

Preventative Search and Rescue for Rocky Mountain National Park (RMNP) Phase 1 Report

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Rocky Mountain National Park



EXECUTIVE SUMMARY

The responsibility for promoting safety in our national parks and recreational areas is shared by those who visit the parks and by the National Park Service, which should provide information about risks and exposures to those who are unfamiliar with the park environment. Collecting and analyzing search and rescue and injury data in our national park system can provide information about what activities visitors engage in that are most likely to lead to injuries, illness, and rescue. The risks and exposures are different depending on the park's location, elevation and natural characteristics making the collection of park-specific data important to making the information relevant to those who need it. Although natural events such as cold, heat, visibility, lightning, rock slides, snow and ice all may cause a search and rescue to be required, most of the reasons for a search and rescue at the Rocky Mountain National Park were reportedly due to a lack of preparation on the part of the park visitor and insufficient information about the conditions they encountered during their visit and activity in the park. However, as can be seen in this report, data not presently collected could be very useful in planning how to reduce injuries, illnesses and the need for a search and rescue.

For the years 2009-2011, the overall rate of fatal injuries was 0.145 per 100,000 visitors (13 deaths in 8,955,087 recreational visitors) and the overall non-fatal injury/illness rate was 1.8 injuries per 100,000 visitors (161 in 8,955,087 recreational visitors). The fatal injury rate is slightly higher than that reported in a 2002 report, but the non-fatal injury rate is notably lower than previously reported. More men than women were involved in a search and rescue, but it may be that more men engage in activities that put them at risk of requiring a search and rescue. The 20 to 29 age group were over-represented in the reports. Visitor data was not broken down by gender or age group so interpretation of the risk in these groups cannot be determined.

The overall picture suggested in this report is that park visitors between 20 and 29 are likely to initiate more incident reports, but are less likely to do so as a result of an injury or illness. Those over 50 years of age are more likely to experience an injury or illness requiring a search and rescue. In both cases, the primary contributing causes reported are poor judgment and insufficient preparation. The primary activity in both search and rescue and injury/illness was day hiking. These findings could aid in interventions targeting these age groups and providing greater information to assist them in preparations for their activities, but cannot be accepted with confidence due to the lack of critical pieces of information in the incident reports. First, the incident report does not report whether an injury or illness necessitated the search and rescue operation or whether the injury was a result of first becoming lost. This information by age group would be important in understanding whether those over 50 are experiencing falls, developing altitude sickness or are injured as a result of getting off a maintained trail, especially as darkness sets in. Additionally, it is likely that the use of alcohol and drugs as a contributing factor is underreported; few reports of drugs were cited as a contributing cause, but it is likely to be a cause in the under 30 age group. The primary contributing causes given in this report, poor judgment and insufficient preparation, could be the focus of future safety programs in the park, but more information is needed to target the messages.

The Rocky Mountain National Park would benefit from more complete reporting on the disposition and duration of searches. Adding a response category for whether the incident report was initiated from inside the park or outside the park would aid in determining how much information was available at the time the search was undertaken. Greater information could be collected on factors related to human error i.e., poor judgment could be better defined to include specific details such as beginning a hike too late in the day, underestimating the time needed to make the hike and underestimating the fitness level required.

Introduction

Systematic analysis of illnesses and injuries occurring among visitors at the Rocky Mountain National Park (ROMO) has not been done. In 2002, the ROMO was included in a national survey in which almost 20,000 visitor incidents were assessed for the period 1993-1998 (Tuler & Golding, 2002). Data collected came primarily from the following sources: Emergency Medical Services Reports; Case Incidents Reports; and Morning Reports (Tuler & Golding, 2002). In that study, 21 fatal injuries were reported reflecting a rate of 0.13 fatal injuries per 100,000 visitors which was below the overall rate reported among the 30 parks (0.10 per 100,000) in the sample (Tuler & Golding, 2002). A total of 979 nonfatal injuries were reported reflecting a rate of 5.70 per 100,000 visitors; the nonfatal injury rate was higher than that reported (4.33 per 100,000) for all 30 parks in the sample (Tuler & Golding, 2002).

In 2008, Moffett & Newman reported fatal and nonfatal causes of injury based on Morning Reports. The three leading causes of fatalities were drowning (more than 30% of deaths), followed by motor vehicles (more than 25%), and falls (more than 20%) (Moffett & Newman, 2008). By activity the three leading causes of fatalities were driving (more than 25%), followed by swimming (more than 15%), followed by a tie between hiking and boating (more than 10%) (Moffett & Newman, 2008).

Tuler & Golding (2002) found that much of the data that would be useful for assessing visitor risk were not collected or were missing and that data on risk exposure was limited. Among a number of recommendations, the following represent some important suggestions for improvements: 1) establishing and maintaining a reporting system that would be useful and user-friendly, but adaptable to local and regional needs; 2) that the National Parks Service (NPS) collect detailed data about numbers and socio-demographic characteristics of visitors and the nature of visitor activities; that the NPS develop better mechanisms for systematic sharing of information among parks and managers in Washington DC; 3) that the NPS develop and conduct on-going analysis and evaluation of visitor injury data; and 4) that interdisciplinary teams of park staff should be established to conduct risk condition inventories at each park (Tuler & Golding, 2002).

The purpose of the project was to identify and review search and rescue incident reports, park visitor fatalities and injury data. The long term goal of the ROMO and NPS staff is to reduce the number of unintentional injuries among visitors. This project was developed to describe the patterns of visitor injuries based on existing data and to ensure the appropriate strategies and materials are available to prevent injuries and modify injury patterns.

Variables used to describe search and rescue incidents

Injury data were obtained from the park staff at ROMO and entered into an excel spreadsheet for analysis. Data sources from years 2009-2011 included: Emergency Medical Services Reports (EMSRs) and Search and Rescue Reports (SAR).

Demographics.

Reporting of gender and age is based on the gender and age of the leader of the group or individual that initiated an incident report. If there was an injury or illness, the age and gender are those of the injured or ill person(s). The type of visitor associated with the incident report was classified as National Park Service personnel (NPS), designated group (outdoor organization, park concession, tour group, youth/school/church group) and other (individuals, families and all other groups).

Characteristics of incident reports.

Duration and disposition of the search and rescue operation is presented exactly as it was extracted from the database. The expense of the search and rescue was categorized as being above or below \$500.00 based on budgetary systems in the national parks. Time of day represents when the incident was reported and not necessarily the time the individual or group went missing or incurred an injury or illness. Time was categorized into night (midnight to 5 am), morning (5 am to noon), afternoon (noon to 5 pm) and evening (5 pm to evening). The lag time could be hours to days between when the party became lost or experienced an injury to when the party was reported missing. For purposes of staffing, the ROMO is interested in when peak activity periods occur so they can anticipate staffing needs. To assist in addressing this, the number of incidents by season and time of

day were calculated and presented as a percent of total reports and as the number of incident reports per 100,000 visitors to the park.

Contributing factors.

Contributing factors were coded in order of importance with contributing factor 1 being considered the primary reason for the incident report. Each incident report gives up to three contributing factors. The primary and secondary contributing factors are reported here because of a small number of responses in the tertiary contributing factor. The contributing factors were recoded both because of small numbers and because there were many related factors. Not represented in the dataset are the factors avalanche, equipment failure, fire, flood, natural event and weather-related heat events. The recoding was done by combining categories. Factors attributable to nature included: events related to animals, rock slides, and snow or ice. Factors attributable to weather included: cold, visibility, lightning and wind. Human error included darkness, drugs, falls, fatigue or physical condition, insufficient preparation, and insufficient information or poor judgment.

Activities engaged in at the time of the incident report.

