

## **Survived Spinal Cord Injury Resulting from Motor Vehicle Crashes among the Navajo: 1984-1987.** David C. Martin, Class of 1989.

Unintentional injuries are the leading cause of productive years of life lost and the leading cause of death among the Navajo people. Vehicle related injuries are not only the leading cause of death on the reservation, but account for the greatest number of injury related hospital inpatient days and hospital discharges. Spinal Cord Injury (SCI) has been described by numerous clinicians as one of the most devastating and catastrophic conditions in all of medicine. Reports from the National Spinal Cord Injury Statistical Center reveal that in a recent year, 6500 cases of neurological impairment resulted from acute SCI in the United States. In addition, there were about 4700 acutely spinal cord injured Americans who were dead on arrival and another 1300 who died after admission to a hospital.

A computer printout of the Navajo Area Indian Health Service's "Active Spinal Cord Injury List" on February 21, 1990, reveals the identity of 184 Navajo persons with traumatic spinal cord injury who are receiving some measure of follow up care through the Area Rehabilitative Services Branch. The dates of injury are from 1957 to 1989. The Navajo Nation's population estimate for 1989 is 186,000. The point-prevalence of traumatic spinal cord injury among the Navajo is therefore one per thousand. Of 45 Navajo people who were spinal cord injured from 1984 to 1987 and who received follow-up through the Navajo Area Rehabilitative Services Branch, 40 (89%) are known to be motor-vehicle related injuries. 37 of these individuals are currently followed through the Spinal Cord Clinic conducted at Gallup Indian Medical Center. They constitute the target population for this study.

The purpose of this study was to characterize the spectrum of survived spinal cord injury resulting from motor vehicle crashes among the Navajo people. The characterization includes factors relative to the injury event and to the post-event survival of spinal cord injured individuals. This information is to be used as convincing evidence to our tribal leaders, health service planners, legislators, and others that spinal cord injuries are exacting a toll of catastrophic proportions in terms of human suffering, human resources, and fiscal resources, in the Navajo Nation. By also convincing these groups that injury events are not random and are preventable--and that primary prevention has the potential for reducing state and federal expenditures--the allocation of funds for preventive measures becomes a more feasible option. The information in this report forms a basis for making specific recommendations regarding evaluation of risk for spinal cord injury and planning effective prevention strategies.

### **Methods**

All Navajo Area IHS beneficiaries known to have been spinal-cord injured from 1984 to 1987 are represented in this study. The study focuses upon those within the above group whose spinal cord injuries are motor vehicle related, and who continue to receive follow up care through the Area Spinal Cord Injury Clinic as of the date of this report (i.e., through 1989). These subjects are, therefore, from two to six years post-injury. All cases were identified through the Navajo Area IHS Spinal Cord Register. A systematic review of their medical records was conducted to obtain information pertaining to the severity of their injuries and the follow-up care since their injury. Motor vehicle crash data were obtained from the appropriate state bureaus of traffic safety. Available data were recorded on a Spinal Cord Injury Review Form developed specifically for this study.

Several limitations were accepted in conducting the study. The data sources did not have identical reporting techniques. Therefore the quantity and accuracy of information varied from one source to another. In several cases where the actual crash information was unavailable, information regarding the injury event was accepted from the Emergency Medical Service or Emergency Room report found in the patient's service unit hospital record. Budgetary constraints occurring in the Indian Health Service in 1989 also affected the follow up of spinal cord patients in the Navajo Area. Information on the follow up of some patients is felt to be somewhat incomplete.

### **Results**

The annual incidence of traumatic spinal cord injury resulting in complete or partial quadriplegia or paraplegia is approximately 3 to 3.5 per 100,000 in the United States.<sup>2</sup> The incidence rate among the Navajo population by comparison is as follows:

11 cases in 1984 (pop. 162,200) or 6.8 per 100,000

10 cases in 1985 (pop. 166,700) or 6.0 per 100,000

10 cases in 1986 (pop. 171,000) or 5.8 per 100,000

Thus, the incidence of spinal cord injury (SCI) among the Navajo is approximately two to three times that of the United States total population. Other comparisons between the Navajo SCI group and US statistics appear in Table 1.

Motor vehicles crashes caused the spinal injuries in 85% of cases (Table 1). Among the 37 motor-vehicle-related SCI victims, 41% were drivers, 46% passengers, and 11% pedestrians. The location of the injury was 43% cervical, 49% thoracic, and 8% lumbar. 54% (20/37) of the lesions were "complete," i.e., had a permanent lack of sensory and motor function below the level of the injury. Of the 14 victims who were ejected from the vehicle, none were known to have been wearing a seat belt. Single-vehicle rollovers were the most frequent crash type. Of the 32 SCI victims who were vehicle occupants, 23 (72%) were in pick-up trucks, including 2 who were in the cargo area.

