Comparison of Snowboard and Alpine ski injuries

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AN INTRODUCTION TO SNOW SPORTS INJURIES AND SAFETY

- Alpine snow sports remain very popular winter pastimes - it is estimated that there are currently almost 300 million skiers and snowboarders in the world today.

- Alpine skiing itself underwent a huge renaissance with the introduction of carving skis in the mid 1990's and design improvements continue every year.
- Skiers can choose from a huge range of different ski designs all basically based on the carving system.
- New developments continue apace in all sports - advancements in soft ski boots, integrated and mechatronic binding systems, electronic filaments in skis, ski rails - to name a few.

- Unfortunately, as with every other outdoor sport, snow sports are associated with a risk of injury.
- But that risk is much lower than most people believe - less than 0.5% in fact to give you a ballpark figure.

Overall injury rates and how they are calculated

- Some of the participants may do dangerous things, but the sports themselves are not inherently dangerous.
- Injury rates allow us to compare different sports and different time spans.
- For snow sports they can be expressed in one of two ways
  - *Injuries Per Thousand Skier Days (IPTSD) or*
  - *Mean Days Between Injury (MDBI)*

Injuries Per Thousand Skier Days

IPTSD

- IPTSD has been traditionally used to denote an overall injury rate.

- It is derived by dividing the number of injuries seen by the total number of skier/boarder days and then multiplying by 1000.
- Alpine skiing carries an injury risk of about 2 injuries per 1000 skier days. In other words, for every 1000 people skiing on any particular day, 2 will sustain an injury that requires medical attention.
- For skiboarding (snowblading) the current risk is slightly lower and for snowboarding the rate is slightly higher, somewhere between 3-5 injuries per 1000 boarder days in most studies.
- It follows therefore that the lower the IPTSD figure, the less likely injuries are to occur.
- Moreover, in many countries, the risk of injuries from alpine sports has been declining slightly in recent years which is of course good news.

- We can also look at this risk in percentage terms too - i.e. 2/1000 or less than 0.2%. (Pretty low I think)
- If you're still not convinced, think of an average game of soccer. How many players normally sustain an injury within the space of 90 minutes? Lets say 3 (its often more). That's 3/22 = 14% or at least 35x the injury rate of skiing and snowboarding over a much smaller time frame!
- Think soccer's a dangerous sport? No, of course not. Well, it's more risky than skiing or snowboarding.....

- A study in the December 2006 New Zealand Medical Journal by Bentley et al looked at the involvement of adventure tourism and adventure sports activity in injury claims made to the Accident Compensation Corporation (ACC) during a one year period from July 2004 to June 2005.

- Nearly 19,000 incidents were included in the study. The authors found that four activities (horse riding, mountain biking, tramping/hiking, and surfing) were responsible for approximately 60% of all adventure tourism and adventure sports-related injuries.
- Skiing and snowboarding were responsible for only 0.7% and 1% of claims respectively.

- Out of 27 fatalities in the study, none were from snow sports (whereas there were 6 deaths associated with both mountaineering and fishing).

Mean Days Between Injury
MDBI

- MDBI is more usually used to define the frequency of injuries.
- It gives a statistical value for how many days you would have to ski or snowboard in order to sustain an injury. It is derived by dividing the total number of skier/boarder days by the frequency of the particular injury.
- For example, the MDBI for an anterior cruciate injury whilst alpine skiing is about 2100 days. This means on average, you would have to ski for approx 2100 days before you sustained an ACL injury.
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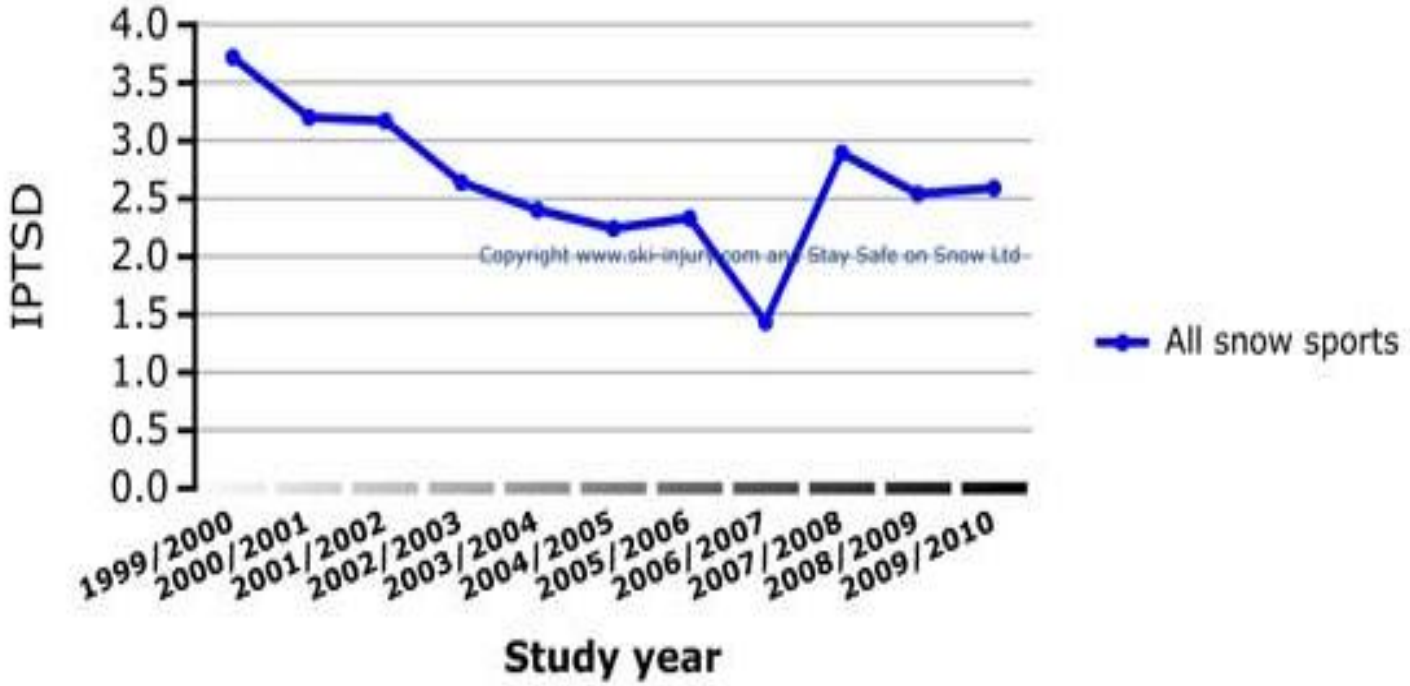
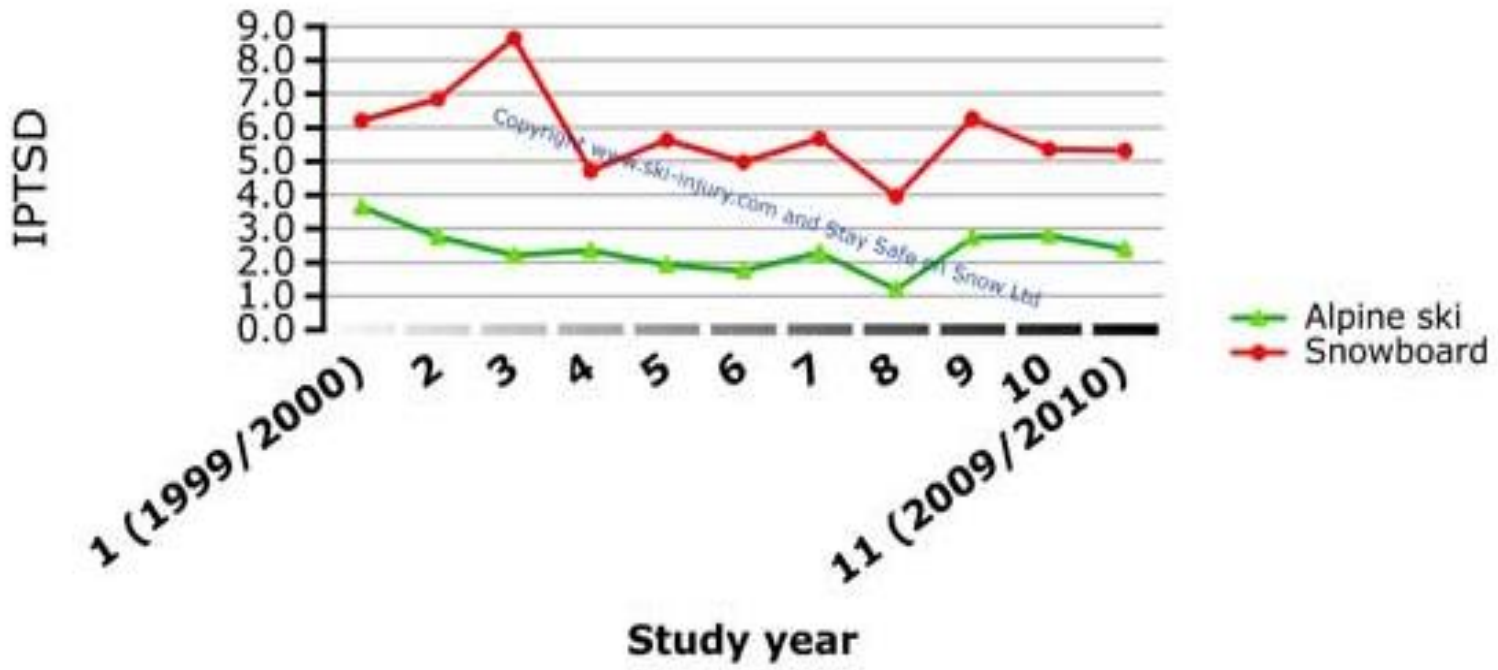
- This time, the higher the MDBI the less likely an injury is to occur. Again, a very small risk really.
  A large scale American case control study published in the American Journal of Sports Medicine in 2012 (Kim et al, AJSM 2012; 40: 770) showed that the average MDBI for snowboarding was 345 days and for skiing 400 days.

