

Disparities in Hospitalizations of Rural American Indians

CAROL C. KORENBROT, PHD,* SARA EHLERS, MPH,* AND JAMES A. CROUCH, MPH†

BACKGROUND. Disparities in hospitalization rates, particularly rates for avoidable hospitalizations, are indicators of potentially unmet health needs and inefficient use of health resources. Hospitalization rates that the Indian Health Service (IHS) can report underestimate disparities for American Indians (AIs) and Alaska Natives (ANs) relative to other Americans, because the IHS cannot track all hospitalizations of AIs/ANs in their user population.

OBJECTIVES. To compare hospitalization and avoidable hospitalization rates for a rural AI/AN user population with those of non-Indians living in the same counties where both groups use the same hospital system, regardless of the expected source of payment.

RESEARCH DESIGN. Retrospective analysis of California hospital discharge data for 1996 linked to rural IHS user data for 1995 and 1996 (3920 hospitalizations) compared with a random sample of discharge data for the rest of the non-Indian population in the 37 counties of the IHS Contract Health Service delivery area (7840 hospitalizations).

MEASURES. Hospitalization and avoidable

hospitalization rates and risk ratios (RRs).

RESULTS. Hospitalization and avoidable hospitalization rates were both higher for the AI/AN user population than for the non-Indian general population. The age-adjusted hospitalization ratios were 72% higher for men (RR 1.72, confidence interval [CI] 1.40–2.12) and 52% higher for women (RR 1.52, CI 1.36–1.92). The comparable ratios for avoidable hospitalizations were 136% higher for men (RR 2.36, CI 1.52–3.29) and 106% higher for women (RR 2.06, CI 1.32–3.50).

CONCLUSIONS. Disparities in both hospitalization and avoidable hospitalization rates of rural AIs/ANs in California were previously undetected by either federal IHS or state hospital discharge data alone. At least some of the disparities are likely reducible with improved access to care.

Key words: American Indians; Native Americans; health services access; health services utilization; health services indicators; hospitalizations; avoidable hospitalizations; ACSC; preventable hospitalizations. (Med Care 2003; 41:626–636)

The federal Indian Health Care Improvement Act (P.L.94–437) has grown in importance since 1975 to become the fundamental legal authority for finance of health care provided by tribal health programs and the Indian Health Service (IHS).¹ The law calls for “eliminating the deficiencies in health status and resources of all

tribes.”² A variety of indicators for health status and health resource use, however, show disparities for the estimated 60% of American Indians (AIs) and Alaska Natives (ANs) who use IHS-funded health care relative to the US population as a whole.^{3–5} Life expectancy is shorter for AIs/ANs (71.1 years compared with 75.8 years),⁶

From the *Institute for Health Policy Studies, University of California, San Francisco, California.

From the †California Rural Indian Health Board, Sacramento, California.

Supported by a grant to the California Rural Indian

Health Board by the California Endowment (no. 20001-583).

Address correspondence and reprint requests to: Carol C. Korenbrot, PhD, Institute for Health Policy Studies, University of California, 3333 California St., Suite 265, San Francisco, CA 94118. E-mail: ckoren@itsa.ucsf.edu.

and the average IHS funding for personal medical services is only 60% of the federal benchmark, even after accounting for Medicaid and Medicare contributions.⁷ The barriers in access to ambulatory care for AIs/ANs relative to non-Indians have also been described.^{1,3,8,9} Given poor health status, low resources, and high barriers to access, it is surprising that hospitalization rates for the IHS user population have not revealed disparities except for a few select diagnostic groups.¹⁰

Information that comes from IHS hospital use data indicates that hospitalization rates for its AI/AN user population are lower in nearly every age group than for the United States as a whole.^{4,10} Low hospitalization rates for AIs have at times been suggested as potential indicators of the positive impact on health associated with access to IHS services.^{11,12} A national survey of AIs/ANs living on or near Indian lands did reveal that more survey respondents had a usual source of ambulatory care than the US population as a whole.³ Still, because the IHS published hospitalization rates are for users of clinics and are compared with those of the general US population, it is puzzling that the rates are substantially lower.

The hospitalization rates that the IHS can report underestimate the rates of AIs/ANs relative to those reported for other Americans, especially in the western regions of the country, where most AIs/ANs live.⁶ IHS information by itself excludes hospitalizations outside the IHS and tribal hospitals, unless paid for by IHS Contract Health Service funds.^{6,13,14} There are increasing numbers of hospitalizations of the AI/AN user population that IHS funds do not cover.¹³ IHS funding is declining on a per capita basis,¹⁴ and the proportion of the federal benchmark health benefits covered fell from 57% to 52% between 1999 and 2000.⁷ Many health needs compete for declining IHS Contract Health Service funds. Obtaining payment for hospitalizations can be a difficult process, particularly as the end of the fiscal year approaches.⁸ This is particularly true in areas with no IHS or tribal hospital. In California, for example, IHS Contract Health Service funds paid for only 99 hospitalizations in 1997.⁶ The IHS reported that its national hospitalization rate for the AI/AN user population was 65.4 per 1000, and the US rate for the general population was even higher (114.3 per 1000), but the California reported rate was only 15.7 per 1000.⁶ When the western

states of California, Oregon, Washington, and Idaho, which rely heavily on Contract Health Service funds for hospitalizations, are excluded from determinations of a national IHS rate and the rate is adjusted for the differences in the ages of the 2 populations, the IHS rate is closer to the US rate, but still not higher (92.5 compared with 118.5 per 1000).¹⁰

