

# The Validity of Injury Surveillance System Measures of Assault

## A Lesson From the Study of Violence in Alaska

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This article considers the validity of estimates of intentional violence using a statewide injury recording system: the Alaska Trauma Registry (ATR). One benefit of using data from an injury surveillance system is that its records are generated without police involvement, thereby reducing the likelihood of undercounting. However, there is reason to suspect that measures of violence derived from injury surveillance systems do not accurately measure underlying levels of assault in a population and are instead partly a reflection of influential patient characteristics. The ATR was used to compare assault injury cases of Alaska Natives with those of non-Natives to determine if patient characteristics varied between racial groups and to determine if those characteristics served to bias comparisons of injury rates. Results indicate that differences in assault injury rates are partly attributable to a greater proportion of Alaska Native patients being hospitalized for injuries of only minor or moderate severity.

**Keywords:** *measurement validity; injury surveillance system*

Criminologists have continually struggled to find an accurate measure of intentional violence that will allow for ecological comparisons between jurisdictions and across time. The measures that we have traditionally relied on—police statistics, victimization surveys, and self-report surveys—are each better suited for purposes other than developing an understanding of locational differences in the incidence and prevalence of intentional harmful acts that could be defined as criminal. As violence has become an issue of importance to public health officials (Guerrero, 2002; Koop & Lundberg, 1992), the use of measures of intentional violence based on medical records has become increasingly popular. For example, both emergency department

(e.g., Rand, 1997) and hospital admission (e.g., Lipton & Gruenewald, 2002) records have been employed as alternatives to more traditional measures of intentional violence. Although these public health measures are seen as avoiding many of the problems associated with more traditional measures (Stone et al., 1999), their validity and reliability have yet to be given the scrutiny traditional measures of intentional violence have received. In this article the validity of measures from a specific injury surveillance system, the Alaska Trauma Registry (ATR), is considered.

### **Traditional and Public Health Measures of Intentional Violence**

When used as initially intended, data from sources such as police crime reports and victimization surveys can be of great value in the study of intentional violence and its aftermath. However, the use of that data becomes problematic when employed in ways beyond those originally designed. As is described below, the usual criminological indicators are better suited for purposes other than making comparisons on a geographic basis. Given this problem, measures of interpersonal violence that are derived from medical sources are seen as a promising alternative for considering ecological patterns of violence.

Dating back to 1930, the main source of police crime statistics in the United States is the Uniform Crime Reports (UCR). They were originally developed by the International Association of Chiefs of Police and then, shortly after its inception, taken over by the U.S. Federal Bureau of Investigation (FBI). There are varying explanations of the original purpose of the UCR. Some argue that they were developed to provide annual national estimates of crime (Lynch & Jarvis, 2008) that would undermine newspapers' concoction of circulation-enhancing "crime waves" (Maltz, 1977; Maltz & Targonski, 2002). Another view sees the UCR as a product of the

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police professionalism movement in which standardized departmental statistics were to allow commanders to judge departmental (Robison, 1966) and individual effectiveness—thereby making possible the control of officer discretion within centralized chains-of-command (Banas & Trojanowicz, 1985). Whatever the original purpose, the UCR are not intended to be used to make comparisons between jurisdictions. Critics pointed out the problematic nature of using the UCR for comparative purposes within the 1st year of publication (Sellin, 1931; Warner, 1931) and the report *Crime in the United States* has carried a longstanding warning that users of UCR data are “cautioned against comparing statistical data of individual reporting units” (Federal Bureau of Investigation [FBI], 2005, p. v, emphasis in original).

Measures of intentional violence based on crimes known to the police are problematic when making cross-jurisdictional comparisons for a couple of reasons. First of all, according to Lowman and Palys (1991), police crime statistics are subject to *instrumental bias* which results from errors arising in the actual processing and recording of case information. This instrumental bias leads to the so-called “dark figure” of crime (Biderman & Reiss, 1967) in which the police recognize as occurring only a portion of the crime that actually does occur in society. The dark figure is a result of many processes including variations in citizen reporting and police recording practices, methodological problems associated with the imputation and estimation of measures, and instances of political manipulation and fabrication (Mosher, Miethe, & Phillips, 2002). Secondly, Lowman and Palys (1991) point to the *essential bias* of police crime statistics; they argue that the differential deployment of the police results in crime statistics that are as much a reflection of the activities of those who record crime as they are an indication of the underlying harmful behavior. Given that the processes contributing to essential and instrumental bias are not randomly distributed across the population but are instead a function of variations in socioeconomic and police jurisdictional characteristics, their effects are stronger in some jurisdictions than in others. Ultimately, the difference in rates of intentional violence between jurisdictions becomes an unknown product of the differences in police activity, in citizen reporting, and in the actual amount intentional violence in each jurisdiction.