Overall Injury Rate
Scotland 1999-2010



Injury Rates
1999-2010



Fatalities

- Whilst they usually receive media attention, deaths due to participating in a snow sport are thankfully very rare indeed.
- The most complete data series on fatalities comes from the USA. From the 1991/92 to the 2003/04 season inclusive, a total of 459 traumatic deaths have been recorded within the boundaries of ski resorts in the US. Deaths from any other cause (including heart attacks) are not included in these figures.
- 58 of these deaths were snowboarders and 401 were skiers.
- A total of 650.7 million skier days took place during these 13 seasons giving a death rate of 0.71 deaths per million skier days (or one death every 1.4 million skier days - really exceptionally low).

- The very latest point data available is also American and comes from the 2008/09 season when 39 fatalities occurred out of the 57.4 million skier/snowboarder days reported for the season. Thirty of the fatalities were skiers (19 male, 11 female) and nine of the fatalities were snowboarders, (8 male, 1 female).
- Among the fatalities, eight of those involved were reported as wearing a helmet at the time of the incident. The rate of fatality converts to 0.68 deaths per million skier/snowboarder visits.

  Collisions of all sorts account for 90% of all fatalities - trees are the most commonly struck object accounting for some 60% of all fatalities. Collisions with other persons account for about 10% of all fatalities.

Serious injuries from snow sports

- Fortunately, only a minority of injuries seen across all snow sports are classed as serious or potentially life-threatening.
- Defining such injuries as those with an Injury Severity Score (ISS) >= 12 shows that only about 1% of all snow sports injuries meet this criteria.
- In a comprehensive 10 year study from Canada looking at all such injuries, an incidence of 0.06 severe injuries per 1000 skier days was derived (ref McBeth et al, American Journal of Surgery, 2009). The mean ISS was 20.8. The commonest mechanisms of severe injury were falls and collisions with (static) natural objects - like trees. The head (52% of all injuries), chest (42.9%) and spinal column (34.2%) were the commonest sites of injury.
- 40% of all casualties required a surgical operation. 2.6% of casualties died.

Alpine Skiing

- *Current injury rate in Scotland - 2.38 injuries per 1000 skier days (419 MDBI)*

  About one third(1/3) of all alpine ski injuries affect the knee joint - these usually involve either the medial collateral ligament(MCL), anterior cruciate ligament (ACL), the meniscus (cartilage) or any combination of the three.

Snowboarding

- *Current injury rate in Scotland - 5.31 injuries per 1000 boarder days (188 MDBI)*
- Boarding was the fastest growing snow-sport during the 1990's but its popularity has levelled out in the last three seasons at about 25% of all slope users.
- The resurgence in skiing's popularity (mainly due to freestlye skis) plus the attraction of skiboarding (snowblading) has had an undoubted effect on the plateau in snowboarding popularity.
- The current injury rate for snowboarding in Scotland is 5.31 injuries per 1000 snowboarder days - about twice that seen in alpine skiing.
- Snowboarding has a different injury profile to skiing. Upper limb injuries predominate, usually as a result of falls onto an outstretched hand.
  - The incidence of wrist fractures is particularly high, especially amongst beginners and children.
  - Whilst they are available, the majority of snowboarders still do not wear wrist guards despite very strong evidence to support their use in recent years.
  - More importantly, we now have good evidence to indicate the best type of guard to wear to protect against wrist injury .

