

## **An Analysis of Visitor Risk in the National Park System**



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## 1.0 Introduction

This report describes the methods and results of a risk analysis of visitor accidents that occurred in 30 National Park units between 1993 and 1998. The data were collected during visits to each of the parks between May and September 2000. The data were analyzed between September 2000 and March 2001.

The remainder of this section describes the methods of data collection and analysis that were used. Sections 2-31 present brief summaries of the results of the analysis for each individual park. Section 32 describes the results of the analysis of the combined data from all the parks. Section 33 provides conclusions from our analysis.

### 1.1 Methods

This section summarizes the methods that were used in the gathering and analyzing the data, including data sources, sampling strategies, coding protocols, and analysis.

### 1.2 Data Sources

Various accident and incident data are available for the period from 1993-98. The following sources were used: *Emergency Medical Services Reports (EMSRs)* or “*Run Sheets*,” *Case Incident Reports (CIRs)*; and, *Morning Reports*.

Typically, National Park Service (NPS) personnel who respond to a visitor accident/incident will complete an *Emergency Medical System Report (EMSR)* in the field, indicating briefly the nature and the location of the accident/incident, basic medical and demographic information pertaining to the victim, and a summary of NPS personnel responses. NPS personnel may subsequently complete a *Case Incident Report (CIR)*. These records are filed at the NPS unit concerned.

CIRs are supposed to be filed for all visitor accidents/incidents that require the assistance of park personnel. CIRs provide space for standardized categories of information, such as the time, date, location, and type of the accident, as well as a narrative description of the sequence of events, contributing factors, parties involved, and personnel responses. CIRs may also include additional information, such as photographs of the scene. The level of detail reported, however, varies according to the nature of the accident, who is filing the report, the amount of time available to complete the report, and other competing demands on that person's time. The CIRs are filed at the NPS unit concerned.

The more serious incidents/accidents that meet criteria set down by the NPS and the Department of the Interior (DOI) also appear in the NPS *Morning Reports*. These include Level 1 reports (such as those reporting employee fatalities, property damages in excess of \$100,000, and major natural or man-made disasters) and Level 2 reports (such as those reporting visitor fatalities, wildlife attacks, major search and rescue efforts, aircraft accidents, multiple injuries, and structural fires). Presently, visitor *fatality* data are tracked by the DOI's Office of Managing Risk and Public Safety (MRPS). Data on visitor fatalities are extracted from the NPS *Morning Reports* and maintained as a set of spreadsheets that can be sorted by various categories, such as

the region and park unit involved, the primary cause of the fatality, the name, age, and sex of the victim, and whether drug and/or alcohol use was a contributing factor.

Aside from the *Morning Reports*, these data sets are accessible only at the individual NPS units, which necessitated on-site visits to each park to gather the relevant data. The ways in which the data are maintained varies enormously from park to park and from year to year. The older data are primarily in paper form, whereas some or all of the more recent data may be computerized. The paper records are often the most complete sources of information, although there were inevitably problems with missing files at some parks. Crosschecking between the paper and computer records allowed some but by no means all of these gaps to be filled. Furthermore, at many parks the EMSRs are intermingled with the CIRs, so it was not possible to crosscheck one set of data with the other.

### 1.3 Sampling Strategy

The number of CIRs at any given NPS unit can be quite large, although only a portion pertains to visitor accidents. For example, Yosemite often has over 4,000 CIRs on file for each year, but only 500 per year pertain to visitor accidents. Consequently, the project team adopted a *systematic* random sampling strategy to select relevant cases for inclusion in the database. The desired sample size for each park unit was originally set at 100 for each of the six years (1993 through 1998). Many parks, however, average 50 or fewer visitor accidents per year and we found that it was practically infeasible to gather adequate information on 100 incidents with the resources available. Consequently, the sample size was reduced to 50 visitor accidents.

Each park maintains annual logs of CIRs, including the date, location, and nature of the accident. Our trained data gatherers examined each log to identify the total number of CIRs by year and the CIR ID number for each accident. If there were 50 or fewer visitor accidents for a particular park, then the CIR numbers were used to identify the relevant files and data for each accident were entered in the database. Any accidents involving fatalities were treated separately. For example, a park might have 3 accidents that involve fatalities and 50 that involve only injuries and illnesses. This gives a total of 53 visitor accidents for a given year in our sample. If there were more than 50 non-fatal visitor accidents, the data gatherers would calculate a sampling ratio. For example, if the annual log indicated 100 visitor injuries, we would record every other incident in the database. In this fashion we would be sure to have a random sample of accidents distributed over the entire year.

Visitor accidents were defined as those that:

- involved the direct use of, or interaction with, park facilities or resources;
- required first aid; or
- resulted in serious injury, illness, or death of a visitor (including injuries, illnesses, and deaths resulting from vehicle and vessel operation); and,
- in the case of serious injury or illness, required immediate transportation to a medical facility.

By this definition, the database does *not* include information about:

- accidents involving on-duty NPS, Volunteer-in-Parks (VIP), Student Conservation Association (SCA), Youth Conservations Corps (YCC), cooperating association, contractor, or concession employees;
- accidents/incidents arising from pre-existing medical conditions (e.g., strokes);
- property damages or losses at any level;
- crashes of aircraft not engaged in sight-seeing activities or other recreational activities directly involving park lands and waters; and,
- injuries, illnesses, or deaths resulting from criminal activities (e.g., homicide, suicide, assault, robbery, vandalism, terrorism).

Visitor fatalities comprise only a small proportion of CIRs, but they are obviously of significant concern to the NPS. In the following sections they are analyzed separately. Unfortunately, some of the fatality data were incomplete in several of the parks. Consequently, the project team supplemented the CIR data gathered with the information available from the *Morning Reports*.

#### **1.4 Coding Protocols**

The project team reviewed the literature on visitor safety as well as a selection of CIRs and the *Morning Reports* to identify the kinds of information available in the NPS records that would be most pertinent to a comprehensive risk analysis on visitor accidents. The database includes information, where available, on:

- the date, time, and location of the accident/incident;
- the nature and severity of the harm and the number of people involved;
- the demographic characteristics of those involved (e.g., age, sex, race);
- the nature of activities in which the victims were engaged (e.g., wildlife watching, snowmobiling, rock climbing, back country hiking)
- the nature of the environment at the accident site(e.g., river, cliffs, steep paths);
- the apparent cause of the harm (i.e., primary and secondary initiating events);
- other contributing factors or relevant conditions (e.g., fog, snow); and,
- actions taken in response to the accident/incident by park personnel and others.

Coding protocols were developed and incorporated into a computerized data entry form to allow for the efficient and consistent coding and entry of accident/incident data in the field using laptop computers. Senior project members spent one day at Lowell and 4 days at the Delaware Water Gap to pilot test the data collection and coding protocols and to train the graduate students in their use. The data were e-mailed back to Clark University at the conclusion of each park visit.

#### **1.5 Risk Analysis**

The data were cleaned-up and recoded as necessary before being analyzed using a standard statistical software package. Descriptive statistics (e.g., frequencies and cross-tabulations) were used to summarize and examine the patterns of fatalities and non-fatal injuries and illnesses. Descriptive statistics were also used to highlight “high risk” populations, activities, environments, and conditions.

Sections 2-31 present brief summaries of the results of the analysis for each individual park in our sample. The summary for each park is organized in a similar fashion, although each summary is tailored to highlight any distinctive patterns and relationships for that park. Each summary begins with an introduction that describes the total number of visitor accidents, the number of fatalities, and the number of non-fatal injuries and illnesses. As an overall indication of the level of risk associated with each park we also present these data as rates per 100,000 visitors and per 1,000,000 visitor hours. Simplistically, risk can be seen as the relationship between the number of people exposed (i.e., the number of people involved in an activity or “risk denominator”) and the number who are hurt or killed (the “risk numerator”). In parks with missing data for particular years, the visitation data were adjusted accordingly before calculating the risk ratios.

The second section of each park summary presents information on the nature of accidents that involve fatalities, including an examination of “high risk” populations, activities, environments, and conditions, where the data are available. Accidents involving fatalities are separated out for two reasons: (1) they are qualitatively distinct from other accidents because of the severe nature of the consequences; and, (2) because we believe we have a relatively complete set of information on all visitor fatalities between the years 1993 and 1998, as distinct from a sample. During the data collection phase we gathered information on all fatal visitor accidents and these data were crosschecked with the *Morning Reports*.

The third section of each park summary presents information on the nature of visitor accidents that involve *only* injuries and illnesses. Each section includes an examination of the patterns of injuries and illnesses according to demographic variables (such as age, gender, race, and nationality), temporal variables (such as day, time of day, and month), activities, primary initiating events, contributing factors, nature of injury or illness, and response. Each summary highlights the “high risk” populations, activities, environments, and conditions.

Because we have only a sample of the visitor accidents at many of the parks, we used a process of weighting to produce the frequency and cross-tabulation results presented in the following pages. Weighting was necessary in two situations: (1) where a park has more than 50 visitor accidents in one or more of the years in questions; or, (2) where the number of accidents in the database is less than the total number of visitor accidents reported in the logs. In these cases, the information in the database represents only a sample of the accidents at that park. For example, if there were 100 accidents at a park in 1995, the database has only a random sample of 50 of those accidents. In another park, the accident logs may indicate that there were 50 accidents in 1995 but the database has data on only 25 accidents because information on the remaining 25 accidents was missing or unavailable. Without weighting the database to reflect these discrepancies, the database would severely underestimate the actual number of accidents at each park. Weighting is a statistical manipulation that multiplies the number of accidents in the database to approximate the actual number of accidents. In these two fictitious cases, using a weight of 2 would bring the number of sampled accidents in line with the actual number. Thus, if the sample of 50 accidents included 5 automobile accidents involving male drivers, we would assume that there were actually 10 automobile accidents involving male drivers among the total

actual number of 100 accidents for that year. The situation is a little more complicated, however, because the number of accidents in the logs and the number in the database vary from year to year. We calculated an average weight for each park based on aggregate numbers for the period in question. Thus, the weights were calculated by dividing the total number of visitor accidents reported in the CIR logs between 1993 and 1998 by the number of visitor accidents recorded in the database. The weighting factors used are shown in Table 1.1. A weighting factor of “1” indicates that the database contains data on all the accidents indicated in the accident logs.

| Park Code | Weight | Park Code | Weight |
|-----------|--------|-----------|--------|
| ASIS      | 3.38   | LAME      | 9.89   |
| BADL      | 1.00   | LIBI      | 1.00   |
| BIBE      | 1.29   | LOWE      | 1.00   |
| BLRI      | 3.19   | MEVE      | 1.55   |
| CAVE      | 1.35   | MORA      | 1.56   |
| CAHA      | 1.18   | MORU      | 1.00   |
| CANY      | 1.00   | NATR      | 1.34   |
| CURE      | 1.00   | OLYM      | 2.31   |
| CUVA      | 1.00   | OZAR      | 1.00   |
| DENA      | 1.30   | PAIS      | 6.80   |
| DEWA      | 1.23   | PORE      | 1.00   |
| EVER      | 1.24   | ROMO      | 4.09   |
| FOSU      | 1.00   | SAGU      | 1.00   |
| GETT      | 1.23   | STLI      | 9.91   |
| GRTE      | 2.52   | YOSE      | 11.96  |

**Table 1.1: Weighting Factors**

Section 32 describes the results of the analysis of the combined data from all the parks. The section begins with an introduction that describes the total number of visitor accidents, the number of fatalities, and the number of non-fatal injuries and illnesses for all parks, along with the risk ratios per 100,000 visitors and per 1,000,000 visitor hours for each park. The second section presents an overview of the combined data on accidents involving fatalities. The third section presents information on the combined sample of visitor accidents that involve non-fatal injuries and illnesses. This section includes an examination of the patterns of injuries and illnesses according to demographic variables (such as age, gender, race, and nationality), temporal variables (such as day, time of day, and month), activities, primary initiating events, contributing factors, nature of injury or illness, and response. This section also highlights the “high risk” populations, activities, environments, and conditions for the 30-park sample as a whole.

Section 33 presents some brief conclusions about the nature of the data and our interpretation of the findings.

## 2.0 Assateague Island National Seashore

### 2.1 Introduction:

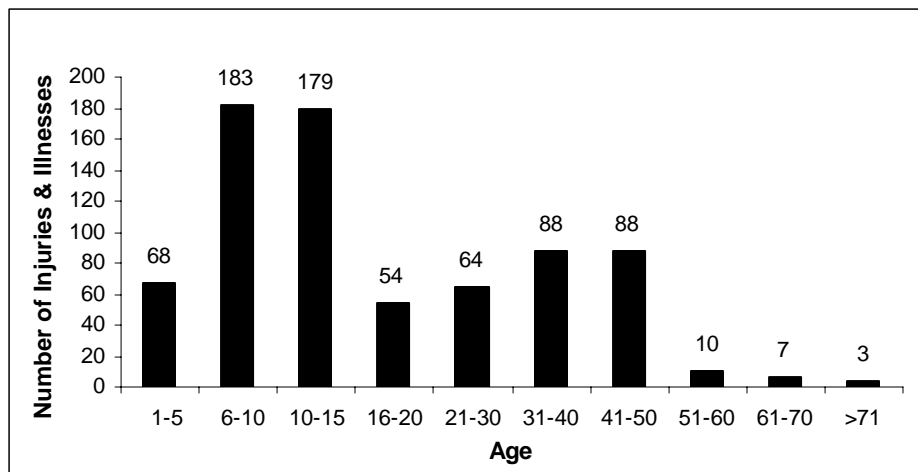
Between 1993 and 1998, there were 900 visitor accidents at Assateague National Seashore, resulting in no recorded fatalities and 906 non-fatal injuries and illnesses. Since there were 11,528,302 visitors to the park during this period for a total of 100,129,923 visitor-hours, this results in an average of 7.8 accidents, 0 fatalities, and 7.86 injuries and illnesses per 100,000 visitors, and 8.9 accidents, 0 fatalities, and 9.05 injuries and illnesses per 1,000,000 visitor-hours.

### 2.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were no recorded accidents that resulted in fatalities.

### 2.3 Accidents Involving No Fatalities

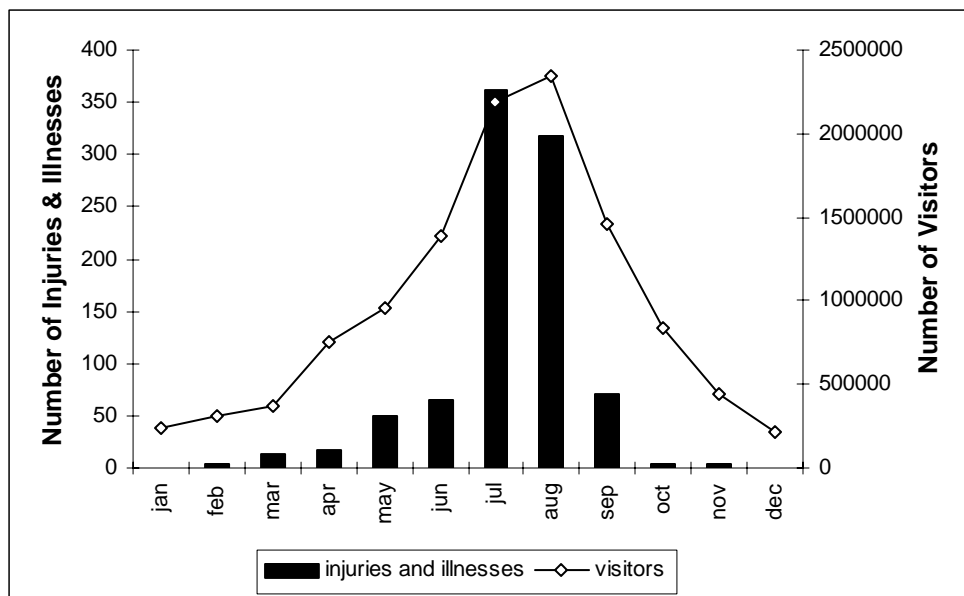
Between 1993 and 1998, there were an estimated 906 visitor injuries and illnesses arising from accidents that did not involve fatalities. Forty-five percent of the victims were male and 47% were female (in 7% of cases the gender of the victim was unknown). The overwhelming majority of victims (86%) were white, with 2% African-American, and 1% Hispanic. Ninety-two percent of the injured visitors were residents of the US, 1.5% were from Canada. The distribution of victims by age is shown in Figure 2.1.



**Figure 2.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=744)**

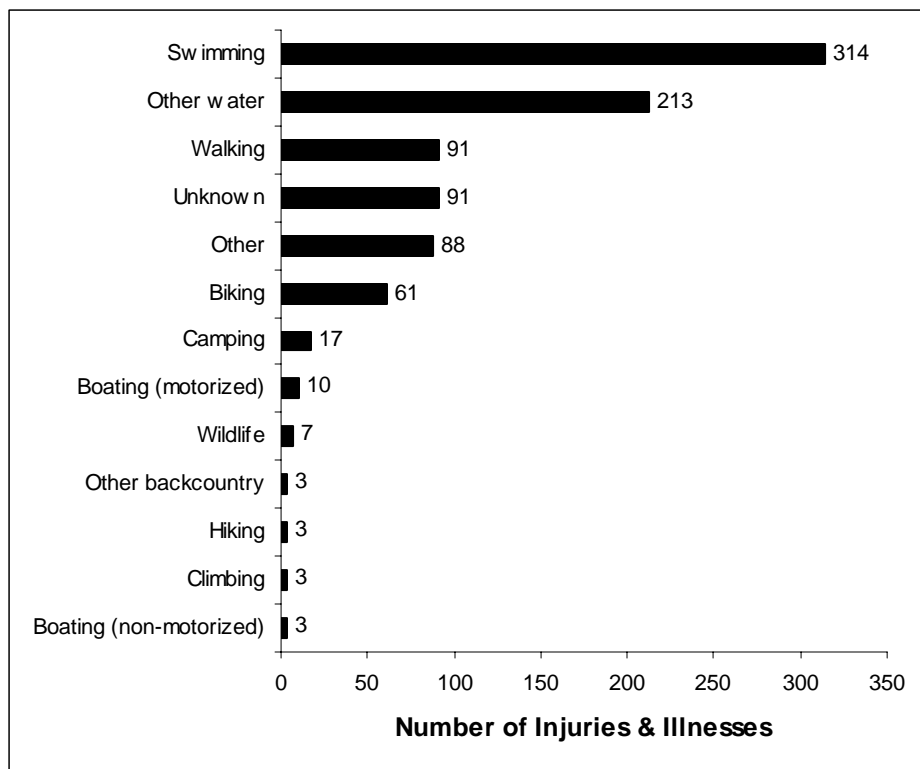
Over 75% of the victims were injured between noon and 6p.m., and 20% between 6am and noon. Sixty-two percent of the victims were injured on weekdays and 38% on weekends. The distribution of injured by month is shown in Figure 2.2, and reveals a pattern that mirrors visitation rates, with a peak in the spring/early summer and a smaller peak in the fall.





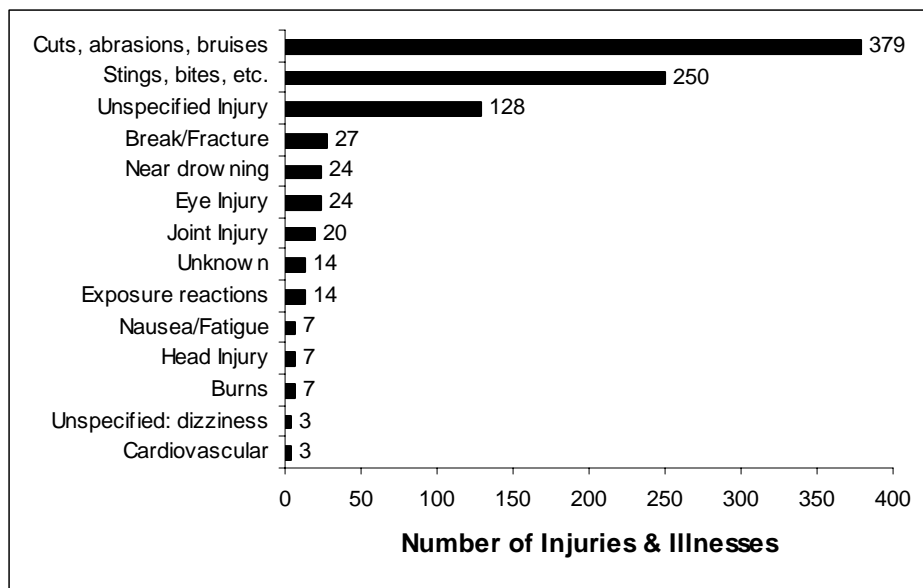
**Figure 2.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=906)**

Figure 2.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are swimming (35%), or engaged in other water related activities (such as wading, surfing) (24%), and walking (10%), although for a substantial number of injuries and illnesses (10%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 2.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=906)**

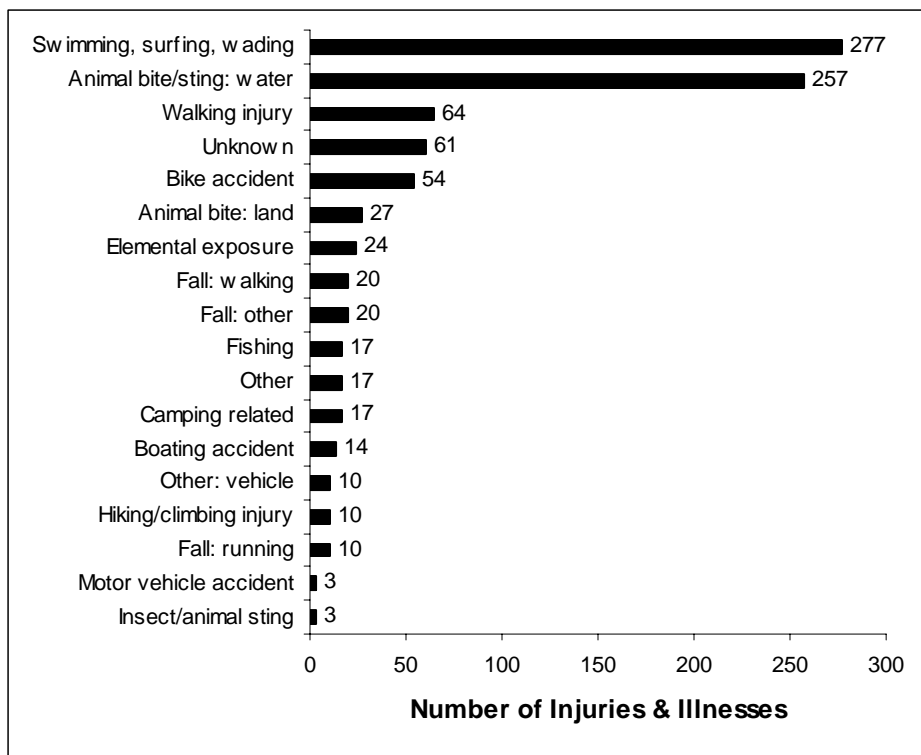
Forty-two percent of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 28% were due to stings and bites, and 14% were due to unspecified injuries and illnesses, as illustrated in Figure 2.4. Males are more likely to suffer cuts and abrasions (199/379) than women (142/379), but females are more likely (139/250) than males (105/250) to suffer stings and bites.



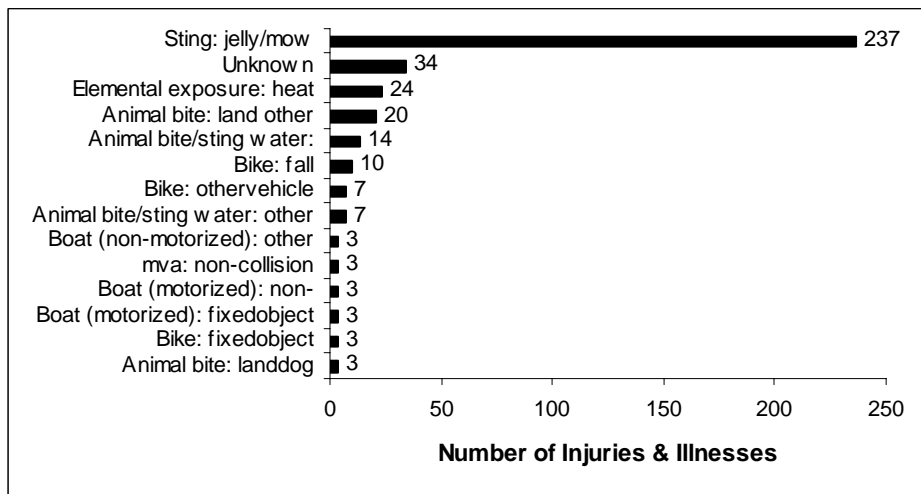
**Figure 2.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=906)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 906 injuries and illnesses occurring during this period, 686 (76%) could be considered less serious because the visitors were treated and released, and 162 (18%) could be considered more serious, since they required transportation to medical facility. Of those requiring transportation, 115 (71%) were transported by ambulance and 47 (29%) were transported by privately owned vehicle. Twenty-four people (3%) refused treatment and in 7 (1%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 10 cases it is unknown what if any response was taken. Of the 162 injuries and illnesses requiring transportation to a medical facility, 54 were for the treatment of cuts, abrasions, and bruises, and 30 were for unspecified injuries and illnesses. Eighty percent (304/379) of cuts, abrasions, and bruises, and 95% (237/250) of stings and bites were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 2.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 2.6.



**Figure 2.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=906)**



**Figure 2.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=372)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 68 injuries and illnesses associated with these activities, 25% are driver-related, 10% environmental factors, 5%

road-related, and 5% are a result of equipment failure. In 45 cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

### 3.0 Badlands National Park

#### 3.1 Introduction:

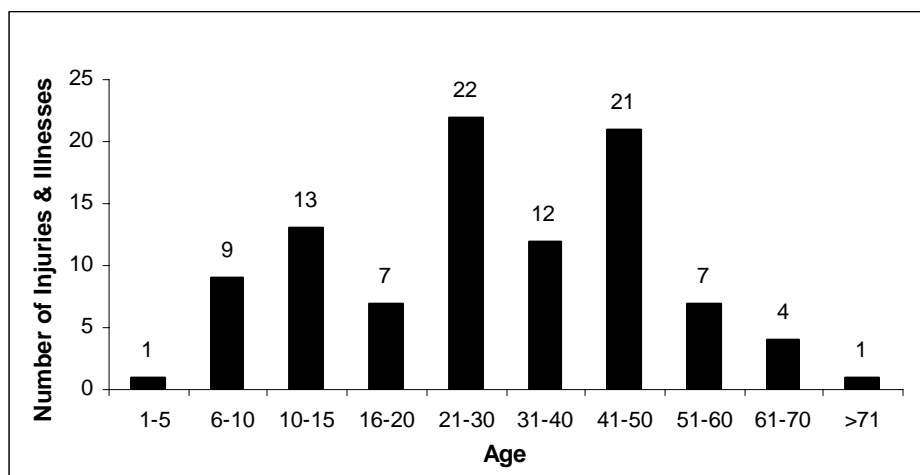
Between 1993 and 1996, there were 108 visitor accidents at Badlands National Park, resulting in 5 fatalities and 106 non-fatal injuries and illnesses<sup>1</sup>. Since there were 4,410,191 visitors to the park during this period for a total of 19,864,525 visitor hours, this results in an average of 2.45 accidents, 0.11 fatalities, and 2.40 injuries and illnesses per 100,000 visitors, and an average of 5.44 accidents, 0.25 fatalities, and 5.34 injuries and illnesses per 1,000,000 visitor-hours.

#### 3.2 Accidents Involving Fatalities:

Between 1993 and 1997, there were 3 accidents that resulted in a total of 5 fatalities. All five fatalities were Native American males and all 5 fatalities occurred on weekend days. Three fatalities occurred while driving, and two fatalities were due to falls.

#### 3.3 Accidents Involving No Fatalities

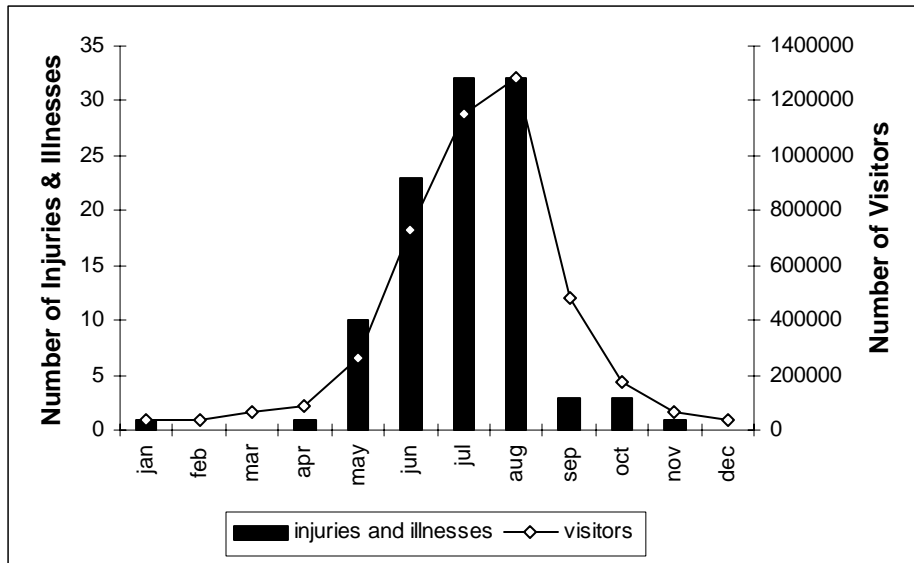
Between 1993 and 1997, there were 105 accidents that resulted in a total of 106 visitor injuries and illnesses. Fifty-three percent of the victims involved in accidents without fatalities were male and 46% were female. Most of the injured or ill (81%) were white with 1% Asian, and 18% of unknown ethnicity. The overwhelming majority (92%) of victims were residents of the US, although there were 3% from Germany, and 1% from each of Austria, Belgium, Holland, Japan, and the UK. The distribution of victims by age is shown in Figure 3.1.



**Figure 3.1: Visitor Injuries and Illnesses by Age, 1993-96 (N=97)**

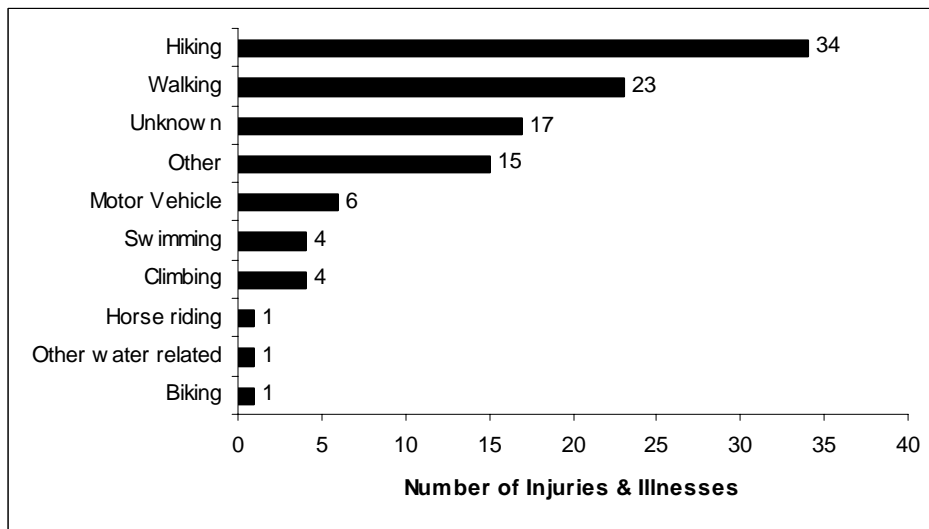
Almost 53% of the victims were injured between noon and 6p.m., and 29% between 6am and noon. Sixty-seven percent of the victims were injured on weekdays and 33% (70/231) on weekends. The distribution of injured by month is shown in Figure 3.2, and reveals a pattern that mirrors visitation rates, with a steep peak in the summer.

<sup>1</sup> Data were not available for 1997 and 1998, except for limited information about 4 fatalities in 1997.



**Figure 3.2: Visitor Injuries and Illnesses by Month, 1993-96 (N=106)**

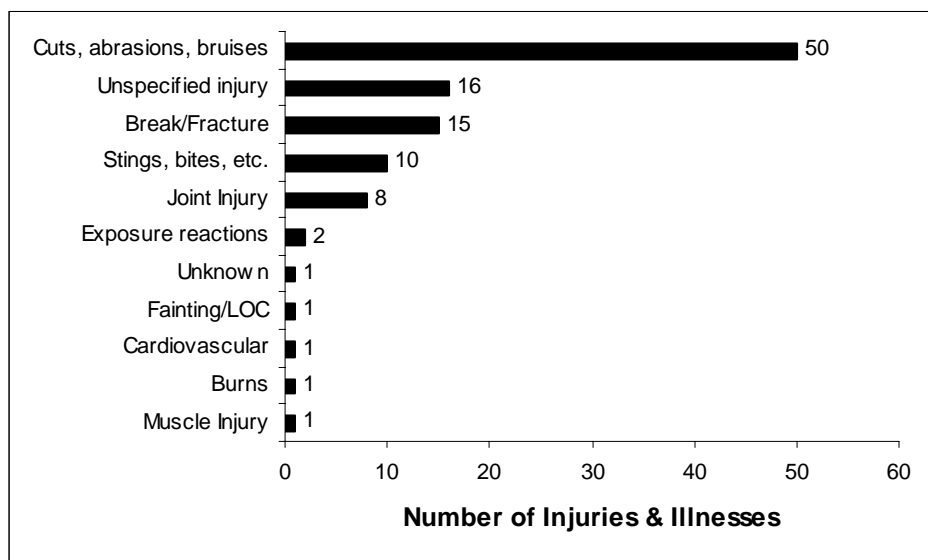
Figure 3.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are hiking (32%) and walking (22%), and motor vehicle accidents are notable by their absence. For a substantial number of injuries and illnesses (14%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 3.3: Visitor Injuries and Illnesses by Activity, 1993-96 (N=106)**

Turning to the nature of visitor injuries and illnesses, we see that almost half (47%) of all injuries and illnesses between 1993 and 1996 were cuts, abrasions, and bruises; 14% involved broken

bones or fractures; 10% resulted from stings and bites, as illustrated in Figure 3.4. Females suffered 40% of the cuts and abrasions, and males suffered 58%.



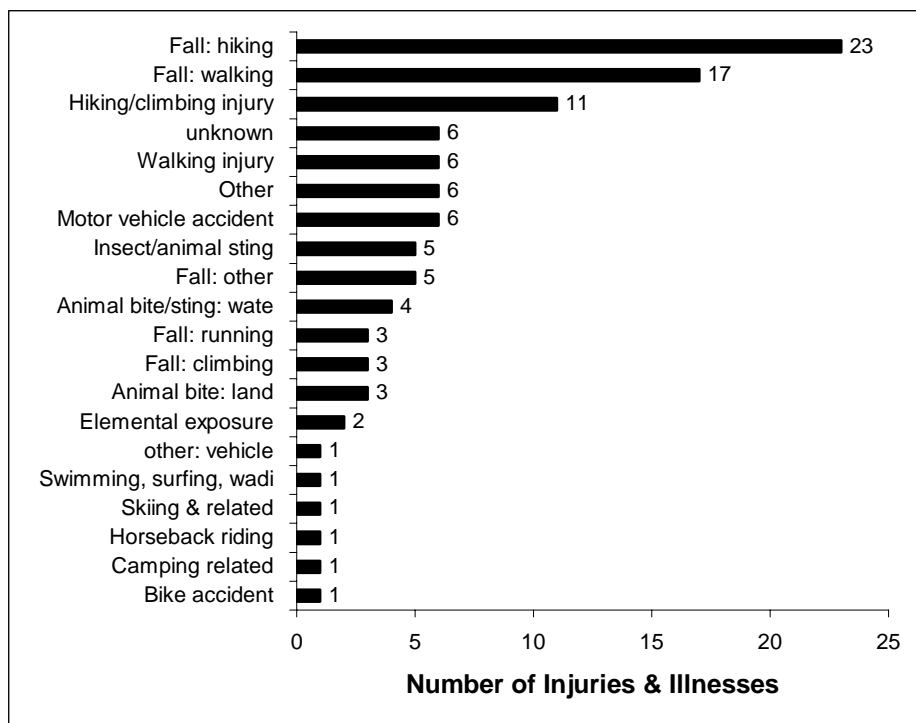
**Figure 3.4: Types of Visitor Injuries and illnesses, 1993-96 (N=106)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 106 injuries and illnesses occurring during this period, 64 (60%) could be considered less serious because the visitors were treated and released, and 29 (27%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 13 (12%) were transported by ambulance and 16 (15%) were transported by privately owned vehicle. Two people (2%) refused treatment and in 7 (7%) cases victims were advised to seek additional medical attention.

The majority of injuries and illnesses involving suspected breaks or fractures (13/15) required transportation to a medical facility, although it is not known how many of these cases were subsequently diagnosed as true breaks or fractures. By contrast, the majority of cuts and abrasions (38/50) and half of the stings and bites (5/10) were treated and released by park personnel on the scene.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 3.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Not surprisingly given the predominance of hiking and walking as activities at Badlands, falls while hiking (22%) or walking (16%), and other hiking/climbing injuries (10%) comprise a larger proportion of all visitor injuries and illnesses.





**Figure 3.5: Visitor Injuries and Illnesses by Primary Event, 1993-96 (N=106)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Since there are few accidents related to these activities at Badlands, there are few data on contributory factors.

## 4.0 Big Bend National Park

### 4.1 Introduction:

Between 1993 and 1998, there were 329 visitor accidents at Big Bend National Park, resulting in 9 fatalities and 335 non-fatal injuries and illnesses. Since there were 1,877,562 visitors to the park during this period for a total of 5,686,960 visitor-hours, this results in an average of 17.52 accidents, 0.48 fatalities, and 17.86 injuries and illnesses per 100,000 visitors, and 5.81 accidents, 0.16 fatalities, and 5.93 injuries and illnesses per 1,000,000 visitor-hours.

### 4.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 9 accidents that resulted in a total of 9 fatalities. The 9 fatalities were all males, including 2 boys between 11 and 15. Three of the victims were Mexican, 5 were U.S. residents, and the nationality of one other is unknown. Four of the fatalities occurred on weekends and four on weekdays. The primary event in the accidents were boating capsizing (1), heat exhaustion while hiking (2), fall while hiking (1), fall while horseback riding (1), motor vehicle accident (1), drowning while swimming or wading (1); reaction to flora (1), and one unknown. Search and rescues were conducted in 8/9 of the accidents.

### 4.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 335 visitor injuries and illnesses arising from accidents that did not involve fatalities. Fifty percent of the victims were male and 50% were female. Thirty percent of the victims were white, but in 70% of the cases the nationality is unknown. Ninety-four percent of the victims were residents of the US, 1% were from Canada, 1% from Germany, and 2% of unknown nationality. The distribution of victims by age is shown in Figure 4.1.

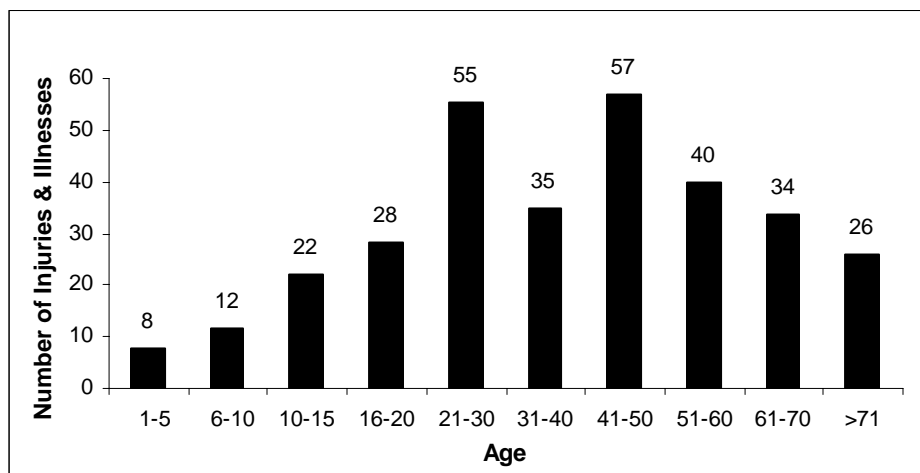
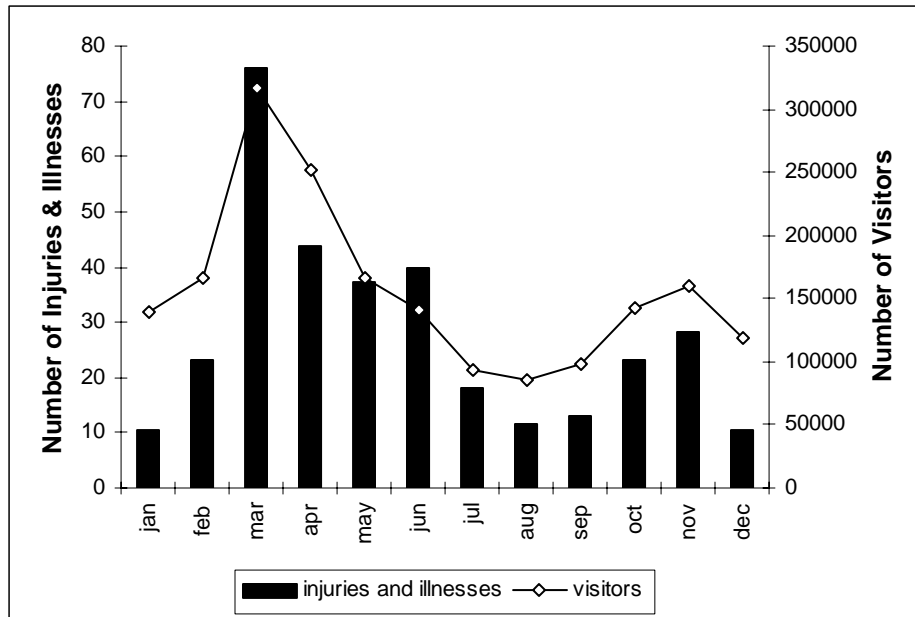


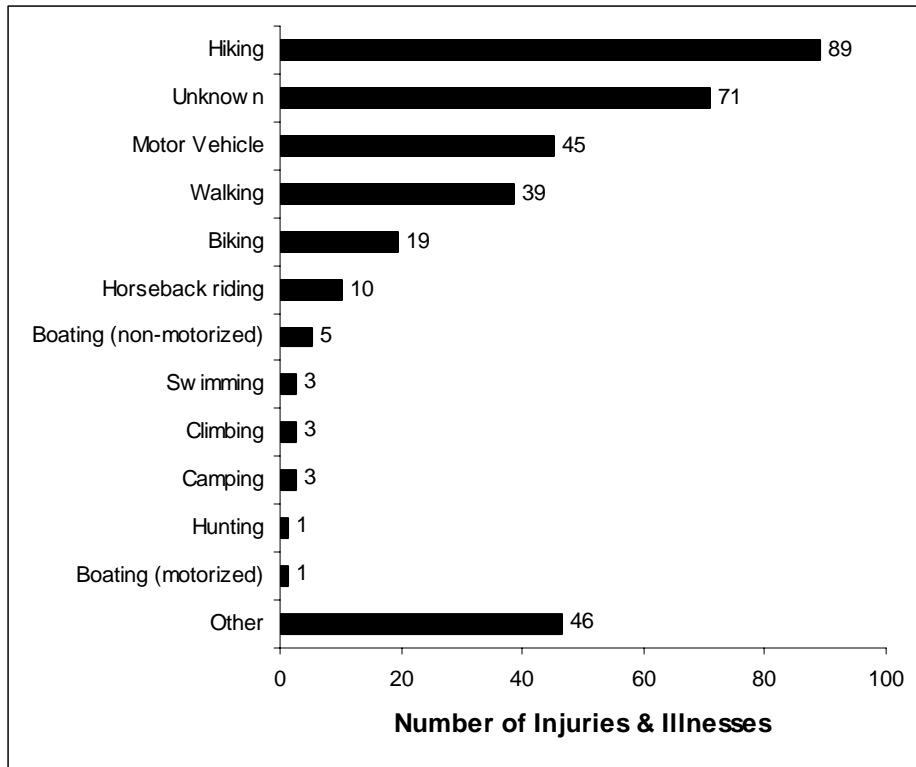
Figure 4.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=316)

Over 49% of the victims were injured between noon and 6p.m., and 32% between 6am and noon. Sixty-two percent of the victims were injured on weekdays and 38% on weekends. The distribution of injured by month is shown in Figure 4.2, and reveals a pattern that mirrors visitation rates, with a peak in the early spring and a smaller peak in the fall.



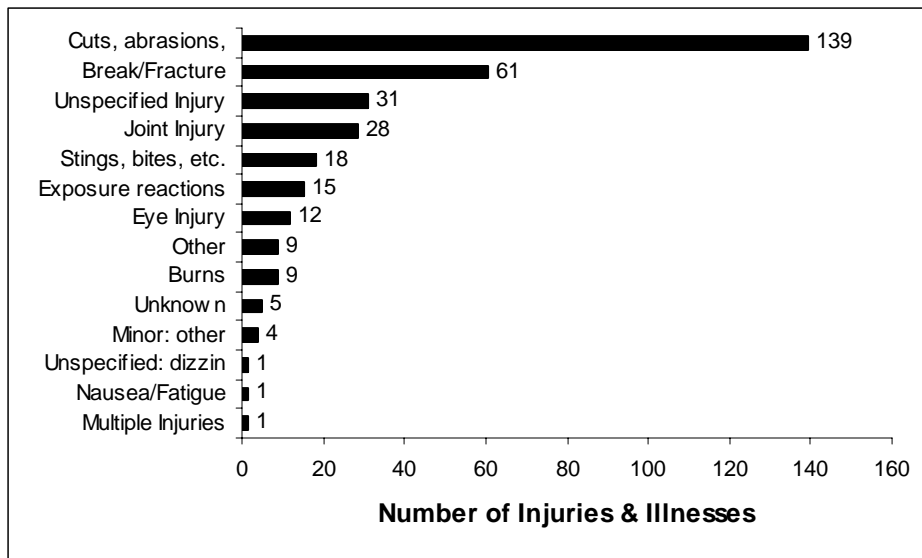
**Figure 4.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=335)**

Figure 4.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are hiking (27%), driving or riding in motor vehicles (13%), or walking (12%), although for a substantial number of injuries and illnesses (21%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 4.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=335)**

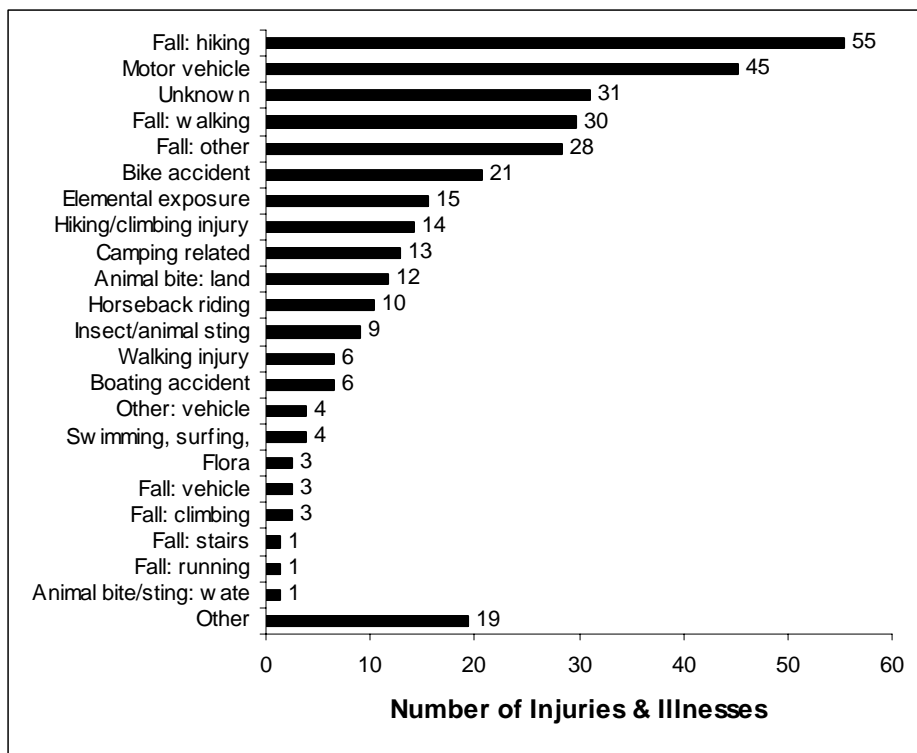
Turning to the nature of injuries and illness, we see (Figure 4.4) that 42% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 18% involved broken bones or fractures; 9% were unspecified injuries; and 9% were injuries to joints (such as twisted ankles or dislocated shoulders). Males were more likely to suffer cuts and abrasions (77/139) compared with females (62/139), while females (36/60) were more likely to suffer broken bones/fractures than males (24/60).



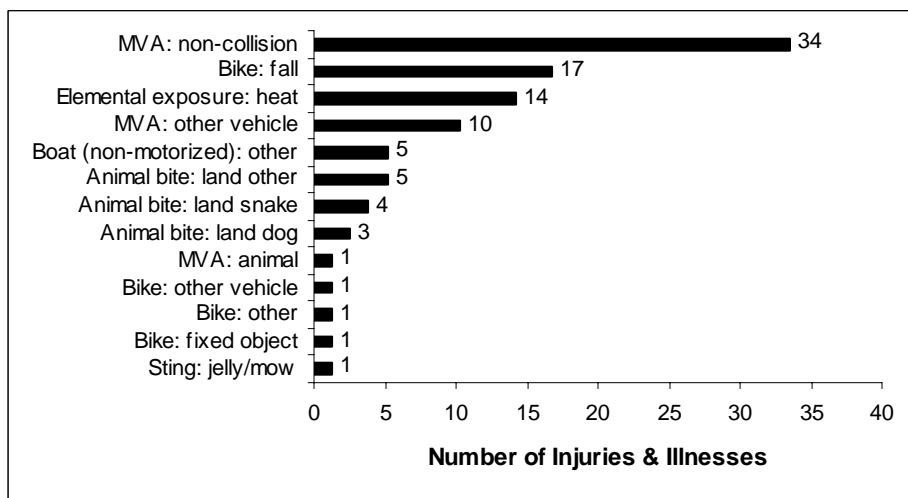
**Figure 4.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=335)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 335 injuries and illnesses occurring during this period, 195 (58%) could be considered less serious because the visitors were treated and released, and 99 (30%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 86 (87%) were transported by ambulance and 13 (13%) were transported by privately owned vehicle. Ten percent of victims were advised to seek additional medical attention. Of the 99 injuries and illnesses requiring transportation to a medical facility, 26 (26%) were for the treatment of cuts, abrasions, and bruises, and 32 (32%) were for suspected breaks and fractures. Seventy-four percent (103/139) of cuts, abrasions, and bruises were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 4.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 4.6.



**Figure 4.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=335)**



**Figure 4.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=98)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 71 injuries and illnesses associated with these activities, 29% are driver-related, 18% road-related, and 2% are a

result of equipment failure. In 2% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

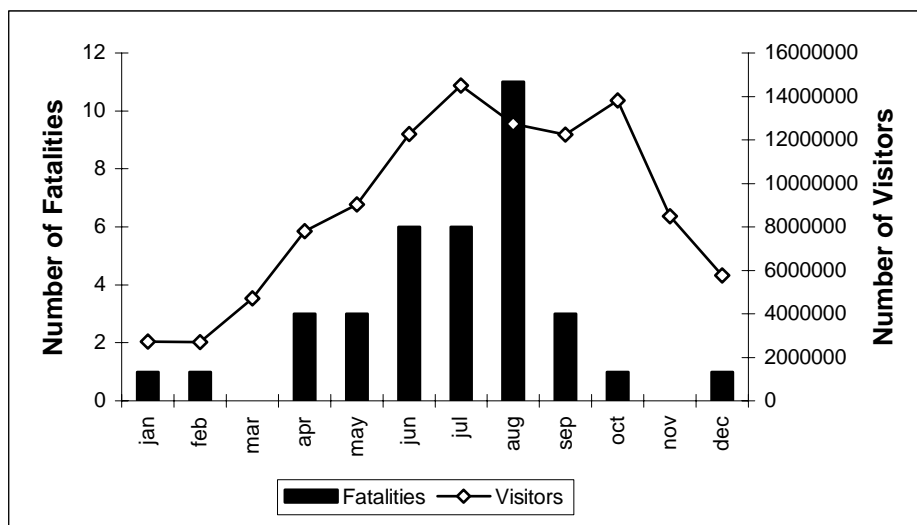
## 5.0 Blue Ridge Parkway

### 5.1 Introduction:

Between 1993 and 1998, there were 950 visitor accidents at Blue Ridge Parkway, resulting in 36 fatalities and 1222 non-fatal injuries and illnesses. Since there were 106,802,332 visitors to the park during this period for a total of 672,527,208 visitor-hours, this results in an average of 0.89 accidents, 0.03 fatalities, and 1.14 injuries and illnesses per 100,000 visitors, and 1.41 accidents, 0.05 fatalities, and 1.82 injuries and illnesses per 1,000,000 visitor-hours.

### 5.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 35 accidents that resulted in a total of 36 fatalities. Thirty-five (97%) of the fatalities were U.S. residents, and 1 (3%) was Canadian. Sixteen (44%) were white, one (3%) was Asian, and the race/ethnicity of the other 19 victims was unknown. Eight (22%) of the 36 victims were female and 27 (75%) were male. Forty-three percent (12/28) of the fatalities occurred between 12:00 noon and 6:00pm, and 29% (8/28) occurred between 6:00pm and 12:00 midnight. Fifty-three percent (19/36) of the fatalities occurred on weekdays and 47% (17/36) on weekends. The distribution of fatalities (Figure 5.1) follows the pattern of visitation, except for an exaggerated peak in August.

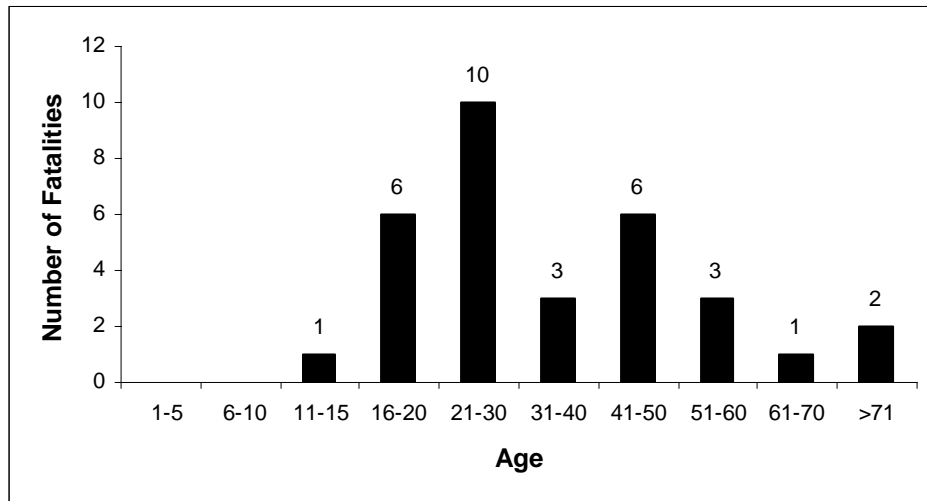


**Figure 5.1: Visitor Fatalities by Month, 1993-98 (N=36)**

Motor vehicle accidents are responsible for 89% (32/36) of all fatalities, including 100% (8/8) female fatalities and 85% (23/27) of the male fatalities. Motor vehicle accidents account for 83% (5/6) of fatalities among those 16-20 years old and 80% (8/10) of those 21-30 years old. Figure 5.2 clearly illustrates the peak in fatalities in the 21-30 year age group. Forty-four percent (14/32) of motor vehicle fatalities involved collisions with fixed objects, 34% (11/32) involved collisions with other vehicles, and 22% (7/32) involved non-collisions (e.g., running off road, rollovers). Driver related factors (e.g., driver inattention, falling asleep at the wheel, etc.) were the primary contributing factors in 66% (21/32) fatalities and road conditions contributed to 12%



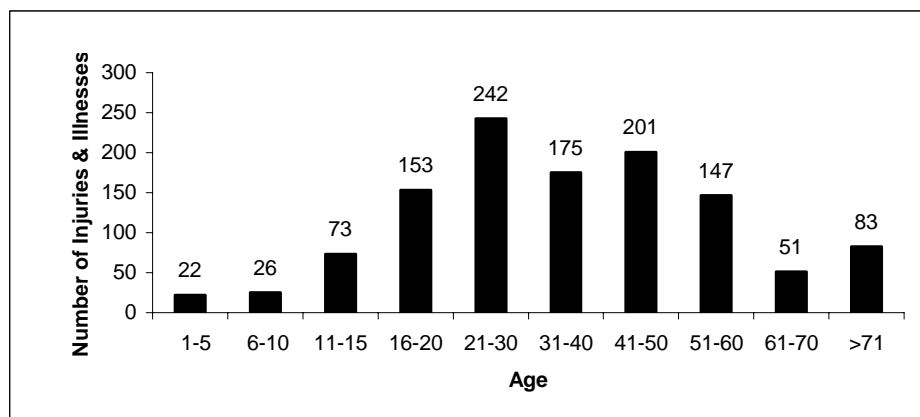
(4/32) fatalities. In 22% (7/32) of fatalities due to MVAs, the contributing factors were unknown.



**Figure 5.2: Visitor Fatalities by Age, 1993-98 (N=36)**

### 5.3 Accidents Involving No Fatalities

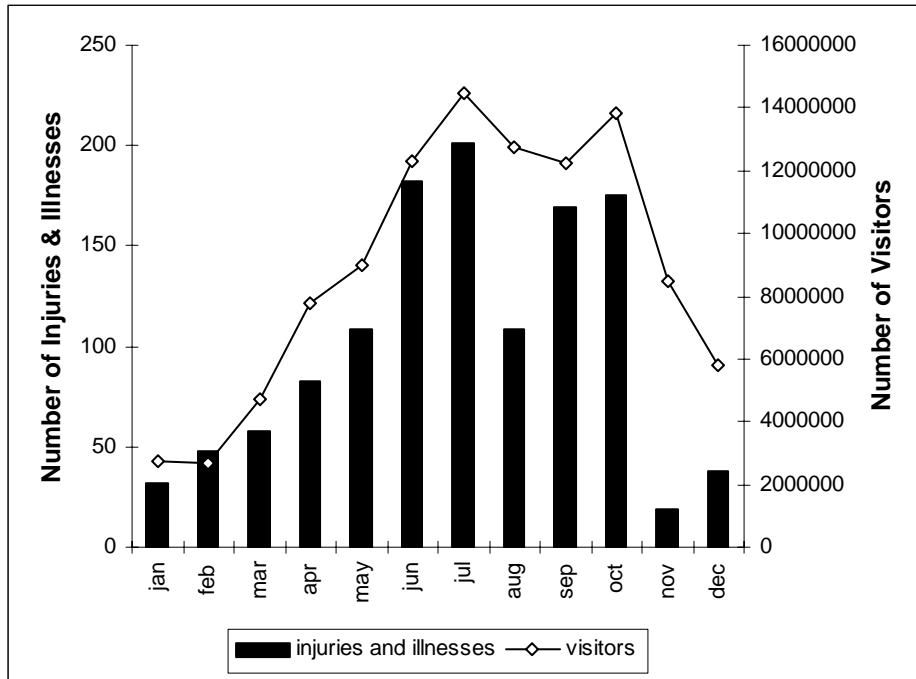
Between 1993 and 1998, there were an estimated 1222 visitor injuries and illnesses arising from accidents that did not involve fatalities. Fifty-seven percent of the victims were male and 43% were female. The race and ethnicity of the overwhelming majority of victims (87%) were unknown, with only 12% identified as white. Ninety-seven percent were residents of the US, 1% were from France, and 0.5% were from Canada. The distribution of victims by age is shown in Figure 5.3. As with the fatalities, there is a peak among 21-30 year olds.



**Figure 5.3: Visitor Injuries and Illnesses by Age, 1993-98 (N=1174)**

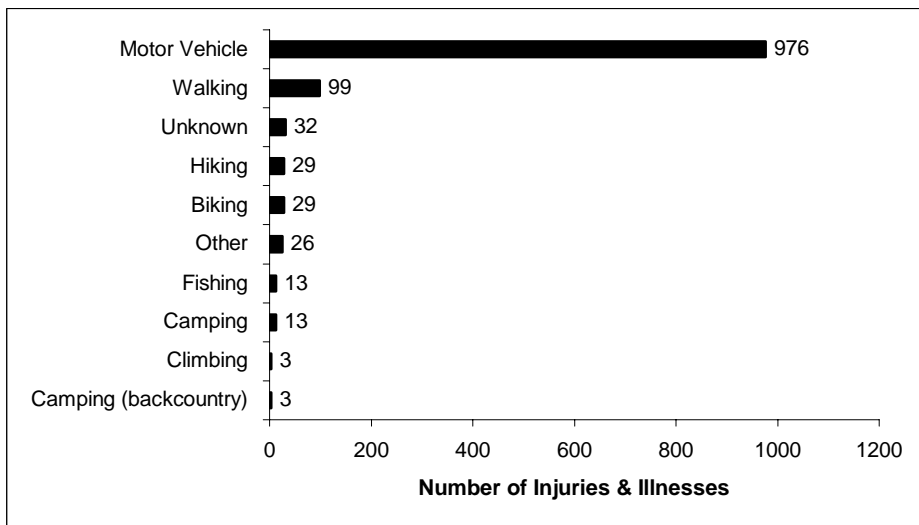
Almost 51% of the victims were injured between noon and 6p.m., 22% between 6am and noon, and 21% between 6:00pm and midnight. Fifty-eight percent of the victims were injured on

weekdays and 42% on weekends. The distribution of injured by month is shown in Figure 5.4, and reveals a pattern that mirrors visitation rates, with a peak in the summer and a smaller peak in the fall.



