An Assessment of Potential Injury Surveillance Data Sources in Alaska Using an Emerging Problem: All-Terrain Vehicle-Associated Injuries

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Synopsis

Using injuries associated with three-wheeled all-terrain vehicles in Alaska as an example, the existing injury data bases were assessed for usefulness, cost, simplicity, acceptability, flexibility, sensitivity, specificity, representativeness, and timeliness. In this study strengths and weaknesses of existing data for all-terrain vehicles were identified and ways to improve data collection and linkages across data systems are suggested.

Based on this evaluation, linked death certificates and medical examiner data provide an excellent mechanism for monitoring vehicle-related fatalities. Information sources for nonfatal and nonvehicle-related injuries require further development. Police records provide supplemental information, but they are limited to the events reported to police. Although other sources were explored, they added no advantage to the primary sources. Data processing, analysis, and dissemination—traditional responsibilities for public health and other governmental agencies—can transform these data sources into meaningful mechanisms to define injury trends and monitor injury-specific intervention strategies.

INJURIES ARE the leading cause of deaths occurring before 45 years of age in the United States (*1,2*). In spite of this enormous impact, epidemiologic research into the cause and prevention of injuries has not kept pace with research efforts concerning other health problems. An essential component of injury research involves developing and maintaining surveillance systems to target injury problems and to evaluate the effectiveness of injury control interventions (*3,4*). Developing and maintaining new surveillance systems can be costly. One potential solution is to use existing data bases to construct or improve an injury surveillance plan.

In Alaska, recent epidemiologic investigations into injury problems (*5,6*), including a study on the growing importance of injuries associated with three-wheeled all-terrain vehicles (ATVs) (*5*), provided an opportunity to evaluate existing data bases for their usefulness in a statewide surveillance system for injuries. Using as an example injuries associated with ATVs, we reviewed a variety of potential reporting sources. This report will describe these injury data bases, assess their usefulness in an injury surveillance system, and offer recommendations for establishing statewide injury surveillance based on existing data sources.

Methods

Mortality. All Alaska death certificates for 1983–84 were reviewed manually to identify deaths due to injuries. Using the ninth International Classification of Diseases (ICD9) supplementary classification of external causes of injury and poisonings (E codes) (*7*), injury-related deaths were coded for the Alaska Division of Vital Statistics (ADVS) by the National Center for Health Statistics (NCHS) to reflect the underlying cause of death as understood from information on the certificate at the time of coding. Certificates of deaths related to ATVs were compared with a list of deaths attributed to ATVs that were routinely selected by ADVS staff as part of a special project sponsored by the U.S. Consumer Product Safety Commission (CPSC). Because four-wheeled ATVs were not generally available in Alaska at the time of this study, we limited our evaluation to injuries associated with three-wheeled ATVs.

Autopsy records from the four State medical examiners (MEs) who perform all autopsies in Alaska were compared to death certificates for all fatalities attributed to ATVs, snow machines (referred to as snowmobiles outside of Alaska), motor vehicle collisions, drownings, hypothermia, impact injuries, and other unexplained unintentional injury deaths. Alaska law requires that deaths attributable to injuries be investigated by a coroner or magistrate who may order an autopsy to be performed by an ME. All coroners and magistrates were surveyed to identify any investigated deaths known or suspected to be related to ATVs.

Data tapes shared by the Alaska Departments of Public Safety (DPS) and Transportation (DOT) were analyzed to identify ATV incidents investigated by police. Alaska law requires that the two departments receive police reports for all vehicular incidents in which a person is injured or in which property damage exceeds $500.

All units of the Alaska Emergency Medical Services were surveyed to identify ATV fatalities. Community health aides, village public safety officers, and sanitarians of the Indian Health Service (IHS) provided additional information about ATV fatalities among rural Alaskans. Medical personnel at facilities of the U.S. Army, Air Force, and Coast Guard were contacted to identify fatal ATV-associated injuries among military personnel and dependents in Alaska.

The CPSC supplied a list of fatalities associated with ATV use in Alaska obtained from the Commission's ongoing data sources—(*a*) a death certificate reporting system, (*b*) the National Electronic Injury Surveillance System (*8*) for product-related injuries, (*c*) an ME's and coroner's reporting system, (*d*) a news clipping service, and (*e*) consumer reports that reach the CPSC.

Morbidity. IHS and two of three major private referral hospitals in the State provided patient records for this study. In Alaska, the IHS provides medical care for all Native Americans as well as non-Native Americans in rural areas. Medical records for persons hospitalized as a result of injuries were coded according to the E code format. All inpatient records coded E819-E825 (motor vehicle-related injuries) were reviewed to identify ATV-associated injuries. Outpatient records for ATV-associated injuries were available from IHS and from one private hospital (for 1984 only).

