# NEVADA'S INJURY DATA SURVEILLANCE PROJECT

# An Analysis of the Injury Surveillance Data System in Nevada


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# I. EXECUTIVE SUMMARY

## Project Purpose

Injury surveillance, the tracking and monitoring of injury data, provides essential information to guide the planning and implementation of injury prevention and control and injury treatment efforts. This report provides an evaluation of data available for injury surveillance activities in Nevada, and provides recommendations for further improving the usefulness of these data for injury surveillance and control in Nevada.

The report is a product of the Nevada State Health Division's (NSHD) Injury Data Surveillance Project. To provide an independent assessment of the system, NSHD used the services of Research Applications, a health services research and planning firm with expertise in injury data collection and analysis.

## Overview of Project Findings

Nevada possesses a wealth of injury surveillance data resources. While all of the injury-related databases have some weaknesses and shortcomings, strengths were much more prevalent than weaknesses. These data generally appear to be accurate and timely and most data field contents are appropriate and well edited. Data for most fields are reasonably complete. There is consistency across databases where similar data are collected in more than one database. As a result, the quality of the data was such that the researchers were comfortable using many of the fields to produce a companion document to this report that provides a brief overview of injuries in Nevada (see *Nevada's Injury Data Surveillance Project - An Overview of Injuries in Nevada*).

Overall, the assessment confirmed that Nevada has a number of excellent databases available to serve as the foundation of an effective injury surveillance system. While a strong foundation exists, Nevada's individual databases do not yet form a cohesive system and do not comprehensively address the issue of injuries due to a number of gaps. The most significant gaps identified were:

- the absence of a statewide emergency department database
- the absence of a statewide emergency medical services database
- the absence of several data fields within existing databases
- incomplete reporting of E-codes in the statewide hospital discharge database

## Project Recommendations

Based on the assessment, the following recommendations were developed to identify several of the highest priority actions that would help develop Nevada's individual databases into an effective injury surveillance system.

Recommendation 1: Establish a Trauma Data and Research Advisory Board to coordinate the multi-agency efforts required to develop and operate an effective trauma surveillance system.

Recommendation 2: Expand the existing Data Warehouse.

Recommendation 3: Develop an array of standard monitoring and analysis procedures and reports.

Recommendation 4: Expand the capacity to provide ad hoc reports to respond to inquiries about specific injury issues and to support specific projects.

Recommendation 5: Standardize and centralize Emergency Department data into a statewide database.

Recommendation 6: Standardize and centralize Emergency Medical Services data into a statewide database.

Recommendation 7: Mandate and enforce the submission of E-codes in hospital discharge data and provide separate fields for E-codes in all databases.

Recommendation 8: Include the Trauma Registry Database in future injury surveillance and linkages.

Database-Specific Recommendations: See Table 77 for recommendations regarding fields to be added, fields for which data collection should be improved, and other database-specific improvements.

# II. INTRODUCTION

In a report from its Injury Surveillance Workgroup, the State and Territorial Injury Prevention Directors Association (STIPDA) defined *injury surveillance* as "the ongoing capacity for tracking and monitoring the incidence, causes, and circumstances of fatal and nonfatal injuries and the timely dissemination of this information to those who need to know for the planning and the implementation of measures to control, reduce or eliminate injuries and to improve health outcomes."

Injury surveillance is one of the five core components of a state injury prevention program that have been identified by STIPDA, i.e.:

- Collecting and analyzing injury data
- Designing, implementing and evaluating interventions
- Building a solid infrastructure for injury prevention
- Providing technical support and training
- Affecting public policy[1]

As the first component of an injury prevention program, injury surveillance provides the informational basis for the remaining components. Surveillance data is used to guide the planning and implementation of injury prevention/reduction and injury treatment efforts. Injury surveillance is fundamental to injury prevention and treatment; therefore, Healthy People 2010 established a national objective of improving data surveillance systems.[2] Within Nevada, the Nevada State Health Division (NSHD) initiated the Injury Data Surveillance Project for the purpose of providing injury data and assessment findings.

This report is a product of the Injury Data Surveillance Project. The report details the results of an analysis of Nevada's current injury surveillance system, assesses that system's suitability for providing injury data that would support injury prevention and treatment efforts, and provides recommendations for further improving the effectiveness of the system. To provide an independent assessment of the system, NSHD used the services of Research Applications, a medical research and planning firm with expertise in data collection and analysis.

Following the analysis of the injury surveillance system itself, Research Applications used data from that system to produce a brief overview of injuries in Nevada, including injury rates, types, causes and risks (see the Companion Report entitled "*An Overview* of *Injuries in Nevada – 2003*).

# III. REPORT ROADMAP

This report analyzes injury data from Nevada. The first section of the report provides a discussion of the project purpose and methodology and this is followed by a brief discussion of the characteristics of an ideal statewide injury surveillance information system. The next section provides a brief description of each of the data bases evaluated for this report.

Each database is analyzed in the following order:

- Description of File Structure
- Evaluation of Missing Data and Duplicate Data
- Evaluation of Demographic Fields
- Evaluation of Injury Severity Fields
- Evaluation of Injury Type Fields
- Evaluation of Mechanism of Injury Fields
- Evaluation of Injury Outcome Fields
- Evaluation of Date, Time and Location of Injury Fields
- Evaluation of Safety Equipment Use Fields
- Evaluation of Other/Contributing Factor Fields
- Evaluation of Economic/Cost of Injury Fields

Each database is also analyzed in terms of its potential use as part of a larger injury surveillance system. The next section examines the quality of linked databases and examines consistency across databases.

The final sections of the report look at the overall "system" of injury data in Nevada, the system's strengths and the gaps in the system. The final section makes recommendations for improvements to the current system. An Appendix summarizes key findings for each of the databases analyzed.

# IV. METHODOLOGY

The goals of this effort were to provide an analysis of Nevada's current injury surveillance system, assess that system's suitability for providing injury data that would support injury prevention and treatment efforts, and provide recommendations for further improving the effectiveness of the system. The approach used in the analysis was to:

- Assess each of the currently available injury-related databases to determine how well it provides accurate, comprehensive and useful information about the specific injury domain for which it is intended.

- Assess the "system of databases" to determine how well the array of currently available databases addresses the full picture of injuries with regard to volume, cause, mechanism, treatment, etc.

All data files were provided in SAS data file formats and analysis of each file was conducted using either SAS or SPSS software. Each was evaluated for duplicate records, and where appropriate, as in the case of multiple hospital admission for the same individual, multiple records for the same individual were combined into a single record for that individual. Other files with duplicate records were unduplicated using standard data processing methods. Descriptive statistics such as frequencies, means and standard deviations were used to evaluate the distribution and range of values within key data fields. Data fields were cross-tabulated to check for referential integrity and individual data sets were cross-referenced to check for external referential integrity among the data sets (e.g., the number of reported motor vehicle crash fatalities in the Nevada Department of Transportation (NDOT) data were compared to the number reported in the death certificate file).

Data was also linked across files to combine information for a single record for analysis (e.g., to combine the record of a vehicle crash with the occupant's hospital admission records). Linkage of data files was accomplished using AutoMatch probabilistic linkage software. When personal identifiers are missing or inconsistent, probabilistic linkage infers which records link (i.e., pertain to the same individual) by looking at similarities in the data. The linkage software provides a "score" which reports the likelihood that two records pertain to the same individual and, thus, should be joined to create a single record. The score is created by examining pairs of fields contained in two databases which ideally report either (a) the same data or (b) data which should be similar/related. For each pair of fields, a point value is generated based on the exact match/similarity of the fields. For some pairs of fields, exact matches may be required (e.g., the software should not match a hospital record for a patient who was sent home with a crash record of a person reported as dying on-scene regardless of how similar age, sex, accident characteristics, etc. may be). For most fields (e.g., age) an exact match generates the highest point value, but similar data may generate some points. Multiple pairs of fields are examined and scored; the points are combined for all pairs and a final score created. A cutoff is set and records with scores above the cutoff are considered to be matches.

# V. SUGGESTED CHARACTERISTICS OF AN INJURY SURVEILLANCE SYSTEM

As described by STIPDA, an injury surveillance system should have the capacity to:

- ❑ Track and monitor information about injuries, including incidence, causes and circumstances
- ❑ Include data on all injuries, both fatal and nonfatal injuries
- ❑ Make the data available in a timely manner
- ❑ Disseminate that information to those who need it to assist them with planning and implementation of injury prevention/reduction efforts and health outcomes improvement/medical treatment efforts

This report will focus on the first three capabilities, which in essence describe the building of a data system. When this data system is in place, reports can then be developed and analytical processes instituted to use that data effectively. Key characteristics of an injury surveillance data system are described below. Later sections of this report will consider these criteria in examining the databases that make up Nevada's system.

***Data Integrity*** – Data should meet the data integrity standards expected of any health care database. Data in each field should be accurate, complete, reliable, valid and clear in meaning. Data should be accurately and completely conveyed from origin to final database inclusion. To prevent double-counting, duplicate copies of records should not exist in the same database.

***Uniformity in coding/coding systems and formats*** – The coding of data fields (e.g., diagnoses, mechanism of injury, race/ethnicity, occupation) should be the same across databases in order to facilitate comparisons, correct interpretations and linkages of data across databases. Similarity in formatting (e.g., using the same number of digits to record dates) can also facilitate programming of reports and data linkage. Ideally, the selected systems should be nationally used, which would facilitate comparisons of Nevada's data with that of other state and national databases.

***Comprehensiveness*** – The data system should, ideally include all occurrences of injury, or, more realistically, all injuries above a given level of severity (e.g., all those requiring medical care) regardless of mechanism of injury, location of occurrence, medical treatment facility type, etc. The system should also provide sufficient information on each injury to be useful for injury planning and implementing prevention and treatment efforts. Based on the authors' examination of trauma data systems, their experience using those systems for reporting and analysis, and compilation of recommendations from various injury-related organizations, the authors suggest that *at least* the following categories of data should be included in an effective injury data set (see Table V-1).

**TABLE V-1: Minimum Data Categories/Sample Fields Required for a Trauma Surveillance System**

| DATA CATEGORY | SAMPLE DATA FIELDS |
|---|---|
| Case Identification | identification of each injured individual (or each individual above a given severity level) at least once |
| Incident Description | mechanism of injury (vehicle crash, assault, fall, etc.)<br>E-codes (describe cause/mechanism, whether violence related and occurrence location)<br>date/time<br>geographic location (county, zip) |
| Contributing Factors | risk behaviors<br>activities at time of injury<br>profession (if work-related)<br>drug/alcohol use at time of injury<br>weather<br>vehicle speed (if vehicle crash) |
| Demographics | age<br>gender<br>race/ethnic group<br>residence |
| Injury Description | diagnosis code<br>body part<br>severity<br>blunt vs. penetrating |
| Safety Device Usage | seat belt use<br>bicycle helmet use |
| Medical Care Providers Used | type of care provider (e.g., ambulance, emergency department, inpatient acute hospital, rehab hospital, nursing facility)<br>provider name/identification<br>provider location<br>provider trauma care preparation (e.g., hospital trauma accreditation level, EMS level) |
| Medical Care Provided | diagnostic procedures<br>medical treatments<br>operative procedures |
| Injury Outcomes | economic costs<br>deaths<br>discharge destination (home, nursing home, etc.)<br>disabilities<br>lost work days |

To provide this kind of comprehensive data, STIPDA's Injury Surveillance Working Group recommends that each state have *at least* the following data sources available for use in injury surveillance (see *Section VII – Analysis of Nevada's Injury Surveillance Databases as a System* for a comparison of this list with those databases available in Nevada):[3]

- ❑ Death certificates
- ❑ Medical examiner/coroner system
- ❑ Fatality analysis reporting system (FARS)
- ❑ Child death review data
- ❑ Hospital discharge data
- ❑ Emergency department data
- ❑ Emergency medical services (EMS) data
- ❑ Uniform Crime Reporting (UCR) system
- ❑ National Occupant Protection Use Survey (NOPUS)
- ❑ Behavioral Risk Factor Surveillance System (BRFSS)
- ❑ Youth Risk Behavior Risk Survey

***Timeliness*** – For tracking and response purposes (e.g. biological terrorism), data should be submitted to a central location and evaluated immediately so that interventions can begin promptly where needed. For most other injury reporting and program evaluation purposes, data should be available within 6 months following the end of a reporting year.

***Ability to match and join records for the same case from the various contributing databases*** **–** A single source of information is unlikely to contain all of the information required regarding an injury (see previous bullet: *comprehensiveness*); therefore, information from various sources must frequently be joined. Due to confidentiality concerns, many health care databases do not contain patient identifiers such as name or social security number. In these cases, the matching process is best-performed using probabilistic linkage. The NSHD has both the software and the trained personnel to accomplish this matching.

***Integration with other surveillance systems*** – Some of the databases which contribute to trauma surveillance, (e.g., emergency department, hospital discharge data) are also important for monitoring other issues such as infectious diseases, hospital-acquired infection rates and biological/chemical terrorism. The databases may also be used for medical outcomes studies (e.g., to examine differences in patient outcomes by treatment methodology) and for performance studies (e.g., to track differences in mortality rates among hospitals or physicians). To avoid duplication of effort, databases and planning activities must be coordinated among the various users to ensure the multi-utility of the data collected and to minimize the demands placed on data collection personnel.

***Confidentiality*** – To protect patient confidentiality, health care databases, which are the primary source of injury data, often do not contain personal identifiers such as name or social security number. If identifiers are contained in the database, policies and procedures must be developed in compliance with federal and state regulations (e.g., HIPAA) to describe how the data will be safely stored, who can access the data, under what safeguards, how the data can be reported, etc. Even if obvious person identifiers are removed, medical database contents should be protected and public reports or incident descriptions should not contain cell sizes or details that might allow an individual to be identified (e.g., zip code of an accident together with date and gender might allow a driver to be identified.)

***State-specific issues*** – States should include additional data elements regarding injury mechanisms, risk factors or other issues that are of particular importance or prevalence in that state.

# VI. ANALYSIS OF NEVADA'S INJURY DATABASES - STRENGTHS, WEAKNESSES AND GAPS -

## Overview of Nevada's Injury-related Databases

A number of agencies and organizations collect information about injury in Nevada including hospitals, police, fire departments, vital record systems, the State Health Division, the Nevada Department of Transportation and emergency medical service (EMS) providers. While many organizations collect some information about injuries that occur in Nevada, only a few collect data on a statewide basis. Because injury surveillance activities require a population-based perspective, the databases that were evaluated for this project were limited to those that collect injury information on a statewide basis. The injury information systems included in this analysis are described below.

### *The Nevada Safety Management System*

The Nevada Safety Management System is a database of motor vehicle crash information maintained by the Nevada Department of Transportation (NDOT). This database is compiled from information from police or driver reports of motor vehicle crashes that occur in Nevada on public roads. These police crash reports are submitted to NDOT by police agencies throughout Nevada. All motor vehicle crashes resulting in either any bodily injury or property damage of $250 or more are reportable. The data collected include information about the date, time and location of the crash, the vehicles involved, the level of injury, contributing factors, safety equipment and the type of crash. In addition, for individuals involved in injury crashes, additional person-specific information such as safety belt usage, age, gender and seat position is collected. If the crash is a property damage only collision, a small amount of information is collected about the driver(s) involved such as alcohol use, state of residence and gender. Otherwise, if no injury is involved, no other person-specific information is collected. The data analyzed for this project were for 59,035 reported crashes that occurred in Nevada in 2001.

### *The UB-92 Hospital (Inpatient) Discharge Data*

The Nevada UB-92 Hospital Discharge Database is a database of information about people discharged from non-federal acute care hospitals in Nevada. Nevada is one of 42 states and the District of Columbia that have a statewide hospital discharge data set.[4] These data are collected in the standard Uniform Billing 92 (UB-92) format and include demographic information and information on diagnoses, mechanism of injury, diagnostic and operative procedures, hospital charges, discharge destination and hospital length of stay. The data analyzed for this project were for 234,659 discharges that occurred in 2001.

## *The Nevada Death Certificate Database*

This database contains information about individuals who died in Nevada (both Nevada residents and non-residents) and about Nevada residents who died outside of Nevada but whose death was reported to Nevada by the state in which the death occurred. Each record in the data set contains information about: (1) the identity of the individual, such as name, SSN and father's name, (2) the demographic characteristics of the individual, including occupation, education level, age, date of birth, gender, age at death, county and state of residence, (3) the circumstances of death, including date, time, place and manner of death, (4) information about the death certificate itself, including where filed and the individual who provided the death certificate information and (5) the cause of death using ICD10 codes and ICD10 groupings. The 2001 database contained 17,477 death records. Among these records, 96% (16,826 records) were for deaths that occurred in Nevada (regardless of residency) and 93% (16,234 records) were for Nevada residents (regardless of state of death). For injury surveillance purposes, the analysis of these data was limited to the records for deaths that occurred in Nevada (regardless of residency).

## *The Nevada Trauma Registry*

The Nevada trauma registry has information about individuals treated for trauma at selected trauma center hospitals (Level I through IV) in Nevada. Trauma patients are identified for inclusion in this registry as outlined by Nevada Administrative Code 450B by injury severity scoring systems measurements (e.g., Glasgow Coma Score, Trauma Score) mechanism of injury (e.g. falls of more than 20 feet, motor vehicle crashes with specific types of harmful events) and injury diagnoses (e.g., penetrating injury to the head, flail chest). The registry includes demographic information, and information on mechanism of injury, diagnoses, injury outcome, injury severity, insurance status, hospital charges and length of stay. The data analyzed for this project were for individuals treated during 2001 and 2002 – both those injured and treated within Nevada and those injured outside Nevada but treated at a Nevada hospital. The data set included records for 6,189 individuals injured in 2001 and 6,372 individuals injured in 2002.

## *Behavioral Risk Factor Surveillance System*

Nevada participates in the national behavioral health risk survey conducted by telephone interviews. This survey contains a core set of questions concerning health status, access to health care, health awareness, use of preventive services and health knowledge and attitudes. These data are weighted to adjust for calculating age-specific and other characteristic percentages. These data are only available at a statewide summary level, but formulas can be used to make calculations for smaller geographic units such as counties.

## *Youth Risk Behavior Survey*

Nevada participates in the national behavioral health risk survey conducted during class time among middle and high school students. This survey contains a core set of questions concerning health status, access to health care, health awareness, use of preventive services and health knowledge and attitudes. These data are weighted to adjust for calculating age-specific and other characteristic percentages. These data are only available at a statewide summary level, but formulas can be used to make calculations for smaller geographic units such as counties.

# DETAILED ANALYSIS OF INDIVIDUAL DATABASES

Research Applications performed a detailed analysis of each available database to assess validity, quality, completeness and overall utility of the data. The following issues were examined:

- File Structure and description;
- Duplicates/missing data;
- Demographic data;
- Injury severity;
- Injury type;
- Mechanism of injury/E-coding;
- Injury outcomes;
- Date, time and location;
- Safety information;
- Economic costs of injury; and
- Utility for injury surveillance and limitations on utility.

## The Nevada Safety Management System

### *File Structure and Description*

This database is maintained by the Nevada Department of Transportation and has information about reportable motor vehicle crashes that occur in Nevada. The crash database is a relational model with separate tables maintained for collisions, occupants, pedestrians, vehicles and contributing factors. Numerous reference tables are also used with look-up values to populate the data tables. The individual tables were linked together to create a single person-specific table. The original file, provided in SAS format, included 134,738 records for individuals involved in reported crashes in 2001.

The data file included records for property damage only collisions, injury and fatal crashes involving only motor vehicles and crashes involving pedestrians and pedacyclists. Due to the heterogeneous nature of the records in the file, it was decided that, in order to properly evaluate the database it would be necessary to first disaggregate the data into four separate tables for: (1) property damage only collisions, (2) vehicle drivers and occupants involved in injury crashes, (3) pedestrians and (4) collisions. Each table was evaluated individually with the results presented on the following pages.

### *Duplicates/Missing Data*

The "Property Damage Only" table was created by first selecting records where the category field indicated the crash was a property damage only crash. This table was then unduplicated using the date, time, street location and vehicle number fields, leaving 75,596 records in this table (666 records with duplicate values for date, time, street location and vehicle number were eliminated from the file). Each record in this file should be seen as representing the *vehicles* in the crash rather than the individuals because no person-specific information is included in these records other than a few fields about the drivers (no information is provided about other occupants of these crash vehicles). This table could be used with the occupant table in certain types of analyses that only include drivers.

The driver/occupant table was created by selecting all records that were not coded as "property damage only" crashes (severity not equal to "2") and where the crash category was not coded as a pedestrian or pedacyclist. This file was then unduplicated by date time, street location, vehicle number and occupant number to produce a file with 55,725 vehicle occupants involved in injury crashes (296 records were eliminated because of duplicate entries for date, time, location, vehicle, and occupant number). The occupant table has one record for each individual involved as an occupant of a motor vehicle involved in an injury crash (pedestrians are considered in a separate table). An examination of the data in this table indicated that 580 of these records had no occupant information. Of these 580 records, 424 indicated the record was for either a parked vehicle or there was no driver in the vehicle. The remaining 156 records with missing information might have been for hit-and-run crashes, runaway vehicles or the information for these occupants simply was not collected. All 580 records with the missing occupant information were excluded from further analysis, leaving 55,145 records for analysis.

Among the 55,145 records with occupant information, 2,005 records (4%) had occupant age missing. Among the 2005 records with missing age, 582 (29%) also had occupant gender missing. Among the 53,140 with age recorded, three records had ages that were obviously incorrect (e.g., age 369, 1020, 1099), indicting the need for a reasonability check edit.

The pedestrian table was created by selecting all records that were not coded as "property damage only" crashes and where the crash category was coded as either pedestrian or pedacyclist. This file was then unduplicated using date and time of crash, street location and pedestrian number. The process of unduplicating was particularly important for this file because the unduplicated file had 2,455 records while the de-duplicated file had only 1,771 records in it (a decrease of 684 records or 28%). Approximately 42% of the records in the pedestrian table (747 records) were for pedacyclists and the remaining 58% (1,024 records) were for pedestrians on foot.

Approximately 5% of the records (93 records) in the pedestrian table had missing information for pedestrian age and less than 1% had missing information for gender (23 records) and reported injury (nine records).

The collision table was created to include one record for each *crash* that occurred. The original file included a unique crash number field that is supposed to identify each specific crash and ideally this table could have been created by simply unduplicating the crash file using the crash number. However, in order to check the accuracy of the crash number, the file was first de-duplicated on the crash number field (producing a file with 59,691 unique crash records) and then de-duplicated using the date and time of the crash and the street and reference street of the crash location. This method produced a file that had only 59,035 records, a difference of 656 records. Manual inspection of the file that was unduplicated on crash number alone showed that the extra 656 records did have identical date, time and street locations, but different crash numbers. This suggested two possibilities: either two crashes did occur at the same location and time – unlikely but possible, for example a second crash caused by congestion from the first crash, or more likely these duplicates were simply re-submissions or corrections to other records. Manual inspection of the date modified field showed that all of these records had been modified; therefore, the most accurate way to create a file of collisions only appeared to be to de-duplicate the records based on date, time and street location rather than the crash number. Using this method resulted in a table with 59,035 reported crashes in 2001.

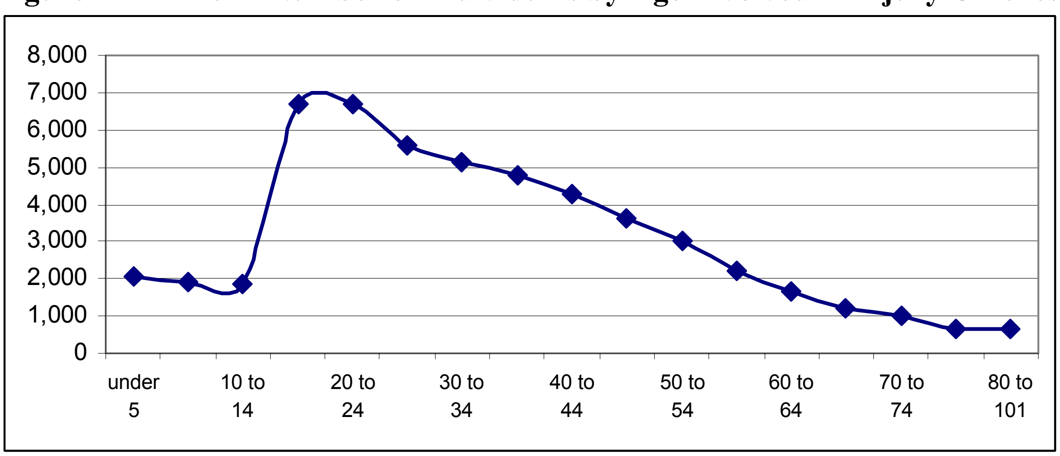
Nearly all data fields in the collision table were complete. A somewhat disproportionate number of records had the time of the crash listed at 12:00 or 12:01 AM. Some of these records probably represent missing data (i.e., missing data may default to a zero which translates as 12:00 AM). The number of these potential missing crash times was small and should not materially affect any analyses that look at crash times.

## *Demographic Fields*

The demographic data in the crash data resides principally in the driver/occupant and pedestrian tables. The property damage only and collision tables include age and gender of the driver but no information on other occupants. Demographic information in the occupant and pedestrian tables is limited to date of birth (not provided for analysis) age, gender and the state of residence of drivers.

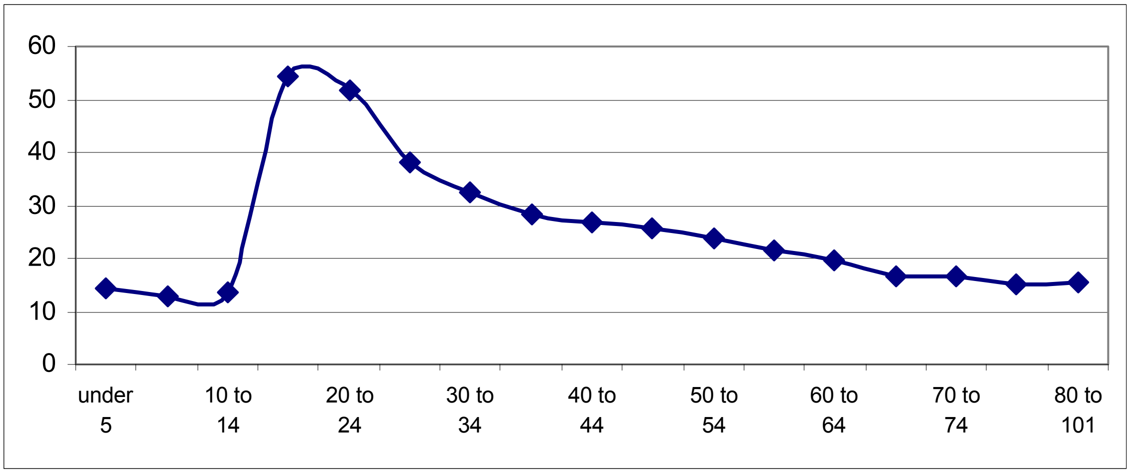
Approximately 4% of records for motor vehicle occupants had age missing. Among the 2005 records with missing age, 582 (29%) also had occupant gender missing. Among the 53,140 with age recorded, three records had ages that were obviously incorrect (e.g., age 369, 1020, 1099). Among the remaining 53,137 records, the mean age was 33.7 years and the median age was 31 years. Figure 1 depicts the age distribution among the occupant records. As Figure 1 indicates, the distribution of age peaks in the age 15 to 24 age groups and then tapers off with increasing age.

**Figure 1 Total Number of Individuals by Age Involved in Injury Crashes 2001**



Both the total number of individuals involved in injury crashes peak in the teenage/young adult year and the rate per thousand individuals shows a similar pattern as shown in Figure 2.

**Figure 2 Rate per Thousand Residents by Age for Individuals Involved in Injury Crashes**




In analyses that look at age it is often important to also consider gender. For example the occupant data indicate that the rate per thousand male residents is generally somewhat higher than the rate per thousand female residents. The difference in rates for males and females is particularly pronounced for adolescents/young adults and for elderly occupants as shown in Figure 3 on the following page. While males appear to be more likely to be involved in injury crashes, this does not, necessarily, mean that males are necessarily more dangerous drivers. It is possible that the differences in population-based rates between males and females may simply be the result of males having a higher exposure level (i.e., males may spend more time driving or as occupants of motor vehicles than females.) Therefore, any population-based rate analyses of gender differences should also take into account differences between males and females in exposure levels, which was not available for this analysis. Such analyses could use national data or estimates to adjust for these differences, but it should be kept in mind that national estimates might not accurately reflect conditions in Nevada.

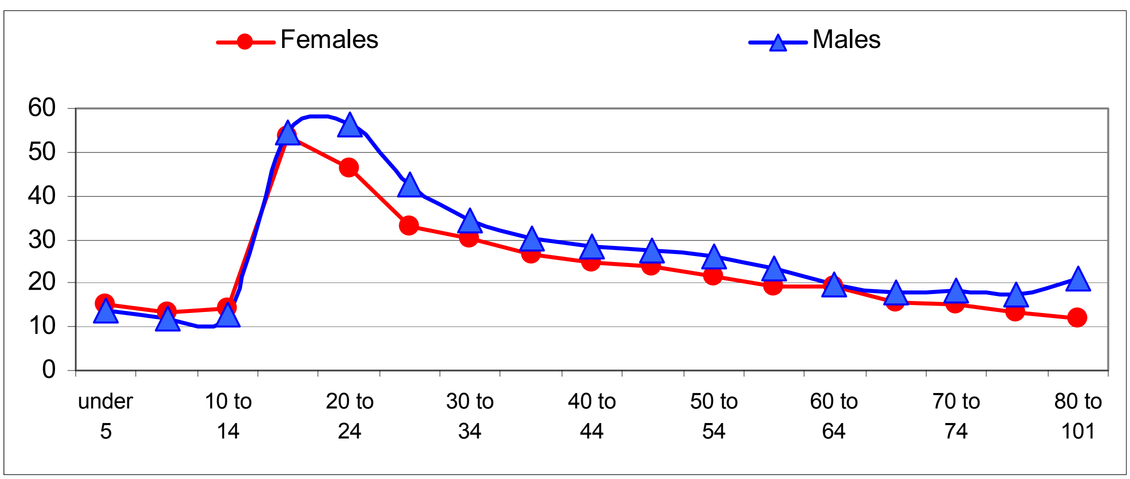
Table 1 on the following page presents the number of individuals involved in injury crashes by gender and age group, the total population of Nevada by gender and age group, and the crude injury crash involvement rate per thousand by gender and age group.

**Table 1 Number and Rate per Thousand Residents Individuals Involved in Injury Crashes**

| Age | Females in Injury Crashes | Males in Injury Crashes | Pop 2000 Females | Pop 2000 Males | Total Pop 2000 | Rate per 1000 Females | Rate per 1000 Males | Rate per 1000 Both Genders |
|---|---|---|---|---|---|---|---|---|
| Under 5 | 1,055 | 1,024 | 70,048 | 74,489 | 144,537 | 15.1 | 13.7 | 14.4 |
| 5 to 9 | 971 | 941 | 72,293 | 78,191 | 150,484 | 13.4 | 12.0 | 12.7 |
| 10 to 14 | 968 | 908 | 68,567 | 71,089 | 139,656 | 14.1 | 12.8 | 13.5 |
| 15 to 19 | 3,219 | 3,470 | 60,122 | 63,455 | 123,577 | 53.5 | 54.7 | 54.2 |
| 20 to 24 | 2,873 | 3,817 | 62,230 | 67,597 | 129,827 | 46.2 | 56.5 | 51.6 |
| 25 to 29 | 2,343 | 3,238 | 70,828 | 76,029 | 146,857 | 33.1 | 42.6 | 38.1 |
| 30 to 34 | 2,273 | 2,876 | 75,604 | 83,285 | 158,889 | 30.1 | 34.5 | 32.4 |
| 35 to 39 | 2,120 | 2,674 | 80,454 | 88,906 | 169,360 | 26.4 | 30.1 | 28.3 |
| 40 to 44 | 1,934 | 2,330 | 77,605 | 81,714 | 159,319 | 24.9 | 28.5 | 26.8 |
| 45 to 49 | 1,664 | 1,955 | 69,903 | 71,292 | 141,195 | 23.8 | 27.4 | 25.6 |
| 50 to 54 | 1,379 | 1,651 | 63,663 | 63,530 | 127,193 | 21.7 | 26.0 | 23.9 |
| 55 to 59 | 1,022 | 1,208 | 52,517 | 51,385 | 103,902 | 19.5 | 23.5 | 21.5 |
| 60 to 64 | 794 | 860 | 41,646 | 43,318 | 84,964 | 19.1 | 19.9 | 19.5 |
| 65 to 69 | 555 | 627 | 35,470 | 35,476 | 70,946 | 15.6 | 17.7 | 16.7 |
| 70 to 74 | 473 | 549 | 31,631 | 29,981 | 61,612 | 15.0 | 18.3 | 16.6 |
| 75 to 79 | 325 | 350 | 24,204 | 20,211 | 44,415 | 13.4 | 17.3 | 15.2 |
| 80 to 101 | 299 | 338 | 25,386 | 16,138 | 41,524 | 11.8 | 20.9 | 15.4 |
| Unknown | 603 | 823 | | | | | | |
| Total | 24,870 | 29,639 | 982,171 | 1,016,086 | 1,998,257 | | | |

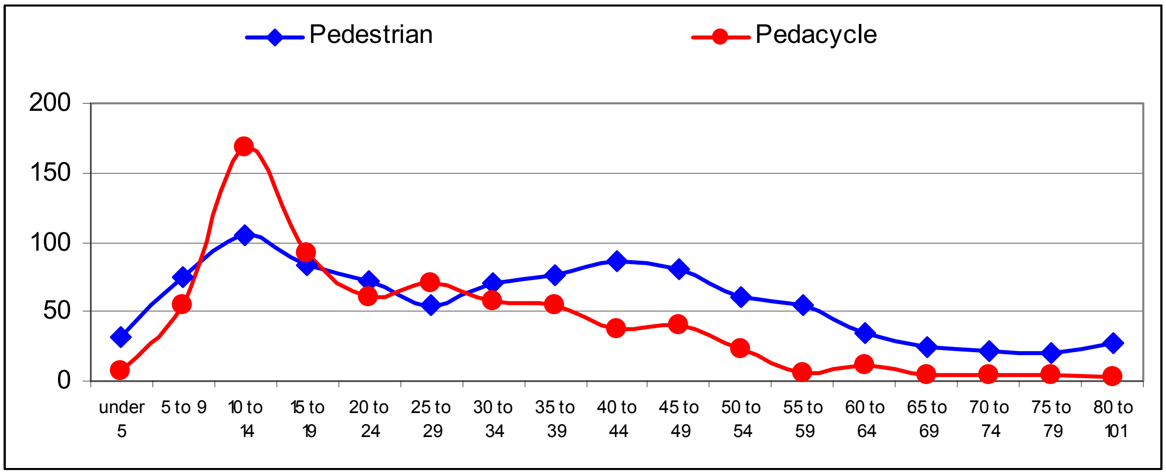
Figure 3 depicts the rates for involvement in injury crashes per thousand male and female residents in 2002. Table 1 provides the actual rates by gender and age group.

**Figure 3 Rate of Involvement in Injury Crashes per Thousand Residents by Age and Gender - 2001**



For pedestrians and pedacyclists there also appears to be a strong association with age. The age distribution for pedestrians and pedacyclists peaks in the age ten-to-14 age category. This peak is especially pronounced for pedacyclists as shown in Figure 4. There also appears to be a resurgence of pedestrian crash victims for those between the ages of 40 and 50.

**Figure 4 Total Pedestrians and Pedacyclists by Age Group Involved in Injury Crashes**




For drivers involved in crashes, the state of residence is also provided. Only about 1.4% of records for drivers (487 records) did not include the state of residence of the driver. Table 2 provides the number of records by state of residence for drivers of vehicles involved in injury crashes in 2001.

**Table 2 State of Residence for Drivers Involved in Injury Crashes 2001**

| State | Drivers | Percent of Total | State | Drivers | Percent of Total |
|---|---|---|---|---|---|
| Alabama | 6 | 0.02% | Missouri | 23 | 0.07% |
| Alaska | 14 | 0.04% | Montana | 17 | 0.05% |
| Arizona | 213 | 0.61% | Nebraska | 7 | 0.02% |
| Arkansas | 12 | 0.03% | Nevada | 31,923 | 91.24% |
| California | 1,268 | 3.62% | New Jersey | 12 | 0.03% |
| Canal Zone | 1 | 0.00% | New Mexico | 18 | 0.05% |
| Colorado | 61 | 0.17% | New York | 27 | 0.08% |
| Connecticut | 7 | 0.02% | North Carolina | 9 | 0.03% |
| Delaware | 2 | 0.01% | North Dakota | 3 | 0.01% |
| Florida | 43 | 0.12% | Ohio | 20 | 0.06% |
| Foreign | 79 | 0.23% | Oklahoma | 15 | 0.04% |
| Georgia | 18 | 0.05% | Oregon | 78 | 0.22% |
| Hawaii | 11 | 0.03% | Pennsylvania | 20 | 0.06% |
| Idaho | 70 | 0.20% | Rhode Island | 4 | 0.01% |
| Illinois | 35 | 0.10% | South Carolina | 2 | 0.01% |
| Indiana | 9 | 0.03% | South Dakota | 5 | 0.01% |

| State | Drivers | Percent of Total | State | Drivers | Percent of Total |
|---|---|---|---|---|---|
| Iowa | 14 | 0.04% | Tennessee | 10 | 0.03% |
| Kansas | 16 | 0.05% | Texas | 65 | 0.19% |
| Kentucky | 8 | 0.02% | Utah | 165 | 0.47% |
| Louisiana | 6 | 0.02% | Vermont | 1 | 0.00% |
| Maine | 1 | 0.00% | Virginia | 9 | 0.03% |
| Maryland | 5 | 0.01% | Washington | 72 | 0.21% |
| Massachusetts | 19 | 0.05% | West Virginia | 1 | 0.00% |
| Michigan | 29 | 0.08% | Wisconsin | 20 | 0.06% |
| Minnesota | 17 | 0.05% | Wyoming | 8 | 0.02% |
| Mississippi | 2 | 0.01% | Unknown | 487 | 1.39% |
| | | | Total | 34,987 | 100.00% |

In summary, the demographic information in the crash data, while limited, appears to be generally complete and reliable and the distribution of ages and genders does not appear to be unusual.

## *Injury Severity*

Injury severity information is included in the crash data for all individuals involved in injury crashes (as drivers, passengers or pedestrians), whether or not they are themselves injured. Injury severity is categorized according to a five level scale as follows: (1) no injury, (2) fatal injury, (3) Class A injury, (4) Class B injury and (5) Class C injury. Fatal injuries are defined as deaths that occur within 30 days of the crash. Class A injuries are defined as "serious visible injuries" and include bleeding wounds, distorted body members, and any condition that requires the victim to be carried from the scene of the crash. Class B injuries are defined as "minor visible injuries" and include bruises, abrasions, swelling, limping, or obviously painful movement. Class C injuries are defined as "non-visible injuries" such as complaint of pain without visible signs of injury.

One of the shortcomings of the crash data is that the injury severity for uninjured individuals is indicated by null values in the injury severity field. That is, if the crash victim is uninjured, injury severity is null, thus making it impossible to know if the person was truly uninjured or whether the injury information is missing. A second shortcoming is that reported injury severity is generally thought to be unreliable because police officers are not trained as clinicians and they are working without benefit of diagnostic tests; therefore the reporting may be somewhat subjective (e.g., if there is a lot of blood, the police officer might report a serious injury when, in fact, the injury is superficial).

Approximately 50% of those involved in injury crashes were injured themselves. Table 3, on the following page, presents the number and percentage of individuals involved in injury crashes by level of reported injury severity.

**Table 3 Number and Percent of Individuals in Injury Crashes by Reported Injury Severity**

| Reported Injury Severity | Number | Percent of Total |
|---|---|---|
| Fatal | 255 | 0.5% |
| Class A | 1,365 | 2.5% |
| Class B | 5,305 | 9.6% |
| Class C | 20,681 | 37.5% |
| No Injury | 27,539 | 49.9% |
| Total | 55,145 | 100.0% |

Reported injury severity among those involved in injury crashes appears to increase consistently with age. Table 4 presents the percentage of involved occupants by age group and police reported injury severity. Figures 5a through 5e depict reported injury severity for fatal, major, moderate and minor injuries by age group and the linear regression equations and R-squared values for these linear regressions. The linear regression models show a fairly strong association between reported injury severity and age especially for more severe (fatal and Class A) injuries. It should be kept in mind that these data do not include individuals involved in non-injury crashes and, therefore, the real association between age and injury severity may be somewhat different.

**Table 4 Reported Injury Severity for Occupants in Injury Motor Vehicle Crashes by Age - 2001**

| Age | Fatal | Class A | Class B | Class C | No Injury |
|---|---|---|---|---|---|
| Under 5 | 0.1% | 1.0% | 4.8% | 10.5% | 83.6% |
| 5 to 9 | 0.1% | 0.9% | 7.2% | 26.1% | 65.7% |
| 10 to 14 | 0.3% | 1.9% | 8.7% | 29.5% | 59.7% |
| 15 to 19 | 0.4% | 2.7% | 12.1% | 33.2% | 51.6% |
| 20 to 24 | 0.4% | 2.6% | 10.9% | 38.9% | 47.1% |
| 25 to 29 | 0.4% | 2.9% | 9.7% | 40.4% | 46.5% |
| 30 to 34 | 0.4% | 2.2% | 9.8% | 42.3% | 45.3% |
| 35 to 39 | 0.4% | 2.7% | 8.8% | 41.2% | 46.9% |
| 40 to 44 | 0.4% | 2.3% | 10.3% | 41.9% | 45.0% |
| 45 to 49 | 0.7% | 2.9% | 9.2% | 44.4% | 42.8% |
| 50 to 54 | 0.5% | 2.6% | 7.9% | 44.0% | 45.1% |
| 55 to 59 | 0.6% | 2.2% | 9.4% | 43.4% | 44.3% |
| 60 to 64 | 0.9% | 3.0% | 9.5% | 42.1% | 44.5% |
| 65 to 69 | 0.7% | 2.5% | 10.7% | 41.6% | 44.5% |
| 70 to 74 | 1.2% | 3.9% | 10.4% | 36.9% | 47.7% |
| 75 to 79 | 0.7% | 4.0% | 13.8% | 38.5% | 43.0% |
| 80 to 101 | 1.7% | 3.8% | 15.5% | 37.0% | 42.0% |
| All Ages | 0.5% | 2.5% | 9.6% | 37.5% | 49.9% |

**Figure 5a** **Percent of Individuals Involved in Injury Crashes with Fatal Injuries by Age – 2001**

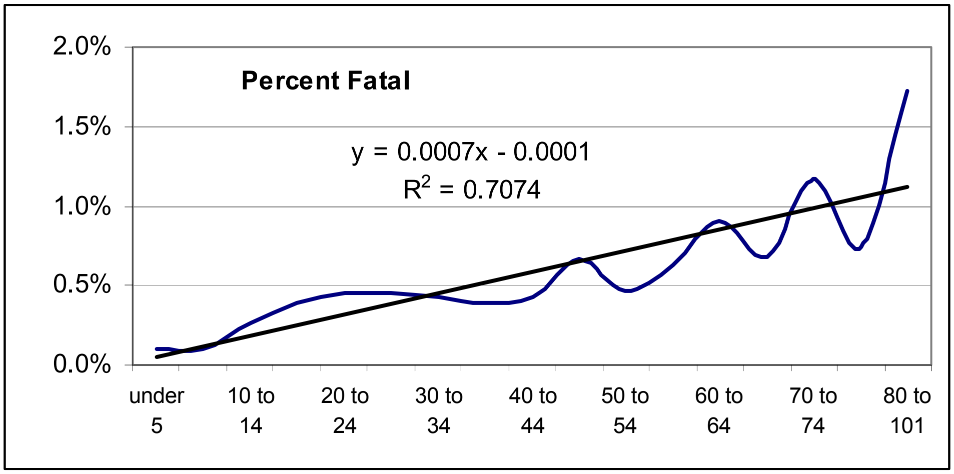



**Figure 5b** **Percent of Individuals Involved in Injury Crashes with Class A Injuries by Age – 2001**

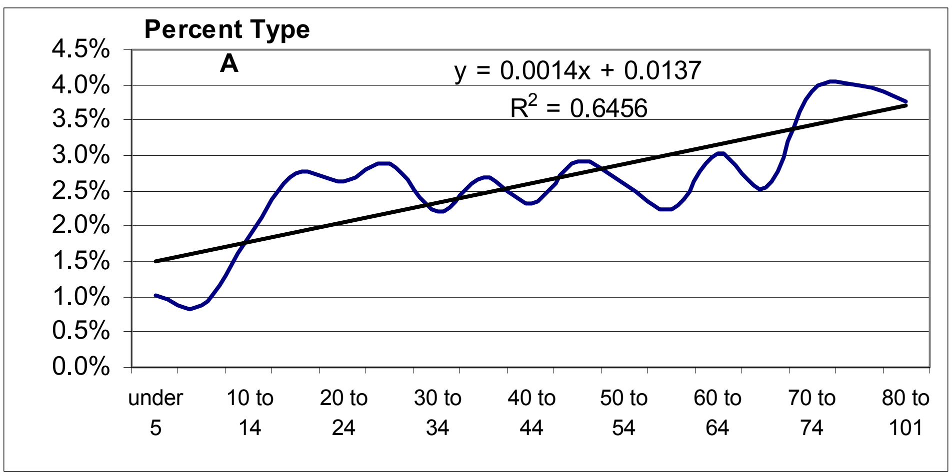


**Figure 5c** **Percent of Individuals Involved in Injury Crashes with Class B Injuries by Age 2001**

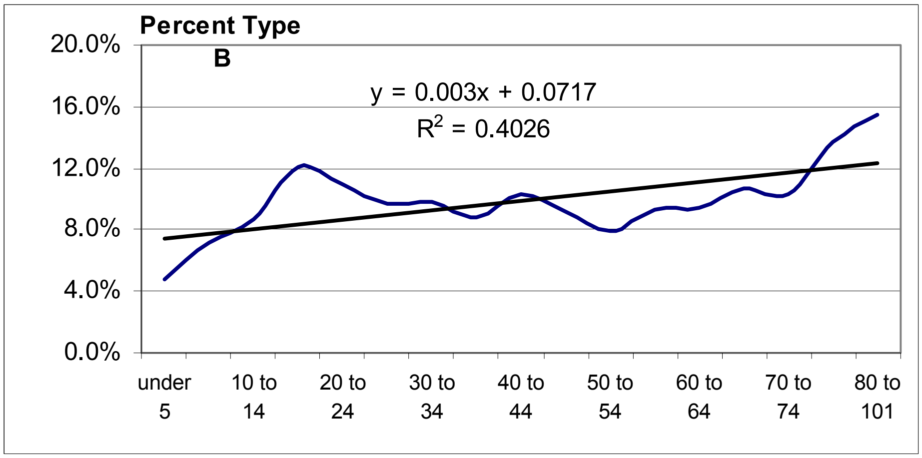



**Figure 5d** **Percent of Individuals Involved in Injury Crashes with Class C Injuries by Age 2001**

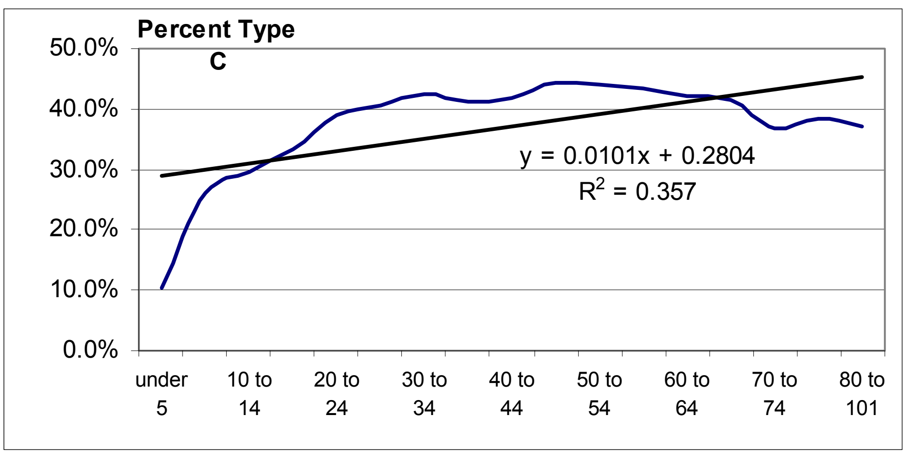
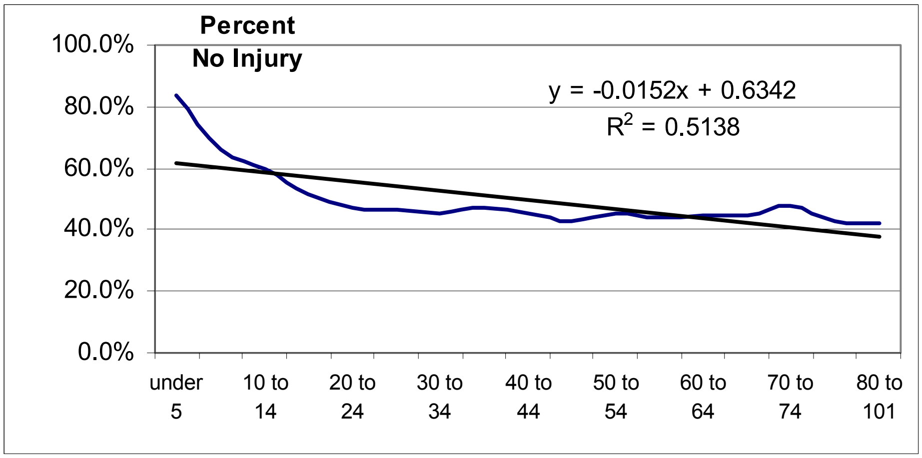
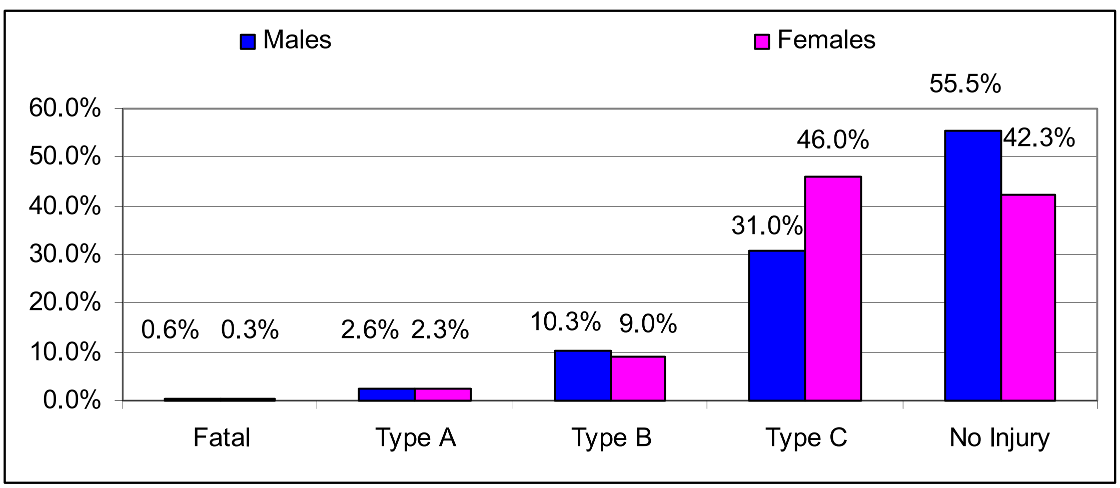


**Figure 5e Percent of Individuals Involved in Injury Crashes with No Reported Injuries by Age 2001**




The data also show some differences in injury severity by gender, but these differences may be influenced by other differences between male and female occupants such as safety belt use, seat position, driver sobriety and contributing factors. Nonetheless, the data seem to indicate that a higher percentage of females involved in injury crashes have some degree of reported injury, but a higher proportion of males have more severe injuries. Figure 6 depicts the proportion of reported injury severity by gender in the 2001 crash data.

