Trauma among American Indians in an Urban County

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SYNOPSIS

Objective. To describe severe injury among American Indians in a large metropolitan county given that most previous studies of the high Indian injury morbidity and mortality rates have been conducted primarily in rural areas.

Methods. A retrospective analysis of a hospital trauma registry was conducted for the years 1986-92 at the Harborview Medical Center, the only Level I trauma center in King County, Washington, a metropolitan county with the seventh largest number of urban American Indians in the United States.

Results. Of 14,851 King County residents included in the registry, 593 (4%) were classified as American Indian. With King County whites as the reference, the age-standardized incidence ratio for inclusion of American Indians in the registry was 4.4 (95% confidence interval 4.1, 4.8). The standardized incidence ratios and proportional incidence ratios showed significant differences in mechanism and whether it was intentional or unintentional among Indians compared with whites.

Hospitalizations for stab wounds, bites, and other blunt trauma were all significantly more frequent among Indians. Trauma admissions among Indians were disproportionately associated with assaults. A high proportion (72.3%) of American Indians tested had blood alcohol levels exceeding 0.1%.

Conclusion. Urban American Indians experience high rates of trauma, differing from those among whites. Efforts to reduce injury in urban areas should include collaboration with representative urban American Indian organizations.

American Indians suffer from injury morbidity and mortality at rates that far exceed those among other races.[1,2] Although more than half of American Indians live in urbanized or metropolitan areas, most information on injury morbidity is derived from Indian Health Service (IHS) and tribal facilities that are located primarily in rural areas.[3]

It is important to characterize specific patterns of injury among urban Indians because culturally specific institutions such as Indian health and social service agencies and schools exist in some urban areas for the implementation of injury prevention activities.

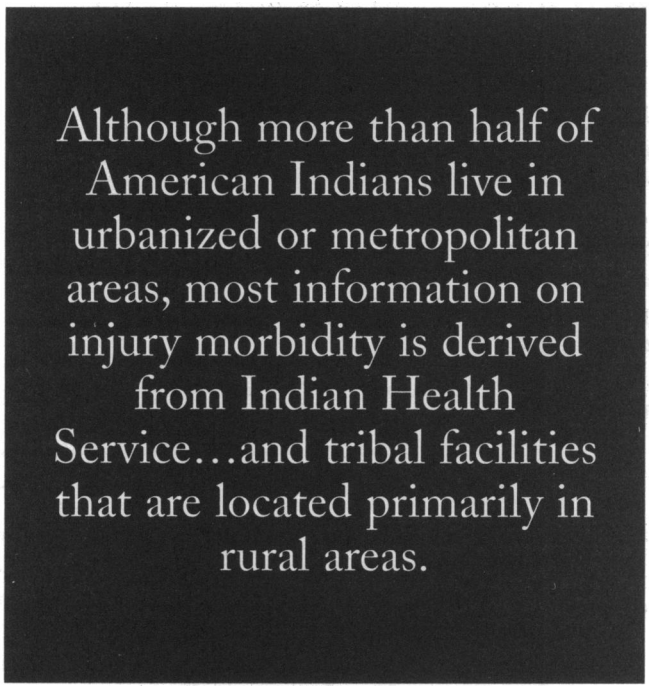
Previously, we found that Indians in King County, Washington, experienced higher injury mortality rates than whites and African Americans in the

same county. Additionally, injuries accounted for a substantial proportion of excess mortality among Indians compared with other races.[4]

There are few data describing injury morbidity among Indians that do not come from IHS or tribal facilities in the State of Washington, partly because the statewide hospital discharge data system does not include information on patient race.

To assemble data on the patterns of serious injury among American Indians in an urban area, we compared characteristics of injuries leading to hospitalization among Indians and persons of other races in the Harborview Medical Center Trauma Registry, a data set that includes comprehensive information on mechanisms, intent, clinical characteristics, and outcomes of injured patients admitted to Harborview, a Level I trauma center in Seattle.