The Chandra Sekar and Deming method (*9*) was used to estimate the total number of nonfatal ATV-associated injuries in Alaska based on the cases identified from medical records and DOT-DPS reports.

Results

Mortality data. From all data sources, 20 fatalities due to ATV-related incidents during 1983–84 in Alaska were identified. No single data source identified all 20 fatalities (chart).

Manual review of death certificates identified 13 persons (65 percent) who died of ATV-related injuries. Only one certificate could be identified by using the ICD Code E821 (nontraffic accident involving other off-road motor vehicles), the code which most closely categorizes an off-road ATV-associated injury. The other 12 deaths were identified as ATV-related on the basis of the narrative cause-of-death section added by magistrates or coroners.

Seven ATV-associated fatalities were identified from sources other than death certificates. Of these deaths, three were identified from ME records. Two deaths were reported to the Alaska Division of Public Health by a rural magistrate familiar with the State ATV study. Finally, one death was reported by an IHS emergency room nurse, and one was identified in a police report from DOT-DPS.

To determine why these seven fatalities escaped identification as ATV-associated during the initial review of death certificates, we searched all certificates for deaths attributed to snow machines, motor vehicle collisions, drownings, hypothermia, impact injuries, and other unspecified unintentional injury causes. We found certificates for four of these seven deaths: three deaths had been attributed to impact injuries of unspecified origin, and one death to a motor vehicle crash. Death certificates for the two deaths reported by the rural magistrate were filed at a later date, and these two deaths were attributed to a snow machine crash. No death certificate had been filed by March 1988 for the death identified only by the police report.

MEs recorded 13 (65 percent) ATV-associated fatalities. Four other ATV-related deaths were investigated by MEs, but the fatal injuries were attributed to other causes: two were identified as snow machine-associated deaths; one was attributed to an unspecified recreational vehicle incident; and, for one death, circumstances surrounding the injury event were not noted. Autopsies were performed in all 17 deaths investigated by MEs. Of the three cases for which no ME investigation occurred, one body was lost at the scene of the

fatal event, one death occurred in a hospital more than 4 months after the date of injury, and no record was found for the person identified only by the DOT-DPS records.

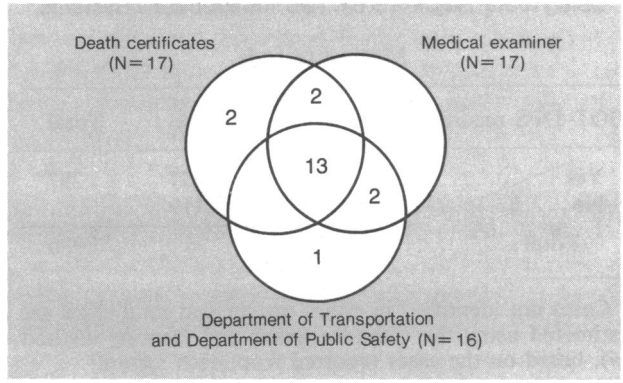
DOT-DPS reports were available for 15 fatal ATV incidents in which 16 persons died. For 14 fatal events, the vehicle coded was an ATV. One incident report incorrectly labeled the vehicle as a snow machine. The report for one incident with two fatalities, not filed with DOT-DPS at the time of the record search, was filed at a later date. For three of four fatal incidents in which a report was not filed, a conventional motor vehicle crash did not occur: in one incident, the immediate cause of death was cold exposure; no DOT-DPS report was filed for the incident in which the body was lost; and no report was available for a passenger fatally injured by falling off a trailer being pulled by an ATV. For one person who died more than 8 months after injury, no DOT-DPS report was on file.

The CPSC recorded nine deaths (45 percent) secondary to ATV crashes. All of these deaths were reported to CPSC via the death certificate program. All of these deaths occurred in 1983; no 1984 deaths were recorded. No additional ATV-associated deaths were identified through the surveys of magistrates and coroners, emergency medical services representatives, IHS personnel (community health aides, village public safety officers, and sanitarians), and medical personnel of the Armed Forces.

Morbidity data. Surveillance of nonfatal ATV-related injury events was less complete than surveillance of fatalities. Although the three study hospitals treat most trauma cases in the State, and each vehicular incident resulting in injury must by law be reported to the police, few cases appeared in both the hospital and police files. When the 534 inpatients and outpatients treated in hospitals for ATV-related injuries were compared to 297 drivers and passengers involved in vehicle incidents investigated by police, only 20 names appeared on both lists. No common characteristics for these 20 persons were identified. No other sources were evaluated for surveillance of nonfatal ATV-associated injuries.

