

Outpatient and Hospital Visits Associated With Otitis Media Among American Indian and Alaska Native Children Younger Than 5 Years

Aaron T. Curns, MPH*; Robert C. Holman, MS*; David K. Shay, MD, MPH‡; James E. Cheek, MD, MPH§; Stephen F. Kaufman, MS||; Rosalyn J. Singleton, MD¶; and Larry J. Anderson, MD‡

ABSTRACT. *Objective.* To describe the burden of otitis media (OM) among American Indian and Alaska Native (AI/AN) children.

Methods. OM morbidity among AI/AN younger than 5 years was evaluated using OM-associated outpatient visit and hospitalization rates. These rates were compared with outpatient and hospitalization rates for the general US population of children younger than 5 years. AI/AN children who were younger than 5 years and receiving care through the Indian Health Service or tribally operated facilities and US children younger than 5 years of age were studied.

Results. From 1994–1996, the average annual rate of AI/AN OM-associated outpatient visits was 138 per 100 children younger than 5 years. Among AI/AN children younger than 1 year (infants), these rates were almost 3 times greater than those for US infants (318 vs 110 visits per 100 infants, respectively). AI/AN children 1 to 4 years of age had rates 1.5 times greater than US children of the same age (107 vs 65 visits per 100 children, respectively). AI/AN children also experienced higher rates of OM-associated hospitalization than did US children (5643 vs 2440 per 100 000 infants, 823 vs 665 per 100 000 1- to 4-year-olds).

Conclusion. We found that AI/AN children, especially AI/AN infants, have higher OM-associated outpatient and hospitalization rates than those for the general US population of children. The disparity in rates suggests that additional prevention programs and continued resources are needed to reduce OM morbidity among AI/AN children. *Pediatrics* 2002;109(3). URL: <http://www.pediatrics.org/cgi/content/full/109/3/e41>; *otitis media, American Indian, Alaska Native, outpatient, hospitalization.*

national Classification of Diseases, Ninth Revision, Clinical Modification; NHDS, National Hospital Discharge Survey; RR, relative risk; CI, confidence interval; PCV, pneumococcal conjugate vaccine.

Otitis media (OM) is one of the most common and costly health problems that affect children younger than 5 years in the United States.^{1,2} Approximately half of US children have an episode of OM before their first birthday, and 9 of 10 children have an episode by 5 years of age.^{3,4} OM is the most common diagnosis associated with the prescription of antibiotics in the United States,⁵ and when and how antibiotics should be used for this condition remains the subject of continuing debate.^{6–12} Furthermore, from 1% to 7% of children can be expected to have surgical procedures related to OM.^{4,13,14}

It is widely known that OM morbidity is greater among specific groups of American Indian/Alaska Native (AI/AN) children than among the general US population of children.^{15–18} Recent comparisons of AI/AN OM morbidity with that of the general US population are lacking, as are aggregate estimates of OM morbidity among all AI/AN children. Therefore, we examined OM-associated outpatient and hospitalization data for AI/AN children younger than 5 years available from the Indian Health Service (IHS). We compared these results with previously published rates of OM outpatient visits² and newly computed hospitalization rates for the general US population of children younger than 5 years.

ABBREVIATIONS. OM, otitis media; AI/AN, American Indian and Alaska Native; IHS, Indian Health Service; ICD-9-CM, *Inter-*

From the *Office of the Director and ‡Respiratory and Enteric Viruses Branch, Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention, US Department of Health and Human Services, Atlanta, Georgia; §Epidemiology Program, Office of Public Health, Indian Health Service Headquarters, US Department of Health and Human Services, Albuquerque, New Mexico; ||Indian Health Service, US Department of Health and Human Services, Rockville, Maryland; ¶Alaska Native Tribal Health Consortium and Arctic Investigations Program, National Center for Infectious Diseases, Centers for Disease Control and Prevention, US Department of Health and Human Services, Anchorage, Alaska.

