ORIGINAL RESEARCH

Risk Factors Associated With Camp Accidents

Tricia B. Elliott, MS4; Barbara A. Elliott, PhD; Mark R. Bixby, MD

From the School of Medicine, University of Minnesota (Ms Elliott), Department of Family Medicine, School of Medicine Duluth, University of Minnesota (Dr Elliott), and Departments of Family Medicine, School of Medicine Duluth and Family Practice and Community Health, University of Minnesota, University of Minnesota/North Memorial Health Care Family Practice Residency Program, YMCA Camp Widjiwagan (Dr Bixby).

Objective.—Project goals included creating a database for medical incidents at a Minnesota canoe and backpacking camp and identifying those most at risk within this population using one summer's experience.

Methods.—YMCA Camp Widjiwagan employed a total of 123 staff and served 725 campers in summer 2000. This resulted in 9418 camper trail days (CTD), 2497 staff trail days (STD), and 20 150 participant days (PD), the evaluation units for this study. Data were collected using routine documentation: treatment logs (TL) for any event that required care, and incident reports (IR) for more serious injuries and near misses. Information was entered into an Access database and analyzed using descriptive statistics and analysis of variance.

Results.—Canoe and backpack trips were compared using staff and camper days (CD). There were 582 TL and 59 IR, including 12 cases that resulted in evacuation to medical care (1/1000 PD). Canoe groups were no more at risk than backpack groups ($P = .607$), and campers reported more incidents than staff regardless of sex or location of injury (0.4/1000 CD compared with 0.1/1000 CD; $P < .001$). The camper groups most at risk were those beginning a series of advanced canoe trips (10 IR/1000 CTD; $P < .001$) and those on the longest, most advanced backpack trips (9 IR/1000 CTD; $P < .001$).

Conclusion.—Careful tracking of health incidents and near misses over time can reveal which campers and camper groups are at greatest risk for injuries and illnesses occurring during participation.

Key words: wounds, injury, epidemiology, adolescents, risk factors, athletic injury, recreation

Introduction

Little research has been done to document the injuries and illnesses that participants in adventure camps and organizations experience as a part of wilderness trips. Designing a means of tracking these experiences was identified as a goal at Camp Widjiwagan, a Young Men's Christian Association (YMCA) adventure camp in northern Minnesota. The project reported here had 2 aims: first, to create a database for information storage, and second, to analyze the first season's data to initiate long-term, ongoing evaluation at Camp Widjiwagan.

In the past, documentation of these events at Widji-

wagan has been only on paper, and there has been no formal analysis of the information. A review of the summer 1999 findings by the Medical Director of the camp (M.B.) indicated that incidents seemed to occur more often on canoe trips than on backpacking trips (and for females more often than males) and that the most common injury was a sprained ankle. This information left several existing questions unanswered and raised others: 1) how many incidents actually occur; 2) what injuries are experienced; and 3) who is at increased risk for injuries?

On the basis of these indications, 4 hypotheses were proposed for analyzing this project's data: 1) few reported incidents result in evacuation or transfer of the camper for medical treatment; 2) females are either injured or are reporting incidents more often than males; 3) the most common injury is a sprained/strained lower extremity; and 4) those on canoe trips are more likely to report incidents than those on backpack trips. Within

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Corresponding author: Tricia B. Elliott, MS4, 4340 London Road, Duluth, MN 55804 (e-mail: elli0346@umn.edu).

Table 1. Widjiwagan trip types

Camper year	Skill level	Canoeing		Backpacking			
		Group name	Length (nights)	Location	Group name	Length (nights)	Location
One	Beginner	Intro	4–5	BWCAW*	Isle Royale	5	Isle Royale
Two	Beginner- Intermediate	BWCA†	9–10	BWCAW*	Bighorns	6–7	Bighorn Mts, WY
Three	Intermediate	Quetico	9–14	Quetico Provincial Park	Rocky Mountains	8–12	Spanish Peaks, CO or Absarokas, MT
Four	Advanced	Explorer	20–21	Ontario to Grand Portage	Explorer	15–16	Wind Rivers, WY
Five	Advanced	Advanced Explorers	20–21	Ontario or Manitoba	Advanced Explorers	16–18	Beartooths, MT
Six	Advanced	Voyageur	41–49	Northwest Territories or Yukon	Mountaineers	33–37	Alaska or Yukon

*BWCAW indicates Boundary Waters Canoe Area Wilderness (national name and designation of wilderness area).

†BWCA indicates Boundary Waters Canoe Area.

each activity type, it was expected that first-level advanced canoeists (“Explorers”) and beginner-intermediate level backpackers (“Bighorns”) would have the greatest number of reportable incidents.

