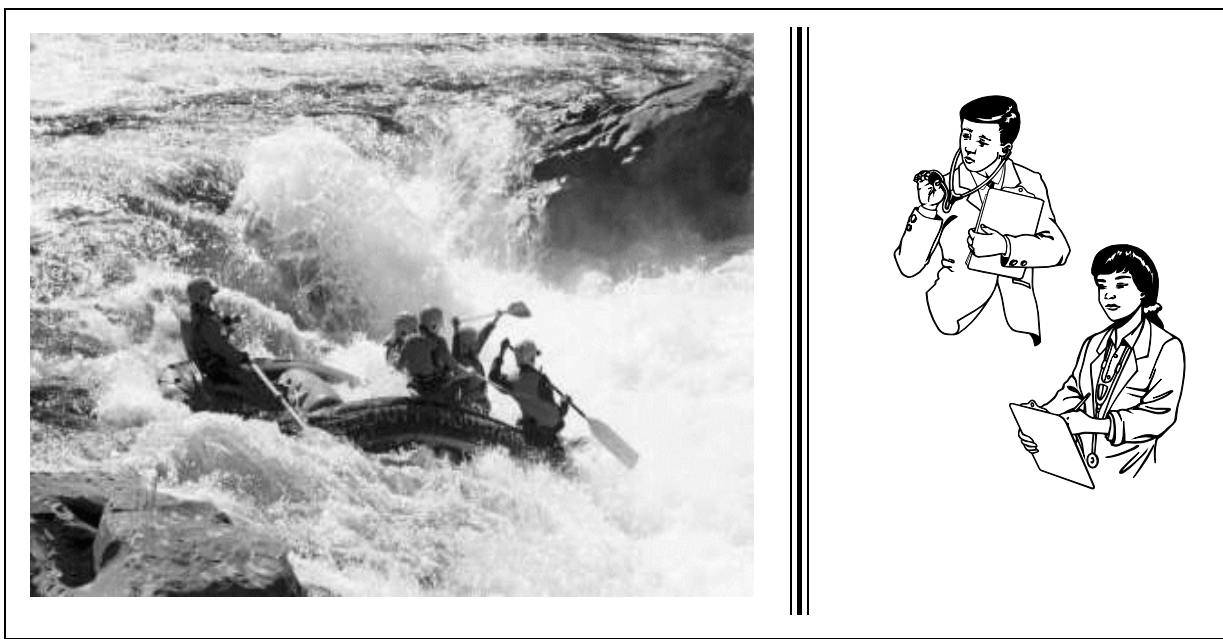


# Injuries in Commercial Whitewater Rafting

## 1999 Annual Report

*A Summary of Injuries Reported by  
Licensed Commercial Whitewater Outfitters  
on West Virginia Rivers*



Prepared for:

The West Virginia Division of Natural Resources on behalf of the Whitewater Commission

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June, 2000

## Introduction

Since 1994, commercial rafting outfitters in West Virginia have been required to report injuries sustained by their guests that “occur during the performance of a licensee’s [outfitter’s] services while underway [on the river]” that “require medical treatment by a licensed health care provider, excluding diagnostic analysis” (West Virginia Legislative Rule §47-27-11 [Accident Reports]). This generally has been interpreted by the West Virginia Division of Natural Resources (DNR) to mean that injuries requiring a treatment procedure (e. g., setting a fracture, sutures, etc.) performed by a medical doctor, osteopath, registered nurse, or physician’s assistant must be reported. In this report, an overview and analysis is presented of injuries reported by the commercial rafting industry during the 1999 season under the requirement set forth in §47-27-11. No judgment was made in this analysis as to whether reported injuries conform to reporting requirement, thus, all injury reports submitted by licensed outfitters are included. However, evidence will be presented suggesting that many injuries that were reported fail to meet the reporting requirement.

Injuries were unevenly distributed among outfitters (Table 1). Five outfitters accounted for 69% of reported injuries, while accounting for only 40% of commercial river use. Only one (ACE) reported injuries in proportion with their share of river use. The remaining 31% of injuries were unevenly distributed among the other 25 outfitters. This suggests that some outfitters are over-reporting for documentation, liability, or other undetermined reasons, while other outfitters may be under-reporting or not reporting at all. Determining how many injuries go unreported is made difficult by verification complexities and self-reporting methodologies used by most regulatory agencies (Whisman and Hollenhorst, 1999).

