Injuries in West Virginia Commercial Whitewater Rafting

2001-2010 Trend Analysis

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

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EXECUTIVE SUMMARY

A total of 589 individuals were injured while participating in a commercial whitewater trip for the ten-year period 2001-2010. The injured ranged in age from eight to seventy-eight years with a mean age of 34.3 years. Over one-half (55.4%) of injured persons were female, and over one-half (57%) of those injured had taken at least one commercial rafting trip prior to the trip on which they were injured. Over one-third (39%) of injuries occurred between the hours of 12:01 PM to 2:00PM. Injuries were equally distributed between weekdays (49%) and weekends (51%).

Almost one-half (48%) of reported injuries occurred on the New River, closely followed by the Gauley with forty-one percent. This trend analysis suggests that the vast majority of commercial whitewater rafting injuries is relatively minor and occur with regularity. The ten-year injury rate (Injuries Per Thousand Rafter Days or *IPTRD*) for all designated whitewater zones was calculated as *IPTRD* =0.309.

Musculoskeletal injuries (sprains/ strains, dislocations, and fractures) comprised the majority (45%) of incidents. Injuries to soft tissue (contusions, lacerations, abrasions, and puncture wounds) followed (39%). There were a very small number of concussions, which may be explained by required helmet use. Also rare were environmental illnesses (i.e. hypothermia, anaphylaxis, sunburn, dehydration). The anatomical region where injuries occurred most frequently included the lower extremities (39%), followed by the upper extremities (22%), and the head/neck/face (20%).

The raft continues to be the primary location for almost one-half (48%) of the injuries sustained by commercial rafters for the years 2001-2010, followed by injuries sustained in the river (36%) and seven percent on shore. Injuries most likely to occur in the raft were to the knee and face. Injuries while in the water included the arm/wrist/hand, hip/leg/foot, the head/neck and shoulder. Injuries to the abdomen/chest/back, ankle, and arm/wrist/hand occurred while guests were on shore.

Overall, females more frequently received contusions, while males sustained more sprains, dislocations, fractures, and lacerations. Over the ten-year period, sprains and strains occurred more often to the ankle and knee; dislocations primarily to the shoulder and fractures more often involved the arm/wrist/hand.

Over one-half (52%) of injured guests/year required evacuation to an outfitter base camp or medical facility, or were prevented from completing their raft trip. Evacuations ranged from a low of 32% FY 2009 to a high of 81% FY 2006. Thirty three percent of the injury reports submitted for the ten-year period indicated that the injured were evaluated by a medical or osteopathic doctor, EMT or paramedic (13%), a registered nurse (3%), or by a physicians assistant (2%). Eleven percent of reports indicated that persons with some other training

performed evaluation of the injured. A large percentage (38%) of injury reports did not indicate by whom or if the injured were evaluated. Over one-half (52%) of injury reports noted that the injured received some form of treatment including a splint or cast (42%), stitches (18%), medication (11%), surgery (2%), or other unspecified treatment (33%). Twenty two percent of reports indicated "diagnosis only."

Based on the trend analysis the following recommendations are suggested:

1. Explore incorporating preventive measures such as attaching face protection to helmets; encourage the use of mouth guards to protect teeth, or carrying fewer passengers per raft.
2. Emphasize guide training/education. Training guides on injury prevention and injury reporting is a desirable technique because it is non-authoritarian, serves the guides' desires, stresses modification of behavior while maintaining individual choice, is cost effective, and has the ability to increase the quality of the rafting experience for guests.
3. All invested parties must decide if the reporting of injuries is important, the need for monitoring; how monitoring should be conducted, who should conduct it, and how to enforce compliance and penalties for not reporting.
4. Implement a quality incident reporting system by collecting reliable guest data to calculate incident rates. Incident rates are used to measure performance over time.
5. The definition of a "reportable injury" may be inconsistently interpreted, and therefore clarification of reporting requirements is needed to ensure consistent reporting.
6. Report only medically significant injuries or illnesses *for both customers and guides.* This presents a more realistic view of injuries and how, when, and, where they occur.
7. Report near misses. Near miss incidents can be important predictors for future accidents and should be embraced by outfitters as a valuable teaching and training tool for guides.
8. Create a system to verify the participant numbers provided by outfitters.
9. Efforts should be taken to determine the cause of injuries by conducting a Root Cause Analysis. By identifying root causes, behaviors, actions, inactions, or conditions can be changed to prevent injuries from occurring again.

INTRODUCTION

The collection and review of injury data associated with commercial whitewater rafting in West Virginia is an important area of risk management. Examination of injury data as part of the risk management process allows outfitters and guides to make better-informed decisions about actual risks. When viewed over time, patterns can be identified that can indicate where attention is needed to reverse an unwanted trend, to educate guides, to strategize preventative measures, to gauge the success of measures that have been implemented, and to share experiences by recounting significant events.

