



Racial and Ethnic Differences in Pediatric Readmissions for Common Chronic Conditions

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Objective To compare the timing and magnitude of variation of pediatric readmission rates across race/ethnicity for selected chronic conditions: asthma, diabetes, seizures, migraines, and depression.

Study design Retrospective analysis of hospitalizations at 48 children's hospitals in the 2013 Pediatric Health Information System database for children (ages 0-18 years) admitted for asthma (n = 36 910), seizure (n = 35 361), diabetes (n = 12 468), migraine (n = 5882), and depression (n = 5132). Generalized linear models with a random effect for hospital were used to compare the likelihood of readmission by patients' race/ethnicity, adjusting for severity of illness, age, payer, and medical complexity. Adjusted readmission rates were calculated by week over 1 year.

Results Significant variation in adjusted readmission rates by race/ethnicity existed for conditions aside from depression. Disparities for diabetes and asthma emerged at 3 and 4 weeks, respectively; they remained divergent up to 1 year with the highest 1-year readmission rates in non-Hispanic blacks vs other race/ethnicities (diabetes: 21.7% vs 13.4%, $P < .001$; asthma: 21.4% vs 14.6%, $P < .001$). Disparities for migraines and seizure emerged at 6 and 7 weeks, respectively; they remained up to 1 year, with the highest 1-year readmission rates in non-Hispanic whites vs other race/ethnicities (migraine: 17.3% vs 13.6%, $P < .001$; seizure: 23.9% vs 21.9%, $P < .001$).

Conclusions Readmission disparities behave differently across chronic conditions. They emerge more quickly after discharge for children hospitalized with asthma or diabetes than for seizures or migraines. The highest readmission rates were not consistently observed for 1 particular race/ethnicity. Study findings can impact pediatric chronic disease management to improve care for children with these conditions. (*J Pediatr* 2017;186:158-64).

Preventing hospital readmissions continues to be a key aim of health system initiatives striving to optimize the quality of transitions of care for hospitalized patients. Unfortunately, the effectiveness of discharge and follow-up care is not equitable across all hospitalized children. For all types of admissions, children with non-Hispanic black race/ethnicity have higher readmission rates when compared with children of other race/ethnicities.¹ This finding is upheld when controlling for differences in age, insurance, chronic conditions, and other attributes that could confound the relationship between race/ethnicity and the likelihood of readmission. Some view this disparity as an opportunity to reduce unnecessary readmissions by achieving equality in hospital discharge and including follow-up care across children's race/ethnicities.

To help achieve this equality, more granular information about hospital readmissions in children across race/ethnicities is needed. Patterns and details that delineate when disparities emerge and which race/ethnicities carry the highest and lowest readmission risk, would be helpful to understand and devise solutions. Coupling this information with specific groups of children (eg, those with particular types of chronic conditions) might help clinicians better determine how to resolve readmission disparities. Therefore, we conducted a multicentered study to assess the timing and magnitude of racial/ethnic disparities in hospital readmissions for children with common chronic conditions.

Methods

This is a retrospective analysis of index hospitalizations (inpatient and observation) for children age 0-18 years from January 1 to December 31, 2013, from

APR-DRG	All-Patient-Refined Diagnosis-Related-Groups
CCC	Complex chronic conditions
LOS	Length of stay
PHIS	Pediatric Health Information System

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Supported by the Agency for Healthcare Research and Quality (K08HS024554 [to K.P.]). The authors declare no conflicts of interest.

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<http://dx.doi.org/10.1016/j.jpeds.2017.03.046>

48 hospitals from the Pediatric Health Information System (PHIS). PHIS includes clinical and billing data from tertiary care children's hospitals and accounts for approximately 20% of all US pediatric hospitalizations. Deidentified data are submitted by participating hospitals. An encrypted medical record number permits identification of readmissions to the same hospital.² Data quality is ensured through a joint effort between the Children's Hospital Association (Overland Park, Kansas) and participating hospitals as previously described.³ In accordance with the policies of the Cincinnati Children's Hospital Medical Center Institutional Review Board, this research, using a deidentified data set, was not considered human subjects research.

We used All-Patient-Refined Diagnosis-Related-Groups (APR-DRG; 3M Corporation, Salt Lake City, Utah) to identify index admissions for 5 chronic pediatric conditions: asthma (APR-DRG 141), seizure (APR-DRG 53), diabetes (APR-DRG 420), migraine (APR-DRG 54), and depression (APR-DRG 751). These 5 chronic conditions were selected for analysis based on their high admission prevalence as well as their contrasting pathophysiology.