Outfitter	Frequency	Percent of Injuries	Percent of River Use
ACE Whitewater (ACE)	6	10%	11%
Rivers/River II (RIV)	1	2%	10%
Extreme Expeditions (EEI)	5	8%	5%
Alpine Bible Camp (ABC)	0	0%	1%
Blackwater Outdoor Center (BOC)	0	0%	<1%
Blueridge Outfitters (BRO)	0	0%	1%
Cantrell Canoes (CCR)	0	0%	1%
Cheat River Outfitters (CRO)	2	3%	<1%
Class VI (CVI)	10	17%	11%
Drift-a-Bit (DAB)	3	5%	3%
Historical River Tours (HRT)	0	0%	<1%
Laurel Highlands (LHR)	0	0%	1%
Mountain River Tours (MRT)	13	22%	8%
Mountain Streams and Trails (MST)	0	0%	<1%
New River Scenic NRSW)	3	5%	3%
New and Gauley River Tours (NGRA)	1	2%	3%
North American (NARR)	0	0%	8%
Passages to Adventures (PTA)	1	2%	1%
Precision Rafting (PRE)	0	0%	<1%
River Riders (RRI)	1	2%	1%
River & Trails (RTO)	0	0%	1%
Songer Whitewater (SW)	7	12%	5%
The Rivermen (TR)	3	5%	8%
USA Raft (USA)	0	0%	5%
Appalachian Wildwater (AW)	1	2%	5%
Whitewater Adventurers (WWA)	0	0%	<1%
Calleva Outdoors (CAV)	0	0%	<1%
WV Whitewater (WVW)	1	2%	1%
Whitewater Information (WWI)	0	0%	2%
Wildwater Expeditions (WWE)	2	3%	2%

## Incidence Rates

A total of 60 injuries sustained by rafting guests were reported in 1999. Fourteen reports describing injuries of river

River Segment	Frequency	Percent	Incidence per 1,000 User Days
Cheat Canyon	2	3%	0.625
Lower New	31	52%	0.233
Upper New	3	5%	0.132
Upper Gauley	15	25%	0.395
Lower Gauley	8	13%	0.379
Shenandoah	1	2%	0.112
Total	60	100%	0.263

guides were submitted but are excluded from this analysis. The frequency of injuries reported on each river segment roughly corresponded with commercial river use. Thirty-one injuries (52%) were reported on the Lower New River, which in 1999 accounted for 58% of reported commercial river use (Table 2). This was followed by the Upper Gauley River with 15 (25%) injuries and 17% of river use; Lower Gauley with 8 (8%) injuries and 9% of river use; Upper New with 3 (5%) injuries and 10% of river use, Cheat Canyon with 2 (3%) injuries and 1% of

river use, and Shenandoah with 1 (2%) injuries and 4% of river use.

Injury incidence rates ranged from 0.112 per 1,000 user days on the Shenandoah to 0.625 per 1,000 on the Cheat Canyon. The overall incidence rate was 0.263 per 1,000 across all rivers (Table 2). These rates are lower than the somewhat elevated rate of 0.441 per 1,000 reported in 1998, but consistent with the overall rates derived for the previous years. For example, Whisman and Hollenhorst (1999) reported overall injury incidence rates 0.263 per 1,000 for the 1995-97 seasons. The accuracy of injury incidence rates in commercial rafting is questionable because of suspected over-reporting of minor injuries that may not meet the reporting criteria, and by verification complexities that preclude the determination of how many possibly reportable injuries that go unreported.

## Injuries

The age of persons for whom injury reports were submitted in 1999 ranged from 7 to 53, with an average of 30 years. A majority were between the ages of 20 to 39 years (40%) or were over forty (17%). Fifteen percent of injured individuals were less than 20 years old, but the age or birth date of 17 (28%) of injured boaters was not reported. Forty percent of injured persons were female. Most individuals (55%) sustaining injuries during 1999 had previous rafting experience, meaning they had taken at least one commercial rafting trip prior to the trip on which they were injured. These individuals had taken an average of 3.1 previous rafting trips.