There were 29 possible activities that the subjects were engaged in at the time of the incident report, but only 19 were represented in the dataset. These 19 were collapsed into categories based on injury prevention and staffing needs of the ROMO. The categories included vehicle-related incidents, climbing, sporting events, day hiking, overnight hiking, and winter activities. Specifically, vehicle activities included motorized aircraft, bicycling, non-motorized boating, snow vehicle and other vehicle. Climbing activities included: scrambling, technical climbing with ropes, technical climbing without ropes, mountaineering with ropes, ski or snowboard mountaineering, and mountaineering without ropes. Sporting activities included fishing, hunting/gathering and swimming. Hiking or day walking was a separate category, as was hiking overnight (e.g. backpacking). The ROMO provides special instruction to visitors coming into the park for backpacking activities. Winter activities included: skiing, snowshoeing and snowboarding.

Fatalities.

Gender, age, search duration and disposition, primary contributing factor and activity engaged in are described for the deaths occurring in the years 2009-2011.

Analyses of search and rescue incident reports.

The incident reports are described in terms of the numbers of reports per year, month of the year, day of the week and time of day. An overview of the incident reports includes the number of injuries per incident report, whether a search and rescue was undertaken, the expense incurred in a search and rescue, the disposition and duration of each search and rescue undertaken, and the gender and age of the leader and other participants in the party associated with the incident report (up to three individuals described per incident report). A comparison was then made between incident reports that resulted in a full search and rescue and those that did not result in a search and rescue using the characteristics of the incident, demographics of the individuals, the visitor activities, and contributing factors that prompted the incident report. The type of search and rescue undertaken was described.

Analysis of injury incidents

Injury analysis within the incident reports

Injury rates were calculated by month for each of the three years using the number of recreational visitors to the ROMO for the same period of time. Injuries per 100,000 visitors were graphed to present trends by month. The goal of the analyses was to compare incidents that involved an injury or illness to those that did not in order to assess what exposures were higher in those who sustained an injury or illness. First, an overview of injury/illness reports by year, month, day of week and time of day (when the report came in) was described. Second, the data were categorized into two groups based on whether the incident reported included an injured or ill individual. Demographics, characteristics of the search, activities and contributing factors were compared between incidents with and without an injury or illness. Due to the high number of day hiking incidents and the possibility that interventions might reduce these adverse events, analyses were undertaken to compare search and rescue outcomes of hiking events to other activities that resulted in an injury.

Results

Fatalities

Between 2009-2011 there were 13 fatalities reported in the ROMO. Twelve (92.3%) decedents were males and one (7.7%) was female. The age of the decedents and disposition of the search are shown in Table 1. The majority of deaths occurred among people who were 50 years of age or older, found by searches that lasted under 24 hours and were among people involved in hiking or day walking. The primary causes of death were falls, although for three deaths, no information on cause was provided.

Incident Reports

Table 2 shows the distribution of incident reports by year, month of the year, day of the week and time of day. Peaks are seen in the summer months beginning in June and continuing through September. As expected, Saturdays and Sundays had the highest number of incidents; reports came in during the afternoon and evening hours with about 75% of incidents reported between 1:00 pm and 10:00 pm. Table 3 shows the number of incident reports by time of day during each season of the year. In the winter months, afternoon was the most likely time to receive a report, but in summer the evening hours were the busiest time for incidents to be reported. Figure 1 shows graphically the number of searches per 100,000 recreational park visitors by month for each of the three years. The highest number of searches occurred in February of 2010, followed by August of that same year. Peaks in the winter months may be associated with higher levels of snowfall when winter activities such as snowshoeing and cross-country skiing attract winter visitors.

The majority of incidents did not involve any injuries or illnesses (Table 4). When there was an illness/injury the incident usually involved only one. More than half of the incidents resulted in a search with most of them costing less than \$500. A majority of incidents were resolved without agency assistance. Of those that did involve agency assistance, 3.3% were determined to be unnecessary; 15.6% of the records did not provide information on the disposition of the search. Although the majority of searches lasted less than 24 hours, more than 20% of records did not note the duration of the search. Over 70% of people involved in incidents in the park were males with the highest percentage of involved people being 20-29 years of age.

The number of searches conducted was greater in 2010 than in 2011 but no significant differences were observed by month of the year, day of the week and time of day (Table 5). Overall, evenings had the highest number of incoming search and rescue reports and were slightly more likely to require searches (Figure 2). Approximately 95% of incidents were reported by individuals, families and other social groups with the remaining 5% reported by formal groups and NPS workers. Table 6 shows a comparison of characteristics of individuals involved in incidents that required a search and those that did not. Visitors involved in a search and rescue were more often male, between 20 and 29 years of age, were more frequently engaged in climbing and less likely to be day hikers compared to those not requiring a search. Weather and natural events were cited more frequently as contributing factors in those needing search and rescue. Figure 3 compares the age distribution of those involved in an incident report by whether a search and rescue was undertaken. Day hiking and climbing were the primary activities reported in the incident reports, regardless of search status (Figure 4). Categories of human error as primary and secondary contributing causes are shown in Figures 5 and 6, respectively. Poor judgment and insufficient preparation were more frequently reported when a search was needed; falls and darkness were more frequently reported in cases where a search was not undertaken. However, the secondary causes, falls and darkness, were more frequently reported in cases of a search. Figure 7 shows that the most common method of rescue was hiking to locate and rescue the park visitor.

Injuries

Figure 8 is a graph of the injuries reported in the ROMO per 100,000 recreational visitors to the park during the years 2009-2011. Peak times for injuries were seen for the summer months, but there was also a peak in the winter months in January and February, likely due to winter activities such as backcountry skiing, snowboarding and snowshoeing. The month of November consistently showed no injuries occurring in the ROMO. July and August were the months with the highest number of injuries. Figure 9 shows the time of day and whether an

injury or illness occurred. Injuries were more frequently reported in the afternoon, whereas non-injury incidents occurred in the evening hours.

Table 7 shows a comparison of characteristics of park visitors who were injured or ill in an incident report compared to those who were not injured or ill. Approximately 90% of injuries were reported by individuals, families and other social groups with the remaining 10% occurring among formal groups and NPS workers. A greater number of injured or ill individuals were older than 50 compared to those not injured or ill (46.3% vs. 27.0%; Table 7). Although overall a higher percentage of visitors were aged 20-29 years, there was a lower percentage of incidents involving injury/illness among this age group while there was a higher percentage of injury/illness incidents among visitors aged 50 years and older (Figure 10). Nearly 77% of the injured or ill visitors required a rescue by searchers. Of those not injured or ill, 81% did not require a search and rescue. By far the most common visitor activity was hiking, but the relative proportion of injuries in climbers and backpackers was elevated as well (Figure 11). Human error was the most commonly reported category of primary and secondary contributing factors. Within this category, injuries were more frequently attributed to fatigue and falls (Figure 12). Insufficient preparation and fatigue were commonly cited secondary causes for injury/illness incidents (Figure 13).

Comparing day hiking to other visitor activities showed that individuals engaged in day hiking were more likely to be found than those participating in other activities, but other activities were more likely to be resolved without agency assistance (Figure 14). Rescuing a hiker usually cost less than \$500 and those involved in other activities needing searches more often cost greater than \$500 (Figure 15).

Comparison to the Rocky Mountain Visitor Study conducted in summer 2010 and winter 2011.

A random survey of park visitors was undertaken from June 18, 2010, through June 24, 2010 (Blotkamp et al., 2011). A total of 755 respondents returned questionnaires asking about activities they undertook in the ROMO. Those returning the questionnaires were significantly older than those who did not respond and were more likely to be visiting with their families. Thus, the survey may not be representative of the population of ROMO park visitors overall. Nonetheless, we compared the percentage of those who came to the park for purposes of day hiking with the percent of day hikers in the incident and injury reports. Hikers were overrepresented in the incidents report compared to the visitor survey. In the summer 2010 survey, 57% reported that they came to the ROMO to hike. In this report, the overall percent of hikers requiring a search was 65.3%; 72.7% did not require a search but prompted an incident report. Similarly, 64.6% of incident reports where an injury or illness occurred were due to day hiking. Future data collection related to incident reports should assess whether visitors who had not planned on hiking in the ROMO spontaneously decide to hike and whether this accounts for the contributing factor of being unprepared in the incident reports. In the winter 2011 report on 579 park visitors, 34% reported snowshoeing as their primary activity in the park (Papadogiannaki et al., 2011). Again, it is possible that proper planning had not been undertaken. This is an area where targeted messages about adequate planning could be initiated, but more information is needed.

