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Injury patterns at US and Canadian overnight summer camps: first year of the Healthy Camp study

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ABSTRACT

Objective: To describe injury patterns at overnight summer camps in 2006, and identify risk factors for more significant injury.

Design: Surveillance data obtained from Healthy Camp Study from 2006 were analyzed from 71 overnight camps, representing 437 541 camper-days and 206 031 staff-days.

Results: Injuries were reported in 218 campers and 81 staff. 51.8% of injured campers were male versus 34.6% of staff. Among campers, 60.1% were evaluated off-site; 2.3% required hospital admission. 43.9% of injuries required >24 h activity restriction (deemed "significant injury"). Among campers, significant injury was associated with camp sessions ≥ 14 days (RR 1.48); among staff, with male sex (RR 1.85) and camper-to-staff ratio (RR 0.67). There were no associations with age, time of day, setting, or level of supervision.

Conclusions: Significant injuries are uncommon at overnight summer camps. Rates appear similar to those in comparable activities. Targeted interventions may further reduce injury risk.

Approximately 11 million children and young adults attend summer camp annually.¹ The camp experience commonly includes high-risk activities such as team sports, water activities, wilderness hiking, and horseback riding. However, the rate and severity of injuries in the setting of summer camp have been poorly characterized. A prior study has described injury surveillance data from a small sample of summer camps,² but we know of no such publications from a broad sample.

The objectives of the current study are to: (1) characterize rates and patterns of injury in a sample of overnight (residential) camps, and (2) identify correlates of more significant injuries.

PATIENTS AND METHODS

Data source and collection: the Healthy Camp study

Data provided for analysis were collected between June 1, 2006 and August 10, 2006, the first of a 5-year surveillance study of injury and illness in a large sample of summer camps—the Healthy Camp Study. Camps were recruited for voluntary participation via online advertisements and presentations at camp conventions and meetings. The population targeted by these recruitment methods includes the entire membership of the American Camp Association (ACA), which included over 2400 summer camps in the United States and Canada; a precise count is not available because this population changed somewhat during the recruitment period. The camps included for this

study (ie, residential camps self-selecting for study by responding to recruitment literature) therefore constitute a convenience sample of camps, representing 33 states and two Canadian provinces (range 1–8 camps per state).

Reporters at each camp were identified on acceptance of that camp for inclusion in the Healthy Camp study and were typically a health-care provider (eg, camp nurse) but could include a camp administrator with previously approved access to patient data. Reporters provided data via an online data entry tool, Camp Reporting Information Online (RIO), by methods similar to those described previously.^{2,3} Briefly, all reporters were asked to complete a weekly exposure report listing the number of campers on site along with the number of events of illness or injury. In addition, for each such event, reporters completed an illness or injury report form detailing information regarding the affected camper's demographics, the nature of the illness or injury, and associated circumstances. Reports could be updated throughout the study; typically, reporters gathered information prospectively, concurrent with the patient encounter, and reported them online shortly after the completion of the patient encounter or batched at the end of the day or week. Data were reported for both illness and injury; only injury data are described herein.

Measures

Any injury was included if it resulted in medical attention during dates of participation in an overnight camp program, regardless of where the injury occurred, and restricted the affected individual from camp activities for 4 h or more. For each camp, the sizes of the population at risk were reported in "camper-days" or "staff-days," ie, the sum of the daily population of campers or staff at camp on each day of the week in question. For each injury, data recorded included patient demographics, timing of injury, activity type, anatomical location, and short-term sequelae.

Data analysis

Data were analyzed using commercially available statistical software. For comparison of categorical variables, differences were analyzed using relative risks and χ^2 tests. For comparison of continuous variables, differences were analyzed using independent-sample two-tailed t tests. Multiple logistic regression was performed using block entry.