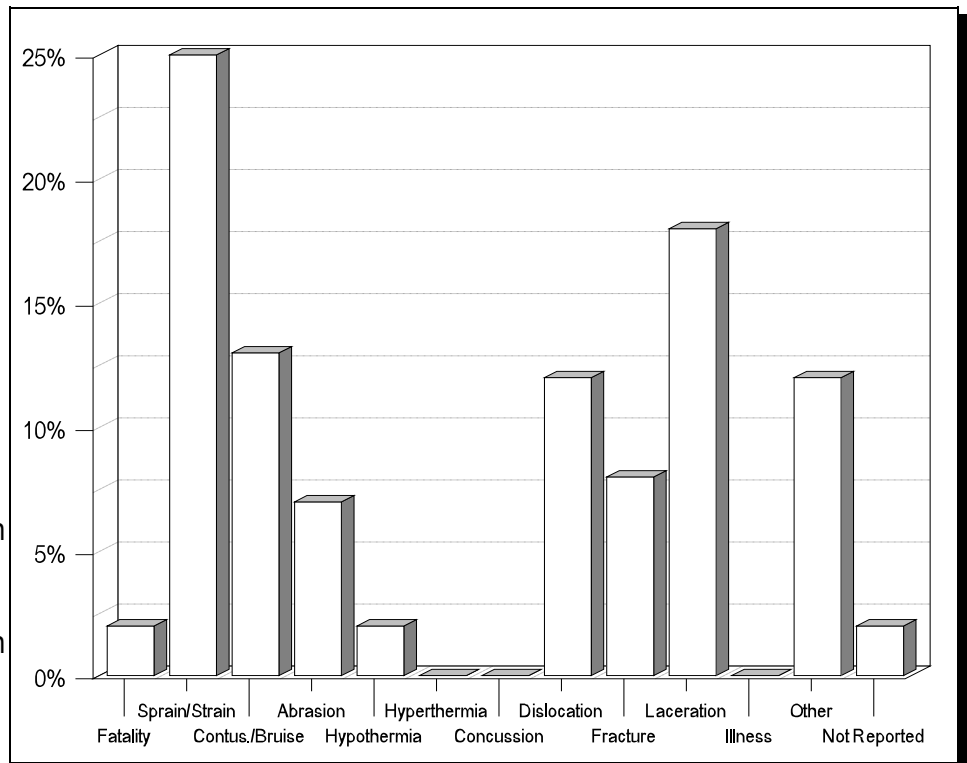
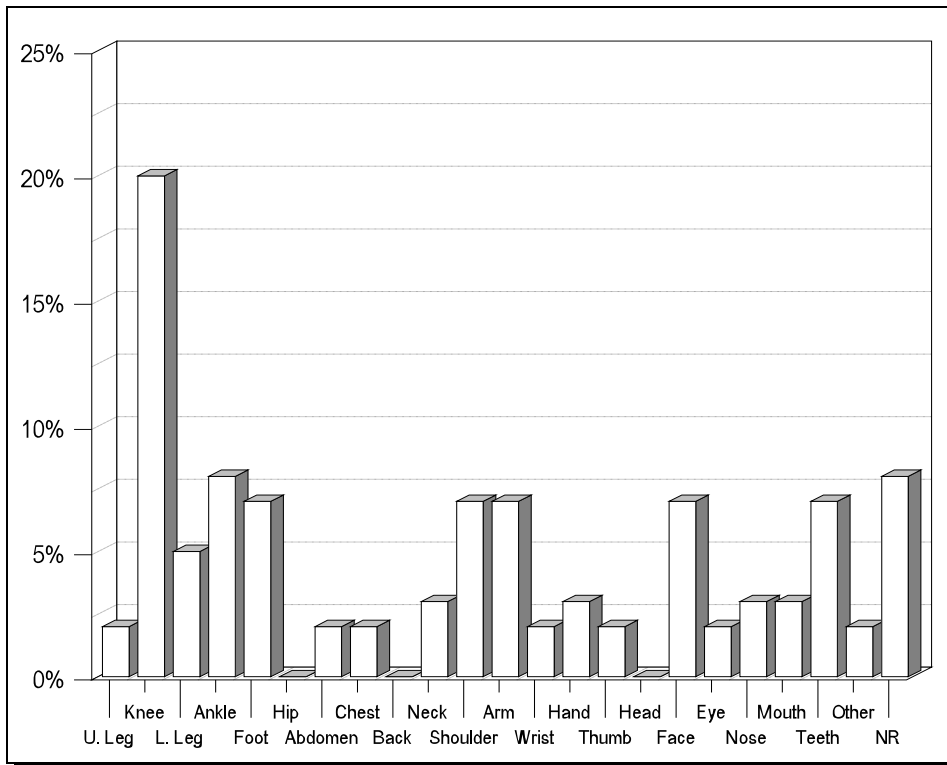


Figure 1. Percent of injuries by type of injury.