**Figure 6 Percent of Reported Injury Severity for Involved in Injury Crashes by Gender - 2001**




Again, it should be stressed that the differences between genders in reported injury severity may be the result of other factors (e.g., seat position, safety belt usage) or to differences in how police interpret injury severity rather than physiological differences between males and females.

Injury severity information is also provided in the crash data in terms of *crash severity*. That is, the severity of collisions is categorized by the highest level of injury of *any* individual involved in the crash. The categories of crash severity are “property damage only” (with no injuries), “fatal accident” and “injury accident.” This method of categorizing injury severity of the crash is useful for identifying contributing factors involved in injury collisions or for identifying locations of injury crashes, but not for identifying injuries to specific individuals. Table 5 presents the distribution of crash severity among the reported collisions in 2001.

**Table 5 Crash Severity (highest level of injury sustained in the crash) 2001**

| Injury Severity | Total | Percent of Total |
|---|---:|---:|
| Fatal | 273 | 0.5% |
| Property Damage Only | 39,754 | 67.3% |
| Non Fatal Injury | 19,008 | 32.2% |
| Total Collisions | 59,035 | 100.0% |

Many researchers and analysts consider reported injury information to be unreliable because of the subjective nature of the way injuries are categorized and the fact that police officers are not clinicians. Linkage of the crash data to hospital discharge data, however, showed that records for pedestrians and drivers with police-reported fatal injuries and Class A and Class B injuries were about 19 times more likely to link to hospital inpatient records than records for drivers or pedestrians with Class C injuries. The linkage also produced 130 records for patients with police-reported Class C injuries that linked to inpatient records. These linkage results suggest that while police generally are likely to identify serious injuries (as shown by the much higher linkage rates for fatal, Class A and B injury records) they are also likely to categorize some serious injuries as minor injuries (as evidenced by the number of Class C injuries that linked to hospital inpatient records). This suggests that the more serious the injury, the more likely the police report of injury severity is to be reliable.

### *Injury Type*

The crash data provide no information on injury type (e.g., burn, blunt injury, fracture, swelling, etc.) or body region.

### *Mechanism of Injury*

The crash data obviously are limited to only injuries that result from motor vehicle crashes. The data provide a limited level of sub-categorization such as the type of vehicle involved (e.g., motorcycle, passenger car, truck, etc.), the seat position or status of the individual (e.g., driver, passenger, pedestrian, bicyclist), ejection status, contributing factors (e.g., failure to yield, speeding) and collision type (e.g., rear-end, head-on, sideswipe).

A total of 34,989 vehicles were involved in injury crashes in 2001 and less than 1% of the records indicated that vehicle type was unknown. Table 6, on the following page, lists the types of vehicles involved in injury crashes. While the vehicle type is reported for nearly all vehicles, noticeably missing from the definition of vehicle types are animals or animal-drawn vehicles and off-road vehicles such as all terrain vehicles. Bicycles, while not listed under vehicle type can be identified from the collision type field.

**Table 6 Vehicles Involved in Injury Collisions by Vehicle Type 2001**

| Vehicle Type | Number of Vehicles | Percent of Total |
|---|---|---|
| Standard Passenger | 24,762 | 70.8% |
| Pickup | 5,727 | 16.4% |
| Small Passenger Car | 2,206 | 6.3% |
| Motorcycle | 601 | 1.7% |
| Single Unit Truck | 430 | 1.2% |
| Truck with One Trailer | 300 | 0.9% |
| Taxi/Limo Rented (1990) | 288 | 0.8% |
| Unknown | 212 | 0.6% |
| Bus Commercial | 117 | 0.3% |
| Pickup and Small Trailer | 104 | 0.3% |
| Moped | 36 | 0.1% |
| Truck with Two Trailers | 34 | 0.1% |
| Law Enforcement Vehicle | 31 | 0.1% |
| Bus – School | 27 | 0.1% |
| Passenger Car and Trailer | 21 | 0.1% |
| Motor Home | 19 | 0.1% |
| Other | 17 | 0.0% |
| Law Enforcement Motorcycle | 13 | 0.0% |
| Construction Vehicle | 11 | 0.0% |
| Ambulance | 10 | 0.0% |
| Fire Equipment | 7 | 0.0% |
| Motor Home with Trailer | 5 | 0.0% |
| Farm Implement | 4 | 0.0% |
| Motorcycle with Sidecar | 4 | 0.0% |
| Truck with Three Trailers | 2 | 0.0% |
| Mobile Home | 1 | 0.0% |
| Total | 34,989 | 100.0% |

An area of special concern in injury surveillance is motorcycle crashes. Injuries from motorcycle crashes are important because, although only about 1% of all people involved in injury crashes were riding a motorcycle, the severity of their injuries tends to be much greater than injuries to occupants of passenger cars and trucks. Table 7 presents the total number of individuals involved in motorcycle and non-motorcycle crashes by reported injury severity, the percentage of individuals in each category and the simple odds ratio for each category of injury. As Table 7, on the following page, shows, individuals involved in motorcycle crashes appear to be much more likely to have fatal, Class A and Class B injuries than do drivers and occupants of non-motorcycles.

**Table 7 Reported Injury Severity for Motorcyclists and Non-Motorcyclists - 2001**

| | Number of Persons in Injury-Related Motorcycle Crashes | Number of Persons in Injury-Related Non-Motorcycle Crashes | Percent of Persons in Injury-Related Motorcycle Crashes | Percent of Persons in Injury-Related Non-Motorcycle Crashes | Odds Ratio |
|---|---|---|---|---|---|
| Fatal | 19 | 236 | 2.9% | 0.4% | 6.62 |
| Class A | 136 | 1,229 | 20.5% | 2.3% | 9.09 |
| Class B | 303 | 5,002 | 45.7% | 9.2% | 4.98 |
| Class C | 178 | 20,503 | 26.8% | 37.6% | 0.71 |
| No Injury | 27 | 27,512 | 4.1% | 50.5% | 0.08 |
| Total | 663 | 54,482 | 100.0% | 100.0% | |

Seat position data appears to be mostly complete with only about 1% of records for vehicle occupants having unknown seat position. Table 8 presents the distribution of reported seat positions for occupants of vehicles involved in injury crashes in 2001.

**Table 8 Seat Position for Occupants of Motor Vehicles Involved in Injury Collisions - 2001**

| Seat Position | Number of Occupants | Percent of Total |
|---|---|---|
| Left Front | 34,987 | 63.4% |
| Right Front | 11,241 | 20.4% |
| Right Second Seat | 3,659 | 6.6% |
| Left Second Seat | 2,688 | 4.9% |
| Middle Second Seat | 1,087 | 2.0% |
| Unknown | 576 | 1.0% |
| Middle Front | 479 | 0.9% |
| Other | 198 | 0.4% |
| Left Third Seat | 78 | 0.1% |
| Right Third Seat | 78 | 0.1% |
| Middle Third Seat | 60 | 0.1% |
| Left Fourth Seat | 5 | 0.0% |
| Middle Fourth Seat | 5 | 0.0% |
| Right Fourth Seat | 4 | 0.0% |
| Total | 55,145 | 100.0% |

The 2001 crash data had records for 1,771 people injured in pedestrian/pedacycle crashes. Among these records, 747 (42%) were for pedacyclists and the remaining 1,024 were for pedestrians. A particularly useful way to look at these data for pedestrian and pedacycle crashes is by gender and age group as there appears to be specific groups at elevated risk for both pedestrian and pedacycle crashes as shown by Figure 7a and Figure 7b. Males make up the majority of both pedestrians and pedacyclists. Sixty-two percent of foot pedestrians were males and 82% of pedacyclists were males. Figures 7a and 7b also appear to indicate that substantial numbers of middle aged (age 40 to 50) individuals and senior citizens are involved in pedestrian crashes.

**Figure 7a Gender by Age for Pedestrians Involved in Injury Crashes - 2001**

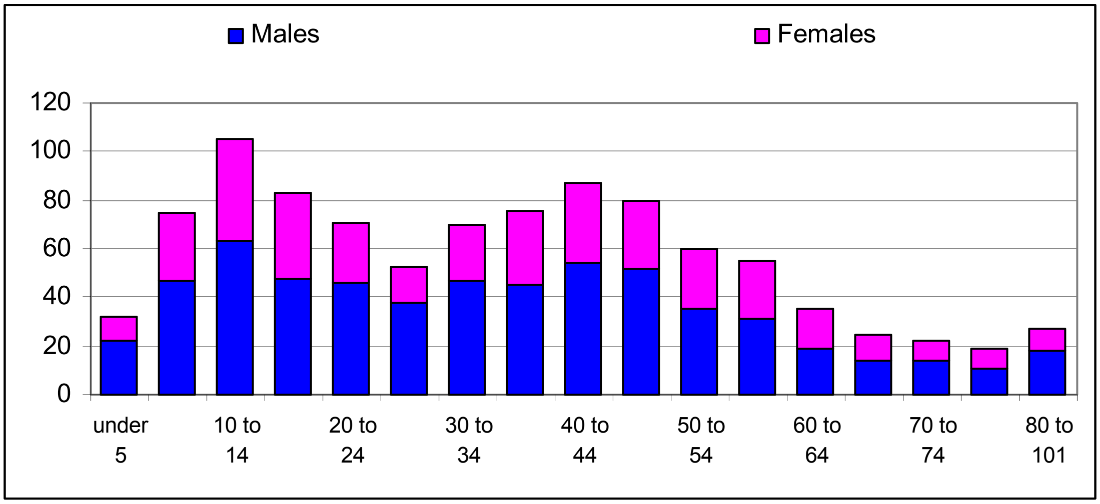
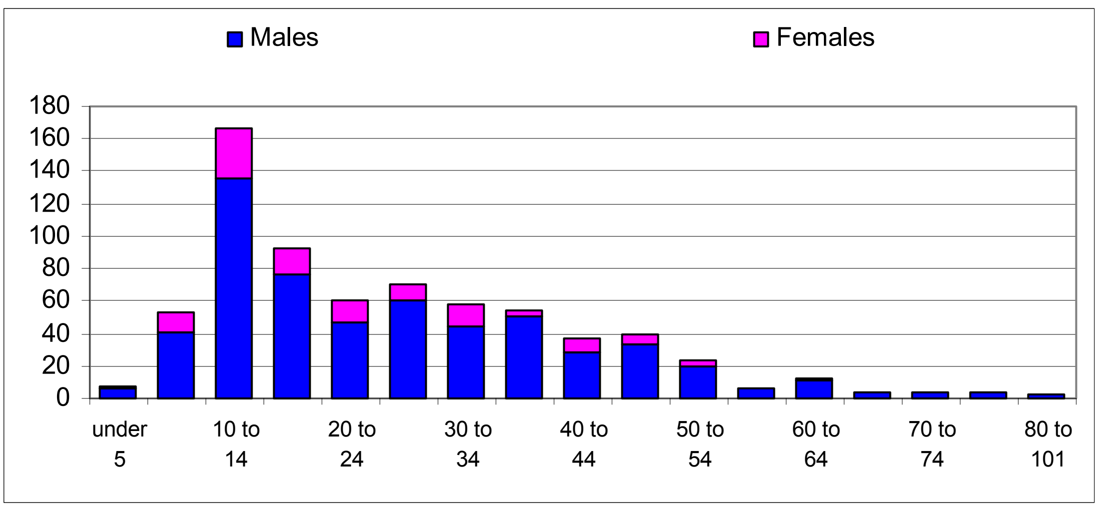



**Figure 7b Gender by Age for Pedacyclists Involved in Injury Crashes - 2001**




The crash data indicate that among individuals involved in injury crashes, 985 were reported to be ejected from the vehicle and 52 had unknown ejection status. Cross-tabulating these data with safety belt usage and injury severity can be a useful way of presenting the effectiveness of safety belt usage, although one of the limitations of presenting the data this way is that a large percentage of the records indicating the occupant was ejected also had seat belt status reported as "unknown." Table 9, on the following page, displays the difference in seat belt usage between occupants who were reported to be ejected and occupants who were not ejected.

**Table 9 Reported Safety Belt Usage Between Ejected and Non-Ejected Occupants - 2001**

| | Ejected Occupants | | Non-Ejected Occupants | |
|---|---|---|---|---|
| Safety Belt Status | Number | Percent | Number | Percent |
| Seat Belt Used | 47 | 4.80% | 48,767 | 90.13% |
| Seat Belt Not Used | 286 | 29.00% | 3,411 | 6.30% |
| Unknown | 652 | 66.20% | 1,930 | 3.57% |
| Total | 985 | 100.00% | 54,108 | 100.00% |

Each collision is assigned one contributing factor. Failure to yield, failure to reduce speed, and inattentive driving accounted for approximately 53% of all reported contributing factors. Table 10 presents the contributing factors listed in the crash data in descending order of frequency. (In looking at contributing factors two things should be kept in mind. First, the crash data only report one contributing factor although crashes might involve multiple contributing factors. Second, there may be a certain amount of subjectivity in the reporting of contributing factors. For example, if the driver is young, the police report might be more likely to indicate that "inexperienced driver" was the contributing factor.)

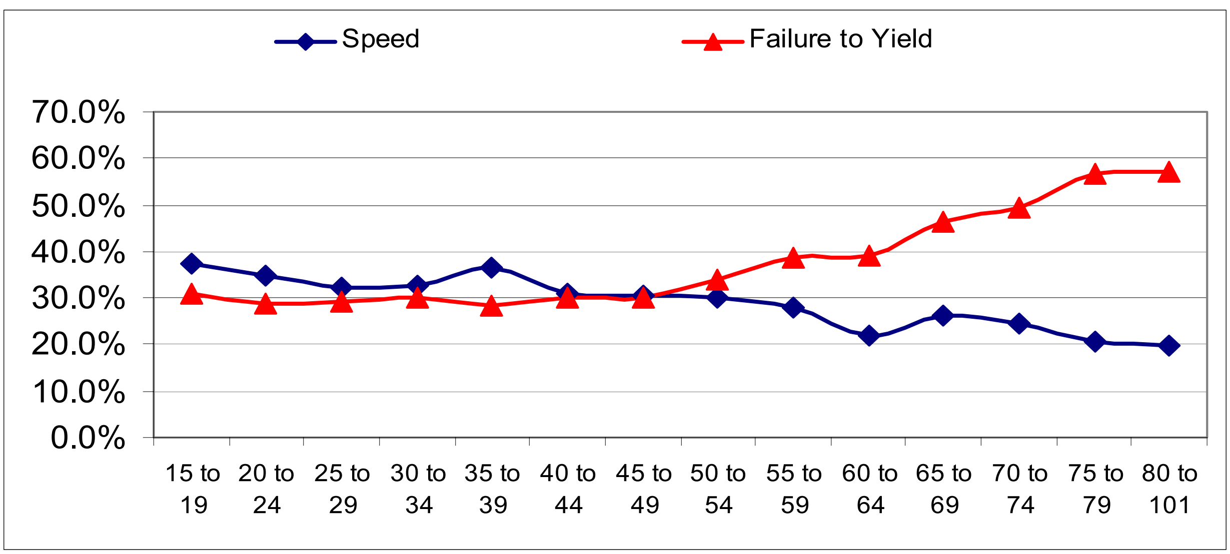
**Table 10 Contributing Factors for Reported Collisions 2001**

| Contributing Factor | Total | Percent of Total |
|---|---|---|
| Failure to Yield | 13,943 | 23.6% |
| Failure to Reduce Speed | 11,032 | 18.7% |
| Inattentive Driving | 6,405 | 10.8% |
| Following Too Close | 4,780 | 8.1% |
| Improper Lane Change | 4,390 | 7.4% |
| Speed Too Fast for Conditions | 3,975 | 6.7% |
| Improper Turn | 2,709 | 4.6% |
| D.U.I. Alcohol | 2,442 | 4.1% |
| Improper Backing | 1,389 | 2.4% |
| Excessive Speed | 813 | 1.4% |
| Non-Contact Vehicle | 804 | 1.4% |
| Improper Passing | 713 | 1.2% |
| Pedestrian in Roadway | 496 | 0.8% |
| Improper Action on Pedacycle | 445 | 0.8% |
| Driving in Other Than Proper Manner | 400 | 0.7% |
| Objects in Roadway | 366 | 0.6% |
| Fatigued Driver | 320 | 0.5% |
| Animal in Roadway (Deer) | 291 | 0.5% |
| Improper Start Position | 289 | 0.5% |
| Defective Tires | 286 | 0.5% |
| Driver Distracted | 239 | 0.4% |
| Unsafe Load | 237 | 0.4% |
| On Wrong Side of Roadway | 228 | 0.4% |

| Contributing Factor | Total | Percent of Total |
|---|---|---|
| Unoccupied Moving Vehicle | 184 | 0.3% |
| Physical Driver Defect | 172 | 0.3% |
| D.U.I. of Drugs | 170 | 0.3% |
| Animal in Roadway (Cow) | 164 | 0.3% |
| Defective Vehicle | 141 | 0.2% |
| Improper Use of Turn Lane | 136 | 0.2% |
| Defective Brakes | 119 | 0.2% |
| Loose Material on Surface | 102 | 0.2% |
| All Others | 855 | 1.4% |
| Total | 59,035 | 100.0% |

Analysis of the contributing factor patterns should be based on selecting only records for drivers identified as being responsible for the crash. Among drivers judged to be responsible for the crash, two particular contributing factors (speeding and failure to yield) account for more than 65% of all contributing factors reported. An interesting age-related pattern emerges in looking at these two factors. Speeding appears to be a much more common contributing factor among younger drivers, while failure to yield becomes more common among older drivers. Figure 8 presents the percentage of crash-responsible drivers, by age, who had speeding and failure to yield as the reported contributing factor. These results may have implications for driver education and re-education programs, or for driver safety interventions targeted at specific age groups.

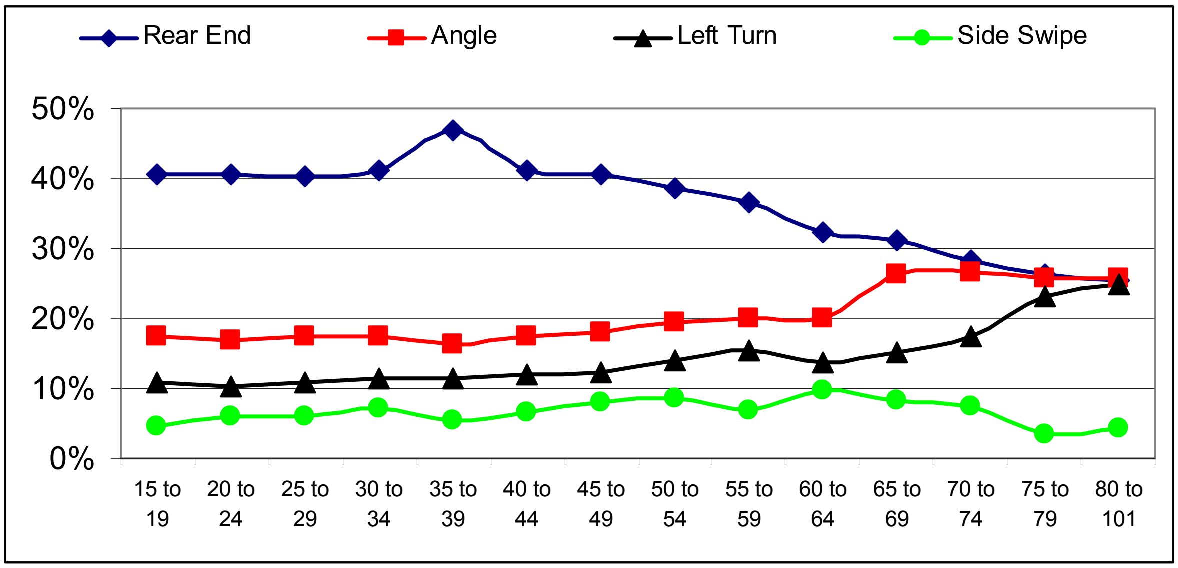
**Figure 8 Percent of Crash-Responsible Drivers, by Age, Involved in Injury Crashes in Which the Police Reported Speeding and Failure to Yield as Factor - 2001**




The crash data list 32 types of collisions but only four of these (Rear-End Collision, Angle Collision, Left-Turn Collision and Sideswipe Collision-Same Direction) account for more than 80% of the records for individuals involved in injury collisions. In looking at these data, there appears to be a relationship between age and certain types of collisions. For example, angle and left-turn collisions appear to be more common among older drivers, while rear-end collisions and sideswipes appear to be less common among older drivers and more common among younger drivers.

Figure 9 depicts the percentage of crash-responsible drivers by age and type of collision.

**Figure 9 Percent of Crash-Responsible Drivers Involved in Injury Crashes by Age and Collision Type - 2001**




## *Injury Outcome*

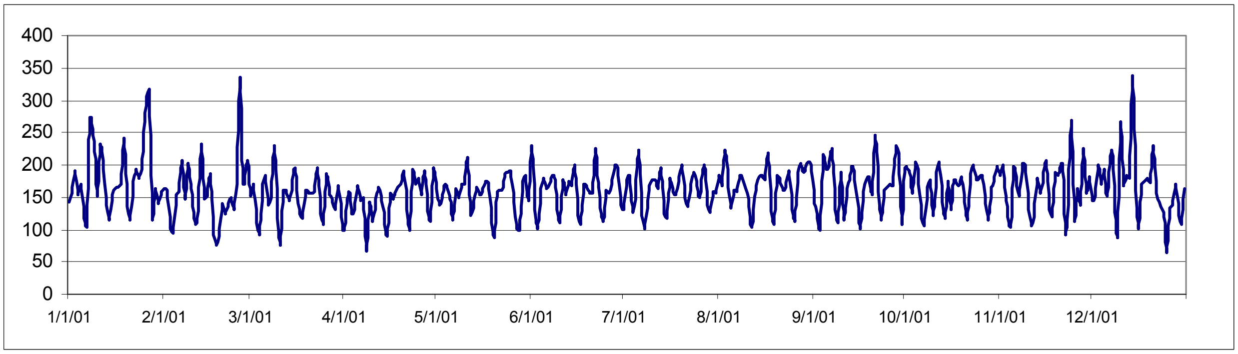
The crash data do not provide any injury outcome information (e.g., whether the person was transported by EMS or hospitalized) other than reported injury severity.

## *Date, Time and Location*

An important element of injury surveillance activities is being able to identify temporal patterns (i.e., date and time) and geographic locations of injury. The crash data are very useful for analyzing when and where motor vehicle crash injuries occur.

Analysis of the reported date of the crash showed no chronological gaps in the crash reporting. The distribution of crash dates shows a very regular pattern of frequencies with predictable peaks by day of the week (Fridays and Mondays). Figure 10, on the following page, depicts the distribution of crashes in 2001.

**Figure 10 Distribution of Crashes by Date 2001**




On average, there were 161.7 crashes per day in 2001. The highest number of crashes for any single day was 338 crashes on December 14, 2001 and the lowest number of crashes was 157 on January 2, 2001. The highest average number of crashes occurred on Fridays and Mondays and the lowest average number of crashes occurred on Sundays as shown in Table 11.

**Table 11 Average Number of Crashes by Day of the Week**

| Day | Average Number of Crashes | Rank |
|---|---|---|
| Sunday | 111.4 | 7 |
| Monday | 169.5 | 2 |
| Tuesday | 166.1 | 5 |
| Wednesday | 167.7 | 4 |
| Thursday | 168.0 | 3 |
| Friday | 199.9 | 1 |
| Saturday | 149.5 | 6 |

The distribution shows a seasonal distribution as well, with the highest average number of daily crashes occurring in January then declining to a low in April, then it begins to rise steadily with a second peak in August (see Figure 11).

**Figure 11 Average Number of Crashes per Day by Month 2001**

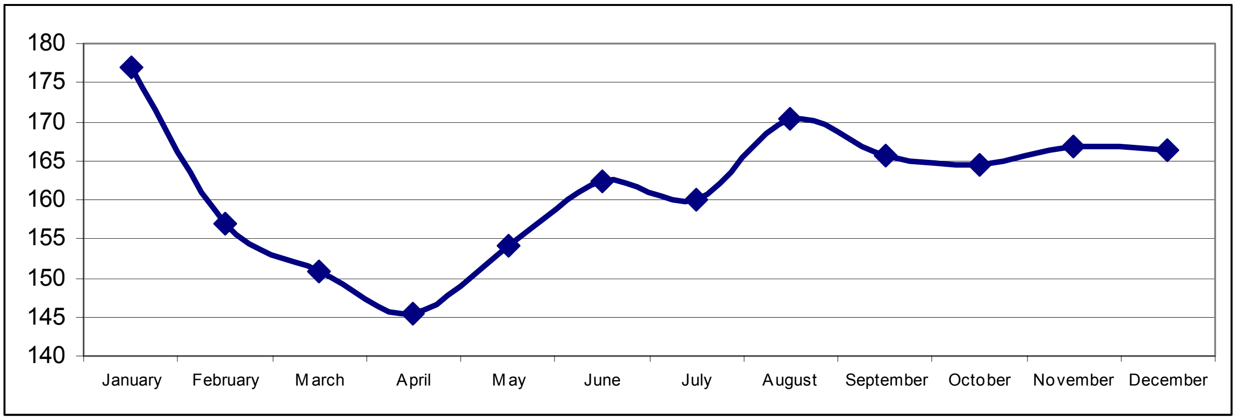


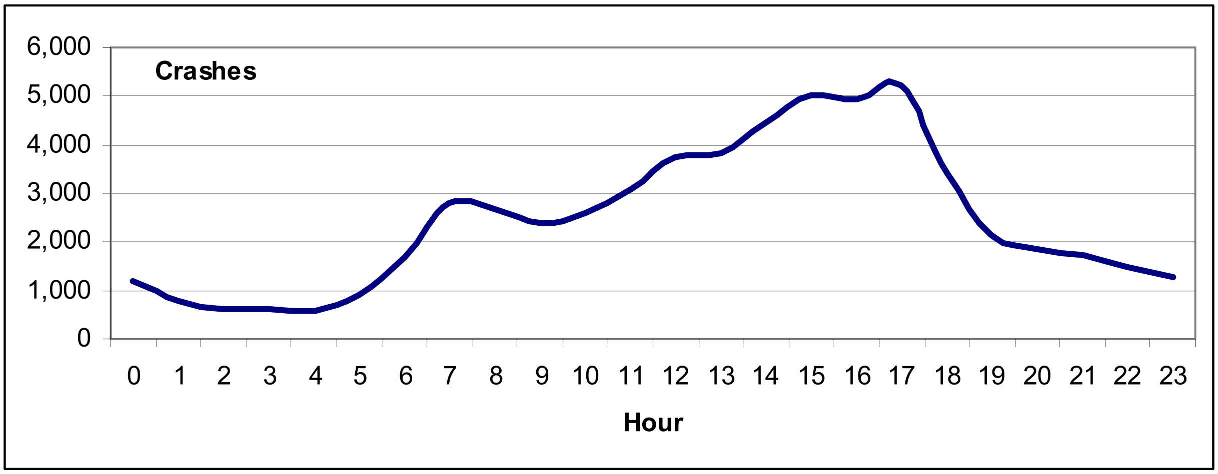

Table 12 presents the average number of reported crashes per day in 2001

**Table 12 Average Number of Crashes per Day by Month 2001**

| Month | Average Number of Daily Crashes | Rank |
|---|---|---|
| January | 176.9 | 1 |
| February | 157.0 | 9 |
| March | 150.8 | 11 |
| April | 145.3 | 12 |
| May | 154.2 | 10 |
| June | 162.3 | 7 |
| July | 160.1 | 8 |
| August | 170.3 | 2 |
| September | 165.6 | 5 |
| October | 164.6 | 6 |
| November | 166.8 | 3 |
| December | 166.4 | 4 |

In looking at the time of day of crashes, the data show peaks during the morning and afternoon rush hours.  Figure 12 depicts the distribution of crashes by time of day

**Figure 12 Total Number of Crashes by Time of Day 2001**




Looking at temporal patterns in crashes is useful for scheduling and managing resources such as police, EMS and emergency department personnel.

On average there were 6.7 crashes per hour in 2001 with a standard deviation of 4.4. The number of crashes per hour, however, is highly variable by hour and day of the week. A useful way to look at temporal patterns in crashes is to construct a grid as shown in Table 13, which shows the average number of crashes per hour by day of the week. In constructing such a table it is important to account for the fact that in each year at least one day of the week occurs 53 times rather than 52 times – in 2001 there were 53 Mondays. In Table 13, values that are one standard deviation less than the 6.7 crashes per hour are lightly shaded. Cells that are one standard deviation greater than average are shaded with stripes and cells that are more than two standard deviations are shaded darkly. As Table 13 indicates, the highest frequency of crashes appears to occur during the afternoon hours of weekdays with Friday afternoon being especially dangerous.

**Table 13 Average Number of Crashes per Hour by Day of Week**

| Hour | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| 0 | 4.6 | 3.0 | 2.5 | 2.5 | 2.6 | 2.8 | 5.0 |
| 1 | 3.6 | 1.9 | 1.0 | 1.3 | 1.5 | 1.9 | 3.5 |
| 2 | 2.8 | 1.4 | 0.9 | 1.2 | 1.1 | 1.4 | 3.1 |
| 3 | 3.0 | 1.3 | 1.3 | 1.1 | 1.0 | 1.4 | 2.6 |
| 4 | 2.7 | 1.3 | 1.1 | 1.3 | 1.2 | 1.4 | 2.1 |
| 5 | 2.7 | 2.6 | 1.9 | 2.5 | 2.5 | 2.2 | 2.8 |
| 6 | 2.6 | 4.7 | 5.3 | 6.1 | 5.5 | 5.1 | 2.9 |
| 7 | 2.8 | 8.7 | 9.4 | 9.9 | 9.7 | 8.6 | 4.3 |
| 8 | 3.5 | 9.1 | 8.5 | 8.6 | 8.5 | 8.3 | 4.9 |
| 9 | 3.6 | 7.3 | 7.5 | 7.4 | 6.7 | 7.8 | 5.8 |
| 10 | 5.1 | 8.5 | 6.3 | 7.0 | 7.3 | 8.6 | 6.8 |
| 11 | 5.6 | 9.5 | 8.8 | 8.7 | 9.2 | **9.6** | 8.1 |
| 12 | 6.5 | 11.3 | 11.1 | 10.9 | 10.1 | 12.9 | 8.6 |
| 13 | 6.8 | 11.6 | 11.1 | 10.1 | 10.5 | 13.0 | 10.5 |
| 14 | 7.0 | 12.8 | 14.0 | 13.1 | 12.3 | **15.8** | 10.1 |
| 15 | 6.8 | 14.8 | 15.6 | 15.4 | 15.3 | 18.6 | 9.8 |
| 16 | 6.8 | 15.5 | 14.7 | 13.7 | 14.6 | 18.6 | 10.7 |
| 17 | 7.3 | 15.1 | 16.1 | 16.4 | 17.3 | 18.2 | 9.6 |
| 18 | 6.8 | 8.9 | 9.4 | 9.9 | 10.1 | 11.6 | 8.9 |
| 19 | 5.6 | 5.1 | 5.0 | 5.1 | 5.0 | 8.1 | 6.8 |
| 20 | 4.3 | 4.9 | 4.1 | 4.3 | 5.0 | 6.5 | 6.3 |
| 21 | 4.1 | 4.0 | 4.9 | 4.6 | 4.4 | 6.1 | 5.4 |
| 22 | 3.2 | 3.5 | 3.3 | 3.5 | 3.2 | 6.1 | 5.3 |
| 23 | 3.4 | 2.5 | 2.1 | 3.1 | 3.1 | 5.0 | 5.5 |

The crash data also has several fields that indicate crash locations including county of crash, and street/intersecting street. The county field is completely filled and indicates that approximately 73% of all reported crashes occurred in Clark County and another 16% occurred in Washoe County. Table 14 presents the total number of collisions in 2001 by county of crash.

**Table 14 Number of Occupants of Motor Vehicles Involved in Injury Crashes 2001**

| County | Occupants | Percent of Total |
|---|---|---|
| Churchill | 556 | 0.9% |
| Clark | 43,168 | 73.1% |
| Douglas | 802 | 1.4% |
| Elko | 1,177 | 2.0% |
| Esmeralda | 99 | 0.2% |
| Eureka | 115 | 0.2% |
| Humboldt | 381 | 0.6% |
| Lander | 125 | 0.2% |
| Lincoln | 150 | 0.3% |
| Lyon | 467 | 0.8% |
| Mineral | 114 | 0.2% |
| Nye | 463 | 0.8% |
| Pershing | 179 | 0.3% |
| Storey | 74 | 0.1% |
| Washoe | 9,593 | 16.2% |
| White Pine | 254 | 0.4% |
| Carson City | 1,318 | 2.2% |
| Total | 59,035 | 100.0% |

Because of the unique situation in Nevada, in which nearly 90% of crashes occur in just two counties (Clark and Washoe) and the high number of tourists and visitors to these two counties, population-based rates by county are essentially meaningless for Nevada (although population-based rates may be meaningful in the other 15 counties). An estimate of the number of visitors and their average length of visit should be used to estimate the population-based rates for these two counties. For example, if the Las Vegas area gets approximately 35 million visitors per year and the average length of stay is five days, this would inflate the average population of Clark County by about 480,000 (i.e., 35 million times five days divided by 365 day per year equals approximately 479,000). Two other considerations should also be taken into account in any such calculation: (1) the population of visitors may have a much higher proportion of people who are of driving age, and (2) only a portion of these will be driving vehicles during their visit. Given the uncertainty about these figures, it is advised that population-based rate comparisons not include Clark and Washoe Counties. Instead, the rates for these counties should only be compared to themselves over time (e.g., the rate in Clark County in 2001 compared to the rate in 2002). Such comparisons should take into consideration not only resident population growth but also growth in the number of visitors to these areas each year. Population-based rates may be meaningful for the remaining 15 counties, but again, these rates should be adjusted for average daily traffic volumes on major highways in these counties.

A more useful way to examine crash locations would be to look at the street locations of the crashes. A cross-tabulation of the main street by the second street showed that the 59,035 crashes in 2001 occurred at only 14,948 main street/second street locations. Among these locations, 14,473 had both a main street and a second street location identified (the remaining 475 locations had only the main street location e.g., Interstate 80). Thirty-nine of these main street/second street locations had 50 or more crashes in 2001. This information could be used to identify locations that are particularly hazardous. This information could also be examined to determine the severity of crashes, types of crashes, or contributing factors that occur at these locations (e.g., pedestrian crashes, failure to yield, failure to reduce speed) to identify particular roadway modifications or interventions to reduce the number of crashes at these locations. Table 15 presents the top 20 specific crash locations that could be identified in the 2001 data.

**Table 15 Top 20 Crash Locations - 2001**

| Main Street | Second Street | Crashes |
|---|---|---|
| Las Vegas Blvd | Flamingo Rd | 249 |
| Tropicana Ave | Las Vegas Blvd | 215 |
| I-15 Sahara Ave Int R-1 | Sahara Ave | 209 |
| Paradise Rd | Tropicana Ave | 173 |
| Las Vegas Blvd | Harmon Avenue | 117 |
| Interstate 15 | I-15 Sahara Ave Int R-1 | 117 |
| Interstate 15 | I-15 Charleston Blvd Int R-3 | 113 |
| Charleston Blvd | Lamb Blvd | 94 |
| Tropicana Ave | Decatur Blvd | 91 |
| Interstate 15 | I-15 Sahara Ave Int R-2 | 89 |
| Sahara Ave | Las Vegas Blvd | 89 |
| Koval Lane | Tropicana Ave | 87 |
| Sahara Ave | Rainbow Blvd | 85 |
| Nellis Blvd | Stewart Avenue | 83 |
| Maryland Parkway | Flamingo Rd | 82 |
| Cheyenne Avenue (LV) | Losee Road | 82 |
| Lake Mead Drive | Gibson Road (H) | 81 |
| Nellis Blvd | Charleston Blvd | 78 |
| Paradise Rd | Flamingo Rd | 77 |
| Decatur Blvd | Sahara Ave | 75 |

Similar analyses could be applied to specific types of crashes such as pedestrian or bicycle crashes. Tables 16 and 17 list the top five locations for foot pedestrian and pedacycle crashes in 2001.

**Table 16 Top Five Locations for Foot Pedestrian Crashes - 2001**

| Main Street | Second Street | Crashes |
|---|---|---|
| Las Vegas Blvd | Spring Mountain Rd | 6 |
| Las Vegas Blvd | Riviera Blvd. | 5 |
| Las Vegas Blvd | Buccanner Blvd. | 5 |
| Virginia Street | Peckham Lane | 5 |
| Las Vegas Blvd | Flamingo Rd | 4 |

**Table 17 Top Five Locations for Bicycle Crashes - 2001**

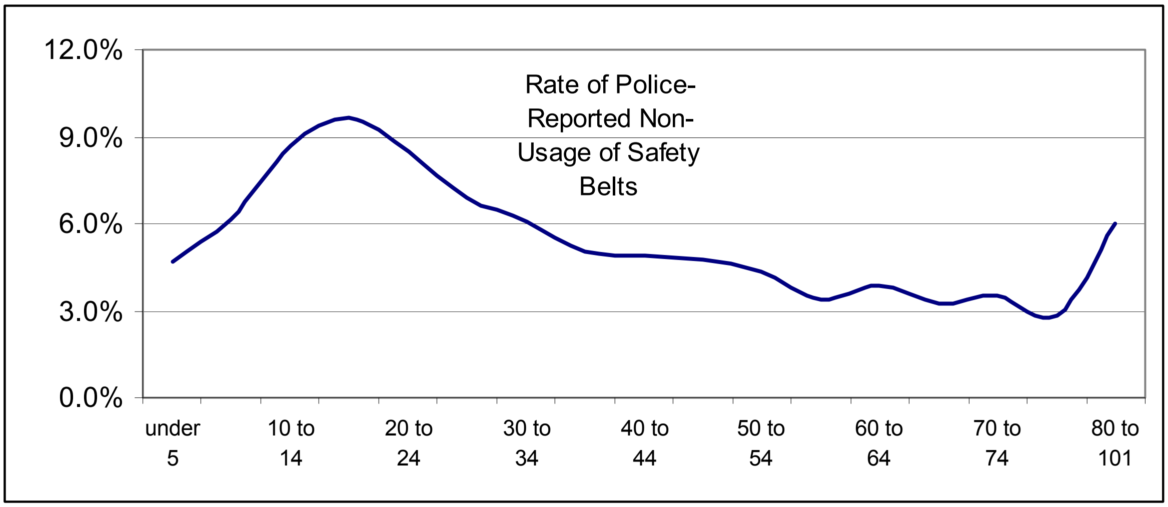
| Main Street | Second Street | Crashes |
|---|---|---|
| Charleston Blvd | Mojave Road | 3 |
| 95 Expwy Jones Blvd Int R-1 | Jones Blvd | 3 |
| Swenson Street | Sierra Vista Drive | 3 |
| Paradise Rd | Harmon Avenue | 3 |
| Nellis Blvd | Cheyenne Avenue (LV) | 3 |

## *Safety Information*

Injury surveillance activities should also examine usage rates for safety equipment such as seat belts and motorcycle helmets. Several characteristics of the seat belt usage information in the crash data, however, limit its usefulness in looking at patterns of seat belt usage. First of all, seat belt and helmet usage is only recorded for individuals involved in injury crashes. Individuals involved in crashes in which injuries occur, especially if they are the person injured, may have different seat belt/helmet usage levels than individuals not involved in injury crashes, where the seatbelt may have, in fact, prevented injury. Secondly, seat belt and helmet usage data from police crash reports are often inflated because police rely on self-reporting of safety belt usage (i.e., people in crashes often say they were wearing a safety belt even if they were not). Thirdly, the Nevada crash data show a remarkably high and probably unreliable level of seat belt usage. In the 2001 crash data, about 91% of individuals were reported to be using a seat belt and only about 6% of individuals involved in injury crashes were reported <u>not</u> to be using seat belts. However, in looking at only occupants with fatal injuries, who presumably are less able to lie about their safety belt usage but also more likely to not be using a safety belt, police reports of safety belt usage drops to about 31%. Observational studies in Nevada show a usage rate of approximately 75%.

Nonetheless, the seat belt usage data has some value for injury surveillance activities. Reports of *non-usage* of seat belts are probably more reliable because people have no motivation to say they were not using a safety belt when, in fact, they were using a belt. The instances of non-usage of seat belts may be useful to identify the *relative* rates of non-usage by age, gender or other characteristics of individuals. For example, Figure 13, below, depicts the percentage of drivers and passengers of cars and small trucks who were involved in injury crashes reported to be *not* using a seat belt by age group. As Figure 13 indicates, teenagers, young adults, and the elderly appear to be *less* likely to use seat belts. It should be kept in mind, however, that while this type of analysis can be used to identify particular age groups for interventions, it only shows the *relative* rate of non-usage, not the actual rate of non-usage of safety belts. Information on actual usage of safety belts should be obtained from observational surveys.

**Figure 13 Percent of Individuals Involved in Injury Crashes with Police-Reported Non-Usage of Safety Belts by Age - 2001**




There also appear to be some important differences in seat usage levels by gender. As was discussed above, the proportion of males and females reported to not be using a seat belt may be a better indicator of the *relative* difference between males and female in belt usage. A simple odds ratio calculation using the numbers of crash occupants reported not to be using a belt shows that males appear to be about 1.13 times as likely as females to be reported not using a safety belt. Simple Chi-square testing indicated that the difference between males and females in the reported non-use of safety belts is statistically significant as shown in Table 18.

**Table 18 Chi-Square Testing for Gender by Belt Use**

| Actual | Males | Females | Total |
|---|---|---|---|
| Belt Used | 25,942 | 22,802 | 48,744 |
| Belt Not Used | 2,145 | 1,397 | 3,542 |
| Total | 28,087 | 24,199 | 52,286 |
| Expected | Males | Females | |
| Belt Used | 26,184 | 22,560 | 48,744 |
| Belt Not Used | 1,903 | 1,639 | 3,542 |
| Chi-Square | 2.75E-17 (1 degree of freedom) | | |

When analyzing safety belt usage, records should first be selected to include only those types of vehicles in which safety belts are normally used (e.g., standard passenger cars, small passenger cars, pickup trucks, etc.). In the 2001 data there were 53,651 records for individuals involved in crashes who were occupants of these types of vehicles. In approximately 91% of these records the police reported a seat belt was in use and 6.2% indicated no safety belt use and 3.1% had unknown safety-belt usage.

Motorcycle helmet usage information tends to be somewhat more reliable than seat belt information because: (a) police can verify if a helmet is actually available, and (b) in states with strict helmet laws such as Nevada levels of compliance with these laws is usually high. The Nevada motor vehicle code requires motorcycle operators and passengers to wear helmets. Title 43 Chapter 8, Section 2 of the Motor Vehicle Code states:

“Except as provided in this section, when any motorcycle, except a trimobile or moped, is being driven on a highway, the driver and passenger shall wear protective headgear securely fastened on the head and protective glasses, goggles or face shields meeting those standards. Drivers and passengers of trimobiles shall wear protective glasses, goggles or face shields which meet those standards.”

Nonetheless, in many states with helmet laws, there are interest groups actively working to repeal helmet laws. Analysis of the data for motorcycle crash victims could provide useful information about the effectiveness of helmets and the potential impact of repeal of helmet laws. One of the limitations of the helmet usage data is that in states that have helmet laws, which Nevada has, it is difficult to obtain enough observations of un-helmeted riders to achieve statistical significance in comparing injury outcomes for helmeted and un-helmeted riders. In the 2001 crash data, only 19 of 663 motorcycle crash victims were reported to be un-helmeted. While these 19 crash victims had a much higher proportion of fatal and Class A and B injures than helmeted riders (89% for un-helmeted versus 69% for helmeted), showing that this difference is statistically significant would probably require using multiple years of data.

