

**THE RISK OF INJURY FOR  
CHILDREN IN ALPINE SPORTS.  
A 8 YEARS CASE-CONTROL  
STUDY**

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# Greece is known for the history



# Greece is known for

the sea and the sun



# Greece is known for

and the financial crisis



A vertical poster featuring a sunset scene. The sky is a gradient of orange and yellow, with a bright sun low on the horizon. In the foreground, a dark silhouette of a hill with a cross on top is visible against the sunset. The text 'GREEK SUN. NOT IN CRISIS.' is overlaid in large, white, bold, sans-serif capital letters.

GREEK  
SUN.  
NOT IN  
CRISIS.

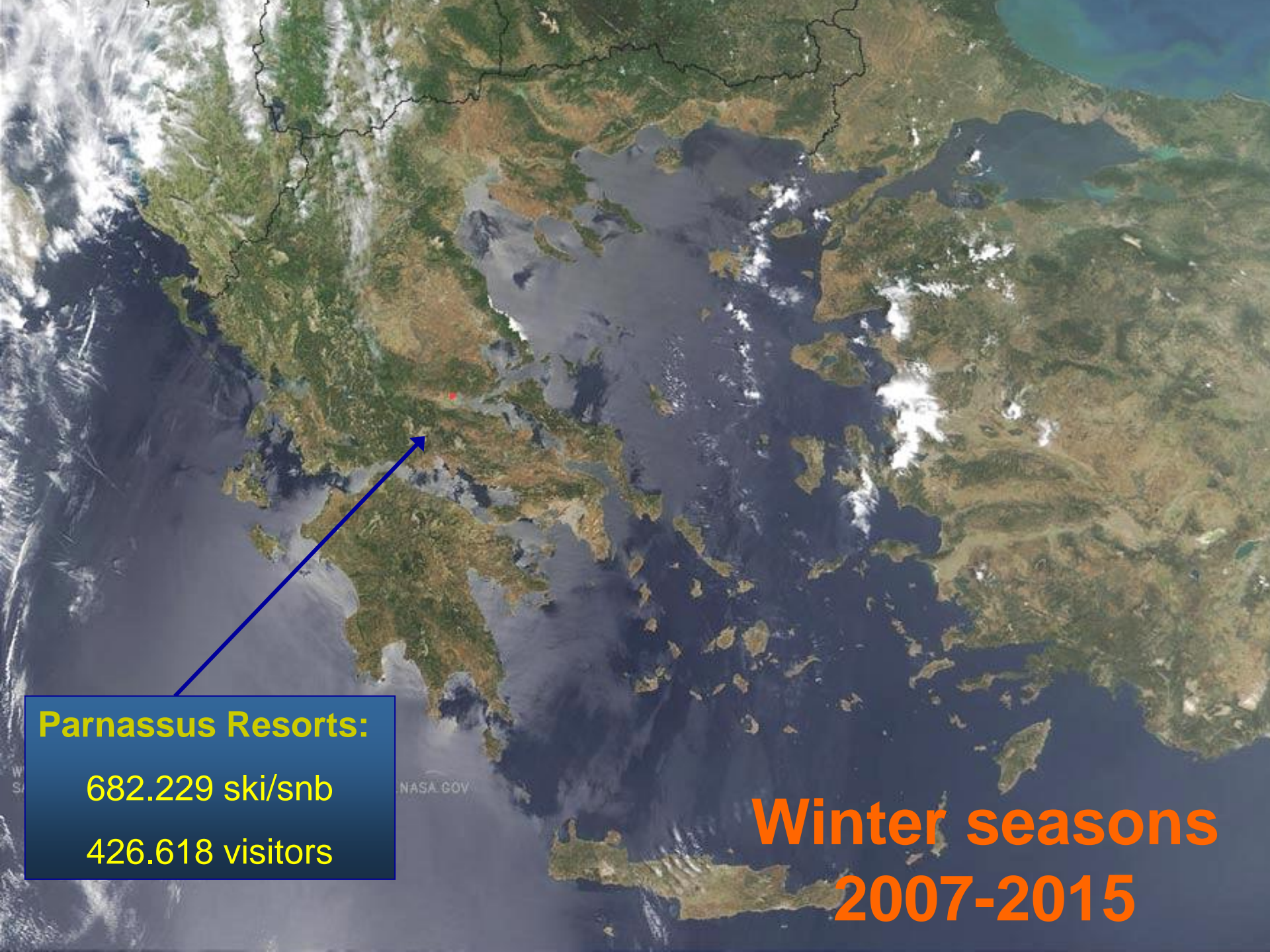
Greece, feel it.

© 2010 United Kingdom Tourist Board

United Kingdom

**But Greece has also mountains**





**Parnassus Resorts:**

682.229 ski/snb

426.618 visitors

**Winter seasons  
2007-2015**

NASA.GOV

Since 2001 we have started to collect data of skiing/snowboarding injuries in Parnassus



# PURPOSE

The purpose of this study is to determine the incidence, the types of injuries amongst children skiing on snow.



# MATERIAL AND METHOD

Prospective case-control study  
during winter seasons 2007-2015



# Our Protocol:

Completed by

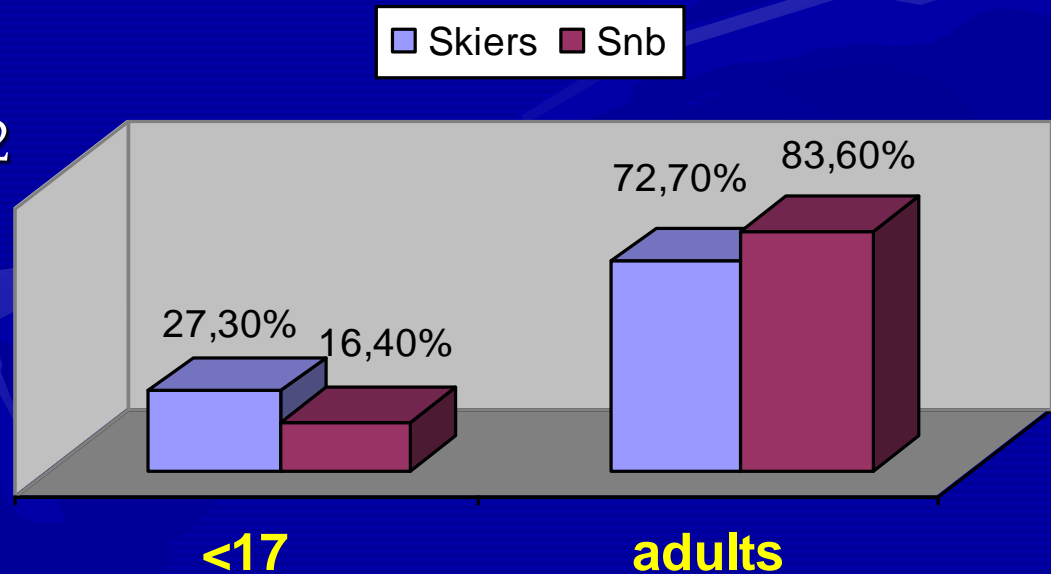
Ski Resort Doctors

ΙΑΤΡΕΙΟ ΧΙΟΝΟΔΡΟΜΙΚΟΥ ΚΕΝΤΡΟΥ ΠΑΡΝΑΣΣΟΥ				
Υπεύθυνος γιατρός :				
Περιοχή: <input type="checkbox"/> Κελλάρια 1950 <input type="checkbox"/> Κελλάρια 1750 <input type="checkbox"/> Φτερόλακκα	No.....			
Ημ/νία:..... Ώρα:..... Αρ.εισητηρίου	<input type="checkbox"/> Άνδρας	<input type="checkbox"/> Skier		
Όνοματεπώνυμο:.....	<input type="checkbox"/> Γυναίκα	<input type="checkbox"/> Snowboarder		
Διεύθυνση:.....		<input type="checkbox"/> Snowblades		
Τηλέφωνα επικοινωνίας:.....	Ύψος:.....cm	<input type="checkbox"/> Επισκέπτης		
Ηλικία:.....	Βάρος:.....Kg	<input type="checkbox"/> Εργαζόμενος		
Ο τραυματισμός έγινε πριν από ..... λεπτά.				
Προσέρχεται: <input type="checkbox"/> Χωρίς συνοδεία <input type="checkbox"/> Όνομα διασώστη		<input type="checkbox"/> Συνοδεία άλλων		
Λοιποί εμπλεκόμενοι :				
Αριθμός Κακώσεων: <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 (Αν >1, τραβήξτε γραμμή μεταξύ αριθμού και κάκωσης)				
<input type="checkbox"/> Αριστερά	<input type="checkbox"/> Κεφαλή	<input type="checkbox"/> Πρόσωπο	<input type="checkbox"/> Αυχένος	<input type="checkbox"/> Σ.Στήλη
<input type="checkbox"/> Δεξιά	<input type="checkbox"/> Ωμος	<input type="checkbox"/> Βραχίονας	<input type="checkbox"/> Αγκόνας	<input type="checkbox"/> Αντιβράχιο
	<input type="checkbox"/> Χέρι	<input type="checkbox"/> Πύελος	<input type="checkbox"/> Ισχίο	<input type="checkbox"/> Μηρός
	<input type="checkbox"/> Άκρος Πόδας	<input type="checkbox"/> Γόνατο-Έσω	<input type="checkbox"/> Γόνατο-Εξω	<input type="checkbox"/> ΠΑΚ
	<input type="checkbox"/> Γόνατο-γενικά	<input type="checkbox"/> Γόνατο-ACL	<input type="checkbox"/> Άλλο.....	
<input type="checkbox"/> Εκδορές	<input type="checkbox"/> Λύση δέρματος	<input type="checkbox"/> Εκγύμωση-Θλάση	<input type="checkbox"/> Διάταση-Διάστρεμμα	
<input type="checkbox"/> Εξάρθρωμα	<input type="checkbox"/> Κάταγμα	<input type="checkbox"/> Απώλεια συνείδησης	<input type="checkbox"/> Ψυκτική βλάβη	
<input type="checkbox"/> Άλλο.....				
<input type="checkbox"/> Παθολογικό αίτιο:.....				
Πριν από τον τραυματισμό προηγήθηκε:			Αντιμετώπιση ασθενούς:.....	
<input type="checkbox"/> Λήψη αλκοόλ <input type="checkbox"/> λήψη φαρμάκων				
<b>Εξοπλισμός:</b>	<b>Εξοπλισμός:</b>	<b>Ρούχα:</b>	<b>Προστατευτικά:</b>	<b>Συνθήκες:</b>
<input type="checkbox"/> Ski συμβατικά	<input type="checkbox"/> Ενοικίαση	<input type="checkbox"/> Κατάλληλα	<input type="checkbox"/> Κράνος	<input type="checkbox"/> Αίθριος καιρός
<input type="checkbox"/> Ski Carving	<input type="checkbox"/> Ατομικός	<input type="checkbox"/> Ακατάλληλα	<input type="checkbox"/> Καρπός	<input type="checkbox"/> Συννεφιά
<input type="checkbox"/> Snowboard	<input type="checkbox"/> Δανεισμένα		<input type="checkbox"/> Γόνατο	<input type="checkbox"/> Βροχή
<input type="checkbox"/> Snowblades				<input type="checkbox"/> Χιόνι
<input type="checkbox"/> .....				<input type="checkbox"/> Ομίχλη
				<input type="checkbox"/> Ισχυροί άνεμοι
<b>Θέση ατυχήματος:</b>	<b>Κύρια αιτία ατυχήματος:</b>			
<input type="checkbox"/> Εντός πίστας (ποιά?).....	<input type="checkbox"/> Ίδια πτώση	<input type="checkbox"/> Ίδιο λάθος		<input type="checkbox"/> Πατημένο χιόνι
<input type="checkbox"/> Εκτός πίστας	<input type="checkbox"/> Άλμα	<input type="checkbox"/> Αποτυχία εξοπλισμού		<input type="checkbox"/> Σκληρό χιόνι
<input type="checkbox"/> Lift (ποιό?).....	<input type="checkbox"/> Σύγκρουση με skier <input type="checkbox"/> Κακή ποιότητα χιονιού			<input type="checkbox"/> Πούδρα
<input type="checkbox"/> Challet	<input type="checkbox"/> Σύγκρουση με Snowboarder			<input type="checkbox"/> Λεωμένο χιόνι
<input type="checkbox"/> Άλλο.....	<input type="checkbox"/> Άλμα	<input type="checkbox"/> Άλλο.....		<input type="checkbox"/> Κέντρο κλειστό
<input type="checkbox"/> Άλλο.....				
<b>Χιονοδρομείτε:</b>	<b>Μαθήματα:</b>	<b>Χιονοδρομία σήμερα:</b>	<b>Ημέρες ανά έτος:</b>	<b>Ημέρες φέτος:</b>
<input type="checkbox"/> 1η μέρα	<input type="checkbox"/> Κανένα	<input type="checkbox"/> 0-2 ώρες	<input type="checkbox"/> 0-5	<input type="checkbox"/> 0-5
<input type="checkbox"/> 1η βδομάδα	<input type="checkbox"/> 1-5	<input type="checkbox"/> 2-4 ώρες	<input type="checkbox"/> 5-10	<input type="checkbox"/> 5-10
<input type="checkbox"/> 1ος μήνας	<input type="checkbox"/> 6-10	<input type="checkbox"/> 4-6 ώρες	<input type="checkbox"/> >10	<input type="checkbox"/> >10
<input type="checkbox"/> 1ος χρόνος	<input type="checkbox"/> >10	<input type="checkbox"/> >6 ώρες		
<input type="checkbox"/> 1-3 χρόνια				
<input type="checkbox"/> 4-6 χρόνια				
<input type="checkbox"/> >6 χρόνια				
	<b>Κάκωση στη χιονοδρομία φέτος:</b>		<input type="checkbox"/> Ναι	<input type="checkbox"/> Όχι
	<b>Παλιότερη κάκωση στη χιονοδρομία:</b>		<input type="checkbox"/> Ναι	<input type="checkbox"/> Όχι
<b>Θεωρείτε τον εαυτό σας:</b>	<input type="checkbox"/> Αρχάριο	<input type="checkbox"/> Μέτριο	<input type="checkbox"/> Εμπειρο	<input type="checkbox"/> Αθλητή/Εκπαιδευτή
<b>Σήμερα χιονοδρομούσατε:</b>	<input type="checkbox"/> Μόνος	<input type="checkbox"/> Με φίλους	<input type="checkbox"/> Με οικογένεια	<input type="checkbox"/> Με εκπαιδευτή
<b>Το επίπεδό τους ήταν:</b>	<input type="checkbox"/> Ίδιο με το δικό σας	<input type="checkbox"/> Καλύτερο	<input type="checkbox"/> Χειρότερο	

# Study Group

From a total of 2847 injured:  
609 injured (with 656 injuries) were under 18 years old

- Skier: 437
- Snowboarder: 172

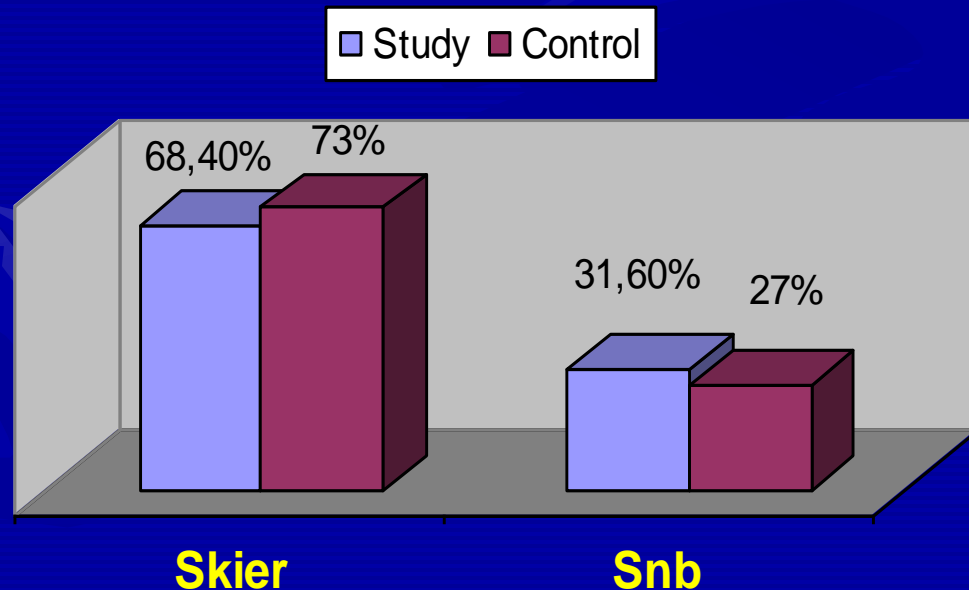


# Control Group

From a total of 1167 uninjured (randomly selected)

uninjured  $\leq 17$  : 186

- Skier: 144
- Snowboarder: 42



## Two Major Indexes:

### 1. Injuries Per Thousand Skier Days (IPTSD)

$$IPTSD = \frac{\text{number of injuries}}{\text{number of skier days}} * 1000$$

### 2. Mean Days Between Injury (MDBI)

$$MDBI = \frac{\text{number of skier days}}{\text{number of specific injury}}$$

**Skier days:** Total tickets number

**“Medically significant injuries”:** those which require medical treatment or keep a person from skiing for at least one day.