Background

For over 70 years, YMCA Camp Widjiwagan (“Widji”) has sent single-sex groups on canoeing and backpacking trips from its base near Ely, Minnesota. Widji’s trail staff members, ages 18 to 27, have experience leading wilderness trips or working with youth, are certified in cardiopulmonary resuscitation (CPR) and either lifeguarding or Wilderness Water Safety, and are Wilderness First Responders. The first 3 weeks of every summer are spent in staff training during which these skills are reviewed.

Widji campers are between 12 and 18 years old. As they get older and more experienced, the campers travel farther away and for longer periods (see Table 1). At age 15–16, experienced campers (and usually third year staff) are invited to return for the first of the series of “Advanced Trips,” a transition to more technical activities like whitewater paddling, river crossings, and back country navigation. All campers spend 3 days in camp before their trips, planning their routes and menus and learning or reviewing needed skills.

Methods

This was a prospective, observational cohort study, designed to obtain descriptive information about wilderness injuries from one summer’s experience at a youth adventure camp. The study was supervised by the University of Minnesota’s Institutional Research Board—Human Subjects Committee, and written consent was obtained from all participants as a part of routine camp documentation.

Widjiwagan has recorded health incidents each summer using routine paperwork. In camp, health professionals (the camp nurses) complete treatment logs (TL). On trail, camp staff fill them out each time someone requires medical attention. If the incident meets specified criteria indicating it is a more serious event (see Table 2),¹ the involved staff are expected to complete an incident report (IR) form. Any incident that results in evacuation of the individual for medical care is detailed on the IR. Copies of these forms (TL and IR) are available from the authors.

Staff are also asked to complete an IR form for each “Near Miss” that occurs during a trip. A Near Miss is “a potentially dangerous situation where safety was compromised but no reportable injury occurred.”¹ Near

Misses are considered to be sensitive predictors of serious accidents.^{2,3} Therefore, in this project, Near Misses that required IR documentation were included in the data and investigated as thoroughly as those events that reported an injury or illness.

Expectations about the completion of these forms are reviewed annually during staff training, and they are discussed as part of each posttrip review and debriefing. During summer 2000, the reports were also reviewed to assure understanding of what had been recorded. The information on the forms was then entered into the MS Access program developed for this project and analyzed using crosstabs and analysis of variance, with significance assessed at $P < .05$. The denominators used for this study were camper days (CD), staff days (SD), and participant days (PD), as indicated in Table 3. Camper and staff days on trail (camper trail days [CTD] and staff trail days [STD]) or in camp (camper in camp days [CICD] and staff in camp days [SICD]) are also displayed separately in the table for clarification.

Results

Widji employed 123 staff and served 725 campers during summer 2000. As evident in Table 3, there were 9418 CTD and 2497 STD, and 3188 CICD and 5047 SICD, totaling 20 150 PD overall. A total of 582 TL and 59 IR were filed. In all, 31 were categorized as injury, 5 as illness, and 17 as Near Misses (which also included staff). Twelve incidents resulted in evacuations; 2 of these victims returned to their trail groups.

As indicated in Table 3, the rates of IR for staff differed in camp and on the trail (3/1000 STD and 0.4/1000 SICD). Both of these were less than the rates reported for campers, whether on canoe trips (5/1000 CTD), backpacking (7/1000 CTD), or in camp (1/1000 CICD). Campers had significantly more reports than staff ($P < .001$).

The most common injuries described in the IR (Table 4) on all trips were strains and sprains, with more injuries localized in the neck and lower extremity among canoeists than backpackers. No patterns emerged from this 1 summer's experience as to which injuries or illnesses resulted in evacuations. Allergies and infectious mononucleosis were the most common reasons for campers being evacuated for illnesses.

HYPOTHESIS 1

Evacuation for needed medical attention

As displayed in Table 3, there were 12 evacuations during summer 2000 for a rate of 12/20 150, or 0.6/1000

Table 2. Incident report criteria¹

<i>Incident report criteria</i>
<ul style="list-style-type: none"> ● Requires more than simple first aid ● Requires more than cursory staff attention ● Requires follow-up by staff in the field ● Requires use of prescription medications ● Interferes with the victim's participation in the group ● Results in an evacuation ● Results in a route change or forced layover

PD. Among campers and staff this rate was the same, and there was also one in-camp incident that resulted in a hospital visit.

HYPOTHESIS 2

Injury and gender

The sex of the person requiring an IR was not important in the rates of reported incidents, whether considered overall ($P = .340$), on canoe trips ($P = .605$), on backpack trips ($P = 1.00$), or in camp ($P = .484$).