Skiboarding (snowblading)

- *Current injury rate in Scotland - 1.99 injuries per 1000 skiboarder days (501 MDBI)*
- Also known as "snowblades", this sport has had a presence on the slopes for a decade or more now.
- Skiboards are mini-skis, shorter than 1m in length and, most importantly, to date the majority have been fitted with non-release bindings.
- Having initially looked like it would establish itself as a separate and prominent snow sport., in recent times its popularity has begun to wane.
- During the 2009/10 season in Scotland for example, only 2.2% of the population on the slopes were using skiboards. At the height of the sports popularity in Scotland (2003/04) almost 10% of the piste population were on skiboards.
- Perhaps the reason for this has been the emerging injury pattern - in many ways this resembles the bad old days of skiing before release bindings with an excess of lower limb injuries and lower leg fractures in particular.
- In addition, the risk of a fracture in particular is higher when using skiboards than any other snow sport. Nevertheless, despite this the risk is still pretty small! *(501 MDBI)*

- If injury occured on a skiboard there is a one in four chance break a bone. A very welcome development since the 2005/06 season was the wider availability of release binding systems as an option on skiboards.

Injuries amongst elite skiers and snowboarders - introduction

- Until recently, there has been very little data available concerning the risks of injury to elite (i.e. World Cup standard) skiers and snowboarders.
- Previous small scale studies had revealed the following injury rates for various sports:
- *Alpine skiing : 1-4 injuries per 1000 runs (Ekeland et al 1985, Bergstrom et al 2001)*
  Snowboarding: 1.3-4 injuries per 100- runs (Torjussen et al 2005/2006)
  Freestyle skiing: 1.6 injuries per 1000 runs (Heir et al 1995)
  Ski jumping: 1.2 injuries per 1000 skier days (Wright et al 1986)

FIS Injury Surveillance System

- In 2006, the FIS (International Ski Federation) in collaboration with the Oslo Sports Trauma Research Centre and financially supported by DJO, set up the FIS Injury Surveillance System.
- Since the 2006/07 season, this has collacted all injuries requiring medical attention that have been sustained by elite skiers and snowboarders during the world cup season.
- A standardised form is used for data collection and this is completed either by the athlete themselves or their coach/physio/doctor. The injury may have occurred during competition or training to be included in the database.

Results to date

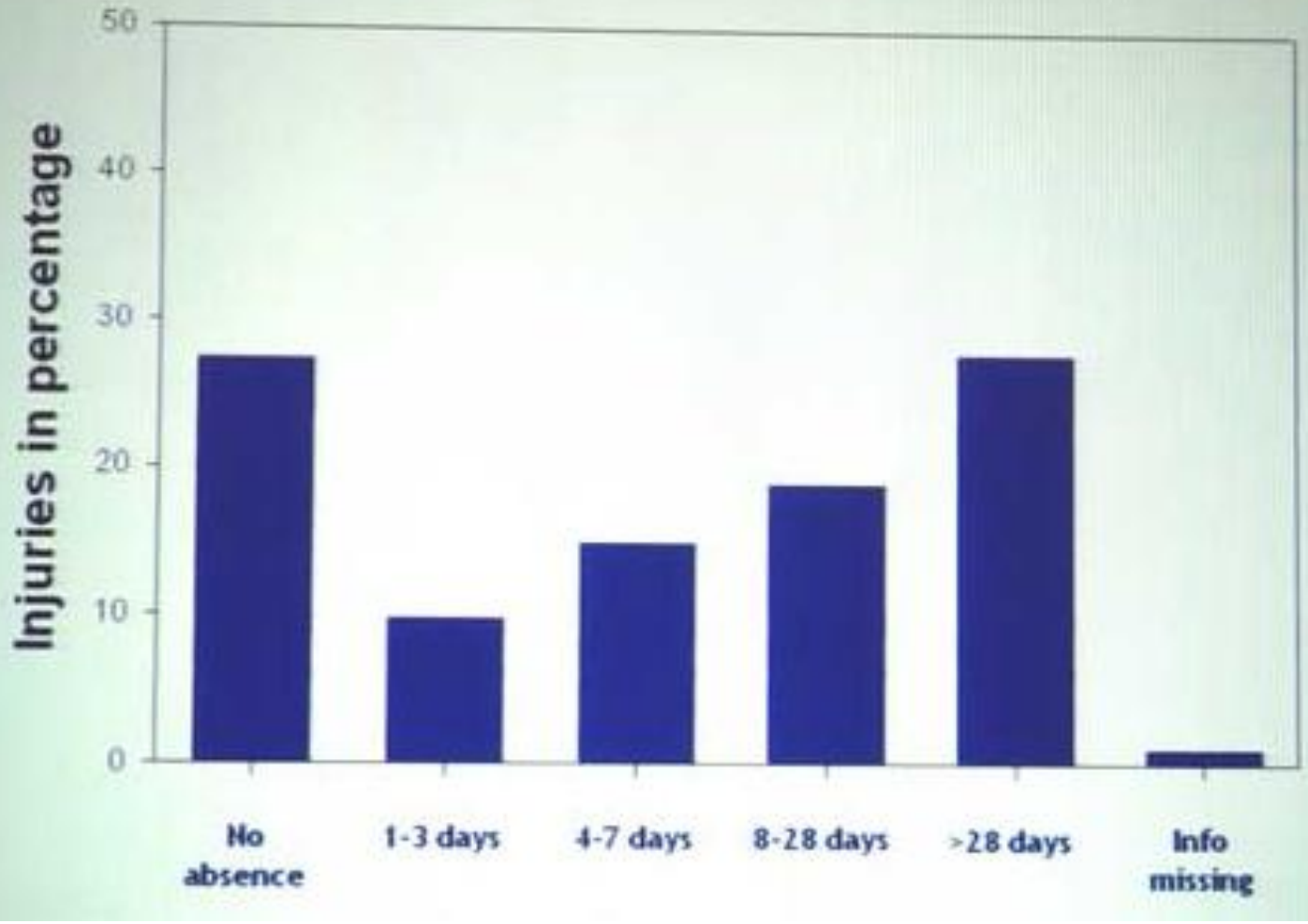
- The latest results from the study were presented at the ISSS 2009 meeting by Tonje Florenes from the Oslo Sports Trauma Research Centre and have now been published in a series of articles in the British Journal of Sports Medicine and the Scandinavian Journal of Medicine and Science in Sports
- So far, during the two seasons 2006/07 and 2007/08 a total of 705 injuries have been recorded amongst 2121 athletes.
- This means that one in three elite skiers/snowboarders sustains an injury!
- 49% of these injuries occur during world cup events.