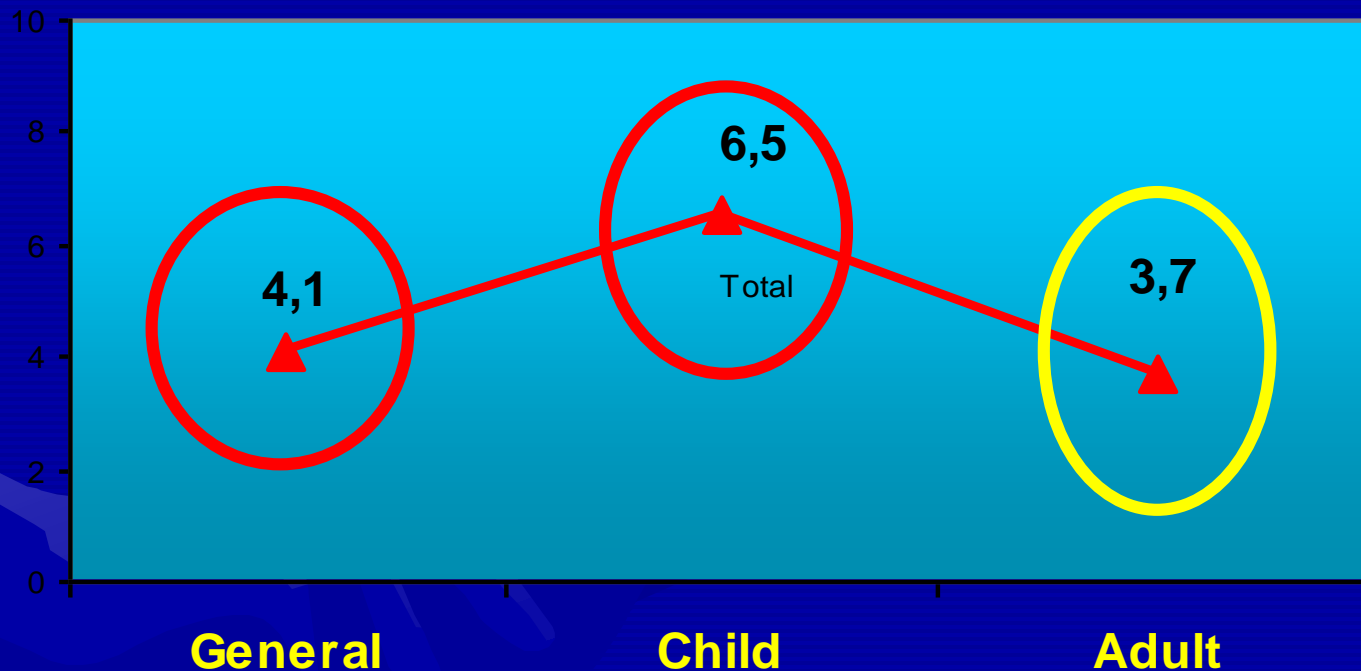
## Statistical analysis

- t – test
- $\chi^2$  - test
- Fisher's exact test
- multivariate logistic regression



# Overall rate of injuries:

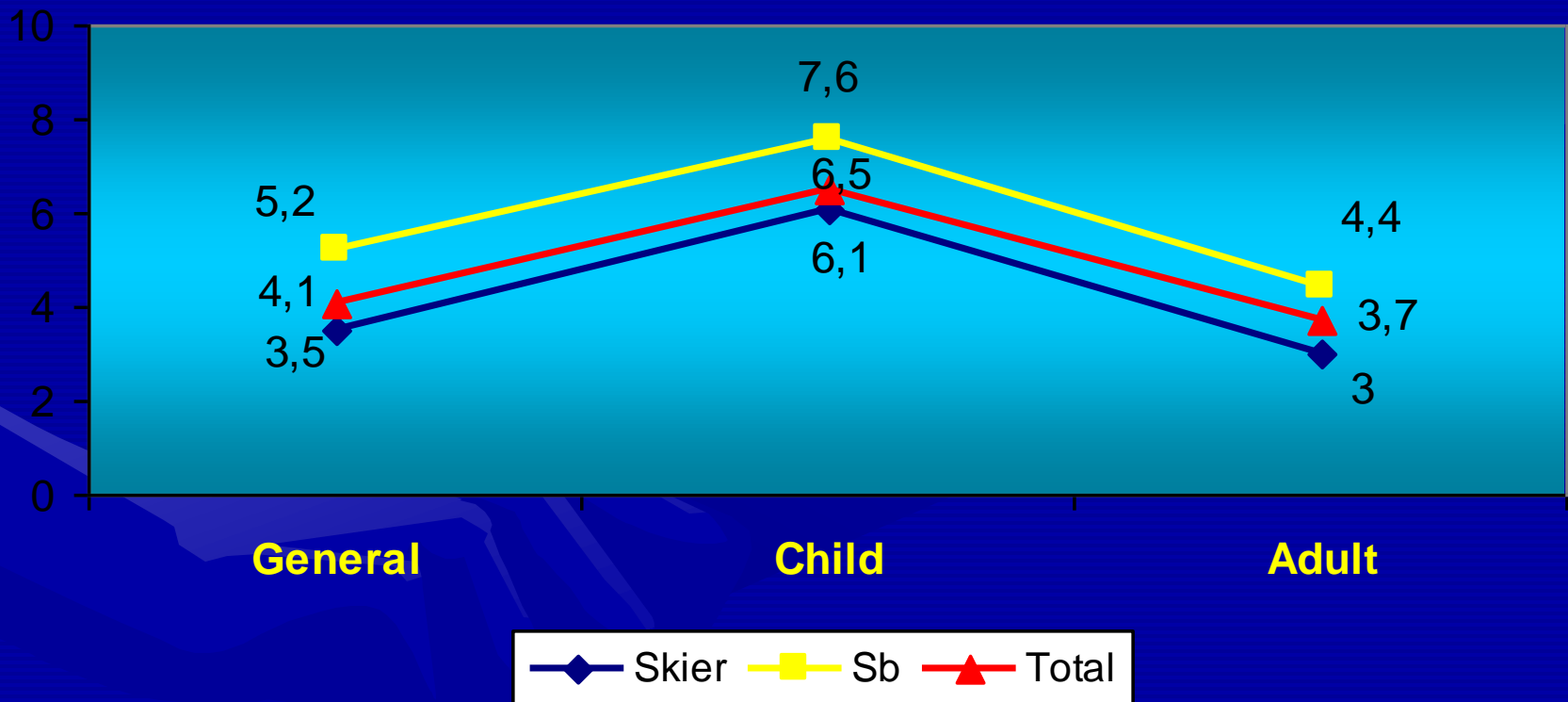
**Injuries per Thousand Skiers Days  
(IPTSD)**



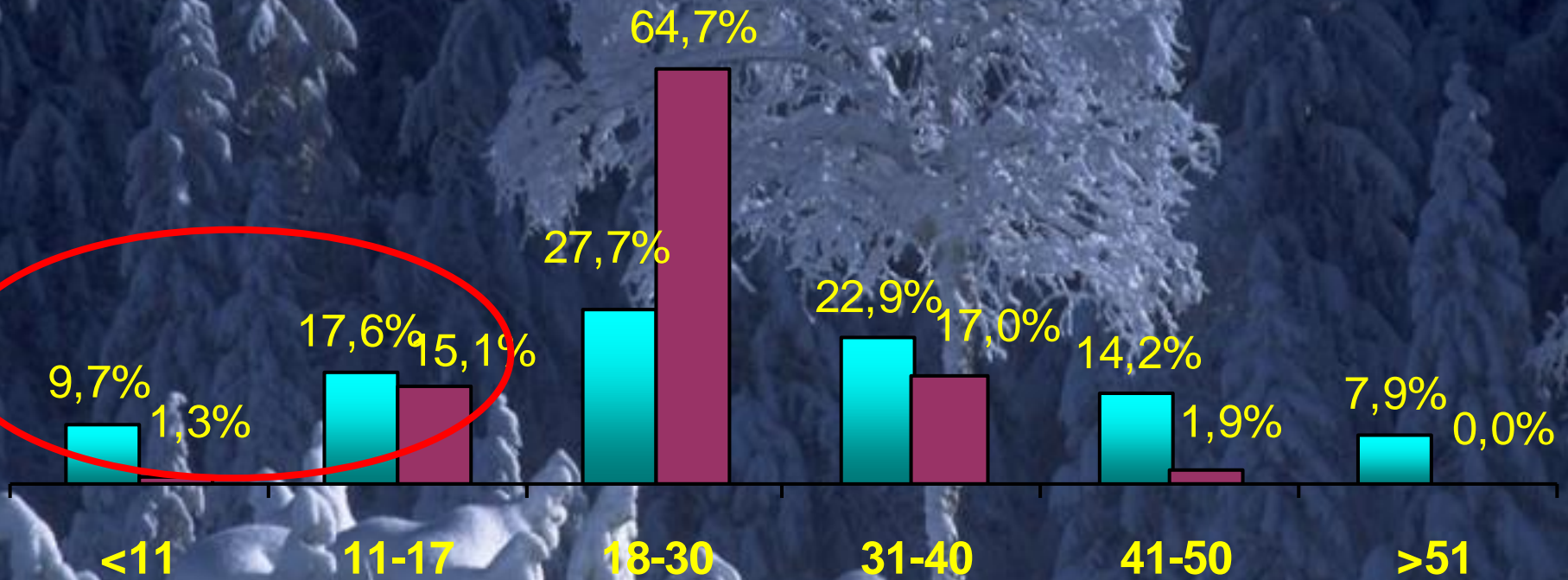
**The overall rate of injuries for children and adolescents is almost the double (compared with adults)**

# Overall rate of injuries:

## Injuries per Thousand Skiers Days (IPTSD)



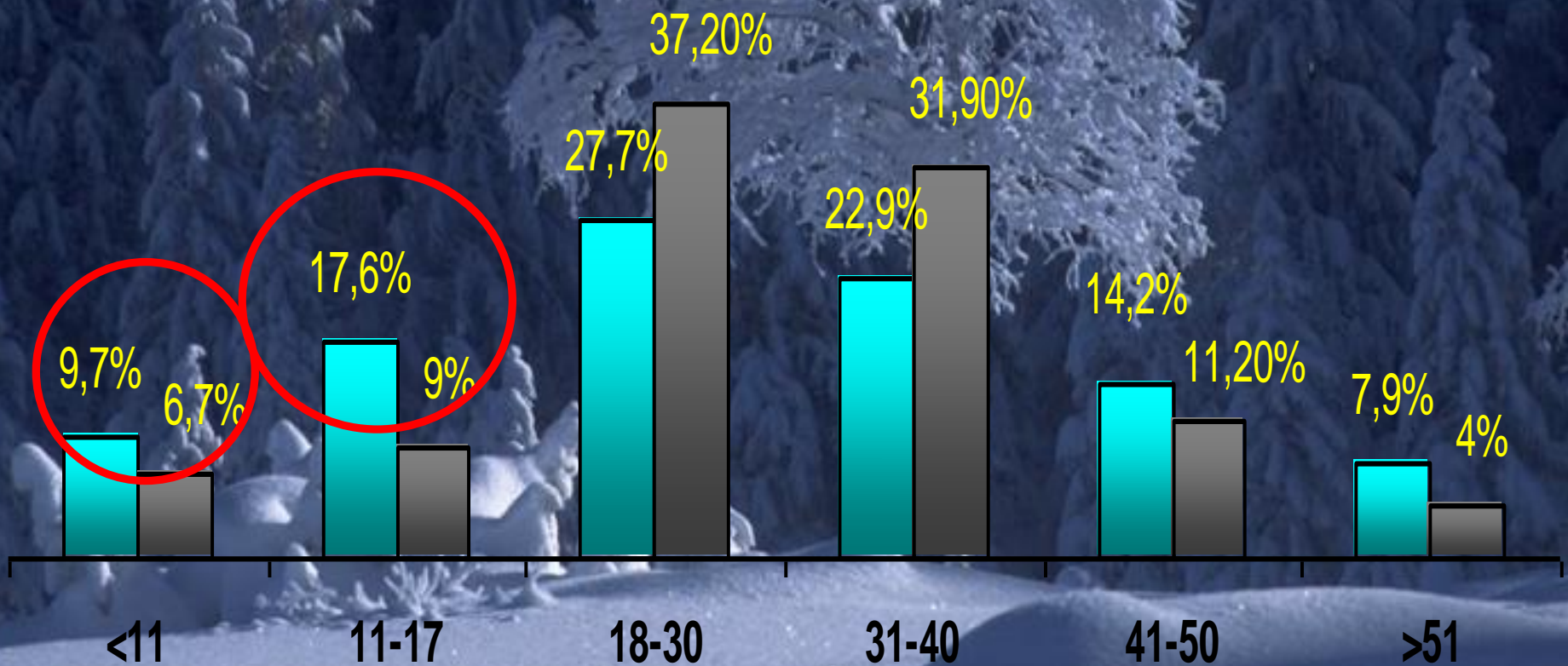
# Age Distribution



Almost 27% of injured skiers are children or teenagers

# Age of skiers

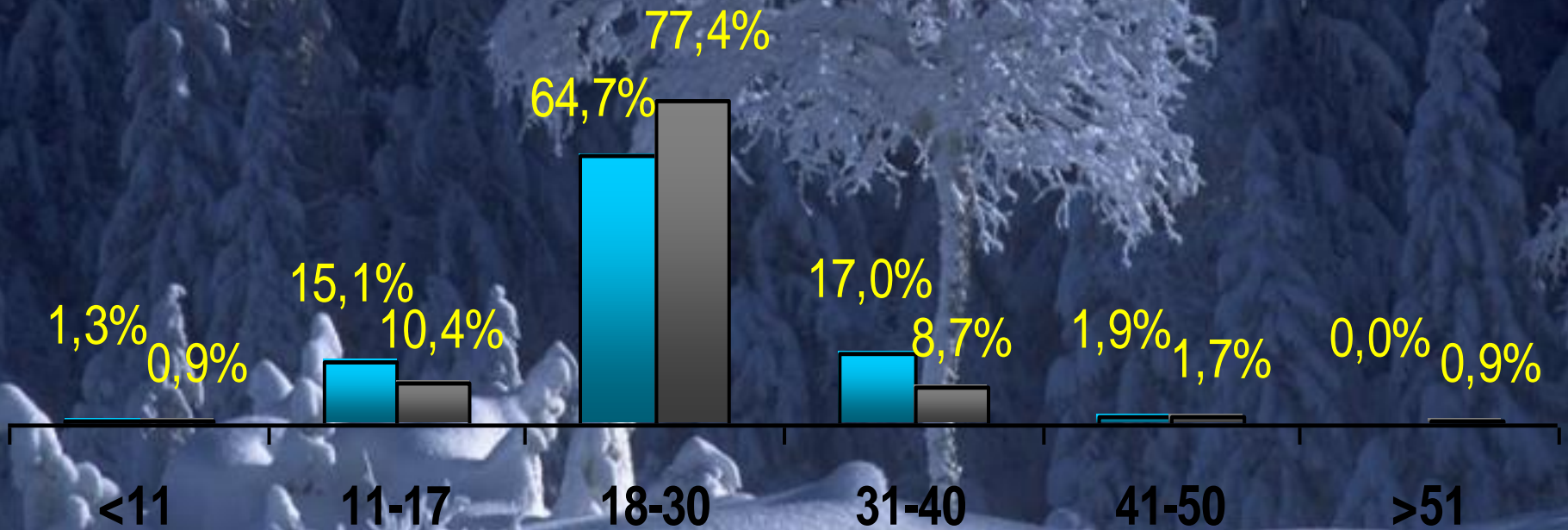
■ Skiers Study ■ Skiers Control



Children and adolescents are more than as twice likely to be injured than other skie

