“SKIING INJURIES IN CHILDREN AND ADOLESCENTS "

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Children in sports

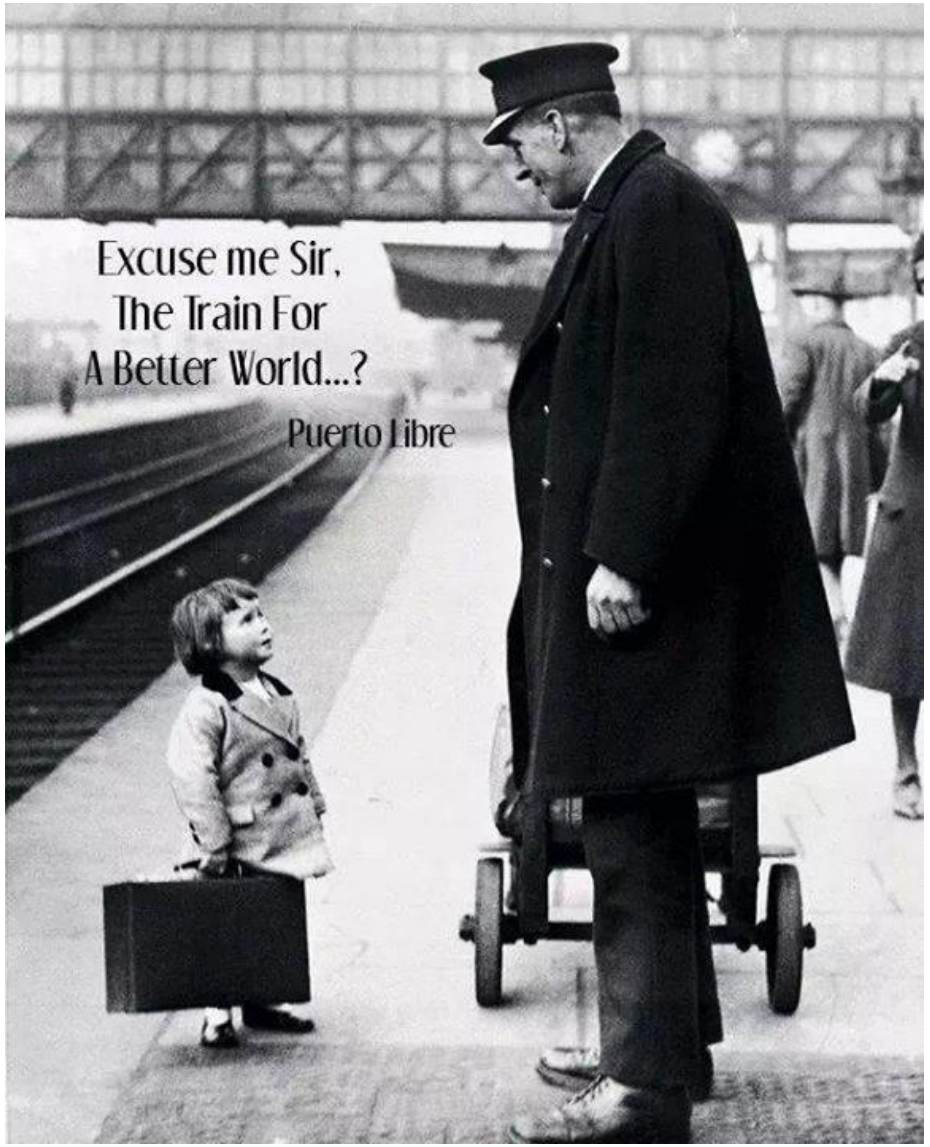
- The past decade has seen an explosion in the number of children participating in team and solo sports

- In 2011, only in USA, more than 46.5 million children played team sports.

Children in sports

- Benefits
  - Physical Fitness
  - Motor development
    - Learn New Skills
    - Improve Skills
  - To Make Friends
  - Build Self-Estimation
  - Have Fun

Children are not small adults



Children in sports

There are differences

- ***Body size***
  - Smaller heads
  - Closer to the ground

➢Unique impact characteristics

(Hoshizaki, et al., 2012)

Children in sports

There are differences

- ***Body growth***
  - there is a decrease in flexibility because of relative bone lengthening
  - Tendons and ligaments are relatively stronger than the epiphyseal plate

➢Fractures

Children in sports

There are differences

- ***Metabolic***
  - Children produce more heat
  - have a low sweating capacity

➢Fatigue

Children in sports

There are differences

- ***Psychology***
  - Risky taking behavior
    - ➢ Excessive speed
    - ➢ Collision

Children in sports

There are differences

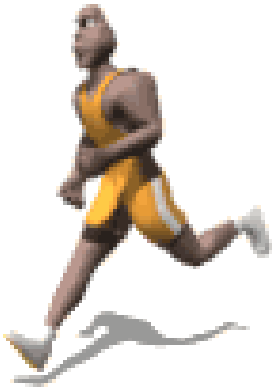
- ***Parental influence***

  - Risky taking behavior

Children in sports

Three age groups:

- <11 years old (children)
- 11-14 years old (adolescents - high school)
- 15-17 years old (adolescents - college)

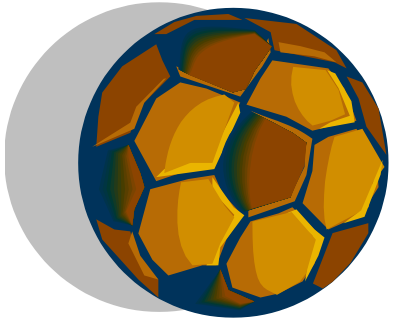


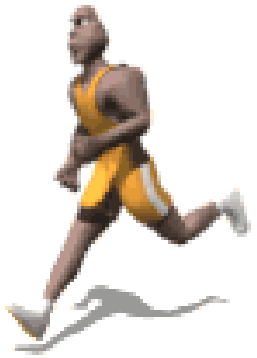
Children in sports

There are differences between these three age groups (even into the same group) regarding:

- Maturity
- BMI
- Stage of puberty

Children are at high risk for injury in almost all the sports





Especially in skiing and boarding:

- 3.9 – 9.1 per thousand skiers days

(Meyers, et al., 2007)

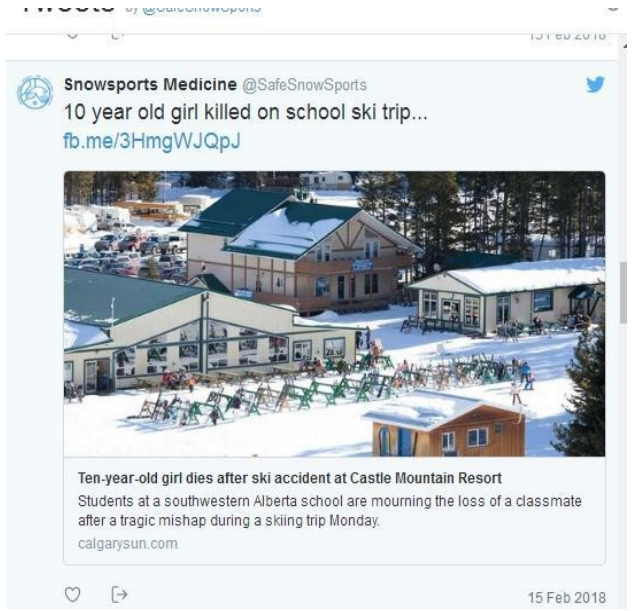
When in general population on the slopes the injury rate is 1-6 injuries/1000 skiers days

In skiing and boarding:

Fatal Injuries

- 0.5 – 1.9 per 1 million skiers days
- 14% of all fatal injuries occurred among child skiers

(Xiang et al, 2004)



Our experience:

Prospective case-control study during winter seasons 2007-2017

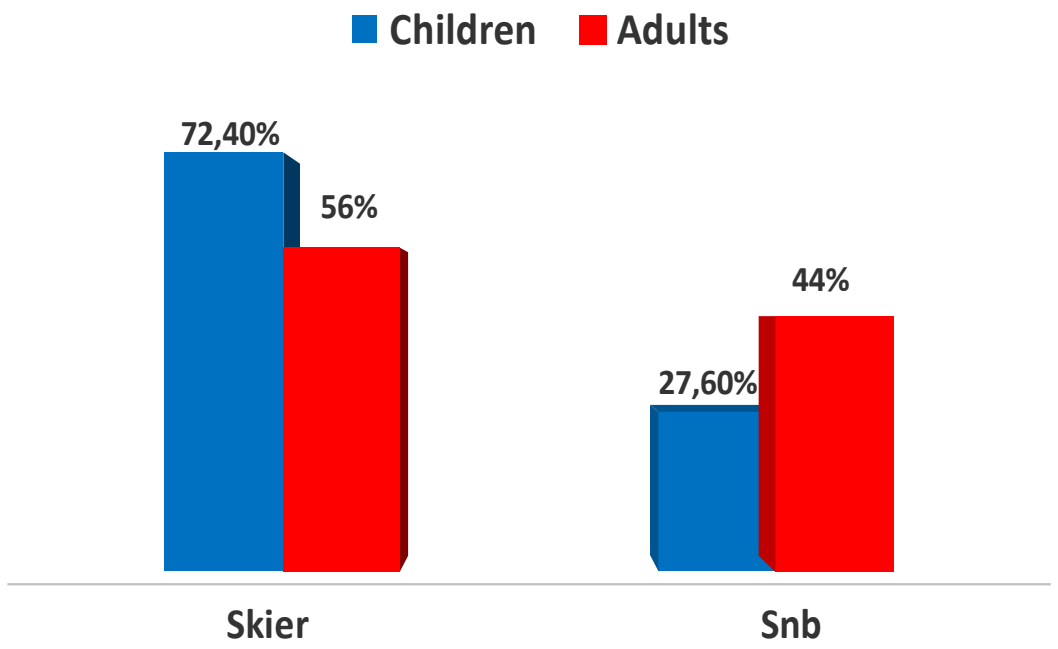
Parnassus Ski Resorts

Study Group

From a total of 3488 injured:

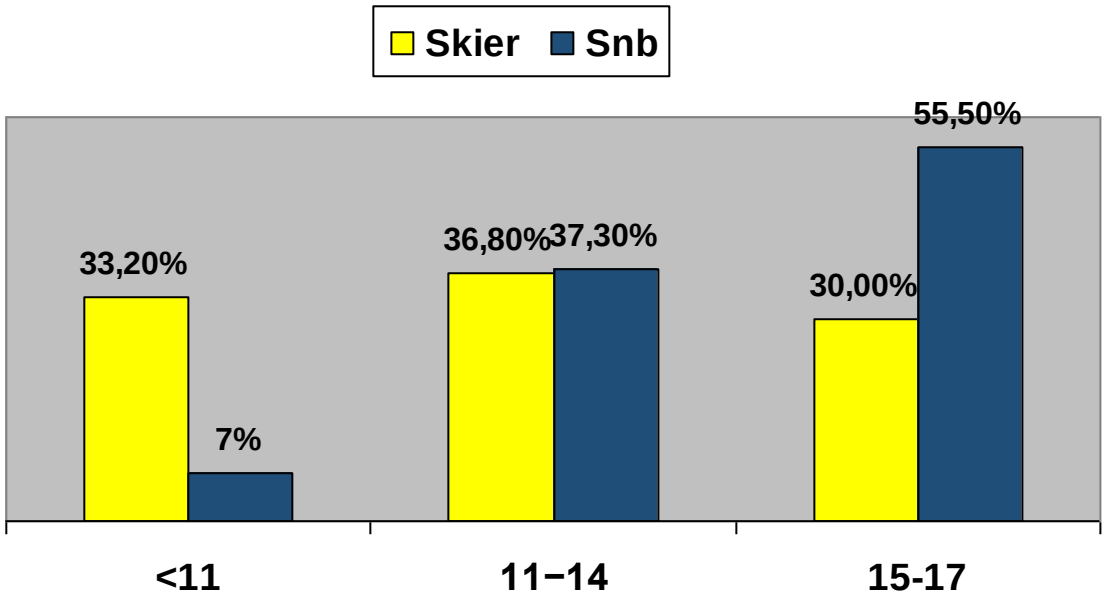
856 injured (with 923 injuries) were under 18 years old

- Skier: 620
- Snowboarder: 236



Study Group

- **3 subgroups:**
  - <11 (206 skiers, 17 snbs)
  - 11-14 (228 skiers, 88 snbs)
  - 15-17 (186 skiers. 131 snbs)

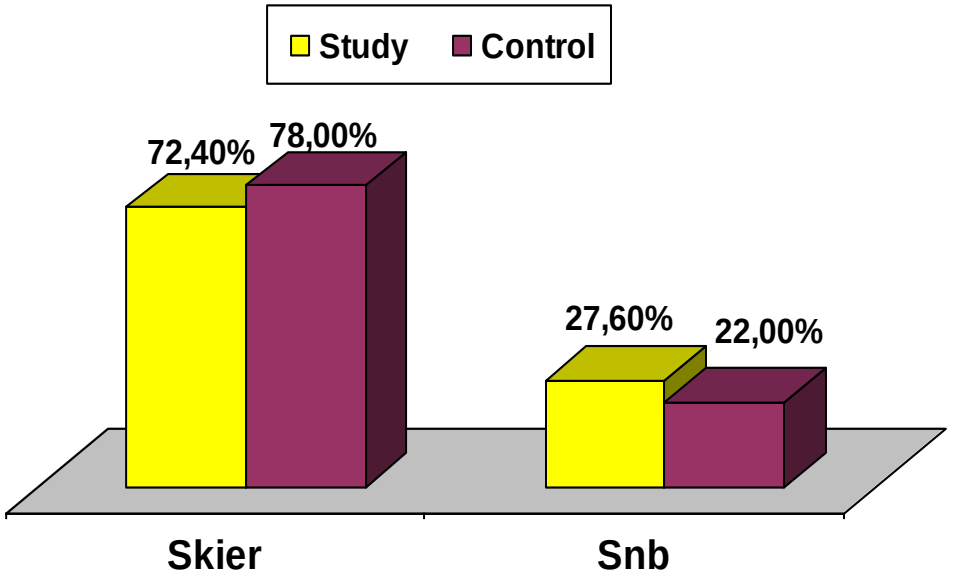


Control Group

From a total of 1290 uninjured (randomly selected)