Types of injuries reported in 1999 included sprains/strains (25%), lacerations (18%), contusions/bruises (13%), dislocations (12%), fractures (8%), abrasions (7%), and hypothermia (2%). One fatality was reported. The remaining injuries included other unspecified injuries (12%), or were not specified at all (2%) (Figure 1). With exception to a decrease in reported lacerations, these proportions are similar to injury types reported in 1998 (Whisman 1999) and in 1995 through 1997 (Whisman and Hollenhorst 1999).

**Figure 2.** Percent of injuries by injured body part.

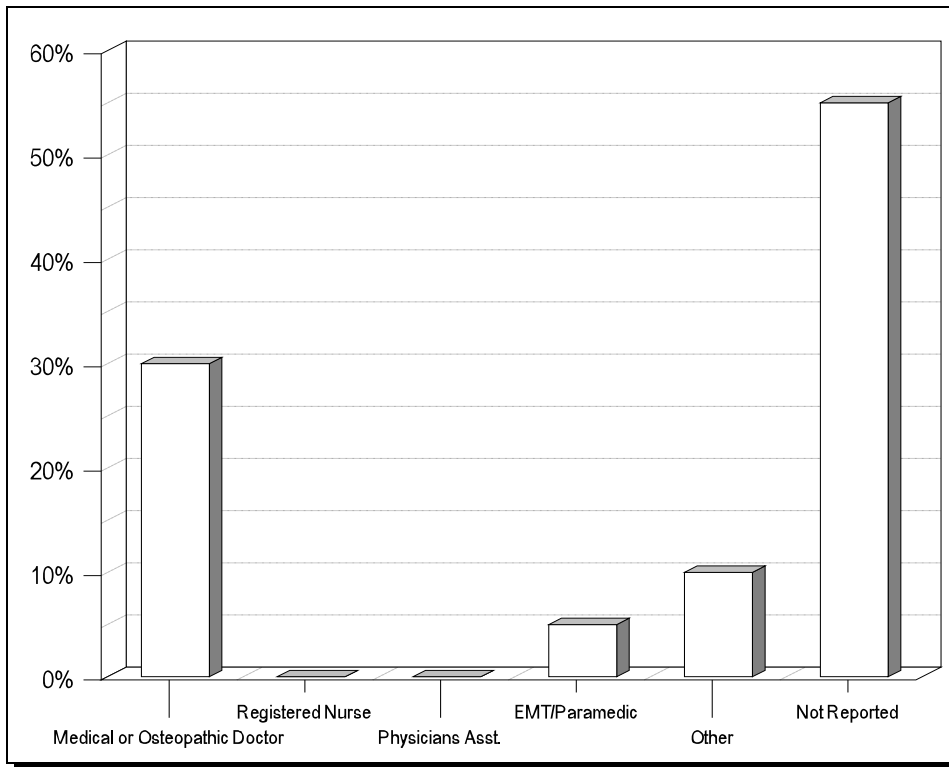
The most frequently injured parts of the body involved some part of the face (22%), including the unspecified facial parts (7%), teeth (7%), nose (3%), mouth (3%), or eye (2%). Knee injuries (20%) were prominent, as were injuries to the arm/wrist/hand (14%) and injuries to the hip/leg/foot (13%). Arm/wrist/hand injuries included the arm (7%), hand (3%), wrist (2%) and thumb (2%), while hip/leg/foot injuries included the foot (7%), lower leg (5%), and upper leg (2%). The remaining injuries consisted of injuries to the ankle (8%), shoulder (7%), neck (3%), and chest (2%), other unspecified body parts (2%), or was not specified (8%) (Figure. 2).

Forty-seven percent of injuries involved evacuation on the injured person either to an outfitter base camp or medical facility, or otherwise prevented the injured person from completing the raft trip. This was significantly higher than the 27% evacuation rate in 1998, but consistent to that in the three years from 1995 to 1997 when an evacuation rate of 40% occurred.

Most injuries sustained by commercial boaters occurred in the raft (43%). Injuries sustained on board the raft typically result from collisions between passengers in the raft, being struck by a paddle or other rafting equipment, or entanglement of extremities in parts of the raft. This was followed by injuries occurring in the water after falling from the raft while running rapids (33%). Passengers thrown from a raft are subject to the forces of high volume, turbulent water in which they may encounter boulder entrapments, floating debris, or other hazards. The remaining injuries occurred on shore (18%), at other unspecified (2%) or at unreported (3%) locations.