Helmet usage for pedacyclists is only reported for 29 of the 713 pedacyclists involved in injury crashes in 2001 making this data virtually useless for looking at helmet usage among bicyclists.

### *Other Risk Factors*

Injury surveillance activities should also look at other factors that may contribute to the likelihood of injury occurrence or injury severity and outcome such as alcohol use, speed limit, contributing factors and collision type (discussed under mechanism of injury) and seat position.

Alcohol usage is of particular importance because of its prominence in many motor vehicle crashes. Approximately 4.6% of the collisions indicated either alcohol or drug involvement in the crash. Alcohol and drug involvement can be determined from the driver sobriety and contributing factor fields in the crash data. Alcohol/drug involvement was identified if the driver sobriety field was

coded as either “Legally Drunk,” “Under Influence (Drugs),” or “Ability Impaired,” or if the contributing factor was identified as either “D.U.I. Alcohol” or “D.U.I. of Drugs.”
The National Highway Traffic Safety Administration (NHTSA) considers alcohol and drug impairment data as generally unreliable. NHTSA estimates that up to 50% or more of crashes involving alcohol are not identified. In about 18% of the Nevada collision records driver sobriety was coded as “unknown,” “unknown if impaired,” “blood alcohol test pending,” or “unknown if impaired (drugs).” While the cases that are coded as legally drunk probably do identify those cases in which the driver is, in fact, drunk it should be kept in mind that the alcohol/drug data probably seriously underestimates the extent of alcohol and drug involvement in crashes.

In looking at driver sobriety by gender, it is immediately apparent that the majority of legally drunk drivers are males. Approximately 76% of the 1,429 drivers who were reported to be legally drunk were males, while males made up only about 59% of drivers of crash vehicles. A simple odd ratio calculation (i.e., dividing the percentage of drunk drivers who were males by the percentage of crash vehicle drivers who were males) indicates that drunk drivers are about 1.28 times more likely to be males than females. Simple Chi-square testing, as shown in Table 19, showed that the difference between the ratio of male drunk drivers to female drunk drivers is statistically significant at a level of confidence of greater than .99. Additional analyses of these data may include logistic regression testing that accounts for other co-variates such as state of residence, age and day of week or time of day.

**Table 19 Chi-Square Testing for Gender by Sobriety**

| **Actual** | **Males** | **Females** | **Total** |
|---|---|---|---|
| Not Drunk | 19,568 | 13,609 | 33,177 |
| Drunk | 1,093 | 334 | 1,427 |
| Total | 20,661 | 13,943 | 34,604 |
| Expected | Males | Females | |
| Not Drunk | 19,809 | 13,368 | 33,177 |
| Drunk | 852 | 575 | 1,427 |
| Chi-Square | 2.91E-40 (1 degree of freedom) | | |

These results indicate that drunk driving appears to be a greater problem among males than females and has implications for driver education and safety interventions.

Another important co-variate to account for in injury surveillance is speed limit because injury severity can reasonably be expected to increase with speed limit. Documenting the relationship between speed limit and severity may be useful for estimating the impact of proposed speed limit changes. One such application could be to show the relationship between the percentage of police-reported fatalities, Class A injuries and Class B injuries for speed limits from 60 to 75 mile per hour as shown in Figures 14a through 14c on the following page. As the regression coefficients and R-squared values on Figures 14a through 14c indicate there appears to be a strong relationship between speed limit and the percentage of fatal, Class A and Class B injuries. Such a model could be used to predict the impact, in terms of expected increases in injury severity, when speed limit increases are proposed. One caveat of this type of analysis is that it should also take into account the expected effect in terms of total numbers of crashes, which may increase or decrease with changes in speed limit.

**Figure 14a** **Percent of Individuals Involved in Injury Crashes with Fatal Injuries by Speed Limit - 2001**

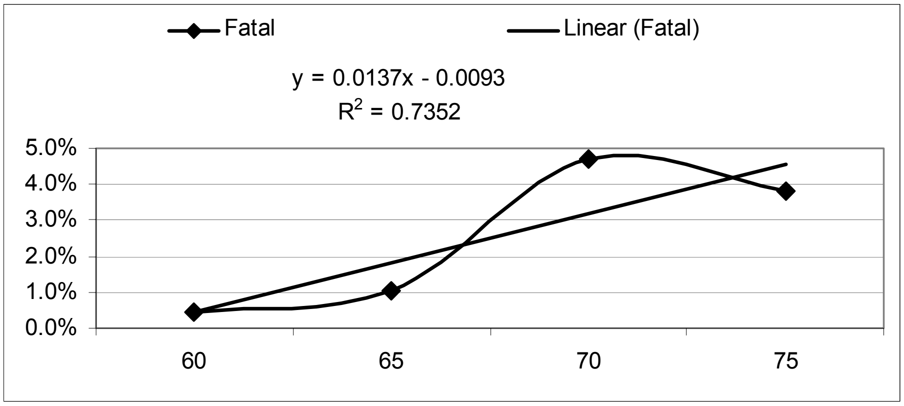



**Figure 14b** **Percent of Individuals Involved in Injury Crashes with Class A Injuries by Speed Limit - 2001**

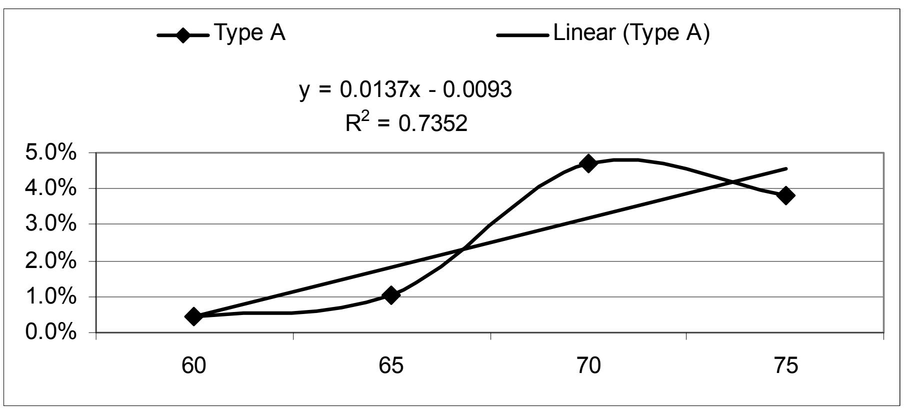
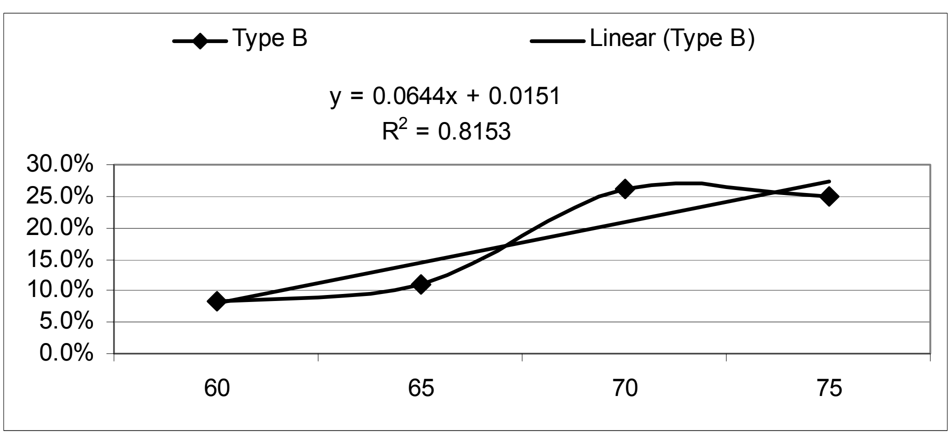



**Figure 14c** **Percent of Individuals Involved in Injury Crashes with Class B Injuries by Speed Limit - 2001**



In reference to seat position, the injury severity shows that front seat occupants appear to generally have higher levels of reported injury severity. Table 20 shows the percentage of reported injuries by seat position. As Table 20 indicates, front seat positions, have higher rates of all levels of injury.

**Table 20 Police Reported Injury Severity Among Front and Second Seat Occupants of Vehicles Involved in Injury Crashes**

| Injury Type | Left Front | Middle Front | Right Front | Left Second | Middle Second | Right Second |
|---|---|---|---|---|---|---|
| Class A | 2.7% | 2.9% | 2.3% | 1.5% | 1.2% | 1.3% |
| Class B | 10.5% | 10.0% | 9.3% | 6.3% | 6.4% | 6.0% |
| Class C | 38.7% | 27.3% | 41.6% | 28.1% | 21.8% | 30.0% |
| Fatal | 0.5% | 0.4% | 0.5% | 0.3% | 0.1% | 0.2% |
| No Injury | 47.6% | 59.3% | 46.3% | 63.9% | 70.5% | 62.6% |

The importance of seat position comes into play in education and legislative efforts aimed at young children. In 2001, 1,589 children were involved as occupants of vehicles involved in injury collisions. Approximately 15.6% of these children were occupants of front seating positions. An important limitation of the crash data is that they provide no information on the use of child safety seats. Table 21 presents the number of children in front and non-front seating positions by level of reported injury severity.

**Table 21 Total Number and Percentage of Children under Age Four by Reported Injury Severity and Seating Position - 2001**

| Injury Type | Total Number of Children Not in Front | Total Number of Children In Front Seat | Percent of Children Not in Front | Percent of Children In Front Seat |
|---|---|---|---|---|
| Class A | 9 | 2 | 0.7% | 0.8% |
| Class B | 60 | 16 | 4.5% | 6.5% |
| Class C | 111 | 24 | 8.3% | 9.7% |
| Fatal | 1 | 0 | 0.1% | 0.0% |
| No Injury | 1,160 | 206 | 86.5% | 83.1% |
| Total | 1,341 | 248 | 100.0% | 100.0% |

As Table 21 indicates, a higher percentage of children in front seating position had Class A, Class B and Class C reported injuries than children not in front seating positions.

## *Economic Costs of Injury*

Injury surveillance activities often look at the economic or financial costs of injury and who bears these costs. While there are economic models that provide estimates of the cost of motor vehicle crashes, the Nevada crash data does not provide any specific cost or economic information (e.g., insurance status). The data do report the police assessment of vehicle damage but this information only provides a limited and a very general assessment of vehicle damage and no information about the cost of injury.

### *Utility of Crash Data for Injury Surveillance and Limitations on Utility*

The information contained in the NDOT crash data is of varying levels of usefulness for injury surveillance activities. The data appear to be very useful for providing information about the demographic characteristics (age, gender, state of residence) of individuals injured in motor vehicle crashes and the time and location patterns of when and where injuries occur. The crash data are somewhat less useful in identifying population-based rates for specific counties or smaller geographic unit, however, due to the unique population characteristics of Nevada (i.e., with 90% of the population concentrated in two counties and a very large visitor population). The crash data also provide opportunities to take an in-depth look at specific sub-populations of interest such as children, young adults, bicyclists, pedestrians and motorcyclists.

The crash data are somewhat useful for looking at injury severity, mechanism of injury, use of safety equipment and contributing factors. Any analyses that use the crash data to look at the aspects of injury must carefully delineate the limits of the crash data in providing reliable and valid information.

The crash data are of no value in looking at injury type and the economic cost of injury.

# The UB-92 Hospital Discharge Data

## *File Structure and Description*

The following evaluation is based on an analysis of the 2001 Nevada Hospital Discharge database. This database has information about individuals discharged from 25 non-federal acute care hospitals in Nevada. The database collects standard data fields from the Uniform Billing 92 (UB-92) hospital discharge record. Data fields include patient demographic information, diagnoses, procedures, admission and discharge dates, length of hospital stay, hospital charges and discharge status. It should be understood, that each record in the database represents a single hospital discharge and that some individuals may be admitted and discharged more than once in a single year. The original data had 234,659 records for hospital discharges; combining multiple records for each single individual showed that 146,915 *individuals* were discharged in 2001. The analysis presented below and on the following pages is based on *hospital discharges for injury-related hospitalizations*, rather than individuals. The 25 facilities and the number of discharge records for each are listed in Table 22.

**Table 22 Number of Discharge Records Submitted by Facility – 2001**

| Hospital Code | Facility Name | Records |
|---|---|---:|
| BA | Battle Mountain General Hospital | 61 |
| BC | Boulder City Hospital | 1,002 |
| CA | Carson Tahoe Hospital | 9,184 |
| CH | Churchill Regional Medical Center | 2,235 |
| DS | Desert Springs Hospital | 15,053 |
| EG | Elko General Hospital | 3,271 |
| GD | Lincoln County Hospital | 148 |
| HS | Columbia Sunrise Hospital | 43,261 |
| HU | Humboldt General Hospital | 855 |
| IV | Incline Village (Lake Tahoe) Medical Center | 50 |
| LM | Lake Mead Hospital | 8,912 |
| MG | Mount Grant General Hospital | 181 |
| MV | Sunrise Mountain View Hospital | 16,715 |
| NG | Nye General Hospital | 309 |
| PG | Pershing General Hospital | 144 |
| SC | Lyon Health Center | 252 |
| SF | Northern Nevada Medical Center | 3,114 |
| SI | St. Rose Siena | 12,361 |
| SM | Saint Mary's Medical Center | 16,178 |
| SR | St. Rose Dominican | 8,793 |
| SU | Summerlin Hospital | 11,088 |
| UM | University Medical Center | 33,730 |
| VL | Valley Hospital | 20,482 |
| WA | Washoe Medical Center | 26,322 |
| WB | William B Ririe Hospital | 958 |
| | Total Records Submitted | 234,659 |

In 2003, the Injury Surveillance Workgroup of the State and Territorial Injury Prevention Directors Association (STIPDA) released *Consensus Recommendations for Using Hospital Discharge Data for Injury Surveillance*. According to this document, injury hospitalizations should be identified using only the primary diagnosis field because there are no national standards for the order in which the other codes are assigned and an injury diagnosis in a subsequent field does not necessarily reflect an injury of sufficient severity that it would have led to a hospitalization on its own. However, the initial analysis of the admission diagnosis and first diagnosis fields identified only about 11,900 records as injury-related. Including all diagnostic fields (the admission diagnosis and 15 diagnostic fields) identified more than 18,000 records with trauma diagnoses. It was, therefore, decided to use all diagnostic fields in the identification of injury hospitalizations. The CDC / STIPDA document recommends that injury hospitalizations be identified using ICD-9 CM diagnostic codes listed in Table 23a and 23b as inclusion and exclusion criteria.

**Table 23a Inclusion Criteria Used to Identify Injury Hospitalizations**

| | |
|---|---|
| 800 – 909.2, 909.4, 909.9 | Fractures; dislocations; sprains and strains; intracranial injury; internal injury of thorax, abdomen, and pelvis; open wound of the head, neck, trunk, upper limb, and lower limb; injury to blood vessels; late effects of injury, poisoning, toxic effects, and other external causes, excluding those of complications of surgical and medical care and drugs, medicinal or biological substances. |
| 910 – 994.9 | Superficial injury; contusion; crushing injury; effects of foreign body entering through orifice; burns; injury to nerves and spinal cord; traumatic complications and unspecified injuries; poisoning and toxic effects of substances; other and unspecified effects of external causes. |
| 995.5 – 995.59 | Child maltreatment syndrome. |
| 995.80 – 995.85 | Adult maltreatment, unspecified; adult physical abuse; adult emotional/ psychological abuse; adult sexual abuse; adult neglect (nutritional); other adult abuse and neglect. |

**Table 23b Exclusion Criteria Used to Identify Injury Hospitalizations**

| | |
|---|---|
| 909.3, 909.5 | Late effects of complications of surgical and medical care; late effects of adverse effects of drug, medicinal, or biological substance. |
| 995.0 – 995.4, 955.6 - 995.7, 995.86, 995.89 | Other anaphylactic shock; angioneurotic edema; unspecified adverse effect of drug, medicinal and biological substance; allergy, unspecified; shock due to anesthesia; anaphylactic shock due to adverse food reaction; malignant hyperpyrexia or hypothermia due to anesthesia. |
| 996 – 999 | Complications due to certain specified procedures; complications affecting specified body systems, not elsewhere classified; other complications of procedures, NEC; complications of medical care, NEC. |

Applying CDC/STIPDA injury case definition to all 16 diagnostic fields in the hospital discharge data identified 18,096 injury-related hospital discharges. Table 24 presents the total number of records, by facility, for all discharge records (both injury related and non-injury related), the number of records indicating injury in *any* of the 16 diagnostic fields, the number of records indicating injury in the admitting diagnosis field, the number of records indicating injury in the *first* diagnostic field and the percent of total discharges that had a trauma diagnosis in any of the diagnosis fields.

**Table 24 Number of Discharge Records and Injury-Related Records by Facility - 2001**

| Hospital | Total Records (Trauma and Non-Trauma) | Trauma Any Diagnostic Filed | Trauma in Admission Diagnosis | Trauma in First Diagnosis Field | Percent Trauma in Any Diagnostic Field |
|---|---|---|---|---|---|
| BA | 61 | 3 | 2 | 2 | 4.9% |
| BC | 1,002 | 118 | 80 | 82 | 11.8% |
| CA | 9,184 | 771 | 370 | 372 | 8.4% |
| CH | 2,235 | 112 | 59 | 61 | 5.0% |
| DS | 15,053 | 906 | 306 | 566 | 6.0% |
| EG | 3,271 | 304 | 242 | 251 | 9.3% |
| GD | 148 | 13 | 6 | 7 | 8.8% |
| HS | 43,261 | 2,314 | 1,197 | 1,354 | 5.3% |
| HU | 855 | 31 | 15 | 15 | 3.6% |
| IV | 50 | 3 | 2 | 2 | 6.0% |
| LM | 8,912 | 583 | 275 | 312 | 6.5% |
| MG | 181 | 8 | 2 | 3 | 4.4% |
| MV | 16,715 | 849 | 430 | 490 | 5.1% |
| NG | 309 | 24 | 8 | 10 | 7.8% |
| PG | 144 | 10 | 4 | 5 | 6.9% |
| SC | 252 | 13 | 6 | 9 | 5.2% |
| SF | 3,114 | 345 | 185 | 165 | 11.1% |
| SI | 12,361 | 718 | 408 | 309 | 5.8% |
| SM | 16,178 | 997 | 609 | 604 | 6.2% |
| SR | 8,793 | 623 | 382 | 230 | 7.1% |
| SU | 11,088 | 709 | 346 | 418 | 6.4% |
| UM | 33,730 | 4,587 | 3,597 | 3,635 | 13.6% |
| VL | 20,482 | 1,127 | 487 | 573 | 5.5% |
| WA | 26,322 | 2,843 | 2,209 | 2,352 | 10.8% |
| WB | 958 | 85 | 64 | 63 | 8.9% |
| Total | 234,659 | 18,096 | 11,291 | 11,890 | 7.7% |

### *Duplicates/Missing Data*

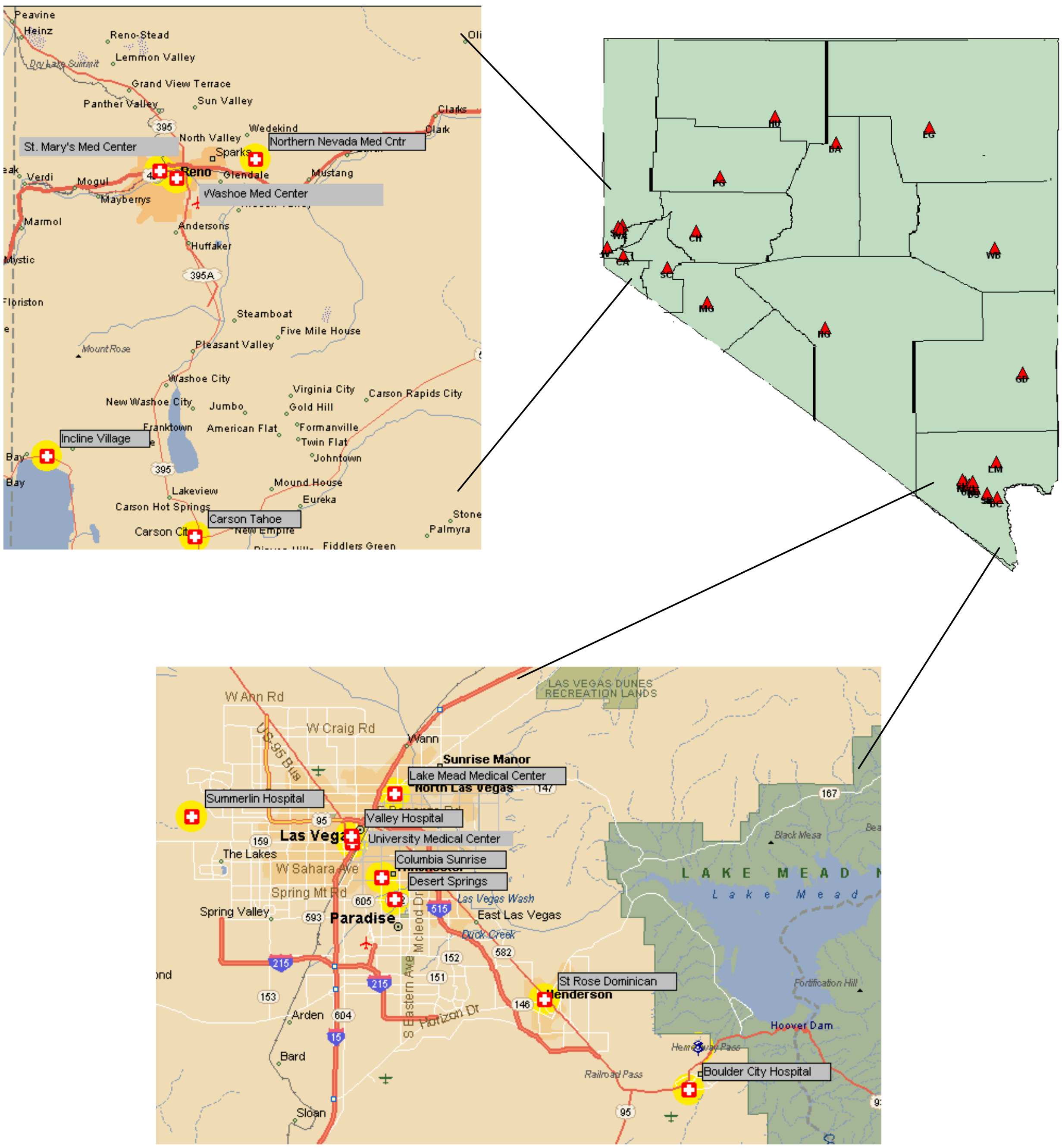
Note that the 25 facilities that submitted discharge data do not include federal hospitals such as Veterans Administration and military facilities. It appeared that most facilities submitted data for the entire 2001 calendar year, although several facilities had low numbers of total discharges. For example, Battle Mountain General Hospital had only 61 discharges and Incline Village had only 50 discharges for the year. While these facilities are very small (under 15 beds), the exceedingly low number of discharges does raise the question as to whether the data for these facilities are complete (if they are not primarily seasonally operating). The data for Incline Village hospital show no admissions between April 3, 2001 and July 19, 2001 and, for Battle Mountain, the data show only a single admission between July 24 and September 17. The data for all other facilities do not show substantial time gaps in admissions. Four facilities (HS, UM, WA and VL) accounted for more than 50% of all discharges and about 60% of injury-related discharges. Table 25 presents the percent and cumulative percent of all discharges and of injury-related discharges by facility in descending order of magnitude.

**Table 25 Percentage of Discharge Records and Injury-Related Records by Facility 2001**

| Hospital | Percent of Total Discharges | Percent of Injury-Related Discharges | Cumulative Percentage of Injury-Related Discharges | Cumulative Percentage of All Hospital Discharges |
|---|---|---|---|---|
| HS | 18.4% | 12.8% | 18.4% | 12.8% |
| UM | 14.4% | 25.3% | 32.8% | 38.1% |
| WA | 11.2% | 15.7% | 44.0% | 53.8% |
| VL | 8.7% | 6.2% | 52.8% | 60.1% |
| MV | 7.1% | 4.7% | 59.9% | 64.8% |
| SM | 6.9% | 5.5% | 66.8% | 70.3% |
| DS | 6.4% | 5.0% | 73.2% | 75.3% |
| SI | 5.3% | 4.0% | 78.5% | 79.2% |
| SU | 4.7% | 3.9% | 83.2% | 83.2% |
| CA | 3.9% | 4.3% | 87.1% | 87.4% |
| LM | 3.8% | 3.2% | 90.9% | 90.6% |
| SR | 3.7% | 3.4% | 94.6% | 94.1% |
| EG | 1.4% | 1.7% | 96.0% | 95.8% |
| SF | 1.3% | 1.9% | 97.4% | 97.7% |
| CH | 1.0% | 0.6% | 98.3% | 98.3% |
| BC | 0.4% | 0.7% | 98.7% | 99.0% |
| WB | 0.4% | 0.5% | 99.1% | 99.4% |
| HU | 0.4% | 0.2% | 99.5% | 99.6% |
| NG | 0.1% | 0.1% | 99.6% | 99.7% |
| SC | 0.1% | 0.1% | 99.8% | 99.8% |
| MG | 0.1% | 0.0% | 99.8% | 99.8% |
| GD | 0.1% | 0.1% | 99.9% | 99.9% |
| PG | 0.1% | 0.1% | 100.0% | 100.0% |
| BA | 0.0% | 0.0% | 100.0% | 100.0% |
| IV | 0.0% | 0.0% | 100.0% | 100.0% |
| TOTAL | 100.0% | 100.0% | | |

Figures 15 depicts the approximate location of the 25 facilities that submitted data in 2001.

**Figures 15 Location of Facilities Submitting Discharge Data – 2001**



*Demographic Information*

The UB-92 data includes information on patient zip code of residence, age, gender and marital status. Approximately 99% of the 18,096 records for injury hospitalizations have valid zip codes. Approximately 14% of the records for injury hospitalizations indicated the patient was not a Nevada resident. These data indicate that a substantial proportion of patients hospitalized for injuries in Nevada may be transferred from adjoining states or are visitors from out of state.

The age distribution shows that the absolute number and population-based rate of injury hospitalizations appears to increase dramatically among senior citizens. Figure 16a presents the distribution of total records for injury hospitalizations by age and Figure 16b presents the rate per 1000 population of all injury hospitalizations and for those among Nevada residents only.

**Figure 16a Number of Injury Hospitalizations by Age 2001**

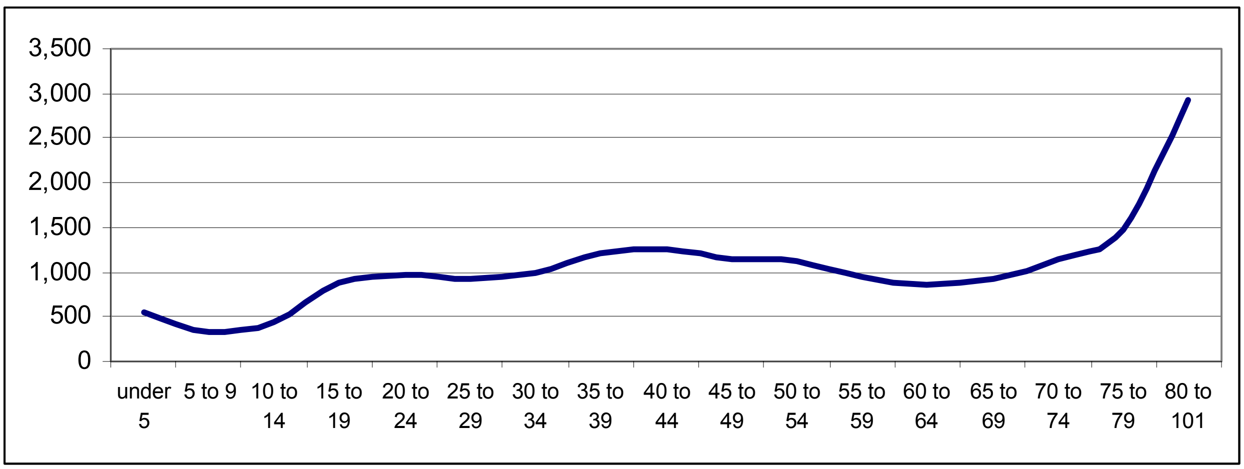
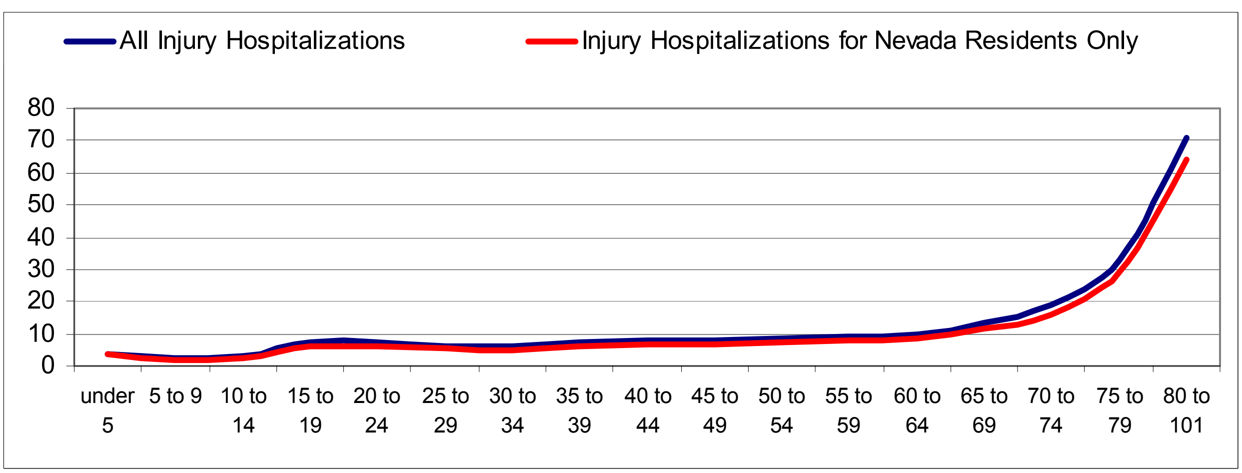



**Figure 16b Injury Hospitalizations per Thousand Residents by Age 2001**



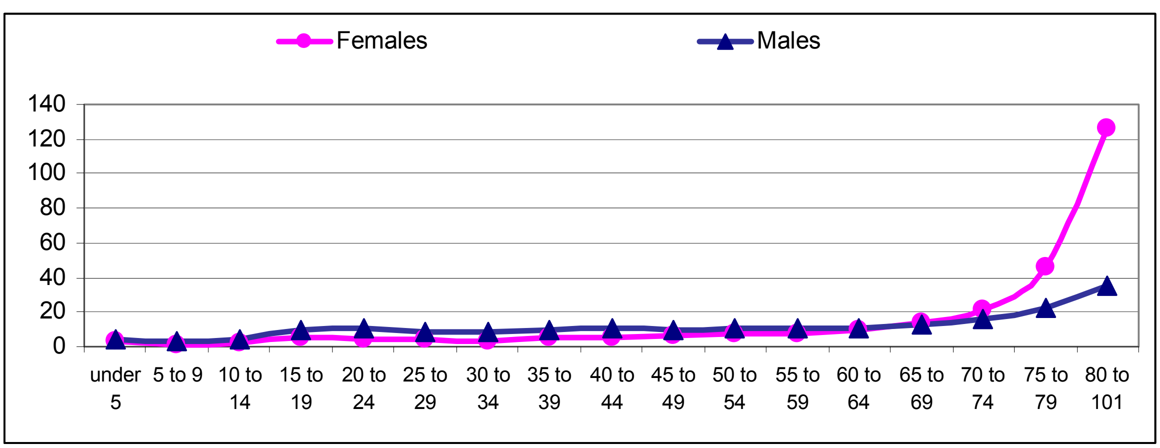
While overall there are more records for injury hospitalizations for males than females, the rate per thousand residents varies with age as shown in Table 26.

**Table 26  Number and Rate/1,000 Residents of Injury Hospitalizations by Age and Gender - 2001**

| Age | Total Injury Hospitalizations for Males | Total Injury Hospitalizations for Females | Rate of Injury Hospitalizations per 1000 Residents for Males | Rate of Injury Hospitalizations per 1000 Residents for Females |
|---|---|---|---|---|
| Under 5 | 325 | 218 | 4.6 | 2.9 |
| 5 to 9 | 204 | 122 | 2.8 | 1.6 |
| 10 to 14 | 297 | 151 | 4.3 | 2.1 |
| 15 to 19 | 571 | 320 | 9.5 | 5.0 |
| 20 to 24 | 691 | 274 | 11.1 | 4.1 |
| 25 to 29 | 636 | 292 | 9.0 | 3.8 |
| 30 to 34 | 673 | 310 | 8.9 | 3.7 |
| 35 to 39 | 767 | 433 | 9.5 | 4.9 |
| 40 to 44 | 806 | 452 | 10.4 | 5.5 |
| 45 to 49 | 689 | 447 | 9.9 | 6.3 |
| 50 to 54 | 652 | 469 | 10.2 | 7.4 |
| 55 to 59 | 547 | 401 | 10.4 | 7.8 |
| 60 to 64 | 427 | 423 | 10.3 | 9.8 |
| 65 to 69 | 441 | 492 | 12.4 | 13.9 |
| 70 to 74 | 501 | 647 | 15.8 | 21.6 |
| 75 to 79 | 555 | 923 | 22.9 | 45.7 |
| 80 to 101 | 905 | 2027 | 35.6 | 125.6 |
| Unknown Age | 4 | 4 | | |
| Total | 9,691 | 8,405 | 9.9 | 8.3 |

Figure 17 depicts the rate of injury hospitalization per thousand residents by age and gender.

**Figure 17 Injury Hospitalizations per Thousand Residents by Age and Gender 2001**



### *Injury Severity*

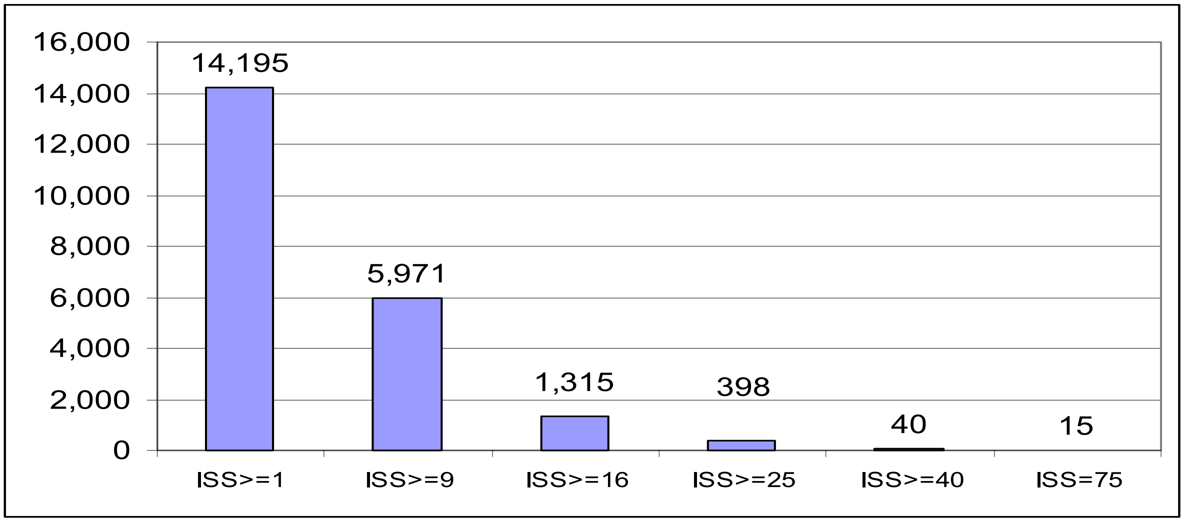
The discharge data do not provide any direct indication of injury severity but injury severity can be calculated from diagnostic fields. The *ICDMAP-90* software was used to calculate injury severity in terms of Abbreviated Injury Severity (AIS) scores and Injury Severity Scores (ISS). The Abbreviated Injury Severity Score is an estimate of the severity of specific types of injuries. AIS scores (depending on the body region of injury) range from 0 to 6, with 0 representing no injury and 6 representing injuries that are usually not survivable. AIS scores are calculated for each injury in each of six body regions. The AIS is not comparable across body regions meaning that an AIS of 2 in the head/neck body region is not of equivalent severity to an AIS of 2 in the chest region. Injury Severity Score (ISS) is an estimate of the combined effect of multiple injuries. ISS scores range from zero (no injury) to 75 (maximum injury). ISS is calculated by summing the squares of the three highest AIS scores by body region. For example, if a patient had a highest AIS in the head/neck body region of 4, in the chest of 3 and in the extremities and pelvic girdle region of 2, the ISS for this patient would be 29 ($4^2 + 3^2 + 2^2 = 29$). An ISS of 75 is generally but not always fatal. Any AIS score of 6 automatically results in an ISS of 75. AIS and ISS are calculated for injuries caused by blunt or penetrating force or burn and are not calculated for injuries resulting from poisoning or overdose. Table 27 presents the distribution of Injury Severity Scores among the injury-related hospital discharges.

**Table 27 Injury Severity Score Among Injury Hospitalizations 2001**

| Injury Severity Score | Records |
|---|---:|
| ISS 0 | 3,901 |
| ISS 1 To 8 | 8,224 |
| ISS 9 To 15 | 4,656 |
| ISS 16 To 24 | 917 |
| ISS 25 To 35 | 358 |
| ISS 40 To 74 | 25 |
| ISS 75 | 15 |
| Total | 18,096 |

An ISS of 16 or greater is generally considered to be a serious injury. Figure 18 depicts the distribution of ISS scores among the injury-related hospital discharge records. As Figure 18 indicates, 1,315 people were hospitalized with an ISS of 16 or greater.

**Figure 18 Injury Severity Among Injury Hospitalizations 2001**




The American College of Surgeons Committee on Trauma (ACSCOT) recommends that Level I and Level II trauma centers should treat at least 1,200 trauma patients per year with at least 240 patients with an ISS of 15 or greater. Table 28 presents the total injury hospitalizations and the number of injury hospitalizations with an ISS of 16 or greater by facility in 2001. The two Level I /II centers in Nevada (University Medical Center – Level I and Washoe Medical Center – Level II) both met the ACS criteria according to the hospital discharge data. Table 28 also indicates that a substantial number of patients with serious injuries are being hospitalized at non-Level I or II facilities.

**Table 28 Injury Severity Score Among Injury Hospitalizations by Facility 2001**

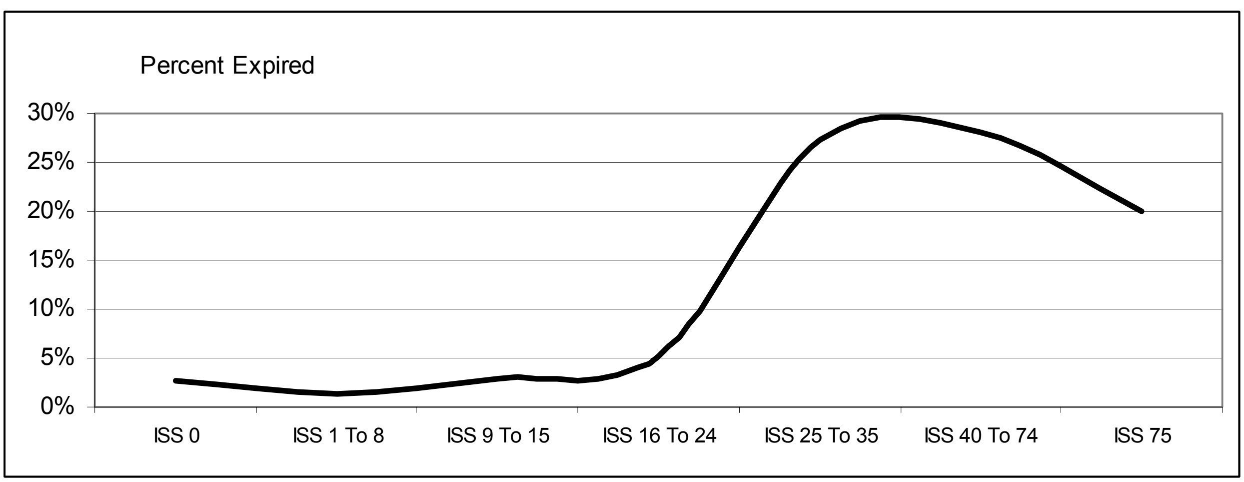
| Hospital | Injury-Related Discharges | Discharges ISS >=16 |
|---|---|---|
| BA | 3 | 0 |
| BC | 118 | 2 |
| CA | 771 | 8 |
| CH | 112 | 4 |
| DS | 906 | 25 |
| EG | 304 | 11 |
| GD | 13 | 1 |
| HS | 2,314 | 114 |
| HU | 31 | 1 |

| Hospital | Injury-Related Discharges | Discharges ISS >=16 |
|---|---|---|
| IV | 3 | 1 |
| LM | 583 | 12 |
| MG | 8 | 1 |
| MV | 849 | 7 |
| NG | 24 | 0 |
| PG | 10 | 0 |
| SC | 13 | 0 |
| SF | 345 | 0 |
| SI | 718 | 9 |
| SM | 997 | 37 |
| SR | 623 | 11 |
| SU | 709 | 9 |
| UM* | 4,587 | 649 |
| VL | 1,127 | 41 |
| WA* | 2,843 | 370 |
| WB | 85 | 2 |
| Total | 18,096 | 1315 |

* Indicates Level I or II Trauma Center

Approximately 2.9% of injury-related hospitalizations ended in death (511 deaths out of 18,096 hospitalizations). Figure 19 depicts the mortality rate by injury severity.

**Figure 19 Mortality Rate for Injury-Related Hospitalizations by Injury Severity Score**



## *Injury Type*

A useful way of reporting specific types of injuries is according to the *Barell Matrix*. This matrix, designed by CDC, is a two-dimensional array of ICD9-CM injury diagnoses grouped by body region and nature of injury. The rows of the matrix provide information about specific body regions (head, spinal cord, vertebral column, etc). The rows are subdivided into separate subcategories (e.g., shoulder, forearm, wrist). The columns of the matrix divide the injuries into types of injuries (e.g., fractures, dislocations, burns, etc.). It should be understood that the *Barell Matrix* is based on the first injury diagnosis code although patients may have multiple body regions of injury. The *Barell Matrix* for the 2001 hospital discharge data is depicted on the following pages.

## Table 29 The Barell Matrix for Inpatient Hospital Discharge Data on Injury Type and System – 2001

| | | | | FRACTURE | DISLOCATION | SPRAINS AND STRAINS | INTERNAL ORGAN | OPEN WOUND | AMPUTATIONS | BLOOD VESSELS | CONTUSION / SUPERFICIAL | CRUSH | BURNS | NERVES | UNSPECIFIED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEAD AND NECK | TRAUMATIC BRAIN INJURY | 1 | TYPE 1 TBI | 237 | | | 993 | | | | | | | | |
| | | 2 | TYPE 2 TBI | 64 | | | 204 | | | | | | | | |
| | | 3 | TYPE 3 TBI | 51 | | | | | | | | | | | |
| | OTHER HEAD FACE AND NECK | 4 | OTHER HEAD | | | | | 182 | | | | | 2 | 3 | 351 |
| | | 5 | FACE | 311 | 5 | 1 | | 298 | | | | | 12 | | |
| | | 6 | EYE | | | | | 54 | | | 55 | | 5 | 0 | |
| | | 7 | NECK | 1 | | 0 | | 38 | | | | 0 | 8 | 1 | |
| | | 8 | HEAD, FACE, NECK UNSPEC. | | | | | | | 5 | 296 | | 29 | 0 | 36 |
| SPINE AND BACK | SPINAL CORD INJURY (SCI) | 9 | CERVICAL SCI | 31 | | | 28 | | | | | | | | |
| | | 10 | THORASIC/DORSAL SCI | 19 | | | 8 | | | | | | | | |
| | | 11 | LUMBAR SCI | 14 | | 7 | | | | | | | | | |
| | | 12 | SACRUM COCCYX SCI | 1 | | 16 | | | | | | | | | |
| | | 13 | SPINE BACK UNSPECIFIED SCI | 0 | | 16 | | | | | | | | | |
| | VERTEBRAL COLUMN INJURY | 14 | CERVICAL VCI | 188 | 35 | 68 | | | | | | | | | |
| | | 15 | THORASIC/DORSAL VCI | 224 | 2 | 4 | | | | | | | | | |
| | | 16 | LUMBAR VCI | 353 | 33 | 53 | | | | | | | | | |
| | | 17 | SACRUM COCCYX VCI | 34 | | 2 | | | | | | | | | |
| | | 18 | SPINE BACK UNSPECIFIED VCI | 23 | | | | | | | | | | | |

| | | | | FRACTURE | DISLOCATION | SPRAINS AND STRAINS | INTERNAL ORGAN | OPEN WOUND | AMPUTATIONS | BLOOD VESSELS | CONTUSION / SUPERFICIAL | CRUSH | BURNS | NERVES | UNSPECIFIED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TORSO | TORSO | 19 | CHEST | 402 | 0 | 8 | 346 | 50 | | 4 | 104 | 0 | 12 | 0 | |
| | | 20 | ABDOMEN | | | | 385 | 67 | | 10 | 53 | | 11 | 0 | |
| | | 21 | PELVIS/ UROGENITAL | 497 | 5 | 23 | 76 | 28 | | 2 | 9 | 0 | 2 | 0 | |
| | | 22 | TRUNK | 0 | | | | 2 | | | 50 | 2 | 6 | 0 | 70 |
| | | 23 | BACK AND BUTTOCK | | | 4 | | 14 | | | 42 | 0 | 19 | | |
| EXTREMITIES | UPPER | 24 | SHOULDER AND UPPER ARM | 588 | 43 | 119 | | 31 | 2 | | 53 | 0 | 6 | | 11 |
| | | 25 | FOREARM AND ELBOW | 398 | 3 | 1 | | 102 | 2 | | 30 | 2 | 10 | | 0 |
| | | 26 | WRIST, HAND AND FINGERS | 116 | 6 | 10 | | 268 | 42 | | 46 | 4 | 29 | | 19 |
| | | 27 | OTHER AND UNSPECIFIED | 6 | | | | 17 | 0 | 26 | 74 | 1 | 8 | 11 | 20 |
| | LOWER | 28 | HIP | 2184 | 38 | 21 | | | | | 93 | | | | 1 |
| | | 29 | UPPER LEG AND THIGH | 438 | | | | | 1 | | 24 | 0 | 0 | | 1 |
| | | 30 | KNEE | 116 | 61 | 30 | | | | | 48 | 1 | 2 | | |
| | | 31 | LOWER LEG AND ANKLE | 1161 | 4 | 48 | | | 2 | | 37 | 3 | | 23 | |
| | | 32 | FOOT AND TOES | 206 | 13 | 4 | | 61 | 3 | | 0 | 32 | 26 | | |
| | | 33 | OTHER AND UNSPECIFIED | 1 | | 50 | | 0 | | 17 | 96 | 3 | 9 | | 82 |
| OTHER & UNSPECIFIED | OTHER & UNSPECIFIED | 34 | OTHER / MULTIPLE | 0 | | 0 | | | 0 | 1 | | | 10 | 0 | |
| | | 35 | UNSPECIFIED SITE | 4 | 0 | 28 | 1 | 15 | | 0 | 79 | 1 | 56 | 11 | 289 |
| WIDE AND LATE | WIDE AND LATE | 36 | SYSTEM-WIDE AND LATE EFFECTS | 3663 | | | | | | | | | | | |

### *Mechanism of Injury*

All injury-related hospitalizations should have an External Cause of Injury Code (E-code) that indicates the mechanism of injury. E-codes that indicate the place of injury (E849) or the perpetrator (E967) and E-codes associated with medical misadventures (E870-E879) are not considered to be valid mechanism of injury codes for the injuries defined by the STIPDA/CDC injury definition.