Hospitalization rates for AIs/ANs who are users of the IHS can be compared with those of other Americans where hospitalizations of both groups occur in the same set of hospitals, whether or not the payer source is IHS. Hospital discharge records of the IHS user population in a state where there are no IHS-operated or tribally operated hospitals offer an opportunity for such a study. AIs/ANs may not be reliably classified, however, on hospital discharge records.^{15,16} One way to enhance identification of AIs/ANs in hospital data files is to link them with the IHS data files of their recent user population.^{17,18} When such linkages were performed for AI/AN children, asthma-related hospitalization rates were found to be higher for AIs/ANs than the statewide rates,¹⁸ whereas without linkages, national rates for AI/AN children using IHS system hospitalizations were lower than rates for white children.¹¹ Using linkage methods in Washington state, AI/AN hospitalization rates for motor vehicle injuries were also found to be higher (82%) than the statewide rate.¹⁷

Once AI/AN users of IHS-financed services are identified in hospital discharge data, not only hospitalization rates can be assessed, but also avoidable hospitalizations.^{19–21} The Institute of Medicine recommended using avoidable hospitalization rates as an indicator of access to care to determine which population groups have unmet health care needs.^{19,20,22–25}

The main purpose of this study is to determine whether disparities exist in hospitalization rates for a rural IHS user population compared with those of a general population of non-Indians living in the same counties. In this study, we compare the hospitalization rates for both populations using the same hospital system and including all hospitalizations regardless of payer source. We hypothesize that there are disparities in hospitalization rates of these AIs/ANs that have not been detected before. The secondary purpose is to determine whether there are disparities in hospitalizations that are potentially avoidable with use of effective ambulatory care for the same groups.

Materials and Methods

Study Design

We conducted a retrospective analysis with federal fiscal year 1996 (FFY96: October 1, 1995 to September 30, 1996) hospital discharge data in the 37 counties that contain all or part of the rural IHS Contract Health Service delivery areas in California.²⁶ We compared hospital discharges for AIs/ANs in the IHS user population in California with a random sample of discharges for non-Indian Californians living in the same counties.

Study Samples

The AI/AN sample of users of IHS services was prepared from a linked data file prepared by the California Department of Health Services (DHS). The DHS received from the IHS (National Patient Information Reporting System, Albuquerque, NM) a file of AIs/ANs living in a rural IHS Contract Health Service delivery area who had at least 1 visit to a tribal health program clinic in FFY95 or FFY96. Of these records, 91% (43,482) had Social Security Numbers (SSNs) and were therefore eligible for linkage to state hospital discharge records. The DHS then linked the IHS user file by SSN to the California hospital discharge data for all discharges in nonfederal, short-stay hospitals (3.1 million, 90% of which had SSNs) in FFY96. To determine the degree of misclassification of the AIs/ANs in the hospital discharge records, we analyzed the distribution of race and ethnic categories on the linked records. Because the linked hospitalizations are those of AIs/ANs who used a clinic at least once in 2 years who might be sicker than a general population, we compared characteristics of the linked hospitalizations to those of people classified as "Native Americans" in the unlinked records. Hospitalizations of newborns were excluded because they are not uniformly reported separate from their mothers, and hospitalizations of infants were excluded because 69% of infant hospital records in California in FFY96 were missing SSNs (Korenbrodt and Ehlers, unpublished data, December 2001), leaving 3920 hospitalizations for analysis. See Figure 1.

The random sample of hospitalizations of non-Indians was prepared from DHS hospital discharge data from which hospitalizations of the AI/AN sample and those indicated as "Native

American" were excluded, along with hospitalizations of all newborns and infants. From the remaining records, a random sample twice as large as the AI/AN sample (7840 hospitalizations) was selected.²⁷

Analyses

To compare the IHS user population and the non-Indian general population hospitalization rates, a linkage adjustment was needed for missing SSNs on hospital records of AIs/ANs. The percentage of hospital records in each age and gender group that included a SSN was determined from the hospital discharge data for the 37 counties (Korenbrodt and Ehlers, Unpublished data, 2001). The adjusted number of hospitalizations was then calculated by dividing the observed number of AI/AN hospitalizations in each group by the percentage with SSNs.

Hospitalization rates were calculated per 1000 population. For AIs/ANs, the numerator of the rate was the number of hospitalizations in each age and gender group after the linkage adjustment. The denominator was the population in each age and gender group in which the hospitalization events occurred that came from the IHS user file, excluding infants. For non-Indians, the numerator of the rate was the number of hospitalizations in each age and gender group. The denominator was the population figure for the counties using the US Census Bureau 1996 intercensal estimates after excluding "Native Americans, American Indians and Alaska Natives" and infants.²⁸ Hospitalizations of women were divided into those of maternity-related diagnoses (ICD-9 codes 630–677 or V27 listed in any of the 24 fields for diagnoses) and nonmaternity diagnoses (all remaining hospital records for women).