Victimization surveys are the other primary criminological data source used to study intentional violence. By design, they avoid many of the problems inherent in the use of police statistics because they capture instances of violence regardless of victim reporting or police initiative. As was the case with its predecessor, the National Crime Survey (NCS), the National Crime Victimization Survey (NCVS) is the only continuously

conducted, nationally representative data source on crime and victimization collected at the incident level that includes detailed specifics about victims, offenders, and criminal acts. For more than three decades it has provided important nationwide estimates of criminal victimization including measures of unreported crime, characteristics of victims and offenders, and the circumstances and consequences of victimization (Groves & Cork, 2008).

Although the robust design and rigorous administration of the NCVS ensures reliable estimates of violent victimization, those estimates are only applicable at the national level and are of little use when conducting ecological analyses at lower levels of aggregation. Attempts were made to develop metropolitan-level estimates of victimization as part of the NCS during its pilot testing, but those efforts were dropped prior to complete implementation of the survey (Groves & Cork, 2008). Even with its tremendously large sample, the relative rarity of violent victimization precludes precise estimates from the NCVS at levels of analysis usually of interest in ecological studies of violence (Pepper & Petrie, 2003). Due to their relatively smaller sample sizes, the few state-level victimization surveys that have been conducted are also of little use in analyses at the substate level.

As intentional violence has become an important issue in the field of public health, researchers have turned to alternative measures of violent behavior to better understand its prevalence and etiology. Although the use of vital statistics bureau records to measure homicide is common (e.g., Cantor & Cohen, 1980; Weaver, Martin, & Petee, 2004), only recently have other measures generated through the provision of health care been used to study violence. For example, trauma center admissions records have been used to study the effects of gun control and three strikes legislation on gunshot wounds (Weichenthal & Roberts, 2004), the effects of unemployment on knife assaults (Reed, Smith, Helmer, Lancaster, & Carman, 2003), and the effects of juvenile curfews (Shatz, Zhang, & McGrath, 1999). A number of specific surveillance systems, including the National Pediatric Trauma Registry (Moskowitz, Griffith, DiScala, & Sege, 2001), the Census of Fatal Occupational Injuries (Janicak, 1999), and the Pregnancy Mortality Surveillance System (Chang, Berg, Saltzman, & Herndon, 2005) have been used to examine the incidents of specific violent acts. Emergency department admissions records have been used to study the associations between the full moon and assaults (Zargar et al., 2004), between drug use and violent victimization (Macdonald et al., 2005), and between depression, alcohol use, and violence (Borges, Cherpitel, Medina-Mora, & Mondragon, 2004).

For those wishing to examine variations in intentional violence across geographic areas, measures derived from public health records might be viewed as a reasonable compromise between measures from police statistics or victimization surveys. One of the benefits of using public health measures of violence is that, like measures drawn from police records, they are taken from a preexisting data source making their use much more cost-effective when compared to measures obtained using victimization surveys. Furthermore, a consideration of the differences between the context in which public health measures are gathered versus the context in which police and victimization measures are obtained helps us to understand the potential benefits of the former in ecological analyses of intentional violence. In short, using public health records to measure violence allows for analyses at lower levels of aggregation—a benefit associated with using police measures—without the extensive underreporting, which is the benefit of using victimization survey measures.

The first potential benefit of public health measures of intentional violence is that they allow for a degree of geographic specificity that is not possible when using measures from victimization surveys such as the NCVS. Unlike victimization survey measures which require tremendous expense to gather reliable and valid data, public health measures of intentional violence are essentially secondary data sources derived from preexisting medical records which allows for data to be gathered on a population rather than sample basis. With a relatively greater number of cases per capita plus the availability of location specifics, it is possible to conduct ecological analyses at lower levels of aggregation than is possible with the NCVS or other robust national victimization surveys. For example, the Centers for Disease Control and Prevention (CDC) has begun to augment its easily accessible assault mortality data available at state (CDC, 2005) and county levels (CDC, 2008) with a newer, highly detailed data set called the National Violent Death Reporting System which currently allows for the study of homicide patterns in 17 states at the census tract level (CDC, 2003). There is no national data source for measuring nonfatal injuries caused by assault, but roughly two thirds of states do have trauma registries—half of which include injury cases admitted to any acute care hospital and the other half for only those injury cases resulting in care in a specialized trauma center (Guice, Cassidy, & Mann, 2007). A further benefit of these registries is that they are designed to include only the most serious medical cases (such as patients receiving trauma center care or patients requiring overnight hospitalization) which serves as something of a control on self-selection biases among the cases. If an assault injury is serious enough, medical necessity

would be expected to outweigh many of the considerations that would regularly preclude the reporting of an act of intentional violence to the police. Although inconsistencies in case inclusion criteria prohibit their combination for analyses across multiple states (Mann, Guice, Cassidy, Wright, & Koury, 2006), state-specific injury registries have proven valuable for intrastate analyses, particularly when atypical levels of analysis are of interest such as Californian zip code areas (Gruenewald & Remer, 2006) or isolated Alaskan villages (Wood & Gruenewald, 2006).