The table below gives a breakdown of these statistics.

	n of athletes	*n of injuries*
Alpine	521	191
Freestyle	416	160
Snowboard	421	237
Ski jumping	213	45
Nordic combined	120	23
Cross country	430	49
TOTAL	**2121**	**705**

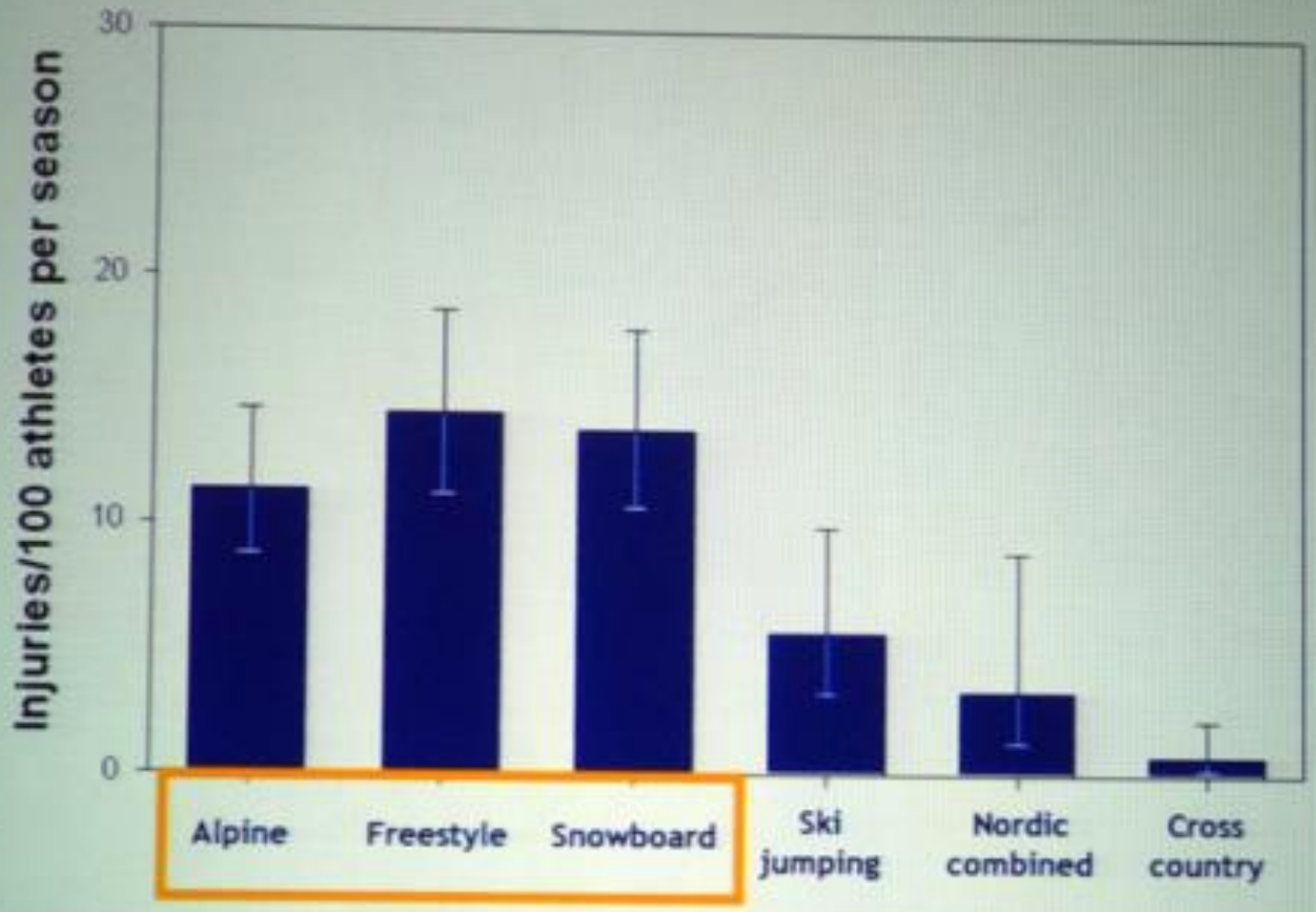
Severity

All injuries (n=705)



Severe injuries >28 days

n=196



Injury location

2006-07 & 2007-08

	All injuries (n=705)						
	0	1-3	4-7	8-28	>28	Missing	Total
Head/face	18	6	23	10	17		74
Neck	3	1		1		1	6
Shoulder/clavicula	19	6	10	15	21	1	72
U.arm/elbow/f.arm	12	4	7	5	10		38
Wrist	10	1	3	1	5	1	21
Hand/finger/thumb	26	4	4	4	4		42
Chest/Abdomen	7	5	6	6	4		28
Lower back	25	11	16	14	10		76
Hip	6	3	3	4	11	1	28
Thigh	10	2	2	2	2	1	19
Knee	28	15	16	41	81	1	182
Lower leg/Achilles	15	5	3	11	11	1	46
Ankle	8	5	12	15	14	1	55
Foot/heel/toe	5	1		5	6		17
Info missing	1						1
Total	193	69	105	134	196	8	705