Avoidable hospitalization rates were calculated for broader age groups and expressed per 10,000 population because they occur in lower numbers (419 for AIs/ANs and 754 for non-Indians). The numerators for AI/AN and non-Indian rates were hospitalizations that had one of 12 diagnoses specified by a panel of physicians to reflect potential problems with access to ambulatory care.^{19–21} The denominators were obtained for avoidable hospitalization rates in the same way as for hospitalization rates.

To determine age-adjusted rates of both hospitalizations and avoidable hospitalizations, di-



FIG. 1. Counties included in the Indian Health Service delivery areas in California are shaded in the map.

rect standardization techniques were used with the year 2000 national standard million population.²⁹ To determine whether there were disparities in hospitalization and avoidable hospitalization rates, the risk ratios (RRs) and 95% confidence intervals (CIs) were calculated with the corresponding *P* values from χ^2 analyses.³⁰ Because the age groups used for age adjustment of hospitalization and avoidable hospitalization rates were different, they are not directly comparable.

Results

Hospitalization Characteristics

Of the 3920 hospitalizations of AIs/ANs in the IHS rural user population, less than one third (29.5%, 1155) were appropriately classified as “Native American” in state hospital discharge data (Table 1). Thus, using the “Native American” race or ethnic category to determine the hospitalization rates of rural AIs/ANs in California without link-

TABLE 1. Race and Ethnic Classification of Rural American Indians in State Hospital Data Records

State Classification	IHS Classification AI/AN
	n = 3920*
Native American†	29.5%
White, non-Hispanic	50.6%
White, Hispanic	9.5%
Other	7.6%
Missing	2.8%

*Hospitalizations of newborns and infants under age 1 year were excluded.

†There were a total of 5815 hospitalizations of people classified as "Native Americans" who were not newborns or infants in the state hospital discharge records for the 37 counties.

AI = American Indian; AN = Alaska Native; IHS = Indian Health Service.

age to IHS user data would have underestimated the hospitalization rates for the rural AI/AN user population by at least 70%. The hospitalizations classified as "Native American" (4660 hospitalizations) that did not link to the AI/AN user population had slightly more male (38.3% vs. 36.3%) and nonmaternity female (43.9% vs. 42.3%) hospitalizations, and slightly more privately insured (20.8% vs. 18.9%) and fewer uninsured (9.1% vs. 12.4%) hospitalizations (Table 2). The "Native American" hospitalizations could include those of (1) AI/AN users of IHS-funded services who did not have an SSN necessary for linkage (approximately 400 hospitalizations), (2) AIs/ANs eligible for IHS services because they were enrolled in a federally recognized tribe and lived in an IHS service area who had not used an IHS service in 2 years, (3) AIs/ANs who were not eligible for IHS-funded services because they were not enrolled in a tribe that is federally recognized, and (4) people who were inappropriately identified as "Native Americans." What the unlinked hospitalizations classified as "Native American" did not include were the hospitalizations of any AIs/ANs in the above groups that were misclassified as a race or ethnic group other than "Native American."

The distribution of hospitalizations of the AI/AN user population by gender, age, and expected payer source differs from that of non-Indian Californian hospitalizations in the same counties (Table 2). Whereas the proportions of hospitalizations of men and women are comparable in both groups, propor-

tionately more of the hospitalizations of women were for maternity-related diagnoses among AIs/ANs (21.4%) than among non-Indians (15.8%). Larger proportions of the hospitalizations occurred in younger AI/AN users than among non-Indians. This finding reflects in part the larger proportions of young AIs/ANs in the user population, and indicates that comparisons of hospitalizations of AIs/ANs to non-Indians require age-specific or age-adjusted rates. The predominant expected payer source for hospitalizations of AIs/ANs was Medicaid (40.1% compared with 21.7% for non-Indians). Given the lower percentage of hospitalizations of people older than 65 years in the AI/AN group, it was not surprising that Medicare accounted for a smaller proportion of the hospitalizations (24.7% compared with 36.4%). Other public sources of insurance (including IHS Contract Health Service funds) paid for a very small proportion (less than 3.8%) of hospitalizations for AIs/ANs, comparable with other public sources for non-Indians (2.6%). Proportionately more than twice as many of the hospitalizations for the AIs (12.4%), however, were uninsured compared with those of non-Indians (6.0%).

Hospitalization Rates

Hospitalization rates were higher for the AI/AN user population than for the non-Indian general population. For men, the age-adjusted RRs were 68% higher (RR 1.68, CI 1.37–2.07), for women 52% higher (RR 1.48, CI 1.35–1.91, $P < 0.0001$) (Table 3). Rates for men and women of every age category were significantly higher for AIs/ANs than for non-Indians, except for males 15 to 19 years old. For the AI/AN males, the RRs ranged from a low of approximately 56% higher for elders 65 years and older (RR 1.56, CI 1.42–1.70) to 105% higher for AI/AN elders 55 to 64 years old (RR 2.05, CI 1.77–2.37). For the women, the RRs ranged from a low of approximately 23% higher for those 25 to 34 years old (RR 1.23, CI 1.12–1.36) to more than 100% higher for the female children 1 to 15 years old (age 1–4 years, RR 2.16, CI 1.49–3.13; age 5–14 years, RR 2.08, CI 1.56–2.77).