Evaluation of surveillance system. Assessment performed during the development stage of a surveillance system can help ensure that surveillance will provide information to persons with a need to know. The quality of a surveillance system can be assessed by reviewing certain qualitative attributes (simplicity, flexibility, and acceptability) and quantitative characteristics (sensitivity, specificity, representativeness, and timeliness) (*4,10*).

All-terrain vehicle-related fatalities identified from selected data sources, Alaska, 1983-84



Injury surveillance should be simple to operate, flexible enough to meet changing program needs, and acceptable to practitioners and the public. Existing sources offer a relatively simple surveillance mechanism to capture injury data. Injury surveillance based on existing data sources sacrifices flexibility, however, because of restrictions on data collection dictated by the program requirements of the primary source. For example, the vital statistics records system had no procedures for amending death certificate codes after filing to reflect information gained through subsequent investigations into the cause of death. Previous studies have addressed a wide range of limitations inherent in the use of death certificates (*11-17*). In contrast, the DOT-DPS reporting mechanism permitted editing of police reports to reflect accurately the final status of the injured persons.

Acceptability is the willingness of responsible parties to furnish data for surveillance purposes. Easy access to sources in Alaska is possible because of a cooperative atmosphere, coordination of program goals, and timely dissemination of information gained from surveillance to the source providers.

Sensitivity is the ability of a system to detect true cases of the event under surveillance. The combined records of vital statistics and MEs captured 95 percent of all ATV deaths (chart). Vital statistics and MEs individually detected 85 percent of fatal cases—the highest sensitivity for ATV-related deaths among all sources investigated. Identification of ATV-associated events required laborious manual record review, however, and comparison

Estimated Nonfatal All-Terrain Vehicle-Related Injuries Using Data Reported by Two Independent Systems

	Medical records		
DOT-DPS records	Yes	No	Total
Yes	20	277	297
No	514	[1]7,119	...
Total	534	...	[1]7,930

[1] Cases not identified in either system and total cases are estimated using the Chandra Sekar and Deming method (*9*), based on the cases reported from each system:

	Medical records		
DOT-DPS records	Yes	No	Total
Yes	a	b	$a+b$
No	c	d	$c+d$
Total	$a+c$	$b+d$	N

NOTE: Estimate of $d = \frac{(b \times c)}{a}$; estimate of $N = a+b+c+d$

with other sources for confirmation. The sensitivity of data sources to detect nonfatal ATV-related injuries was low; when DOT-DPS records (the only centralized system of vehicle-related reports in the State) were compared to available hospital records, only 4 percent of nonfatally injured persons were captured by both systems.

Although the objective of public health surveillance is rarely to identify all cases of disease and injury (*3*), an understanding of the extent of underreporting is essential. Based on an analysis of the number of cases reported by two independent systems (DOT-DPS reports and hospital records), it can be estimated that 7,930 nonfatal ATV-related injuries may have occurred during the 2-year study period (see box) (*9*). Although available cause-of-injury information for nonfatal injuries is known to be limited nationally (*2*), the factors contributing to the lack of sensitivity in the data sources for nonfatal injuries in Alaska require further investigation.

Specificity—the ability of a system to exclude noncases or false-positives—is high for fatalities recorded by vital statistics, MEs, and DOT-DPS. Seventeen deaths (85 percent) were identified by more than one of these sources, thus confirming the cause of death; one other ATV fatality was confirmed by an additional source. High specificity would be expected from these systems with the status of each case documented by individual investigation. Two deaths were identified by one data source only. Further investigation at the local level could reveal whether these are true- or false-positive cases. Assurance of correctly classified reports (specificity) makes further investigation of surveillance cases unnecessary.

Although three-wheeled ATV-related injuries were used as an example for the surveillance of injuries in this study, surveillance of ATV-related injuries may not be representative of all vehicle-related injuries. ATV-associated injuries must be reported to the police in Alaska, in a manner similar to other motor vehicle-related injuries. This reporting occurs in an atmosphere of considerable State and national press attention to ATV-related injuries in recent months. As a result, these injuries may be identified and reported more readily than injuries due to other causes. Data for surveillance of nonvehicle-associated injuries may be even more elusive.

The timely reporting of events, important for analysis and dissemination of information, often depends on the data collection schedule of primary sources. In several sparsely populated States such as Alaska, the NCHS does the ICD coding of deaths certificates. Certificates undergo coding only on an annual basis; death certificate information required prior to annual coding must be retrieved by manual review. Other systems often encounter intrinsic, variable reporting delays, and these can have cumulative effects. For example, because of the death certificate coding delay, the CPSC death certificate reporting system had not yet received ATV-associated fatality reports from Alaska for 1984.