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Reprint requests to (A.T.C.) Centers for Disease Control and Prevention, 1600 Clifton Rd, MS A-39, Atlanta, GA 30333. E-mail: acurns@cdc.gov
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METHODS

Records for outpatient visits among AI/AN children younger than 5 years were obtained from the IHS National Patient Information Reporting System for fiscal years 1994–1996 for group diagnosis codes 250 and 251.¹⁹ These group diagnosis codes encompassed the following *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes: postmeasles OM (055.2), acute nonsuppurative OM (381.0), chronic serous OM (381.1), chronic mucoid OM (381.2), other and unspecified chronic nonsuppurative OM (381.3), nonsuppurative OM, not specified as acute or chronic (381.4), and suppurative and unspecified OM (382). OM-associated outpatient rates for AI/AN children were compared with previously published outpatient rates for US children younger than 5 years for the years 1993–1995.² These estimates relied on the same ICD-9-CM codes listed above except that they excluded postmeasles OM, a rare diagnosis. Individual ICD-9-CM codes were not available in the IHS data to assess the proportion of visits coded only with a postmeasles OM diagnosis. However, no postmeasles OM diagnoses were among the outpatient survey data available for US children younger than 5 years during 1993–1995.²⁰

Hospitalizations among children younger than 5 years with

RESULTS

Outpatient Visits for OM

For 1994–1996, there were 523 074 visits associated with OM among AI/AN children younger than 5 years (Table 1). The average annual rate for OM-associated outpatient visits was 138 per 100 children younger than 5 years. However, rates were almost 3 times higher for infants compared with children 1 to 4 years of age (318 vs 107 visits per 100 children/y; RR: 2.98; 95% CI: 2.97–3.00). The rates were slightly higher for boys than girls (143 vs 132 visits per 100 children/y; RR: 1.08; 95% CI: 1.07–1.09). Children who lived in the Alaska and the Northern Plains regions had the highest rates; children in Oklahoma had the lowest (157 [combined] versus 101 visits per 100 children/y; RR: 1.56; 95% CI: 1.54–1.58).

When compared with the US rates from 1993–1995,² AI/AN rates were almost double those for US children (138 vs 74 per 100 children/y). Much of this disparity occurred among infants: AI/AN infants had an almost 3-fold higher rate than US infants (318 vs 110 visits per 100 children/y). AI/AN children 1 to 4 years of age had rates 1.5 times greater than US children of the same age (107 vs 65 visits per 100 children/y). The rates for US children were similar by region, ranging from 66 per 100 children/y in the West to 78 per 100 children/y in the Midwest.

Among AI/AN children younger than 5 years, OM-associated outpatient visits represented approximately 15% of all outpatient visits. OM-associated outpatient visits accounted for 17% of all outpatient visits among US children younger than 5 years.²

Rates of OM-Associated Hospitalization

Rates of OM-associated hospitalization were significantly higher for AI/AN children than for US children throughout the study period (1994–1996 rates: 1542 vs 1021 per 100 000 children/y; Tables 2 and 3). As with OM-associated outpatient visits, much of the disparity in OM hospitalization rates was attributed to the difference among infants (1994–1996 rates: 5643 vs 2440 per 100 000 infants/y, 823 vs 665 per 100 000 1- to 4-year-olds/y). During

OM listed as a diagnosis were selected from the IHS hospitalization database for fiscal years 1988–1996 and the National Hospital Discharge Survey (NHDS) for calendar years 1988–1996.^{21,22} Detailed descriptions of IHS and NHDS hospitalization data have been published previously.^{23,24} The NHDS excludes hospitalizations that occurred in federal facilities, including IHS or tribally operated hospitals. An OM-associated hospitalization was defined as one with an OM code listed as any of the up to 7 discharge diagnoses in the NHDS record or any of the up to 6 discharge diagnoses in the IHS record. As with the US outpatient data, OM-associated hospitalizations for the IHS and NHDS hospitalization data were selected on the basis of the above ICD-9-CM codes, excluding the postmeasles OM code. The term “OM-associated hospitalization” does not suggest that OM was the primary cause of hospitalization.

OM-associated outpatient and inpatient visits among AI/AN children were examined by age group, gender, geographic region, and month and year of visit. Age groups were defined as children younger than 1 year of age (infants) and children 1 to 4 years of age. NHDS monthly estimates of discharges were made using only records sampled from hospitals fully responding for that year.²³ For both the IHS and NHDS hospitalization data, up to 3 procedures could be listed on a discharge record.