Severe injuries >28 days

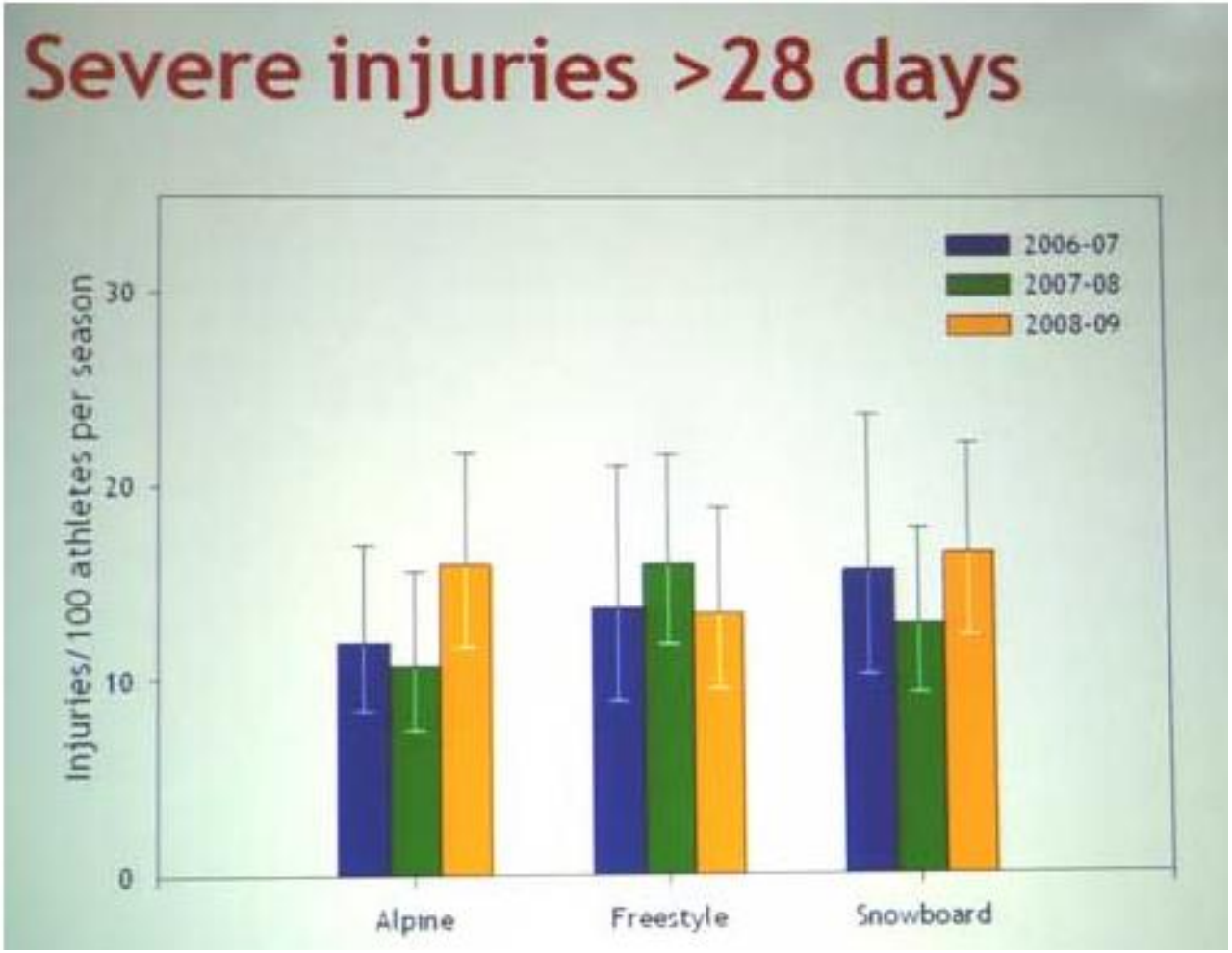


Table 3: Comparison of injuries caused by skiing and snowboarding

Injury	Sport; no. (and %) of injuries	
	Skiing[6] (n = 697)	Snowboarding (n = 132)
Upper body	320 (46)	66 (50)
Head injury	32 (5)	2 (2)
Spinal injury*	29 (4)	16 (12)
Trunk injury	25 (4)	4 (3)
Thumb injury*	67 (10)	1 (1)
Distal radius fracture*	6 (1)	13 (10)
Shoulder dislocation	17 (2)	1 (1)
Other*	84 (12)	27 (20)
Legs	377 (54)	65 (49)
Tibial fracture	21 (3)	1 (1)
Boot-top contusion*	29 (4)	0
Knee sprain*	187 (27)	18 (14)
Ankle sprain*	20 (3)	27 (20)
Foot or ankle fracture*	11 (2)	10 (8)
Laceration*	58 (8)	0

*$p < 0.01$, comparison between the two sports.

- The patterns of injury caused by snowboarding and skiing are distinctly different.
- Snowboarding accidents are characterized by wrist, -spinal and ankle injuries, a significant propensity toward injuries to the left rather than the right leg and a low incidence rate of lacerations and thumb injuries.
- Many of the differences between the injury patterns have likely explanations. It has been well established in alpine skiing that the ski's edge, once the binding has released, is responsible for most lacerations.
- The fact that no lacerations were noted in the snowboarders is presumably due to the nonreleasable nature of most snowboard binding systems. The ski pole is integral in causing the typical "skier's thumb" injury to the ulnar collateral ligament of the first metacarpophalangeal joint.
- Since there is usually no pole used in snowboarding it is not surprising that such injuries were absent.
- Another distinction is the incidence rate of spinal trauma. The manner of riding probably puts snowboarders at greater risk for falling backward and thus for axial-loading injuries, Such injuries are comparatively less common in alpine skiing, likely because most accidents involve a forward fall.
- For example, the incidence rate of coccyx injuries is between 0.15% and 0.30% in alpine skiing,as compared with the 4.6% in snowboarding found in one study.

Arm injuries

- Arm injuries are another area that may be related to the manner of falling, since snowboarders had a high incidence rate of distal forearm fractures.
- Although there were fewer shoulder dislocations in snowboarding this difference was not significant. However, the sport may prove to have a lower incidence rate of shoulder dislocations than alpine skiing because of the absence of ski poles, which are thought to contribute to some 24% of such injuries in skiers.
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lower-leg injuries

- There is a dramatic difference in the distribution of lower-leg injuries,
  - ankle and foot injuries predominating in the snowboarders and
  - knee and boot-top injuries in the skiers.
- This difference is best explained by the comparatively reduced protection of the soft boots commonly used by snowboarders. The benefit of such boots is that they likely prevent the significant stress on the leg that causes contusions or fractures. In addition, the fixed binding of both feet to a snowboard likely decreases the possibility of valgus stress on the knee, a frequent cause of medial ligamentous injury in alpine skiing.
- Many studies have shown a change in the types of lower-leg injuries seen in alpine skiing during the last 50 years.
- This change is related to a move from soft boots and fixed bindings to stiff boots and releasable bindings.
- In 1942, 46% of alpine skiing injuries involved the foot and ankle; by 1976 the rate had dropped to 7%. However, the incidence rate of tibial fractures increased, from 3% in 1942 to 16% in 1964, and then decreased to 6% in 1976, presumably because of refinements in binding systems.

- The incidence rate of knee injuries from alpine skiing has remained relatively stable through the years, although the pattern has changed dramatically:
- Tthe incidence rate of ACL has increased, and there has been a propensity toward complete ligamentous tears.
- One could speculate that the changing pattern of leg injuries in alpine skiing may occur in snowboarding.
- Although ankle injuries were predominant in snowboarding, this pattern could change if the more rigid boots popular in other countries are substituted for the soft boots currently used in Canada. In addition, snowboard technology is changing rapidly. Should a reliable releasable binding system appear on the market the nature of leg injuries could completely change. Of the 37 ankle injuries caused by snowboarding 28 (76%) occurred on the left side, as did 15 (7 1%) of the 21 knee injuries. This is presumably because most snowboarders use a left-foot lead on the board, and the lead foot is more prone to injury, a conclusion also reached by Pino and Colville.4 (A right lead is known as a "goofy foot" in the vernacular of snowboarding.) Unfortunately, the snowboarders were not questioned regarding their stance, since this factor was not anticipated when the questionnaire was designed. A final area in which the pattern of injuries may differ between snowboarding and alpine skiing is femoral fractures. Such fractures are known to account for 0.6% of alpine ski injuries;2' thus, given the number of injuries seen, one might have expected to see at least one such injury in this study (although its absence is not statistically significant). Interestingly, Pino and Colville4 found no femoral fractures in 1 10 snowboarding injuries. It has been established that the speed of travel directly influences the incidence of femoral fractures in alpine skiing.22 Such injuries may prove to be less common in snowboarding simply because snowboarders often travel at significantly slower speeds than alpine skiers. This could change as more snowboarders become experienced and increase their speed on steeper hills.