Because previous studies have identified alcohol use as a cause of excess mortality among Indians and a risk factor for injury, we also compared the prevalence of alcohol use among injured Indians with other races.[5,6]



Methods

Population. King County, Washington, is a metropolitan region with a 1990 Census population of 1,507,319. The county includes the seventh largest concentration of urban Indians in the United States who account for 1.1% of county residents. About 21% (17,305 of 81,483) of the Indians in Washington State in 1990 resided in King County. Of these, 864 resided on the single Indian reservation in King County. In this report, we include Aleuts and Eskimos with American Indians, because they cannot be distinguished in the trauma registry.

The Indian population of the county is diverse with regard to tribal affiliation. The Seattle Indian Health Board, a community health center located in King County's largest city with a primarily American Indian patient population, serves patients from more than 200 tribes, according to a personal communication in 1994 from Ralph Forquera, Executive Director of the Board.

Data source. The Harborview Medical Center (HMC) is the only Level I Trauma Center in a four-state region of the Pacific Northwest. It cares for more than 80% of the seriously injured patients in King County, Washington. HMC maintains a computerized registry of all patients who have been admitted for the care of major trauma since 1986. The HMC Trauma Registry (HTR) includes data on all patients seen in the emergency department with trauma discharge diagnoses who either died in the emergency department or were hospitalized at HMC.

Each patient record contains data on a large number of clinical variables, including the blood alcohol level and the Injury Severity Score (ISS). Race is coded as white, black, Native American, Hispanic, or Asian, and is determined either by self report or observation by hospital staff members. We used data for admissions between January 1, 1986 and December 31, 1992.

Statistical analysis. We used two analytic methods to compare injury hospitalization rates and patterns among races. Average annual rates for whites residing in King county were computed using 14 age groups for each mechanism and intent of injury. We then multiplied these age-specific rates by the age-specific population figures from the 1990 Census for American Indians residing in King County to obtain an expected number of cases for American Indians. Age-standardized incidence ratios (SIRs) were calculated by dividing the number of observed cases by expected cases to compare hospitalization rates among races.

The second analytic strategy focused on differences in the proportional distribution of each mechanism or intent of injury among races. The proportion of all injuries due to each mechanism (or intent) of injury for whites was calculated for each age group. These proportions were multiplied by the total number of injuries for each age group among Indians to yield an expected number of injuries for each mechanism or intent.

An age-adjusted proportional incidence ratio (PIR) was computed by dividing the number of observed cases by the number of expected cases. Ninety-five percent confidence levels (CI) for SIRs and PIRs were computed using the normal distribution when mechanisms or intents included 10 or more expected cases and using the assumption that the observed number of cases was drawn from a Poisson distribution when there were fewer than 10 expected cases.

For both SIRs and PIRs, the number of observations were event-related rather than person-related. That is, if a person was admitted for two separate episodes of injury (but

not if admitted twice for the same injury event), the person is represented twice in the analyses.

ISS was calculated in the usual fashion using the sum of the square of the three highest Abbreviated Injury Scores (AIS) in each of the body regions. AIS values were derived using the computerized method of MacKenzie in which ICD-9 scores are converted into specific scores.[7,8] Chi-square analyses were used to test for differences in proportions of persons with selected diagnoses. Logistic regression analyses were conducted to evaluate the likelihood of elevated blood alcohol levels by race after controlling for other potential explanatory variables.

The Institutional Review Boards of the University of Washington and the Portland Area Indian Health Service both approved the study.

Dramatic differences also distinguished American Indians and blacks from whites with regard to intent of injury. Interpersonal violence causes far higher proportions and rates of injuries among American Indians and blacks than among white populations.

Results

Of the 22,272 cases included in the HTR (Table 1), 823 (3.7%) of the patients were classified as American Indian. More than 90% of all patients included in the registry were Washington State residents, and most injuries occurred in the state. Sixty-seven percent of all those discharged and 72% of American Indians discharged were residents of King County, Washington. The remaining analyses in this report are restricted to American Indians, blacks, and whites who reside in King County.

Of the 14,851 King County residents in the registry, 593 (4.0%) were listed as American Indian. The average crude annual incidence of inclusion in the HTR for King County American Indians was 489.5 per 100,000 population, compared with 110.7 for whites and 524.9 for blacks. Using King County whites as the reference, the SIR for inclusion in the registry was 4.4 (95% CI 4.1, 4.8) for American Indians and 4.7 (95% CI 4.6, 4.9) for blacks.