# Age of Snb

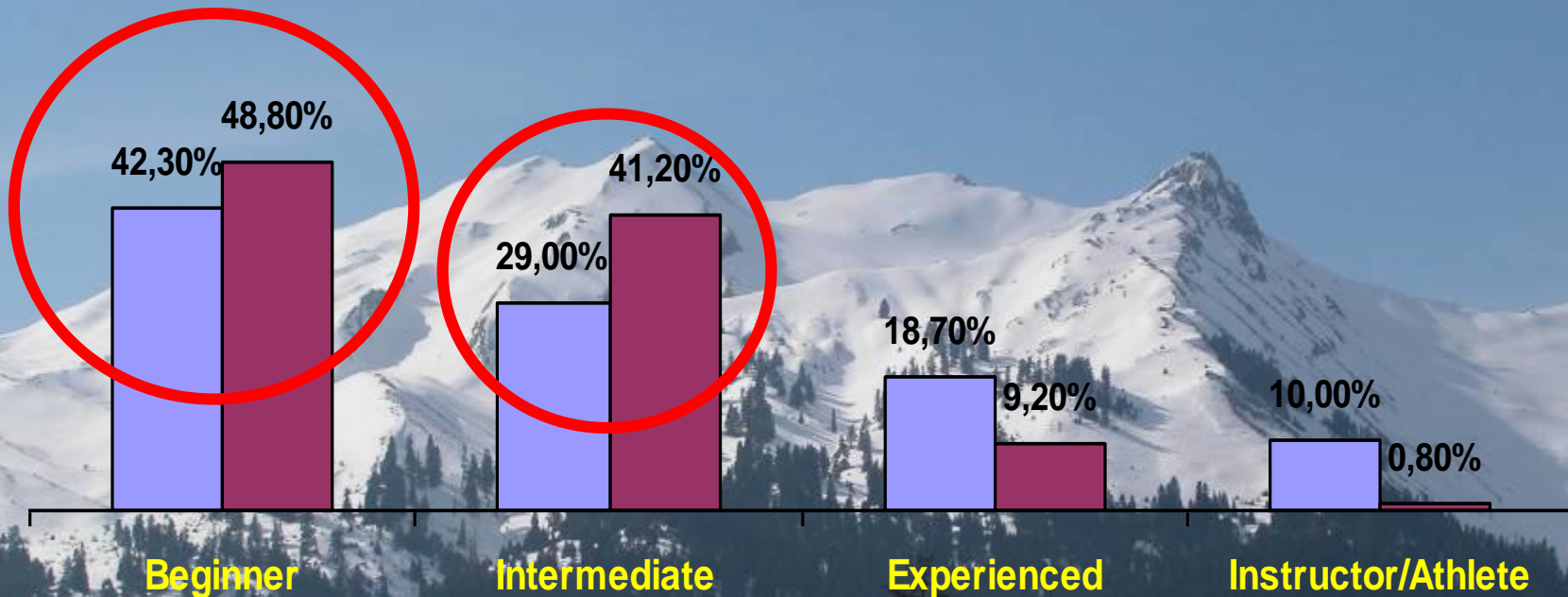
■ Sb Study ■ Sb Control



The same does not seem to happen in snowboard

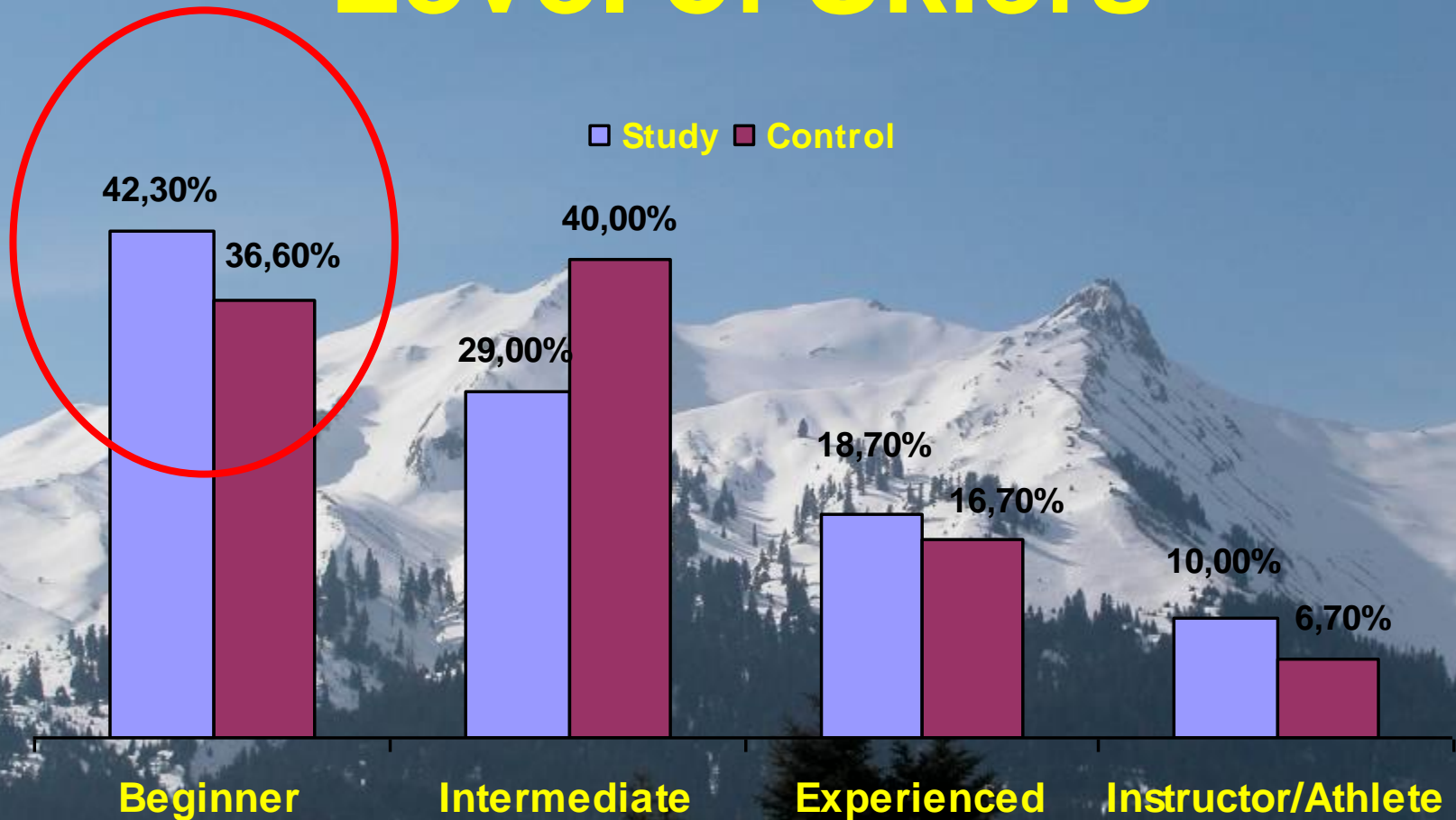
# Skill Level

Skiers Snb



**Injured Skiers and Snb's are mostly beginners and moderate athletes**

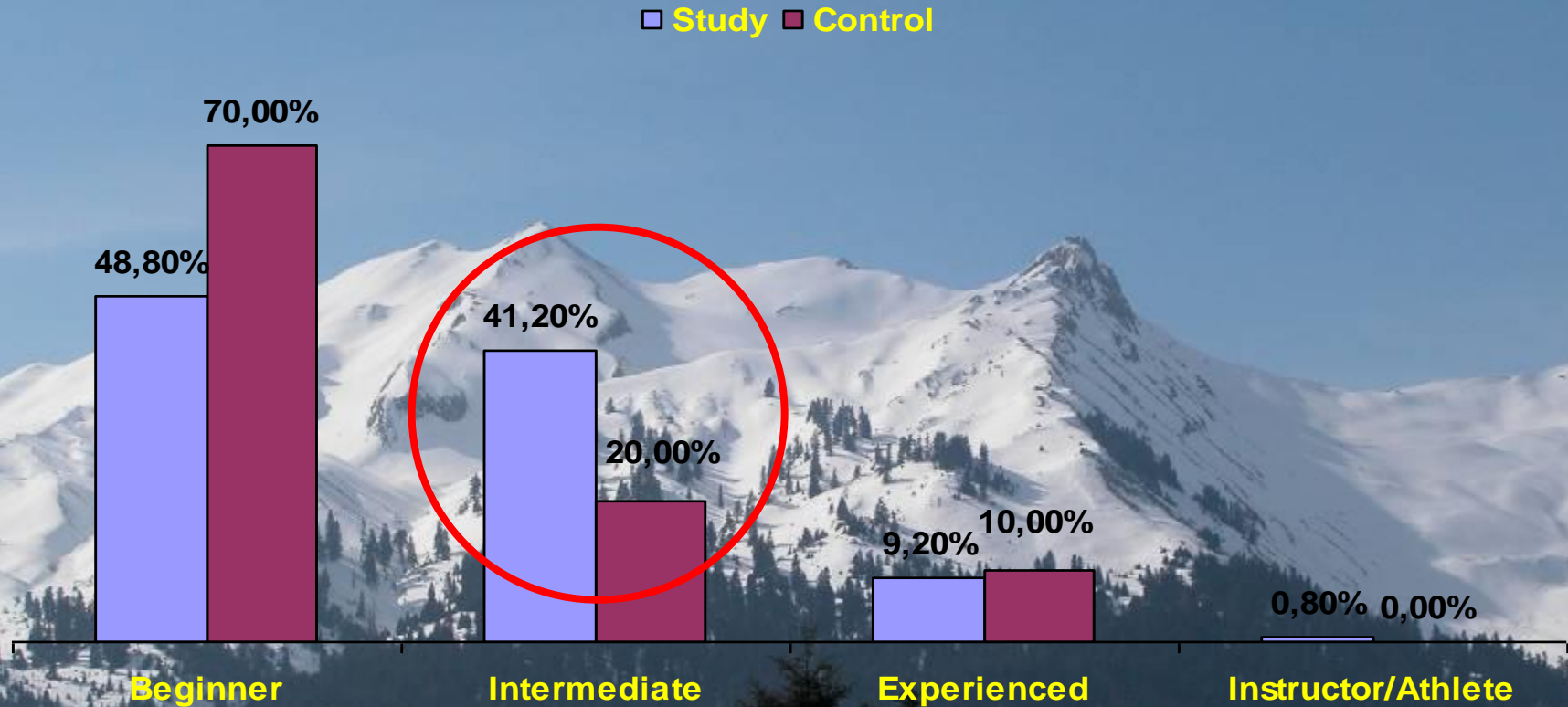
# Level of Skiers



**Beginners are at high risk for injury in skiing**

**( $p < 0.005$ )**

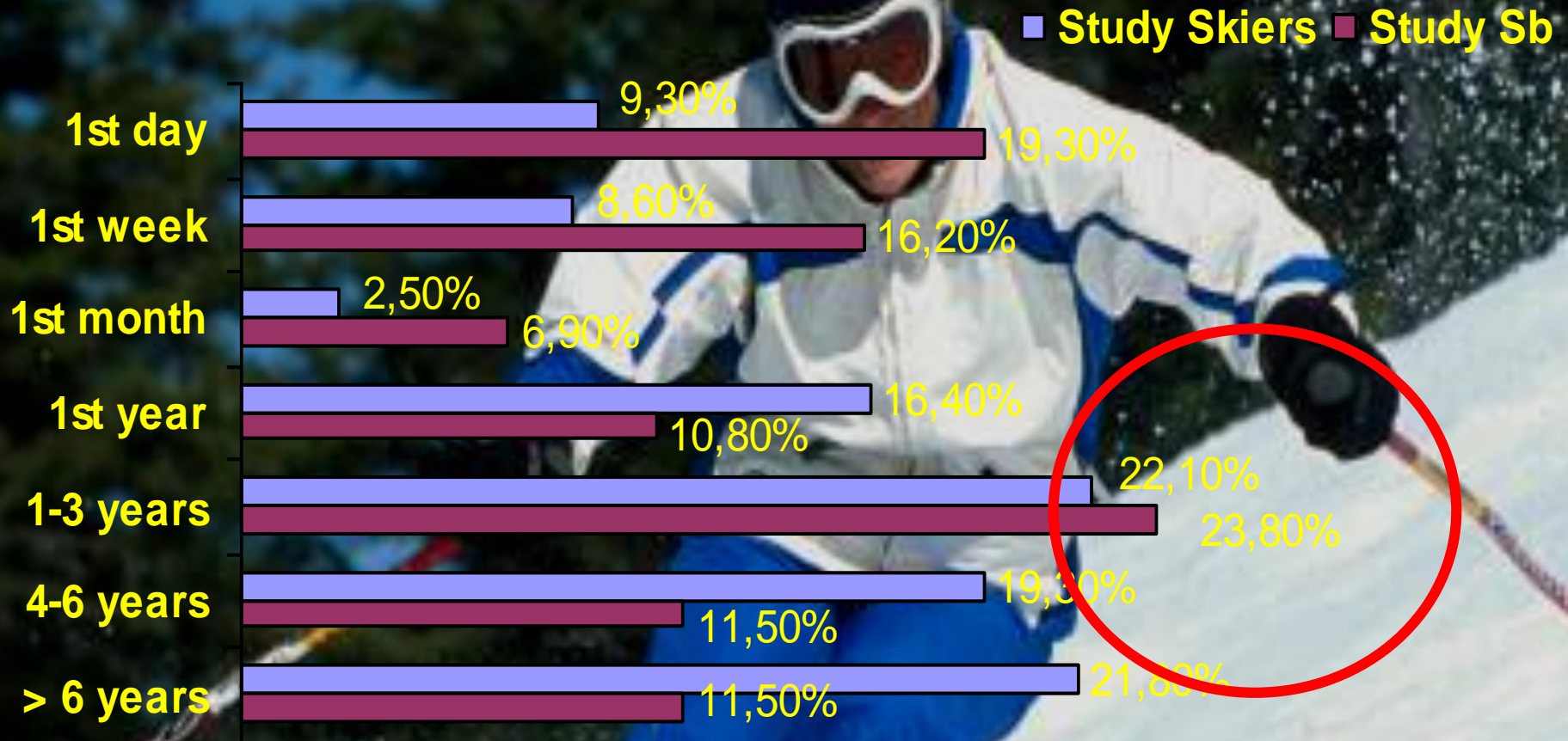
# Level of Snb's



The same happen to moderate snowboarders

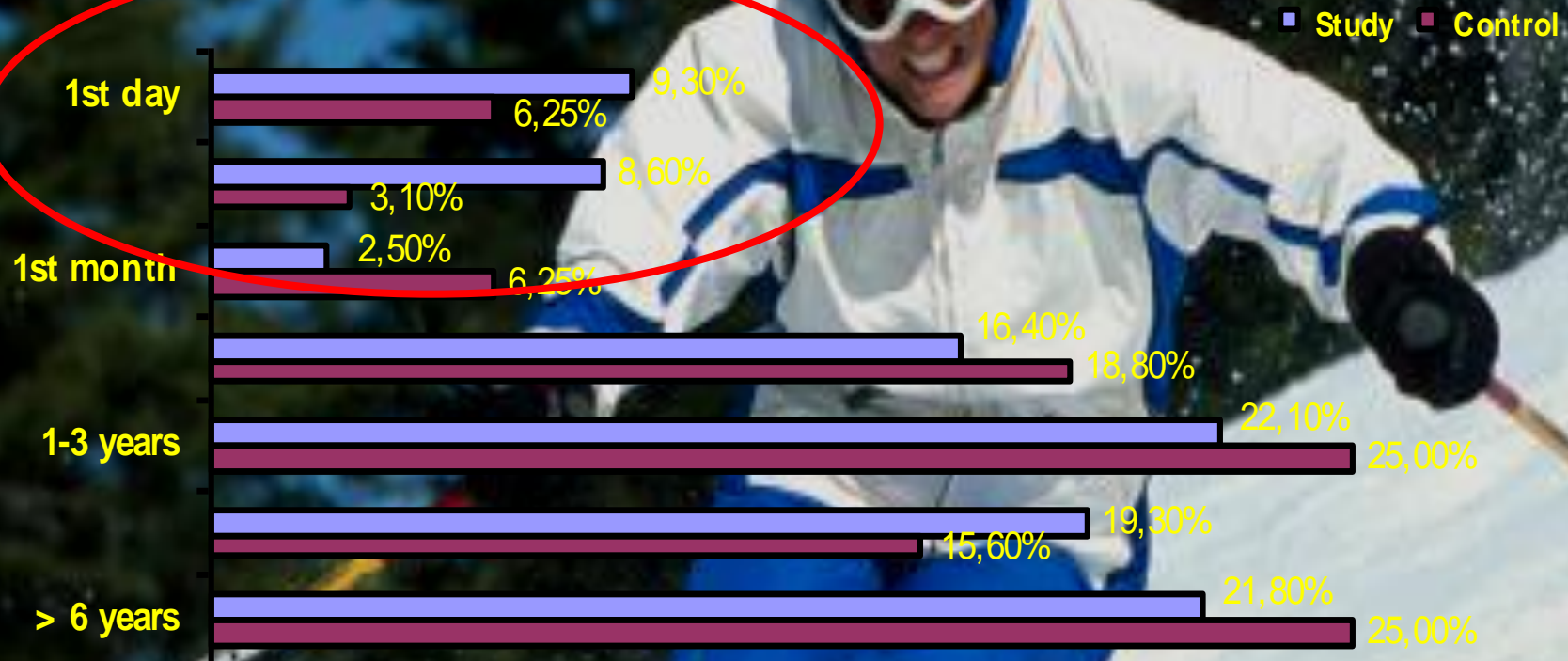
( $p < 0.001$ )

# Experience Level



The majority of the injured skiing or boarding for 1-3 years.