Two camps were identified as possible outliers in early analyses because the total number of

Brief report

Table 1 Characteristics of those injured at overnight summer camps, 2006

	Campers	Staff	Total
Total	218	81	299*
Camp characteristics			
USA	216 (99.1%)	75 (92.6%)	291 (97.3%)
Canada	2 (0.9%)	6 (7.4%)	8 (2.7%)
Short-term†	148 (67.9%)	59 (72.8%)	207 (69.2%)
Long-term	69 (31.6%)	19 (23.5%)	88 (29.4%)
Patient characteristics			
Age (mean (SD)): range	12.8 (2.7): 6–22	20.1 (5.7): 12–54	15.0 (5.6): 6–54
Sex			
Male	113 (51.8%)	28 (34.6%)	141 (47.3%)
Female	105 (48.2%)	52 (64.2%)	157 (52.7%)
Safety training‡	52 (23.9%)	20 (24.7%)	73 (24.4%)

*Numbers that do not total 299 reflect missing data.

†“Short-term” is defined as a camp with sessions lasting less than 13 days or less. “Long-term” camps are those with sessions lasting 14 days or more.

‡The patient had received some form of safety training relevant to the activity during which the injury had been sustained.

camper- and staff-days was over three standard deviations above the mean. Univariate comparisons between these camps and the remaining data also differed markedly on several measures, including a greater camper-to-staff ratio at the larger camps; as such, it was thought that these camps did not reasonably represent the experience of summer camps at large, and so injury data from these two camps were excluded from further analysis.

RESULTS**Overall injury rates**

Of 133 camps reporting for the Healthy Camp Study, 71 were overnight camps, and 60 were day camps; the latter were therefore excluded from analysis. Of the 71 overnight camps, 58 (82.9%) were “long-term,” and 12 (17.1%) were “short-term” camps, with one camp undetermined. A total of 299 injuries were reported over 437 541 camper-days and 206 031 staff-days. Of these, 218 (72.9%) were sustained by campers, yielding a rate of 49.8 per 100 000 camper-days, and 81 (27.1%) by staff, yielding 39.3 per 100 000 staff-days (table 1).

Injuries occurred most frequently between the “waking hours” of 07:00 and 23:00 (95.3%), and apparently more often during heavy activity periods in the morning (09:00 to 12:00: 18.1%), afternoon (14:00 to 17:00: 24.7%), and evening (19:00 to 22:00: 20.1%) (fig 1). Most injuries occurred on site, and during scheduled camp activities (see table 2).

A total of 190 injuries (63.8%) were evaluated off site, of which eight (2.7%) required hospital admission. Additionally, 33 (11.1%) injuries ultimately resulted in temporary or permanent camp leave; no deaths were reported (see table 3).

Associations with injury severity

Univariate analysis revealed an association between “significant injury” (ie, resulting in >24 h restriction from camp activities) and “long-term” camp sessions ($p = 0.002$). There was no such association between significant injury and age, sex, time of day, level of supervision, location, or camper-to-staff ratio (table 4). This association remained when analysis was limited to campers only ($p = 0.002$). When limited to staff only, the only