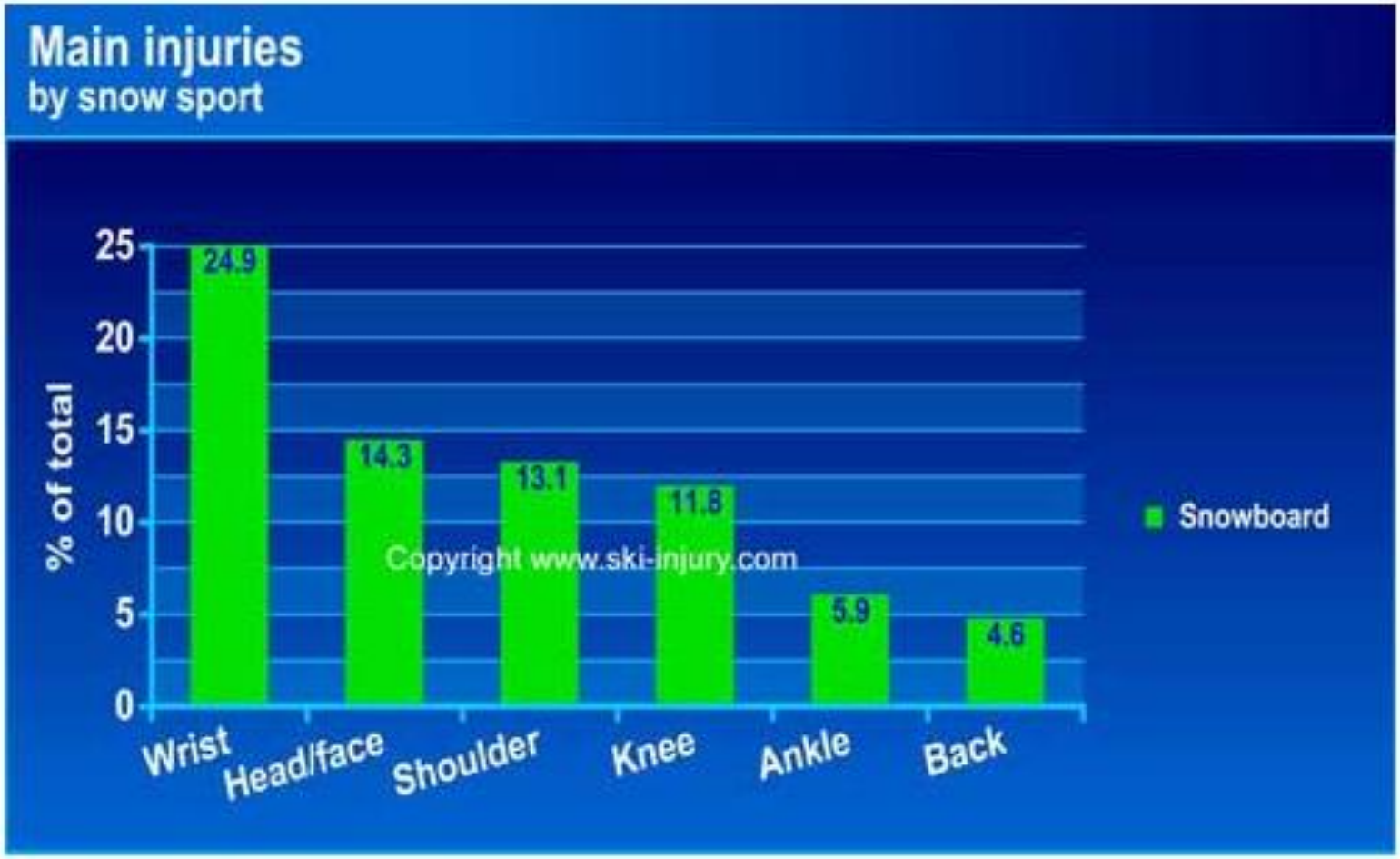
SNOWBOARDING INJURY TRENDS

- Snowboarding has a slightly higher potential for upper extremity injuries, but it may be safer on the knees.
- There is an increased rate of foot and ankle injuries associated with snowboarding.
- The lead foot has twice the number of injuries than the back foot.
- One study showed that the hybrid or “mid-stiffness” boots were the safest style of boots.
- There may be more high-energy injuries such as femur fractures, high speed injuries and injuries caused by getting “big air.”

- The commonest injury is to the wrist, with such an injury occurring once every 750 days, compared to a knee injury once every 1646 days – so the risk of an upper limb injury is about twice that of a knee injury on a snowboard.
- Interestingly, those with the highest risk of injury overall are beginner teenage snowboarders.
- The typical profile of an injured boarder is a young male from a non-skiing background who has had no professional instruction.
- Snowboarding has a completely different pattern of injury to skiing -
  - upper limb injuries predominate, followed by head injuries and lower limb (mainly ankle) injuries.
- injured snowboarders are twice as likely (34% vs 17%) to sustain a fracture compared to skiers. Most of these broken bones involve the wrist joint.
- There are obvious differences between boarders and skiers that may go some way to explaining the differing injury rates. Firstly, most injured boarders generally fall into one of three camps:
- 1. Skiers looking for a new challenge
- 2. Young kids keen to try the trendiest sport
- 3. Teenagers and young adults with little or no previous experience of the environment

- One of the first things a novice snowboarder must learn is the ability to maintain a stable stance – not easy, with both feet fixed in non-release bindings to a relatively narrow board.
- When balance is lost, snowboarders (unlike skiers) cannot ‘step out’ a leg in order to recover, as both feet are firmly attached to the board.
- The instinctive protective reaction in the event of a snowboard fall is to outstretch a hand to break the landing, thus placing the upper limb at risk of injury. This is one of the main reasons why beginner boarders are at higher risk of injury.