On-site administration of first aid for injuries included splinting/immobilization (18%), application of ice (17%), bandages (17%), elevation (16%), direct pressure (13%), antiseptic (8%), CPR (1%), treatment for shock (1%) and other unspecified first aid (5%). No first aid was administered for 2% of injuries.

As stated above, the legislative rule governing injury reporting (§47-27-11 [Accident Reports]) specifies that injuries that “require medical treatment by a licensed health care provider, excluding diagnostic analysis” must be reported to the West Virginia DNR. Of the injury reports submitted during 1999, 30 % indicated that injured individuals were evaluated by a medical or osteopathic doctor (MD or DO), 5% by an EMT or paramedic, and none by a registered

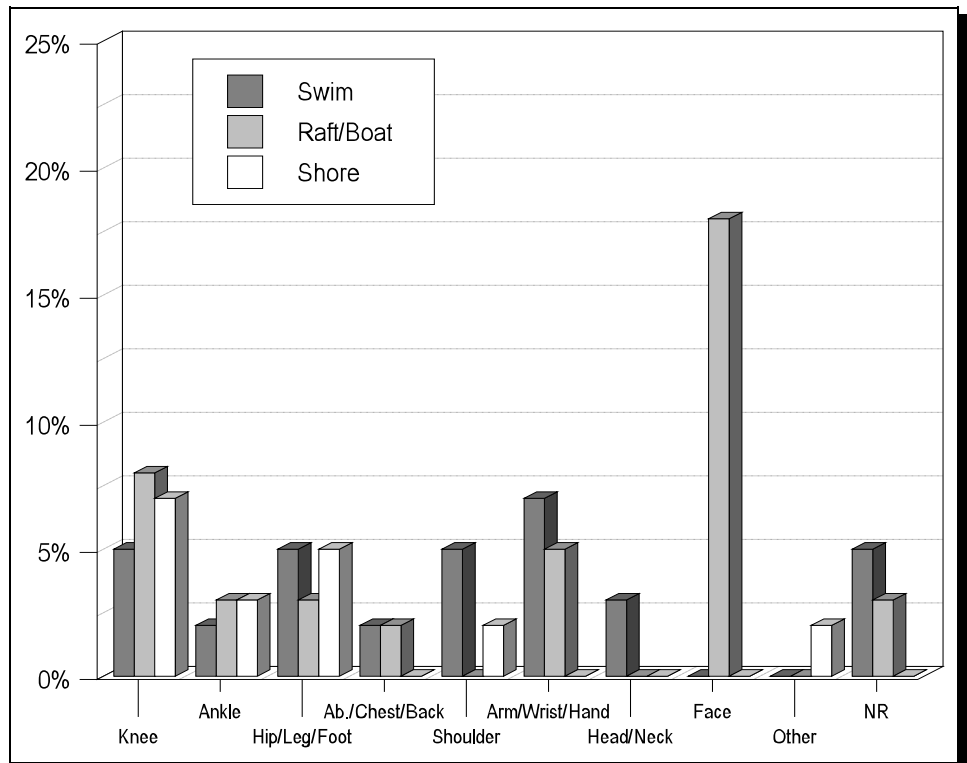


**Figure 3.** Percent of injuries by type of health care professional treated by.

nurse (RN) or physicians assistant (PA) (Figure 3). Ten percent of reports indicated that evaluation of injured individuals was performed by persons with some other training (e.g., First Responder) who most likely were trip leaders or guides. On thirty-three (55%) of injury reports, no response was given as to by whom or if the injured individuals were evaluated. Also, only 27% of reports indicated that injured individuals received treatment in the form of a splint or cast (12%), stitches (3%), medication (2%), surgery (2%), or other unspecified treatment (13%). Eight

percent of reports indicated “diagnosis only,” while on 60% of reports no response was given as to the type of treatment administered.