Approximately 46% of the 18,096 records with an injury diagnosis (in any diagnostic field) also had an E-code (any E-code) and about 40% had a valid *mechanism of injury* E-code. (The Center for Health Data and Research performed a study on the reporting of e-coded injuries in inpatient hospital discharge data from 2000 and earlier. In that earlier study, it was found that 2000 Nevada discharge data contained approximately 65% of the E-coded injuries that were expected with large variation from year-to-year and hospital-to-hospital.) The 2001 data showed that the rate of E-coding varies greatly by institution. Table 30 indicates the percent of injury-related hospital discharge records with any E-code and with valid mechanism of injury E-codes by facility. Several large facilities, submitted no E-coded records in 2001. One facility (UM) that is a Level I Trauma Center used primarily E849 codes in the E-Code field.

**Table 30 E-Coding Among Injury Hospitalizations Records by Facility 2001**

| Hospital | Injury Hospitalizations | Any E Code | Percent With Any E-Code | Valid Mechanism of Injury E-Code | Percent With Valid Mech. of Injury E-Code |
|---|---|---|---|---|---|
| BA | 3 | 3 | 100.0% | 3 | 100.0% |
| PG | 10 | 9 | 90.0% | 9 | 90.0% |
| WA | 2,843 | 2,489 | 87.5% | 2,461 | 86.6% |
| HS | 2,314 | 1,976 | 85.4% | 1,933 | 83.5% |
| GD | 13 | 10 | 76.9% | 10 | 76.9% |
| MV | 849 | 659 | 77.6% | 639 | 75.3% |
| CH | 112 | 86 | 76.8% | 84 | 75.0% |
| WB | 85 | 62 | 72.9% | 60 | 70.6% |
| LM | 583 | 387 | 66.4% | 386 | 66.2% |
| NG | 24 | 14 | 58.3% | 14 | 58.3% |
| SM | 997 | 553 | 55.5% | 553 | 55.5% |
| HU | 31 | 18 | 58.1% | 17 | 54.8% |
| SR | 623 | 253 | 40.6% | 252 | 40.4% |
| CA | 771 | 297 | 38.5% | 297 | 38.5% |
| SC | 13 | 5 | 38.5% | 5 | 38.5% |
| SI | 718 | 247 | 34.4% | 242 | 33.7% |
| IV | 3 | 1 | 33.3% | 1 | 33.3% |
| MG | 8 | 2 | 25.0% | 2 | 25.0% |
| EG | 304 | 50 | 16.4% | 50 | 16.4% |
| BC | 118 | 11 | 9.3% | 11 | 9.3% |
| UM | 4,587 | 1,221 | 26.6% | 169 | 3.7% |
| DS | 906 | 0 | 0.0% | 0 | 0.0% |
| SF | 345 | 0 | 0.0% | 0 | 0.0% |

| Hospital | Injury Hospitalizations | Any E Code | Percent With Any E-Code | Valid Mechanism of Injury E-Code | Percent With Valid Mech. of Injury E-Code |
|---|---|---|---|---|---|
| SU | 709 | 0 | 0.0% | 0 | 0.0% |
| VL | 1,127 | 0 | 0.0% | 0 | 0.0% |
| Total | 18,096 | 8,353 | 46.2% | 7,198 | 39.8% |

Because many of the facilities with low E-coding rates also had large numbers of injury-related discharges, efforts to increase E-coding at these facilities could greatly increase the overall E-coding compliance rate. University Hospital (UM) accounted for approximately one-quarter of all injury-related discharges in 2001. Analysis of the records for this institution showed extensive use of the E849 location code. Improving E-coding compliance at this single institution would have a substantial impact on overall E-coding compliance in the discharge data.

Note that 14 institutions supplied E-coded information to the trauma registry database in 2001; thus coordination/sharing of data among the various data submitters at an institution might facilitate submission of the data for the hospital discharge database.

The fourth digit of the E-code provides more information about the injury, the mechanism or the person injured. For example, the fourth digit for motor vehicle crashes (E810-E819) indicates whether the injured person was a driver or passenger of a passenger car, driver or passenger of a motorcycle or pedestrian. For firearm related injuries (E922, E955, E965, E985) the fourth digit specifies the type of firearm (handgun, shot gun, hunting rifle, etc.) used. Among the 7,198 records with valid mechanism of injury codes, 4,436 (61.6%) had a valid fourth digit. Fourth-digit coding practices, however, vary widely by institution as shown in Table 31.

**Table 31 E-Coding Among Injury Hospitalizations Records by Facility 2001**

| Hospital | Injury-Related Discharges | Valid Mechanism of Injury E-Coded Records | Valid Mechanism of Injury E-Coded Records with Valid Fourth Digit | Percent of Valid Mechanism of Injury E-Coded Records with Valid Fourth Digit |
|---|---|---|---|---|
| BA | 3 | 3 | 2 | 66.7% |
| BC | 118 | 11 | 6 | 54.5% |
| CA | 771 | 297 | 171 | 57.6% |
| CH | 112 | 84 | 52 | 61.9% |
| DS | 906 | 0 | 0 | 0.0% |
| EG | 304 | 50 | 49 | 98.0% |
| GD | 13 | 10 | 6 | 60.0% |
| HS | 2,314 | 1,933 | 1,110 | 57.4% |
| HU | 31 | 17 | 13 | 76.5% |
| IV | 3 | 1 | 1 | 100.0% |
| LM | 583 | 386 | 240 | 62.2% |
| MG | 8 | 2 | 1 | 50.0% |

| Hospital | Injury-Related Discharges | Valid Mechanism of Injury E-Coded Records | Valid Mechanism of Injury E-Coded Records with Valid Fourth Digit | Percent of Valid Mechanism of Injury E-Coded Records with Valid Fourth Digit |
|---|---|---|---|---|
| MV | 849 | 639 | 338 | 52.9% |
| NG | 24 | 14 | 10 | 71.4% |
| PG | 10 | 9 | 4 | 44.4% |
| SC | 13 | 5 | 4 | 80.0% |
| SF | 345 | 0 | 0 | 0.0% |
| SI | 718 | 242 | 127 | 52.5% |
| SM | 997 | 553 | 295 | 53.3% |
| SR | 623 | 252 | 129 | 51.2% |
| SU | 709 | 0 | 0 | 0.0% |
| UM | 4,587 | 169 | 145 | 85.8% |
| VL | 1,127 | 0 | 0 | 0.0% |
| WA | 2,843 | 2,461 | 1,700 | 69.1% |
| WB | 85 | 60 | 33 | 55.0% |
| Total | 18,096 | 7,198 | 4,436 | 61.6% |

The fourth digit of the E849 code indicates the location where the injury occurred (Table 32).

**Table 32 E849 Location Coding Among Injury Hospitalizations Records 2001**

| Fourth Digit E849 | Place where Injury Occurred | Records |
|---|---|---|
| 0 | Home | 879 |
| 1 | Farm | 1 |
| 2 | Mine/Quarry | 0 |
| 3 | Industrial Place and Premises | 234 |
| 4 | Recreational/Sport | 128 |
| 5 | Street/Highway | 525 |
| 6 | Public Building | 127 |
| 7 | Residential Institution | 217 |
| 8 | Other | 236 |
| 9 | Unspecified | 339 |

A small number of records (17 records) had two E849 codes. Thirteen of these records had a "7" combined with some other code, perhaps indicating some confusion over which code to use. Curiously, only a single record indicated the injury took place at a farm and no records indicated injuries occurring at mines or quarries. Nevada, according to the National Mining Association, has a very large mining industry with 176 mines of various types and about 11,900 people employed in the mining industry. It is possible, however, that many of the injuries that occur on farms are coded as "0" (home), and many mine-related injuries may be coded as "3" (industrial place or premise). It should also be cautioned that records coded as "E8490" may simply indicate a missing fourth digit, rather than truly reflect injuries that occur in the home. In any event, due to the uncertainty of the location data, these do not appear to be very useful or reliable for injury surveillance purposes.

Evaluation of specific mechanism of injury is severely restricted by the lack of mechanism of injury E-coding. This problem is compounded by the fact that the largest trauma care provider (a Level I Trauma Center) has a very low e-coding rate and several other mid-sized facilities also have low e-coding rates. These large facilities presumably receive a disproportionate share of the more severe trauma cases. While the reported E-codes can be used to show the relative proportions of mechanisms of injury, it should be kept in mind that because several large and mid-sized facilities have low E-coding rates these proportions might be misleading. For example, motor vehicle crashes and firearm injures typically result in more severe injuries that may be more likely to go to a Level I facility. If the Level I facility, which treats a disproportionate share of these mechanism does not report or under-reports E-codes, the relative proportions of mechanisms may be skewed toward those mechanisms that typically result in less severe injuries. With this caveat in mind, the number of records for major mechanisms of injury are provided in Table 33. Records in Table 33 were identified by the fourth digit of the E-codes and where, possible by third digit of E-codes with only 3 digits. Some records in Table 33 qualify for multiple mechanisms. For example, if a person's injuries resulted from an assault with a handgun, this record would be counted as both a firearm-related injury and as an assault-related injury.

**Table 33 Injury Hospitalizations by Mechanism of Injury** **(Caution - high level of missing data)**

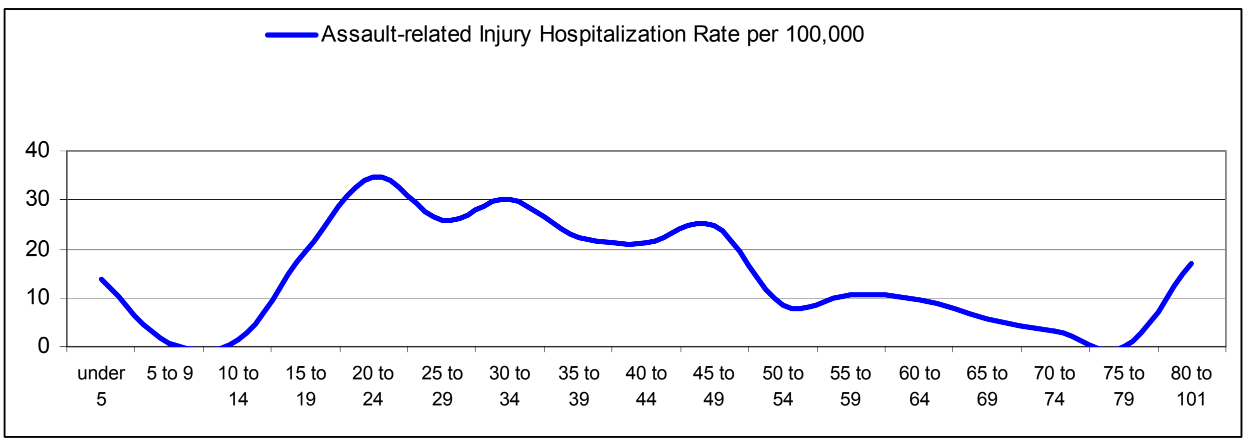
| Mechanism | Injury Hospitalizations |
|---|---:|
| No Mechanism Identified | 10,898 |
| Fall | 3,134 |
| Poison | 1,527 |
| Other Cause | 822 |
| Motor Vehicle Crash | 795 |
| Suicide or Self-inflicted | 703 |
| Assault | 328 |
| Animal-related | 201 |
| Machinery-related | 156 |
| Non-traffic Motor Vehicle Accident | 143 |
| Other Road Vehicle Accident | 141 |
| Bicycle Crash | 96 |
| Pedestrian Crash | 78 |
| Firearm-related | 51 |
| Fire or Flames | 32 |
| Burns (Not from fire or flames) | 29 |
| Drowning | 24 |
| Watercraft Accident | 15 |
| Aircraft-related | 7 |
| Electric-current | 5 |

As Table 33 indicates, falls, poisonings, motor-vehicle crashes and self-inflicted injuries appear to be the most common mechanisms of injury. Again, it should be stressed that the figures presented in Table 32 probably represent an under-count of the true number of cases. For example, the NDOT crash data identify more than 1,900 individuals with Type A or fatal injuries from motor vehicle crashes. Presumably, all of these cases, except the fatalities that occurred before the patient could be hospitalized as an inpatient (e.g., on scene, in the emergency department), would have resulted in an inpatient hospitalization.

While the information on injury mechanism probably undercounts the true magnitude of injuries, this information can be used to identify relative population-based rates by age group. This approach is helpful in identifying specific age groups that are at highest risk for injury from certain mechanisms. Figures 20a through 20k display the population-based rates of injury mechanism calculated from the hospital discharge data. *Again, it should be stressed that due to the incompleteness of E-coding, these rates probably represent at least a 50% or greater undercount of the true rates.*

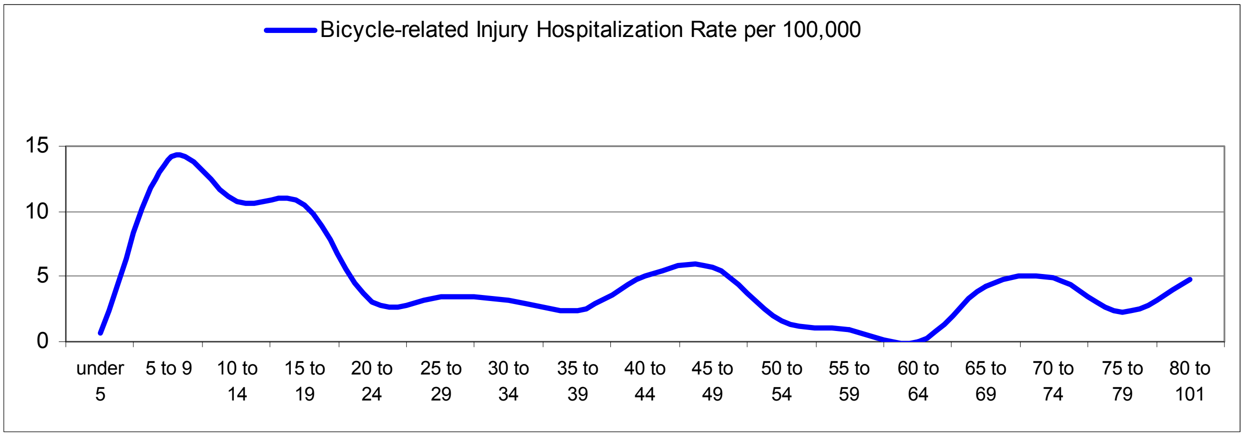
**Figure 20a Rate per 100,000 Residents by Age, Assault Injury Hospitalizations - 2001**

Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.



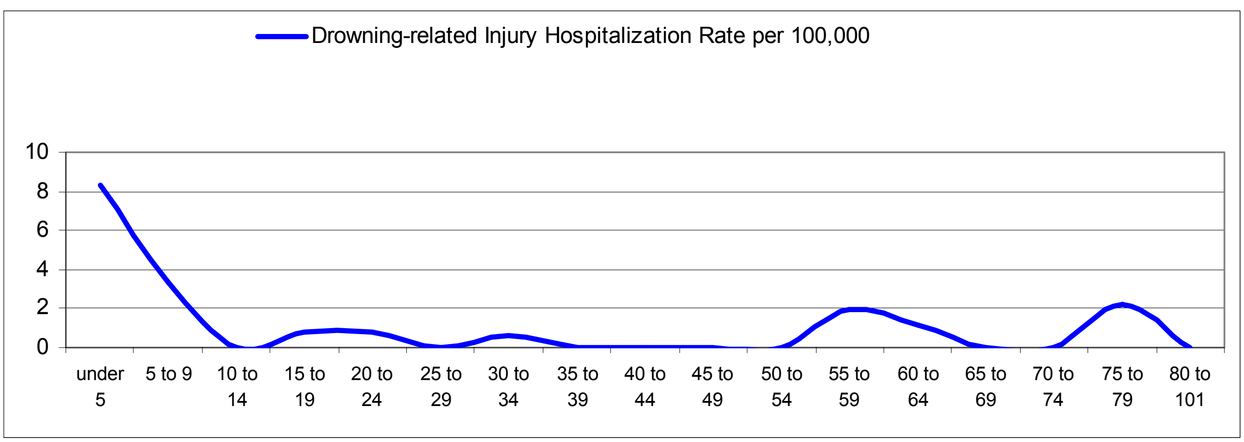

Assault-related injury hospitalizations appear to have their highest rate among younger adults. The rate appears to decline with age but curiously shows a high rate for very young children and for people age 80 and older. The elevated rates in the very young and elderly may represent cases of child abuse or elder abuse.

**Figure 20b   Rate per 100,000 Residents by Age, Bicycle Injury Hospitalizations - 2001**
Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.




The data for bicycle-related injury hospitalizations shows the highest rates for children under the age of 16 with a slight rebound for middle-aged and older adults.

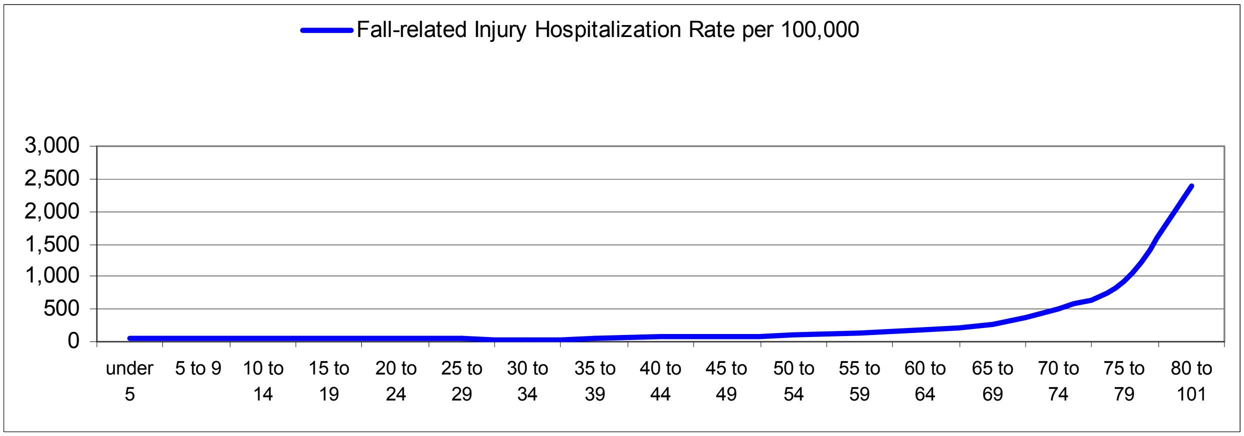
**Figure 20c   Rate per 100,000 Residents by Age, Drowning/Submersion Injury Hospitalizations - 2001**
Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates. Additionally, the small number of cases involved means that a single case can sharply increase the rate in an age category.




The rate for hospitalizations for injuries related to drowning and submersion shows the highest rates are for very young children. These may represent injuries that occur from accidental bathtub submersions. Twelve of the 24 drowning/submersion injuries identified were in children under the age of five and an additional five were for children under the age of ten. *Use caution with these and other injury mechanisms that include low volumes of cases (see Table 33 for case volumes). One case may greatly inflate the rate for an age category.*

**Figure 20d Rate per 100,000 Residents by Age, Fall Injury Hospitalizations - 2001**

Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.




The hospitalization rate for fall-related injuries increases dramatically in senior citizens.

The hospitalization rate for firearm-related injuries shows a very high peak in young adults, as shown in Figure 20e.

**Figure 20e Rate per 100,000 Residents by Age, Firearm Injury Hospitalizations – 2001**

Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates. Additionally, the small number of cases involved means that a single case can sharply increase the rate in an age category.

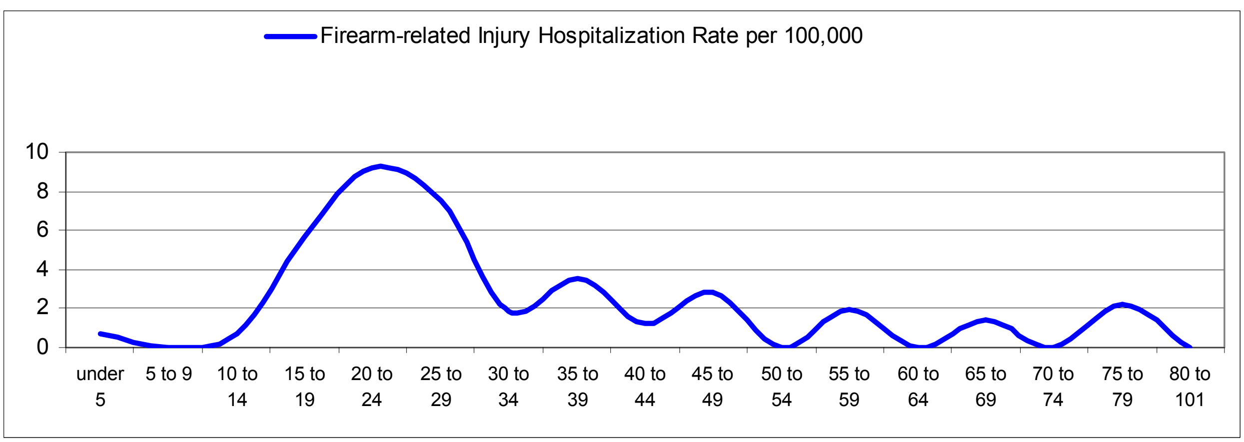
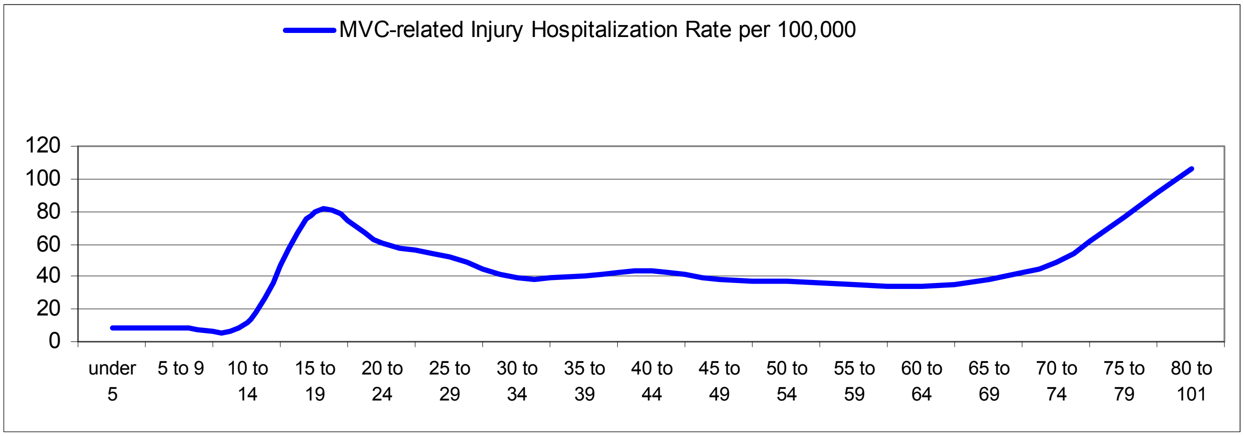


**Figure 20f Rate per 100,000 Residents by Age, Crash Injury Hospitalizations - 2001**

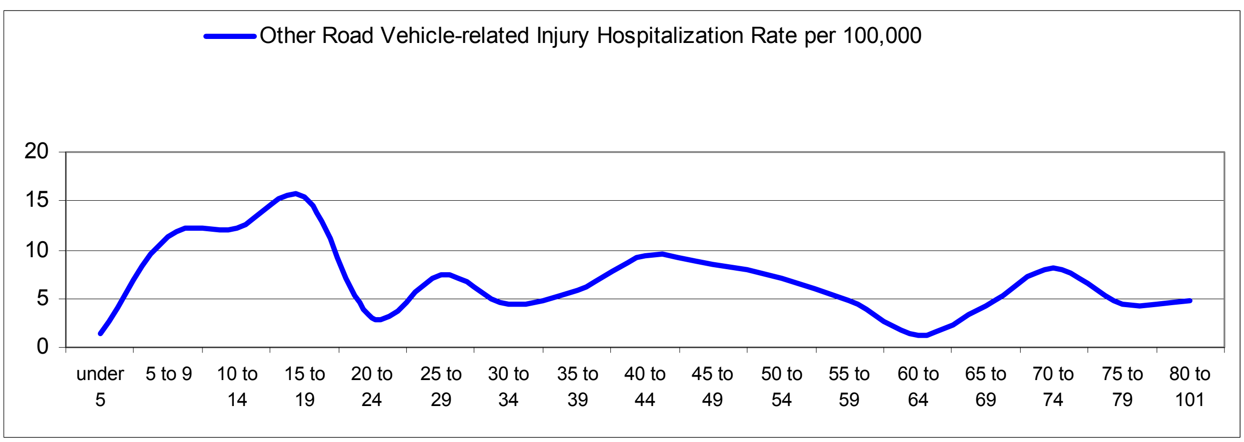
Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.




The rate for hospitalizations for motor vehicle crashes increases dramatically at age 16 then declines with age. It begins to climb again at about age 70.

**Figure 20g Rate per 100,000 Residents by Age for Other Road Vehicle Injury Hospitalizations - 2001**

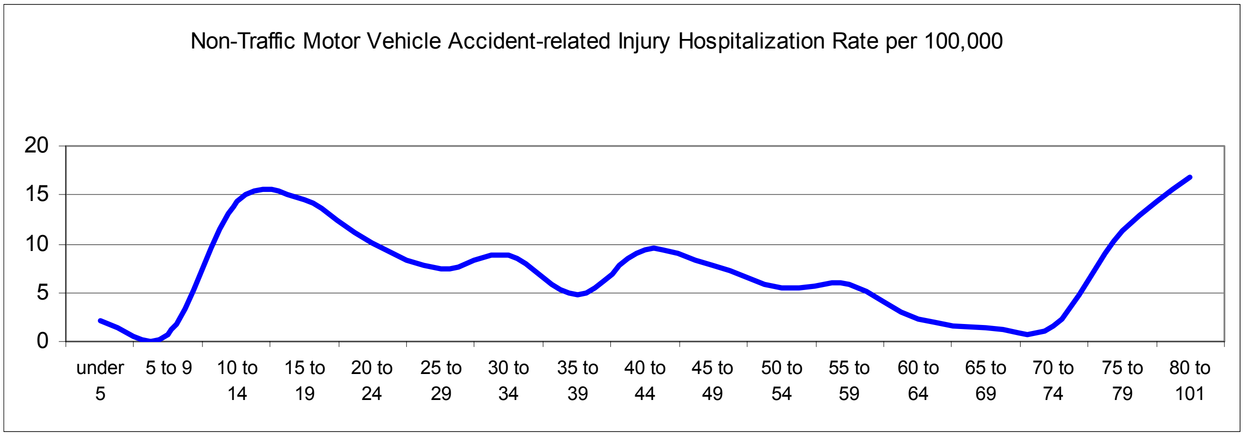
Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.




Other road vehicles include pedacycles, animal drawn vehicles and animals being ridden. The hospitalization rate for injuries related to this mechanism is highest in younger adults.

**Figure 20h Rate per 100,000 Residents by Age Non-Traffic Motor Vehicle Accident-Related Injury Hospitalizations - 2001**

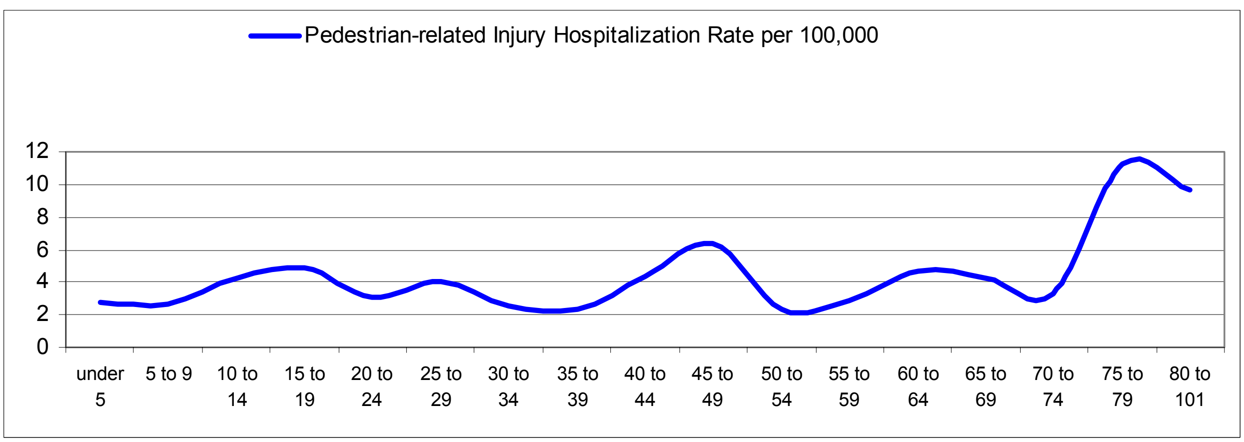
Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.




Non-traffic motor vehicles include off-road vehicles and other vehicles involved in non-traffic crashes. While the high rate for teenagers and young adults is expected, the elevated rate for senior citizens is curious and should be investigated further by examination of individual medical records or other documentation related to these cases.

**Figure 20i Rate per 100,000 Residents by Age, Pedestrian Crash Injury Hospitalizations 2001**

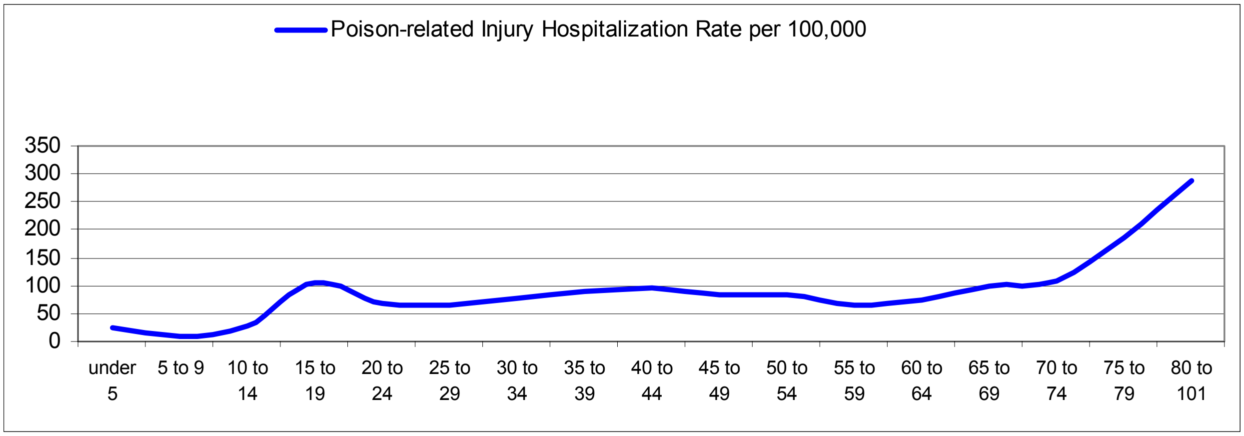
Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.




The rate for pedestrian-related crashes has several remarkable features. The NDOT crash data indicates that the highest numbers of pedestrian crashes involve children under the age of 15, adults in their forties and the elderly. The hospital discharge data show a similar distribution, with rates being highest for the elderly.

**Figure 20j Rate per 100,000 Residents by Age for Poison/Overdose and Adverse Effects Injury Hospitalizations - 2001**

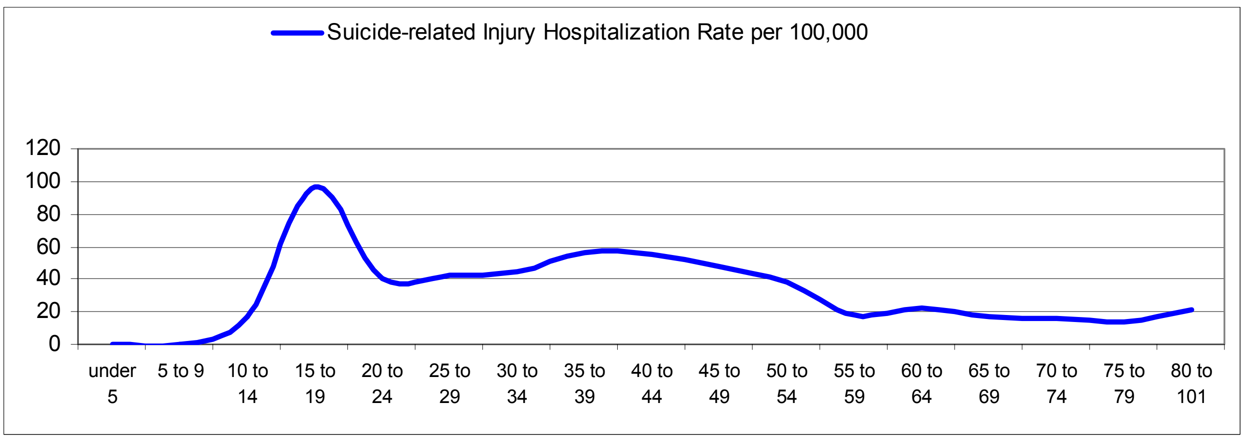
Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.




The rates for injuries related to poisonings, overdoses and adverse effects has a "blip" for those in the age 15 to 20 age group and then shows a steady increase beginning at about age 70.

**Figure 20k Rate per 100,000 Residents by Age, Suicide/Self-Inflicted Injury Hospitalizations 2001**

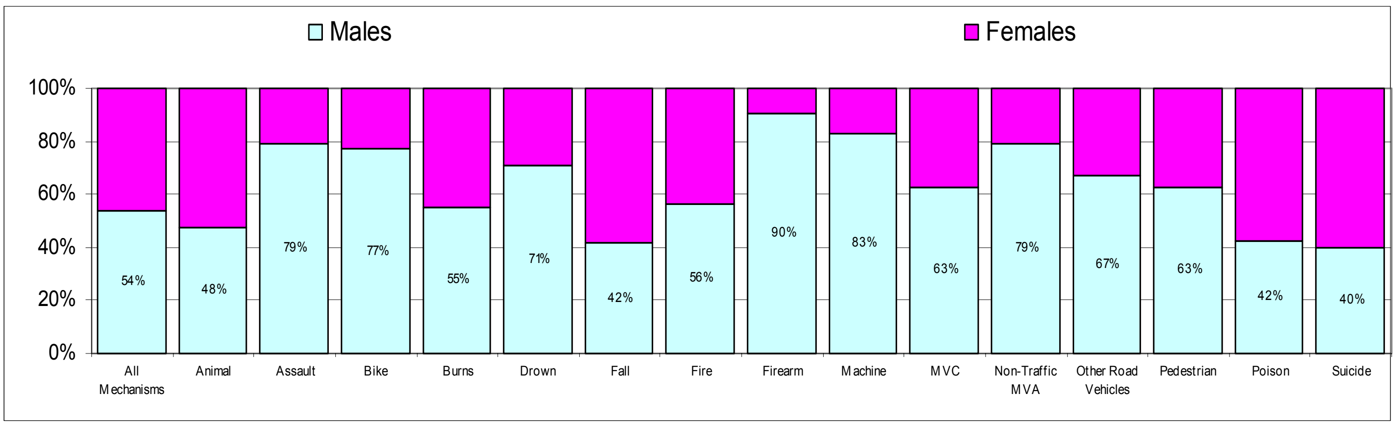
Note: Due to the incompleteness of E-coding, these rates probably represent a 50% or greater *undercount* of the true rates; therefore, the figures should be used to study the *relative rate differences* by age rather than the *actual* rates.




The rate for self-inflicted injuries shows a strong peak in the age 15 to 20 age range and a second peak at about age 40.

In looking at mechanism of injury by gender, the majority of all injury-related hospital admissions are for males. Males make up about 50.8% of the Nevada resident population according to the 2000 Census data, but about 54% of all injury-related hospitalizations. The distribution of gender by mechanism, however, shows several remarkable features (Figure 21). Notably, there were more females than males with animal-related injuries, poisonings, self-inflicted injuries (note that injuries resulting in immediate death would not be included) and fall-related injuries than males. The higher number of females with falls is probably accounted for the fact that the majority of fall-related hospitalizations are among the elderly. The ratio of females to males becomes greater than one (that is there are more females than males) starting at about age 70. The greatest differences between males and females in terms of total number of injury hospitalizations is for firearms, machinery, assault, and bicycle-related injuries.

**Figure 21 Injury Mechanism by Gender 2001**




## *Injury Outcome*

Injury outcome information in the inpatient discharge data is largely limited to discharge status. Discharge data stores discharge information in standard UB-92 coding format. Table 34 presents the distribution of discharge status among injury hospitalization in the 2001 discharge data.

**Table 34 Discharge Status for Injury Hospitalizations 2001**

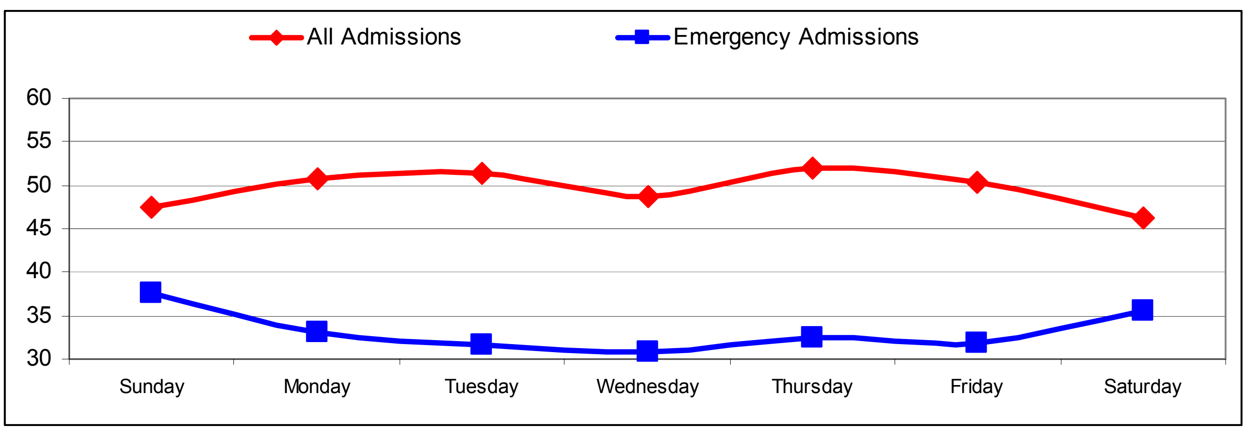
| Code | Description | Records | Percent of Total |
|---|---|---|---|
| 0 | Unknown | 8 | 0.0% |
| 1 | Routine Discharge to Home or Self Care | 10,944 | 60.5% |
| 2 | Discharged/Transferred to Another Short- | 281 | 1.6% |
| 3 | Discharged/Transferred to a Skilled Nursing Facility | 1,518 | 8.4% |
| 4 | Discharged/Transferred to an Intermediate Care Facility | 94 | 0.5% |
| 5 | Discharged/Transferred to Another Type of Institution | 3,185 | 17.6% |
| 6 | Discharged/Transf Home Under Care of Home Health Org. | 1,103 | 6.1% |
| 7 | Left Against Medical Advice | 360 | 2.0% |
| 8 | Discharged/Transf Home Under Care of Home IV Provider | 23 | 0.1% |

| Code | Description | Records | Percent of Total |
|---|---|---|---|
| 20 | Expired | 511 | 2.8% |
| 30 | Still Patient | 2 | 0.0% |
| 50 | Hospice – Home | 20 | 0.1% |
| 51 | Hospice - Medical Facility | 44 | 0.2% |
| 62 | Invalid | 1 | 0.0% |
| 63 | Invalid | 2 | 0.0% |
| | | 18,096 | 100.0% |

## *Date, Time and Location of Injury*

The discharge data provide some information about the date of admission and the source of the admission as well as the type of admission. No information about time of admission is provided, although this information would not be meaningful in that hospital admission time may be many hours after the time of injury. Admission date does show higher numbers of emergency admissions on weekends (Saturday and Sundays). Looking at all admissions shows higher rates of admission on Mondays, Tuesdays and Thursdays (possibly reflecting elective admissions). An unexpected finding in the data was that about 17.6% of records were coded as elective admissions. Examination of the diagnostic coding for these records however, suggested that either the admission type or the diagnostic coding was at times incorrect (e.g., diagnostic coding indicating fractures) because most trauma-related admissions are emergencies and not elective (although some of these could have been for follow-up surgical procedures or rehabilitation services). Figure 22 presents the average number of injury-related hospital admissions by day of the week in 2001.

**Figure 22 Average Number of Injury Admissions by Day of the Week - 2001**




If E-coding were more complete in the hospital discharge data it might be possible to use the date information to examine seasonal patterns in specific mechanisms of injury (e.g. when are suicides, motor vehicle crashes and falls more likely to occur). However, due to the low rate of E-coding such analyses are not reliable within the discharge data.

The discharge data do provide some information about location. As noted under the section on demographic data, the discharge information does appear to provide reliable information about the patient's zip code of residence, but this is not necessarily the same as where the injury occurred. Location information is also provided in the E849 E-code, but E849 codes are so general, as to be of little use for injury surveillance efforts and the use of E849 codes appears to be inconsistent among institutions.

In summary, the discharge data provide little information of value for injury surveillance about where and when injuries occur.

### *Safety Equipment*

The discharge data provide virtually no information about use of safety equipment. Linking these data to other data sets (e.g., motor vehicle crash data) may provide some useful information about the effectiveness of safety belts or motorcycle helmets, but as was noted in the discussion of crash data, the safety equipment information in the crash data is over-reported and of limited usefulness.

### *Other Factors*

The discharge data collect up to 15 diagnostic codes. These codes may be of use identifying multiple injuries, looking at the effect of pre-existing conditions on injury severity or outcome (e.g., diabetes, HIV infection, psychiatric conditions, alcoholism) or looking at injuries in conjunction with certain clinical situations such as injuries during pregnancy.

### *Costs*

The hospital charge information provides some useful information about the economics of injury. It should be understood that charges are not the same as costs or payments although they can be a useful way to make comparisons of the relative economic or financial consequences of injury. Cost to charge ratios can also be used to make relative estimates of the costs of injury. In general the charge information in the discharge data appears to be reliable. The average charge for injury cases was $28,733 with a range from zero to more than one million dollars. In analyzing charge data it is often useful to exclude outliers and charges that are too low to be reasonable. While it is true that some cases can cost hundreds of thousands of dollars, some of the very high charges may be data error (e.g., misplaced decimal points). A useful way to verify the validity of charges is to divide the charges by hospital length of stay to get an average cost per day. Using this method, the average cost per hospital day was about $5,980. Excluding cases with charges above $100,000 and less than $1,000 resulted in an average cost per day of about $5,900.

Despite these limitations, hospital charges can be used to examine the relative financial consequences of injury discharges or specific types of injuries such as traumatic brain injuries (TBI), spinal cord injuries (SCI), pelvic fractures and hip fractures. For example, Table 35 shows that average charges for injury discharges is more than $8,000 greater than for all discharges and that the average charge for pelvic fractures, TBI and SCI is substantially greater than for hip fractures. It should be kept in mind, however, that all hospital charges might not be directly related to the specific injury. For example, patient with a traumatic brain injury may have other injuries that must be treated and included in the overall charge.

**Table 35 Hospital Charges by Type of Injury**

| Type of Discharge | N | Average Charge |
|---|---|---|
| All Discharges | 234,656 | $20,489 |
| All Injury Discharges | 18,096 | $28,733 |
| Hip Fracture | 2,224 | $34,771 |
| TBI | 969 | $42,602 |
| SCI | 1,644 | $44,085 |
| Pelvic Fracture | 816 | $44,569 |

Hospital days are often a good proxy measure of the cost of hospital care for injured people. The average length of stay was 6.0 days with a range of zero to 201 days. Again in looking at hospital length of stay it may be useful to exclude charge or day outliers.

## *Utility of Discharge Data for Injury Surveillance and Limitations on Utility*

In summary, the Nevada hospital discharge data provide useful injury surveillance information about the demographic characteristics of injured individuals, injury severity, the volume of injures, specific types of injuries, where people are treated for injuries and the economic and financial cost of injury. The discharge data have very limited usefulness in looking at mechanism of injury (due to the low E-coding rate), injury outcome, and factors associated with injury or complicating conditions of injury such as pregnancy. The discharge data have little value in looking at where and when injuries occur or the use of safety equipment.

Improvement in E-coding would make the discharge data much more useful for injury surveillance purposes. Improvements in E-coding rates at a few several large volume facilities could have a significant impact on the overall E-coding rate.

## Death Certificate Data

### *File Structure and Description*

The following evaluation is based on an analysis of the 2001 Nevada Death Certificate Registry. This database has information about individuals who died in Nevada (both Nevada residents and non-residents) and Nevada residents who died outside of Nevada. The 2001 database had 17,477 death records. Among these records, 96% (16,826 records) were for deaths that occurred in Nevada (regardless of residency) and 93% (16,234 records) were for Nevada residents (regardless of state of death). For injury surveillance purposes, the analysis of these data was limited to the records for deaths that occurred in Nevada (regardless of residency).

Each record in the data set contains information about: (1) the identity of the individual (e.g., name, SSN, father's name), (2) demographic characteristics (e.g., occupation, education level, age, date of birth, gender, age at death, county and state of residence), (3) the circumstances of death (e.g., date and time of death, place of death, manner of death), (4) the death certificate itself (e.g., where filed, individual who provided the death certificate information) and (5) the cause of death (e.g., ICD10 codes, ICD10 groupings, and place of injury). The data set that was provided for evaluation was stripped of all individual patient identifiers (e.g., name, SSN, date of birth).

Several to identify injury-related deaths in this database were evaluated. These deaths could have been identified through several fields in the data set including the ICD-10 codes (codes that start with "V","W","X" and "Y") and the ICD group fields. The ICD group fields indicate the most common causes of death, types of accidents, methods of suicide and types of transport accidents. Using only the first digit of the ICD code identified 1,602 injury-related deaths. Using this method, however, included 19 deaths that were attributed to surgical and medical misadventures that are <u>not</u> traditionally included in the scope of injury surveillance activities. Using only the top 15 causes of death (the field named ICD_GRP2) failed to identify 70 records that attributed the cause of death to various types of poisoning, firearms, blunt objects, falls and unspecified mechanisms where intent was undetermined. These types of injuries <u>should</u> be included in injury surveillance activities. Using the records for the Injury Group 1 field (ICD_GRP1) that were coded as "50", "51","52","53", "54", "55", and "56" identified 1,583 injury-related deaths. This method excluded those records that attributed deaths to complications of medical/surgical care (coded as "57") while identifying all other records that should be appropriately included in injury surveillance efforts; therefore, it appeared to be the most appropriate way to identify injury-related deaths. Excluding the 101 records for deaths that occurred outside of Nevada left 1,482 records for injury-related deaths that occurred in Nevada in 2001.

The death certificate data provides some information about where the death occurred including the county and city of death as well as whether the death occurred in a hospital or other location. If the death occurred in a hospital, the death certificate indicates the facility and whether the patient was an inpatient or died as an outpatient.

*Duplicates/Missing Data*

The death certificate file did not appear to have any duplicate records or identifiable gaps in the record by date or geographic location for deaths occurring in Nevada. Deaths occurring out of state cannot be verified and are believed to be incomplete and untimely in submission.

*Demographic Information*

The death certificate file provides some demographic information about injury-related deaths including age, gender, city and county of death and city and county of residence. Analyses of these data indicate that there are more injury-related deaths among males and the rate of injury deaths for males is higher for all age groups (Figure 23).