Discussion

The increasing recognition of injuries as a public health problem has prompted efforts to develop surveillance mechanisms that provide information on which to base policy decisions, prevention and control measures, and evaluation of programs. The strengths and weaknesses of the Alaska data systems reported in this paper can provide a valuable resource for developing injury surveillance in other public health programs.

This evaluation identified sources of injury data in Alaska—some sources unique to that State and

others that can be generalized to other States. Data linked to national systems, such as death certificates, CPSC programs, and the National Highway Traffic Safety Administration's Fatal Accident Reporting System (*18*) for vehicle-related deaths on public highways, conform to a standard format and permit comparison of local injury problems to those found in other regions. These standard formats obviate the need to duplicate an exhaustive review like this study in other locations. Data from MEs, police, and other State and local systems will vary, however, and will require local evaluation of their usefulness as case-reporting mechanisms or supplemental sources of information.

Because the process of developing a surveillance system can draw upon existing sources of data, the data characteristics need to be assessed and the surveillance objectives spelled out initially. In Alaska, death certificates, ME records, and DOT-DPS files identified most ATV-related fatalities in the State and provided excellent descriptive information (*5*). Data concerning nonfatal injuries were much less accessible and complete.

We caution that the findings from this assessment of ATV-related injuries in Alaska may not be generalizable to other types of injuries. DOT-DPS records, an important source of supplemental information about ATV-related injuries, are restricted to vehicular events. For nonvehicular injuries, a similar evaluation process may be needed. Finally, the sources evaluated in this study provided limited information about the circumstances surrounding the event, including environmental conditions, mechanism of injury, alcohol as a suspected factor in the event, use of protective clothing, and events leading to the crash. Surveillance based on the data sources evaluated in this study would fail to monitor these risk factors important in injury occurrence, severity, and outcome.

Misclassification of ATV-related injuries occurred in the data systems reviewed. Other studies have assessed the impact of misclassification in death certificates (*11–17*). Misclassified cases adversely affect the predictive value (confirmed cases or noncases) of a surveillance system. Accuracy can be improved by using a clear, specific case definition and by developing good communication between reporting sources and receiving agencies (*19*).

The potential for increased costs must be addressed whenever a new public health program is recommended. Using existing data sources can reduce anticipated costs. Because these existing data sources are maintained for other purposes, however, they may require costly data processing and reorganization to be useful for surveillance or epidemiologic studies. Existing injury data systems usually are not linked, and only two Alaska records systems were computerized: DOT-DPS reports and IHS records (the CPSC, the National Highway Traffic Safety Administration, the IHS, and the NCHS maintain national computerized data bases). Time-consuming manual record reviews of other sources were necessary to identify ATV-associated events, obtain additional descriptive information, and link records. This process would be required for other injuries as well.

Information about cause is essential to identify injuries by external cause category (such as motor vehicle-related or falls) and to develop prevention programs (*20*). Cost considerations have resulted in sporadic use of the standard injury ICD external cause codes (E codes), especially in hospital data systems. Even when the valuable E codes are available, classification of cases often presents problems, and interpretation of the codes can be difficult. Death certificate E codes in Alaska did not identify the specific problem of ATV-associated injuries.

This and other studies of injury in Alaska (*5,6*) form the basis for plans to develop a statewide injury surveillance system. This evaluation of potential injury data sources indicates that linking death certificate and ME data is an excellent mechanism for monitoring injury fatalities. Information about nonfatal injuries, however, requires further development. Police records provide supplemental information, but they are limited in the events described. Other sources were explored, but they added no advantage to the primary sources. Data processing, analysis, and dissemination—traditional public health responsibilities—can transform these data sources into mechanisms to define injury trends and monitor injury-specific intervention strategies.

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Comparison of Health Habits of Military Personnel With Civilian Populations

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Synopsis

The relationship between health habits and health status has gained attention in the literature in recent decades. In this report, the health habits of a particular occupational group—the military—are compared with those of the civilian population, and the extent to which the health habits of the military personnel are associated with their health status is examined. Responses to two surveys conducted in 1985 were analyzed by age group, sex, race, and educational level. The comparisons involved six of the seven health habits included in the Alameda study.

Military personnel, because they are younger and their lives are more regimented, excel in meeting weight standards for the services and engaging in desirable levels of physical activity. Smoking habits of military personnel were less favorable than those of the civilians. An examination of the health status of the military for the year preceding the survey suggested that some health habits have immediate manifestations, but the impact of others may not be evident until later in life.