Avoidable Hospitalization Characteristics

The distributions of avoidable hospitalizations among the AI/AN user population by age and payer sources differ from those hospitalizations of non-

TABLE 2. Comparison of the Distribution of Characteristics of Hospitalizations of American Indians Who Are Indian Health Service Users to Those of "Native Americans" Who Are Non-Indian Health Service Users and to Those of Non-Indians

	AI/AN (IHS users)			"Native Americans" (excluding IHS users)			non-Indians		
	Observed*	Adjusted	(%)	Observed	(%)	P	Observed	(%)	P
	n = 3920	n = 4283	(100)	n = 4373	(100.0)		n = 7840	(100)	
Sex									
Male	1451	1555	(36.3)	1671	(38.2)		2971	(37.9)	
Female, non-maternity	1718	1812	(42.3)	1903	(43.5)		3632	(46.3)	
Female, maternity	751	916	(21.4)	799	(18.3)	0.0012	1237	(15.8)	<0.0001
Age, years*									
1-4	91	151	(3.4)	193	(4.4)		158	(2.0)	
5-14	167	261	(5.8)	339	(7.8)		243	(3.1)	
15-19	306	412	(9.2)	378	(8.6)		370	(4.7)	
20-24	396	513	(11.5)	421	(9.6)		547	(7.0)	
25-34	694	796	(17.8)	777	(17.8)		1201	(15.3)	
35-44	575	606	(13.5)	548	(12.5)		930	(11.9)	
45-54	425	441	(9.8)	440	(10.1)		754	(9.6)	
55-64	417	432	(9.6)	397	(9.1)		758	(9.7)	
65 and older	849	864	(19.3)	880	(20.1)	0.0002	2879	(36.7)	<0.0001
Payer source									
Medicare	1092	1102	(24.7)	1045	(23.9)		2851	(36.4)	
Medicaid	1456	1786	(40.1)	1823	(41.7)		1698	(21.7)	
Other public	155	171	(3.8)	196	(4.5)		206	(2.6)	
Private	779	844	(18.9)	911	(20.8)		2610	(33.3)	
Uninsured	438	554	(12.4)	398	(9.1)	<0.0001	474	(6.0)	<0.0001

*Hospitalizations of newborns and infants younger than 1 year were excluded.
AI = American Indian; AN = Alaska Native; IHS = Indian Health Service.

Indian Californians from the same counties (Table 4). More avoidable hospitalizations occur for younger AIs/ANs than non-Indians, as would be expected with the younger AI/AN population. For both the AIs/ANs and non-Indians, the proportion of avoidable hospitalizations with Medicaid as the expected payer was about the same as for hospitalizations for all diagnoses (Table 2). For the AIs/ANs, however, a slightly higher proportion (15.7%) of the avoidable hospitalizations was uninsured (Table 4) than of all hospitalizations (12.4%, Table 2).

Avoidable Hospitalization Rates

Avoidable hospitalization rates for the AI/AN user population were more than double the rates for the non-Indian general population. RRs of avoidable hospitalizations were more than 100% higher for men (RR 2.26, CI 1.39-2.98) and 87% higher for women (RR 1.87, CI 1.46-3.17, Table 5). Avoidable hospitalization rates for AIs/ANs of every age cate-

gory were significantly higher than for non-Indians. However, when stratified by gender, the rates of avoidable hospitalizations for male AIs/ANs age 15 to 44 years were not significantly higher than those rates for non-Indian males age 15 to 44 years. Likewise, the avoidable hospitalization rates for the AI/AN women older than 75 years were not significantly higher than rates for non-Indian women older than 75 years. For men, the RRs ranged from a low of 95% higher for the AIs/ANs age 65 to 74 years (RR 1.95, CI 1.26-3.02) to 208% higher for the AI/AN men age 45 to 64 years (RR 3.08, CI 2.17-4.39). For women, the significant RRs ranged from a low of 62% higher for women age 45 to 64 years (RR 1.62, CI 1.08-2.42) to 150% higher for AI/AN females age 15 to 44 years (RR 2.50, CI 1.78-3.49).

Discussion

This study provides evidence that the rural IHS user population of California has higher levels of

TABLE 3. Standardized Hospitalization Rates (per 1000 People) and Risk Ratios of Rural American Indians Compared With Non-Indian Californians Living in the Same Counties, by Age and Gender

