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DISPARITIES IN HOSPITALIZATIONS OF AMERICAN INDIANS AND ALASKA NATIVES WHO USE TRIBAL HEALTH PROGRAMS

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SUMMARY

Little is known about the health status of American Indians and Alaska Natives (AIAN) in California. While state hospitalization data can provide information about the health status of a variety of populations, the race information in the data is too unreliable for AIAN unless it is corrected. For the well-defined population of AIAN in California in this report we found that 60% of their hospitalizations were misclassified in other race categories (Figure 1).

The purpose of this study is to present hospitalization rates for AIAN that are corrected for racial misclassification and therefore can be used as health status indicators. While deaths could also be corrected for racial misclassification and used as indicators of health status, death rates are much lower than hospitalization rates and therefore more difficult to use for small areas or subgroups of AIAN. Since hospitalizations depend not only on health status, but also on hospital admission policies of physicians, hospitals and insurers locally, we present the hospitalization rates for AIAN compared to those of White, non-Hispanic people who live in the same counties. In this way the rates are adjusted for area-specific practices. Restricting the reference population to non-Hispanic White people is done so that the disparities in the indicator that result between the AIAN and the White population are more reflective of sociopolitical race and class differences than if the reference group included Hispanic White people.

The AIAN population for this report is that of AIAN entitled to health care through the Indian Health Service in 24 Tribal Health Programs owned and operated by tribes in California. These AIAN are enrolled members of federally recognized tribes or descendants of a roll taken of American Indians in California in 1852. The 24 Tribal Health Programs are those that provide their own clinic services as well as contracting for care from other providers, and account for more than 97% of all AIAN Active Users of Tribal Health Programs in California. The AIAN in this report were users of the Tribal Health Programs during the period between 1998 and 2002.

Findings

Age-specific Hospitalization Rates. After correction for racial misclassification, the hospitalization rates of AIAN are higher than Whites regardless of age group. (All rates are expressed per 10,000 people in the group) (Figure 3).

Under age 15, the hospitalization rate is 368 per 10,000 for AIAN boys compared to 165 for AIAN girls, and 302 for AIAN girls compared to 136 for their White counterparts.

For ages 15 to 44, women are of reproductive age and have higher rates of hospitalization than males whether AIAN or Whites. But for both genders in this age group, AIAN hospitalization rates are higher than those of Whites. For AIAN women the rate is 1,732 per 10,000, while for White women it is 1,071. For AIAN men the rate is 661 compared to 400 for White men.

For ages 45 to 64, the hospitalization rate for AIAN men is 1,666 per 10,000 compared to 987 for Whites; and for AIAN women 1,594 compared to 1,028 for Whites.

Over age 65, hospitalization rates are closer for AIAN and Whites: 3,406 per 10,000 for AIAN men and 3,196 for White men; while 3,330 for AIAN women and 3,090 for White women.

Age-adjusted Hospitalization Rates. After adjustment for age differences between AIAN and Whites, there are significant disparities in hospitalization rates between AIAN and Whites. AIAN rates are higher than those of Whites whether men or women are analyzed separately or combined, and regardless of the year analyzed. Confidence Intervals (CI) were obtained based on 95% lower and upper confidence limits for each rate.

For AIAN the average annual age-adjusted hospitalization rate is 1,424 per 10,000 (CI is 1,406 to 1,442), while for Whites the rate is 981 (CI is 974 to 988) (Figure 4, Table 1).

For AIAN men the rate is 1,180 per 10,000 (CI is 1,154 to 1,206), compared to 843 for Whites (CI is 834 to 852) (Table 1).

For AIAN women the rate is 1,614 per 10,000 (CI is 1,590 to 1,639), compared to 1,129 for Whites (CI is 1,119 to 1,140) (Table 1).

For AIAN in California the annual age-adjusted hospitalization rate is 1,424 per 10,000 (CI is 1,406 to 1,442) compared to 1,143 for all races in the US during 2000, and 1,187 during 2002 (Figure 4, Table 1).

Ratios of Age-adjusted Hospitalization Rates. AIAN are hospitalized 45% more than Whites (Rate Ratio 1.45, with CI of 1.42 to 1.48). The Ratios vary little from year to year.

AIAN men are hospitalized 40% more than White men (Rate Ratio 1.40, CI 1.35 to 1.45).

AIAN women are hospitalized 43% more than White women (Rate Ratio 1.43, CI 1.39 to 1.47).

When considering the annual rate ratios by gender, the AIAN have rates that are at least 37% higher than Whites in any year.

The California AIAN hospitalization rate for 1998 to 2002 was 25% higher than the US rate for all races in 2000, and 20% higher than the rate in 2002.

Conclusions

The findings indicate that AIAN who use rural Tribal Health Programs have hospitalization rates that are consistently at least 40% higher than the White non-Hispanic general population who live in the same counties. AIAN have disproportionately higher hospitalization rates across all years for major age groups and both genders. The disparities in hospitalization rates between AIAN and Whites could be the result of higher prevalence of disease, or similar prevalence of disease with decreased access to prevention or specialty care. In both cases AIAN would have higher levels of morbidity, but different health care and policy improvements would be indicated depending on whether the condition is best approached through improving access to prevention or treatment services, or improving the effectiveness of either type of services.

Investigation of the reasons for disparities in hospitalizations of AIAN can help focus programs and policies on the types of health care needed to reduce the disparities. With the correction for racial misclassification through linkage to IHS registries, disparities in hospitalizations for specific causes of morbidity can now be analyzed, and the findings from such analyses will be presented in the next report of this series.

Investigation of how AIAN hospitalization disparities vary among different Tribal Health Programs can help to focus on AIAN with lowest health status who could use the greatest attention and resources. Analyses of hospitalization disparities at the level of the Tribal Health Program will be released in a future report of this series.

INTRODUCTION

California has more American Indians and Alaska Natives (AIAN) than any other state. In the 2000 Census there were 627,562 people who reported that their racial heritage was either AIAN alone or in combination with one or more other races (US Census, 2000).¹ California also has more federally recognized American Indian tribes than any other state, with 107 out of the total of 555 nationally (Federal Register, December 5, 2003). There are also California Indians who are not enrolled in federally recognized tribes but who are descendants of Indians residing in California in 1852 who were the beneficiaries, or their descendants, of the contentious 1964 settlement of the federal land claim for the taking of California (IHS 2000). A third group of AIAN in California are those enrolled members of federally recognized tribes from all over the US who have relocated to California, many as part of US government relocation programs. In addition, California has substantial numbers of people who are American Indians from Mexico, Central and South America, and Canada who are immigrants or US born. For reasons explained below, the population of AIAN relevant to this report are AIAN who are enrolled in federally recognized tribes or are descendants of American Indians living in California in 1852.

The health status of AIAN in California is largely unknown despite the tremendous AIAN population living in this state. One approach that can be used to determine the health of AIAN is to use hospitalizations, but only after identifying the hospitalizations of AIAN. Hospitalizations can provide valuable information on health status of populations (CDC et al, 2004). Many states compile hospitalization data files to help track population health status (Merrill and Elixhauser, 2002). Hospitalizations occur when a health condition becomes so debilitating that it requires round the clock medical care, or a therapeutic intervention provided safely only in a hospital. Because hospitalizations occur more frequently than deaths they can

be used to study smaller populations and subgroups of populations and a wider variety of health problems.

Although hospitalizations can be used to determine the health of AIAN they can only be useful when hospital records for AIAN are accurately classified. One of the main reasons that little has been known about the AIAN health status in California is because ‘race’ information on the state health data bases is unreliable for AIAN. More than two-thirds of AIAN were found to be misclassified in California hospitalization data files in 1996 (Korenbroet et al, 2003). AIAN who were inaccurately classified as some other race were most often classified as White. Part of this ‘misclassification’ may be due to the most common mixed racial group being White and AIAN, and because many AIAN have English surnames. It is hospital officials, or people other than the patients, that often classify race on the forms used for these state health data bases rather than people classifying their own race as is done with the Census. Other factors contributing to AIAN racial misclassification in hospital records have been hypothesized to include: low population density of AIAN living in an area and long distance from large tribal lands. In California the population density of AIAN is 1.5%, and though there are more than 100 tribal land areas that totaled 520,000 acres in 1990, most are not large areas.

Racial misclassification results in an underestimation of AIAN hospitalization rates. While AIAN in the denominators are based on US Census data where self-declaration defines AIAN race, they are undercounted in the numerators that rely on state data for hospitalizations. Therefore rates of hospitalizations that are based on information from state hospital data bases are artificially low (Korenbroet et al, 2003; Appendix A).

One way to overcome the problem of racial misclassification is to link a tribal or other registry of AIAN living in California to hospitalization data instead

¹ We use the term ‘American Indians and Alaska Natives’ to describe descendants of native indigenous peoples in this report because it describes the major racial group used to group native people in state health data, and it describes the more limited group of native people eligible for the Indian Health Service registry.

of relying on the ‘race’ information provided in the state data base. The registry provides the same AIAN definition for the numerator and the denominator. The Indian Health Service (IHS) maintains a National Patient Information Registry System (NPIRS) of AIAN who use IHS funded programs and meet their eligibility criteria for services.²

The NPIRS registry of AIAN users of IHS funded health care was designed for public health planning and accountability. IHS ‘Active’ Users are AIAN who are enrolled members of federally recognized tribes, and who used an IHS funded service at least once in either the year the data was reported, or in the 2 years prior to the reporting year. In California, descendants of the “1852 Indians” who are not members of federally recognized tribes described above are also eligible for IHS funded health care and included in the registry if they use IHS funded care.