Main Independent Variable

The main independent variable was patients' race/ethnicity, either by self-report by the children's parent or guardian at admission or determined by hospital registration team based on state-based legislation. Four groups of race/ethnicity were assessed: non-Hispanic white, non-Hispanic black, Hispanic, and other. Other included Pacific Islander, Asian, and Native American. The race/ethnicities in the other category were grouped together because individually they had a very low prevalence.

Main Outcome Measure

Readmissions to the same PHIS hospital for the same reason as the index admission (eg, readmissions for seizure were the only type of readmission measured following index admissions for seizure) were calculated by week over the year following an index admission in 2013. Readmission window was calculated from the day of discharge of the index admission. Readmissions themselves were also assessed as index admissions.

Confounding Variables

We also assessed patients' demographic characteristics, including age at admission and payer (public, private, other), and their clinical characteristics, including severity of illness and number of chronic conditions. Severity of illness was measured using 3M Health APR-DRG severity of illness scale (range: 0 [least severe] to 4 [most severe]). The number of complex chronic conditions (CCCs) was measured using a previously reported classification scheme.⁴ Both APR-DRG and CCC relied on the *International Classification of Diseases, Ninth Revision, Clinical Modification* codes to elicit the clinical information needed for analysis.

Statistical Analyses

We assessed the likelihood of readmission with a generalized linear mixed effects model for each of the 5 index admis-

sions. In this analysis, we modeled the readmission risk so it is not impacted by the number of children in a particular racial/ethnic group on their index visit. Each model included a random effect for hospital and fixed effects for APR-DRG severity, payer, age, and medical complexity using the number of CCCs.⁴ Within each APR-DRG cohort, we made 52 statistical tests of the racial disparity in readmission rates corresponding to the 52 weeks during a year. Consequently, we adjusted the *P* values for each test by controlling the false-discovery rate (ie, the expected proportion of rejected null hypotheses that were inappropriate) with the Benjamini-Hochberg method.⁵ All statistical analyses were performed with SAS v 9.4 (SAS Institute, Cary, North Carolina), and *P* < .05 was considered statistically significant.

Results

The numbers of index admissions were 3906 for asthma; 35 687 for seizure; 12 487 for diabetes; 5882 for migraine; and 5132 for depression. Non-Hispanic white race was the most common race/ethnicity for each admission type (range: 56.4% [migraine] to 67.9% [depression]) except for asthma; non-Hispanic black was the most common race/ethnicity for asthma admissions (43.2%). Public insurance was the most common payer for all admissions (range: 42.6% [migraine] to 68.2% [asthma]). Across all admissions, most children did not have a CCC (range: 54.7% [seizure] to 91.7% [depression]). Overall readmission rates varied by diagnosis, with lowest readmission rates in asthma (range across race/ethnicity, 1.5%-2.2%) at 30 days compared with the highest readmission rates in migraines (range across race/ethnicity, 4.7%-6.9%) at 30 days. At 1-year after index admission, readmission rates varied by diagnosis as well, with the lowest readmission rates in depression (range across race/ethnicity, 9.5%-11.3%) and the highest readmission rates in seizure (range across race/ethnicity, 19.6%-23.9%).

Index Admissions and Readmissions for Asthma

The median length of stay (LOS) for index admissions for asthma was 1 day (IQR 1-2) (**Table I**). Median age of index admissions for asthma was 5 years (IQR 2-8); 62.6% were for male subjects and 68.2% used public insurance. Non-Hispanic blacks made up the largest racial/ethnic group (43.2%), followed by Non-Hispanic white (28.2%). Most asthma index admissions (64%) were classified as minor severity of illness, and 6.8% were children with a CCC. Significant (*P* < .05) variation in readmission rates by race/ethnicity following index admission for asthma emerged at 4 weeks and remained significant every week through 1 year (**Figure 1**). The range of readmission rates across racial/ethnic groups following index admissions for asthma ranged 1.5-2.2% at 1 month to 14.1%-21.7% at 1 year (**Table II**; available at www.jpeds.com). Non-Hispanic blacks had the highest rates at all time points. Readmission rates for the other race/ethnicities were similar; most of the time, non-Hispanic white or Hispanic had the lowest readmission rates (**Table II**). The odds of readmission of non-Hispanic blacks were 1.3 higher than Non-Hispanic

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