Age in years*	Males				Females				All						
	AI/AN	Non-Indians	Risk Ratio	(95% CI)	P	AI/AN	Non-Indians	Risk Ratio	(95% CI)	P	AI/AN	Non-Indians	Risk Ratio	(95% CI)	P
	Per 1000	Per 1000				Per 1000	Per 1000				Per 1000	Per 1000			
1-4	43.3	24.9	1.74	(1.23, 2.47)	0.0017	43.8	20.2	2.16	(1.49,3.13)	<0.0001	43.5	22.6	1.93	(1.49,2.48)	<0.0001
5-14	29.4	17.1	1.72	(1.32, 2.24)	0.0001	28.1	13.5	2.08	(1.56,2.77)	<0.0001	28.8	15.4	1.87	(1.54,2.27)	<0.0001
15-19	33.6	25.5	1.32	(0.94, 1.85)	0.11	154.7	92.2	1.68	(1.43,1.97)	<0.0001	94.3	57.1	1.65	(1.45,1.91)	<0.0001
20-24	43.2	21.5	2.00	(1.45, 2.78)	<0.0001	233.0	169.6	1.37	(1.21,1.56)	<0.0001	137.5	89.1	1.54	(1.37,1.74)	<0.0001
25-34	44.5	27.7	1.61	(1.31, 1.97)	<0.0001	162.3	131.6	1.23	(1.12,1.36)	<0.0001	103.7	78.1	1.33	(1.21,1.45)	<0.0001
35-44	78.0	43.0	1.81	(1.54, 2.13)	<0.0001	115.4	77.4	1.49	(1.32,1.69)	<0.0001	97.1	59.9	1.62	(1.47,1.79)	<0.0001
45-54	109.6	69.5	1.58	(1.33, 1.87)	<0.0001	132.3	75.0	1.77	(1.52,2.05)	<0.0001	121.5	72.2	1.68	(1.50,1.88)	<0.0001
55-64	249.5	121.8	2.05	(1.77, 2.37)	<0.0001	161.9	107.4	1.51	(1.28,1.78)	<0.0001	202.6	114.3	1.77	(1.59,1.98)	<0.0001
65 and older	384.0	246.9	1.56	(1.42, 1.70)	<0.0001	354.0	242.6	1.46	(1.34,1.59)	<0.0001	367.4	244.5	1.50	(1.41,1.60)	<0.0001
Age adjusted	115.8	69.1	1.68	(1.37, 2.07)	<0.0001	150.6	101.6	1.48	(1.35,1.91)	<0.0001	132.9	84.5	1.57	(1.42,1.84)	<0.0001

*Hospitalizations of newborns and infants younger than 1 year were excluded.
AI = American Indian; AN = Alaska Native; CI = confidence interval.

hospital use than the general population of non-Indian Californians living in the same counties. When these AIs/ANs are properly classified as a group and hospitalizations of all hospital and payer types are taken into account, the rates are substantially higher than previously reported.^{4,26} When expressed as standardized rates, the 1996 hospitalization rate of rural AIs/ANs in California (133 hospitalizations per 1000) is 60% higher than that of non-Indians (82 per 1000). The standardized hospitalization rate of rural AIs/ANs in California is also substantially higher than that for the national IHS user population rate (78 per 1000) and for the US population (115 per 1000)⁴ in spite of the fact that California hospitalization rates for the general population are lower than US rates. What the findings demonstrate is that IHS reporting of hospitalization rates for AIs/ANs who do not have access to IHS or tribal hospitals and largely depend on Contract Health Services funds for their hospitalizations does not include the majority of their hospitalizations. This effect lowers the national hospitalization rate for IHS users that IHS can report. In California, IHS was the expected primary payer for less than 4% of their hospitalizations (included in "Other Public Insurance," Table 2). Medicaid and Medicare are the predominant expected payer sources for the AI/AN population, and Medicare and private insurance are predominant for the non-Indian population (Table 2). After excluding hospitalizations for which Medicare was the expected payer in both groups, Medicaid and safety net sources (for the uninsured) were the expected payers for the majority (70%) of these hospitalized AIs/ANs but less than half (42%) of the non-Indians.

Routine reporting of hospitalizations for "Native Americans" on hospital discharge records in California underestimates hospitalization rates for AIs/ANs as well. The discharge data failed to identify 70% of the hospitalizations of the rural AIs/ANs in the IHS user population. In a national study, after years of efforts to improve racial and ethnic coding on Medicare enrollment files, Native Americans eligible for Medicare (not necessarily eligible for IHS services) were found to have higher hospitalization rates than white beneficiaries.¹⁶ Efforts to improve identification of AIs/ANs are needed on hospital discharge records as well.¹⁵ The standardized age-adjusted hospitalization rate for the group whose hospital discharge records indicated that they were "Native Americans" but who did not use IHS services (Table 2) is

TABLE 4. Comparison of the Distribution of Characteristics of Avoidable Hospitalizations of American Indians to Those of Non-Indians* in the Same Counties

	AI/AN			Non-Indians		P
	Observed	Adjusted	(%)	Observed	(%)	
	n = 421	n = 458		n = 740		
Sex						
Male	219	235	(51.3)	364	(49.2)	0.09
Female	202	223	(48.7)	376	(50.8)	
Age, years						
Younger than 15*	70	111	(22.9)	81	(10.9)	<0.0001
15-44	112	129	(26.6)	138	(18.6)	
45-64	96	99	(20.5)	128	(17.3)	
65-74	61	62	(12.8)	133	(18.0)	
75 and older	82	83	(17.2)	260	(35.1)	
Payer source						
Medicare	168	170	(35.7)	372	(50.3)	<0.0001
Medicaid	147	180	(37.9)	125	(16.9)	
Other public	4	4	(0.9)	8	(1.1)	
Private	43	47	(9.8)	188	(25.4)	
Uninsured	59	75	(15.7)	47	(6.4)	

*Hospitalizations of newborns and infants younger than 1 year were excluded.