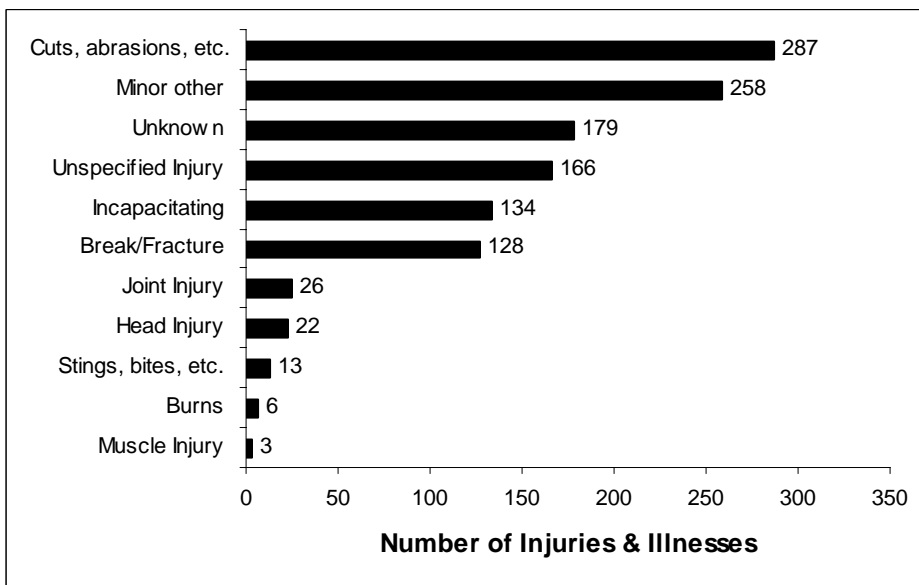
**Figure 5.4: Visitor Injuries and Illnesses by Month, 1993-98 (N=1222)**

Figure 5.5 shows the number of visitor injuries and illnesses by activity. Clearly, the vast majority (80%) of injuries and illnesses occur while visitors are driving or riding in motor vehicles.



**Figure 5.5: Visitor Injuries and Illnesses by Activity, 1993-98 (N=1222)**

Turning to the nature of injuries and illness, we see (Figure 5.6) that 23% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 21% involved minor other injuries, 15% were of an unknown nature, 14% were due to unspecified injuries and illnesses, 11% were incapacitating, and 10% involved broken bones or fractures.

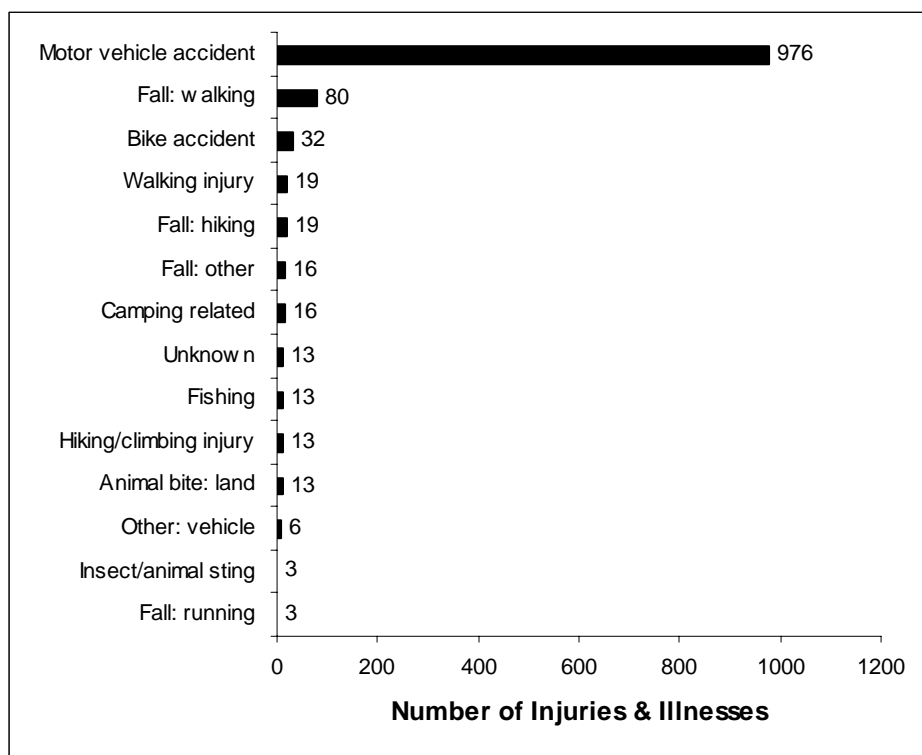


**Figure 5.6: Types of Visitor Injuries and Illnesses, 1993-98 (N=1222)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 1222 injuries and illnesses occurring during this period, 134 (11%) could be considered less serious because the visitors were treated and released, and 880 (72%) could be considered more

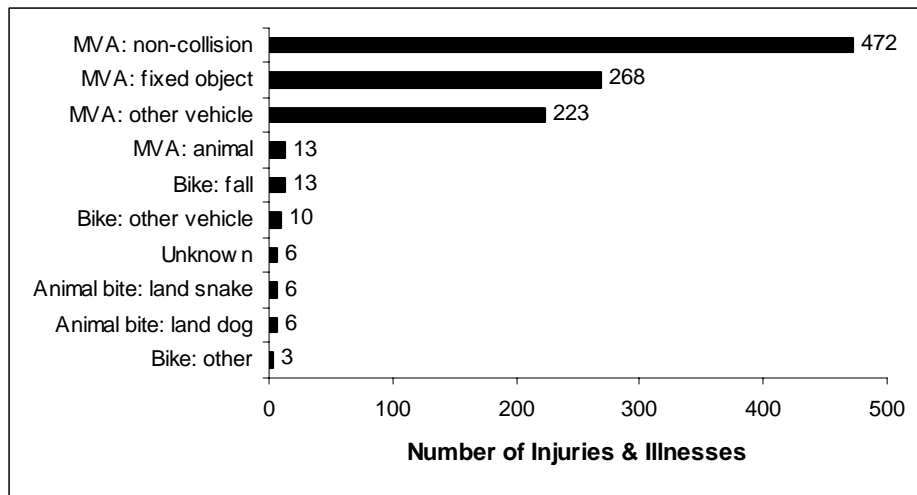
serious, since they required transportation to a medical facility. Of those requiring transportation, 689 (56%) were transported by ambulance and 191 (16%) were transported by privately owned vehicle. Eighty-three people (7%) refused treatment. In 118 (10%) cases it is unknown what if any response was taken. Of the 880 injuries and illnesses requiring transportation to a medical facility, 159 (18%) were for the treatment of cuts, abrasions, and bruises, 198 (22%) were for minor other injuries, 130 (15%) were for unknown injuries, and 109 (12%) were for unspecified injuries and illnesses.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 5.7 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would listed as hiking, but the primary event would be insect/animal sting.



**Figure 5.7: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=1222)**

Figure 5.8 shows that of the 976 MVAs, 472 (48%) were non-collisions, 268 (27%) involved collisions with fixed objects, 223 (23%) involved collisions with other vehicles, and 13 (1%) were due to collisions with animals.



**Figure 5.8: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=1021)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 1008 injuries and illnesses associated with these activities, 61% are driver-related, 20% road-related, and 5% are a result of equipment failure. In 13% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

## 6.0 Carlsbad Caverns National Park

### 6.1 Introduction:

Between 1993 and 1998, there were 347 visitor accidents at Carlsbad Caverns National Park, resulting in 1 fatality and 348 non-fatal injuries and illnesses. Since there were 3,512,947 visitors to the park during this period for a total of 13,462,234 visitor-hours, this results in an average of 9.88 accidents, 0.03 fatalities, and 9.91 injuries and illnesses per 100,000 visitors, and 25.78 accidents, 0.07 fatalities, and 25.87 injuries and illnesses per 1,000,000 visitor-hours.

### 6.2 Accidents Involving Fatalities:

Between 1993 and 1998, there was 1 accident that resulted in 1 fatality. The fatality involved a young Mexican boy aged between 1 and 5 who died from a fall while walking.

### 6.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 348 visitor injuries and illnesses arising from accidents that did not involve fatalities. Thirty-four percent of the victims were male and 66% were female. The overwhelming majority of victims (91%) were from the US, 1% were Mexican, and 5% were from various countries (including Austria, Canada, Denmark, Germany, Guatemala, Japan, Sweden, and Switzerland). Fifty-nine percent were white, 9% Mexican, 3% Asian, and 28% of unknown race/ethnicity. The distribution of victims by age is shown in Figure 6.1, which shows a considerable number of injuries and illnesses among younger visitors.

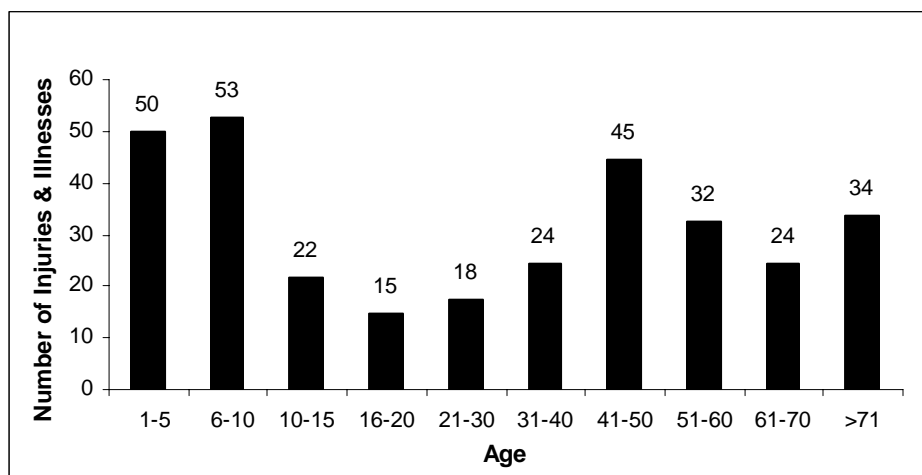
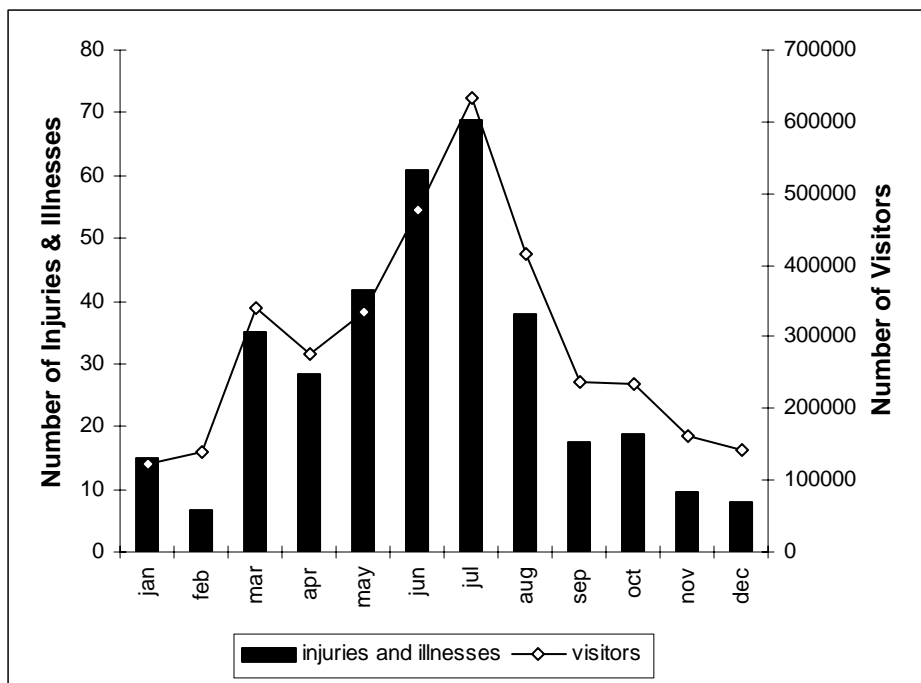


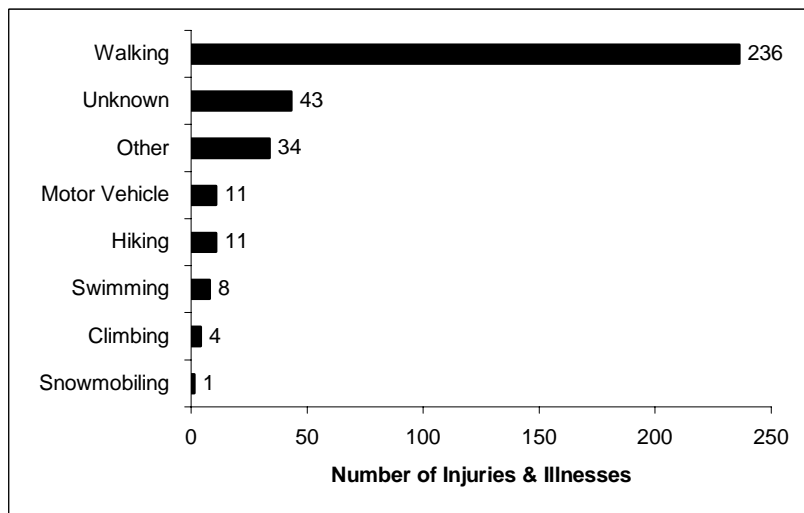
Figure 6.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=316)

Over 58% of the victims were injured between noon and 6p.m., and 32% between 6am and noon. Fifty-eight percent of the victims were injured on weekdays and 42% on weekends. The distribution of injured by month is shown in Figure 6.2, and reveals a pattern that mirrors visitation rates, with a minor peak in the spring and the primary peak in summer.



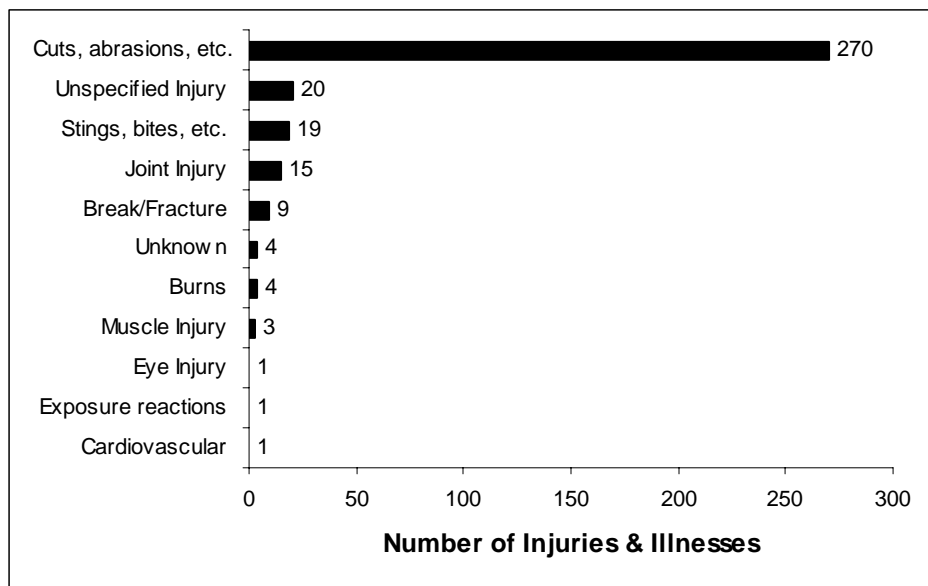
**Figure 6.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=348)**

Figure 6.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are walking (67%), which is not surprising given the nature of the park. For a substantial number of injuries and illnesses (12%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 6.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=348)**

Turning to the nature of injuries and illness, we see (Figure 6.4) that 78% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 5% involved stings, bites, etc.; and 6% were due to unspecified injuries and illnesses. Over 57% of all injuries resulted from falls while walking, and females are more likely to suffer cuts and abrasions (172/270 or 64%) than males (97/270 or 36%).

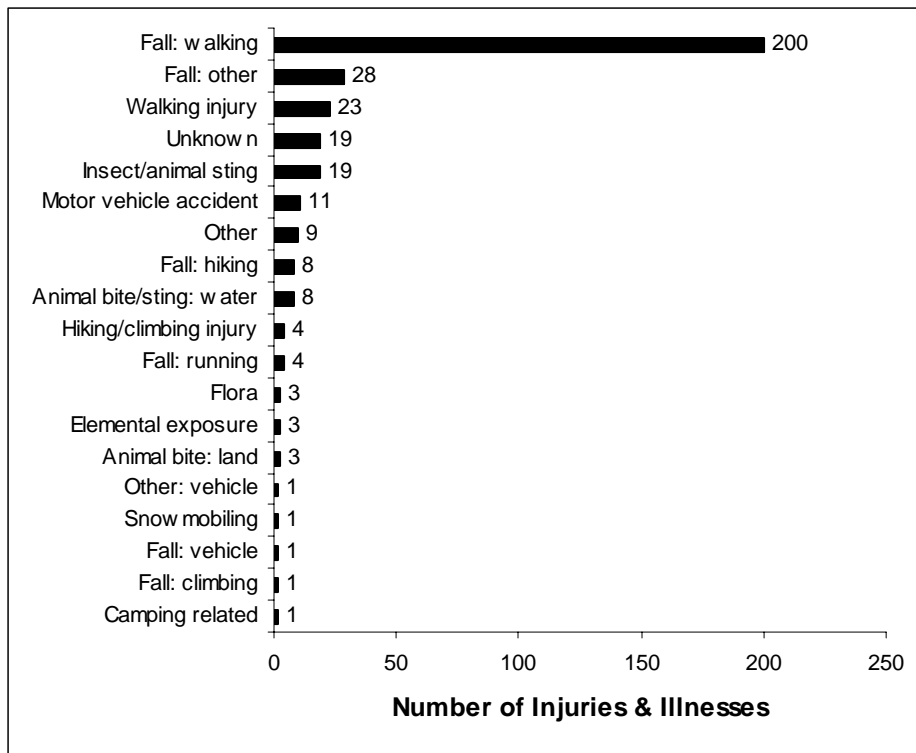


**Figure 6.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=348)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 348 injuries and illnesses occurring during this period, 309 (89%) could be considered less serious because the visitors were treated and released, and 28 (8%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 17 (5%) were transported by ambulance and 11 (3%) were transported by privately owned vehicle. All 17 of these injuries involved cuts, abrasions, and bruises. Ninety-two percent (247/270) of cuts, abrasions, and bruises, and were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 6.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would listed as hiking, but the primary event would be insect/animal sting. Figure 6.5 shows that the majority (242/348 or 70%) of injuries and illnesses arise from falls of various kinds, and that falls while walking are the most common event leading to injuries. A further 6% of injuries, such as strained muscles, are sustained during the course of walking. Five percent of injuries and illnesses result from animal/insect stings.





**Figure 6.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=348)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Since there are few accidents resulting from these kinds of activities at Carlsbad Caverns, there are few data on contributing factors.

## 7.0 Cape Hatteras National Seashore

### 7.1 Introduction:

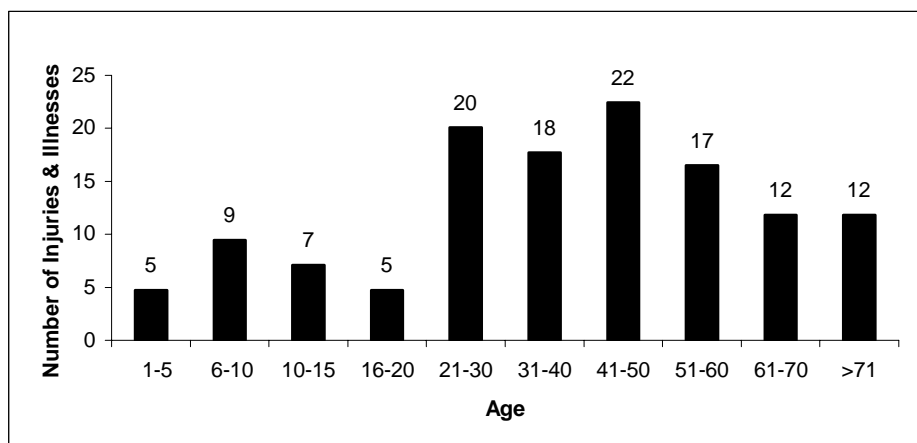
Between 1993 and 1998, there were 187 visitor accidents at Cape Hatteras National Seashore, resulting in 15 fatalities and 158 non-fatal injuries and illnesses. Since there were 14,636,238 visitors to the park during this period for a total of 69,050,860 visitor-hours, this results in an average of 1.28 accidents, 0.10 fatalities, and 1.08 injuries and illnesses per 100,000 visitors, and 2.71 accidents, 0.22 fatalities, and 2.29 injuries and illnesses per 1,000,000 visitor-hours.

### 7.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 15 accidents that resulted in a total of 15 fatalities. The fatalities were all male residents of the US, and included 13 whites and 1 African-American. The race of one victim was unknown. Eleven of the fatalities occurred while the visitors were engaged in water-related activities, including boating (2), swimming (5), and fishing (1). In 10 cases, the primary event precipitating the accident was swimming, surfing, or wading. Two fatalities resulted from boating accidents, 1 from elemental exposure, 1 from a fall while hiking, and 1 from other causes. Four of the fatalities occurred on weekends and 11 on weekdays. Search and rescue efforts were launched for 7/15 of the victims.

### 7.3 Accidents Involving No Fatalities

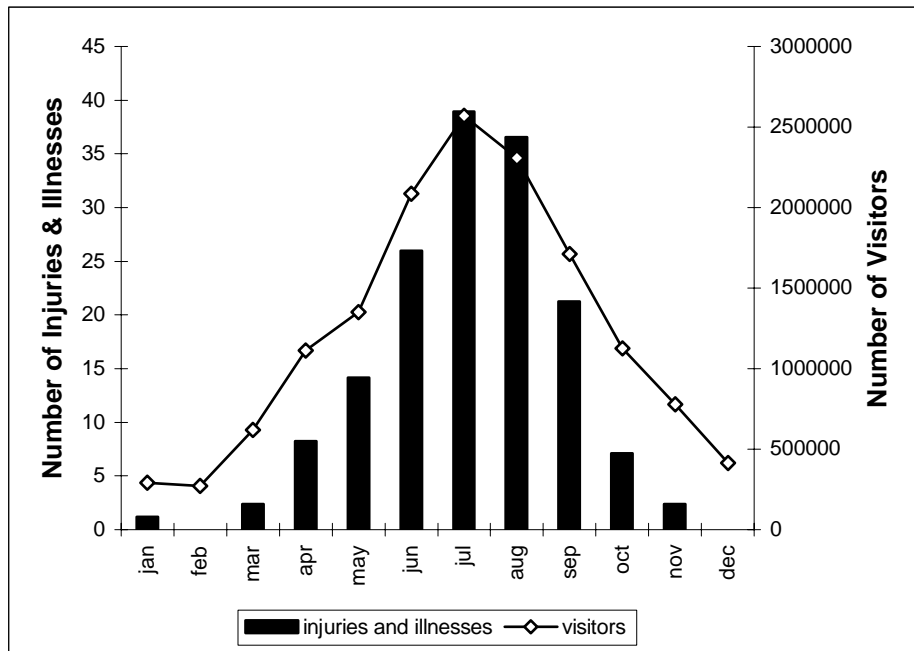
Between 1993 and 1998, there were an estimated 158 visitor injuries and illnesses arising from accidents that did not involve fatalities. Forty-eight percent of the victims were male and 51% were female. The overwhelming majority of victims (90%) were white, with 1.5% Hispanic, and 7% of unknown race or ethnicity. Ninety-seven percent were residents of the US, 2% from Canada, and 1% were from Germany. The distribution of victims by age is shown in Figure 7.1.



**Figure 7.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=126)**

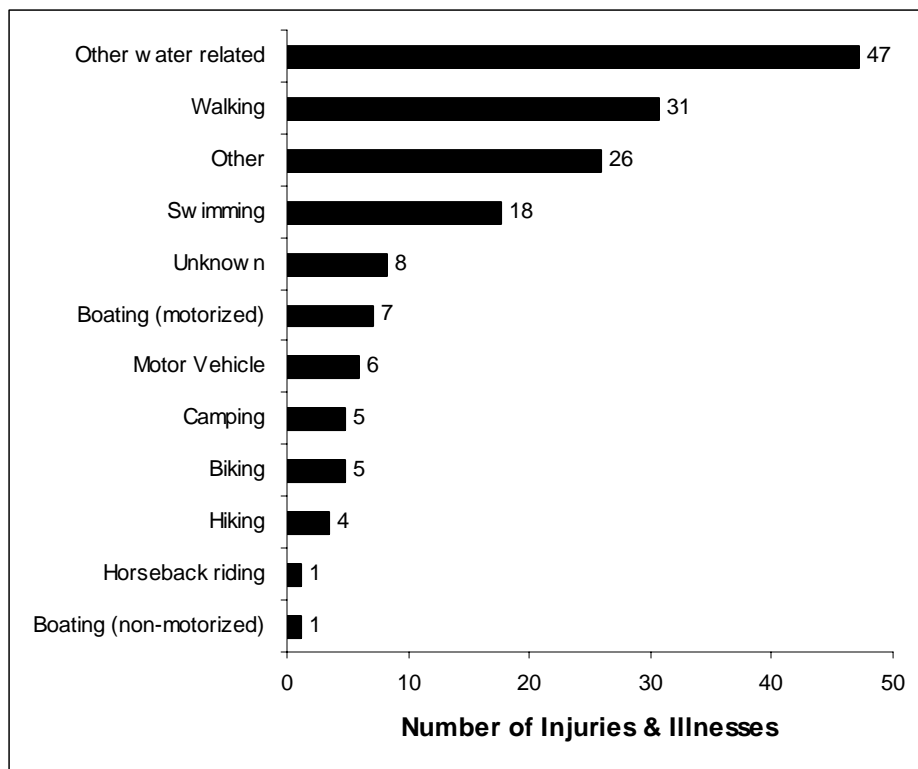
Over 65% of the victims were injured between noon and 6p.m., and 19% between 6am and noon. Sixty-five percent of the victims were injured on weekdays and 35% on weekends. The

distribution of injured by month is shown in Figure 7.2, and reveals a pattern that mirrors visitation rates, with a peak in the summer months of July and August.



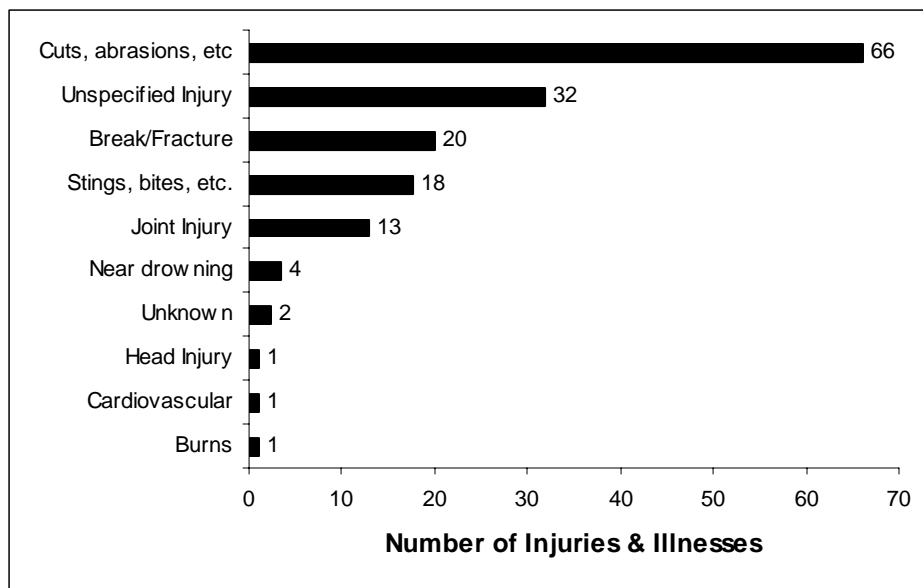
**Figure 7.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=158)**

Figure 7.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors were walking (19%), swimming (11%), or engaged in a variety of other water related activities (30%).



**Figure 7.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=158)**

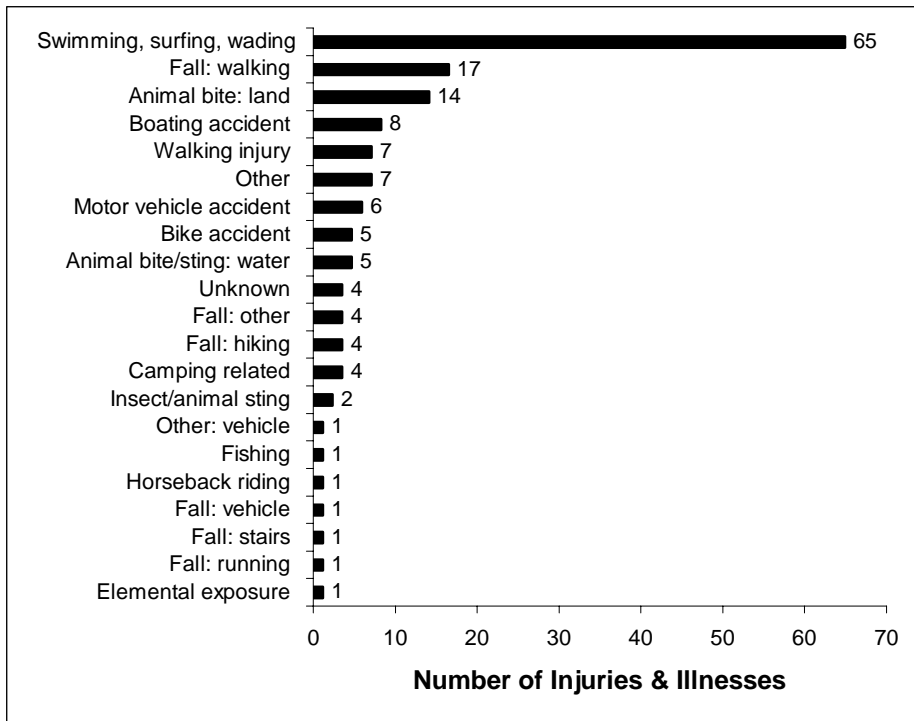
Turning to the nature of injuries and illness, we see (Figure 7.4) that 42% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 13% involved broken bones or fractures; 12% resulted from stings, bites, etc.; and in 20% of the case the injuries and illnesses were unspecified. The incidence of cuts and abrasions is roughly evenly divided between the sexes (47% female and 51% male), but females are more likely to suffer breaks or fractures (14/20 cases) and other unspecified injuries (22/31).



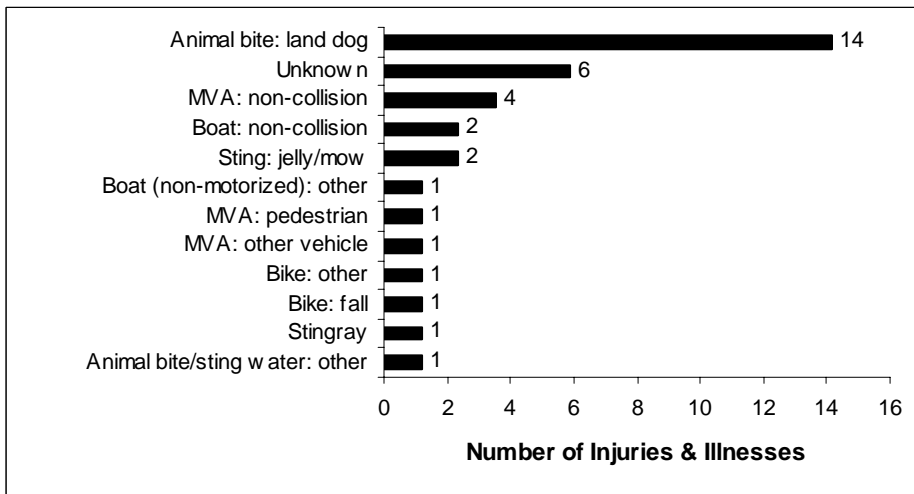
**Figure 7.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=158)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 158 injuries and illnesses occurring during this period, 45 (28%) could be considered less serious because the visitors were treated and released, and 46 (29%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 35 (76%) were transported by ambulance and 11 (24%) were transported by privately owned vehicle. Two people (1.5%) refused treatment and in 61 (39%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 2 cases it is unknown what if any response was taken. Search and rescues were conducted in only 5% of cases.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 7.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 7.6.



**Figure 7.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=158)**



**Figure 7.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=37)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 18 injuries and illnesses associated with these activities, 27% are driver-related, 13% road-related, and 13% are a result of equipment failure. In 27% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.



## 8.0 Canyonlands National Park

### 8.1 Introduction:

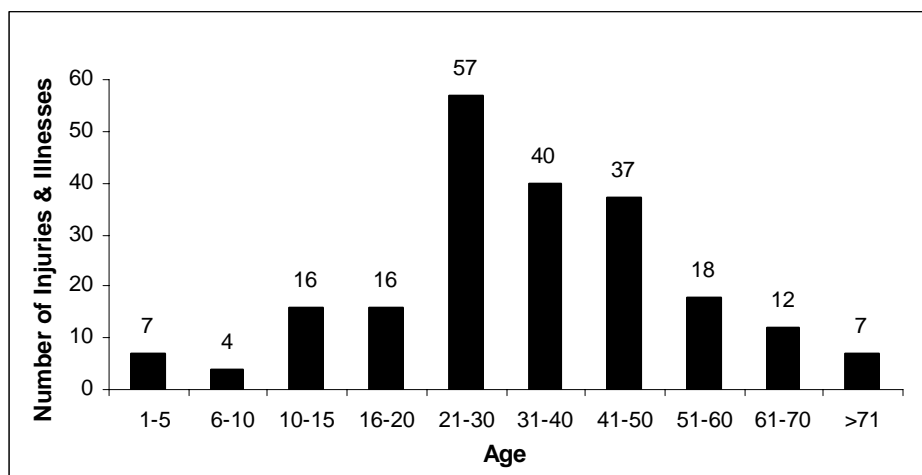
Between 1993 and 1998, there were 231 visitor accidents at Canyonlands National Park, resulting in 8 fatalities and 234 non-fatal injuries and illnesses. Since there were 2,630,282 visitors to the park during this period for a total of 26,716,869 visitor-hours, this results in an average of 8.78 accidents, 0.30 fatalities, and 8.90 injuries and illnesses per 100,000 visitors, and 8.65 accidents, 0.30 fatalities, and 8.80 injuries and illnesses per 1,000,000 visitor-hours.

### 8.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 6 accidents that resulted in a total of 8 fatalities. All eight fatalities were white, US residents. Seven victims were male and one was female. Three of the fatalities occurred on weekends and 5 on weekdays. Five fatalities occurred while visitors were boating, 2 while hiking, and 1 while swimming. Of the five non-motorized boating fatalities, 3 were as a result of capsizing.

### 8.3 Accidents Involving No Fatalities

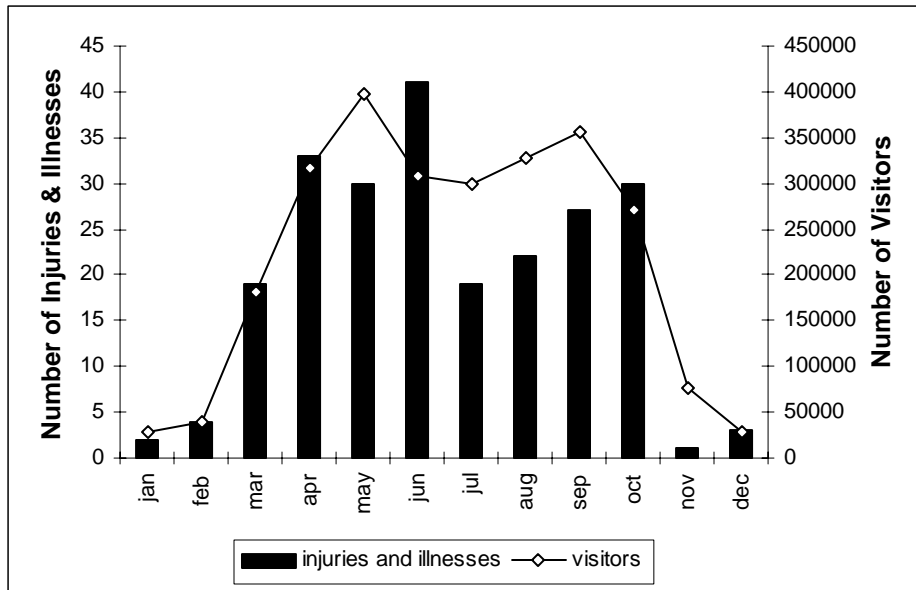
Fifty-four percent of the victims (126/234) involved in accidents without fatalities were male and 44% (103/234) were female. The overwhelming majority of victims (96%) were white and 85% were residents of the US, 4% were from Germany, 3% from Belgium, and 3% from France. The distribution of victims by age is shown in Figure 8.1.



**Figure 8.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=214)**

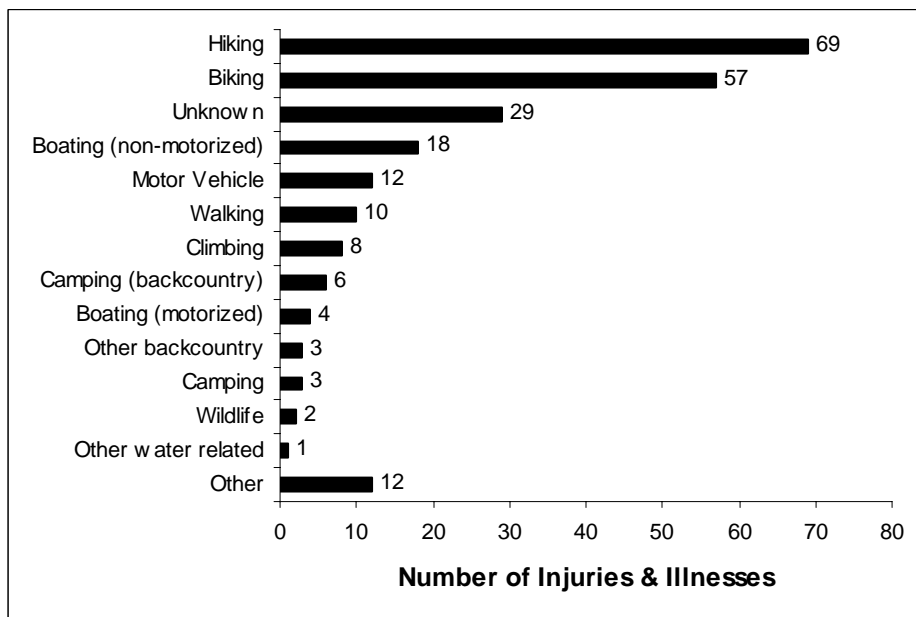
Over 63% (130/206) of the victims were injured between noon and 6p.m., and 26% (54/206) between 6am and noon. Seventy percent of the victims (164/234) were injured on weekdays and 30% (70/231) on weekends. The distribution of injured by month is shown in Figure 8.2, and reveals a pattern that mirrors visitation rates, with a peak in the spring/early summer and a smaller peak in the fall.





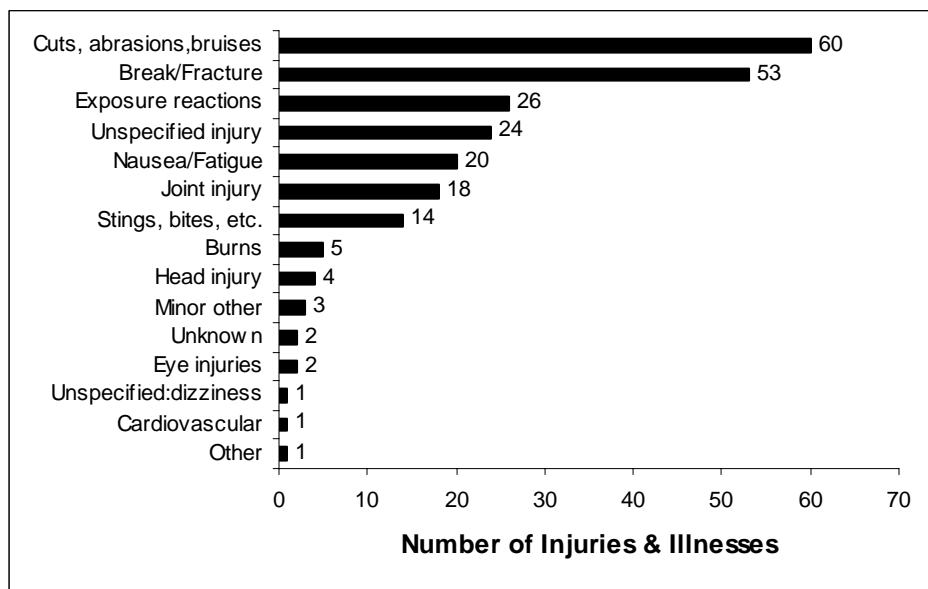
**Figure 8.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=234)**

Figure 8.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are hiking (29%) and biking (24%), although for a substantial number of injuries and illnesses (12%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 8.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=234)**

Turning to the nature of visitor injuries and illnesses, we see (Figure 8.4) that 26% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 23% involved broken bones or fractures; 11% (26/234) resulted from exposure to heat or cold; and 10% were due to unspecified injuries and illnesses. The incidence of breaks and fractures is evenly divided between the sexes (51% female and 49% male), but males are more likely to suffer cuts and abrasions (65%), exposure reactions (65%), and nausea/fatigue (70%).

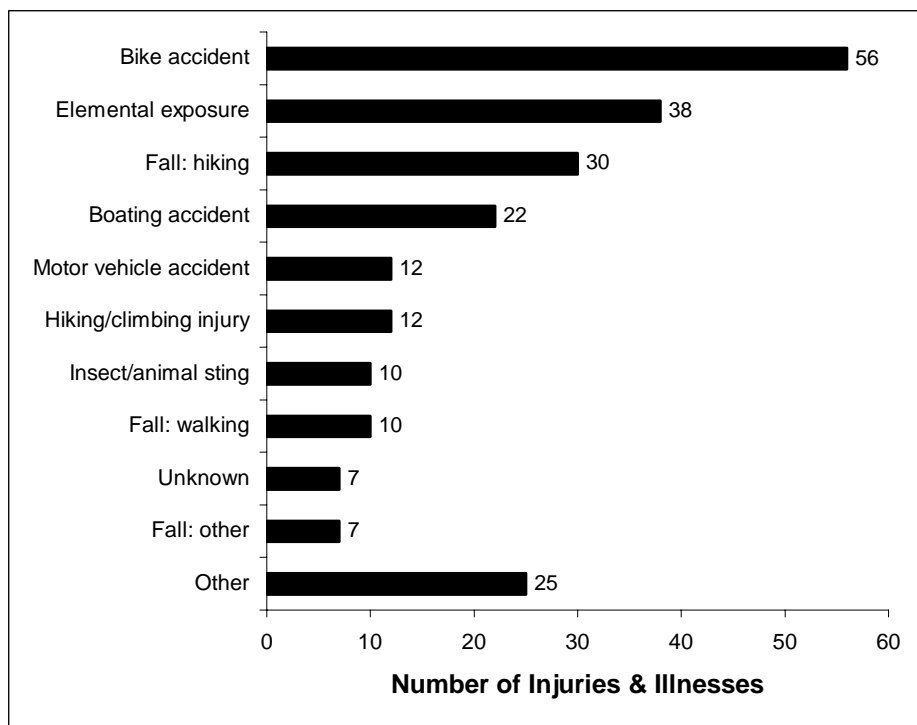


**Figure 8.4: Types of Visitor Injuries and illnesses, 1993-98 (N=234)**

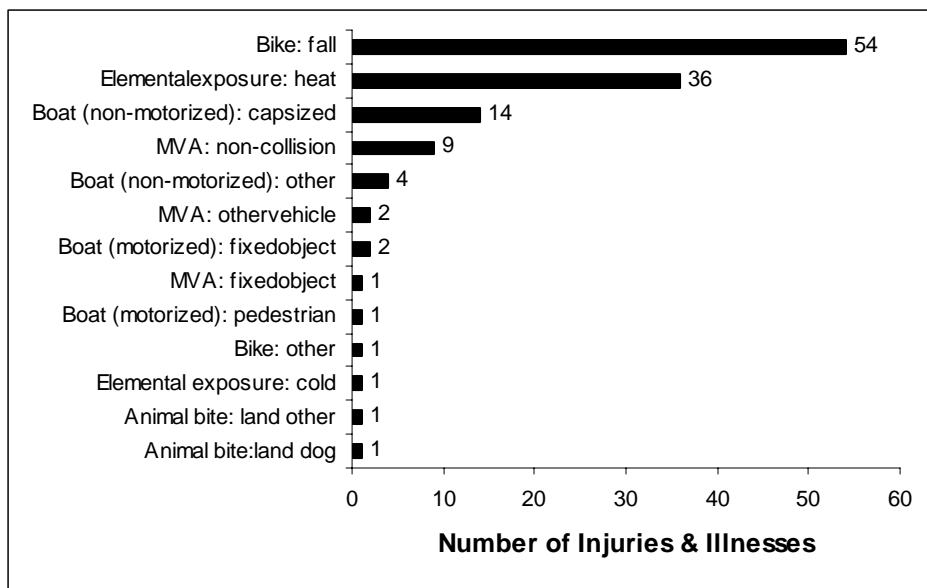
Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 234 injuries and illnesses occurring during this period, 127 (54%) could be considered less serious because the visitors were treated and released, and 103 (44%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 49 (21%) were transported by ambulance and 38 (16%) were transported by privately owned vehicle. Three people (1%) refused treatment and in 16 cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. One case it is unknown what if any response was taken. The majority of injuries and illnesses involving suspected breaks or fractures (36/53 or 68%) required transportation to a medical facility, although it is not known how many of these cases were subsequently diagnosed as true breaks or fractures. By contrast, the majority of cuts and abrasions (43/60 or 72%) and exposure reactions (21/26 or 81%) were treated and released by park personnel on the scene.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 8.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor

was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 8.6.



**Figure 8.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=234)**



**Figure 8.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=129)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 90 injuries and illnesses associated with these activities, 38% are driver-related, 13% environmental factors, 9% road-related, and 6% are a result of equipment failure. In 30% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

## 9.0 Curecanti National Recreation Area

### 9.1 Introduction:

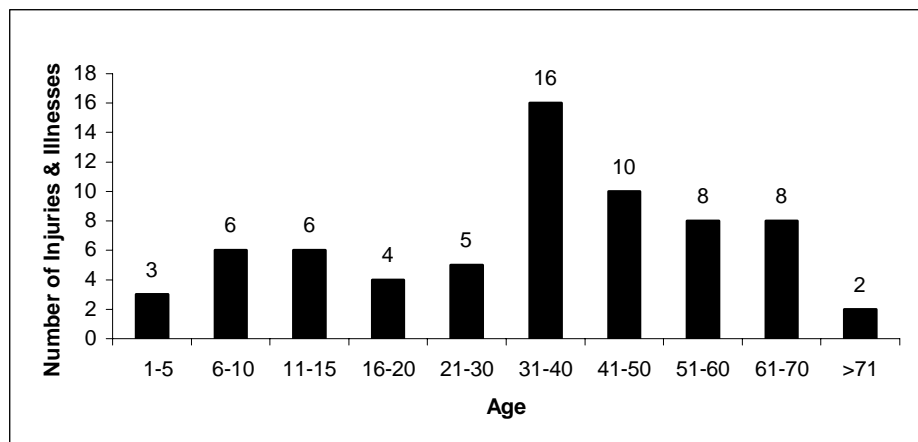
Between 1993 and 1998, there were 85 visitor accidents at Curecanti National Park, resulting in 8 fatalities and 79 non-fatal injuries and illnesses. Since there were 6,104,296 visitors to the park during this period for a total of 28,212,573 visitor-hours, this results in an average of 1.39 accidents, 0.13 fatalities, and 1.29 injuries and illnesses per 100,000 visitors, and 3.01 accidents, 0.28 fatalities, and 2.8 injuries and illnesses per 1,000,000 visitor-hours.

### 9.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 7 accidents that resulted in a total of 8 fatalities. All eight fatalities were white, US residents. Four victims were male and four were female. Three of the fatalities occurred on weekends and five on weekdays. Two fatalities occurred while visitors were engaged in motorized boating, 2 in other water related activities (such as swimming or wading), 2 while driving or riding in motor vehicles, 1 from a fall while hiking, and 1 during unknown activities. Search and rescues were launched in 3 cases.

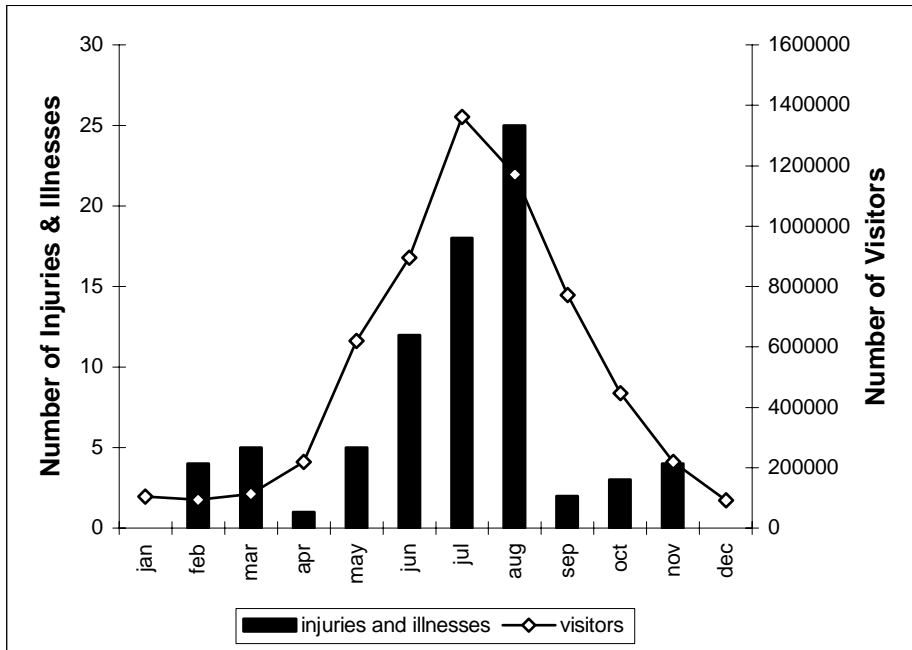
### 9.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 79 visitor injuries and illnesses arising from accidents that did not involve fatalities. Fifty-eight percent of the victims were male and 39% were female. The overwhelming majority of victims (96%) were white and 97% were residents of the US. Two percent of the victims were of Hispanic ethnicity. The distribution of victims by age (Figure 9.1) shows that the teenage and young adults appear to be under-represented among victims, although this may merely reflect the age composition of visitors in general.



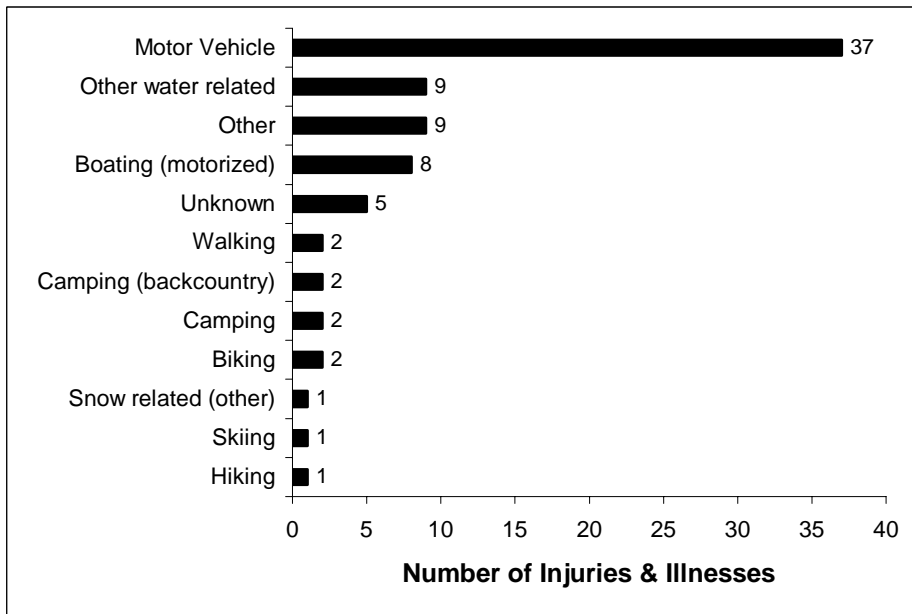
**Figure 9.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=68)**

Almost 43% of the victims were injured between noon and 6p.m., 38% between 6am and noon, and 13% between 6p.m. and midnight. Fifty-six percent of the victims were injured on weekdays and 44% on weekends. The distribution of injured by month is shown in Figure 9.2, and reveals a pattern that mirrors visitation rates, with a peak in the late summer.



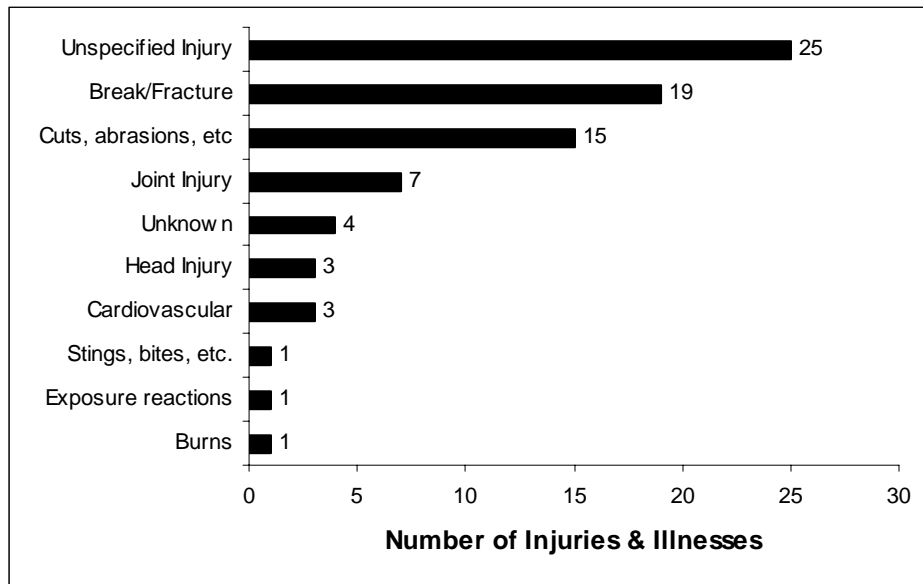
**Figure 9.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=79)**

Figure 9.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are engaged in driving or riding in motor vehicles (47%), boating (10%) and other water-related activities (11%).



**Figure 9.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=79)**

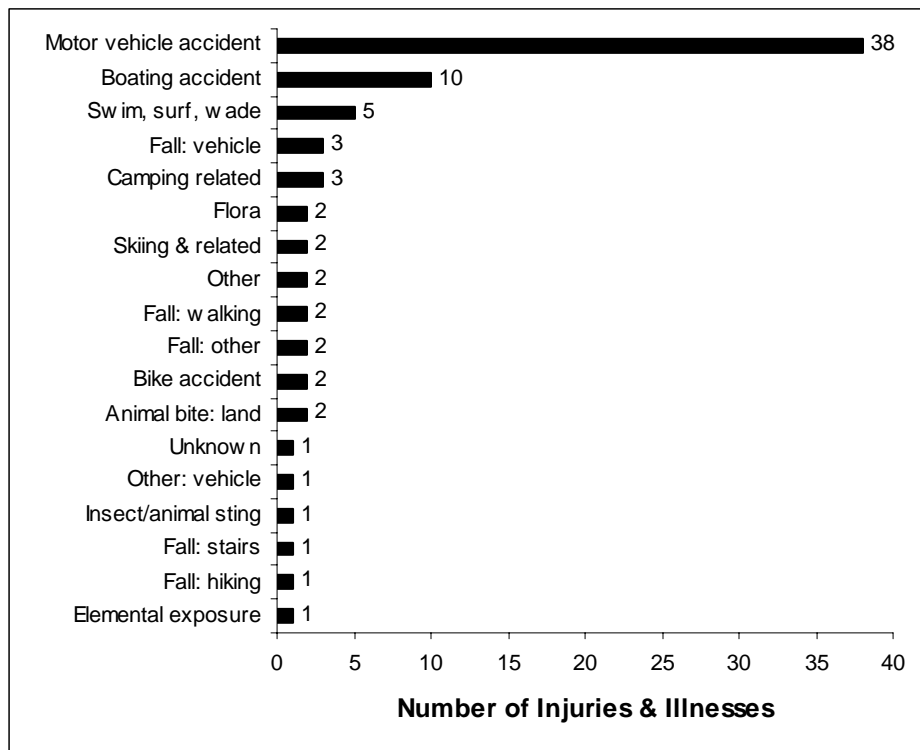
Turning to the nature of injuries and illness, we see (Figure 9.4) that 24% of victims suffered broken bones or fractures and 19% suffered cuts, abrasions, and bruises; but the records indicate 32% suffered unspecified injuries and illnesses.



**Figure 9.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=79)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 79 injuries and illnesses occurring during this period, 25 (32%) could be considered less serious because the visitors were treated and released, and 44 (56%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 41 (52%) were transported by ambulance and 3 (4%) were transported by privately owned vehicle. Five people (6%) refused treatment and in 5 cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. Of the 44 injuries and illnesses requiring transportation to a medical facility, 14 (18%) were for the treatment breaks and fractures, and 13 (16%) were for unspecified injuries and illnesses. There was only 1 search and rescue conducted during this period.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 9.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Evidently, motor vehicle accidents are the primary causal event of accidents at Curecanti. Of 38 motor vehicle accidents, 28 involved non-collisions, 9 involved collisions with other vehicles, and 1 involved hitting a pedestrian. Of the 10 injuries caused by boating accidents, 4 involved collisions with fixed objects and 1 a collision with another boat.



**Figure 9.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=79)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 47 injuries and illnesses for which we have data, 19% are driver-related, 6% environmental factors, 25% road-related, and 2% are a result of equipment failure.

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 47 injuries and illnesses associated with these activities, 19% are driver-related, 6% environmental factors, 25% road-related, and 2% are a result of equipment failure. In 47% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.



## 10.0 Cuyahoga Valley National Recreation Area

### 10.1 Introduction:

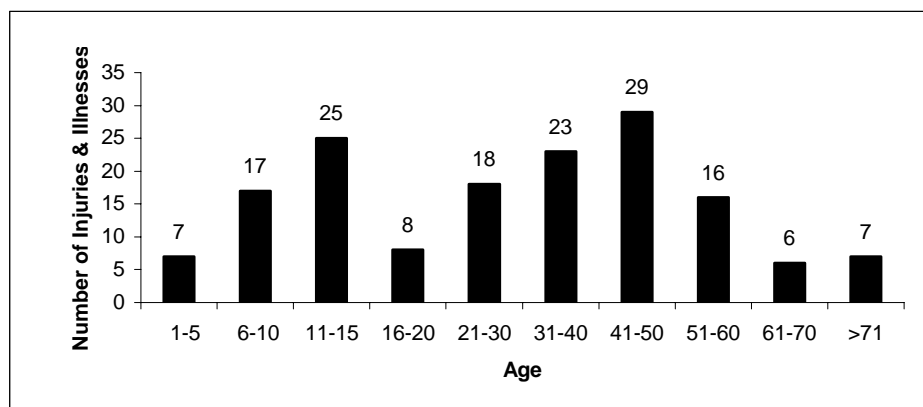
Between 1994 and 1998, there were 186 visitor accidents at Cuyahoga Valley National Recreation Area, resulting in 2 fatalities and 193 non-fatal injuries and illnesses<sup>2</sup>. Since there were 16,912,430 visitors to the park during this period for a total of 50,264,071 visitor-hours, this results in an average of 1.10 accidents, 0.01 fatalities, and 1.14 injuries and illnesses per 100,000 visitors, and 3.70 accidents, 0.04 fatalities, and 3.84 injuries and illnesses per 1,000,000 visitor-hours.

### 10.2 Accidents Involving Fatalities:

Between 1994 and 1998, there were 2 accidents that resulted in a total of 2 fatalities. Both fatalities involved male US residents, one of which was white and the other was of unknown race/ethnicity. One fatality resulted from a non-collision motor vehicle accident and the other from a fall while walking. Both accidents occurred on weekdays, one between 6:00pm and midnight and the other between midnight and 6:00am. Neither accident required a search and rescue effort.

### 10.3 Accidents Involving No Fatalities

Between 1994 and 1998, there were an estimated 193 visitor injuries and illnesses arising from accidents that did not involve fatalities. Forty-one percent of the victims were male and 57% were female. The overwhelming majority of victims (95%) were white, with 1% African-American, and 4% of unknown race/ethnicity. Ninety-nine percent were residents of the US. The distribution of victims by age is shown in Figure 10.1, which shows a peak among 11-15 year olds and another among 41-50 year olds.

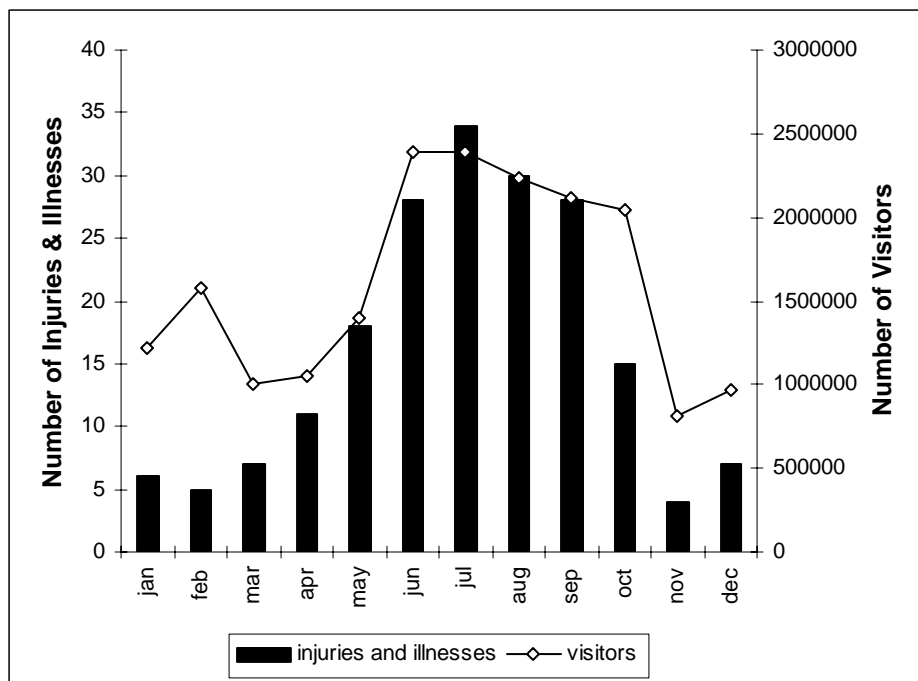


**Figure 10.1: Visitor Injuries and Illnesses by Age, 1994-98 (N=193)**

Over 56% of the victims were injured between noon and 6p.m., and 25% between 6am and noon. A substantial number (34 or 19%) were injured during the evening hours from 6:00pm to

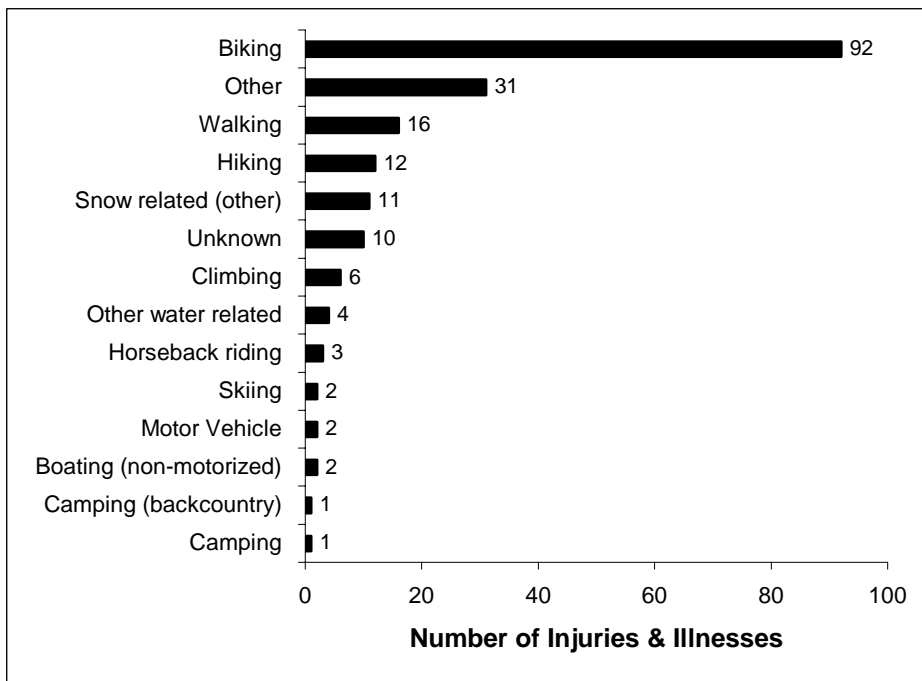
<sup>2</sup> The data for 1993 were missing or unavailable.

midnight.. Fifty-three percent of the victims were injured on weekdays and 47% on weekends. The distribution of injured by month is shown in Figure 10.2, which shows a sustained peak through the summer. Given the visitation rates, there are perhaps fewer than expected injuries and illnesses in the winter months.



