

“General reasons and mechanisms of winter sport accidents: Is it speed only?”

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The faster they ride, the harder...

$$\bar{v} = \frac{s(t)}{t}$$

Doubling the speed produces a four-fold increase in the energy of the impact



External factors

- **Protectors used**
- **Slope conditions**
- **Snow conditions**
- **Visibility / weather**
- **Aggression on slopes**
- **Age of skiing material**



Personal factors

- **Age, gender**
- **Risky behaviour**
- **Skiing experience**
- **Warm-up**
- **Offensive or defensive skiing style**
- **Alcohol, drugs**



Equipment

EUROPEAN STANDARD

EN 1077

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 2007

ICS 13.340.20

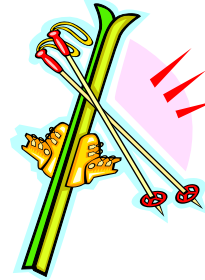
**Impact with a speed up to 20-23km/h
(CE-EN 1077)**



Environmental conditions



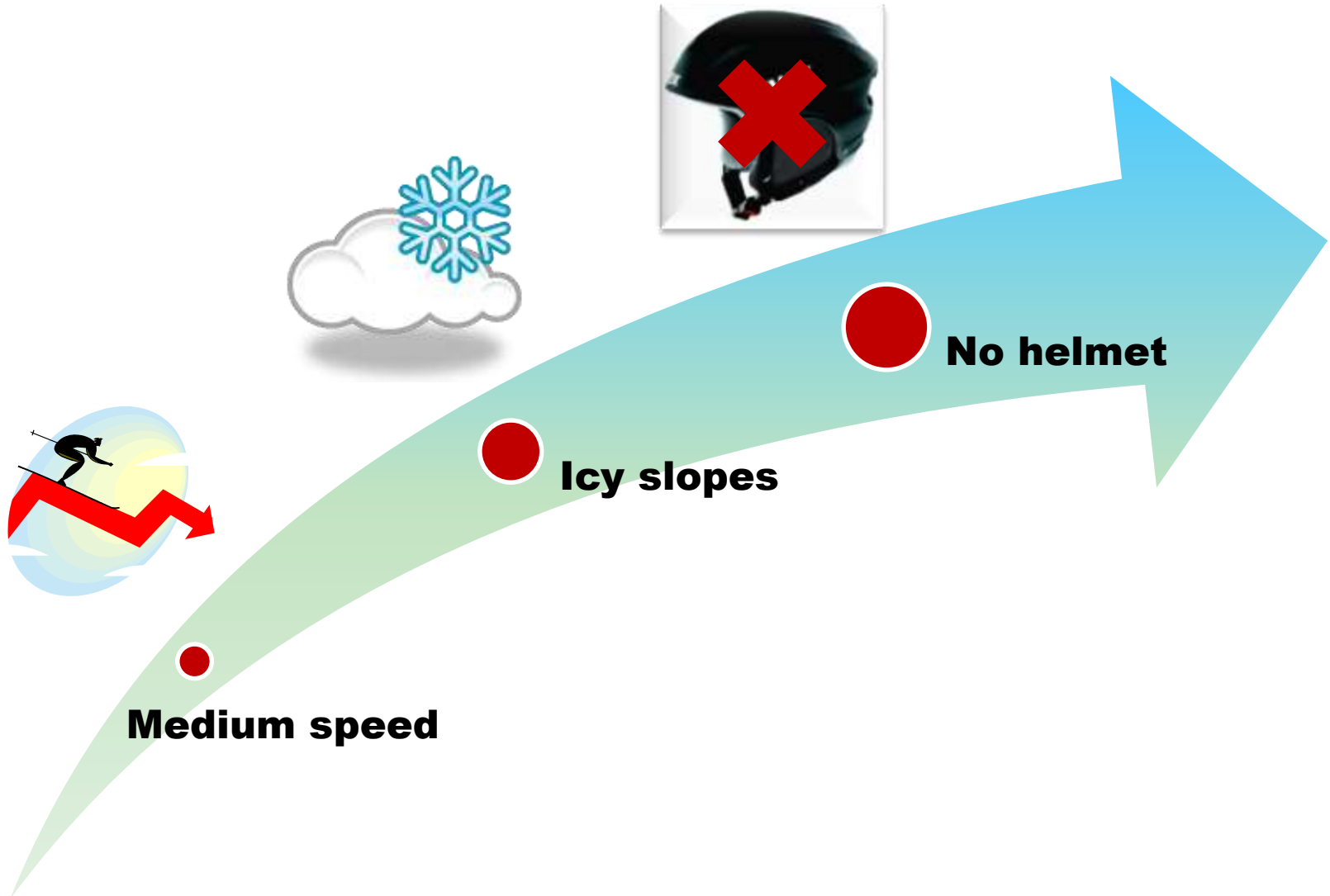
- **Risky behaviour**
- **Low speed**
- **New skiing material**
- **Old snow**
- **Powdry slopes**
- **Drug consumption**



[Are there risk factors for snowboard injuries? A case-control multicentre study of 559 snowboarders.](#) Hasler RM, Berov S, Benneker L, Dubler S, Spycher J, Heim D, Zimmermann H, Exadaktylos AK. Br J Sports Med. 2010 Sep;44(11):816-21.

