Racial and Ethnic Disparities and Bias in the Evaluation and Reporting of Abusive Head Trauma

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Objective To characterize racial and ethnic disparities in the evaluation and reporting of suspected abusive head trauma (AHT) across the 18 participating sites of the Pediatric Brain Injury Research Network (PediBIRN). We hypothesized that such disparities would be confirmed at multiple sites and occur more frequently in patients with a lower risk for AHT.

Study design Aggregate and site-specific analysis of the cross-sectional PediBIRN dataset, comparing AHT evaluation and reporting frequencies in subpopulations of white/non-Hispanic and minority race/ethnicity patients with lower vs higher risk for AHT.

Results In the PediBIRN study sample of 500 young, acutely head-injured patients hospitalized for intensive care, minority race/ethnicity patients (n = 229) were more frequently evaluated ($P < .001$; aOR, 2.2) and reported ($P = .001$; aOR, 1.9) for suspected AHT than white/non-Hispanic patients (n = 271). These disparities occurred almost exclusively in lower risk patients, including those ultimately categorized as non-AHT ($P = .001$ [aOR, 2.4] and $P = .003$ [aOR, 2.1]) or with an estimated AHT probability of ≤25% ($P < .001$ [aOR, 4.1] and $P < .001$ [aOR, 2.8]). Similar site-specific analyses revealed that these results reflected more extreme disparities at only 2 of 18 sites, and were not explained by local confounders.

Conclusion Significant race/ethnicity-based disparities in AHT evaluation and reporting were observed at only 2 of 18 sites and occurred almost exclusively in lower risk patients. In the absence of local confounders, these disparities likely represent the impact of local physicians' implicit bias. *(J Pediatr 2018;■■:■■-■■).*

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Since the publication of *To Err Is Human*,[1] multiple studies have demonstrated disparities in the evaluation, diagnosis, and treatment of a wide variety of medical conditions attributable to differences in patient race or ethnicity.[2-9] Several studies have shown that there are race/ethnicity-based inconsistencies in the evaluation and diagnosis of child physical abuse.[10-13] In a retrospective, single institutional study of 173 victims of pediatric abusive head trauma (AHT), Jenny et al found that young victims of AHT with less severe, nonspecific, clinical presentations (eg, vomiting, irritability) were more likely to be misdiagnosed on initial presentation if the child was from a white family.[10] Lane et al found that, in older children deemed to be at lower risk for physical abuse, skeletal surveys and reports to child protective services were more likely to occur in patients of minority race/ethnicity, even if the fracture was consistent with an accidental mechanism.[11,12] In a retrospective study of infants hospitalized with traumatic brain injury, Wood et al concluded that racial disparities in AHT evaluation and reporting existed across a wide network of 39 pediatric hospitals.[13]

Racial and ethnic biases are often implicit biases, meaning they are unknown and largely invisible to those who hold them. Implicit biases are, therefore, particularly challenging to overcome because they operate "behind the scenes." Clinicians must decide what conditions should be considered in their differential

AHT	Abusive head trauma
PediBIRN	Pediatric Brain Injury Research Network
PICU	Pediatric intensive care unit

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diagnosis based partially on a patient's risk profile. However, unconscious stereotypes can influence medical decision making by causing clinicians to make erroneous assumptions about a patient's risk profile.

In the evaluation of possible child physical abuse, important historical information may be lacking owing to a caregiver being deliberately misleading, a caregiver not knowing the actual circumstances leading to the presentation for care, and/or the patient being nonverbal. In the absence of full or accurate historical data, clinicians may inadvertently allow their implicit biases to enter into their assessments of risk and decision making. This factor has the potential to lead to both overdiagnosis and underdiagnosis of physical abuse and other medical conditions.

From 2010 to 2013, the Pediatric Brain Injury Research Network (PediBIRN) investigators conducted sequential, multicenter, strictly observational, cross-sectional studies to derive and validate a clinical prediction rule that facilitates patient-specific estimation of AHT probability based on different combinations of its 4 predictor variables.[14,15] This effort required the capture of extensive, prospective, demographic, clinical, historical, and radiologic data regarding 500 acutely head-injured children <3 years of age hospitalized for intensive care across 18 participating sites.