IHS population denominators were obtained for each year from 1988–1996 by using the 1997 IHS user population estimates and adjusting retrospectively for annual changes in the IHS service population.^{24,25} The IHS user population included all registered AI/ANs who resided in an IHS area and received health care through the IHS system at least once during the previous 3 years. The service population was an estimate of all federally recognized AI/AN eligible for IHS services regardless of whether they had actually used IHS services. Approximately 60% of all AI/AN in the US reside in the IHS service area.²⁵ The west region was excluded from the hospitalization analysis because the 2 areas composing that region did not have IHS or tribal hospitals (California area) or provided limited hospitalization data (Portland area). AI/AN children in the present study represent AI/AN children who received care through IHS or tribally operated facilities.

Annual US population estimates for children younger than 5 years were obtained from census data, and estimates for infants were obtained from natality data.^{26,27} Population estimates for children 1 to 4 years of age were made by subtracting the number of live births from the census total for children younger than 5 years.²³ Standard errors of NHDS estimates for 95% confidence intervals (CIs) estimation were made using SUDAAN (Research Triangle Institute, Research Triangle Park, NC).²⁸

Tests for trend were conducted for the IHS hospitalization data using linear regression,²⁹ and a weighted least squares regression method was used for NHDS hospitalization rates.³⁰ Within-IHS comparisons for age, gender, and region were conducted by using the data for 1994–1996 for both the outpatient and hospitalization data and by calculating relative risks (RRs) and 95% CIs.

TABLE 1. OM-Associated Outpatient Visits per 100 AI/AN Children Younger Than 5 Years by Age Group, Gender, and Region: IHS, 1994–1996

Characteristic	Visits per 100 Children			
	1994 (N = 189 276)	1995 (N = 170 731)	1996 (N = 163 067)	1994–1996 (95% CI) (N = 523 074)
Total	153	135	126	138 (136–139)
Age (y)				
<1	361	311	285	318 (314–323)
1–4	117	104	99	107 (106–108)
Gender				
Male	159	139	130	143 (141–144)
Female	147	129	122	132 (131–134)
Region				
Alaska	163	151	159	158 (153–162)
East	175	136	119	143 (135–151)
Northern Plains	171	155	146	157 (154–160)
Oklahoma	109	96	98	101 (99–103)
Southwest	171	147	125	147 (145–149)
West	133	117	119	123 (119–126)

TABLE 2. OM-Associated Hospitalizations per 100 000 AI/AN Children Younger Than 5 Years by Age Group, Gender, and Region: IHS, 1988–1990 and 1994–1996

Characteristic	Hospitalizations per 100 000 Children (95% CI)			
	1988–1990 (N = 7514)	1994–1996 (N = 5264)	Percentage Change 1988–1990 Versus 1994–1996	Test for Trend P Value
Total	2564 (2508–2622)	1542 (1501–1584)	–39.9	<.001
Age (y)				
<1	10 375 (10 092–10 665)	5643 (5445–5848)	–45.6	<.001
1–4	1189 (1147–1232)	823 (790–856)	–30.8	<.001
Gender				
Male	2980 (2895–3068)	1729 (1669–1792)	–42.0	<.001
Female	2134 (2060–2210)	1348 (1294–1405)	–36.8	<.001
Region				
Alaska	2444 (2272–2628)	2541 (2379–2715)	3.9	.43
East	1992 (1666–2378)	988 (802–1214)	–50.4	<.001
Northern Plains	3335 (3194–3481)	1284 (1204–1369)	–61.5	<.001
Oklahoma	733 (672–799)	456 (412–506)	–37.8	<.001
Southwest	3298 (3200–3399)	2087 (2014–2163)	–36.7	<.001

TABLE 3. OM-Associated Hospitalizations Per 100 000 Children Younger Than 5 Years by Age Group, Gender, and Region: NHDS, 1988–1990 and 1994–1996