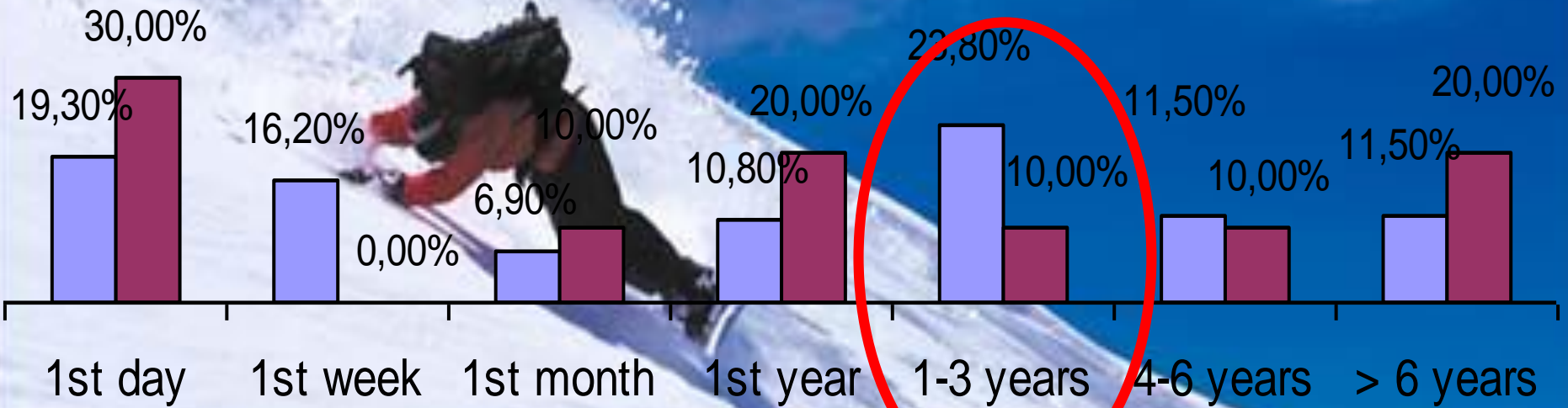
# Skiers Experience



The very new in skiing have almost the twice possibility to sustain an injury

# Snb's Experience

Study Sb Control Sb



The same happen to the more old in boarding

# Lessons taken

■ Skiers Study ■ Snb Study



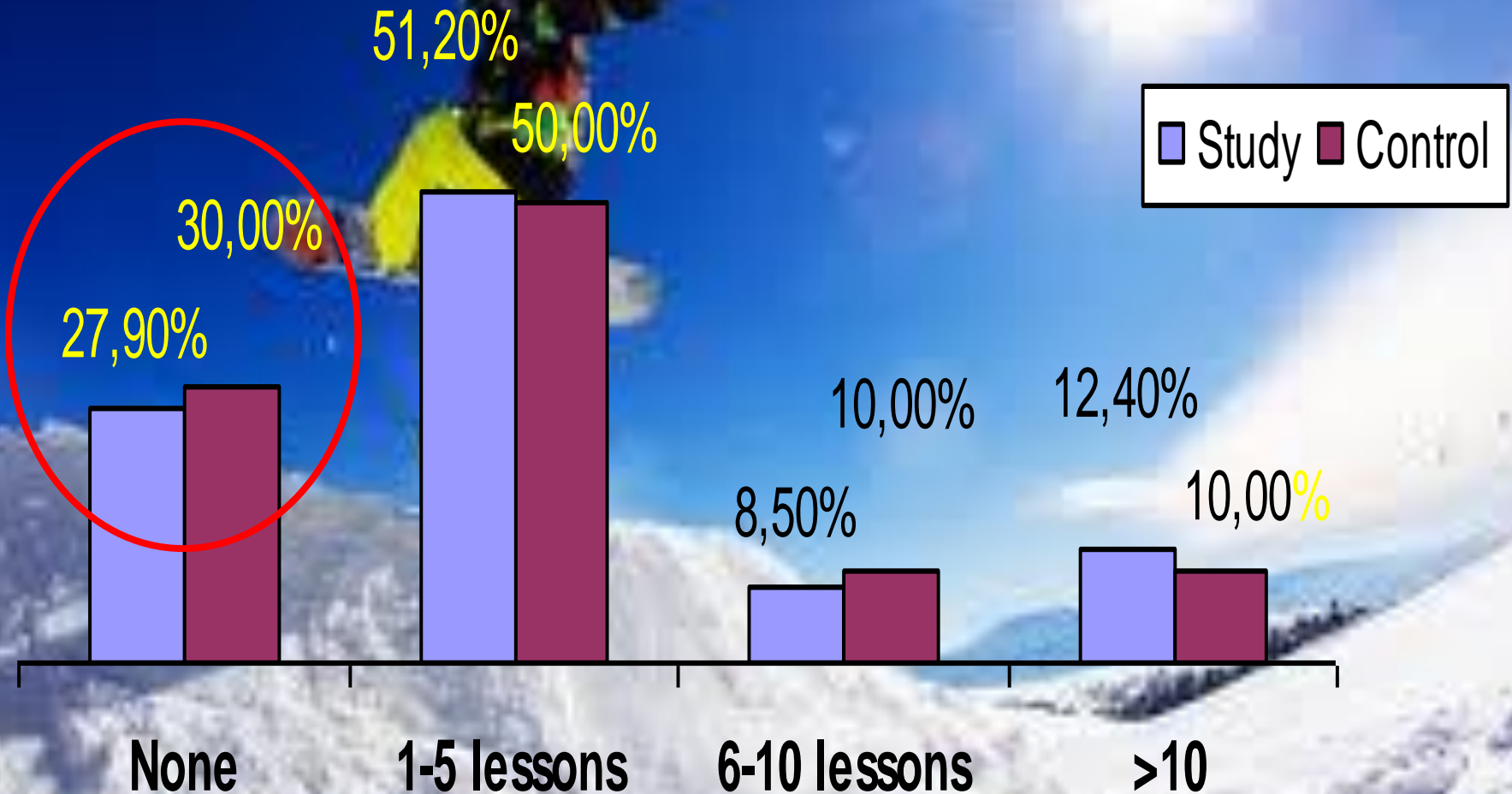
Almost the one third of the injured boarders didn't get any lessons before the injury  
The majority of the injured have gotten 1-5 lessons

# Skiing lessons



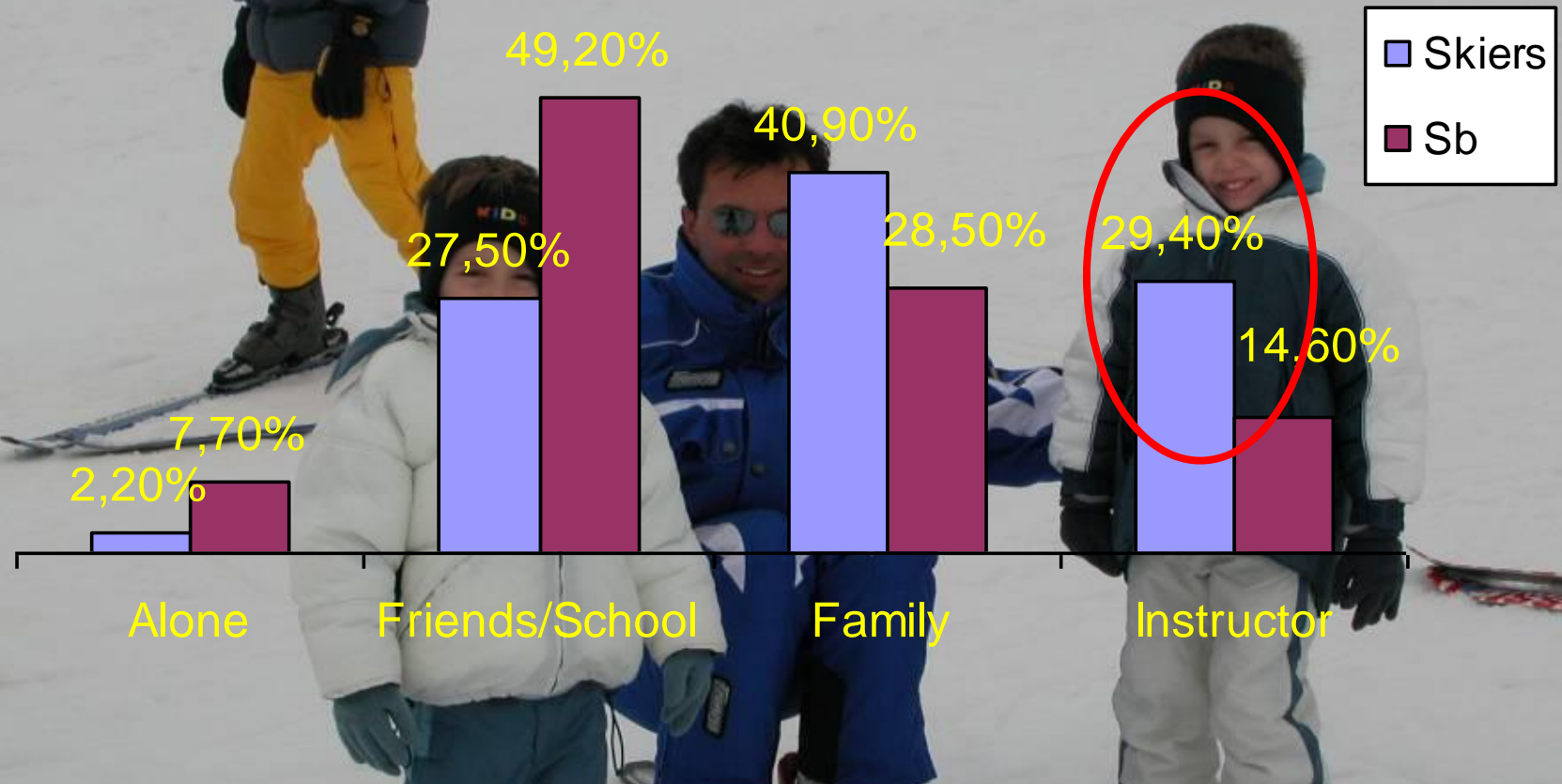
The none lessons is a positive factor for injury in skiing  
On the contrary >10 lessons is a protective factor

# Boarding lessons



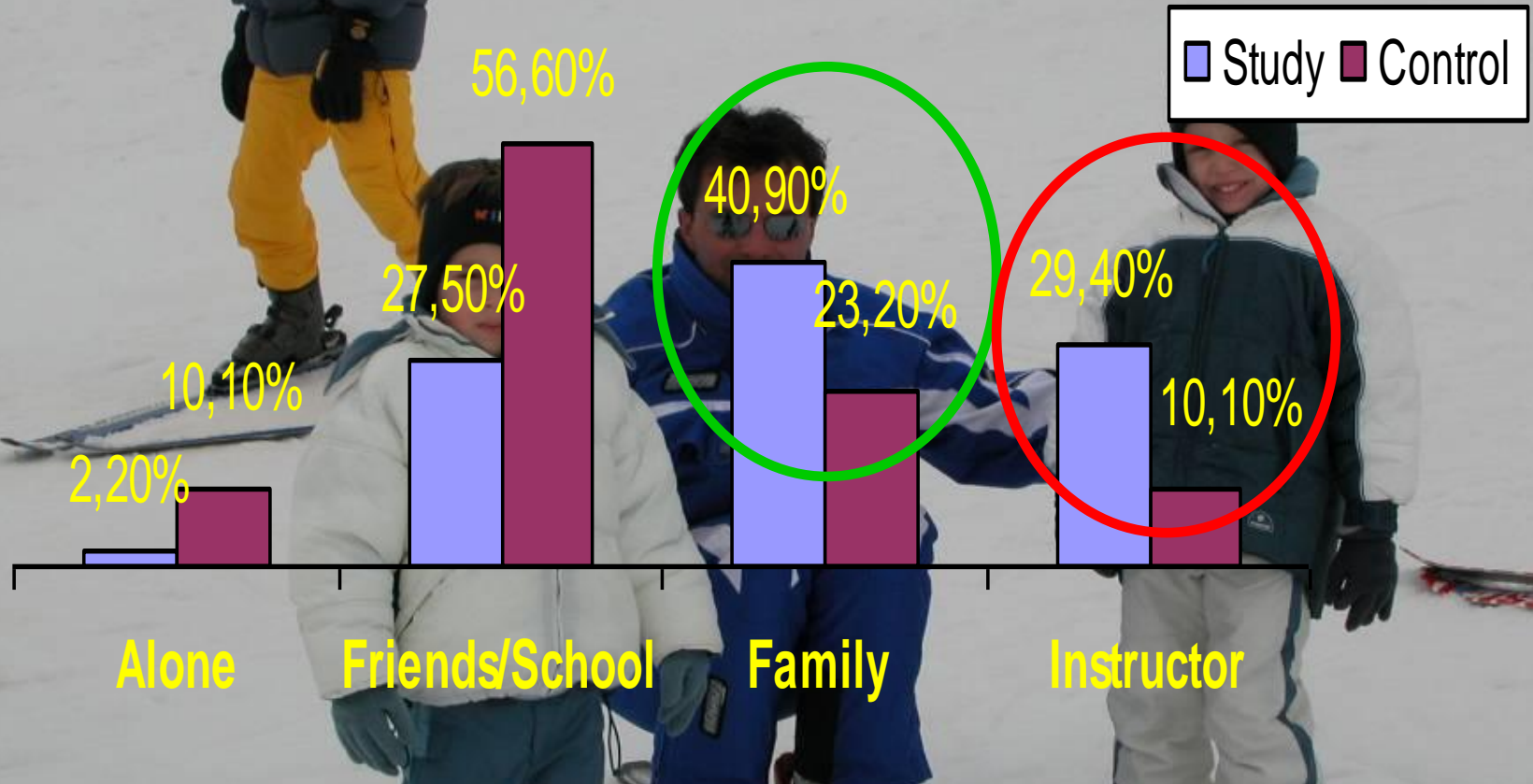
**Paradoxically the none lessons are not predispose to injury**