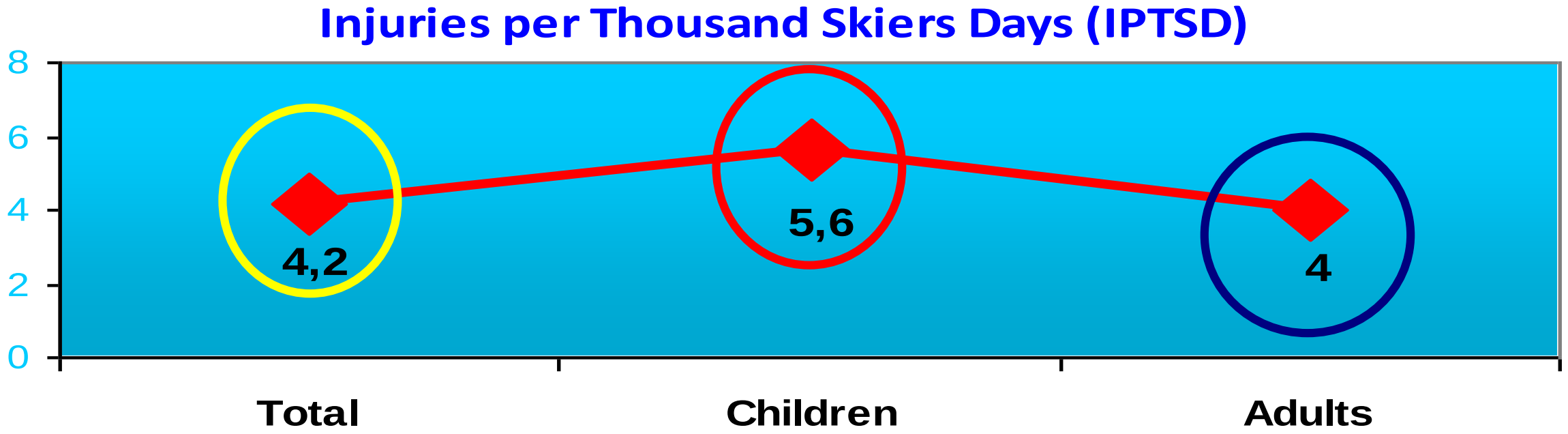
uninjured ≤ 17 : 234

- Skier: 183
- Snowboarder: 51



Results:

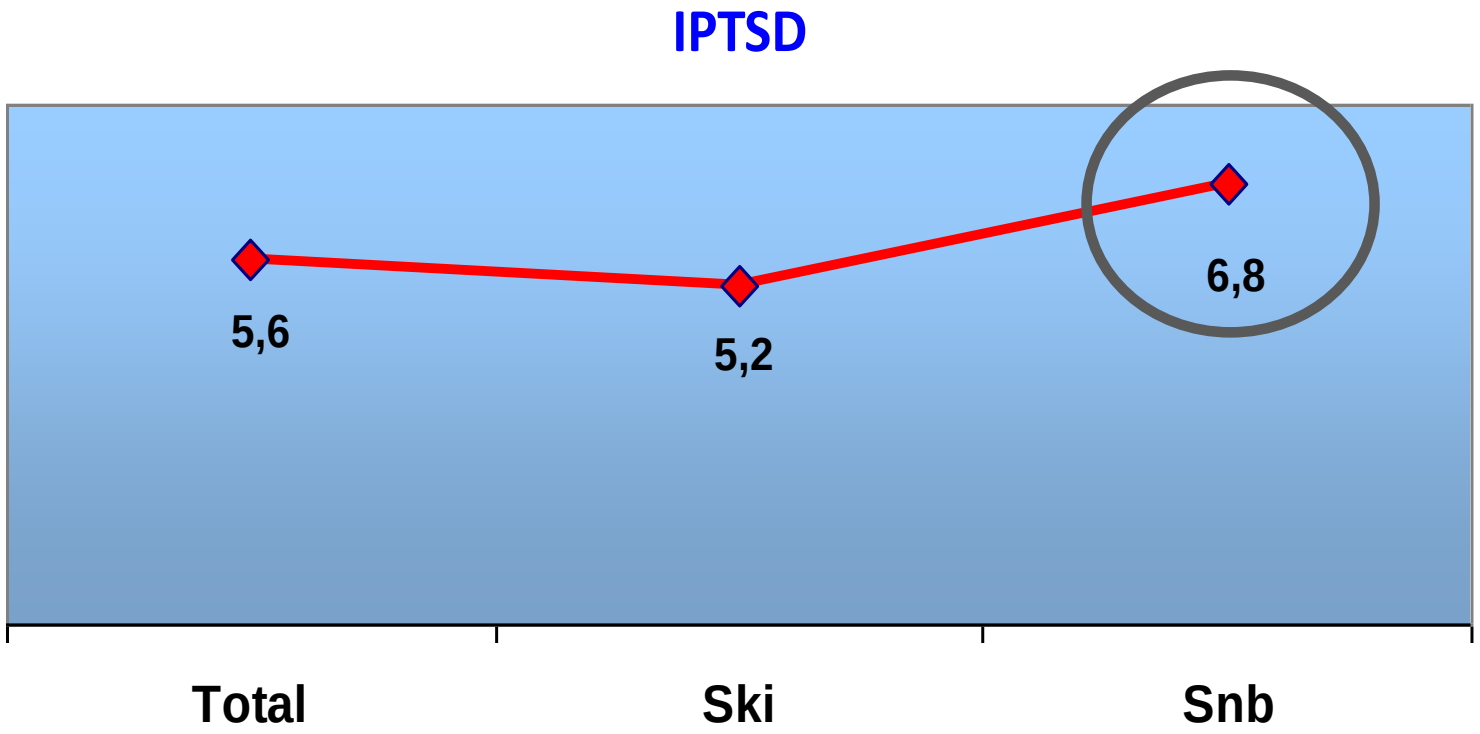
Overall rate of injuries:



The overall rate of injuries for children and adolescents is higher than adults

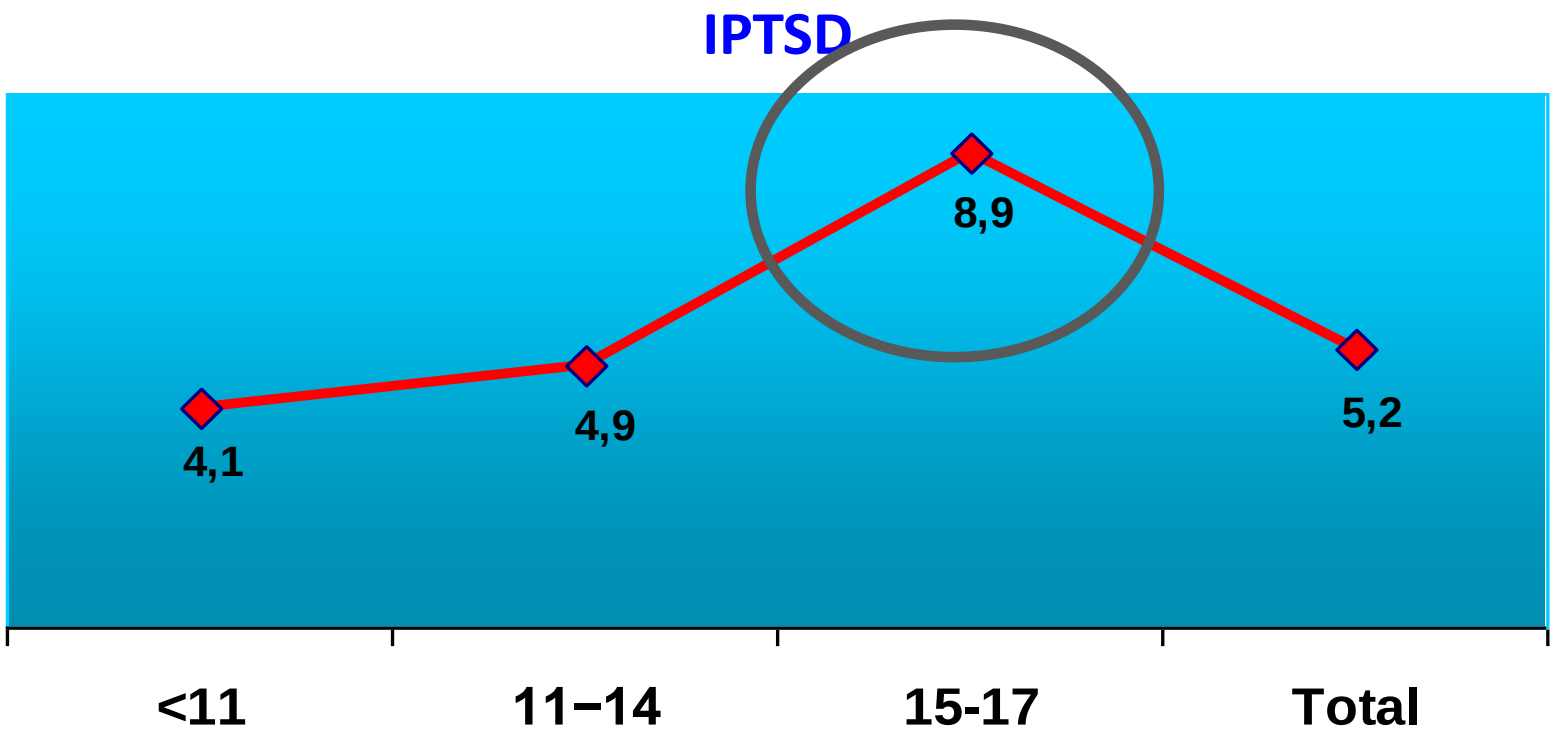
Children skiers counted the 18% of the population on the slopes but sustaining the 25% of all the injuries.

Overall rate of injuries in Children:



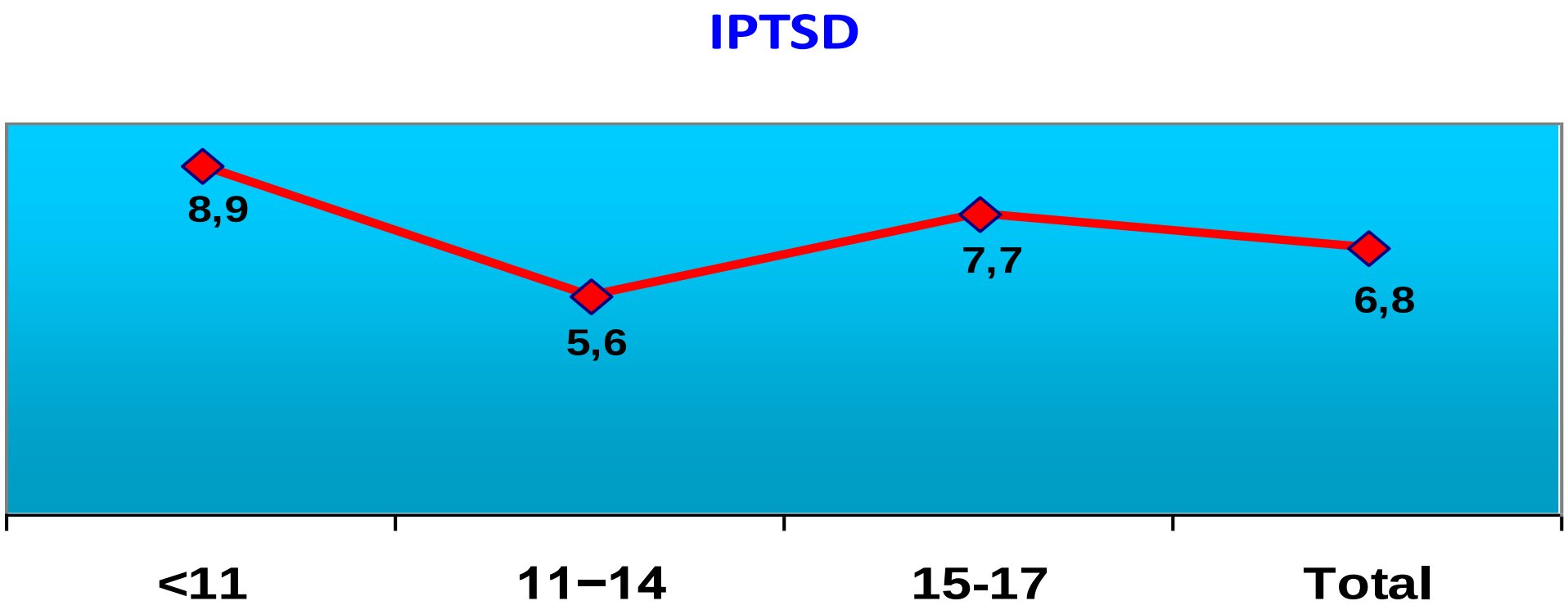
The injury rate in Snb is higher than Skiers

Overall rate of injuries in Children in Skiing:

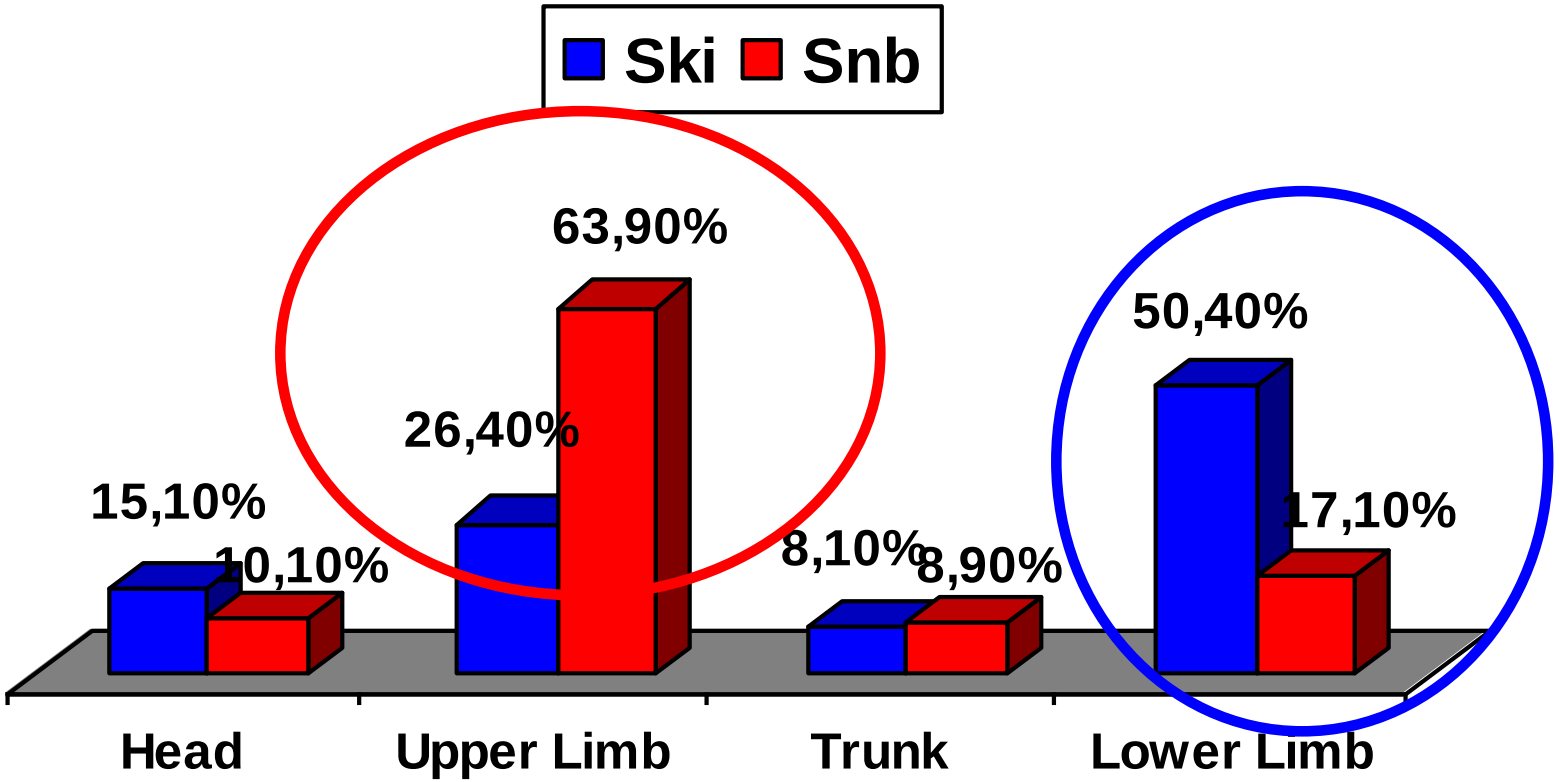


The age subgroup of 15-17 in skiing represent the higher incidence of injuries

Overall rate of injuries in Children in Snowboarding:



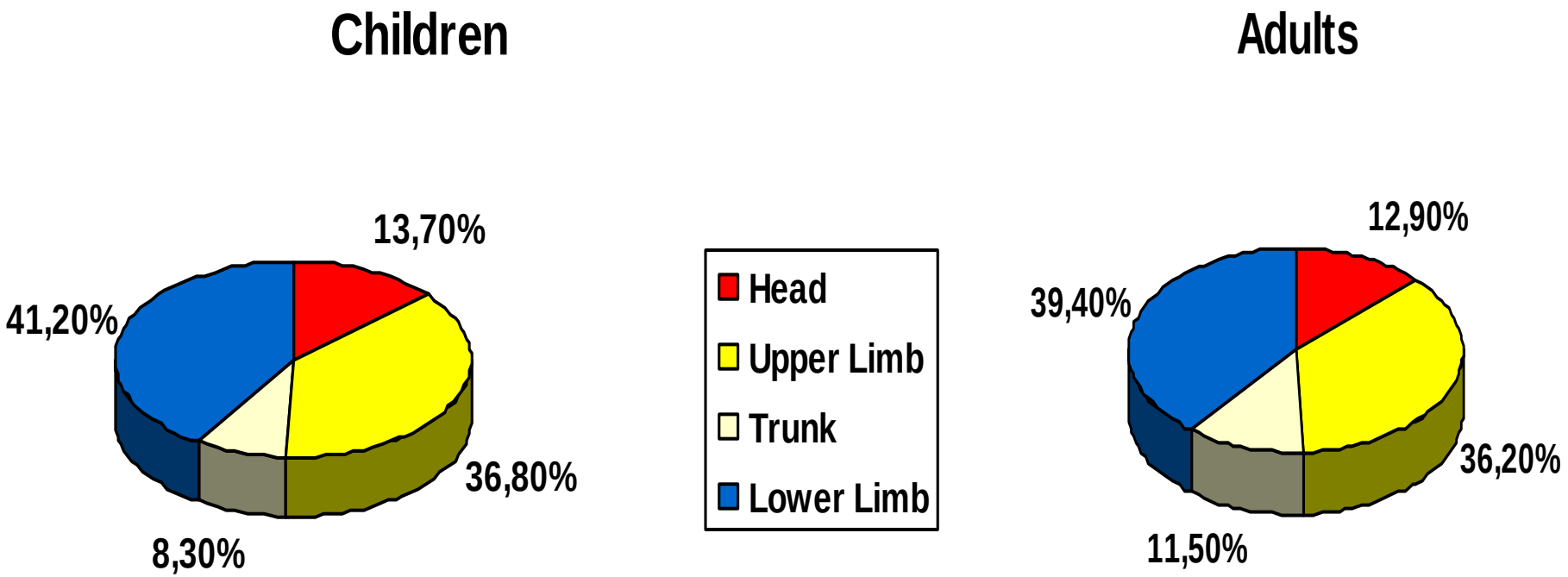
Body Part injured



Snb sustain mainly upper limb injuries while skiers lower limb injuries

Compared with adults

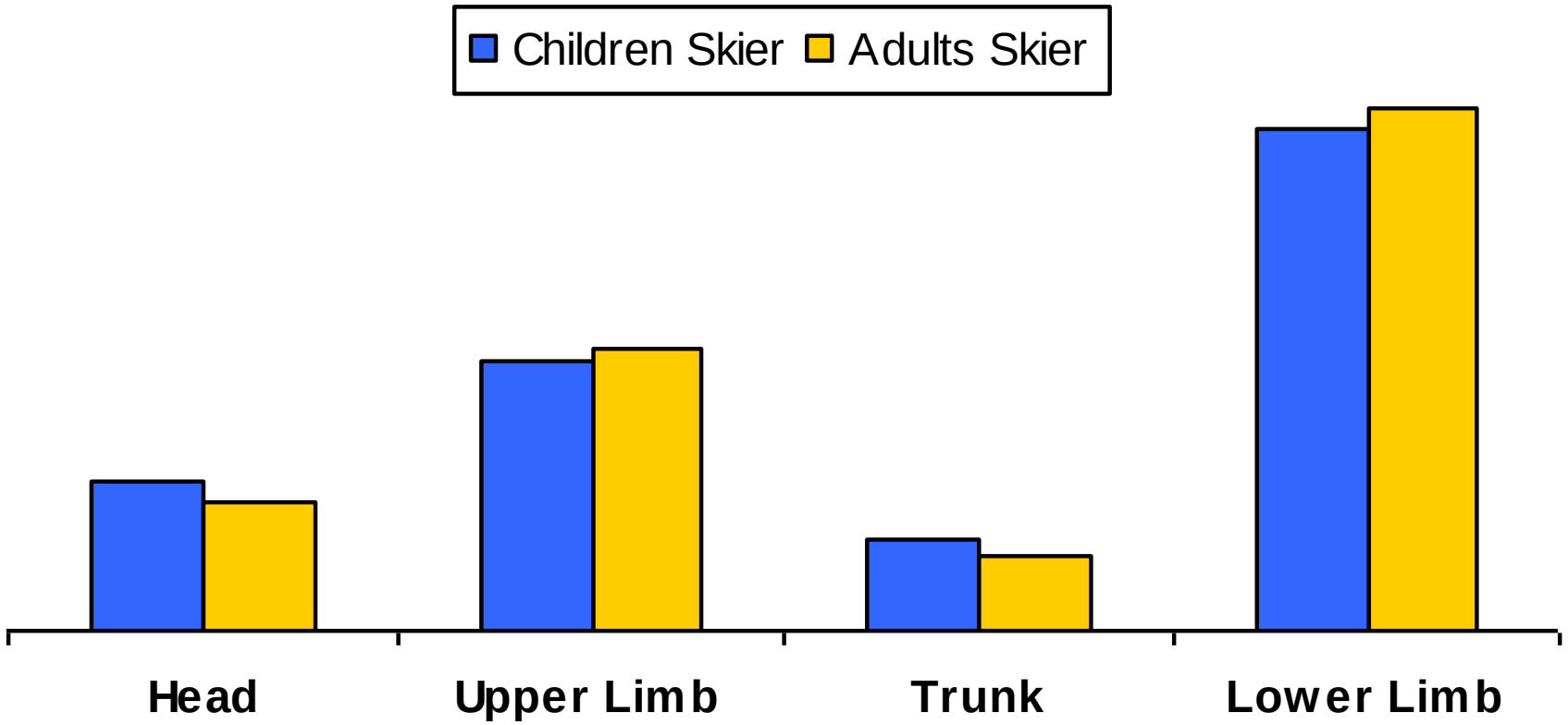
Body Part injured



There are no differences between children and adults

Compared with adults

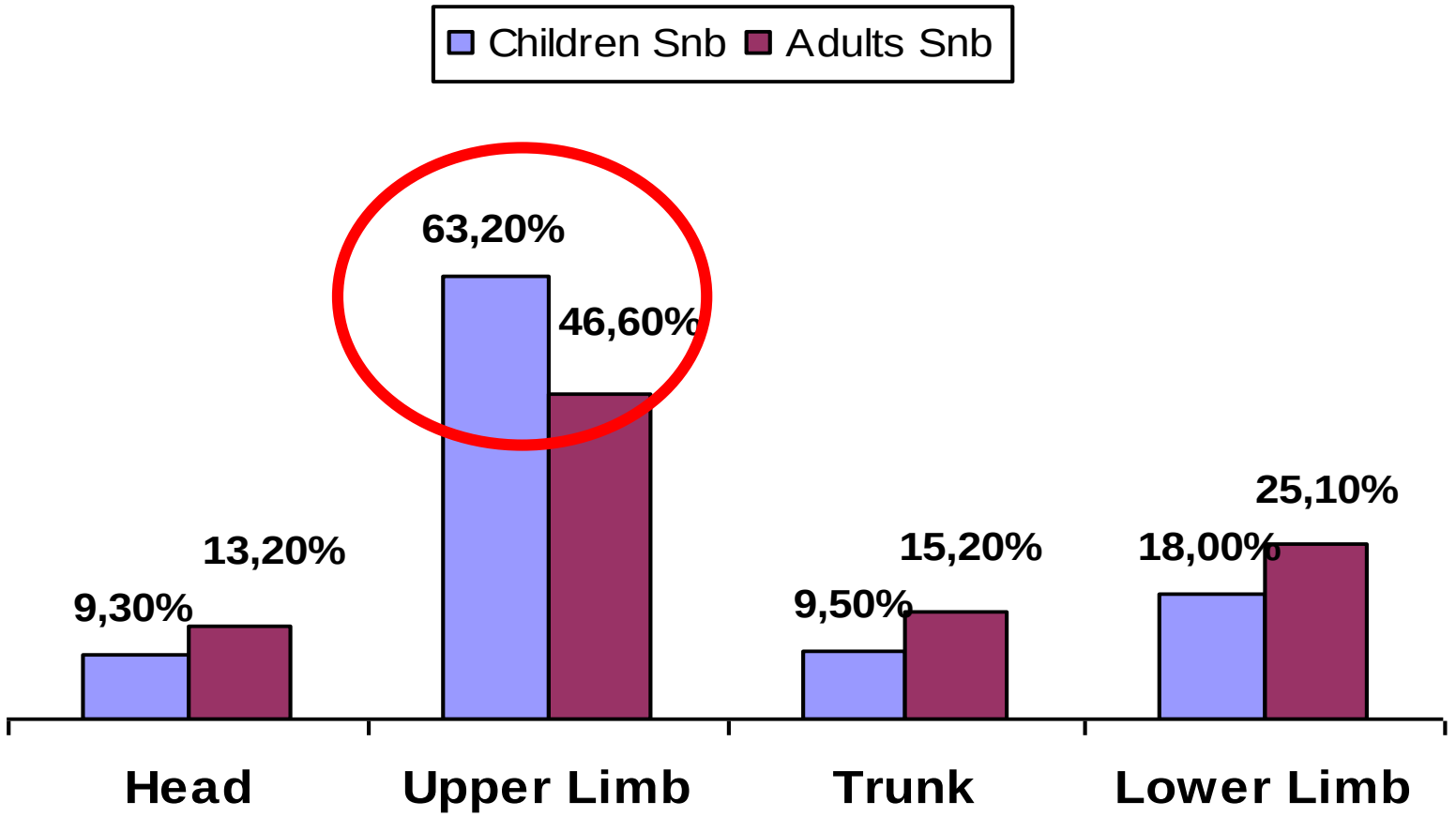
Body part of the injured skiers



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

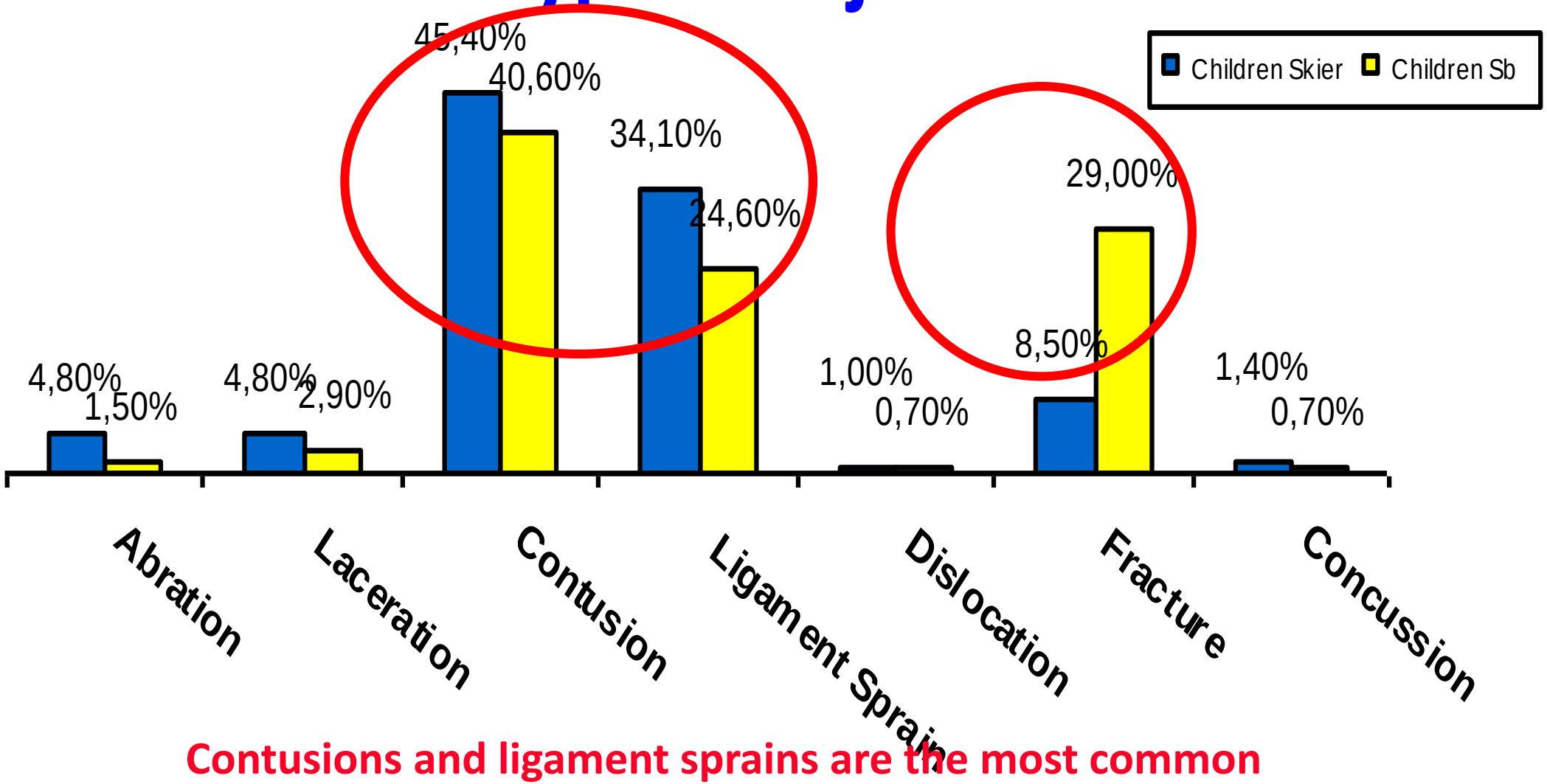
Compared with adults

Body part of the injured Boarders



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

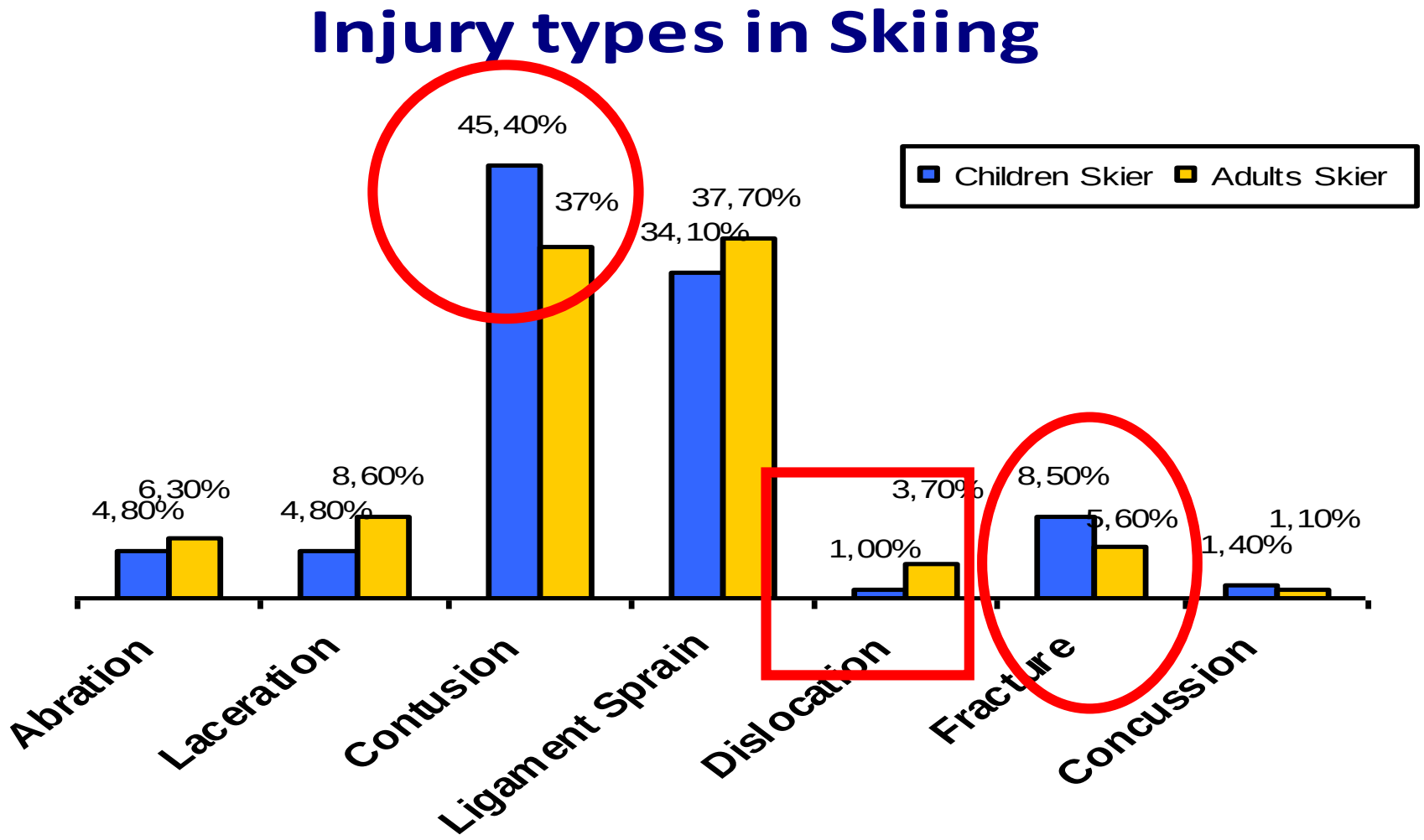
Type of injuries



Contusions and ligament sprains are the most common injuries in skiers

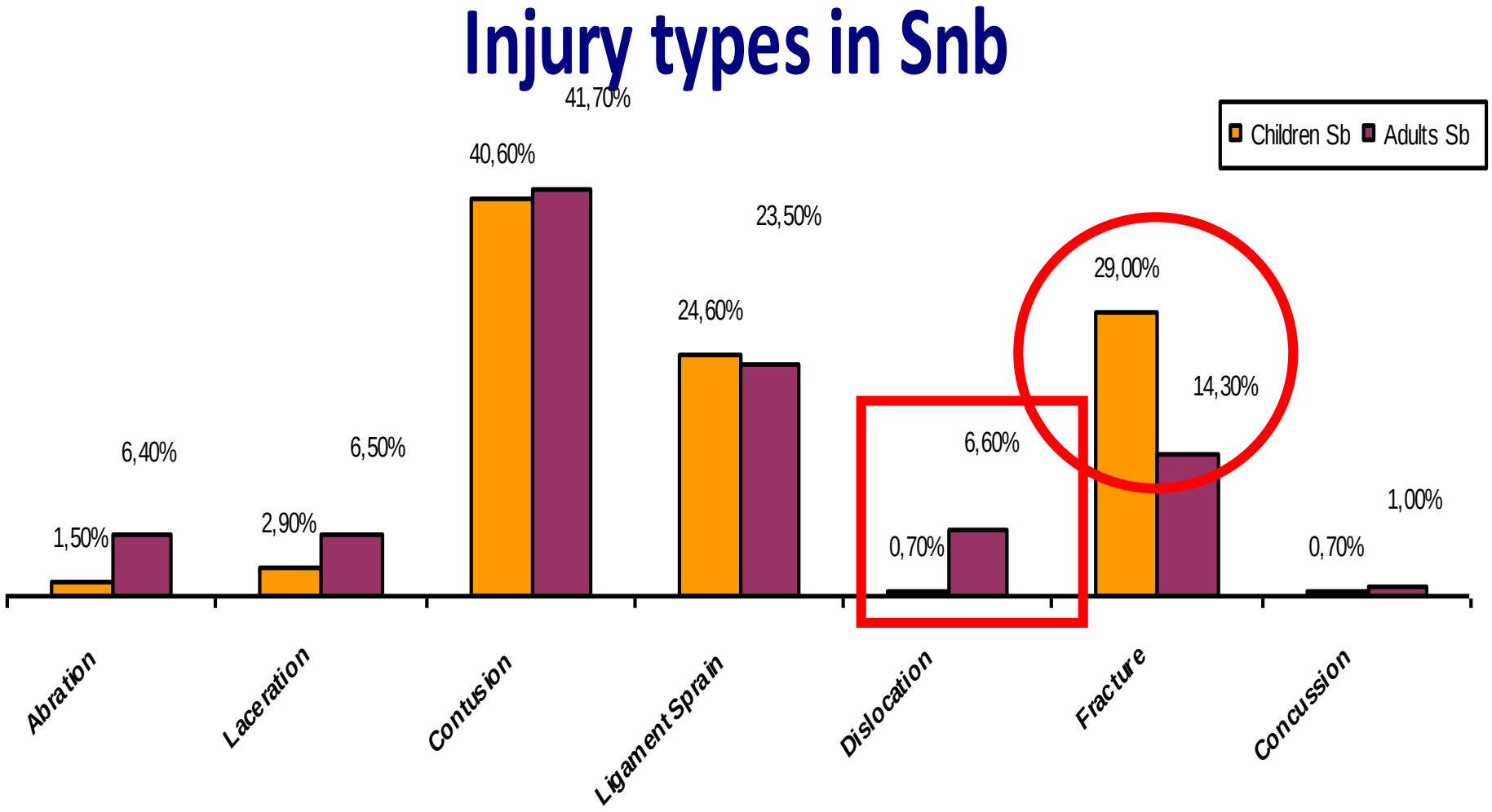
Fractures are the second most common injuries in Snb's

Compared with adults



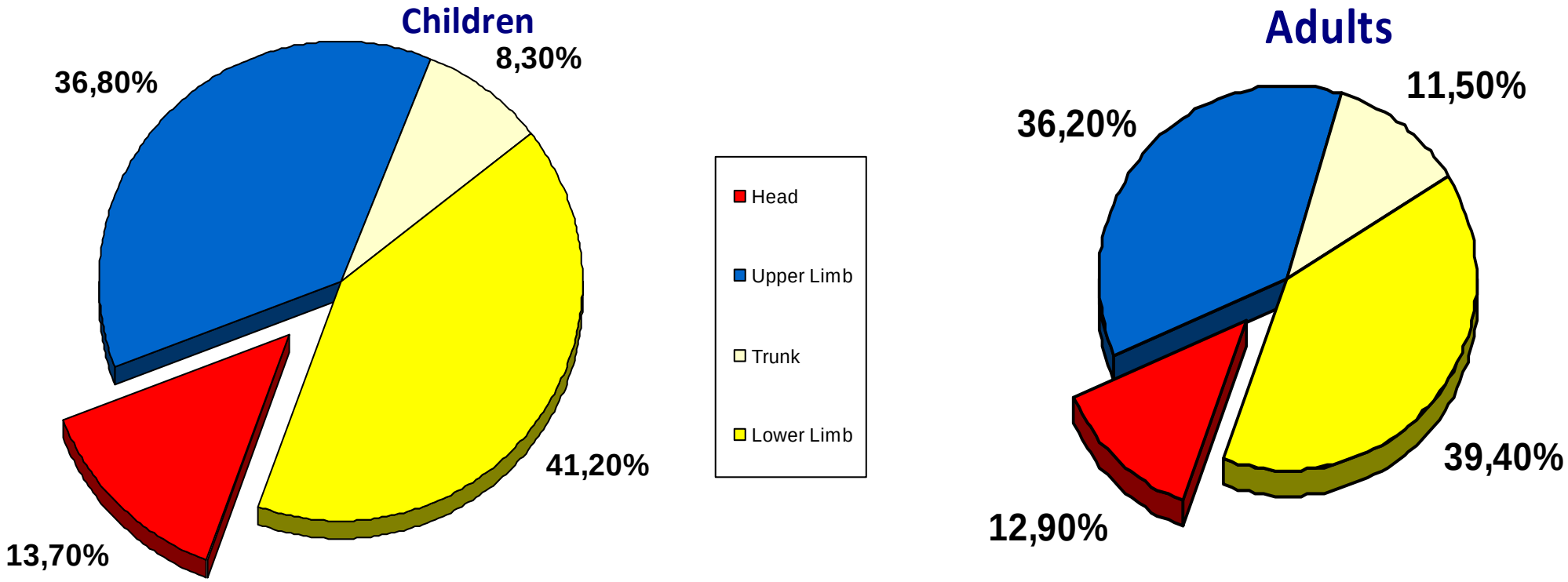
Young skiers sustained more contusions, more fractures and less dislocations than adults