Characteristic	Hospitalizations per 100 000 Children (95% CI)			
	1988–1990 (N = 729 612)	1994–1996 (N = 597 508)	Percentage Change 1988–1990 Versus 1994–1996	Test for Trend P Value
Total	1313 (1080–1546)	1021 (824–1218)	–22.2	.001
Age (y)				
<1	2545 (2018–3072)	2440 (1926–2954)	–4.1	.26
1–4	969 (804–1135)	665 (539–791)	–31.4	<.001
Gender				
Male	1586 (1287–1885)	1151 (928–1374)	–27.4	<.001
Female	1026 (847–1205)	885 (705–1065)	–13.7	.06
Region				
Northeast	1662 (1155–2169)	1158 (873–1442)	–30.3	.02
Midwest	1226 (678–1774)	1130 (590–1670)	–7.8	.28
South	1248 (1013–1482)	966 (723–1209)	–22.6	.009
West	1208 (573–1844)	896 (406–1386)	–25.8	.15

the study period, annual rates declined significantly for all AI/AN children except for those who resided in the Alaska region (Table 2). During 1994–1996, Alaska and the Southwest regions both had higher OM-associated hospitalization rates than each of the other IHS regions. Annual rates also declined for US children, although there were disparities in the magnitude of the decline by age, race, and geographic region (Table 3). The 1994–1996 OM-associated hospitalization rates did not significantly differ by US region.

Diagnoses and Procedures Associated With OM-Associated Hospitalizations

OM was infrequently listed as the first diagnosis on OM-associated hospitalizations (15% AI/AN and 20% US), indicating that other causes were the primary reason for hospitalization and that OM was either an incidental finding or possibly a complication associated with the primary reason for hospitalization. Respiratory diagnoses (eg, acute bronchiolitis, pneumonia, asthma) as a group were the most common diagnoses that accompanied OM on discharge records (present on 47% of AI/AN OM-associated hospitalizations and 31% for US children). Respiratory medication administered by nebulizer (23%), other oxygen enrichment (18%), and lumbar

puncture (11%), were common procedures performed among AI/AN infants, suggesting that concern for sepsis, meningitis, or lower respiratory tract disease were the principle reasons for admission. Lumbar puncture was listed on 13% of OM-associated hospitalizations for US infants. For children 1 to 4 years of age, myringotomy with insertion of tube was listed on 10% of OM-associated hospitalizations for AI/AN children and 16% for US children.

Seasonal Patterns in OM-Associated Illnesses

For AI/AN children, outpatient visits associated with OM peaked in January, whereas hospitalizations peaked in February (Fig 1). Approximately 45% of OM-associated outpatient visits and 50% of OM-associated hospitalizations occurred during December through March. The seasonal pattern was similar for infants and for children 1 to 4 years of age.

DISCUSSION

We found that AI/AN children experienced greater OM morbidity than did the general US population of children younger than 5 years when we examined both outpatient and inpatient visit rates. The increased OM-associated morbidity among AI/AN children is consistent with that found in previous studies.^{15,17,18} In this study, the rate for