[Are there risk factors in alpine skiing? A controlled multicentre survey of 1278 skiers.](#) Hasler RM, Dubler S, Benneker LM, Berov S, Spycher J, Heim D, Zimmermann H, Exadaktylos AK. Br J Sports Med. 2009 Dec;43(13):1020-5.

Combined risk factors



Risky behaviour in helmeted skiers

*Chi-square tests revealed that **ski helmet use did not significantly differ between self-reported risky and cautious people** (81% vs 83%).*

Riding off-piste

*Multivariate regression analysis revealed [...] and **off-slope skiing** (OR 2.2, $P = 0.060$) to be predictive for a risky behavior on ski slopes.*

Ruedl G, Burtscher M, Wolf M, Ledochowski L, Bauer R, Benedetto KP, et al: Are self-reported risk-taking behavior and helmet use associated with injury causes among skiers and snowboarders? Scand J Med Sci Spor Epub 2013 Nov 14, 2013

*The analyses comparing **riders off-piste** versus those on the slope showed a significantly increased **OR of 7.62 ($p=0.004$)** for sustaining a **head injury with need for surgical intervention.***

Association between head injury and helmet use in alpine skiers: Cohort study from a Swiss level I trauma center.

Baschera D, Hasler RM, Taugwalder D, Exadaktylos A, Raabe A.

J Neurotrauma. 2014 Sep 22. [Epub ahead of print]

Beginners?



[Risk factors for injuries in alpine skiing, telemark skiing and snowboarding--case-control study.](#) Sulheim S, Holme I, Rødven A, Ekeland A, Bahr R. Br J Sports Med. 2011 Dec;45(16):1303-9.

[Are there risk factors for snowboard injuries? A case-control multicentre study of 559 snowboarders.](#) Hasler RM, Berov S, Benneker L, Dubler S, Spycher J, Heim D, Zimmermann H, Exadaktylos AK. Br J Sports Med. 2010 Sep;44(11):816-21.

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Higher skill levels?



Ruedl G, Burtscher M, Wolf M, Ledochowski L, Bauer R, Benedetto KP, et al: Are self-reported risk-taking behavior and helmet use associated with injury causes among skiers and snowboarders? Scand J Med Sci Sport, 2013

Mechanism of injury

10% collisions, 90% self-inflicted

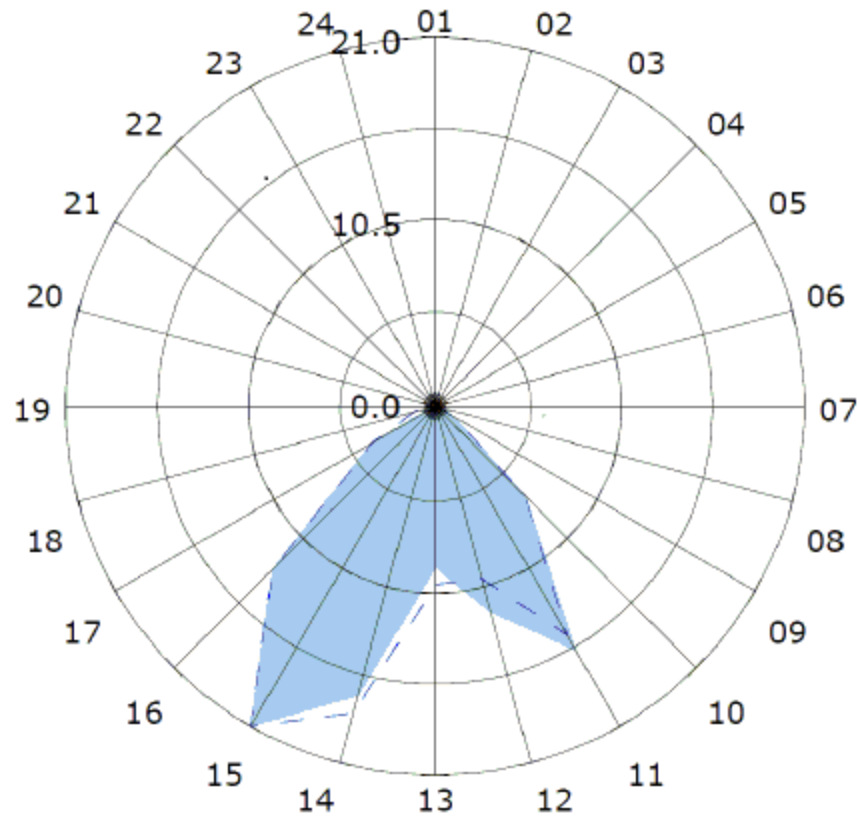


<http://www.suva.ch/startseite-suva/praevention-suva/sichere-freizeit-suva/unfallstatistik-tab-suva.htm>

http://www.bfu.ch/de/Documents/04_Forschung_und_Statistik/02_Statistik/2014/PDF/D_USP_T_09.pdf