AI = American Indian; AN = Alaska Native.

50 per 1000, or nearly 40% lower than the rate for non-Indians (82 per 1000, Table 3), because the hospital discharges with misclassified race or ethnicity are unknown. If the rate of misclassification were as high as that found for the IHS user population, then the actual hospitalization rate for the nonuser population would be 166 per 1000 or twice as high as that of non-Indians, and even higher than that of the user population.

At least part of the increased hospital use by the AI/AN user population is likely to be associated with problems in access to ambulatory care. In this study, when diagnoses were restricted to those thought to be preventable with access to ambulatory care, the hospitalization rates of rural California AIs were more than twice as high as those for other Californians. For the AI/AN men age 45 to 64 years and women older than 64 years, they are more than 3 times as high. A growing number of studies have linked avoidable hospitalization rates with various patient, provider, and payer factors associated with factors in access to care: socioeconomic status,^{20,25} health-seeking behaviors,²³ availability of ambulatory care providers,^{23,24} and coverage of care.¹⁹ Further research with larger samples of AIs/ANs is needed to determine the extent to which the high preventable hospitalization rates are associated with the various patient,

provider, and payer factors associated with access to care. For rural AIs/ANs, there are a number of factors in access to care that have already been documented to be of particular importance and in need of further study, including culturally appropriate care, appropriate specialty care, and distance and transportation to care.^{1,3,8,9}

The disparities in hospitalizations and avoidable hospitalizations over a wide range of ages for the AI/AN men and women users of IHS services are consistent with a general conclusion that additional health resources are needed in rural Contract Health Service delivery areas of the IHS in California. Finance of improved access to ambulatory care for rural AIs/ANs who depend on Contract Health Services is complicated by limited IHS funding. In recent years, the entire AI health care system has grown to rely more both on IHS contracts with tribes and on Medicaid and Medicare to finance health care, and less on the IHS providing direct services.^{13,31} By 1996, IHS operated only 113 of 492 ambulatory care facilities.³¹ A 1997 survey of tribal leaders projected that by 2002, only 6% of tribes would have ambulatory care provided directly by the IHS.³² The IHS does not own or operate clinics in California. Instead, groups, tribes, or tribal consortia form rural Indian health programs and depend to varying extents on

TABLE 5. Avoidable Hospitalization Rates (per 10,000 People) and Risk Ratios of Rural American Indians Compared With Non-Indian Californians Living in the Same Counties, by Age and Gender

	Males			Females			All							
	Risk Ratio	(95% CI)	P	Risk Ratio	(95% CI)	P	Risk Ratio	(95% CI)	P					
	AI/AN	Per 1000	AI/AN	Per 1000	AI/AN	Per 1000	AI/AN	Per 1000	Non-Indians					
Age in years														
Younger than 15*	10.4	2.69	(1.77, 4.10)	<0.0001	7.4	3.2	2.28	(1.40, 3.71)	0.0007	8.9	3.6	2.50	(1.82, 3.44)	<0.0001
15-44	4.1	1.24	(0.84, 1.82)	0.2738	7.6	3.1	2.50	(1.78, 3.49)	<0.0000	5.9	3.2	1.85	(1.45, 2.38)	<0.0001
45-64	22.8	3.08	(2.17, 4.39)	<0.0001	12.3	7.6	1.62	(1.08, 2.42)	0.0184	17.3	7.5	2.30	(1.79, 3.00)	<0.0001
65-74	43.0	1.95	(1.26, 3.02)	0.0025	43.4	18.6	2.33	(1.56, 3.51)	<0.0000	43.3	20.2	2.14	(1.59, 2.89)	<0.0001
75 and older	126.4	2.32	(1.70, 3.17)	<0.0001	67.5	47.1	1.43	(0.99, 2.09)	0.0603	91.0	50.1	1.82	(1.43, 2.30)	<0.0001
Age adjusted	19.4	2.26	(1.39, 2.98)		14.5	7.7	1.87	(1.46, 3.17)		16.5	8.1	2.04	(1.59, 2.73)	

*Hospitalizations of newborns and infants younger than 1 year were excluded. AI = American Indian; AN = Alaska Native; CI = confidence interval.

IHS for funding the operations of their facilities, health programs, and Contract Health Services (P.L.93-638 Indian Self Determination Act). The clinics deliver a limited range of community-oriented primary preventive and therapeutic health services, and there are few if any providers of specialty medical care at any time in the clinics. As a result of limited funding, however, access to ambulatory specialty care, especially that culturally relevant to AIs/ANs, is a significant challenge.^{1,12-14,33}

The Indian Health Care Improvement Act provides an opportunity for the IHS and tribes to improve financing of access to ambulatory care and to reduce inefficient use of hospital care. The Federal Disparity Index methodology developed for implementation of the law is influential for health planning, outcome measurement, and resource allocation of the IHS and Indian tribes.⁷ The index relies primarily on disparities in death, birth, and poverty rates.⁷ The findings of this study indicate that determinations of disparities in hospitalization rates, especially avoidable hospitalization rates, may also be helpful in resource allocation for unmet health needs of AIs/ANs. A number of studies have already indicated that disparities in hospitalization rates for specific groups of diseases can be useful in tracking the health care needs of AIs across the country.^{10,11,34,35}