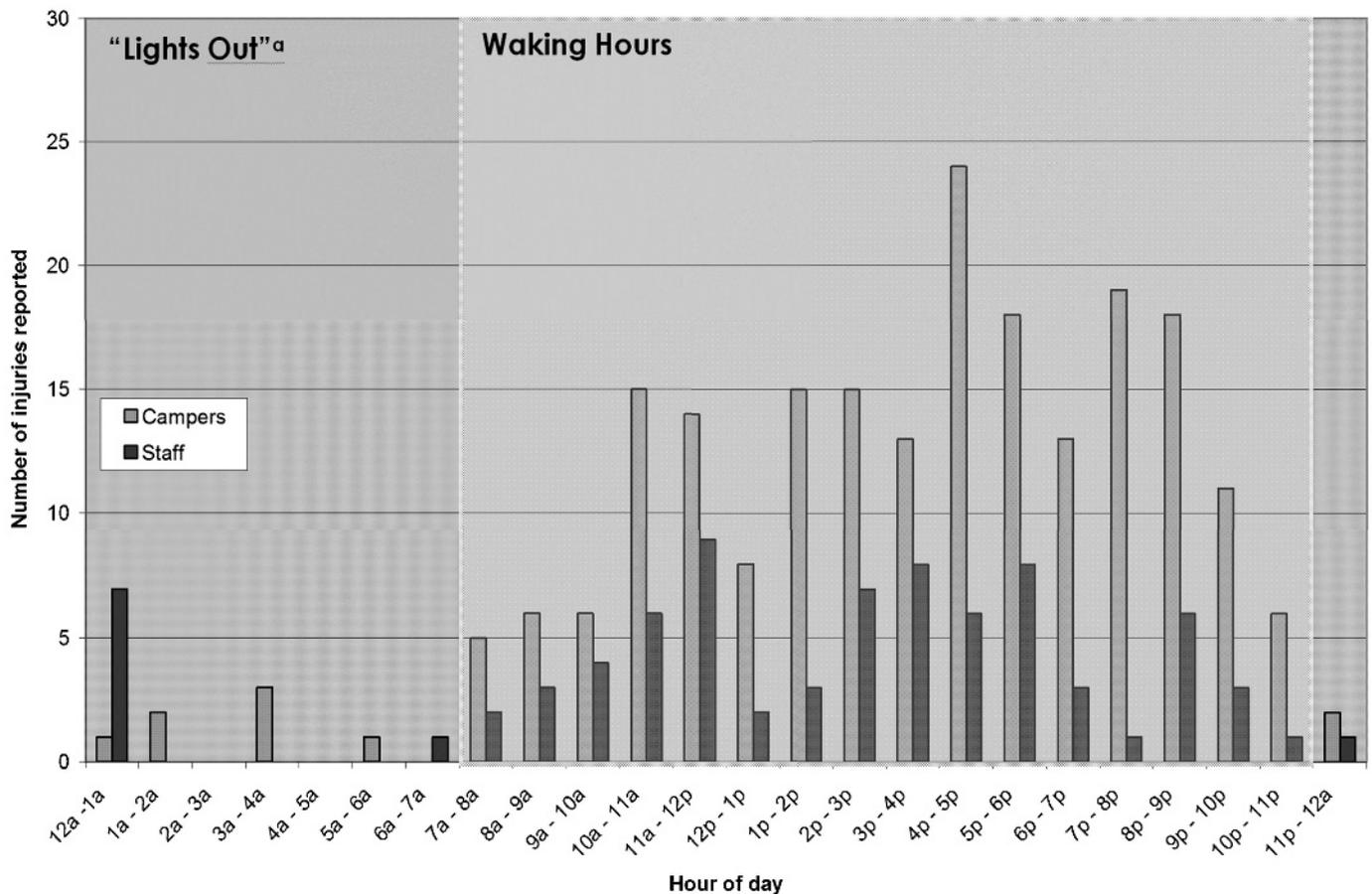
**Figure 1** Timing of injuries sustained at overnight summer camp, 2006.