**Figure 23 Crude Injury-Related Death Rate per 100,000 by Age and Gender - 2001**

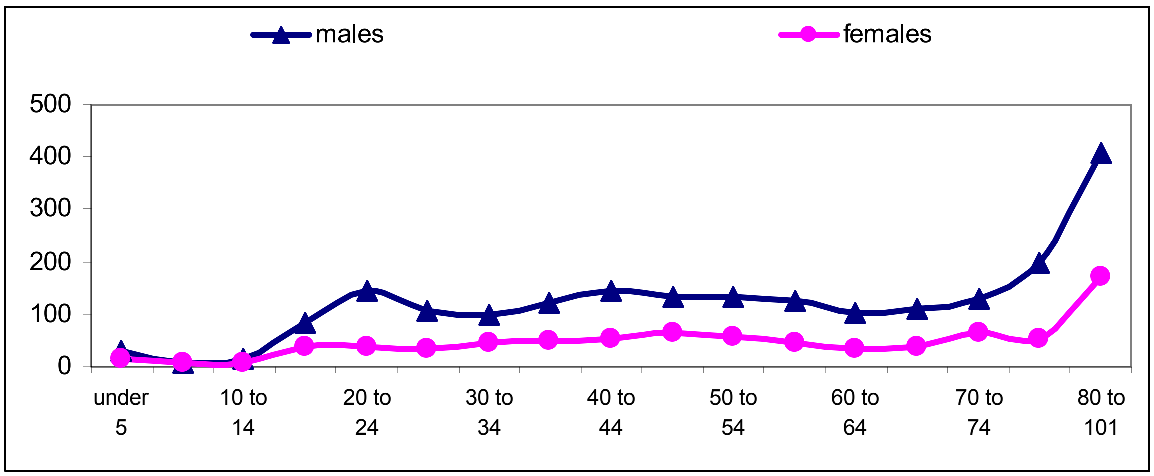



Table 36 presents the number of injury-related deaths by age and gender in the 2001 data and the crude injury-related death rate per 100,000 residents by age and gender.

**Table 36 Total Number of Injury-Related Deaths and Crude Injury-Related Death Rate per 100,000 Residents - 2001**

| Age | Male Injury-Related Deaths | Female Injury-Related Deaths | Male Population 2000 | Female Population 2000 | Male Crude Injury-Related Deaths Rate per 100,000 Residents | Female Crude Injury-Related Deaths Rate per 100,000 Residents |
|---|---|---|---|---|---|---|
| Under 5 | 23 | 11 | 74,489 | 70,048 | 30.9 | 15.7 |
| 5 to 9 | 7 | 5 | 78,191 | 72,293 | 9.0 | 6.9 |
| 10 to 14 | 11 | 5 | 71,089 | 68,567 | 15.5 | 7.3 |

| Age | Male Injury-Related Deaths | Female Injury-Related Deaths | Male Population 2000 | Female Population 2000 | Male Crude Injury-Related Deaths Rate per 100,000 Residents | Female Crude Injury-Related Deaths Rate per 100,000 Residents |
|---|---|---|---|---|---|---|
| 15 to 19 | 53 | 24 | 63,455 | 60,122 | 83.5 | 39.9 |
| 20 to 24 | 99 | 23 | 67,597 | 62,230 | 146.5 | 37.0 |
| 25 to 29 | 81 | 23 | 76,029 | 70,828 | 106.5 | 32.5 |
| 30 to 34 | 83 | 35 | 83,285 | 75,604 | 99.7 | 46.3 |
| 35 to 39 | 107 | 41 | 88,906 | 80,454 | 120.4 | 51.0 |
| 40 to 44 | 118 | 42 | 81,714 | 77,605 | 144.4 | 54.1 |
| 45 to 49 | 95 | 46 | 71,292 | 69,903 | 133.3 | 65.8 |
| 50 to 54 | 85 | 36 | 63,530 | 63,663 | 133.8 | 56.5 |
| 55 to 59 | 64 | 25 | 51,385 | 52,517 | 124.5 | 47.6 |
| 60 to 64 | 45 | 15 | 43,318 | 41,646 | 103.9 | 36.0 |
| 65 to 69 | 39 | 13 | 35,476 | 35,470 | 109.9 | 36.7 |
| 70 to 74 | 39 | 20 | 29,981 | 31,631 | 130.1 | 63.2 |
| 75 to 79 | 40 | 13 | 20,211 | 24,204 | 197.9 | 53.7 |
| 80 to 101 | 66 | 44 | 16,138 | 25,386 | 409.0 | 173.3 |
| Unknown Age | 5 | 1 | | | | |
| Total | 1,060 | 422 | 1,016,086 | 982,171 | | |

The death certificate file also provides information on the residence city and county of decedents. While these data appear to be complete, they are of limited value for injury surveillance due to the unique characteristics of Nevada's population. For example, there was only one injury-related death among the 971 residents of Esmeralda County, which translates to a crude injury death rate of 103 deaths per 100,000 residents. By contrast there were no injury-related deaths among the 1,651 residents of Eureka County. Thus a single death in counties with low populations can have a dramatic (although essentially meaningless) effect on the crude death rate. Using several years of data combined can help to address this limitation. Approximately 83% of the injury-related deaths identified (1,245 deaths) were among Nevada residents. The overall injury-related death rate for Nevada residents was 62.3 deaths per 100,000. Table 37 presents the total number of injury deaths that occurred in each county (regardless of county residency) and the number of injury deaths that occurred among residents of specific counties (regardless of county of death).

**Table 37 Injury Deaths By County of Death and County of Residence 2001**

| County | Population 2000 | Injury Deaths in County | Injury Deaths Among County Residents | Injury Death Rate per 100,000 Among County Residents |
|---|---|---|---|---|
| Carson City | 52,457 | 19 | 31 | 59.1 |
| Churchill | 23,982 | 18 | 14 | 58.4 |
| Clark | 1,375,765 | 1,032 | 884 | 64.3 |
| Douglas | 41,259 | 25 | 18 | 43.6 |

| County | Population 2000 | Injury Deaths in County | Injury Deaths Among County Residents | Injury Death Rate per 100,000 Among County Residents |
|---|---|---|---|---|
| Elko | 45,291 | 41 | 28 | 61.8 |
| Esmeralda | 971 | 5 | 1 | 103.0 |
| Eureka | 1,651 | 2 | 0 | 0.0 |
| Humboldt | 16,106 | 18 | 12 | 74.5 |
| Lander | 5,794 | 4 | 5 | 86.3 |
| Lincoln | 4,165 | 7 | 2 | 48.0 |
| Lyon | 34,501 | 15 | 20 | 58.0 |
| Mineral | 5,071 | 9 | 5 | 98.6 |
| Nye | 32,485 | 31 | 36 | 110.8 |
| Pershing | 6,693 | 4 | 3 | 44.8 |
| Storey | 3,399 | 3 | 2 | 58.8 |
| Washoe | 339,486 | 237 | 177 | 52.1 |
| White Pine | 9,181 | 12 | 7 | 76.2 |
| Total | 1,998,257 | 1,482 | 1,245 | 62.3 |

For counties with very low populations, injury death rates are essentially meaningless because these counties will usually have either very low rates (because of low population numbers and few or no deaths) or very high rates because a few injury deaths in a small population will result in a very high rate. Figure 24 depicts the crude injury-related death rate by county for 2001. As Figure 24 shows, the counties with sparse populations (e.g., Pershing, Nye, Lander, White Pine, Esmeralda, Mineral, Lincoln, Eureka) all have either very low or very high rates.

**Figure 24 Crude Injury-Related Death Rate by County 2001**

< 50 Injury Deaths per 100,000 Residents

50 to 75 Injury Deaths per 100,000

> 75 Injury Deaths per 100,000

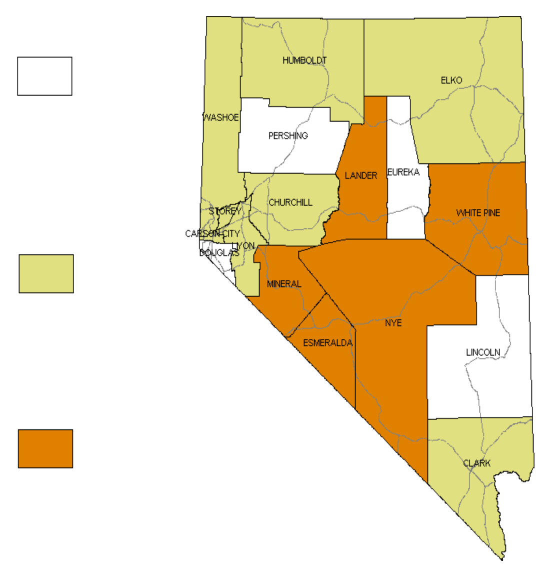
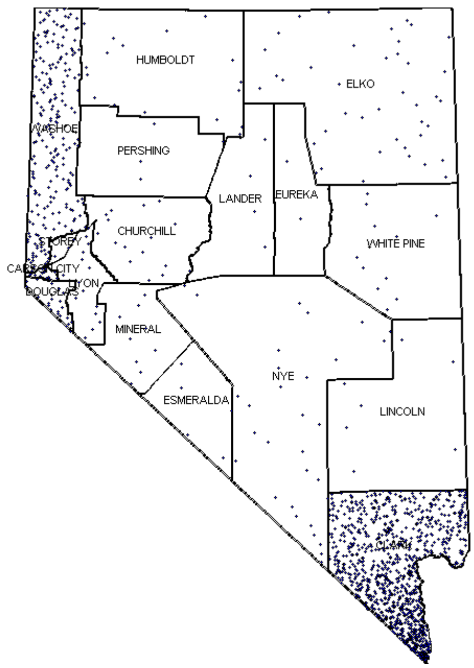


Figure 25 depicts the county where injury-related deaths occurred.

**Figure 25 Injury Deaths by County 2001**




Note: each dot represents a single injury death that occurred in the county but not the actual geographic location where the death occurred

As Figure 25 indicates, most injury-related deaths occurred in Clark, Washoe, Carson City and Douglas Counties. These data on the county of occurrence are somewhat misleading as these counties have hospitals that treat large numbers of trauma patients and the county of death in many cases may be different than the county in which the injury occurred. This is especially true in rural counties with only small community hospitals.

The death certificate data provide some information about race and ethnicity. Table 38 presents the number of injury-related deaths among Nevada residents and the 2000 Census figures by race for Nevada. Table 38 shows higher crude injury-related death rates for African-American and Indians. Racial differences in injury death rates should be interpreted with caution however, due to the small numbers of injury-related deaths and overall population figures for minority populations in Nevada.

**Table 38 Crude Injury-Related Death Rates by Race Among Nevada Residents 2001**

| Race | Injury-Related Deaths | 2000 Population | Rate per 100,000 Residents |
|---|---|---|---|
| White | 1,055 | 1,503,083 | 70.2 |
| Black | 122 | 132,490 | 92.1 |
| Asian, Hawaiian, Pacific Islander and Filipino | 35 | 96,927 | 36.1 |
| Native American | 28 | 26,485 | 105.7 |
| Unknown | 5 | 0 | NA |
| Multiracial and Other Race | NA* | 239,272 | NA |
| All Races | 1,245 | 1,998,257 | 62.3 |

*No code available for multi-racial.

In summary, the demographic information in the death certificate file is mainly useful for looking at differences between age and genders but of little value in looking at geographic population-based rates.

## *Injury Severity and Injury Outcome*

As all individuals represented in the death certificate file died and death represents the most severe level of injury, the only information that the file can provide about injury severity or outcome is the actual number of people who died from injuries. This information could be useful if cross-tabulated with mechanism of injury (i.e., to identify mechanisms with the most severe injury outcomes) or by age to identify specific groups (e.g., senior citizens) who may be more likely to die from injuries.

## *Injury Type*

The death certificate file uses ICD-10 coding, which does not provide information about specific types of injuries (e.g., fractures, wounds, sprains, dislocations, etc.). The death certificate file has virtually no information about specific types of injuries.

## *Mechanism of Injury*

Mechanism of injury for the injury death records can be identified using the ICD10 codes. The ICD10 codes mechanism of injury codes are not identical to the ICD9 E-codes used to identify injury mechanisms in other data sets evaluated (e.g., hospital discharge, ED data), but similar categories of mechanism can be defined. Some death certificate records can qualify for multiple mechanisms. For example, if a person's injuries resulted from an assault with a handgun, this record could be counted as both a firearm-related injury death and as an assault-related injury death.

Several mechanisms, such as machinery-related injuries or injuries involving watercraft result in only a few or no deaths and population-based rates are not meaningful for injury surveillance purposes. However, other mechanisms such as motor vehicle crashes, falls and firearms-related injuries, did result in substantial numbers of deaths and often showed a definitive age-related pattern. Figures 26a through 26j depict the total deaths and population-based injury death rates for various mechanisms of injury. Table 39 presents the most commonly reported mechanisms for injury deaths in 2001.

**Table 39 Most Common Mechanism of Injury for Injury-Related Deaths in Nevada - 2001** **(Total Injury-Related Deaths =1,482)**

| Mechanism | Deaths |
|---|---|
| Suicide | 408 |
| Firearm | 365 |
| Motor Vehicle Crash | 330 |
| Poisoning | 326 |
| Assault | 187 |
| Fall | 92 |
| Other | 73 |
| Airway | 51 |
| Drown | 30 |
| Stabbing | 26 |
| Pedestrian | 23 |
| Fire | 20 |
| Aircraft | 11 |
| Other Road Vehicle Accident | 8 |
| Non-Traffic Motor Vehicle Crash | 6 |
| Water Craft | 4 |
| Bicycle | 2 |

**Figure 26a Crude Injury Death Rate per 100,000 for All Mechanisms by Age - 2001**

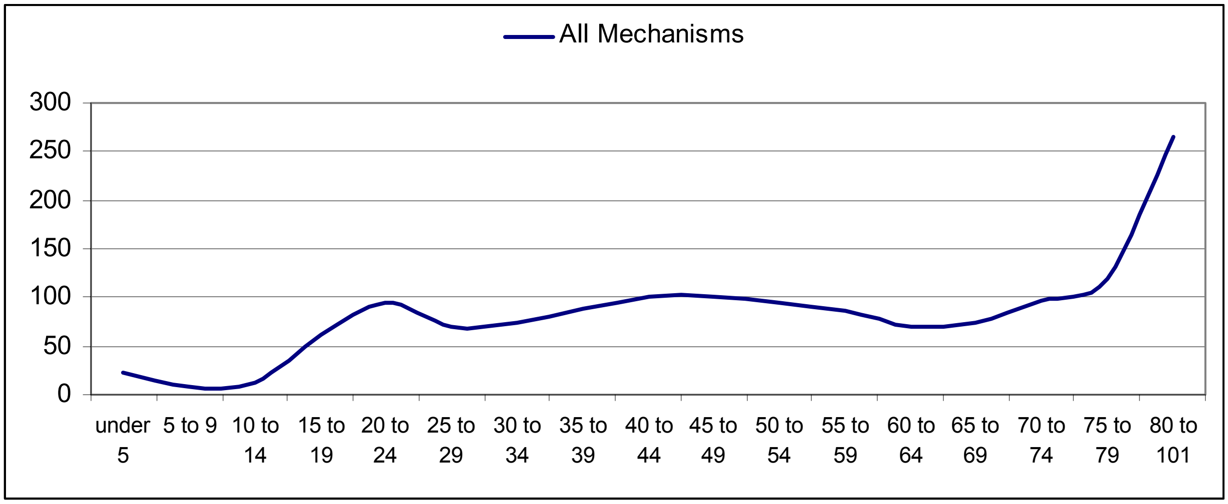



**Figure 26b Crude Injury Death Rate per 100,000 for Motor Vehicle Traffic Crashes by Age - 2001**

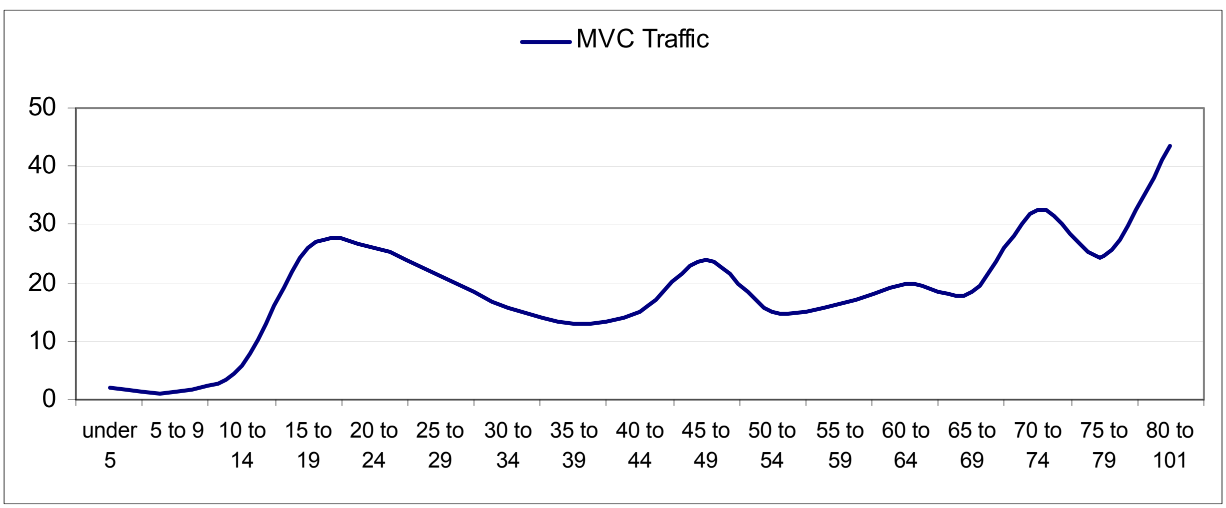


**Figure 26c Crude Injury Death Rate per 100,000 for Bicycle Crashes by Age - 2001**

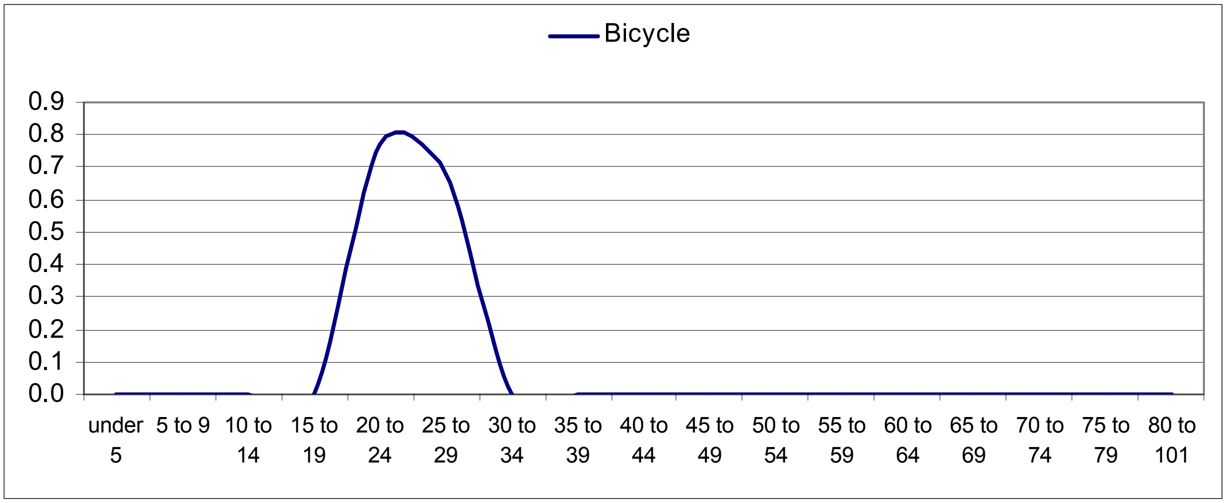



**Figure 26d Crude Injury Death Rate per 100,000 for Pedestrian Crashes by Age - 2001**

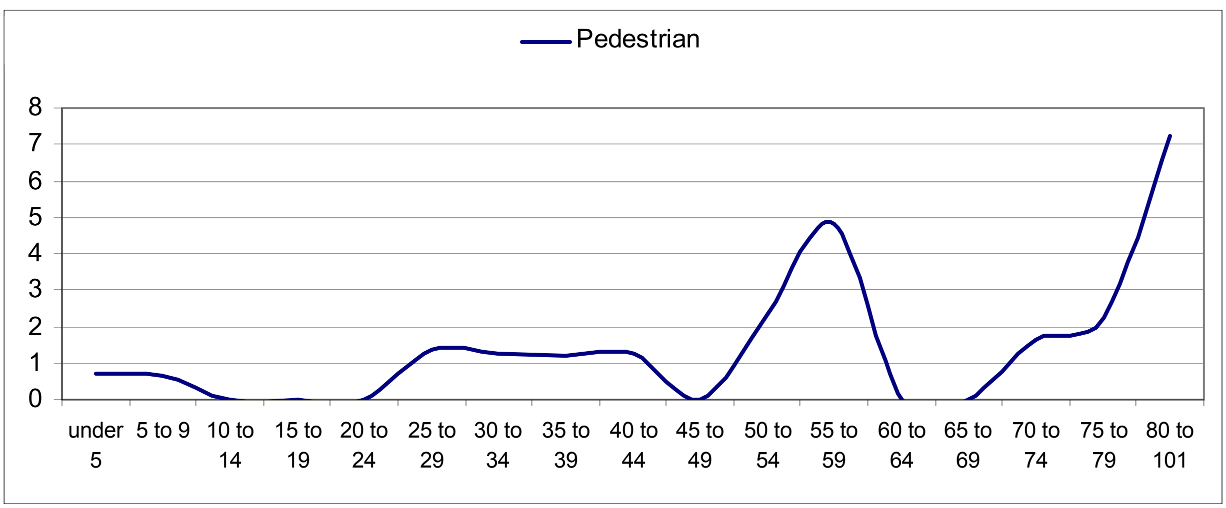


**Figure 26e Crude Injury Death Rate per 100,000 for Assault-Related Injuries by Age - 2001**

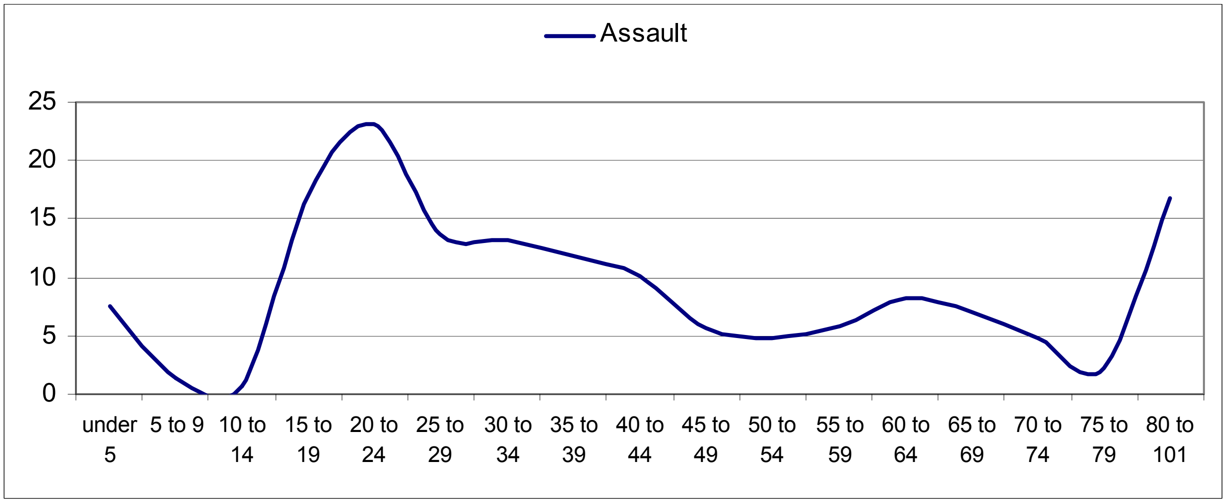



**Figure 26f Crude Injury Death Rate per 100,000 for Firearm-Related Injuries by Age - 2001**

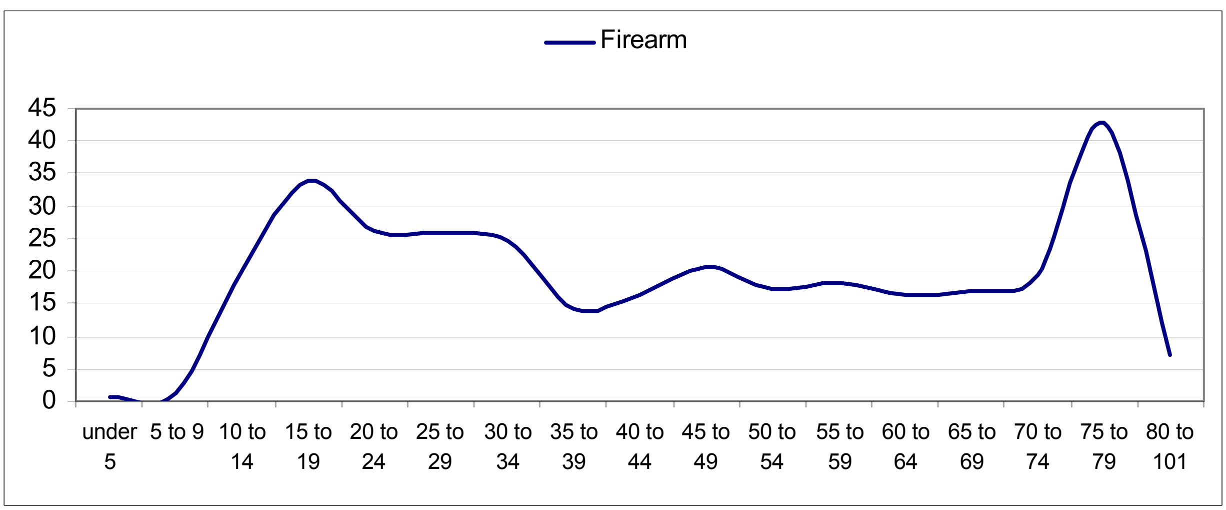


**Figure 26g Crude Injury Death Rate per 100,000 for Fall-Related Injuries by Age - 2001**

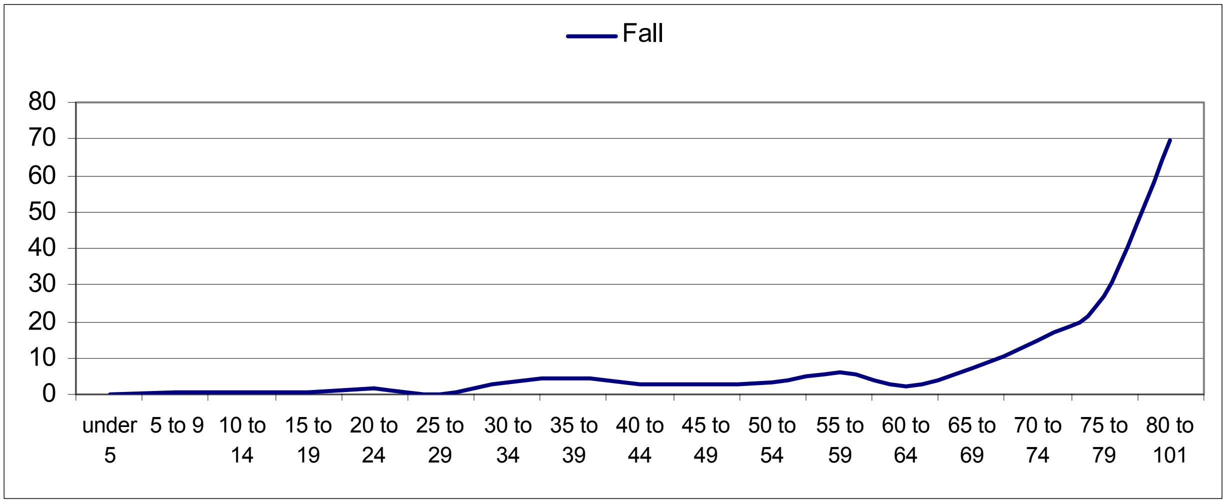



**Figure 26h Injury Death Rate for per 100,000 Self-Inflicted Injuries by Age - 2001**

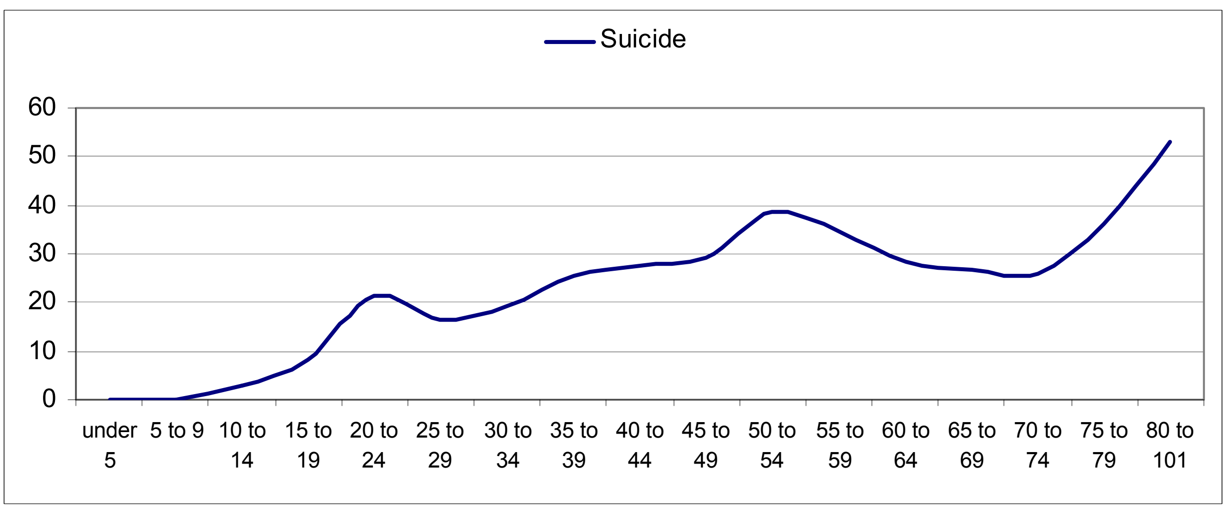


**Figure 26i** **Crude Injury Death Rate per 100,000 for Poison-Related Injuries by Age - 2001**

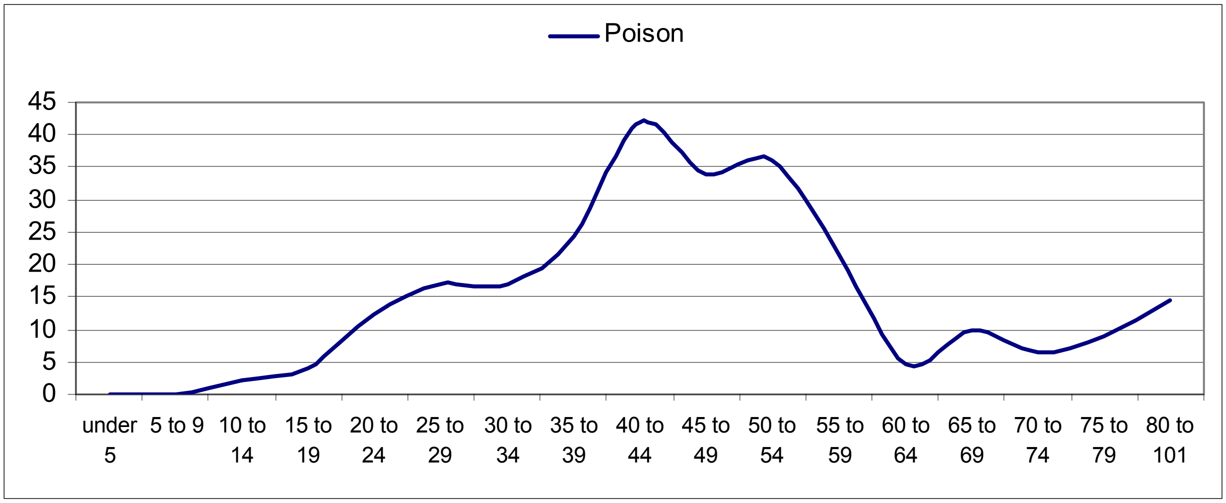
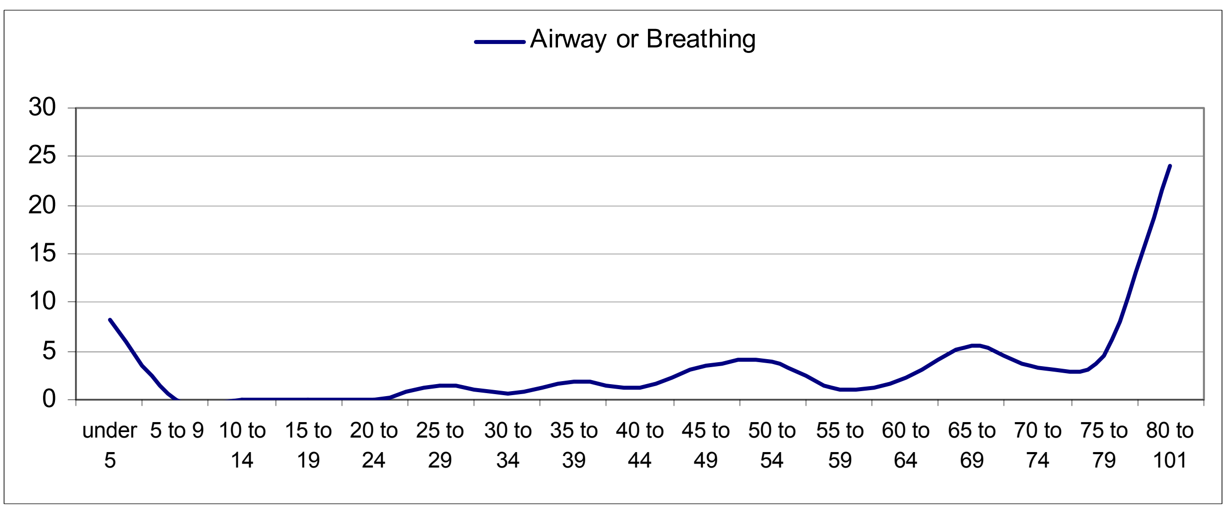


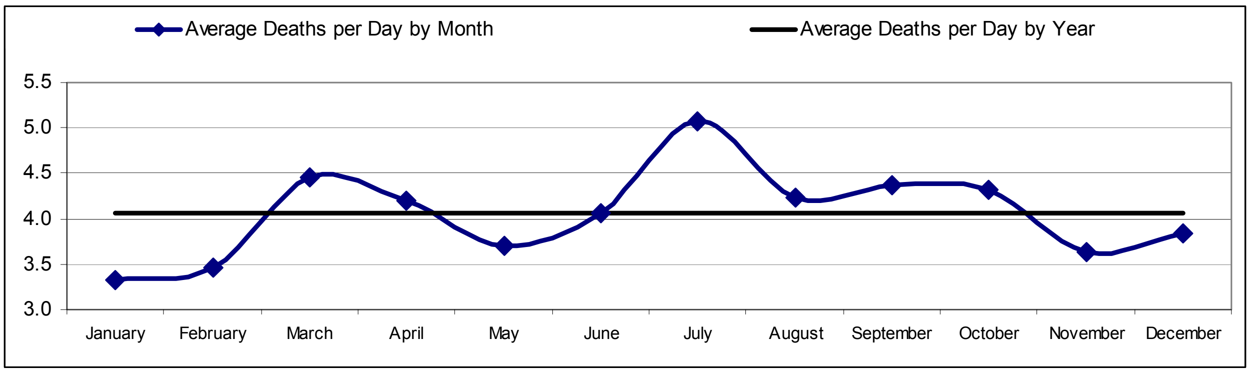

**Figure 26j** **Injury Death Rate per 100,000 for Airway or Breathing-Related Impairment by Age - 2001**



### *Date, Time and Location of Injury*

The death certificate data do not provide any information on time of death although this information would not be useful for injury surveillance activities anyway because time of death is often distant from time of injury. Similarly, date of death may be unrelated to the specific date of injury, but most injury-related deaths will occur within 30 days of injury. The data information in the death certificate file can be used to show seasonal variation in injury-related death patterns as depicted in Figure 27.

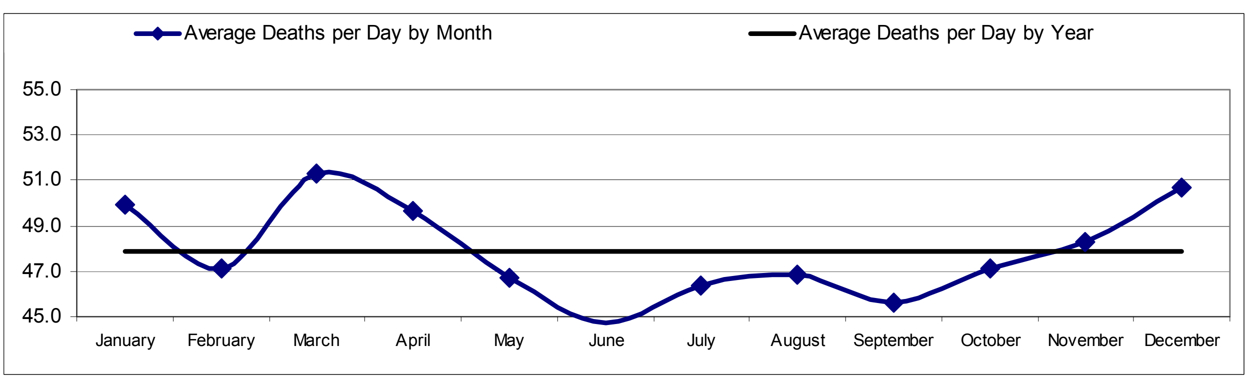
**Figure 27 Average Daily Number of Injury-Related Deaths by Month - 2001**




As Figure 27 illustrates, there appeared to be an increase in the average number of injury-related deaths in the latter part of the summer and early autumn (July through October) and the lowest number of injury-related deaths occurred in January and February.

This pattern is contrasted by the seasonal pattern of all deaths (both injury-related and non injury-related), which shows the summer months to have the lowest average number of deaths per day as depicted in Figure 28.

**Figure 28 Average Daily Number of All Deaths (Injury and Non-Injury) by Month - 2001**



The difference in these patterns suggests that there may be a real seasonal effect on injury-related deaths and the elevated number of injury deaths in the summer/fall months is not an artifact of there being more overall deaths during these months.

As was mentioned under the discussion on demographic information, the city and county of death do not provide meaningful information about where injury-related deaths occur because many injury-related deaths occur in hospitals that may be in different cities or counties than the county or city in which the injury occurred. A more meaningful way of looking at location would be to examine whether these deaths occurred in hospitals (either as an inpatient or an outpatient) or if they occurred outside of a hospital. Looking at the place of occurrence (i.e., whether in a hospital or outside of a hospital) could indicate areas of the state where EMS services may be inadequate. If, for example, a much higher proportion of injury deaths occur outside of hospitals in certain areas, this may indicate that people are dying before they can be transported to hospitals. Table 38 presents the number of total injury-related deaths and those that occurred out-of-hospital (i.e., home, en route, other place) by county of residence. As Table 40 shows, residents of sparsely populated counties such as Esmeralda, Pershing and Storey, were much more likely to die in an out of hospital setting than residents of more populous counties (use caution interpreting due to small numbers).

**Table 40 Injury Deaths by Place of Occurrence and County of Death 2001**

| County | Population 2000 | Out of Hospital Deaths | All Injury Deaths | Percent Out of Hospital |
|---|---:|---:|---:|---:|
| Carson City | 52,457 | 18 | 31 | 58.1% |
| Churchill | 23,982 | 7 | 14 | 50.0% |
| Clark | 1,375,765 | 621 | 884 | 70.2% |
| Douglas | 41,259 | 13 | 18 | 72.2% |
| Elko | 45,291 | 19 | 28 | 67.9% |
| Esmeralda | 971 | 1 | 1 | 100.0% |
| Eureka | 1,651 | 0 | 0 | NA |
| Humboldt | 16,106 | 10 | 12 | 83.3% |
| Lander | 5,794 | 1 | 5 | 20.0% |
| Lincoln | 4,165 | 1 | 2 | 50.0% |
| Lyon | 34,501 | 13 | 20 | 65.0% |
| Mineral | 5,071 | 5 | 5 | 100.0% |
| Nye | 32,485 | 27 | 36 | 75.0% |
| Pershing | 6,693 | 3 | 3 | 100.0% |
| Storey | 3,399 | 2 | 2 | 100.0% |
| Washoe | 339,486 | 108 | 177 | 61.0% |
| White Pine | 9,181 | 2 | 7 | 28.6% |
| Out-of-State Resident | | 147 | 237 | 62.0% |
| Total | 1,998,257 | 998 | 1,482 | 67.3% |

### *Safety Equipment*

The death certificate file does not provide any information about usage of safety equipment such as safety belts or motorcycle helmets.

### *Other Factors*

The death certificate file does not collect contributing causes of deaths that might provide information about other factors related to injury deaths such as pre-existing conditions.

### *Costs*

The death certificate file does not collect any information about the direct costs of injury-related deaths but the file can be used to calculate years of potential life lost. Years of potential life lost can be used to formulate models of the economic costs of these injury-related deaths. There are two general approaches to calculating this number. The first involves assuming that everyone lives to the ages of 65 or 85. The age at which each person dies is then subtracted from either age 65 or 85 and the difference is the years of potential life lost by that individual. The differences are then summed by whatever variable one chooses to use (a demographic one such as race or gender, or a specific cause of death). A second approach to calculating years of potential life lost follows the same logic as the first but does not involve the assumption that everyone lives to ages 65 or 85. Rather a series of gender- and race-specific life tables are used to measure the actual difference between the age of death and life expectancy at that age. Calculating years of potential life lost can help in doing cost-benefit analyses of injury prevention programs or for comparing the potential benefits of injury reduction efforts compared to other causes of death. Using the assumption of age 65, the average potential years of life lost for injury-related deaths was about 22.0 years compared to 3.3 years among non-injury related deaths.

### *Utility of Death Certificate Data for Injury Surveillance and Limitations on Utility*

In summary, the Nevada death certificates provide useful injury surveillance information about age and gender and mechanism of injury. The death certificate data are also useful in looking at the relative importance of injury compared to other causes of death especially in terms of potential years of life lost. These data are also a potential source of information about injury and race. The death certificate data are also useful for looking at the volume of fatal injuries but of no value in looking at non-fatal injuries. The death certificate data have limited usefulness in looking at when and where injury deaths occur and are of no value in looking at use of safety equipment or contributing factors.

## Trauma Data

### *File Structure and Description*

The following evaluation is based on an analysis of the 2001 and 2002 Nevada Trauma Registry database. This database has information about individuals treated for trauma at selected trauma center hospitals (Level I through IV) in Nevada. Trauma patients, as defined in the enabling legislation that created the Nevada Trauma Registry, are identified by injury severity measurements (e.g., Glasgow Coma Score, Trauma Score), mechanism of injury (e.g. falls of more than 20 feet, motor vehicle crashes with specific types of harmful events) and injury diagnoses (e.g., penetrating injury to the head, flail chest). The data set included records for 6,189 individuals injured in 2001 and 6,372 individuals injured in 2002. Table 41 presents the number of records by institution for 2001 and 2002. Fourteen institutions submitted data in 2001 and ten submitted data in 2002.

**Table 41 Number of Trauma Records by Institution - 2001 and 2002**

| Institution | 2001 Records | 2002 Records |
|---|---|---|
| Washoe Medical Center | 2,120 | 2,480 |
| Battle Mountain | 0 | 36 |
| Carson Tahoe | 96 | 18 |
| Churchill | 85 | 2 |
| Desert Springs | 1 | 18 |
| Elko General | 79 | 88 |
| Humboldt | 11 | 10 |
| St. Rose/Siena Hospital | 4 | 4 |
| Pershing | 52 | 0 |
| Saint Mary's | 28 | 0 |
| St. Rose | 26 | 0 |
| South Lyon | 1 | 0 |
| Sunrise | 26 | 7 |
| William B Ririe | 90 | 0 |
| University Medical Center | 3,570 | 3,709 |
| Total | 6,189 | 6,372 |

### *Duplicates/Missing Data*

Evaluation of the trauma data for duplicate records based on age, sex, race, patient zip code and injury date and time identified 16 potential duplicate records among the data. Visual examination of these records suggested that most of these potential duplicate records were updates to existing records in the data file. That is, each duplicate record and its matching record had nearly identical data in all other fields and in most cases the duplicate record provided information that was missing (e.g., payer, occupation) in the first record. Given the small number of duplicates in the file, (about .13% of all records) potential bias from duplicate records was judged to be inconsequential and the data file was analyzed without removal of these potential duplicate records.

Only 14 hospitals in 2001 and 10 in 2002 submitted data. It is impossible to tell how much data may be missing from hospitals that did not submit. (Review of the discharge data shows that there were several small hospitals with few or no serious trauma cases; therefore, the non-submissions may possibly be appropriate – or at least of relatively small volume. A crosswalk of the institution codes between the two databases is needed to estimate the volume of missing cases.)

### *Demographic Information*

The age distribution of records was nearly identical in each year. Table 42 presents the number of records by age group for 2001 and 2002. One record was significantly out of normal age range (137 years old), indicating a potential for inclusion of edits on this field.

**Table 42 Number of Trauma Records by Age Group - 2001 and 2002**

| Age | Y2001 | Y2002 |
|---|---|---|
| Under 5 | 175 | 153 |
| 5 to 9 | 184 | 167 |
| 10 to 14 | 341 | 313 |
| 15 to 19 | 798 | 849 |
| 20 to 24 | 806 | 927 |
| 25 to 29 | 667 | 609 |
| 30 to 34 | 564 | 578 |
| 35 to 39 | 564 | 554 |
| 40 to 44 | 490 | 543 |
| 45 to 49 | 435 | 444 |
| 50 to 54 | 319 | 368 |
| 55 to 59 | 230 | 233 |
| 60 to 64 | 159 | 170 |
| 65 to 69 | 122 | 124 |
| 70 to 74 | 117 | 118 |
| 75 to 79 | 85 | 85 |
| 80 to 102 | 127 | 111 |
| Unknown | 6 | 26 |
| Total | 6,189 | 6,372 |

The gender distribution is also similar in each year with about 70% of records being for males (Table 43).

**Table 43 Number of Trauma Records by Gender - 2001 and 2002**

| Sex | Y2001 | Y2002 |
|---|---|---|
| Female | 1,796 | 1,745 |
| Male | 4,387 | 4,626 |
| Unknown | 6 | 1 |
| Total | 6,189 | 6,372 |

The racial distribution shows an increase in the proportion of white patients in 2002 and a decrease in the proportion reported as unknown race (see Table 44).

**Table 44 Trauma Database Records by Race - 2001 and 2002**

| | Y2001 | | Y2002 | |
|---|---|---|---|---|
| Race | Number | Percent | Number | Percent |
| Asian | 147 | 2.4% | 161 | 2.5% |
| Black | 540 | 8.7% | 444 | 7.0% |
| Hispanic | 1,070 | 17.3% | 1,118 | 17.5% |
| Native American | 30 | 0.5% | 53 | 0.8% |
| Other | 84 | 1.4% | 97 | 1.5% |
| White | 4,019 | 64.9% | 4,405 | 69.1% |
| Unknown | 299 | 4.8% | 94 | 1.5% |
| Total | 6,189 | 100.0% | 6,372 | 100.0% |

Approximately 4,800 records in each year indicated the patient was a Nevada resident. Table 45 presents the reported city of residence for patients from Nevada.