Table 1: Age and disposition of the decedents, Rocky Mountain National Park, 2009-2011

Characteristics	Number N=13 n (%)
Age in years	
20-29	2 (15.4)
40-49	2 (15.4)
50-59	7 (53.8)
60+	2*(15.4)
Disposition of search	
Found by searchers	8 (61.5)
Other	5 (38.5)
Duration of search (n=8)	
<24 hours	6 (75.0)
24-48 hours	2 (25.0)
Categorized activities	
Climbing	
Roped	1 (7.6)
Not roped	2 (15.4)
Scrambling	1 (7.6)
Hiking/day walking	6 (46.1)
Swimming	1 (7.6)
Snowshoeing	1 (7.6)
Suicide	1 (7.6)
Contributing factors/cause	
Fall	6 (46.1)
Fatigue/physical condition	2 (15.4)
Judgment/insufficient information	2 (15.4)
Unknown	3 (23.1)

* One female decedent

Table 2: Temporal characteristics of Rocky Mountain National Park incidents, 2009-2011.

Characteristics	Number N=688 n (%)
Year	
2009	217 (31.5)
2010	248 (36.1)
2011	223 (32.4)
Month of the Year	
January	13 (1.9)
February	13 (1.9)
March	12 (1.7)
April	11 (1.6)
May	22 (3.2)
June	94 (13.7)
July	188 (27.3)
August	210 (30.5)
September	83 (12.1)
October	24 (3.5)
November	11 (1.6)
December	7 (1.0)
Day of the Week	
Sunday	134 (19.5)
Monday	98 (14.2)
Tuesday	93 (13.5)
Wednesday	83 (12.1)
Thursday	67 (9.7)
Friday	78 (11.3)
Saturday	135 (19.6)
Time of Day	
Night (12-5 am)	9 (1.3)
Morning (5-noon)	87 (12.6)
Afternoon (noon-5)	255 (37.1)
Evening (5-midnight)	337 (49.0)

Table 3 showing the highest volume of incidents reported by season and time of day, Rocky Mountain National Park, 2009-2011.

Season and Time of Day	Number of incident reports and % of total	Season and Time of Day	Number of incident reports and % of total
Winter (January-March)		Summer (July-September)	
Morning	4 (0.6)	Morning	61 (8.9)
Afternoon	22 (3.2)	Afternoon	157 (22.8)
Evening	12 (1.7)	Evening	257 (37.4)
		Night	6 (0.9)
Spring (March-June)		Fall (October-December)	
Morning	10 (1.4)	Morning	12 (1.7)
Afternoon	62 (9.0)	Afternoon	14 (2.0)
Evening	52 (7.6)	Evening	16 (2.3)
Night	3 (0.4)		

Figure 1. Number of searches per 100,000 recreational visitors to RMNP by month, 2009-2011

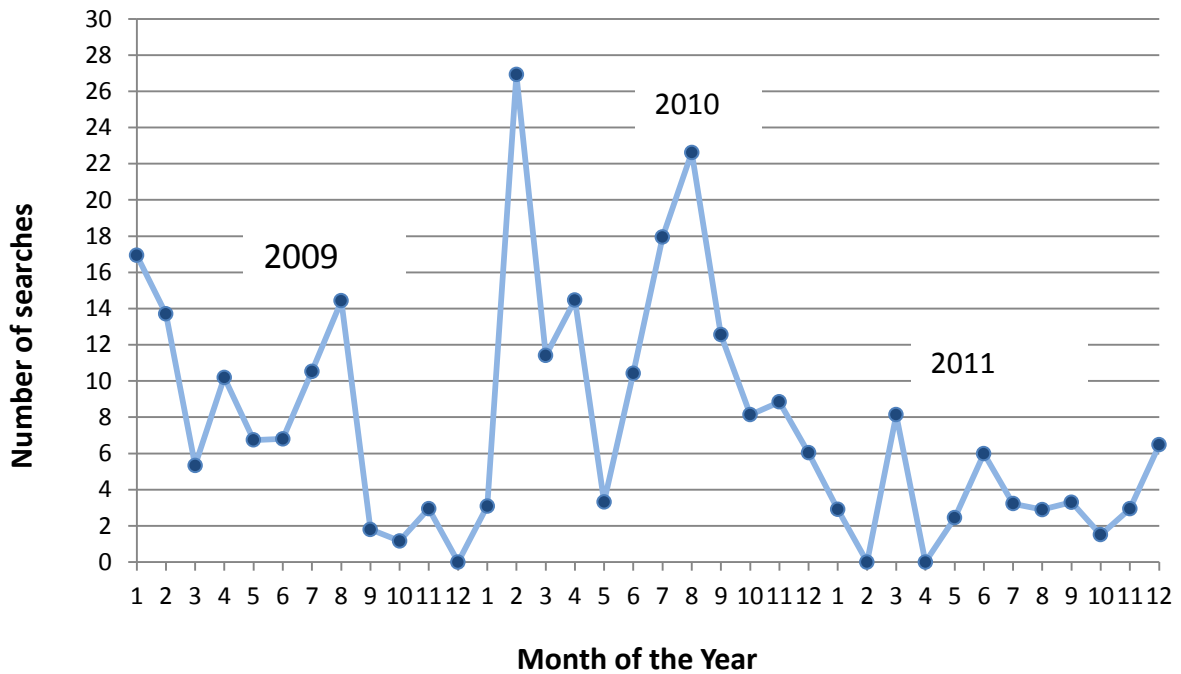


Table 4: Rocky Mountain National Park incidents,
2009-2011.

Characteristics	Number N=688 n (%)
Injuries per incident	
0	527 (76.6)
1	152 (22.1)
2	6 (0.87)
3	2 (0.29)
4	1 (0.15)
Total	688 (100)
Search Conducted	
No	308 (44.8)
Yes	380 (55.2)
Search Expenses greater than \$500	
No	589 (85.6)
Yes	99 (14.4)
Disposition of Search	
Found by searchers	144 (20.9)
Resolved without agency assistance	414 (60.2)
Search unfounded	23 (3.3)
Missing/Unknown	107 (15.6)
Total	688 (100.0)
Duration of Search	
< 24 hours	526 (76.5)
24-48 hours	6 (0.9)
Not Found	1 (0.1)
Unknown	155 (22.5)
Characteristics of People	N=1003 (%)
Gender distribution	
Female	296 (29.5)
Male	707 (70.5)
Total	1003 (100.0)
Age Distribution	
0 to 12	30 (2.9)
12 to 19	103 (10.3)
20 to 29	260 (25.9)
30 to 39	140 (13.9)
40 to 49	112 (11.2)
50 to 59	177 (17.6)
60+	102 (10.2)
Unknown	79 (7.9)
Total	1003 (100.0)

Table 5. Comparison of incidents requiring a search to those that did not, Rocky Mountain National Park, 2009-2011.