An injury database is important to analyze and observe trends, evaluate efficacy of safety and management measures, and predict future frequencies and rates of injury occurrence (Erickson & Leemon, 2000). Trend data can also help to justify policy changes, changes in the level of training or experience for guides; provide invaluable information for planning, evaluating, initiating new policies and procedures, and allocating resources. In addition, injury data when shared can help identify industry wide or localized trends, add to the collective body of knowledge, and shape industry standards. Reviewing injury data allows outfitters to understand the types of injuries, illnesses, and incidents that occur during guided rafting experiences. And in turn, this information can be used to accurately describe potential risks and dangers to customers.

This report documents injury trends reported to the West Virginia Whitewater Commission by the commercial rafting industry for years (FY) 2001-2010. The information contained in this analysis is based on the requirement described in West Virginia Legislative Rule §58-12-11. No judgment was made in this analysis whether reported injuries follow the criteria for reporting established by West Virginia Legislative Rule §58-12-11. Therefore, all injury reports submitted by licensed outfitters are included.

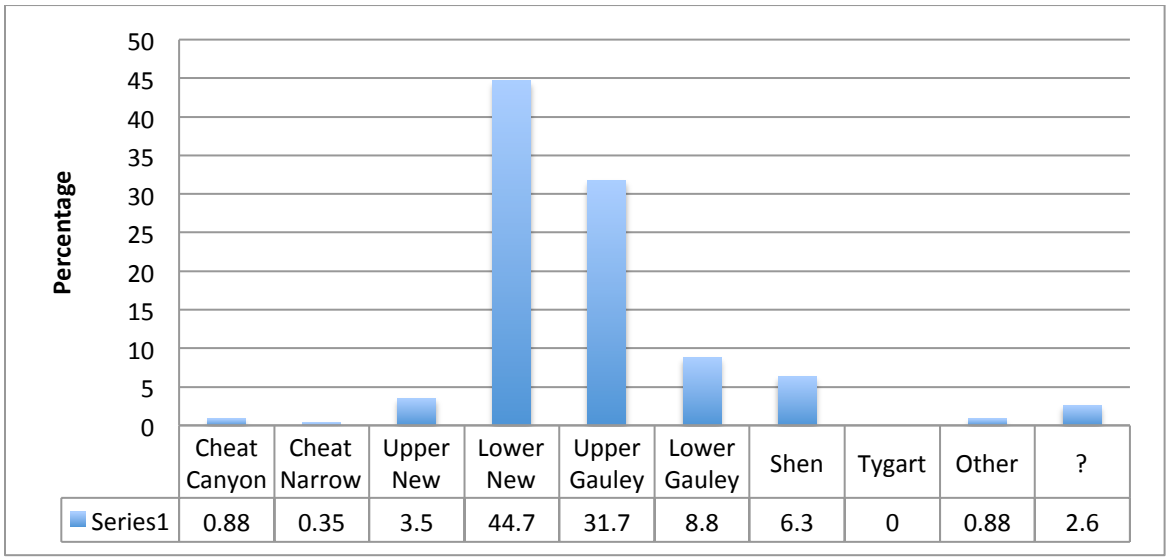
DEMOGRAPHICS

A total of 589 rafting customers were injured over the ten-year period 2001-2010. The age of persons for whom injury reports were submitted ranged from 8 (FY 2010) to 78 years (FY 2005) with a mean age of 34.3 years. A majority (35%) of the injured was between the ages of 23 to 34 years or over age forty (34%). Seventeen percent of injured individuals were less than 23 years of age. Over one-half (55.4%) of injured persons were female. Over one-half (57%) of those injured had taken at least one commercial rafting trip prior to the trip on which they were injured. In comparison, from 1995-1997, the mean age of injured persons was 33.14 years, 53.3% were male, and 59.8% had previous rafting experience.

DESIGNATED WHITEWATER ZONE

Almost one-half (48%) of reported injuries occurred on the New River, followed by the Gauley with forty-one percent. Two hundred sixty injuries (44%) were reported on the Lower New River followed by the Upper Gauley with 187 (32%). The Lower Gauley accounted for 56 (9%) injured guests followed by the Shenandoah with 36 (6%) reported injuries for the ten-year period. The least number of injuries occurred in the Cheat River Canyon (Figure 1). Four injury reports were submitted for the Tygart River during 2005, but no Trip Leader Reports were submitted for the Tygart for 2005. Rivers other than those designated by the West Virginia Department of Natural Resources (WV DNR) were also listed on accident report forms. Fifteen injury reports (2%) did not identify a whitewater zone where guests were injured (Figure 1).

Figure 1. Percent of Injury by Designated Whitewater Zone FY 2001-2010



	Cheat Canyon	Cheat Narrow	Upper New	Lower New	Upper Gauley	Lower Gauley	Shen	Tygart	Other	?
Series1	0.88	0.35	3.5	44.7	31.7	8.8	6.3	0	0.88	2.6

Injuries were also documented by named rapid on the where the injury occurred on each designated whitewater zone for years 2003-2010. Data were not available for review FY 2001 and 2002. Injuries occurred most frequently on the New River at Lower Railroad and Pillow Rock on the Gauley (Table 1). For comparison purposes, the years 1990 through 1995 injuries reported on the Gauley River occurred at Sweets Falls (25%), Insignificant (11%), Pillow Rock (11%), Woods Ferry (5%), Pure Screaming Hell (5%), Iron Ring (4%) and Mash (4%). Note that reported injuries continue to occur at many of these locations (Table 1). Thirty-one injury reports did not identify where on the designated whitewater zone the customer received her injury (State of West Virginia, 2001).