70% of the motor vehicle crashes involved alcohol. Alcohol involvement was not consistently documented in the data sources, however.

Data regarding the costs of SCI were difficult to obtain. My associated at the Craig Rehabilitation Hospital in Denver, the facility in which the majority of Navajos with SCIs receive their rehabilitative care, estimate that the typical 30-45 day stay costs from \$50,000 to \$80,000. This represents only the initial phase of rehabilitation and does not include any long-term costs. It also does not include the costs of the acute care of the injury. That care typically involves surgical stabilization of the spinal fracture (operating room surgeons, anesthesia, recovery room, application of orthopedic traction devices) and post-operative care (intensive nursing care, physical therapy, special rotating beds, etc.). The acute care hospitalization frequently is 6-10 weeks before transfer to the rehabilitation facility.

## Discussion

Most of the findings relative to the injury events represented in this study were not too surprising, confirming the high proportion of alcohol involvement and non-use of seatbelts. Perhaps the most unexpected finding relative to the event was that 12 of these cases (31%) occurred in the two-hour period between 6 AM and 8 AM. This includes four of the crashes that are documented to be alcohol related. Others in this two-hour block of time appear to be individuals commuting to or from work who "fell asleep" or were passengers in vehicles where the driver allegedly fell asleep while driving.

**External Cause:** The finding that almost 90% of spinal cord injuries occurring to Navajo people are the result of motor vehicle crashes, while the proportion of SCIs due to motor-vehicle-related crashes for the US total population ranges from 37 to 55%,<sup>3</sup> supports our strong emphasis upon motor vehicle injuries as opposed to preventive efforts aimed at sports injuries, stabbings, gunshot, and even falls that might be appropriate in other ethnic groups.

**Type of Collision:** The finding that single vehicle rollover crashes account for over 50% of the spinal cord injuries suffered by Navajo people provides impetus to efforts aimed at reducing rollover crashes.

**Population:** The over-representation of males and "young" victims (although somewhat older than the national mean and median age for SCI) reveals information which may have implication for targeting certain counter-measures (i.e., in the workplace).

**Vehicle:** The high percentage of pick-up trucks reflects the popularity of this vehicle on the Navajo Nation.

**Alcohol involvement:** The infrequency of autopsies on Navajo victims, and the high proportion of single-vehicle rollovers, suggest that the 70% figure for alcohol-involved among SCI victims is an under-estimate. Alcohol has both systemic and local physiologic effects that can influence the initial injury and development of post-injury pathology and loss of function. Research at the University of North Carolina indicates that acute intoxication results in more serious injury and a greater likelihood of fatality for comparable accident severities. According to data from the General Motors Research Laboratories, post-contusion spinal cord hemorrhage is increased by acute alcohol intoxication. Alcohol can increase the amount of edema in response to trauma. Acute intoxication, therefore, can result in significant differences in threshold for permanent paralysis.<sup>8</sup>

**Victims:** A slight majority of vehicle occupant victims who were spinal cord injured were passengers as opposed to drivers of the vehicle involved.

**Location of injury:** There were more spinal cord injuries at the thoracic level than at either the cervical or lumbar levels. This was an unexpected finding, since, nationally, the cervical spine is the level most commonly affected by spinal cord damage in motor-vehicle crashes.

**Severity of injury:** There were slightly more "complete" transections of the spinal cord than "incomplete" lesions in the study population. Again this runs counter to national findings for motor-vehicle related spinal cord injuries.

**Hospitalization and Rehabilitation:** Length of hospitalization and rehabilitation correspond with that for the U.S. total population for spinal cord injured individuals. An analysis of the costs involved, both direct and indirect, yields impressive figures demonstrating the fiscal impact that a single spinal cord injury has upon the health care system. Costs presented in the study are based on 1989 dollars, and upon information received from associates of Craig Rehabilitation Hospitals in Denver, Colorado, and the University of Utah.

**Complications:** I attempted to analyze the incidence of complications such as urinary tract infections, decubitus ulcers, pneumonia, gastrointestinal problems, depression, and alcohol-related complications. The data are felt to be

incomplete due to changes in the funding of rehabilitative services for IHS beneficiaries which have occurred in the past six to nine months. Furthermore, data were collected for those events which 1) required hospitalization, and 2) required surgical intervention.