Table 2 Activity and type of injuries sustained at overnight summer camp, 2006

	Camper	Staff	Total
Total	218	81	299*
Site and activity during injury			
On site; scheduled activity ("on duty")	195 (89.4%)	66 (81.5%)	261 (87.3%)
On site, "off duty"	0 (0.0%)	9 (11.1%)	9 (3.0%)
Off site; scheduled activity ("on duty")	22 (10.1%)	4 (4.9%)	26 (8.7%)
Off site, not in camp activity	1 (0.5%)	2 (2.5%)	3 (1.0%)
Level of supervision			
Scheduled instructional activity	115 (52.8%)	31 (38.3%)	146 (48.8%)
Scheduled evening program	34 (15.6%)	11 (13.6%)	45 (15.0%)
Free time	50 (22.9%)	14 (17.3%)	64 (21.4%)
During meal	3 (1.4%)	5 (6.2%)	8 (2.7%)
Overnight	4 (1.8%)	2 (2.5%)	6 (2.0%)
Other	12 (5.5%)	18 (22.2%)	30 (10.0%)
Type of injury			
Bruise, strain, sprain, swelling	101 (46.3%)	47 (58.0%)	148 (49.5%)
Laceration/bleeding	42 (19.3%)	8 (9.9%)	50 (16.7%)
Fracture/dislocation (including teeth)	37 (17.0%)	10 (12.3%)	47 (15.7%)
"Blow to head"	14 (6.4%)	7 (8.6%)	21 (7.0%)
Environmental injury†	3 (1.4%)	3 (3.7%)	6 (2.0%)
Bite/sting	4 (1.8%)	1 (1.2%)	5 (1.7%)
Other	8 (3.7%)	9 (11.1%)	17 (5.7%)
Anatomical location of injury			
Skull	18 (8.3%)	9 (11.1%)	27 (9.0%)
Face, eye, ear, nose, throat	21 (9.6%)	5 (6.2%)	26 (8.7%)
Neck	4 (1.8%)	2 (2.5%)	6 (2.0%)
Torso (chest, back, abdomen)	13 (6.0%)	4 (4.9%)	17 (5.7%)
Upper extremity	44 (20.2%)	21	65 (21.7%)
Wrist/hand	10 (4.6%)	4 (4.9%)	14 (4.7%)
Fingers	22 (10.1%)	6 (7.4%)	28 (9.4%)
Other upper extremity	13 (6.0%)	11 (13.6%)	27 (9.0%)
Lower extremity	103 (47.2%)	37 (45.7%)	141 (47.2%)
Knee	30 (13.8%)	12 (14.8%)	42 (14.0%)
Ankle	36 (16.5%)	15 (18.5%)	51 (17.1%)
Foot	13 (6.0%)	4 (4.9%)	17 (5.7%)
Toe	9 (4.1%)	4 (4.9%)	13 (4.3%)
Other lower extremity	15 (6.9%)	2 (2.5%)	17 (5.7%)
Other (eg, groin, buttocks)	8 (3.7%)	0 (0.0%)	8 (2.7%)
Multiple sites	3 (1.3%)	0 (0.0%)	3 (1.0%)

*Numbers that do not total 299 reflect missing data.

†Includes burns, electrical, heat, and water-related injuries.

associations with significant injury were with increasing age ($p = 0.048$) and camper-to-staff ratio ($p = 0.036$). Multivariate logistic regression using these same covariates redemonstrated

the association between significant injury and long-term camp sessions, in the entire data set ($RR = 2.60$, $p = 0.001$) or when limited to campers only ($RR = 3.60$, $p < 0.001$). A similar model,

Table 3 Evaluation of injuries sustained at overnight summer camp, 2006

	Camper	Staff	Total
Total	218	81	299*
Treatment site(s)			
Treated entirely on site	86 (40.8%)	21 (25.9%)	107 (35.8%)
Treated off site and released	126 (57.8%)	56 (69.1%)	182 (60.9%)
Treated off site and admitted	5 (2.3%)	3 (3.7%)	8 (2.7%)
Return to camp routine			
Returned to normal routine in 4–8 h	81 (37.2%)	22 (27.2%)	103 (34.4%)
Returned to normal routine in 8–24 h	48 (22.0%)	17 (21.0%)	65 (21.7%)
Returned to normal routine in 24–48 h	27 (12.4%)	9 (11.1%)	36 (12.0%)
Returned to normal routine in >48 h	19 (8.7%)	17 (21.0%)	36 (12.0%)
Never returned to normal routine but remained at camp	16 (7.3%)	6 (7.4%)	22 (7.4%)
Left camp but returned later	4 (1.8%)	5 (6.2%)	9 (3.0%)
Left camp and did not return	22 (10.1%)	2 (2.5%)	24 (8.0%)
Died	0	0	0

*Numbers that do not total 299 reflect missing data.