Table 1.
Rapid on Designated Whitewater Zone with Highest Frequency of Injury
FY 2003-2010

River	Rapid	Frequency
New	Lower Railroad	24
	Greyhound Bus	19
	Middle Keeney	18
	Surprise	15
	Jump Rock	12
	Millers Folly	10
Gauley	Pillow Rock	24
	Sweets Falls	19
	Iron Ring	9
	Hungry Mother	7
	Woods Ferry	4
Shenandoah	Bull Falls	3
	Bulls Tail	2
Cheat Canyon	Calamity	2
Unknown		31

Injury Rates and Designated Whitewater Zone

Calculating injury rates based on the amount of participation provides a useful unit of measurement in order to track trends over time. However, injury rates in West Virginia commercial whitewater rafting is questionable because of suspected discrepancies in the reporting of injuries that may not meet the criteria established by the West Virginia Whitewater Commission (WV WWC), reportable injuries that go unreported, incomplete or illegible injury report forms, and the variability of monthly user numbers.

Injury rates are presented in Table 2 for each whitewater zone by Injuries Per 1000 Rafter Days (*IPTRD*). A *rafter day* is defined as a paying guest on a whitewater zone for any part of a day. Dividing the number of reported injuries by the total number of rafting participants for a particular whitewater zone and multiplying by 1000 calculates this rate. The injury incidence rate for the period 2001-2010 was calculated to be *IPTRD* = 0.309.

Table 2.
Reported Injuries and Estimated Injury Incidence Rates by Designated Whitewater Zone

River	Number of Injuries	Percent	IPTRD
Cheat Canyon	6	1	0.239
Cheat Narrows	2	.33	0.129
Lower Gauley	56	9.5	0.220
Upper Gauley	187	31.7	0.556
Lower New	260	44.1	0.213
Upper New	21	3.5	0.078
Shenandoah	36	6.1	0.168
Tygart	0	0	0
Totals	589	100	0.309

For comparison purposes, 244 injured guests were reported from 1990 through 1995, on the Gauley River, accounting for 45% of injured guests for the period. Annual injury rates on the Gauley ranged from a low of 20 injured during 1995 to a high of 64 through 1992. However, the requirements for reporting the injured changed in 1994 making annual comparisons of injury rates questionable. FY 2000, sixty-one injured guests were reported among the 134,570 customers on the New River (*IPTRD*=0.453). On the Gauley, thirty-one injured guests were reported for 62,393 customers (*IPTRD*=0.496) (State of West Virginia, 2001).

Previous reports noted an annual average of 90 injured guests (119 injured FY 1992 to 53 injured FY 1995) (Zhu, Norton, & Whisman, 1996). Two hundred injured guests were reported from 1995 through 1997, (*IPTRD*=0.263) Incidence rates ranged from 0.145 per 1,000 on the Shenandoah to 0.381 per 1,000 on the Gauley (Whisman & Hollenhorst, 1999).

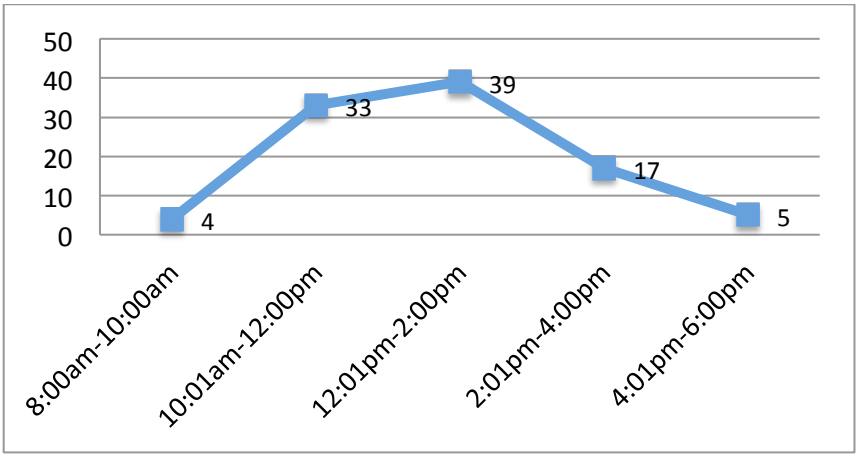
In comparison, the Colorado River Outfitters Association reported 51 injured guests FY 2008; 33 injured guests FY 2009, and 40 injured guests FY 2010 on Colorado rivers. The *IPTRD* for 2008-2010 = 0.081. During this same period, 11 fatalities were reported (K. Wahlers, personal communication, December 9, 2011).

No matter what the injury rate, decreasing the incidence of all injuries is an important goal of risk-management. Knowing the nature and prevalence of injuries is an important first step towards allocating resources and educational efforts to decrease such incidents. The

average number of injured FY 2001-2010 was 50.5 injured persons/year; with a range of 19 injured persons reported FY 2006 to a high of 94 injured persons FY 2010.
During the ten-year period 2001-2010 nine fatalities were recorded on designated whitewater zones. This translates into .004 Fatalities Per 1000 Rafter Days. The national incidence of commercially guided rafting fatalities is estimated to range from one death per 250,000 person visits to one death per 400,000 person visit days (American Whitewater, 2007).