Active Users of IHS funded health care in California are AIAN who use Tribal Health Programs (THP) or Urban Indian Health Programs. California tribes have organized tribal consortia that pool their IHS funds to operate THP that provide either direct care and contract care, or contract care only. Direct care consists of comprehensive primary care (medical, dental) and limited ancillary services provided in their own facilities (usually laboratory and pharmacy, emergency transportation), and contract care is specialty (medical, dental, vision, behavioral) or specialized ancillary care (diagnostic imaging, durable medical equipment). Currently there are 24 THP with direct care facilities and contract care programs, and 6 with contract care only. Tribes provide direct care in clinics, and can use IHS Contract Health Service (CHS) funds to make referrals and purchase specialty ambulatory care or hospitalizations from non-tribal facilities or

providers. Counties that include tribal lands are referred to as Contract Health Service Delivery Areas (CHSDA). There are also 6 Urban Indian Health Programs with direct care only. There is no IHS or tribal hospital in California, and therefore AIAN are hospitalized in the same hospitals as non-AIAN.

By linking the NPIRS registry data files for the THP with those for every hospital discharge in the state, the hospitalizations of these AIAN who use the THP can be analyzed to determine the extent and causes of severe morbidity (Korenbroet et al, 2003). State hospital data provide comparative information on hospitalizations for other groups that are not misclassified to the extent of AIAN, such as Whites. The differences with the sociopolitical dominant racial group, White non-Hispanics, provide a measure of disparities in health status that can be reasonably achieved with equitable health care and living conditions.

The primary purpose of this report is to provide information on the health status of AIAN Active Users in the NPIRS registry during 1998 to 2002. Because hospitalization admissions and discharges reflect health care practices that can vary from place to place, it is important to compare hospitalization rates for one group to those of another group in the same hospital service areas. In this way differences in hospitalizations between groups of people that should be treated the same are more valid as indicators of health status and not differences in hospital practices. For this reason this report presents the extent of disparities in hospitalization rates of AIAN Active Users in California with those of White non-Hispanics (hereafter referred to as AIAN user and White populations) who live in the same area.

² The US Government became responsible through constitutional case law for providing health care and other services to AIAN as compensation for land, mineral and water rights that AIAN lost. The IHS became the responsible agency for providing health care through the Transfer Act of 1954. Under the Indian Self-Determination and Education Assistance Act of 1975 (P.L.93-638) tribes have the option of operating their own direct care facilities and contract care programs (Dixon et al, 2001; Grossman 2003; Rhoades 2000).

METHODS

Populations

AIAN Population. The AIAN population of interest for this report refers to AIAN who were Active Users of tribally owned and operated THP in California (California Area IHS, 2006). Active Users are AIAN who are enrolled members of federally recognized tribes or descendants of Indians documented in California on June 1, 1852 (IHS 2000), and who used an IHS funded service in a THP at least once in either the Federal Fiscal Year (FFY) the data was reported, or in the 2 years prior to the reporting year.

The AIAN Active User data was obtained from the IHS National Patient Information Registry System (NPIRS) Active User Demographic data files for the California Area from FFY 1998 to 2002.

Data for Users of the 24 rural THP that provided their own direct services (clinic services) as well as contract health services (other providers) was included. From this population of AIAN Active Users infants, i.e. users less than 1 year of age, were excluded. Infants were excluded since most do not have Social Security Numbers (SSN) necessary for the linkage process (see Appendix B). The resulting AIAN Active Users will be referred to as either 'AIAN user population', 'AIAN users', or 'AIAN' hereafter.

White Population. The comparison group is that of White non-Hispanics who resided in counties where THP service areas are located, i.e. the IHS Contract Health Service Delivery Area (CHSDA). The population of non-Hispanic Whites in the 37 CHSDA counties was determined after excluding infants, since infants were excluded from the AIAN population. In addition, an adjustment to the population had to be made for calculation of hospitalization rates because a random sample of the hospitalizations of Whites was used. A statistical sampling adjustment has been done to ensure that the White population denominators correspond to the White hospitalization numerators when determining rates (Appendix C). The White non-Hispanic population will be referred to as 'White non-Hispanics' or 'Whites' hereafter.

The data source for the White population by county for 1998 and 1999 was obtained from the U.S. Census. In the 2000 Census people with mixed racial heritage were able to respond with multiple races. Therefore for 2000 and beyond Bridged Race Estimates were developed from Census data by the National Center for Health Statistics to account for people of mixed race (NCHS 2004).

Hospitalizations

AIAN Hospitalizations. The data source for hospitalizations is the Patient Discharge Data obtained from the Office of Statewide Health Planning and Development of the California Department of Health Services. PDD data contains all records of people discharged alive from short-stay, non-federal health facilities in California.

AIAN hospitalizations are from patient discharge data for the California Department of Health Services for hospitalizations in calendar years 1998 and 2002 that were linked by SSN to IHS NPIRS Active User files for FFY 1998 to 2002 (Korenbroet et al, 2003). The linkage was done by the Center for Health Statistics in the Office of Health Information and Research (CHS/OHIR) of the California Department of Health Services (Appendix A). Separate linkages were performed for AIAN and hospitalizations in each of the five years. Hospitalization data that had missing SSN data could not be linked to the NPIRS Active User files and therefore an adjustment for missing SSN was done to account for missing SSN on patient discharge data (Appendix B). All hospitalizations of infants were excluded because they are underrepresented in the NPIRS file and have large rates of missing SSN in the patient discharge files and could not be linked.

White Hospitalizations. The hospital data for Whites was obtained from Patient Discharge Data files for calendar years 1998 to 2002 prepared by the CHS/OHIR of the California Department of Health Services. Data records that linked to the NPIRS files were flagged with a special indicator.

Records were excluded if they were flagged, the Race was not White, or the Ethnicity was Hispanic. Hospitalizations of White infants were also excluded because they were excluded from the AIAN population. A simple random sample of the remaining White non-Hispanic hospitalizations was selected from aggregated data between 1998 and 2002 without replacement so that the White hospitalization sample size would be only 3 times as large as the AIAN hospitalization sample size (i.e. adjusted for missing SSN). In this way statistical comparisons between AIAN and White hospitalizations, hospitalization rates and rate ratios can be made with a sample size for Whites as large as possible, without being so large that any difference tested between the two groups would be statistically significant.

Hospitalization Rates

Rates are expressed as hospitalizations per 10,000 people at-risk.

Linkage adjusted AIAN hospitalization rates. The crude hospitalization rate is defined as the number of linkage-adjusted AIAN hospitalizations divided by their corresponding population (Appendix B).

White hospitalization rates. The crude hospitalization rate is defined as the number of White hospitalizations divided by their corresponding population (Appendix C).

Age-adjusted hospitalization rates. The age-adjusted hospitalization rates were obtained by determining the age-specific crude hospitalization rates for each gender and year. The age categories were: 1-14, 15-44, 45-64, 65 and older. These age categories were chosen because they were the same categories used for most national rates and thus allowed for comparisons (Klein et al., 2005). The age-specific rates for both AIAN and Whites were multiplied by the pro-

portion of the Standard Million population in each age group and added to age-adjust the rates to the Standard Million population. The age-adjusted hospitalization rate for AIAN in the 24 combined THP corresponds to that of the age-adjusted rate for Whites in the combined CHSDA counties (Appendix C).

Age-adjusted hospitalization rates are determined for 1-year and 5-year averages: 1998 to 2002.

Rate ratios. The rate ratio is a measure of the disparity that exists between the hospitalization rates of the AIAN and White populations. The rate ratio is obtained by dividing the age-adjusted AIAN hospitalization rate by the age-adjusted White hospitalization rate. The rate ratios are determined by gender using the annual and 5 year average hospitalization rates.

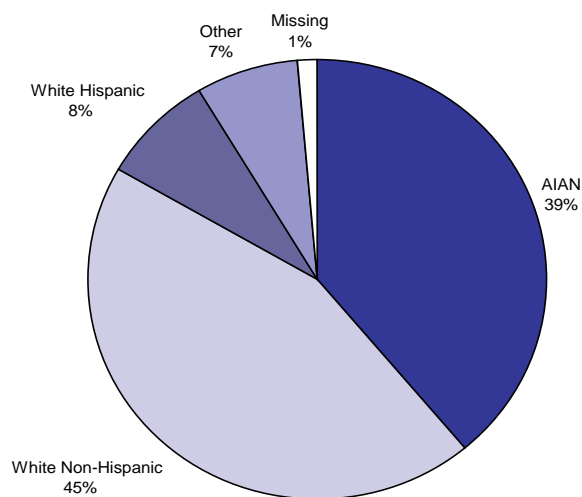
Statistical Significance. A determination of significance is based on analyzing confidence intervals (CI), with a 95% level of confidence, for the AIAN and White hospitalization rates and their corresponding rate ratio. Our criterion for a significant difference between two rates is that the 95% confidence intervals of two rates do not overlap. In this case a comparable statistical test of the significance would indicate that the difference between the estimates was statistically significant (Washington DOH, 2002). This criterion is conservative since in some cases in which the 95% confidence intervals of two rates do overlap a comparable statistical test would indicate that the difference between the estimates was statistically significant. An additional criterion to determine that rates are significantly different is based on verification that the CI for the rate ratio does not contain the value of 1.0.