The use of public health records to measure intentional violence is potentially beneficial because the dark figure is thought to be smaller for measures based on medical records than for those derived from police data or even victimization surveys. In terms of the difference between public health measures and police measures, research indicates that a large proportion of assaults with injuries requiring emergency medical care never come to the attention of the police (Boyle & Kirkbride, 2006; Houry, Feldhaus, Nyquist, Abbott, & Pons, 1999; Sutherland, Sivarajasingam, & Shepherd, 2002; Warburton & Shepherd, 2004). There is also an indication that the likelihood of the police recording an assault is unassociated with its severity (Shepherd, 1997). Even victimization survey results appear to underreport the problem of serious violence when compared to public health measures. A comparison of the results of the emergency department records-based Study of Injured Victims of Violence (SIVV) with the results from the National Crime Victimization Survey (NCVS) indicates that the NCVS underestimates the incidence of violence resulting in injury. There were 2.5 times as many emergency department patients requiring treatment for violent crimes in the SIVV than victims in the NCVS reporting treatment at a hospital emergency department for violent victimization (Rand, 1997).

A consideration of the differences between the context in which public health measures are gathered versus the context in which police and victimization measures are obtained helps us to understand why there is less underreporting in the former compared to either of the latter. In this regard, "context" can be thought of as the circumstances that determine if an intentional violent act eventually is officially recorded. For an act of violence to come to the attention of the police, the victim or a third-party must decide (a) that the act is wrong, (b) that the act is a crime, (c) that the police are the solution to the problem, and (d) that the benefits of informing the police are greater than the costs of doing so (Gottfredson & Gottfredson, 1988). Unless the police discover it on their own, a decision contrary to any one of these contingencies results in an act of intentional violence not being included in the police statistics.

Each contingency is influenced by any number of factors associated with the violent act and ultimately influences the chances of an offense being officially recorded. For example, retrospective studies have found that child sexual abuse is less likely to have been reported when it involves victimization at a younger age, which in turn is associated with victims being less likely to view their abuse as wrong or to know that it is criminal (Goodman-Brown, Edelstein, Goodman, Jones, & Gordon, 2003; Paine & Hansen, 2002). Likewise, there is some evidence that men are more likely than women to report nonstranger violence to the police because they typically lack the social networks that women can rely on to help them cope with the aftermath of a violent crime (Kaukinen, 2002). There is also a whole host of factors that increase or decrease the likelihood that a victim of violence will think that informing the police is beneficial including victim sex (Felson & Paré, 2005), geographic isolation (Ruback & Ménard, 2001), neighborhood socioeconomic disadvantage (Baumer, 2002), neighborhood social cohesion (Goudriaan, Wittebrood, & Nieuwbeerta, 2006), fear of reprisal, and a desire to protect the offender (Felson, Messner, Hoskin, & Deane, 2002). Although the seriousness of an offense is the prime determinant of cases being brought to the attention of the police (Gottfredson & Gottfredson, 1988), it is clear that there are many other contextual circumstances that make some cases much more likely to be reported than others.

As with those based on police statistics, measures of intentional violence derived from victimization surveys are also subject to contextual influences that influence the types of cases captured during the interview process. Although the dark figure of victimization survey-based estimates of intentional violence is certainly less than that of estimates based on police statistics, not all of the possible cases that could be included are captured by some surveys and there are specific contextual influences that are thought to lead to underestimations of intentional violence in some victimization surveys compared to others. A number of authors have pointed to the effect of context on the differences between the results of the NCVS versus those from the National Violence Against Women Survey (NVAWS). Some have argued that specific cues within the NCVS serve as signals to participants to restrict their responses to only those acts of violence that they believe to be criminal (Tourangeau & McNeeley, 2003) thereby failing to capture the cases of "those who by some objective criteria can be regarded as victims of violence but who do not perceive themselves to be crime victims" (Felson et al., 2002, p. 641). One important difference between the two surveys is the way in which they are introduced. The NVAWS was introduced as a survey about personal safety, whereas the NCVS is introduced as a "survey to determine

how often people are victims of crime” (U.S. Census Bureau, 2003, p. A2-2). The screening questions of the two surveys also create contextual differences that are thought to create incompatibilities in estimates of intentional violence; the NVAWS asked about specific acts of violence, whereas the NCVS screening questions are framed with reference to the “types of crimes” the study covers (Bachman, 2000; Rand & Rennison, 2005). For these reasons and others, it is clear that the context laid during survey administration results in substantially different estimates of violent victimization.