Characteristics	Search Conducted n (%)	No Search n (%)
Year		
2009	116 (30.5)	101 (32.8)
2010	211 (55.5)	37 (12.0)
2011	53 (14.0)	170 (55.2)
Total reports	380 (100.0)	308 (100.0)
Month of the Year		
January	8 (2.1)	5 (1.6)
February	10 (2.6)	3 (1.0)
March	9 (2.4)	3 (1.0)
April	8 (2.1)	3 (1.0)
May	11 (2.9)	11 (3.6)
June	52 (13.7)	42 (13.6)
July	104 (27.4)	84 (27.3)
August	115 (30.3)	95 (30.8)
September	41 (10.8)	42 (13.6)
October	13 (3.4)	11 (3.6)
November	5 (1.3)	6 (1.9)
December	4 (1.0)	3 (1.0)
Total	380 (100.0)	308 (100.0)
Day of the Week		
Sunday	81 (21.3)	53 (17.2)
Monday	57 (15.0)	41 (13.3)
Tuesday	57 (15.0)	36 (11.7)
Wednesday	49 (12.9)	34 (11.0)
Thursday	30 (7.9)	37 (12.0)
Friday	40 (10.5)	38 (12.3)
Saturday	66 (17.4)	69 (22.4)
Total	380 (100.0)	308 (100.0)
Time of Day		
Night (12-5 am)	8 (2.1)	1 (0.3)
Morning (5-noon)	41 (10.8)	46 (14.9)
Afternoon (noon-5)	139 (36.6)	116 (37.7)
Evening (5-midnight)	192 (50.5)	145 (47.1)
Total	380 (100.0)	308 (100.0)

Figure 2. Time of day incident reported by search status, Rocky Mountain National Park, 2009-2011

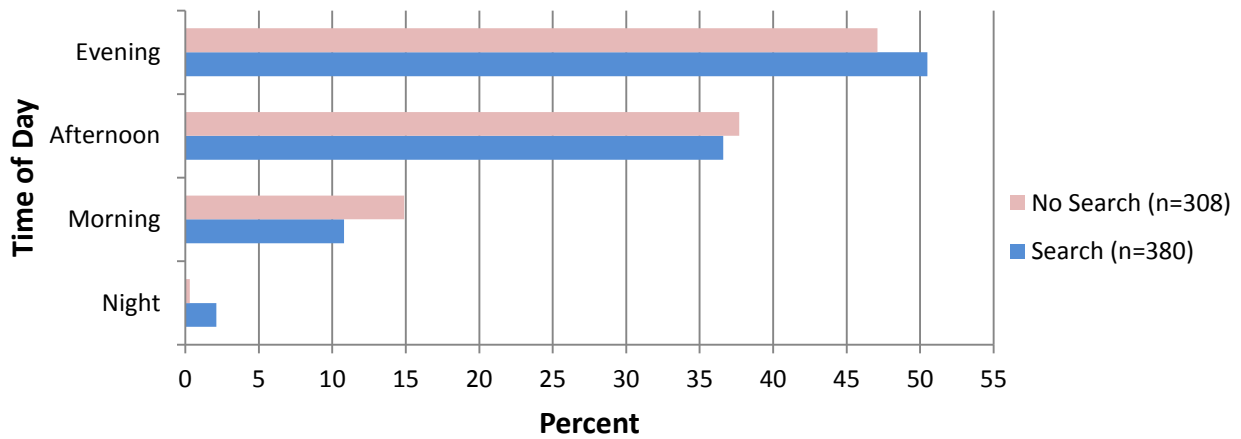


Table 6. Comparison between individuals involved in a search and those who did not require a search, Rocky Mountain National Park, 2009-2011.

Characteristic	Search Conducted n (%)	No Search n (%)
Age of visitor		
0 to 11	18 (3.3)	12 (3.1)
12 to 19	57 (10.5)	46 (12.1)
20 to 29	164 (30.1)	96 (25.3)
30 to 39	82 (15.1)	58 (15.3)
40 to 49	74 (13.6)	38 (10.0)
50 to 59	98 (18.0)	79 (20.8)
60+	51 (9.4)	51 (13.4)
Total	544 (100)	380 (100)
Gender		
Female	155 (27.1)	141 (32.8)
Male	418 (72.9)	289 (67.2)
Categorized activities:		
Vehicle-related	12 (3.2)	8 (2.6)
Climbing	69 (18.2)	37 (12.0)
Sporting event	4 (1.0)	4 (1.3)
Day hiking	248 (65.3)	224 (72.7)
Backpacking	19 (5.0)	15 (4.9)
Winter Activities	16 (4.2)	7 (2.3)
Unknown/Other	12 (3.1)	13 (4.2)
Total	380 (100)	308 (100)
Primary contributing factor		
Nature	10 (5.6)	6 (5.9)
Weather	6 (3.3)	3 (3.0)
Human error	164 (91.1)	92 (91.1)
Secondary contributing factor		
Nature	13 (15.1)	2 (4.9)
Weather	8 (9.3)	0
Human error	65 (75.6)	39 (95.1)

Figure 3. Age of visitors involved in search incidents, Rocky Mountain National Park, 2009-2011

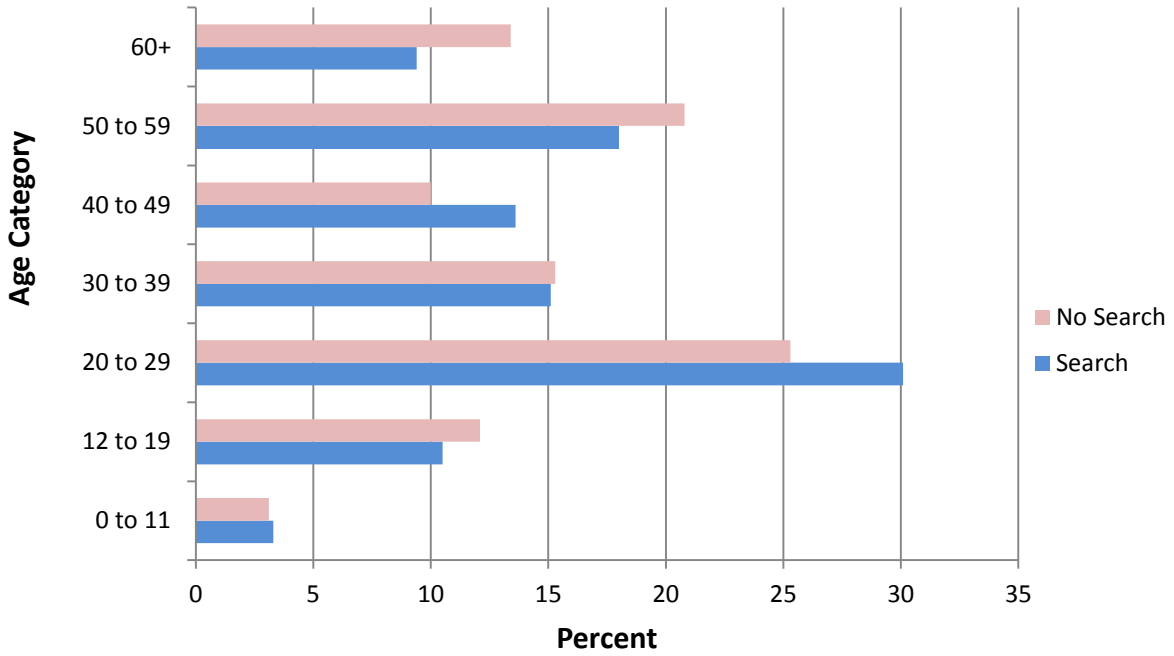


Figure 4. Activity category by search status, Rocky Mountain National Park, 2009-2011