Confidence Intervals were determined for rates according to Fay and Fauer in 1997 and for rate ratios according to Flanders in 1984.

RESULTS

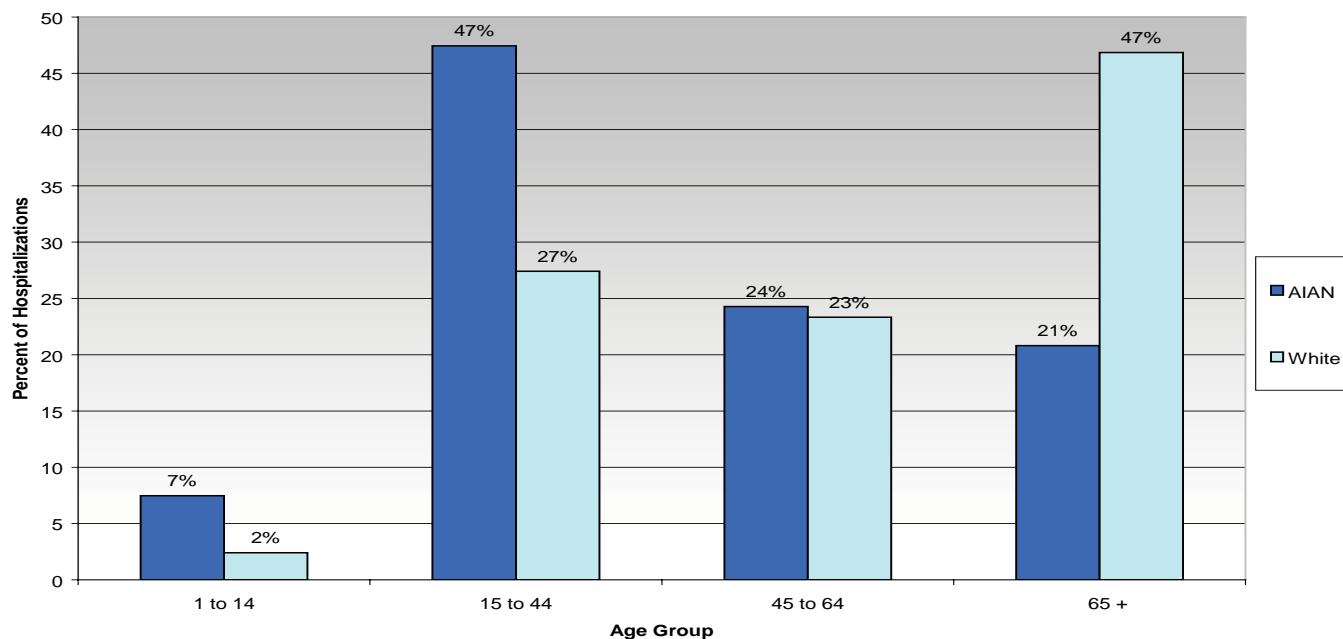
Racial Misclassification of AIAN in Hospital Data. Three out of every five (60%) AIAN users of Tribal Health Programs who were hospitalized were misclassified in hospital data in a racial group other than AIAN (Figure 1). The majority of misclassified AIAN users (53%) were incorrectly classified as Whites, of whom 45% were classified as White non-Hispanics and 8% as White Hispanics (Appendix A). Based on these findings a linkage method was used to resolve the issue of racial misclassification (Methods, Appendix B).

Figure 1. Racial Classification of AIAN who are IHS Active Users in California Hospital Records, 1998 to 2002.



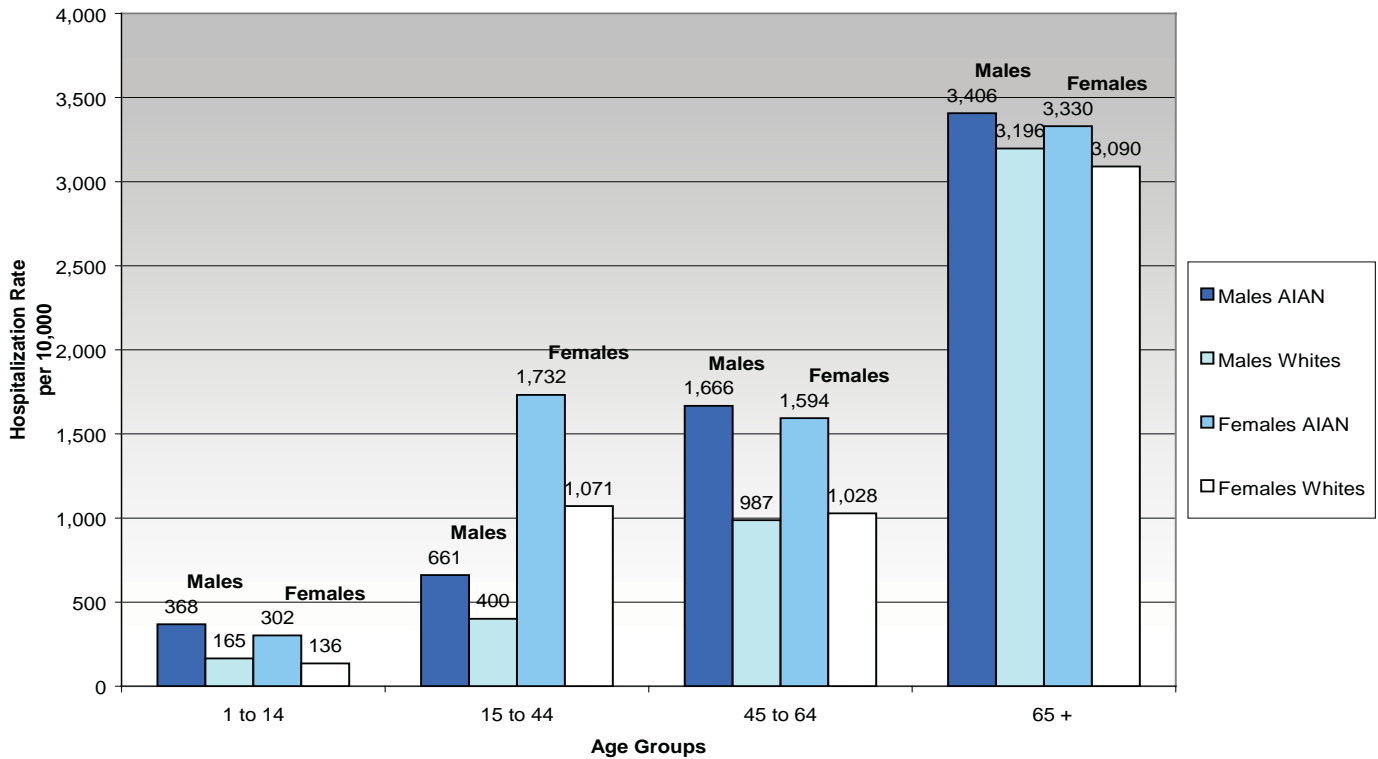
AIAN and White Hospitalizations. More hospitalizations of AIAN occur at younger ages than hospitalizations of Whites. Among AIAN hospitalizations 54% are for those under the age of 44 years compared to only 29% of White hospitalizations. Hospitalizations for youth under the age of 14 occur for 7% of AIAN compared to 2% of Whites (Figure 2). Some of this affect is due to the larger population of AIAN children who are under age 15 compared to Whites, and also because the age-specific hospitalization rates are greater for young AIAN than for Whites (Figure 3).

Figure 2. Hospitalizations for AIAN and Whites in California, 1998 to 2002.



Age-specific Hospitalization Rates. The age-specific hospitalization rates are greater for AIAN under age 15 than for Whites (Figure 3). In the age group 15 to 44 years of age, women are of reproductive age and have much higher rates of hospitalization than males whether AIAN or Whites, yet both AIAN males and females have higher rates than their White counterparts. In the 45 to 64 age group AIAN males and females also have higher rates than Whites. For people above the age of 65, hospitalization rates are more similar for AIAN and Whites.

Figure 3. Age-Specific Hospitalization Rates for AIAN and Whites by Gender, 1998 to 2002.



Age-adjusted Hospitalization Rates. After adjustment for differences in the population age distributions for AIAN and Whites, statistically significant disparities in hospitalization rates between AIAN and Whites have been identified. AIAN rates are higher than those of Whites whether males or females are analyzed separately or combined. For AIAN the average annual age-adjusted hospitalizations rate is 1,424 per 10,000, while for Whites the rate is 981. For AIAN females the rate is 1,614 per 10,000, compared to 1,129 for Whites. For AIAN males the rate is 1,180 per 10,000, compared to 843 for Whites. Hospitalization rates for AIAN are also higher than Whites during each year, and for each gender, or combined genders (Figure 4, Table 1).

Figure 4. Age-Adjusted Hospitalization Rates for AIAN and Whites, in California during 1998 to 2002, compared to US-All Races for 2000 and 2002.