Although public health measures of intentional violence are an appealing alternative, they have not been subject to the scrutiny normally given to the dependent variable in criminology. With the exception of comparisons of measures of homicide generated by the police with those produced by vital statistics bureaus (Cantor & Cohen, 1980; Sherman & Langworthy, 1979) and a recent study comparing coroner records with vital statistics records (Comstock, Mallonee, & Jordan, 2005), few studies have examined the validity and reliability of medical measures as indicators of intentional violence. It is unclear the extent to which public health measures generated by injury surveillance systems underestimate the extent of serious violence and, as with police and victimization survey measures, the degree to which contextual circumstances increase or decrease the likelihood of injury cases being recorded.

A number of studies have shown that public health estimates of intentional violence derived from injury surveillance systems are subject to a similar sort of instrumental bias that results in a slippage from the actual amount of injury in a population to the amount eventually recorded. This slippage begins even before treatment is given. Some injury cases, particularly those that are less serious or those involving blunt trauma, are not recorded because patients sometimes leave an emergency department against medical advice (Ding, Jung, Kirsch, Levy, & McCarthy, 2007) or without being treated (Fernandes, Price, & Christenson, 1997). Once treated, not all injury cases are recorded (Goldberg, Gelfand, Levy, & Mullner, 1980; Lawrence, Miller, Weiss, & Spicer, 2007) and many end up being recorded incorrectly (Hunt et al., 2007; LeMier, Cummings, & West, 2001; Schwartz, Nightingale, Boisoineau, & Jacobs, 1995; Winn, Agran, & Anderson, 1995).

Aside from patient-driven and clerical sources of undercounting, other contextual factors that are potentially associated with assault victimization also influence the likelihood of an injury case being recorded. This is especially true for those injury surveillance systems (such as the ATR) that use



hospital admissions as a requirement for case inclusion. Race, gender, and health insurance status are all associated with the likelihood of hospital admission following traumatic injury (Selassie, McCarthy, & Pickelsimer, 2003; Svenson & Spurlock, 2001). Emergency department workloads and hospital resources have also been shown to have an effect on hospitalization of injury patients following treatment (Reilly et al., 2005). These studies indicate that cases can be excluded from injury surveillance systems for reasons other than those related to extent of injury or medical necessity and that the likelihood of a case being included is partly a function of patient and case characteristics. This has the potential to bias the comparison of rates of violence across those characteristics that in turn lessens the utility of public health measures of intentional violence.

## Method

In this study records from the Alaska Trauma Registry (ATR) were examined to find out if there were variations across patient characteristics that could bias comparisons of measures of intentional violence. Like most other studies on public health and criminal justice in Alaska, these comparisons were made between Alaska Natives (the indigenous inhabitants of the state) and non-Natives. Comparisons between these two groups were made on the severity of injuries recorded in the ATR. Cross-tabulations and comparisons of race-specific age-adjusted injury rates were used to test the hypothesis that there were differences in the severity of injuries of cases recorded in the ATR for Alaska Natives as compared to non-Native Alaskans.

There is good reason to expect that Alaska Natives and non-Native Alaskans might have different patterns of health care utilization. As a part of its treaty obligations and trustee responsibilities (Kunitz, 1996), the U.S. federal government provides comprehensive health care without cost to American Indians and Alaska Natives (Cunningham, 1993). There is some evidence that this benefit provides Alaska Natives with better access to the health care system. For example, according to the Behavioral Risk Factor Surveillance System (BRFSS), Alaska Natives were more likely than White Alaskans to receive preventive health care. In the 1997 BRFSS, White Alaskans (20.4%; 95% CI = 16.7%-24.1%) were more than twice as likely as Alaska Natives (8.8%; 95% CI = 5.0%-12.6%) to report not having a routine physical examination in the 2 years prior to the survey (Bolen, Rhodes, Powell-Griner, Bland, & Holtzman, 2000).

The present study examined all cases of injuries caused by assault that were recorded in the ATR for the years 1991 through 2000. A standardized statewide record of all injuries that result in a hospital admission or declaration of death in an emergency department, the ATR has been kept since the beginning of 1991 for all 24 acute care hospitals in Alaska (Sallee, Moore, & Johnson, 2000). Each hospital has a trauma registrar who abstracts up to 144 data elements from the medical records of all injury patients with either (a) hospital admissions of at least 24 hr or (b) with transfers to another hospital for advanced care (Hill, Wells, Andon, & Ballew, 2004) thereby restricting the data set to only those serious injury cases that have the greatest need of treatment. A broad range of information concerning each individual trauma case is recorded in the ATR. For the purposes of this research, the most important information in the ATR includes the city where the injury occurred, the race/ethnicity of the trauma patient, and the cause of injury ICD-9 E-code classifying the injury as being caused by assault. The managers of the ATR have made considerable effort to insure that it provides reliable estimates of serious traumatic injury in Alaska. Three different validation studies have been conducted to determine the extent to which applicable cases are captured in the database. According to Moore and Murphy (2001), 90% of potential cases in 11 hospitals, 87% of potential cases in 6 hospitals, and 91% of potential cases in 11 hospitals were eventually recorded in the ATR database in 1999, 1998, and 1994, respectively. Ultimately, the ATR should be seen as providing statewide, population-based data for nearly all cases of seriously injured Alaskans receiving treatment and admission to a hospital (Johnson & Moore, 1997) rather than as accurate reflection of traumatic injury in the state.