The large number of body part categories were collapsed to facilitate cross-tabulation for the purpose of identifying injury associations. Apparent associations were observed in injured body parts by location of occurrence (Figure 4). Injuries occurring in the raft more commonly were to the face and to a lesser extent the knee. Injuries occurring in the water or on shore involved the arm/wrist/hand, shoulder, knee and leg. In the years spanning 1995 through 1998, injured body parts appeared to vary by gender, with female boaters more frequently sustaining arm/wrist/hand and facial injuries, while males slightly more frequently sustained injuries to the knee and shoulder. While slight variations were observed in 1999, no statistically significant gender association was found in the body part injured. However, a gender association was observed



**Figure 4.** Percent of injuries by body part and location of occurrence.

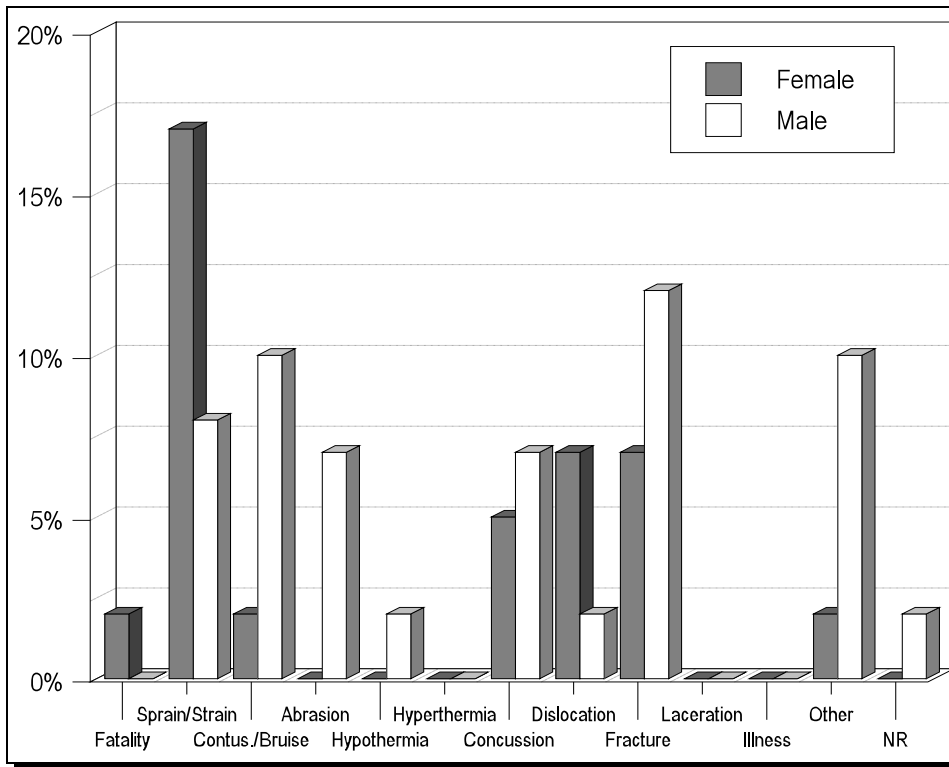


Figure 5. Percent of injury types by gender.

in 1999 in reported injury type that was not seen in previous years. In 1999, female boaters were more likely to sustain a sprain or strain while males were more likely to sustain a contusion/bruise or fracture (Figure 5).

Finally, an association was observed between injury type and injured body part. Lacerations more commonly involved injuries to the face, while sprains/strains occurred more often to the knee, ankle, and arm/wrist/hand. Fractures more often involved the extremities, including the hip/leg/foot, arm/wrist/hand, abdomen/chest/back (i.e.,

ribs), or the face (i.e, nose), and dislocations more often involved the shoulder (Figure 6).

## Summary

During the 1999 rafting season, a total of 60 injury reports were submitted on behalf of guests of commercial rafting outfitters who sustained injuries. The average age of injured persons was 30 years, 40% were female, and 55% had previous rafting experience. The overall injury incidence rate was 0.263 per 1,000 rafters for the year, which was lower than the incidence rate in 1998, but consistent with the incidence rate observed in 1995-97.

The most frequently injured parts of the body were the parts of the face and the extremities (arm/wrist/hand, hip/leg/foot, knee, ankle). Predominant injury types included sprains/strains and