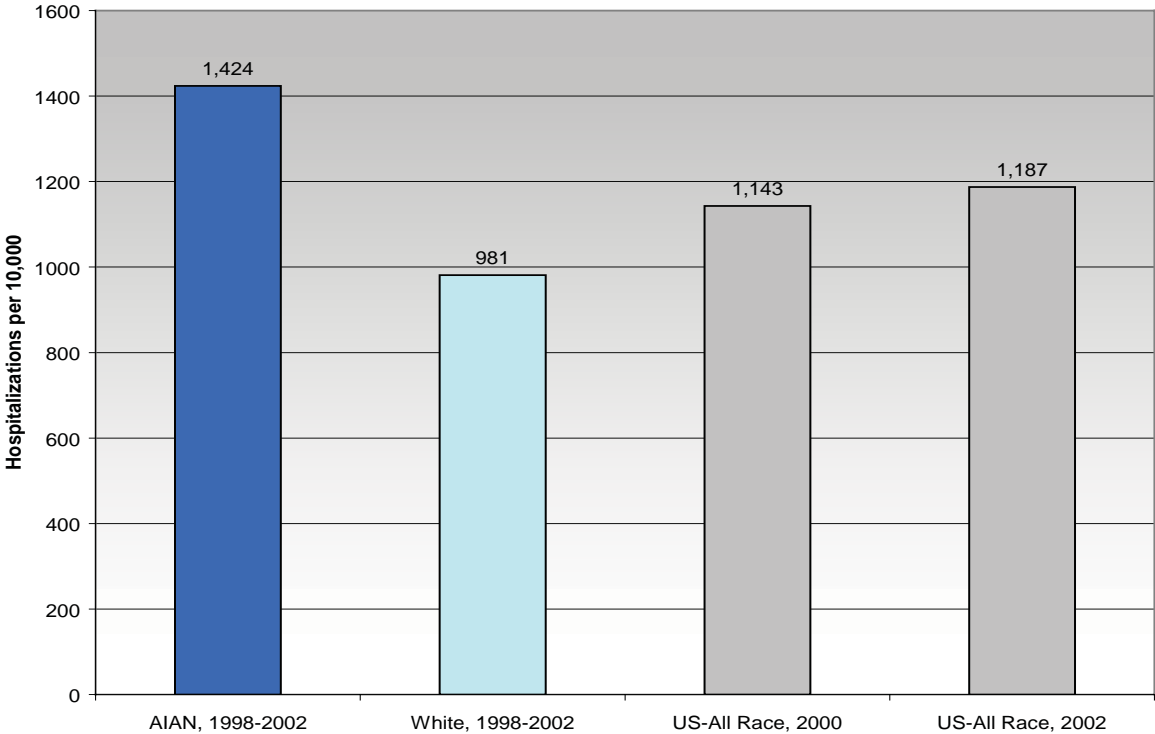


Table 1. Age-adjusted hospitalization rates for AIAN and Whites in California stratified by gender and year from 1998 to 2002, compared to US-All Races[^] in 2000 and 2002.

California Rate per 10,000									US-All Race [*] Rate per 10,000	
	Gender	1998	1999	2000	2001	2002	Average 1998-2002	95% CI ^{^^}	2000	2002
AIAN	Male	1,199	1,203	1,143	1,192	1,165	1,180	(1154,1206)		
	Female	1,624	1,590	1,601	1,608	1,649	1,614	(1590,1639)		
	All	1,443	1,416	1,400	1,425	1,438	1,424	(1406,1442)		
White	Male	838	849	836	846	843	843	(834,852)		
	Female	1,131	1,130	1,121	1,129	1,134	1,129	(1119,1140)		
	All	980	985	976	982	983	981	(974,988)		
US-All Races [^]	All								1,143	1,187

[^]US Source: *National Hospital Discharge Survey*, 2002. National Center for Health Statistics.

^{^^}Confidence Interval

Hospitalization Rate Ratios. The average Rate Ratio demonstrates that AIAN are hospitalized 45% more than Whites (with a 95% CI of 1.42 to 1.48). The average Rate Ratio for AIAN men from 1998 to 2002 is 40% higher than that of White men (95% CI 1.35, 1.45). AIAN women are hospitalized 43% more than White women (95% CI 1.39, 1.47). When considering the annual rate ratios by gender, the AIAN men have rates that are at least 37% higher than Whites in any year, and women at least 41% higher (Table 2).

Comparisons of AIAN Rates and Rate Ratios with US General Population. The average AIAN hospitalization rate for 1998 to 2002 was higher than the US rates for all races in 2000 and 2002. In 2000 the US rate for the General Population was 1,143 per 10,000 people and in 2002 it was 1,187 (Table 1). The AIAN hospitalization rate in California was 25% higher than the US-All Race rate in 2000 and 20% higher than the rate in 2002 (Table 2).

Table 2. Rate ratios of age-adjusted hospitalization rates for California AIAN compared to Whites by gender and year, during 1998 to 2002, and compared to US-All Races[^] in 2000 and 2002.

California AIAN to White Rate Ratio								California AIAN to US-All Race [^] Rate Ratio	
Gender	1998	1999	2000	2001	2002	Average 1998-2002	95% CI ^{^^}	2000	2002
Male	1.43	1.42	1.37	1.41	1.38	1.40*	(1.35, 1.45)		
Female	1.44	1.41	1.43	1.42	1.45	1.43*	(1.39, 1.47)		
All	1.47	1.44	1.43	1.45	1.46	1.45*	(1.42, 1.48)	1.25	1.20

[^]US Source: *National Hospital Discharge Survey*, 2002. National Center for Health Statistics.

^{^^}Confidence Interval

*Statistically significant differences.

DISCUSSION & CONCLUSIONS

The findings indicate that AIAN who use rural THP have hospitalization rates that are consistently about 45% higher than the White non-Hispanic population who live in the same counties. A significant disparity in hospitalization rates exists across all years for both genders and major age groups. However, before concluding that higher hospitalization rates for the AIAN user population demonstrate that they have lower health status than Whites, it is important to examine other potential explanations for the differences.

One potential explanation for higher hospitalization rates of the AIAN user population could be because they were a clinic user population and not a general population like the Whites and therefore had higher morbidity. In an earlier study of AIAN user hospitalizations for 1996, however, we compared the characteristics of the hospitalized AIAN users of the THP to those of hospitalized AIAN who did not link to the AI/AN user file (Korenbroet et al 2003) and the differences in characteristics of two hospitalized AIAN populations were small. The findings are consistent with the conclusion that the AIAN population that uses the THP primary care clinics at least once in 3 years is not likely to have much higher representations of people who are hospitalized more than the rest of the AIAN population in the area. The differences in proportions of AIAN users and non-AIAN users who are either uninsured or privately insured were much smaller than the differences with Whites. Furthermore if the racial misclassification rate was the same for the non-AIAN user group as for AIAN users the hospitalization rate for the non-AIAN users would be even higher than that of the AIAN user population. This is possible if the non-AIAN user group contains more AIAN without access to preventive care that is as effective as that of the THP. In any case it does not appear that the AIAN user population is particularly more likely to be hospitalized than other AIAN in the contract care counties of California.

The disparities in hospitalization between AIAN and Whites could be the results of higher prevalence

of disease, or similar prevalence of disease with decreased access to prevention services or specialty care (Grossman, 2003). In both cases AIAN would have higher levels of morbidity, but different health care and policy improvements would be indicated depending on whether the condition is best approached through improving access to prevention or treatment services or effectiveness of the services.

Implications for Improvements in Health Care.

Investigation of specific reasons (the diagnoses) for hospitalizations can help focus services for AIAN on the types of health care needed to reduce disparities in health. Racial misclassification of hospitalization data had previously prevented investigation of hospitalizations of AIAN by major causes of disease. However with the reduction in racial misclassification through linkage to registries, disparities in hospitalizations for specific causes can now be analyzed. In the next report in the *American Indian Health in California* series the diagnostic reasons for the hospitalizations in this report are being used to analyze the potential causes of hospitalization disparities.

For AIAN, as for all others in the US, there has been growth in the extent to which diseases are related to unhealthy 'lifestyle' behaviors rather than infections. The extent to which behavior-related diseases underlie the higher hospitalization rates for AIAN in California in this report needs to be investigated. In the next report tobacco-related, alcohol, and alcohol and drug-related hospitalizations will be analyzed. If there are large disparities in these behavior-related hospitalizations, then behavior modification programs designed by and for AIAN are likely to help reduce disparities in these hospitalizations.

The extent to which chronic diseases such as diabetes, heart disease, cancer and asthma could help explain disparities in hospitalization rates will be investigated. In the next report the disparities in hospitalizations for these diagnoses will be analyzed. If there are large disparities in these chronic disease hospitalizations, then prevention and treat-

ment programs designed by and for AIAN to prevent chronic diseases and their complications are likely to help reduce disparities in hospitalizations.

In a previous report in this series we found large disparities in mortality rates due to injuries for this AIAN user population in California after linkage to AIAN registries (Johnson et al, 2006). Hospitalizations for injuries will be released in the next report and could help explain disparities in hospitalization rates and further support the need for injury prevention efforts to help reduce disparities in hospitalizations, as well as deaths.

In an earlier study we established that the AIAN user population had higher rates of hospitalizations that were preventable with access to effective preventive care services (Korenbrodt et al 2003). We have found that hospitalizations for these diagnoses continued to be higher for AIAN than Whites during 1998 to 2002. These findings will be presented in a future study. They indicate that improving prevention and treatment services will not be enough by itself, but that access of AIAN to the services will need to be improved as well. Transportation, child care and culturally competent health care services have all been reported to reduce racial disparities in health care outcomes (Institute of Medicine 2003).