When do Injuries Occur?
Reported injuries were somewhat evenly distributed over a day of rafting. Over one-third (39%) of guests were injured between the hours of 12:01 PM to 2:00PM. The least number of injured (5%) were reported between the hours of 4:01 PM to 6:00 PM. The injured were equally distributed between weekdays (Monday-Friday, 49%) and weekends (51%).

Figure 2. Time of Injury by Percent



TYPES OF INJURIES

According to Fiore (2003) whitewater injuries happen by (1) striking an object in the river, a participant, or piece of equipment, (2) through traumatic stress by interaction of the paddler's position in relationship to her equipment and the forces generated by moving water, (3) overuse injuries, and (4) submersion and environmental injuries. Many of the injuries reported by outfitters over the ten-year period fall into one of these categories. Overall, musculoskeletal injuries (sprains/ strains, dislocations, and fractures) comprised the majority (45%) of incidents. Injuries to soft tissue (contusions, lacerations, abrasions, and puncture wounds) followed (39%). The type and percent of injuries are depicted in Table 3.

Table 3.

Type of Injury by Percent

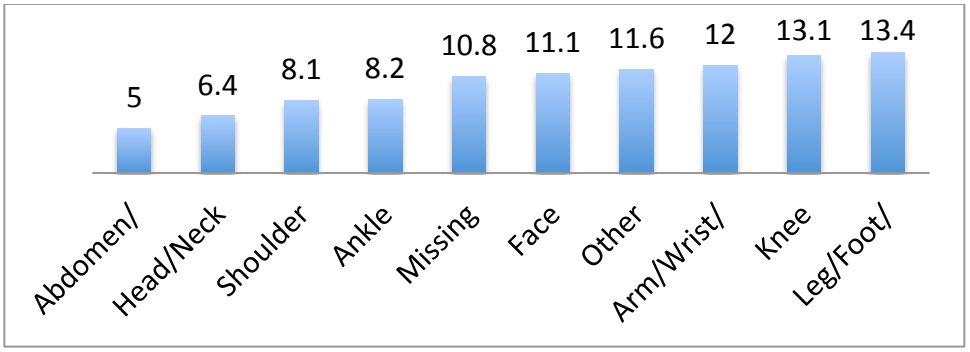
Injury / Year	S/S	Contus	Abras	Hypo	Ill	Concuss	Dislo	Frac	Lacer	Fatal	Other	TOTALS
2001	21	13	2	2	1	1	7	9	22	0	10	88
2002	27	11	0	0	0	0	10	10	15	0	10	83
2003	20	10	8	0	0	0	1	13	9	0	13	74
2004	20	12	0	1	0	0	14	10	19	1	10	87
2005	18	7	1	1	0	2	7	9	25	2	8	80
2006	8	2	0	0	0	3	2	2	3	1	3	24
2007	7	7	0	0	0	1	11	5	6	0	3	40
2008	4	8	3	0	0	0	4	4	7	2	4	36
2009	7	4	1	0	0	2	2	3	9	2	5	35
2010	6	8	1	0	0	3	5	6	15	1	4	49
Totals	**138**	**82**	**16**	**4**	**1**	**12**	**63**	**71**	**130**	**9**	**70**	**596**
% of Total	**23%**	**13.7%**	**2.6%**	**0.67%**	**0.16%**	**2%**	**10.5%**	**11.9%**	**21.8%**	**1.5%**	**11.7%**	**100%**

Legend- S/S=Sprain/Strain, Contus=Contusion, Abras=Abrasion, Hypo=Hypothermia, Ill=Illness, Conc=Concussion, Dislo=Dislocation, Frac=Fracture, Lacer=Laceration, Fatal=Fatality

INJURY BY ANATOMICAL REGION

Commercial rafters' injuries by anatomical region are shown in Figure 3. Among all injuries, regardless of severity, over one-third (39%) were to the lower extremities (leg/foot/hip, knee, ankle). These were followed by injuries to the upper extremities including the arm/wrist/hand and shoulder (22%); and the head, neck, and face (17%), and other (12%). The anatomical region of injury was not specified on eleven percent of reports (Figure 3).