A number of potential limitations to this study should be taken into consideration. First, as with most IHS published studies, the AIs/ANs in this study were identified through the use of a primary care clinic (at least once in 2 years) and then compared with a population that was not identified through a source of health care. The "active user" type of files are used in this study and those of IHS as opposed to tribal enrollment files, because enrollment files contain records of AIs/ANs who have moved out of the service delivery area, and there are no files for AIs/ANs enrolled in tribes outside California who have moved into service delivery areas. While many visits to rural Indian health program clinics address preventive care or minor ailments,^{9,26} the IHS user population may have higher levels of underlying disease or conditions than those of the entire rural AI/AN population, and may therefore have higher hospitalization rates. This could be true because hospitalization rates of "Native Americans" who did not use IHS services were estimated anywhere from 40% lower than the rates of non-Indians to 166% more, depending on the extent of ethnic misclassification.

The adjustment of hospitalization rates for AIs/ANs with missing SSNs also has to be considered a limitation of this study. We performed comparisons of hospitalization and avoidable hospitalization rates both with and without adjustment for missing SSNs to those for the entire population in the 37 counties in a technical report (Korenbrod and Ehlers, Unpublished data, 2001). Without the linkage adjustment, age-adjusted hospitalization rates for the AIs/ANs were still at least 16% higher than the rates for California as a whole, and avoidable hospitalization rates were 25% higher. These disparity measures are known to be underestimates because they assume no missing SSNs among AIs/ANs. The California Department of Health Services has entered into an agreement with IHS and the California Rural Indian Health Board to perform more linkages to state health databases in the future, and will use more fields of information than SSNs. Still, the addition of probabilistic matches using name, date of birth, and gender has so far increased the number of linked records by only 1%. Future studies with larger samples for rural AIs/ANs that include the increasing numbers of infants and children with SSNs should reduce these limitations and expand the determination of health needs.

Finally, any generalization of the findings from this study of rural California AIs/ANs to AIs/ANs in other rural areas must be made with caution. There is great diversity in health and health care among AIs/ANs, as well as extensive commonalities. California AIs/ANs have had their own history with the IHS.¹⁴ The phenomena of underreporting of AI/AN hospitalizations if only IHS-paid hospitalizations are quantified and misclassifying AIs/ANs on state health records occur in all areas of the country to some degree, but they may have had a greater effect of masking the health needs and resource efficiency of AIs/ANs in California and other areas that rely on Contract Health Services for specialized care more than other areas of the country.

Acknowledgments

We would like to thank the California Area Office of the IHS who approved this linkage of record by the California Department of Health Services. No personal identifying information of any AI/AN was disclosed by the California Department of Health Services with researchers at the University of California, San Francisco.

We would also like to express our gratitude to the following people who have helped in this study and provided suggestions to improve earlier versions of this manuscript: Dorothy Rhoades, MD, MPH, Native Elder Research Center, University of Colorado Health Sciences Center, and the University of Washington School of Medicine; the California Department of Health Services, Center for Health Statistics, Office of Health Information and Research; and Chi Kao, PhD, and Sabrina Wong, PhD, of our research group at the Institute for Health Policy Studies.

References

1. **Cunningham PJ.** Health care utilization, expenditures and insurance coverage for American Indians and Alaska Natives eligible for the Indian Health Service. Institute of Medicine. In: Cunningham PJ, ed. *Changing Numbers, Changing Needs*. Washington, DC: National Academy Press; 1996:31–60.
2. **Title 25 Indians.** Sec. 1621. Indian Health Care Improvement Fund [U.S. Code Online web site]. January 2, 2001. Available at: http://www.access.gpo.gov/uscode/title25/chapter18_subchapterii.html. Accessed March 24, 2002.
3. **Cunningham PJ, Cornelius LJ.** Access to ambulatory care for American Indians and Alaska Natives: relative importance of personal and community resources. *Soc Sci Med* 1995;40:393–407.
4. **Indian Health Service.** Trends in Indian Health [Indian Health Service Web site]. November 8, 1998. Available at: <http://www.ihs.gov/PublicInfo/publications/trends97/trends97.asp>. Accessed March 24, 2002.
5. **Brenneman GR, Handler AO, Kaufman SF, et al.** Health status and clinical indicators. In: Rhoades ER, ed. *American Indian Health: Innovations in Health Care, Promotion and Policy*. Baltimore, MD: Johns Hopkins University Press; 2000:103–121.
6. **Indian Health Service.** Regional Differences in Indian Health, 1998–99 [Indian Health Service Web site]. January 9, 2000. Available at: <http://www.ihs.gov/PublicInfo/Publications/trends98/region98.asp>. Accessed March 24, 2002.
7. **Indian Health Service.** Final Results for the 2001 Indian Health Care Improvement Fund. April 1, 2001. Available at: <http://www.ihs.gov/NonMedicalPrograms/Lnf/>. Accessed March 24, 2002.
8. **Cunningham PJ.** Access to care in the Indian Health Service. *Health Aff* 1993;12:226–233.
9. **Dixon M.** Access to care for American Indians and Alaska Natives. In: Dixon M, Roubideaux Y, eds. *Promises to Keep: Public Health Policy for American Indians and Alaska Natives*. Washington, DC: American Public Health Association Press; 2001:61–88.