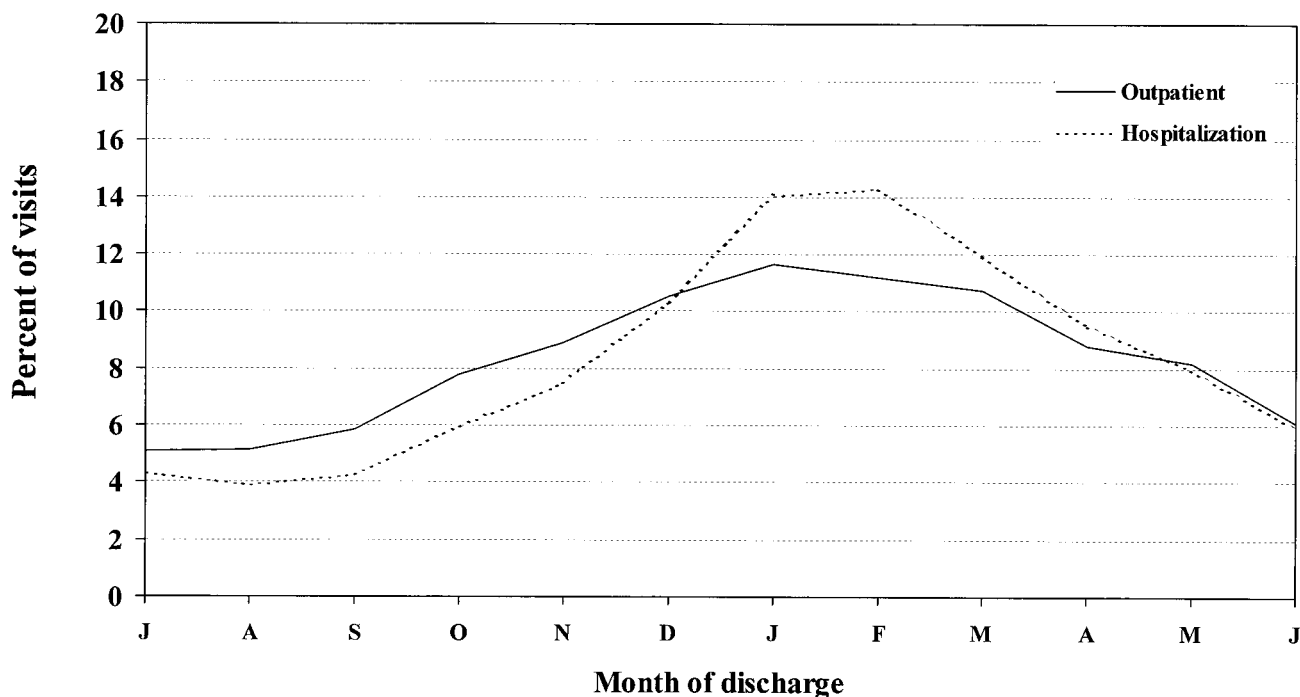


Fig 1. Distribution of OM-associated outpatient visits and hospitalizations by month of discharge, AI/AN children younger than 5 years, fiscal years 1994–1996.

outpatient OM-associated visits among AI/AN children was twice that of US children. The disparity was greatest among infants, among whom the outpatient visit rate for AI/AN infants was 3 times as high as for US infants. AI/AN children also had greater rates of OM-associated hospitalizations than US children. As seen for outpatient visits, the difference was greatest between AI/AN and US infants. These findings are consistent with those of earlier studies that have described AI/AN's higher overall infectious disease hospitalization rates^{24,31} and higher rates for specific infectious diseases such as gastroenteritis,³² bronchiolitis,³³ and pneumonia.¹⁷

Examining the disparities in risk factors for OM between the AI/AN and general US population highlights potential strategies to reduce the excess OM morbidity among AI/AN children. AI/AN children are more likely than their US counterparts to live in poverty, to have parents with a lower education level, and to reside in crowded housing conditions, all of which are socioeconomic conditions that could increase AI/AN children's risk for infectious disease morbidity and mortality.^{25,34} Long-term initiatives to improve housing conditions, increase educational and employment opportunities, and improve access to care are ongoing²⁵ and may reduce the disparity in OM morbidity between AI/AN children and children in the general US population.

Maternal smoking is another factor that may contribute to increased OM morbidity among AI/AN children. There is evidence that smoking by the mother and others in the household increases OM morbidity among young children.^{3,4,35} Twenty percent of AI/AN women reported smoking during pregnancy compared with approximately 14% in the general US population.³⁶ Maternal smoking varied

by IHS region, with the highest rates of approximately 40% occurring in the North Plains and Alaska regions. Of interest, the greatest OM-associated outpatient visit rates were found in these 2 regions. The Oklahoma region, which had the lowest outpatient visit rates among the IHS regions, had maternal smoking rates similar to the IHS average of 20%.³⁶ Maternal smoking among the general US population did not vary appreciably by region, ranging from 12% (Northeast) to 16% (Midwest),³⁷ which was consistent with outpatient OM visit rates being similar by region. Reducing the number of AI/AN mothers who smoke while pregnant and after the birth of their children should be a priority because maternal smoking has been associated with a number of health problems, in addition to OM, in the infant and young child.^{35,38–41}

Encouraging breastfeeding is another possible OM prevention strategy for AI/AN infants. Regional estimates of breastfeeding rates among AI/AN mothers in the IHS service area (ie, living on or near reservations) were unavailable. Limited data suggest that AI/AN breastfeeding rates vary among different groups of AI/AN.⁴² However, breastfeeding rates for AI/AN mothers in general were higher compared with other groups, but they remained below the Healthy People 2000 objective of 75% of mothers breastfeeding their infants in the early postpartum period.⁴² Breastfeeding has been shown to reduce the incidence of OM and respiratory disease in general among specific groups of AI/AN infants.^{43,44} Because much of the disparity in OM morbidity occurred among AI/AN infants, increased breastfeeding could have substantial impact on OM morbidity. In addition, because OM infection before 1 year of age is a risk factor for repeated OM infec-

tion,³ preventing OM infections among AI/AN infants might decrease their risk for later, repeated OM infections.