**Table 45 Number of Trauma Records by Nevada City of Residence - 2001 and 2002**

| Patient City | Y2001 | Y2002 | | Patient City | Y2001 | Y2002 |
|---|---|---|---|---|---|---|
| Alamo | * | * | | Lovelock | 37 | 10 |
| Amargosa Valley | * | * | | McDermitt | * | 5 |
| Austin | * | * | | McGill | 7 | * |
| Battle Mountain | 14 | 13 | | Mercury | * | * |
| Beatty | 6 | * | | Mesquite | 6 | * |
| Beowawe | * | * | | Midas | * | * |
| Blue Diamond | * | * | | Minden | 32 | 15 |
| Boulder City | 12 | 14 | | Moapa | * | * |
| Bunkerville | * | * | | Moundhouse | * | * |
| Caliente | 6 | * | | Nixon | * | 5 |
| Carlin | * | 6 | | North Las Vegas | 275 | 200 |
| Carson City | 183 | 171 | | North Vegas | 40 | 65 |

| Patient City | Y2001 | Y2002 | | Patient City | Y2001 | Y2002 |
|---|---|---|---|---|---|---|
| Charleston | * | * | | Not Available | * | * |
| Crescent Valley | * | * | | Overton | 7 | 9 |
| Crystal Bay | * | * | | Owyhee | * | * |
| Dayton | 28 | 27 | | Pahrump | 77 | 75 |
| Duckwater | * | * | | Panaca | * | * |
| Elko | 24 | 30 | | Pioche | * | * |
| Ely | 12 | 5 | | Reno | 773 | 824 |
| Empire | * | 7 | | Round Mountain | 6 | * |
| Eureka | 5 | * | | Schurz | * | 5 |
| Fallon | 102 | 62 | | Searchlight | * | * |
| Fernley | 37 | 31 | | Silver City | * | * |
| Gabbs | * | * | | Silver Springs | 23 | 41 |
| Gardnerville | 54 | 51 | | Smith Valley | * | * |
| General Delvry | 74 | 64 | | Sparks | 235 | 244 |
| Genoa | * | * | | Spring Creek | 11 | 21 |
| Gerlach | * | * | | Stagecoach | * | * |
| Glenbrook | * | * | | Stateline | 8 | 5 |
| Golconda | * | * | | Sun Valley | 75 | 68 |
| Goldfield | * | * | | Tonopah | 12 | 8 |
| Hawthorne | 5 | 10 | | Unknown, LV | * | * |
| Henderson | 231 | 223 | | Verdi | 8 | * |
| Imlay | * | * | | Virginia City | 11 | 5 |
| Incline Village | 19 | 21 | | Wadsworth | * | 12 |
| Indian Springs | 5 | * | | Washoe Valley | * | * |
| Jean | 9 | 13 | | Wellington | 5 | * |
| Lamoille | * | * | | Wells | * | * |
| Las Vegas | 2,228 | 2,322 | | West Wendover | * | * |
| Las Vegas PO Bo | 17 | * | | Winnemucca | 25 | 11 |
| Las Vegas | * | * | | Yerington | 22 | 27 |
| Laughlin | * | 7 | | Zephyr Cove | * | * |
| Logandale | 6 | 6 | | | | |
| | | | | | | |
| | | | | Total Nevada Residency | 4,840 | 4,825 |
| | | | | Total All Residency | 6,189 | 6,372 |

* indicates a value of fewer than 5 cases and has been used to insure patient confidentiality.

Examination of records for out-of-state residents identified records for patients from 47 other states and 20 foreign countries. Among out-of-state residents, the greatest number of records was for residents of California (1,687 records or 13.4%), Arizona (295 records or 2.3%) and Utah (144 records or 1.1%).

The patient zip code field appears to be remarkably complete with only 54 records for U.S. residents having missing or invalid zip codes. This high level of zip coding probably reflects the fact that patient zip code is required for most hospital billing systems.

The patient's occupation is indicated by the occupation field in the data set. Analysis of this field indicated that about 56% of the records do not indicate the patient's occupation and a substantial proportion of the remainder indicate the patient's occupation as "minor", "student", "unemployed", "other" or "retired." In fact only about 10% of the records indicate a specific industry or profession. Moreover, the occupation field appears to define some occupations by industry (e.g., logging, mining, trucking) and others by profession (e.g., driver, electrician, firefighter). Given the low rate of reporting, lack of specificity and how the data are reported (i.e., mixing of industry with profession); the occupation data is of little use for occupational injury surveillance.

Table 46 presents the number of reported occupations among the 2001 and 2002 data.

**Table 46 Number of Trauma Records by Occupation - 2001 and 2002**

| Occupation | Y2001 | Y2002 | Total |
|---|---|---|---|
| Not Available | 196 | 3,627 | 3,823 |
| Not Done/Doc | 2,728 | 2 | 2,730 |
| Minor | 737 | 540 | 1,277 |
| Other | 662 | 571 | 1,233 |
| Unemployed | 701 | 519 | 1,220 |
| Retired | 312 | 184 | 496 |
| Not Recorded | 201 | 275 | 476 |
| Construction | 206 | 140 | 346 |
| Professional | 111 | 130 | 241 |
| Student | 73 | 71 | 144 |
| Casino Worker | 52 | 51 | 103 |
| Disabled | 34 | 41 | 75 |
| Law Enforcement | 39 | 29 | 68 |
| Trucking | 41 | 27 | 68 |
| Military | 28 | 25 | 53 |
| Self employed | 6 | 44 | 50 |
| Agriculture | 11 | 13 | 24 |
| Healthcare | 2 | 21 | 23 |
| Prisoner | 14 | 7 | 21 |
| Mining | 7 | 13 | 20 |
| Driver | 13 | 6 | 19 |
| Fire Fighter | 7 | 10 | 17 |
| Unknown | 1 | 11 | 12 |
| Entertainer | 6 | 1 | 7 |
| Electrician | | 5 | 5 |
| Homemaker | | 5 | 5 |
| Logging | 1 | 4 | 5 |
| Total | 6,189 | 6,372 | 12,561 |

## *Injury Severity*

The Trauma Registry provides information about injury severity, both pre-hospital and upon arrival at the Emergency Department (ED). The injury severity information includes Glasgow Coma Score, Trauma Score, Abbreviated Injury Scores and Injury Severity Scores.

Glasgow Coma Score is a measure of neurological injury. A Glasgow Coma Score of 15 indicates no neurological injury and a score of 3 indicates severe neurological injury. Among the records indicating EMS transport, a significant proportion (approximately 19%) did not have the Scene Glasgow Coma Score recorded. Table 47 presents the reported scene Glasgow Coma Score for patients transported by EMS in 2001 and 2002.

**Table 47 Number of Trauma Records by Glasgow Coma Score for Patients Transported by EMS - 2001 and 2002**

| GCS | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| Not recorded | 966 | 1,004 | 1,964 | 18.7% |
| 3 | 203 | 238 | 444 | 4.2% |
| 4 | 13 | 17 | 34 | 0.3% |
| 5 | 20 | 20 | 45 | 0.4% |
| 6 | 40 | 33 | 79 | 0.8% |
| 7 | 20 | 27 | 54 | 0.5% |
| 8 | 34 | 30 | 72 | 0.7% |
| 9 | 35 | 24 | 68 | 0.6% |
| 10 | 47 | 32 | 89 | 0.8% |
| 11 | 43 | 33 | 87 | 0.8% |
| 12 | 40 | 52 | 104 | 1.0% |
| 13 | 73 | 100 | 186 | 1.8% |
| 14 | 286 | 284 | 584 | 5.6% |
| 15 | 3,327 | 3,481 | 6,823 | 64.8% |
| Total | 5,147 | 5,375 | 10,522 | 100.0% |

Glasgow Coma Score is also recorded at time of ED arrival. Table 48 presents this distribution.

**Table 48 Trauma Records by ED Arrival Glasgow Coma Score - 2001 and 2002**

| ED GCS | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| Missing | 270 | 137 | 407 | 3.2% |
| 3 | 364 | 433 | 797 | 6.3% |
| 4 | 24 | 14 | 38 | 0.3% |
| 5 | 17 | 10 | 27 | 0.2% |
| 6 | 39 | 24 | 63 | 0.5% |
| 7 | 28 | 32 | 60 | 0.5% |
| 8 | 25 | 25 | 50 | 0.4% |
| 9 | 29 | 25 | 54 | 0.4% |
| 10 | 34 | 18 | 52 | 0.4% |
| 11 | 35 | 39 | 74 | 0.6% |
| 12 | 36 | 38 | 74 | 0.6% |
| 13 | 75 | 66 | 141 | 1.1% |
| 14 | 236 | 234 | 470 | 3.7% |
| 15 | 4,977 | 5,277 | 10,254 | 81.6% |
| Total | 6,189 | 6,372 | 12,561 | 100.0% |

While about 97% of records had ED arrival Glasgow Coma Scores, cross-tabulating the reported arrival condition with the ED Glasgow Coma Score identified some records with apparent discrepancies between the reported condition and the reported GCS on ED arrival. For example, some records indicated the patient condition as "alert" although the Glasgow Coma Score was very low, indicating severe neurological impairment. Other records reported the patient was unresponsive, but the GCS of 13, 14, or 15 indicated little or no neurological impairment. Table 49 presents a sample of records with questionable GCS or patient condition fields.

**Table 49 Examples of Records with Discordant Values for Arrival Condition vs. Glasgow Coma Score - 2001 and 2002**

| Patient Condition | ED GCS | Records |
|---|---|---|
| Alert | 3 | 21 |
| Alert | 4 | 1 |
| Alert | 6 | 1 |
| Responsive Only to Pain | 13 | 6 |
| Responsive Only to Pain | 14 | 5 |
| Responsive Only to Pain | 15 | 13 |
| Unresponsive | 13 | 2 |
| Unresponsive | 14 | 1 |
| Unresponsive | 15 | 25 |

Trauma Score is a measure of acute trauma. A Trauma Score of 12 indicates the least severe level of injury and a score of 0 indicates the most severe level of injury. Among the records indicating EMS transport, approximately 25% did not have the scene Trauma Score recorded. Table 50 presents the reported scene Trauma Score for patients transported by EMS in 2001 and 2002.

**Table 50 Number of Trauma Records by Scene Trauma Score for Patients Transported by EMS - 2001 and 2002**

| Scene Trauma Score | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| Not Recorded | 1,318 | 1,360 | 2,678 | 25.5% |
| 0 | 51 | 54 | 105 | 1.0% |
| 1 | 7 | 7 | 14 | 0.1% |
| 2 | 11 | 12 | 23 | 0.2% |
| 3 | 5 | 12 | 17 | 0.2% |
| 4 | 27 | 45 | 72 | 0.7% |
| 5 | 13 | 12 | 25 | 0.2% |
| 6 | 18 | 30 | 48 | 0.5% |
| 7 | 23 | 20 | 43 | 0.4% |
| 8 | 75 | 83 | 158 | 1.5% |
| 9 | 63 | 33 | 96 | 0.9% |
| 10 | 107 | 92 | 199 | 1.9% |
| 11 | 312 | 277 | 589 | 5.6% |
| 12 | 3,117 | 3,338 | 6,455 | 61.3% |

Trauma Score is also recorded at time of ED arrival. Table 51 presents the distribution of ED arrival Trauma Scores for patients treated in 2001 and 2002.

**Table 51 Number of Trauma Records by ED Arrival Trauma Scores - 2001 and 2002**

| ED Trauma Score | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| Missing | 394 | 249 | 643 | 5.1% |
| 0 | 88 | 89 | 177 | 1.4% |
| 1 | 3 | 7 | 10 | 0.1% |
| 2 | 16 | 18 | 34 | 0.3% |
| 3 | 11 | 10 | 21 | 0.2% |
| 4 | 139 | 220 | 359 | 2.9% |
| 5 | 17 | 15 | 32 | 0.3% |
| 6 | 26 | 31 | 57 | 0.5% |
| 7 | 22 | 13 | 35 | 0.3% |
| 8 | 80 | 72 | 152 | 1.2% |
| 9 | 51 | 24 | 75 | 0.6% |
| 10 | 95 | 102 | 197 | 1.6% |
| 11 | 277 | 263 | 540 | 4.3% |
| 12 | 4,970 | 5,259 | 10,229 | 81.4% |

While about 86% of records had ED arrival Trauma Scores, cross-tabulating the reported arrival trauma score with reported condition identified a small number of records with discordance between the reported trauma score and the patient's condition. Table 52 presents a sample of records with questionable trauma score or patient condition fields.

**Table 52 Arrival Condition by Trauma Score Among Patients - 2001 and 2002**

| Patient Condition | ED Trauma Score | Records |
|---|---|---|
| Alert | 2 | 3 |
| Alert | 4 | 11 |
| Responsive Only to Pain | 10 | 30 |
| Responsive Only to Pain | 11 | 34 |
| Responsive Only to Pain | 12 | 20 |
| Unresponsive | 10 | 24 |
| Unresponsive | 11 | 12 |
| Unresponsive | 12 | 16 |

The trauma registry data collect information on injury severity in terms of Abbreviated Injury Severity Scores and Injury Severity Scores. Abbreviated Injury Severity Scores (AIS) identify specific injuries for specific body regions and range from 0 to 6 (depending on body region), with a 0 representing no injury and 6 representing injuries that are usually not survivable. Injury Severity Scores (ISS) indicate the combined effect of multiple injuries and are calculated by summing the squares of the three highest AIS scores in different body regions. ISS scores range from 0 to 75, with 0 representing no injury and 75 representing usually fatal injury.

The Trauma Registry data were processed through a commercial software program (ICDMAP-90) that translates diagnostic codes into AIS and ISS values. The ISS values that were calculated using this method were compared with the ISS values provided in the trauma data. This comparison indicated that about 66% of records had a reported ISS score that was the same as the calculated ISS score. Among the 3,293 records with differences in the reported and calculated ISS, about 81% (2,668) were within 9 points of one another and the remaining 19% were more discordant. The difference in reported and calculated ISS scores should be investigated further.

## *Injury Type*

The diagnostic codes in the Trauma Registry provide an opportunity to look at specific types of injuries or specific body regions or systems. A useful way of reporting specific types of injuries is according to the *Barell Matrix*. This matrix, designed by CDC, is a two-dimensional array of ICD9-CM injury diagnoses grouped by body region and nature of injury. The rows of the matrix provide information about specific body regions (head, spinal cord, vertebral column, etc). The rows are subdivided into separate subcategories (e.g., shoulder, forearm, wrist). The columns of the matrix divide the injuries into types of injuries (e.g., fractures, dislocations, burns, etc.). It should be understood that the *Barell Matrix* is based on the first injury diagnosis code although patients may have multiple body regions of injury. The *Barell Matrix* for the 2001 Trauma Registry data is presented on the following pages.

## Table 53 Barell Matrix for Trauma Registry Data

| | | | | FRACTURE | DISLOCATION | SPRAINS AND STRAINS | INTERNAL ORGAN | OPEN WOUND | AMPUTATIONS | BLOOD VESSELS | CONTUSION / SUPERFICIAL | CRUSH | BURNS | NERVES | UNSPECIFIED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEAD AND NECK | TRAUMATIC BRAIN INJURY | 1 | TYPE 1 TBI | 518 | | | 1500 | | | | | | | | |
| | | 2 | TYPE 2 TBI | 5 | | | 705 | | | | | | | | |
| | | 3 | TYPE 3 TBI | 8 | | | | | | | | | | | |
| | OTHER HEAD FACE AND NECK | 4 | OTHER HEAD | | | | | 269 | | | | | | 2 | |
| | | 5 | FACE | 225 | 1 | 1 | | 327 | | | | | 13 | | |
| | | 6 | EYE | | | | | 20 | | | 17 | | 1 | 2 | |
| | | 7 | NECK | 35 | | | | 109 | | | | 2 | 2 | 2 | |
| | | 8 | HEAD, FACE AND NECK UNSPECIFIED | | | | | | | 24 | 404 | | 10 | | |
| SPINE AND BACK | SPINAL CORD INJURY (SCI) | 9 | CERVICAL SCI | 22 | | | 5 | | | | | | | | |
| | | 10 | THORASIC/DORSAL SCI | 43 | | | 4 | | | | | | | | |
| | | 11 | LUMBAR SCI | 20 | | 15 | | | | | | | | | |
| | | 12 | SACRUM COCCYX SCI | 25 | | 13 | | | | | | | | | |
| | | 13 | SPINE BACK UNSPECIFIED SCI | 10 | | 11 | | | | | | | | | |
| | VERTEBRAL COLUMN INJURY | 14 | CERVICAL VCI | 33 | 1 | 330 | | | | | | | | | |
| | | 15 | THORASIC/DORSAL VCI | 222 | 0 | 57 | | | | | | | | | |
| | | 16 | LUMBAR VCI | 267 | 1 | 113 | | | | | | | | | |
| | | 17 | SACRUM COCCYX VCI | 87 | | 0 | | | | | | | | | |
| | | 18 | SPINE BACK UNSPECIFIED VCI | 1 | | | | | | | | | | | |

| | | | | FRACTURE | DISLOCATION | SPRAINS AND STRAINS | INTERNAL ORGAN | OPEN WOUND | AMPUTATIONS | BLOOD VESSELS | CONTUSION / SUPERFICIAL | CRUSH | BURNS | NERVES | UNSPECIFIED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TORSO | TORSO | 19 | CHEST | 266 | 1 | 3 | 865 | 193 | | 56 | 183 | 0 | 8 | 0 | |
| | | 20 | ABDOMEN | | | | 648 | 207 | | 26 | 107 | | 1 | 0 | |
| | | 21 | PELVIS/UROGENITAL | 292 | 8 | 8 | 21 | 33 | | 13 | 0 | 0 | 1 | 0 | |
| | | 22 | TRUNK | 1 | | | | 1 | | | 75 | 1 | 0 | 0 | 30 |
| | | 23 | BACK AND BUTTOCK | | | 7 | | 87 | | | 23 | 0 | 2 | | |
| EXTREMITIES | UPPER | 24 | SHOULDER AND UPPER ARM | 280 | 43 | 27 | | 117 | 1 | | 97 | 0 | 1 | | 2 |
| | | 25 | FOREARM AND ELBOW | 221 | 0 | **6** | | 27 | 2 | | 16 | 3 | 5 | | 0 |
| | | 26 | WRIST, HAND AND FINGERS | 72 | 9 | 16 | | 54 | 13 | | 43 | 4 | 7 | | 1 |
| | | 27 | OTHER AND UNSPECIFIED | 0 | | | | 5 | 1 | 52 | 67 | 1 | 3 | 7 | 3 |
| | LOWER | 28 | HIP | 63 | 22 | 5 | | | | | | | | | |
| | | 29 | UPPER LEG AND THIGH | 324 | | | | | 2 | | 0 | 0 | 2 | | 1 |
| | | 30 | KNEE | 47 | 4 | 10 | | | | | 22 | 0 | 0 | | |
| | | 31 | LOWER LEG AND ANKLE | 544 | 11 | 20 | | | 3 | | 27 | 1 | 3 | 0 | |
| | | 32 | FOOT AND TOES | 90 | 0 | 3 | | 13 | 3 | | 17 | 0 | 0 | | |
| | | 33 | OTHER AND UNSPECIFIED | 1 | | 13 | | 267 | | 25 | 170 | 0 | 2 | | 3 |
| OTHER & UNSPECIFIED | OTHER & UNSPECIFIED | 34 | OTHER / MULTIPLE | 6 | | 0 | | | 0 | 3 | | | 0 | 2 | |
| | | 35 | UNSPECIFIED SITE | 0 | 1 | 4 | 2 | 8 | | 0 | 252 | 2 | 19 | 11 | 289 |
| WIDE AND LATE | WIDE AND LATE | 36 | SYSTEM-WIDE AND LATE EFFECTS | 7 | | | | | | | | | | | |

## *Mechanism of Injury*

The E-code field provides information about the external cause of injury. All records in the data set had an external cause of injury; however, a small number of these records (3 records) had E849 codes, which indicate the injury location rather than the injury cause. Approximately 52% of records had fourth digits for E-codes, although a small number of these records had invalid fourth digit codes. Table 54 presents the number of reported E-codes among the 2001 and 2002 data. Shaded rows indicate E-codes with invalid fourth digits.

**Table 54 Number of Trauma Records by E-Code - 2001 and 2002**

| Code | Description | 2001 | 2002 | Total |
|---|---|---|---|---|
| 804 | Fall In, On, or From Railway Train - Railway Employee | 1 | 0 | 1 |
| 804.1 | Fall In, On, or From Railway Train - Railway Passenger | 1 | 1 | 2 |
| 804.2 | Fall In, On, or From Railway Train - Pedestrian | 2 | 0 | 2 |
| 805.2 | Railway, Hit by Rolling Stock - Pedestrian | 0 | 1 | 1 |
| 806.1 | Other Spec Railway Accident - Railway Passenger | 1 | 0 | 1 |
| 810 | MVA Traffic, Collision w/ Train - Driver of MV, Non MC | 1 | 1 | 2 |
| 810.1 | MVA Traffic, Collision w/ Train - Passenger in MV, Non MC | 0 | 1 | 1 |
| 810.7 | MVA Traffic, Collision w/ Train - Pedestrian | 1 | 0 | 1 |
| 811 | MVA Traffic, Re-entr Collision w/ MV - Driver of MV, Non MC | 1 | 16 | 17 |
| 811.1 | MVA Traffic, Re-entr Collision w/ MV - Passenger in MV, Non MC | 0 | 7 | 7 |
| 811.2 | MVA Traffic, Re-entr Collision w/ MV - Motorcyclist | 1 | 4 | 5 |
| 811.3 | MVA Traffic, Re-entr Collision w/ MV - Passenger on Motorcycle | 0 | 1 | 1 |
| 812 | Other MVA Traffic, Collision w/ MV - Driver of MV, Non MC | 826 | 820 | 1,646 |
| 812.1 | Other MVA Traffic, Collision w/ MV - Passenger in MV, Non MC | 397 | 441 | 838 |
| 812.2 | Other MVA Traffic, Collision w/ MV - Motorcyclist | 82 | 140 | 222 |
| 812.3 | Other MVA Traffic, Collision w/ MV - Passenger on Motorcycle | 10 | 12 | 22 |
| 812.6 | Other MVA Traffic, Collision w/ MV - Pedal Cyclist | 0 | 3 | 3 |
| 812.8 | Other MVA Traffic, Collision w/ MV - Other Person | 0 | 1 | 1 |
| 812.9 | Other MVA Traffic, Collision w/ MV - Unspec Person | 3 | 0 | 3 |
| 813 | MVA Traffic, Collision w/ Other Veh - Driver of MV, Non MC | 16 | 8 | 24 |
| 813.1 | MVA Traffic, Collision w/ Other Veh - Passenger in MV, Non MC | 12 | 5 | 17 |
| 813.2 | MVA Traffic, Collision w/ Other Veh - Motorcyclist | 6 | 2 | 8 |
| 813.3 | MVA Traffic, Collision w/ Other Veh - Passenger on Motorcycle | 1 | 0 | 1 |
| 813.6 | MVA Traffic, Collision w/ Other Veh - Pedal Cyclist | 96 | 99 | 195 |
| 813.7 | MVA Traffic, Collision w/ Other Veh - Pedestrian | 0 | 1 | 1 |
| 813.8 | MVA Traffic, Collision w/ Other Veh - Other Person | 1 | 2 | 3 |
| 814.6 | MVA Traffic, Collision w/ Pedestrian - Pedal Cyclist | 1 | 2 | 3 |
| 814.7 | MVA Traffic, Collision w/ Pedestrian - Pedestrian | 444 | 423 | 867 |
| 815 | Other MVA Traffic, Highway Collision - Driver of MV, Non MC | 33 | 58 | 91 |
| 815.1 | Other MVA Traffic, Highway Collision - Passenger in MV, Non MC | 18 | 25 | 43 |
| 815.2 | Other MVA Traffic, Highway Collision - Motorcyclist | 51 | 25 | 76 |
| 815.3 | Other MVA Traffic, Highway Collision - Passenger on Motorcycle | 3 | 1 | 4 |
| 815.8 | Other MVA Traffic, Highway Collision - Other Person | 0 | 1 | 1 |

| Code | Description | 2001 | 2002 | Total |
|---|---|---|---|---|
| 816 | MVA Traffic, Loss Control-No Collision - Driver of MV, Non MC | 665 | 739 | 1,404 |
| 816.1 | MVA Traffic, Loss Control-No Collision - Passenger in MV, Non MC | 399 | 502 | 901 |
| 816.2 | MVA Traffic, Loss Control-No Collision - Motorcyclist | 118 | 182 | 300 |
| 816.3 | MVA Traffic, Loss Control-No Collision - Passenger on Motorcycle | 3 | 17 | 20 |
| 816.9 | MVA Traffic, Loss Control-No Collision - Unspec Person | 9 | 5 | 14 |
| 817 | Noncollision MVA Traffic, Board/Alight - Driver of MV, Non MC | 0 | 1 | 1 |
| 817.1 | Noncollision MVA Traffic, Board/Alight - Passenger in MV, Non MC | 11 | 9 | 20 |
| 817.2 | Noncollision MVA Traffic, Board/Alight - Motorcyclist | 3 | 0 | 3 |
| 817.7 | Noncollision MVA Traffic, Board/Alight - Pedestrian | 0 | 1 | 1 |
| 817.8 | Noncollision MVA Traffic, Board/Alight - Other Person | 1 | 0 | 1 |
| 818 | Other Noncollision MVA Traffic - Driver of MV, Non MC | 99 | 3 | 102 |
| 818.1 | Other Noncollision MVA Traffic - Passenger in MV, Non MC | 82 | 15 | 97 |
| 818.2 | Other Noncollision MVA Traffic - Motorcyclist | 59 | 8 | 67 |
| 818.3 | Other Noncollision MVA Traffic - Passenger on Motorcycle | 5 | 2 | 7 |
| 818.7 | Other Noncollision MVA Traffic - Pedestrian | 0 | 2 | 2 |
| 818.8 | Other Noncollision MVA Traffic - Other Person | 3 | 2 | 5 |
| 819 | MVA Traffic, Unspec Nature - Driver of MV, Non MC | 3 | 1 | 4 |
| 819.1 | MVA Traffic, Unspec Nature - Passenger in MV, Non MC | 5 | 0 | 5 |
| 819.2 | MVA Traffic, Unspec Nature - Motorcyclist | 1 | 3 | 4 |
| 819.6 | MVA Traffic, Unspec Nature - Pedal Cyclist | 1 | 1 | 2 |
| 820 | N-traffic Accident, Snow MV - Driver of MV, Non MC | 3 | 7 | 10 |
| 820.1 | N-traffic Accident, Snow MV - Passenger in MV, Non MC | 0 | 3 | 3 |
| 820.2 | N-traffic Accident, Snow MV - Motorcyclist | 1 | 0 | 1 |
| 820.8 | N-traffic Accident, Snow MV - Other Person | 1 | 1 | 2 |
| 821 | N-traffic Accident, Other Off-Road MV - Driver of MV, Non MC | 33 | 46 | 79 |
| 821.1 | N-traffic Accident, Other Off-Road MV - Passenger in MV, Non MC | 13 | 11 | 24 |
| 821.2 | N-traffic Accident, Other Off-Road MV - Motorcyclist | 98 | 102 | 200 |
| 821.3 | N-traffic Accident, Other Off-Road MV - Passenger on Motorcycle | 3 | 7 | 10 |
| 821.6 | N-traffic Accident, Other Off-Road MV - Pedal Cyclist | 0 | 1 | 1 |
| 821.7 | N-traffic Accident, Other Off-Road MV - Pedestrian | 1 | 0 | 1 |
| 821.8 | N-traffic Accident, Other Off-Road MV - Other Person | 23 | 28 | 51 |
| 821.9 | N-traffic Accident, Other Off-Road MV - Unspec Person | 0 | 1 | 1 |
| 822 | Other MVA N-traffic Collision, Move Object - Driver of MV, Non MC | 2 | 1 | 3 |
| 822.1 | Other MVA N-traffic Collision, Move Object - Passenger in MV, Non MC | 0 | 2 | 2 |
| 822.2 | Other MVA N-traffic Collision, Move Object - Motorcyclist | 6 | 6 | 12 |
| 822.6 | Other MVA N-traffic Collision, Move Object - Pedal Cyclist | 2 | 1 | 3 |
| 822.7 | Other MVA N-traffic Collision, Move Object - Pedestrian | 0 | 1 | 1 |
| 823 | Other MVA N-Traffic Collision, Stat Object - Driver of MV, Non MC | 10 | 7 | 17 |
| 823.1 | Other MVA N-Traffic Collision, Stat Object - Passenger in MV, Non MC | 13 | 2 | 15 |
| 823.2 | Other MVA N-Traffic Collision, Stat Object - Motorcyclist | 85 | 72 | 157 |
| 823.3 | Other MVA N-Traffic Collision, Stat Object - Passenger on Motorcycle | 1 | 0 | 1 |
| 824 | Other MVA N-Traffic, Board/Alight - Driver of MV, Non MC | 1 | 0 | 1 |
| 824.1 | Other MVA N-Traffic, Board/Alight - Passenger in MV, Non MC | 2 | 8 | 10 |
| 824.2 | Other MVA N-Traffic, Board/Alight - Motorcyclist | 2 | 0 | 2 |
| 824.8 | Other MVA N-Traffic, Board/Alight - Other Person | 0 | 2 | 2 |
| 825 | Other MVA N-Traffic, Other & Unspec Nature - Driver of MV, Non MC | 5 | 9 | 14 |

| Code | Description | 2001 | 2002 | Total |
|---|---|---|---|---|
| 825.1 | Other MVA N-Traffic, Other & Unspec Nature - Passenger in MV, Non MC | 1 | 9 | 10 |
| 825.2 | Other MVA N-Traffic, Other & Unspec Nature - Motorcyclist | 35 | 99 | 134 |
| 825.3 | Other MVA N-Traffic, Other & Unspec Nature - Passenger on Motorcycle | 1 | 1 | 2 |
| 825.7 | Other MVA N-Traffic, Other & Unspec Nature - Pedestrian | 0 | 4 | 4 |
| 825.8 | Other MVA N-Traffic, Other & Unspec Nature - Other Person | 0 | 1 | 1 |
| 826 | Pedal Cycle Accident - Pedestrian | 1 | 2 | 3 |
| 826.1 | Pedal Cycle Accident - Pedal Cyclist | 72 | 86 | 158 |
| 827.2 | Animal-Drawn Veh Accident - Rider of Animal | 3 | 1 | 4 |
| 828.2 | Accident, Ridden Animal - Rider of Animal | 66 | 60 | 126 |
| 828.8 | Accident, Ridden Animal - Other Person | 1 | 1 | 2 |
| 829.8 | PTOS: Skateboard Accident | 5 | 4 | 9 |
| 830.1 | H2O Craft Accident, Submersion - Small Boater (Powered) | 1 | 1 | 2 |
| 830.3 | H2O Craft Accident, Submersion - Pass of Other H2O Craft | 1 | 0 | 1 |
| 830.4 | H2O Craft Accident, Submersion - H2O Skier | 3 | 1 | 4 |
| 830.5 | H2O Craft Accident, Submersion - Swimmer | 0 | 1 | 1 |
| 831 | H2O Craft Accident, Other Injury - Small Boater (Unpowered) | 6 | 1 | 7 |
| 831.1 | H2O Craft Accident, Other Injury - Small Boater (Powered) | 14 | 14 | 28 |
| 831.3 | H2O Craft Accident, Other Injury - Pass of Other H2O Craft | 8 | 6 | 14 |
| 831.4 | H2O Craft Accident, Other Injury - H2O Skier | 2 | 4 | 6 |
| 831.8 | H2O Craft Accident, Other Injury - Other Person | 0 | 2 | 2 |
| 832 | H2O Transport, Other Submersion/Drown - Small Boater (Unpowered) | 1 | 0 | 1 |
| 832.1 | H2O Transport, Other Submersion/Drown - Small Boater (Powered) | 0 | 1 | 1 |
| 834.1 | H2O Transport, Other Multi-level Fall - Small Boater (Powered) | 1 | 0 | 1 |
| 834.4 | H2O Transport, Other Multi-level Fall - H2O Skier | 1 | 0 | 1 |
| 834.8 | H2O Transport, Other Multi-level Fall - Other Person | 0 | 1 | 1 |
| 835.4 | H2O Transport, Other & Unspec Fall - H2O Skier | 0 | 2 | 2 |
| 835.8 | H2O Transport, Other & Unspec Fall - Other Person | 0 | 1 | 1 |
| 836.1 | H2O Transport, Machinery Accident - Small Boater (Powered) | 1 | 0 | 1 |
| 838.4 | Other & Unspec H2O Transport Accident - H2O Skier | 1 | 0 | 1 |
| 838.5 | Other & Unspec H2O Transport Accident - Swimmer | 2 | 0 | 2 |
| 838.8 | Other & Unspec H2O Transport Accident - Other Person | 2 | 3 | 5 |
| 840.2 | Powered Aircraft, Tkoff/Land - Ground-Ground Commercial Crew | 0 | 1 | 1 |
| 840.4 | Powered Aircraft, Tkoff/Land - Ground-Air Commercial Occupant | 0 | 1 | 1 |
| 840.5 | Powered Aircraft, Tkoff/Land - Other Powered Aircraft Occupant | 3 | 3 | 6 |
| 841.2 | Other & Unspec Powered Aircraft - Ground-Ground Commercial Crew | 0 | 2 | 2 |
| 841.3 | Other & Unspec Powered Aircraft - Ground-Ground Commercial Occupant | 1 | 1 | 2 |
| 841.5 | Other & Unspec Powered Aircraft - Other Powered Aircraft Occupant | 0 | 5 | 5 |
| 842.6 | Unpowered Aircraft - Unpowered Aircraft Occupant | 1 | 5 | 6 |
| 842.7 | Unpowered Aircraft - Parachutist | 2 | 1 | 3 |
| 843.6 | Fall In/ On/ From Aircraft - Unpowered Aircraft Occupant | 1 | 1 | 2 |
| 843.7 | Fall In/ On/ From Aircraft - Parachutist | 0 | 1 | 1 |
| 844.6 | Other Spec Air Transport - Unpowered Aircraft Occupant | 0 | 1 | 1 |
| 844.7 | Other Spec Air Transport - Parachutist | 0 | 1 | 1 |
| 844.8 | Other Spec Air Transport - Ground Crew/Airline Employee | 0 | 1 | 1 |
| 844.9 | Other Spec Air Transport - Other Person | 1 | 0 | 1 |
| 846 | Powered Veh w/in Premises of Industrial/Commercial Establishment | 3 | 0 | 3 |

| Code | Description | 2001 | 2002 | Total |
|---|---|---|---|---|
| 847 | Accidents Involving Cable Cars Not Running on Rails | 1 | 0 | 1 |
| 848 | Accidents Involving Other Veh, NEC | 4 | 2 | 6 |
| 849.2 | Location Codes | 0 | 2 | 2 |
| 849.3 | Location Codes | 1 | 0 | 1 |
| 850.2 | Acc Poison - Other Opiates and Related Narcotics | 1 | 0 | 1 |
| 854.2 | Acc Poison - Psychostimulants | 1 | 0 | 1 |
| 861.3 | Acc Poison - Other Cleansing and Polishing Agents | 0 | 1 | 1 |
| 880 | Fall On or From Stairs/Steps - Escalator | 4 | 5 | 9 |
| 880.1 | Fall On or From Stairs/Steps - Sidewalk Curb | 1 | 0 | 1 |
| 880.9 | Fall On or From Stairs/Steps - Other Stairs or Steps | 37 | 43 | 80 |
| 881 | Fall On or From Ladders/Scaffolding - Ladder | 62 | 60 | 122 |
| 881.1 | Fall On or From Ladders/Scaffolding - Scaffolding | 26 | 30 | 56 |
| 882 | Fall From or Out of Building/Other Structure | 130 | 120 | 250 |
| 883 | Fall into Hole/Other Surface Opening - Jump/Dive into H2O [pool] | 9 | 5 | 14 |
| 883.2 | Fall into Hole/Other Surface Opening - Storm Drain/Manhole | 1 | 0 | 1 |
| 883.9 | Fall into Hole/Other Surface Opening - Other Hole/Surface Opening | 0 | 4 | 4 |
| 884 | Other Multi-level Fall - Playground Equipment | 11 | 2 | 13 |
| 884.1 | Other Multi-level Fall - Cliff | 32 | 22 | 54 |
| 884.2 | Other Multi-level Fall - Chair | 12 | 6 | 18 |
| 884.3 | Other Multi-level Fall - Wheelchair | 2 | 0 | 2 |
| 884.4 | Other Multi-level Fall - Bed | 7 | 2 | 9 |
| 884.5 | Other Multi-level Fall - Other Furniture | 5 | 4 | 9 |
| 884.9 | Other Multi-level Fall - Other Multi-Level Fall | 127 | 108 | 235 |
| 885 | Fall on Same Level From Slipping/Tripping/Stumbling | 75 | 30 | 105 |
| 885.1 | Fall on Same Level From Roller Skates | 0 | 2 | 2 |
| 885.2 | Fall on Same Level From Skateboard | 5 | 1 | 6 |
| 885.3 | Fall on Same Level From Skis | 37 | 59 | 96 |
| 885.4 | Fall on Same Level From Snowboard | 38 | 73 | 111 |
| 885.9 | Fall on Same Level Other Slipping/Tripping/Stumbling | 30 | 70 | 100 |
| 886 | Fall From Collision/Push/Shoving By, W/ Other Person - In Sports | 5 | 4 | 9 |
| 886.9 | Fall From Collision/Push/Shoving By, W/ Other Person - Other/Unspec | 0 | 1 | 1 |
| 888 | Other and Unspec Fall | 36 | 2 | 38 |
| 888.1 | Other and Unspec Fall | 0 | 3 | 3 |
| 888.8 | Other and Unspec Fall | 2 | 1 | 3 |
| 888.9 | Other and Unspec Fall | 0 | 13 | 13 |
| 890 | Private Dwelling Conflagration - Conflagration Explosion | 1 | 0 | 1 |
| 890.2 | Private Dwelling Conflagration - Other Smoke and Fumes | 0 | 1 | 1 |
| 890.3 | Private Dwelling Conflagration - Conflagration Burning | 8 | 4 | 12 |
| 893.2 | Clothing Ignition - Controlled Fire Not in Building/Structure | 1 | 0 | 1 |
| 893.8 | Clothing Ignition - Oth Spec Sources | 1 | 1 | 2 |
| 894 | Ignition of Highly Inflammable Material | 8 | 8 | 16 |
| 897 | Accident by Controlled Fire Not in Building/Structure | 1 | 1 | 2 |
| 898.1 | Accident by Other Spec Fire and Flames - Other | 3 | 2 | 5 |
| 906 | Other Injury by Animal - Dog Bite | 6 | 9 | 15 |
| 906.3 | Other Injury by Animal - Other Animal Bite (Except Arthropod) | 3 | 2 | 5 |
| 906.8 | Other Injury by Animal - Other Spec Injury Caused by Animal | 16 | 15 | 31 |

| Code | Description | 2001 | 2002 | Total |
|---|---|---|---|---|
| 907 | Lightning | 2 | 0 | 2 |
| 909.2 | Cataclysmic Earth - Avalanche, Landslide, Mudslide | 0 | 1 | 1 |
| 910.1 | Accidental Drown/Submersion - Other Sport w/ Diving Equipment | 1 | 0 | 1 |
| 910.3 | Accidental Drown/Submersion - Swim/Diving for Non-Sport Purposes | 2 | 1 | 3 |
| 910.4 | Accidental Drown/Submersion - In Bathtub | 3 | 0 | 3 |
| 910.8 | Accidental Drown/Submersion - Other Accidental Drown/Submersion | 4 | 1 | 5 |
| 914 | Foreign Body Accidentally Entering Eye and Adnexa | 0 | 3 | 3 |
| 916 | Struck Accidentally by Falling Object | 47 | 35 | 82 |
| 917 | Striking Against/Struck Accidentally- In Sports | 70 | 45 | 115 |
| 917.1 | Striking Against/Struck Accidentally- Crowd, Collective Fear/Panic | 1 | 0 | 1 |
| 917.2 | Striking Against/Struck Accidentally- In Running H2O | 1 | 2 | 3 |
| 917.4 | Striking Against/Struck Accidentally - Other stationary object without subsequent fall | 0 | 4 | 4 |
| 917.5 | PTOS: Skiing Accident - Resulting in Fall | 0 | 1 | 1 |
| 917.8 | Striking Against/Struck Accidentally- Other stationary object with subsequent fall | 0 | 18 | 18 |
| 917.9 | Striking Against/Struck Accidentally- Other | 17 | 58 | 75 |
| 918 | Caught Accidentally In or Between Objects | 9 | 17 | 26 |
| 919 | Machinery Accident - Agricultural Machines | 0 | 1 | 1 |
| 919.1 | Machinery Accident - Mining and Earth-Drilling Machinery | 1 | 2 | 3 |
| 919.2 | Machinery Accident - Lifting Machines and Appliances | 1 | 2 | 3 |
| 919.3 | Machinery Accident - Metalworking Machines | 2 | 0 | 2 |
| 919.4 | Machinery Accident - Woodworking and Forming Machines | 2 | 4 | 6 |
| 919.7 | Machinery Accident - Earth Moving/Scraping/Other Excavating Machine | 8 | 5 | 13 |
| 919.8 | Machinery Accident - Other Spec Machinery | 6 | 4 | 10 |
| 919.9 | Machinery Accident - Unspec Machinery | 3 | 1 | 4 |
| 920 | Cutting Object Accident - Powered Lawn Mower | 1 | 1 | 2 |
| 920.1 | Cutting Object Accident - Other Powered Hand Tools | 15 | 6 | 21 |
| 920.2 | Cutting Object Accident - Powered Household Appliances/Implements | 2 | 1 | 3 |
| 920.3 | Cutting Object Accident - Knives, Swords, and Daggers | 9 | 8 | 17 |
| 920.4 | Cutting Object Accident - Other Hand Tools and Implements | 4 | 2 | 6 |
| 920.8 | Cutting Object Accident - Other Spec Cut/Piercing Instrument/Object | 43 | 30 | 73 |
| 920.9 | Cutting Object Accident - Unspec Cut/Piercing Instrument/Object | 5 | 1 | 6 |
| 921.1 | Pressure Vessel Explosion Accident - Gas Cylinders | 2 | 1 | 3 |
| 921.8 | Pressure Vessel Explosion Accident - Other Spec Pressure Vessels | 1 | 0 | 1 |
| 922 | Firearm Missile Accident - Handgun | 23 | 17 | 40 |
| 922.1 | Firearm Missile Accident - Shotgun (Automatic) | 1 | 0 | 1 |
| 922.2 | Firearm Missile Accident - Hunting Rifle | 1 | 1 | 2 |
| 922.4 | Firearm Missile Accident - Air Gun | 2 | 0 | 2 |
| 922.8 | Firearm Missile Accident - Other Spec Firearm Missile | 4 | 2 | 6 |
| 922.9 | Firearm Missile Accident - Unspec Firearm Missile | 2 | 1 | 3 |
| 923.1 | Explosive Material Accident - Blasting Materials | 0 | 1 | 1 |
| 923.2 | Explosive Material Accident - Explosive Gases | 1 | 2 | 3 |
| 923.8 | Explosive Material Accident - Other Explosive Materials | 2 | 1 | 3 |
| 924 | Accident, Hot/Corrosive Material - Hot Liquids/Vapors/Steam | 12 | 5 | 17 |
| 924.1 | Accident, Hot/Corrosive Material - Caustic/Corrosive Substances | 0 | 1 | 1 |

| Code | Description | 2001 | 2002 | Total |
|---|---|---|---|---|
| 924.2 | Accident, Hot/Corrosive Material - Hot (Boiling) Tap Water | 1 | 1 | 2 |
| 924.3 | Accident, Hot/Corrosive Material - Hot Liquids/Vapors/Steam | 2 | 0 | 2 |
| 924.4 | Accident, Hot/Corrosive Material - Hot Liquids/Vapors/Steam | 1 | 0 | 1 |
| 924.6 | Accident, Hot/Corrosive Material - Hot Liquids/Vapors/Steam | 3 | 0 | 3 |
| 924.8 | Accident, Hot/Corrosive Material - Other | 1 | 2 | 3 |
| 925 | Accident, Electric Current - Domestic Wiring and Appliances | 0 | 1 | 1 |
| 925.2 | Accident, Electric Current - Industrial Wires/Appliance/Machinery | 1 | 2 | 3 |
| 925.8 | Accident, Electric Current - Other Electric Current | 1 | 1 | 2 |
| 926.2 | Radiation Exposure - Visible/Ultraviolet Light Sources | 0 | 1 | 1 |
| 927 | Overexertion and Strenuous Movements | 0 | 1 | 1 |
| 928.8 | Other/Unspec Environmental Causes - Other | 1 | 0 | 1 |
| 928.9 | Other/Unspec Environmental Causes - Unspec Accident | 13 | 3 | 16 |
| 929 | Late Effects of Injury - MVA | 1 | 0 | 1 |
| 929.3 | Late Effects of Injury - Accidental Fall | 0 | 1 | 1 |
| 950 | Suicide/Self Poison- Analgesics, Antipyretics & Antirheumatics | 0 | 1 | 1 |
| 952 | Suicide/Self Poison - Motor Vehicle Exhaust Gas | 1 | 0 | 1 |
| 953 | Suicide/Self Injury - Hanging | 8 | 8 | 16 |
| 955 | Suicide/Self Injury - Handgun | 48 | 46 | 94 |
| 955.1 | Suicide/Self Injury - Shotgun | 0 | 3 | 3 |
| 955.2 | Suicide/Self Injury - Hunting Rifle | 2 | 4 | 6 |
| 956 | Suicide and Self-Inflicted Injury by Cut/Piercing Instrument | 57 | 54 | 111 |
| 957 | Suicide/Self Injury, Jump, High Place - Residential Premises | 5 | 3 | 8 |
| 957.1 | Suicide/Self Injury, Jump, High Place - Other Man-Made Structures | 5 | 4 | 9 |
| 957.2 | Suicide/Self Injury, Jump, High Place - Natural Sites | 1 | 0 | 1 |
| 958 | Suicide/Self Injury - Jumping or Lying Before Moving Object | 5 | 5 | 10 |
| 958.1 | Suicide/Self Injury - Burns, Fire | 1 | 0 | 1 |
| 958.5 | Suicide/Self Injury - Crashing of Motor Vehicle | 6 | 6 | 12 |
| 960 | Fight/Brawl/Rape - Unarmed Fight or Brawl | 88 | 70 | 158 |
| 960.1 | Fight/Brawl/Rape - Rape | 1 | 1 | 2 |
| 961 | Assault by Corrosive or Caustic Substance, Except Poisoning | 1 | 0 | 1 |
| 963 | Assault by Hanging and Strangulation | 3 | 0 | 3 |
| 965 | Assault by Firearms/Explosives - Handgun | 299 | 351 | 650 |
| 965.1 | Assault by Firearms/Explosives - Shotgun | 7 | 10 | 17 |
| 965.2 | Assault by Firearms/Explosives - Hunting Rifle | 0 | 1 | 1 |
| 965.3 | Assault by Firearms/Explosives - Military Firearms | 0 | 1 | 1 |
| 965.4 | Assault by Firearms/Explosives - Other and Unspec Firearm | 24 | 7 | 31 |
| 966 | Assault by Cutting and Piercing Instrument | 348 | 375 | 723 |
| 967 | Child/Adult Battering/Other Maltreatment - By Father/Stepfather | 2 | 0 | 2 |
| 967.2 | Child/Adult Battering/Other Maltreatment - By Mother/Stepmother | 0 | 2 | 2 |
| 967.3 | Child/Adult Battering/Other Maltreatment - By Spouse/Partner | 0 | 1 | 1 |
| 967.4 | Child/Adult Battering/Other Maltreatment - By Child | 1 | 0 | 1 |
| 967.7 | Child/Adult Battering/Other Maltreatment - By Other Relative | 1 | 0 | 1 |
| 967.8 | Child/Adult Battering/Other Maltreatment - By Non-related Caregiver | 1 | 0 | 1 |
| 967.9 | Child/Adult Battering/Other Maltreatment - By Unspec Person | 1 | 0 | 1 |
| 968.1 | Assault by Other/Unspec Means - Pushing from a High Place | 1 | 3 | 4 |
| 968.2 | Assault by Other/Unspec Means - Striking by Blunt/Thrown Object | 127 | 120 | 247 |

| Code | Description | 2001 | 2002 | Total |
|---|---|---|---|---|
| 968.5 | Assault by Other/Unspec Means - Vehicular Assault | 3 | 3 | 6 |
| 968.6 | Assault by Other/Unspec Means - Air Gun | 0 | 1 | 1 |
| 968.8 | Assault by Other/Unspec Means - Other Spec Means | 4 | 5 | 9 |
| 968.9 | Assault by Other/Unspec Means - Unspec Means | 9 | 10 | 19 |
| 970 | Injury Due to Legal Intervention by Firearms | 12 | 9 | 21 |
| 971 | Injury Due to Legal Intervention by Explosives | 0 | 1 | 1 |
| 973 | Injury Due to Legal Intervention by Blunt Object | 1 | 2 | 3 |
| 975 | Injury Due to Legal Intervention by Other Spec Means | 3 | 1 | 4 |
| 985 | Firearms/Explosives, Un/Intentional – Handgun | 1 | 2 | 3 |
| 985.4 | Firearms/Explosives, Un/Intentional - Other/Unspec Firearm | 1 | 1 | 2 |
| 986 | Injury by Cut/Piercing Instruments, Undetermined Un/Intentional | 2 | 1 | 3 |
| 987.9 | Fall From High Place, Un/Intentional - Unspec Site | 1 | 0 | 1 |
| 988.5 | Other/Unspec Injury, Un/Intentional - Crashing of Motor Vehicle | 1 | 0 | 1 |
| | Total | 6,189 | 6,371 | 12,560 |

The Trauma Registry indicates the chief complaint of the patient, which appears to be defined principally by mechanism of injury. Comparison of the chief complaint field with the E-codes identified a small number of records with discord between the reported chief complaint and the reported E-code. Table 55 presents a sample of records that appear to have a discrepancy between the chief complaint and the reported E-code.