Implications for Federal Health Policy. These results demonstrate the need for greater attention to the health of AIAN who rely on the Indian Health Service (IHS) in California. Historically the IHS has lacked data on the hospitalizations of AIAN in California more than any other area of the IHS (IHS 1999; IHS 2001). While the primary reason is the lack of any IHS or Tribal hospital in California, another reason is the exceptionally low funding of IHS Contract Health Service services in California due to historical and political reasons (Roubideaux et al, 2001). As a result the THP in California have exceptionally low funds to put towards hospitalizations. Contract Health Service data would have given the IHS information on hospitalizations for the AIAN user population. California now can provide on-going monitoring of hospi-

talizations of the AIAN user population to determine whether policies that help THP to improve the care they offer reduces disparities in AIAN health status.

Given that tribal self-determination is a reality and tribal health services are likely to continue to expand, the IHS will not have all of the tools to address fully the disparities that currently exist. To be fully successful partnerships will first need to be formed between tribal health authorities, states, the IHS, other regional tribal health boards and research institutions to mutually define the salient indicators for surveillance and to devise novel data linkages to achieve these aims (Grossman 2003). In the end, the resulting surveillance data will be of higher quality, with less racial misclassification.

Limitations of the Data in this Report. The linkages used in this report are important to improve the accurate identification of AIAN being hospitalized in California. They correct the problem of racial misclassification for these AIAN in state hospital data. The linkages also account for the AIAN hospitalizations occurring in California that are not represented in IHS reports.

The AIAN user population used in the denominator of hospitalization rates in this report is not strictly a population. They are clinic users in one or more years of a 3-year period (for example 1996 to 1998), while hospitalizations are for the third year only (for example 1998). To the extent that AIAN users from the first two years left California prior to the third year and could not be hospitalized in California in the third year, the AIAN User hospitalization rate is underestimated. The White population, on the other hand, is adjusted every year for estimated numbers of births, deaths and migration and not required for linkage to hospitalizations at all.

It is important to note that the IHS NPIRS registry was used rather than tribal enrollment registries. An advantage of the IHS registry over tribal registries is that not all tribal members live in California and therefore are not necessarily hospitalized in California.

Another limitation of the study is the adjustment of AIAN hospitalization rates for missing Social Security Numbers on state hospital data. The rates used for adjustment are based on the missing SSN rates for all races combined in the hospital data file since AIAN records cannot be identified reliably without the SSN linkage. The extent to which hospital records of AIAN users have different rates of missing SSN would affect the linkage adjusted hospitalization rates.

Finally, careful consideration should be taken when generalizing the findings from AIAN in this study to other AIAN. The AIAN in this study are identified by participation in a rural THP therefore they may not necessarily be representative of AIAN populations in urban areas. Nor may rural AIAN in California be representative of rural AIAN throughout the Nation since there may be differing access issues as well as different systems of health care.

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APPENDIX A.

DETERMINATION OF RACIAL MISCLASSIFICATION IN THE AIAN STUDY POPULATION

I. Rationale

American Indians and Alaska Natives (AIAN) are widely misclassified in other racial categories in state hospital discharge data bases used to determine the numerators of hospitalization rates, but not in population (census) data used to determine the denominators. This bias results in underestimation of the hospitalization rates of AIAN.

One way to estimate the extent of racial misclassification of AIAN is to determine how Active Users of Tribal Health Programs are racially classified in hospital discharge data bases. Since all Active Users of Tribal Health Programs funded by the Indian Health Service are AIAN enrolled in federally recognized tribes, the misclassification rate can be determined by linking AIAN Active Users to state hospital discharge data bases, and observing the racial classification of each AIAN in the state hospital discharge data base. In California in 1996 the misclassification rate for AIAN Active User hospitalizations determined in this way was 70% (Korenbroet et al, 2003).

The purpose of the analyses is to determine the following for AIAN Active User hospitalizations: 1) the rates of racial misclassification each year for 1998 to 2002; 2) the rate of racial misclassification of AIAN Active User hospitalizations for the 5 years as a whole 1998 to 2002; and to compare these annual and overall average rates to the rate of misclassification found for 1996 hospital records (70%). The vast majority of these misclassified AIAN records are classified as White non-Hispanic records.

II. Data Sources

The Indian Health Service (IHS) National Patient Information Reporting System (NPIRS) gave the California Department of Health Services Active User data files from FFY 1998 to 2002. California State patient hospital discharge data (PDD) was obtained from the Office of Statewide Health Planning and Development for calendar years 1998 to 2002. The California Department of Health Services used SSN to link the Active User and state PDD files (Korenbroet et al, 2003). Separate linkages were performed for AIAN Active Users and hospitalizations in each of the five years.

III. Population

AIAN Active Users are AI/AN who were enrolled members of federally recognized tribes and who used an IHS funded service at least once in either the year the data was reported, or in the 2 years prior to the reporting year. The Study Sample consists of AIAN Active Users in the population who were hospitalized in a non-federal health facility in California and discharged alive between 1998 and 2002.

IV. Outcome Variables

The outcome variable is defined as Racial Classification of a hospitalization in the 'race' field of the hospital record, and correct racial classification of a hospitalization of an AIAN Active User is that of "Native American/Eskimo/Aleut." Incorrect racial classification (misclassification) of a hospitalization of Active User is defined as any of the following: White, Black, Asian/Pacific Islander, Other, or Unknown. The ethnic classifications of AIAN Active Users racially misclassified as Whites were further subdivided into the following ethnic groups: Hispanic, Non-Hispanic (including unknown ethnicity).

V. Study Variables

The study variable is Year of Hospitalization.

VI. Explanatory Variables

According to the literature, misclassification of AIAN is likely to be a function of variables that are not included in this linked dataset: distance from a large land reservation and population density of AIAN in the hospital service area. Therefore no potentially explanatory variables are analyzed in this analysis.

VII. Analyses

For the rates of racial misclassification each year between 1998 to 2002, we performed analysis of the Race and Ethnic Classification by Year for all hospitalizations of AIAN Active Users using the distribution of the variable ‘Race’ from the linked hospitalization data file. The correct classification rates for AIAN Active User hospital records are shown as “AIAN.” The annual racial misclassification rate equals 100% minus this correct classification rate. The overall average rate of racial misclassification for the 5 years as a whole 1998 to 2002, is 100% minus the correct classification rate for the combined records of those years. The distribution of records misclassified in other racial and ethnic categories are shown by race and ethnic category.

VIII. Results

Annual rates of racial misclassification. The rates of racial misclassification for AIAN Active Users on hospital discharge records varied slightly between 1998 and 2002, with the range being between 58 and 63%. In Table A.1 the correct classification rates for AIAN Active User hospital records are shown. The distribution of records misclassified in other racial and ethnic categories are also shown. Most misclassified records are classified as White non-Hispanic.

Table A.1. Race and ethnic classification of hospitalizations of American Indians, from an IHS Registry, in State Hospital Data Records, 1998 to 2002.

Year	1998		1999		2000		2001		2002		1998-2002	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
AIAN	1746	42.2%	1930	39.4%	2011	38.7%	1996	36.8%	2242	38.1%	9925	38.9%
White												
Non-Hispanic*	1754	42.4%	2138	43.6%	2296	44.1%	2518	46.5%	2639	44.9%	11,345	44.4%
Hispanic	306	7.4%	416	8.5%	429	8.2%	419	7.7%	492	8.4%	2062	8.1%
Other	251	6.1%	350	7.1%	391	7.5%	407	7.5%	444	7.6%	1843	7.2%
Missing	80	1.9%	69	1.4%	75	1.4%	77	1.4%	63	1.1%	364	1.4%
All Races	4137	100%	4903	100%	5202	100%	5417	100%	5880	100%	25,539	100%

*Includes those with missing Hispanic ethnicity, less than 1% of the hospitalizations of Whites.

APPENDIX B.

ADJUSTMENT OF AIAN HOSPITALIZATIONS FOR LINKAGE WITH IHS DATA: RATES OF MISSING SSN FOR LINKAGE IN HOSPITALIZATION DATA

I. Rationale

When linking databases deterministically by one or more specified data fields, the resulting linked data records underestimate the number of true linked records by the extent to which there is missing data in the data field(s) used in the linkage. To adjust for this linkage problem, the number of linked records is weighted for the extent of missing data in the specified data fields.

Linking IHS databases for AIAN Active Users to state hospital discharge data bases by Social Security Number (SSN), is one way to determine the hospitalization rates of AIAN. However these linked records do not include those AIAN Active Users who were unable to link as a result of hospital records that do not have SSN. In order to account for this, the numerator of the hospitalization rates for the number of linked records for the AIAN Active User population must be adjusted for the extent to which there are missing SSN in the hospital discharge data base fields.

Furthermore, SSN are not randomly distributed among people and therefore the weights for missing SSN should be determined for groups of hospitalized people with known different levels of SSN. SSN are more common among men than women up to certain ages, and among older people rather than younger people, people with Medicaid compared to those with Private or No Insurance, US-born compared to non-US born Hispanic, etc. and other such characteristics. Weights for individuals with all of the combinations of these characteristics would be ideal, but in reality hospitalization records have only information on age and gender that is reliable enough to use for generating adjustment weights for missing SSN. Thus age and gender should be taken into account when determining the rates of missing SSN and the resultant adjustment weights for hospitalization rates determined from records linked by SSN.

The purpose of the analysis is to determine rates of missing SSN. The rates of missing SSN will be compared by year, and an average rate for all five years will be determined. The linkage weights needed to adjust hospitalizations from 1998 to 2002 are then determined from the rate of Missing SSN for each year, age and gender group a by an arithmetic formula. Finally, the linkage adjusted weights are multiplied times AIAN hospitalizations to obtain linkage adjusted hospitalizations.