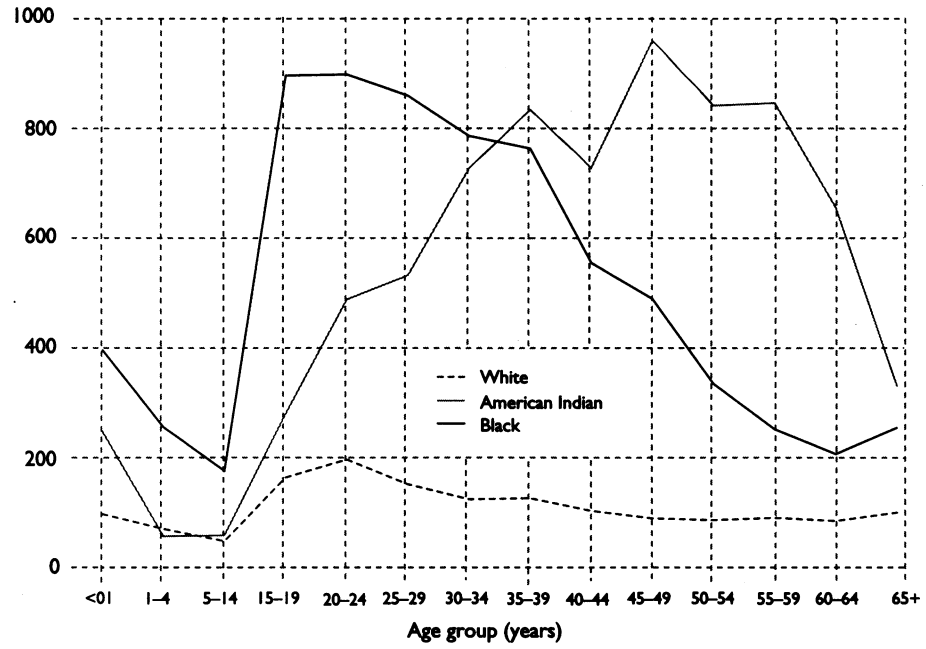
For all races, about three quarters of persons (range 73.2% to 76.6%) included in the HTR were male (Table 1). Although the age structure of the American Indian population is younger than that for whites, the mean age for persons included in the registry was slightly older for American Indians (37.3 years) than for whites (35.6 years). The age distribution of American Indian patients was shifted toward older ages in comparison with whites and blacks (data not shown). Age-specific discharge rates for trauma among American Indians were particularly high for persons ages 35 and older. For whites and blacks, age-specific rates were highest between the ages of 15 and 39, while rates among American Indians were highest between ages 30 and 59 (Figure).

Table 1. Number of cases by race, residence, gender, and age, Harborview Trauma Registry, Seattle, WA, 1986–92

	White		American Indian		Black		Other		
Categories	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Total
Cases	16,369	73.5	823	3.7	3,075	13.8	2,005	9.0	22,272
Washington residents	15,198	72.9	744	3.6	3,007	14.4	1,907	9.1	20,856
King County residents	9,911	66.7	593	4.0	2,803	18.9	1,544	10.4	14,851
Gender									
Male	7,250	73.2	438	73.9	2,146	76.6	1,176	76.2	11,010
Female	2,661	26.8	155	26.1	657	23.4	368	23.8	3,841
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Age in years									
Male	35.0	17.9	37.5	13.9	30.3	13.9	31.0	16.9	
Female	37.5	23.8	36.6	15.3	28.7	18.1	33.9	21.9	
Combined	35.6	19.7	37.3	14.3	29.9	15.0	31.7	18.3	

SD=Standard Deviation

Age-specific annual discharge rates per 100,000 population by race, Harborview Trauma Registry, King County residents, 1986–92, Seattle, WA



ICD-9 V codes, which are used to describe selected medical and social factors influencing health status, are included in HTR discharge diagnoses. American Indians were far more likely to have a V code for homelessness (11.6%) than whites (2.5%; Odds ratio [OR] = 5.2, 95% CI= 3.9, 6.9), or blacks (1.9%; OR = 6.7, 95% CI =4.6, 9.9).