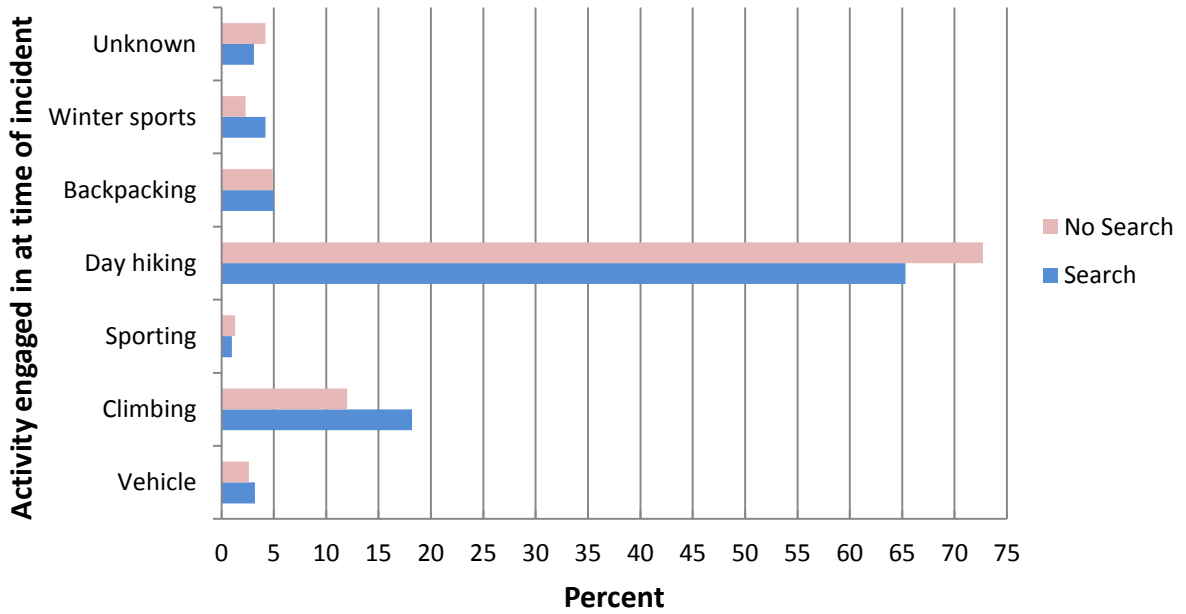


Figure 5. Primary contributing human error factors by search status, Rocky Mountain National Park, 2009-2011

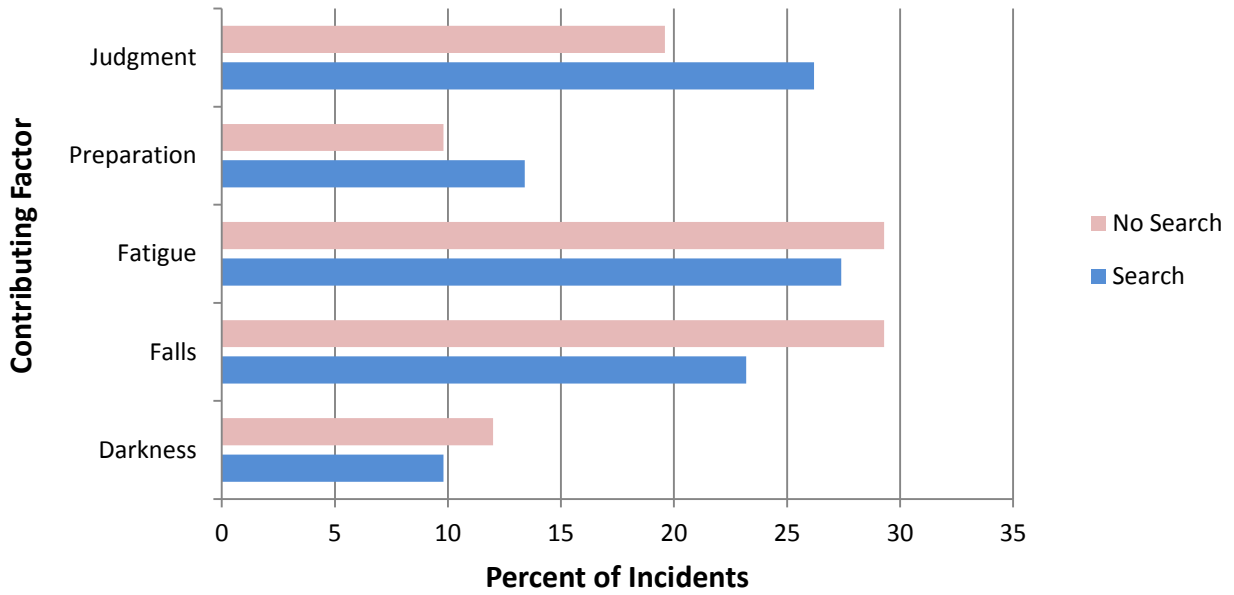


Figure 6. Secondary contributing human error factors by search status, Rocky Mountain National Park, 2009-2011

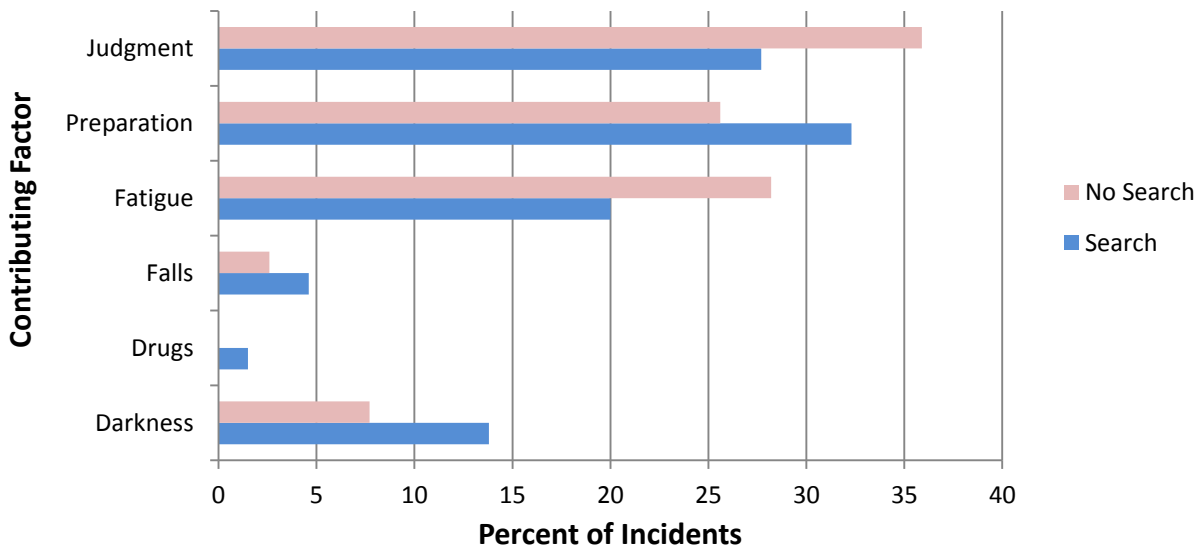


Figure 7:
Type of rescue operation (n=267), Rocky Mountain National Park,
2009-2011