II. Data Sources

California State patient hospital discharge data (PDD) was obtained from the Office of Statewide Health Planning and Development for calendar years 1998 to 2002.

III. Population

The population consists of all people hospitalized in non-federal hospitals in California from 1998 to 2002 regardless of race.

IV. Outcome Variables

The outcome variables are: 1) rate of Missing SSN defined by the percent of hospital discharge records (of all races combined) without a SSN in the data field; and 2) Linkage Adjustment Weights defined as the amount that a linked hospital record needs to be multiplied by to account for hospital records of the group that could not be linked because the SSN in the hospital record was missing.

V. Study Variables (constructed)

The study variable is Year of Hospitalization.

VI. Explanatory Variables

Age(10age groups)andGender(Male,Female).Proportionately more men than women have ‘non-missing’ SSN at any given age, and the greater the age of men or women, the greater the proportion of people with ‘non-missing’ SSN.

VII. Analyses

We performed bivariate analysis of the percent of hospitalizations Missing SSN by Year for all hospitalizations in the specified age and gender groups, and combined the results for each group for all 5 years as well.

The rates of Missing SSN were determined for each age and gender group in the hospital discharge data before records were linked to the AIAN Active Users. The rates of Missing SSN were converted to a linkage adjustment weight by taking the inverse of the rate of non-Missing SSN: Linkage weight = $1 / (1 - \text{Missing SSN rate})$

The linkage adjusted weights were then multiplied times their respective number of hospitalizations for each year and age group (Table B.8). For example, for a 30% Missing SSN rate the weight of $1 / (1 - 0.3)$, or 1.43 would be multiplied times the number of hospitalizations for each year and age group.

VIII. Results

The combined rates of missing SSN for hospital records of all age and gender groups are similar for 1998, 1999, 2000, 2001, and 2002 (range from 8.9% to 9.5%) (Tables B.1 to B.6). The rates were the same between 2000 and 2002 (i.e. 9.5%) (Tables B.4 to B.6). This was a higher rate than that prior to 2000, 8.9% in 1998 and 9.0% in 1999 (Tables B.2 and B.3). The rate for missing SSN among infants remained high throughout about 64%.

The combined rates of missing SSN for all age and gender groups decreased between the 1996 and 1998-1999 time period, but rates of missing SSN increased again by 2000 to rates almost as high as in 1996. The rate of missing SSN for 1996 was 10.0% (Table B.7), 8.9% in 1998 and 9.0% in 1999 (Tables B.2 and B.3) and 9.5% from 2000 to 2002 (Tables B.4 to B.6).

The combined age and gender rate rate of missing SSN for 1998-2002 was 9.3% (Table B.1). For males the rate was 8.3% for 1998 to 2002. For females the rate was 9.9% for 1998 to 2002 (Table B.1). In 1996 the male (9.1%) and female (10.6%) rates were higher (Table B.7). Rates for women are consistently higher than for men regardless of time period. Thus the lack of progress in reducing missing SSN since 1998 appears to be a more acute problem for women than men.

Table B.1 Rates of missing Social Security Numbers and linkage adjustment weights for hospital discharge records by age and gender, 1998 to 2002.

Age Groups	Males				Females				All			
	Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges	
	Number	Percent	Linkage Adjustment Weight	Number	Number	Percent	Linkage Adjustment Weight	No.	Number	Percent	Linkage Adjustment Weight	Number
Under 1 year*	140,302	63.8%	2.7640	219,837	102,681	64.8%	2.8436	158,378	242,983	64.2%	2.7968	378,215
1 - 4	66,053	37.6%	1.6033	175,548	49,549	37.8%	1.6083	131,008	115,602	37.7%	1.6054	306,556
5 - 14	82,958	32.9%	1.4901	252,210	65,405	32.5%	1.4813	201,299	148,363	32.7%	1.4862	453,509
15 - 19	44,140	25.8%	1.3474	171,203	109,191	23.7%	1.3112	460,094	153,331	24.3%	1.3208	631,297
20 - 24	26,459	15.6%	1.1844	169,938	174,597	21.6%	1.2750	809,555	201,056	20.5%	1.2583	979,493
25 - 34	46,707	10.9%	1.1221	429,317	294,467	15.9%	1.1897	1,846,583	341,174	15.0%	1.1763	2,275,900
35 - 44	41,215	5.7%	1.0602	726,139	75,655	6.1%	1.0649	1,241,042	116,870	5.9%	1.0632	1,967,181
45 - 54	32,352	3.7%	1.0384	875,006	29,875	3.2%	1.0334	925,252	62,227	3.5%	1.0358	1,800,258
55 - 64	25,104	2.9%	1.0296	872,060	30,972	3.6%	1.0376	855,029	56,076	3.2%	1.0336	1,727,089
65+	33,300	1.3%	1.0130	2,589,376	64,702	1.9%	1.0193	3,409,888	98,002	1.6%	1.0166	5,999,264
Total	538,590	8.3%	1.0906	6,480,634	997,094	9.9%	1.1103	10,038,128	1,535,684	9.3%	1.1025	16,518,762

*Excluded Healthy Newborns (ICD-9 Diagnosis Codes V30 to V39) before determining rates of missing SSN.

Table B.2 Rates of missing Social Security Numbers and linkage adjustment weights for hospital discharge records by age and gender, 1998.

1998 Age Groups	Males				Females				All			
	Discharges Missing SSN		Discharges		Discharges Missing SSN		Discharges		Discharges Missing SSN		Discharges	
	Number	Percent	Linkage Adjustment Weight	Number	Number	Percent	Linkage Adjustment Weight	Number	Number	Percent	Linkage Adjustment Weight	Number
Under 1 year*	27,233	64.8%	2.8370	42,058	19,876	65.7%	2.9123	30,270	47,109	65.1%	2.8680	72,328
1 - 4	12,799	37.3%	1.5952	34,302	9,424	36.4%	1.5732	25,866	22,223	36.9%	1.5857	60,168
5 -14	16,675	33.8%	1.5094	49,407	13,155	33.6%	1.5072	39,094	29,830	33.7%	1.5084	88,501
15 - 19	8,566	26.3%	1.3567	32,580	20,846	22.1%	1.2835	94,366	29,412	23.2%	1.3016	126,946
20 - 24	4,966	16.0%	1.1910	30,971	33,288	20.9%	1.2645	159,122	38,254	20.1%	1.2519	190,093
25 - 34	8,540	9.7%	1.1073	88,158	51,368	13.9%	1.1618	368,803	59,908	13.1%	1.1509	456,961
35 - 44	7,197	5.0%	1.0529	143,131	12,724	5.3%	1.0559	240,142	19,921	5.2%	1.0548	383,273
45 - 54	5,607	3.5%	1.0367	158,358	5,491	3.3%	1.0338	168,144	11,098	3.4%	1.0352	326,502
55 - 64	4,585	2.8%	1.0291	162,310	5,729	3.6%	1.0373	159,229	10,314	3.2%	1.0331	321,539
65+	6,172	1.2%	1.0122	512,354	12,659	1.9%	1.0191	675,326	18,831	1.6%	1.0161	1,187,680
Total	102,340	8.2%	1.0889	1,253,629	184,560	9.4%	1.1039	1,960,362	286,900	8.9%	1.0980	3,213,991

*Excluded Healthy Newborns (ICD-9 Diagnosis Codes V30 to V39) before determining rates of missing SSN.

Table B.3 Rates of missing Social Security Numbers and linkage adjustment weights for hospital discharge records by age and gender, 1999.

1999 Age Groups	Males				Females				All			
	Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges	
	Number	Percent	Linkage Adjustment Weight	Number	Number	Percent	Linkage Adjustment Weight	Number	Number	Percent	Linkage Adjustment Weight	Number
Under 1 year*	27,942	62.1%	2.6387	44,993	20,557	63.5%	2.7365	32,395	48,499	62.7%	2.6788	77,388
1 - 4	13,221	36.6%	1.5774	36,118	9,888	36.7%	1.5802	26,931	23,109	36.7%	1.5786	63,049
5 - 14	16,229	32.6%	1.4848	49,707	12,612	31.8%	1.4665	39,647	28,841	32.3%	1.4766	89,354
15 - 19	8,367	25.2%	1.3361	33,264	20,792	22.5%	1.2897	92,573	29,159	23.2%	1.3016	125,837
20 - 24	5,021	15.8%	1.1875	31,795	33,346	21.1%	1.2669	158,285	38,367	20.2%	1.2529	190,080
25 - 34	8,908	10.4%	1.1158	85,805	54,455	15.0%	1.1764	363,146	63,363	14.1%	1.1643	448,951
35 - 44	7,841	5.5%	1.0579	143,294	13,519	5.5%	1.0586	244,025	21,360	5.5%	1.0584	387,319
45 - 54	5,938	3.6%	1.0371	165,878	5,580	3.2%	1.0326	176,747	11,518	3.4%	1.0348	342,625
55 - 64	4,783	2.8%	1.0291	168,879	5,986	3.6%	1.0374	166,085	10,769	3.2%	1.0332	334,964
65+	6,263	1.2%	1.0121	522,539	12,563	1.8%	1.0187	685,442	18,826	1.6%	1.0158	1,207,981
Total	104,513	8.2%	1.0887	1,282,272	189,298	9.5%	1.1054	1,985,276	293,811	9.0%	1.0988	3,267,548

*Excluded Healthy Newborns (ICD-9 Diagnosis Codes V30 to V39) before determining rates of missing SSN.