The severity of Alaska Natives' and non-Native Alaskans' assault injury cases were compared using the Abbreviated Injury Scale (AIS; Committee on Medical Aspects of Automotive Safety, 1971). As rankings of the threat-to-life associated with an injury, scores on the AIS serve as a rating of the severity of an injury (Lefering, 2002). As is shown with the examples presented in Table 1, each injury is classified using information from the AIS-Dictionary (Association for the Advancement of Automotive Medicine, 1990) as being (a) minor, (b) moderate, (c) serious, (d) severe, (e) critical, or (f) unsurvivable (Greenspan, McLellan & Greig, 1985). In cases where a patient received multiple injuries, the ATR records the AIS score for the single most serious injury.

Three basic analyses were conducted. First, cross-tabulations and chi-square tests of statistical significance were completed to determine if

**Table 1**  
**The Abbreviated Injury Score (AIS) Severity Scaling**  
**by Threat-to-Life and Examples of Injury**

AIS Score	Severity Level	Threat-to-Life	Example Injury
1	Minor	Not life threatening	Fracture of a finger
2	Moderate	Not life threatening	Closed undisplaced tibial fracture
3	Serious	Not life threatening	Perforation of the colon
4	Severe	Survival probable	Incomplete transection of the thoracic aorta
5	Critical	Survival unclear	Bilateral intracerebral bleeding
6	Fatal	Unsurvivable	Penetrating injury to the brain stem

Note: Adapted from Committee on Medical Aspects of Automotive Safety, 1971, p. 278; Lefering, 2002, p. 53; Senkowski & McKenney, 1999, p. 493.

there were differences in the severity of injuries of Alaska Native and non-Native Alaskan patients whose cases were recorded in the ATR. The rates for comparing the injury cases of Alaska Natives and non-Native Alaskans were then calculated using the standardized rate comparison function of the StatsDirect epidemiological statistical program to determine if variations in aggregate injury severity made a difference when comparing the two subpopulations' injury rates. This function allows for comparison of age-adjusted rates for two different study subpopulations. The comparison is made in the form of a ratio of the rates of one subpopulation (such as Alaska Natives) to the rates of the other subpopulation (such as non-Native Alaskans) and confidence intervals (CI) for the rate ratios (RR) are calculated based on a Poisson distribution (Sahai & Kurshid, 1996). Given that the likelihood of arriving alive at the hospital of record is a function of the distance from the injury scene (Grossman et al., 1997), these analyses were first conducted for three different levels of geography including (a) injuries that occurred in Anchorage, (b) injuries that occurred outside of Anchorage, and (c) the total of all injuries in the entire state. Then, to consider the ramifications of variations in aggregate injury severity on ecological analyses of assault injuries, age-adjusted rate comparisons are made between Alaska's isolated and nonisolated regions. Finally, so as to put the other results into context, the differences between Alaska Native and non-Native injury rates based on the ATR will be compared with similar measures based on death certificate records and police homicide data.

**Table 2**  
**Proportion of Injury Assaults of Serious or Greater Severity**  
**by Location for Alaska Natives and Non-Natives, 1991-2000**

Geography	Percentage of Cases of Serious or Greater Severity <sup>a</sup>		Chi-Square	<i>p</i>
	Alaska Native	Non-Native		
Alaska total	22.5	39.4	114.628	<.001
Anchorage	27.8	47.9	52.697	<.001
Non-Anchorage	20.4	31.3	31.661	<.001

a. Abbreviated Injury Score greater than or equal to 3.

## Results

The first set of analyses compared the proportion of assault injury cases with AIS scores that were considered “serious” or greater (i.e., AIS > or = 3) for Alaska Native trauma patients versus non-Native patients. The results of those analyses, presented in Table 2, indicate that a greater proportion of non-Natives were hospitalized for cases of injury that were classified as serious or greater. Regardless of the level of geography, Alaska Native patients were more likely than non-Native patients to be hospitalized for assault injuries of minor or moderate severity.