- The Scotland research indicates that many snowboarders also learn from friends.
- This can be a risky road to take as professional instruction (coupled with accrued experience) reduces your risk of injury.
- Interestingly, Snowboarders who have lessons but who have little experience on a snowboard are more likely to be injured - probably because they push their limits too far too quickly.
- Proper instruction should also help prevent the development of bad habits which can be hard to eradicate later on, unfortunately restricting your progress in the sport.


Main injuries
by snow sport
% of total
25
20
15
10
5
0
24.9
14.3
13.1
11.8
5.9
4.6
Wrist
Head/face
Shoulder
Knee
Ankle
Back
Snowboard
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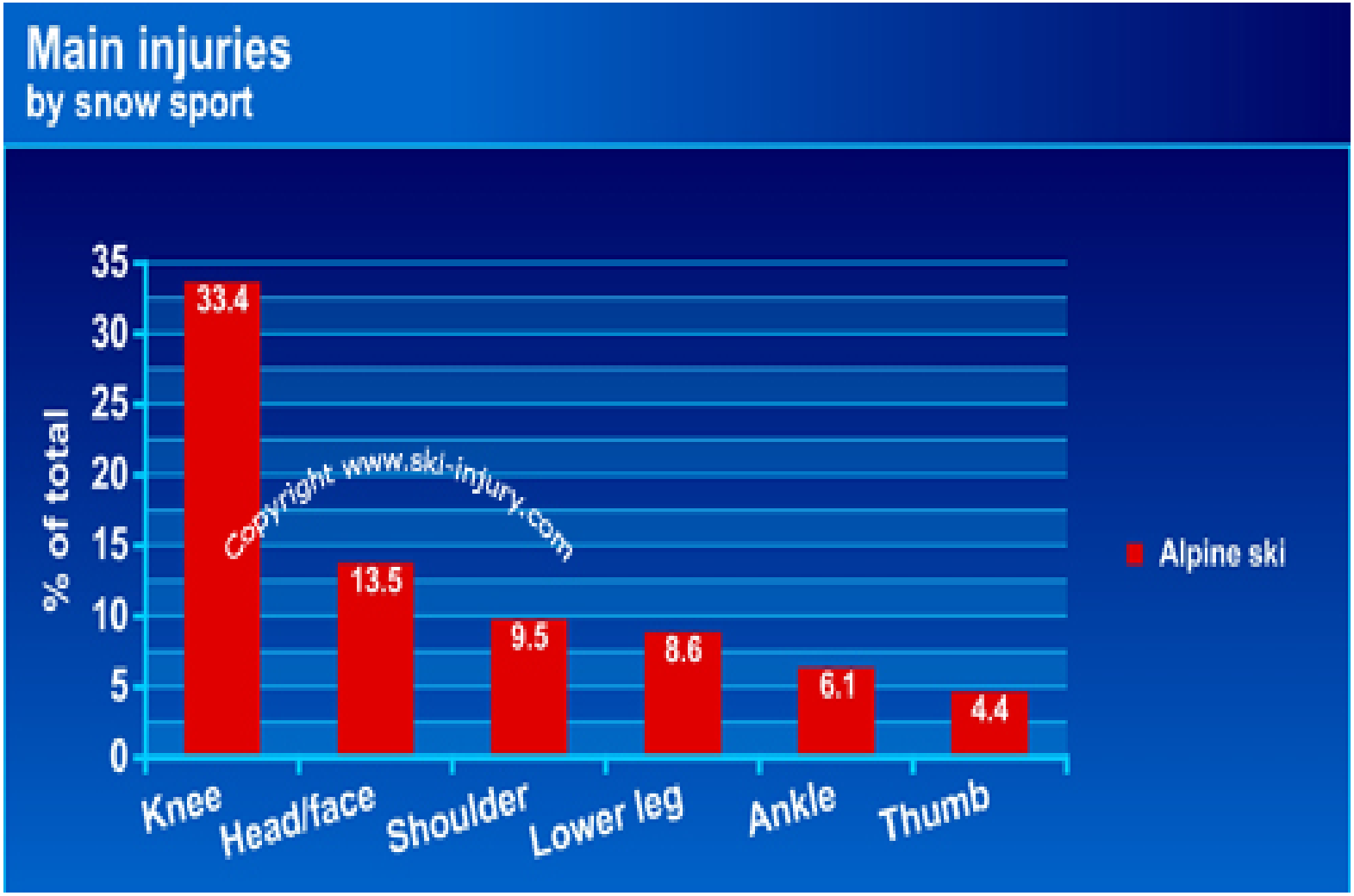
Main injuries
by snow sport
% of total
35
30
25
20
15
10
5
0
33.4
13.5
9.5
8.6
6.1
4.4
Knee
Head/face
Shoulder
Lower leg
Ankle
Thumb
Alpine ski
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Injury classification
Snowboard
% of total
35
30
25
20
15
10
5
0
32.2
11.9
27.8
8.6
15.0
4.4
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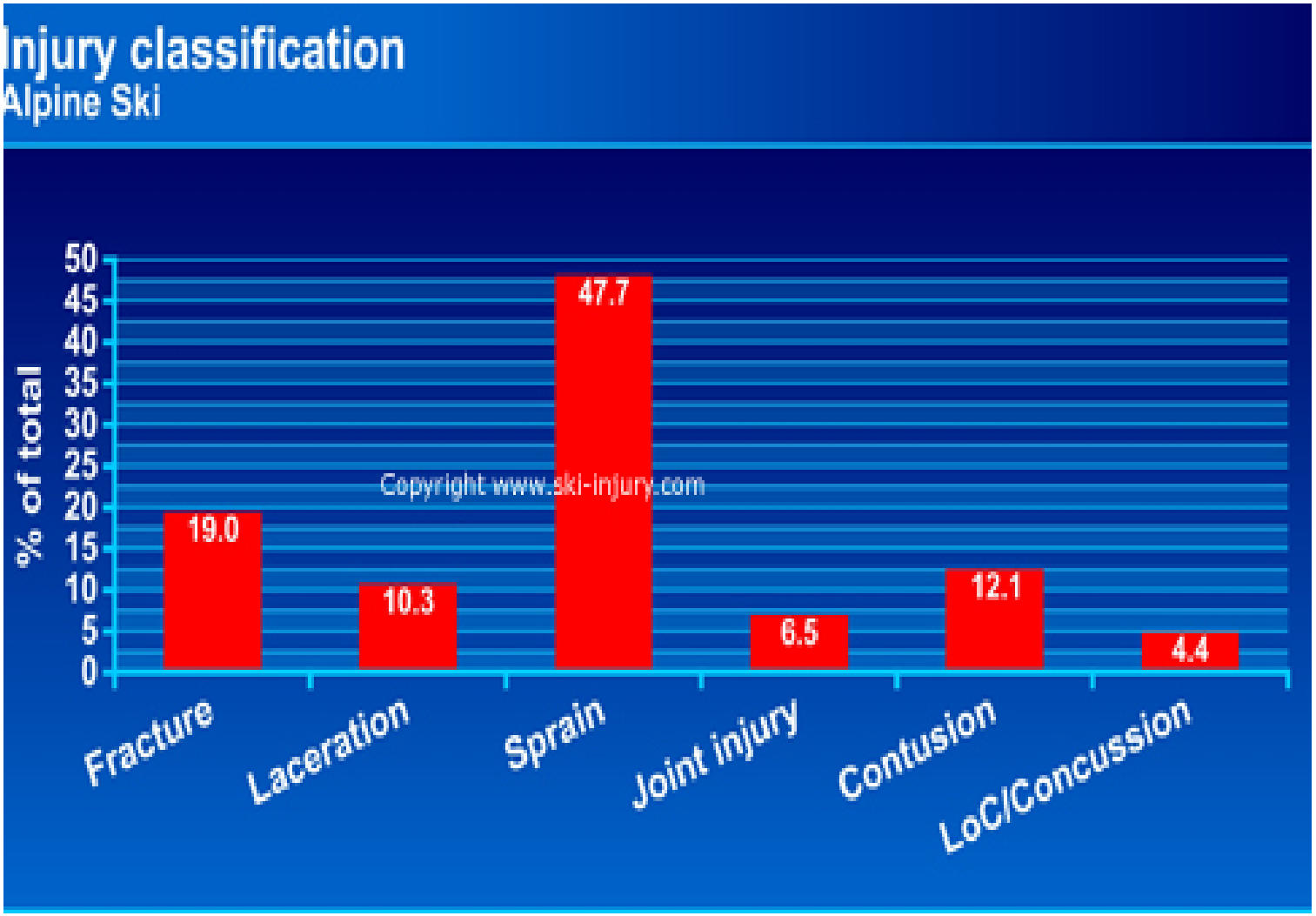
Fracture
Laceration
Sprain
Joint injury
Contusion
LoC/Concussion