HYPOTHESIS 3

Common injuries and locations

As listed on Table 4, the most common injury overall was a strain/sprain (36%). Soft tissue injuries were also common, including lacerations, puncture wounds, burns, blisters, and avulsions. The most common strain/sprain location differed by activity: for canoeists, neck sprains and strains were most commonly reported (40% of the sprains and strains), followed by ankle injuries (30%). For backpackers, no 1 location was more commonly reported than others for sprains and strains.

HYPOTHESIS 4A

Trip types at greater risk of IR

Camper IR rates using CTD were compared to evaluate whether canoeists or backpackers were more likely to report health issues. Contrary to what was hypothesized, canoeists were not more likely to have incidents than backpackers (5/1000 CTD compared with 7/1000 CTD; $P = .607$). However, there were differences in risk for injuries within the canoe and backpack groups (Table 5). As expected, the Explorers reported significantly more incidents than any other canoe group (10/1000 CTD, $P < .001$). The "Mountaineers," rather than the "Big-

Table 3. Treatment log and incident reports for campers and staff*

	On trail						In camp		Total	
	Canoe		Backpack		Total					
	TL	IR	TL	IR	TL	IR	TL	IR	TL	IR
Staff (n = 123)	1857 STD		640 STD		2497 STD		5047 SICD		7544 SD	
Rates	29/1000, n = 54	2/1000, n = 4	30/1000, n = 19	3/1000, n = 4	29/1000, n = 73	3/1000, n = 8	6/1000, n = 28	0.4/1000, n = 2	13/1000, n = 101	1s/1000, n = 10
Evacuations		1								1
Near Misses		3		2				0		5
Campers (n = 725)	7003 CTD		2415 CTD		9418 CTD		3188 CICD		12 606 CD	
Rates	46/1000, n = 322	5/1000, n = 29	36/1000, n = 88	7/1000, n = 16	44/1000, n = 410	5/1000, n = 45	22/1000, n = 71	1/1000, n = 4	64/1000, n = 803	4/1000, n = 49
Evacuations		7		3				1		11
Illnesses		2		2				1		
Injuries		15		9				3		
Near misses		12		5				0		
Totals	42/1000, n = 376	4/1000, n = 33	35/1000, n = 107	7/1000, n = 20	41/1000, n = 483	4/1000, n = 53	12/1000, n = 99	0.7/1000, n = 6	45/1000, n = 905	3/1000, n = 59
Total participants	8860 PTD		3055 PTD		11 915 PTD		8235 PICD		20 150 PD	

*CD indicates camper days; CICD, camper in camp days; CTD, camper trail days; IR, incident reports; PD, participant days; PICD, participant in camp days; PTD, participant trail days; STD, staff trail days; SICD, staff in camp days; and TL, treatment log.

Table 4. Injuries and illnesses listed in incident reports (some listed more than one condition or anatomic site)

	<i>Canoe</i>	<i>Backpack</i>	<i>In camp</i>	<i>Number of evacuations</i>	<i>Total percentages (%)</i>
Abrasion	10%	18%			3
Laceration	15%	27%	20%	1	18
Sprain/strain	30%	55%	60%	3	36
Locations					
Neck	4	1	1		
Shoulder	1		1		
Back	1	1			
Hand/finger		1	2		
Hip		1			
Leg		1			
Knee	1	1	1		
Ankle/foot	3	1			
Burn	5%	9%	20%	1	8
Avulsion	5%			1	3
Puncture	10%				5
Blister			20%		3
Impaled object	10%			1	5
Bee sting/anaphylaxis	10%			2	5
Illness	10%	18%	20%	3	13
Totals	<i>N</i> = 20 IR*	<i>N</i> = 11 IR	<i>N</i> = 6 IR	<i>N</i> = 12	<i>N</i> = 39 IR

*IR indicates incident reports.

horn” groups, reported more incidents than any other backpacking group (9/1000 CTD; $P < .001$).

HYPOTHESIS 4B

Trip types at greater risk for Near Misses

Near Misses were compared by sex- and trip-type; backpackers and canoeists were analyzed separately. For canoeists, there were no statistically significant differences in the reported number of Near Misses by male and female camper groups ($P = .194$). However, there were significant differences in the reports of Near Misses by canoe trip type ($P < .001$): the “Advanced Explorers” had the highest number of Near Misses (3/1000 CTD). Only 1 backpack trip type, the male Mountaineers, reported any Near Misses (7/1000 CTD).

Discussion

More published data regarding illnesses and injuries among campers and staff at adventure camps and organizations have been based on IR. Analyses of these records have been periodically presented at annual risk management conferences⁴ and otherwise have been infrequently published, providing limited summaries for comparison with this study’s findings.