PIRs and SIRs for various injury mechanisms and intents differed markedly among races (Tables 2 and 3). For instance, hospitalizations for stab wounds, bites, and other blunt trauma were all significantly more frequent among American Indians than among whites. The pattern among American Indians was similar to that among blacks for each of these mechanisms.

This study provides evidence of alarming patterns of injury among these Indians.

Although the PIRs for motor vehicle incidents, gunshot wounds, and burns were each less than one among American Indians, using the white population as the reference, the SIRs for each of these mechanisms were greater than one, indicating a higher incidence rate among American Indians compared with whites.

Among blacks, however, both the PIR and SIR for gunshot wounds exceeded those for American Indians. About 17% of trauma admissions for American Indians and blacks were caused by stab wounds, compared with 6.5% of injury admissions for whites. Although the proportion of gunshot wounds was similar among American Indians (3.0%) and whites (4.3%), a much higher proportion of injuries from gunshot wounds occurred among blacks (14.4%).

Dramatic differences also distinguished American Indians and blacks from whites with regard to intent of injury (Table 3). The PIRs (2.6 for American Indians and 3.2 for blacks) and SIRs (11.7 for American Indians and 15.3 for blacks) for assault suggest that interpersonal violence causes far higher proportions and rates of injuries among American Indians and blacks than among whites.

Data on blood alcohol testing and results were incomplete in the trauma registry until mid-1989. During the 1990–92 period, blood alcohol levels were determined in the emergency department for 55.6% of whites, 56.5% of American Indians, and 54.8% of blacks in the trauma registry. Among those tested, American Indians were far more likely than other races to have blood alcohol levels exceeding not only 0.1 percent (72.3% of American Indians, 30.8% of whites, and 44.9% of blacks), but also 0.3 percent (35.8% of American Indians, 5.1% of whites, and 16.3% of blacks). After controlling for age, injury severity score and intent, American Indian race remained strongly associated with the likelihood of having a blood alcohol concentration greater than 0.1 percent (OR = 4.7, 95% CI = 3.3, 6.6).

Alcohol use was strongly associated with certain types of trauma admission among American Indians. For instance, among persons admitted for stab wounds and tested for alcohol, 92.5% of American Indians, compared with 52.1% of blacks and 48.3% of whites, had blood alcohol levels greater than 0.1 percent.

Table 2. Percentages of injury mechanisms, Harborview Trauma Registry, Seattle, WA, by race, 1986–92, King County, WA

Mechanism	White N=9,991 Percent	American Indian (N=593) Percent	PIR[a]	95% CI	SIR[b]	95% CI	Black (N=2,803) Percent	PIR[a]	95% CI	SIR[b]	95% CI
Motor vehicle incidents	21.8	6.4	0.3	0.2,0.4	1.3	0.9,1.7	11.2	0.5	0.5,0.6	2.4	2.2,2.7
Fall	20.7	28.7	1.4	1.2,1.6	6.1	5.2,7.0	13.4	0.6	0.6,0.7	3.1	2.8,3.4
Other blunt trauma	11.2	19.7	1.8	1.4,2.1	7.8	6.4,9.2	16.8	1.5	1.4,1.6	7.1	6.5,7.8
Stab	6.5	17.2	2.6	2.1,3.1	11.6	9.5,14.2	17.2	2.6	2.4,2.9	12.4	11.3,13.6
Firearm injury	4.3	3.0	0.7	0.4,1.0	3.1	1.8,5.0	14.4	3.4	3.0,3.7	16.0	14.4,17.5
Pedestrian	6.8	8.3	1.2	0.9,1.6	5.4	4.0,7.2	5.5	0.8	0.7,0.9	3.9	3.3,4.5
Other penetration	2.0	2.7	1.4	0.7,2.0	6.0	3.5,9.8	2.5	1.3	1.0,1.6	6.0	4.6,7.4
Burn	9.3	5.6	0.6	0.4,0.8	2.6	1.7,3.5	9.2	1.0	0.9,1.1	4.7	4.1,5.3
Bite	1.3	3.0	2.3	1.4,3.6	10.1	6.0,15.9	2.4	1.8	1.4,2.2	8.5	6.6,10.9[a]

[a]Proportional incidence ratio
[b]Standardized incidence ratio

American Indians had the highest proportion of low severity (ISS 0-9) injuries (78.1%), compared with 63.0% for whites and 74.2% for blacks. Because less severe injuries are likely to be associated with lower hospital charges, the lower mean hospital charge for American Indians ($10,783) compared with whites ($13,267) was consistent with the severity data. However, a much greater proportion of American Indians (90.4%) than whites (46.8%) or blacks (78.9%) listed Medicaid as the primary payer.

