Racial disparities in hydrocephalus treatment

- Racial disparities in hydrocephalus mortality and shunt revision: a study from the Hydrocephalus Clinical Research Network
- Role of psychiatric, cardiovascular, socioeconomic, and demographic risk factors on idiopathic normal pressure hydrocephalus: A retrospective case-control study
- Cross-Sectional Analysis on Racial and Economic Disparities Affecting Mortality in Preterm Infants with Posthemorrhagic Hydrocephalus
- Racial and socioeconomic disparities in outcomes following pediatric cerebrospinal fluid shunt procedures
- The effects of socioeconomic status and race on pediatric neurosurgical shunting
- Racial, ethnic, and socioeconomic disparities in patient outcomes after craniotomy for tumor in adult patients in the United States, 1988-2004

Several studies of administrative data have noted higher mortality rates for Black/African American children with shunted hydrocephalus. A longitudinal study of children with hydrocephalus secondary to myelomeningocele showed lower lifetime rates of shunt revision in minority children compared to White children, indicating a possible disparity in hydrocephalus treatment. The goal of this study is to identify racial and ethnic disparities in mortality or shunt revision rates by using the Hydrocephalus Clinical Research Network (HCRN) hydrocephalus registry sample.

The HCRN registry was queried for patients with shunted hydrocephalus for whom data on all lifetime hydrocephalus procedures were available. Patients with a primary shunt placement before 2023 were included, with follow-up extending through March 19, 2024. A Cox proportional hazards model was created to determine the effect of race and ethnicity on mortality while controlling for age at initial shunt placement, sex, hydrocephalus etiology, gestational age at birth, and the presence of complex chronic conditions. Similarly, a proportional means model was used to evaluate the association with the lifetime number of shunt revision surgeries. The author hypothesized that when controlling for other variables, minority children would have higher mortality and fewer shunt revision surgeries than White children.

A total of 5656 children were included in the analysis of mortality. There were 579 deaths. Race and ethnicity were independently associated with mortality, with Black (HR 1.32, 95% CI 1.05-1.65), other non-White (HR 1.39, 95% CI 1.03-1.86), and Hispanic (HR 1.50, 95% CI 1.22-1.84) children having a higher mortality rate than White children. In the analysis of 4081 children with shunts, Hispanic ethnicity was also independently associated with fewer total shunt revisions (HR 0.84, 95% CI 0.72-0.98).

In children with hydrocephalus, when controlling for other factors, there is a higher mortality rate among Hispanic, Black, and other non-White children, and fewer shunt revisions among Hispanic children. These findings highlight important potential disparities in hydrocephalus treatment [1].

Patient race (i.e., White; Native Hawaiian, or other Pacific Islander) was found to be associated with iNPH development. Meanwhile, after excluding those with cerebrovascular disease, cardiovascular risk factors were not found associated with iNPH. Lastly, iNPH cases were more inclined to have a history of alcohol use disorder and prior psychiatric disorder. Overall, this data reveals that a racial disparity

exists amongst iNPH, as well as highlights the role of various cardiovascular and psychiatric risk factors, which can potentially provide direction in etiology elucidation [2].

Among preterm infants with intraventricular hemorrhage and resultant PHH, black infants and those insured by Medicaid have significantly increased mortality but these 2 effects are independent. Further studies are needed to fully understand the factors affecting these racial and socioeconomic disparities [3].

Findings in a study, that utilized US population-level data, suggest the presence of racial and socioeconomic status outcome disparities following pediatric CSF shunting procedures [4].

A retrospective chart review was performed on all pediatric patients who underwent ventriculoperitoneal shunting from 1990-2010 at the Department of Neurological Surgery, University of Rochester Medical Center, 601 Elmwood Ave., Box 670, Rochester, NY, 14642, USA. Race and insurance type were recorded and assessed against specific outcome measures to statistically compare complication rates.