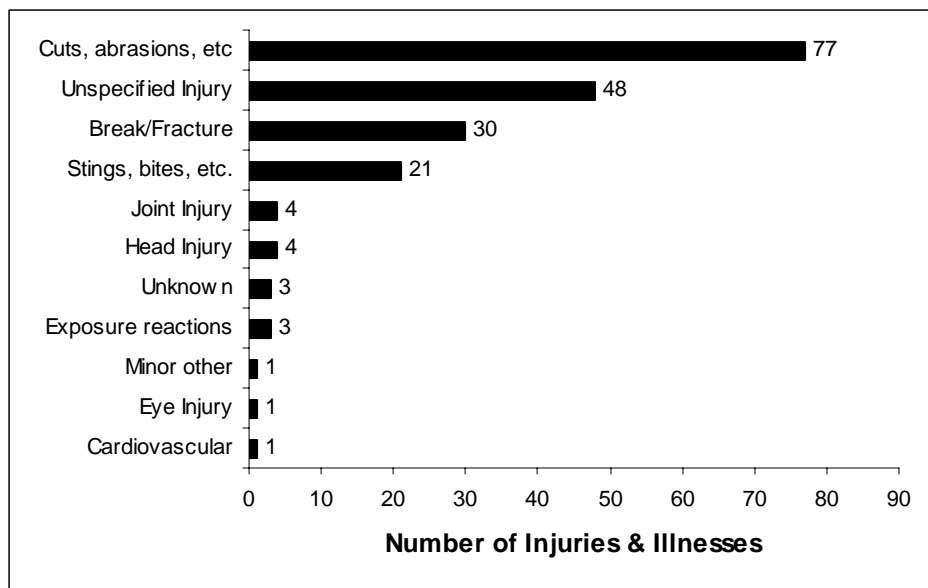
**Figure 10.2: Visitor Injuries and Illnesses by Month, 1994-98 (N=193)**

Figure 10.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are biking (48%), walking (8%), and hiking (6%), although there are also substantial numbers of injuries and illnesses (16%) that arise during a variety of miscellaneous activities here classified as “other.”



**Figure 10.3: Visitor Injuries and Illnesses by Activity, 1994-98 (N=193)**

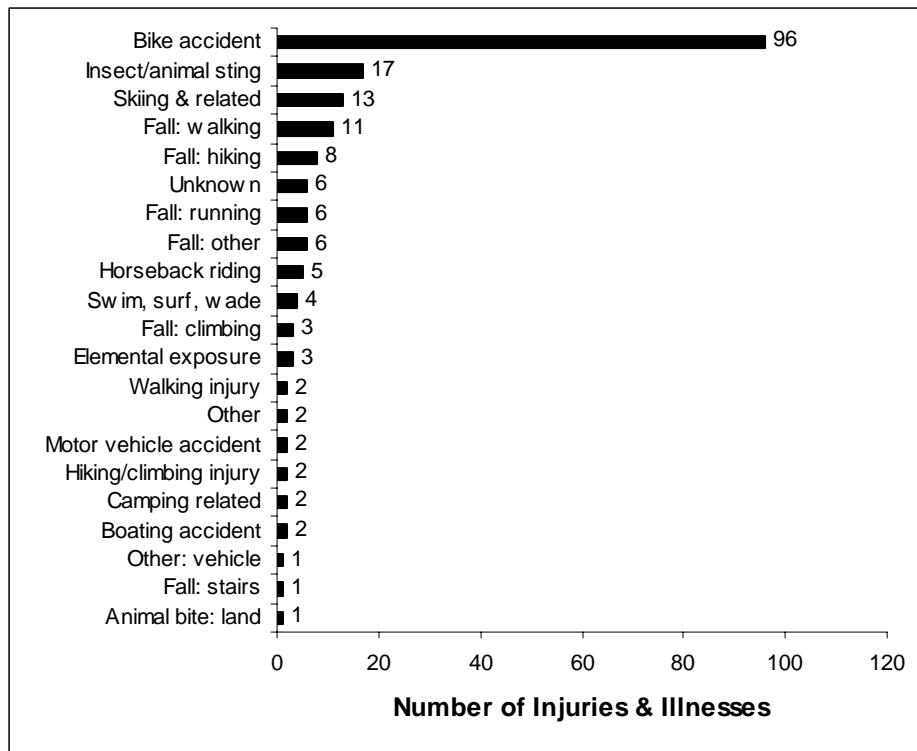
Turning to the nature of injuries and illness, we see (Figure 10.4) that 40% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 15% involved broken bones or fractures; 11% resulted from stings and bites; and 25% were due to unspecified injuries and illnesses. Females are more likely than males to be the victims of breaks and fractures (18/40 for females versus 12/40 for males), cuts and abrasions (41/77 for females versus 35/77 for males), stings and bites (12/21 for females versus 9/21 for males), and various unspecified injuries (32/49 for females versus 16/49 for males).



**Figure 10.4: Types of Visitor Injuries and Illnesses, 1994-98 (N=193)**

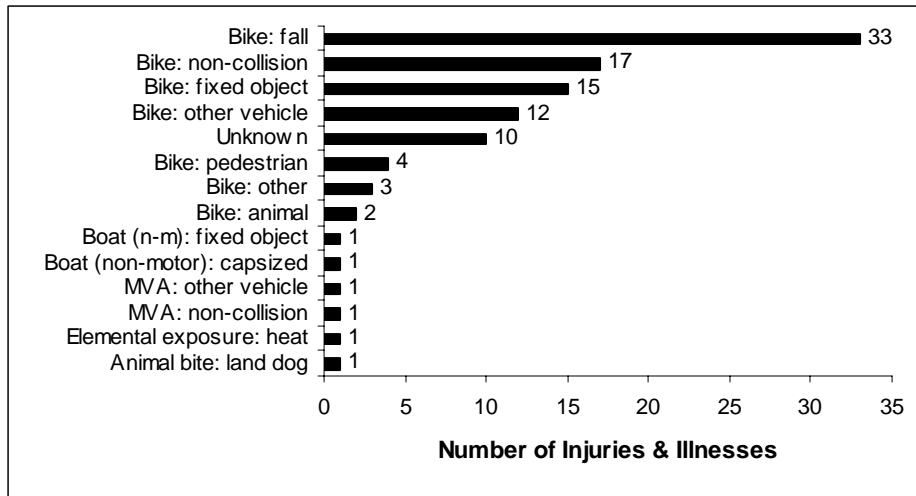
Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 193 injuries and illnesses occurring during this period, 81 (42%) could be considered less serious because the visitors were treated and released, and 88 (46%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 69 (36%) were transported by ambulance and 19 (10%) were transported by privately owned vehicle. One person refused treatment and in 22 cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 1 case it is unknown what if any response was taken. Of the 88 injuries and illnesses requiring transportation to a medical facility, 31 (16%) were for breaks and fractures, 25 (13%) were for the treatment of cuts, abrasions, and bruises, and 28 (14%) were for unspecified injuries and illnesses. Fifty-four percent (42/77) of cuts, abrasions, and bruises, and 62% (13/21) of stings and bites were treated and released. There were 4 search and rescues.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 10.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting.



**Figure 10.5: Visitor Injuries and Illnesses by Primary Event, 1994-98 (N=193)**

Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 10.6. Evidently, biking accidents are the primary event causing 50% (96/193) of all injuries at Cuyahoga Valley NRA. Figure 10.6 shows that 34% (33/96) of bike accidents involve falls, 17% (17/96) involve non-collisions (e.g., running off the road), 15% (15/96) involve collisions with fixed objects, and 12% (12/96) involve collisions with other vehicles, including other bicycles. Out of the 90 cases of bike accidents on which we have some information about contributing factors, 61% (55/90) were attributed to driver related factors (e.g., loss of control), 13% (12/90) to road conditions, 3% (3/90) to equipment failure, and 2% (2/90) to environmental conditions (e.g., fog, rain).



**Figure 10.6: Visitor Injuries and Illnesses by Secondary Event, 1994-98 (N=102)**

## 11.0 Denali National Park and Preserve

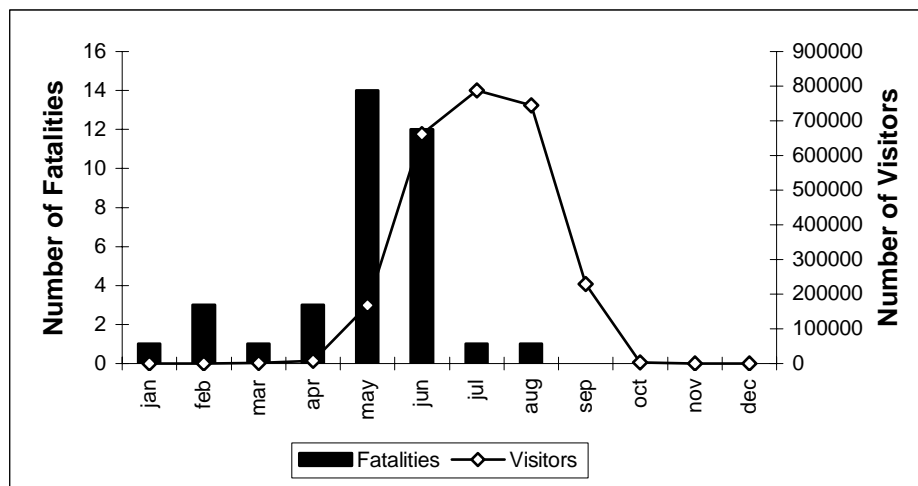
### 11.1 Introduction:

Between 1993 and 1998, there were 393 visitor accidents at Denali National Park and Preserve, resulting in 36 fatalities and 412 non-fatal injuries and illnesses. Since there were 2,607,367 visitors to the park during this period for a total of 35,694,533 visitor-hours, this results in an average of 15.07 accidents, 1.38 fatalities, and 15.79 injuries and illnesses per 100,000 visitors, and 11.01 accidents, 1.01 fatalities, and 11.53 injuries and illnesses per 1,000,000 visitor-hours.

### 11.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 22 accidents that resulted in a total of 36 fatalities. Eighty-three percent (30/36) of the victims were male and 17% (6/36) were female. Seventy-five percent (27/36) of the victims were residents of the US, 3 (8%) were from Germany, and the other 6 were from Croatia, Korea, Russia, Spain, Taiwan, and the UK. Ninety-four percent were white and 2 (6%) were Asian. Nineteen (53%) of the fatalities occurred on weekends and 17 (47%) on weekdays. Forty-seven percent of the fatalities (16/34) occurred between 12:00 noon and 6:00pm, 26% (9/34) between 6:00am and 12:00 noon, 21% (7/34) between 6:00pm and 12:00 midnight, and 6% (2/34) between 12:00 midnight and 6:00 am. Search and rescue efforts were launched for 92% (33/36) of the victims.

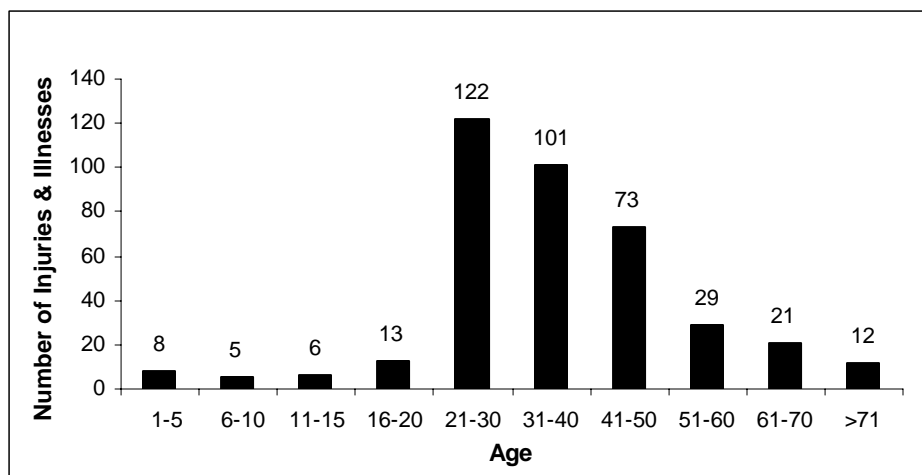
The primary activities in which visitors were engaged at the time of the accidents include climbing (64%), hiking (3%), walking (3%), and “other” activities (30%). The primary events leading to the fatalities include falls while climbing (39%), vehicle accidents (28%), and hiking/climbing injuries (14%). Seventy-one percent (27/33) of the victims were between 21 and 40 years of age. It would appear from Figure 11.1 that most of these fatalities occur among the younger, more adventurous visitors who come to Denali ahead of the main tourist season when the conditions may be more dangerous.



**Figure 11.1: Visitor Fatalities by Month, 1993-98 (N=36)**

### 11.3 Accidents Involving No Fatalities

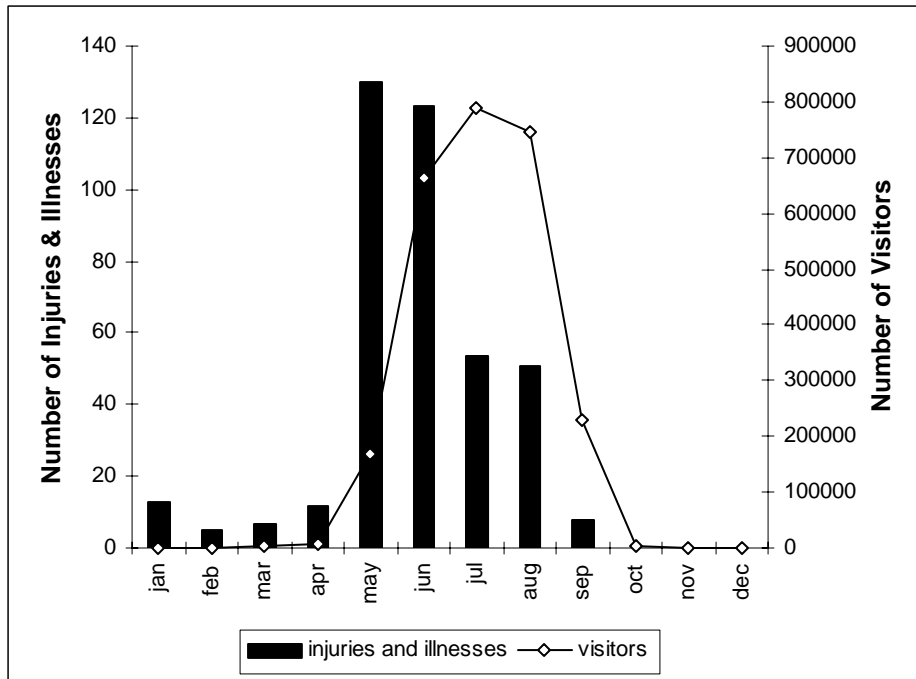
Between 1993 and 1998, there were an estimated 412 visitor injuries and illnesses arising from 371 accidents that did not involve fatalities. Seventy-six percent of the victims were male and 24% were female. The overwhelming majority of victims (87%) were white. Sixty-three percent of victims were residents of the US, 5% were from Japan, 5% from the UK, and the remainder was from 19 other countries. The distribution of victims by age is shown in Figure 11.2, which probably reflects the distribution of visitors by age with relatively few children and teenagers.



**Figure 11.2: Visitor Injuries and Illnesses by Age, 1993-98 (N=390)**

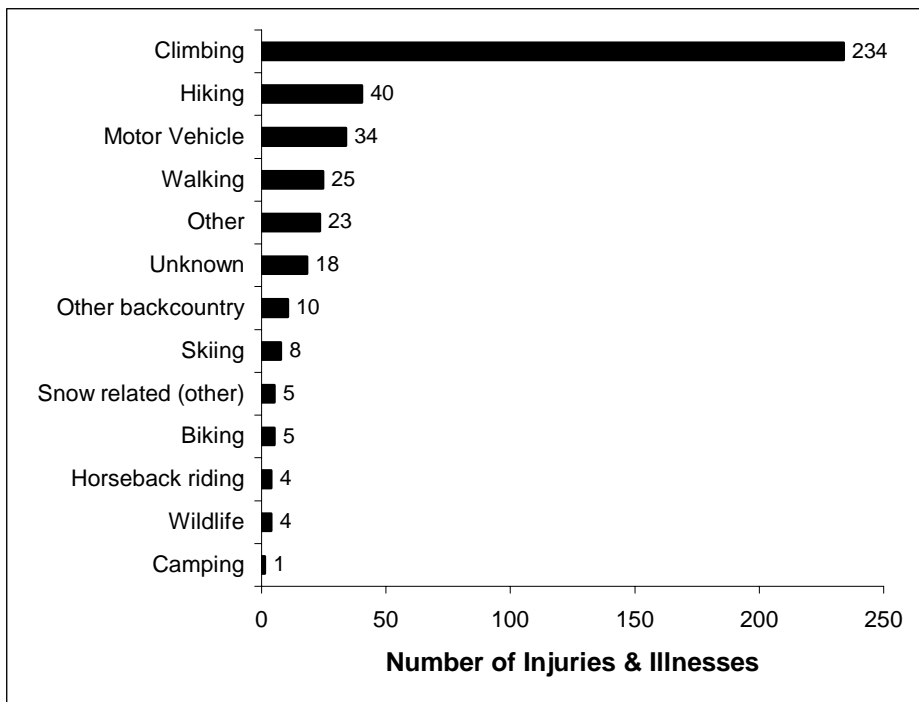
Over 51% of the victims were injured between noon and 6p.m., 25% between 6am and noon, and 18% between 6:00pm and 12:00 midnight. Seventy-one percent of the victims were injured on weekdays and 29% on weekends. The distribution of injured by month is shown in Figure 11.3, and reveals a pattern similar to that found with fatalities. It appears that a higher proportion of accidents occur prior to the main tourist season, and may well include the more adventurous visitors.





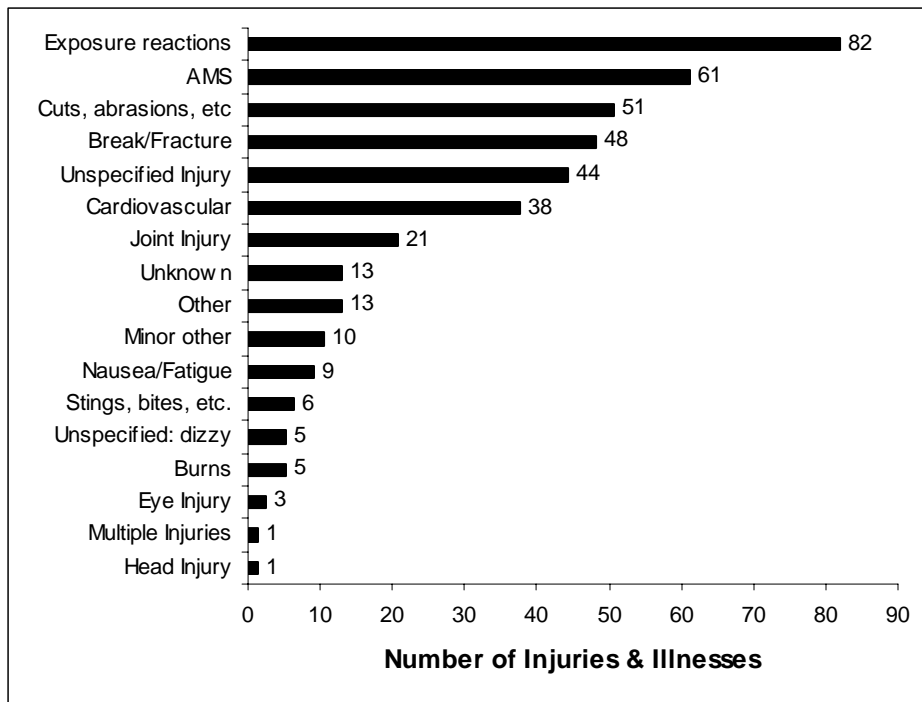
**Figure 11.3: Visitor Injuries and Illnesses by Month, 1993-98 (N=402)**

Figure 11.4 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are climbing (57%) hiking (10%), driving (8%), and walking (6%).



**Figure 11.4: Visitor Injuries and Illnesses by Activity, 1993-98 (N=412)**

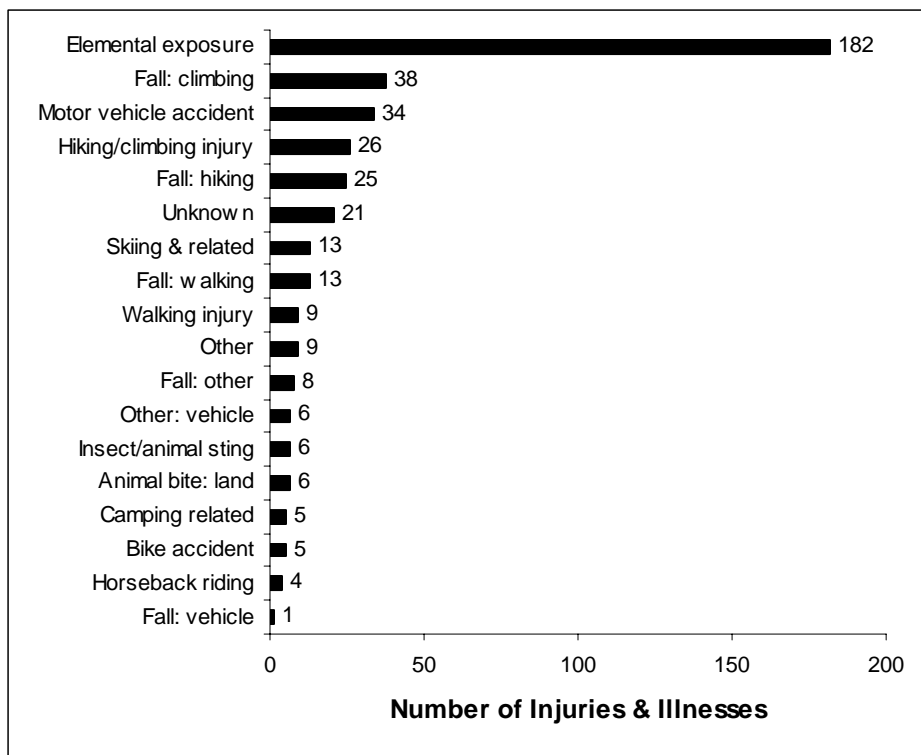
Turning to the nature of injuries and illness, we see (Figure 11.5) that 20% of all injuries and illnesses between 1993 and 1998 were reactions to cold exposure; 15% involved acute mountain sickness (AMS), 12% involved cuts, abrasions, and bruises, 12% involved broken bones or fractures; 10% involved cardiovascular problems and 11% were due to unspecified injuries and illnesses. The incidence of breaks and fractures is roughly evenly divided between the sexes (21/48 female and 27/48 male), but males are more likely to suffer exposure reactions (75/82), AMS (56/61), cuts and abrasions (31/51).



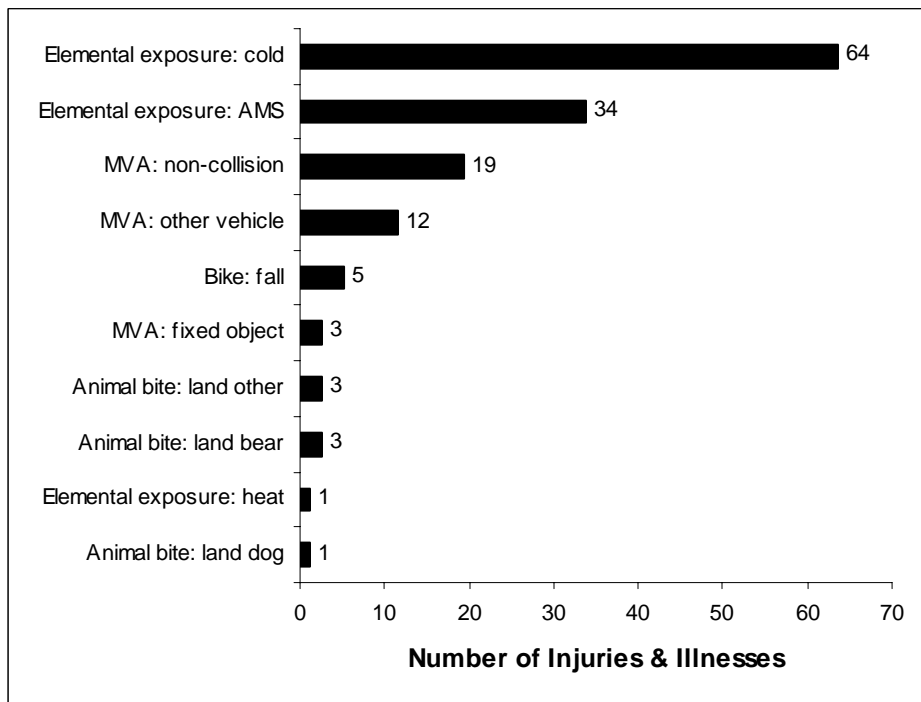
**Figure 11.5: Types of Visitor Injuries and Illnesses, 1993-98 (N=412)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 412 injuries and illnesses occurring during this period, 212 (51%) could be considered less serious because the visitors were treated and released, and 174 (43%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 143 (35%) were transported by ambulance and 31 (8%) were transported by privately owned vehicle. Ten people (2%) refused treatment and in 9 (2%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. Of the 174 injuries and illnesses requiring transportation to a medical facility, 40 (23%) were for the treatment of broken bones or fractures, 24 (14%) were for the treatment of cuts, abrasions, and bruises, and 24 (14%) were for exposure. Seventy percent (57/82) of exposure cases, 70% (43/61) of AMS cases, and 50% of cuts, abrasions, and bruises (25/51) were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 11.6 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 11.7.



**Figure 11.6: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=ZZ)**



**Figure 11.7: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=ZZ)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 39 injuries and illnesses associated with these activities, 60% were driver-related and 3% were road-related. In 33% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

## 12.0 Delaware Water Gap National Recreation Area

### 12.1 Introduction:

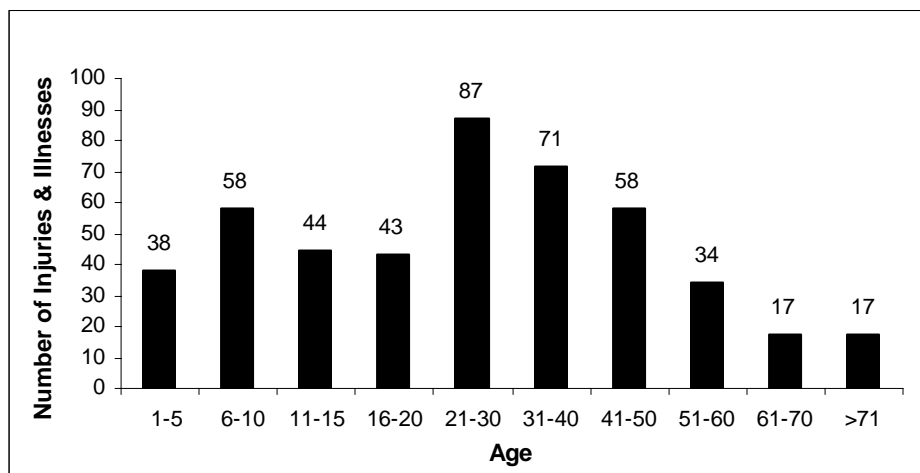
Between 1993 and 1998, there were 435 visitor accidents at Delaware Water Gap NRA, resulting in 10 fatalities and 538 non-fatal injuries and illnesses. Since there were 28,096,558 visitors to the park during this period for a total of 126,274,177 visitor-hours, this results in an average of 1.55 accidents, 0.04 fatalities, and 1.91 injuries and illnesses per 100,000 visitors, and 3.44 accidents, 0.08 fatalities, and 4.26 injuries and illnesses per 1,000,000 visitor-hours.

### 12.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 9 accidents that resulted in a total of 10 fatalities. Nine fatalities were US residents, and one was Chinese. Eight victims were male and two were female. Four of the fatalities occurred on weekends and six on weekdays. Four fatalities occurred while visitors were driving or riding in motor vehicles, four while swimming or wading, one while riding a horse, and one while hunting. Of the four fatalities due to motor vehicle accidents, two involved collisions with other vehicles, one involved a collision with a fixed object, and one involved a “non-collision” accident. In three of the four MVAs, driver-related factors were identified as the primary contributing factor. Search and rescue efforts were launched in three of the fatal cases.

### 12.3 Accidents Involving No Fatalities

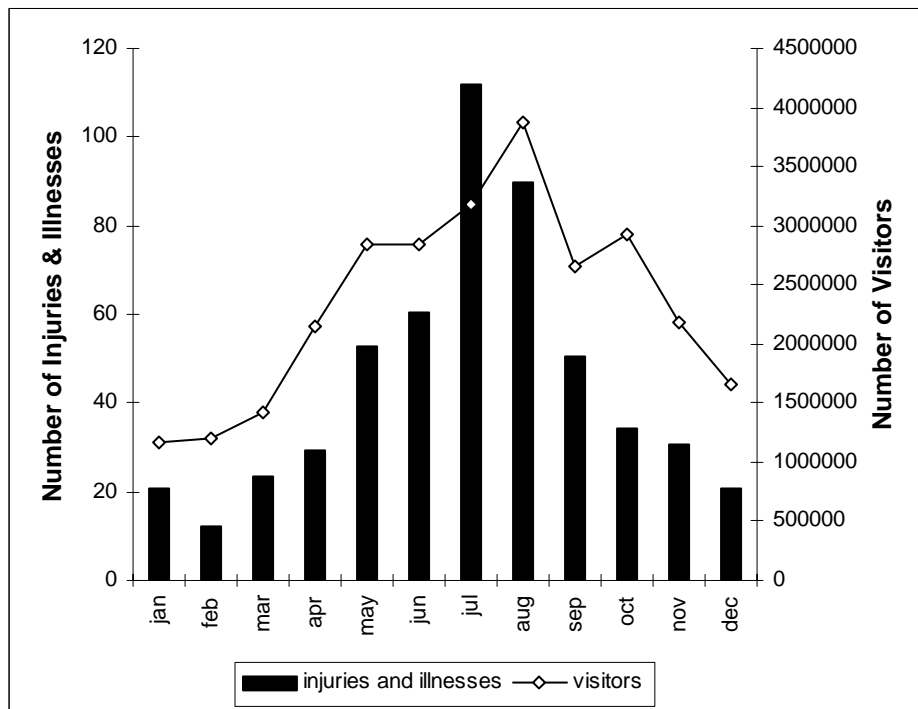
Between 1993 and 1998, there were an estimated 538 visitor injuries and illnesses arising from 426 accidents that did not involve fatalities. Fifty-seven percent of the victims were male and 42% were female. The gender of the victims was unknown in 6 (1%) cases. The overwhelming majority of victims (99%) were residents of the US. The distribution of victims by age is shown in Figure 12.1.



**Figure 12.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=469)**

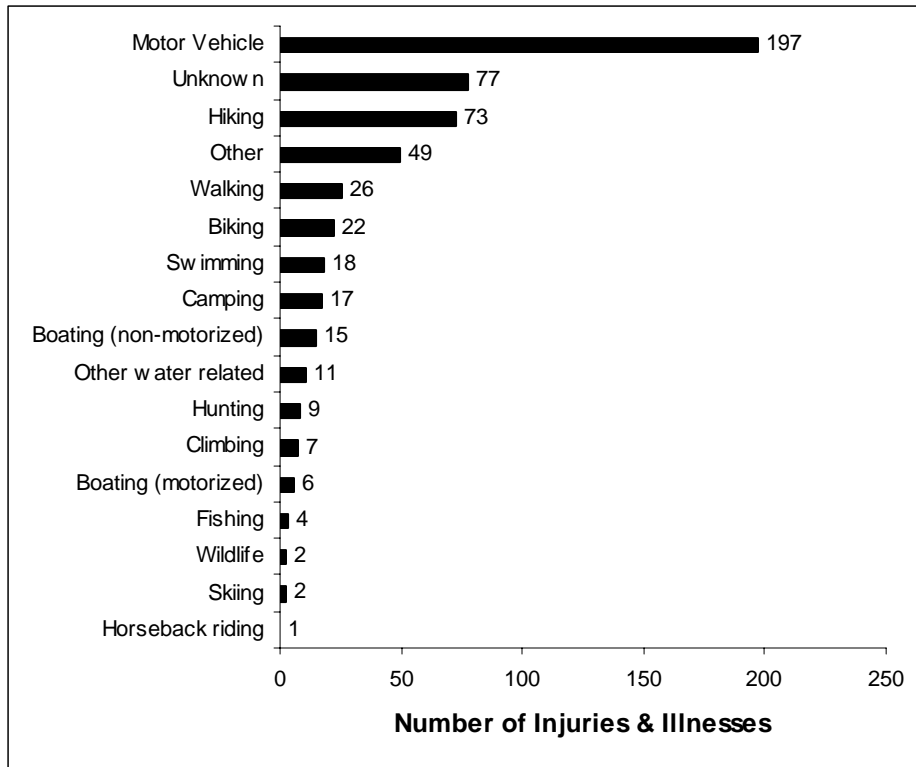
Almost 69% of the victims were injured between noon and 6p.m., 18% between 6am and noon, and 12% between 6:00pm and midnight. Forty-six percent of the victims were injured on

weekdays and 54% on weekends. The distribution of injured by month is shown in Figure 12.2, and mirrors visitation rates with a peak in the summer.



**Figure 12.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=538)**

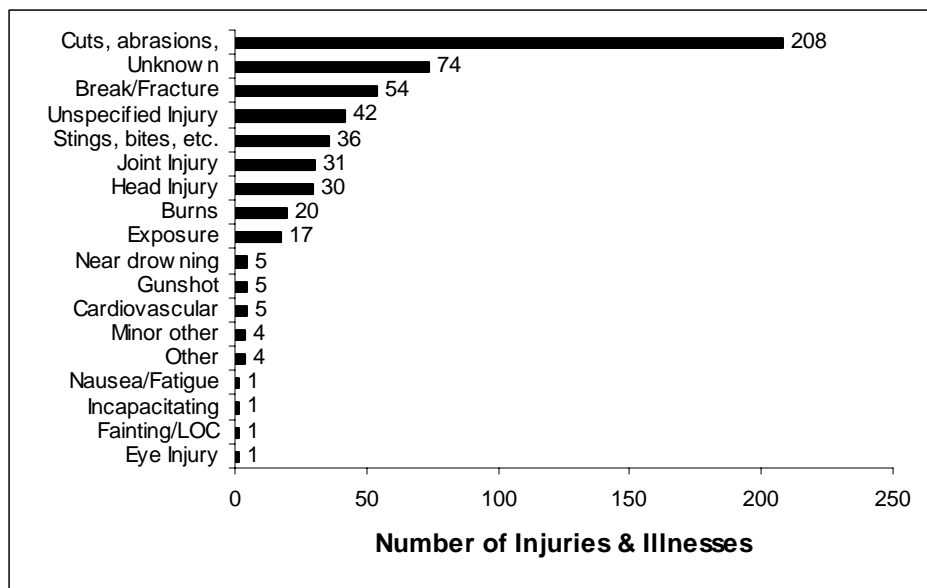
Figure 12.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are driving or riding in motor vehicles (37%) hiking (13.5%) and walking (5%), although for a substantial number of injuries and illnesses (14%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 12.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=538)**

Turning to the nature of injuries and illness, we see (Figure 12.4) that 39% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 10% involved broken bones or fractures; 8% were due to unspecified injuries and illnesses, and 7% were due to stings and bites. In 14% of cases the nature of the injury was unknown. Relatively more males suffer cuts and abrasions (61%) and breaks and fractures (57%).

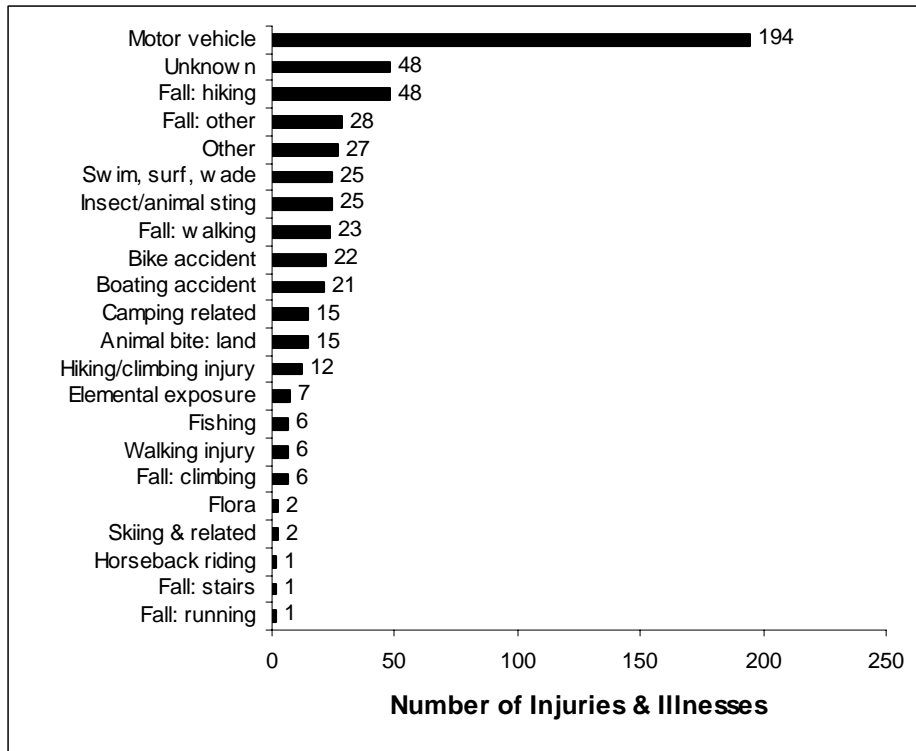




**Figure 12.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=538)**

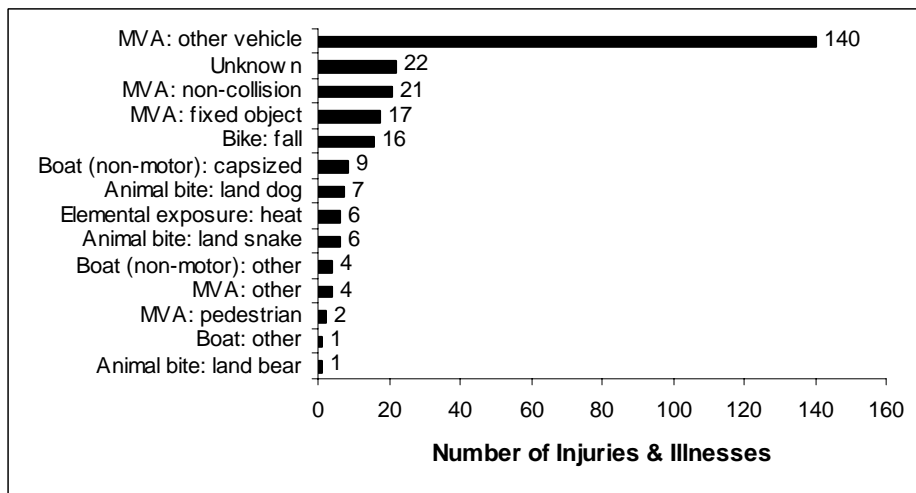
Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 538 injuries and illnesses occurring during this period, 205 (38%) could be considered less serious because the visitors were treated and released, and 225 (42%) could be considered more serious, since they required transportation to a medical facility. Two hundred ten people (39%) were transported by ambulance and 15 (3%) were transported by privately owned vehicle. Four people (1%) refused treatment and in 48 cases (9%) other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 15 cases it is unknown what if any response was taken. There were 43 (8%) search and rescues. Of the 225 injuries and illnesses requiring transportation to a medical facility, 70 (31%) were for the treatment of cuts, abrasions, and bruises, and 36 (16%) were for unknown injuries and illnesses. Fifty-two percent (109/208) of cuts, abrasions, and bruises, and 28% (21/74) of stings and bites were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 12.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 12.6.



**Figure 12.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=ZZ)**

Figure 12.6 shows that 72% (140/194) of motor vehicle accidents involve collisions with other vehicles, 11% (21/194) involve non-collisions (e.g., running off road), and 9% (17/194) involve collisions with fixed objects.



**Figure 12.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=ZZ)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 236 injuries and illnesses associated with these activities, 49% are driver-related, 3% environmental factors, 19% road-related, and 3% are a result of equipment failure. In 24% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

## 13.0 Everglades National Park

### 13.1 Introduction:

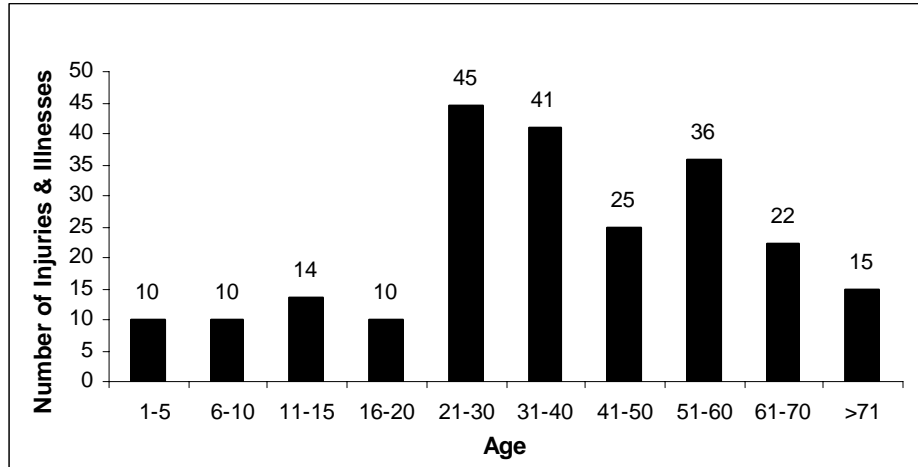
Between 1993 and 1998, there were 215 visitor accidents at Everglades National Park, resulting in 1 fatality and 246 non-fatal injuries and illnesses. Since there were 5,678,541 visitors to the park during this period for a total of 31,194,566 visitor-hours, this results in an average of 3.79 accidents, 0.02 fatalities, and 4.32 injuries and illnesses per 100,000 visitors, and 6.9 accidents, 0.03 fatalities, and 7.87 injuries and illnesses per 1,000,000 visitor-hours.

### 13.2 Accidents Involving Fatalities:

Between 1993 and 1998, there was 1 accident that resulted in 1 fatality. The fatality involved a white, male from the US. The fatality occurred when the 70+ year-old man fell off his motor boat and drowned.

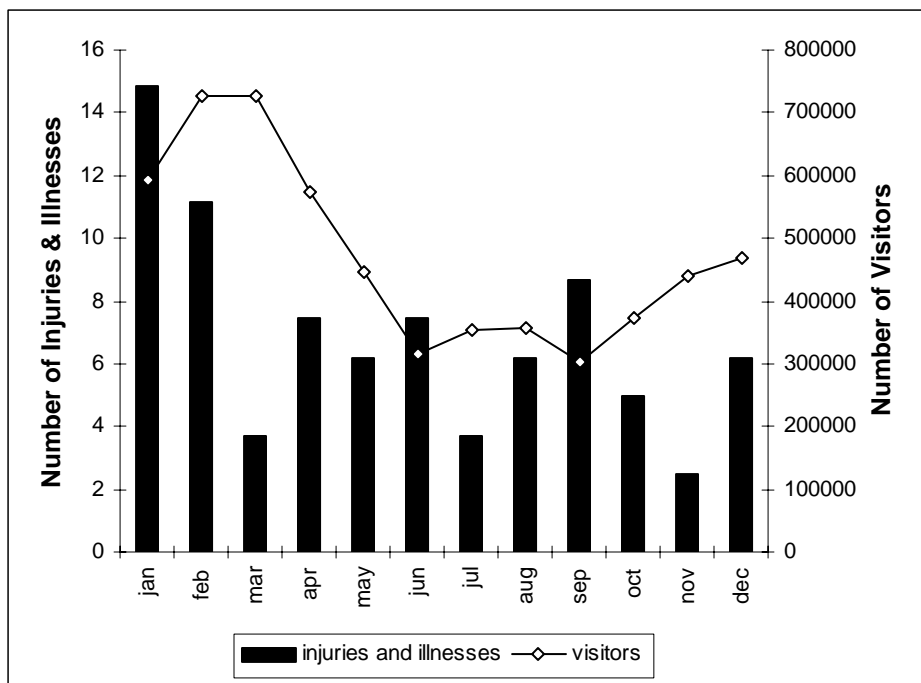
### 13.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 246 visitor injuries and illnesses arising from 214 accidents that did not involve fatalities. Fifty percent of the victims were male and 48% were female and the gender of 2% of the victims was unrecorded. The overwhelming majority of victims (71%) were white, with 7% Hispanic, 3% African-American and 18% of unknown race/ethnicity. Eighty percent of victims were residents of the US, 6% were from Germany, and 3% from Canada. The distribution of victims by age is shown in Figure 13.1.



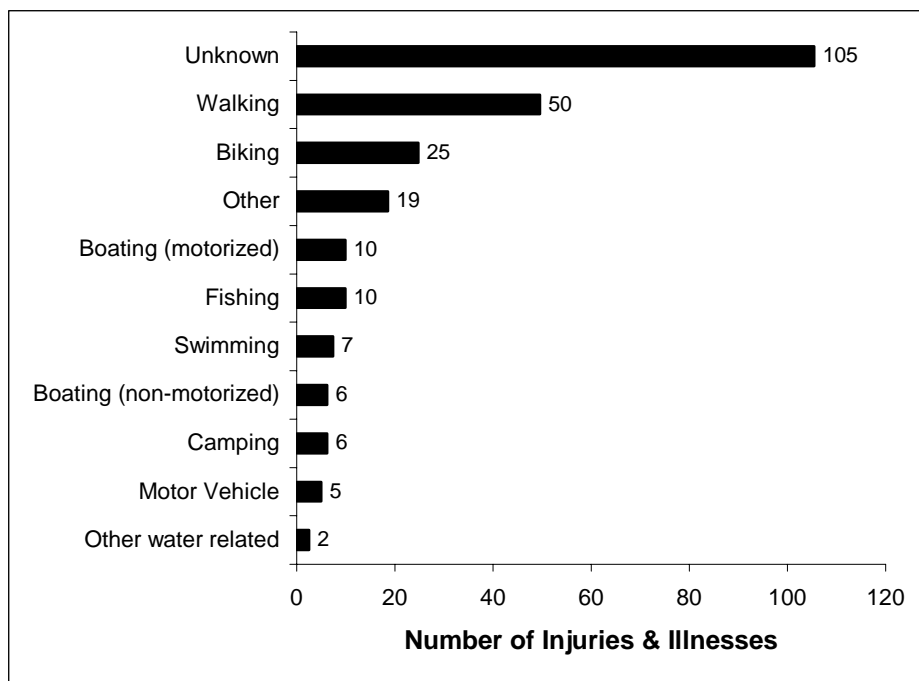
**Figure 13.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=227)**

Over 46% of the victims were injured between noon and 6p.m., 35% between 6am and noon, and 14% between 6:00pm and midnight. Seventy-two percent of the victims were injured on weekdays and 28% on weekends. The distribution of injured by month is shown in Figure 13.2, and reveals a pattern similar to that of visitation rates, although we have data on only 34% (83/246) of the cases.



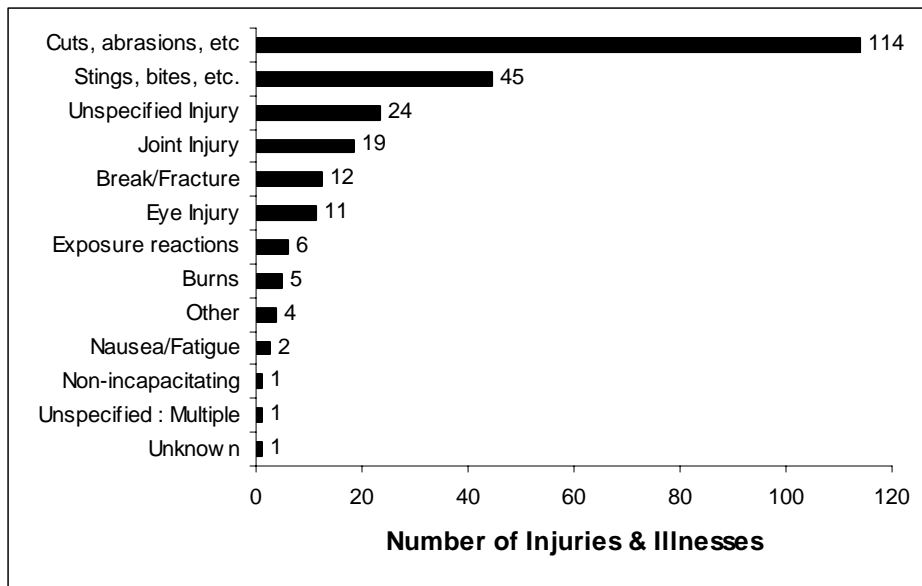
**Figure 13.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=83)**

Figure 13.3 shows the number of visitor injuries and illnesses by activity. Clearly, many injuries and illnesses occur while visitors are walking (20%) and biking (10%), although for a significant number of injuries and illnesses (43%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 13.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=246)**

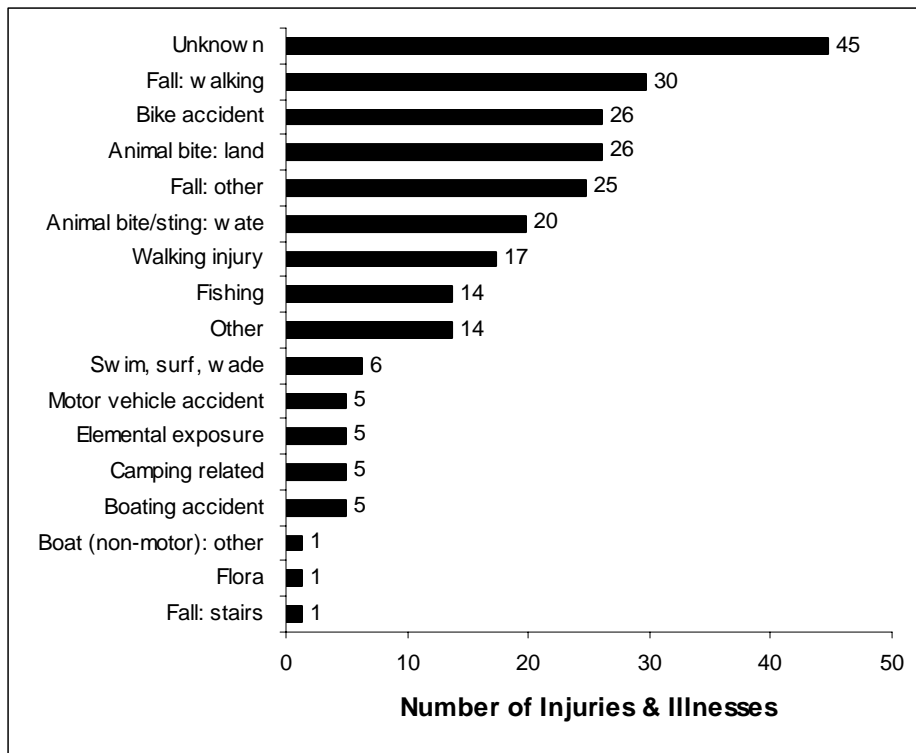
Turning to the nature of injuries and illness, we see (Figure 13.4) that 47% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 18% involved animal stings and bites; and 6% resulted from broken bones and fractures; and 10% were due to unspecified injuries and illnesses. The incidence of breaks and fractures is evenly divided between the sexes (48% female and 50% male), but males are more likely to suffer cuts and abrasions (70%), stings, bites, etc. (23%). These data do NOT include injuries and illnesses occurring in conjunction with fatalities. Those are described in Section 13.2.



**Figure 13.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=246)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 246 injuries and illnesses occurring during this period, 91 (37%) could be considered less serious because the visitors were treated and released, and 61 (25%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 24 (10%) were transported by ambulance and 37 (15%) were transported by privately owned vehicle. Twenty-four people (10%) refused treatment. In 52 (21%) cases it is unknown what if any response was taken. Of the 61 injuries and illnesses requiring transportation to hospital, 23 (38%) were for the treatment of cuts, abrasions, and bruises, 6 (10%) were for fractures/broken bones, and 6 (10%) were for joint injuries (e.g., twisted ankles). Forty-six percent (53/114) of cuts, abrasions, and bruises, and 35% (16/45) of stings and bites were treated and released.

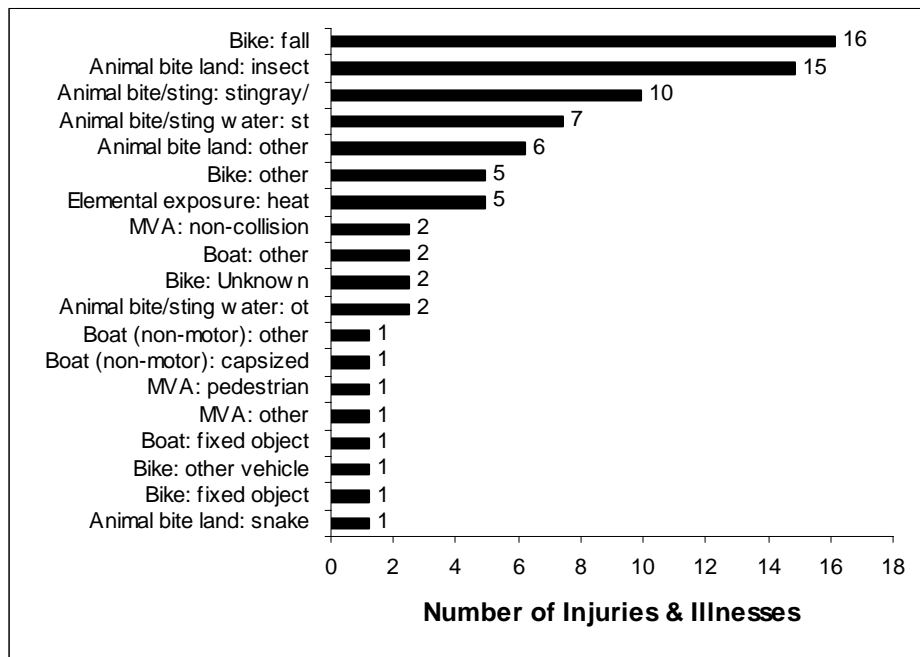
Visitors may be injured in numerous ways as they participate in various activities, and Figure 13.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting.



**Figure 13.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=214)**



Where we have sufficient information (usually for biking, boating, and motor vehicle accidents, we can also identify secondary causal events, as illustrated in Figure 13.6.



**Figure 13.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=214)**

## 14.0 Fort Sumter National Monument

### 14.1 Introduction:

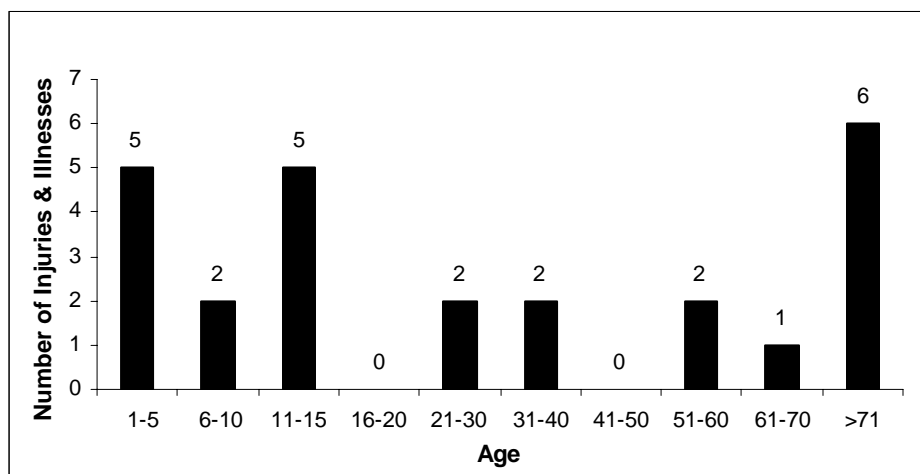
Between 1993 and 1998 (excluding 1996), there were 32 visitor accidents at Fort Sumter National Monument, resulting in no fatalities and 32 non-fatal injuries and illnesses<sup>3</sup>. Since there were 1,684,302 visitors to the park during this period for a total of 1,944,206 visitor-hours, this results in an average of 1.9 accidents, 0 fatalities, and 1.9 injuries and illnesses per 100,000 visitors, and 16.46 accidents, 0 fatalities, and 16.46 injuries and illnesses per 1,000,000 visitor-hours.

### 14.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were no fatal accidents.

### 14.3 Accidents Involving No Fatalities

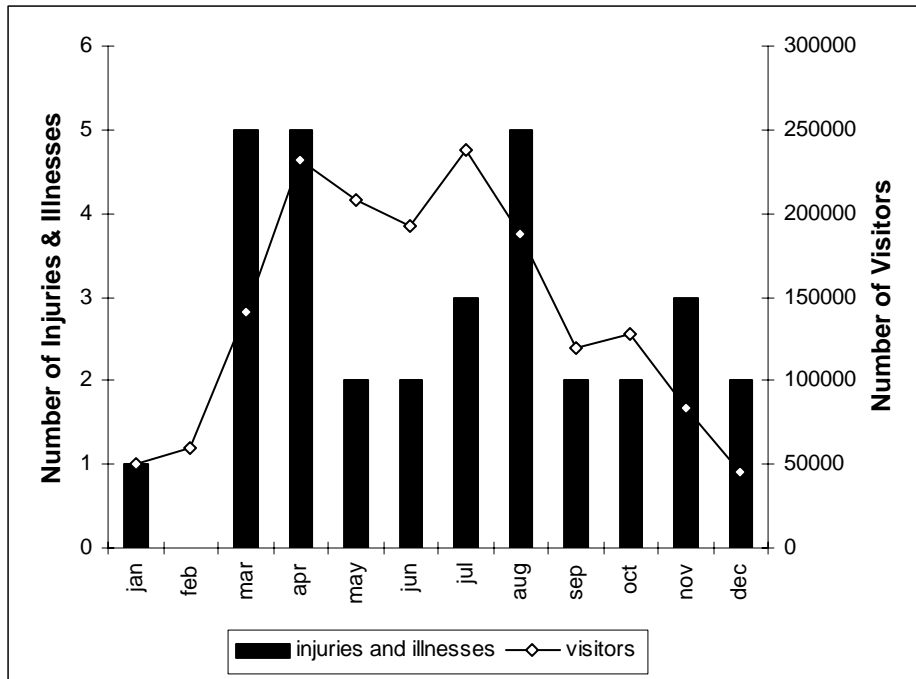
Between 1993 and 1998, there were 32 visitor injuries and illnesses arising from 32 accidents. Fifty-three percent of the victims were male and 47% were female. All of the victims (100%) were white and residents of the US. The distribution of victims by age is shown in Figure 14.1.



**Figure 14.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=25)**

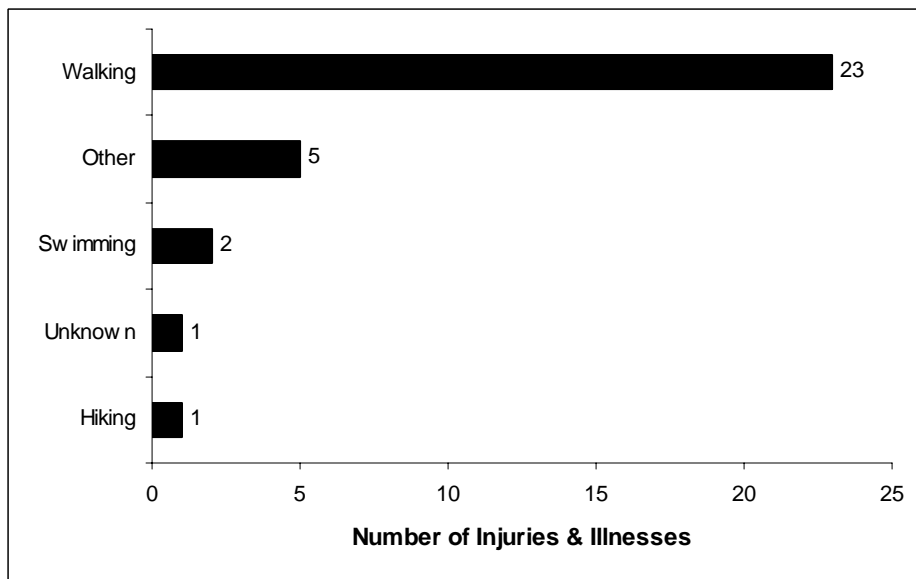
Seventy-one percent of the victims were injured between noon and 6pm, and 23% between 6:00am and noon. Fifty-six of these injuries occurred on weekdays and 44% on weekends. The distribution of injured by month is shown in Figure 14.2.

<sup>3</sup> Data for 1996 were unavailable.