[[Causes and factors associated with collisions on ski slopes](#)]. Ruedl G, Kopp M, Burtscher M, Bauer R, Benedetto K. Sportverletz Sportschaden. 2013 May;27(2):100-4. doi: 10.1055/s-0032-1330767. Epub 2013 Feb 12. German.

Hours of the day



Kollektiv NBUV Ski NBUV Snowboard

Quelle: UVG-Statistik, NBUV & UVAL, 2008-2012
Hochrechnung aus Stichprobe

Alcohol consumption ?



[Alcohol as a risk factor for downhill skiing trauma.](#) Salminen S, Pohjola J, Saarelainen P, Sakki A, Roine R. J Trauma. 1996 Feb;40(2):284-7.

[Impact of alcohol consumption on winter sports-related injuries.](#) Gaudio RM, Barbieri S, Feltracco P, Spaziani F, Alberti M, Delantone M, Trevisiol P, Righini F, Talarico A, Sanchioni R, Spagna A, Pietrantonio V, Zilio G, Dalla Valle R, Vettore G, Montisci M, Bortoluzzi A, Sacco A, Ramacciato G, Pasetti A, Mognato E, Ferronato C, Costola A, Ori C, Avato FM. Med Sci Law. 2010 Jul;50(3):122-5.

[Wie häufig und warum stürzen Skifahrer und Snowboarder?](#) Philippe M, Ruedl G, Feltus G, Woldrich T, Burtscher M. Sportverletz Sportschaden. 2014 Sep 11. [Epub ahead of print] German.

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10 FIS Rules for the Conduct of Skiers and Snowboarders



Rule 1: Respect for others

A skier or snowboarder must behave in such a way that he does not endanger or prejudice others.



Rule 2: Control of speed and skiing or snowboarding

A skier or snowboarder must move in control. He must adapt his speed and manner of skiing or snowboarding to his personal ability and to the prevailing conditions of terrain, snow and weather as well as to the density of traffic.



Rule 3: Choice of route

A skier or snowboarder coming from behind must choose his route in such a way that he does not endanger skiers or snowboarders ahead.



Rule 4: Overtaking

A skier or snowboarder may overtake another skier or snowboarder above or below and to the right or to the left provided that he leaves enough space for the overtaken skier or snowboarder to make any voluntary or involuntary movement.



Rule 5: Entering, starting and moving upwards

A skier or snowboarder entering a marked run, starting again after stopping or moving upwards on the slopes must look up and down the slopes that he can do so without endangering himself or others.



Rule 6: Stopping on the piste

Unless absolutely necessary, a skier or snowboarder must avoid stopping on the piste in narrow places or where visibility is restricted. After a fall in such a place, a skier or snowboarder must move clear of the piste as soon as possible.



Rule 7: Climbing and descending on foot

A skier or snowboarder either climbing or descending on foot must keep to the side of the piste.



Rule 8: Respect for signs and markings

A skier or snowboarder must respect all signs and markings.



Rule 9: Assistance

At accidents, every skier or snowboarder is duty bound to assist.



Rule 10: Identification

Every skier or snowboarder and witness, whether a responsible party or not, must exchange names and addresses following an accident.



www.fis-snowkidz.com



Accident prevention on ski slopes - Perceptions of safety and knowledge of existing rules.
 Hildebrandt C, Mildner E, Hotter B, Kirschner W, Höbenreich C, Raschner C.
 Accid Anal Prev. 2011 Jul;43(4):1421-6.



Outcome	Crude OR (95% CI)	Adjusted OR (95% CI)	P-value
Moderate to severe TBI			
alpine skiers	2.76 (0.75-10.2)	2.37 (0.63-8.86)	0.202
snowboarders	23.3 (3.52-153.5)	27.7 (3.26-235.3)	0.002
Open head injury			
alpine skiers	1.66 (0.35-7.95)	1.18 (0.24-5.88)	0.843
snowboarders	----	----	
Complicated minor TBI			
alpine skiers	2.22 (0.60-8.18)	1.89 (0.50-7.13)	0.350
snowboarders	----	----	