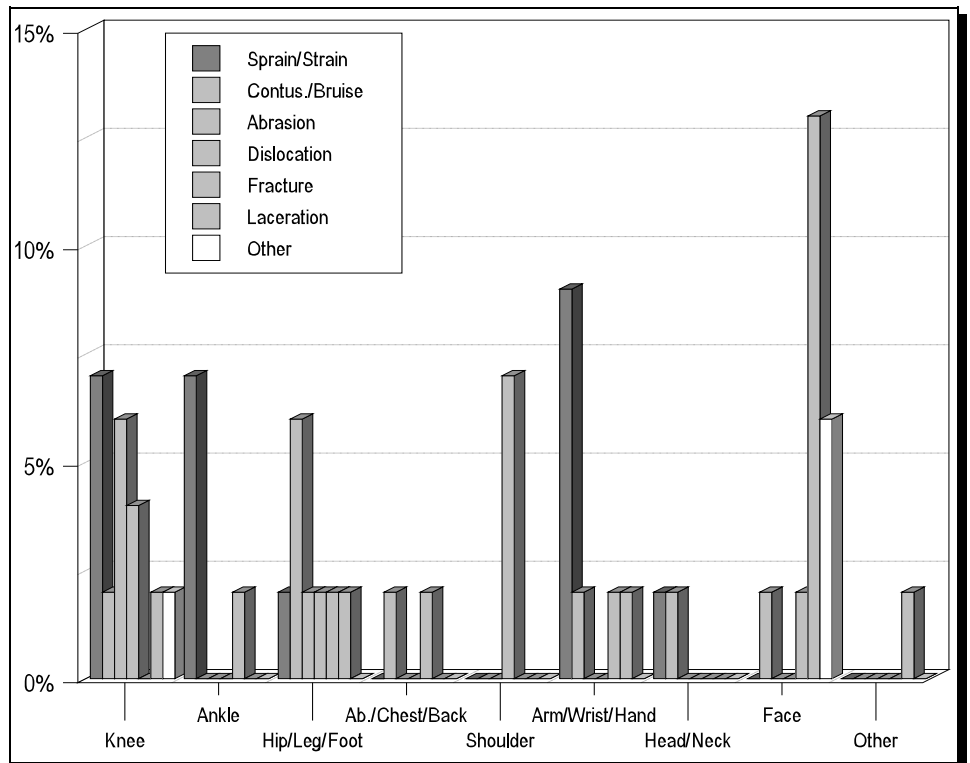


Figure 6. Percent of injured body parts by injury types.

lacerations, followed by contusions/bruises, dislocations, fractures, and abrasions. One fatality was reported. On-site administration of first aid included application of ice, bandages, splinting/ immobilization, antiseptic, elevation, direct pressure, treatment for shock, and CPR. No first aid was administered for 2% of injuries.

Most injuries occurred in the raft as a result of collisions among passengers, being struck by a paddle or other equipment, or entanglement of extremities in parts of the raft. Injuries occurring in the raft more commonly were to the face, while injuries occurring in the water involved the extremities. No gender association was found in the body part injured as was observed in previous years, but the reported injury type was observed to vary by gender in 1999. Female boaters more frequently sustained a sprain or strain while males more frequently sustained a contusion/bruise or fracture. Finally, facial injuries more commonly were lacerations; knee, ankle, and arm/wrist/hand injuries were more frequently sprains/strains; and dislocations more often involved the shoulder.

Finally, only five outfitters accounted for most of the injuries reported in the year, and only 35% of injury reports indicated that injured persons were evaluated by one of the four recognized categories of licensed health care providers. Furthermore, only 27% of reports indicated that injured individuals received treatment in the form of a splint or cast, stitches, medication, or surgery, and 8% percent of reports indicated "diagnosis only." On most injury reports submitted in 1999, the type of treatment administered was not reported.

## Conclusions and Recommendations

It appears that many injuries reported in 1999 were not necessarily "*reportable*" under current reporting requirements. As well, few outfitters accounted for most of the reported injuries, reinforcing the suspicion that a small number of outfitters are over-reporting while others are under-reporting or not reporting at all. A comparison of the number of injuries reported in the last five years (1995-1999) to the number that would be expected assuming an incidence rate of 0.263 per 1,000 users further illustrates this point (Table 3).

Similarly, verification limitations make it difficult to determine if or how many injuries go unreported. Combined, these factors are cause for concern in that they almost certainly affect the determination of actual incidence rates or the true characteristics of rafting injuries. More effort is needed to verify injury rates and severity. As in the September Whitewater Commission meetings of 1996 and 1999, it is recommended that the Commission emphasize the importance of and need for accurate injury reporting, and reiterate the definition of a reportable injury as specified in §47-27-11.