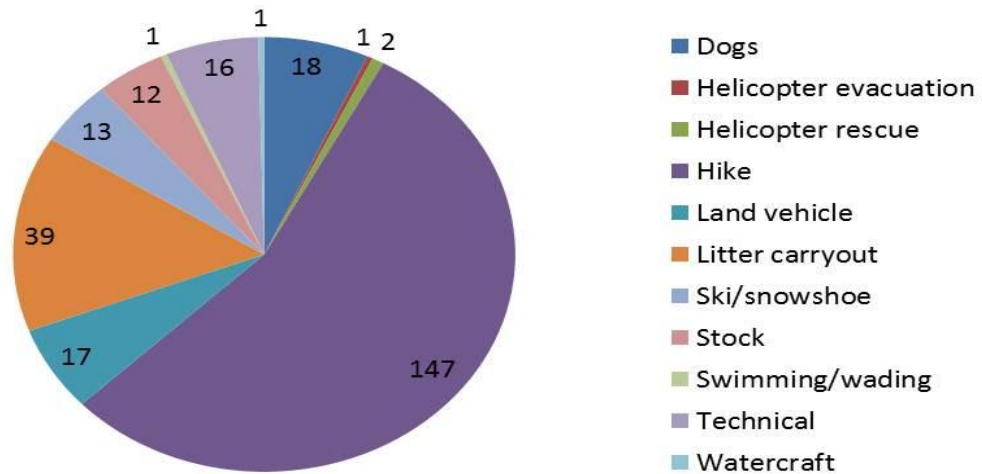


Figure 8. Injuries per 100,000 recreational visitors to RMNP by month,
2009-2011

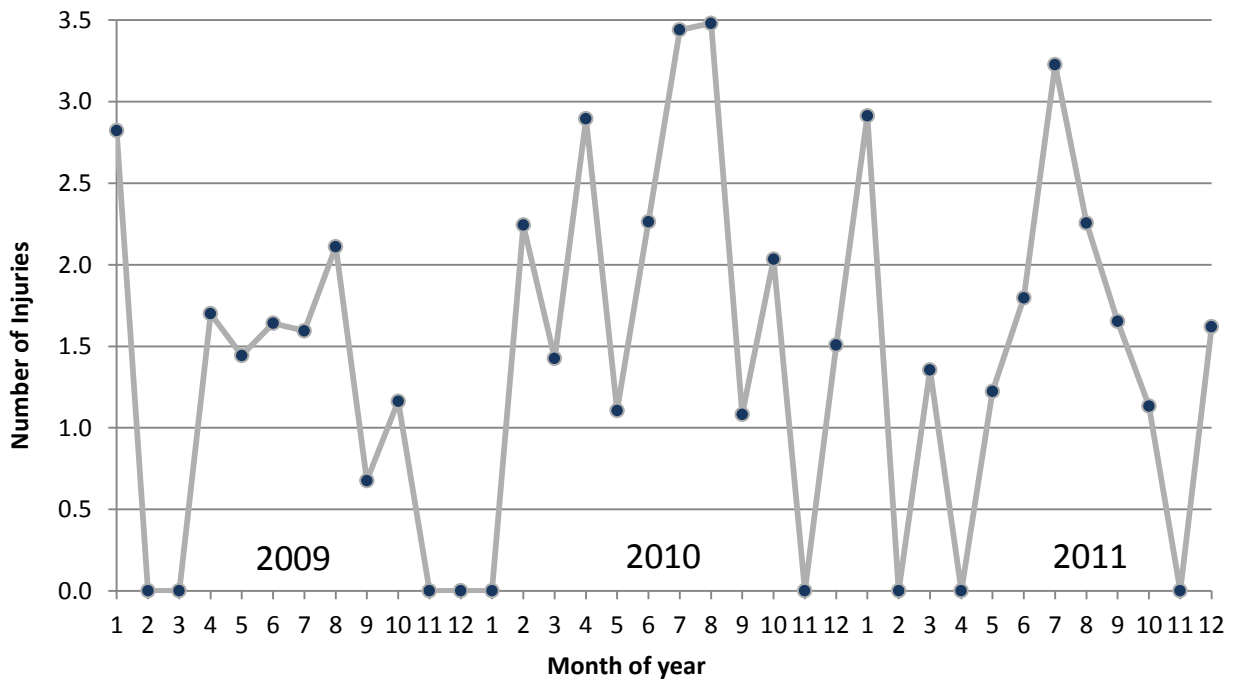
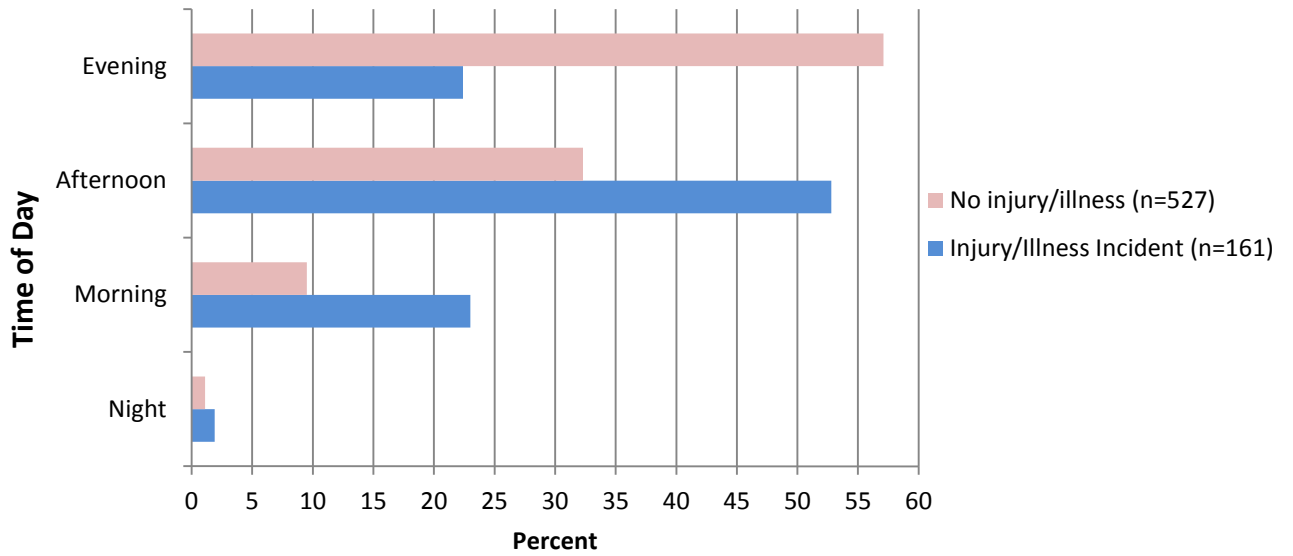


Figure 9. Time of day by injury status, Rocky Mountain National Park, 2009-2011



Tables 7. Comparison of characteristics of those who were injured or ill to those who were not at the Rocky National Park, 2009-2011.

Characteristic	Injury or Illness n (%)	No Injury or Illness n (%)
Age distribution		
0 to 11	4 (2.5)	23 (3.1)
12 to 19	12 (7.5)	89 (12.0)
20 to 29	33 (20.7)	221 (29.7)
30 to 39	15 (9.4)	121 (16.3)
40 to 49	23 (14.5)	88 (11.8)
50 to 59	38 (23.9)	134 (18.0)
60+	34 (22.4)	67 (9.0)
Total	159 (98.8)	743
Gender		
Female	74 (45.4)	214 (26.2)
Male	89 (54.6)	603 (73.8)
Park Visitors		
NPS	1 (0.6)	2 (0.4)
Indiv/family/other	145 (90.1)	510 (96.8)
Designated group ¹	14 (8.7)	11 (2.1)
Unknown	1 (0.6)	4 (0.8)
Total	161 (100)	161 (100)
Disposition of Search		
Found by searchers ²	73 (76.8)	71 (14.6)
Resolved: no agency assistance	20 (21.1)	394 (81.1)
Search unfounded	2 (2.1)	21 (4.3)
Missing/Unknown	66	41
Categorized activities:		
Vehicle-related	0	20 (3.8)
Climbing	29 (18.0)	77 (14.6)
Sporting event	1 (0.6)	7 (1.3)
Day hiking	104 (64.6)	368 (69.8)
Backpacking	13 (8.1)	21 (4.0)
Winter	5 (3.1)	18 (3.4)
Unknown/Other	9 (5.6)	16 (3.0)
Primary contributing factor		
Nature	12 (8.5)	5 (3.6)
Weather	1 (0.7)	7 (5.0)
Human error	128 (90.8)	128 (91.4)
Secondary contributing factor		
Nature	5 (8.9)	10 (14.1)
Weather	5 (8.9)	3 (4.2)
Human error	46 (82.2)	58 (81.7)

¹Outdoor organization, park concession, tour group, youth/school/church groups

²72 of the 73 where an injury was reported were found by searchers within 24 hours and one was found within 48 hours. Where no injury was reported, all 71 were found within 24 hours.

