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Emergency Department Visits by Children With Congenital Heart Disease

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ABSTRACT

BACKGROUND Data related to the epidemiology and resource utilization of congenital heart disease (CHD)-related emergency department (ED) visits in the pediatric population is limited.

OBJECTIVES The purpose of this analysis was to describe national estimates of pediatric CHD-related ED visits and evaluate medical complexity, admissions, resource utilization, and mortality.

METHODS This was an epidemiological analysis of ED visit-level data from the 2006 to 2014 Nationwide Emergency Department Sample. Patients age <18 years with CHD were identified using International Classification of Diseases-9th Revision-Clinical Modification codes. We evaluated time trends using weighted regression and tested the hypothesis that medical complexity, resource utilization, and mortality are higher in CHD patients.

RESULTS A total of 420,452 CHD-related ED visits (95% confidence interval [CI]: 416,897 to 422,443 visits) were identified, accounting for 0.17% of all pediatric ED visits. Those with CHD were more likely to be <1 year of age (43% vs. 13%), and to have ≥1 complex chronic condition (35% vs. 2%). CHD-related ED visits had higher rates of inpatient admission (46% vs. 4%; adjusted odds ratio: 1.89; 95% CI: 1.85 to 1.93), higher median ED charges ($1,266 [interquartile range (IQR): $701 to $2,093] vs. $741 [IQR: $401 to $1,332]), and a higher mortality rate (1% vs. 0.04%; adjusted odds ratio: 1.25; 95% CI: 1.07 to 1.45). Adjusted median charges for CHD-related ED visits increased from $1,219 (IQR: $673 to $2,138) to $1,630 (IQR: $901 to $2,799), while the mortality rate decreased from 1.13% (95% CI: 0.71% to 1.52%) to 0.75% (95% CI: 0.41% to 1.09%) over the 9 years studied.

CONCLUSIONS Children with CHD presenting to the ED represent a medically complex population at increased risk for morbidity, mortality, and resource utilization compared with those without CHD. Over 9 years, charges increased, but the mortality rate improved. (J Am Coll Cardiol 2018;72:1817–25) © 2018 by the American College of Cardiology Foundation.

Congenital heart disease (CHD) affects >1% of newborns, making it the most common form of major birth defect (1). While the incidence of CHD has remained stable over the past 50 years, interventional options and resultant outcomes for many forms of CHD have changed dramatically. With major advances in prenatal diagnosis, surgical techniques, and intraoperative and post-operative care, patients who once would have died in infancy are now surviving to childhood, adolescence, and adulthood, thus transforming once fatal lesions into new forms of chronic disease in childhood and beyond (2–5). Given the complexity and size of this population, children with CHD consume a disproportionately large share of available resources (6), with yearly expenditures in the United States approaching

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ABBREVIATIONS AND ACRONYMS

CCC = complex chronic condition

CHD = congenital heart disease

ED = emergency department

NEDS = Nationwide Emergency Department Sample

$6 billion, and notable recent increases in both institutional costs and charges to the patient (7,8).

Much of the current published data characterizing the costs and outcomes of care for CHD patients focuses on the inpatient setting (9). Among children with CHD, there have been efforts to both measure the value of care provided and identify pre-operative risk factors for increased resource utilization while hospitalized (10–12). However, the data regarding visits to the emergency department (ED) among pediatric patients with CHD are lacking, and there are none that offer a national population-based assessment.

The purpose of this study was to describe nationwide estimates of pediatric CHD-related ED visits over a 9-year period, detail their medical complexity and admissions, and test the hypothesis that, over the time period studied, ED visits in children with CHD resulted in increased resource utilization and decreased mortality.

TABLE 1 Demographic of the Study Population, NEDS 2006 to 2014

	All Visits (N = 241,540,848)	Visits Without CHD (n = 241,120,396)	Visits With CHD (n = 420,452)	p Value*
Age, yrs				<0.0001
<1	12.63	12.57	43.23	
1–4	31.91	31.90	30.33	
5–9	20.92	20.93	12.19	
10–14	18.77	18.79	8.44	
15–17	15.77	15.78	5.79	
Sex				<0.0001
Male	52.67	52.67	53.88	
Female	47.33	47.33	46.11	
Primary payer				<0.0001
Government	52.71	52.69	60.76	
Private	35.25	35.26	32.04	
Other	12.04	12.05	7.18	
Time of visit				<0.0001
Weekday	69.11	69.11	72.21	
Weekend	30.89	30.89	27.79	
Region of hospital				<0.0001
Northeast	18.18	19.19	12.22	
Midwest	23.39	23.28	24.91	
South	38.48	38.49	33.52	
West	19.95	19.94	29.34	
Teaching status of hospital				<0.0001
Metropolitan nonteaching	37.77	37.80	18.46	
Metropolitan teaching	43.87	43.82	74.25	
Nonmetropolitan	18.36	18.38	7.27	
Location of patient				<0.0001
Urban	80.73	80.72	86.78	
Rural	19.27	19.28	13.22	

Values are %. *Comparison between ED visits with CHD and ED visits without CHD.

CHD = congenital heart disease; ED = emergency department; NEDS = Nationwide Emergency Department Sample.

METHODS

DATA SOURCE. We used the discharge data from the Nationwide Emergency Department Sample (NEDS), the largest publicly available all-payer ED database that contains a 20% stratified sample of ED visits from across the United States, provided by the Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality (13,14). NEDS data are provided by the HCUP State Inpatient Databases and the State Emergency Department Databases that capture the discharge information on ED visits that do versus do not result in an admission to the same hospital, or transfer to another hospital, respectively. Of note, NEDS does not capture urgent care visits. NEDS provides appropriate weights to obtain weighted national estimates (15).

SEE PAGE 1826

STUDY POPULATION. For this study, we used NEDS data from 2006 to 2014 and limited analyses to visits of patients younger than 18 years of age. The unit of analysis is the ED visit, not a patient. A patient may therefore be represented by multiple ED visits in any given year or multiple years. For each visit in NEDS, up to 15 International Classification of Diseases-9th Revision-Clinical Modification (ICD-9-CM) diagnostic codes before 2014, up to 30 ICD-9-CM diagnostic codes in 2014, and 9 ICD-9-CM procedure codes across all years are provided. We identified CHD-related ED visits using ICD-9 CM-and acute CHD-associated comorbidities, which included heart failure, cyanosis, arrhythmia, pulmonary hypertension, acute respiratory disease, acute gastrointestinal disease, acute neurological disease, sepsis, and acute kidney injury. We classified CHD into 3 groups hierarchically: single-ventricle complex CHD, non-single-ventricle complex CHD, and simple CHD, using ICD-9-CM (Online Appendix).

OUTCOMES OF INTEREST. We examined the following outcomes of interest: 1) admitted or transferred for inpatient hospitalization; 2) mortality (died in ED or during admission associated with ED visit); and 3) total inflation-adjusted ED visit charges.

COVARIATES. We examined patient and hospital characteristics as covariates. These included age in years (<1, 1 to 4, 5 to 9, 10 to 14, and 15 to 17 years), sex, insurance status (government, private, and