**Figure 14.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=32)**

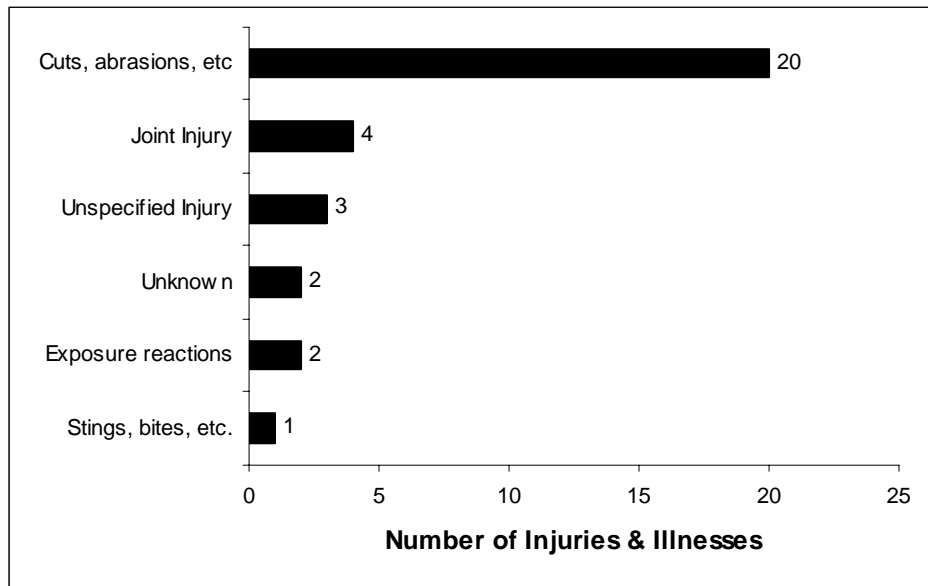
Figure 14.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur from walking (72%).



**Figure 14.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=32)**

Turning to the nature of injuries and illness, we see (Figure 14.4) that 63% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 13% involved joint injuries;

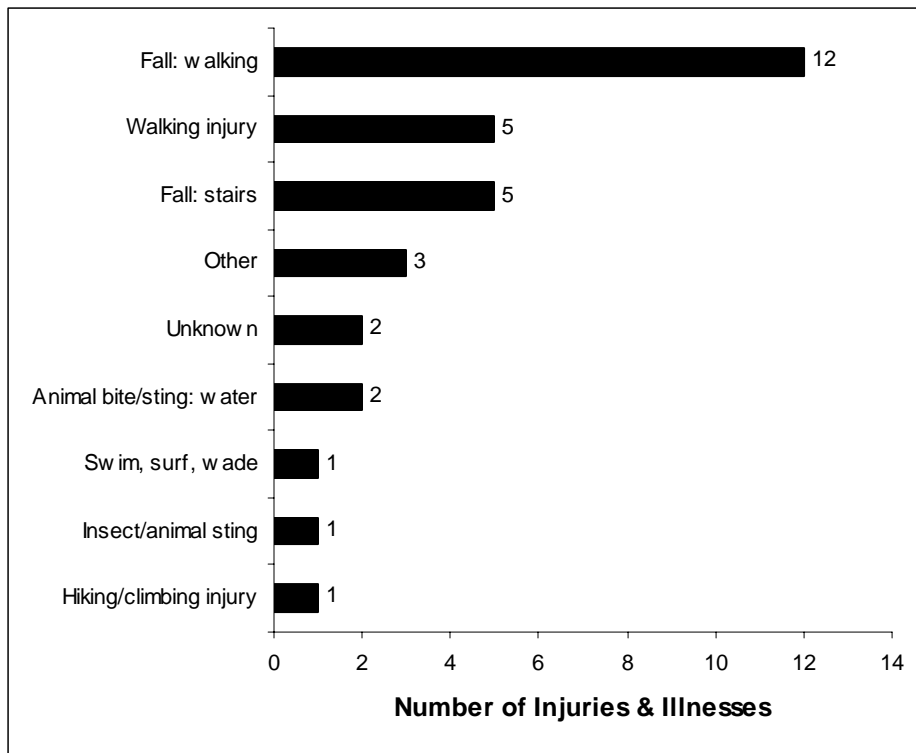
and 9% were due to unspecified injuries and illnesses. The incidence of cuts, abrasion, and bruises is roughly evenly divided between the sexes (45% female and 55% male), but females are more likely to joint injuries (75%).



**Figure 14.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=32)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 32 injuries and illnesses occurring during this period, 19 (59%) could be considered less serious because the visitors were treated and released, and 11 (34%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 10 (31%) were transported by ambulance and 1 (3%) was transported by privately owned vehicle. No one injured refused treatment. Of the 11 injuries and illnesses requiring transportation to hospital, 5 (45%) were for the treatment of cuts, abrasions, and bruises.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 14.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting.



**Figure 14.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=32)**

## 15.0 Gettysburg National Military Park

### 15.1 Introduction:

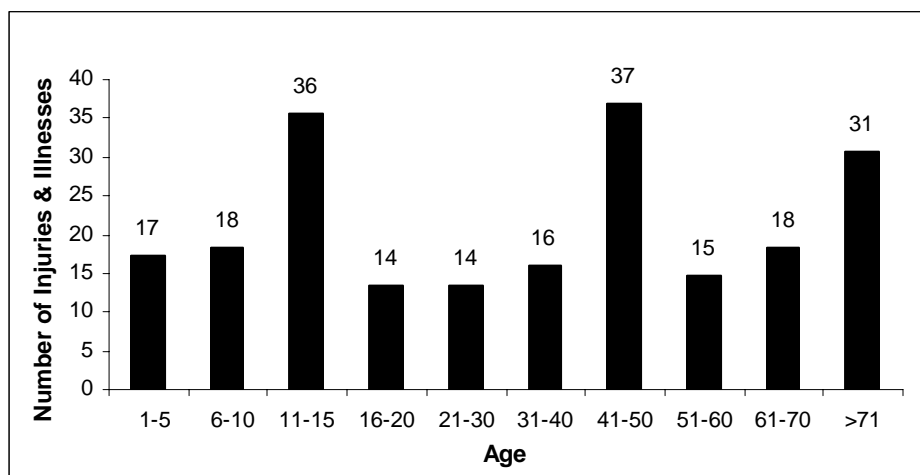
Between 1993 and 1998, there were 257 visitor accidents at Gettysburg National Military Park, resulting in 2 fatalities and 280 non-fatal injuries and illnesses. Since there were 9,790,417 visitors to the park during this period for a total of 30,698,619 visitor-hours, this results in an average of 2.63 accidents, 0.02 fatalities, and 2.86 injuries and illnesses per 100,000 visitors, and 8.37 accidents, 0.07 fatalities, and 9.14 injuries and illnesses per 1,000,000 visitor-hours.

### 15.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 2 accidents that resulted in a total of 2 fatalities. Both fatalities were white males from the US and occurred on a weekday. One fatality occurred during activities associated with walking, the other was the result of a motor vehicle accident.

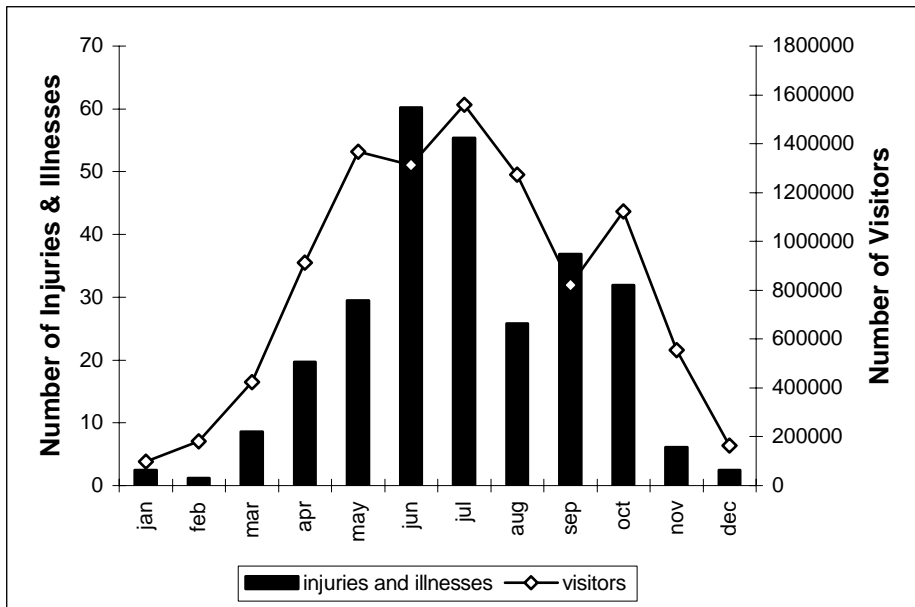
### 15.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 280 visitor injuries and illnesses arising from accidents that did not involve fatalities. Thirty-three percent of the victims were male and 66% were female. Thirty-nine percent of the victims were white, but in 60% of cases the race/ethnicity was unrecorded. Ninety-eight percent of accident victims were from the US. The distribution of victims by age is shown in Figure 15.1 with notable peaks among three age groups, 11-15, 41-50, and over 71.



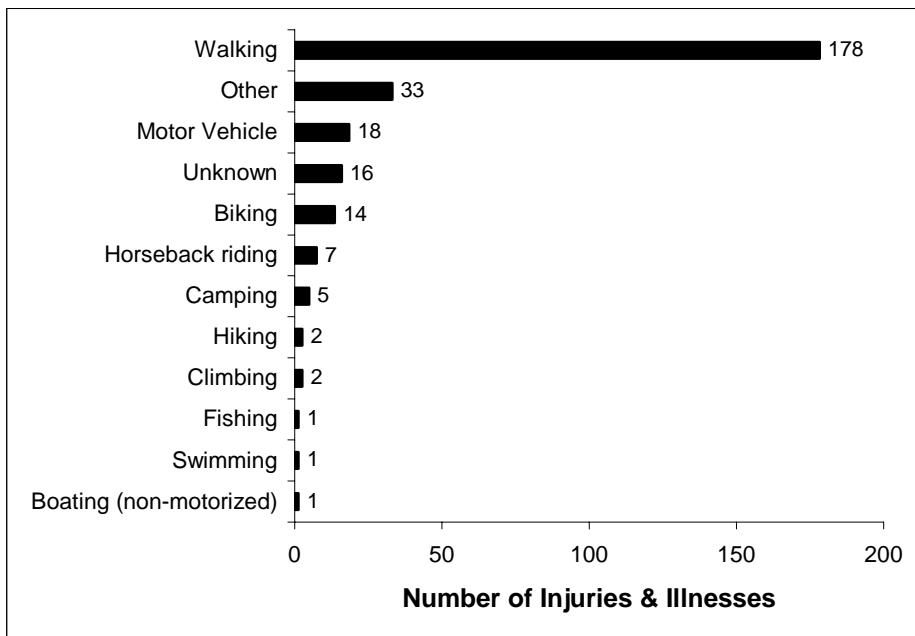
**Figure 15.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=215)**

Thirty-one percent of the victims were injured between 6am and noon and 60% between noon and 6pm. Sixty-six percent of the victims were injured on weekdays and 33% on weekends. The distribution of injured by month is shown in Figure 15.2, and reveals a pattern that mirrors visitation rates, with a peak in the spring/early summer and a smaller peak in the fall.



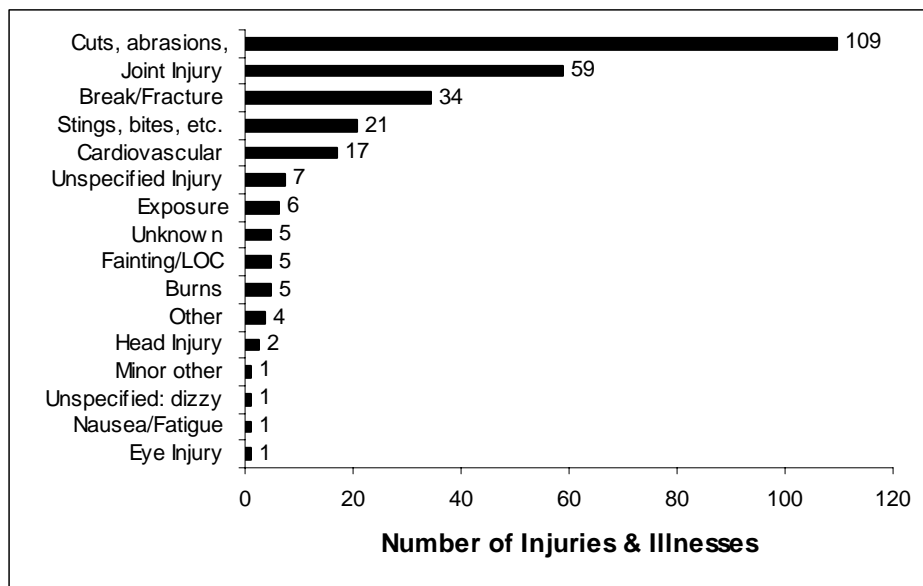
**Figure 15.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=280)**

Figure 15.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are walking (63%), driving or riding in motor vehicles (7%), or while they are engaged in various “other” activities (12%).



**Figure 15.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=280)**

Turning to the nature of injuries and illness, we see (Figure 15.4) that 39% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 21% involved joint injuries; and 12% involved broken bones and fractures. Females comprise 59% (64/109) and males 40% (44/109) of those suffering cuts, abrasions and bruises.. In addition, females also comprise a larger proportion of those suffering broken bones and fractures (79%) and joint injuries (83%).

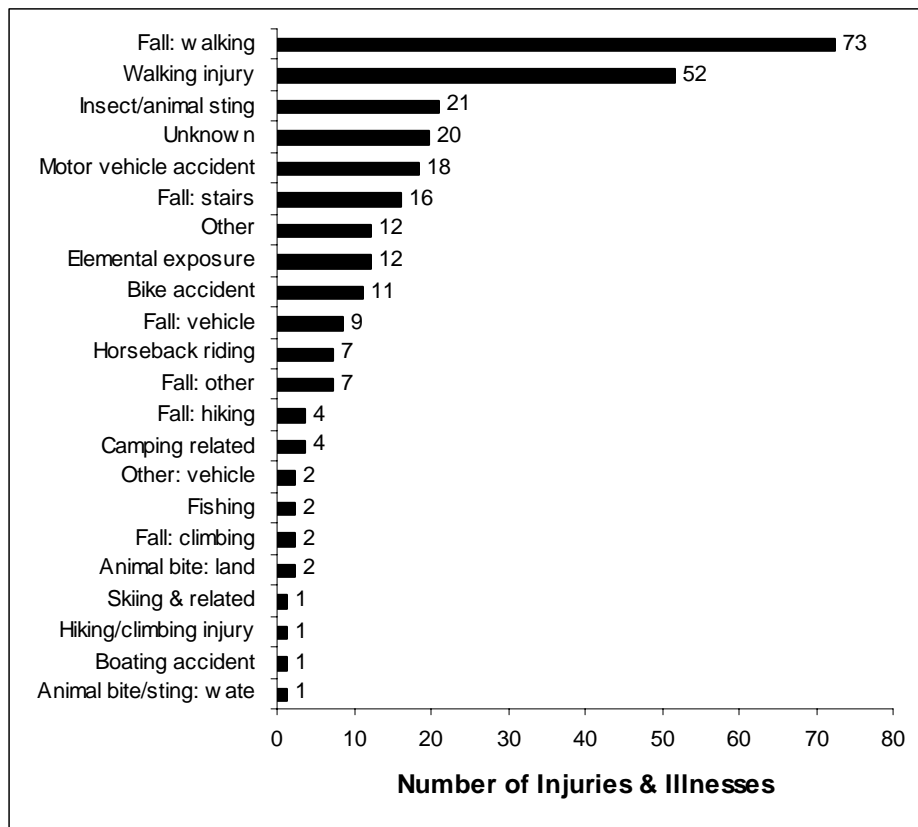


**Figure 15.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=280)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 280 injuries and illnesses occurring during this period, 98 (35%) could be considered less serious because the visitors were treated and released, and 120 (43%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 90 (32%) were transported by ambulance and 30 (11%) were transported by privately owned vehicle. Sixteen people (6%) refused treatment and in 11 (4%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 2 (1%) cases it is unknown what if any response was taken. Of the 120 injuries and illnesses requiring transportation to hospital, 40 (33%) were for the treatment of cuts, abrasions, and bruises, and 17 (12%) were for joint injuries. Thirty-nine percent (43/109) of cuts, abrasions, and bruises, and 60% (12/20) of stings and bites were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 15.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. Of the 178 injuries while walking, 73 (41%) are due to falls and 52 (29%) are due to “walking injuries,” such as stubbed toes, pulled muscles, cramps.





**Figure 15.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=280)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 31 injuries and illnesses associated with these activities at Gettysburg, 56% are driver-related, 12% road-related, and 16% are a result of other factors. In 5% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

## 16.0 Grand Teton National Park

### 16.1 Introduction:

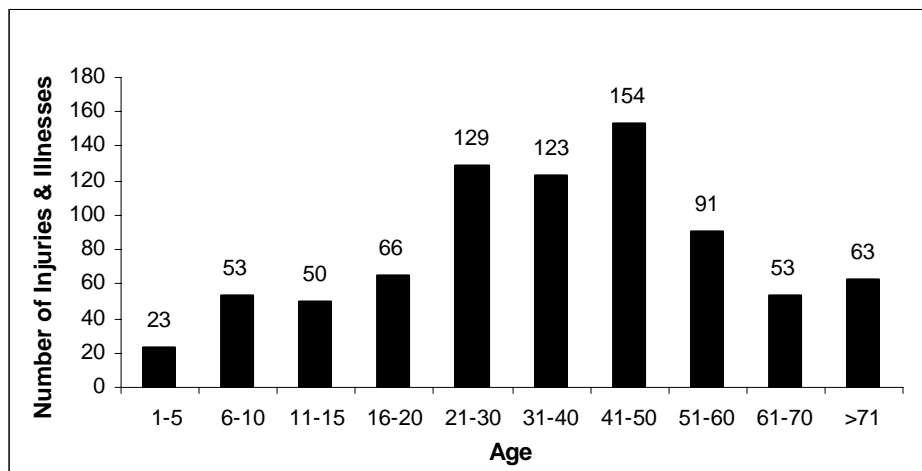
Between 1993 and 1998, there were 781 visitor accidents at Grand Teton National Park, resulting in 25 fatalities and 827 non-fatal injuries and illnesses. Since there were 15,989,664 visitors to the park during this period for a total of 115,579,137 visitor-hours, this results in an average of 4.88 accidents, 0.18 fatalities, and 5.17 injuries and illnesses per 100,000 visitors, and 6.76 accidents, 0.24 fatalities, and 7.15 injuries and illnesses per 1,000,000 visitor-hours.

### 16.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 25 accidents that resulted in a total of 28 fatalities. Of the 28 fatalities 22 were white, 1 Asian, and 5 unknown. Twenty-seven of the fatalities involved US residents, one involved an Austrian. Twenty-two victims were male and six were female. Nine of the fatalities occurred on weekends and 19 on weekdays. Thirteen fatalities occurred while visitors were climbing, 5 while operating motor vehicles, 2 while hiking, and 1 while swimming.

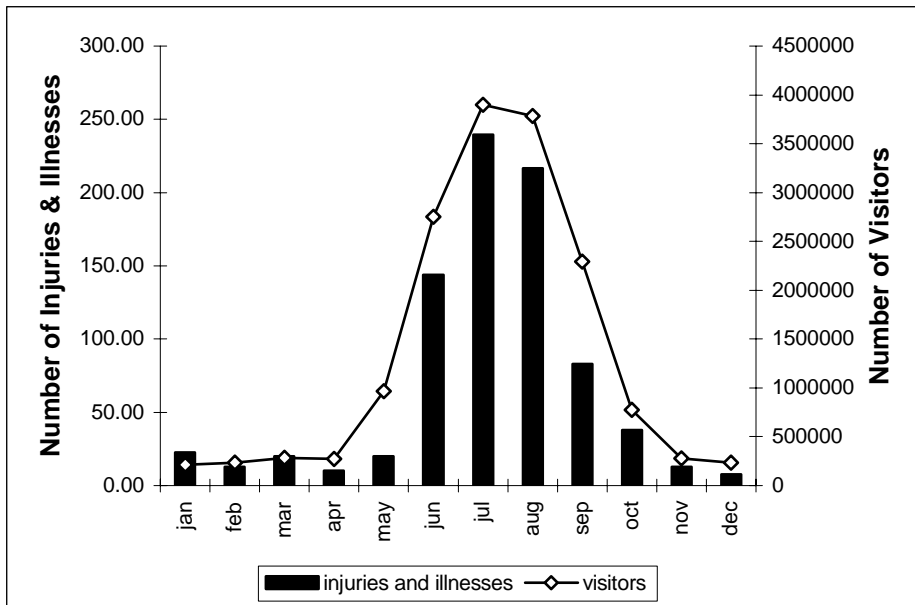
### 16.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 827 visitor injuries and illnesses arising from 756 accidents that did not involve fatalities. Forty-eight percent of the victims were male and 52% were female. The overwhelming majority of victims (95%) were residents of the US. Forty percent were white, but the race/ethnicity of 57% of the victims were unknown. The distribution of victims by age is shown in Figure 16.1.



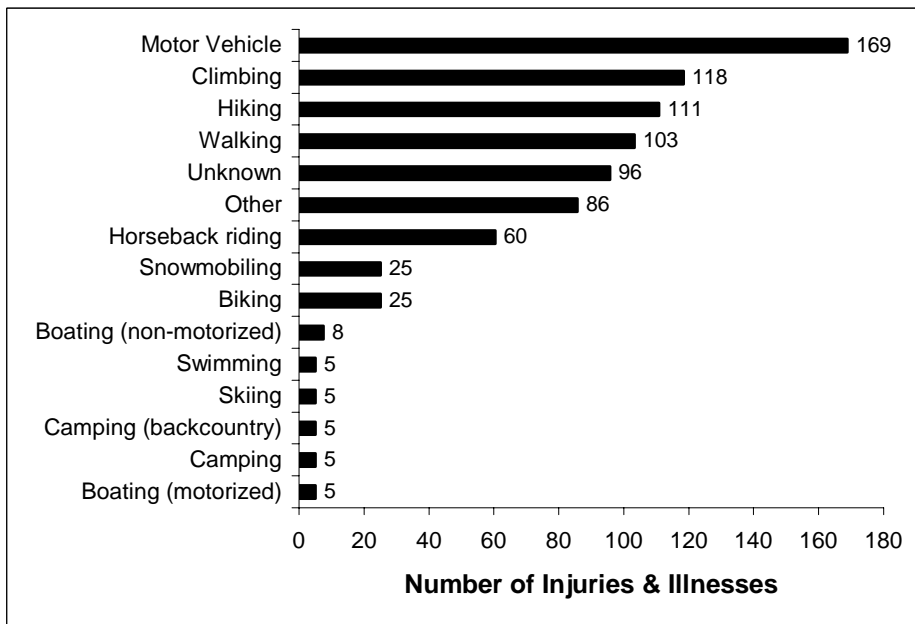
**Figure 16.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=804)**

Over 44% of the victims were injured between noon and 6p.m., 30% between 6am and noon, and 20% between 6:00pm and midnight. Seventy-two percent of the victims were injured on weekdays and 28% on weekends. The distribution of injured by month is shown in Figure 16.2, and reveals a pattern that mirrors visitation rates, with accident rates peaking in the summer months.



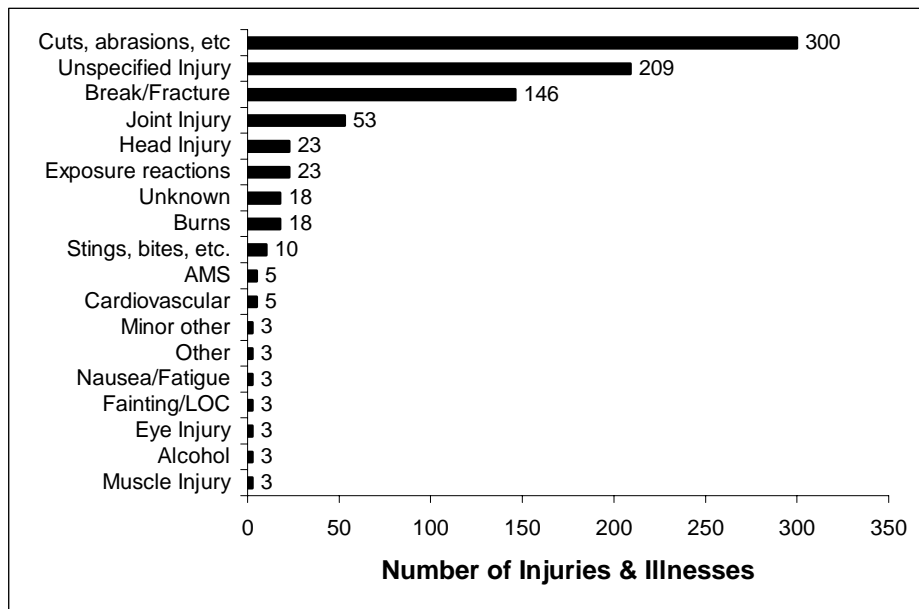
**Figure 16.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=827)**

Figure 16.3 shows the number of visitor injuries and illnesses by activity. Most injuries and illnesses occur while visitors are operating motor vehicles (20%), climbing (15%), hiking (13%), and walking (13%). Unfortunately, for a significant number of injuries and illnesses (12%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 16.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=827)**

Turning to the nature of injuries and illness, we see (Figure 16.4) that 36% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 18% involved broken bones or fractures; and 25% were due to unspecified injuries and illnesses. The incidence of breaks and fractures is fairly evenly divided between the sexes (55% (81/146) female and 45% (66/146) male), as are cuts and abrasions (51% (154/300) female and 49% (146/300) male).

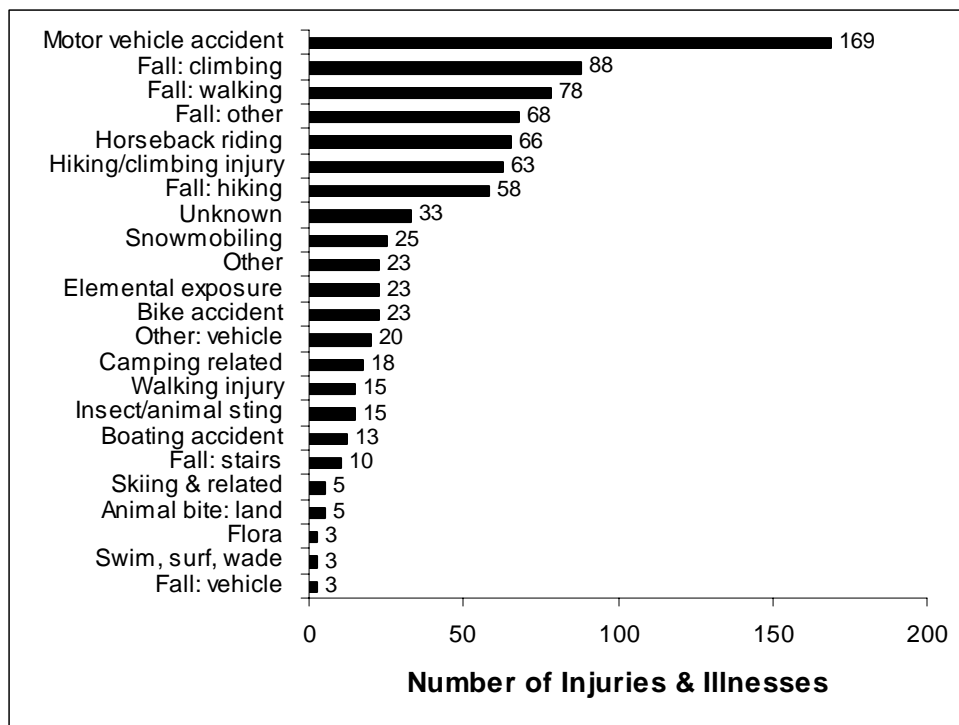


**Figure 16.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=827)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 827 injuries and illnesses occurring during this period, 282 (34%) could be considered less serious because the visitors were treated and released, and 502 (60%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 391 (47%) were transported by ambulance and 110 (13%) were transported by privately owned vehicle. Twenty people (2%) refused treatment and in 13 (1.5%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 5 (<1%) cases it is unknown what if any response was taken. Of the 502 injuries and illnesses requiring transportation to hospital, 154 (31%) were for the treatment of cuts, abrasions, and bruises, 116 (23%) were for suspected breaks and fractures, and 149 (30%) were for unspecified injuries and illnesses. Forty-one percent (123/300) of cuts, abrasions and 53% (28/53) of joint injuries were treated and released.

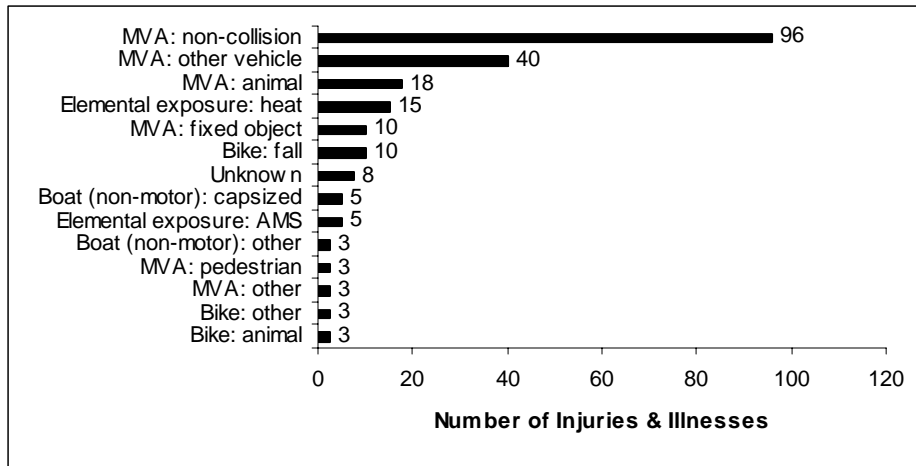
Visitors may be injured in numerous ways as they participate in various activities, and Figure 16.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor

was stung by an insect while hiking, the activity would listed as hiking, but the primary event would be insect/animal sting. Motor vehicle accidents are the primary cause of injuries and illnesses in 20% of cases, and falls while climbing (88), walking (78), hiking (58), and engaging in other activities (68) collectively account for 35% (292/827) of all injuries and illnesses.



**Figure 16.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=827)**

Where we have sufficient information (usually for biking, boating, and motor vehicle accidents, we can also identify secondary causal events, as illustrated in Figure 16.6. Of the 169 motor vehicle accidents, 96 involve non-collisions, 40 involve collisions with other vehicles, 18 involve collisions with animals, 10 involve collisions with fixed objects, and 3 involve collisions with pedestrians.



**Figure 16.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=227)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 199 injuries and illnesses associated with these activities, 68% are driver-related, 1% environmental factors, 4% road-related, and 26% are unknown.

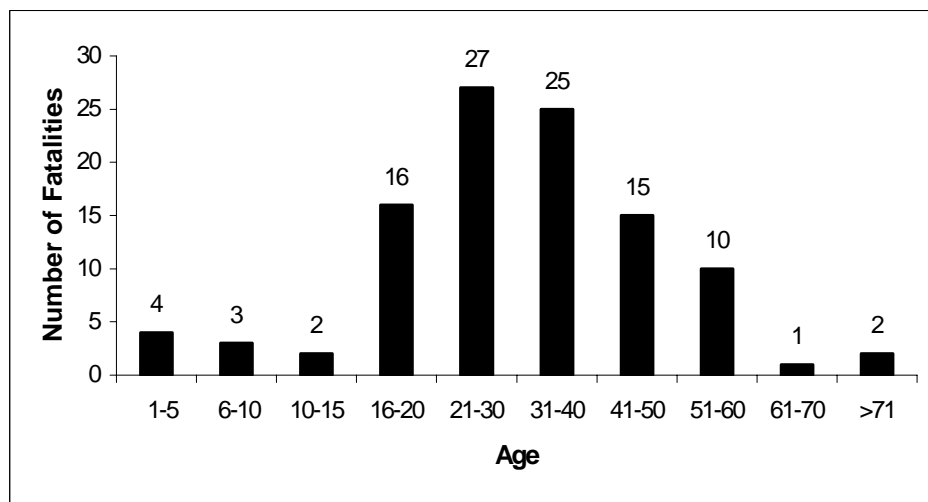
## 17. Lake Mead National Park

### 17.1 Introduction:

Between 1995 and 1998, there were 2,070 visitor accidents at Lake Mead National Park, resulting in 106 fatalities and 3,560 non-fatal injuries and illnesses.<sup>4</sup> Since there were 36,506,024 visitors to the park during this period for a total of 304,091,998 visitor-hours, this results in an average of 5.67 accidents, 0.29 fatalities, and 9.75 injuries and illnesses per 100,000 visitors, and 6.81 accidents, 0.35 fatalities, and 11.71 injuries and illnesses per 1,000,000 visitor-hours.

### 17.2 Accidents Involving Fatalities:

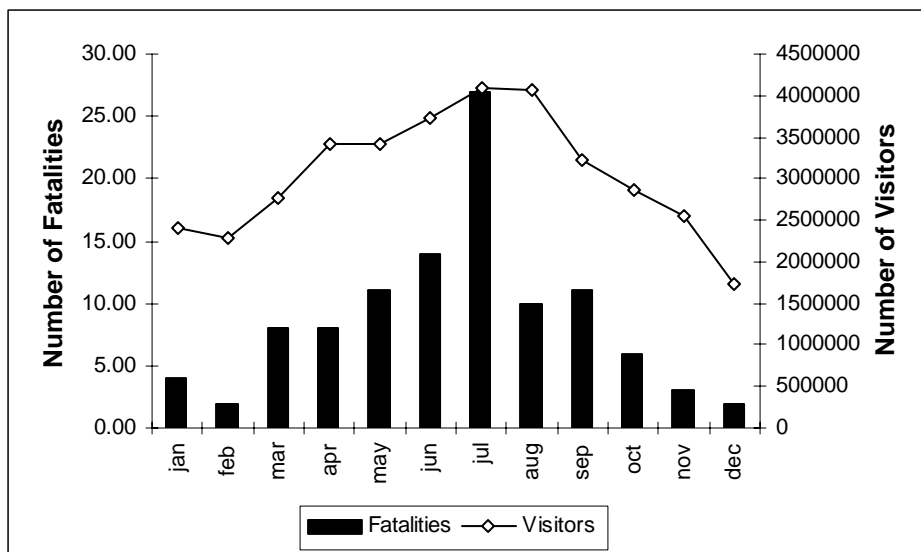
Between 1993 and 1998, there were 91 accidents that resulted in a total of 106 fatalities. All but two of the fatalities were US residents. Eighty-one fatalities were white, 14 Hispanic, and 7 were African-American. Eighty-seven percent (92) of the victims were male. Fifty-one (48%) of the fatalities occurred on weekends and 55 (52%) on weekdays. Twenty-six fatalities (25%) occurred while visitors were boating, 24 (23%) while swimming, 22 (21%) during other water related activities, and 13 (12%) while operating motor vehicles. The distribution of fatalities by age is shown in Figure 17.1.



**Figure 17.1: Visitor Fatalities by Age, 1993-98 (N=106)**

The distribution of fatalities by month (Figure 17.2) mirrors the pattern in visitation rates, with a peak in July.

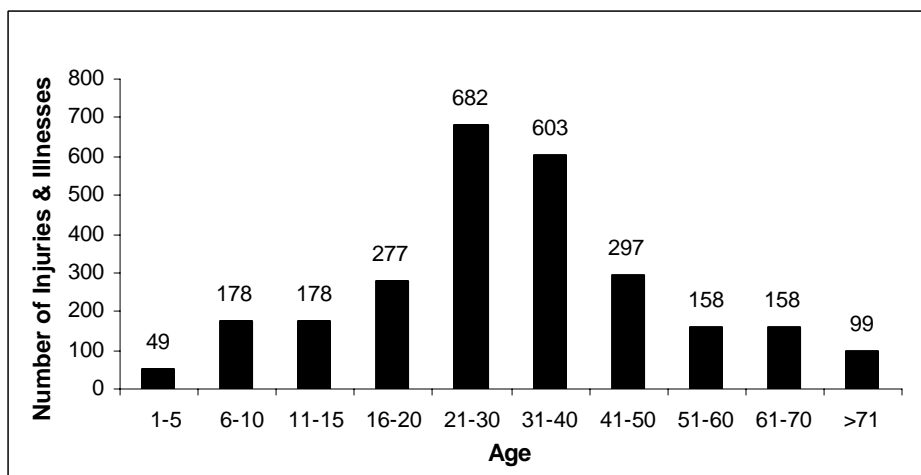
<sup>4</sup> Injury data for 1993 and 1994 were unavailable.



**Figure 17.2: Visitor Fatalities by Age, 1993-98 (N=106)**

### 17.3 Accidents Involving No Fatalities

Between 1995 and 1998, there were an estimated 3,560 visitor injuries and illnesses arising from 1979 accidents that did not involve fatalities. Sixty-three percent of the victims were male, 35% were female, and the gender of 2% of the victims was unrecorded. The overwhelming majority of victims (94%) were US residents. Seventy-six percent were white, 6% were Hispanic, 2% Asian, 1% African-American, and 14% of unknown race/ethnicity. The distribution of victims by age is shown in Figure 17.3.

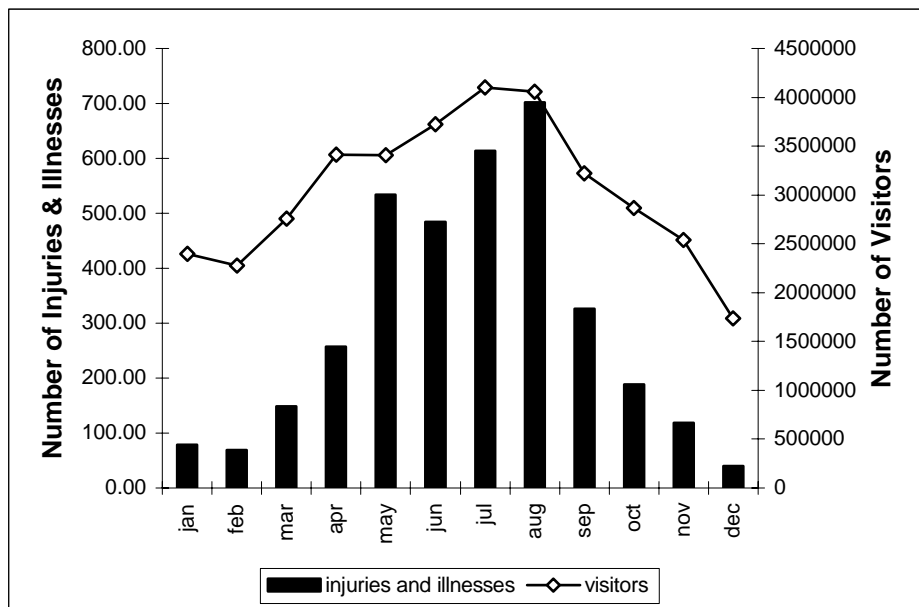


**Figure 17.3: Visitor Injuries and Illnesses by Age, 1995-98 (N=2680)**

Almost 54% of the victims were injured between noon and 6p.m., 22% between 6am and noon, and 17% between 6:00pm and midnight. Forty-eight percent of the victims were injured on

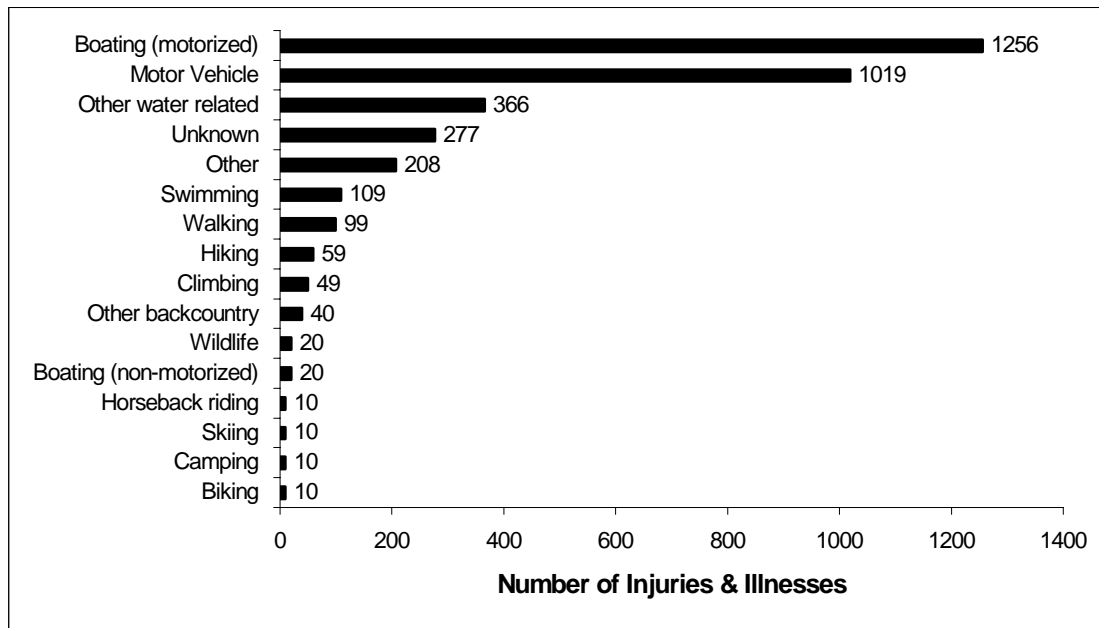


weekdays and 52% on weekends. The distribution of injured by month is shown in Figure 17.4, and reveals a pattern that mirrors visitation rates.



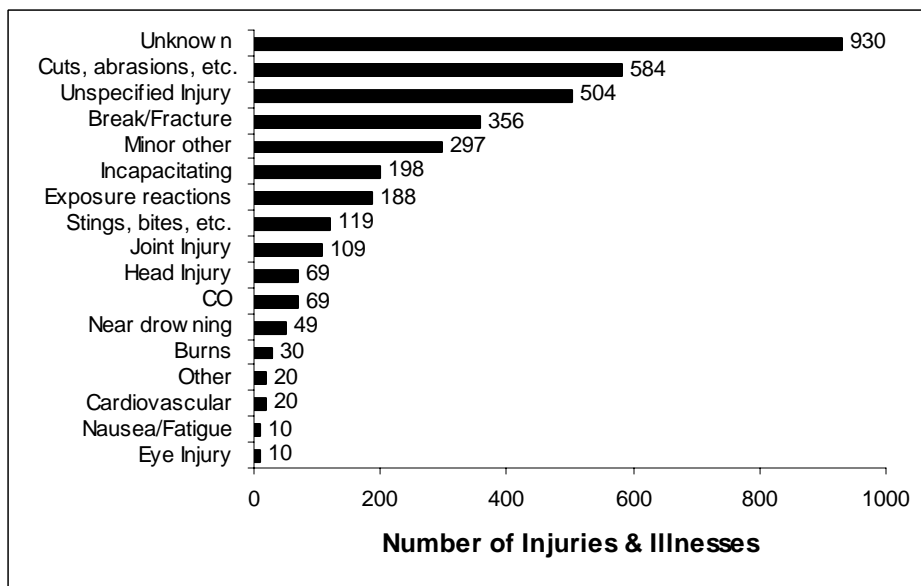
**Figure 17.4: Visitor Injuries and Illnesses by Month, 1995-98 (N=3560)**

Figure 17.5 shows the number of visitor injuries and illnesses by activity. Most injuries and illnesses occur while visitors are operating motorized boats (35%), operating motor vehicles (28%), or while they are engaged in other water-related activities (10%). For (8%) of injuries and illnesses there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 17.5: Visitor Injuries and Illnesses by Activity, 1995-98 (N=3560)**

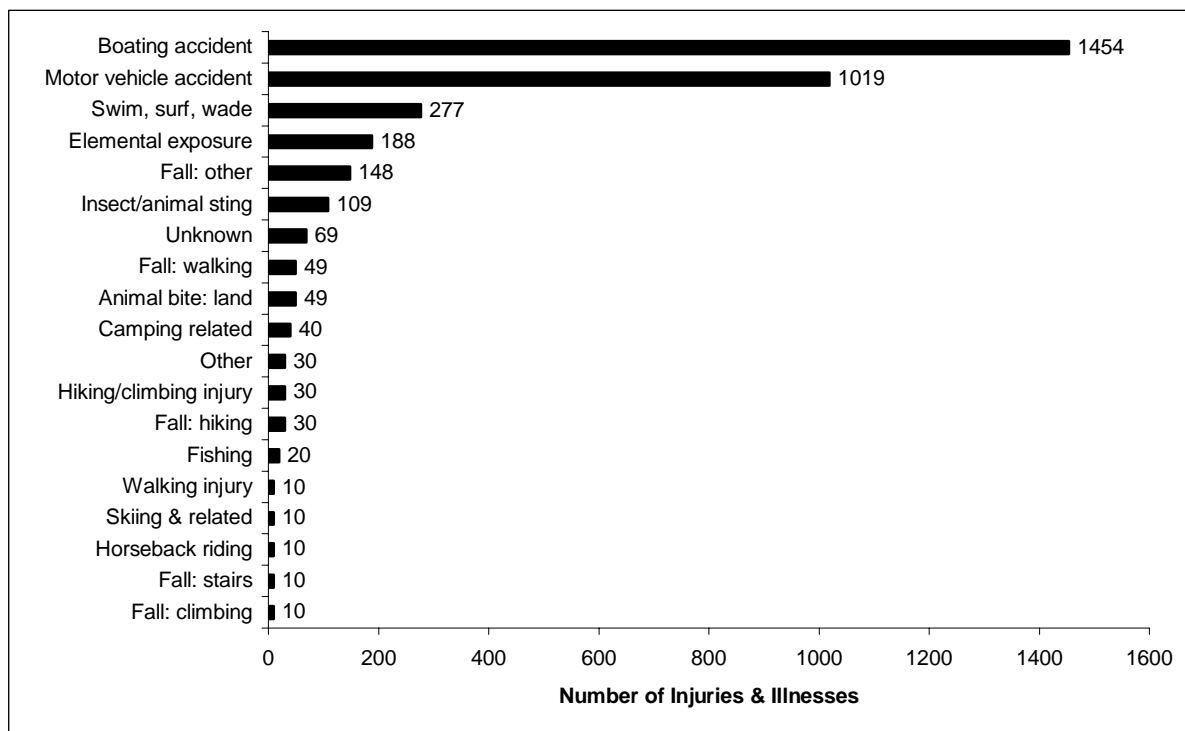
Turning to the nature of injuries and illness, we see (Figure 17.6) that 40% of all injuries and illnesses between 1995 and 1998 were unknown or unspecified with 16% injuries involving cuts, abrasions, and bruises, 10% involving breaks or fractures, and 8% involving minor other injuries. Males predominate as victims of cuts, abrasions, and bruises (68% male vs. 32% female), as victims of breaks and fractures (75% male vs. 25% female), and as victims of unknown injuries (65% males versus 35% females). The unspecified injuries are roughly evenly split between males (53%) and females (47%).



**Figure 17.6: Types of Visitor Injuries and Illnesses, 1995-98 (N=3650)**

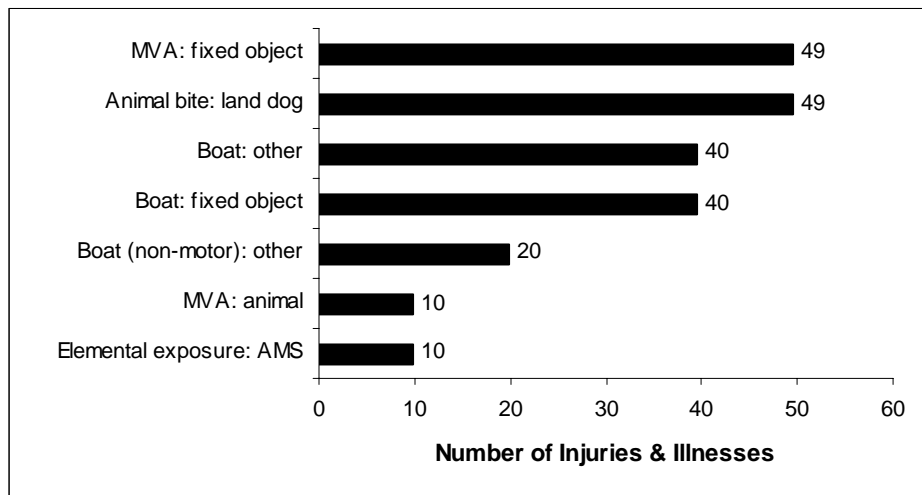
Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 3,650 injuries and illnesses occurring during this period, 583 (16%) could be considered less serious because the visitors were treated and released, and 2136 (60%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 1,908 (54%) were transported by ambulance and 227 (6%) were transported by privately owned vehicle. Fifty-nine people (2%) refused treatment and in 59 (2%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 722 (20%) cases it is unknown what if any response was taken. Of the 2,136 injuries and illnesses requiring transportation to hospital, 297 (13%) were for the treatment of cuts, abrasions, and bruises, and 831 (39%) were for unknown and unspecified injuries and illnesses. Thirty-nine percent (227/583) of cuts, abrasions, and bruises, and 75% (99/118) of stings and bites were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 17.7 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would listed as hiking, but the primary event would be insect/animal sting.



**Figure 17.7: Visitor Injuries and Illnesses by Primary Event, 1995-98 (N=3560)**

Where we have sufficient information (usually for biking, boating, and motor vehicle accidents, we can also identify secondary causal events, as illustrated in Figure 17.8.



**Figure 17.8: Visitor Injuries and Illnesses by Secondary Event, 1995-98 (N=2492)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 2265 injuries and illnesses associated with these activities, 53% are driver-related, 2% environmental factors, 1% road-related, and .5% are a result of equipment failure. In 930 (41%) cases of boating and motor vehicle injuries and illnesses the contributing factors are unknown.

## 18.0 Little Bighorn Battlefield National Monument

### 18.1 Introduction:

Between 1993 and 1998, there were 12 visitor accidents at Little Bighorn Battlefield National Monument, resulting in no fatalities and 12 non-fatal injuries and illnesses. Since there were 2,233,285 visitors to the park during this period for a total of 2,237,111 visitor-hours, this results in an average of 0.54 accidents, 0 fatalities, and 0.537 injuries and illnesses per 100,000 visitors, and 5.36 accidents, 0 fatalities, and 5.36 injuries and illnesses per 1,000,000 visitor-hours.

### 18.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were no fatal accidents.

### 18.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were 12 visitor injuries and illnesses arising from 12 accidents. Three of the victims were male and 9 were female. Ten of the victims were white and 2 were of unknown race/ethnicity. Ten victims were residents of the US, 1 was from Canada, and the nationality of the twelfth was unknown. Two victims were under 15 years of age, 2 were between 51 and 60, and two were over 71.

Seven of the victims were injured between noon and 6p.m., and four between 6am and noon. Eight of the victims were injured on weekdays and four on weekends. The distribution of injured by month is shown in Figure 18.1, and although the numbers are extremely small, the pattern mirrors visitation rates, with a peak in the summer.

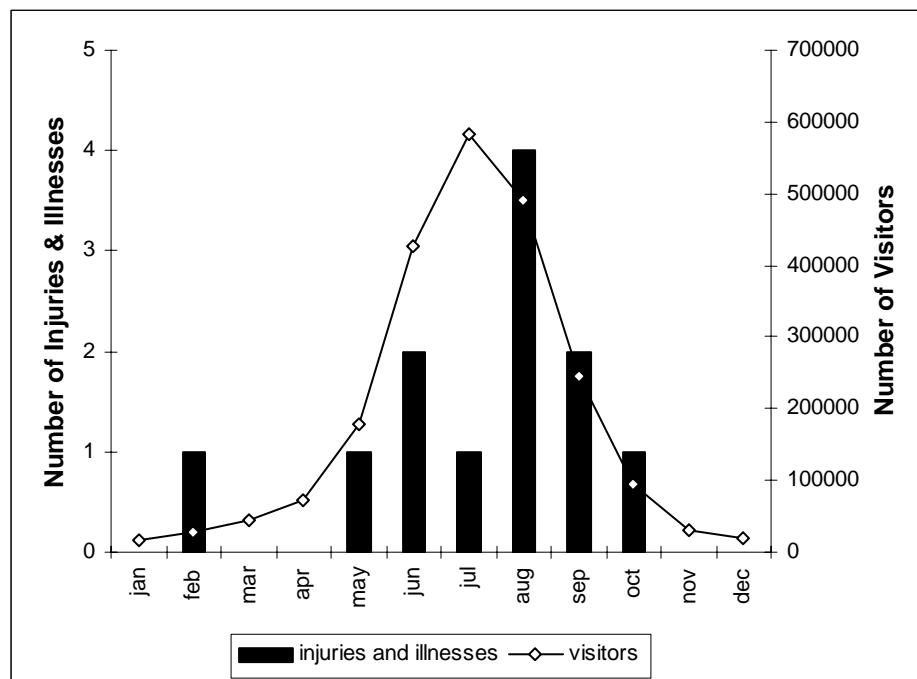


Figure 18.1: Visitor Injuries and Illnesses by Month, 1993-98 (N=12)

Falls accounted for 8 out of the 12 injuries, including 5 falls while walking and 3 while engaged in other activities. As a result of these falls, one visitor suffered a broken or fractured bone, six visitors suffered cuts, bruises, and abrasions, and one visitor suffered an eye injury. One visitor suffered a sting or bite, one suffered other minor injuries, and two suffered other unspecified injuries. Six visitors required transportation by ambulance to a medical center, three were treated and released, and two refused treatment. In one case the response on the part of park personnel was unknown. Table 18.1 shows the response to the various injuries.

| <b>Type of Injury</b>        | <b>Ambulance</b> | <b>Refused Treatment</b> | <b>Treat and Release</b> | <b>Unknown</b> |
|------------------------------|------------------|--------------------------|--------------------------|----------------|
| Break/fracture               | 1                | 0                        | 0                        | 0              |
| Cuts, abrasions, and bruises | 3                | 1                        | 2                        | 0              |
| Eye injury                   | 0                | 0                        | 1                        | 0              |
| Sting/bite                   | 1                | 0                        | 0                        | 0              |
| Unspecified injury           | 1                | 1                        | 0                        | 0              |
| Minor other                  | 0                | 0                        | 0                        | 1              |
| <b>Total</b>                 | <b>6</b>         | <b>2</b>                 | <b>3</b>                 | <b>1</b>       |

**Table 18.1: Visitor Injuries and Illnesses by Response, 1993-98 (N=12)**

## 19.0 Lowell National Historic Park

### 19.1 Introduction:

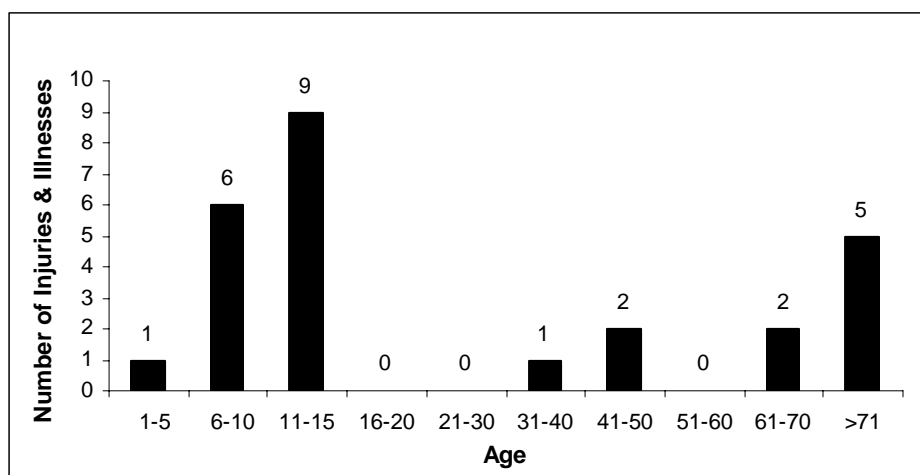
Between 1993 and 1998, there were 42 visitor accidents at Lowell National Historic Park, resulting in 46 injuries and illnesses and no fatalities. Since there were 3,147,809 visitors to the park during this period for a total of 4,276,433 visitor-hours, this results in an average of ZZ accidents, 0 fatalities, and 0.89 injuries and illnesses per 100,000 visitors, and ZZ accidents, 0 fatalities, and 6.55 injuries and illnesses per 1,000,000 visitor-hours.

### 19.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were no accidents leading to visitor fatalities.

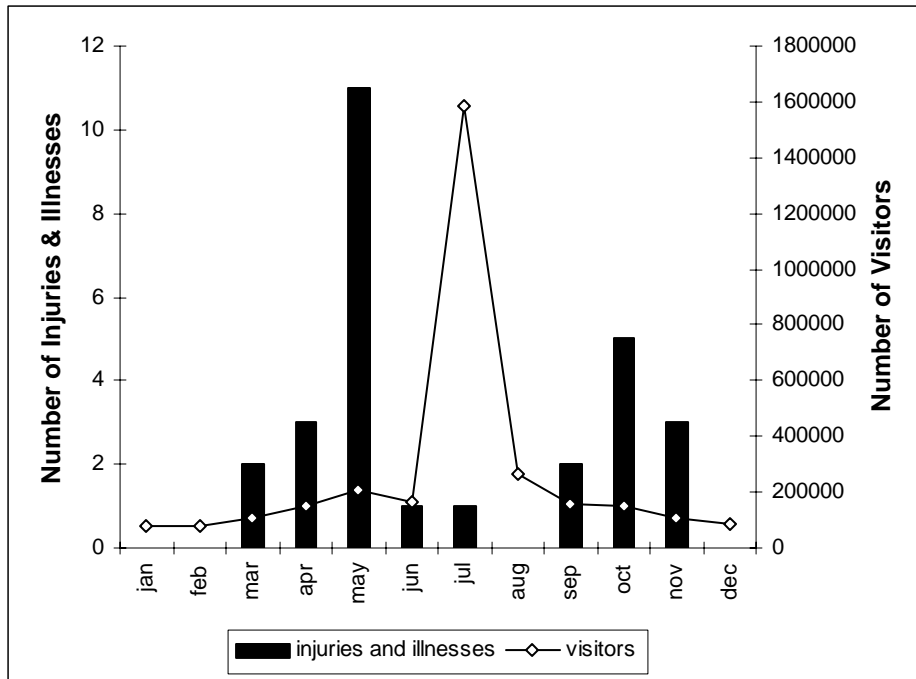
### 19.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were 46 non-fatal visitor injuries and illnesses. Thirty-seven percent of the victims were male, 46% were female, and in 17% of cases the gender of the victim was unknown. Four victims were white, one was Hispanic, and in 41 (89%) cases the race/ethnicity of the victim was unknown. Over 93% of the injured visitors were residents of the US, 2% were from the UK, and the nationality of the remaining 4% was unknown. The ages of only 26 (56%) victims was known (Figure 19.1), but would seem to indicate a disproportionate number of accidents among those under 15 years.



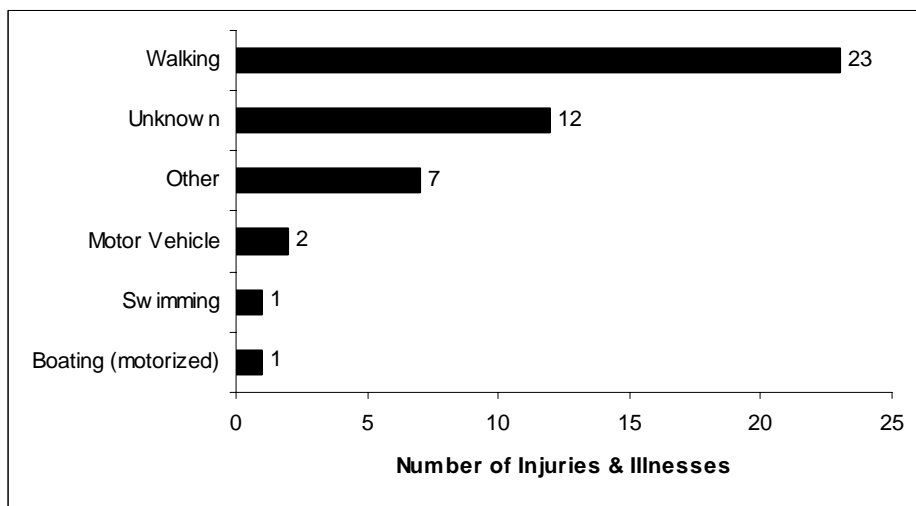
**Figure 19.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=26)**

Fifty percent of the victims were injured between noon and 6p.m., and 46% between 6am and noon. Sixty-eight percent of the victims were injured on weekdays and 32% on weekends. The distribution of injured by month is shown in Figure 19.2, and reveals a curious pattern that at first seems unrelated to visitation rates. We believe, however, that this may be a result of the large number of school fieldtrips to Lowell during the late spring and early fall.



**Figure 19.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=28)**

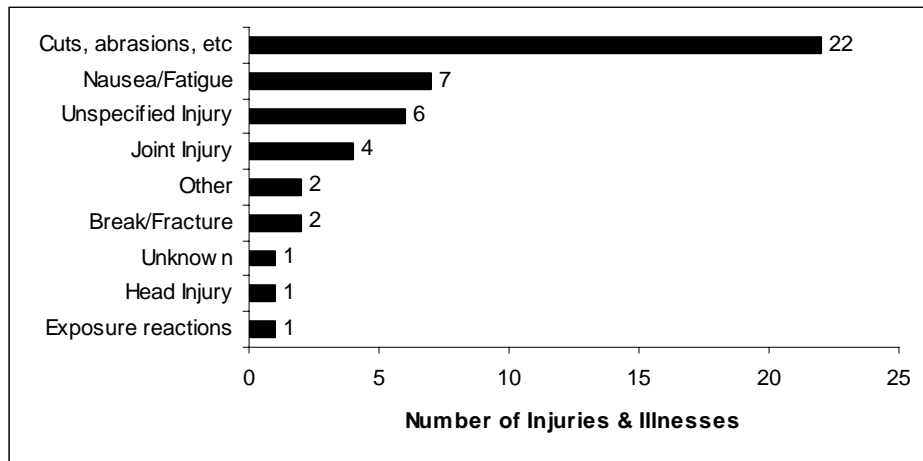
Figure 19.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are walking (50%) but for a substantial number of injuries and illnesses (26%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident, and 15% are grouped into a miscellaneous category of “other.”



**Figure 19.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=46)**



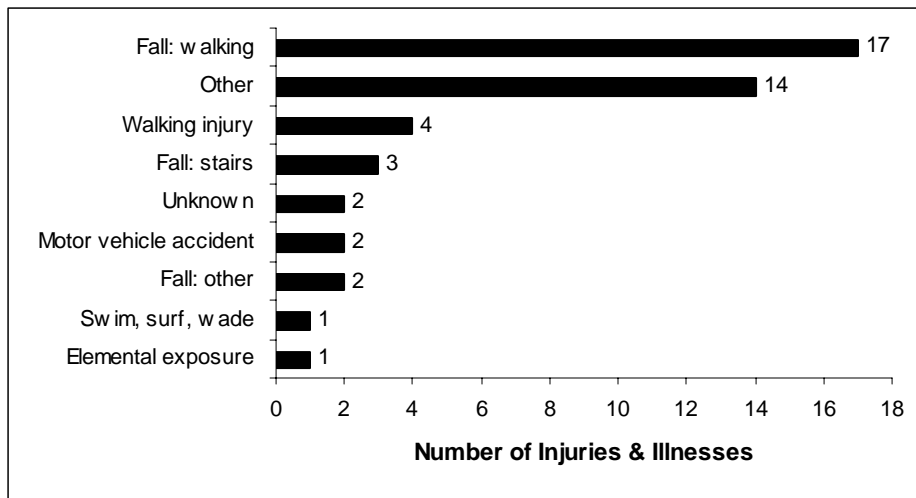
Turning to the nature of injuries and illness, we see (Figure 19.4) that 48% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 15% involved nausea and fatigue; and 13% were due to unspecified injuries and illnesses.