Injury classification
Alpine Ski
% of total
50
45
40
35
30
25
20
15
10
5
0
19.0
10.3
47.7
6.5
12.1
4.4
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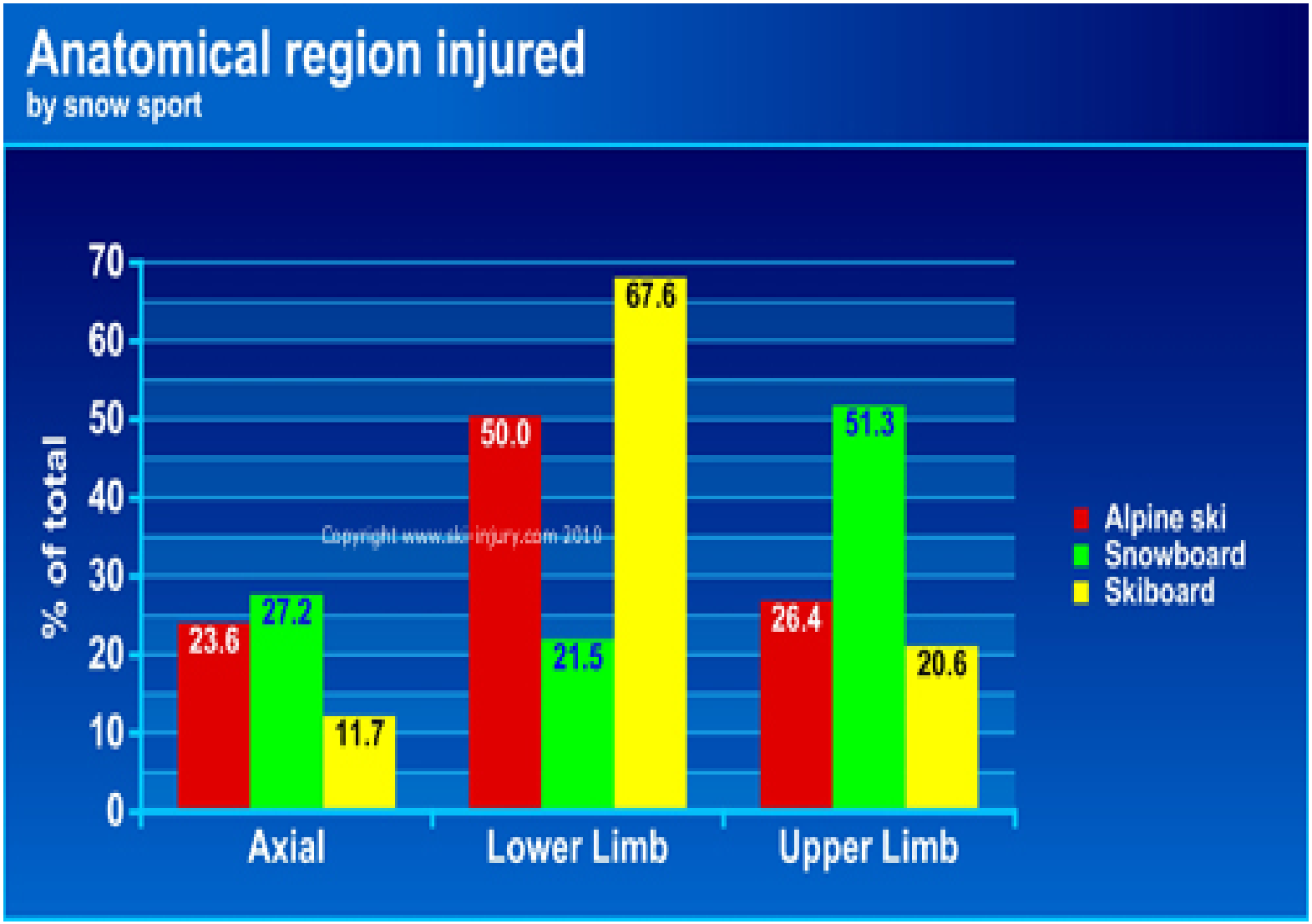
Fracture
Laceration
Sprain
Joint injury
Contusion
LoC/Concussion



w shows the five commonest injury locations seen amongst alpine skiers in Scotland, again

ALPINE SKI INJURIES

- Despite the emergence in the 1990's of snowboarding, skiboarding and on-piste telemark skiing, alpine skiing still remains the most popular snow sport by far, accounting for about two thirds of all those on ski slopes, depending on which country you focus on.
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References

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- ALPINE SKIING AND SNOWBOARDING INJURIES , American Orthopaedic Society for Sports Medicine (AOSSM SPORTS TIPS)
- http://www.ski-injury.com/


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