Table 4 Bivariate associations with significant injury among campers, staff, and overall dataset

	Campers (n = 218)		Staff (n = 81)		Overall (n = 299)	
	p Value	RR (95% CI)*	p Value	RR (95% CI)	p Value	RR (95% CI)
Age	0.47	NA	0.36	NA	0.35	NA
Sex (male vs female)	0.48	0.93 (0.74 to 1.15)	0.048	1.66 (1.03 to 2.89)	0.16	1.16 (0.95 to 1.41)
Time of day†	0.35	1.35 (0.65 to 2.83)	0.72	0.88 (0.47 to 1.67)	0.54	1.14 (0.72 to 1.84)
Length of camp session (≥14 vs <14 days)	0.002	1.48 (1.12 to 1.97)	0.26	1.41 (0.74 to 2.67)	0.002	1.45 (1.11 to 1.88)
Level of supervision‡	0.15	NA	0.14	NA	0.23	NA
Location (on- vs off site)	0.45	1.16 (0.77 to 1.74)	0.40	0.73 (0.40 to 1.35)	0.84	1.04 (0.73 to 1.46)
Camper-to-staff ratio§	0.12	NA	0.036	NA	0.99	NA
Camper versus staff member	NA	NA	NA	NA	0.15	1.72 (0.93 to 1.52)

All p values refer to those associated with χ^2 tests, except for continuous variables (age and camper-to-staff ratio), which are p values for two-tailed, unpaired t tests. Values in bold and italics are those with statistically significant associations ($p < 0.05$).

*Relative risk with 95% confidence interval.

†Waking hours (07:00 to 23:00) versus "Lights-out" (23:00 to 07:00).

‡Levels of supervision include: scheduled instructional activity; scheduled evening program; free time; during meal; overnight; and other. Relative risks were not assessed, as this was not a dichotomous variable.

§Camp-wide camper-to-staff ratio, for the total numbers of staff and campers during the week of injury.

limited to staff only, did not significantly predict significant injury (data not shown for multivariate analyses).

DISCUSSION

The potential public health impact of injury at summer camp is enormous, as unintentional injury represents 44% of all childhood deaths,^{4,5} with over 11 million children exposed to such injury at summer camps annually.^{1,3,6} Despite this, little is known regarding injuries from summer camp activities.

Our study reports a rate of 49 reported injuries per 100 000 camper-days. The working definition of injury is identical to that in Yard *et al* in a smaller sample of summer camps, and the injury rate reported therein is similar (39 per 100 000 camper-days).² Other studies in comparable settings include hospital visits from a Boy Scout Jamboree (79.9 per 100 000 camper-days),⁷ and canoe and backpacking injuries (40 per 100 000 camper-days).⁸ Estimates of playground injury rates are between 0.25 and 2.18 injuries per 100 000 child-hours (6 to 52 per 100 000 child-days).^{9,10} A more appropriate comparison might be between the reported hourly rate of playground injuries and our hourly rate of injuries to campers during waking hours (ie, including only injuries sustained during the 16 "waking hours" indicated in fig 1). This rate works out to 3.0 camp injuries per (awake) camper-hour, which is slightly higher than the greatest estimate of playground injuries noted above. Overall, however, our reported injury rate among campers appears comparable to those in similar settings, despite the varying study definitions of injury.

In our study, significant injury was not associated with age or sex among campers, although it was associated with male sex among staff. Population-based studies similarly show little difference in rates of non-fatal, unintentional injury between 5-to-9-year-olds (10.1% annually), 10-to-14-year-olds (12.0%), and 15-to-19-year-olds (13.5%), while rates among males are significantly greater than females in all age groups.¹¹ It may be that the camp experience attenuates gender differences in exposure to high-risk activities, at least among campers.^{8,12}

Our study suggests that camp injuries tend to occur in relation to scheduled activity times. This schedule may vary between camps, but this trend has been observed previously.¹³ This argues against the popular opinion that injuries are more likely during unsupervised events.

Horseback riding and water sports are often concerning for parents of overnight campers. Horseback riding is very high risk,

with a pediatric hospitalization rate of 49 to 60 per 100 000 h of riding;^{14,15} drowning accounts for 6.1% of all deaths among 10–19-year-olds in the USA.¹⁶ The exact activity when injuries occurred was not routinely reported; however, out of 83 reports (29.0%) including such descriptors, 16 were related to equestrian activities and seven to water activities. Only two of these (both equestrian) resulted in significant injury. Notably, informal surveillance data suggest fewer than five deaths per year nationally for campers and for staffers,^{17–20} of which eight (five staff and three campers) were attributable to water activities, and 10 (eight staff and two campers) to off-site motor-vehicle collisions; none were associated with equestrian activities.