10. **Holman RC, Curns AT, Kaufman SF, et al.** Trends in infectious disease hospitalizations among American Indians and Alaska Natives. *Am J Public Health* 2001;91:425–431.
11. **Hisnanick JJ, Coddington DA, Gergen PJ.** Trends in asthma-related admissions among American Indian and Alaskan native children from 1979 to 1989. *Arch Pediatr Adolesc Med* 1994;148:357–363.
12. **Rhoades ER.** History and organization of Indian Health Services and systems. In: Rhoades ER, ed. *American Indian Health: Innovations in Health Care, Promotion and Policy*. Baltimore, MD: Johns Hopkins University Press; 2000:74–92.
13. **Rhoades ER.** American Indians and the private health care sector. *West J Med* 2002;176:7–9.
14. **Dixon M.** Unique role of tribes in the delivery of health services to Native Americans. In: Dixon M, Roubideaux Y, eds. *Promises to Keep: Public Health Policy for American Indians and Alaska Natives*. Washington, DC: American Public Health Association Press; 2001:31–60.
15. **Blustein J.** The reliability of racial classification in hospital discharge abstract data. *Am J Public Health* 1994;84:1018–1021.
16. **Eggers PW, Greenberg LG.** Racial and ethnic differences in hospitalization rates among aged Medicare beneficiaries, 1998. *Health Care Financ Rev* 2000;21:91–105.
17. **Sullivan M, Grossman DC.** Hospitalization for motor vehicle injuries among American Indians and Alaska Natives in Washington. *Am J Prev Med* 1999;17:38–42.
18. **Liu LL, Stout JW, Sullivan M, et al.** Asthma and bronchiolitis hospitalizations among American Indian children. *Arch Pediatr Adolesc Med* 2000;154:991–996.
19. **Weissman JS, Gatsonis C, Epstein AM.** Rates of avoidable hospitalizations by insurance status in Massachusetts and Maryland. *JAMA* 1992;268:2388–2394.
20. **Pappas G, Hadden WC, Kozak LJ, et al.** Potentially avoidable hospitalizations: inequalities in rates between US socioeconomic groups. *Am J Public Health* 1997;87:811–816.
21. **Kozak LJ, Hall MJ, Owings MF.** Trends in avoidable hospitalizations, 1980–1998: a national indicator of gaps and improvements in access to care. *Health Aff (Millwood)* 2001;20:225–232.
22. **Millman M, ed.** *Access to Health Care in America*. Institute of Medicine. Washington, DC: National Academy Press; 1993.
23. **Bindman AB, Grumbach K, Osmond D, et al.** Preventable hospitalizations and access to health care. *JAMA* 1995;274:305–311.
24. **Falik M, Needleman J, Wells BL, et al.** Ambulatory care sensitive hospitalizations and emergency visits: experiences of Medicaid patients using federally qualified health centers. *Med Care* 2001;39:551–561.
25. **Blustein J, Hanson K, Shea S.** Preventable hospitalizations and socioeconomic status. *Health Aff* 1998;17:177–189.
26. **California Area Office.** California Area 1994–95 profile of the Indian Health Service. Sacramento, CA: California Area Office, Indian Health Service; 1995.
27. **SAS** [computer program]. Version 8.2. Cary, NC: SAS Institute; 2001.
28. **California Department of Health Services.** Race/Ethnic Population Estimates, April 1990 to July 1999. April 10, 2001. Available at: <http://www.dof.ca.gov/HTML/DEMOGRAP/repndat.htm>. Accessed: February 26, 2003.
29. **Klein RJ, Schoenborn CA.** Age adjustment using the 2000 projected U.S. population. *Healthy People 2010 Stat Notes* 2001;20:1–12.
30. **Epi Info 2000** [computer program]. Version 1.1.2. Atlanta, GA: Centers for Disease Control and Prevention; 2001.
31. **Dixon M, Mather D, Shelton BL, et al.** Organizational and economic changes in Indian health care systems. In: Dixon M, Roubideaux Y, eds. *Promises to Keep: Public Health Policy for American Indians and Alaska Natives*. Washington, DC: American Public Health Association Press; 2001:89–121.
32. **Dixon M, Shelton BL, Roubideaux Y, et al.** Tribal Perspectives on Indian Self-determination and Self-governance in Health Care Management. Vol 4. Denver, CO: National Indian Health Board; 1998.
33. **Cunningham PJ, Altman BM.** Use of ambulatory health care services by American Indians with disabilities. *Med Care* 1993;31:600–616.
34. **Lowther SA, Shay DK, Holman RC, et al.** Bronchiolitis-associated hospitalizations among American Indian and Alaska Native children. *Pediatr Infect Dis J* 2000;19:11–17.
35. **Holman RC, Parashar UD, Clarke MJ, et al.** Trends in diarrhea-associated hospitalizations among American Indian and Alaska Native children, 1980–1995. *Pediatrics* 1999;103:E11.