# Skiing/Boarding with:



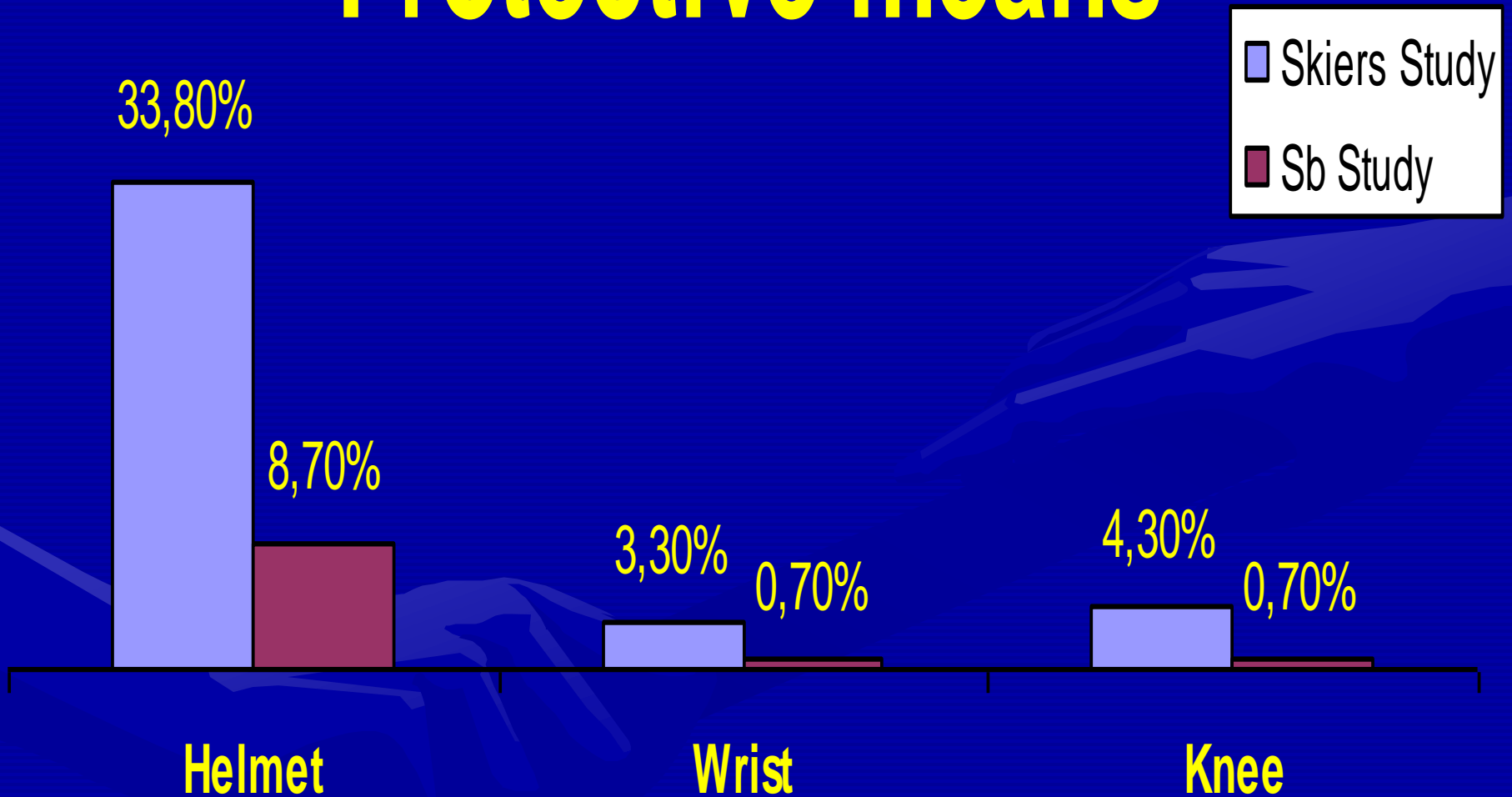
**1 out of 3 young skiers were injured when skiing with an instructor**

# Skiing with:

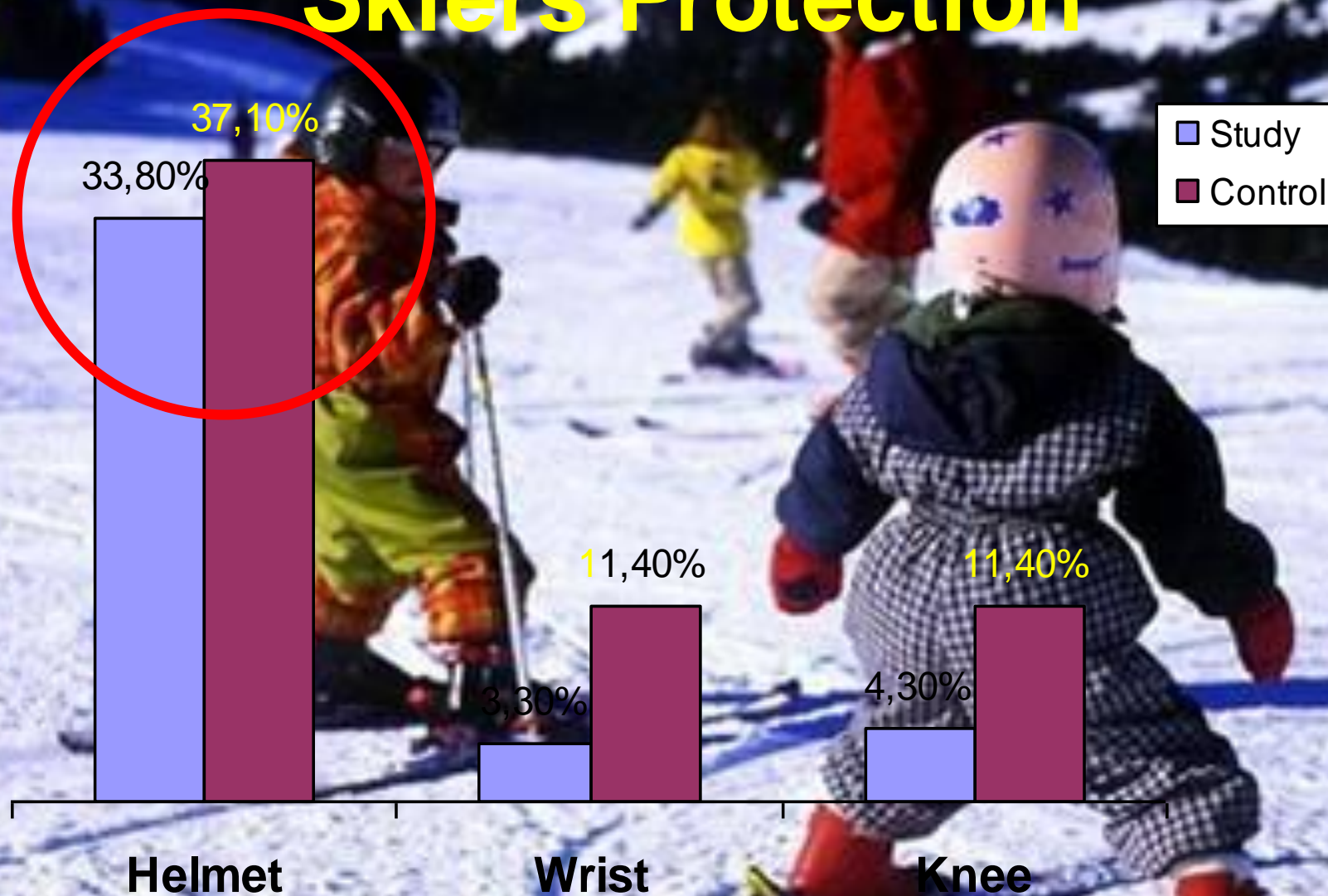


**Skiing with family or an instructor is a risk factor for injury**

# Protective means

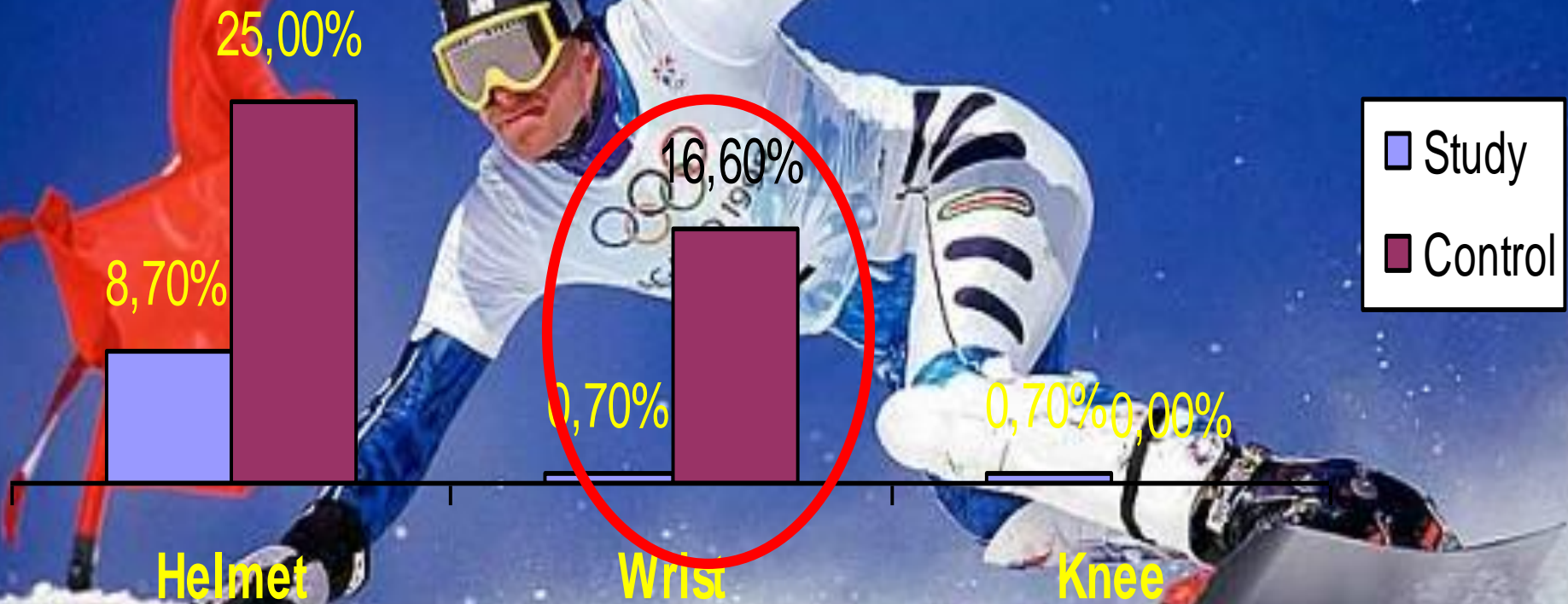


# Skiers Protection



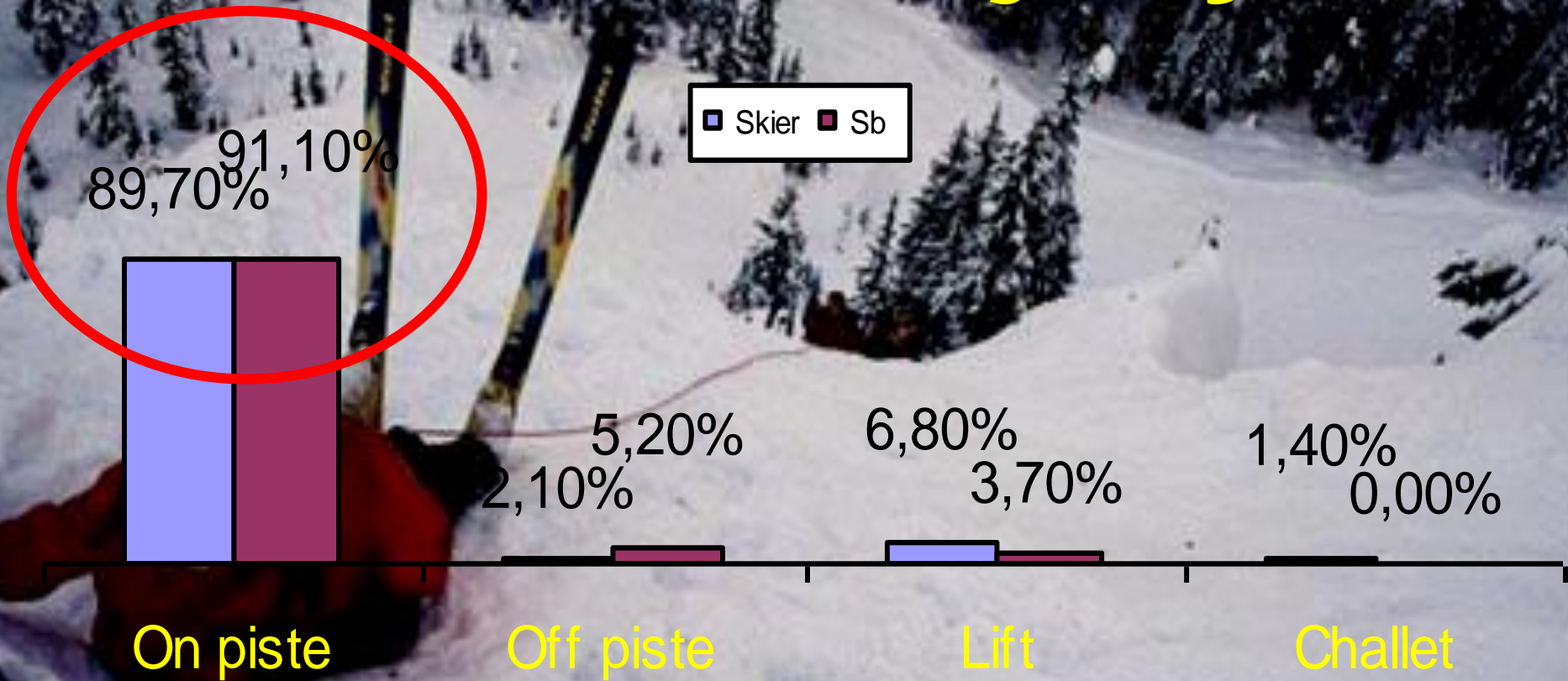
**The use of a helmet does not affect on the injuries of skiers**