Figure 3. Percent Injuries by Anatomical Region FY 2001-2010



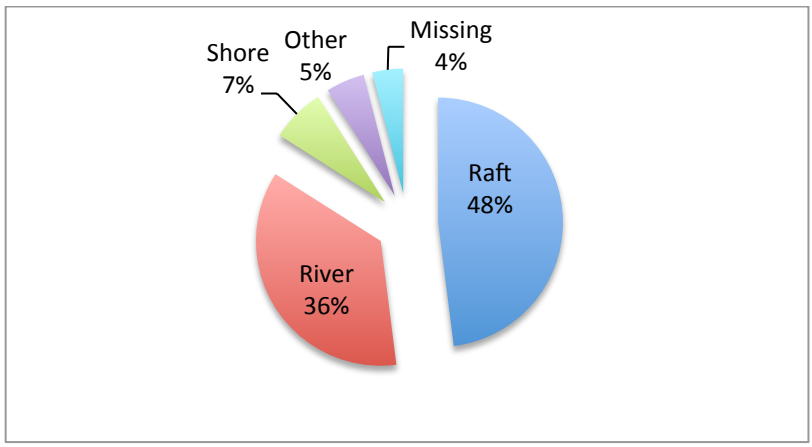
INJURY SETTING

Rafting takes place in a highly dynamic environment that creates unique situations and mechanisms for injury. Factors that contribute to injuries on the river and its environ includes *raft technology* or the objects and actions necessary to participate in a raft trip, such as the raft, equipment, the physical tasks of loading and unloading a raft, paddling a raft, etc.; *the river and its environ*, and *environmental conditions* such as air and water temperature, sun exposure, contact w/ flora and fauna, and surrounding activities such as swimming, jumping, horseplay, and shoreline activities.

The setting where reported injuries took place included the raft, river, or on shore (Figure 4). Each of these locations presents its own unique set of circumstances for injury. Injuries sustained in the raft are usually a result of passengers colliding with one another, being struck by a paddle or other piece equipment, or arms and legs being entangled in parts of the raft. The raft was the location for almost one-half (48%) of the injuries sustained by commercial rafters FY 2001-2010.

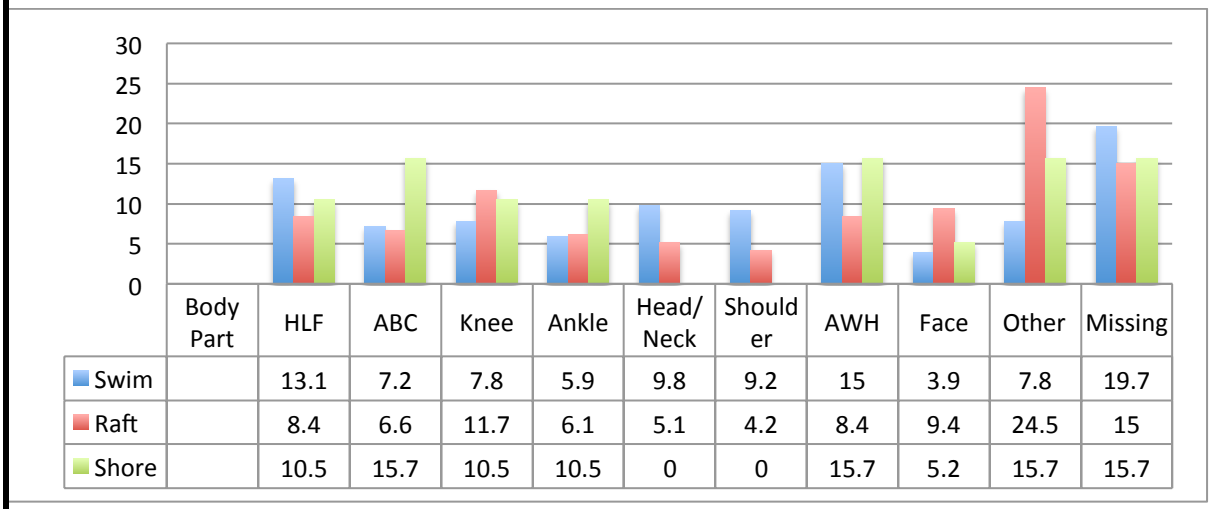
Injuries in the raft were followed by injuries sustained in the river (36%). Being ejected from the raft into the river subjects the passenger to the forces of high volume, turbulent water in which the swimmer may encounter hydraulics, foot entrapments, impacts with rocks, floating debris, or other hazards. Seven percent of injuries for this period occurred while participants were on shore. Potential for injury on shore occurs when rafters slip and fall on wet slippery or loose rocks, walk on irregular surfaces, or succumb to horseplay. The remainder of injuries was identified as other (5%) or was missing (4%). These rates are similar to those reported FY 1990-1995 when 53% of injuries occurred in the raft, 34% in the water, and 8% on shore (Zhu, Norton, & Whisman, 1996).

Figure 4. Setting For injury



Injuries most likely to occur in the raft were to the face and knee; injuries to the ankle/wrist/hand and hip/leg/foot occurred in the water; and injuries on shore occurred to the ankle/wrist/hand, abdomen/back/chest, and to the ankle. It should be noted here that a significant number of setting locations were identified as "other" or "missing" (Figure 5).