**Table 55 Comparison of Chief Complaint with E-code for Patients - 2001 and 2002**

| Chief Complaint | E-Code | Description | Records |
|---|---|---|---|
| Gun Shot Would | 814.6 | MVA Traffic, Collision w/ Pedestrian - Pedal Cyclist | 1 |
| Motorcycle Crash | 812.1 | Other MVA Traffic, Collision w/ MV - Passenger in MV, Non MC | 2 |
| Motorcycle Crash | 816 | MVA Traffic, Loss Control-No Collision - Driver of MV, Non MC | 4 |
| Motorcycle Crash | 821 | N-traffic Accident, Other Off-Road MV - Driver of MV, Non MC | 2 |
| Motorcycle Crash | 825 | Other MVA N-Traffic, Other & Unspec Nature - Driver of MV, Non MC | 3 |
| Motorcycle Crash | 825.1 | Other MVA N-Traffic, Other & Unspec Nature - Passger in MV, Non MC | 1 |
| Motorcycle Crash | 916 | Struck Accidentally by Falling Object | 1 |
| Motorcycle Crash | 968.2 | Assault by Other/Unspec Means - Striking by Blunt/Thrown Object | 1 |
| Motor Vehicle Crash | 917 | Striking Against/Struck Accidentally- In Sports | 1 |
| Motor Vehicle Crash | 917.1 | Striking Against/Struck Accidentally- Crowd, Collective Fear/Panic | 1 |
| Motor Vehicle Crash | 920.8 | Cutting Object Accident - Other Spec Cut/Piercing Instrument/Object | 1 |
| Motor Vehicle Crash | 922.8 | Firearm Missile Accident - Other Spec Firearm Missile | 1 |
| Motor Vehicle Crash | 965 | Assault by Firearms/Explosives – Handgun | 1 |
| Motor Vehicle Crash | 966 | Assault by Cutting and Piercing Instrument | 2 |
| Motor Vehicle Crash | 968.2 | Assault by Other/Unspec Means - Striking by Blunt/Thrown Object | 1 |
| Not Available | 812 | Other MVA Traffic, Collision w/ MV - Driver of MV, Non MC | 1 |
| Not Available | 812.1 | Other MVA Traffic, Collision w/ MV - Passenger in MV, Non MC | 2 |
| Not Available | 813 | MVA Traffic, Collision w/ Other Veh - Driver of MV, Non MC | 1 |
| Not Available | 816 | MVA Traffic, Loss Control-No Collision - Driver of MV, Non MC | 3 |
| Not Available | 816.1 | MVA Traffic, Loss Control-No Collision - Passenger in MV, Non MC | 3 |
| Not Available | 816.2 | MVA Traffic, Loss Control-No Collision - Motorcyclist | 1 |

| Chief Complaint | E-Code | Description | Records |
|---|---|---|---|
| Not Available | 825.1 | Other MVA N-Traffic, Other & Unspec Nature - Passger in MV, Non MC | 1 |
| Not Available | 826 | Pedal Cycle Accident – Pedestrian | 1 |
| Not Available | 888 | Other and Unspec Fall | 1 |
| Not Available | 914 | Foreign Body Accidentally Entering Eye and Adnexa | 1 |
| Not Available | 916 | Struck Accidentally by Falling Object | 1 |
| Not Available | 928.9 | Other/Unspec Environmental Causes - Unspec Accident | 6 |
| Pedestrian | 813.8 | MVA Traffic, Collision w/ Other Veh - Other Person | 2 |
| Pedestrian | 818.1 | Other Noncollision MVA Traffic - Passenger in MV, Non MC | 1 |
| Pedestrian | 888 | Other and Unspec Fall | 1 |
| Suicide | 818.3 | Other Noncollision MVA Traffic - Passenger on Motorcycle | 1 |
| Water | 828.8 | Accident, Ridden Animal - Other Person | 1 |

The injury site field provides information about where the injury occurred using E894 codes. All records in the data set had injury site indicators as shown in Table 56 which also indicates an unusually high number of records reported that the injury site was a street or highway.

**Table 56 Number of Trauma Records by Injury Site - 2001 and 2002**

| Code | Site | Y2001 | Y2002 | Total |
|---|---|---|---|---|
| E849.0 | Home | 557 | 504 | 1,061 |
| E849.1 | Farm | 12 | 12 | 24 |
| E849.2 | Mine/Quarry | 8 | 8 | 16 |
| E849.3 | Industrial Place and Premises | 120 | 96 | 216 |
| E849.4 | Recreational/Sport | 561 | 709 | 1,270 |
| E849.5 | Street/Highway | 4,488 | 4,604 | 9,092 |
| E849.6 | Public Building | 152 | 151 | 303 |
| E849.7 | Residential Institution | 43 | 24 | 67 |
| E849.8 | Other | 100 | 84 | 184 |
| E849.9 | Unspecified | 148 | 180 | 328 |
| | Total | 6,189 | 6,372 | 12,561 |

Injury type can also be classified as blunt, penetrating, burn or unknown. Classifying injury type by this method is useful as penetrating injuries are often more serious and are more likely to require surgical intervention than blunt injuries. Approximately 84% of records indicated blunt injuries and about 15% were penetrating injuries. Table 57 presents the number of reported injury types among the 2001 and 2002 data.

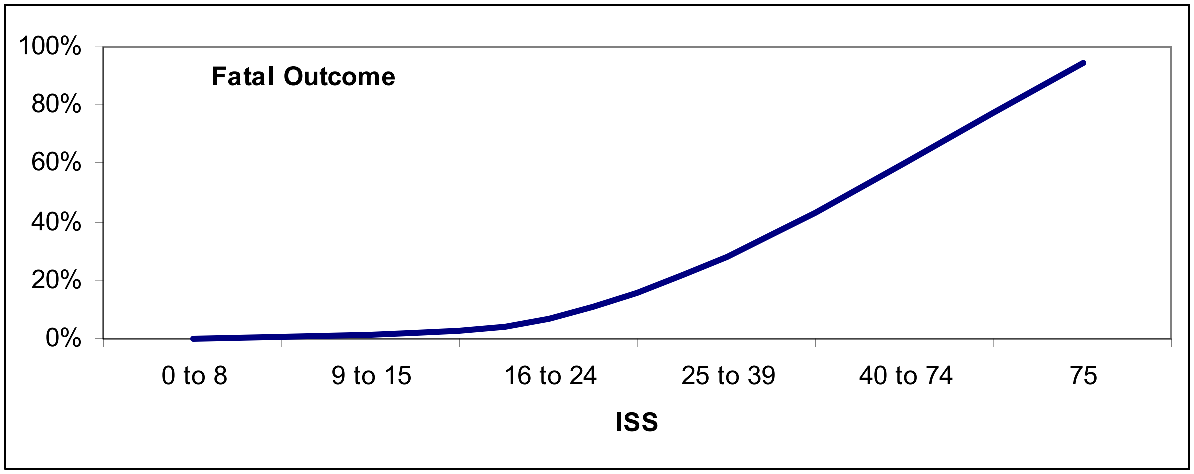
**Table 57 Number of Trauma Records by Injury Type - 2001 and 2002**

| Injury Type | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| Blunt | 5,188 | 5,391 | 10,579 | 84.2% |
| Burn | 51 | 29 | 80 | 0.6% |
| Unknown | 11 | 2 | 13 | 0.1% |
| Penetrating | 939 | 950 | 1,889 | 15.0% |
| Total | 6,189 | 6,372 | 12,561 | 100.0% |

*Injury Outcome*

Approximately 4.4% of records in the Trauma Registry indicated a fatal outcome. The probability of death was strongly predicted by Injury Severity Score as illustrated in Figure 29.

**Figure 29 Mortality by Injury Severity Score - 2001 and 2002**




Other indicators of injury outcome in the Trauma Registry are the post ED disposition of the patient and the patient's hospital discharge status. Table 58 indicates post ED disposition of Trauma Registry patients.

**Table 58 Number of Trauma Records by ED Disposition - 2001 and 2002**

| Disposition from ED | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| AMA | 35 | 49 | 84 | 0.7% |
| DOA (Death) | 46 | 48 | 94 | 0.7% |
| Death | 56 | 59 | 115 | 0.9% |
| Direct Admit | 2 | 0 | 2 | 0.0% |
| To Hospital Floor | 1,911 | 1,880 | 3,791 | 30.2% |
| Home | 1,866 | 1,994 | 3,860 | 30.7% |
| ICU | 796 | 910 | 1,706 | 13.6% |
| Intermed Care | 31 | 24 | 55 | 0.4% |
| Jail | 74 | 69 | 143 | 1.1% |
| Mental Health | 0 | 3 | 3 | 0.0% |
| Not Applicable | 0 | 32 | 32 | 0.3% |
| Not Available | 22 | 5 | 27 | 0.2% |

| Disposition from ED | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| Not Done/Doc | 2 | 0 | 2 | 0.0% |
| Not Recorded | 5 | 0 | 5 | 0.0% |
| OR | 1,014 | 999 | 2,013 | 16.0% |
| Observation | 15 | 4 | 19 | 0.2% |
| P9ICU | 9 | 3 | 12 | 0.1% |
| PICU | 148 | 149 | 297 | 2.4% |
| Telemetry | 122 | 128 | 250 | 2.0% |
| Transfer | 35 | 16 | 51 | 0.4% |
| Total | 6,189 | 6,372 | 12,561 | 100.0% |

Approximately 98% of the 1,706 records that indicated the ED disposition was the Intensive Care Unit (ICU) also indicated the number of ICU days. ICU days can serve as a proxy measure of injury severity or injury outcome.

The ED disposition field indicated that approximately 62% of patients were hospitalized as inpatients. Approximately 83% of records for inpatient admissions also reported hospital length of stay. Approximately 99% of records for patients who were hospitalized as inpatients also included hospital discharge destination.

Table 59 presents a hospital discharge status for patients who were hospitalized as inpatients.

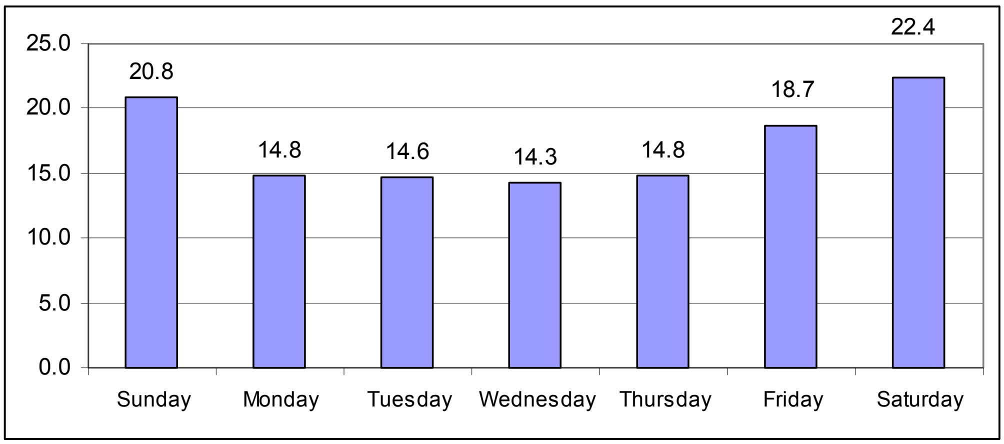
**Table 59 Discharge Status for Trauma Patients - 2001 and 2002**

| Discharge Destination | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| AMA | 30 | 23 | 53 | 0.7% |
| Acute Care Hosp | 51 | 62 | 113 | 1.4% |
| Death | 164 | 177 | 341 | 4.4% |
| Discharged, SNF | 0 | 1 | 1 | 0.0% |
| Group Home | 5 | 2 | 7 | 0.1% |
| Home | 3,037 | 3,050 | 6,087 | 77.8% |
| Home Health | 2 | 12 | 14 | 0.2% |
| Jail | 35 | 33 | 68 | 0.9% |
| Mental Health | 8 | 10 | 18 | 0.2% |
| Not Available | 4 | 15 | 19 | 0.2% |
| Not Done/Doc | 17 | 0 | 17 | 0.2% |
| Not Recorded | 1 | 0 | 1 | 0.0% |
| Nursing Home | 58 | 40 | 98 | 1.3% |
| Psych | 1 | 2 | 3 | 0.0% |
| Rehab | 467 | 510 | 977 | 12.5% |
| Subacute | 0 | 4 | 4 | 0.1% |
| Total | 3,880 | 3,941 | 7,821 | 100.0% |

### *Date Time and Location of Injury*

The Trauma Registry provides considerable information about where and when injuries occur in Nevada. The injury date field is complete for all records in the data set. The average number of records per day shows a cyclical pattern with the highest average number of injuries occurring during weekends. Figure 30 depicts the average number of records by day of the week for 2001 and 2002.

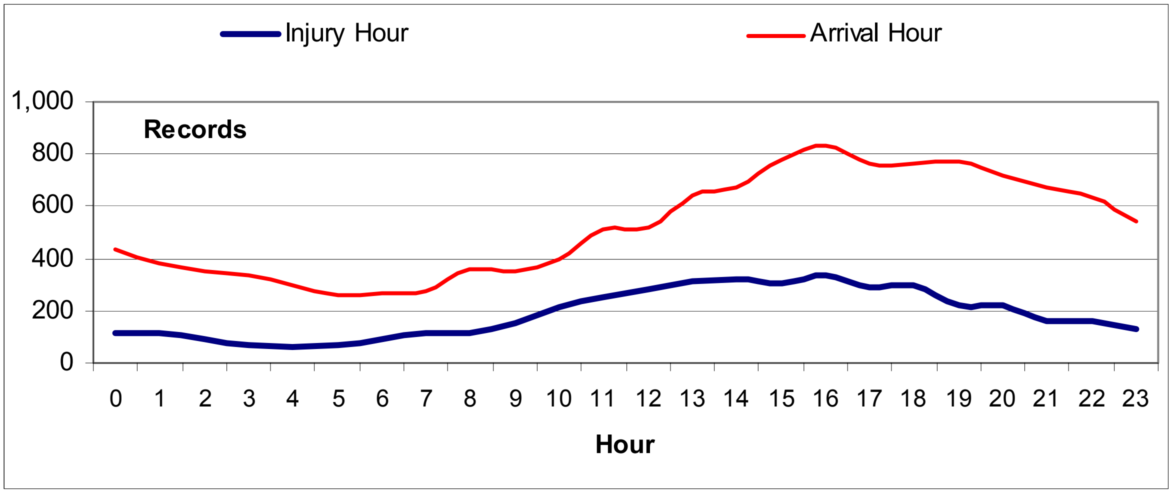
**Figure 30 Average Number of Records by Day of Week - 2001 and 2002**




Injury time is missing in approximately 64% of the records; because hospitals may not have this information, it is difficult to determine whether these missing cases are truly unknown or simply not entered. The remaining records indicate that time of injury appears to be heaviest around the 16:00 - 17:00 hours of the day. Analysis of the ED arrival times showed that arrival times essentially mirrored reported injury times with a peak number of patients arriving between 16:00 and 17:00. Only a very small number of records (34 records) did not have the ED arrival time reported.

Figure 31 depicts the distribution of reported injury and ED arrival times.

**Figure 31 Injury and ED Arrival Times for Patients - 2001 and 2002**




Approximately 2.2% of records (284 records) did not report ED discharge time. Analysis of the difference between ED arrival date and ED discharge date identified three records with a difference of ten or more days. All other records indicated that ED arrival and discharge dates were the same (85% of records), one day after arrival (14.9% of records) or two days after ED arrival (.01% of records). ED length of stay is reported in the data in terms of hours and fractions of an hour. ED length of stay was missing in 4,680 records (37% of records); however, recalculating this field by using the ED arrival date/time and ED discharge date/time reduced the percentage of missing ED length of stay to 308 records (2.2% of records).

All records for patients injured in Nevada indicated the city of injury or at least the area of Nevada in which the injury occurred. Approximately 80% of all injuries occurred in either Las Vegas or the Reno/Carson City/Washoe County area.

**Table 60 Number of Trauma Records by Injury City - 2001 and 2002**

| Injury City | Y2001 | Y2002 | Total | Injury City | Y2001 | Y2002 | Total |
|---|---|---|---|---|---|---|---|
| Unknown, LV | 3,311 | 2,428 | 5,739 | Ely | 11 | 8 | 19 |
| Reno | 770 | 834 | 1,604 | North Las Vegas | * | 14 | 18 |
| Sparks | 201 | 196 | 397 | Verdi | 13 | 5 | 18 |
| Carson City | 141 | 102 | 243 | Carson Co. | * | 14 | 15 |
| Washoe Co. | 74 | 122 | 196 | Pershing Co. | 12 | * | 15 |
| Las Vegas | 62 | 105 | 167 | Stagecoach | * | 10 | 14 |
| Fallon | 111 | 37 | 148 | Beatty | 7 | 6 | 13 |
| Fernley | 62 | 51 | 113 | Boulder City | 7 | 6 | 13 |
| Lovelock | 78 | 31 | 109 | Austin | 10 | * | 12 |
| Churchill Co. | 31 | 49 | 80 | Caliente | 5 | 7 | 12 |
| Gardnerville | 35 | 41 | 76 | Humboldt Co. | 5 | 7 | 12 |
| Pahrump | 40 | 36 | 76 | Las Vegas PO Bo | * | 12 | 12 |
| Sun Valley | 24 | 39 | 63 | Laughlin | * | 9 | 12 |
| Elko Co. | 31 | 31 | 62 | Storey Co. | * | 8 | 12 |
| Washoe Valley | 35 | 27 | 62 | Virginia City | 8 | 3 | 11 |
| Unknown N. Nevada | 22 | 35 | 57 | Zephyr Cove | 5 | 6 | 11 |
| Incline Village | 26 | 27 | 53 | Eureka | 8 | * | 9 |
| Elko | 19 | 31 | 50 | Gabbs | 5 | * | 9 |
| Douglas Co. | 26 | 23 | 49 | Schurz | 5 | * | 9 |
| Henderson | 34 | 13 | 47 | Mesquite | 6 | * | 8 |
| Silver Springs | 18 | 29 | 47 | Nixon | * | 6 | 8 |
| Winnemucca | 20 | 25 | 45 | Spring Creek | * | 5 | 8 |
| Heavenly Valley | 20 | 16 | 36 | Carlin | * | * | 7 |
| Battle Mountain | 16 | 19 | 35 | Indian Springs | * | * | 7 |
| Yerington | 14 | 21 | 35 | Walker Lake | * | * | 6 |
| Dayton | 17 | 16 | 33 | Wells | * | * | 6 |
| Hawthorne | 7 | 26 | 33 | Lander Co | * | * | 5 |
| Minden | 19 | 13 | 32 | Mc Gill | 5 | * | 5 |
| Tonopah | 14 | 15 | 29 | Nye County | * | * | 5 |
| Lyon Co. | 6 | 19 | 25 | Overton | * | * | 5 |
| Wadsworth | 5 | 19 | 24 | Other | 35 | 40 | 75 |
| Gerlach | 9 | 14 | 23 | | | | |
| | | | | Total | 5,487 | 4,692 | 10,179 |

* indicates a value of fewer than 5 cases and has been used to insure patient confidentiality.

Approximately 81% of the records indicated the patient was injured in Nevada and about 7% indicated the person was injured in California. About 10% indicated that the state in which the person was injured was "unknown." Approximately 38% of the 10,179 records that indicated the patient was injured in Nevada had a valid zip code for the place of injury; the remaining 62% of the records did not provide information about the zip code of place of injury.

The Trauma Registry also provided some information about how patients arrived at the trauma center facility including whether the patient was transported by EMS or transferred from another facility. The Emergency Medical Service Unit or other emergency response unit (e.g., ski patrol, fire department) that transported the patient is identified in the EMS field. Approximately 84% of the records identify an EMS/ emergency responder as having transported the patient; 5.5% of patients were identified as being transported by private vehicle or as walk-in patients and 11% did not identify the means of transportation. Table 61 presents the reported transport method for patients injured in 2001 and 2002 and Table 62 presents the reported type of transport method.

**Table 61 Trauma Records by Transport Method for Patients Injured - 2001 and 2002**

| Mode of ED Arrival | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| EMS Transported | 5,147 | 5,375 | 10,522 | 83.8% |
| Not Recorded | 706 | 646 | 1,352 | 10.8% |
| Private Vehicle/Walk-In | 336 | 351 | 687 | 5.5% |
| Total | 6,189 | 6,372 | 12,561 | 100.0% |

**Table 62 EMS Transported Trauma Records by EMS Transport Method for Patients Injured in 2001 and 2002**

| EMS Transport Method | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| ALS | 2,859 | 2,979 | 5,838 | 46.5% |
| ALS/Helicopter | 1 | 127 | 128 | 1.0% |
| Amb/Amb | 159 | 62 | 221 | 1.8% |
| Amb/Fixed Wing | 13 | 0 | 13 | 0.1% |
| Amb/Heli | 367 | 476 | 843 | 6.7% |
| Ambulance | 1,160 | 1,272 | 2,432 | 19.4% |
| BLS | 40 | 12 | 52 | 0.4% |
| BLS/Helicopter | 1 | 1 | 2 | 0.0% |
| Fixed Wing | 33 | 19 | 52 | 0.4% |
| Fixed Wing | 88 | 153 | 241 | 1.9% |
| Helicopter | 945 | 849 | 1,794 | 14.3% |
| ILS | 1 | 2 | 3 | 0.0% |
| Not Available | 15 | 1 | 16 | 0.1% |
| Not Done/Doc | 4 | 1 | 5 | 0.0% |
| Not Recorded | 5 | 30 | 35 | 0.3% |
| Private Vehicle/Walk-In | 484 | 380 | 864 | 6.9% |
| Police | 14 | 8 | 22 | 0.2% |
| Total | 6,189 | 6,372 | 12,561 | 100.0% |

Times for EMS dispatch, scene arrival, scene departure, hospital arrival and scene time, and transport time are recorded in the dataset in 24-hour time format and scene time and transport time is recorded in minutes. Recording is incomplete; among the records with evidence of EMS transport, between 57% and 63% had valid times recorded for dispatch, scene arrival, scene transport, hospital arrival and scene time and transport time (see Table 63 on following page).

**Table 63 Trauma Records with Valid Times for Patients Transported by EMS - 2001 and 2002**

| Time Interval | Y2001 | Y2002 |
|---|---|---|
| Percent With Valid Dispatch Time | 57.39% | 57.77% |
| Percent With Valid Scene Arrival Time | 57.41% | 57.49% |
| Percent With Valid Scene Departure Time | 61.61% | 63.57% |
| Percent With Valid Hospital Arrival Time | 62.37% | 63.91% |
| Percent With Valid Scene Time | 56.67% | 56.93% |
| Percent With Valid Transport Time | 61.38% | 63.31% |

The Trauma Registry captures information about the transferring facility for patients who are transferred from other hospitals, medical offices, urgent care centers, long-term care facilities and group homes. Approximately 12.2% of records indicated the patient had been transferred from another facility. All records indicating transfer also identified the transferring facility. Approximately 6% of records indicated unknown transfer status. Table 64 presents the transfer status for patients transported by EMS in 2001 and 2002.

**Table 64 Transfer Status Among Patients - 2001 and 2002**

| Transfer Status | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| Not Transferred | 4,988 | 5,278 | 10,266 | 81.7% |
| Transferred | 674 | 861 | 1,535 | 12.2% |
| Unknown | 527 | 233 | 760 | 6.1% |
| Total | 6,189 | 6,372 | 12,561 | 100.0% |

## *Safety Equipment*

The safety equipment field indicates reported use of safety equipment such as seat belts, airbags, helmets and flotation devices. Table 65 presents the reported safety equipment usage for patients injured in 2001. Data on safety equipment usage for 2002 was not available at the time of this report but has since become available.

**Table 65 Number of Trauma Records by Safety Equipment Usage - 2001**

| Safety Equipment Usage | Y2001 |
|---|---|
| Not Reported | 551 |
| 2-point seat belt | 112 |
| 3-point seat belt | 868 |
| Airbag | 188 |
| Car seat | 25 |

| | |
|---|---|
| Helmet | 524 |
| None | 3,863 |
| Unknown | 58 |
| Total | 6,189 |

## *Other Factors*

The Trauma Registry does collect some information that may be useful for looking at other factors that might affect injury severity such as seat position or occupant/pedestrian status for those injured in motor vehicle crashes. Cross-tabulating this field with the fourth digit of the E-code (which also indicates seat position/status) showed 100% agreement between the position field and the fourth digit of the E-code. Table 66 presents the reported seat position for patients injured in motor vehicle crashes in 2001 and 2002.

**Table 66 Number of Trauma Records by Seat Position for Patients Injured in Motor Vehicle Crashes - 2001 and 2002**

| Seat Position | Y2001 | Y2002 | Total | Percent of Total |
|---|---|---|---|---|
| Driver | 1,697 | 1,717 | 3,414 | 43.6% |
| Motorcycle Driver | 548 | 643 | 1,191 | 15.2% |
| Motorcycle Passenger | 27 | 41 | 68 | 0.9% |
| Not Done/Doc | 1 | | 1 | 0.0% |
| Other Specified | 29 | 38 | 67 | 0.9% |
| Passenger | 953 | 1,040 | 1,993 | 25.4% |
| Pedal Cyclist | 100 | 107 | 207 | 2.6% |
| Pedestrian | 446 | 432 | 878 | 11.2% |
| Unspecified | 12 | 6 | 18 | 0.2% |
| Total | 3,813 | 4,024 | 7,837 | 100.0% |

The Trauma Registry also provides some information on blood alcohol levels for 509 of the 12,561 records (about 4%). Blood alcohol values in the Trauma Registry range from 0 to 514. Due to a software programming glitch that allowed the decimal point to vary, the range of values appeared to include a number of observations with out-of-range values. An edit during data entry to ensure consistent formatting of values might be helpful.

The database contains no field that describes which factor(s) qualified the case as trauma registry-eligible. Such a field could be helpful for detecting rollovers, assessing the appropriateness of trauma criteria, describing injury circumstances, etc.

## *Costs*

The hospital charges field appears to be reported erratically, with some charges reported as whole dollar figures, and some reported as dollars and cents with decimal points. Reported charges ranged from zero to more than two million dollars. Dividing the total charges by the hospital days provides a way to look at the reliability of hospital charges. The calculated cost per hospital day ranged from $45 per day to more than $160,000 per day. Further examination of the charge data showed that charge reporting appears to be a function of the reporting facility. Only six of the 16 facilities provided charge information as shown in Table 67. Facilities that are not designated as trauma centers are not required to report these data.

Length of stay information appears to be more complete than charge information; although, due to a problem with the NTRACS software, length of stay information was not calculated for about 74% of the records provided to the registry for one large facility (MOY2).

**Table 67 Trauma Records Length of Stay by Institution - 2001 and 2002**

| Facility | Observations | N | Missing | Minimum | Maximum | Average |
|---|---|---|---|---|---|---|
| Washoe Medical Center | 4,600 | 1,217 | 3,383 | 0 | 90 | 6.8 |
| Battle Mountain | 36 | 35 | 1 | 1 | 1 | 1.0 |
| Carson Tahoe | 114 | 111 | 3 | 0 | 92 | 2.0 |
| Churchill Community | 87 | 78 | 9 | 0 | 4 | 1.0 |
| Desert Springs | 19 | 19 | 0 | 0 | 30 | 4.4 |
| Northeastern NV Regional | 167 | 165 | 2 | 0 | 370 | 6.4 |
| Humboldt | 21 | 18 | 3 | 0 | 92 | 7.2 |
| St. Rose Siena | 8 | 7 | 1 | 1 | 3 | 1.4 |
| Pershing | 52 | 51 | 1 | 0 | 1 | 1.0 |
| Saint Mary's Regional | 28 | 27 | 1 | 1 | 11 | 3.4 |
| St. Rose Dominican | 26 | 24 | 2 | 1 | 10 | 3.0 |
| South Lyon | 1 | 1 | 0 | 3 | 3 | 3.0 |
| Sunrise | 33 | 33 | 0 | 0 | 10 | 2.5 |
| William B Ririe | 90 | 89 | 1 | 0 | 1 | 1.0 |
| University Medical Center | 7,279 | 7,245 | 34 | 0 | 347 | 5.8 |

The average charge per hospital day can be calculated by dividing charges by length of stay. Calculating average charge per day is a way to identify whether charges are reasonable (hospital charges are usually about $3,000 to $7,000 per day) and whether an institution is reporting charges as a whole dollar figure or as dollars and cents without a decimal point.

In summary, the hospital charge information appears to be very erratic and not reported, or not reported in the same format, by all facilities. Length of stay may provide a better estimate of the financial consequences of providing inpatient medical care to injured individuals provided that the programming glitch is corrected.

### *Utility of Trauma Registry Data for Injury Surveillance and Limits on Utility*

In summary, the Nevada Trauma Registry data provide much useful injury surveillance information about demographic characteristics of injured individuals, injury severity, volume of injuries, specific types of injuries, mechanism of injury and where people are treated for injuries. These data also provide useful information about EMS care, although some fields are incomplete. The Trauma Registry data have limited usefulness in looking at factors associated with injury such as blood alcohol level. The Trauma Registry data have little value in looking at the financial costs of injury due to the unreliability of charge information.

## Behavioral Risk Factor Surveillance System

The Behavioral Risk Factor Surveillance System Survey (BRFSS) is a nationwide survey developed by the U.S. Centers for Disease Control and Prevention (CDC) and conducted by each state to monitor state-level prevalence of the major behavioral risks among adults associated with premature morbidity and mortality. The underlying philosophy of this survey is to collect data on actual behaviors, rather than on attitudes or knowledge, that would be especially useful for planning, initiating, supporting, and evaluating health promotion and disease prevention programs. The BRFSS survey changes from year to year. CDC develops a standard core questionnaire for states to use to provide data that can be compared across states. Individual states also can add questions. These data are drawn from a telephone survey and, unlike the other data sets evaluated for this project; they represent a small *sample* of the overall population of Nevada and not the entire universe of a sub-population of Nevada residents (e.g., people hospitalized with injuries, people involved in motor vehicle crashes).

The BRFSS data provided for evaluation included the 2000, 2001 and 2002 data sets. The survey questions ask about a wide range of demographic, health status, health care and health-related behaviors, including tobacco use, sexual practices, health screening, physical activity and diet. Only a very limited number of questions on the survey are relevant for injury surveillance. The injury-relevant questions on the 2000 survey are: (1) availability of home smoke alarms, (2) use of bicycle helmets, and (3) the prevalence of drinking and driving. On the 2001 survey the only question relevant to injury surveillance is about the presence of firearms in the residence. The 2002 survey includes questions about: (1) drinking and driving, (2) use of seat belts, and (3) firearms.

# EXAMINATION OF LINKED FILES

## *Linked Hospital-to-Death File*

This file was created by linking the UB92 file to the death certificate file using *AutoMatch* probabilistic linkage software. The probabilistic data linkage method uses common fields in both data sets such as gender, date of birth, hospital and so forth to identify records that are statistically most likely to pertain to the same individual. The hospital file indicated that 5,384 people died as inpatients in Nevada hospitals in 2001. The death certificate file indicated that 5,436 people died as inpatients at the hospitals included in the hospital discharge file. This difference of 52 patients could be due to several factors such as miscoding of the discharge status in the hospital file (some people may have died but were not identified as deaths) or the death certificate file may have identified patients who died as outpatients (e.g., in the emergency department) as inpatients or identified the hospital of death incorrectly.

A total of 5,275 records were linked, meaning that 98% of hospital records matched to a death certificate and 97% of death certificates indicating inpatient deaths matched to a hospital record. Examination of the demographic characteristics of the matched and unmatched records in both data sets showed virtually no differences in the distribution of age and gender between the linked and unlinked records as shown in Figures 32 through 34.

**Figure 32 Comparison of Age Distribution of All Hospital Records for Patients who Died with Records that Linked to a Death Certificate - 2001**

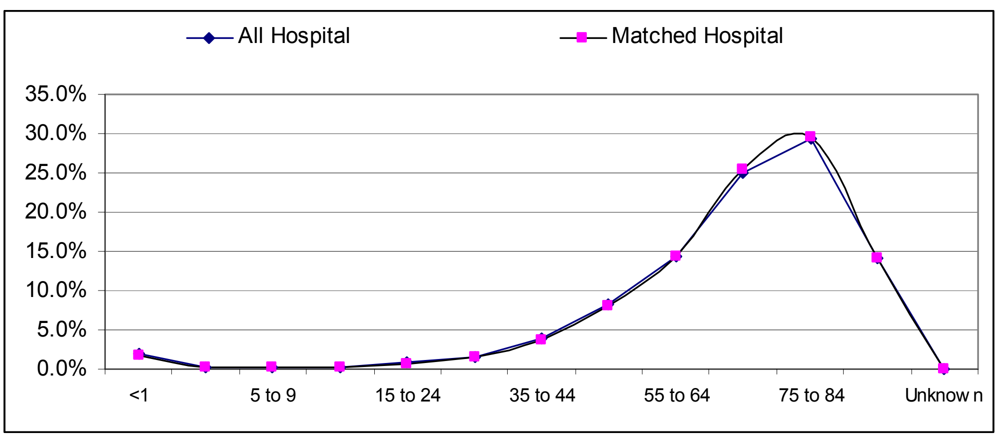


**Figure 33** **Comparison of Age Distribution of All Death Certificates for All Deaths with Records that Linked to a Hospital Record - 2001**

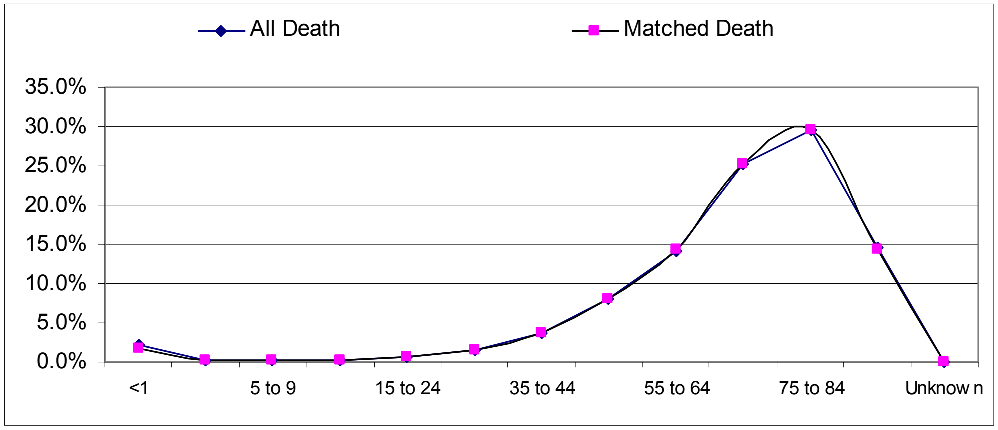
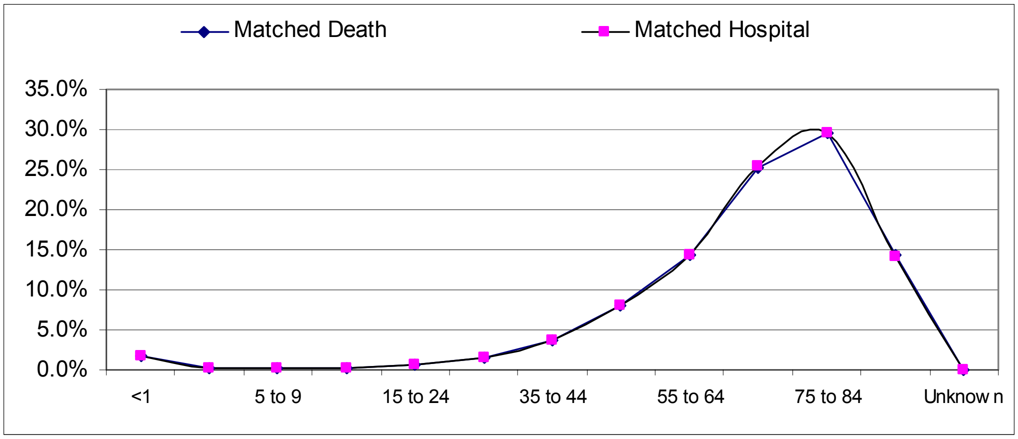



**Figure 34** **Comparison of Age Distribution of Matched Certificates with Age Distribution in Matched Hospital Records - 2001**




Comparison of other key fields such as gender, hospital of death and month of death did not identify any notable differences between the records that were matched and the records that did not match. In short, the matched records appear to be a very good representation of each of the underlying record sets from which they were created.

The linked data set included 236 records where the death certificate file indicated an injury was the cause of death, while there were 380 records that indicated the reason for the hospitalization was an injury as shown in Table 68.

**Table 68 Comparison of Hospital and Death Certificate Codes for Linked Records – 2001**

| | Injury Hospitalization | | Total |
|---|---|---|---|
| | Yes | No | |
| Injury Death | | | |
| Yes | 178 | 58 | 236 |
| No | 202 | 4,837 | 5,039 |
| Total | 380 | 4,895 | 5,275 |

The records in which there is a disagreement between the hospital record and the death certificate suggest several possibilities. It may be that these records are false positive matches. That is, they do not, in fact, pertain to the same individual. The number of false positives can be reduced by raising the cutoff threshold in the matching program, or by trying other linkage strategies. Another possibility is that either the hospital or death certificate files or both may have incomplete or inaccurate coding. A sample of disagreement records should be manually reviewed to identify potential causes.

The death certificate file does add some demographic information not available in the hospital discharge file (e.g., race and ethnic information), although much of the information in the death certificate file (e.g., date of death, age, gender) is already available in the hospital discharge data and vice versa. A good use of the matched file is to compare the diagnostic coding in both data sets. It is possible that hospital records are inappropriately being coded as injury hospitalizations or that death certificates have inaccurate cause of death codes. Also, because the hospital file does not have complete E-coding information, the matched file can be useful for examining mechanism of injury. Table 69 shows a comparison of mechanism of injury between linked and unlinked hospital records.

**Table 69 Mechanism of Injury in Linked and Unlinked Records - 2001**

| Mechanism | Linked Records | All Hospital Records | Percent of Linked Records | Percent of All Hospital Records |
|---|---|---|---|---|
| Poison | 27 | 1,527 | 7.1% | 8.4% |
| Fall | 100 | 3,136 | 26.3% | 17.3% |
| Motor vehicle crash | 20 | 799 | 5.3% | 4.4% |
| Firearm | 10 | 56 | 2.6% | 0.3% |
| Poison | 27 | 1,527 | 7.1% | 8.4% |
| Suicide | 15 | 703 | 3.9% | 3.9% |
| Other | 181 | 10,348 | 47.6% | 57.2% |
| Total | 380 | 18,096 | 100.0% | 100.0% |

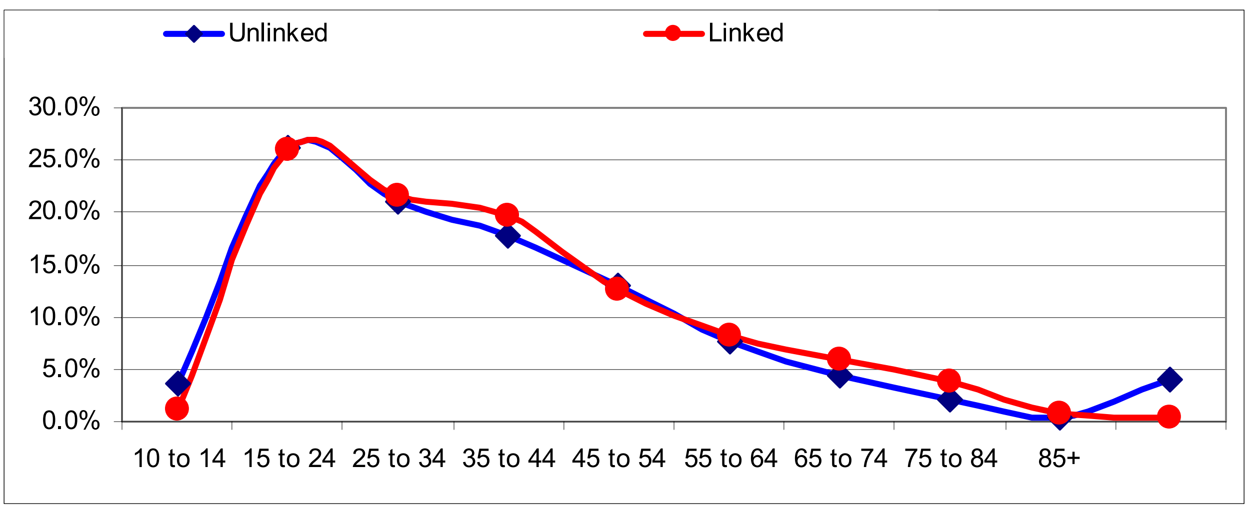
## *Linked Crash-to-Hospital File*

This file was created by linking the 2001 NDOT motor vehicle crash file to the 2001 UB92 file using *AutoMatch* probabilistic linkage software. The crash file had 5,687 records for drivers or pedestrians with Class A, or Class B or fatal injuries. In the hospital discharge file it was difficult to determine how many records were for motor vehicle crash victims due to the low level of E-coding in this file.

The matching was accomplished by matching drivers, pedestrians and passengers in separate matches. Little information was available on passengers, so only a few of this type of matches were expected. The final match produced 602 matches of drivers to inpatient, 257 matches of pedestrians to inpatient records and 32 matches of passengers to inpatient records. Five crash records matched to more than a single hospital record. Combining the files left a total of 920 matched pairs of records.

An examination of the matched pairs found that matched records found similar age distributions between the linked and unlinked files. Figure 35 depicts the age distribution of linked and unlinked records for individuals age 10 and older among motor vehicle occupants.

**Figure 35 Comparison of Crash Record Age Distribution for Unlinked and Linked Records - 2001**




The linked records show some differences from unlinked records in terms of gender and seat belt use. The linked records have a higher proportion of males and non-users of seat belts; however, this is to be expected as males and non-seat belt users are more likely to be injured (and thus hospitalized).

Figures 36 and 37 compare gender and seat belt use for linked and unlinked records.

**Figure 36 Comparison of Linked and Unlinked Crash-to-Hospital Records by Gender – 2001**

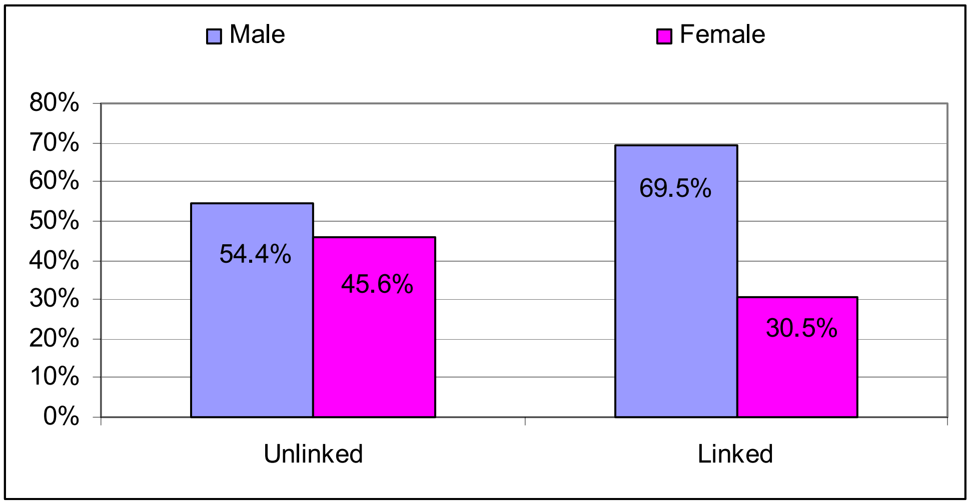
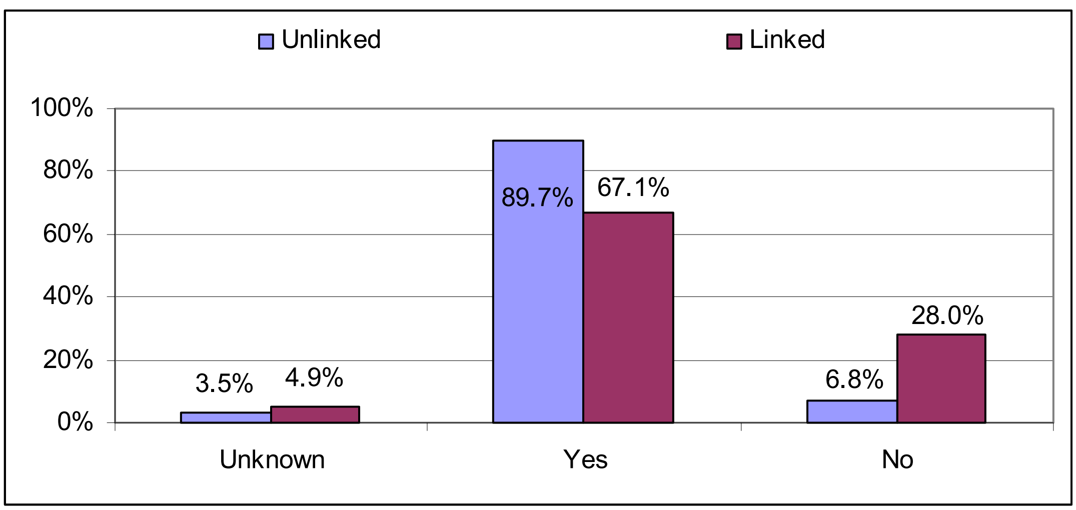



**Figure 37 Comparison of Linked and Unlinked Crash-to-Hospital Records by Seat Belt Use**




## *Potential Uses of Linked Data Sets*

Linked data open new opportunities for research and analysis. Often a single data set does not include all of the data fields needed for analysis. For example, if researchers would like to examine the effectiveness of seat belts, motor vehicle crash data provide information about seat belt usage and other factors that could contribute to the severity of injury (e.g., type of crash, speed limit, seat position), but little information about injury outcome. Hospital discharge data, on the other hand, provide much information about injury outcome (e.g., injury severity, hospital charges, hospital length of stay) but no information about seat belt usage or other contributing factors. Linking crash and discharge data provides an opportunity to overcome the limitations of the individual data sets. By way of illustration, Table 70 presents the average charges and length of stay from linked crash-hospital discharge records for individuals involved in injury crashes in 2001. As Table 70 shows, the average charge and length of stay for individuals using seat belts were substantially lower than charges and length of stay for individuals who were reported not to be using seat belts. An in-depth analysis of the relationship between seat belt use and injury outcome should also examine other independent variables, such as age, sex, seat position, vehicle type and type of crash that could have an effect on injury outcome.