**Figure 19.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=46)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 46 injuries and illnesses occurring during this period, 20 (43%) could be considered less serious because the visitors were treated and released, and 13 (28%) could be considered more serious, since they required transportation to a medical facility. Four visitors (9%) were transported by ambulance and 9 (20%) were transported by privately owned vehicle. Four people (9%) refused treatment and in 2 cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 7 (15%) cases the victim was advised to seek additional treatment at his or her convenience. Of the 13 injuries and illnesses requiring transportation to a medical facility, 7 (54%) were for the treatment of cuts, abrasions, and bruises. Fifty-four percent (12/22) of cuts, abrasions, and bruises were treated and released, and all of seven of those suffering nausea were advised to seek additional treatment.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 19.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Evidently, falls are the primary event leading to injuries at Lowell, and lead to 47% of all injuries.



**Figure 19.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=46)**

## 20.0 Mesa Verde National Park

### 20.1 Introduction:

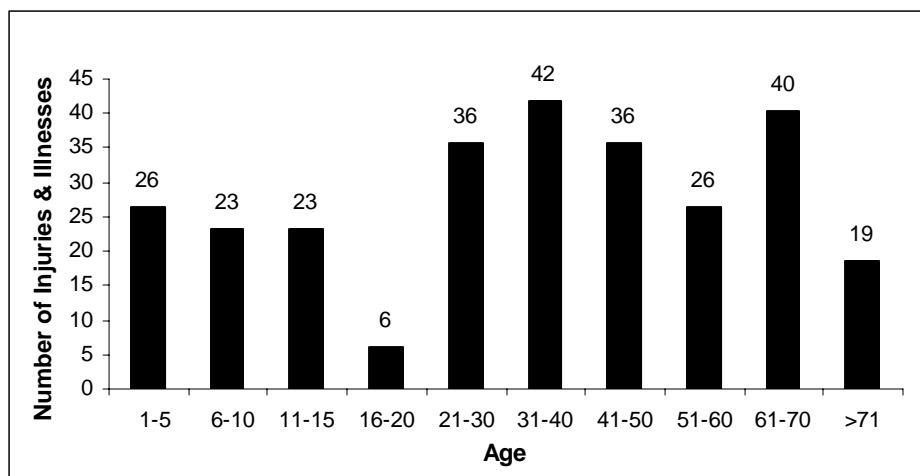
Between 1993 and 1998, there were 298 visitor accidents at Mesa Verde National Park, resulting 307 injuries and illnesses and no fatalities. Since there were 3,864,515 visitors to the park during this period for a total of 32,517,232 visitor-hours, this results in an average of 7.71 accidents, 0 fatalities, and 7.94 injuries and illnesses per 100,000 visitors, and 9.16 accidents, 0 fatalities, and 9.44 injuries and illnesses per 1,000,000 visitor-hours.

### 20.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were no accidents that resulted fatalities.

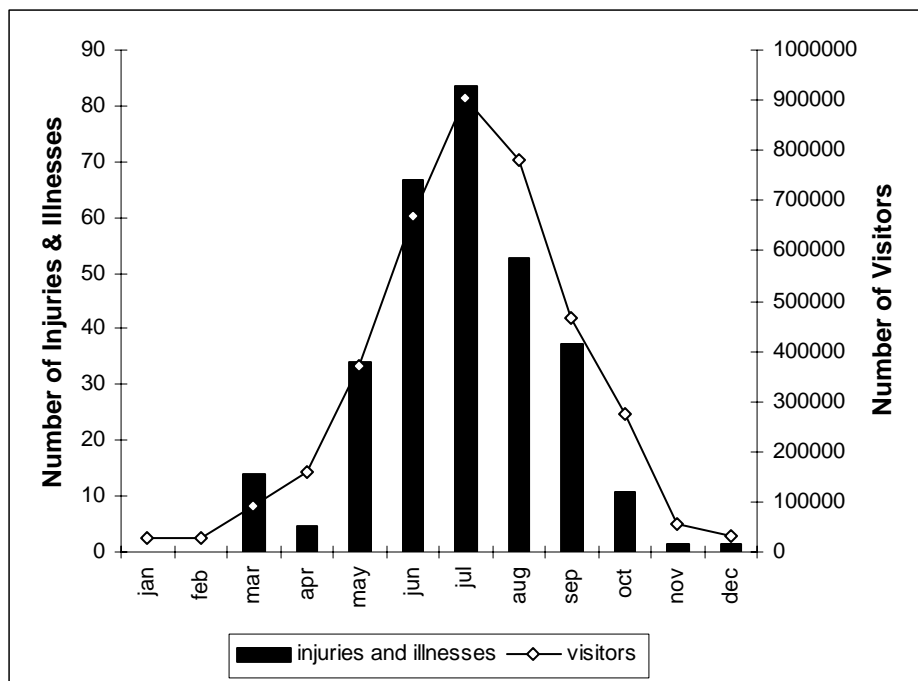
### 20.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 307 visitor injuries and illnesses. Thirty-eight percent of the victims were male and 61% were female. The overwhelming majority of victims (88%) were white, with 3% Hispanic, 3% Asian, 1% Native American, and 5% of unknown race/ethnicity. Eighty-nine percent of the victims were residents of the US, 2% were from Germany, 1.5% from the UK, 1% from France, and 1% from Switzerland. The distribution of victims by age is shown in Figure 20.1.



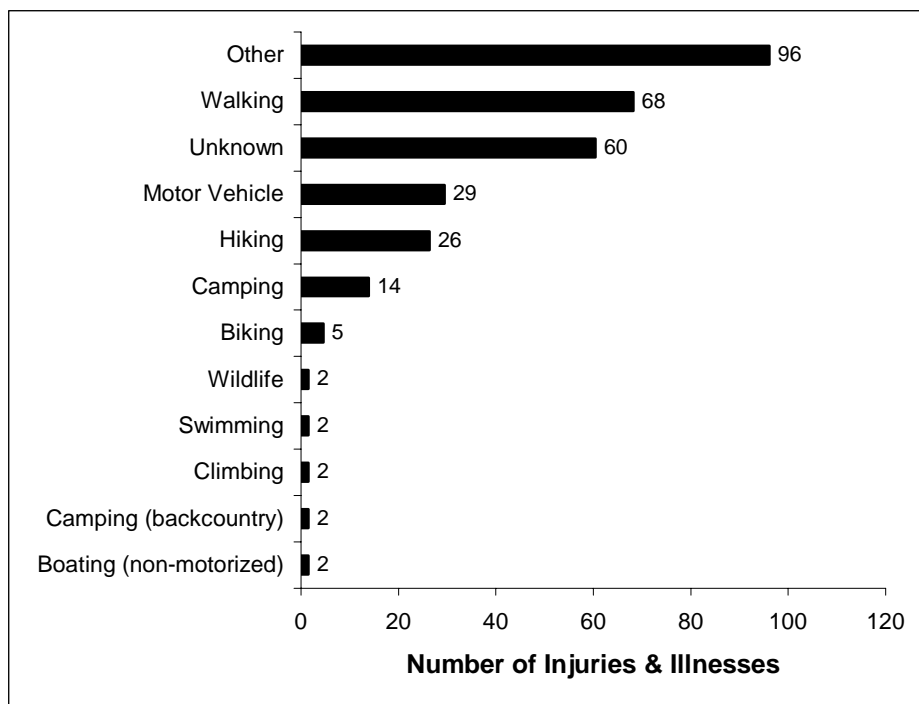
**Figure 20.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=277)**

Over 61% of the victims were injured between noon and 6p.m., 24% between 6am and noon, and 13% between 6:00pm and midnight. Sixty-six percent of the victims were injured on weekdays and 34% on weekends. The distribution of injured by month (Figure 20.2) mirrors visitation rates, with a peak in the summer.



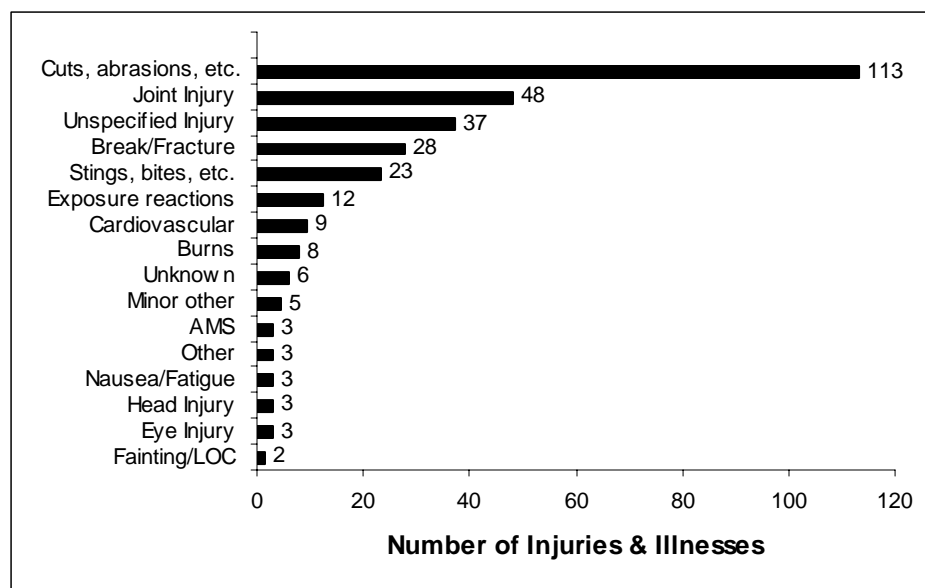
**Figure 20.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=307)**

Figure 20.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur during a variety of activities here classified as other (31%), but walking (22%), driving or riding in vehicles (10%), and hiking (9%) all result in a number of injuries. For a substantial number of injuries and illnesses (20%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 20.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=307)**

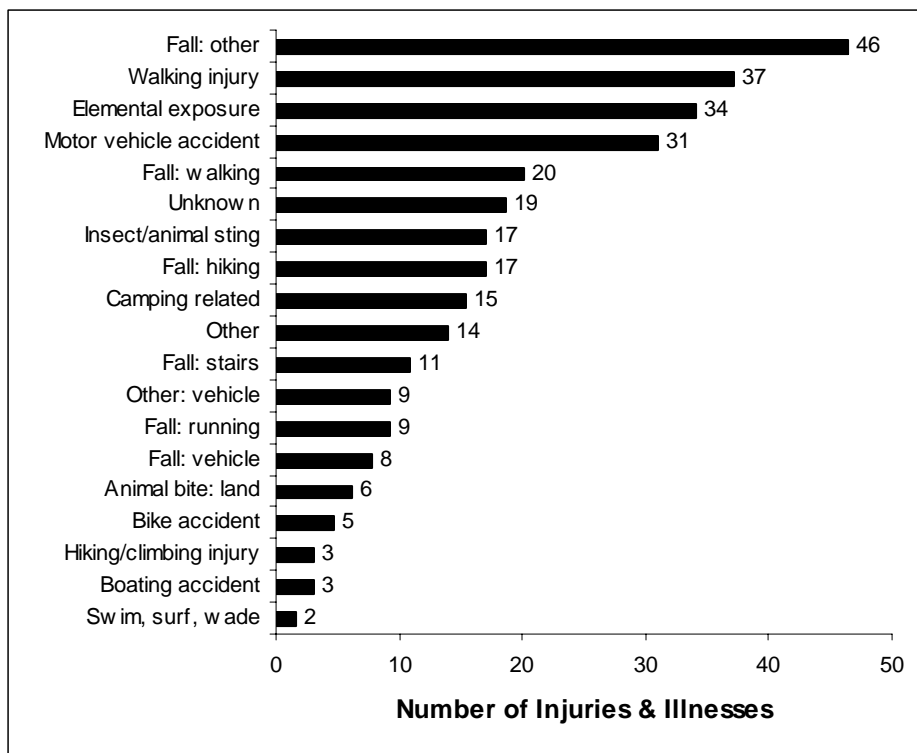
Turning to the nature of injuries and illness, we see (Figure 20.4) that 37% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 16% involved joint injuries (such as twisted ankles), 9% involved broken bones or fractures; and 8% percent resulted from stings and bites. Twelve percent were due to unspecified injuries and illnesses. Male visitors were more likely to suffer cuts and abrasions (59%) than females (40%), but females were more likely to suffer most other kinds of injuries.



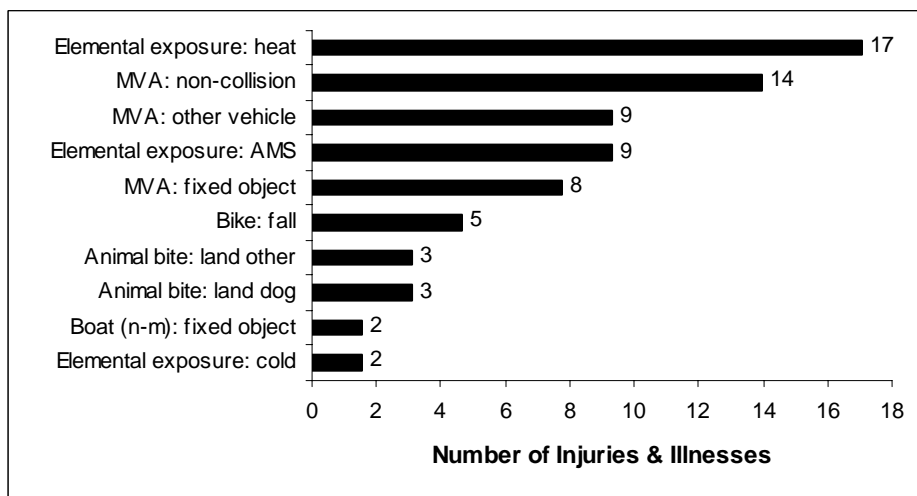
**Figure 20.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=307)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 307 injuries and illnesses occurring during this period, 209 (68%) could be considered less serious because the visitors were treated and released, and 76 (25%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 62 (20%) were transported by ambulance and 14 (5%) were transported by privately owned vehicle. Five people (1.5%) refused treatment and in 15 (5%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In ZZ cases it is unknown what if any response was taken. Of the 76 injuries and illnesses requiring transportation to a medical facility, 20 (26%) were for broken bones and fractures, 17 (22%) were for the treatment of cuts, abrasions, and bruises, and 13 (17%) for joint injuries. Seventy-eight percent (88/113) of cuts, abrasions, and bruises, 69% of joint injuries (33/48), and 83% (19/23) of stings and bites were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 20.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 20.6.



**Figure 20.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=ZZ)**



**Figure 20.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=ZZ)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 37 injuries and illnesses associated with these activities, 38% are driver-related, 4% environmental factors, and

33% road-related. In 25% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.



## 21.0 Mount Rainier National Park

### 21.1 Introduction:

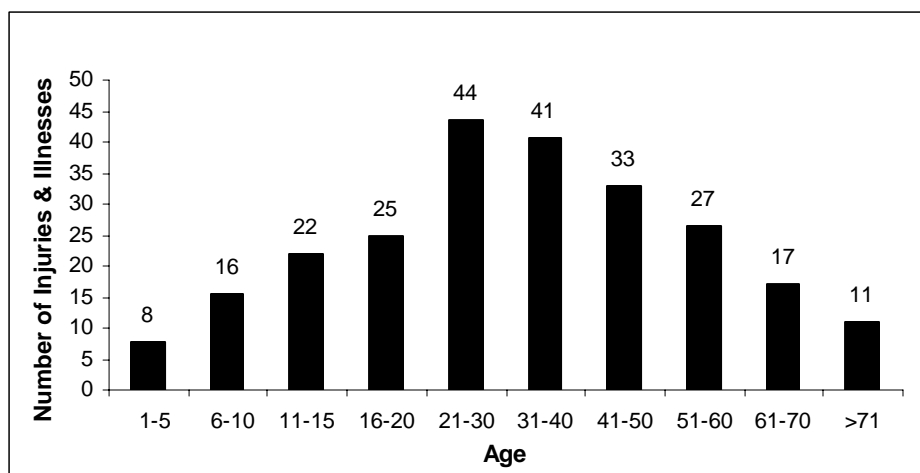
Between 1996 and 1998, there were 239 visitor accidents at Mount Rainier National Park, resulting in 4 fatalities and 253 non-fatal injuries and illnesses. Since there were 4,008,527 visitors to the park during this period for a total of 49,275,265 visitor-hours, this results in an average of 5.96 accidents, 0.10 fatalities, and 6.30 injuries and illnesses per 100,000 visitors, and 4.85 accidents, 0.08 fatalities, and 5.13 injuries and illnesses per 1,000,000 visitor-hours.

### 21.2 Accidents Involving Fatalities:

Between 1996 and 1998, there were 4 accidents that resulted in a total of 4 fatalities. All four fatalities were white, male, and U.S. residents. Two of the fatalities occurred on weekends and two on weekdays, and two occurred in the afternoons and 2 in the evenings. Three fatalities occurred while visitors were climbing (2 falls and one exposure), and 1 while driving. Three search and rescue operations were launched.

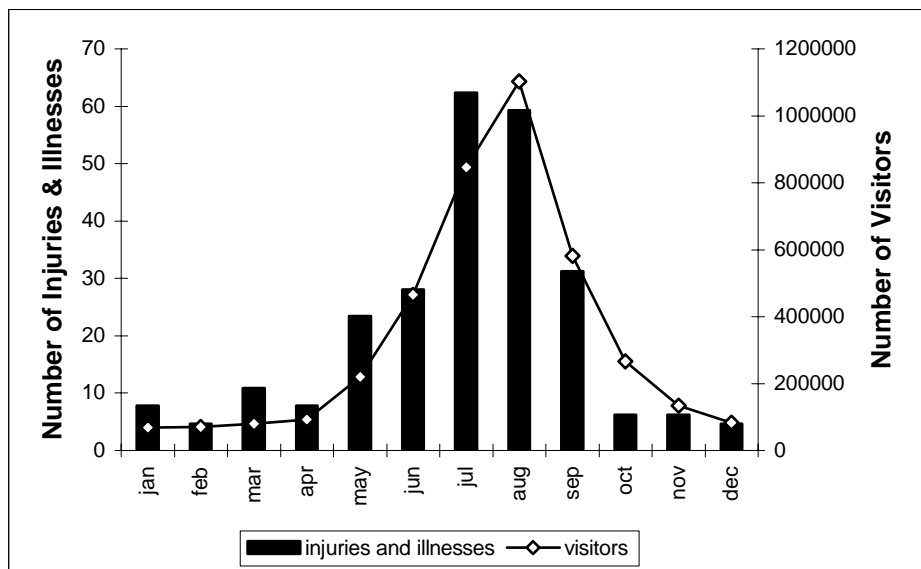
### 21.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 253 visitor injuries and illnesses arising from 235 accidents that did not involve fatalities. Fifty-seven percent of the victims were male and 41% were female. The overwhelming majority of victims (91%) were white, with 4% Asian, 1% Hispanic, and 4% of unknown race/ethnicity. Ninety-six percent of the victims were residents of the US, 1% was from Germany, and there was less than 1% from each of the following countries: Canada, France, and Spain. There was 1% of unknown nationality. The distribution of victims by age is shown in Figure 21.1.



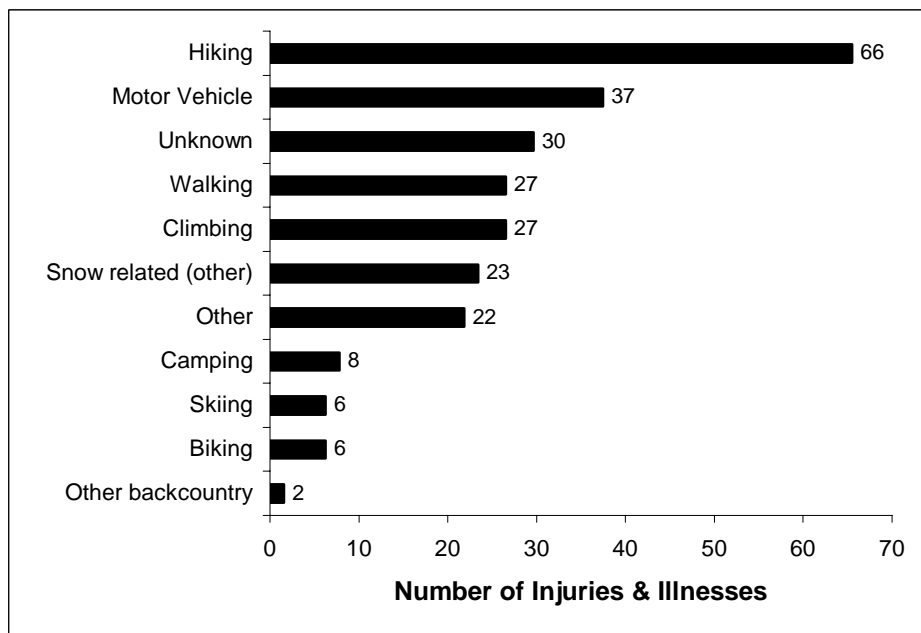
**Figure 21.1: Visitor Injuries and Illnesses by Age, 1996-98 (N=242)**

Over 68% of the victims were injured between noon and 6p.m., 14% between 6am and noon, and 14% between 6:00pm and midnight. Fifty-one percent of the victims were injured on weekdays and 49% on weekends. The distribution of injured by month is shown in Figure 21.2, and reveals a pattern that mirrors visitation rates, with a peak in the summer.



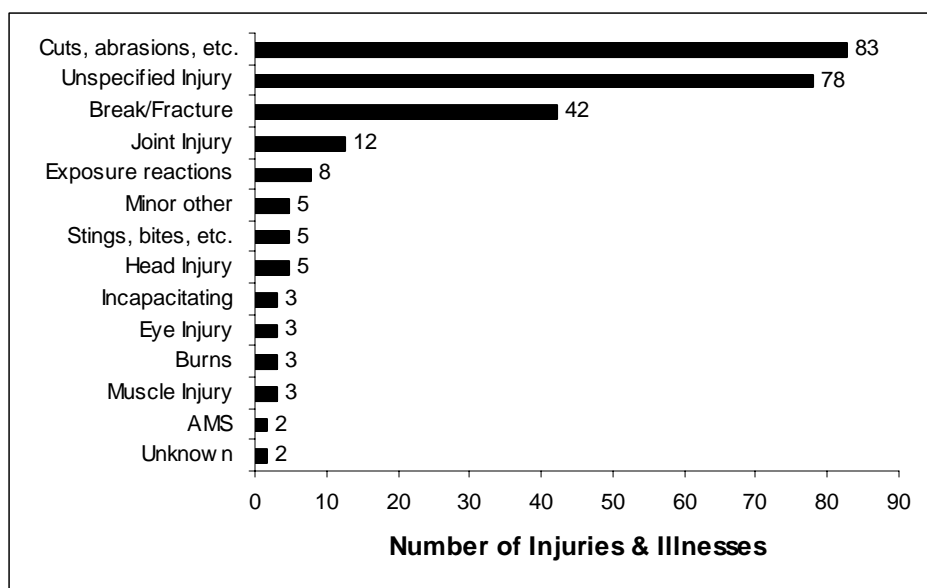
**Figure 21.2: Visitor Injuries and Illnesses by Month, 1996-98 (N=253)**

Figure 21.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are hiking (26%), driving or riding in motor vehicles (15%), and walking (11%), although for a substantial number of injuries and illnesses (12%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 21.3: Visitor Injuries and Illnesses by Activity, 1996-98 (N=253)**

Turning to the nature of injuries and illness, we see (Figure 21.4) that 33% of all injuries and illnesses between 1996 and 1998 were cuts, abrasions, and bruises; 17% involved broken bones or fractures, and 31% were due to unspecified injuries and illnesses. There were more female (23/42) than male (19/42) victims of breaks and fractures, but more male (56/83) than female (25/83) victims of cuts and abrasions, and more male (45/78) than female (31/78) victims of unspecified injuries.

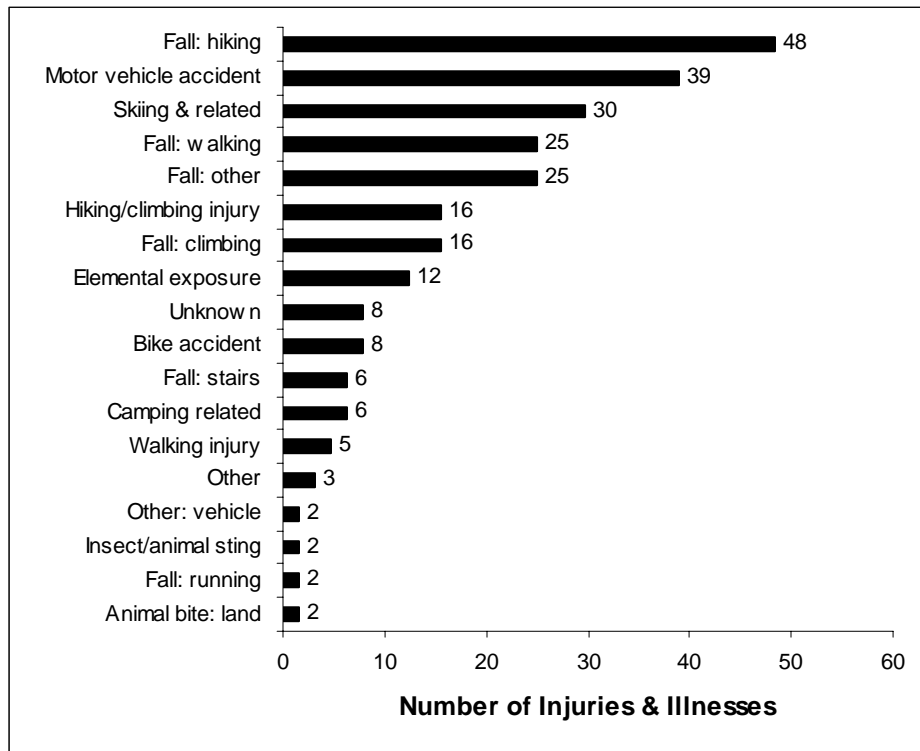


**Figure 21.4: Types of Visitor Injuries and Illnesses, 1996-98 (N=253)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 253 injuries and illnesses occurring during this period, 119 (47%) could be considered less serious because the visitors were treated and released, and 126 (50%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 69 (27%) were transported by ambulance and 58 (23%) were transported by privately owned vehicle. Three people (1%) refused treatment. Of the 126 injuries and illnesses requiring transportation to a medical facility, 23 (18%) were for the treatment of cuts, abrasions, and bruises, 30 (24%) were for breaks and fractures, and 44 (35%) were for unspecified injuries and illnesses. Seventy-one percent (59/83) of cuts, abrasions, and bruises, and 36% (28/78) of unspecified injuries were treated and released.

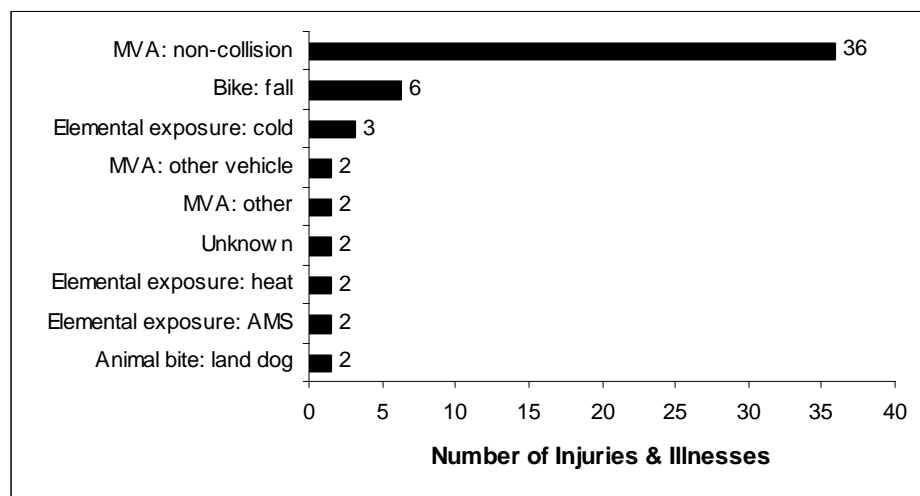
Visitors may be injured in numerous ways as they participate in various activities, and Figure 21.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor

was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Figure 21.5 shows that 73% (48/66) of hiking and 93% (25/27) of injuries involve falls



**Figure 21.5: Visitor Injuries and Illnesses by Primary Event, 1996-98 (N=ZZ)**

Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 21.6.



**Figure 21.6: Visitor Injuries and Illnesses by Secondary Event, 1996-98 (N=55)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 47 injuries and illnesses associated with these activities, 67% are driver-related, 10% road-related, and 10% are a result of equipment failure. In 13% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

## 22.0 Mount Rushmore National Memorial

### 22.1 Introduction:

Between 1993 and 1997, there were 179 visitor accidents at Mount Rushmore National Memorial, resulting in no fatalities and 183 non-fatal injuries and illnesses<sup>5</sup>. Since there were 9,318,575 visitors to the park during this period for a total of 12,271,760 visitor-hours, this results in an average of 1.92 accidents, 0 fatalities, and 1.96 injuries and illnesses per 100,000 visitors, and 14.59 accidents, 0 fatalities, and 14.91 injuries and illnesses per 1,000,000 visitor-hours.

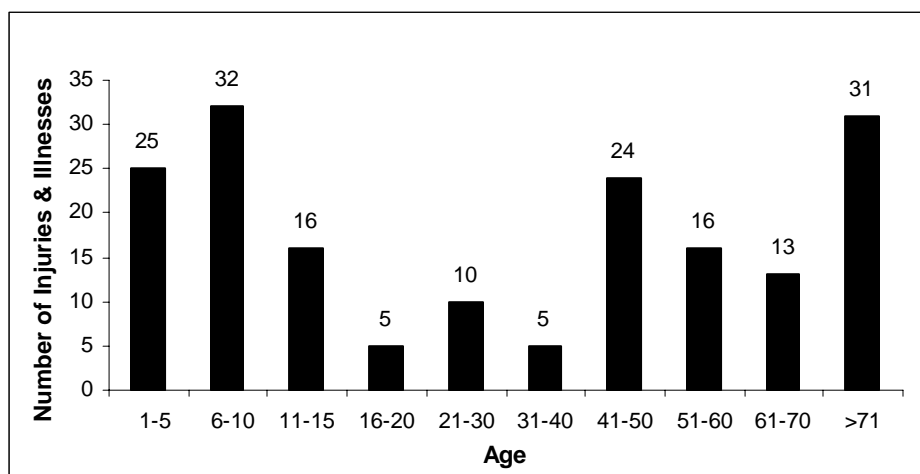
### 22.2 Accidents Involving Fatalities:

Between 1993 and 1997, there were no fatal accidents at Mount Rushmore National Memorial.

### 22.3 Accidents Involving No Fatalities

Between 1993 and 1997, there were an estimated 183 visitor injuries and illnesses arising from 179 accidents. Forty percent of the victims were male and 60% were female. The overwhelming majority of victims (90%) were residents of the US, with 4% from Canada, and 5% of unknown nationality. Twenty-six percent of the victims were known to be white, but the race/ethnicity of 74% was unknown.

Figure 22.1 shows that the victims are disproportionately older and younger than might be expected, if one assumes that the age of visitors is normally distributed. This distribution, however, may reflect the actual distribution of visitors by age.

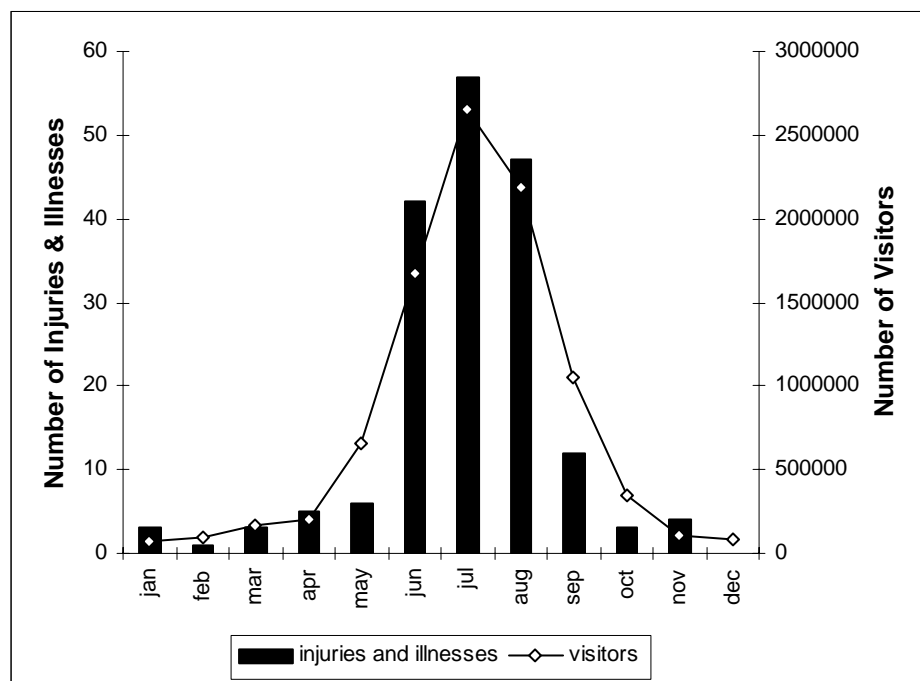


**Figure 22.1: Visitor Injuries and Illnesses by Age, 1993-97 (N=177)**

Over 47% of the victims were injured between noon and 6p.m., 30% between 6am and noon, and 23% between 6:00pm and midnight. Sixty-four percent of the victims were injured on weekdays

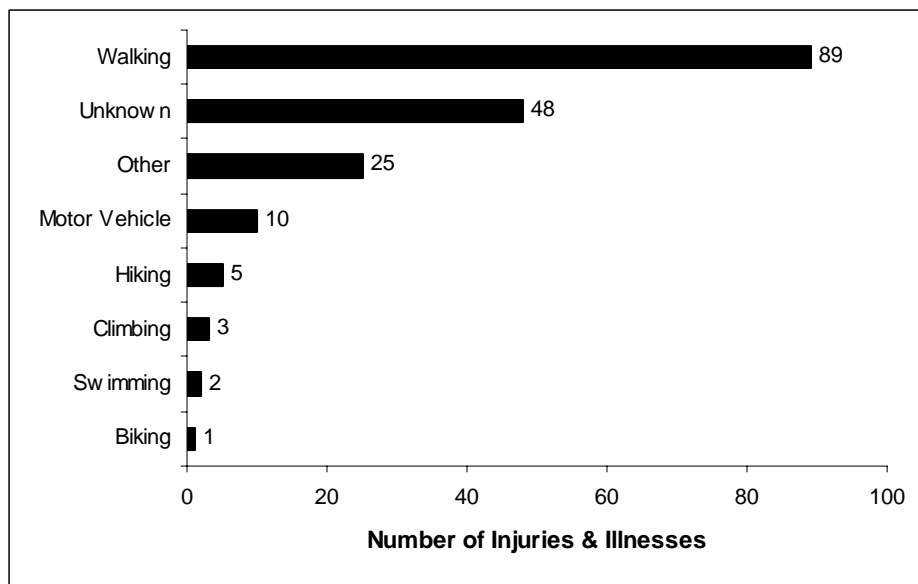
<sup>5</sup> The data for 1998 were unavailable.

and 36% on weekends. The distribution of injured by month is shown in Figure 22.2, and reveals a pattern that mirrors visitation rates, with a peak in the summer.



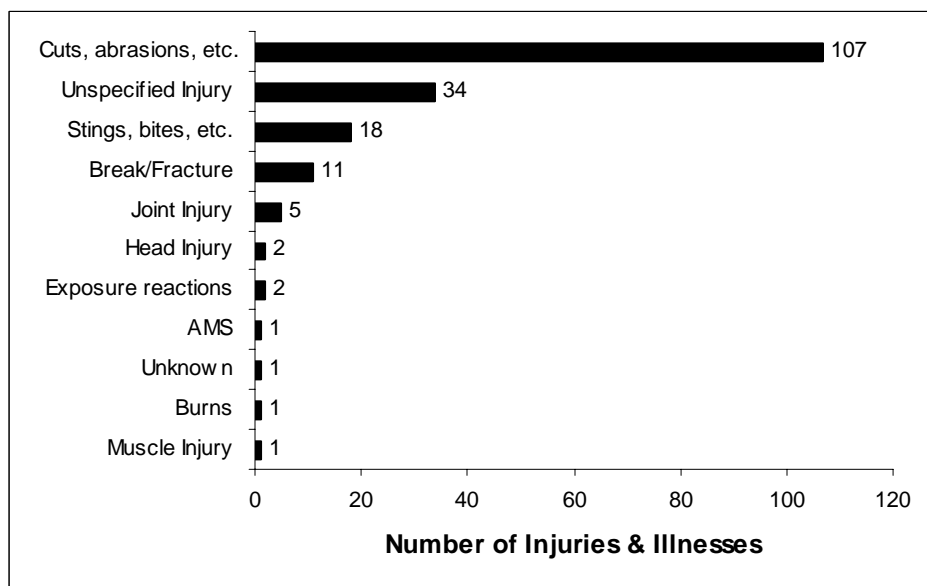
**Figure 22.2: Visitor Injuries and Illnesses by Month, 1993-97 (N=183)**

Figure 22.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are walking (49%) and engaged in various other activities (14%), although for a substantial number of injuries and illnesses (26%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 22.3: Visitor Injuries and Illnesses by Activity, 1993-97 (N=183)**

Turning to the nature of injuries and illness, we see (Figure 22.4) that 58% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 10% involved stings, bites, etc.; and 19% were due to unspecified injuries and illnesses. Fifty percent (51/102) of cuts, abrasions, and bruises, and 50% of stings and bites (9/18) occurred among children younger than 15 years of age.

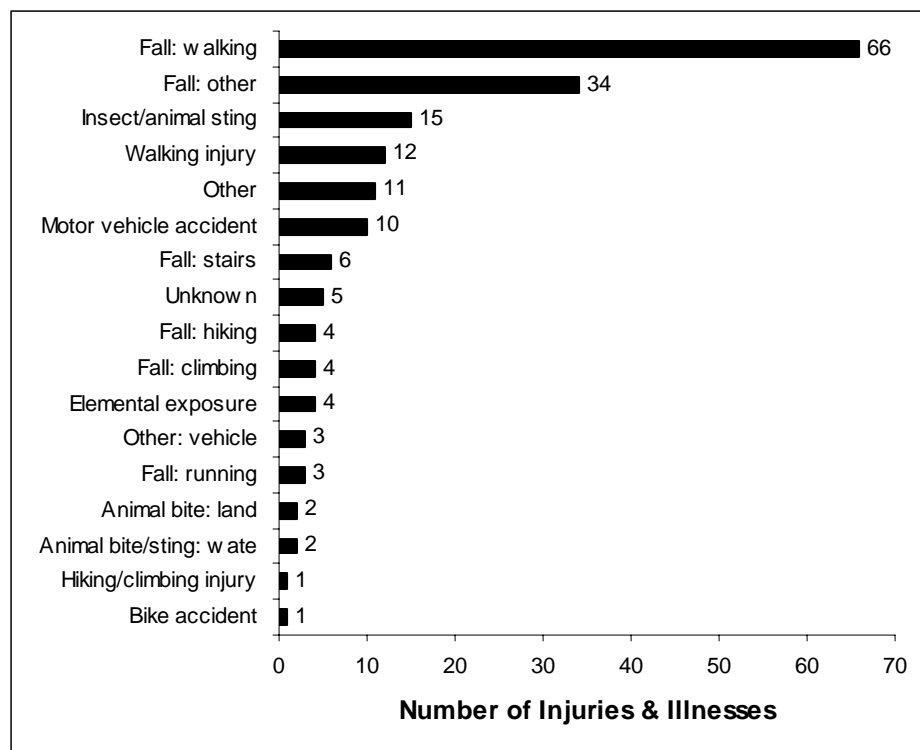


**Figure 22.4: Types of Visitor Injuries and Illnesses, 1993-97 (N=183)**



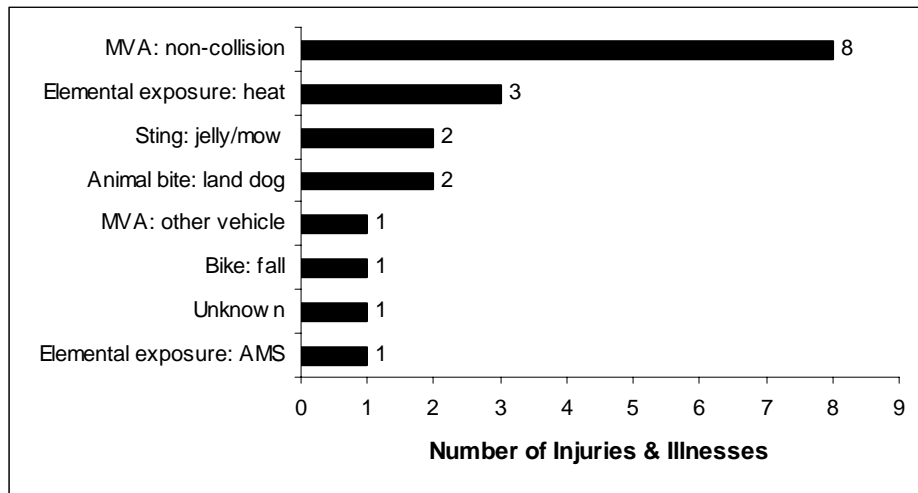
Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 183 injuries and illnesses occurring during this period, 151 (83%) could be considered less serious because the visitors were treated and released, and 25 (14%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 21 (12%) were transported by ambulance and 4 (2%) were transported by privately owned vehicle. In 6 (3%) cases it is unknown what if any response was taken. Of the 25 injuries and illnesses requiring transportation to a medical facility, 8 (32%) were for the treatment of cuts, abrasions, and bruises, 7 (28%) were for suspected broken bones or fractures, and 6 (24%) were for unspecified injuries and illnesses. Ninety percent (96/107) of cuts, abrasions, and bruises were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 22.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Figure 22.5 shows that 74% (66/89) of the injuries incurred while walking are due to falls, and that all falls of various kinds result in 64% (117/183) of all injuries and illnesses.



**Figure 22.5: Visitor Injuries and Illnesses by Primary Event, 1993-97**

Where we have sufficient information (usually for biking, boating, and motor vehicle accidents) we can also identify secondary causal events, as illustrated in Figure 22.6. This figure shows that 8/10 motor vehicle accidents are non-collisions.



**Figure 22.6: Visitor Injuries and Illnesses by Secondary Event, 1993-97 (N=ZZ)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to accidents. Of the 11 injuries and illnesses associated with motor vehicles and biking at Mount Rushmore, 8 have no information about contributory factors.

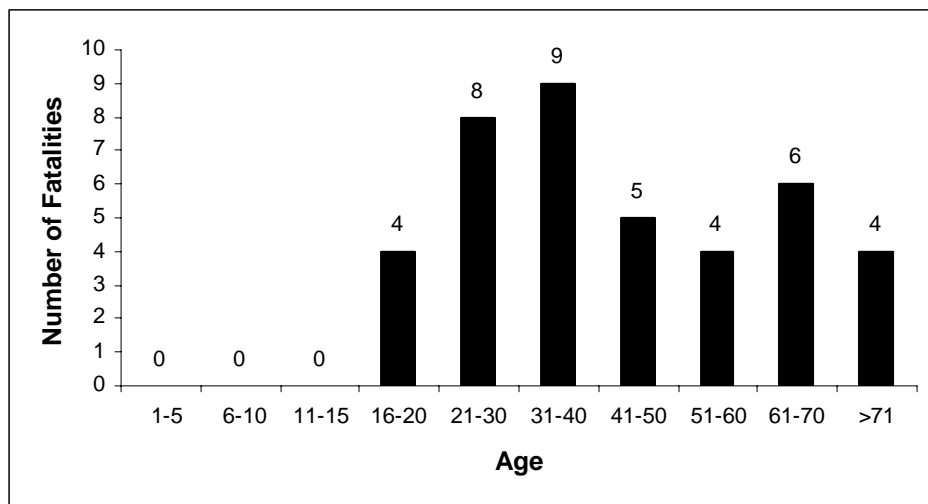
## 23.0 Natchez Trace Parkway

### 23.1 Introduction:

Between 1993 and 1998, there were 412 visitor accidents at Natchez Trace Parkway, resulting in 41 fatalities and 685 non-fatal injuries and illnesses. Since there were 34,781,424 visitors to the park during this period for a total of 140,693,790 visitor-hours, this results in an average of 1.18 accidents, 0.12 fatalities, and 1.97 injuries and illnesses per 100,000 visitors, and 2.93 accidents, 0.29 fatalities, and 4.87 injuries and illnesses per 1,000,000 visitor-hours.

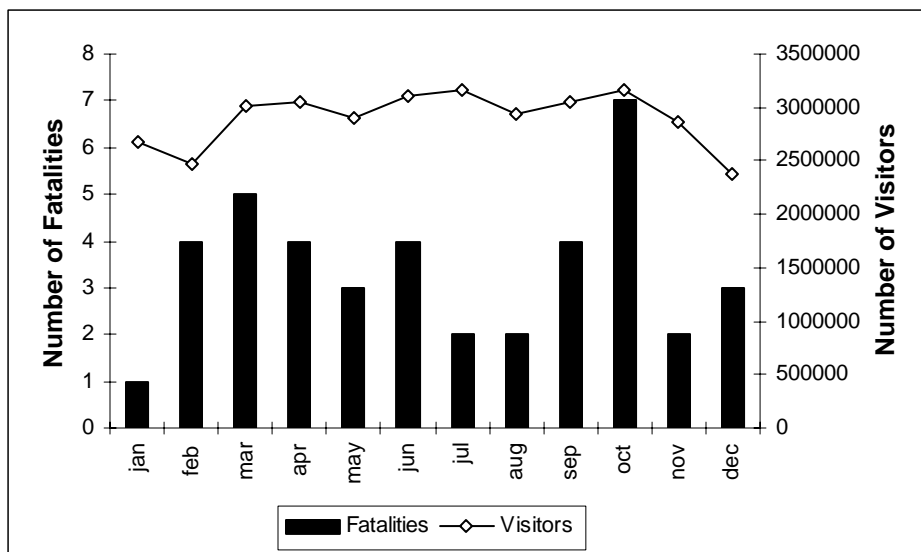
### 23.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 40 accidents that resulted in a total of 41 fatalities. Seventy-three percent of the victims were male and 27% were female. All of the victims were US residents. Twelve percent of the victims were white, 7% were African-American, but in the overwhelming majority of cases (80%) the race/ethnicity of the victim was unknown. The distribution of victims by age (Figure 23.1) shows a peak among 21-40 year olds.



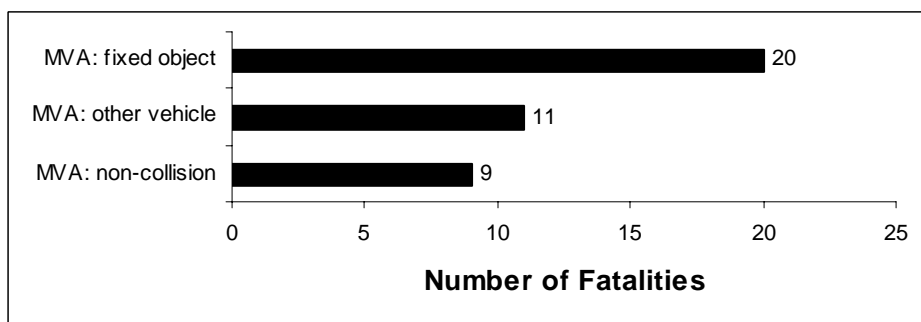
**Figure 23.1: Visitor Fatalities by Age, 1993-98 (N=40)**

Over 29% of the fatalities occurred between noon and 6p.m. and 12% between 6am and noon, but it is notable that 34% of the fatalities occurred in the evening hours between 6:00pm and midnight and a further 24% between midnight and 6:00am. Forty-six percent of the fatalities occurred on weekdays and 54% on weekends. The fatalities are distributed throughout the year (Figure 23.2) in a pattern that approximates visitation rates, but there is a notable peak in October.



**Figure 23.2: Visitor Fatalities by Month, 1993-98 (N=41)**

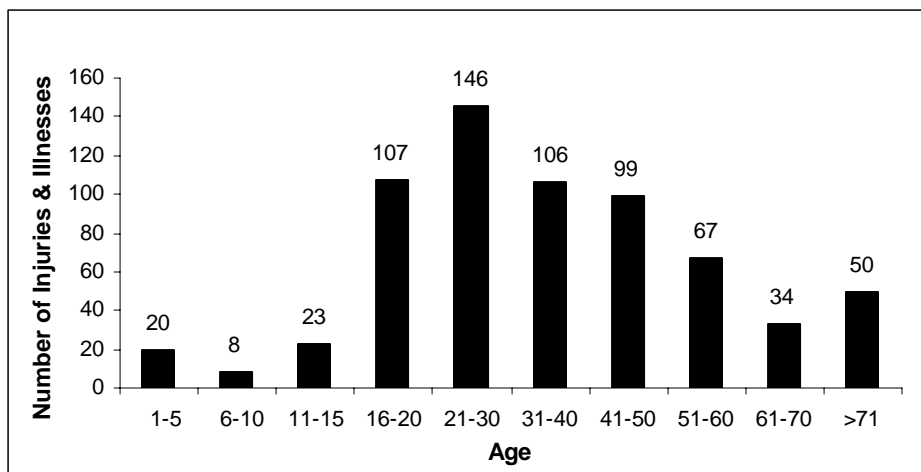
Ninety-eight percent (40/41) of visitor fatalities occur while visitors are driving or riding in motor vehicles. Twenty motor vehicle fatalities involved collisions with fixed objects, 11 involved collisions with other vehicles, and 9 involved non-collisions (Figure 23.3).



**Figure 23.3: Visitor Fatalities by Secondary Event, 1993-98 (N=40)**

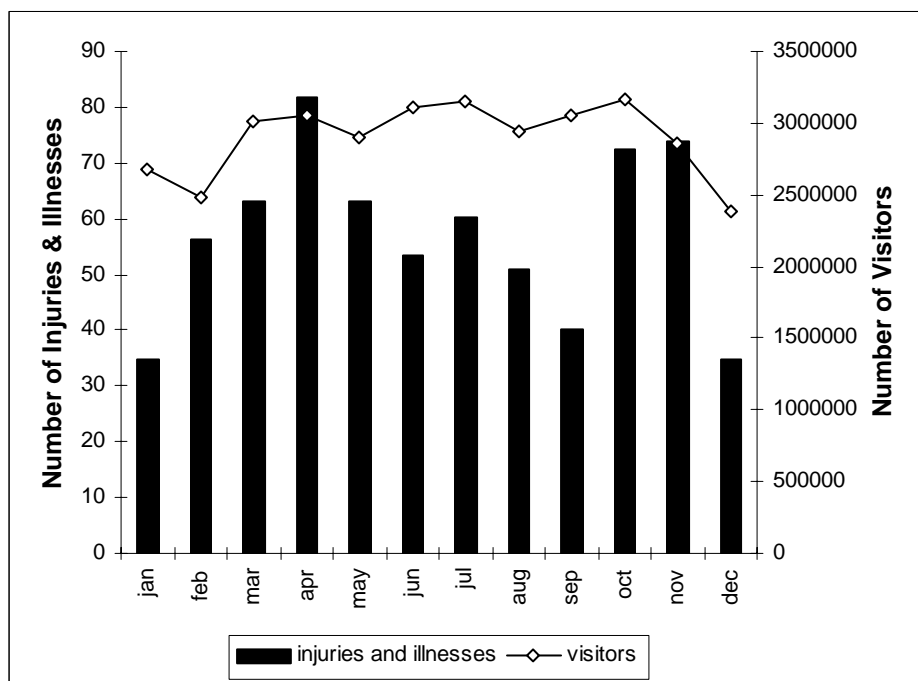
### 23.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 685 visitor injuries and illnesses arising from 372 accidents that did not involve fatalities. Fifty-five percent of the victims were male and 44% were female. Ninety-nine percent of the victims were residents of the US. The race/ethnicity of the victims was unknown in 99% of cases. The distribution of victims by age is shown in Figure 23.4.



**Figure 23.4: Visitor Injuries and Illnesses by Age, 1993-98 (N=659)**

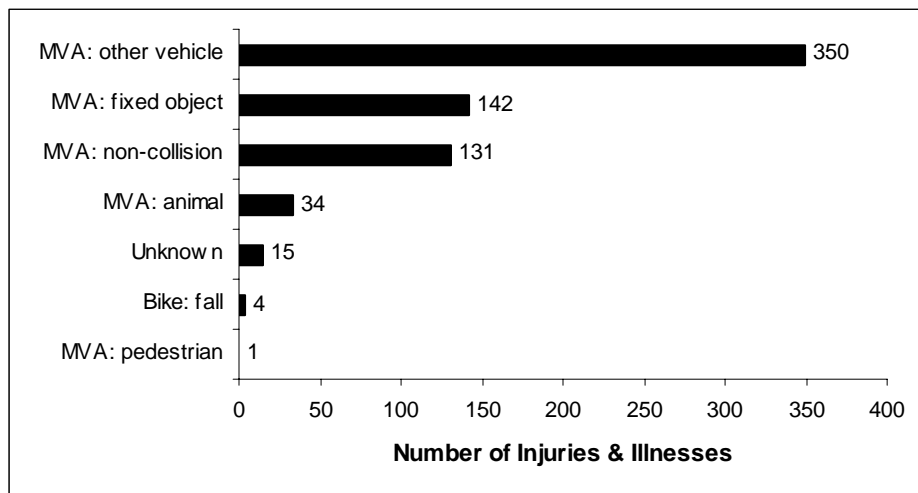
Over 45% of the victims were injured between noon and 6p.m., 22% between 6:00pm and midnight, 13% between midnight and 6:00am, and 19% between 6am and noon. Seventy-one percent of the victims were injured on weekdays and 29% on weekends. The distribution of injured by month (Figure 23.5) corresponds generally with visitation rates, although there are two minor peaks in injuries in the spring and the fall that are not mirrored in the visitation data.



**Figure 23.5: Visitor Injuries and Illnesses by Month, 1993-98 (N=685)**

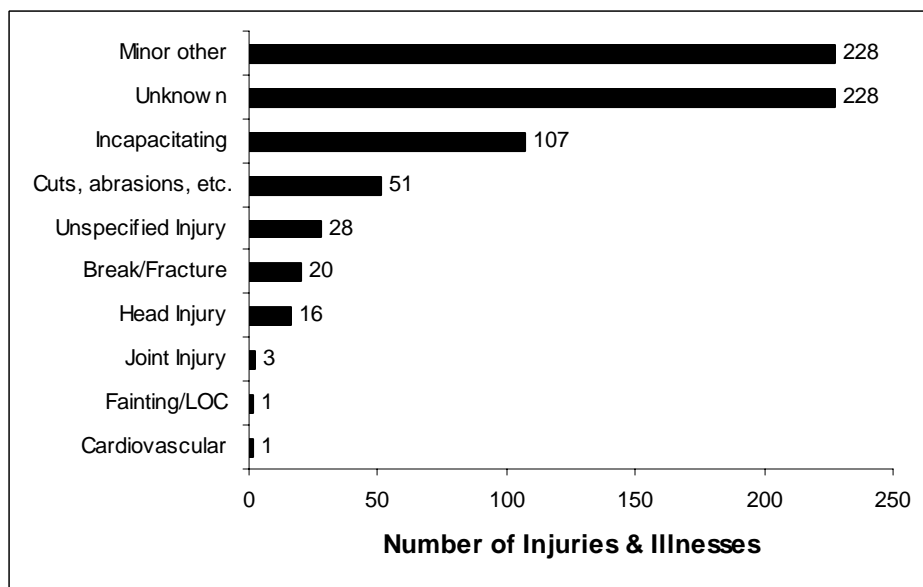
Not surprisingly given the patterns above and the nature of the park, 98% of the injuries and illnesses occurred while visitors were driving or riding in motor vehicles. Figure 23.6 shows that

52% (350/671) MVAs involved collisions with other vehicles, 21% (142/671) involved collisions with fixed objects, 20% (131/671) involved non-collisions, and 5% (34/671) involved animals on the road.



**Figure 23.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=677)**

Turning to the nature of injuries and illness, we see (Figure 23.7) that 33% of all injuries and illnesses between 1993 and 1998 were of an unknown nature; 33% involved minor other injuries, and 16% were classified as incapacitating.



**Figure 23.7: Types of Visitor Injuries and Illnesses, 1993-98 (N=685)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of

the 685 injuries and illnesses occurring during this period, 13 (2%) could be considered less serious because the visitors were treated and released, and 579 (85%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 498 (73%) were transported by ambulance and 80 (12%) were transported by privately owned vehicle. 16 people (2%) refused treatment. In 72 (11%) cases it is unknown what if any response was taken.

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 677 injuries and illnesses associated with these activities, 65% are driver-related, 7% road-related, and 1% are a result of equipment failure. In 27% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

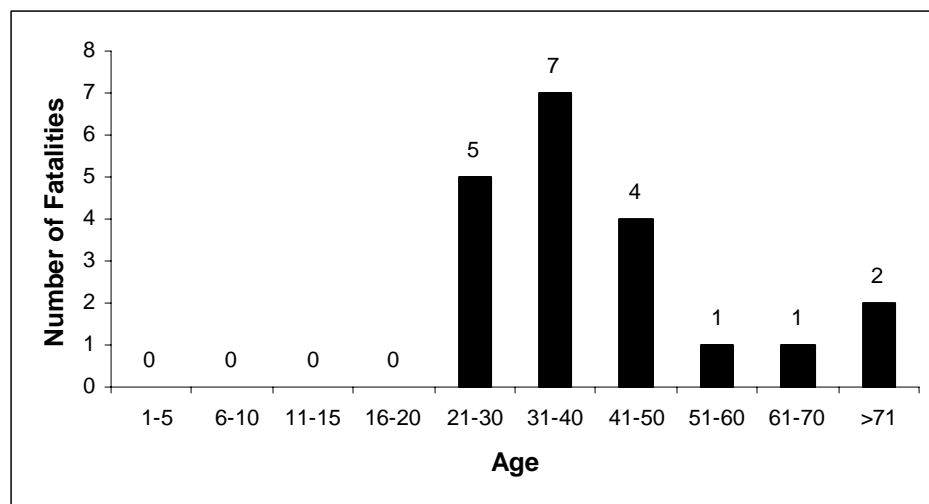
## 24.0 Olympic National Park

### 24.1 Introduction:

Between 1993 and 1998, there were 712 visitor accidents at Olympic National Park, resulting in 20 fatalities and 723 non-fatal injuries and illnesses. Since there were 20,492,225 visitors to the park during this period for a total of 115,787,615 visitor-hours, this results in an average of 3.47 accidents, 0.10 fatalities, and 3.53 injuries and illnesses per 100,000 visitors, and 6.15 accidents, 0.17 fatalities, and 6.25 injuries and illnesses per 1,000,000 visitor-hours.

### 24.2 Accidents Involving Fatalities:

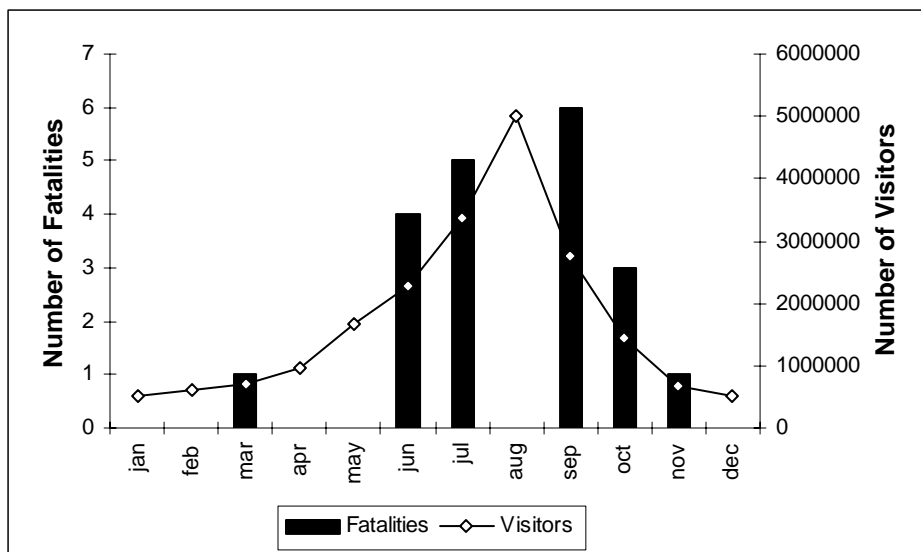
Between 1993 and 1998, there were 17 accidents that resulted in a total of 20 fatalities. Fourteen of the fatalities were male and 6 were female. Nineteen of the victims were residents of the US, and one was from the UK. All 20 victims were white. The distribution of victims by age is shown in Figure 24.1.



**Figure 24.1: Visitor Fatalities by Age, 1993-98 (N=20)**

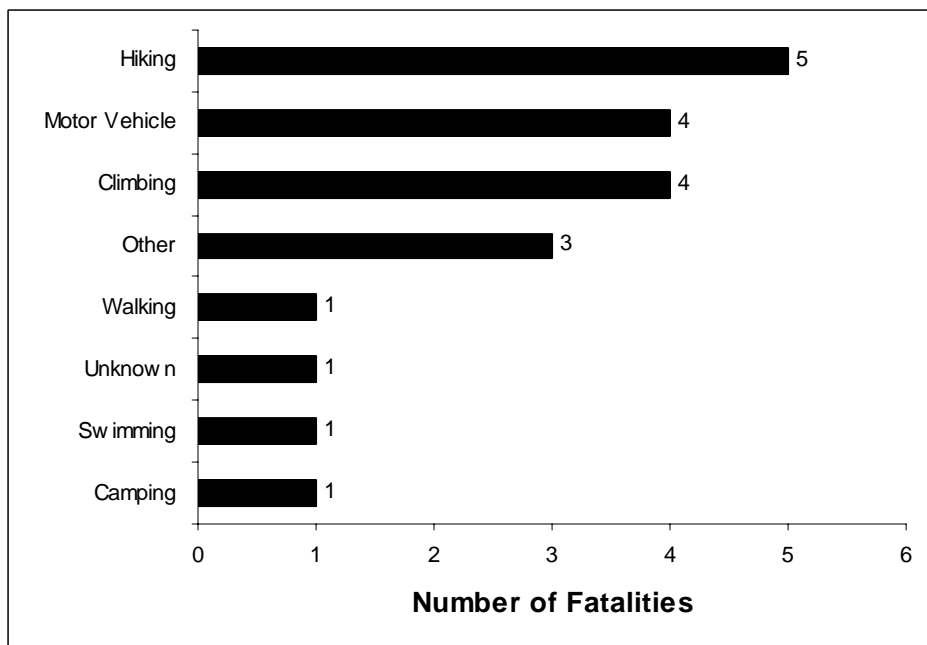
Ten of the fatalities occurred between noon and 6p.m., 4 between 6am and noon, 3 between 6:00pm and midnight, and 1 between midnight and 6:00am. Nine of the fatalities occurred on weekdays and 11 on weekends. The distribution of injured by month is shown in Figure 24.2, and reveals a pattern that mirrors visitation rates, with a peak summer. There is a peculiar absence of fatalities in August, but this may reflect the relatively short period under consideration and the relatively small number in the sample.