Figure 5. Percent of Injured Anatomical Region and Setting of Occurrence (2003-2010)



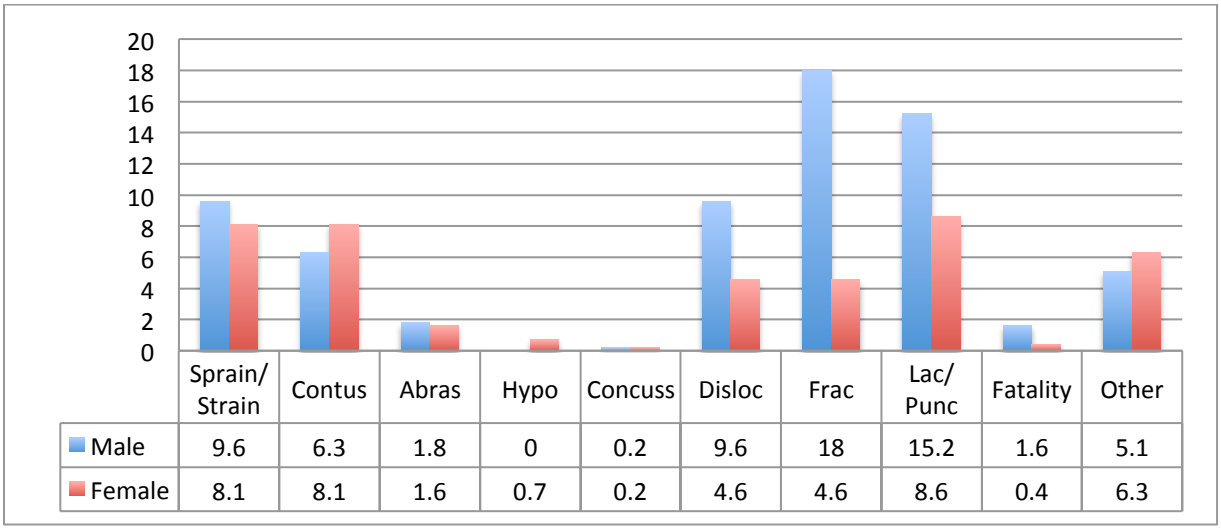
Body Part	HLF	ABC	Knee	Ankle	Head/ Neck	Shoulder	AWH	Face	Other	Missing
Swim	13.1	7.2	7.8	5.9	9.8	9.2	15	3.9	7.8	19.7
Raft	8.4	6.6	11.7	6.1	5.1	4.2	8.4	9.4	24.5	15
Shore	10.5	15.7	10.5	10.5	0	0	15.7	5.2	15.7	15.7

Injuries also appeared to vary by sex. Over the ten-year period, females more frequently received contusions, while males sustained more sprains, dislocations, fractures, and lacerations (Figure 6). Sprains and strains occurred more often to the ankle and knee, dislocations primarily involved the shoulder and fractures more often involved the arm/wrist/hand.

TREATMENT BY HEALTH CARE PROVIDER

Evacuations occur when the injured leaves before the end of their raft trip. These evacuations suggest that the individual's condition required medical care or was no longer able to participate because of the injury or illness. On average, just over one-half (52%) of injured guests/year required evacuation to an outfitter base camp or medical facility, or otherwise prevented the injured from completing the raft trip. Evacuations ranged from a low of 32% FY 2009 to a high of 81% FY 2006.

Figure 6. Percent of Injuries by Sex

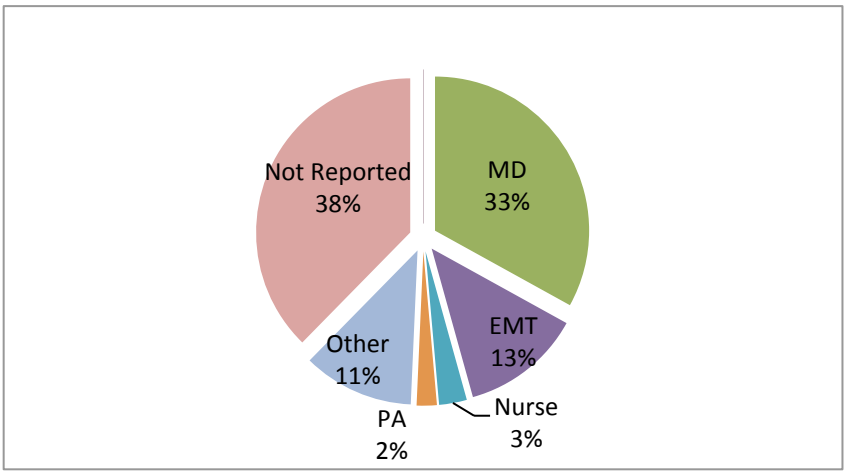


	Sprain/ Strain	Contus	Abras	Hypo	Concuss	Disloc	Frac	Lac/ Punc	Fatality	Other
Male	9.6	6.3	1.8	0	0.2	9.6	18	15.2	1.6	5.1
Female	8.1	8.1	1.6	0.7	0.2	4.6	4.6	8.6	0.4	6.3

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. Thirty three percent of the injury reports submitted FY 2001-2010 indicated that the injured were evaluated by a medical or osteopathic doctor (MD or DO), 13% by an EMT or paramedic, 3% by a registered nurse (RN), and 2% by a physicians assistant (Figure 6). Eleven percent of reports indicated that evaluation of the injured was performed by persons with some other training (e.g., First Responder, Wilderness First Responder) who most likely were trip leaders or guides. Of particular concern, who indicated no response or if the injured were evaluated on over one-third (38%) of injury reports.

Over one-half of injury reports (52%) noted that the injured received some form of treatment including a splint or cast (42%), stitches (18%), medication (11%), surgery (2%), or other unspecified treatment (33%). Twenty two percent of reports indicated "diagnosis only."