Since most injuries occur in the raft while running rapids, involve injuries to the face, and result from contact among passengers or paddling equipment, preventive measures such as attaching face protection to paddling helmets, carrying fewer passengers per raft, or portaging dangerous rapids seem reasonable. However, these remedies likely are not without undesirable consequences (Whisman and Hollenhorst, 1999). For example, while face guards or other protective equipment may reduce facial injuries, they may contribute to a higher rate of more serious neck injuries or drowning as a result of entanglement with unseen obstacles such as rocks, trees or other debris in the water. Furthermore, while reducing the number of persons in each raft may reduce facial injuries, the result would be less paddling effort or power, which is the only means used to propel a raft through whitewater rapids. Less paddling power may lead to an increased rate of raft pins and flips, more passengers falling from the raft in turbulent whitewater, and an increased exposure to potentially injurious hazards in the water or to drowning. Finally, the consequence of walking around rapids is that it may detract from the nature of rafting as an adventure sport, and subject passengers to greater exposure to slippery rocks, poison ivy, snakes, bees, or other hazards. Further investigation is needed to determine the relative benefits and risks associated with these and similar preventive measures.

**Table 3. River Use, Reported Injuries, and Expected injuries for the West Virginia Commercial Rafting Industry for 1995 through 1999.**

Outfitter	1995	1996	1997	1998	1999	Total	Reported Injuries	Expected Injuries <sup>a</sup>	Difference <sup>b</sup>
Wildwater Expeditions	5,796	5,831	5,467	6,024	5,113	28,231	5	7	-2
Cheat River Outfitters	-	-	-	-	685	685	2	0	2
North American River Runners	20,636	20,069	19,431	18,501	18,409	97,046	5	26	-21
Mountain River Tours	20,901	21,436	19,222	20,173	17,296	99,028	49	26	23
New River Scenic	6,846	6,465	6,900	7,075	7,415	34,701	6	9	-3
Mountain Streams and Trails	3,058	2,653	2,326	1,968	522	10,527	4	3	1
Whitewater Adv. Cheat Canyon	1,323	1,017	0	324	341	3,005	2	1	1
Blackwater Outdoor Center	1,267	1,223	1,808	1,814	291	6,403	0	2	-2
Songer Whitewater	10,451	9,954	11,044	11,806	11,837	55,092	64	14	50
USA Raft	14,942	14,114	12,360	12,309	10,936	64,661	0	17	-17
Alpine Bible Camp	3,402	3,217	3,783	3,236	3,355	16,993	3	4	-1
Blueridge Outfitters	9,003	8,951	7,804	8,542	3,315	37,615	0	10	-10
Appalachian Wildwaters	15,684	13,520	13,385	15,290	12,367	70,246	1	18	-17
New and Gauley River Adv	5,620	6,522	6,199	7,140	6,656	32,137	8	8	0
Class VI	27,223	26,056	25,759	25,683	24,206	128,927	65	34	31
ACE Whitewater	27,734	25,625	23,920	27,959	25,225	130,463	42	34	8
River and Trails Outfitters	7,647	7,972	8,302	7,800	2,937	34,658	14	9	5
Cheat Whitewater World	917	941	413	0	0	2,271	0	1	-1
Extreme Expeditions	-	6,710	9,854	10,976	11,728	39,268	8	10	-2
New/Gauley Expeditions	6,187	-	-	-	-	6,187	1	2	-1
Whitewater Information	7,806	9,891	7,053	4,875	5,546	35,171	22	9	13
Cantrell Canoes	1,161	1,291	1,508	3,143	3,074	10,177	1	3	-2
River Riders	1,369	1,876	1,269	2,505	2,404	9,423	24	2	22
Laurel Highlands	2,047	2,736	1,823	1,501	1,162	9,269	0	2	-2
Passages to Adventures	3,700	4,847	3,985	3,137	3,015	18,684	7	5	2
Rivers	26,807	23,662	19,992	22,310	23,738	116,509	4	31	-27
Precision Rafting	1,214	1,238	1,125	994	841	5,412	1	1	0
The Rivermen	16,402	17,225	16,929	17,789	17,484	85,829	6	23	-17
West Virginia Whitewater	2,044	1,923	2,142	2,314	1,246	9,669	9	3	6
Drift-a-Bit	6,487	5,734	5,872	5,073	6,625	29,791	19	8	11
Historical River Tours	1,340	1,229	1,779	1,660	266	6,274	7	2	5
Totals	259,014	253,928	241,454	251,921	228,035	1,234,352	379	324	55

<sup>a</sup> Expected injuries were calculated using an estimated injury incidence rate of 0.263 injuries per 1,000 users.

<sup>b</sup> A positive difference indicates more injuries were reported than would be expected at a rate of 0.263 per 1,000 users.

## References

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