The proportion of all motor-vehicle related spinal cord injuries occurring to Navajo people from 1984 to 1987 which the cases in this study represent cannot be known with certainty. Because autopsies are seldom performed upon fatally-injured victims of motor vehicle crashes on the reservation, the number of fatal victims who had spinal cord injuries is unknown.

The physical consequences of spinal cord injury are enormous: paralysis of arms or legs or both, bowel and bladder dysfunction, problems with balance, sensation, muscle spasms, hyperactive reflexes, disordered temperature control, irregular pulse and blood pressure, and changes in sexual function. The impact is much larger, of course. Relationships with loved ones and friends become strained and uncomfortable for an indeterminable length of time. Money concerns and legal matters present awesome obstacles. Living arrangements and occupational changes become major concerns. With unemployment from 50-70% among adult Navajos, the potential employability of a spinal cord-injured Navajo is minimal. If the victim returns home, a caregiver must frequently leave the job market, thus eliminating another potential wage-earner from the family. Society at large must provide assistance to the victim and family. The tragedy of SCI therefore extends well beyond the suffering of the victim.

### **Conclusions/Recommendations:**

The state of Arizona does not have a mandatory seat belt law. The person who represents a large segment of the Navajo population in the Arizona legislature has repeatedly opposed passage of such a law. This representative is also a member of the Navajo Tribe. It is recommended that he and other state representatives for the State of Arizona be lobbied to support adoption of a law similar to that of the Navajo Nation. Ample evidence exists that passage of such a law would decrease motor vehicle related morbidity and mortality, if enforced. Promotion of restraint usage should be implemented in worksites throughout Navajo Area. The age group revealed to be most affected by spinal cord injury in this study, are of the age most likely to be employed. Incentive programs should be developed, including proposals which may be funded through governmental and non-governmental funding sources. Funding should be sought to expand the ratio of Navajo police officers to population served from 1:1,000 to at least 4:1,000. To effectively enforce the existing restraint and DWI laws, the likelihood of apprehension as perceived by the public combines with other factors essential to deterrence, including the certainty, severity, and swiftness of punishment for violations of existing laws.

The development of an "Awareness and Prevention Team" should be pursued. Throughout the course of preparing this study, I have become acquainted with a number of the spinal cord injured individuals and their families, some of whom are very verbal regarding their experiences since being insured. These persons would be key to an effective team that could visit schools, worksites, and community groups to discuss the importance of wearing seatbelts and using child restraints. The option of videotaping some of the severely affected spinal cord individuals could also be an effective means of presenting information about the implications of a severe injury to persons at risk. An analysis of the factors relative to the injury event are leading to a risk profile of persons at risk for motor vehicle related spinal cord injuries. This would be useful as a component of the Awareness and Prevention Team efforts.

Injury Prevention Advocates are needed. Not only doctors and nurses,<sup>7</sup> but also the community level (chapter people) are needed to be empowered to look at their communities for problem areas, "death traps" or "dead man's curves," and to put the necessary pressure on whoever is necessary to make the indicated environmental changes.

An additional study suggested by the data, would involve a determination of commuting miles traveled by employees of reservation and border town enterprises. Long commuting distances are not unusual for employed residents of the Navajo Nation, with daily round-trip distances of up to 150 miles or more. Certain employment centers, such as Window Rock and Fort Defiance in Arizona and Navajo in New Mexico, are notably without housing for the large number of people who work there. A portion of such a study might be to determine whether or not employees would avail themselves of housing nearer their work if it were available. The Navajo Housing Authority might utilize such information for planning and/or prioritizing construction of housing units.

Finally, to have an intact brain and intact sensation and function about the head, neck and shoulders, yet to lack basic hand and locomotion skills, is indeed a tragic disability. With the loss of bowel and bladder control the problem seems overwhelming. Just 50 years ago, traumatic spinal cord injury was lethal in 60 to 80% of cases. With improved medical and surgical care, and effective modern rehabilitation, these people now usually live. Traumatic spinal cord injury remains a devastating condition that alters every aspect of the victim's life. Deep within each of these victims the hope for a cure remains. Living with the knowledge that a moment's thoughtlessness, or stupidity has had such long-term effects must be torture indeed. The knowledge that these catastrophic events are highly preventable must give us the impetus to promote injury prevention efforts with all our might.

**References:**

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**Table 1: Spinal cord injury victims: Navajo (1984-1987) vs. United States (1986).**

	<u>Navajo</u>	<u>United States</u>
Male:female ratio	6:1	4:1
Age at injury (years):		
Mean	33	29.7
Median	28	25
Mode	29	19
External causes (%):		
Motor vehicle	85	47
Falls	9	21
Other/unknown	4	31