# Boarders Protection

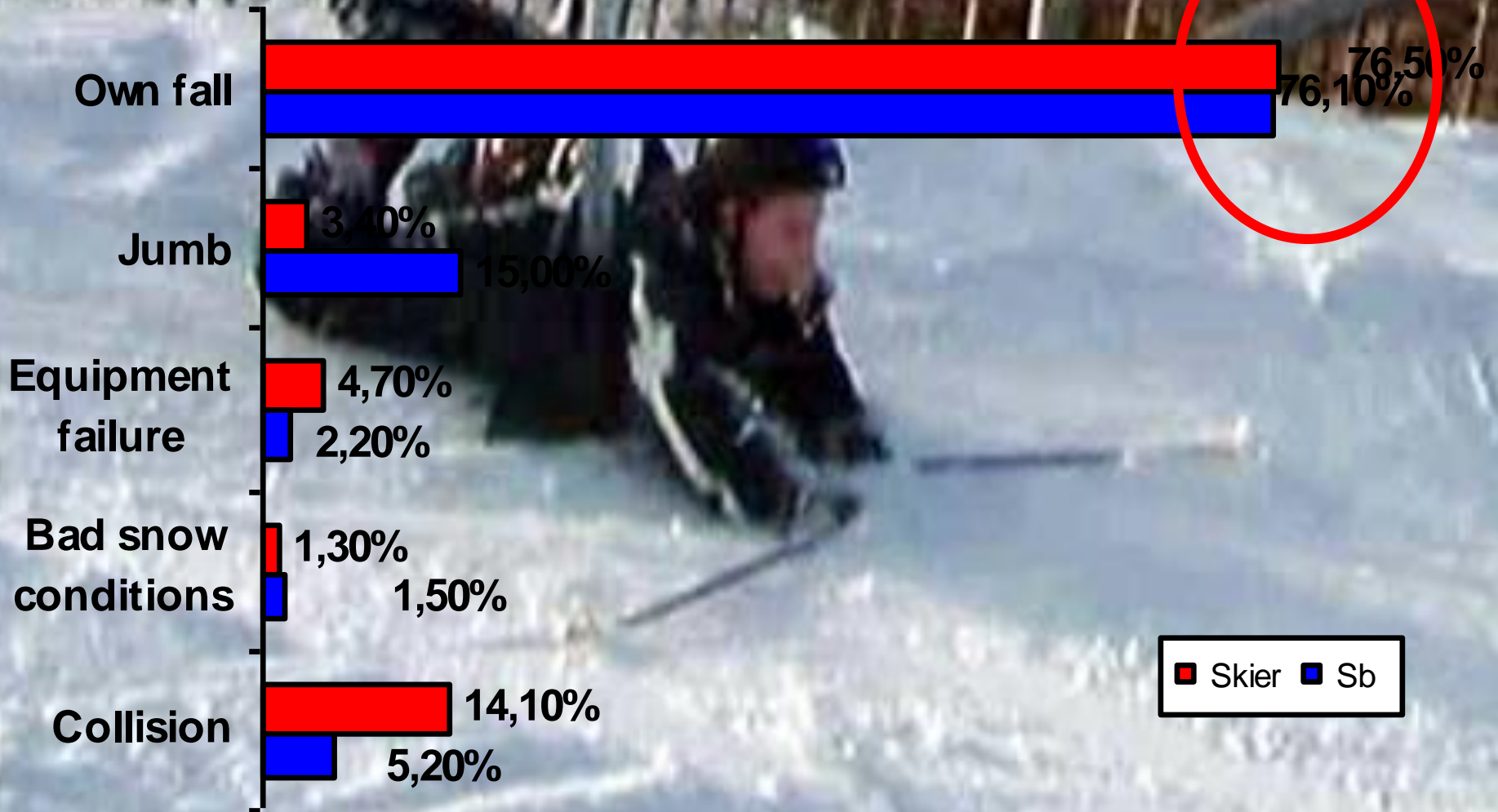


**But the use of a wrist protector declines very significantly the injuries of Snb**

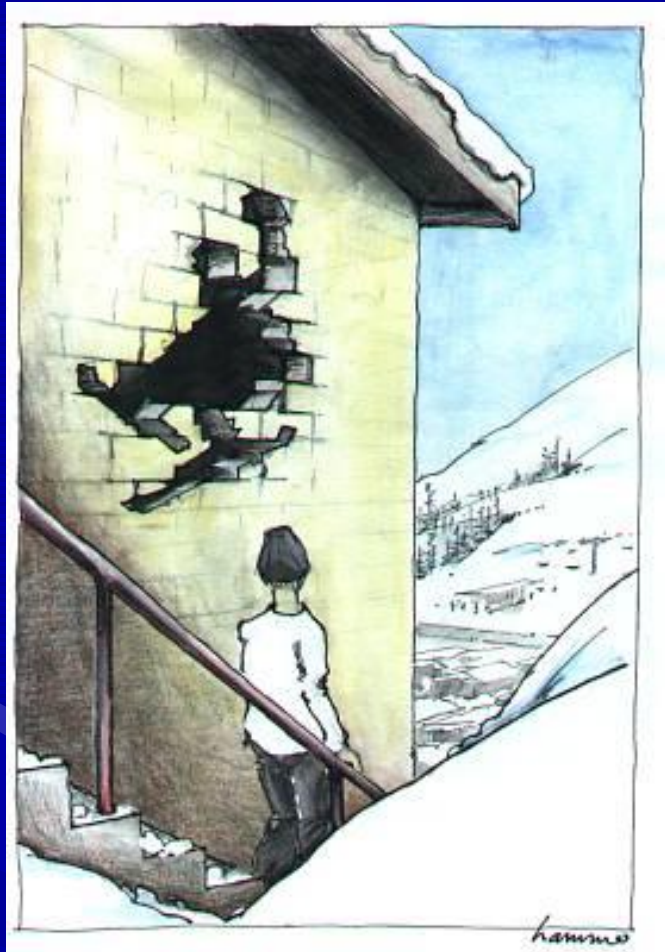
# Site of Injury



# Cause of Injury



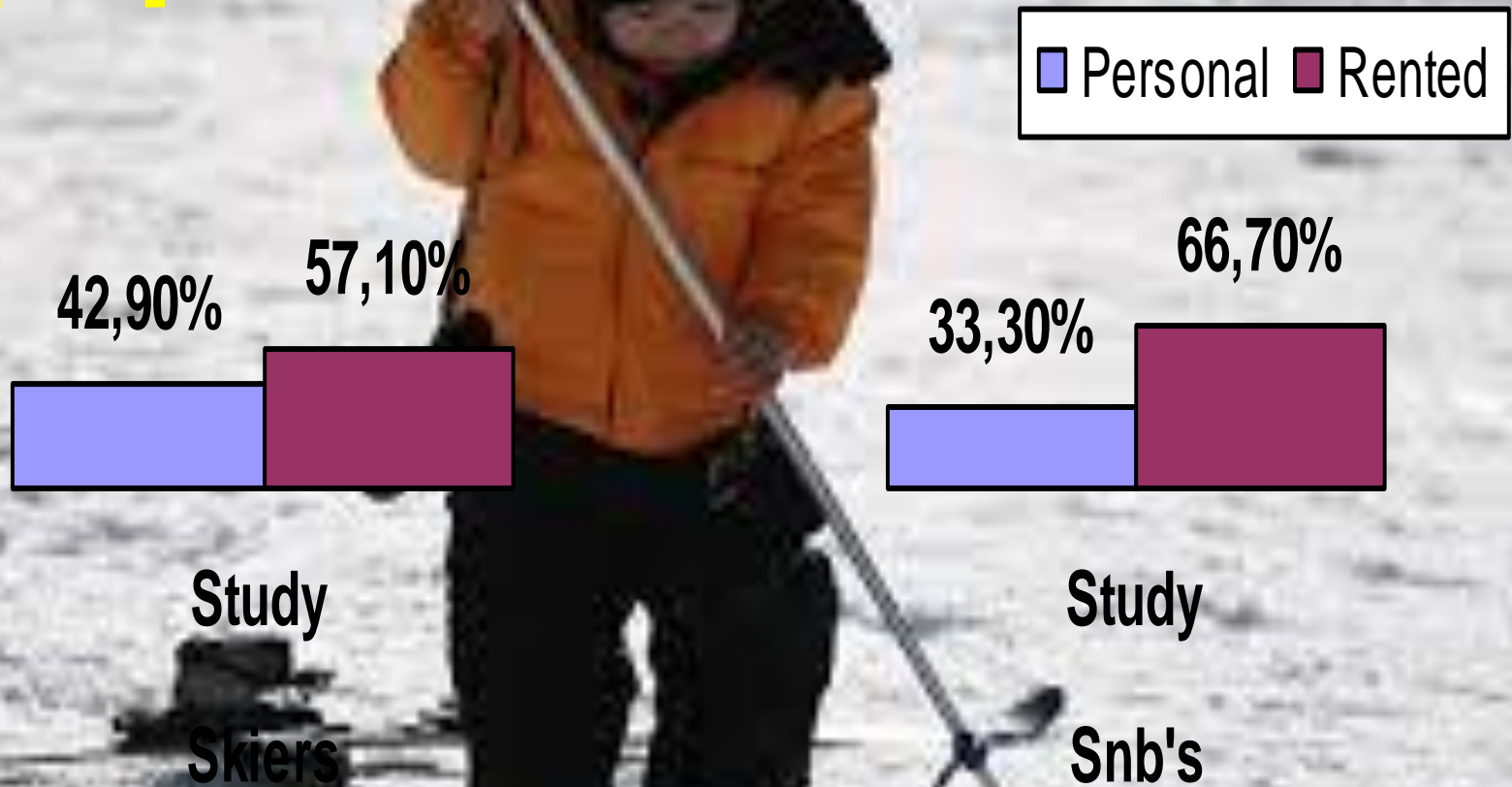
**Collisions are more often the  
next cause of injury for skiers  
(14.1%)**



