

Original paper

Self-reported skill level and injury severity in skiers and snowboarders

Claude Goulet^{a,*}, Brent E. Hagel^b, Denis Hamel^c, Gilles Légaré^d

^a Laval University, Department of Physical Education, Faculty of Education, Québec, Canada

^b University of Calgary, Departments of Paediatrics and Community Health Sciences, Faculty of Medicine, Calgary, Canada

^c Québec Public Health Institute, Research, Formation and Development Unit, Québec, Canada

^d Université du Québec à Rimouski, Département des sciences infirmières, Rimouski, Canada

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Abstract

There is evidence to suggest that the rate of injury is lower for expert skiers and snowboarders than for beginners. A better understanding of the relation between injury severity and skill level is also needed for planning injury prevention strategies. Our objective was to examine the severity and location of injuries sustained by self-reported expert and beginner skiers and snowboarders. A case-control study design was used. Injured skiers and snowboarders had to report their skill level on a 5 point scale (1: “beginner”; 5: “expert”). Two sets of severely injured cases were defined based on the type of injury and ambulance evacuation. Controls were those who did not sustain severe injuries. Logistic regression analyses were performed to relate injury severity to skill level. Subjects were 22 078 injured skiers and snowboarders who reported to the ski patrol with an injury sustained on the slopes of an alpine ski centre of the Canadian province of Québec during the seasons 2001–2002 to 2004–2005. Compared with beginners, experts had an increased risk of suffering from a severe injury (adjusted odds ratio [AOR]: 1.88; 95% CI: 1.58–2.23). Expert snowboarders were also more likely to suffer from a severe injury or be evacuated by ambulance (AOR: 1.18; 95% CI: 1.02–1.38). Results suggest that the type of activities or manoeuvres performed by expert skiers and snowboarders may increase the risk of sustaining a severe injury compared with beginner participants.

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1. Introduction

There is evidence that injury rates are lower for expert skiers and snowboarders compared with beginners^{1–3}. Even if experts are less frequently injured, our prior work suggests they may be more likely to sustain a severe injury⁴. Moreover, the injury pattern of experts and beginners may be different^{1,5}.

The objective of this study was to examine the severity of injury and body region injured by self-reported skill level among skiers and snowboarders.

2. Methods

Subjects were injured skiers and snowboarders reporting to the ski patrol at a ski station in the Canadian province of Québec during the 2001–2002 to 2004–2005 seasons. In Québec, two provincial statutes require that prospective ski patrol members complete a structured program of first aid education to qualify, and that a standard injury report form (IRF) must be completed when ski patrollers are asked to treat an injury^{6,7}.

The IRF captures data on skill level through a validated 5 point scale⁸ (1: “beginner”; 5: “expert”). Only extremes of the skill level scale were analysed to reduce misclassification. Two sets of cases were defined; (1) those who suffered from a severe injury according to clinical opinion (Table 1)⁹; (2) those evacuated by ambulance. Controls were those injured skiers and snowboarders who did not have severe injuries. Four body regions of injury were categorised: (1) head-neck; (2) trunk; (3) upper extremity; (4) lower extremity.

* Corresponding author at: Department of Physical Education, Faculty of Education, Pavillon de l'Éducation physique et des sports, 2300, rue de la Terrasse, local 2176, Université Laval, Québec (Québec) G1 V 0A6 Canada. Tel.: +1 418 656 3870; fax: +1 418 656 3020.

E-mail address: claud.goulet@fse.ulaval.ca (C. Goulet).

Table 1
Severe injuries based on clinical opinions^a.

Type of injury	Body region injured
Compound fracture	Head Arm, forearm, elbow, wrist, hand, thumb Cervical, dorsal, lumbar spine Shoulder blade, collar bone, thorax, ribs, hip-pelvis Thigh, knee, lower leg, ankle, foot
Simple fracture	Head Cervical, dorsal, lumbar spine Hip-pelvis
Any fracture	Neck
Dislocation	Cervical, dorsal, lumbar spine Hip-pelvis Elbow Knee
Internal injury	Abdomen, thorax Head
Concussion	Head
Burn	Face, head, nose, mouth
Cut	Eye

^a Adapted from Lipskie⁹.

Logistic regression analyses were performed (SAS software) independently for each set of cases and body regions to relate the severity and body region of injury to skill level (beginner vs. expert). Odds ratios were adjusted for age, sex, helmet use, season, type of activity (snowboarding vs. alpine skiing), and location of injury (snow-park vs. other slopes).

Multi-Level models with the MLwiN statistical software, and Generalised Estimating Equations (GEE) with SAS statistical software were also used to account for potential season and ski area effects.

3. Results

The proportion of ski areas contributing reports ranged from 80% (2004–2005) to 86% (2003–2004). Contributing ski areas represent over 95% of total Québec ski area visits. No differences in effect estimates or standard errors were found using Multi-Level models and GEE. Therefore, these analyses are not reported.

From Table 2, expert skiers were more likely to suffer a severe injury (adjusted odds ratio [AOR]: 1.88; 95% CI: 1.58–2.23), and be evacuated by ambulance (AOR: 1.28; 95% CI: 1.11–1.46). Expert snowboarders were more likely to sustain a severe injury or be evacuated by ambulance (AOR: 1.18; 95% CI: 1.02–1.38).