Figure 10. Age of visitors involved in incidents by injury/illness status, Rocky Mountain National Park, 2009-2011

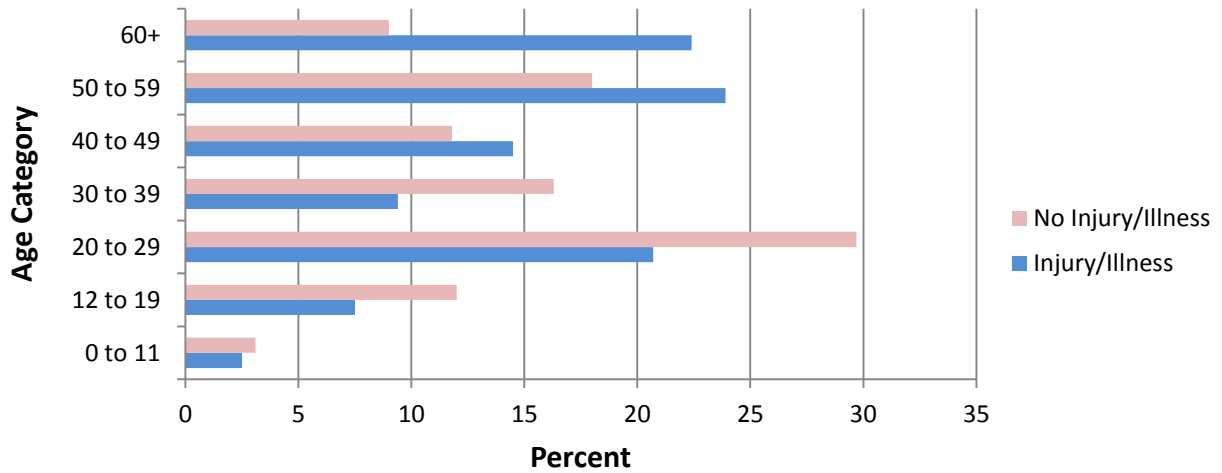


Figure 11. Activity category by injury/illness status, Rocky Mountain National Park, 2009-2011

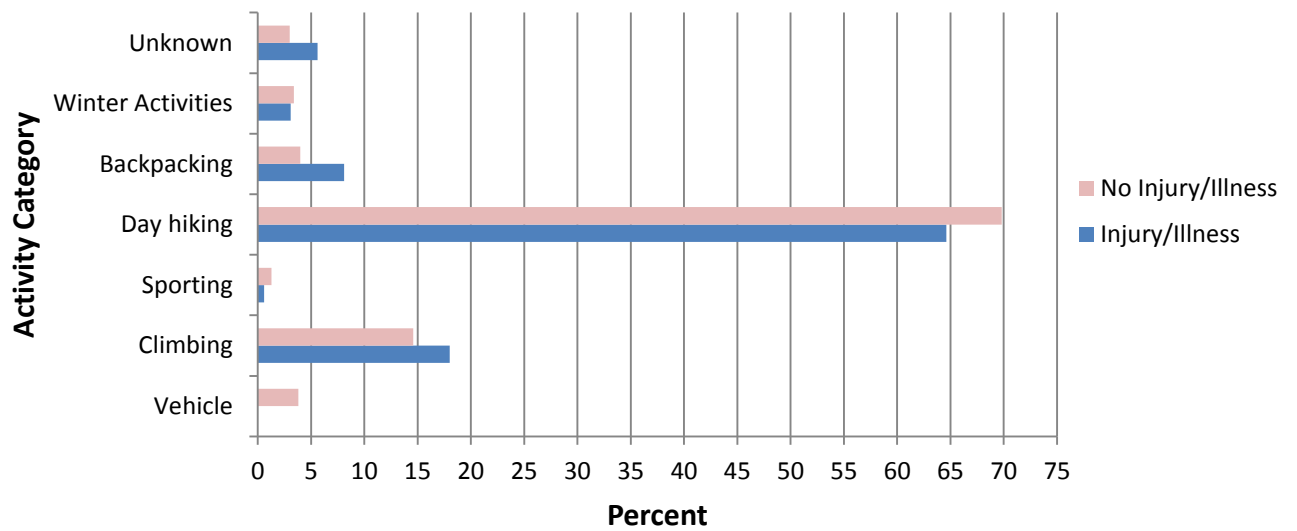


Figure 12. Primary contributing factors by injury/illness status, Rocky Mountain National Park, 2009-2011

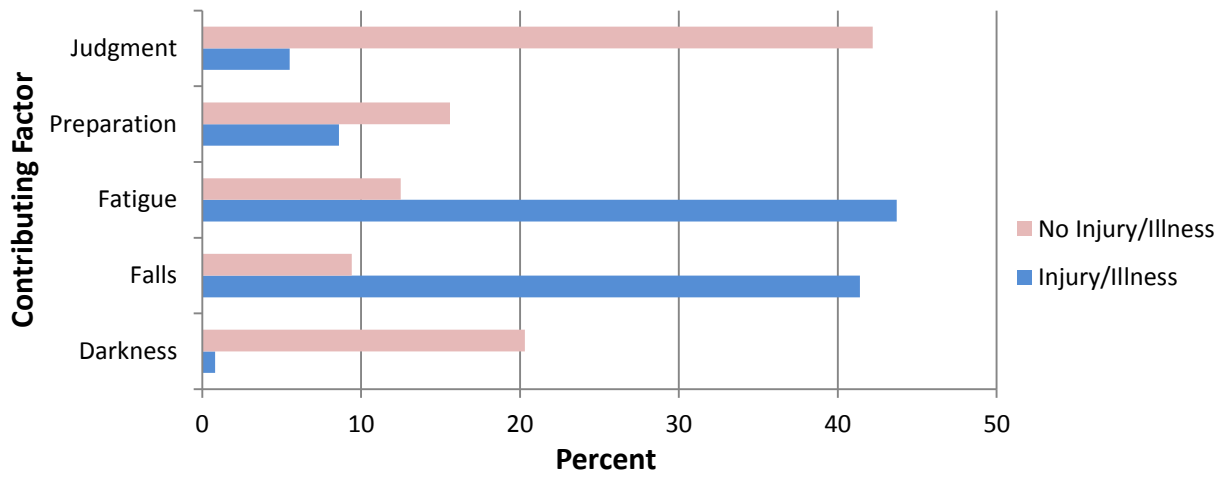


Figure 13. Secondary contributing factors by injury/illness status, Rocky Mountain National Park, 2009-2011

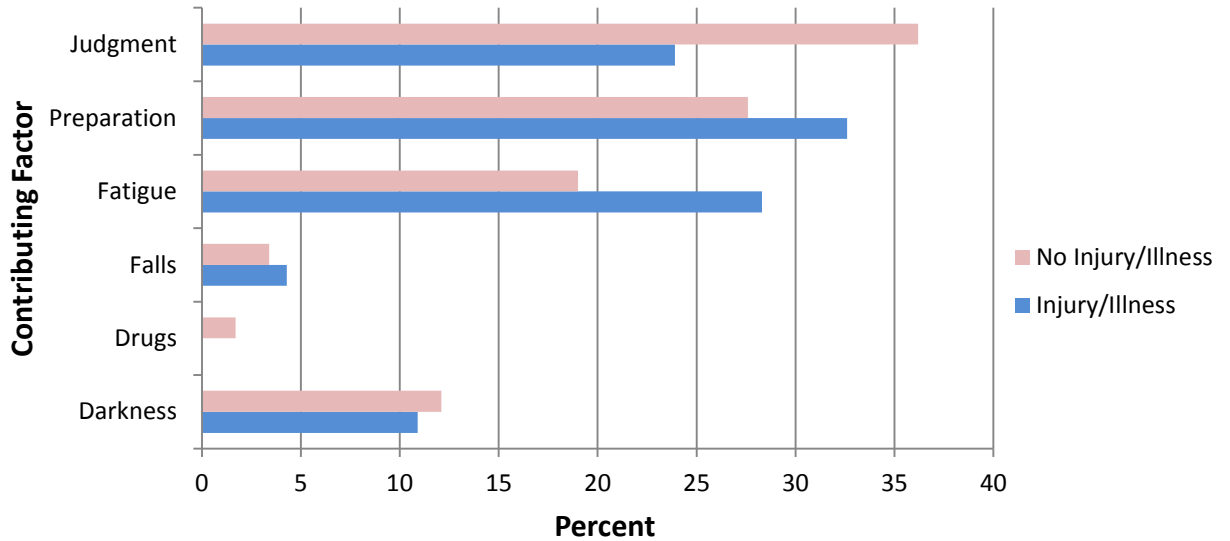


Figure 14. Disposition of search for day hikers compared to other visitor activities, Rocky Mountain National Park, 2009-2011