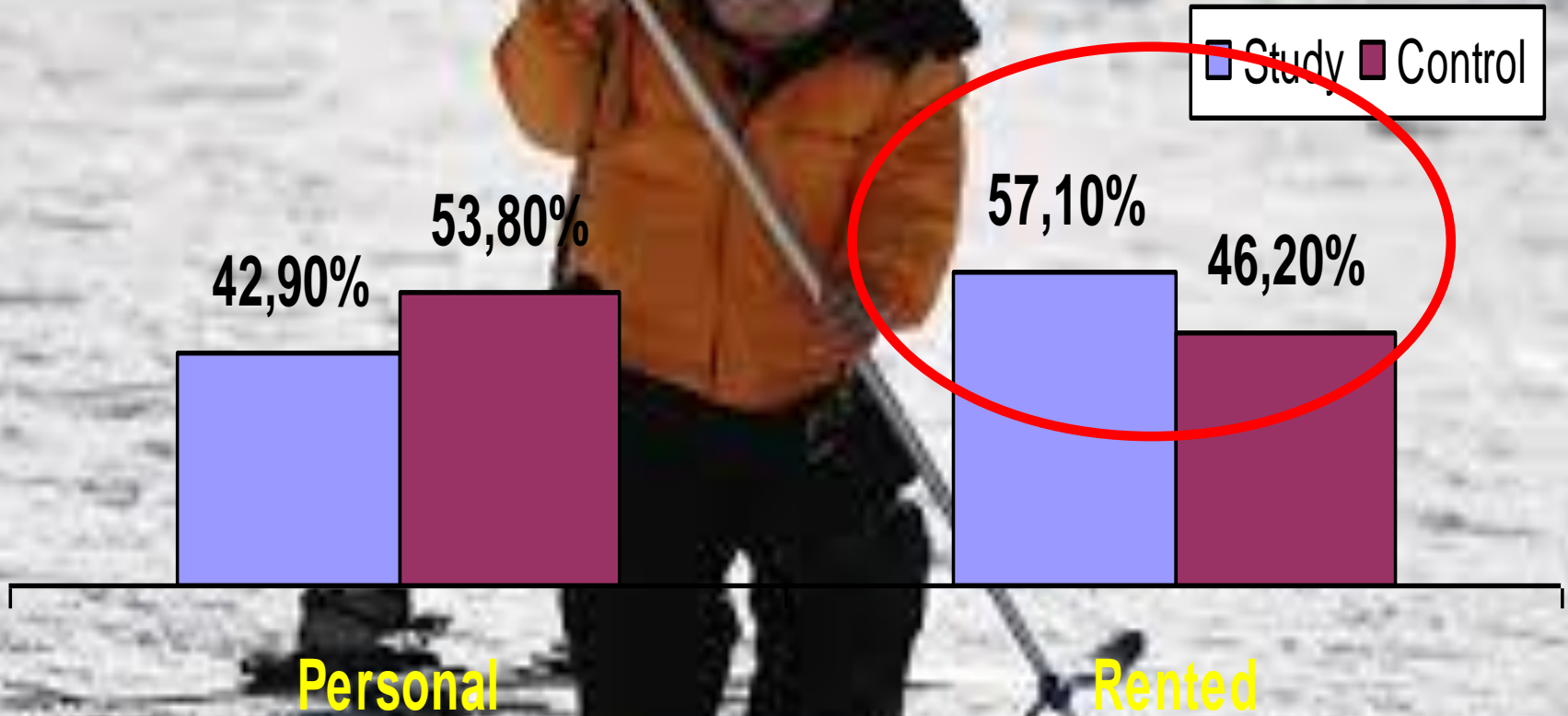
**... and jumps for  
snowboarders**

**(15.0 vs 3.4%), ( $p < 0.001$ )**

# Equipment



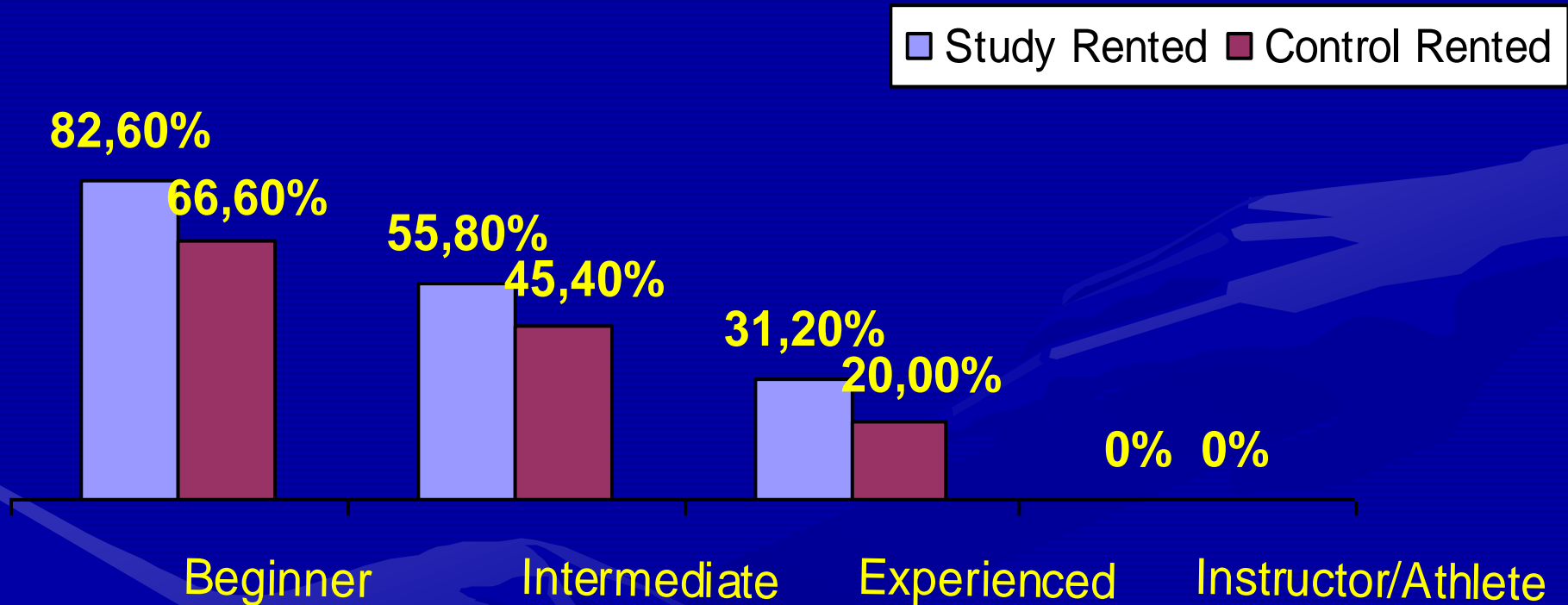
# Skiers equipment



**The use of rented equipment is a risk factor for injury in skiing**

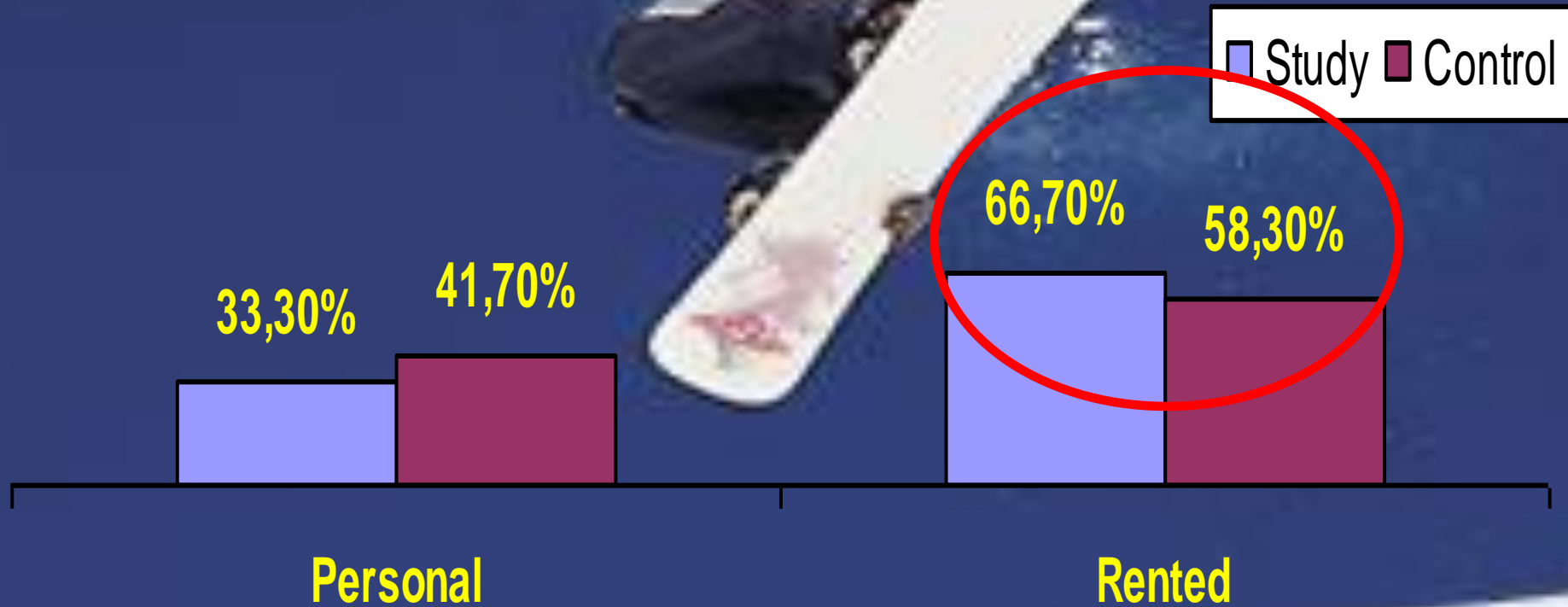
**( $p < 0.005$ )**

# Skiers equipment



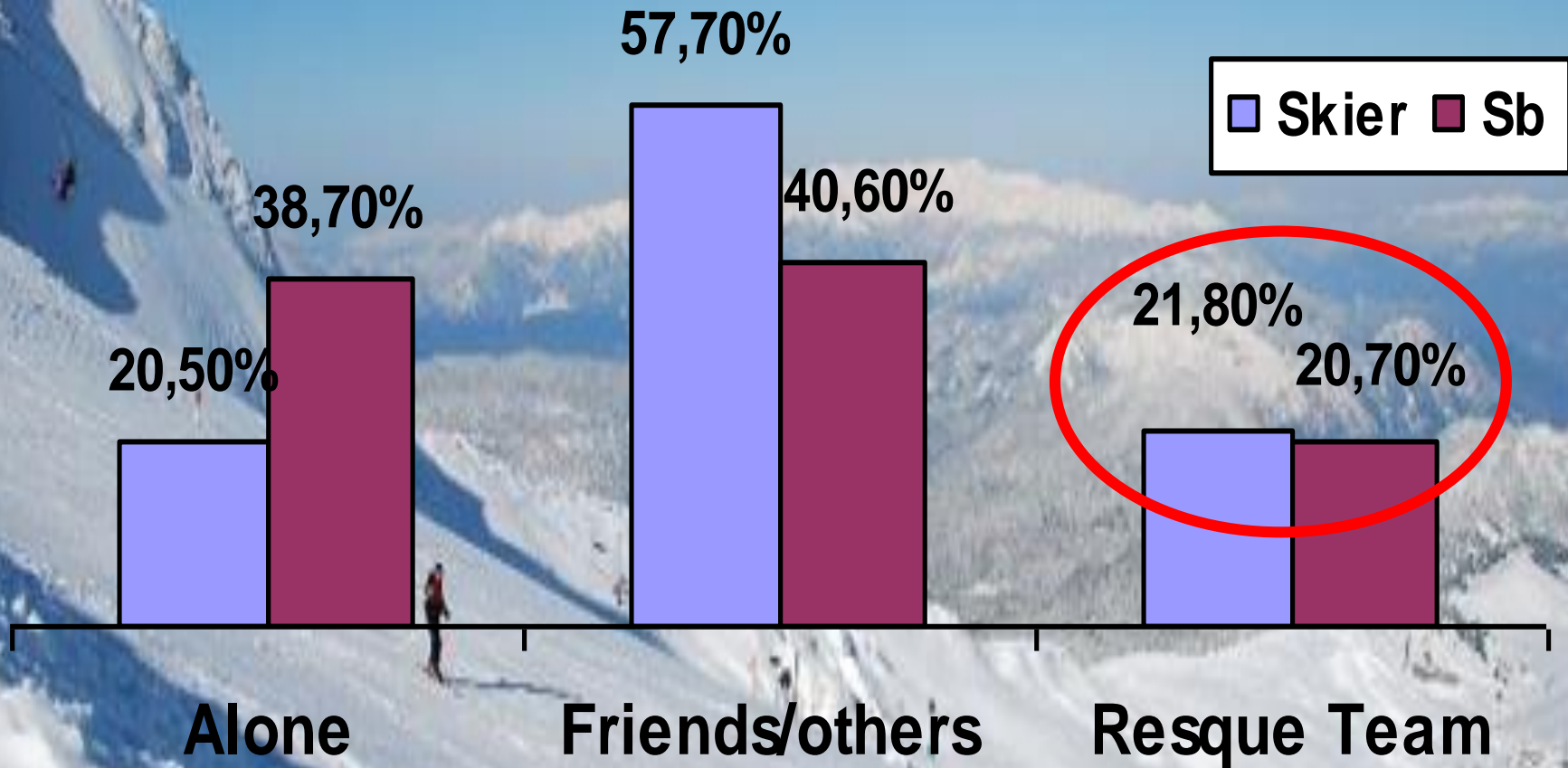
**Independently of the skill level...**

# Boarders equipment



The use of rented equipment is also a risk factor for injury in boarding

# Transfer to doctor



**1 out of 5 injured needs to be transferred to the doctor by the rescue team**



**Lower Limb: 49.9%**

**Upper Limb: 26.6%**

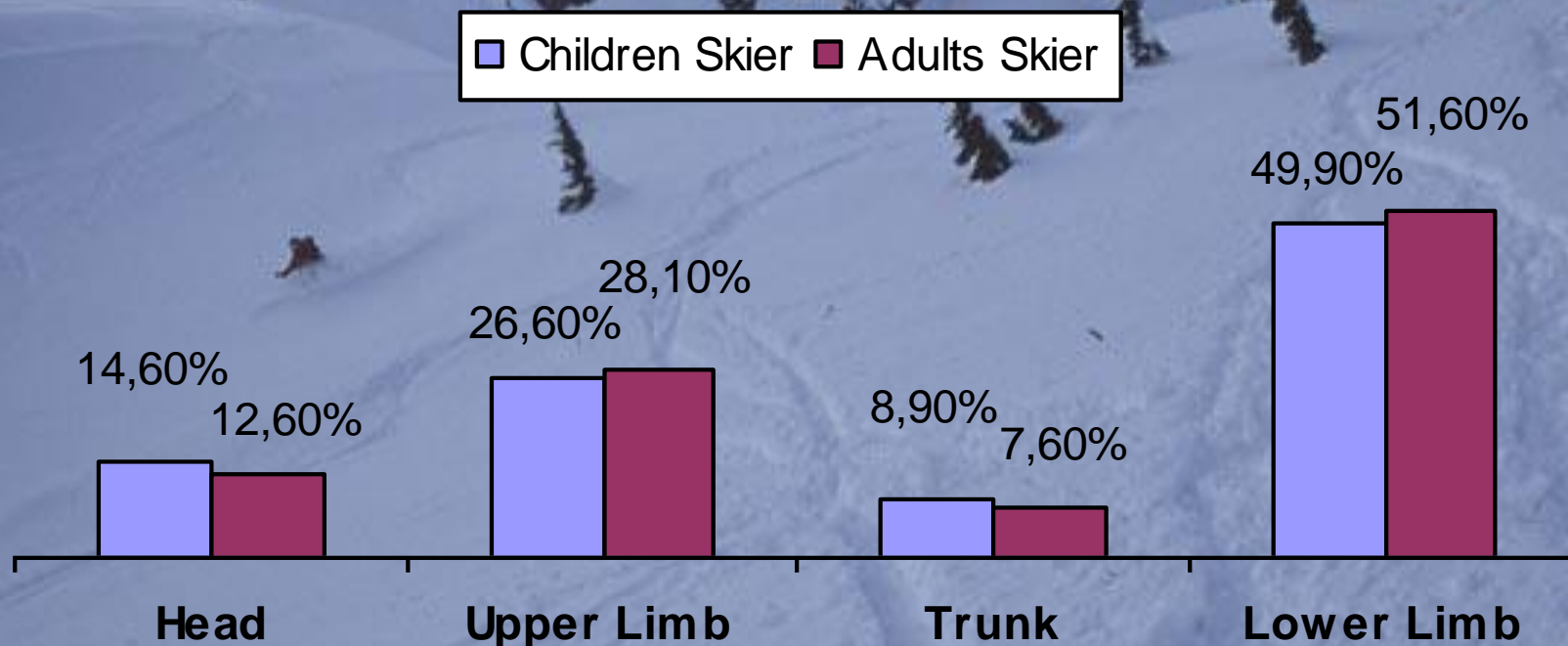
**Lower Limb: 18.0%**

**Upper Limb: 63.2%**



# Compared with adults

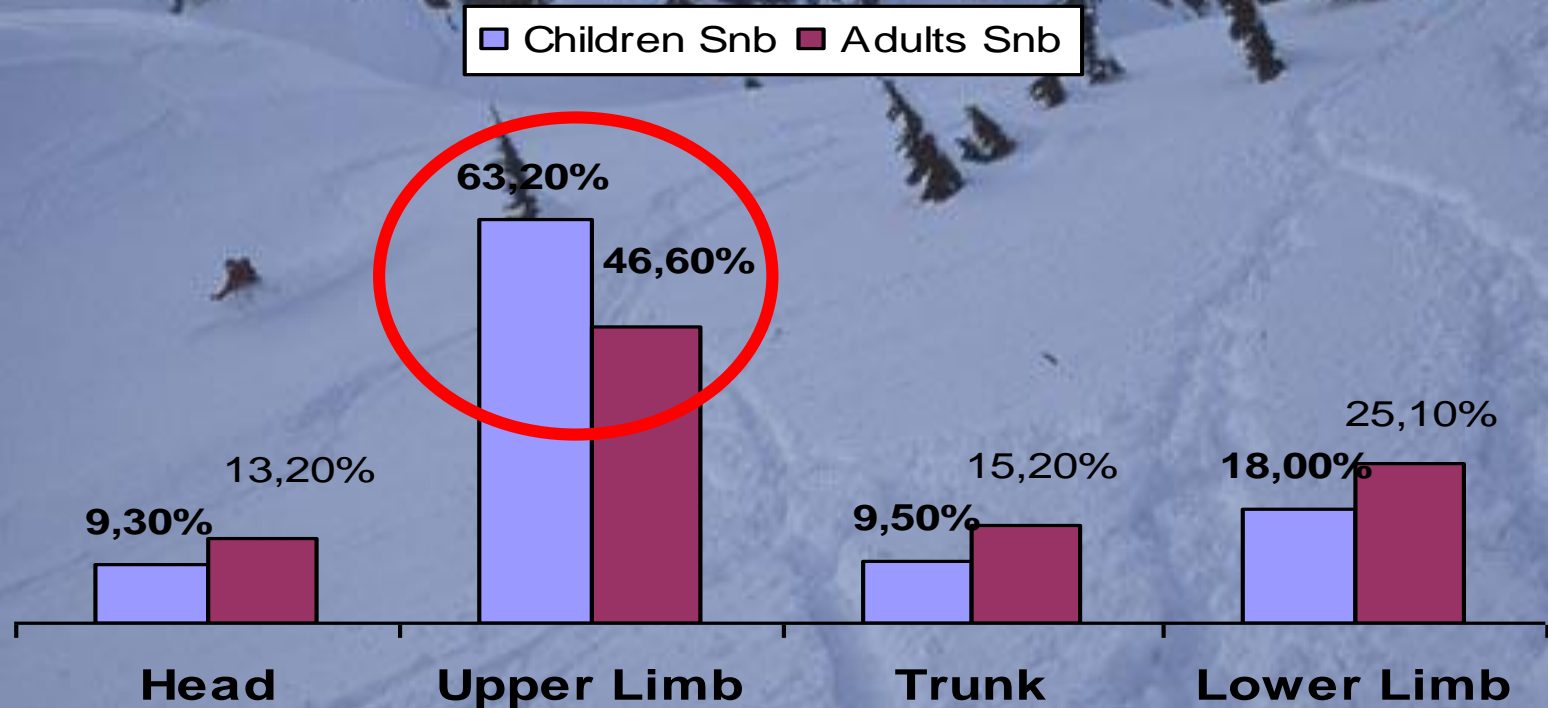
## Body part of the injured skiers



**It is not observed statistical significant difference between children and adults skiers**

# Compared with adults

## Body part of the injured Boarders

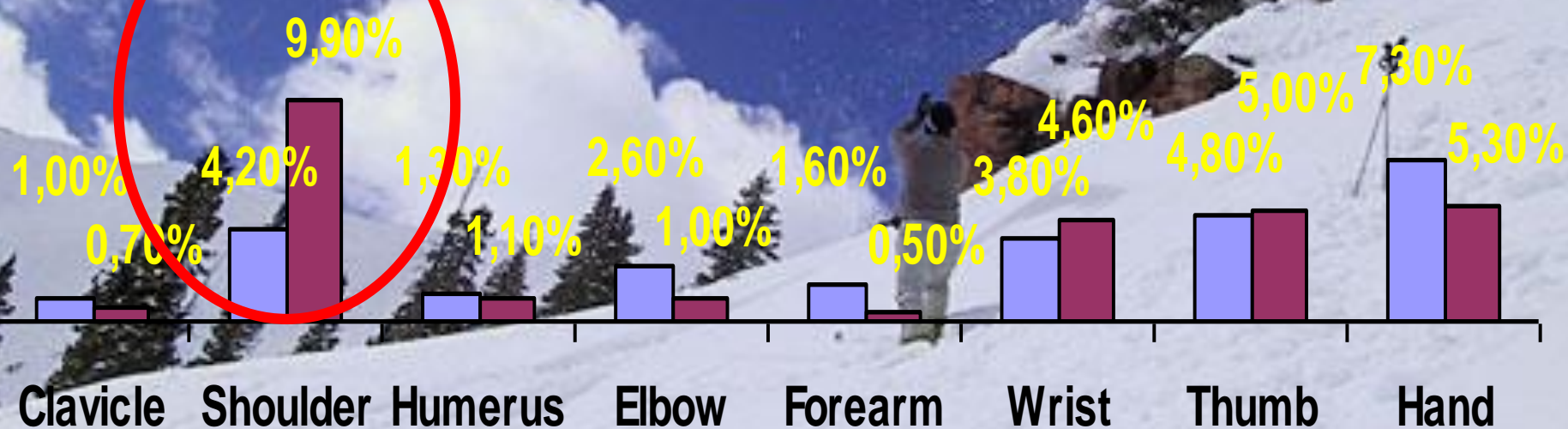


Young snowboarders represent a significant higher incidence of upper limb injuries than adults