Compared with adults



Young snowboarders sustained more fractures and less dislocations than adults

Head Injuries

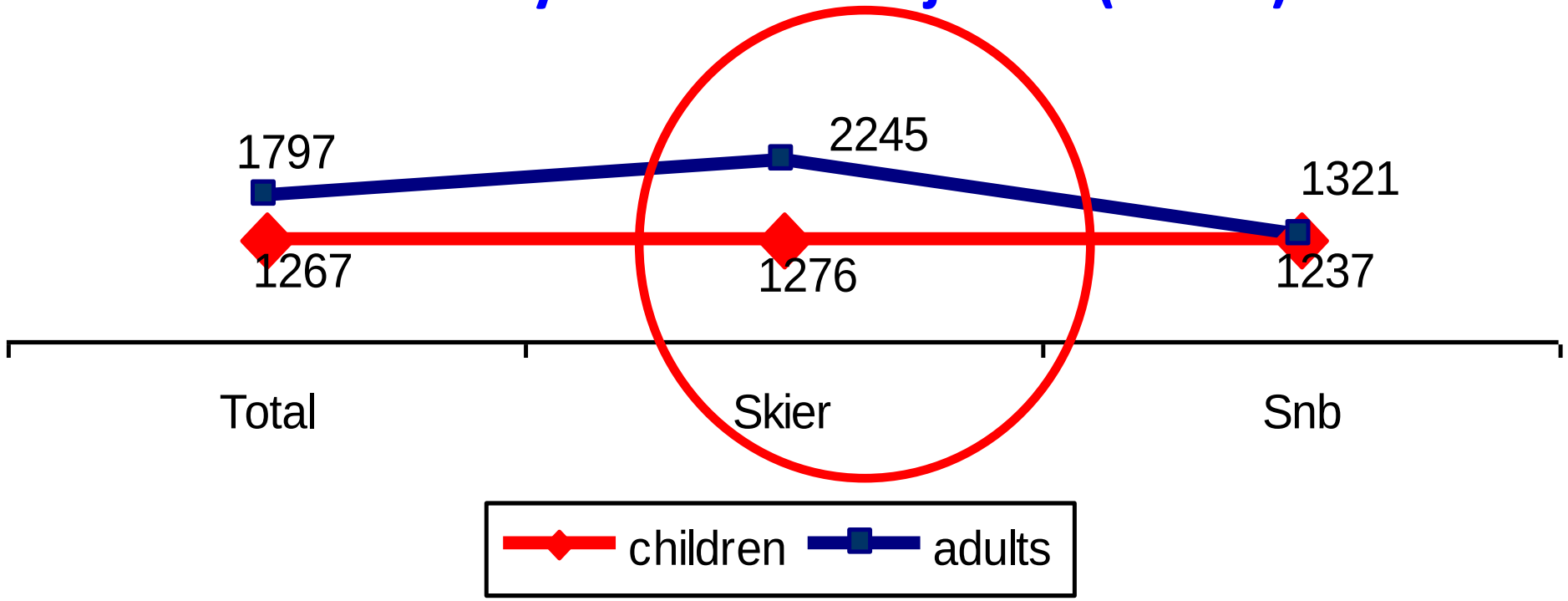


13,7% of all the injuries in children and 12,9%% in adults are head injuries

Compared with adults

Head Injuries

Mean Days Between Injuries (MDBI)



Children skier sustain higher prevalence of head injuries than adults

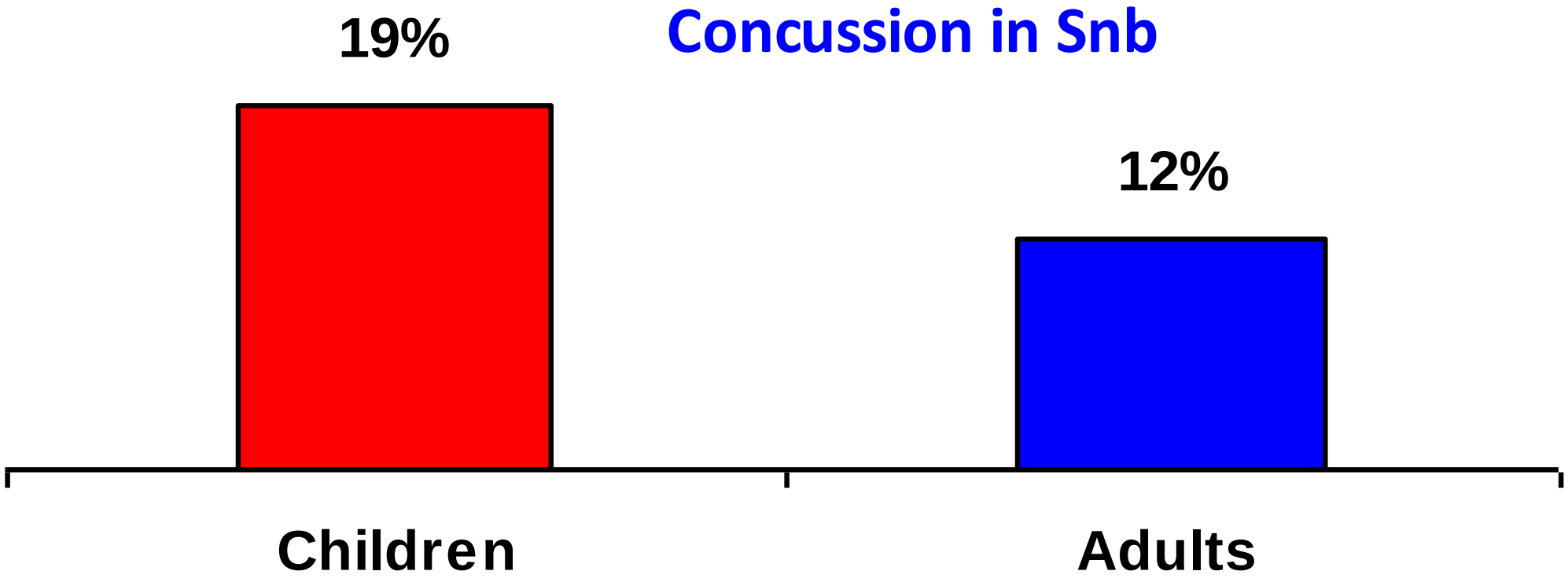
Compared with adults

Head Injuries

- 9% of head injuries in skiing are concussions (the same with adults).

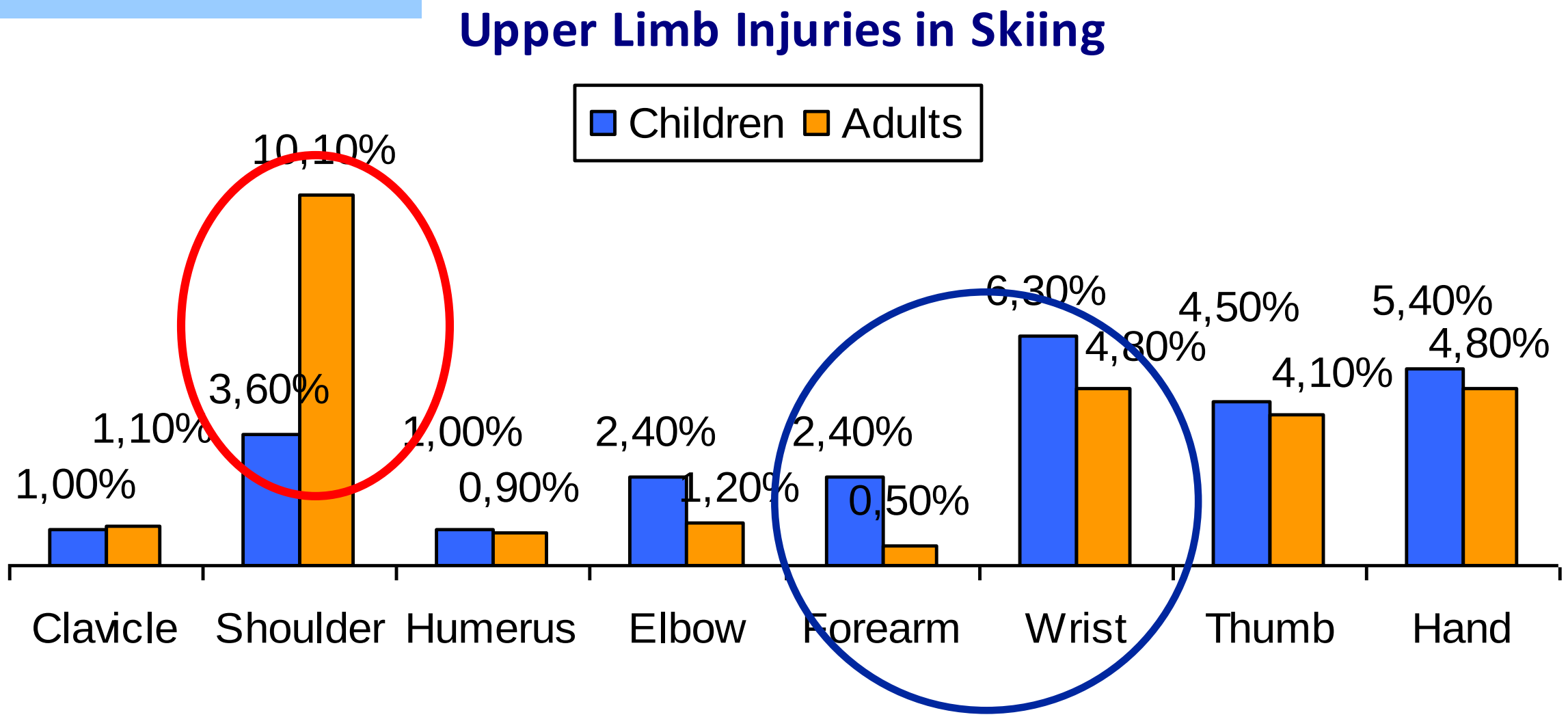
Compared with adults

Head Injuries



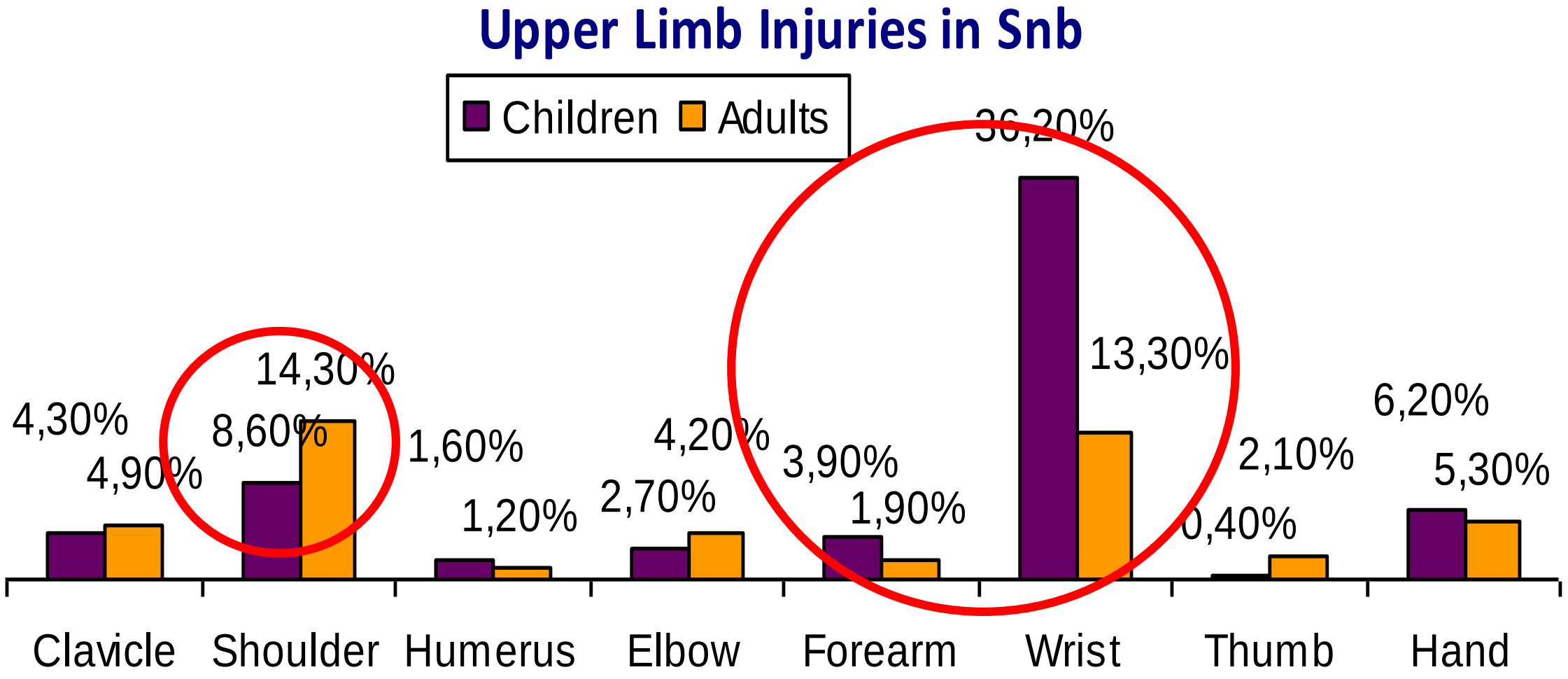
Children boarders sustain more concussions than adults

Compared with adults



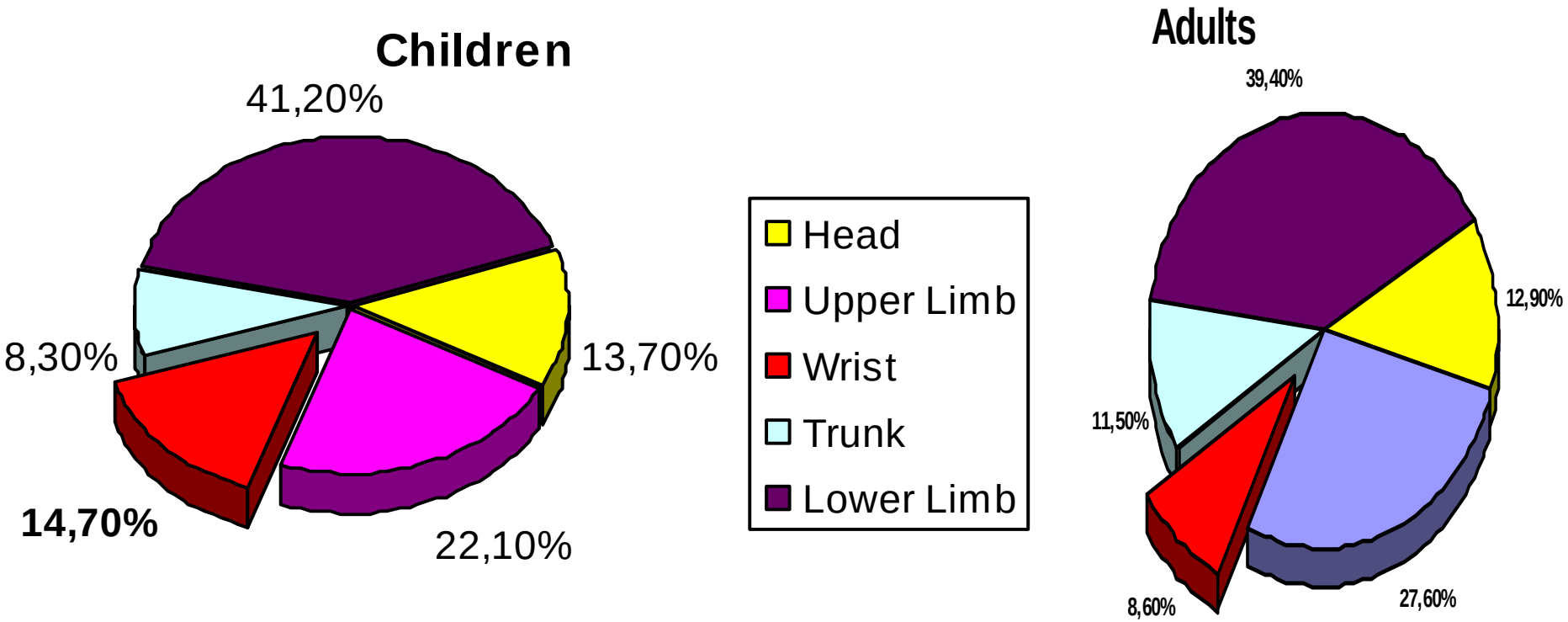
Children sustain less shoulder but more forearm and wrist injuries than adults

Compared with adults



The same happens in snowboard….