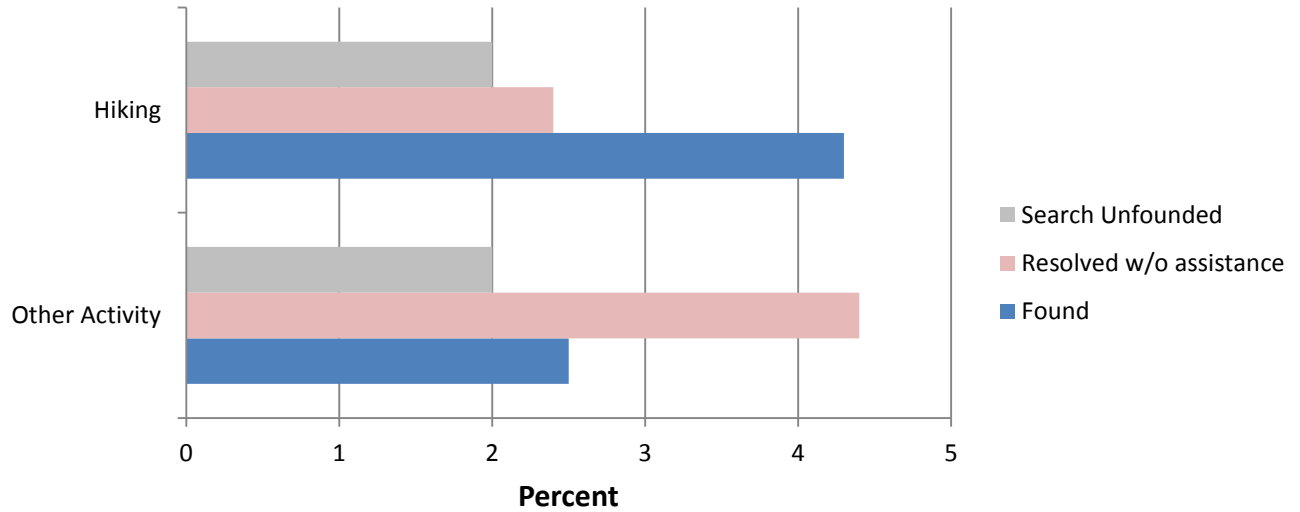
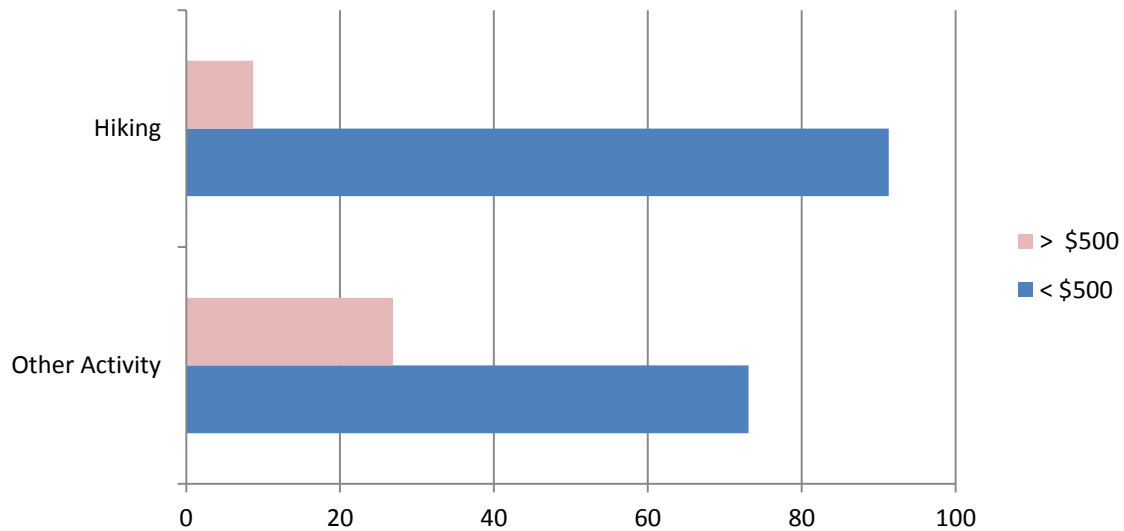


Figure 15. Costs of search for day hikers compared to all other visitor activities, Rocky Mountain National Park, 2009-2011



Injury Prevention Program/Activity Gaps

In order to assess gaps in the programs and activities relative to the injuries, the report describes incidents that occurred in RMNP in 2009-2011. Injury prevention programs targeting hikers and young park visitors (age 20-29 years) and older park visitors (50+ years of age) are warranted based on the results presented in this report. Novice hikers are likely to underestimate their ability, resulting in significant fatigue at the high altitudes, resulting in potentially unnecessary search and rescue operation. Signage near the entrance to popular hiking trails which includes information about the risk of storms, fatigue, and dehydration might serve as reminders to novice hikers.

Climbing also presents a hazard in the park and developing some education materials for the park and signage near popular climbing locations within the park might be useful in addressing this risky activity. Injury/illness peaks coincide with specific months and seasons during the year, as would be expected. The peaks are during the summer when there are a large number of visitors who are likely to be inexperienced and unfamiliar with the influence of altitude on physical exertion and the unpredictable weather in the mountains. The peaks which are seen during winter months may be more related to the winter weather but may be occurring among people who are more familiar with the area. It might be useful for park personnel at entrances to elicit more detailed information from visitors about their planned activities and to provide guidance. It may be useful to obtain more detailed information from people involved with park incidents with regard to their experience in the mountains, where they are from, and more specifics about the activities that they were engaged in as well as their preparedness for the activities they were involved in to appropriately design educational materials to reduce the number of incidents.

A number of issues involving the quality and completeness of the data available were evident in the preparation of this report. In order to properly monitor visitor and staff risk, data should be routinely compiled and reported so trends can be identified with more certainty. As Tuler and Golding (2002) reported, much of the detailed data that would be useful for assessing visitor and staff risk and safety is not collected or is missing from the incident reports. For example: what initially prompted the search – did an injury occur and the visitor could not get back from wherever he or she were or did they initially become disoriented and incur an injury as a result of trying to find their way out of the mountains; what was the initiating event and what happened first. Reports can come in directly from the lost or injured party using the limited cell phone service available in certain areas of the park, by another visitor in the park who encounters the lost or injured park visitor, or by a third party when someone does not return home when expected. If the report is made by someone in the park at the time, then the search and rescue team would probably have greater information on the person's whereabouts, however, if the call came in from offsite, then it is very likely that the NPS would have little or no information about the missing person's location in the park. These data have not been collected but would be useful for understanding the disposition and duration of the search.

Further, even when information is included on forms, forms were not always completed. If those who complete the forms were aware of the usefulness of the information, they might be more willing to complete the forms.

Data is not available about risk exposures, for example, how many people are involved in hiking or climbing in the park and how much time are people spending in the high risk activities so that exposure to risk can be understood relative to the number of people involved in activity-related incidents. Along with this, collecting more complete information on demographic characteristics of park visitors and activities of visitors would improve the ability to estimate risk and develop targeted educational materials.

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