Figure 6. Treatment by Professional Health Care Provider



CONCLUSIONS AND RECOMMENDATIONS

The type and frequency of injury varied very little over the period 2001-2010 and in comparison to previous years. The majority of commercial whitewater rafting injury is relatively minor and occurs with regularity. Musculoskeletal injuries were the majority (45%) reported followed by injuries to soft tissue (39%). Sprains and strains occurred more often to the ankle and knee, dislocations primarily involved the shoulder and fractures more often involved the upper extremities. Over one-half of injured guests/year required evacuation, or were prevented from completing their raft trip. One-third of injury reports indicated that the injured were evaluated by a medical or osteopathic doctor, EMT or paramedic (13%), a registered nurse (3%), or by a physician's assistant (2%). Eleven percent of reports indicated that persons with other training performed evaluation of the injured.

Injuries continue to occur at similar locations (named rapids) within designated whitewater zones. For example, injuries continue to be reported on the Gauley River at Sweets Falls Insignificant, and Pillow Rock. The raft continues to be the primary setting for almost one-half of the injuries sustained by commercial rafters, followed by injuries sustained in the river and a small percentage on shore. Injuries most likely to occur in the raft were to the knee and face. Injuries while in the water included both the upper and lower extremities, including the shoulder, and the head and neck. Overall, females more frequently received contusions, while males sustained more sprains, dislocations, fractures, and lacerations.

Injury reporting has also remained consistent, meaning that there continues to be "holes" in the way injuries are defined, how injury reports are completed, submitted, reviewed, followed-up, and how guests are counted. The following sections outline the major findings from the trend analysis and provide recommendations for each.

Injury Prevention

In order to prevent injuries it is essential to have information about the factors that contribute to their occurrence. With this information one can begin to understand the options for prevention. Effective injury prevention requires an approach that includes education, engineering, and enforcement.

Education

Decreasing the incidence of all injuries is an important goal of risk management. The creation of annual risk management reports can help build institutional risk management knowledge. The reports can be used to train staff in organization's risk management history. When viewed over time, injury patterns can be identified that can indicate where attention is needed to reverse an unwanted trend, to educate staff, to strategize preventative measures, to gauge the success of measures that have been implemented, and to share experiences by recounting significant events.

Knowing the nature and prevalence of injuries is an important first step towards allocating resources and educational efforts to decrease such incidents. Potentially, the best approach to reducing injuries may be through guide education. Guide education is a desirable technique because it is non-authoritarian, serves the guides' desires, stresses modification of behavior while maintaining individual choice, is cost effective, and has the ability to increase the quality of the rafting experience for guests. Guide education should take place during seasonal staff trainings or as in-service training. Encourage guides to educate or make customers aware on what, where, and why injuries occur on raft trips to reduce injuries, or at the least to enhance the customer's experience. Ideally, this information should be presented during the safety talk and reiterated as needed during the trip. As guide awareness about accidents, injuries, illnesses, and hazards improves, guides are more likely to report injuries.

Engineering

The majority of injuries continue to occur in the raft. Consideration should be given to incorporating preventive measures such as attaching face protection to helmets, encouraging the use of mouth guards to protect teeth, or carrying fewer passengers per raft. While these remedies take a common sense approach to injury prevention, they might not be cost effective or without undesirable consequences.

Efforts should be taken to determine the cause of injuries by conducting a Root Cause Analysis. Root Cause Analysis uses a structured approach to identify the factors that resulted in an injury. By identifying root causes, behaviors, actions, inactions, or conditions can be changed to prevent injuries from occurring again.

Enforcement

Greater effort is needed to verify injury rates, injury severity, and documentation of related medical costs. Collected data should reflect reported injuries. This information is accurate only to the extent that outfitters are conscientious about reporting injuries. All invested parties must decide if the reporting of injuries is important, the need for monitoring; how monitoring should be conducted, who should conduct it, and how to enforce compliance and penalties for not reporting.

Injury Reporting

Review of injury reports suggested that the definition of a "reportable injury" may be inconsistently interpreted, and clarification of reporting requirements may be needed to ensure consistent reporting. Many Injury Report Forms had information that was incomplete, illegible, missing, or marked "other". This absence of information creates a void in the reporting system by failing to communicate a true picture of the frequency and severity of injuries being sustained by customers. This lack of information along with no oversight (e.g. who's responsibility is it to follow-up with the patient?) also creates suspect and questionable information. Combined, these factors are cause for concern since they have the potential to affect the actual incidence rates or the true characteristics of rafting injuries. Because of these concerns, no generalizations can or should be made about commercial whitewater in West Virginia. Unless each of these concerns is addressed the reporting of injuries should not be continued.

The accurate collection and analysis of annual injury reports can help build institutional risk management knowledge, allow WVDNR and outfitters to properly identify and focus on illnesses and injuries in a particular area, and will let the West Virginia commercial whitewater rafting industry to better administer safety.