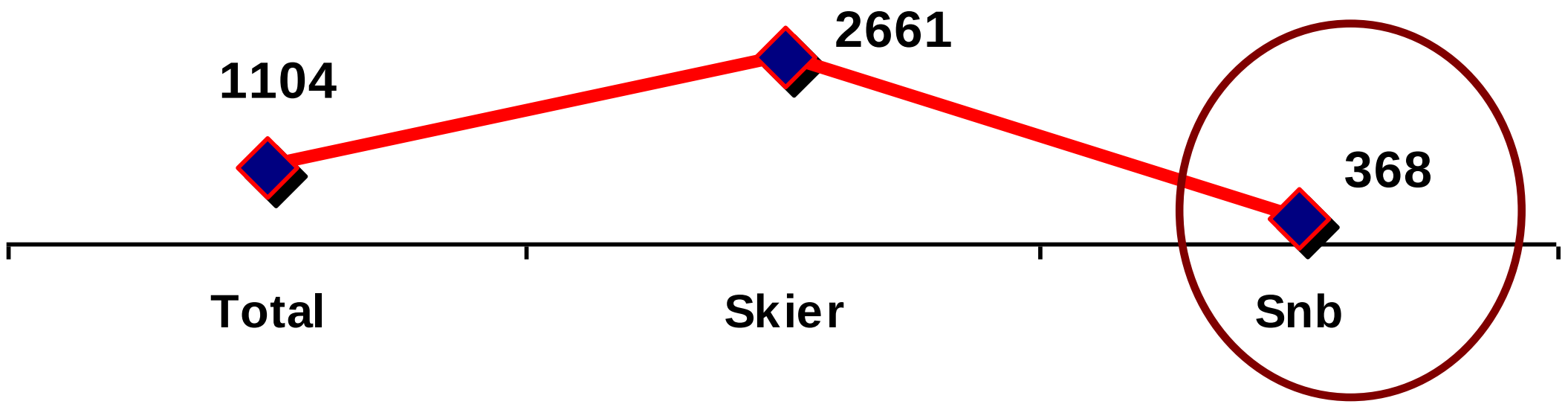
Wrist Injuries



15% of all the injuries in children and 9% in adults are wrist injuries

Wrist Injuries

Mean Days Between Injuries (MDBI)

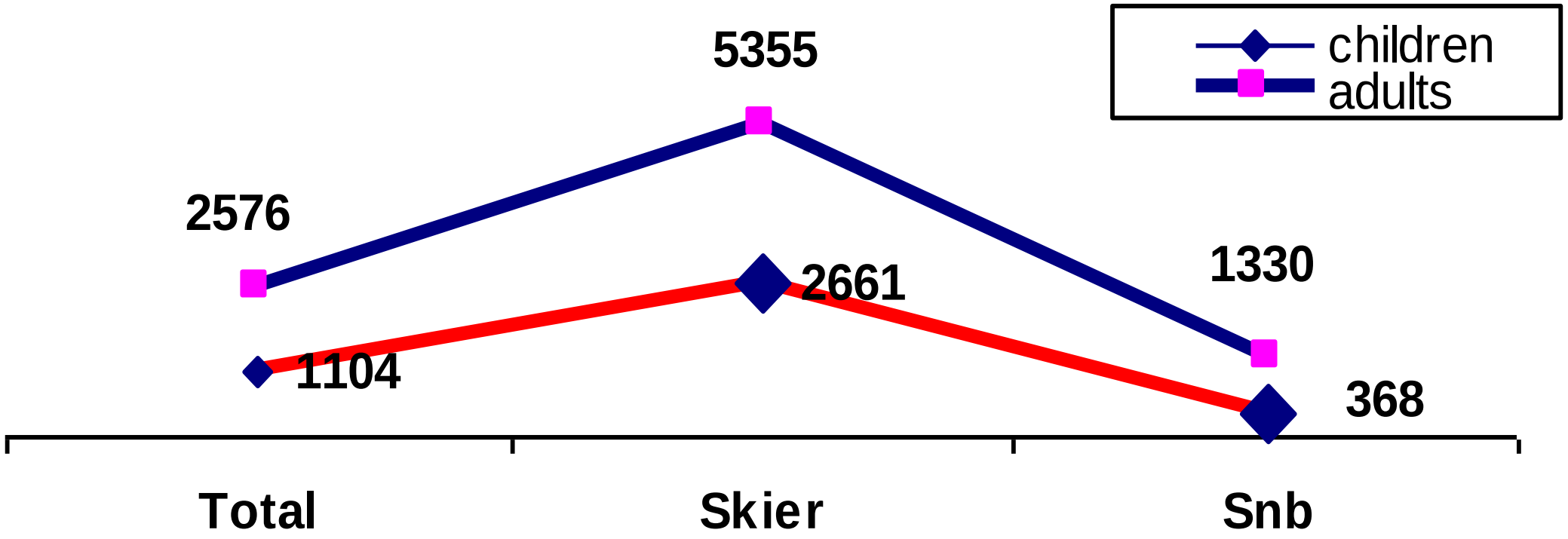


Children snowboarders have seven times more the possibility to sustain a wrist injury than skiers

Compared with adults

Wrist Injuries

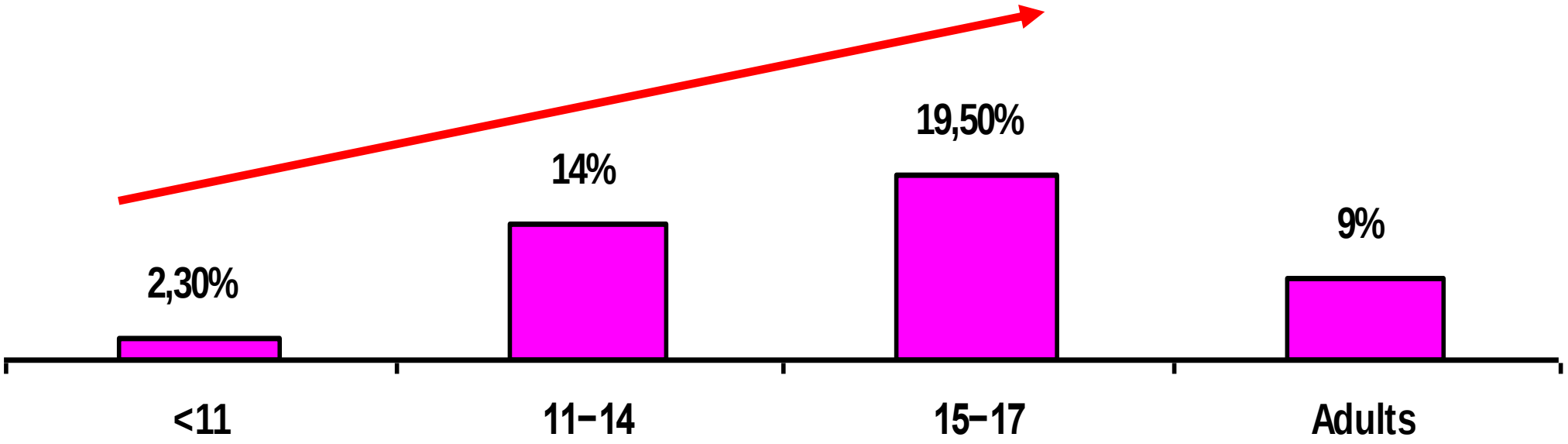
Mean Days Between Injuries (MDBI)



Children sustain higher prevalence of wrist injuries than adults

Wrist Injuries

Wrist injuries in boarding



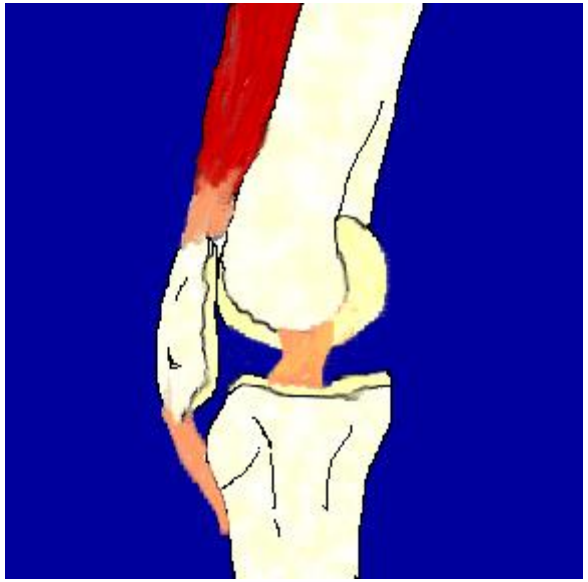
As age increases the prevalence of wrist injuries is higher

Wrist Injuries

- 55% of all wrist injuries in young boarders are fractures (the same with adults).

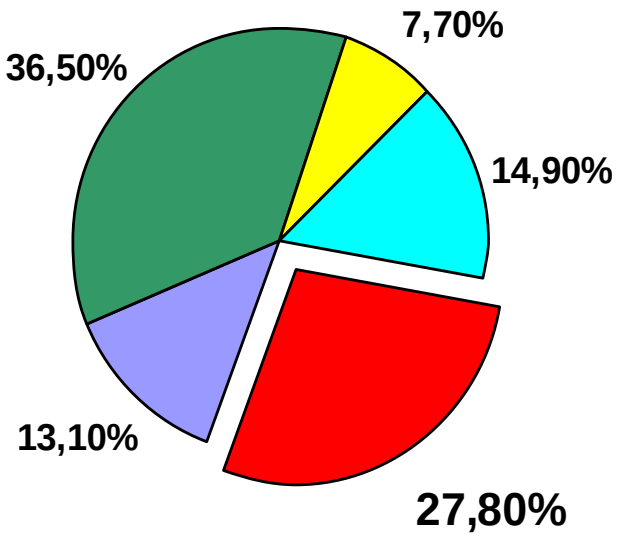
Knee Injuries

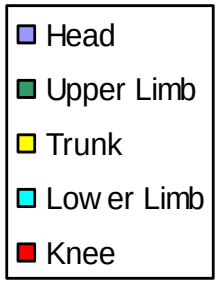
The main problem in alpine sports (especially in skiing)