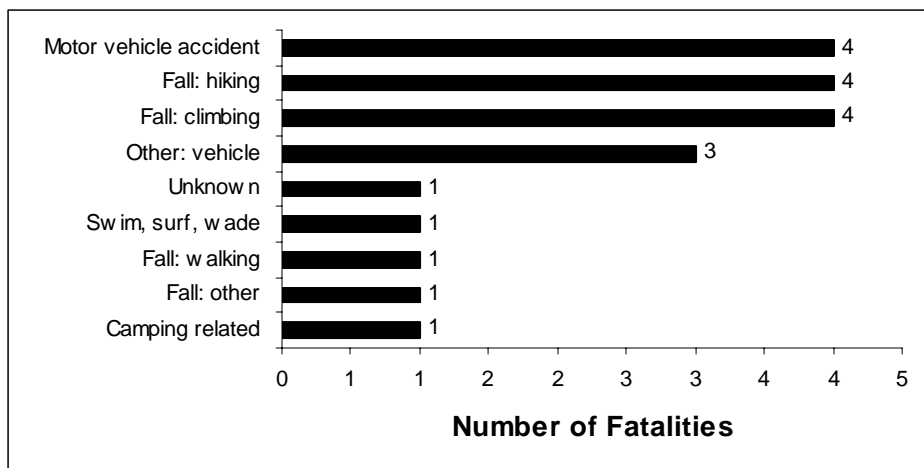
**Figure 24.2: Visitor Fatalities by Month, 1993-98 (N=20)**

Figure 24.3 shows the number of visitor fatalities by activity. Clearly, most fatalities occur while visitors are hiking (5), driving motor vehicles (4), and climbing (4).



**Figure 24.3: Visitor Fatalities by Activity, 1993-98 (N=20)**

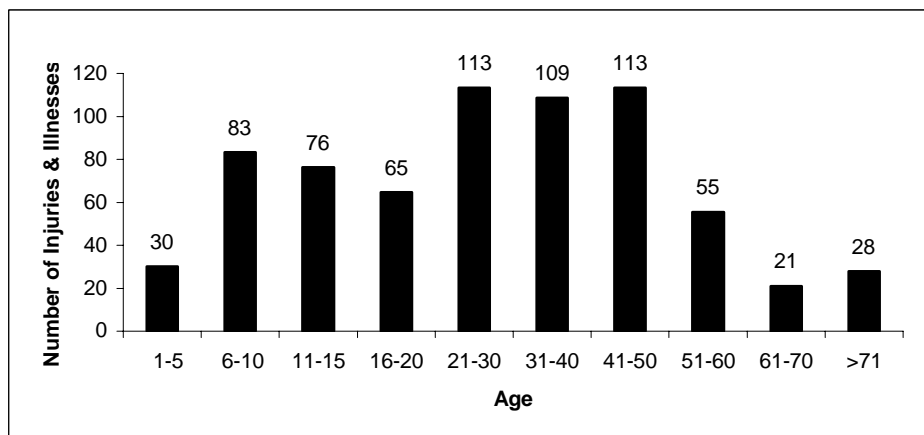
Figure 24.4 shows that 4 out of 5 hiking fatalities and all the climbing fatalities resulted from falls.



**Figure 24.4: Visitor Fatalities by Primary Event, 1993-98 (N=ZZ)**

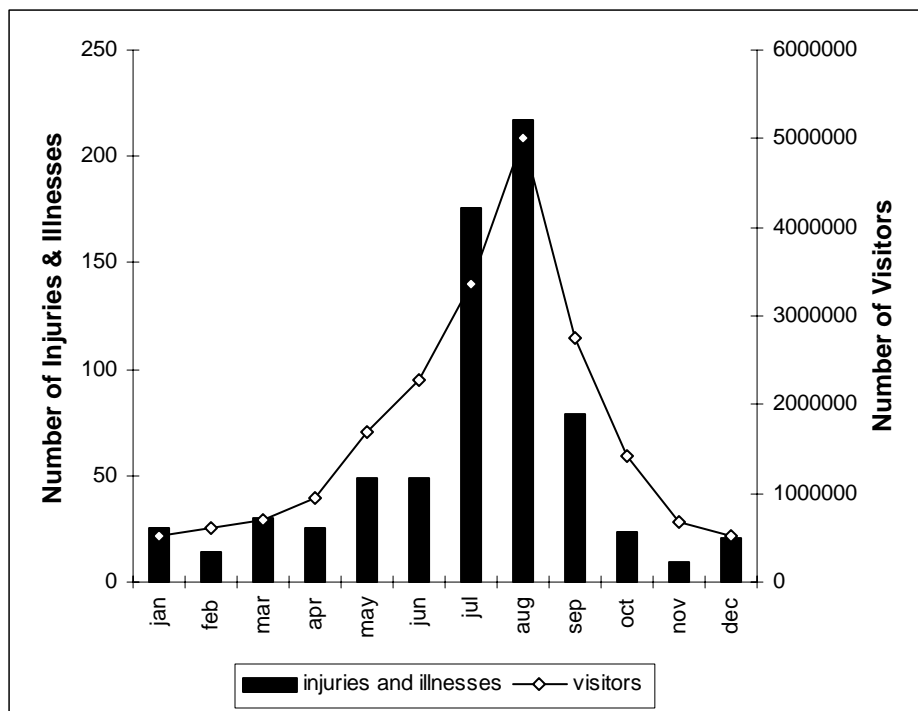
**24.3 Accidents Involving No Fatalities**

Between 1993 and 1998, there were an estimated 723 visitor injuries and illnesses arising from 695 accidents that did not involve fatalities. Fifty-six percent of the victims were male and 44% were female. The overwhelming majority of victims (97%) were white. Ninety-six percent were residents of the US, 1% were from Germany, 1% from Canada. The distribution of victims by age is shown in Figure 24.5.



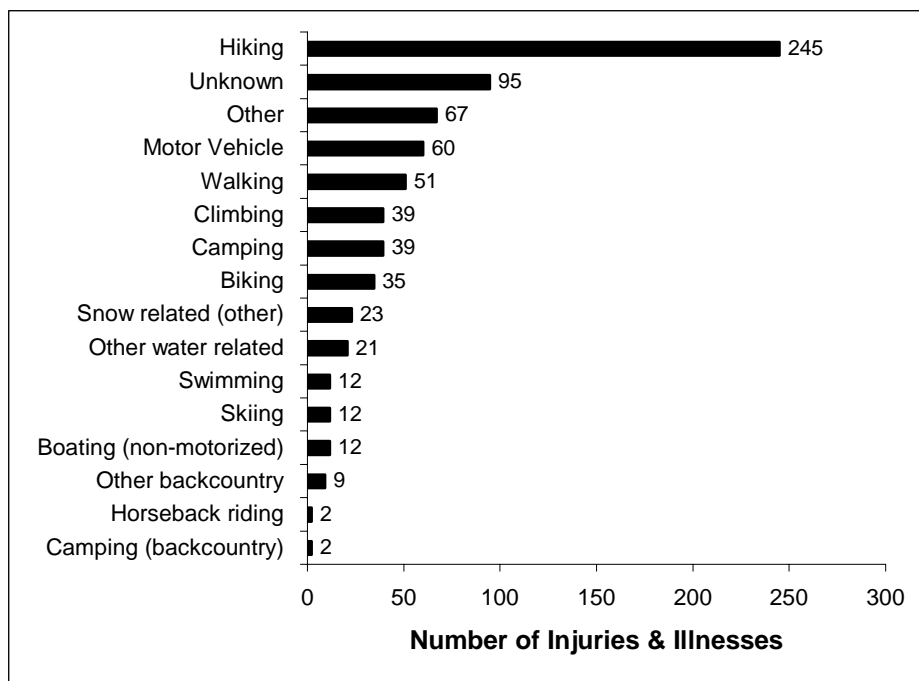
**Figure 24.5: Visitor Injuries and Illnesses by Age, 1993-98 (N=693)**

Over 61% of the victims were injured between noon and 6p.m., 21% between 6am and noon, and 17% between 6:00pm and midnight. Sixty percent of the victims were injured on weekdays and 40% on weekends. The distribution of injured by month is shown in Figure 24.6, and reveals a pattern that mirrors visitation rates, with a peak in the summer.



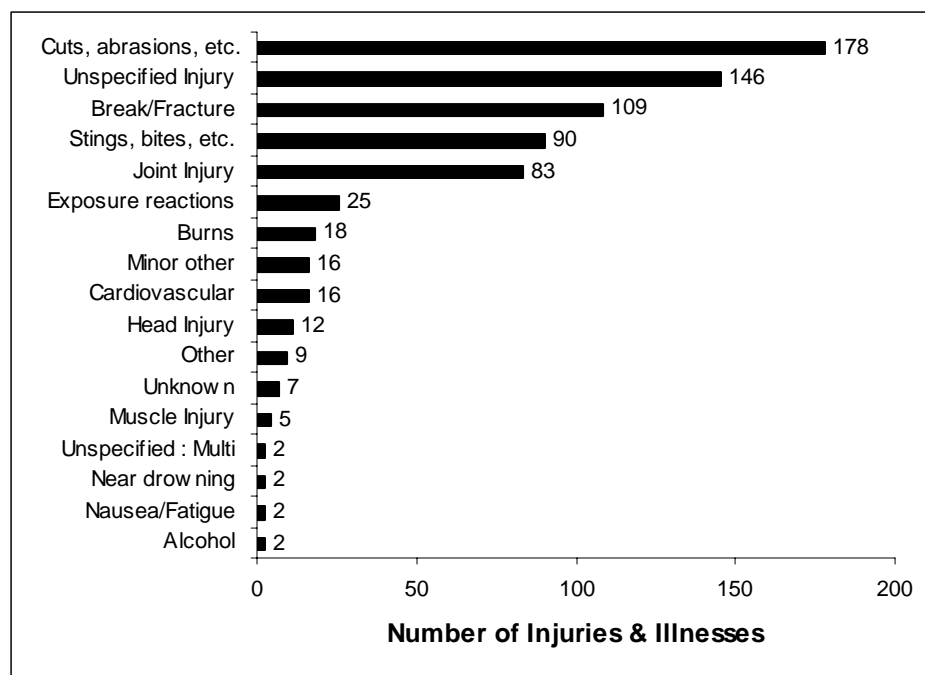
**Figure 24.6: Visitor Injuries and Illnesses by Month, 1993-98 (N=716)**

Figure 24.7 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are hiking (34%), driving or riding in motor vehicles, or engaged in various “other” activities (9%), although for a substantial number of injuries and illnesses (13%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 24.7: Visitor Injuries and Illnesses by Activity, 1993-98 (N=ZZ)**

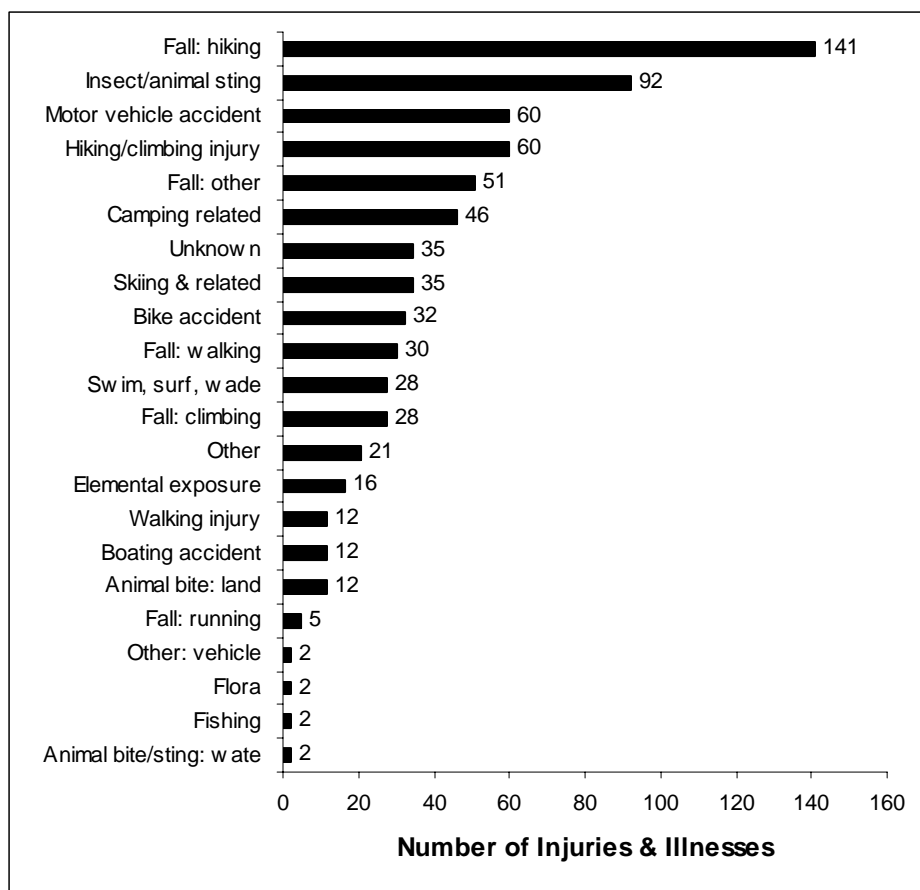
Turning to the nature of injuries and illness, we see (Figure 24.8) that 25% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 15% involved broken bones or fractures; 12% were stings and bites; and 20% were unspecified injuries and illnesses. More of those visitors suffering suspected breaks/fractures are females (62/109) than males (46/109), but more of those suffering cuts and abrasions are males (111/178) than females (67/178), and more of those suffering stings and bites are male (58/90) than females (32/90). Females comprise a larger proportion (79/146) of those suffering unspecified injuries than do males (67/146).



**Figure 24.8: Types of Visitor Injuries and Illnesses, 1993-98 (N=723)**

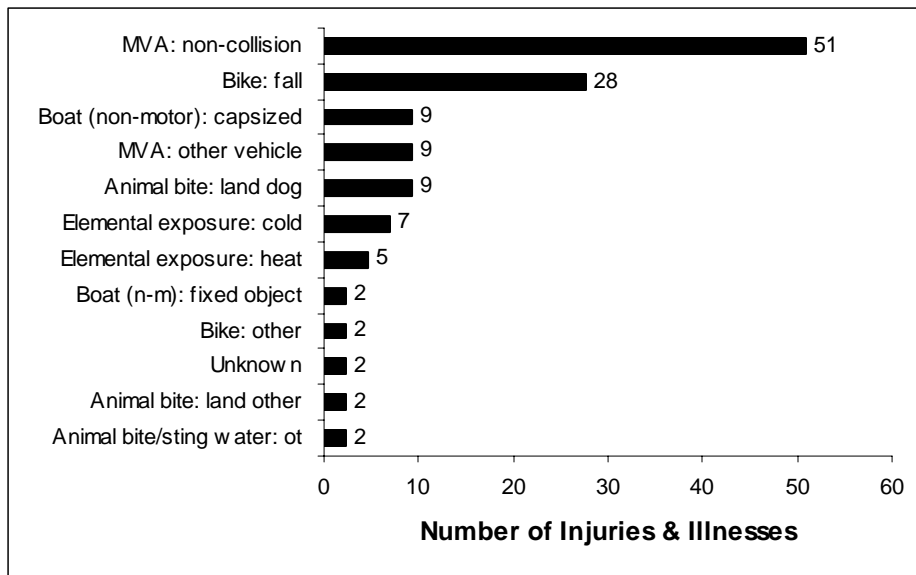
Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 723 injuries and illnesses occurring during this period, 303 (42%) could be considered less serious because the visitors were treated and released, and 359 (49%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 213 (29%) were transported by ambulance and 146 (20%) were transported by privately owned vehicle. Seven people (1%) refused treatment and in 30 (4%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 21 (3%) cases it is unknown what if any response was taken. Of the 359 injuries and illnesses requiring transportation to medical facility, 58 (16%) were for the treatment of cuts, abrasions, and bruises, 94 (26%) were for suspected breaks/fractures, and 97 (27%) were for unspecified injuries and illnesses. Sixty percent (106/178) of cuts, abrasions, and bruises, and 82% (74/90) of stings and bites were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 24.9 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would listed as hiking, but the primary event would be insect/animal sting. Figure 24.9 shows that 141/245 hiking and 28/39 climbing injuries are due to falls.



**Figure 24.9: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=723)**

Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events. Thus, Figure 24.10 shows that 51/60 motor vehicle accidents involve non-collisions and 9 involved collisions with other vehicles, and that 28/35 bicycle accidents involve falls from bikes.



**Figure 24.10: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=129)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 104 injuries and illnesses associated with these activities, 51% are driver-related, 11% environmental factors, 16% road-related, and 11% are a result of equipment failure. In 11% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown

## 25.0 Ozark National Scenic Riverways

### 25.1 Introduction:

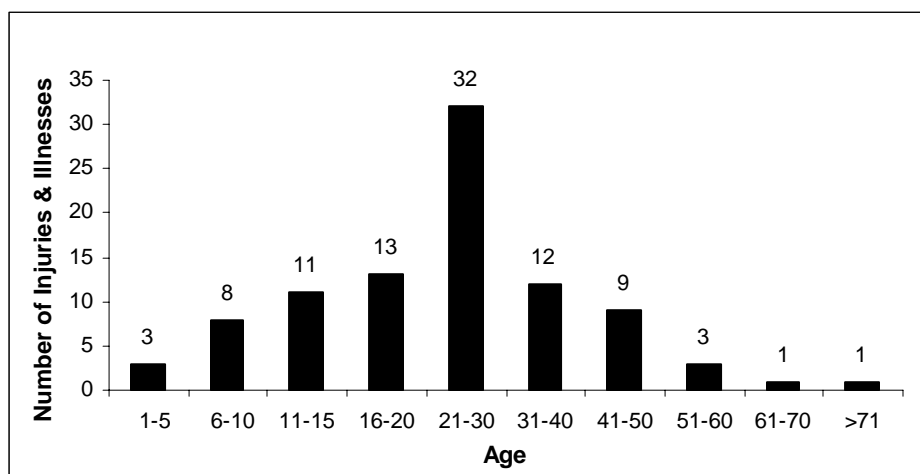
Between 1993 and 1998, there were 118 visitor accidents at Ozark National Scenic Riverways, resulting in 7 fatalities and 107 non-fatal injuries and illnesses. Since there were 9,007,731 visitors to the park during this period for a total of 25,491,126 visitor-hours, this results in an average of 1.25 accidents, 0.08 fatalities, and 1.19 injuries and illnesses per 100,000 visitors, and 4.43 accidents, 0.27 fatalities, and 4.20 injuries and illnesses per 1,000,000 visitor-hours.

### 25.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 6 accidents that resulted in a total of 7 fatalities. The seven victims were all male residents of the US between the ages of 21 and 70. Three of the victims died while driving or riding in motor vehicles, 2 died while boating (motorized), and 2 died while swimming. Six of the victims were white. Three died on weekdays and three on weekends.

### 25.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 107 visitor injuries and illnesses arising from 107 accidents that did not involve fatalities. Fifty-five percent of the victims were male and 45% were female. The overwhelming majority of victims (95%) were residents of the US, 45% were white, and 55% were of unknown race/ethnicity. The distribution of victims by age (Figure 25.1) shows a distinct peak among 21-30 year olds.



**Figure 25.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=93)**

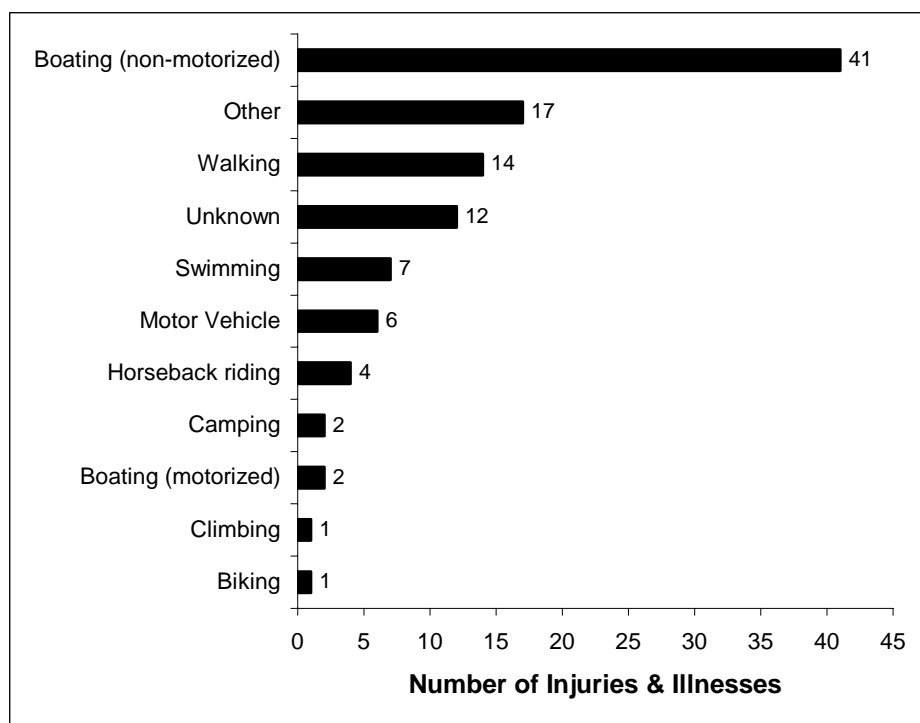
Almost 61% of the victims were injured between noon and 6p.m., 17% between 6am and noon, and 22% between 6:00pm and midnight. Twenty-nine percent of the victims were injured on weekdays and 71% on weekends. The distribution of injured by month is shown in Figure 25.2, and reveals a pattern that mirrors visitation rates, with a peak in the summer.





**Figure 25.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=107)**

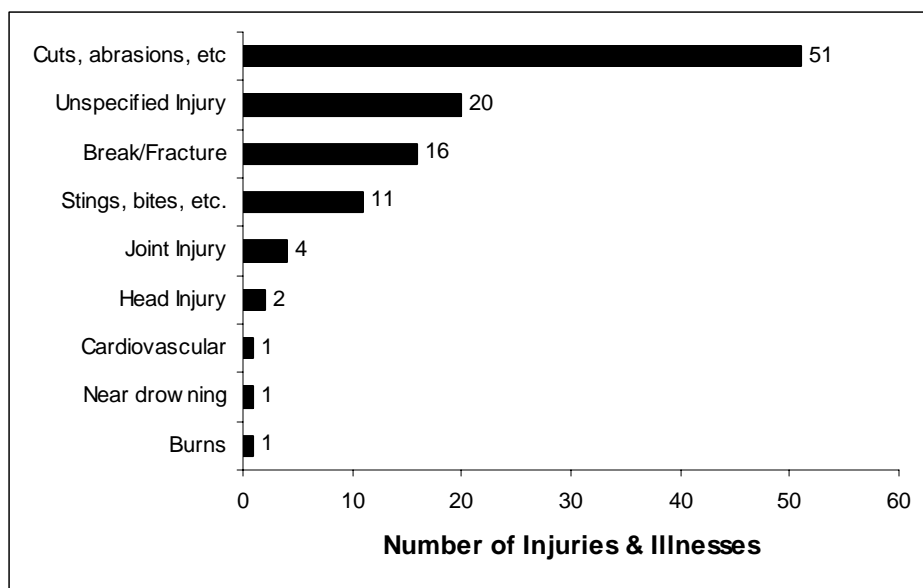
Figure 25.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are engaged in non-motorized boating (38%), walking (13%), and various “other” activities (16%), although for a substantial number of injuries and illnesses (11%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 25.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=107)**

Turning to the nature of injuries and illness, we see (Figure 25.4) that 48% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 15% involved broken bones or fractures; 10% resulted from stings and bites; and 19% were due to unspecified injuries and illnesses.

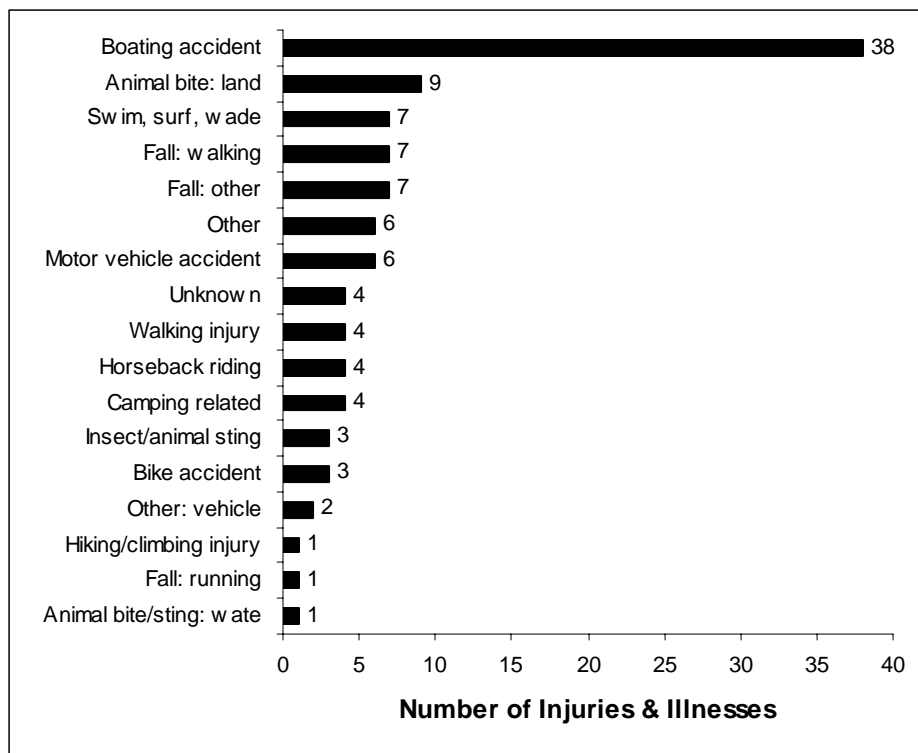
Females comprise a larger proportion of victims with breaks and fractures (10/16) and unspecified injuries (13/20), but males comprise a higher proportion of those suffering cuts and abrasions (31/51), and stings and bites (9/11).



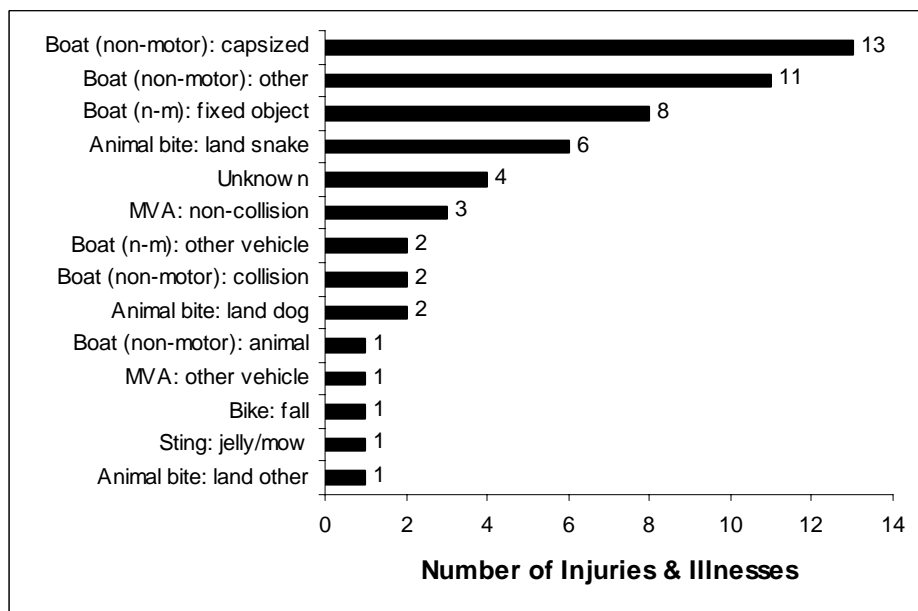
**Figure 25.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=107)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 107 injuries and illnesses occurring during this period, 51 (48%) could be considered less serious because the visitors were treated and released, and 54 (50%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 38 (35%) were transported by ambulance and 16 (15%) were transported by privately owned vehicle. Two people (2%) refused treatment. Of the 54 injuries and illnesses requiring transportation to a medical facility, 16 (30%) were for the treatment of cuts, abrasions, and bruises, 12 (22%) were for suspected breaks and fractures, and 12 (22%) were for unspecified injuries and illnesses. Sixty-nine percent (35/51) of cuts, abrasions, and bruises, and 36% (4/11) of stings and bites were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 25.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 25.6.



**Figure 25.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=107)**



**Figure 25.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=56)**

Figure 25.5 shows that 38 of the 43 injuries sustained while boating (both motorized and non-motorized) are due to boating accidents. Figure 25.6 shows the various kinds of boating accidents involved.

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 47 injuries and illnesses associated with these activities, 34% are driver-related, 9% environmental factors, and 4% are a result of equipment failure. In 51% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

## 26.0 Padre Island National Seashore

### 26.1 Introduction:

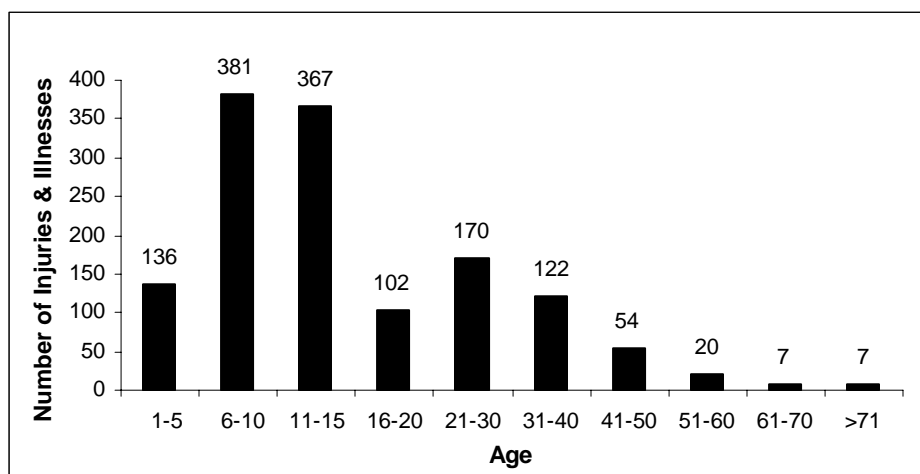
Between 1993 and 1998, there were 1825 visitor accidents at Padre Island National Seashore, resulting in 2 fatalities and 1843 non-fatal injuries and illnesses. Since there were 4,663,531 visitors to the park during this period for a total of 32,783,081 visitor-hours, this results in an average of 39.13 accidents, 0.04 fatalities, and 39.52 injuries and illnesses per 100,000 visitors, and 55.67 accidents, 0.06 fatalities, and 56.21 injuries and illnesses per 1,000,000 visitor-hours.

### 26.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 2 accidents that resulted in a total of 2 fatalities. In one accident two motor vehicles collided in the afternoon of weekends day in July 1993. One white US male between 41 and 50 years old was killed. In the other accident a US male of unknown ethnicity died while hiking one weekday in May 1994.

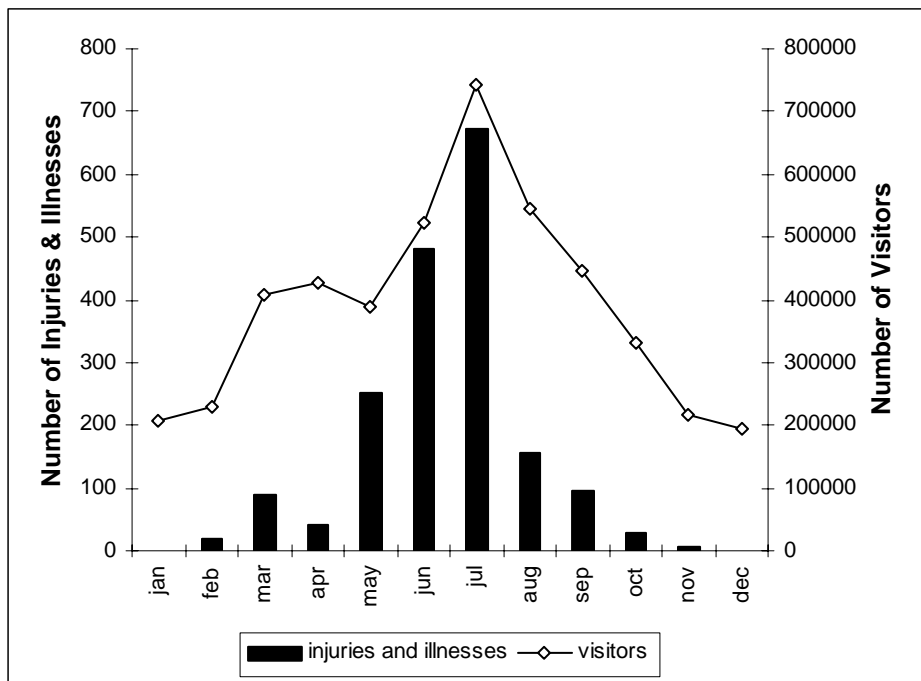
### 26.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 1843 visitor injuries and illnesses arising from 1823 accidents that did not involve fatalities. Forty-three percent of the victims were male, 35% were female, and the gender of 23% of the victims was unknown. The overwhelming majority of victims (77%) were residents of the US, although the nationality of 23% was unknown. Twenty-six percent of the victims were white, 2% Hispanic, and 72% of unknown race/ethnicity. The distribution of victims by age is shown in Figure 26.1. Clearly younger visitors are more likely to suffer harm, and 65% of the victims are under 15 years of age.



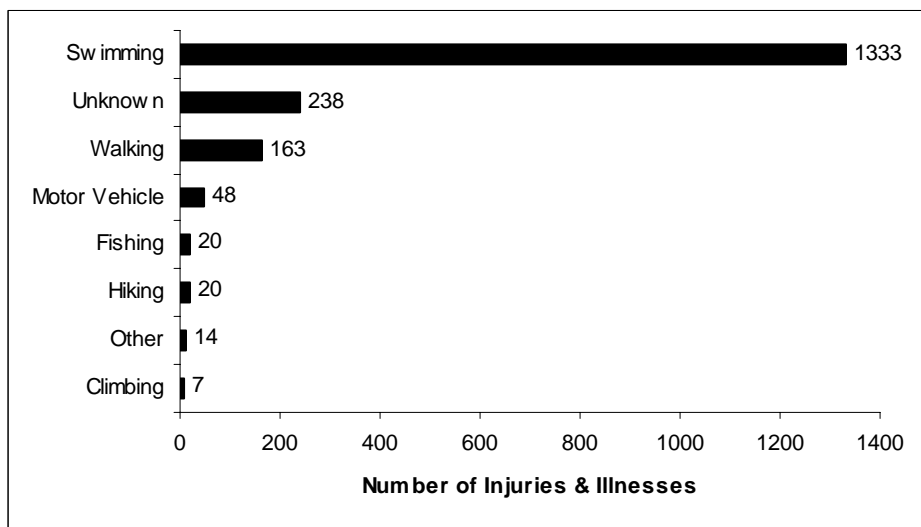
**Figure 26.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=1367)**

Over 65% of the victims were injured between noon and 6p.m., 15% between 6am and noon, 12% between midnight and 6:00am, and 8% between 6:00pm and midnight. Fifty-two percent of the victims were injured on weekdays and 48% on weekends. The distribution of injured by month is shown in Figure 26.2, and reveals a pattern that mirrors visitation rates, with a peak in the summer although there is no corresponding minor peak in the spring.



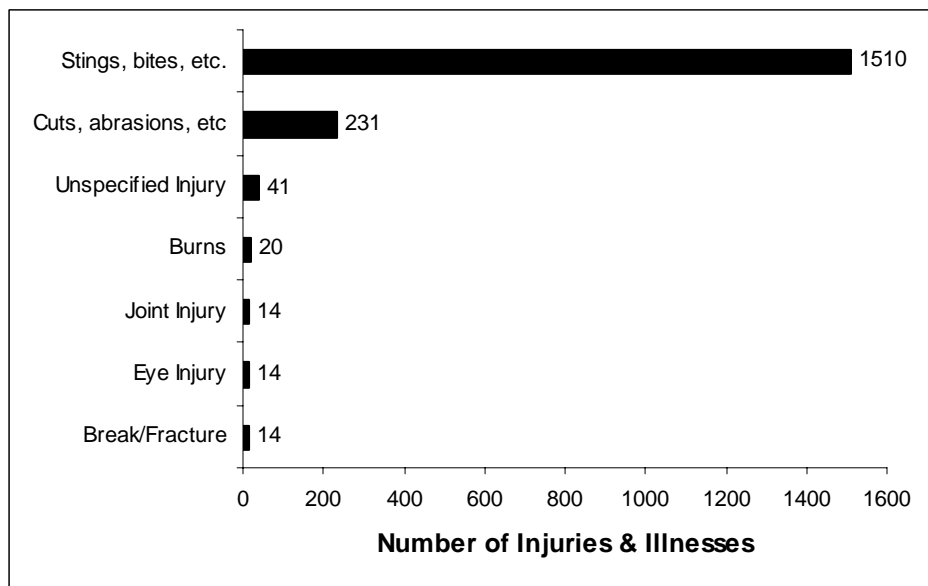
**Figure 26.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=1843)**

Figure 26.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are swimming (72%) and walking (9%), although for a substantial number of injuries and illnesses (13%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



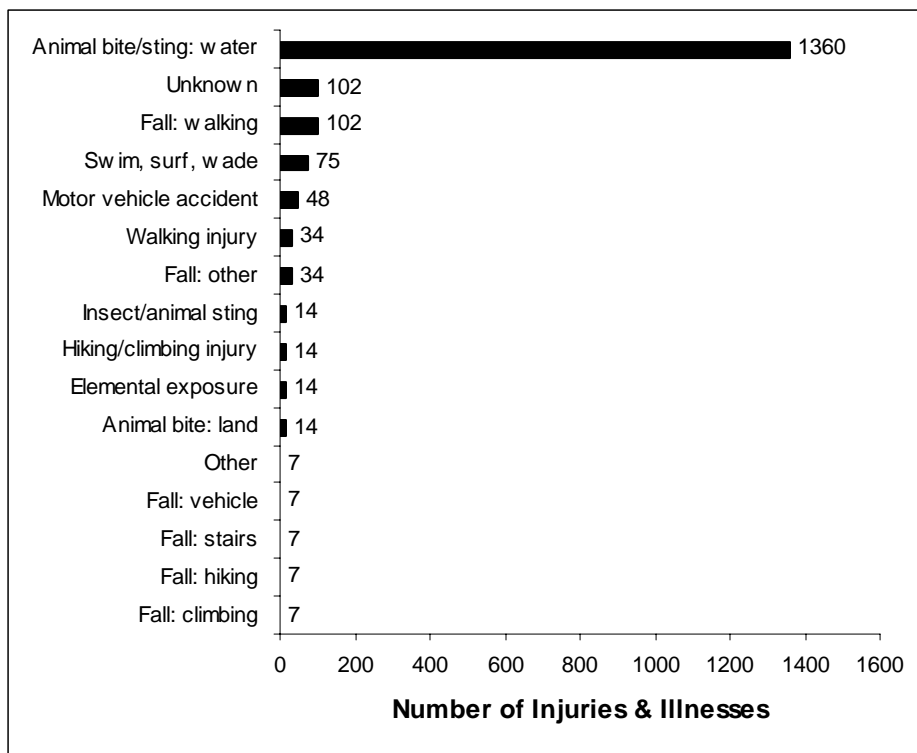
**Figure 26.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=1843)**

Turning to the nature of injuries and illness, we see (Figure 26.4) that 1510 (82%) of all 1843 injuries and illnesses between 1993 and 1998 were stings and bites, with cuts, abrasions, and bruises accounting for an additional 13% of cases. Of these 1510 stings and bites we have information on the ages of only 1108, but this indicates that 71% (782/1108) of all stings and bites are suffered by children under 15.



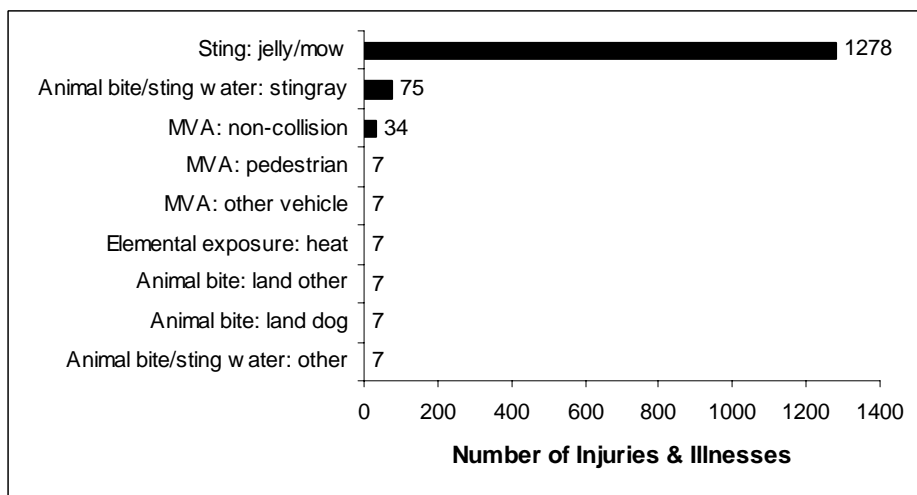
**Figure 26.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=1843)**





**Figure 26.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=1843)**

Figure 26.5 indicates that 90% (1360/1510) of these stings and bites occur in the water, and Figure 26.6 shows that 1278 are stings from jellyfish and Portuguese men of war, 75 are stings from stingrays, and 7 are stings from other marine fauna.



**Figure 26.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=1428)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 1843 injuries and illnesses occurring during this period, 1714 (93%) could be considered less serious because the visitors were treated and released, and 68 (4%) could be considered more serious, since they required transportation to a medical facility. Seven people (<1%) refused treatment and in 14 (<1%) cases it is unknown what if any response was taken. Ninety-seven percent (1462/1510) of stings and bites were treated and released.

## 27.0 Point Reyes National Seashore

### 27.1 Introduction:

Between 1993 and 1998, there were 239 visitor accidents at Point Reyes National Seashore, resulting in 7 fatalities and 247 non-fatal injuries and illnesses. Since there were 14,491,489 visitors to the park during this period for a total of 69,638,923 visitor-hours, this results in an average of 1.65 accidents, 0.05 fatalities, and 1.70 injuries and illnesses per 100,000 visitors, and 3.43 accidents, 0.10 fatalities, and 3.55 injuries and illnesses per 1,000,000 visitor-hours.

### 27.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 6 accidents that resulted in a total of 7 fatalities. Five victims were male and two were female. Five victims were white, US residents and the nationality and race/ethnicity of 2 others was unknown. Two of the fatalities occurred on weekends and five on weekdays. Three of the fatalities occurred while visitors were boating (1 motorized and 2 non-motorized), 1 while hiking, 1 while Scuba diving, and 1 while engaged in other activities. The activity of one victim was unrecorded. Two search and rescues were launched.

### 27.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 247 visitor injuries and illnesses arising from 233 accidents that did not involve fatalities. Forty-three percent of the victims were male, 56% were female, and the gender of 3 (1%) of victims was unrecorded. The overwhelming majority of victims (87%) were white, with 3% Asian, 2% Hispanic, and 8% of unknown race/ethnicity. Ninety-nine percent of the victims were residents of the US. The distribution of victims by age is shown in Figure 27.1.

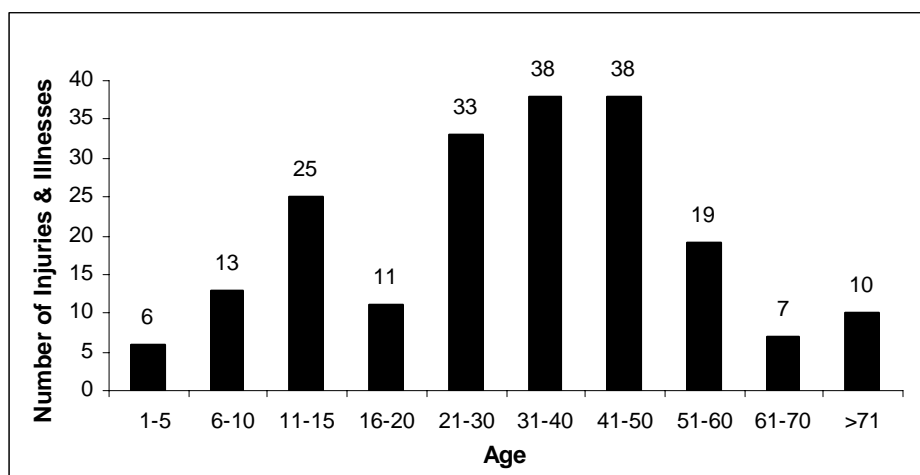
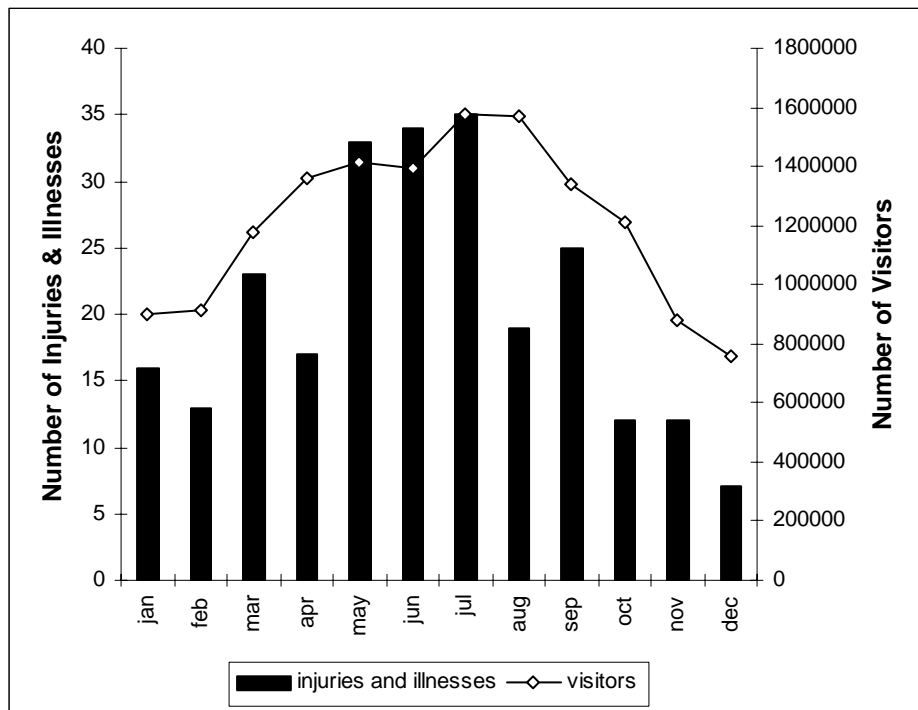


Figure 27.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=200)

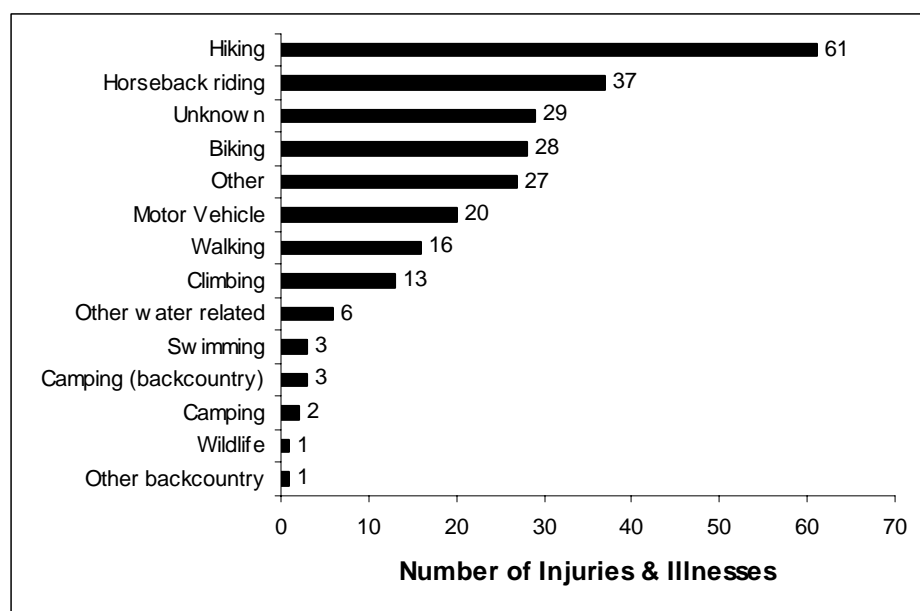
Over 69% of the victims were injured between noon and 6p.m., 20% between 6am and noon, and 10% between 6:00pm and midnight. Forty-eight percent of the victims were injured on

weekdays and 52% on weekends. The distribution of injured by month is shown in Figure 27.2, and reveals a pattern that mirrors visitation rates, with a peak in the spring/early summer.



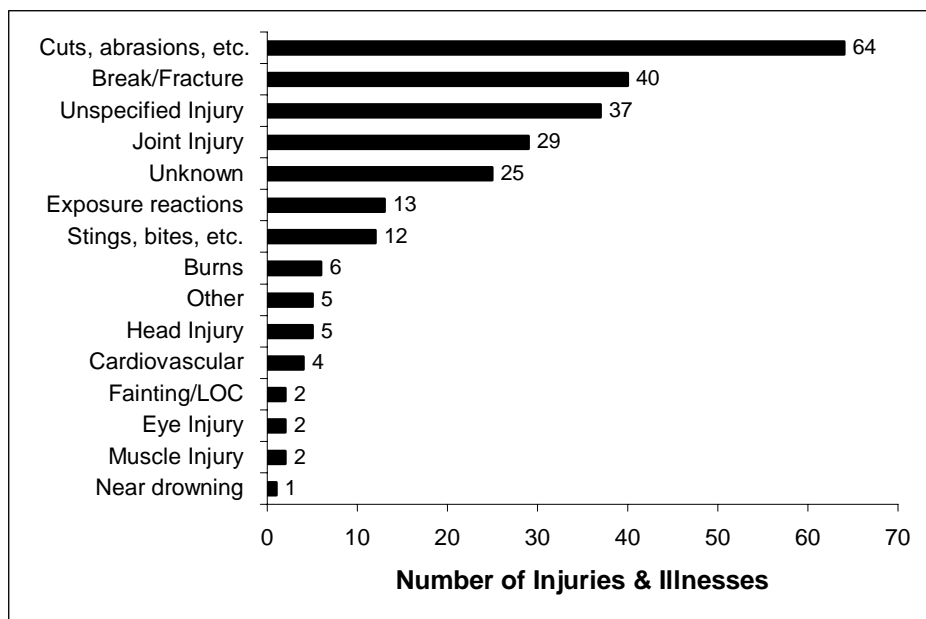
**Figure 27.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=246)**

Figure 27.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are hiking (25%), horseback riding (15%), biking (11%), and engaged in various “other” activities (11%). For a substantial number of injuries and illnesses (12%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 27.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=247)**

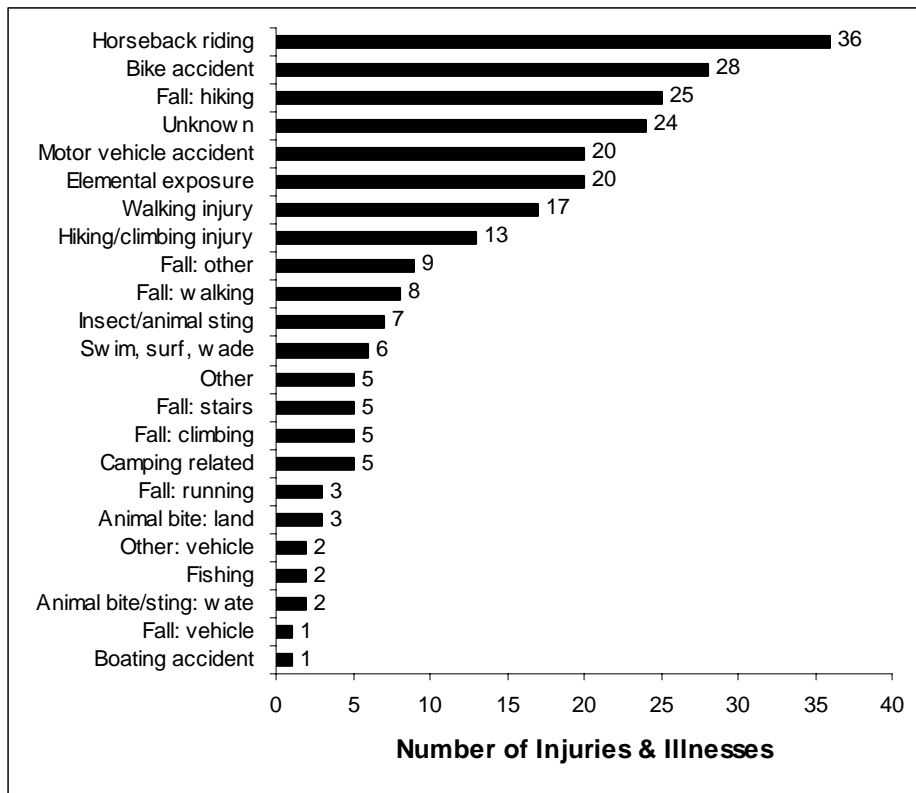
Turning to the nature of injuries and illness, we see (Figure 27.4) that 26% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 16% involved broken bones or fractures; 15% were due to unspecified injuries and illnesses, and 12% involved joint injuries (e.g., twisted ankles). In 10% of cases the nature of the injury was unrecorded. Victims of cuts and abrasions are more likely to be males (55%) than females (45%), but victims of broken bones/fractures (62%), unspecified injuries (57%), and joint injuries (72%) are more likely to be females.



**Figure 27.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=ZZ)**

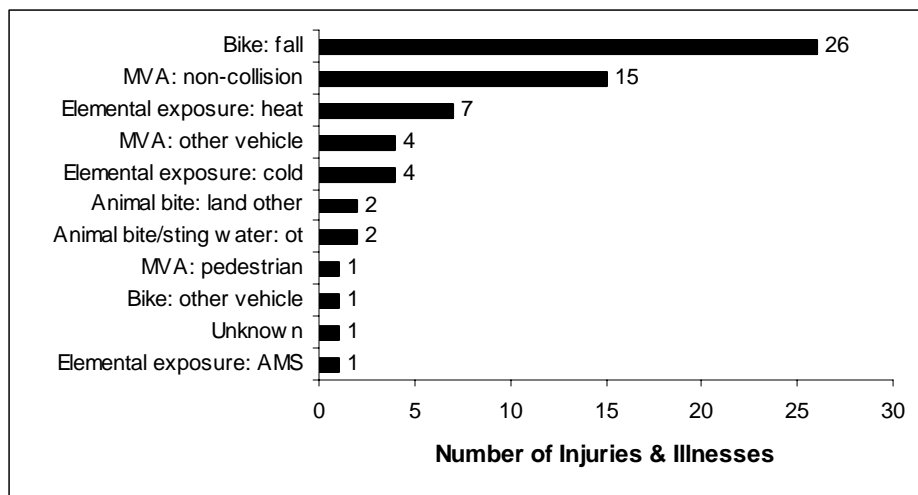
Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 247 injuries and illnesses occurring during this period, 93 (38%) could be considered less serious because the visitors were treated and released, and 108 (44%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 72 (29%) were transported by ambulance and 36 (15%) were transported by privately owned vehicle. Nine people (4%) refused treatment and in 17 (7%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 3 (1%) cases it is unknown what if any response was taken. There were 18 search and rescues launched during this period. Of the 108 injuries and illnesses requiring transportation to a medical facility, 28 (26%) were for broken bones/fractures, and 21 (19%) were for unspecified injuries and illnesses. Fifty-six percent (36/64) of cuts, abrasions, and bruises, and 55% (16/29) of joint injuries were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 27.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting. Evidently, horseback riding (15%), bike accidents (11%), and falls while hiking (10%) are the most common primary initiating events leading to injuries and illnesses.



**Figure 27.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=247)**

From the smaller sample of 64 injuries and illnesses for which we can identify secondary causal events (Figure 27.6), we can see that falls from bikes account for 26/28 bike accidents and that 15/20 MVAs involve non-collisions, 4/20 involve collisions with other vehicles, and 1 involved a collision with a pedestrian.



**Figure 27.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=64)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 48 injuries and illnesses associated with these activities, 29% are driver-related, 25% road-related, and 4% are a result of equipment failure. In 42% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.



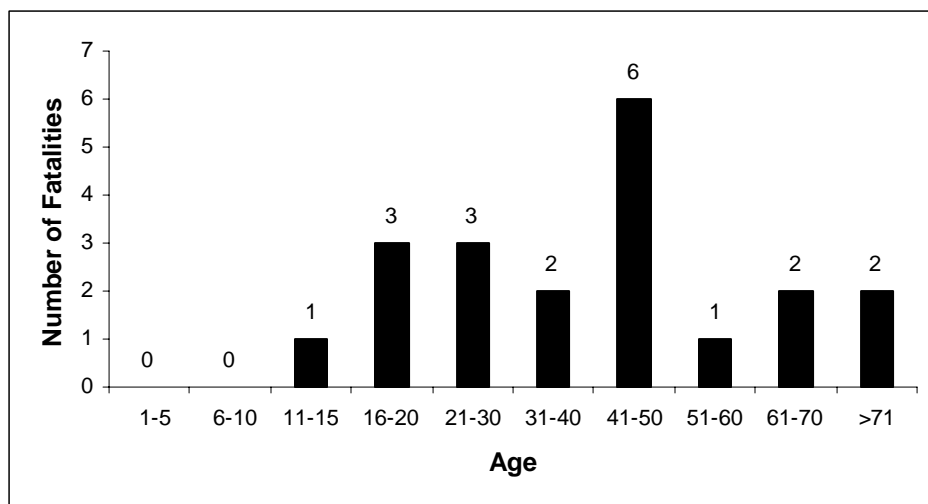
## 28.0 Rocky Mountain National Park

### 28.1 Introduction:

Between 1993 and 1998, there were 1000 visitor accidents at Rocky Mountain National Park, resulting in 22 fatalities and 1318 non-fatal injuries and illnesses. Since there were 17,551,492 visitors to the park during this period for a total of 127,229,570 visitor-hours, this results in an average of 5.70 accidents, 0.13 fatalities, and 7.50 injuries and illnesses per 100,000 visitors, and 7.86 accidents, 0.17 fatalities, and 10.35 injuries and illnesses per 1,000,000 visitor-hours.

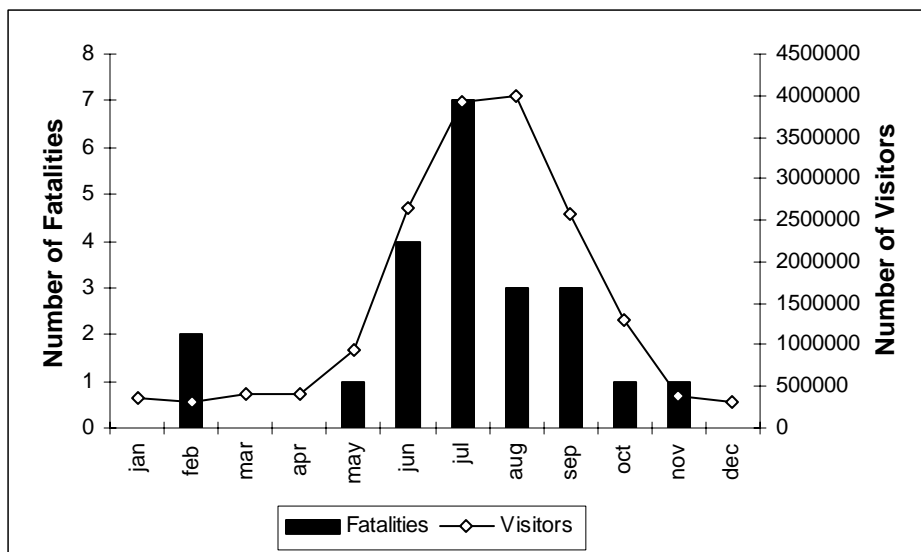
### 28.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 21 accidents that resulted in a total of 22 fatalities. Twenty of the victims were male and 2 were female. Twelve of the victims were white, 1 Asian, and the race/ethnicity of 9 was unknown. Twenty were residents of the US, 1 was from Japan, and the nationality of 1 was unknown. The distribution of victims by age is shown in Figure 28.1.



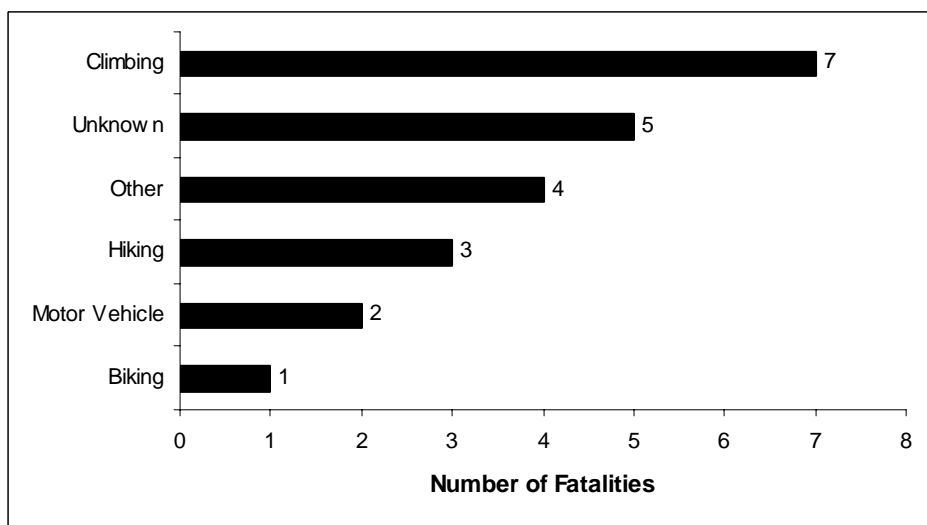
**Figure 28.1: Visitor Fatalities by Age, 1993-98 (N=20)**

Eleven of the fatalities occurred between noon and 6p.m., and 6 between 6am and noon. Sixteen of the fatalities occurred on weekdays and 6 on weekends. The distribution of fatalities by month is shown in Figure 28.2, and reveals a pattern that mirrors visitation rates, with a peak in the summer. Search and rescue efforts were launched in 15/22 cases.



