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# Patterns of Surgical Care and Health Disparities of Treating Pediatric Finger Amputation Injuries in the United States

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- BACKGROUND:** Digital amputation in children is a very strong indication for replantation, but little is known about the epidemiology and distribution of care for pediatric finger amputation injuries in the United States. The specific aims of this study were to examine trends in the surgical management of pediatric finger amputation injuries in the United States from 2000 to 2006, and to identify potential treatment disparities among various demographic groups.
- STUDY DESIGN:** Data from the 2000, 2003, and 2006 Healthcare Cost and Utilization Project Kids' Inpatient Database were used to identify discharge records containing at least one ICD-9-CM procedure code corresponding to digit amputation or replantation. National estimates were generated using weighted frequency calculations, and a weighted logistic regression model was used to examine the influence of various demographic factors on treatment.
- RESULTS:** There were 1,321 weighted discharge records that satisfied our inclusion criteria. From 2000 to 2006, the rate of attempted digit replantation for pediatric finger amputation injuries has remained stable at approximately 40%. The majority of injuries were treated at nonchildren's (86%) and teaching (76%) hospitals; 52% of digit replantations were performed at hospitals with a volume of 1 to 2 digit replantations per year. We found that blacks (odds ratio [OR] 0.47), Hispanics (OR 0.37), and children without insurance (OR 0.38) were less likely to receive attempted replantation (all  $p < 0.05$ ), even after controlling for potential confounding factors.
- CONCLUSIONS:** The proportion of pediatric digit amputation injuries managed by replantation remained stable between 2000 and 2006. Whites and children with private health insurance were more likely to receive replantation than blacks, Hispanics, and children without health insurance, even after controlling for confounding factors. (J Am Coll Surg 2011;213:475–485. © 2011 by the American College of Surgeons)
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Mutilating finger injuries with associated disfigurement and disability are a devastating problem, causing functional, psychosocial, and financial consequences.<sup>1–3</sup> For children, in particular, these injuries can have a profound impact on the

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development of subjective body image and independence.<sup>3,4</sup> Compared with adult patients, whose surgical decision making process is often complicated by the need to consider medical comorbidities and social circumstances, the indications for digit replantation in children are generally more liberal and aggressive in order to provide better restoration of function as well as optimal psychosocial and developmental outcomes.<sup>5,6</sup> Over the past 4 decades, microsurgical advancements have permitted pediatric digit replantation and other reconstructive hand procedures to become widely practiced throughout the world.<sup>7</sup> However, despite the routine application of reconstructive digit surgery among children and adolescents for many years, little is known about the epidemiology and pattern of surgical care for pediatric finger amputation injuries in the United States.

Currently, the shortage of on-call emergency hand surgeons and declining reimbursements for reconstructive

**Abbreviations and Acronyms**

HCUP	=	Healthcare Cost and Utilization Project
ISS	=	Injury Severity Score
KID	=	Kids' Inpatient Database
MDC	=	major diagnostic category
NIS	=	Nationwide Inpatient Sample
OR	=	odds ratio

procedures have made access to emergency hand or digit replantation a major concern.<sup>8-11</sup> A 2006 survey of the American College of Emergency Physicians (ACEP) found that hand surgery was one of the top 5 specialties associated with a shortage of on-call emergency coverage.<sup>8</sup> More specifically, other studies have observed a decline in attempted digit replantation over the past decade and a shift in the distribution of complex reconstructive hand procedures toward select regional and teaching facilities.<sup>9-12</sup> In addition to the potential shortage and maldistribution of competent providers, concerns regarding access to reconstructive hand surgery are further compounded by recent health disparity literature demonstrating disproportionate access to emergency room specialty services and worse trauma outcomes among uninsured children and children in minority groups.<sup>13,14</sup> Taken together, these findings raise considerable alarm regarding access to pediatric digit replantation and potential inequities regarding the pattern of care.

Although several published studies have evaluated traumatic digit amputations in the adult population and noted a decline in upper extremity replantation surgery, the impact of this trend on children remains unknown.<sup>9-12</sup> Given the unique indications for digit replantation in children and availability of supplemental health insurance plans, such as the State Children's Health Insurance Plan (SCHIP), it is critical to independently evaluate pediatric reconstructive surgery use and potential disparities in care separately from adults. The purpose of this study was to examine temporal trends in the surgical management (replantation vs amputation) of pediatric finger amputation injuries in the United States from 2000 to 2006, and to identify potential treatment disparities among various demographic groups.

**METHODS****Data source**

We performed a retrospective cohort study using national discharge data from the 2000, 2003, and 2006 Healthcare Cost and Utilization Project (HCUP) Kids' Inpatient Database (KID), sponsored by the Agency for Healthcare Research and Quality (AHRQ, Rockville, MD).<sup>15</sup> The HCUP is a family of administrative health care databases

produced through a federal-state-industry partnership to collect national health care data for use in research and policy planning. The KID comprises data from more than 5,000 community hospitals in 38 states to provide the only available national sample of all-payer pediatric inpatient discharges.<sup>16</sup> Community hospitals are defined as nonfederal, short-term (less than 30-day stay) hospitals available to the public in the United States.<sup>16</sup> This includes academic medical centers and specialty hospitals but excludes Veterans Administration, Department of Defense, and Indian Health Service hospitals, as well as rehabilitation hospitals and hospital units of institutions such as prisons, mental institutions, and developmental centers.<sup>16,17</sup>

Similar to the more commonly used HCUP Nationwide Inpatient Sample (NIS), the KID is derived from a state-level sampling frame of hospital discharges based on the American Hospital Association Annual Survey of Hospitals. However, unlike the NIS, which represents a sample of hospitals, the KID represents a sample of individual pediatric discharges from all hospitals in the sampling frame.<sup>18</sup> Systematic random sampling is used to select 10% of uncomplicated in-hospital births and 80% of complicated in-hospital births and other pediatric cases.<sup>16,18</sup> Oversampling of complicated births and pediatric nonbirths is done to ensure that the KID contains a comprehensive case mix of pediatric diseases and conditions. For generation of discharge weights to produce national and regional epidemiologic estimates, KID records are poststratified by the same characteristics used to define the NIS sampling strata (US region, urban or rural location, teaching status, ownership, and number of beds), with the addition of a stratum for free-standing children's hospitals to account for potential differences in practice patterns, severity of illness, and available services between children's hospitals and other hospitals.<sup>16-19</sup>

Each record in the KID includes individual level and hospital-level information as separate files. The 2 files were merged via a linked hospital identification variable to create a complete dataset with demographic, clinical, insurance, payment, and hospital information for each discharge record. Details and definitions of all variables included in the dataset are provided at the HCUP database documentation Website (<http://www.hcup-us.ahrq.gov/db/nation/kid/kiddbdocumentation.jsp>).

**Study population**

For this study, case selection was based on fulfillment of 2 criteria: a major diagnostic category (MDC) of 21 (injury and poisoning) or 24 (multiple significant trauma); and receipt of an International Classification of Diseases, 9<sup>th</sup> Revision, Clinical Modification (ICD-9-CM) procedure code of either digit replantation (84.21 for thumb, 84.22 for nonthumb) or digit amputation (84.01 for nonthumb,

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