN IN THE UNITED STATES: EPIDEMIOLOGY AND TRENDS OVER TIME

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☐ **Abstract—Background: The emergency care system for children in the United States is fragmented. A description of epidemiological trends based on emergency department (ED) volume over time could help focus efforts to improve emergency care for children. Objectives: To describe the trends of emergency care for children in the United States from 2006–2014 in EDs across different pediatric volumes. Methods: We analyzed pediatric visits to EDs using the Health Care Utilization Project Nationwide Emergency Department Sample in a representative sample of 1,000 EDs annually from 2006–2014. We report trends in disease severity, mortality, and transfers based on strata by pediatric volume and other hospital characteristics. Results: From 2006–2014, there were 318,114,990 pediatric ED visits. Pediatric visits remained steady but declined as a percentage of total visits (−3.91%, $p = 0.0007$). The majority (92.7%) of children were cared for in lower-volume EDs (<50,000 pediatric visits/year), where mortality was higher vs. the highest-volume EDs. Mortality decreased over time (0.34/1,000 to 0.27, $p = 0.0099$), whereas interhospital transfers increased ($p = 0.0020$). ED visits increased for children with Medicaid insurance (40.7% to 56.7%, $p < 0.0001$), whereas rates of self-pay insurance decreased (13.6% to 9.45%, $p = 0.0006$). The most common reasons for pediatric ED visits were trauma (25.6%); ear, nose, and throat; dental/mouth disorders (21.8%); gastrointestinal diseases (17.0%); and respiratory diseases (15.6%). Conclusions: Overall, pediatric ED visits have remained stable, with lower mortality rates, whereas Medicaid-funded pediatric visits have increased over time. Most children still seek care in lower-volume EDs. Efforts to improve pediatric care could be best focused on lower-volume EDs and interhospital transfers.**

☐ **Keywords—pediatrics; epidemiology; trauma; emergency medicine**

INTRODUCTION

Parents expect high-quality emergency care for their sick child regardless of where they seek care; however, emergency departments (EDs) are not created equally, and pediatric emergency care in the United States has been characterized as "uneven" by a 2006 Institute of Medicine report (1). Although pediatric preparedness among EDs has improved since then, there remain gaps

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and disparities of care across the spectrum of EDs in the United States (2–5). A notable contributor to this could be that pediatric specialists are not available in all communities due to a limited workforce (6,7). In some studies, critically ill children presenting to hospitals with pediatric acute care specialists have superior outcomes compared with those transferred from outside hospitals without specialists (8–11). Although this has been attributed to provider training, it could also be related to volume of patients presenting to individual EDs.

Indeed, a notable characteristic of the "unevenness" of pediatric emergency care is high variability of annual pediatric patient volume among individual EDs, and there is growing evidence of the relationship between ED volume and patient outcomes (12). For example, some studies have reported on improved outcomes in higher ED volumes for both children and adults in certain instances—e.g., in resuscitation, cardiac arrest and dysrhythmias, sepsis, and chronic obstructive pulmonary disease (4,13–16). A 2014 study also revealed differences in mortality rates among various cases in the ED by pediatric patient volume—for example, sepsis, respiratory failure, and pneumonia (17).

These findings are important because the majority of pediatric patients are treated in lower-volume EDs (3,18). However, in these lower-volume EDs, the total numbers of critically ill pediatric patients have not been well described. Previous epidemiologic research on pediatric emergency care on this topic has focused on binary distinction between pediatric EDs or nonpediatric EDs (i.e., general EDs). For example, a recent epidemiologic study on pediatric emergency care looked at severity of pediatric patients in pediatric EDs vs. general EDs but did not look at volume and more granular differences in ED volume (19).

This study uses the Nationwide Emergency Department Sample database to describe differences in characteristics of pediatric emergency care across varying pediatric volume. Moreover, we looked at trends in mortality over time and patterns across pediatric volume, as we hypothesized that mortality rates would inversely vary by pediatric ED volume category and would decrease over time. The results of this study will help guide future pediatric emergency research and improvement efforts by increasing the understanding of U.S. pediatric emergency care from 2006–2014.

METHODS

Design

This is a retrospective cross-sectional analysis using data from the 2006 to 2014 Nationwide Emergency Department Sample (NEDS), a component of the Healthcare Cost and Utilization Project developed by the Agency for Healthcare Research and Quality (20,21). This study was exempt from Institutional Review Board approval.

Study Setting and Population

The NEDS is the largest all-payer ED database with the purpose of producing a nationally representative sample of U.S. hospital-based EDs and is available for the years 2006 through 2014. The NEDS dataset contains approximately 30 million ED visits each year across about 1,000 hospitals (a sample of about 20% of U.S. hospital EDs) that are weighted to provide national estimates for 135 million ED visits. The database is built using stratified sampling based on the following hospital characteristics: geographic region, trauma center designation, urban or rural location, teaching status, and hospital ownership or control. Notably, NEDS is an "event-level" database, meaning that each visit constitutes a unique record and is not aggregated by patient.

Outcome Measures

Demographic characteristics included for analysis include the following: 1) patient-level variables: age (all patients < 18 years), sex (binary), urban-rural classification of the patient's residence (large central metropolitan area, large fringe metropolitan area, medium and small metropolitan areas, metropolitan area, and micropolitan and rural areas), insurance status (Medicare, Medicaid, private insurance, self-pay, or other); and 2) hospital-level variables: ED volume and designation as a major trauma center, urban or rural status of the hospital, ownership of the hospital, and teaching status of the hospital. Dependent variables included primary diagnosis, trauma status, and disposition (death, admitted, transferred, or discharged).

Pediatric ED volume was defined as the following: 1) low: 1–1,799; 2) medium-low: 1,800–4,999; 3) medium: 5,000–9,999; 4) high: 10,000–19,999; 5) very high: 20,000–50,000; and 6) extremely high: > 50,000. The low- to high-volume cutoffs have standardly been used by National Pediatric Readiness-related projects, but we added the sixth category of "extremely high" volume for additional granularity and for the purposes of identifying children's hospitals, as such a variable is not collected by the NEDS (2–4).

We classified ED visit types using the International Classification of Diseases, ninth revision (ICD-9)-based Diagnosis Grouping System (DGS) and classified severity of all visits using the diagnosis-based Severity Classification System (SCS). This system was described in 2013 and developed by the Pediatric Emergency