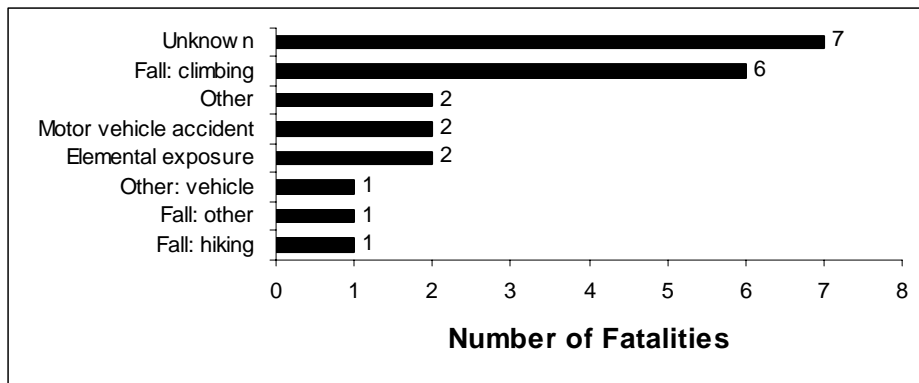
**Figure 28.2: Visitor Fatalities by Month, 1993-98 (N=22)**

Figure 28.3 shows the number of visitor fatalities by activity. Climbing resulted in 7 fatalities, but for 5 fatalities there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 28.3: Visitor Fatalities by Activity, 1993-98 (N=22)**

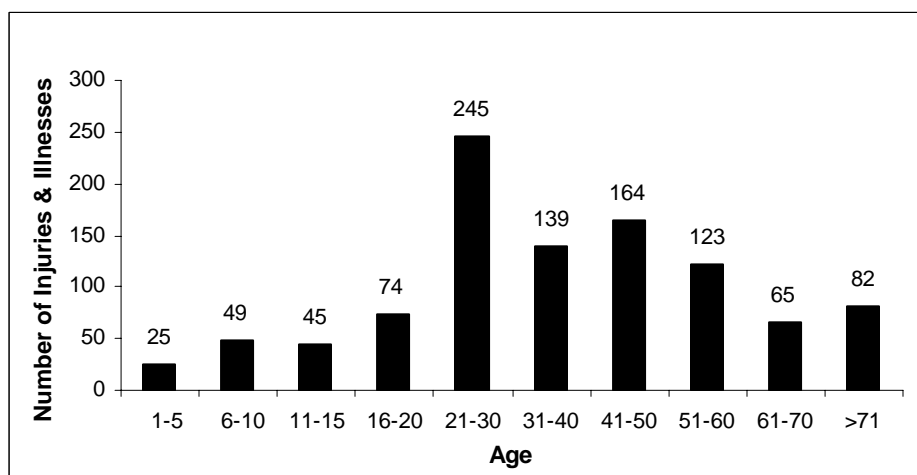
Figure 28.4 illustrates the distribution of fatalities by primary causal event. In seven cases the primary event is unknown, but falls account for 6/7 climbing fatalities.



**Figure 28.4: Visitor Fatalities by Primary Event, 1993-98 (N=22)**

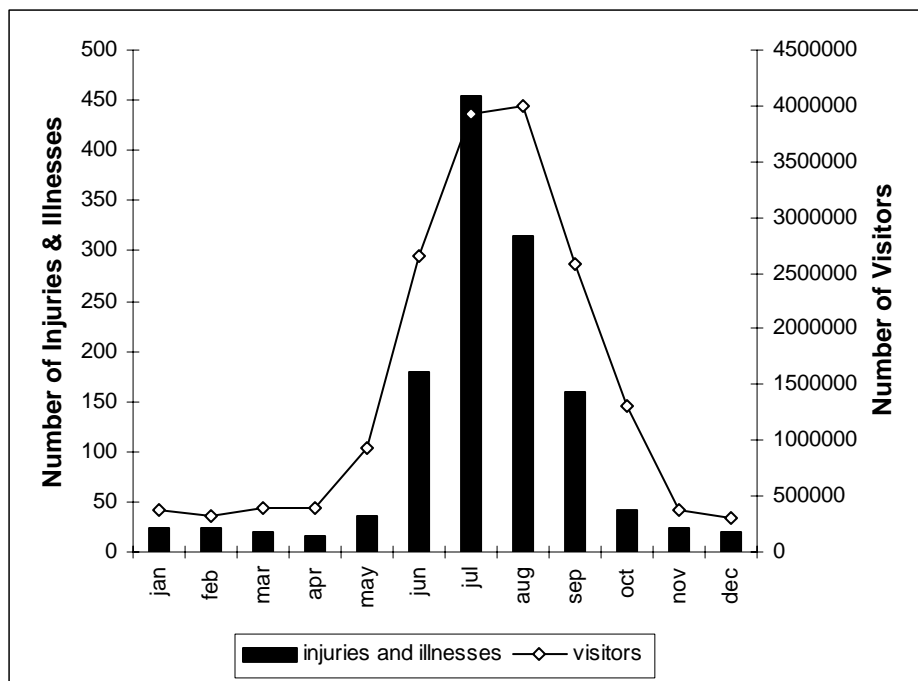
### 28.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 1317 visitor injuries and illnesses arising from 979 accidents that did not involve fatalities. Forty-nine percent of the victims were male and 49% were female. In 29 (2%) cases the gender of the victim was unrecorded. Thirty-nine percent of the victims were white, 1% Asian, and 1% Hispanic. In 59% of cases the race/ethnicity of the individuals was unrecorded. Seventy-two percent of the victims were residents of the US, 2% were from Colombia, 1% were from Germany, and 1% were from Canada. Almost 22% of the victims were of unknown nationality. The distribution of victims by age is shown in Figure 28.5.



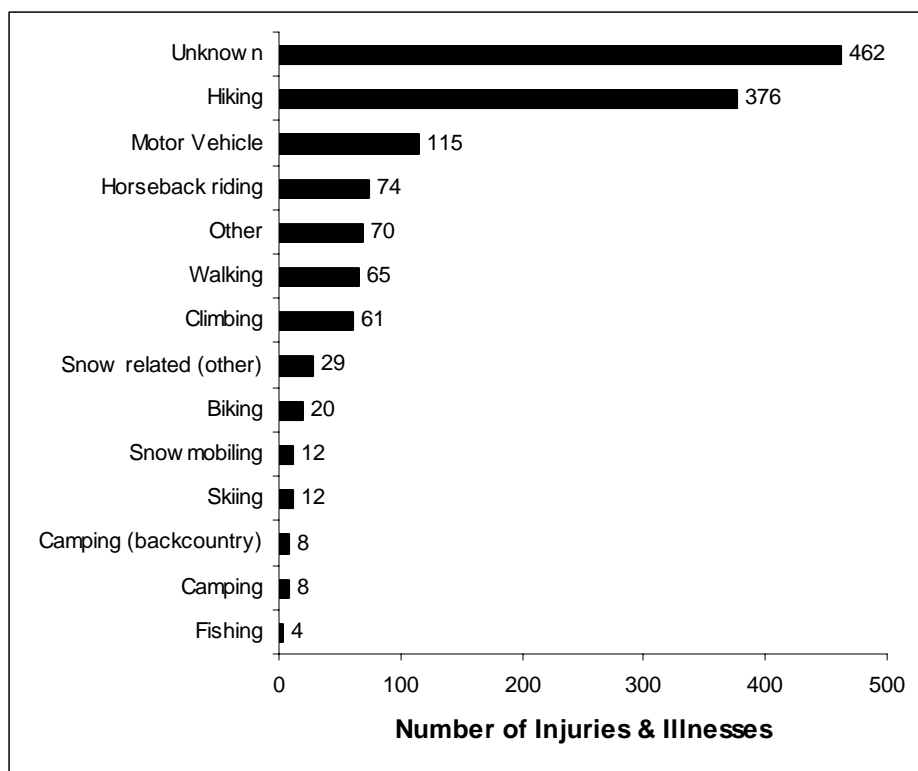
**Figure 28.5: Visitor Injuries and Illnesses by Age, 1993-98 (N=ZZ)**

Over 61% of the victims were injured between noon and 6p.m., 30% between 6am and noon, and 7% between 6:00pm and midnight. Sixty-six percent of the victims were injured on weekdays and 34% on weekends. The distribution of injured by month is shown in Figure 28.6, and reveals a pattern that mirrors visitation rates, with a peak in the summer.



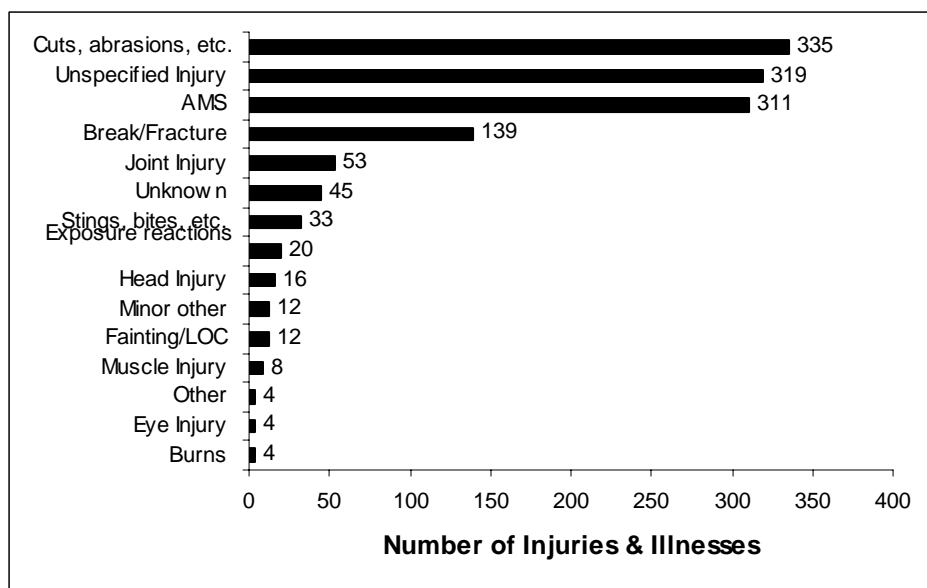
**Figure 28.6: Visitor Injuries and Illnesses by Month, 1993-98 (N=1317)**

Figure 28.7 shows the number of visitor injuries and illnesses by activity. Many injuries and illnesses occur while visitors are hiking (29%), driving or riding in motor vehicles (9%), and riding horses (6%), although for a substantial number of injuries and illnesses (35%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 28.7: Visitor Injuries and Illnesses by Activity, 1993-98 (N=1317)**

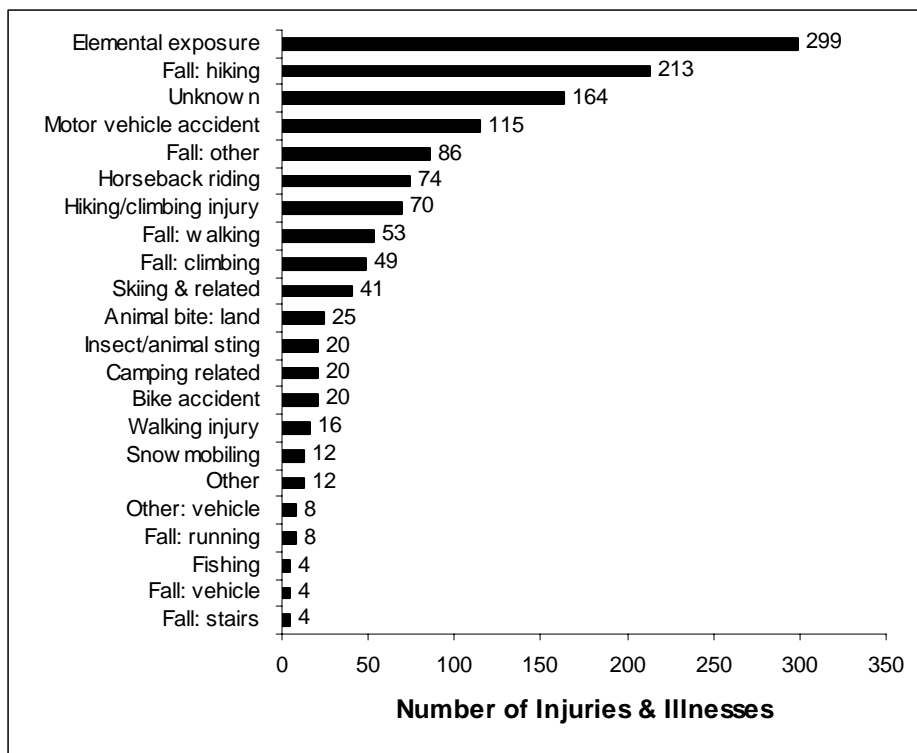
Turning to the nature of injuries and illness, we see (Figure 28.8) that 25% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 24% involved acute mountain sickness (AMS); 11% involved broken bones or fractures; and 24% were due to unspecified injuries and illnesses. The incidence of many of these injuries and illnesses are roughly evenly divided between male and female victims. For example, cuts, abrasions and bruises include 155 female victims and 160 male victims, breaks and fractures afflicted 74 females and 65 males, and unspecified injuries were suffered by 155 females and 160 males. AMS victims were more likely to include females (168/311) than males (143/311).



**Figure 28.8: Types of Visitor Injuries and Illnesses, 1993-98 (N=1317)**

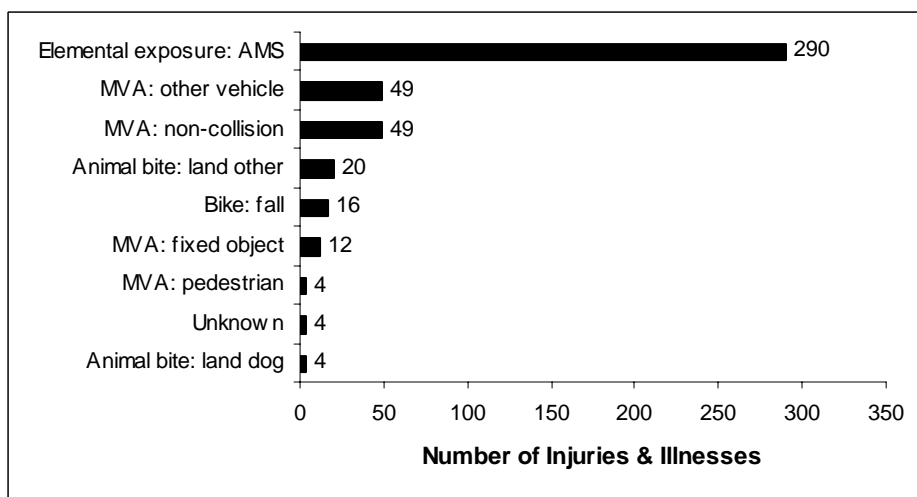
Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 1317 injuries and illnesses occurring during this period, 888 (67%) could be considered less serious because the visitors were treated and released, and 323 (25%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 249 (19%) were transported by ambulance and 74 (6%) were transported by privately owned vehicle. Forty-nine people (4%) refused treatment. In 53 (4%) cases it is unknown what if any response was taken. Of the 323 injuries and illnesses requiring transportation to a medical facility, 90 (28%) were for the treatment of cuts, abrasions, and bruises, and 94 (29%) were for unspecified injuries and illnesses. Sixty-six percent (221/335) of cuts, abrasions, and bruises, and 97% (303/311) of AMS cases were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 28.9 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event would be insect/animal sting.



**Figure 28.9: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=1317)**

Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 28.10.



**Figure 28.10: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=450)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a

few accident types, such as boating, biking, and vehicle accidents. Of the 135 injuries and illnesses associated with these activities, 67% are driver-related, 6% road-related, and 12% are a result of equipment failure. In 15% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.



## 29.0 Saguaro National Park

### 29.1 Introduction:

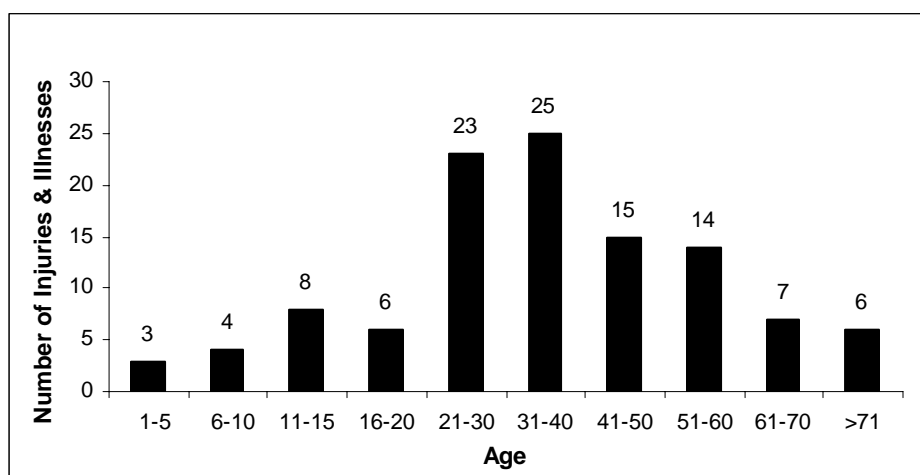
Between 1993 and 1998, there were 99 visitor accidents at Saguaro National Park, resulting in 4 fatalities and 132 non-fatal injuries and illnesses. Since there were 4,456,978 visitors to the park during this period for a total of 6,205,170 visitor-hours, this results in an average of 2.22 accidents, 0.09 fatalities, and 2.96 injuries and illnesses per 100,000 visitors, and 15.95 accidents, 0.64 fatalities, and 21.27 injuries and illnesses per 1,000,000 visitor-hours.

### 29.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 4 accidents that resulted in a total of 4 fatalities. All four fatalities were white, US residents. Three victims were male and one was female. All of the fatalities occurred on weekdays while visitors were driving or riding in motor vehicles. Three of the fatalities were due to collisions with other vehicles, and one was a non-collision.

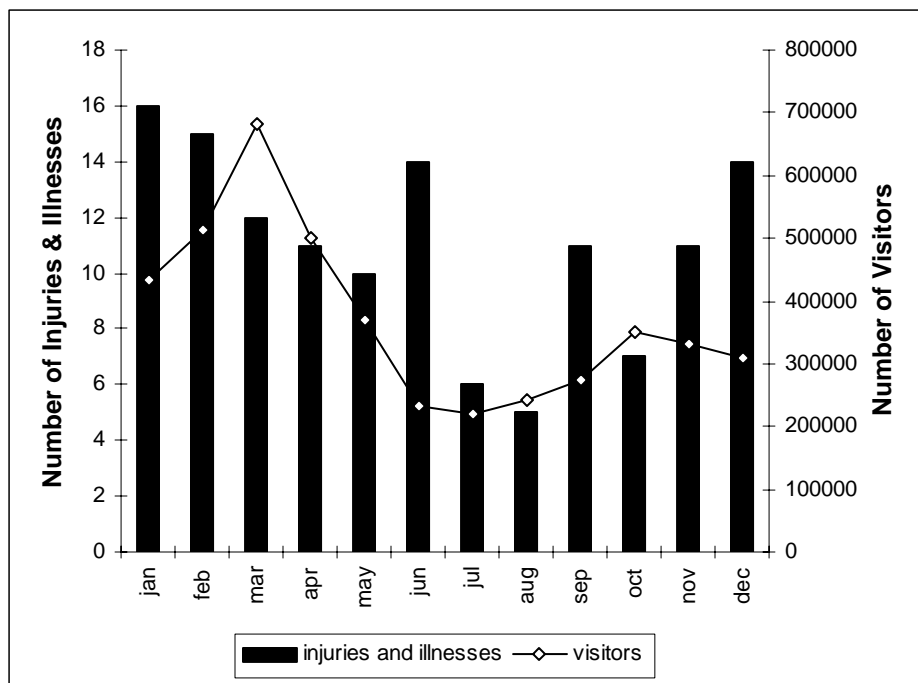
### 29.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were 132 visitor injuries and illnesses arising from 95 accidents that did not involve fatalities. Fifty-nine percent of the victims were male and 41% were female. The overwhelming majority of victims (92%) were residents of the US, and the nationality of 7% of victims was unknown. One third of the victims were known to be white, but the race/ethnicity of 2/3 of the victims was unknown. The distribution of victims by age is shown in Figure 29.1.



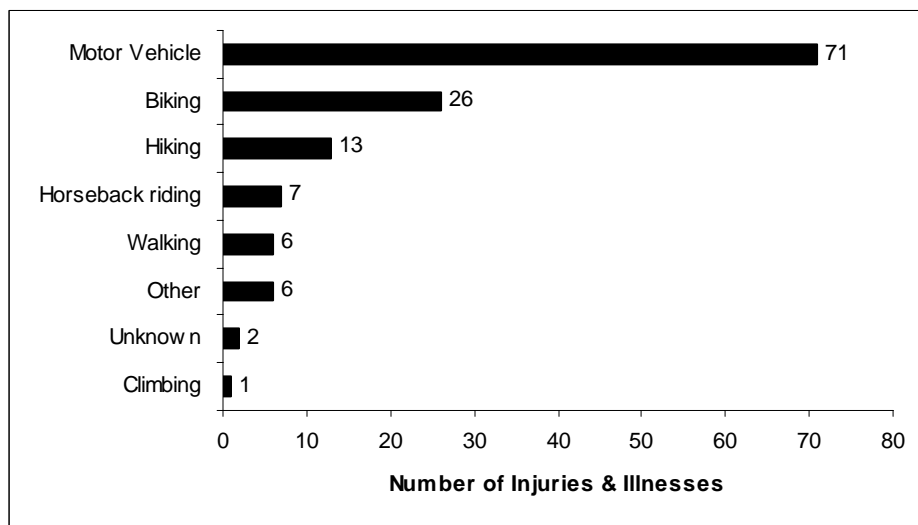
**Figure 29.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=111)**

Over 46% of the victims were injured between noon and 6p.m., 31% between 6am and noon, and 19% between 6pm and midnight. Fifty-five percent of the victims were injured on weekdays and 45% on weekends. The distribution of injuries and illnesses by month (Figure 29.2) follows the visitation rates to some extent, but appears to be less closely associated than in other parks.



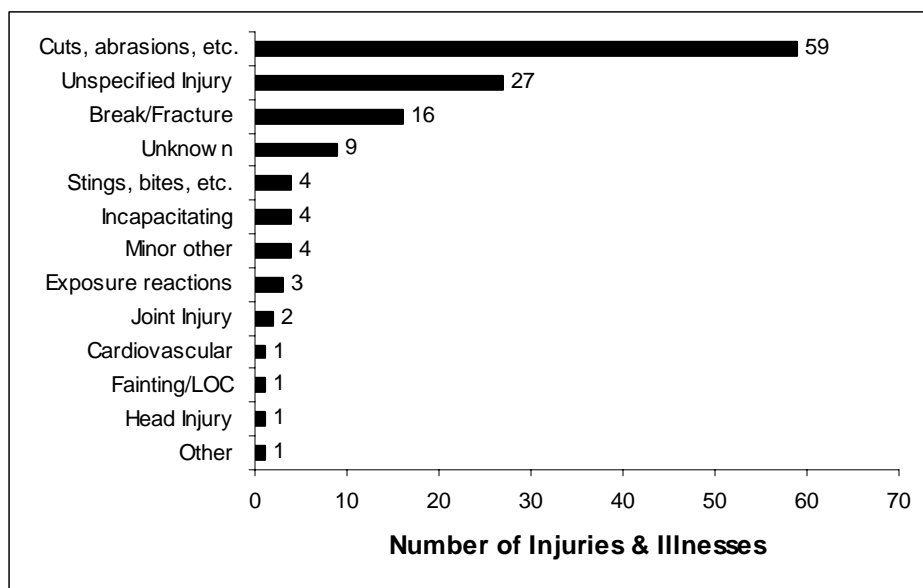
**Figure 29.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=132)**

Figure 29.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are driving or riding in motor vehicles ((54%), biking (10%) and hiking (20%). In only a small proportion of injuries and illnesses (1.5%) is there no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 29.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=132)**

Turning to the nature of injuries and illness, we see (Figure 29.4) that 45% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 12% involved broken bones or fractures; and 20% were due to unspecified injuries and illnesses. Females are more likely to suffer breaks and fractures (56% female and 44% male), but males are more likely to suffer cuts and abrasions (63%), and unspecified injuries (59%).

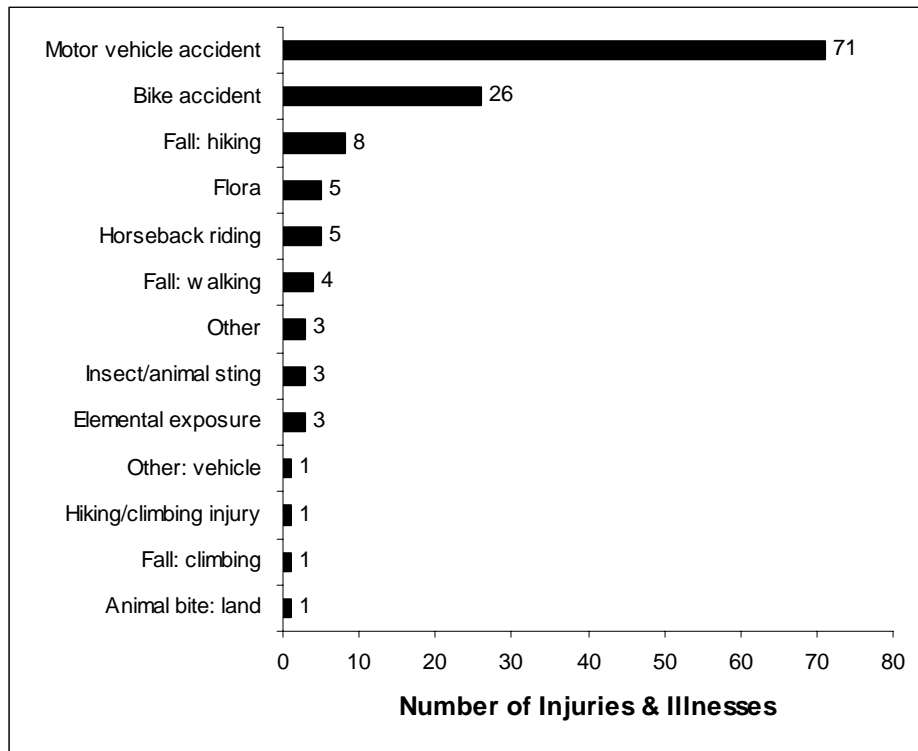


**Figure 29.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=132)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 132 injuries and illnesses occurring during this period, 17 (13%) could be considered less serious because the visitors were treated and released, and 89 (67%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 82 (62%) were transported by ambulance and 7 (5%) were transported by privately owned vehicle. In 13 cases park personnel recommended that the victim seek additional treatment at his or her convenience. Eight people (6%) refused treatment and in 4 (3%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In only one case was it unknown what if any response was taken. Search and rescues were conducted in 7/132 (5%) of cases. Of the 89 injuries and illnesses requiring transportation to a medical facility, 27 (33%) were for the treatment of cuts, abrasions, and bruises, and 21 (25%) were for unspecified injuries and illnesses. Twenty percent (12/59) of cuts, abrasions, and bruises were treated and released.

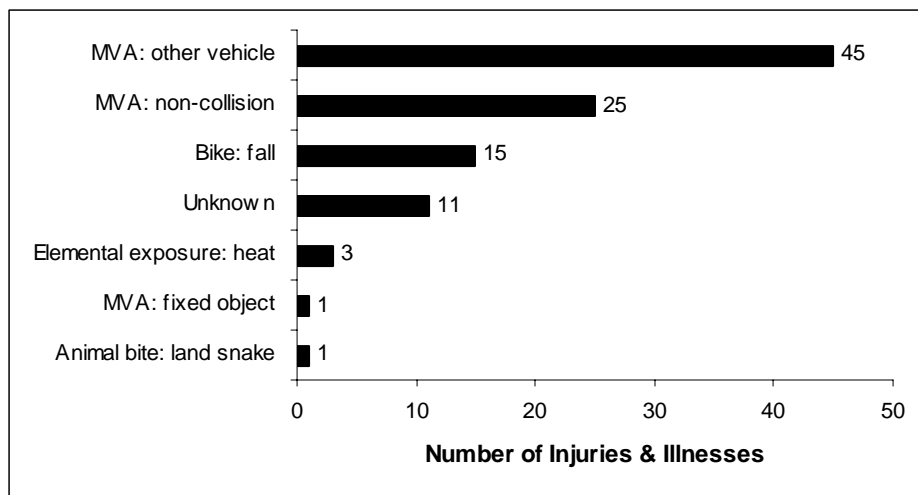
Visitors may be injured in numerous ways as they participate in various activities, and Figure 29.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would be listed as hiking, but the primary event

would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 29.6.



**Figure 29.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=132)**

Sixty-three percent (45/71) of motor vehicle accidents involved collisions with other vehicles, 35% (25/71) involved non-collisions, and 1% (1/71) involved collisions with fixed objects. Fifteen of the 26 (58%) bicycle accidents involved falls while riding.



**Figure 29.6: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=101)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 92 injuries and illnesses associated with these activities for which we have information, 48% are driver-related, 5% road-related, and 3% are a result of equipment failure. In 43% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

### 30.0 Statue of Liberty/Ellis Island National Monument

#### 30.1 Introduction:

Between 1993 and 1998, there were 2976 visitor accidents at Statue of Liberty/Ellis Island National Monument, resulting in 2 fatalities and 5302 non-fatal injuries and illnesses. Since there were 27,042,648 visitors to the park during this period for a total of 81,127,944 visitor-hours, this results in an average of 11.00 accidents, 0.01 fatalities, and 19.60 injuries and illnesses per 100,000 visitors, and 36.68 accidents, 0.02 fatalities, and 65.35 injuries and illnesses per 1,000,000 visitor-hours.<sup>6</sup>

#### 30.2 Accidents Involving Fatalities:

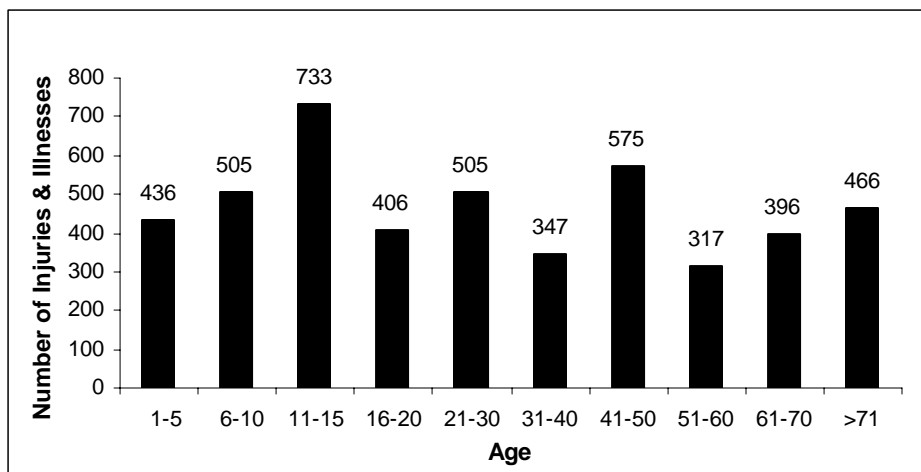
Between 1993 and 1998, there were 2 accidents that resulted in a total of 2 fatalities. One white US male and one African-American US male died in 1998. One victim died as a result of a motor vehicle accident and another while walking. Both victims died on weekdays between 12 noon and 6pm.

#### 30.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 5302 visitor injuries and illnesses arising from accidents that did not involve fatalities. Sixty-four percent of the victims were male and 35% were female. In 1% of cases the gender of the victim was unrecorded. The overwhelming majority of victims (93%) were residents of the US, with 1% were from Japan and 1% from the UK. Another 266 (4%) victims were from Australia, Belgium, Canada, China, France, Germany, Ireland, Italy, Korea, Mexico, Sweden, and Venezuela. The nationality of 30 victims was unknown. The distribution of victims by age (Figure 30.1) shows a peak among 11-15 year olds, and surprising lack of injuries among 16-40 if we assume a normal distribution of visitors by age.

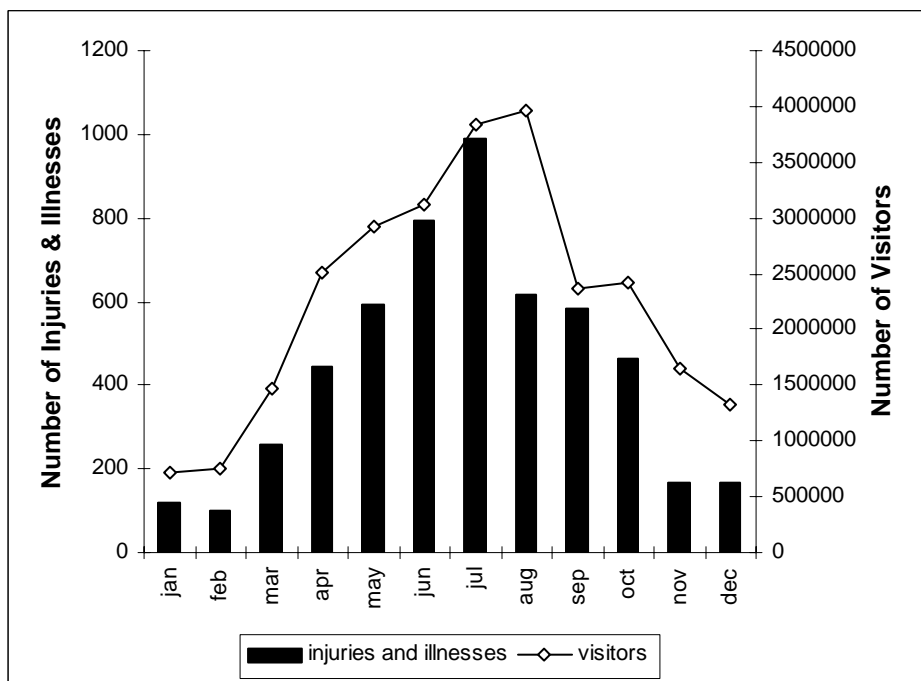
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<sup>6</sup> The number of injuries and illnesses estimated on the basis of the sample of accidents taken seems high compared with other parks. While the sample of accidents was taken at random from the entire set of park records, it would appear that multi-victim accidents may be over-represented. When weighted, this leads to a reasonable estimate in the number of accidents, but an overestimate in the numbers of injuries and illnesses. While the number of injuries and illnesses may be on the high side, the relative proportion of accidents by activity, injury, etc. should be unaffected.



**Figure 30.1: Visitor Injuries and Illnesses by Age, 1993-98 (N=4687)**

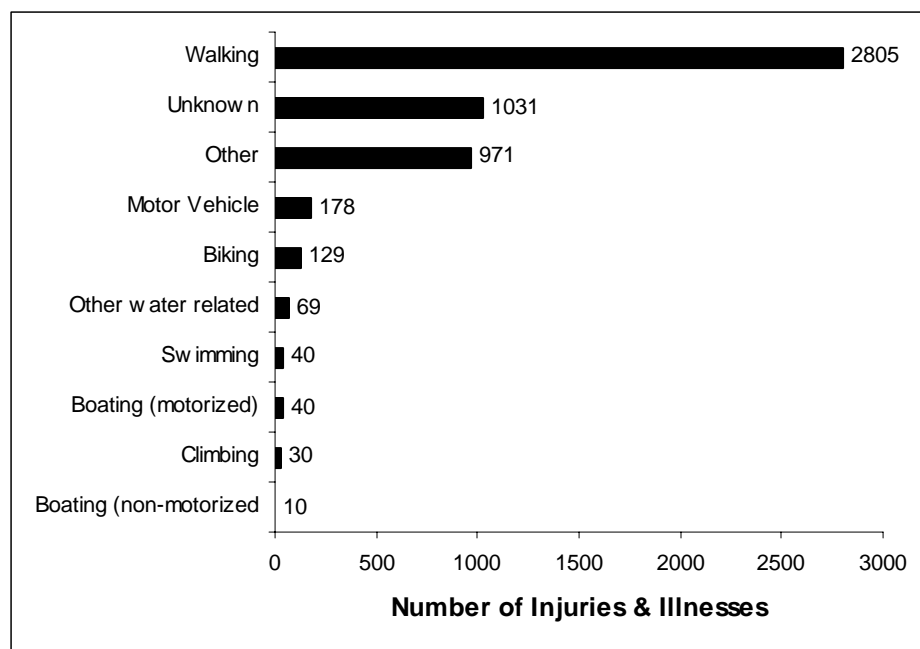
Over 67% of the victims were injured between noon and 6p.m., and 28% between 6am and noon. Sixty-six percent of the victims were injured on weekdays and 34% on weekends. The distribution of injured by month is shown in Figure 30.2, and reveals a pattern that mirrors visitation rates, with a peak in summer.



**Figure 30.2: Visitor Injuries and Illnesses by Month, 1993-98 (N=5302)**

Figure 30.3 shows the number of visitor injuries and illnesses by activity. Clearly, most injuries and illnesses occur while visitors are walking (53%) and various “other” activities (18%), although for a substantial number of injuries and illnesses (19%) there is no recorded information

about the nature of the activities in which the victim was engaged at the time of the accident. Several of the entries captured here involve activities that are not officially sanctioned or permitted by the park (e.g., boating). Nevertheless, these entries are intended to characterize what victims were doing when they were hurt.<sup>7</sup>

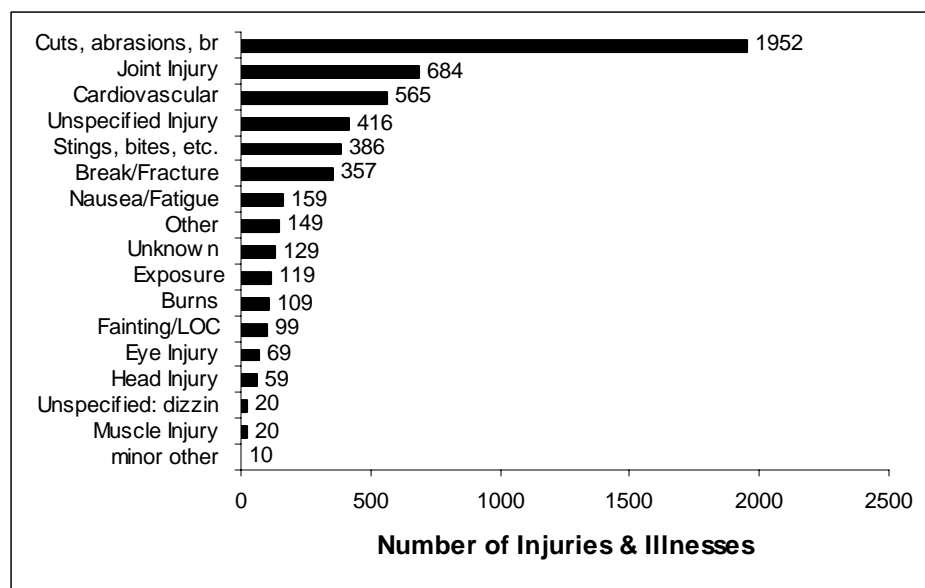


**Figure 30.3: Visitor Injuries and Illnesses by Activity, 1993-98 (N=5302)**

Turning to the nature of injuries and illness, we see (Figure 30.4) that 37% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 13% involved joint injuries (e.g., twisted ankles); 11% involved cardiovascular problems; 7% involved stings and bites, and 8% were due to unspecified injuries and illnesses. The incidence of cuts, abrasions, and bruises is roughly evenly divided between the sexes (50% female and 49% male, with 1% unknown gender), but females are more likely to suffer joint injuries (77%), cardiovascular problems (74%), and other unspecified injuries (79%).

<sup>7</sup> Given the nature of the park, we suspect that several of the motor vehicle and biking accidents may involve park staff or concessionaires rather than visitors, but this distinction was not clear in the records.

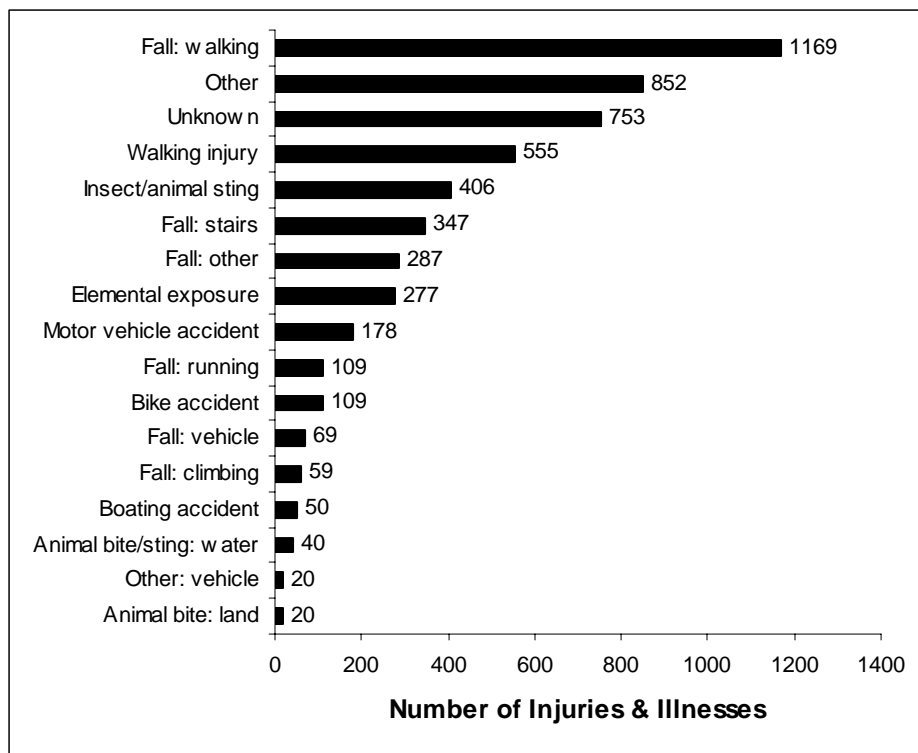




**Figure 30.4: Types of Visitor Injuries and Illnesses, 1993-98 (N=5302)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 5302 injuries and illnesses occurring during this period, 3161 (60%) could be considered less serious because the visitors were treated and released, and 1347 (25%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 971 (18%) were transported by ambulance and 377 (7%) were transported by privately owned vehicle. Three hundred eighty six people (7%) refused treatment and in 79 (1.5%) cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 30 (<1%) cases it is unknown what if any response was taken. Of the 1347 injuries and illnesses requiring transportation to a medical facility, 476 (35%) were for the treatment of cuts, abrasions, and bruises. Sixty-two percent (1209/1952) of cuts, abrasions, and bruises, 61% of cardiovascular problems (347/565), 48% of joint injuries (327/684) and 77% (297/386) of stings and bites were treated and released.

Visitors may be injured in numerous ways as they participate in various activities, and Figure 30.5 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person walking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while walking, the activity would be listed as walking, but the primary event would be insect/animal sting.



**Figure 30.5: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=5302)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 297 injuries and illnesses associated with these activities, 57% are driver-related, 10% road-related, and in 17% of the cases the contributing factors are unknown.

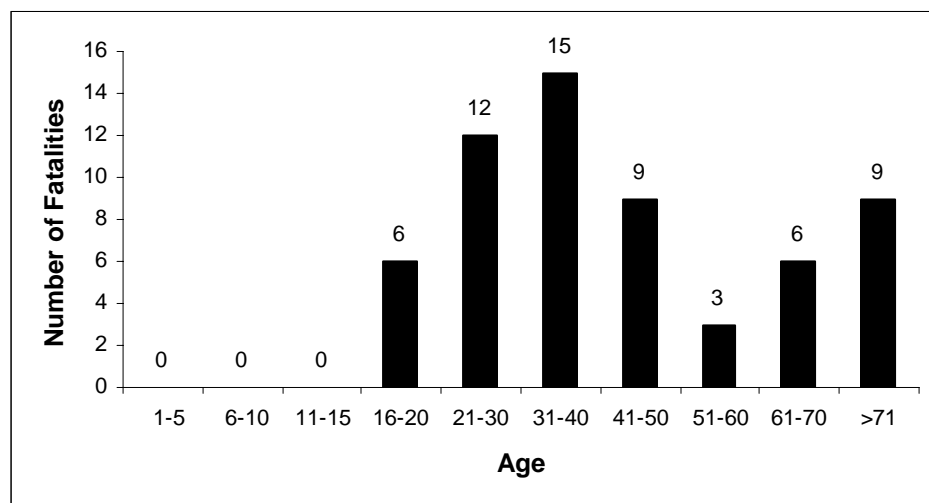
## 31.0 Yosemite National Park

### 31.1 Introduction:

Between 1993 and 1998, there were 3713 visitor accidents at Yosemite National Park, resulting in 53 fatalities and 4114 non-fatal injuries and illnesses. Since there were 23,133,477 visitors to the park during this period for a total of 469,752,888 visitor-hours, this results in an average of 16.05 accidents, 0.29 fatalities, and 17.78 injuries and illnesses per 100,000 visitors, and 7.90 accidents, 0.14 fatalities, and 8.76 injuries and illnesses per 1,000,000 visitor-hours.

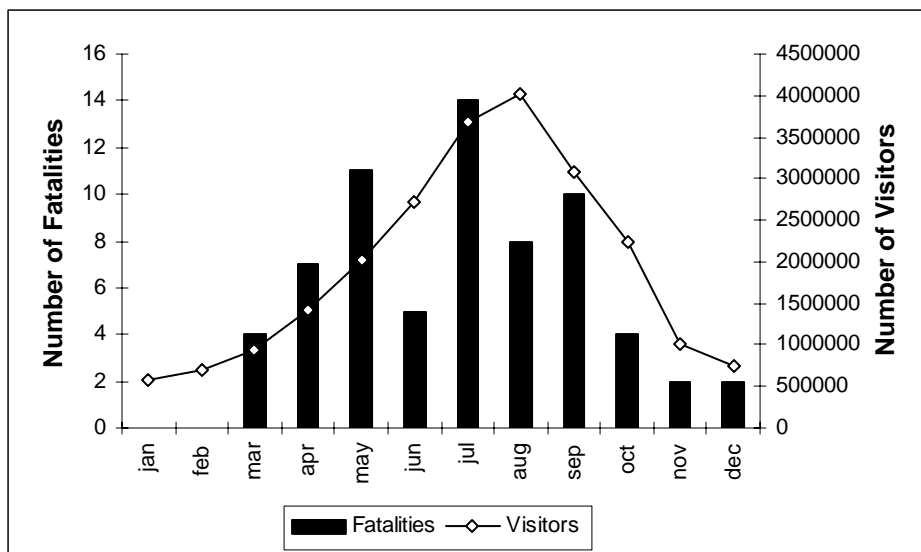
### 31.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 53 accidents that resulted in a total of 67 fatalities. Eighty-seven percent of the fatalities were male and 10% were female. The overwhelming majority of victims (88%) were white, 9% were Asian, and 3% were Hispanic. Eighty-one percent of the fatalities were residents of the US, 2 (3%) were from Germany, 2 (3%) were from France, and 2 (3%) were from the UK. The other 7 fatalities were from 7 countries (Croatia, Czech Republic, India, Japan, Korea, Norway, and Spain). The distribution of victims by age is shown in Figure 31.1, with a peak among 31-40 year olds and a subsidiary peak in those over 71.



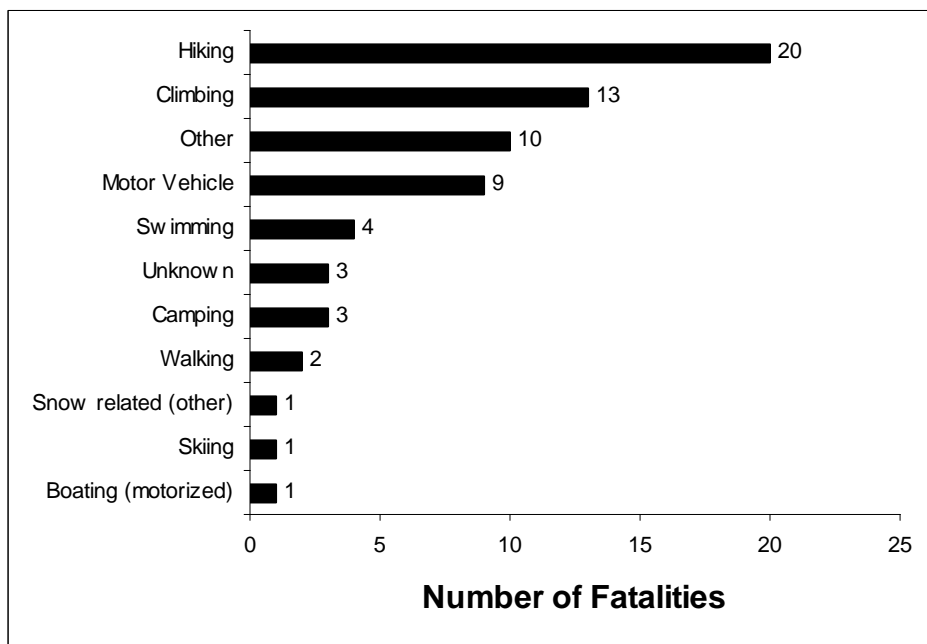
**Figure 31.1: Visitor Fatalities by Age, 1993-98 (N=60)**

Almost 47% of the fatalities occurred between noon and 6p.m., 26% between 6am and noon, and 21% between 6:00pm and midnight. Sixty-one percent of the fatalities occurred on weekdays and 39% on weekends. The distribution of fatalities by month is shown in Figure 31.2, and reveals a pattern that mirrors visitation rates, with a peak in the summer, although there are slightly more fatalities than expected in March, April, May, and July. Sixty-seven percent (45) of fatalities necessitated search and rescues.



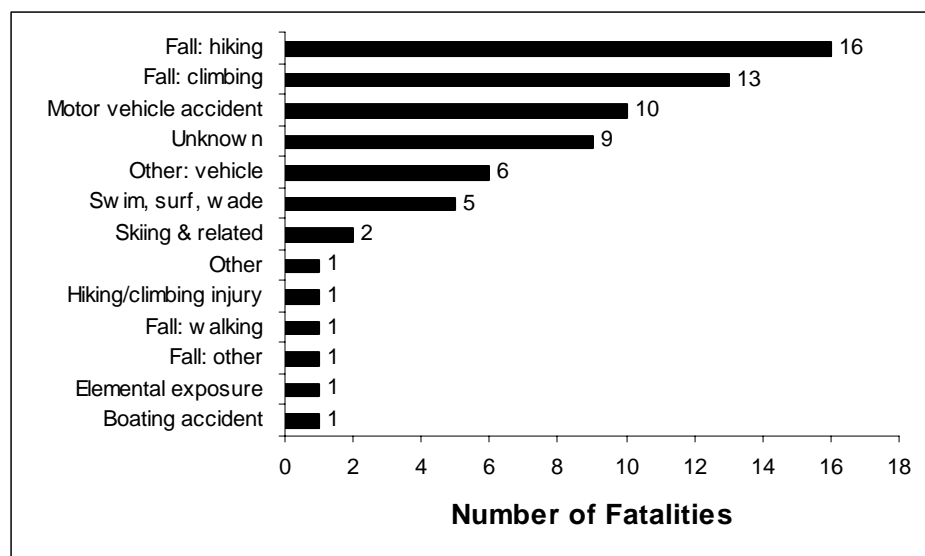
**Figure 31.2: Visitor Fatalities by Month, 1993-98 (N=67)**

Figure 31.3 shows the number of visitor fatalities by activity. Clearly, most fatalities occurred while visitors were hiking (30%), climbing (13%), and driving or riding in motor vehicles (13%). Fifteen percent of fatalities occurred while visitors were engaged in various activities here classified as “other.” In 4% of fatalities there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 31.3: Visitor Fatalities by Activity, 1993-98 (N=67)**

Figure 31.4 shows the distribution of fatalities by primary event. Thus, while there were only 9 fatalities among visitors driving or riding in cars, motor vehicles were the primary event causing a total of 10 fatalities. Falls account for 65% (13/20) of all hiking fatalities, and all (13/13) of the climbing fatalities.



**Figure 31.4: Visitor Fatalities by Primary Event, 1993-98 (N=67)**

### 31.3 Accidents Involving No Fatalities

Between 1993 and 1998, there were an estimated 4114 visitor injuries and illnesses arising from 3660 accidents that did not involve fatalities. Forty-five percent of the victims were male and 52% were female. Seventy percent of the victims were white, 7% Asian, 7% Hispanic, and less than 1% African-American. In 14% of cases, the race/ethnicity of the victim was unknown. Eighty-seven percent (3600/4114) of the victims were residents of the US, 3% (144/4114) were from the UK, and 1% (48/4114) were from Holland. One hundred eighty victims (4%) were from Australia, France, Germany, India, Israel, Italy, Latvia, Mexico, Spain, and Switzerland. In 3% of cases the nationality of the victims was unknown. The distribution of victims by age is shown in Figure 31.5.

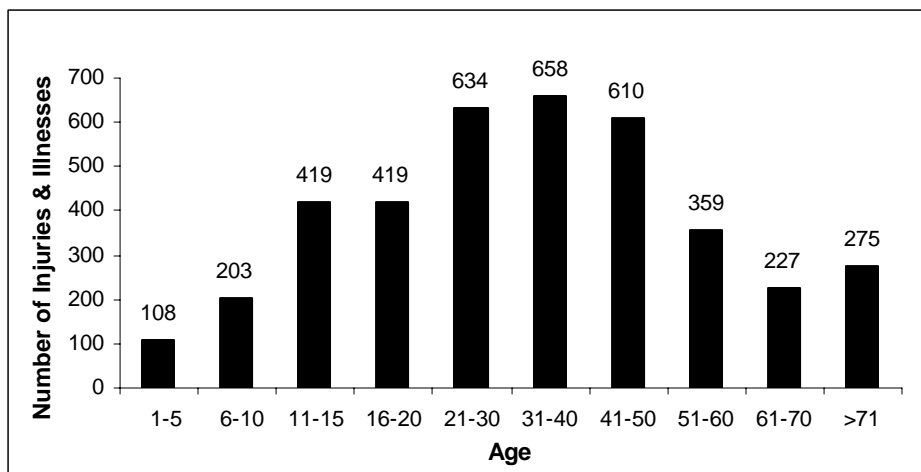


Figure 31.5: Visitor Injuries and Illnesses by Age, 1993-98 (N=3911)

Over 51% of the victims were injured between noon and 6p.m., 34% between 6am and noon, and 11% between 6:00pm and midnight. Sixty-one percent of the victims were injured on weekdays and 39% on weekends. The distribution of injured by month is shown in Figure 31.6, and reveals a pattern that mirrors visitation rates, with a peak in the summer. There are slightly elevated levels of injuries and illnesses than expected for the numbers of visitors in the winter months of December, January, and February.

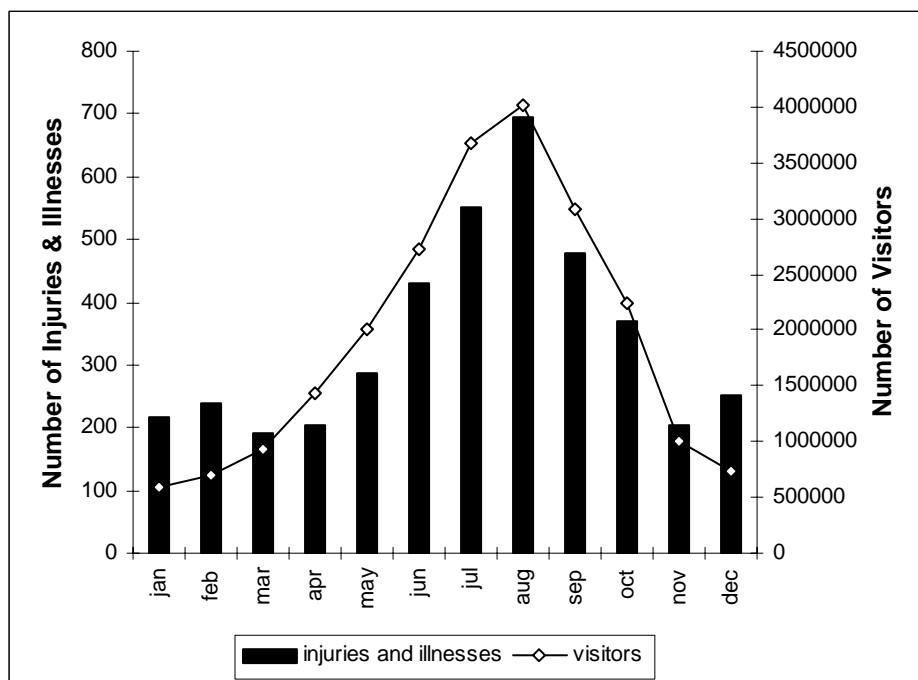
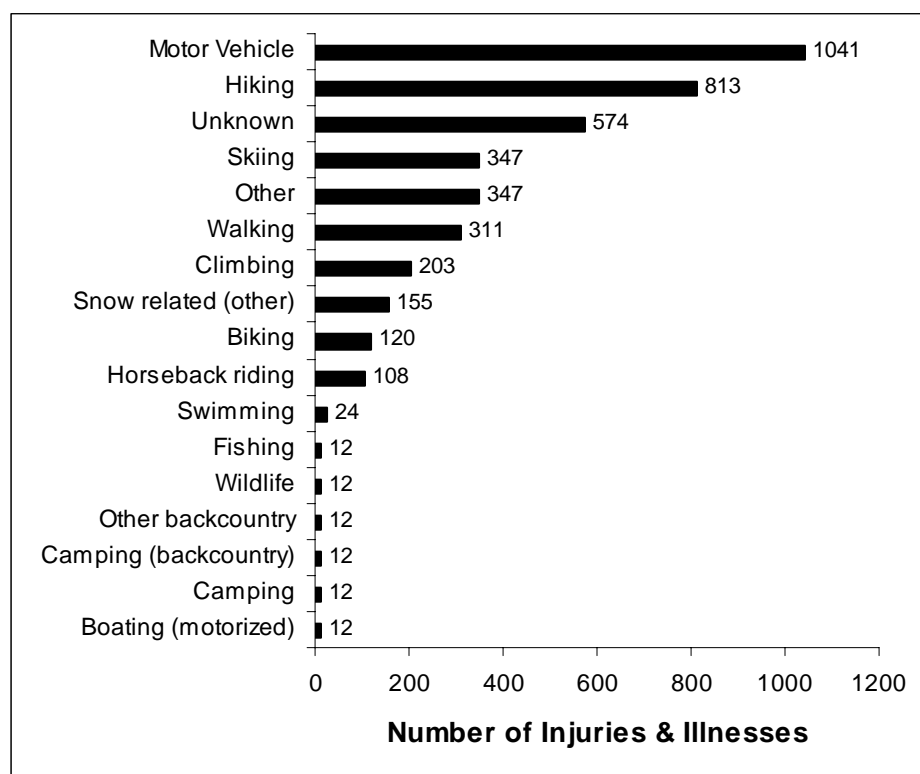


Figure 31.6: Visitor Injuries and Illnesses by Month, 1993-98 (N=4114)

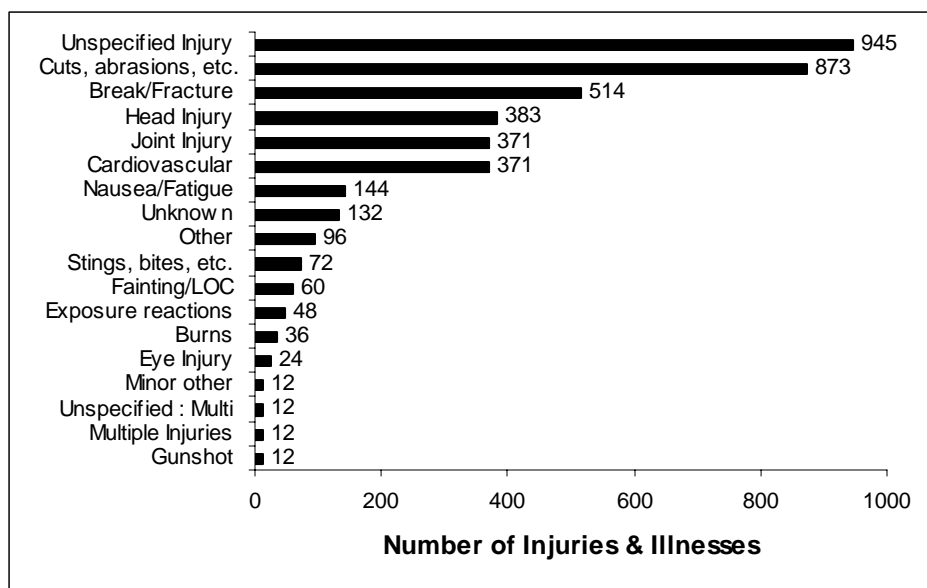
Figure 31.7 shows the number of visitor injuries and illnesses by activity. Clearly, the largest share of injuries and illnesses occur while visitors are driving or riding in motor vehicles (25%), hiking (20%) and skiing (8%), although for a substantial number of injuries and illnesses (14%) there is no recorded information about the nature of the activities in which the victim was engaged at the time of the accident.



**Figure 31.7: Visitor Injuries and Illnesses by Activity, 1993-98 (N=4114)**

Turning to the nature of injuries and illness, we see (Figure 31.8) that 21% of all injuries and illnesses between 1993 and 1998 were cuts, abrasions, and bruises; 12% involved broken bones or fractures; 9% involved head injuries (e.g., concussion), 9% involved joint injuries (e.g., twisted ankles), and 9% involved cardiovascular problems. Unfortunately, 23% of the cases were recorded only as “unspecified injuries.”

Males comprise a larger share of the victims of cuts, abrasions, and bruises (490/873) compared with females (371/873). Females form the majority of victims in the other primary injuries, including breaks/fractures (287/514 vs. 203/514), head injuries (299/383 vs. 143/383), joint injuries (227/371 vs. 143/371), and cardiovascular problems (203/371 vs. 167/371). Females also form the majority of victims of unspecified injuries (526/945 vs. 419/945).