Discussion

This study provides evidence of alarming patterns of injury among urban Indians. The most important features of these patterns are the overall high injury rates, the high proportion of intentional injuries, a significant proportion of injuries among the homeless, and the overwhelming role of alcohol use in injuries among Indians. Several limitations to this study must be considered in interpreting this evidence.

The most important limitation is the potential sampling bias associated with hospital trauma registry data. Although the HMC is the main Level I trauma center for the county, a number of hospitals in other parts of the county also provide inpatient trauma care. Among medical control hospitals for the county's emergency medical system, nearly all gunshot wound victims as well as more than 70% of victims of motor vehicle and pedestrian incidents, stab wounds, and other injuries are transported to HMC. Only one-third of persons sustaining fall-related injuries, however, are transported to HMC.

Thus, while ascertainment may have been relatively complete for most severe injuries and certain conditions such as major burns (Harborview is the only burn center in the region), large numbers of patients with other injuries, such as those sustained in falls, were cared for in other hospitals. For this reason, accurate population-based injury rates cannot be derived from the data in this study.

A second limitation concerns the potential bias introduced by comparing data among races based on care provided at a single facility where persons of some races may be more likely to use the facility than persons of other races. HMC is a public hospital located near a number of low

Table 3. Intent of injury, Harborview Trauma Registry, Seattle, WA, by race, 1986–92, King County, Washington

Mechanism	White N=9,991 Percent	American Indian (N=593) Percent	PIR[a]	95% CI	SIR[b]	95% CI	Black (N=2,803) Percent	PIR[a]	95% CI	SIR[b]	95% CI
Unintentional	72.8	49.7	0.7	0.6,0.8	3.0	2.7,3.4	44.9	0.6	0.6,0.7	2.9	2.8,3.1
Assault	13.8	36.6	2.6	2.3,3.0	11.7	10.1,13.2	54.4	3.2	3.0,3.4	15.3	14.5,16.2
Legal intervention	0.5	1.0	2.1	0.8,4.6	9.4	3.5,20.6	0.6	1.2	0.6,1.8	5.7	3.3,9.2
Suicide	5.7	4.0	0.7	0.4,1.0	3.2	2.0,4.7	2.8	0.5	0.4,0.6	2.4	1.8,2.9
Other, unknown	8.3	2.4	—	— —	—	— —	8.6	—	— —	—	— —

[a]Proportional incidence ratio
[b]Standardized incidence ratio

income communities in central Seattle. To the extent that certain racial and ethnic groups are disproportionately represented in these communities, comparisons of incidence ratios by race may result in spuriously elevated rates among minorities.

According to the 1990 Census, the American Indian population of King County is broadly distributed across the county, whereas there are high concentrations of blacks in several neighborhoods close to the medical center. It is probable that, at least in the case of blacks, geographic proximity to the hospital and financial barriers to use of other facilities resulted in a higher likelihood of them seeking care for injury at the medical center. The extent to which this phenomenon affects American Indians cannot be fully assessed. However, the fact that injury severity (as measured by ISS) was lower among American Indians than other races may reflect bias introduced by referral of more severely injured white victims from outlying areas of the county, or a high likelihood that American Indians used the HMC facility even in cases of less severe injuries.

Recognition of the epidemic of injury among urban blacks should be extended to include recognition of a similar epidemic among urban American Indians.

Although the SIRs would be particularly sensitive to differential referral patterns, the PIRs would be less markedly affected. Even accounting for the probable referral bias introduced by relying on trauma registry data, conditions for which both PIRs and SIRs are elevated likely reflect truly increased rates of injury. For instance, the 11.7 SIR and 2.6 PIR for assault and the 11.6 and 2.6 for stab wounds among American Indians compared with whites are not likely to be explained solely by different use patterns by county residents of different races.