# Compared with adults

## Upper Limb Injuries in Skiing

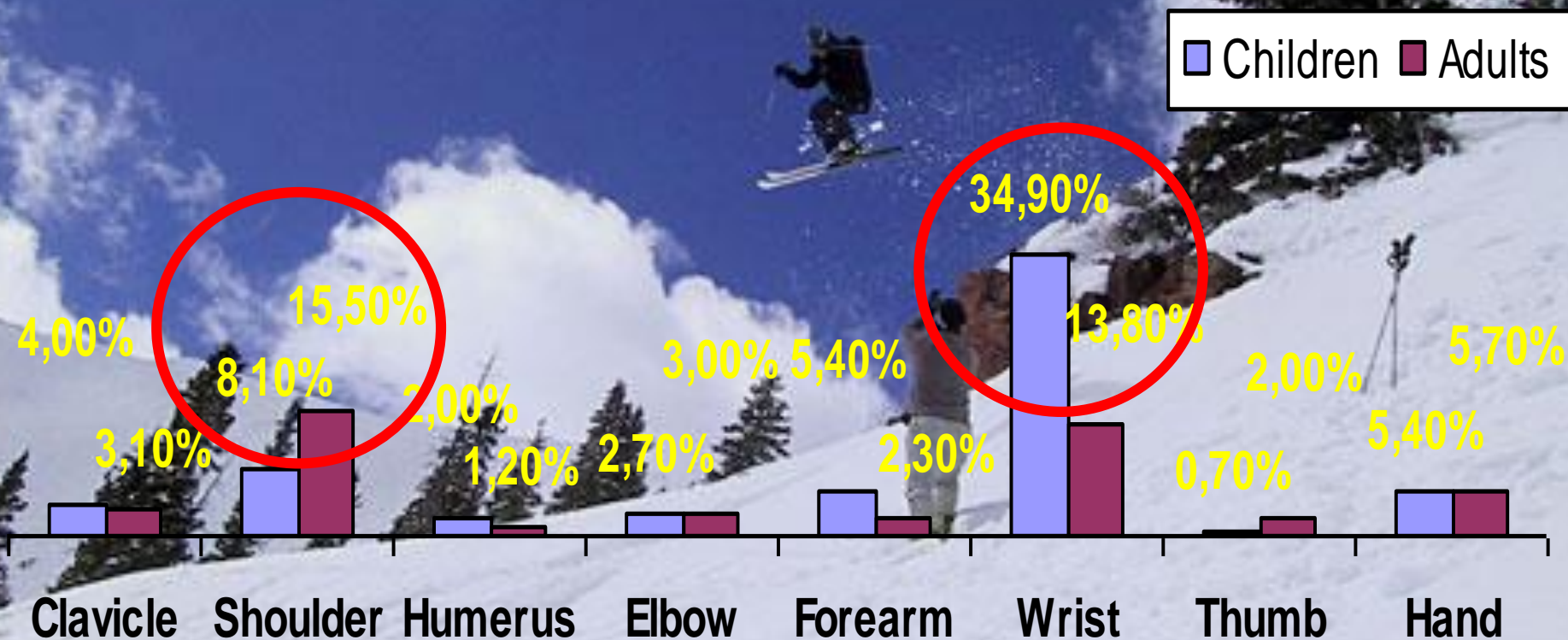
Children Adults



**Shoulder injuries have statistical significant differences in skiing**

# Compared with adults

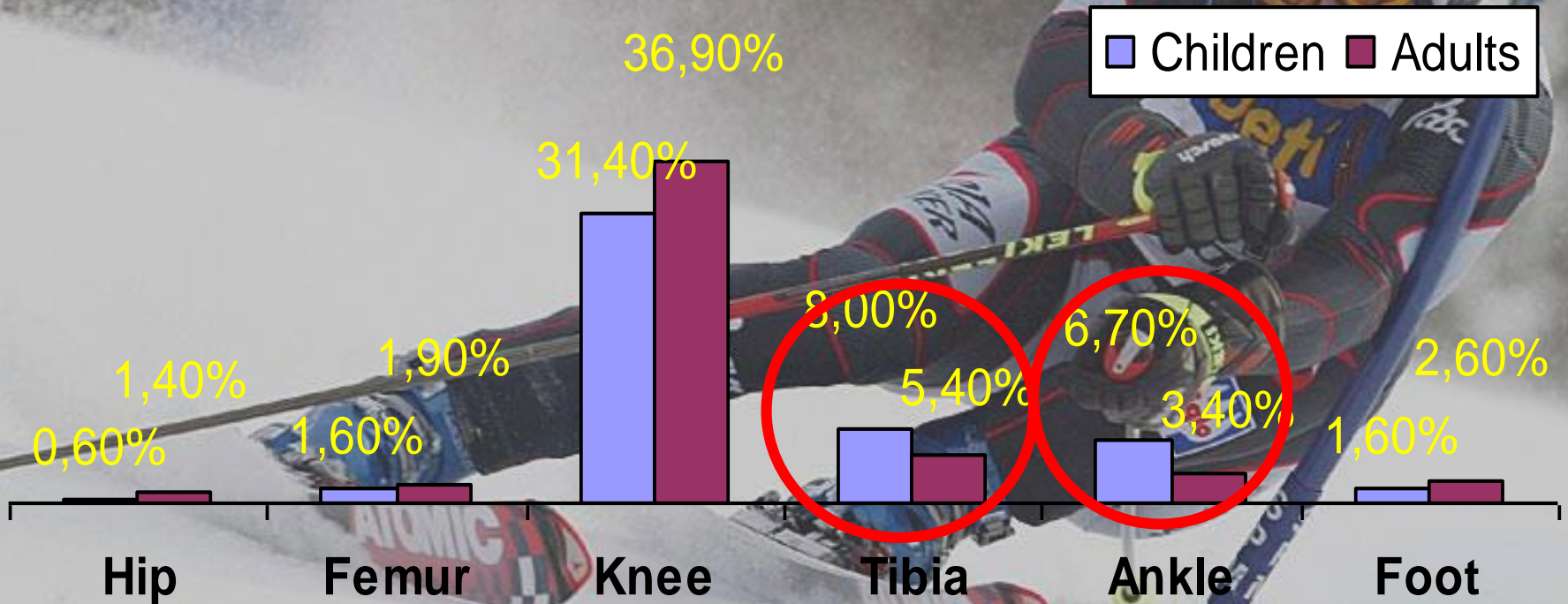
## Upper Limb Injuries in Boarding



Shoulder and wrist injuries have statistical significant differences in boarding

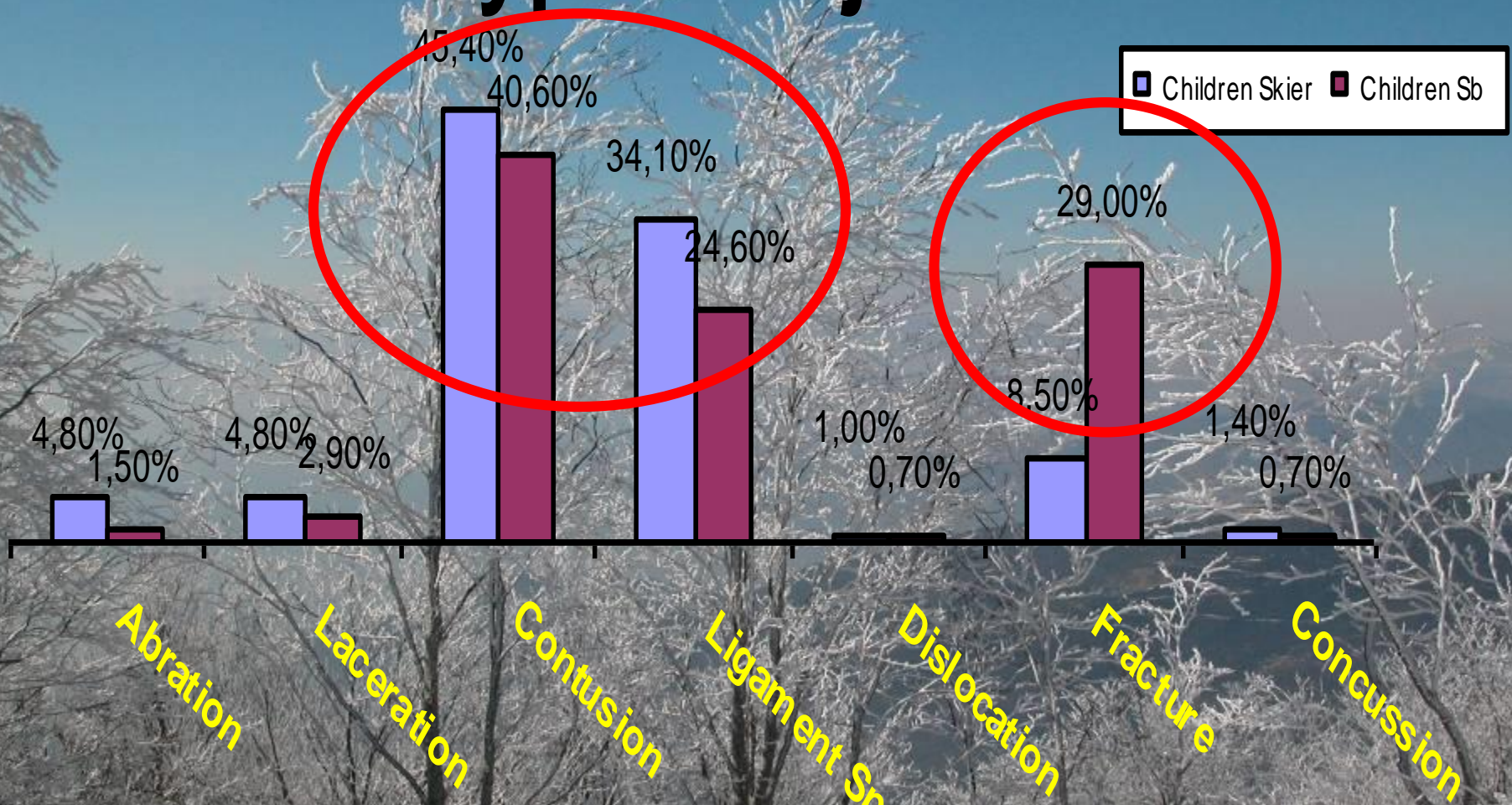
# Compared with adults

## Lower Limb Injuries in Skiing



Tibia and ankle injuries have statistical significant differences in skiing ( $p < 0.005$ )

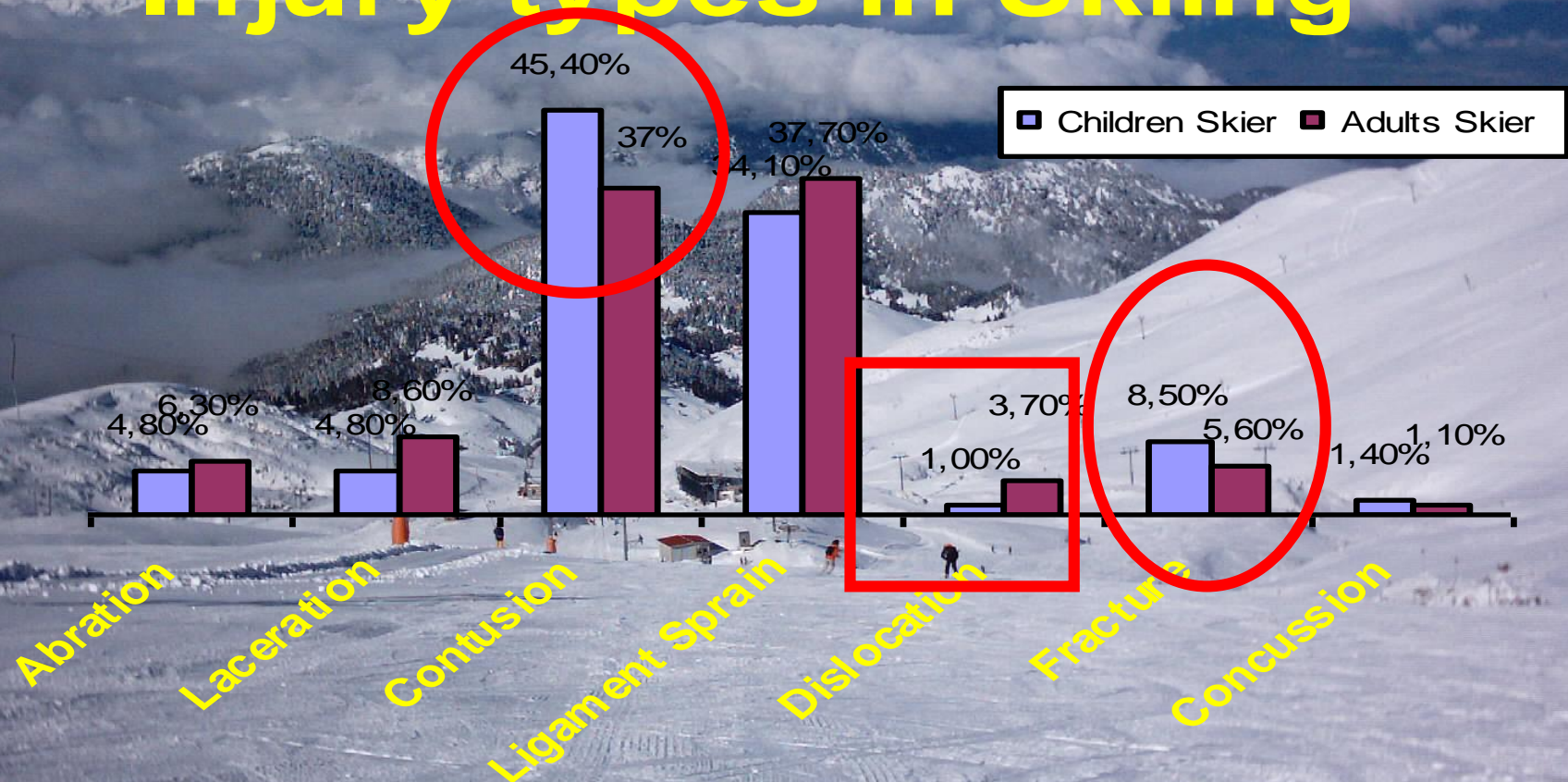
# Type of injuries



Contusions and ligament sprains are the most common injuries in skiers  
Fractures are the second most common injuries in skiers

# Compared with adults

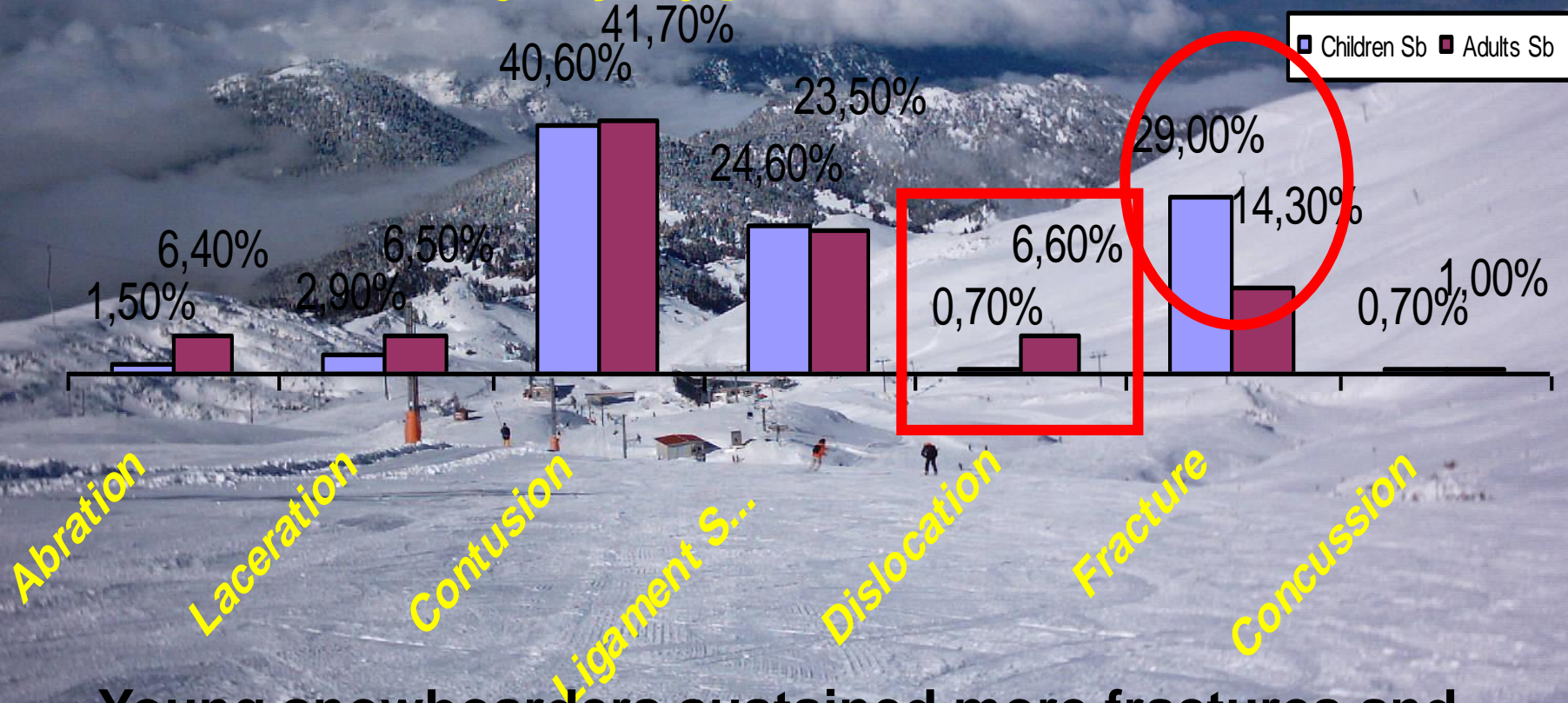
## Injury types in Skiing



Young skiers sustained more contusions, more fractures and less dislocations than adults

# Compared with adults

## Injury types in Snb



**Young snowboarders sustained more fractures and less dislocations than adults**

# Conclusions:

- Children and adolescents are at higher risk of injury in all snow sports, especially alpine skiing, where are more than as twice likely to be injured than other skiers.



- Children skiers counted the 16% of the population on the slopes but sustaining the 28% of all the injuries.



# Conclusions:

- The types and the causes of these injuries are also different than the adults



- Certain factors are associated with this increased risk:

- Activity
- Lower skill level
- Early stages of instruction/experience
- Use of rental equipment
- Collisions
- Instructors
- Family



# Conclusions:

- Understanding and addressing these factors provides pathways for risk reduction





Can you show  
me the way for  
safe skiing?

خيالمنون