This is the first study known to the authors to examine the relationship of camp duration with injury rates. The association between significant injury and long-term camp persists when controlling for level of supervision, and may reflect complacency regarding safety precautions over a longer camp session. It is also likely that long-term camps tend to include more high-risk activities (eg, horseback riding), although the event rates in the present study are insufficient to identify the particular high-risk activities. It is also likely that longer camp sessions have a different time distribution of activities, ie, that more time is spent out of supervised activities during a protracted camp session; or that activities are more time-consuming, and therefore more prone to carelessness and injury. This finding should help direct future analyses of the Healthy Camp Study and may prompt additional study and interventions focusing on injuries at long-term overnight camps.

Advantages/limitations

This study represents the first large-scale analysis of injuries at overnight camps. Our proxy of injuries requiring 24 h restriction from camp activities appears to be a reasonable representation of a significant alteration in the child's routine. It is not clear whether camps included in this study accurately represent the population of overnight summer camps at large, or even those which are members of the ACA. For instance, camps elected to participate in the Healthy Camp Study without compensation and therefore may preferentially represent camps engaged in safety promotion. In fact, the authors know of no available data regarding the distribution of camper demographics or activities offered at summer camps as a whole, or even when limited to ACA members. Finally, results might not apply to very large camps like the two camps excluded for

What is already known on the subject

- ▶ An estimated 11 million children and young adults attend summer camp annually¹ and are exposed to a wide variety of activities at high risk for injury.
- ▶ Regulations regarding safety at summer camps differ markedly between states.^{2,3}
- ▶ Little has been reported regarding morbidity and mortality.²⁻⁴

What this study adds

This study represents:

- ▶ the first large-scale study to describe injury rates and correlates at overnight camps;
- ▶ the first study known to the authors to examine the relationship of injury rates to camp characteristics such as the duration of camp sessions;
- ▶ the first study known to the authors which attempts to capture injury data prospectively among American summer camps with a broad geographic distribution.

study. Preliminary analyses suggested that these camps had a much greater camper-to-staff ratio, and that injuries at these camps followed a different pattern in terms of injury type and anatomical distribution (data not shown). The Healthy Camp Study will continue data collection through 2011; future studies may assess rates and types of injury over time, and more precise rates of infrequent injury types.

CONCLUSIONS

Overall, serious injuries were rare in our sample of overnight summer camps, and the injury risk appears comparable to those in similar settings, suggesting that presence at overnight camp is not a significant risk factor for serious injury. Camp sessions lasting 14 days or more apparently present an increased risk for significant injury. The Healthy Camp Study continues to accrue data and may reveal injury trends at summer camp over time, more precise estimates of injury, and measures of uncommon but concerning injury mechanisms such as equestrian activities, water activities, and motor-vehicle crashes.

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Competing interests: Several of the authors are affiliated with these organizations. EW is on the Advisory Board for the American Camp Association, and BG is employed by the American Camp Association. EY and RDC are employed by the Center for Injury Research and Policy. LEE is employed by the Association of Camp Nurses. None of these individuals was involved directly in the data analysis, and none of these agencies is believed to have a vested interest in the results of this study.

Each author contributed substantially to this study in the following areas: EG: conception and design of the present analysis, analysis and interpretation of data drafting the article, revising the article critically; EW: conception and design of the present analysis, conception and design of the Healthy Camp Study, analysis and interpretation of data, revising the article critically; RS: conception and design of the present analysis, analysis and interpretation of data, revising the article critically; EY: conception and design of the Healthy Camp Study, revising the article critically; BG: conception and design of the Healthy Camp Study, revising the article critically; RDC: conception and design of the Healthy Camp Study, revising the article critically; LEE: conception and design of the Healthy Camp Study, revising the article critically; RC: conception and design of the present analysis, analysis and interpretation of data, drafting the article, revising the article critically.

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