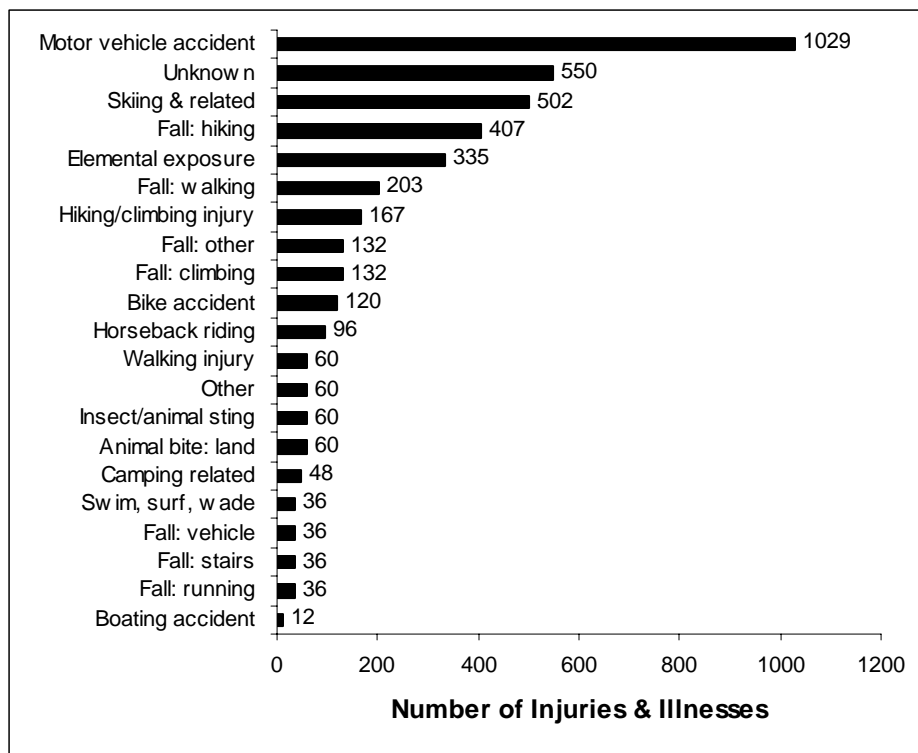


**Figure 31.8: Types of Visitor Injuries and Illnesses, 1993-98 (N=4114)**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 4114 injuries and illnesses occurring during this period, 1088 (26%) could be considered less serious because the visitors were treated and released, and 2236 (54%) could be considered more serious, since they required transportation to a medical facility. Of those requiring transportation, 1124 (27%) were transported by ambulance and 112 (27%) were transported by privately owned vehicle. On hundred ninety one people (5%) refused treatment and in 191 cases other responses were taken, such as an investigation of the accident scene by a ranger and follow up, especially if the victim had already vacated the scene. In 359 (9%) cases it is unknown what if any response was taken. Of the 2236 injuries and illnesses requiring transportation to a medical facility, 335 (15%) were for the treatment of cuts, abrasions, and bruises, 394 (18%) were for breaks/fractures, and 490 (22%) were for unspecified injuries and illnesses.

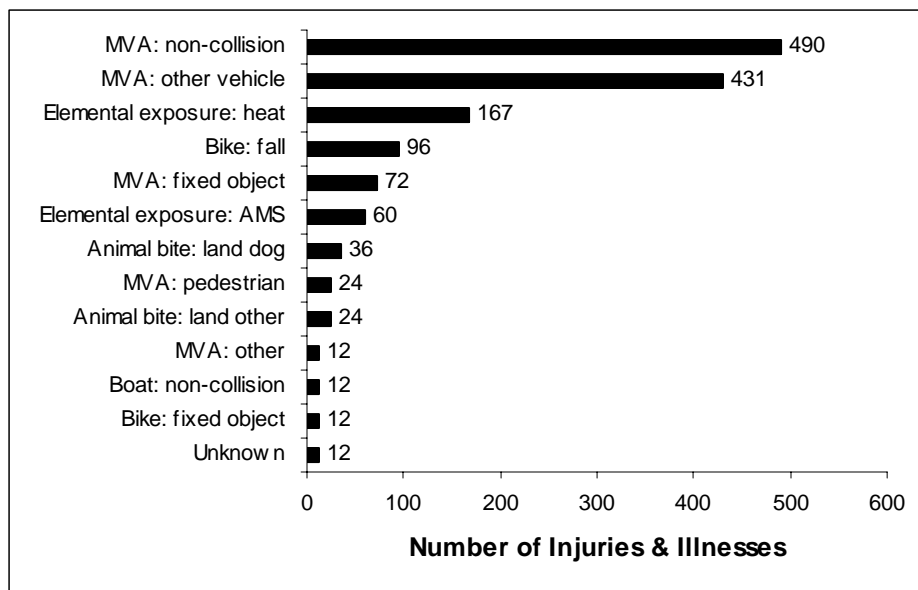
Visitors may be injured in numerous ways as they participate in various activities, and Figure 31.9 illustrates the distribution of injuries and illnesses by primary causal event. For example, a person hiking may be hurt by a fall, by exposure to heat or cold, or by insect stings. If a visitor was stung by an insect while hiking, the activity would listed as hiking, but the primary event would be insect/animal sting. Where we have sufficient information (usually for biking, boating, and motor vehicle accidents), we can also identify secondary causal events, as illustrated in Figure 31.10.





**Figure 31.9: Visitor Injuries and Illnesses by Primary Event, 1993-98 (N=4114)**

Motor vehicles are the primary causal event in 25% (1029/4114) of all injuries and illnesses. Of these 1029 accidents, 490 (48%) involve non-collisions (such as running off the road), 431 (42%) involve collisions with other vehicles, 72 (7%) involve collisions with fixed objects, and 25 (2%) involve collisions with pedestrians.



**Figure 31.10: Visitor Injuries and Illnesses by Secondary Event, 1993-98 (N=1447)**

There is relatively little information in park accident reports (CIRs) about the factors that contribute to visitor accidents. Data about these factors often are entered into CIRs for only a few accident types, such as boating, biking, and vehicle accidents. Of the 1160 injuries and illnesses associated with these activities for which we have information, 42% are driver-related, 24% road-related, and 12% are a result of other factors. In 33% of the cases of biking, boating, and motor vehicle injuries and illnesses the contributing factors are unknown.

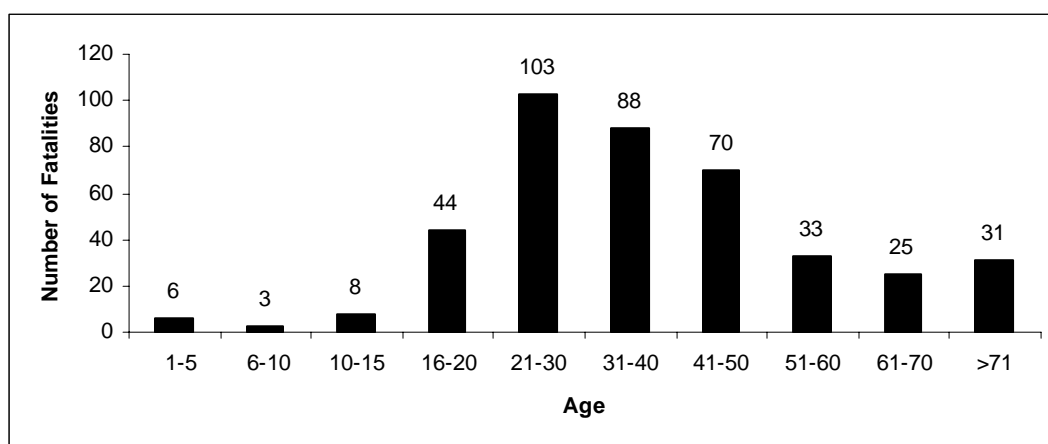
## 32. The 30-Park Sample

### 32.1 Introduction:

Between 1993 and 1998, there were 19,365 visitor accidents in the 30 parks, resulting in 443 fatalities and an estimated 24,746 non-fatal injuries and illnesses (Table 32.1). Since there were 446,961,159 visitors to the 30 parks during this period for a total of 2,851,580,367 visitor-hours, this results in an average of 4.33 accidents, 0.10 fatalities, and 5.54 injuries and illnesses per 100,000 visitors, or an average of 6.79 accidents, 0.16 fatalities, and 8.68 injuries and illnesses per 1,000,000 visitor hours.<sup>8</sup>

### 32.2 Accidents Involving Fatalities:

Between 1993 and 1998, there were 384 accidents that resulted in a total of 443 fatalities. Forty-six percent of the victims were between 21 and 40, and 86% were male.



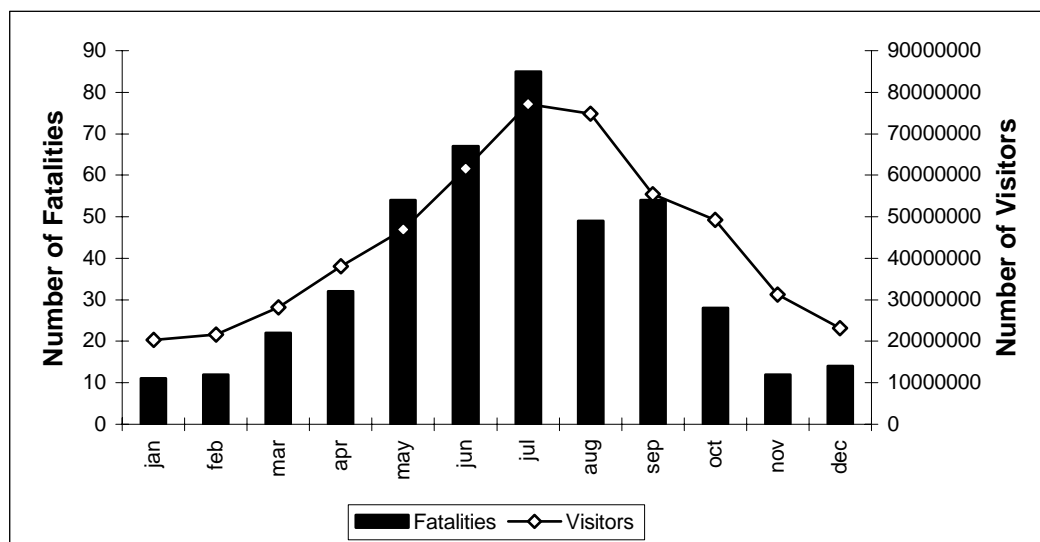
**Figure 32.1: Number of Fatalities by Age (N=411)**

Ninety-two percent of all fatalities were U.S. residents, with 1% from Mexico, Germany, and the UK respectively. Sixty-nine percent of all fatalities were white, 5% Hispanic, 3% Asian, and 3% African-American. Fifty-six percent of the fatalities occurred on weekdays, with 48% occurring between 12:00noon and 6:00pm, 21% between 6:00am and 12:00noon, and 22% between 6:00pm and midnight. The number of fatalities closely follows the distribution of visitors by month (Figure 32.2).

Motor vehicle accidents are responsible for 29% (127/443) of all fatalities, with 18% from swimming, wading, and surfing; 15% from climbing accidents; 11% from boating, and 10% from hiking. Falls account for 22% of fatalities, including falls while climbing (12%), hiking (7%), and walking (2%). Of the 124 motor vehicle accidents for which we have information, 40% involve accidents without collisions (e.g., running off the road); 30% involve collisions with fixed objects, and; 29% involve collisions with other vehicles. In the 170 fatalities

<sup>8</sup> The visitation data used to calculate the risk ratios have been adjusted to allow for missing data in individual parks.

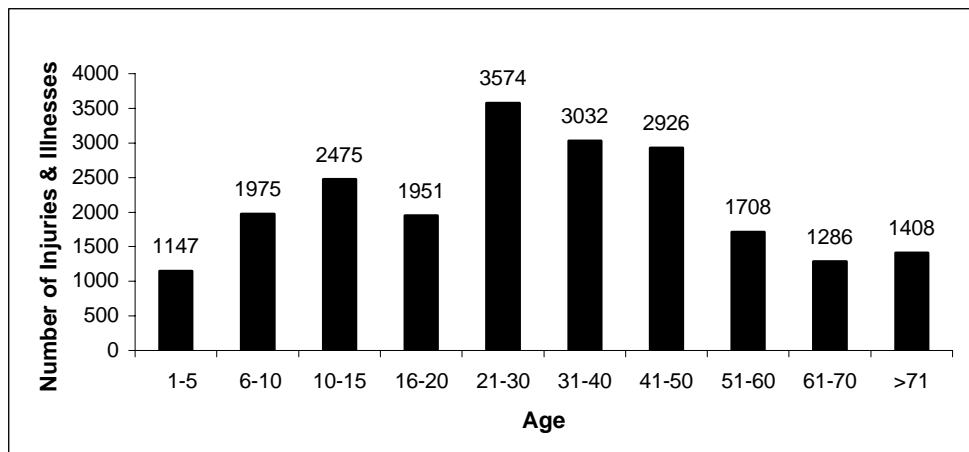
involving automobiles, boats, and bicycles, 56% of all fatalities were due to driver-related factors (e.g., falling asleep while driving, loss of vehicle control), while in 32% of all cases the primary contributing factors were unknown, or unreported. Of the 443 fatalities, 244 (55%) required search and rescue efforts. Twenty nine percent (129/443) of the victims were transported by ambulance and subsequently died, and 60% were dead at the time park personnel arrived on the scene.



**Figure 32.2: Number of Fatalities by Month (N=440)**

### 32.3 Accidents Involving No Fatalities:

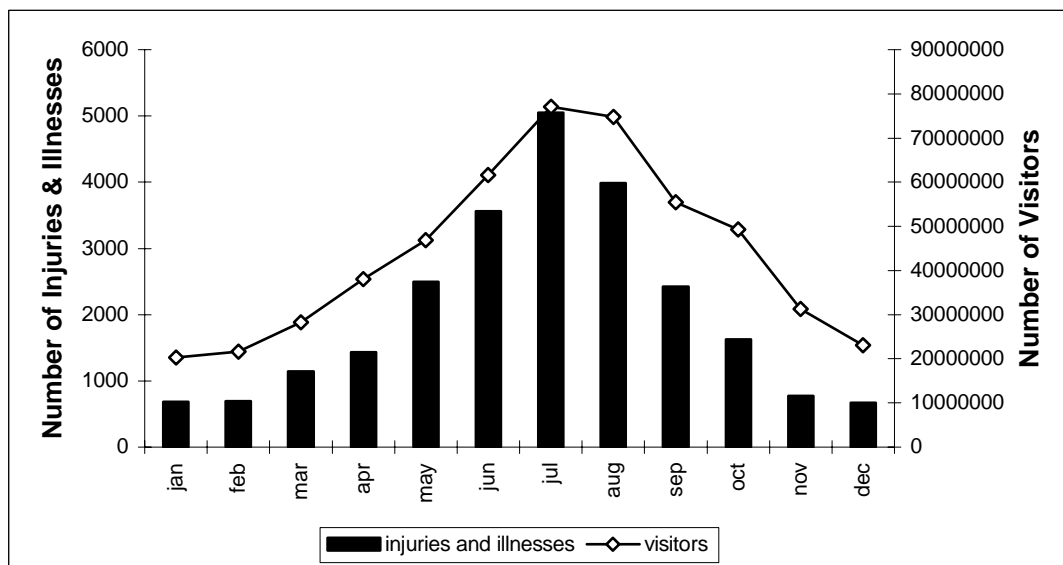
There were 24,746 injuries arising from 18,981 accidents that did not involve fatalities. Forty-eight percent of the victims were male and 49% were female. The distribution of victims by age is shown in Figure 32.3. Assuming that the number of visitors by age is normally distributed, the number of injuries and illnesses suffered by visitors between 16 and 20 years of age appears to be lower than would be expected. This may merely reflect the lower visitation rates among this age group. Without better data on the age distribution of visitors, we cannot tell.



**Figure 32.3: Number of Visitor Injuries and illnesses by Age, 1993-98 (N=21481)**

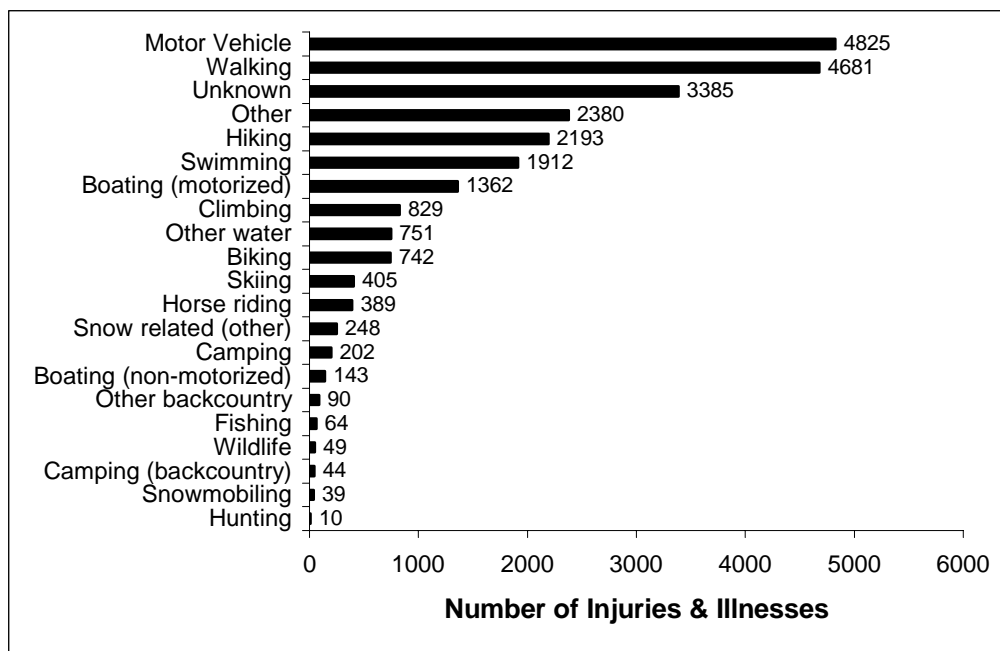
Almost 90% of those visitors that suffer injuries and illnesses are from the United States, 1% are from the UK, 0.5% from Canada, and 0.5% from Germany. Fifty-five percent are white, 3% Hispanic, and 3% Asian. These results are highly uncertain, however, because the race and ethnicity is unknown in almost 40% of cases.

Sixty percent of the injuries and illnesses occurred on weekdays, with 59% occurring between 12:00 noon and 6:00 pm, 26% between 6:00am and 12:00 noon and 11% between 6:00pm and midnight. Figure 32.4 indicates that the distribution of injuries and illnesses by month closely reflects the numbers of visitors.



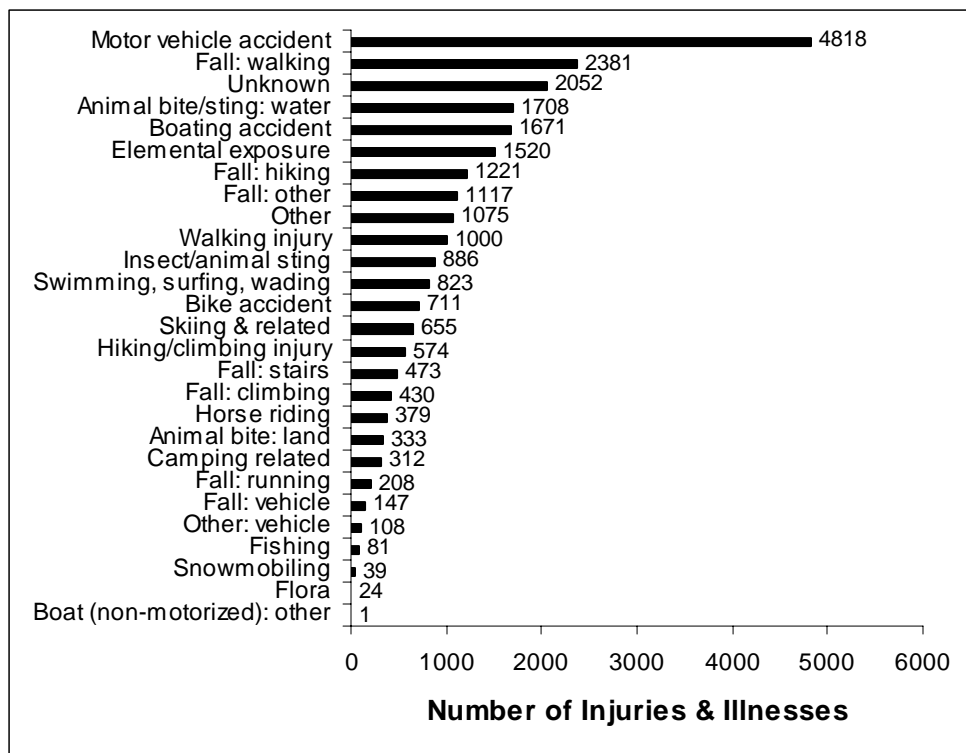
**Figure 32.4: Visitor Injuries and Illnesses by Month, 1993-98 (N=24547)**

Figure 32.5 shows that 20% of all visitor injuries and illnesses occur while driving or riding in motor vehicles, 19% arise during walking on prepared walkways and around exhibits, 9% while hiking, 8% while swimming, and 6% while boating (both motorized and non-motorized). In 14% of cases the primary activity of the victim was unknown.



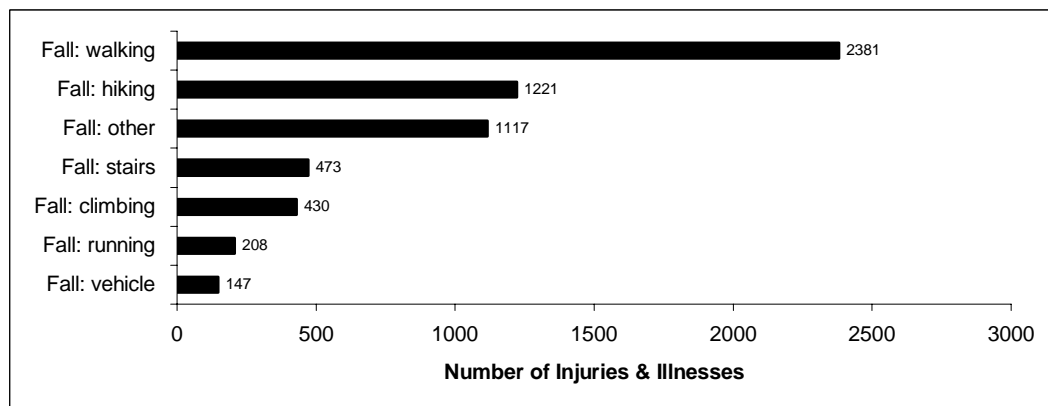
**Figure 32.5: Visitor Injuries and Illnesses by Activity, 1993-98 (N=24746)**

Visitors may be injured in different ways while engaging in various activities. For example, hikers may trip and fall or be stung by insects. Consequently, we identify the primary event leading to an injury or illness in Figure 32.6.

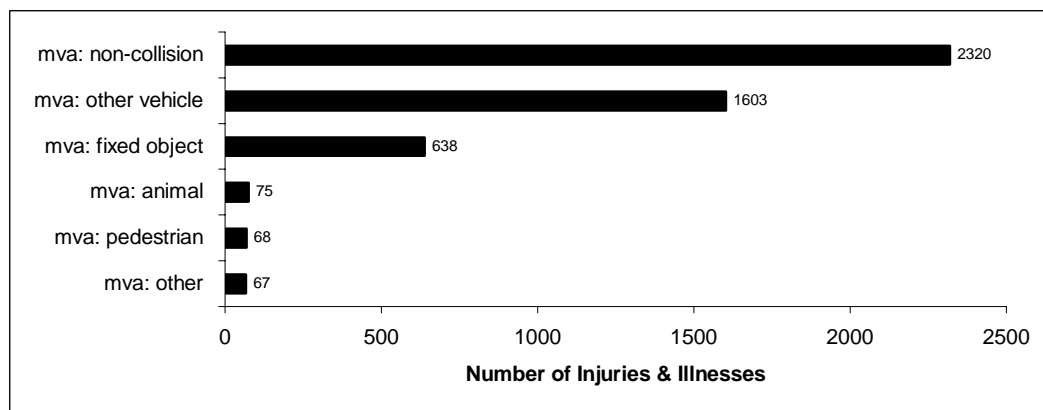


**Figure 32.6: Primary Event in Visitor Injuries and illnesses, 1993-98 (N=24746)**

Falls of various kinds result in 5977 injuries or about 24% of the total injuries and illnesses. Motor vehicle accidents result in 4818 injuries (19%) and all water and land-based stings and bites account for about 2766 (11%) injuries and illnesses. Figure 32.7 shows the breakdown of falls by different kinds of activities. Figure 32.8, shows that 23% of the motor vehicle injuries arise from accidents that do not involve collisions, 6% involve collisions with other vehicles, and 6% involve collisions with fixed objects.

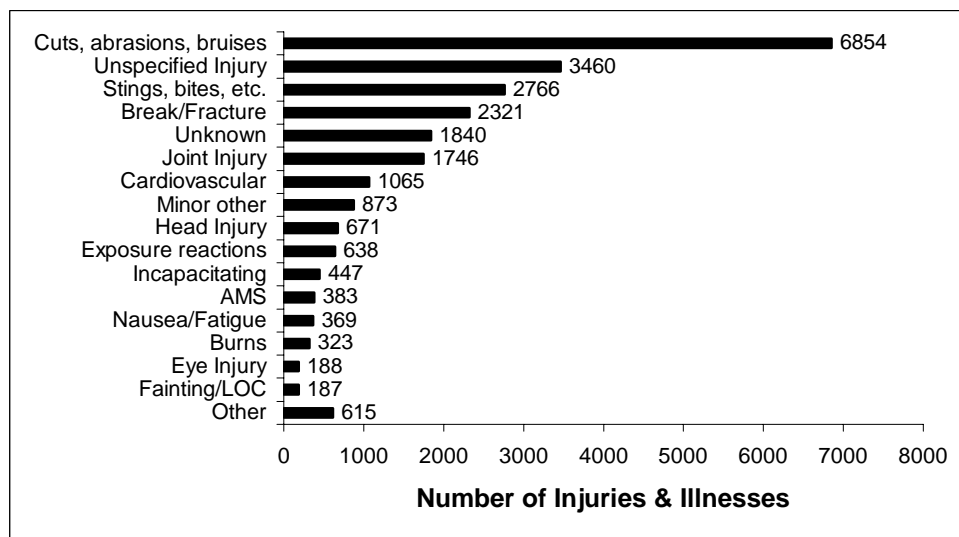


**Figure 32.7: Visitor Injuries from Falls, 1993-98 (N=5977)**



**Figure 32.8: Visitor Injuries from Motor Vehicle Accidents, 1993-98 (N=4769)**

Figure 32.9 shows the kinds of injuries and illnesses experienced, including cuts, abrasions, and bruises (28%); stings and bites (11%); and broken bones and fractures (9%). In 14% of cases the injury is unspecified.



**Figure 32.9: Types of Visitor Injuries and illnesses, 1993-98**

Absent accurate medical diagnoses it is difficult to gauge the seriousness of individual visitor injuries and illnesses. Nevertheless, there are data on the kind of response taken at the scene. Of the 24746 injuries and illnesses occurring during this period, 10986 (44%) could be considered less serious because the visitors were treated and released, and 10143 could be considered more serious since the injured visitors required transportation to a medical facility. Thirty percent (7369/24746) were transported by ambulance, and 2774 (11%) were transported by privately owned vehicle. Nine hundred fifty-one (4%) refused treatment and in 1502 (6%) cases it is unknown what if any response was taken.



There is relatively little information about contributing factors; data are available for only 28% of injuries and illnesses that resulted from biking, boating, and motor vehicle accidents. For those 6907 injuries and illnesses on which we have information, 53% are driver related, 11% refer to road conditions, 2% involve equipment failures, and 1% involve environmental factors.

## 33.0 Conclusions

### 33.1 Introduction:

The National Park Service has an enormous amount of data on visitor accidents at each of its park units. We have been able to assemble and analyze only a small portion of these data for a relatively brief period (1993-1998) and for a relatively small number (30) of the total number of park units in the National Park System. Nevertheless, the database assembled includes a substantial amount of information on almost 20,000 visitor accidents and much important knowledge can be gained from this and subsequent analyses of the database. The knowledge can be useful for NPS and park unit management efforts to better understand visitor safety and to improve visitor safety management programs. This is the first study to date that has evaluated visitor accidents across multiple parks for multiple years using the data collected routinely by NPS units (other studies have been conducted for specific parks). As such, the study also provides important information to managers about the quality of the data being retained by parks and its usefulness for future analyses.

Unfortunately, we must conclude with some caveats about the data and the analysis. Much of the information that we would like to use in the evaluation of visitor accidents is missing from park records. For example, data about ethnicity are missing in more than 40% of the records and data on contributing factors are often collected for only a small subset of visitor activities, such as biking, boating, and motor vehicles. There can be many reasons for this, not the least of which is that the cumbersome nature of the visitor accident recording system means that the reports entered are frequently incomplete and, for example, often lack complete narrative accident descriptions.

Many NPS staff that we encountered expressed frustration with the current CIR system, and complained that it was cumbersome to use and did not allow for easy retrieval of information in ways that would be most useful to the users. Given the difficulties of using the CIR system, some parks have begun to develop their own accident databases (e.g., the CRIME System developed at Mount Rainier National Park). This also means that data are not entered fully or accurately. Improving the accuracy and reliability of information will require the establishment and maintenance of an accident reporting system that is both useful and user friendly.

### 33.2 Broad patterns:

In spite of these caveats, broad patterns begin to emerge from these data and these patterns are illustrated in the previous sections and summarized here.

*Many of the accidents that involve visitors are relatively mundane.* They include bee stings, cuts, abrasions, bruises, and the like. A measure of their relatively minor severity is that 44% of all injured or ill visitors were treated and released by park personnel. A substantial fraction (41%) of injured or ill visitors, however, required transportation to medical facilities for further assessment and/or treatment. Falls of various kinds result in about 24% of all injuries and illnesses and motor vehicle accidents result in about 19% additional injuries and illnesses.

*The broad pattern of risks in the parks can be summarized in the form of risk ratios (Table 33.1).* We provide risk ratios in the form of the number of accidents and injuries per 100,000 visitors and per 1,000,000 visitor-hours, with the proviso that such measures do not allow for the enormous variations among parks in terms of visitor activities and risk conditions. Better measures of risk would incorporate measures of the degree of exposure, such as the amount of time people are engaged in a given activity (such as hiking, rock climbing, wilderness camping), the number of person-miles walked on trails, or the total vehicle miles driven in a given park. Unfortunately, these kinds of data on the degree of exposure are not available. Consequently, we are forced to use the relatively simplistic, alternate measures.

*The patterns and rates of accidents vary substantially from park to park.* In large part this reflects the specific characteristics and uses of a park (e.g., urban vs. rural, recreation area vs. national monument). In most parks we find that a relatively small number of activities account for a large share of visitor accidents. For example, motor vehicle, hiking, and walking accidents account for a substantial fraction of the injuries and illnesses in many of the parks we studied. Given the very different nature of individual parks and the kinds of activities pursued, we believe it would be misleading to try to rank parks on the basis of relatively simple measures of visitor risk.

In an effort to identify some of the most important patterns between and among the 30 parks, we conducted a hierarchical cluster analysis using the widely available statistical analysis program SPSS. We began the cluster analysis by looking at how parks cluster according to the types of activities associated with most injuries and illnesses (Section 33.3). Next we examined how the parks clustered according to the sex (Section 33.4) and age (Section 33.5) of the victims. Finally (Section 33.6), we conducted a cluster analysis using all of the variables (i.e., activity type, sex, and age). In conducting these analyses we excluded all records in our database for which the values of the variable under consideration was “unknown” and “other.”

### **33.3 Park clusters by activity:**

In most parks we find that a relatively small number of activities account for a large share of visitor accidents. For example, motor vehicle, hiking, and walking accidents often account for a substantial fraction of the injuries and illnesses in many of the parks we studied. The particular set of activities associated with the largest share of accidents, however, varies from park to park. In one park, motor vehicle accidents may dominate, whereas in another park hiking and climbing accidents may dominate. The cluster analysis indicates that the sample of 30 parks may be divided into five types according to the clusters of activities that dominate in terms of visitor injuries and illnesses. The five activity clusters are:

- 1) “backcountry” or adventure recreation activities that tend to entail relatively vigorous physical exertion, such as backcountry camping, hiking, mountaineering, and climbing;
- 2) “frontcountry” or day-use activities that tend to entail less vigorous physical exertion, such as walking outside on paved surfaces and interpretive trails and walking indoors;
- 3) motoring activities;

| Park code | Number of Fatal Accidents | Number of Non-fatal Accidents | Total Number of Accidents | Number of Fatalities | Number of Injuries & Illnesses | Number of visitors | Accidents/ 100,000 visitors | Fatalities/ 100,000 visitors | Injuries & Illnesses/ 100,000 visitors | Number of visitor-hours | Accidents/ 1,000,000 visitor-hours | Fatalities/ 1,000,000 visitor-hours | Injuries & Illnesses/ 1,000,000 visitor-hrs | Missing data*    |
|-----------|---------------------------|-------------------------------|---------------------------|----------------------|--------------------------------|--------------------|-----------------------------|------------------------------|--|-------------------------|------------------------------------|-------------------------------------|---|------------------|
| ASIS      | 0                         | 900                           | 900                       | 0                    | 906                            | 11528302           | 7.81                        | 0.00                         | 7.86                                   | 100129923               | 8.99                               | 0.00                                | 9.05  |                  |
| BADL*     | 3                         | 105                           | 108                       | 5                    | 106                            | 4410191            | 2.45                        | 0.11                         | 2.40                                   | 19864525                | 5.44                               | 0.25                                | 5.34  | 1997-98          |
| BIBE      | 9                         | 320                           | 329                       | 9                    | 335                            | 1877562            | 17.52                       | 0.48                         | 17.86                                  | 56586960                | 5.81                               | 0.16                                | 5.93  |                  |
| BLRI      | 35                        | 915                           | 950                       | 36                   | 1222                           | 106802332          | 0.89                        | 0.03                         | 1.14                                   | 672527208               | 1.41                               | 0.05                                | 1.82  |                  |
| CAVE      | 1                         | 346                           | 347                       | 1                    | 348                            | 3512947            | 9.88                        | 0.03                         | 9.91                                   | 13462234                | 25.78                              | 0.07                                | 25.87                                       |                  |
| CAHA      | 15                        | 172                           | 187                       | 15                   | 158                            | 14636238           | 1.28                        | 0.10                         | 1.08                                   | 69050860                | 2.71                               | 0.22                                | 2.29  |                  |
| CANY      | 7                         | 224                           | 231                       | 8                    | 234                            | 2630282            | 8.78                        | 0.30                         | 8.90                                   | 26716869                | 8.65                               | 0.30                                | 8.76  |                  |
| CURE      | 7                         | 78                            | 85                        | 8                    | 79                             | 6104296            | 1.39                        | 0.13                         | 1.29                                   | 28212573                | 3.01                               | 0.28                                | 2.80  |                  |
| CUVA*     | 2                         | 184                           | 186                       | 2                    | 193                            | 16912430           | 1.10                        | 0.01                         | 1.14                                   | 50264071                | 3.70                               | 0.04                                | 3.84  | 1993             |
| DENA      | 22                        | 371                           | 393                       | 36                   | 412                            | 2607367            | 15.07                       | 1.38                         | 15.81                                  | 35694533                | 11.01                              | 1.01                                | 11.55                                       |                  |
| DEWA      | 9                         | 426                           | 435                       | 10                   | 538                            | 28096558           | 1.55                        | 0.04                         | 1.91                                   | 126274177               | 3.44                               | 0.08                                | 4.26  |                  |
| EVER      | 1                         | 214                           | 215                       | 1                    | 246                            | 5678541            | 3.79                        | 0.02                         | 4.32                                   | 31194566                | 6.89                               | 0.03                                | 7.87  |                  |
| FOSU*     | 0                         | 32                            | 32                        | 0                    | 32                             | 1684302            | 1.90                        | 0.00                         | 1.90                                   | 1944206                 | 16.46                              | 0.00                                | 16.46                                       | 1996             |
| GETT      | 2                         | 255                           | 257                       | 2                    | 280                            | 9790417            | 2.63                        | 0.02                         | 2.86                                   | 30698619                | 8.37                               | 0.07                                | 9.14  |                  |
| GRTE      | 25                        | 756                           | 781                       | 28                   | 827                            | 15989664           | 4.88                        | 0.18                         | 5.17                                   | 115579137               | 6.76                               | 0.24                                | 7.15  |                  |
| LAME*     | 91                        | 1979                          | 2070                      | 106                  | 3560                           | 36506024           | 5.67                        | 0.29                         | 9.75                                   | 304091998               | 6.81                               | 0.35                                | 11.71                                       | 1993-94 injuries |
| LIBI      | 0                         | 12                            | 12                        | 0                    | 12                             | 2233285            | 0.54                        | 0.00                         | 0.54                                   | 2237111                 | 5.36                               | 0.00                                | 5.36  |                  |
| LOWE      | 0                         | 42                            | 42                        | 0                    | 46                             | 3147809            | 1.33                        | 0.00                         | 1.46                                   | 4276433                 | 9.82                               | 0.00                                | 10.76                                       |                  |
| MEVE      | 0                         | 298                           | 298                       | 0                    | 307                            | 3864515            | 7.71                        | 0.00                         | 7.94                                   | 32517232                | 9.16                               | 0.00                                | 9.44  |                  |
| MORA*     | 4                         | 235                           | 239                       | 4                    | 253                            | 4008527            | 5.96                        | 0.10                         | 6.30                                   | 49275265                | 4.85                               | 0.08                                | 5.13  | 1993-95          |
| MORU*     | 0                         | 179                           | 179                       | 0                    | 183                            | 9318575            | 1.92                        | 0.00                         | 1.96                                   | 12271760                | 14.59                              | 0.00                                | 14.91                                       | 1998             |
| NATR      | 40                        | 372                           | 412                       | 41                   | 685                            | 34781424           | 1.18                        | 0.12                         | 1.97                                   | 140693790               | 2.93                               | 0.29                                | 4.87  |                  |
| OLYM      | 17                        | 695                           | 712                       | 20                   | 723                            | 20492225           | 3.47                        | 0.10                         | 3.53                                   | 115787615               | 6.15                               | 0.17                                | 6.24  |                  |
| OZAR      | 6                         | 107                           | 113                       | 7                    | 107                            | 9007731            | 1.25                        | 0.08                         | 1.19                                   | 25491126                | 4.43                               | 0.27                                | 4.20  |                  |
| PAIS      | 2                         | 1823                          | 1825                      | 2                    | 1843                           | 4663531            | 39.13                       | 0.04                         | 39.52                                  | 32783081                | 55.67                              | 0.06                                | 56.21                                       |                  |
| PORE      | 6                         | 233                           | 239                       | 7                    | 247                            | 14491489           | 1.65                        | 0.05                         | 1.70                                   | 69638923                | 3.43                               | 0.10                                | 3.55  |                  |
| ROMO      | 21                        | 979                           | 1000                      | 22                   | 1317                           | 17551492           | 5.70                        | 0.13                         | 7.50                                   | 127229570               | 7.86                               | 0.17                                | 10.35                                       |                  |
| SAGU      | 4                         | 95                            | 99                        | 4                    | 132                            | 4456978            | 2.22                        | 0.09                         | 2.96                                   | 6205170                 | 15.95                              | 0.64                                | 21.27                                       |                  |
| STLI      | 2                         | 2974                          | 2976                      | 2                    | 5302                           | 27042648           | 11.00                       | 0.01                         | 19.61                                  | 81127944                | 36.68                              | 0.02                                | 65.35                                       |                  |
| YOSE      | 53                        | 3660                          | 3713                      | 67                   | 4114                           | 23133477           | 16.05                       | 0.29                         | 17.78                                  | 469752888               | 7.90                               | 0.14                                | 8.76  |                  |
|           | <b>384</b>                | <b>18981</b>                  | <b>19365</b>              | <b>443</b>           | <b>24746</b>                   | <b>446961159</b>   | <b>4.33</b>                 | <b>0.10</b>                  | <b>5.54</b>                            | <b>2851580367</b>       | <b>6.79</b>                        | <b>0.16</b>                         | <b>8.68</b>                                 |                  |

Table 33.1: Summary of Accident Data for 30 Park Units in Sample

- 4) water-related activities, including swimming, motorized boating, and non-motorized boating; and
- 5) biking-related activities

The hierarchical cluster analysis also assigned parks to each of these activity types. The numbers in parentheses indicate the proportion of all visitor accidents associated with the activity cluster.

Parks in which *motor vehicle operation* accounted for the largest number of injuries and illnesses to visitors were: NATR (98%); BLRI (84%); CURE (57%); SAGU (57%); and DEWA (48%).

Parks in which *water-related activities* accounted for the largest number of injuries and illnesses to visitors were: PAIS (84%); ASIS (74%); OZAR (64%); CAHA (59%); and LAME (57%). Within the category of water-related activities two sub-categories were identified:

- 1) park units in which water-related accidents involve primarily swimming and wading activities (ASIS, PAIS, CAHA); and
- 2) park units in which water-related accidents involve primarily boating activities, including LAME (motorized boating) and OZAR (non-motorized boating).

Parks in which *backcountry activities* accounted for the largest number of injuries and illnesses to visitors were: DENA (77%); ROMO (57%); OLYM (53%); BADL (51%); MORA (47%); CANY (45%); BIBE (43%); PORE (41%); GRTE (36%); and YOSE (33%). Within this category five sub-categories were identified:

- 1) Parks in which biking and horseback riding also contributed significant numbers of accidents. In CANY biking accounted for 30% of visitor related injuries and illnesses. In PORE horseback riding accounted for 19% and biking accounted for 15% of visitor related injuries and illnesses.
- 2) Parks in which motor vehicle accidents also contributed significant numbers to visitor injuries and illnesses (more than 15%). This group includes OLYM (11%) and ROMO (15%).
- 3) Parks in which walking on paved areas, interpretive trails, and indoors (i.e., front country activities) also contributed significant numbers to visitor injuries and illnesses. This subgroup includes BADL (31%).
- 4) Parks in which no other activity contributed a significant number to visitor injuries and illnesses (DENA).
- 5) Parks in which two or more additional activities were associated with significant additional visitor injuries and illnesses. This subcategory includes MORA (19% motor vehicle related and 15% snow related), BIBE (21% motor vehicle related and 18% front country), YOSE (33% motor vehicle related and 16% snow related), and GRTE (26% motor vehicle related and 16% front country).

Parks in which *frontcountry activities* accounted for the largest number of injuries and illnesses to visitors were: LIBI (100%); FOSU (88%); CAVE (87%); LOWE (85%); STLI (82%); MORU (81%); GETT (77%); MEVA (45%); and EVER (41%). Two parks in this category, EVER and MEVE, have secondary activities that also contributed to significant numbers of visitor injuries and illnesses. At EVER biking accounted for an additional 20% and water-related activities accounted for an additional 21% of visitor related injuries and illnesses. At MEVE motor vehicle operation and backcountry related activities each accounted for an additional 20% of visitor related injuries and illnesses.

The cluster of frontcountry parks can be further subdivided into urban-historical parks (LOWE, STLI, FOSU, GETT, MORU, LIBI) at which the primary attractions are historical monuments or urban structures/areas, and nature-oriented parks (CAVE, MEVA, EVER) at which the primary attractions are nature walks and overlooks on paved areas or interpretive trails.

*Biking* was the primary activity associated with visitor injuries and illnesses at only CUVA, where it was associated with 61% of visitor injuries and illnesses. At three other parks, CANY, EVER, and PORE, biking was associated with more than 15% of park-related visitor injuries and illnesses, but other activities had higher proportions of injuries and illnesses.

### **33.4 Park clusters by age:**

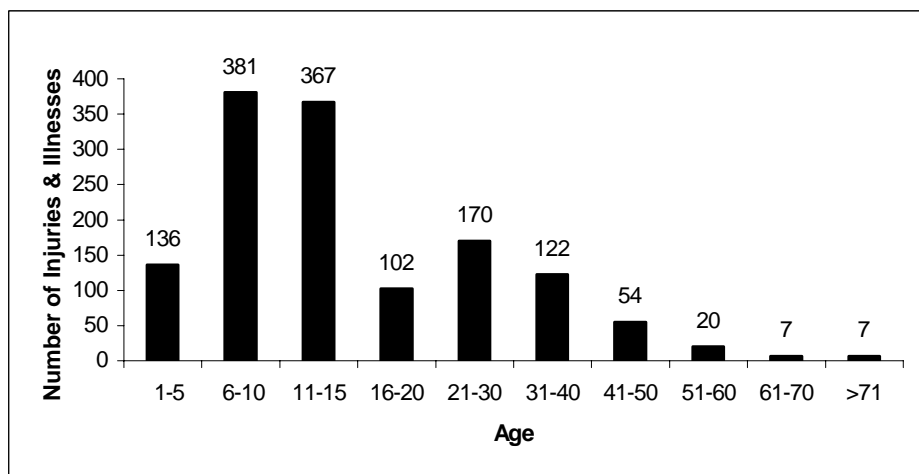
Two primary categories can be defined with respect to the age of visitors who were injured or became ill during their visit to a park. First, several parks are characterized by the high proportion of children 15 years and under who suffered injuries or illnesses. Within this category three sub-categories can be defined, according to whether young and middle-aged adults (ages 16 – 60) or older adults (61 and over) were also involved in relatively high numbers (but not as large as those 15 years and under).

- 1) Children 15 and under suffered the highest proportion of injuries and illnesses with relatively large numbers also of young and middle-aged adults but not the older adults (ASIS, PAIS);
- 2) Children 15 and under suffered the highest proportion of injuries and illnesses with relatively large numbers also of older adults (FOSU, LOWE), though readers should note the relatively small numbers of injuries and illnesses represented here; and,
- 3) Children 15 and under suffered the highest proportion of injuries and illnesses with relatively large numbers also of young, middle-aged, and older adults (CAVE, GETT, STLI, LIBI, MEVA).

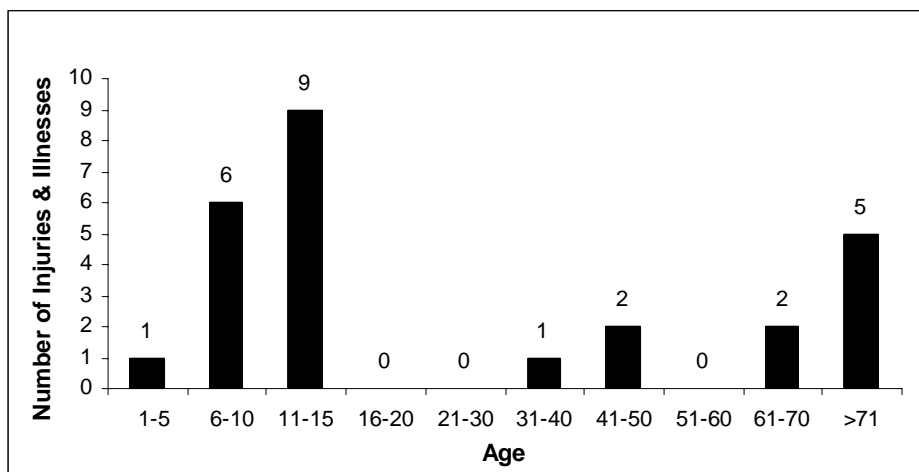
Second, several parks are characterized by the by the high proportion of middle-aged adults (31-60) who suffered injuries or illnesses. Within this category sub-categories can be defined, according to whether children (0-15) and young adults (16-30) were also involved in relatively high numbers.

- 1) Middle-aged adults had the greatest proportion with relatively large numbers also of children (ages 0-15) and young adults (ages 16-30) (BADL, CURE, CUVA, DEWA, OLYM, PORE);
- 2) Middle-aged adults had the greatest proportion with relatively large numbers also of young adults (ages 16-30) (BLRI, CANY, DENA, LAME, NATR, ROMO); and,
- 3) Middle-aged adults had the greatest proportion (BIBE, CAHA, EVER, GRTE, MORA, SAGU, YOSE).

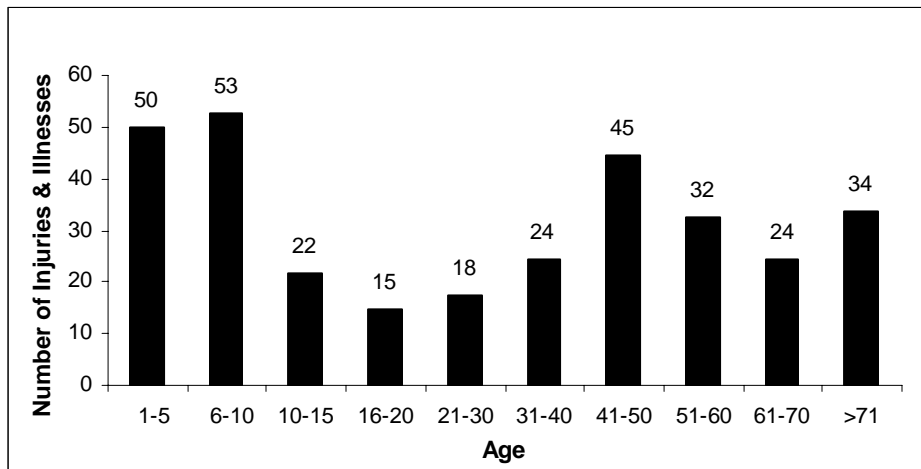
These six sub-categories can be illustrated using the data from the risk analysis database (Figures 33.1 to 33.6). Each sub-category has a unique pattern that can be represented by the charts representing the ages of visitors who suffered injuries or illnesses in a park.



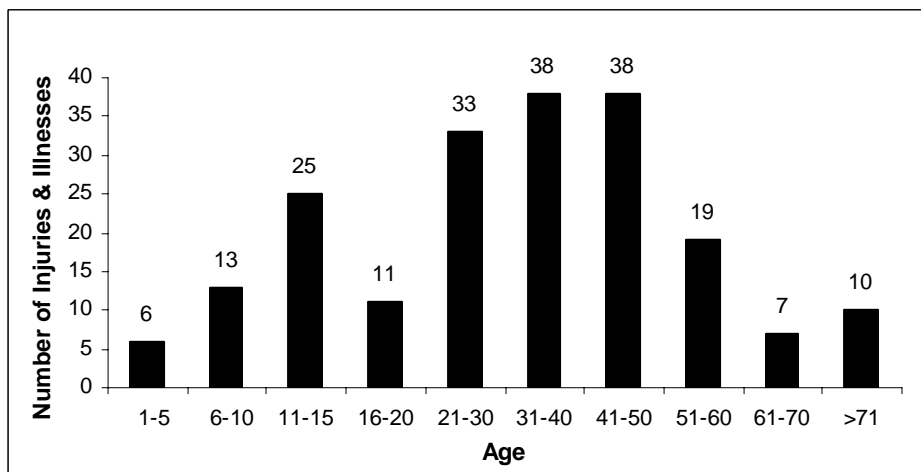
**Figure 33.1: PAIS where children were the most likely victims, with relatively large numbers also of adults but not the elderly.**



**Figure 33.2: LOWE where children were the most likely victims, with relatively large numbers also of elderly but not adults.**

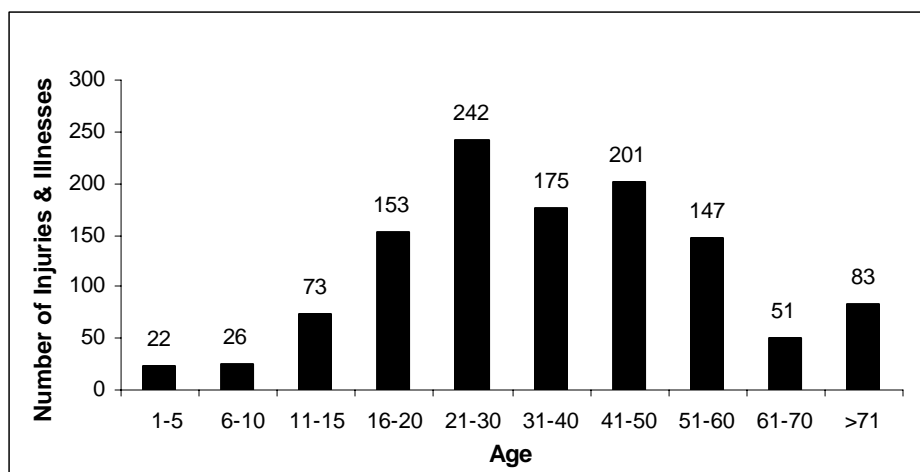


**Figure 33.3: CAVE where children were the most likely victims, with relatively large numbers also of both adults and the elderly.**

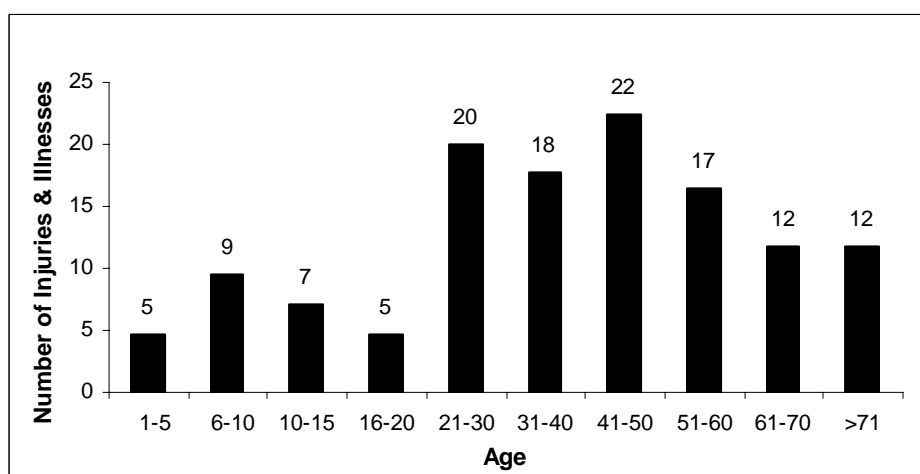


**Figure 33.4: PORE where middle-aged adults were the most likely victims, with relatively large numbers also of children and young adults.**





**Figure 33.5: BLRI where middle-aged adults were the most likely victims, with relatively large numbers also of young adults.**



**Figure 33.6: CAHA where middle-aged adults were the most likely victims.**

### 33.5 Park clusters by sex:

Parks vary widely with respect to how many of the victims are male or female. Denali National Park had the highest percentage of males involved in accidents (76%). Little Bighorn National Monument had the highest percentage of females involved in accidents within our sample (75%).

The cluster analysis revealed three groups of parks: (1) parks in which the proportions of male and female victims were similar; (2) parks in which there were proportionally more male victims; and (3) parks in which there were proportionally more female victims. The cluster analysis considered parks to be male-dominated if the percentage of male victims was higher than 53% and female-dominated if the percentage of female victims was higher than 54%. Thus, the three groups are

- 1) parks in which the proportions of male and female victims were similar (EVER, BIBE, ROMO, ASIS, CAHA, and GRTE);
- 2) parks in which there were proportionally more female victims (YOSE, LOWE, PORE, CUVA, MORU, MEVE, STLI, CAVE, GETT, AND LIBI); and
- 3) parks in which there were proportionally more male victims (DENA, LAME, CURE, SAGU, MORA, BLRI, DEWA, NATR, OLYM, OZAR, PAIS, CANY, BADL, FOSU).

Unfortunately, this analysis does not necessarily highlight clearly the differences between the parks. For example, parks considered as having similar proportions of male and female victims ranged from 49% to 52% females (i.e, 51% to 48% males). Parks with proportionally higher male victims ranged from 53% to 76% males. Parks with proportionally higher female victims ranged from 54% to 75% females.

From a management perspective, 53% males vs. 47% females may still seem very close to an even split, and one might wish to define the groups slightly differently. For example, the threshold could be set at 60% visitor accidents involving males or females. Table 33.2 shows the results of using this approach. Using this selection criterion places more park units in the “evenly split” group. Ultimately, there is no “correct” choice to use for defining the groups. The choice should be one that provides the most benefit for management efforts to understand and respond to visitor safety needs in the park system.

One difficulty of interpreting these results is that we don’t know how many of the visitors were male or female – we know only the number of males and females who reported suffering injuries or illnesses. Consequently, a higher proportion of male victims may not indicate that males are at greater risk, *per se*, but rather that a higher proportion of males visited that park.

### 33.6 Park clusters by activity, age, and sex

Finally, we conducted a cluster analysis using all of the above variables: activity types, age groups, and sex of visitors who suffered injuries and illnesses at the parks in our sample. The thirty park units grouped into five major categories, that are roughly the same as those that emerged from our analysis of activity types (Section 33.3). The five groups are:

- 1) Parks in which ***motor vehicle operation*** accounted for the largest number of injuries and illnesses to visitors (BLRI, NATR, DEWA, SAGU, CURE);
- 2) Parks in which ***frontcountry activities*** accounted for the largest number of injuries and illnesses to visitors (LOWE, STLI, CAVE, FOSU, GETT, MORU, LIBI);
- 3) Parks in which ***backcountry activities*** accounted for the largest number of injuries and illnesses to visitors (CANY, PORE, OLYM, ROMO, BIBE, GRTE, MORA, YOSE, BADL, DENA);
- 4) Parks in which ***water-related activities*** accounted for the largest number of injuries and illnesses to visitors (CAHA, OZAR, ASIS, PAIS, LAME); and,
- 5) Parks in which ***a mix of activities*** accounted for the largest number of injuries and illnesses to visitors (EVER, MEVE, CUVA).

For each of these groups, however, sub-groups associated with the variables of age and sex can be defined. These subgroups illustrate that visitor accident characteristics can be defined for sets of

| Park clusters                                    | Percentage of victims by sex |           |
|--|------------------------------|-----------|
|  | Females                      | Males     |
| <b>Parks with similar proportions of victims</b> |                              |           |
| SAGU   | 41                           | 59        |
| MORA   | 42                           | 58        |
| BLRI   | 43                           | 57        |
| DEWA   | 43                           | 57        |
| NATR   | 44                           | 56        |
| OLYM   | 44                           | 56        |
| OZAR   | 45                           | 55        |
| PAIS   | 45                           | 55        |
| CANY   | 45                           | 55        |
| BADL   | 47                           | 53        |
| FOSU   | 47                           | 53        |
| EVER   | 49                           | 51        |
| BIBE   | 50                           | 50        |
| ROMO   | 50                           | 50        |
| ASIS   | 51                           | 49        |
| CAHA   | 51                           | 49        |
| GRTE   | 52                           | 48        |
| YOSE   | 54                           | 46        |
| LOWE   | 55                           | 45        |
| PORE   | 57                           | 43        |
| CUVA   | 58                           | 42        |
| <b>Parks with more female victims</b>            |                              |           |
| MORU   | <b>60</b>                    | 40        |
| MEVE   | <b>61</b>                    | 39        |
| STLI   | <b>64</b>                    | 36        |
| CAVE   | <b>66</b>                    | 34        |
| GETT   | <b>67</b>                    | 33        |
| LIBI   | <b>75</b>                    | 25        |
| <b>Parks with more male victims</b>              |                              |           |
| DENA   | 24                           | <b>76</b> |
| LAME   | 36                           | <b>64</b> |
| CURE   | 40                           | <b>60</b> |

**Table 33.2: Clusters by sex using a 60% threshold for inclusion**

park units on the basis of visitor activities and visitor characteristics. An understanding of these groupings could be useful for improving park management visitor safety programs.

Parks in which *motor vehicle operation* accounted for the largest number of injuries and illnesses to visitors include BLRI, NATR, DEWA, SAGU, and CURE. These park units may be grouped into two sub-groups. First, the visitors suffering injuries and illnesses in BLRI and NATR are primarily of the ages 16-60 and proportionally more likely to be male (57% and 56%, respectively). Second, visitor accidents at the three other park units (DEWA, SAGU, and CURE) are more likely to involve middle-aged adults (31-60) with a secondary population of children (0-15 years old). Again, males are more likely to suffer the injuries and illnesses (57%, 59%, and 60% respectively). It would appear that families with children may be more likely to be victims in these three parks than in BLRI and NATR.

Parks in which *frontcountry activities* accounted for the largest number of injuries and illnesses to visitors include LOWE, STLI, CAVE, FOSU, GETT, MORU, and LIBI. The visitors suffering from injuries and illnesses at these parks are more likely to be children (ages 0-15). These park units may be grouped into two sub-groups based on other features of the visitors. First, after children (ages 0-15), middle-aged adults (31-60 years old) account for the highest proportion of visitor injuries and illnesses at STLI, CAVE, GETT, MORU, and LIBI. At each of these parks, the victim is more likely to be a female, as well (with respectively 64%, 66%, 67%, 60%, and 75% of the victims being female). LIBI is unique among these parks because no young adult (16-30 years old) suffered an injury or illness during their visit.

Second, after children (ages 0-15), elderly adults (ages 61 and over) account for the highest proportion of visitor injuries and illnesses at LOWE and FOSU. Sex is not a variable that helps to define this group, however since 55% of the victims at LOWE were female, but only 47% was female at FOSU.

Parks in which *backcountry activities* accounted for the largest number of injuries and illnesses to visitors include CANY, PORE, OLYM, ROMO, BIBE, GRTE, MORA, YOSE, BADL, and DENA. These park units may be grouped into three sub-groups based on other features of the victims.

First, at BIBE, GRTE, MORA, and YOSE, there are more middle-aged adult victims (31-60). Sex is not a variable that helps to define this group further, however. Males were more likely to be among the victims at MORA (58%), but females were more likely to be victims at YOSE (54%). At GRTE and BIBE there was an even split among females and males (with 52% and 50% females, respectively).

Second, at CANY, PORE, OLYM, BADL, DENA, and ROMO, a combination of middle-aged visitors (ages 31-60) and those from other younger age groups (0-15 or 16-30) suffer the most injuries and illness. Sex is not a variable that helps to define this group further, however. Males were proportionally more represented as the victims of visitor accidents at CANY (55%), DENA

(76%), BADL (53%), OLYM (56%) and PORE (53%). At ROMO there was an even split among females and males.

Parks in which *water-related activities* accounted for the largest number of injuries and illnesses to visitors include CAHA, OZAR, ASIS, PAIS, and LAME. These park units may be grouped into three sub-groups based on other features of the visitors.

First, visitors suffering injuries and illnesses at ASIS and PAIS are most often children (ages 0-15) who were swimming or wading. Sex is not a variable that helps to define this group further.

Second, victims at CAHA and OZAR were more likely to be middle-aged adults (ages 31-60) who were boating or swimming. Sex is not a variable that helps to define this group further.

Third, many of the victims at LAME were males, who were aged 16-60 and engaged in activities using motorized boats.

Parks in which *a mix of activities* accounted for the largest number of injuries and illnesses to visitors include EVER, MEVE, and CUVA. At CUVA biking is the activity associated most often with visitor injuries and illnesses, with walking the second most significant activity. At EVER walking along paved areas and interpretive trails, as well as biking and water-related activities accounted for most visitor injuries and illnesses. And, at MEVE walking along paved areas and interpretive trails and indoors at the visitor center accounted for most accidents, but backcountry activities and motor vehicle operations were also important factors. This final category can be thought of as including “outliers” that are distinct from the other parks in our sample. According to the hierarchical cluster analysis they are most closely aligned with the parks in the group defined by backcountry activities, described above.

The project has assembled an extensive database on almost 20,000 accidents at 30 selected National Park units and attempted to paint with broad-brush strokes the major patterns that emerge from the analysis of visitor injuries and illnesses. . Although the park units vary enormously in terms of risk conditions and the information in the database represents only a sampling of accident events in the 378 units within the entire National Park System, we believe that the information may be used to explore visitor risk management strategies and options, especially in conjunction with the findings from the companion analysis of visitor experiences and opinions.

### **Acknowledgements**

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