A complete record was found for 373 patients who received 849 shunting procedures at the institution. No differences were found between racial groups and insurance type for overall shunt survival, total revision number, or average time to failure. However, nonwhite patients spent an average of 3 days longer in the hospital at initial shunting ($p = 0.04$), and those with public insurance stayed for 5 days longer ($p = 0.002$). Patients with public insurance were more likely to present with shunt failure from outside hospitals ($p = 0.005$) and be born prematurely ($p < 0.001$). Private patients were more likely to have a neoplasm present at the time of initial shunt placement ($p = 0.003$).

While the overall revision rate was not affected by race or insurance status, there were significant delays in discharge for patients with public insurance. Moreover, potential disparities in outpatient access to primary physicians and specialists may be affecting care [5]

The literature examining racial and ethnic disparities in pediatric hydrocephalus reveals consistent evidence that minority populations, particularly Black, Hispanic, and other non-White children, experience worse outcomes compared to their White counterparts. The primary study by Rocque et al. (2025) using the Hydrocephalus Clinical Research Network (HCRN) registry strengthens the case for systemic inequities in healthcare delivery and outcomes.

1. Strengths of the Primary Study (Rocque et al., 2025)

Large, prospective dataset: With 5,656 children included in the mortality analysis and 4,081 in the shunt revision cohort, the study offers robust statistical power. Rigorous methodology: The use of Cox proportional hazards models and control for confounding variables (e.g., age at initial shunt, gestational age, chronic conditions) increases the reliability of the observed associations. Novel

findings: The association of higher mortality in minority children and fewer revisions in Hispanic children, despite controlling for clinical variables, points to care process disparities rather than purely biological explanations.

2. Limitations and Interpretative Cautions

Causality remains unclear: The study is observational. While associations are strong, they do not establish causality. The lower revision rate among Hispanic children could either reflect undertreatment, barriers to access, or better surgical outcomes — though the higher mortality suggests the former. Socioeconomic data not directly integrated: While race and ethnicity are analyzed, insurance status, income level, and neighborhood-level SES indicators are not included. This limits insight into the complex interplay between race and class. Data source limitations: The HCRN centers may not be fully representative of all geographic or institutional contexts, potentially introducing bias. Synthesis with Supporting Literature The findings of Rocque et al. are echoed across several studies:

Jin et al. (2016) and Attenello et al. (2015) highlight that racial and economic disparities are independent predictors of increased mortality in hydrocephalus and related pathologies (e.g., PHH). Medicaid coverage — a proxy for low SES — independently correlates with worse outcomes, reinforcing the notion that both race and poverty are crucial risk factors.

Walker et al. (2014) found no differences in shunt survival or revision numbers, but nonwhite and publicly insured children had longer hospital stays and were more likely to present with complications from outside facilities, suggesting disparities in pre- and post-hospital care access, rather than in acute management.

Ghaffari-Rafi et al. (2020), while focused on iNPH, support that race (and potentially psychiatric comorbidities) may play a role in disease development and care patterns. Though not directly comparable to pediatric hydrocephalus, these data emphasize broader racialization of neurological care.

Key Themes and Implications

A. Structural and Institutional Bias These disparities may arise from implicit bias, differential access to care, differences in follow-up protocols, or parental engagement shaped by historical mistrust in healthcare institutions. Fewer shunt revisions in Hispanic children, despite higher mortality, may suggest under-recognition or under-treatment of shunt failures.

B. Socioeconomic Determinants

Insurance status, hospital of origin, and perinatal history (e.g., prematurity) are proxies for healthcare fragmentation and unequal resources. The intersection of race and poverty likely amplifies risks.

C. Need for Systems-Level Interventions

Enhance equity in post-operative follow-up and early complication detection. Implement community-based interventions and education programs to support families from underserved populations. Broaden inclusion of socioeconomic variables in large-scale registries like HCRN to better understand root causes.

Conclusions

The consistent signal across studies — that racial and socioeconomic disparities affect outcomes in pediatric hydrocephalus — underscores an urgent need for targeted policy, educational, and clinical interventions. The findings from the HCRN dataset should galvanize the neurosurgical community to address not only technical outcomes but also systemic inequities in pediatric neurosurgical care.

1)
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