The standardized rate comparisons presented in Table 3 indicate that the overrepresentation of Alaska Natives among the ranks of the least severely injured does indeed have an impact on the differences in assault injury rates for Alaska Natives versus non-Natives. In the top half of Table 3, comparisons are made for rates of assault injuries of all levels of severity. Across all geographic levels, the Alaska Native rates were higher than those of non-Native Alaskans. On a statewide basis, Alaska Natives were 7 times more likely than non-Natives to be hospitalized for assault (RR = 7.0; 95% CI = 6.6-7.6). The differences between the two groups for assaults in Anchorage were even more dramatic.

When injury severity was taken into account by focusing only on the most severely injured cases (see the bottom half of Table 3) the differences in assault injury hospitalization rates for Alaska Natives and non-Native Alaskans were less than what was found for injuries of all levels of severity. The rates of hospitalization for assault victims with injuries of serious or greater severity across Alaska were “only” 4 times higher for Alaska Native

**Table 3**  
**Annual Age-Adjusted<sup>a</sup> Assault Injury Rates Per 100,000**  
**Population by Location of Injury and Injury Severity**  
**for Alaska Natives and Non-Natives, 1991-2000**

Geography	Rate per 100,000 Population		Rate Ratio	95% CI
	Alaska Native	Non-Native		
All assault cases				
Alaska total	211.5	30.0	7.0	6.6-7.6
Anchorage	296.7	31.5	9.4	8.4-10.6
Non-Anchorage	189.7	28.7	6.6	6.0-7.2
Serious <sup>b</sup> assault cases				
Alaska total	48.0	12.0	4.0	3.5-4.6
Anchorage	82.8	15.2	5.4	4.4-6.7
Non-Anchorage	39.1	9.2	4.3	3.6-5.1

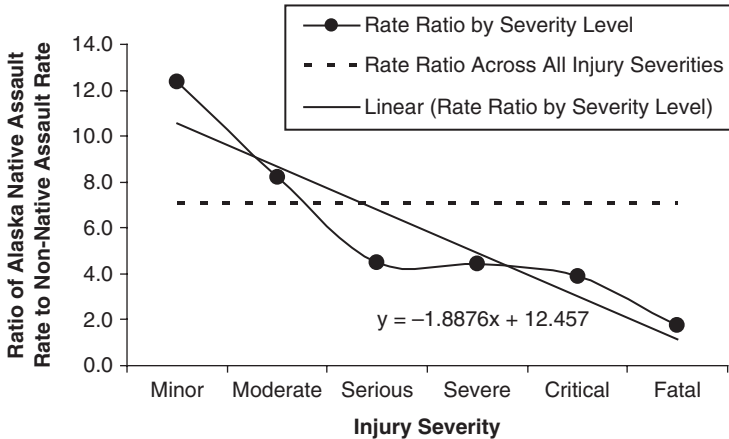
a. Rates are age-adjusted to the U.S. 2000 standard population.

b. Abbreviated Injury Score greater than or equal to 3.

victims than for non-Native victims (RR = 4.0; 95% CI = 3.5-4.6), whereas in Anchorage the risk was “just” more than 5 times greater (RR = 5.4; 95% CI = 4.4-6.7). Even though the differences between the two subpopulations remain substantial for the most serious assaults, it is clear that the differences in hospitalization rates for Alaska Natives versus those for non-Natives are much larger when all levels of assault injury severity are considered than when only the most serious cases are examined.

The decrease in the ratios of hospitalization rates as the severity of assault injury increases is also apparent when the rate ratios are calculated for each level of injury seriousness. A comparison of the different rate ratios of hospitalization for assault injuries for each level of injury severity is shown in Figure 1. There is an inverse association between the severity of injury and the ratio of hospitalization rates for injuries caused by assault when comparing the rates for Alaska Natives with those for non-Natives. The line of best fit calculated for the distribution shown in Figure 1 indicates that a single unit increase in the AIS injury severity score resulted in a decrease of 1.89 rate ratio units. In other words, the difference between Alaska Natives' and non-Natives' hospitalization rates for assault injuries decreased by 189% with each increase in injury severity. Although not as substantial, similar inverse associations were found for differences in injuries brought about by other causes; for each unit increase in the AIS injury severity score, there

**Figure 1**  
**Ratio of Annual Age-Adjusted<sup>a</sup> Rates of Assault Injury per 100,000 Population for Alaska Natives Versus Non-Natives by Injury Severity, Alaska, 1991-2000**



a. Rates are age-adjusted to the U.S. 2000 standard population.

was a 37% decrease in the differences in rates of injury caused by motor vehicle crashes and an 88% decrease in the differences in rates caused by self-harm.