Tables B.4 Rates of missing Social Security Numbers and linkage adjustment weights for hospital discharge records by age and gender, 2000.

Age Groups	Males				Females				All			
	Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges	
	Number	Percent	Linkage Adjustment Weight	Number	Number	Percent	Linkage Adjustment Weight	Number	Percent	Linkage Adjustment Weight	Number	
Under 1 year*	28,506	64.8%	2.8410	43,990	20,808	66.0%	2.9420	31,523	49,314	65.3%	2.8823	75,513
1 - 4	13,357	38.0%	1.6130	35,145	10,113	38.7%	1.6303	26,158	23,470	38.3%	1.6204	61,303
5 - 14	16,987	33.6%	1.5061	50,551	13,399	33.0%	1.4935	40,548	30,386	33.4%	1.5005	91,099
15 - 19	9,224	27.0%	1.3700	34,156	22,522	24.3%	1.3202	92,860	31,746	25.0%	1.3332	127,016
20 - 24	5,385	16.0%	1.1898	33,755	35,706	22.1%	1.2833	161,753	41,091	21.0%	1.2661	195,508
25 - 34	9,475	11.1%	1.1248	85,380	59,917	16.2%	1.1929	370,472	69,392	15.2%	1.1796	455,852
35 - 44	8,261	5.7%	1.0608	144,197	15,463	6.2%	1.0664	248,469	23,724	6.0%	1.0643	392,666
45 - 54	6,560	3.8%	1.0391	174,491	5,975	3.2%	1.0335	184,230	12,535	3.5%	1.0362	358,721
55 - 64	5,330	3.1%	1.0315	174,343	6,298	3.7%	1.0386	169,384	11,628	3.4%	1.0350	343,727
65+	7,160	1.4%	1.0141	514,708	13,842	2.0%	1.0208	678,801	21,002	1.8%	1.0179	1,193,509
Total	110,245	8.5%	1.0934	1,290,716	204,043	10.2%	1.1133	2,004,198	314,288	9.5%	1.1054	3,294,914

*Excluded Healthy Newborns (ICD-9 Diagnosis Codes V30 to V39) before determining rates of missing SSN.

Tables B.5 Rates of missing Social Security Numbers and linkage adjustment weights for hospital discharge records by age and gender, 2001.

Age Groups	Males				Females				All			
	Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges	
	Number	Percent	Linkage Adjustment Weight	Number	Number	Percent	Linkage Adjustment Weight	Number	Percent	Linkage Adjustment Weight	Number	
Under 1 year*	27,864	62.6%	2.6706	44,543	20,201	63.4%	2.7330	31,858	48,065	62.9%	2.6963	76,401
1 - 4	13,322	38.0%	1.6120	35,089	10,009	38.8%	1.6344	25,785	23,331	38.3%	1.6214	60,874
5 - 14	16,747	32.8%	1.4870	51,135	12,971	31.9%	1.4683	40,671	29,718	32.4%	1.4786	91,806
15 - 19	8,832	25.2%	1.3370	35,038	22,604	24.8%	1.3299	91,126	31,436	24.9%	1.3319	126,164
20 - 24	5,480	15.4%	1.1824	35,522	36,395	22.2%	1.2857	163,798	41,875	21.0%	1.2660	199,320
25 - 34	9,781	11.6%	1.1315	84,177	63,736	17.3%	1.2089	368,775	73,517	16.2%	1.1938	452,952
35 - 44	8,978	6.1%	1.0652	146,772	16,657	6.6%	1.0708	251,940	25,635	6.4%	1.0687	398,712
45 - 54	7,112	3.9%	1.0402	184,123	6,451	3.3%	1.0344	193,929	13,563	3.6%	1.0372	378,052
55 - 64	5,188	2.9%	1.0300	178,314	6,753	3.8%	1.0400	175,658	11,941	3.4%	1.0349	353,972
65+	7,064	1.4%	1.0137	521,083	13,182	1.9%	1.0196	686,666	20,246	1.7%	1.0170	1,207,749
Total	110,368	8.4%	1.0916	1,315,796	208,959	10.3%	1.1147	2,030,206	319,327	9.5%	1.1055	3,346,002

*Excluded Healthy Newborns (ICD-9 Diagnosis Codes V30 to V39) before determining rates of missing SSN.

Tables B.6 Rates of missing Social Security Numbers and linkage adjustment weights for hospital discharge records by age and gender, 2002.

2002 Age Groups	Males				Females				All			
	Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges		Discharges Missing SSN		All Discharges	
	Number	Percent	Linkage Adjustment Weight	Number	Number	Percent	Linkage Adjustment Weight	Number	Percent	Linkage Adjustment Weight	Number	
Under 1 year*	28,757	65.0%	2.8558	44,253	21,239	65.7%	2.9146	32,332	49,996	65.3%	2.8803	76,585
1 - 4	13,354	38.3%	1.6200	34,894	10,115	38.5%	1.6262	26,268	23,469	38.4%	1.6226	61,162
5 -14	16,320	31.7%	1.4651	51,410	13,268	32.1%	1.4727	41,339	29,588	31.9%	1.4685	92,749
15 - 19	9,151	25.3%	1.3388	36,165	22,427	25.2%	1.3360	89,169	31,578	25.2%	1.3368	125,334
20 - 24	5,607	14.8%	1.1737	37,895	35,862	21.5%	1.2743	166,597	41,469	20.3%	1.2544	204,492
25 - 34	10,003	11.7%	1.1320	85,797	64,991	17.3%	1.2094	375,387	74,994	16.3%	1.1942	461,184
35 - 44	8,938	6.0%	1.0639	148,745	17,292	6.7%	1.0723	256,466	26,230	6.5%	1.0692	405,211
45 - 54	7,135	3.7%	1.0386	192,156	6,378	3.2%	1.0326	202,202	13,513	3.4%	1.0355	394,358
55 - 64	5,218	2.8%	1.0285	188,214	6,206	3.4%	1.0348	184,673	11,424	3.1%	1.0316	372,887
65+	6,641	1.3%	1.0130	518,692	12,456	1.8%	1.0186	683,653	19,097	1.6%	1.0161	1,202,345
Total	111,124	8.3%	1.0906	1,338,221	210,234	10.2%	1.1138	2,058,086	321,358	9.5%	1.1045	3,396,307

*Excluded Healthy Newborns (ICD-9 Diagnosis Codes V30 to V39) before determining rates of missing SSN.

APPENDIX C.

SAMPLING ADJUSTMENT FOR WHITE NON-HISPANICS IN THE CONTRACT HEALTH SERVICE DELIVERY AREA (CHSDA) COUNTIES.

California has counties that are deemed Contract Health Service Delivery Area (CHSDA) counties whenever they contain at least one Tribal Health Program. California has 37 CHSDA counties among 58 total counties. In order to compare hospitalization rates for AIAN Active Users, who attend Tribal Health Programs, to those of White non-Hispanics in similar geographic areas it is necessary to identify the total White population (excluding infants less than 1 year of age) who resided in CHSDA counties. When obtaining rates for White non-Hispanics it is important to reduce the total population denominator so that it corresponds to the random sample of the hospitalization numerator (Table C.1).

Since the numerators are based on a random sample of all White non-Hispanic hospitalizations (3 times the AIAN Active User hospitalizations) a corresponding sampling needs to be done for the White non-Hispanic population denominator. The sampling fraction for each year, age and gender category was determined from the random sample of hospitalizations among all White non-Hispanic hospitalizations. These random sampling fractions were then multiplied by the number of White non-Hispanic residents in each CHSDA county by year, age and gender category. In this way the total population of White non-Hispanics was reduced proportionately to that of the population needed for hospitalization rates without distorting the year, age or gender distribution of the population.

Table C.1 Random sample of the White hospitalizations* in the THP contract care counties by gender, age, and year, 1998 to 2002.

Age Groups	1998						1999						2000						
	Male			Female			Male			Female			Male			Female			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
1 - 14	163	3.2%	145	1.9%	197	3.2%	148	1.7%	223	3.4%	179	1.9%							
15 - 44	976	19.5%	2,508	33.6%	1,170	19.0%	2,966	33.6%	1,196	18.3%	3,186	33.1%							
45 - 64	1,285	25.6%	1,427	19.1%	1,603	26.0%	1,689	19.1%	1,840	28.2%	2,006	20.9%							
65 +	2,592	51.7%	3,394	45.4%	3,188	51.8%	4,033	45.6%	3,274	50.1%	4,245	44.1%							
All Ages	5,016	100.0%	7,474	100.0%	6,158	100.0%	8,836	100.0%	6,533	100.0%	9,616	100.0%							
Age Groups	2001						2002						1998-2002 Total						
	Male			Female			Male			Female			Male			Female			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
1 - 14	239	3.4%	179	1.8%	229	3.1%	182	1.7%	1,884	2.4%	377	2.4%							
15 - 44	1,335	19.2%	3,262	33.2%	1,397	19.1%	3,464	32.9%	21,460	27.4%	4,292	27.4%							
45 - 64	1,917	27.6%	2,055	20.9%	2,122	28.9%	2,317	22.0%	18,261	23.3%	3,652	23.3%							
65 +	3,449	49.7%	4,330	44.1%	3,585	48.9%	4,577	43.4%	36,667	46.8%	7,333	46.8%							
All Ages	6,940	100.0%	9,826	100.0%	7,333	100.0%	10,540	100.0%	78,272	100.0%	15,654	100.0%							

*A random sample of the total white hospitalizations is used in the calculation of hospitalization rates as explained in the Methods.