**Table 70 Mean Hospital Length of Stay and Hospital Charges for Seat Belt Users and Non-users Among Linked Crash-Hospital Discharge Records**

| | Seat Belt Non-Users | Seat Belt Users |
|---|---:|---:|
| N | 155 | 371 |
| Mean Length of Stay | 9.5 days | 6.5 days |
| Mean Hospital Charge | $53,187 | $34,411 |

The linked crash hospital discharge data could also be used to examine specific types of injuries associated with crash events or types of crashes. For example, Table 71 shows the percentage of linked records that indicated traumatic brain injuries, spinal cord injuries, hip fractures, lower leg fractures, and pelvic fractures for pedestrians, motorcyclists, and for drivers and non-drivers of passenger cars. As Table 71 shows, motorcyclists appear to be at much greater risk for traumatic brain injury, lower leg fractures and pelvic fractures than occupants of passenger cars. Pedestrians appear to be at greater risk for lower leg fractures. Drivers of passenger cars appear to be much more likely to have any of these types of injury than non-drivers.

**Table 71 Injuries for Pedestrians, Motorcyclists, Passenger Car Drivers and Non-Drivers Linked Among Crash-Hospital Discharge Record**

| | Pedestrians N=203 | Motorcyclists N=109 | Drivers Passenger Cars N=459 | Non-Drivers Passenger Cars N=59 |
|---|---:|---:|---:|---:|
| Traumatic Brain Injury | 22.6% | 15.6% | 16.3% | 15.3% |
| Spinal Cord Injury | 11.8% | 23.9% | 25.5% | 3.4% |
| Hip Fracture | 1.0% | 1.8% | 3.5% | 0.0% |
| Lower Leg Fracture | 41.5% | 39.5% | 20.7% | 10.2% |
| Pelvic Fracture | 16.3% | 9.2% | 11.1% | 0.0% |

For this project, two linked data sets were developed (motor vehicle crash-to-hospital discharge data and hospital discharge-to-death certificate data). A variety of other linked data sets could be developed given the high level of personal identifiers available in many of the injury data sets available in Nevada. These could include linking crash data to trauma registry data, linking trauma registry data to hospital discharge data and linking death certificate data to crash data. Linking these other data sets will provide additional opportunities to examine a wide range of issues. In addition, linked data may also be useful for evaluation of the reliability or completeness of reported data. For example, analyses of police reports of injury severity could be compared to hospital reports or trauma registry data to derive estimates of the validity of police-reported injury severity. Additionally, police reports of alcohol involvement could be compared to blood alcohol levels reported in linked trauma data.

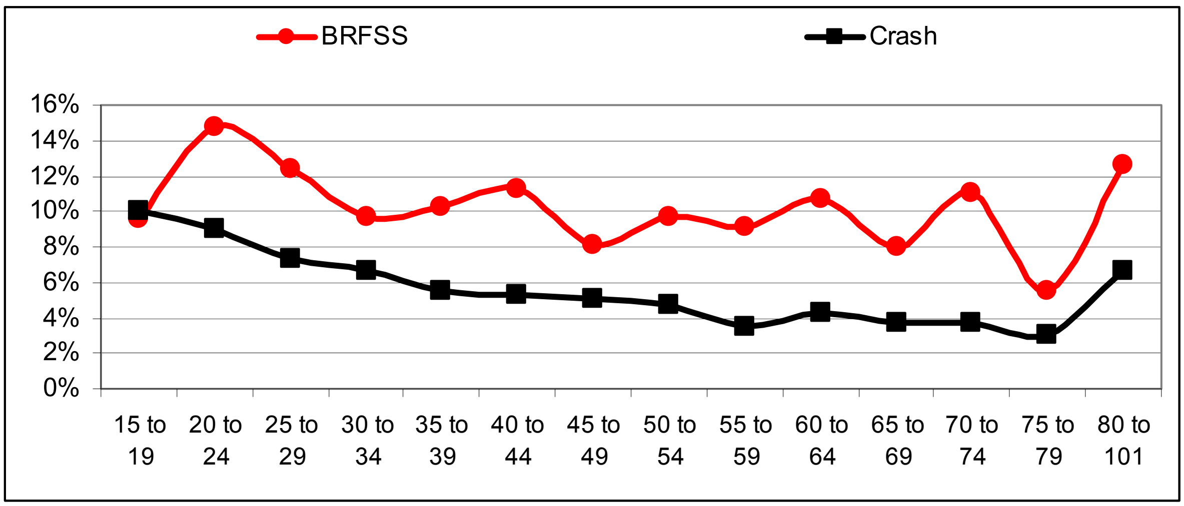
### *Comparison of Files to One Another*

Each of the data sources evaluated in these analyses looks at injury data from a different perspective but there is some overlap between the data sources. For example, the crash file provides information about police-reported seat belt use while the BRFSS file provides an estimate of self-reported seat belt usage. Theoretically, these overlaps in data from each file should agree or at least be relatively similar to one another. A large disagreement between data sources may point to validity, reliability or completeness problems in one or both of the files. If, on the other hand, similar results are obtained in separate independent data systems, we can have more confidence that the data are in fact reliable and valid.

*Crash Reported Seat Belt Use Versus BRFSS Reported Seat Belt Use*

As was noted earlier, seat belt usage in the crash data appears to be unbelievably high (about 91% of those in injury crashes reported to be using seat belts). The BRFSS data also collect information on seat belt usage. One way to check the validity of these data is to compare non-usage rates by age group. While neither number may be correct, if the data show similar trends among age groups this would provide more credibility that there are in fact real differences in seat belt usage between age groups. Indeed, comparing non-usage rates between the two data files does show that non-usage appears to decline with age and then swings up again in senior citizens as shown in Figure 38.

**Figure 38 Comparison of Non-Usage of Seat Belts in 2001 NDOT Crash Data with 2002 BRFSS Data**




*Comparison of Crash Reported Motor Vehicle Deaths to Death Certificate Reported Motor Vehicle Deaths*

The NDOT crash data and the death certificate data both provide information about deaths that occur in Nevada due to motor vehicle crashes. The death certificate file indicates a total of 358 motor vehicle crash deaths in Nevada in 2001 while the crash file indicates only 255 motor vehicle crash deaths. However, when including only Nevada residents in the death certificate file the number of motor vehicle deaths in the crash file is only 264. The difference between the crash and death certificate file may be because some of the motor vehicle crash deaths that occur in Nevada may be from injuries incurred in crashes in other states. These patients may be transferred to trauma hospitals in Las Vegas or Reno where they subsequently die. Presumably, Nevada residents who die in Nevada from injury crashes are more likely to be injured in Nevada crashes, although some of these may also be injured in out-of-state crashes and transferred to Nevada hospitals. In summary, it appears that the crash and death certificate files do report similar numbers of motor vehicle crash deaths.

*Comparison of Hospital Reported Injury Deaths to Death Certificate Reported Injury Deaths*

The hospital discharge data and the death certificate file both provide information about injury-related deaths that occur in hospitals. The hospital discharge data showed 294 deaths for patients whose first diagnosis was an injury, while the death certificate file showed only 209 deaths for injury related deaths. As shown in Table 72, the greatest discrepancy appears to be at two facilities (hospitals UM and HS). Perhaps the difference can be attributed to how these two facilities code records or complete death certificates.

**Table 72 Comparison Between Discharge Data and Death Certificate Data for Reported Deaths - 2001**

| Hospital | Deaths Among Patients With Injury in First Diagnostic Field | Death Certificate Injury Deaths | Difference |
|---|---|---|---|
| Boulder City | 1 | 0 | 1 |
| Carson Tahoe | 5 | 1 | 4 |
| Churchill Community | 1 | 1 | 0 |
| Desert Springs | 5 | 7 | -2 |
| Northeastern NV Regional | 3 | 1 | 2 |
| Sunrise | 38 | 23 | 15 |
| Humboldt | 1 | 0 | 1 |
| Lake Mead | 4 | 2 | 2 |
| Mountain View | 11 | 2 | 9 |
| Nye Regional | 1 | 0 | 1 |
| South Lyon | 1 | 0 | 1 |
| Northern Nevada | 2 | 0 | 2 |
| Saint Rose Sienna | 4 | 2 | 2 |
| Saint Mary's Regional | 17 | 10 | 7 |
| Saint Rose Dominican | 2 | 4 | -2 |
| Summerlin | 5 | 6 | -1 |
| University Medical Center | 106 | 70 | 36 |
| Valley | 13 | 8 | 5 |
| Washoe Medical Center | 74 | 72 | 2 |
| Total | 294 | 209 | 85 |

*Comparison of Number of Inpatient Hospital Injury Records with Trauma Records*

Nevada legislation requires that seriously injured patients be entered into the state trauma registry. The 2001 trauma registry showed that 14 facilities submitted data to the registry. The 2001 hospital discharge data showed that 16 facilities had patients with an Injury Severity Score of 16 or greater as shown in Table 73. (All information needed to determine eligibility for the trauma registry database is not available in the hospital discharge database. The ISS provides a reasonable estimate of cases that would be eligible.) Five facilities had only one or two patients with an ISS of 16 or greater. Together, these data suggest that the trauma registry is probably collecting trauma records from most or all facilities that should be submitting data to the registry. A crosswalk of identification codes for the two databases would be needed to analyze submissions by hospital.

**Table 73 Injury Severity Score Among Injury Hospitalizations by Facility - 2001**

| Hospital | Injury-Related Discharges | Discharges ISS >=16 |
|---|---:|---:|
| Battle Mountain | 3 | 0 |
| Boulder City | 118 | 2 |
| Carson Tahoe | 771 | 8 |
| Churchill Community | 112 | 4 |
| Desert Springs | 906 | 25 |
| Northeastern NV Regional | 304 | 11 |
| Grover C Dils | 13 | 1 |
| Sunrise | 2,314 | 114 |
| Humboldt | 31 | 1 |
| Incline Village | 3 | 1 |
| Lake Mead | 583 | 12 |
| Mount Grant | 8 | 1 |
| Mountain View | 849 | 7 |
| Nye Regional | 24 | 0 |
| Pershing General | 10 | 0 |
| South Lyon | 13 | 0 |
| Northern Nevada | 345 | 0 |
| Saint Rose Sienna | 718 | 9 |
| Saint Mary's Regional | 997 | 37 |
| Saint Rose Dominican | 623 | 11 |
| Summerlin | 709 | 9 |
| University Medical Center* | 4,587 | 649 |
| Valley | 1,127 | 41 |
| Washoe Medical Center* | 2,843 | 370 |
| William B. Ririe | 85 | 2 |
| Total | 18,096 | 1315 |

* Indicates Level I or II Trauma Center

# VII. ANALYSIS OF NEVADA'S INJURY SURVEILLANCE DATABASES AS A SYSTEM - STRENGTHS, WEAKNESSES AND GAPS -

The previous section assessed the contents of each of Nevada's injury-related databases. While deficiencies were found in each of the databases, strengths were more prevalent. Overall the data collected appeared to be accurate and timely. Field contents appeared to be appropriate and well edited. Data for most fields was reasonably complete. Where similar data was collected in more than one database, the data compared across databases was consistent. As a result, the quality of the data was such that the researchers were comfortable using many of the fields to produce a companion report that provides a brief overview of injuries in Nevada (see *Nevada's Injury Data Surveillance Project - An Overview of Injuries in Nevada*).

To refer to this array of databases as a "system," however, is somewhat inaccurate because (as is true throughout the U.S.) Nevada's individual databases do not yet form a cohesive whole. Physically, the databases are stored and made available through a variety agencies rather than through a central location. Structurally, the databases at times use a different coding format to store the same information. Conceptually, the databases take different approaches – from the requirement to include all cases (e.g., the Hospital Discharge database) to including only those that meet selected criteria (e.g., the Safety Management System includes only crashes in which injuries occurred or property damage exceeded $250).

Most importantly, the databases cannot be said to form a complete system because they do not comprehensively address the issue of injuries. A number of significant gaps exist. These "deficiencies" or "gaps" exist because the databases were developed at different *times* for different *purposes* by different *groups*. One of the key databases, the Safety Management System for motor vehicle crash data, was not even developed primarily for the purpose of providing health care data. (This database was originally developed to serve the needs of the Nevada Department of Transportation, such as engineering and crash prevention. The volume of injuries associated with traffic accidents; however, has resulted in its becoming a valuable resource for health professionals.) Gaps also exist because several key databases have not yet been developed or made available on a statewide basis.

There are five key types of informational "gaps" present in the Nevada injury surveillance system – injury occurrence gaps, database gaps, database case gaps, database field gaps and field content gaps. Each is described briefly in the following paragraphs.

## Gaps in the Nevada Injury Surveillance System

### *Injury Occurrence Gaps*

Injury occurrence gaps are injuries that are not identified because the injured individuals do not come into contact with any component of the medical, legal or governmental system that would collect information about the injury. This lack of contact most often occurs in cases of non-fatal injuries for which no medical treatment is required and in cases of non-fatal injuries that should receive medical treatment but, for a variety of reasons, do not.

Injuries that require no medical treatment are of interest to public health workers; however, because of their minor severity, they are of lower priority for targeting Nevada's prevention and reduction efforts.

In contrast, injuries that should receive treatment, but do not, are of significant concern and present difficult challenges. Since most injury surveillance data is obtained through medical service providers (e.g., hospital discharge records, emergency department records), untreated injuries are difficult to count. Health surveys are the most widely used means of counting these injuries. Addressing the root causes of these occurrence gaps can bring these individuals into the treatment system and, consequently, to the attention of injury surveillance. Root causes may include:

- ❑ not seeking treatment due to lack of insurance
- ❑ not seeking treatment due to lack of education regarding the seriousness of the injury and its consequences
- ❑ lack of ready access due to geographic and/or transportation barriers
- ❑ mental health/legal issues

### *Database Gaps*

Databases can be created to track injuries that come to the attention of some component of the medical, legal or other governmental system. Database gaps occur when no database exists for a significant component of the system. The Nevada system of databases does not describe the volume and types of services provided at several key points in the injury treatment continuum (e.g., ambulance services, emergency departments, skilled nursing facilities, outpatient rehabilitation services). Data on other injury-related issues (e.g., prevalence of risk behaviors, use of protective devices) can also be collected via surveys, research studies, etc. Clearly, collecting extensive data on all injuries and all services would be both impractical and cost-prohibitive. For this reason, STIPDA has recommended a minimum set of databases that states should include in an injury surveillance system.

**TABLE 74 Comparison of Databases Recommended by STIPDA with Databases Currently Available in Nevada**

| DATABASE NAME | AVAILABILITY IN NEVADA |
|---|---|
| Death Certificates | Yes |
| Medical Examiner/Coroner System | Yes, at county level |
| Fatality Analysis Reporting System (FARS) | Yes |
| Child Death Review Data | Unknown – recommend to pursue |
| Inpatient Acute Hospital Discharge Data | Yes |
| Emergency Department Data | Collected by individual hospitals in various formats (paper logs, electronic systems) and containing varying amounts of data, but not compiled statewide |
| Emergency Medical Services (EMS) data | Collected by individual EMS units in various formats and containing varying amounts of data, but not compiled statewide |
| Uniform Crime Reporting (UCR) System | Unknown – recommend to pursue |
| National Occupant Protection Use Survey (NOPUS) | Unknown – recommend to pursue |
| Behavioral Risk Factor Surveillance System (BRFSS) | Yes |
| Youth Risk Behavior Surveillance System (YRBSS) | Yes |

The following paragraphs describe several key database gaps and the impact of their absence:

Emergency Department Data. Over 29.5 million people were treated for injuries in U.S. emergency departments in 2000;[5] however, only 12 states have established statewide databases that collect data on emergency department visits. Nevada does not have a statewide database into which all emergency department visits are compiled. *This lack of emergency department data presents a significant database gap in Nevada's injury surveillance system.*

Death and hospitalization databases, for example, do not contain reports for all firearm injuries – many of which are treated in emergency departments and released. A study in neighboring Washington State showed that only 36% of non-fatal firearm injuries are hospitalized – the remaining 64% are treated in emergency departments and released. For these firearm injuries, as for many other minor to moderate injuries, Nevada has no centralized source of information.

Emergency department data is important not only as a source of injury data, but for other areas of public health. Most prominent recently is the monitoring of emergency department data to provide an infrastructure for rapid and early detection of epidemics and chemical/biological terrorism. Because of its potential for multiple uses, it is important that the efforts to collect, standardize and centralize the data be coordinated among all potential users.

Standardizing data sets to national recommendations has advantages in that it minimizes duplication of planning efforts and produces data sets that are comparable for research and monitoring. The Frontlines of Medicine Project, for example, provides a suggested set of variables for an emergency department encounter database.[6] CDC is involved in a number of efforts which can contribute ideas to or serve as models for Nevada in creating the emergency department data system especially the Data Elements for Emergency Department Systems (DEEDS), which is a national effort to systematize data collection within emergency departments and provide data for patient treatment as well as disease and injury surveillance. The National Electronic Disease Surveillance System may serve as a model as could The National Electronic Telecommunications System for Surveillance, which collects, transmits and analyzes weekly reports of notifiable diseases.

<u>Emergency Medical Systems (ambulance/emergency responder) Data</u> Although individual emergency medical systems companies collect data on ambulance runs throughout Nevada, there is no centralized database in which these data are compiled and analyzed. *This is another significant database gap in Nevada's injury surveillance system*. This data could be used to address a number of key issues in medical services planning and evaluation, for example:

- Transport time – EMS personnel generally track the amount of time from dispatch to arrival, time on scene and time from the scene to arrival at the hospital. This data can be useful for planning the number, geographic placement and staffing of EMS companies; for assessing 911/notification processes; for determining EMS levels of care needed; for assessing the need for services such as advanced life support and central radio command, etc.

- Patient status indicators – As the first medically trained personnel who see a patient, EMS personnel can provide early information on vital signs and other medical status indicators that describe injury severity, type, etc. This information can be used by for medical researchers to categorize or severity-adjust patients and thus more accurately compare results of various treatments. It can also be used to examine issues such as transport patterns and outcomes (e.g., direct transport of severe cases to trauma centers vs. transport to community hospitals for stabilization followed by transport to trauma centers).

- ❑ Case types and severity – Studying the types and severity of injuries handled by EMS personnel by region can help in planning EMS and emergency department training and staffing activities.

Outpatient Medical Services   Outpatient data is not fully centralized in any state, although estimates on outpatient volumes and services have been made by CDC and by various HMOs/medical insurance plans using medical claims data.

Physician Office Services   Physician office data is not fully centralized in any state.  HMOs and other medical insurance plans collect medical claims data on physician office visits.  The data is often incomplete (due to payment policies, lack of detail on capitated services provided, poor data submission, etc.), but can be helpful for studying volume, treatments and long-term costs.

Skilled Nursing Facility/Long Term Care.  This data can be useful for measuring the long-term impact of injury in terms of disability and costs.

Rehabilitation Facility   Rehabilitation hospitals and outpatient rehabilitation facilities may provide services (e.g., physical therapy, occupational therapy) after or instead of hospitalization at an acute care facility.  Data from these facilities provides a more complete picture of costs.  The facilities also can provide information on disabilities, level of function, treatments needed, etc.

Non-public hospitals   Nevada's inpatient acute hospital discharge database does not include inpatient hospitalizations at federal hospitals such as Veterans Administration facilities and military hospitals.

## *Database Case Gaps*

Database contents gaps occur when a database exists and when an injury qualified for inclusion in that database is not included.  This can occur, for example, if an individual trauma case is not identified by hospital personnel as meeting the criteria for inclusion in that database.  It can also occur on a more global basis – as when an entire hospital does not submit its data to a database.  In the Nevada databases, there appeared to be few case gaps (except potentially for missing data from some hospitals in the trauma registry database).

## *Database Field Gaps*

Regarding those databases that do exist, there are specific pieces of information which, ideally, should be found within those systems, but which are not collected.  These have been identified in the previous review of the individual databases (Section VI).  Table 75  provides a summary of key missing field

## TABLE 75 Minimum Data Categories and Sample Data Fields Required for a Trauma Surveillance System

Cells shaded in green appear to be complete, reliable and valid. Cells in yellow are incomplete or unreliable. Cells in red are not available. Cells in gray are not applicable.

| DATA CATEGORY | SAMPLE DATA FIELDS* | Crash | Hospital | Trauma | Death |
|---|---|---|---|---|---|
| Data completeness/duplication | presence of duplicate records | | | | |
| | data appears complete (no gaps or missing records) | | | | |
| Incident Description | mechanism of injury (e.g., crash, assault, fall) | | E-coding low | | |
| | E-codes | | Incomplete | | |
| | date/time | | No times currently – on new format | Injury times incomplete | Time of Death not available |
| | geographic location (county, zip) | | | | |
| Contributing Factors | risk behaviors/contributing factors | Only one contributing factor | | No pre-existing conditions | Contributing causes not listed |
| | seat belt/helmet usage | Seat belt usage appears high | | | |
| | activities at time of injury | | | | |
| | profession (if work-related) | | | | |
| | drug/alcohol use at time of injury | Alcohol field may be incomplete | | Alcohol data is collected in various formats | |
| | weather | | | | |
| | speed limit | | | Not collected | |
| Demographics | age | | | | |
| | gender | | | | |
| | race/ethnic group | | Not currently – on new format | | |
| | residence | only for driver | | Not collected | |
| Injury Description | diagnosis code | | | | |
| | body part | | | | |
| | severity | | | Glasgow + Trauma | |
| | blunt vs. penetrating | | | | |
| Safety Device Usage | seat belt use | Seat belt usage appears high | | | |
| | child seat use | not currently– on new version | | | |
| | bicycle helmet use | not currently– on new version | | | |
| | type of care (e.g., ambulance, ED, acute hospital, rehab hospital, nursing facility) | not currently– on new version | | | |
| Medical Care Providers Used | name/identification | | | | |
| | trauma care preparation (e.g., hospital trauma accreditation level, EMS level) | not currently– on new version | Available Outside of Database | Available Outside of Database | |
| | diagnostic procedures | | | | |
| Medical Care Provided | treatments | | | | |
| | operative procedures | | | | |
| Injury Outcomes | economic costs | | | Charge data in various formats | |
| | deaths | | | | |
| | discharge destination (home, nursing home, etc.) | | | | |
| | disabilities | | | not collected | |

* Table provides only a sampling of key fields that should be included. A full array of fields should be identified using national recommendations, model databases and input from users.

Adding to or modifying database field contents, coding and layout generally involves a long and laborious process because of: (a) the difficulty in defining the information needs of a variety of users, (b) the need to assess impact of the potential changes on data collectors (e.g., increased/decreased collection time, ease of obtaining the desired information), (c) the challenges of selecting the most useful structure and format for the changes, and (d) the associated costs for the organizations and users involved (e.g., programming costs, re-training efforts). To ensure that the resulting data is truly useful, a representative group of database holders, collectors and users should work together to plan changes.

National standards or recommendations are available for many databases. Use of these (generally voluntary) guidelines can have many benefits, including fostering the ability to easily make comparisons of Nevada data with data from other states. Layouts of databases from states that have already implemented and used a database (and thereby experienced much of the planning, critiquing and revising which goes into creating a useful array of data) can also serve as useful models.

### *Field Contents Gaps*

This final type of gap occurs when a field exists but data is not completely or consistently entered. This type of gap existed to some degree in all databases examined. Significant examples were shown previously in Table 75; two are the most significant examples are described below:

- Within the Trauma Registry database, Scene Glasgow Coma Score is missing in 19% of cases transported by EMS and Scene Trauma Score is missing in about 26%.

- In the hospital discharge database, E-code information is recorded in only about 40% of cases with an injury diagnosis (see following section for further discussion of E-codes).

## Identification of Additional Problems with the Nevada Databases

### *E-codes*

E-codes are alphanumeric codes that describe external causes of injuries. The codes begin with an "E," which is followed by three numeric digits and, for some, a decimal and an additional digit. E-codes describe: (a) the mechanism of injury (e.g., motor vehicle, fall, burn); (b) whether the injury was violence-related (e.g., assault, self-inflicted); and (c) for unintentional injuries, location of occurrence (e.g., home, industrial site). Most national and Nevada health databases use the ICD-9-CM E-coding system. The Nevada death certificate data is coded using the newer ICD-10 version, which is intended to provide more detailed data on injury circumstances.

Nationwide, 42 states and the District of Columbia reported having a statewide hospital discharge data system.[7] Thirty-six of the 42 states (85.6%) routinely collect E-codes in that system; and 23 (54.8%)

mandate the submission of E-codes. Nevada has a statewide hospital discharge database and collects E-codes; however, the use of E-codes by the hospitals is not mandated. It appears that states which mandate E-coding are more likely to have these codes submitted on records of injury related cases (86.5% average) than states which do not mandate the practice (58.2%).

Only 12 states have a statewide Emergency Department database; eleven collect E-code data and 9 have mandated E-code submission.

Trauma registries have been established in 17 states and the District of Columbia; all routinely collect E-codes.

## *Coding and Formatting*

As noted in Section V, the coding of diagnoses, mechanism of injury, race/ethnicity and other fields should be the same across databases in order to facilitate comparisons, correct interpretations of data and data linkages. Consistency in formatting (e.g., using the name number of digits to record dates) can also facilitate programming of reports and data linkage.

Fortunately, Nevada's database designers have in many cases chosen to use common or national standard systems for many of their fields as required by the Health Insurance Portability and Accountability Act (HIPAA). Diagnosis codes, for example, are coded using the ICD-9-CM system (except for in the Death Certificate database, which uses ICD-10 codes instead). Use of these national systems will facilitate comparisons both among Nevada's databases and with other state and national databases.

# VIII. RECOMMENDATIONS

This report has focused on evaluating the injury-related databases available in Nevada and assessing their utility (both individually and as a system) for injury surveillance. Nevada has a number of excellent databases available to form the foundation of an injury surveillance system. The following recommendations are offered to identify several of the highest priority actions which would help turn those individual databases into an effective injury surveillance system.

**Recommendation 1: Establish a Trauma Data and Research Advisory Board.**

A board should be created to coordinate the multi-agency efforts required to develop and operate an effective trauma surveillance system. The board's tasks would include:

- ❑ Coordinate data efforts among agencies, including database design and modification of current databases (e.g., addition of new fields and the standardization of coding systems);
- ❑ Guide the establishment of new statewide databases for emergency department data, emergency medical services data, etc.;
- ❑ Identify and prioritize injury research, reporting and education needs;
- ❑ Guide report development and dissemination of injury data;
- ❑ Provide for centralized access to injury data and injury databases; and
- ❑ Report information regarding statewide data efforts and other databases back to their agencies;
- ❑ Table 76 presents a sample of recommended members and their expected contributions.

**TABLE 76 Recommended Composition for a Trauma Data and Research Advisory Board**

| GROUP | EXAMPLES OF REPRESENTATIVES | PRIMARY CONTRIBUTIONS |
|---|---|---|
| Data Contributors | Inpatient Hospitals<br><br>Emergency Medical Services<br><br>Department of Transportation<br><br>Trauma Registry<br><br>Office of Vital Stats - Death Cert. | Represent needs/interests of data collection personnel and contributing organizations<br><br>Report information regarding statewide data needs back to their organizations<br><br>Coordinate coding systems, data format, etc. among databases |
| Frontline Data Users | Nevada State Health Division<br><br>Agencies/groups active in injury prevention<br><br>Medical professional groups<br><br>Colleges/Universities<br><br>Public health educators | Identify data needs for research, reporting and public health education<br><br>Identify and prioritize trauma study topics<br><br>Identify effective venues for disseminating trauma data |
| Data/Research Experts<br><br>(These skills can often be found among individuals who represent the Data Contributors and/or Data Users) | Bio-statisticians<br><br>Epidemiologists<br><br>Database developers<br><br>Programmers | Ensure statistical validity and reliability of data reporting and interpretation<br><br>Ensure appropriate design of research studies<br><br>Guide development/modification of database structure and format<br><br>Provide recommendations on hardware, software, communications and security |
| Public | Patient advocacy organizations<br><br>Schools (e.g., drivers ed, health and physical education teachers) | Represent public education needs<br><br>Preview public reports and educational materials |

**Recommendation 2: Expand the existing Data Warehouse.**

As indicated throughout this report, Nevada has a wealth of injury-related data useful for injury surveillance activities and has built a substantial infrastructure to maintain these data. In addition, Nevada has related public health information that may be useful for looking at the relationship between injury and other public health problems and issues (e.g., mental health, alcohol and substance abuse, maternal and child health, long term care).

Housing these data sets in a common data warehouse and developing expertise in the matching of these data sets with one another would provide an exceptional ability to truly understand the impact of injury on public health in Nevada.

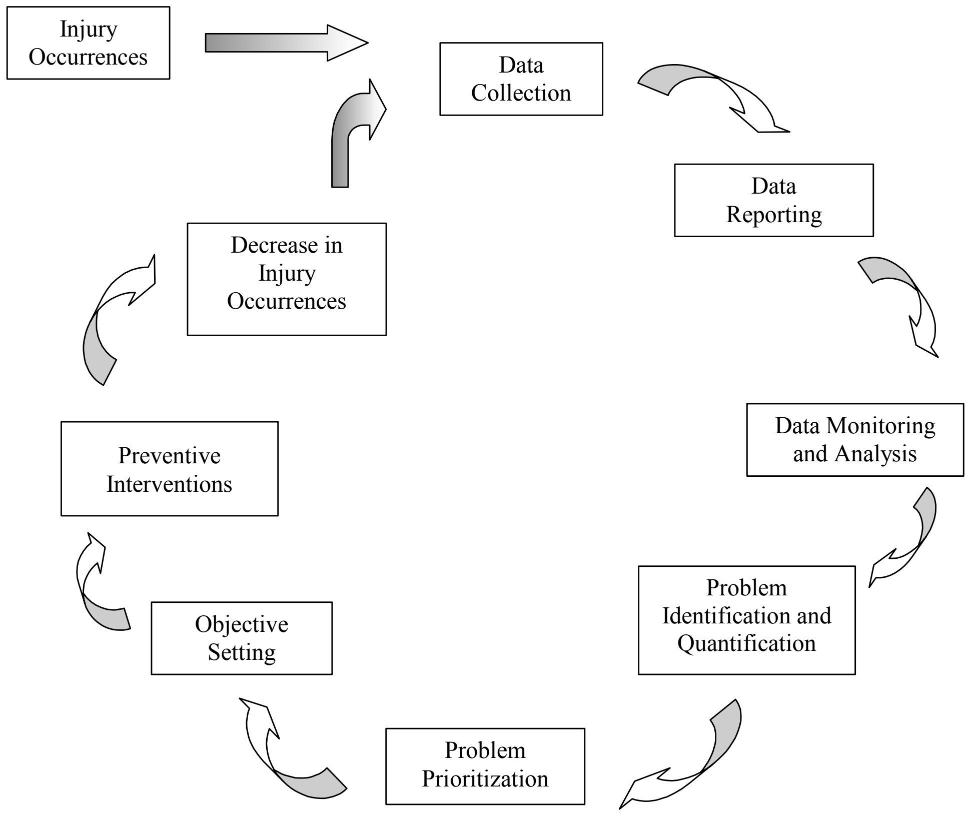
Fully exploiting this capability will require developing mechanisms for establishing common identifiers across databases to improve matching and linking databases within the warehouse. Data in such a public health data warehouse should also be available for State Health Division and other health professionals within the state, as well as through the Internet for national access via the Nevada Interactive Health Database. Similar public health data warehouses are being developed within state health departments in other states such as the Michigan Department of Community Health, the Maine Department of Health and the Kansas Department of Health and Environment.

The State Health Division already has acquired key software to support such a data warehouse, including Oracle 9i Enterprise Edition and Application Server, Integrity matching software, ArcIMS mapping software. Additional software that should be considered for inclusion in the data warehouse are ICDMAP software for are calculating injury severity from ICD-9 diagnostic codes and address matching-geo-coding software to develop GIS coordinates for address information in the available data sets. Additionally, the State Health Division has developed an interactive web site that can be queried by end-users.

**Recommendation 3: Develop an array of standard reports and analysis procedures.**

This report, *Analysis of the Injury Surveillance Data System in Nevada*, has focused on the collection and compilation of data into a data surveillance system. Data collection is just the beginning of a process of reporting, analysis and action (See Figure 39) that results, ideally, in a decrease in injuries. Nevada has already implemented Step 1 – the collection of data – through the databases studied in this report. That data collection effort can be further enhanced by making changes and enhancements recommended in this report. In order to effectively use the data, the next key steps for Nevada must be to design and produce an array of standard reports and to implement timely monitoring and analysis of those reports.

**Figure 39 The Injury Surveillance and Reduction Cycle**




## Characteristics of the Reporting Package

Among the characteristics required of the reporting package are the following:

- Comprehensive – The report package should serve as a tool to the variety of organizations involved in preventing and caring for injuries. It should include reports which provide information for assessing injuries, prioritizing injury prevention efforts, identifying medical services needs, evaluating medical treatments, tracking results of educational and preventive efforts, estimating the human and financial impact of injuries, projecting the needs for medical services, guiding the implementation of laws and regulations about use of safety devices, etc.

- Broad – The package should include "overview" reports to broadly describe the problem of injuries, tally injuries and show the relative number of occurrences of each injury type.

- Specific – The package should progress to "drill down" reports, which focus on specific injury types (e.g., hip fractures, traumatic brain injuries) and injury mechanisms (e.g., suicide, motor vehicle crashes, falls, assaults, firearms). The topics for these focused reports should be selected to provide more detailed information on those types of injuries and mechanisms of injury that are identified as being most "significant" based on frequency of occurrence, impact (e.g., death rate, injury severity, disability rate, medical costs), and preventability.

- Descriptive – Reports begin with statistics (e.g., tables and graphs displaying frequencies of injuries, means, tests of statistical significance of differences between risk groups, etc), but should also include a written component of explanations and interpretations. Depending upon the purpose of each report and the expertise of the report's intended audience, explanations may be minimal (e.g., details on the data source, case inclusion notes, etc.) or comprehensive.

- Multi-faceted – Reports should assess injuries from various perspectives including injury type, mechanism, risk group, geographic area, contributing factors (e.g., alcohol involvement), severity, time of year, and other key factors.

- Comparative – Reports should include comparisons with national rates as well as tracking of year-to-year trends in Nevada. Reports should also make comparisons within Nevada regarding various sub-populations.

- Tailored – Reports should be tailored to various audiences, providing differing levels of detail, explanation and statistical complexity for each report user population.

- Recurrent – Reports should be produced regularly in a consistent format to allow tracking of changes and to promote familiarity with and use of the data. Monthly, quarterly and annual reports should be scheduled.

**Report Design Process**

Creation of a serious of reports will be a major project undertaking requiring a project plan, a detailed project timeline and considerable time and effort. Several considerations regarding characteristics of the reporting package and the process for report development are noted below to serve as a starting point for the project plan.

- Determine Reporting Needs – The specific types of injury data needed to provide an informational basis for assessing injuries, prioritizing injury prevention efforts, identifying medical services needs, supporting evaluation of medical treatments, etc. must be identified. The Trauma Data and Research Advisory Board discussed in Recommendation 1, which represents the data needs of various user populations within Nevada, can help to identify the types of injury data which are needed to support their activities. Additionally, an overview analysis of the data (similar to that provided in the companion to this report, ***Nevada's Injury Data Surveillance Project - An Overview of Injuries in Nevada***, but possibly more extensive***)*** should be used to identify priorities for "drill down reports." Epidemiologists and public health data experts can also help to ensure that the necessary fields and statistics are included in each report to address common questions and data needs.

- ❑ Create Detailed Specifications - Experts in epidemiology and public health data should be involved with programmers in the design of the tables and graphs that form the basis of written reports. They should create detailed specifications of what should be included in each report, how calculations should be performed, how report cells should be defined, etc. They must ensure, for example, that:
    - injuries are properly grouped
    - cases to be included and excluded are clearly defined using ICD-9-codes, E-codes, zip codes, consistent age/gender groupings, etc.
    - cases occurring in multiple databases are not double-counted
    - data “gaps” are recognized to prevent underestimates
    - appropriate statistical tests are incorporated to identify differences among sub-groups and to assess trends/changes in data as a report is repeated each month, quarter or year

- ❑ Develop and Test Programs – Programmers should develop the programs based on the specifications provided and test them to ensure accuracy of programming and validity of the underlying data.

- ❑ Develop a Reporting Schedule – An annual reporting schedule should be developed based upon the frequency with which type of data is needed. Monthly, quarterly and annual reports should be included.

- ❑ Implement an Analysis Process – As noted earlier, reports begin with tables and graphs, which display data gleaned from the various databases. This data must then be organized, interpreted and explained to produce written reports for use by a variety of publics. Each table and graph produced should be assigned to a qualified data analyst and reviewed in a timely manner to monitor changes in injury patterns and trends. This analysis should begin at NSHD, but may also involve a staff from other agencies and groups involved in injury prevention and treatment, including those suggested for the Trauma Data and Research Advisory Board. The analyst(s) should then write a clear and concise synopsis of findings for inclusion with the tables and graphs. An analysis “chain of command” should be established so that, whenever analysts note changes, anomalies or other significant findings in the data, these findings can be immediately reported to agencies and groups responsible for addressing the issues.

- ❑ Distribute Reports – For each report, a recipient list should be developed so that timely distribution can occur. Key reports should also be made available to interested parties through the Data Warehouse.

- ❑ Track Use of Reports – Bi-annual evaluations of the use of reports should occur. Users should be surveyed or interviewed to assess utility, clarity and comprehensiveness of the reports. Actions taken based upon the contents of the reports (e.g., educational programs implemented, services established) should be recorded to support the utility of the reports.

- ❑ Update Reporting Needs – As new injury prevention activities are implemented, additional reports should be developed to track changes in the injuries that these activities are targeted at preventing, thereby evaluating the effectiveness of these activities. Changes and additional reports should also be implemented as injury patterns change over time and as new issues arise.

**Recommendation 4: Expand the capacity to provide ad hoc reports to respond to inquiries about specific injury issues and to support specific projects.**

Ad hoc reports should be available to NSHD, the Trauma Data and Research Advisory Board, member agencies, researchers, public health organizations, etc. to support their prevention efforts and research. Publicly available reporting capability is currently available through the existing Data Warehouse using a web-based query and should be expanded as additional databases are added.

**Recommendation 5: Standardize and centralize Emergency Department data into a statewide database.**

Although data is collected at the hospital level, Nevada does not have a statewide database into which all emergency department visits are compiled. Because emergency department visits represent a much larger portion of injuries than do hospitalizations and deaths and because these injuries are often counted and described nowhere else in an injury surveillance system, *this lack of emergency department data represents the most significant database gap in Nevada's injury surveillance system.*

At least some emergency department data is collected at each facility (in emergency department logs, billing systems, etc.); therefore, the basic building blocks of the database do exist. Nevertheless, selecting the most appropriate fields, standardizing the datasets and creating a data submission system will require a coordinated effort among hospitals, their data processing/software vendors, the state and researchers who will use the data. This effort would be an ideal task for the Trauma Data and Research Advisory Board mentioned in Recommendation 1. Standardizing the data to national recommendations should be considered to minimize duplication of planning efforts and produce comparable data for research and monitoring.

**Recommendation 6: Standardize and centralize Emergency Medical Services data into a statewide database.**

As was true for emergency departments, individual emergency medical systems companies collect data on ambulance runs throughout Nevada. This data should also be standardized and compiled into a statewide system to provide data for comparisons among EMS organizations, systems planning and research.

**Recommendation 7: Mandate and enforce the submission of E-codes in hospital discharge data and provide separate fields for E-codes in all databases.**

Collection of E-codes is an essential component of injury surveillance. States which mandate E-coding are more likely to have these codes submitted on records of injury-related cases than states which do not; therefore, Nevada should consider mandating the practice, monitoring and reporting compliance by hospital and fully enforcing compliance. E-codes are already being submitted for nearly 100% of records for the trauma registry; this data could be shared within each facility with the personnel who complete the discharge data. This effort could begin with improving E-coding at the larger facilities.

Ideally, E-codes should be recorded in one or two fields designated specifically for these codes. This approach is effective because the presence of a distinct field serves as a reminder that E-codes should be included when appropriate. The current layout for the hospital discharge data allows E-codes to be recorded in the secondary diagnosis code fields along with other diagnoses. Because the record layout was recently revised, it is not expected that additional changes can be made in the near future to add separate E-code fields. Until such time as the record layout can be revised, training and assistance should be offered to hospitals to encourage the inclusion of E-codes in the secondary diagnosis fields. At the time of the next revision of the layout, one or two additional fields should be added for separate recording of E-codes. Additionally, the inclusion of an edit or a warning that advises data submitters of the need for an E-code (based upon the presence of an injury diagnosis code), could also promote more complete coding.

**Recommendation 8: Include the Trauma Registry Database in future injury surveillance and linkages.**

The trauma registry database was not available for use in the epidemiology report this year. It is a rich source of data and is reasonably clean and complete. The E-coding in this database is complete, in contrast with that in the discharge data, and would provide essential mechanism of injury data.

**Database-Specific Recommendations**

Specific deficiencies were identified for individual databases under *Section VI – Analysis of Nevada's Injury Databases*. The most significant deficiencies are listed in Table 77 for corrective actions.

**Table 77 Database-Specific Recommendations**

| | |
|---|---|
| Safety Management (Vehicle Crash) System | Add/improve fields as described in Table 75.<br>Develop de-duplication algorithms. |
| Inpatient Acute Hospital Discharge | Add/improve fields as described in Table 75.<br>Mandate and enforce E-coding.<br>Include separate field for E-codes. |
| Trauma Registry | Add/improve fields as described in Table 75.<br>Standardize charge and blood alcohol information format. |
| Death Certificate | Add/improve fields as described in Table 75.<br>Several injury fields included near the bottom of the death certificate (e.g., date of injury) are not included in the database and would be useful for injury surveillance. |

## APPENDIX

## SUMMARY OF KEY DATABASE FINDINGS

On the following pages are brief summaries of the key findings regarding each of the databases evaluated for this project.

## Nevada Safety Management System Data (NDOT Crash Data)

*File Structure*
File structure is a bit confusing having property damage only crashes (PDO), injury and pedestrian crashes all in a single table. It would be easier to work with these data if there were separate tables for (1) collisions (i.e., with all collision relevant fields), (2) property damage only crashes, (3) drivers and occupants of injury crash vehicles and (4) pedestrians and pedacyclists.

*Duplication*
A large number of duplicate pedestrian records were identified. This may be an artifact of how the files were compiled into a single table, but it appears to be a result of updates to records in which the original record(s) were not deleted on update.

*Missing Data*
Data appear to be complete for all areas and time periods.

*Injury Severity*
Reported injury severity uses a standard "KABCO" coding. Police-reported injury severity is probably reliable for serious injuries (fatal, class A, class B), and probably less reliable for lower severity injuries.

*Mechanism of Injury*
Crash data collect vehicle type. It would be better and possibly easier to simply collect vehicle identification numbers (VINs), which can be decoded in batch processing to provide more information about vehicle characteristics.

*Safety Belt/Helmet Usage*
Safety belt reporting is overstated (as expected). It does, however, reflect similar non-usage patterns found in other data (i.e., highest rate of non-use in young people and senior citizens). Helmet usage appears to reflect high compliance with Nevada helmet law. The restraint data should also capture information on child safety seat usage and air bag deployment. Collecting VIN would allow collection of information on whether vehicle is air bag equipped.

*Contributing Factors*
Only one contributing factor is collected. Crashes often involve multiple factors. There may be some subjectivity in how contributing factors are reported. Collision types should be collapsed into a smaller number of more definitive types of crashes (e.g., rollover, head-on, fixed object, sideswipe, rear-end, t-bone). The data system should also collect the direction of impact (12 points of clock). Alcohol usage reporting appears to be low or missing in many cases. A similar situation is found in many states. NHTSA estimates that at most police detect about 50% of alcohol-involved crashes.

*Date, Time, Location*
These fields are very useful. They appear to be complete and very detailed. The data appear to be very useful for identifying high crash locations and time/date patterns of crashes. GIS coordinates or latitude/longitude coordinates would be very helpful for mapping high crash locations.

*Summary and Recommendations*
In general the crash data are very useful for injury surveillance. Addition of VIN and GIS coordinates would greatly enhance usefulness of these data. Additional fields to consider for collection include multiple contributing factors, child safety seat information, information about whether EMS transports the crash victim from scene and to which hospital would facilitate linkage of data. Raising the reporting threshold for property damage only crashes to higher level (e.g., $2,500) would reduce data collection burden and allow more resources for collecting additional data elements.

## UB-92 Hospital Discharge Data

*File Structure*
Single table structure is easy to work with. Having a personal identifier is useful for arraying multiple records into a single file.

*Duplication*
A large number of multiple records were found (i.e., multiple records for single individual). Arraying records into a single record for each individual reduced records from 235,000 discharges to about 145,000 individuals. Analyses of these data should look at effect of multiple admission for single individual (e.g., charges, length of stay, etc.).

*Missing Data*
Some institutions have very low numbers of records (e.g., less than one discharge per day). This may indicate missing data.

*Injury Severity*
The diagnostic fields can be translated to ISS and AIS using commercially available software (e.g., ICD-MAP 90). Other severity adjusters can also be used (e.g., APG-DRG).

*Mechanism of Injury*
E-coding is very sporadic. There is high compliance at some facilities and low compliance at others. The highest volume trauma center is one of the lowest E-coders. A separate field for E-coding should be made available. All records with ICD9 diagnostic codes 800 to 999 should be E-coded. The low E-coding level is probably the greatest limitation of these data. E849 coding can be used, but not as a primary code. E849 coding is not particularly useful for injury surveillance.

*Charge and Length of Stay*
These data appear to be very clean. They are useful for estimating economic costs of injury.

*Summary and Recommendations*
The highest priority for these data should be to obtain as complete as possible E-coding. E-codes are already collected at nearly 100% level for the trauma registry. Improvements at the Level I Trauma Center alone would greatly improve overall compliance. Other considerations of importance are injury severity calculation, which can be accomplished with little expense or effort (cost of software is about $1,000 and time to process is about 15 to 20 minutes).

## Trauma Registry Data

*File Structure*
File structure is a single table that is easy to understand.

*Duplication*
A very small number of potential duplicates were found (16 records in 2001/2002 or about 0.1% of total).

*Missing Data*
Data were only available for 14 facilities. Many smaller facilities in UB92 data had no inpatients with an ISS >=16 or only one or two. There might be some facilities that have not submitted however.

*Injury Severity*
Comparing Injury Severity with scores produced by ICDMAP showed that about two-thirds were in complete agreement, but one third had discordant ISS scores. ICDMAP produced a higher percentage of records with a valid ISS score. This issue should be investigated further. There are also some records in which reported patient condition appears not to agree with GCS and Trauma Score.

*Safety Equipment*
These data were not collected in 2002. They would be very useful for research and injury surveillance purposes.

*Mechanism of Injury*
E-Coding is almost 100% compliant. These would be an excellent source of information about non-fatal injury incidence in Nevada.

*Alcohol Use*
Many data appear to be out of range. This would be an excellent source of specific laboratory values on level of intoxication and its contribution to injury severity and incidence.

*Pre-hospital Care Data*
Dates and times are filled in sporadically. The trauma data would be an excellent source of information about field triage patterns for EMS.

*Summary and Recommendations*
The Trauma Data are in general very clean and represent a very good source of information about injury incidence in Nevada. An additional field to identify why the record was eligible would be useful (e.g., rollover crash, fall from height, etc.) for comparison with other sources of data (e.g., crash, hospital discharge, death certificate).

## Death Certificate

*File Structure*
Single table is easy to use. Data dictionary should be updated to reflect ICD10 coding only.

*Duplicates*
No evidence of duplicate records found.

*Missing Data*
No evidence of missing records found.

*ICD-Coding*
Using only ICD10 codes limits identification of specific types of injuries. This may change as ICD10-CM comes into use. There does appear to be a higher number of hospital inpatient deaths for those with injury diagnoses than appear in death certificate file (294 in hospital discharge versus 209 in death certificate). Several injury fields included near the bottom of the death certificate (e.g., date of injury, injury at work) are not included in the database and would be useful for injury surveillance. Collecting contributing causes would be useful for research and injury surveillance purposes.

*Summary*
The death certificate file follows the standard protocol for death certificates in U.S. This file is useful for injury surveillance but only for severe injures which represent the “tip of the iceberg,” in injury surveillance.

## REFERENCE NOTES

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