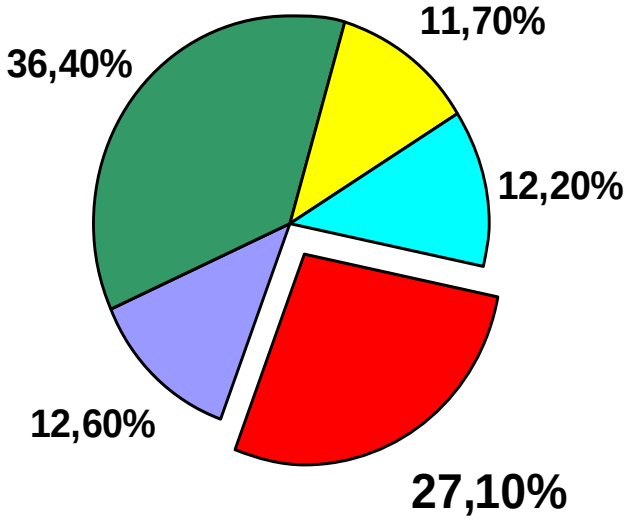
Knee Injuries

Children





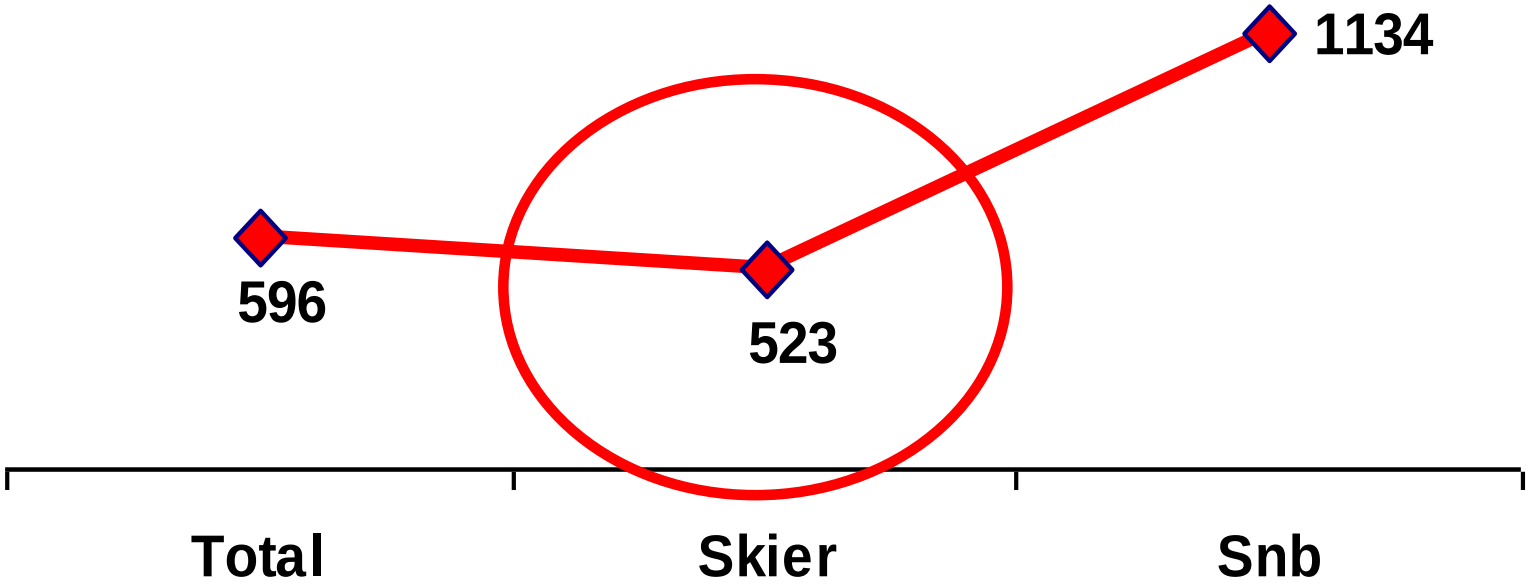
Adults



27.8% of all the injuries in children and 27.1% in adults are knee injuries

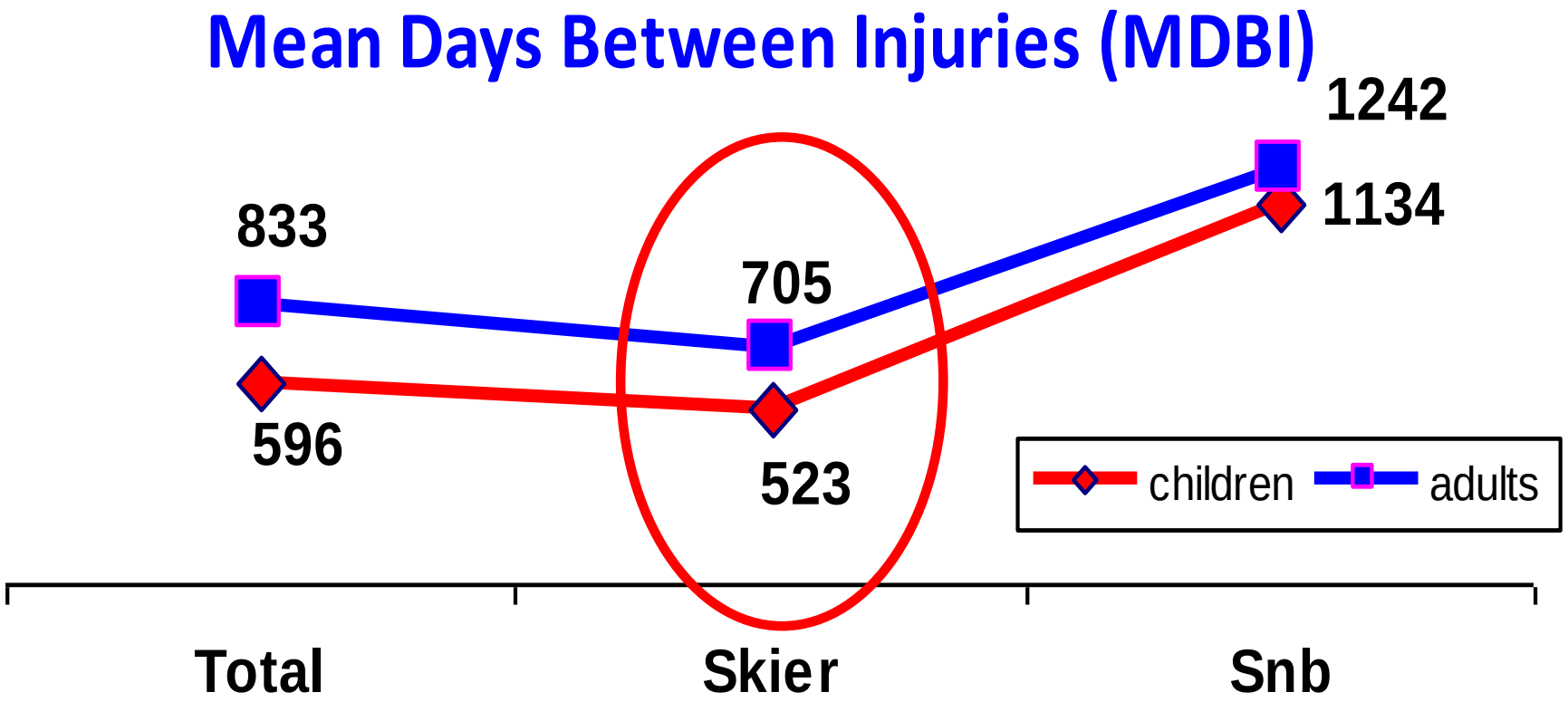
Knee Injuries in children

Mean Days Between Injuries (MDBI)



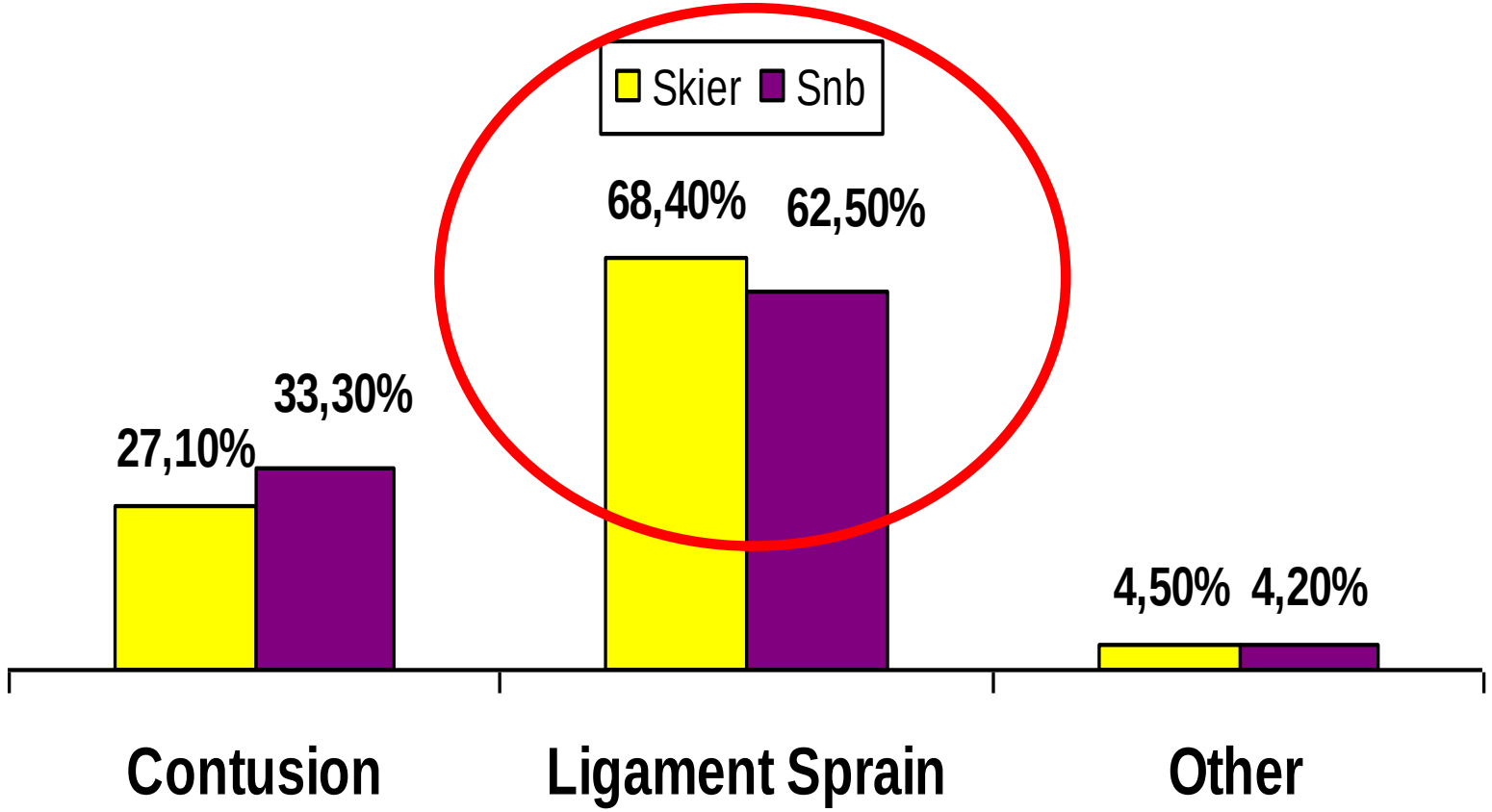
Children skiers have the double the possibility to sustain a knee injury than snowboarders

Compared with adults



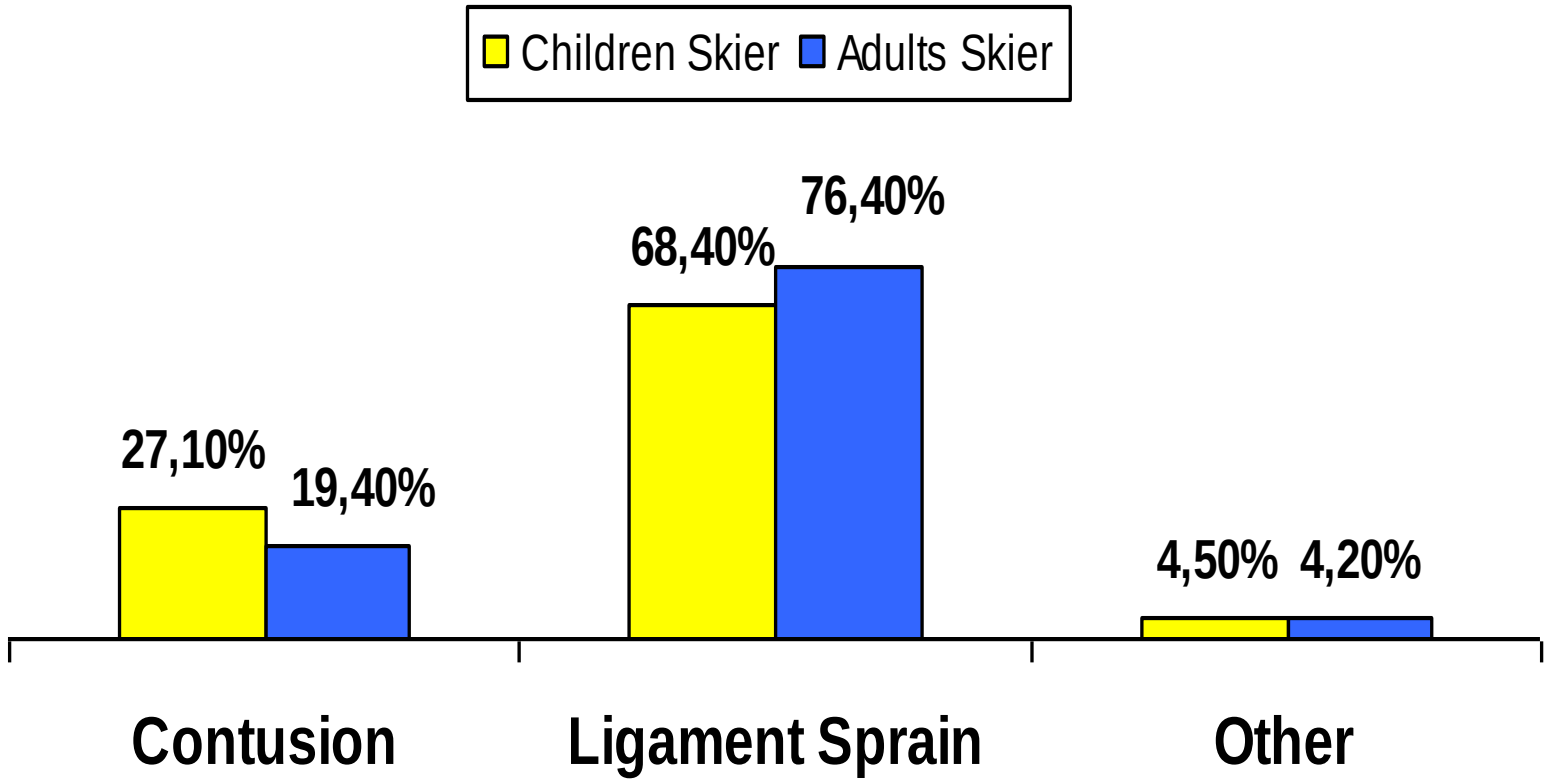
Children skier sustain higher prevalence of knee injuries than adults