In this article, we present the results of a novel, secondary analysis of the PediBIRN dataset designed to characterize racial/ethnic disparities in the evaluation and reporting of suspected AHT. We hypothesized that such disparities would be verified at multiple individual sites and occur more frequently in patients with lower, patient-specific estimates of AHT probability.

Methods

This retrospectively designed, secondary analysis used de-identified data captured prospectively by PediBIRN investigators with detailed methods described previously.[14,15] All 18 participating sites obtained approval for the 2 parent studies with a waiver of informed consent from their local institutional review board. This secondary analysis was determined to be exempt from review by the Institutional Review Board at Penn State Health Hershey Medical Center.

In both parent studies[14,15] and at every participating site, (1) eligible patients were children <3 years of age hospitalized acutely in a pediatric intensive care unit (PICU) for the treatment of symptomatic, acute, closed (nonpenetrating), traumatic, cranial, or intracranial injuries confirmed by computed tomography or magnetic resonance imaging; (2) patients were excluded if initial neuroimaging revealed clear evidence of pre-existing brain malformation, disease, infection, or hypoxia-ischemia; or if head injuries resulted from collisions involving motor vehicles; (3) PICU providers and child abuse consultants involved directly in the patient's care worked with research coordinators to capture and verify the accuracy of all required data (including race and ethnicity); and (4) strict methods were deployed to avoid convenience sampling; to ensure complete, uniform, prospective data capture; and to eliminate missing data.

The 18 participating sites were PICUs located in US or Canadian urban centers. Fourteen of the 18 PICUs participated in both parent studies. Eligible patient volumes varied considerably across sites, from an average of <1-4 patients per month. Applying the a priori definitional criteria for AHT used in both parent studies (**Table I**; available at www.jpeds.com), the prevalence of AHT at individual sites varied from 23% to 75% of eligible patients.

For this secondary analysis, (1) a patient was considered "evaluated for abuse" if he or she underwent radiologic skeletal survey and/or retinal examination by an ophthalmologist; (2) a patient was considered "reported for abuse" if any professional from his or her medical treatment facility made (or verified) a report of suspected child maltreatment to a child protection or investigative agency; (3) all patients with race/ethnicity other than white/non-Hispanic were designated "minority race/ethnicity"; (4) AHT-related practice "disparity" was defined as a difference in the proportion of patients evaluated or reported for suspected AHT that was statistically significant ($P < .05$) by χ^2 analysis (or Fisher exact test for small samples); and (5) the PediBIRN 4-variable clinical prediction rule was used to calculate a patient-specific estimate of AHT probability for every patient.[16]

Analyses of the entire dataset included (1) χ^2 analysis and calculation of aORs to identify disparities in AHT evaluation and reporting in comparison groups of white/non-Hispanic and minority race/ethnicity patients from all 18 sites; and (2) χ^2 analysis (or Fisher exact test) to identify and characterize AHT-related evaluation and reporting disparities in subpopulations of white/non-Hispanic and minority race/ethnicity patients with a lower vs a higher risk for AHT. For these analyses of subsamples, patients were categorized as lower risk for AHT in 2 different ways: (1) if they were ultimately categorized as non-AHT in a parent study (**Table I**); and (2) if their patient-specific, estimated probability of AHT was ≤25%.

aORs were calculated for every practice comparison that revealed disparity. ORs were adjusted for differences in patient age (<6 months vs >6 months), sex, and head injury mechanism (isolated contact injuries vs any inertial injuries).

Analyses of site-specific data included (1) χ^2 analysis (or Fisher exact test) and calculation of aORs to identify disparities in AHT evaluation and reporting in comparison groups of white/non-Hispanic vs minority race/ethnicity patients at each individual site; and (2) similar analyses to identify and characterize AHT evaluation and reporting disparities in subpopulations of white/non-Hispanic and minority race/ethnicity patients with a lower vs a higher risk for AHT (a) from all sites with confirmed AHT-related practice disparities, and (b) from all remaining sites. Again, aORs were calculated for every comparison that revealed a P value of <.05.

To identify local confounders that might explain AHT-related practice disparities confirmed at specific sites, we applied χ^2 analysis (or Fisher exact test) with Bonferroni correction to identify any significant ($P < .05$) differences in the frequencies of various demographic, historical, clinical, laboratory, and

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