Among those available is 5 years of National Outdoor Leadership School (NOLS) experience, published in 1992, that described an injury rate of 2.3/1000 PD.⁵ The comparable rate of injury for the current study is 0.3/1000 PD. A study reported the services rendered in 1995 by the emergency department at Yellowstone Park indicated that recreational visitors needed care in their clinic for more injuries and illnesses than park staff,⁶ a finding that is consistent with the observation in the current study as well. Information about evacuations was also included both in the NOLS report and in a report from the 1985 Scout Jamboree.⁷ The NOLS report indicated a 1.5/1000 PD evacuation rate;⁴ the Scouts reported that scouts were referred for medical care away from the Jamboree at a rate of 0.85/1000 PD.⁶ Our report indicates an evacuation rate of 0.6/1000 PD at Widji.

Regarding injury types, the most commonly reported injury in the current study was a strain or sprain; this is consistent with what has been reported in the literature.^{5,8} In the 5-year summary of the NOLS experience, 80% of the injuries involved strains, sprains, or other soft tissue injuries.⁴ All strain and sprain injuries in the current study were associated with portaging/hiking, falls, or equipment failure, and additional study is needed to better understand how these factors contribute to injuries. The primary location for sprains and strains

Table 5. Distribution of incident reports within canoe and backpack groups

among canoeists at Widji was the neck, followed by ankle strains and sprains; no one location was noted among backpacker reports. During summer 2000 staff training at Widji, extra emphasis was placed on spine and head injuries. This training could have made the staff especially aware of these injuries, which may have skewed the reporting.

The results of this study also indicate that the campers at greatest risk for injury can be identified by trip type. The risk-prone groups appear to be those making skill transitions. The canoe Explorers are on their first advanced trip, an honor which brings with it high expectations coupled with a steep increase in both physical and emotional demands. In contrast, the oldest, most experienced backpackers, the Mountaineers, reported the most incidents. These backpackers are also adapting to change; before this trip they have traveled mostly in the Rocky Mountains, whereas the Arctic setting presents unfamiliar challenges. Most of the reported injuries were related to falls on unstable ground or during river crossings, indicating that the environment was an important

factor. Further studies can address what specifically puts these campers at greater risk.

Many potential factors influence the rates of reported injuries, illnesses, and evacuations. These include the training of the staff, the adequacy of the first-aid supplies, the supervision of the participants, the risks taken in each setting, the participants' circumstances (only 3 of the reports indicated exhaustion was a contributing factor in the current study), or even the completion of the forms. Further studies will need to investigate the role of these factors in the reported experiences.

In addition, a reduction in future injuries may be influenced if primary care providers can be better informed of the types of activities and risks their patients will engage in at camp (each trip is of increasing challenge), as noted by other studies.^{9,10} Preexisting illness or injury may also predispose participants to further incidents. All campers and staff are required to see their primary care providers and turn in a completed "camp physical" before their camp experience. If an association between preexisting conditions and incidents can be doc-

umented, this may also be important information in reducing future incidents.

The Near Miss reports raise several questions. For canoeists, the Advanced Explorers reported the greatest number of Near Misses. During these trips, campers are introduced to whitewater paddling, and all the reported Near Misses were water-related (swamps, falls in fast water, etc.). It may be hypothesized that these groups were inadequately prepared before going on trail; however, it is equally possible that because these groups did not also report higher numbers of incidents, effective whitewater safety and rescue training was being practiced. Further study might focus on this question because Near Misses are important predictors for serious events.^{2,3} For backpackers, the Mountaineers were the only group to report Near Misses (as well as the trip type with the highest rates of incidents reported). This may indicate considerable risks are inherent in these backpacking trips or a lower threshold for reporting among this group during summer 2000. Subsequent analyses are needed to explore this question.

An additional consideration when interpreting the reports of Near Misses is an observation from the posttrip review discussions. Near Misses may have been generally underreported during summer 2000 (consistent with other reports¹). Staff were educated about the importance of Near Misses during staff training, but rates of reporting may have differed from person to person.

It is also estimated that illnesses were underreported overall because previous studies have found that hygiene-related illness (diarrhea, head colds, etc) occur at relatively high rates on wilderness camping trips.^{4,5} It was observed in posttrip reviews that several illnesses were also undocumented. Future collection strategies may be useful in assuring this documentation.

Conclusions

The findings of this study are important for wilderness camp organizations. Once a data collection and storage system is in place, analysis can be useful in understanding the setting's experience and the health risks to the campers and staff. The results of this 1 summer's experience at a youth adventure camp indicate that although it is important to prioritize every person's health and safety, camper- and trip-type risks offer important insights for understanding and addressing these events. Future analyses can identify trends and contributing factors to better focus these findings. In addition, this in-

formation can be used to improve staff training and guide risk management.

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