Finally, vaccines against pathogens that cause OM should reduce OM and have a substantial effect in populations that are at high risk for OM, such as AI/AN children. The pneumococcal conjugate vaccine (PCV) is 1 example. PCV reduces in varying degrees the risk of pneumococcal invasive disease, otitis media, and tube placement⁴⁵ and is now part of the routine childhood immunization schedule.⁴⁶ In recognition of the increased risk for invasive pneumococcal disease,^{17,47} PCV is recommended for AI/AN children younger than 60 months.⁴⁶ PCV is recommended for all children younger than 24 months. In 1 study, PCV reduced OM visits by 8.9%.⁴⁵ With this reduction and widespread vaccination coverage, PCV could prevent up to 40 000 visits associated with OM among AI/ANs during a 3-year period. The impact of PCV among Southwestern Native Americans is presently being studied.⁴⁸ Other vaccines under evaluation (eg, live attenuated influenza vaccine) or in development (eg, respiratory syncytial virus vaccine) could also reduce OM among AI/AN children and US children in general.^{49–54} Data presented in this report along with future reports can be used to help evaluate the effectiveness of these vaccines and associated vaccination programs by monitoring trends in OM morbidity.

OM morbidity varied among the IHS regions. For example, Oklahoma had the lowest OM-associated outpatient and hospitalization rates compared with each of the other regions. It is interesting that the lower OM-associated morbidity in the Oklahoma region is consistent with other studies that show that children in the Oklahoma region have lower rates of infectious disease hospitalizations,^{24,32,33} as well as a lower infant mortality rate.³⁶ The reasons for these differences have not been clearly defined and warrant additional study. Another difference between IHS regions was the lack of a decrease during the study period in OM-associated hospitalizations in Alaska, whereas the other IHS regions had substantial decreases (increase of 3.9% in Alaska versus decreases of 36.7% to 61.5% for the other regions). We wondered whether this might be attributable to a lack of access to outpatient tube placement facilities. The Alaska region had the highest proportion of OM-associated hospitalizations with tube placements of all IHS regions (19% vs 8% of OM-associated hospitalizations among 1- to 4-year-olds). This suggests that lack of access to outpatient facilities that perform tube placement may have contributed at least in part to the disparity in the change in hospitalization rates over time by IHS region.

This study has several limitations. There were too few years of IHS AI/AN outpatient data available to assess long-term trends in outpatient visits. Although AI/AN children who receive care through the IHS may not be representative of all AI/AN children, we believe that they likely provide reliable information on AI/AN children who live on or near Native American reservations, because IHS and tribal facilities are convenient to these areas and com-

prehensive medical care is provided free of charge.^{55,56} Because of the sample size limitations associated with national survey data, we were unable to compare the OM-associated hospitalization rates and trends of non-AI/AN Alaskan children with the rest of the US to determine whether a similar regional disparity observed among AI/AN children also was present for the general US population. Finally, we recognize that in most cases, OM is not the primary reason for an OM-associated hospitalization. We found that 47% of the OM-associated hospitalizations among AI/AN children and 31% among the general US population were also coded for a respiratory diagnosis, and as group these were the most common accompanying diagnoses. However, it remains unclear why OM would be diagnosed more often among hospitalized AI/AN children than US children and whether this finding further reflects a disparity in OM morbidity between the 2 groups.

We found that AI/AN children, specifically AI/AN infants, have higher OM-associated outpatient and hospitalization rates than do children in the general US population. The disparity in rates suggests a need and opportunity for additional prevention programs to improve the health status of AI/AN children. Some programs that might improve the health status of AI/AN children include encouraging breastfeeding of AI/AN infants, reducing maternal smoking, and introducing new vaccines that target pathogens associated with OM.

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