APPENDIX D.

ADJUSTMENT OF HOSPITALIZATION RATES TO STANDARD AGE DISTRIBUTION: AGE DISTRIBUTIONS FOR AIAN AND WHITE STUDY POPULATIONS

I. Rationale

The purpose of the analysis is to determine the demographic characteristics (gender, age) for AIAN Active Users and White non-Hispanics in the single Contract Health Service Delivery Area (CHSDA) counties (i.e. 37 counties) between 1998 and 2002. A comparison of the corresponding age distributions by gender for both populations is essential in order to determine whether it is necessary to make adjustments for population age differences of either or both genders prior to making comparisons of their hospitalization rates for these populations. The purpose of this chapter is to address the following questions:

1. What are the age distributions of AIAN Active User and White non-Hispanic populations in the CHSDA service area by gender for each year between 1998 and 2002 and all years combined?
2. Is it necessary to adjust the AIAN and White hospitalization rates for age differences between their populations?

II. Data Sources

Data Source for AIAN Active Users. The IHS National Patient Information Reporting System (NPIRS) provided IHS Active User Demographic data files for the California Area from FFY 1998 to 2002.

Data Sources for White non-Hispanics. Data for White non-Hispanic population by county was obtained from National Center for Health Statistics (NCHS) and U.S. Census Bridged Race Estimates. For 1998 and 1999, data was obtained for California from <http://www.cdc.gov/nchs/about/major/dvs/popbridge/datadoc.htm#inter1>. For 2000, 2001, and 2002, data stratified by sex and age, were released from NCHS on September 14, 2004. The postcensal estimates were updated annually as additional data became available.

III. Populations

Study Population: AIAN. The population of AIAN is that of Active Users of the 24 THP with the largest numbers of Active Users (at least 100 per year) for the 37 CHSDA counties in California as a whole between 1998 to 2002. Active Users are defined in Appendix A. The study population excluded AIAN Active Users of rural THP with less than 100 Active Users, urban THP and infants (Active Users less than one year of age). These AIAN Active Users account for 98% of Active Users of all rural THP, and are studied as essentially equivalent to the Active Users of the 37 CHSDA counties.

Comparison Population: White non-Hispanics. The comparison group is that of White non-Hispanic residents of the CHSDA counties as a whole (See Appendix C).

IV. Outcome Variables

The age group distributions (1-14, 15-44, 45-64, 65+) of males and females.

V. Study Variables

The study variables are AIAN Active Users and non-Hispanic Whites in all 37 CHSDA counties combined.

VI. Explanatory Variables

None

VII. Analyses

A frequency distribution of age groups for the AIAN Active Users and for White non-Hispanics by gender was calculated for the CHSDA county area as whole.

AIAN Active Users for CHSDA. The age distribution of AIAN Active Users by gender for all 24 THP was obtained for each year between 1998 and 2002 and for all years combined (Table D.1).

White non-Hispanics for CHSDA.

The age distribution of non-Hispanic Whites in the 37 CHSDA counties was obtained by gender for each year between 1998 and 2002 and for all years combined (Table D.2).

VIII. Results

Age distributions of AIAN and White populations in the CHSDA service area. The age distributions for AIAN Active Users are different than those for the White non-Hispanics in the CHSDA service area during 1998 to 2002, with AIAN having a younger population and Whites an older population. The age distributions of AIAN Active Users in the CHSDA service area are shown by gender in Table D.1, and for White non-Hispanics in Table D.2. Among those between the ages of 1 and 14 years the proportion of AIAN was 27% compared to only 17% for Whites. The proportions are similar for AIAN (46%) and Whites (41%) who were between 15 and 44 years old. However as age increased there was a lower percentage of AIAN than Whites. Among those 65 years of age and older, 26% were AIAN and 41% were Whites.

For AIAN the age distributions are similar between males and females for each year between 1998 and 2002, with higher proportions of males than females in the 1-14 age category for each year. For White non-Hispanics the distributions are similar between males and females although there are higher proportions of females than males for each year in the 65 and older age category.

Since the age distributions are different for AIAN and Whites it is necessary to make an adjustment for age differences in order to compare hospitalization rates for AIAN Active Users to those for White non-Hispanics. The Standard Million 2000 US Population will be used to obtain age-adjusted rates (Table D.3).

Table D.1 AIAN Active Users by gender, age, and year, 1998 to 2002.

Age Group	1998				1999				2000			
	Male		Female		Male		Female		Male		Female	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1-14	5,052	33.1%	4,975	26.3%	6,012	32.2%	5,781	25.6%	6,273	31.1%	6,171	25.3%
15-44	6,820	44.7%	8,896	47.1%	8,385	44.9%	10,683	47.3%	9,115	45.2%	11,487	47.1%
45-64	2,408	15.8%	3,447	18.2%	3,071	16.5%	4,231	18.7%	3,465	17.2%	4,661	19.1%
65+	972	6.4%	1,570	8.3%	1,197	6.4%	1,897	8.4%	1,298	6.4%	2,061	8.5%
All Ages	15,252	100.0%	18,888	100.0%	18,665	100.0%	22,592	100.0%	20,151	100.0%	24,380	100.0%
	2001				2002				1998-2002 Total			
	Male		Female		Male		Female		Male		Female	
Age Group	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1-14	6,052	30.0%	5,918	24.0%	5,975	28.7%	5,837	22.8%	58,046	27.5%	11,609	27.5%
15-44	9,149	45.3%	11,736	47.5%	9,510	45.6%	12,235	47.9%	98,016	46.4%	19,603	46.4%
45-64	3,671	18.2%	4,911	19.9%	3,927	18.8%	5,198	20.3%	38,990	18.5%	7,798	18.5%
65+	1,312	6.5%	2,130	8.6%	1,422	6.8%	2,298	9.0%	16,157	7.6%	3,231	7.6%
All Ages	39,056	100.0%	47,260	100.0%	40,246	100.0%	48,838	100.0%	406,261	100.0%	81,252	100.0%

Table D.2 Percent of White population* in the contract care counties by age, gender and year, 1998 to 2002.

Age	1998						1999						2000					
	Male			Female			Male			Female			Male			Female		
	Number	Percent		Number	Percent		Number	Percent		Number	Percent		Number	Percent		Number	Percent	
1 - 14	10,304	18.4%		11,424	19.1%		11,887	17.6%		10,882	16.0%		13,481	18.5%		13,305	17.3%	
15 - 44	24,475	43.6%		23,422	39.2%		29,418	43.6%		27,881	40.9%		30,190	41.5%		29,920	39.0%	
45 - 64	13,296	23.7%		13,969	23.4%		16,299	24.2%		16,598	24.3%		18,840	25.9%		19,721	25.7%	
65 +	8,077	14.4%		10,919	18.3%		9,795	14.5%		12,817	18.8%		10,262	14.1%		13,805	18.0%	
All Ages	56,153	100.0%		59,734	100.0%		67,398	100.0%		68,178	100.0%		72,773	100.0%		76,750	100.0%	
Age	2001						2002						1998-2002 Total		1998-2002 Average			
	Male			Female			Male			Female			Number	Percent	Number	Percent		
	Number	Percent		Number	Percent		Number	Percent		Number	Percent		Number	Percent	Number	Percent		
1 - 14	14,174	18.4%		12,952	16.8%		13,977	17.3%		12,791	16		125,176	17.4%	25,035	17.4%		
15 - 44	32,689	42.4%		30,331	39.2%		34,258	42.5%		31,993	39		294,577	41.0%	58,915	41.0%		
45 - 64	19,399	25.2%		19,979	25.9%		21,006	26.1%		22,145	27		181,252	25.2%	36,250	25.2%		
65 +	10,808	14.0%		14,020	18.1%		11,390	14.1%		15,047	18		116,941	16.3%	23,388	16.3%		
All Ages	77,070	100.0%		77,283	100.0%		80,632	100.0%		81,976	100		717,946	100.0%	143,589	100.0%		

*A weighted sample of the total white population is used in the calculation of hospitalization rates as explained in the Methods.

Table D.3 Weights for adjustment of AIAN and White populations to the US Standard Million population in 2000.

Age	Population	Adjustment weight
Under 1 year	3,795,000	0.0138
1 year	3,759,000	0.0137
2-4	11,433,000	0.0416
5-6	3,896,000	0.0142
7-8	11,800,000	0.0430
9	4,224,000	0.0154
10-11	8,258,000	0.0301
12-14	11,799,000	0.0430
15-17	11,819,000	0.0430
18-19	8,001,000	0.0291
20-24	18,257,000	0.0665
25-29	17,722,000	0.0645
30-34	19,511,000	0.0710
35-39	22,180,000	0.0808
40-44	22,479,000	0.0819
45-49	19,806,000	0.0721
50-54	17,224,000	0.0627
55-59	13,307,000	0.0485
60-64	10,654,000	0.0388
65-69	9,410,000	0.0343
70-74	8,726,000	0.0318
75-79	7,415,000	0.0270
80-84	4,900,000	0.0178
85 and over	4,259,000	0.0155
All ages	274,634,000	1.0000

Klein RJ, Schoenborn CA. Age adjustment using the 2000 projected U.S. population. Healthy People Statistical Notes, no. 20. Hyattsville, Maryland: National Center for Health Statistics. January 2001.

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