The final analysis considered the effects of the selection bias on geographically based comparisons of assault injuries. These comparisons were made between two areas typically examined when studying intentional violence in Alaska. Specifically, the isolated, roadless region of northern and western Alaska was compared with the remaining, nonisolated portion of the state consisting of areas connected by the state’s solid and marine highway system. Taking into account all assault hospitalizations, the results presented in Table 4 confirm other studies (Berman & Leask, 1994; Landen, 1996) which have shown that the prevalence of intentional violence is greatest in the most isolated portions of Alaska. The overall rate of assault injury hospitalizations in that region was nearly 2.5 times the rate of the nonisolated region (RR = 2.4; 95% CI = 2.2-2.6). However, after considering (a) that Alaska Natives are more likely to be hospitalized for less severe injuries and (b) that the population of the isolated region is predominantly Alaska

**Table 4**  
**Annual Age-Adjusted<sup>a</sup> Assault Injury Rates per 100,000**  
**Population by Injury Severity for Isolated and Nonisolated**  
**Regions of Alaska, 1991-2000**

Injury severity	Rate per 100,000 Population		Rate Ratio	95% CI
	Isolated Region	Nonisolated Region		
All assaults	118.9	50.4	2.4	2.2-2.6
Serious assaults <sup>b</sup>	34.2	20.2	1.7	1.5-2.0
Nonserious assaults <sup>c</sup>	84.7	30.2	2.8	2.5-3.1

a. Rates are age-adjusted to the U.S. 2000 standard population.

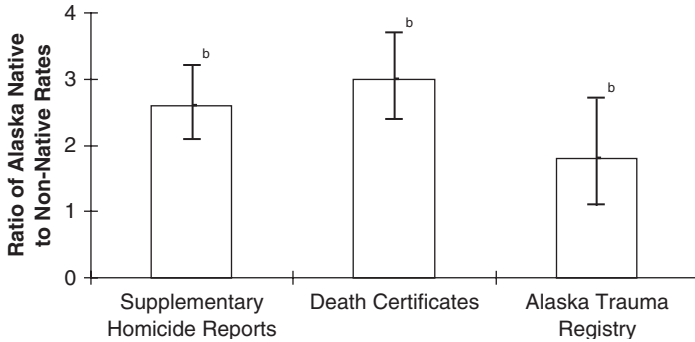
b. Abbreviated Injury Score greater than or equal to 3.

c. Abbreviated Injury Score less than 3.

Native, the extent of the relationship between isolation and assault injury rates is called into question. When the comparison was made only on the basis of serious assaults, the magnitude of the difference between the rates of assault injuries for isolated versus nonisolated regions was cut in half from 140% greater (i.e., RR = 2.4) to 70% greater (i.e., RR = 1.7). Failure to consider the selection bias contributing to the overall rates of assault injury hospitalization results in an overestimation of the extent of intentional violence in locations that are predominantly populated by Alaska Natives relative to locations in which Alaska Natives are in the minority.

To put the above results into context, other measures of Alaska Native and non-Native intentional violence were compared. The best available data allowing for statewide comparisons are those measuring fatalities caused by assault. In Figure 2, a comparison of Alaska Native to non-Native rate ratios is made between ultimately fatal assault hospitalizations recorded in the ATR with homicides recorded in the UCR Supplementary Homicide Reports as well as with homicides recorded the Alaska Bureau of Vital Statistics death certificate database. Overall, this comparison reinforces two points. First, as with the ATR, the other measures indicate that Alaska Natives have higher rates of intentional violence compared to non-Natives. More important, there is a consistency across the rate ratios of the three measures of fatal assaults (in that the differences are within confidence intervals and therefore not statistically significant) and the non-ATR rate ratios more closely resemble the rate ratios for serious assault injury hospitalizations recorded in the ATR as opposed to the rate ratios for those hospitalizations resulting from more minor injuries.

**Figure 2**  
**Ratio of Annual Age-Adjusted<sup>a</sup> Assault Injury Fatality**  
**Rates per 100,000 Population by Data Source for**  
**Alaska Natives and Non-Natives, 1991-2000**



a. Rates are age-adjusted to the U.S. 2000 standard population.

b. 95% Confidence Interval.

Aside from homicide data, further comparisons between rates of intentional violence among Alaska Natives and non-Natives are difficult to draw because of a lack of a statewide case-level data set that includes victim race. The Alaska State Troopers' (AST) calls-for-service database does record victim race for all offenses committed outside of places served by municipal police, but geographic incompatibilities with the ATR prohibit direct comparisons between the two data sources. A consideration of only the AST data for the year 2000 indicates that Alaska Natives are twice as likely to be the victims of assaults known to AST when compared to non-Native Alaskans (RR = 2.0; 95% CI = 1.8-2.2). As with comparisons made with homicide data, the AST rate ratio is closer to that of the ratios of the most serious assault injury hospitalization rates in the ATR comparisons.