For expert skiers, the proportion of head or neck injuries (AOR: 1.86; 95% CI: 1.65–2.10), trunk injuries (AOR: 1.76; 95% CI: 1.47–2.10), and upper extremity injuries (AOR: 1.88; 95% CI: 1.68–2.11) was greater than that for beginners. For snowboarders, the proportion of upper extremity injuries was lower for experts compared with beginners (AOR: 0.68; 95% CI: 0.60–0.76) (Table 2).

Combining severity and body region (Table 2), the risk of sustaining a more severe lower extremity injury was greater for expert skiers (AOR: 1.43; 95% CI: 1.18–1.74). When an

Table 2

Characteristics of reported injuries sustained by skill reported skiers and snowboarders, and results of the logistic regression analyses, or odds of sustaining an injury by experts, Québec, Canada, 2001–2005.

Characteristics	Alpine skiing			Snowboarding		
	Expert no. (%)	Beginner no. (%)	Adjusted OR (95% CI) ^a	Expert no. (%)	Beginner no. (%)	Adjusted OR (95% CI) ^a
Severity						
Evacuation by ambulance	474 (16.5%)	1 173 (12.5%)	1.28 (1.11, 1.46)	324 (14.7%)	895 (11.8%)	1.18 (0.99, 1.41)
Severe injury	320 (11.1%)	569 (6.1%)	1.88 (1.58, 2.23)	282 (12.8%)	798 (10.5%)	1.13 (0.99, 1.36)
Ambulance or severe injury	623 (21.6%)	1 463 (15.6%)	1.39 (1.23, 1.57)	475 (21.6%)	1 320 (17.3%)	1.18 (1.02, 1.38)
Body region^b						
Head and neck	693 (24.1%)	1 463 (15.6%)	1.86 (1.65, 2.10)	490 (22.3%)	1 440 (18.9%)	1.10 (0.95, 1.28)
Trunk	288 (10.0%)	533 (5.7%)	1.76 (1.47, 2.10)	259 (11.8%)	744 (9.8%)	1.13 (0.93, 1.38)
Upper extremity	880 (30.5%)	1 448 (15.4%)	1.88 (1.68, 2.11)	1 052 (47.9%)	4 327 (56.8%)	0.68 (0.60, 0.76)
Lower extremity	1 275 (44.3%)	6 394 (68.2%)	0.43 (0.39, 0.47)	579 (26.3%)	1 576 (20.7%)	1.63 (1.42, 1.88)
Severity^c and body region^d						
Head and neck	309 (44.6%)	596 (40.7%)	1.17 ^e (0.93, 1.46)	239 (48.8%)	814 (56.5%)	0.72 ^e (0.56, 0.94)
Trunk	133 (46.2%)	263 (49.3%)	0.88 ^e (0.62, 1.24)	130 (50.2%)	376 (50.5%)	1.06 ^e (0.73, 1.54)
Upper extremity	99 (11.3%)	142 (9.8%)	1.02 ^e (0.75, 1.40)	106 (10.1%)	196 (4.5%)	1.67 ^e (1.21, 2.30)
Lower extremity	207 (16.2%)	701 (11.0%)	1.43 ^e (1.18, 1.74)	101 (17.4%)	227 (14.4%)	1.30 ^e (0.92, 1.83)

^a OR, odds ratio; CI, confidence interval. Adjusted for age, sex, location (snow-park, other slopes), helmet use, and season.

^b Proportions (%) are calculated for all injuries.

^c Severe injury as defined in Table 1 or evacuation by ambulance.

^d Proportions (%) are calculated for all injuries of each body region.

^e Controls are non-severe injuries of each body region. That is, for each body region, severe injuries are compared to non-severe injuries for frequency of injuries sustained by experts vs. beginners/intermediates.

injury occurred to the head or neck, there was evidence that the risk of sustaining a more severe injury was lower for expert snowboarders (AOR: 0.72; 95% CI: 0.56–0.94), but the risk of a more severe upper extremity injury was greater (AOR: 1.67; 95% CI: 1.21–2.30).

4. Discussion

The results suggest that expert skiers and snowboarders may be at increased risk of sustaining a severe injury compared with beginners. Moreover, there is evidence that the body regions injured are different for experts and beginners.

The increased risk of severe injuries observed for experts, and the difference in body regions injured cannot be fully explained by the age, sex, location of injury (snow-park vs. other slopes), use of a helmet, or season as all of these variables were accounted for in the regression modeling. Torjussen and Bahr also reported different injury patterns for elite and recreational snowboarders⁵. These differences in pattern and risk of severe injury are likely the result of experts using different techniques, participating at higher speeds and more aggressively than beginners. Further specific information on the biomechanics of the injuries is required to test these hypotheses.

We have considered potential limitations of the study related to injury reporting and data quality in a previous report⁴.

5. Conclusion

The body regions injured and severity of injuries differ for expert and beginner skiers and snowboarders making skill level of the target population a consideration in the development and implementation of prevention strategies.

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