A third limitation of the study is likely to result in systematic underestimation of injury among American Indians. This limitation stems from the fact that racial misclassification of American Indians has been repeatedly demonstrated in disease registries in the Pacific Northwest.[9-12] For instance, in the Oregon Injury Registry, a statewide surveillance system of injuries resulting in hospitalization or death, injury rates among American Indians were underestimated by one-third.[10]

Although the extent of assignment of race by hospital staff members based on observation is not known, it is likely that a number of persons who would have self-identified as American Indians were classified as another race by staff members. It is not likely that persons of other races were classified as American Indians. The net effect of this pattern of misclassification would be to underestimate systematically SIRs among American Indians. Because some previous studies have shown higher misclassification rates among younger Indians, differences in the age-specific rates among Indians compared with other races in this study may be partially due misclassification.

The high age-adjusted SIR (4.4) among American Indians compared with whites is consistent with data from other sources, and likely reflects a true elevation in the incidence of serious injury among Indians. In our previous population-based study of injury mortality in King County, age-adjusted unintentional injury mortality rates were more than double those of whites (69 per 100,000 compared with 29 per 100,000 and 1.8 times those among blacks).[4]

The only other unintentional injury morbidity data regarding urban American Indians in the Northwest is related to fire and burn injuries.[13] In a population-based study of unintentional residential fire injuries in King County, the fire-related injury incidence rates among Indians were 4.4 times greater (95% CI 1.5,12.8) than those among whites.

Our results are consistent with findings from other urban studies that have found that blacks in the United States have high injury hospitalization rates,[14] and show that trauma disproportionately affects other urban minority populations as well. Recognition of the epidemic of injury among urban blacks should be extended to include recognition of a similar epidemic among urban American Indians. This epidemic mirrors a similar problem evident in the high rates of injury morbidity and mortality among reservation-based Indians.

A second important finding is the high proportion of intentional injuries among American Indians. Although combined homicide and suicide rates among Indians (38 per 100,000) were similar to those among blacks (39 per 100,000), these rates were more than twice the rate among whites. The high SIR for injuries due to assault (11.7) suggests that current initiatives to address violence should include specific plans to address the needs of urban American Indians.

High rates of injury morbidity and mortality among homeless people have been previously documented,[15-17] but, to our knowledge, the association of homelessness to high injury rates among urban American Indians has not been previously addressed. Initially, we did not seek to assess the association of injury with homelessness, and ascertainment of homelessness by reliance on a discharge ICD-9 code certainly underestimates the actual prevalence of homelessness.

Nevertheless, the unanticipated finding that more than 11% of Indian injury hospitalizations occurred among homeless people deserves further investigation.

The high prevalence of morbidity and mortality associated with alcohol abuse among American Indians has been repeatedly demonstrated.[18,19] In this study, nearly three quarters of injured Indian trauma patients had blood alcohol levels exceeding 0.1 percent (a level frequently used to define legal intoxication), and more than one-third (compared with 5% of whites) had levels exceeding 0.3 percent. Because Indians and other races were tested for blood alcohol levels in similar proportions, these differences are not due to differential ascertainment based on race. Such differential ascertainment was found in a study of 42 American Indians included in a trauma registry in Tucson, AZ, where a greater proportion of American Indians compared with other races were tested for blood alcohol level.[20] Even so, the authors concluded that the high proportion of American Indians with detectable blood alcohol levels (85%) was not accounted for solely by differential ascertainment. If injury rates among urban Indians are to be reduced, efforts to reduce alcohol abuse must have a high priority.

It is important to emphasize explicitly that the root cause of high injury rates (both intentional and unintentional) among urban Indians are highly unlikely to be related to any biological characteristics of Indian people. Rather, the high rates of poverty, underemployment, and inadequate education that characterize this population are associated with conditions such as homelessness and substance abuse, which increase the risk for injury. The role of racism and cultural disruption associated with the adverse health status of urban American Indians has not been adequately defined and deserves further study. Regardless of the underlying reasons for high rates of injury among urban Indians, we conclude that the development and implementation of initiatives in urban injury control should include urban American Indians as a target population for injury reduction. Efforts to reduce injury in urban areas should include collaboration with representative urban Indian organizations.

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