Pediatric Cochlear Implantation: Variation in Income, Race, Payer, and Charges Across Five States

Zhen Huang, MD, MBA, Heather Gordish-Dressman, PhD, Diego Preciado, MD, and Brian K. Reilly, MD

Corresponding Author:
Zhen Huang, MD, MBA
Assistant Professor
Department of Otorhinolaryngology
University of Texas—Health Science Center at Houston
6431 Fannin St, MSB 5.036
Houston, TX 77030
Email: zhen.j.huang@uth.tmc.edu
Phone: 469-964-8039

Heather Gordish-Dressman, PhD
Assistant Professor of Integrative Systems Biology and Pediatrics
George Washington University School of Medicine and Health Sciences
Children’s National Health System
Washington, DC 20010

Diego Preciado, MD, PhD
Associate Professor of Pediatric Otolaryngology
George Washington University School of Medicine and Health Sciences
Children’s National Health System
Washington, DC 20010

Brian K. Reilly, MD
Assistant Professor of Pediatric Otolaryngology
George Washington University School of Medicine and Health Sciences
Children’s National Health System
Washington, DC 20010

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Background:

Children with bilateral severe to profound sensorineural hearing loss (SNHL) benefit from pediatric cochlear implantation (PCI). Among other benefits, children with SNHL who receive PCI are more likely to develop normal speech and academic successes comparable to their normal-hearing peers [1,2].

Early diagnosis and PCI treatment, especially by 12 months of age, are critical to PCI success and speech and language outcomes. Children with delayed diagnosis or treatment are more likely to experience language and speech delays that may result in educational and psychosocial challenges later in life [3]. Despite the importance of early implantation, only 55% of eligible children in the United States between the ages of 1 and 6 years of life actually receive cochlear implantation [4]. This rate of PCI is better in other developed countries, such as the United Kingdom (U.K.) (73%) and Australia (80%) [5]. Factors associated with disparities in treatment include insurance type, socioeconomic status, presence of an additional co-morbidity, and race. These disparities in treatment persist even in the presence of adequate Medicaid coverage that secures equal access to PCI regardless of socioeconomic status [6].

Stern et al. found that the rate of PCI in White and Asian American children was three times that of Hispanic children and ten times that of African-American children. Additionally, more PCI children lived in postal areas with above-average median incomes than did their comparison group of children fitted only with hearing aids [7].

In addition to socioeconomic disparities, geographic differences in care lag behind, despite rising healthcare costs, and these higher costs do not necessarily result in better outcomes. For example, despite national guidelines, common procedures such as tonsillectomy suffer from geographic variations. Boss et al. examined 583,000 outpatient tonsillectomies nationwide in 2006 and found that compared to the South, tonsillectomy rates were significantly lower in the West [8]. Hence, healthcare disparities exist across various dimensions, and although national guidelines exist such as the universal newborn hearing screen, pediatric cochlear implantation is not immune to geographic differences.

Objectives:

The objectives of the study are: 1) investigate pediatric cochlear implantation across representative states within the United States; and 2) analyze any regional differences in age, median household income, race, insurance, and total hospital charges.

Methods:

Data from children (0.5 to 18 years) who received cochlear implantation surgery were collected from the 2011 State Ambulatory Surgery and Services Databases from California (CA), Florida (FL), Maryland (MD), New York (NY), and Kentucky (KY) as a part of the Healthcare Cost and
Utilization Project. We performed data analysis using a combination of Kruskal-Wallis and Wilcoxon rank-sum tests, as well as nominal logistic regression.

Results:

512 cases of pediatric cochlear implantation were performed during 2011 (January 1-December 31) across the five states. The overall mean and median age of implantation were 5.6 years and 4 years, respectively. There was no statistical difference in age of implantation across states (p=0.85). However, there were statistical differences in primary payer (p<0.001), median household income quartiles of patients who received an implant (p<0.006), race (p<0.001), and total charges, for 4 of the states, with the exception of CA who did not have available charge data (p<0.001).

Summary table of multivariate comparison of all outcomes (excluding total charges)

<table>
<thead>
<tr>
<th>State</th>
<th>Age*</th>
<th>Income quartile</th>
<th>Race</th>
<th>Primary payer</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>FL</td>
<td>1.03 (0.43)</td>
<td>1.60 (&lt;0.001)</td>
<td>0.87 (0.15)</td>
<td>0.58 (&lt;0.001)</td>
</tr>
<tr>
<td>KY</td>
<td>1.01 (0.92)</td>
<td>1.24 (0.32)</td>
<td>0.47 (0.005)</td>
<td>0.22 (&lt;0.001)</td>
</tr>
<tr>
<td>MD</td>
<td>1.05 (0.15)</td>
<td>1.68 (&lt;0.001)</td>
<td>0.90 (0.31)</td>
<td>0.64 (0.002)</td>
</tr>
<tr>
<td>NY</td>
<td>1.04 (0.17)</td>
<td>0.120 (0.17)</td>
<td>1.23 (0.014)</td>
<td>0.52 (&lt;0.001)</td>
</tr>
<tr>
<td>Overall effect of outcome (p-value)</td>
<td>0.55</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Data presented are relative risk ratios and p-values.

Graph of total median hospital charges for PCI by state

![Graph of total median hospital charges for PCI by state](image)
**Conclusion:**

Age of pediatric cochlear implantation appears to be similar across five states in cross-sectional analysis. However, the median age of four years for PCI is still far from the FDA-approved age of 12 months for implantation. This may be evidence that our newborn hearing screening programs need better ways of capturing patients for follow up and initiating early intervention and evaluation.

Geographic variations in charges, payer, race, and median household income do occur with statistical significance in pediatric cochlear implantation. Further analysis of contributing factors at each state level may help elucidate the root cause of these disparities and improve and justify a more uniform approach to healthcare delivery and standards of care.

**Key Words:**
Geographic variation, disparity, cochlear implantation, pediatric
References: