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Short communication

Vaccine-preventable, hospitalizations among American Indian/Alaska Native children using the 2012 Kid's Inpatient Database

Amanda J. Nickel [a,*], Susan E. Puumala [b,c], Anupam B. Kharbanda [d]

[a] Children's Research Institute, Children's Hospitals and Clinics of Minnesota, 2525 Chicago Avenue South, Minneapolis, MN 55404, United States
[b] Center for Health Outcomes and Prevention Research, Sanford Research, 2301 E 60th Street North, Sioux Falls, SD 57104, United States
[c] Department of Pediatrics, Sanford School of Medicine of the University of South Dakota, 1400 W 22nd Street, Sioux Falls, SD 57105, United States
[d] Critical Care Services, Children's Hospitals and Clinics of Minnesota, 910 Building, Suite 40-460, Minneapolis, MN 55404, United States

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ABSTRACT

Our aim was to assess the odds of hospitalization for a vaccine-preventable, infectious disease (VP-ID) in American Indian/Alaska Native (AI/AN) children compared to other racial and ethnic groups using the 2012 Kid's Inpatient Database (KID) The KID is a nationally representative sample, which allows for evaluation of VP-ID in a non-federal, non-Indian Health Service setting. In a cross-sectional analysis, we evaluated the association of race/ethnicity and a composite outcome of hospitalization due to vaccine-preventable infection using multivariate logistic regression. AI/AN children were more likely (OR = 1.81, 95% CI = 1.34, 2.45) to be admitted to the hospital in 2012 for a VP-ID compared to Non-Hispanic white children after adjusting for age, sex, chronic disease status, metropolitan location, and median household income. This disparity highlights the necessity for a more comprehensive understanding of immunization and infectious disease exposure among American Indian children, especially those not covered or evaluated by Indian Health Service.

1. Introduction

American Indian/Alaska Native (AI/AN) children have been disproportionally affected by vaccine-preventable, infectious diseases (VP-ID) [1]. Access to the Indian Health Service (IHS) and tribal resources has reduced disparities in preventative care between AI/AN and non-Hispanic white persons [2]. In fact, immunization rates among children covered by IHS are largely the same or better than the general population of the US since 2005 [3,4]. Studies using IHS data have shown that infection rates for VP-ID like varicella, rotavirus, *Haemophilus influenzae* (Hib), Hepatitis B (Hep B), and invasive pneumococcal disease have declined among AI/AN persons since the introduction of vaccines [5–9]. Despite these improvements, AI/AN infants included in IHS reporting continued to have a higher rate of hospitalization for pertussis than the general population from 2000–2004 [10].

It is difficult to determine whether these findings extend to AI/AN children not included in IHS reporting. Only 40% of the 5.2 million AI/AN in the U.S. are serviced by IHS [11,12]. To qualify for IHS one must belong to a federally recognized tribe as well as meet certain tribal lineage requirements [2,13]. In addition, 78% of AI/ANs live outside designated AI/AN areas, where it is more difficult to access IHS or tribal health services [11,13]. Therefore, a significant proportion of people that identify as AI/AN are not captured in research evaluating VP-IDs despite sharing similar health risks and cultural practices to those serviced by IHS.

The aim of this analysis was to evaluate the rate of hospitalization for vaccine-preventable diseases in all racial/ethnic groups included in the 2012 Kids' Inpatient Database (KID) compared to white children, with a focus on AI/AN children. Given the historical disparities in VP-ID burden, we hypothesized that AI/AN children hospitalized in a non-federal, non-IHS setting were more likely to be admitted for VP-ID than white children.

2. Methods

2.1. Design and study sample

This was a cross-sectional analysis of pediatric hospitalizations for VP-ID using the 2012 KID prepared by the Agency for

Abbreviations: ID, Infectious Disease; VP-ID, Vaccine-preventable infectious disease; aOR, adjusted odds ratio; OR, odds ratio; CI, confidence interval.

* Corresponding author at: Children's Hospitals and Clinics of Minnesota, Mail Stop 40-L08, 2525 Chicago Avenue South, Minneapolis, MN 55404, United States.
E-mail addresses: Amanda.Nickel@childrensmn.org (A.J. Nickel), Susan.Puumala@sanfordhealth.org (S.E. Puumala), Anupam.Kharbanda@childrensmn.org (A.B. Kharbanda).

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Healthcare Research and Quality (AHRQ) as part of the Healthcare Resource Utilization Project (HCUP). The KID is a nationally representative sample of pediatric discharges from all short-term, non-rehabilitation hospitals in 44 participating states [14]. IHS and other federal hospitals are not included in this dataset. By using this dataset we attempted to more closely capture the general population of AI children.

2.2. Outcomes

The primary outcome was a composite measure of VP-ID hospitalization, which we defined as any patient hospitalized with an *International Classification of Disease – ninth revision* (ICD-9) code for an infection that could reasonably be prevented with routine childhood vaccinations recommended in the 2012 CDC immunization guidelines (see Table 1) [15,16]. We examined diagnoses in all 25 diagnostic fields provided in the 2012 KID database. Individual vaccine preventable diseases with >10 cases in the AI/AN population were also analyzed as secondary outcomes.

2.3. Clinical variables

The primary exposure of interest was race/ethnicity, which was reported in the KID using uniform coding. Race was missing in 8.24% of records, and these patients were excluded from the analysis. Covariates including age (<2, 2–6, >6 years), gender, chronic disease, location, household income, and hospital region were evaluated for association with ID hospitalization and inclusion in the adjusted model. Chronic disease was considered present if the patient had one or more conditions meeting the AHRQ definition of a chronic disease [17]. Location was dichotomized into metropolitan and nonmetropolitan per the 2013 National Center for Health Statistics' Urban-Rural Classification Scheme for Counties [18]. Median household income was separated into quartiles based on median household incomes of patients' zip codes [14].

2.4. Analysis

The Stata (StataCorp. 2013. *Stata Statistical Software: Release 13*. College Station, TX: StataCorp LP) suite of *Survey* commands was used for all analyses to account for the sampling design of the KID. Pearson Chi-square tests were used to analyze differences in patient characteristics between children hospitalized with VP-ID and all other hospitalizations.

Table 1
ICD-9 Codes used to create composite outcome of VP-ID hospitalization.

Infectious disease	ICD-9 Codes
Hep B	070.20-070.23, 070.30-070.33
Rotavirus[a]	008.61
Diphtheria	032.1-032.3, 032.81-032.85, 032.89, 032.9
Tetanus	037
Pertussis[a]	033.0-033.1, 033.8-033.9 484.3
Hib[a]	041.5, 320.0
Pneumococcal[a]	038.2, 320.1, 481
Polio virus	045.00-045.03, 045.10-045.13, 045.20-045.23, 045.90-045.93
Measles	055.0-055.2, 055.71, 055.79, 055.8, 055.9
Mumps	072.0-072.3, 072.71-072.72, 072.79, 072.8-072.9
Rubella	056.00-056.01, 056.09, 056.71, 056.79, 056.8-056.9
Varicella	052.0-052.2, 052.7-052.9
Hep A	070.0, 070.1
Meningococcal	036.0-036.3, 036.40-036.43, 036.81-036.82, 036.89, 036.9

[a] Infectious diseases with enough cases in AI/AN patients (>10) to conduct univariate analyses.

Univariate logistic regression was performed to assess the association between VP-ID hospitalization and race/ethnicity and clinical covariates. Collinearity was not an issue given the low to moderate correlation (max Cramer's V = 0.34) between variables. We examined each covariate for interaction with race on VP-ID hospitalizations, and significant interaction terms ($p = 0.05$) in a bivariate analysis were included in the adjusted model. All covariates associated with VP-ID ($p = 0.10$) in a univariate model were included in the multivariate model.

In sensitivity analyses, we compared the severity of illness between AI/AN and white children hospitalized with VP-ID using a Pearson Chi-square test. Severity of illness and risk of mortality measures were developed for HCUP, and they were calculated using Disease Staging, AHRQ Co morbidity Measures, and All Patient-Refined-DRGs (diagnosis related groups) [14].

3. Results

3.1. Study sample

Approximately 50% of all VP-ID hospitalizations were children <2 years old compared to only 24% of all other non-birth hospitalizations (see Table 2). Females were less likely to be hospitalized for VP-ID compared to their male counterparts ($p < 0.001$), and children hospitalized for VP-ID were less likely to have a concurrent chronic disease than those hospitalized for other reasons ($p < 0.001$). The proportion of children living in a nonmetropolitan area at the time of their hospitalization did not differ between those hospitalized for VP-ID and other hospitalizations ($p = 0.40$).

Table 2
Patient characteristics of all non-birth hospitalizations of children in 2012.

	VP_ID diagnosis[a] N = 12,732	Other diagnoses N = 2,928,730	χ^2 p-value
Characteristics	Weighted %[b] (95% CI)	Weighted %[b] (95% CI)	
Racial/Ethnic Groups			<0.0001
American Indian/ Alaska Native	1.7 (1.2, 2.4)	1.0 (0.8, 1.3)	
Non-Hispanic white	48.3 (45.3, 51.3)	49.8 (47.9, 51.6)	
African American	15.3 (13.9, 16.9)	18.9 (17.8, 20.1)	
Hispanic	26.3 (23.2, 29.6)	22.4 (20.6, 24.3)	
Asian	3.2 (2.5, 3.9)	2.5 (2.2, 2.9)	
Other	5.3 (4.6, 6.2)	5.4 (4.8, 6.0)	
Age			<0.0001
<2 years	49.5 (47.9, 51.1)	23.8 (23.2, 24.5)	
2–6 years	24.5 (23.4, 25.6)	15.2 (14.7, 15.7)	
>6 years	26.0 (24.8, 27.3)	61.0 (59.9, 62.0)	
Sex			<0.0001
Female	46.8 (45.7, 47.9)	56.3 (55.6, 56.9)	
Chronic Disease Present	53.8 (52.0, 55.6)	59.4 (58.4, 60.4)	<0.0001
Location			0.40
Nonmetropolitan	17.3 (15.8, 19.0)	16.9 (15.9, 17.9)	
Median Household Income			<0.0001
≥63,000	15.9 (14.3, 17.7)	18.4 (17.1, 19.7)	
48,000–62,999	21.9 (20.4, 23.5)	22.4 (21.6, 23.2)	
39,000–47,999	25.2 (23.7, 26.6)	25.1 (24.3, 25.9)	
≤38,999	37.0 (34.5, 39.6)	34.2 (32.7, 35.6)	
Region			0.10
Northeast	16.4 (13.1, 20.3)	17.5 (14.8, 20.5)	
Midwest	21.3 (17.3, 26.0)	22.3 (19.4, 25.6)	
South	41.6 (36.3, 47.0)	38.8 (35.4, 42.4)	
West	20.7 (16.8, 25.3)	21.4 (18.5, 24.7)	

[a] VP-ID diagnosis if patient was discharged with any diagnosis described in Table 1.
[b] Weighted using scaled weights provided by HCUP to produce national level estimates.