## Discussion and Conclusions

Based on the results presented above, two things are clear. First of all, injury morbidity rates as estimated by hospitalizations for Alaska Natives are significantly higher than those recorded for non-Native Alaskans. These differences existed across different geographic levels; they are found



for injuries brought about by other causes; and they are similar to what has been found in studies examining injury fatalities (Day & Lanier, 2003). The other main finding is that the tremendous differences between Alaska Natives' and non-Natives' rates of hospitalization for traumatic injury found when comparing assault injuries of all severities were substantially reduced when the comparisons were based only on the most serious assault injuries because Alaska Natives were more likely than non-Natives to be hospitalized for less serious injuries. It appears that the tremendous overall difference between estimated Alaska Native and non-Native injury rates found when using data from the ATR is the result of the actual elevated incidence of serious injury in the Alaska Native population combined with a greater proportion of Alaska Natives receiving overnight hospitalization for injuries of only minor or moderate severity. Ultimately, as was shown in the consideration of assault injury hospitalization rates for the isolated and nonisolated portions of Alaska, this selection bias results in a geographic comparison that overestimates the differences in assault injury rates when areas with majority Alaska Native populations are compared to areas with relatively smaller Alaska Native populations.

Identifying the source of this selection bias requires consideration of the context in which intentional violent acts eventually are or are not recorded in the ATR. Just as there are many contingencies underlying the recording of cases in police records or victimization surveys, a number of decisions are made regarding injuries caused by intentional violence that determine the likelihood of any case meeting the inclusion criteria of an injury surveillance system. In regards to the ATR, decisions are made by injury victims (or their surrogates) about whether medical care is necessary and where to obtain it and then, on diagnosis, medical practitioners decide if the patient requires admission to the hospital for an overnight stay rather than release immediately following treatment. By including only those cases resulting in overnight hospitalization, the ATR excludes potential cases when a victim decides medical care is unnecessary, when a victim seeks medical care from a clinic not offering overnight hospitalization, or when an attending physician decides to treat and release the patient. In turn, all of these contingencies are predicated on the seriousness of the injury in interaction with numerous circumstances related to access to health care including health insurance status, hospital resources, and emergency practitioner workload (Reilly et al., 2005; Svenson & Spurlock, 2001).

With these factors in mind, it is possible to speculate on the reasons why Alaska Natives are much more likely than non-Natives to be hospitalized for injuries of minor or moderate severity. One possibility is that health care

facilities serving Alaska Natives have a greater capacity compared to those serving non-Natives that might equate to more hospital beds available for inpatient care. In the state's rural areas where a larger proportion of the population is Alaska Native, hospitals generally have an occupancy rate of only 30% (Rarig, Coti, Keady, Waring, & Wright, 2002). Another possibility is that overnight hospitalization for relatively minor injuries might be more likely to be covered by the publicly funded health insurance of Alaska Natives than it is to be covered by the private plans of non-Natives who have health insurance. Although the effect of health insurance status on hospital admissions in Alaska is unknown, research from South Carolina indicates that among patients suffering minor to moderate injuries, those covered by government insurance plans such as Medicaid are much more likely to be hospitalized when compared with similar cases of patients without health insurance or those covered by private insurance (Selassie, McCarthy, & Pickelsimer, 2003). Although there are certainly many other possible explanations for the overrepresentation of Alaska Natives among those hospitalized for minor or moderately severe injuries, it is clear that contextual influences other than the seriousness of an injury also determine which patients are hospitalized following an intentional act of violence hospitalization and, ultimately, which cases are recorded in the ATR.

Regardless of the particular sources of the selection bias, the results presented above serve as a caution to those who would use measures of intentional violence based on hospitalizations as an alternative to police or victimization data in ecological analyses. These results support those who have argued that comparisons of subpopulations using hospitalization data should only be made after taking into account the relative severity of injuries resulting in admission (Lefering, 2002). Failure to do so leaves open the potential for overestimation of serious injuries resulting from intentional violence (a) at the total population level and, especially (b) for certain segments of the population.

Of course, the results from this study are based on records from only one state—an atypical state at that—and point to the potential for bias in regards to only one application of hospitalization records. As with police and victimization data, records from the ATR and other injury surveillance systems are useful for purposes other than ecological analyses of intentional violence including monitoring the incidence of specific types of injuries (e.g., gunshot wounds or traumatic brain injuries) or examining the quality of emergency medicine. Moreover, as research from Washington state has demonstrated, it is possible to use hospitalization records for comparing patterns of intentional injuries across races by first establishing a lack of selection bias in

terms of injury severity thereby ensuring an equal basis for comparisons (Johnson, Sullivan, & Grossman, 1999; Sullivan & Grossman, 1999). Ultimately, instead of being treated as complete representations of assault injury in a population unaffected by factors other than injury seriousness, measures of intentional violence based on hospitalization records should be used with the same care given more traditional indicators of intentional violence.

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