Report only medically significant injuries or illnesses. Minor injuries such as abrasions or cuts that did not affect the raft experience should not be included. Also, report all injuries for *both customers and guides*. This presents a more realistic view of injuries and how, when and where they occur. Criteria for what constitutes a reportable incident should include an injury or illness that requires more than simple first aid, requires follow-up care or the use of prescription medications, interferes with active participation, or evacuation to a medical facility (Leemon & Schimelpfenig, 2003).

Attention should be given to reporting near misses. A near miss, or close call is a potentially dangerous situation where safety was compromised but no reportable injury was sustained. Near miss incidents can be important predictors for future accidents and should be embraced by outfitters as a valuable teaching and training "tool" for guides since a lot can be learned by evaluating near miss information.

To implement a quality incident reporting system the following criteria should be

considered (Leemon, 2006).

1. Create an incident report form that is clear, concise, and easy to complete. A form that contains too many parts will limit compliance by guides since it may take time to complete. A well-designed Injury Report Form can insure that injuries are properly reported, investigated and acted upon. Reliable information can also support the WW industry in the event of a serious accident by showing diligence in collecting and analyzing injury data to successfully respond to potential lawsuits and allow the commercial whitewater rafting industry in West Virginia to better administer safety.

2. Define what needs to be reported. Including injury, illness and near miss. Consider the following criteria for reporting injuries:

- Requires more than simple first-aid
- Requires more than brief guide attention
- Requires follow-up care by guides in the field
- Requires follow-up care by a medical professional
- Requires the use of prescription drugs
- Interferes with the client's active participation
- Requires evacuation from the field
- Results in a near miss

3. All injury report forms should have a narrative section. Train guides to write these concisely, factually, and legibly. The narrative should present a clear understanding of the event.

4. Collect reliable guest data to calculate incident rates. Incident rates are used to measure performance over time. A raft day is one person on a trip for one day. The common rate factor is injuries per 1,000 raft participants.

5. Injury and guest numbers should be accurate and accessible. To achieve this storage system that allows for easy retrieval should be implemented.

6. Data analysis should focus on the most frequent and most severe incidents. Patterns should be identified that contribute to injuries, identify trends in the data, such as changes in incident rates over time, designated whitewater zone, or setting (raft, water, shore).

7. Create an organizational culture that values learning from injury reports and trends. Encourage reporting by using the information responsibly. Injury data should be reported to guides so that they can see the value of their efforts to complete the injury report form and have ownership in the process. Ultimately, guides and guests are the ones who are going to benefit.

Tracking accidents, injuries, and illnesses can help prevent them in the future by allowing

WV DNR and outfitters to help them properly identify and focus on accidents, injuries and illnesses in a particular area. By using this information outfitters may be better equipped to identify and handle problem areas. To accomplish this, accurate reporting and record keeping is essential. Currently this is not happening.

As mentioned in previous reports, the number of injuries being reported under current reporting requirements may be questionable. This combined with the annual numbers of commercial rafters reported to WV DNR should be considered suspect, since there is no independent system to verify the participant numbers provided by outfitters. Inaccurate reporting of participant numbers creates problems when attempting to calculate injury rates for a specific whitewater zone leading to inaccuracies in annual injury rates. Therefore, caution is advised when making annual comparisons of injury rates. Inaccuracies in reporting actual commercial use numbers have been acknowledged by the WV WWC along with recommended solutions to this problem (Whitewater Regulation Sub-Committee, 2010). It is suggested that these recommendations be considered in order to accurately reflect annual participant numbers, which will allow for more accurate injury rates.

REFERENCES

American Whitewater. (2011). *Guided rafting accident statistics.* Reterived October 23, 2011 from http://www.americanwhitewater.org/content/Article/view/articleid/29824/

Fiore, D. C. (2003). Injuries associated with whitewater kayaking and rafting. *Wilderness and Environmental Medicine, 14*(3), 255-260.

Leemon, D. (2006). This is No Accident: Improving Risk Management through Incident Reporting. *2006 Wilderness Risk Manager's Conference Proceedings. Retrieved October 5, 2011, from* www.nols.edu/.../wrmc_proceedings_06_incident_reporting_leemon

Leemon, D. and Schimelpfenig, T. (2003). Wilderness injury, illness, and evacuation: National Outdoor Leadership School's incident profiles, 1999-2002. *Wilderness and Environmental Medicine 14*, 174-182.

State of West Virginia. (2001, November). *Preliminary performance review of the Whitewater Commission.* Unpublished manuscript, Office of Legislative Auditor, Charleston, WV.

Whisman, S. A. and S. J. Hollenhorst. 1999. Injuries in Commercial Whitewater Rafting. *Clinical Journal of Sports Medicine* 9:18-23.

Whisman, S. A., Hollenhorst, S. J., and Jones, C. (n.d.) *A Summary Report Submitted the West Virginia Division of Natural Resources as Part of Design, Management, and Implementation of a Limits of Acceptable Change (LAC) Process for a three-year study on the Gauley, New, Cheat, Shenandoah, and Tygart Rivers of West Virginia. Unpublished manuscript,* Recreation, Parks, and Tourism Management Program, Division of Forestry West Virginia University, Morgantown, WV.

Zhu, K., Norton, V. and Whisman, A. (1996). *Whitewater rafting injuries in West Virginia 1990-1995: A Descriptive Study.* Unpublished manuscript