Type of knee injuries in children



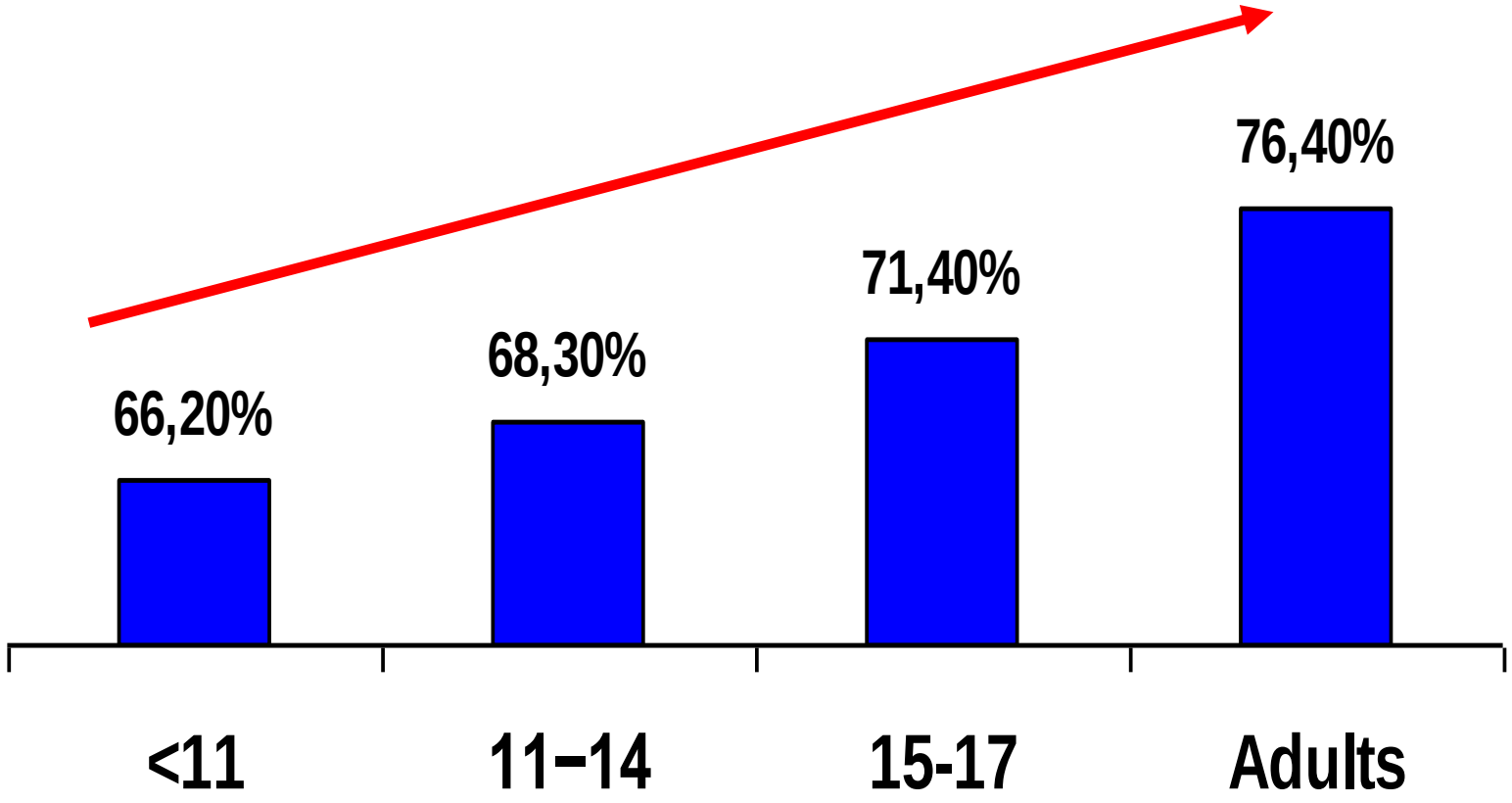
Ligament sprains are the most common knee injuries

Compared with adults



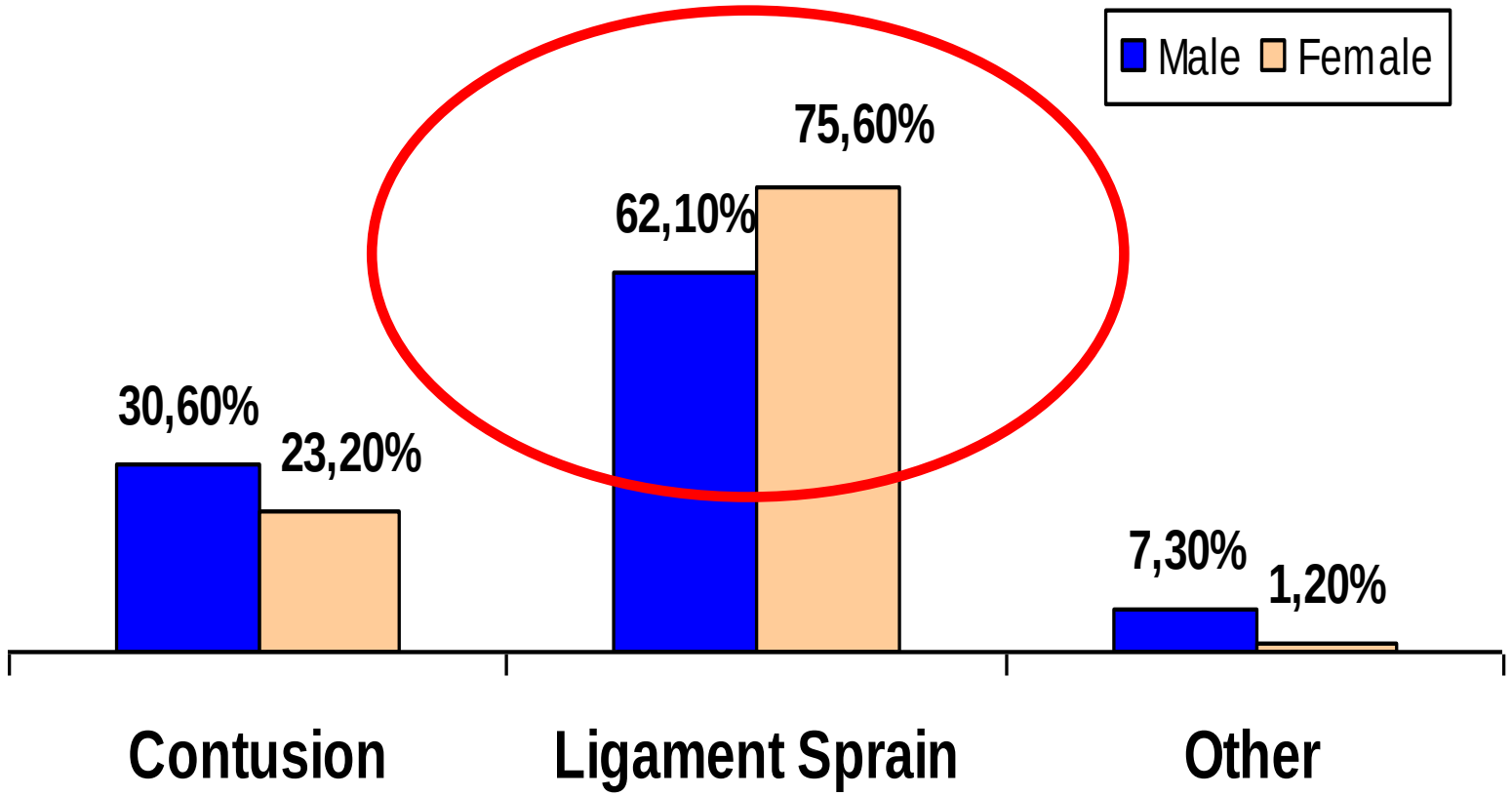
There are not differences in injury types in skiing…

Knee injury types in skiing



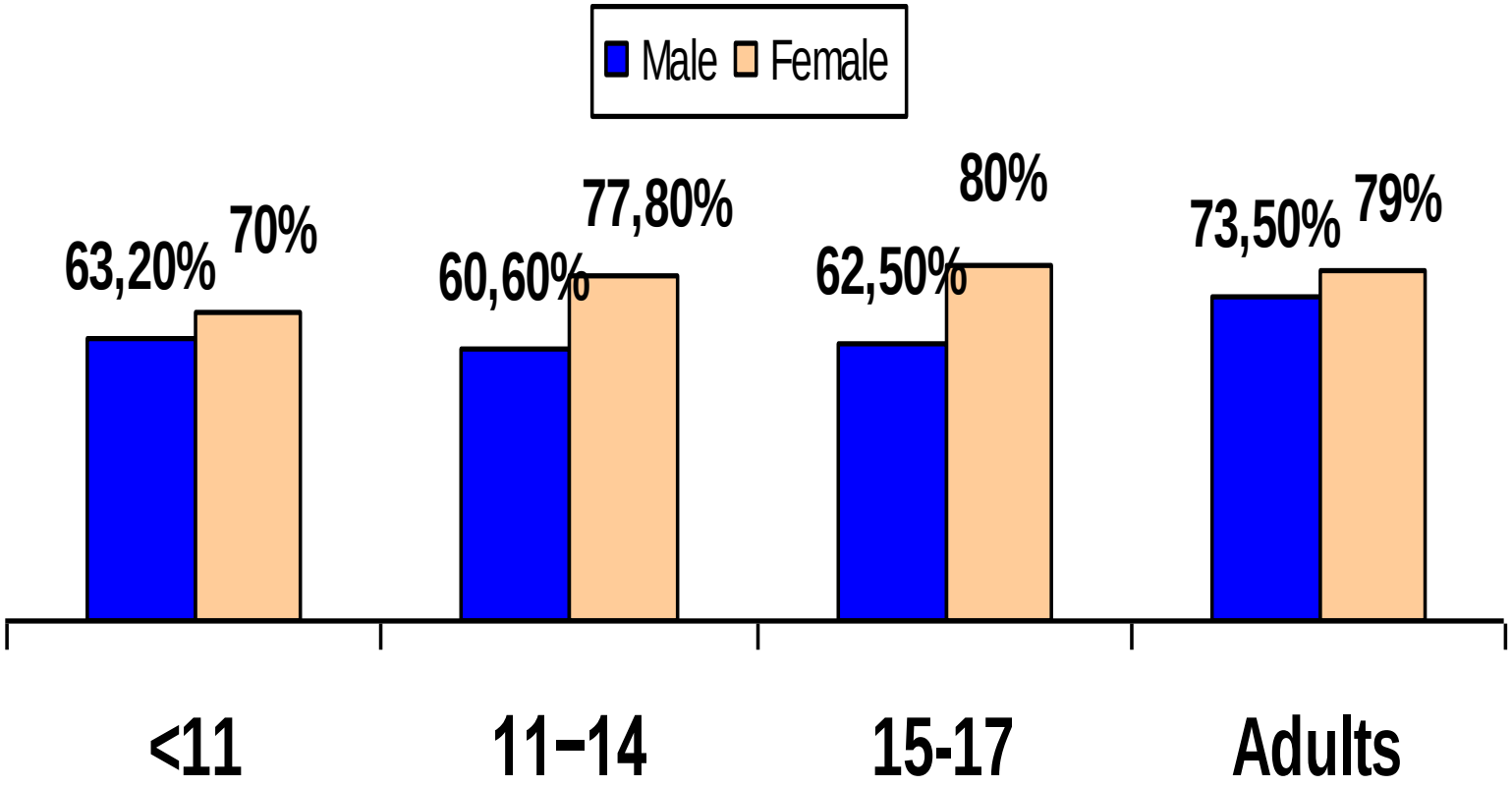
As age increases the prevalence of knee ligament sprains is higher

Knee injury types in skiing



Female skiers sustain a significantly higher prevalence of knee ligament injuries than males $p<0,005$

Knee injury types in skiing



…in all ages

Risk factors

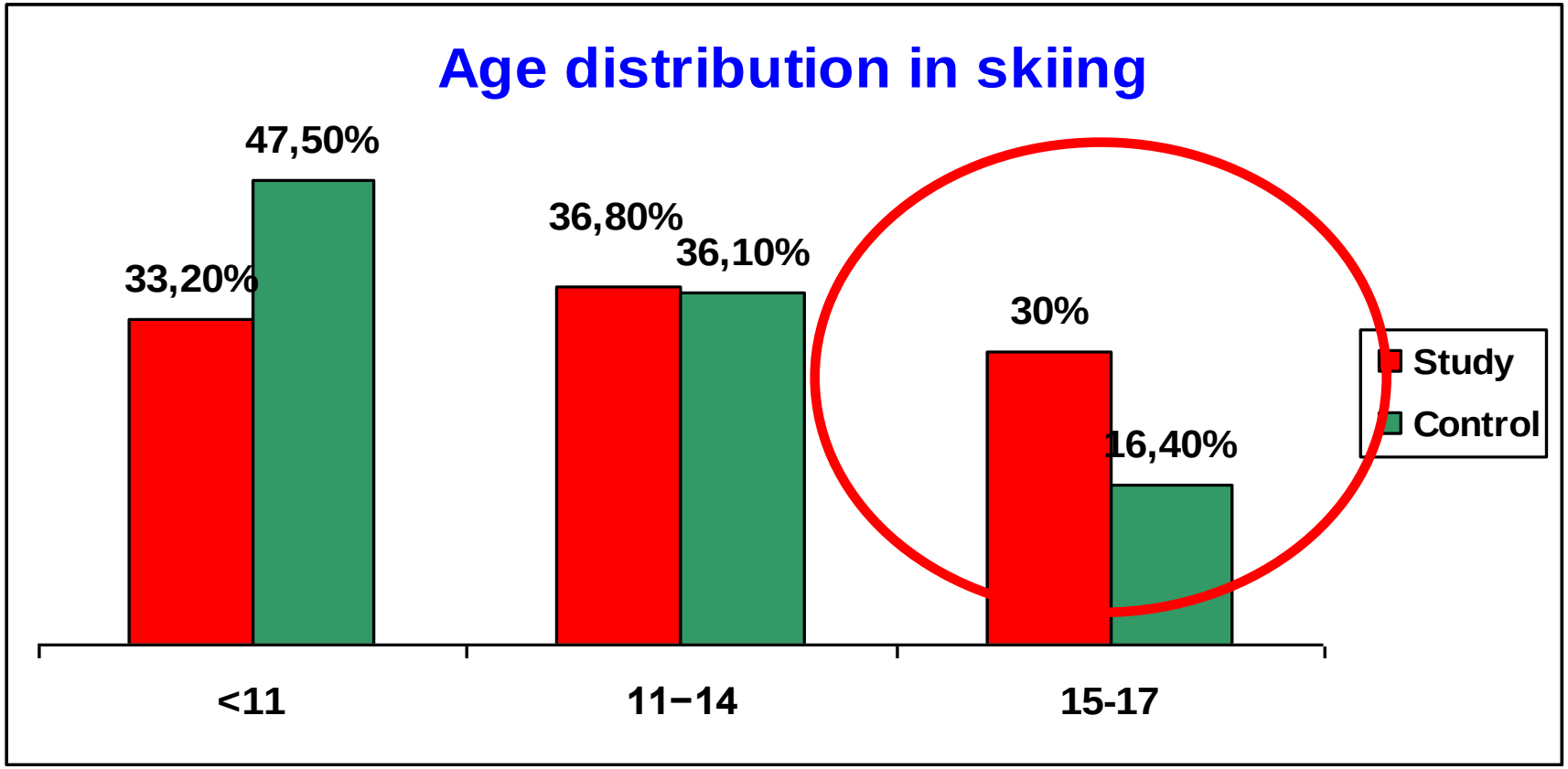
- Age
- Gender
- Ability
- Experience
- Hours of skiing
- Company
- Equipment

Risk factor: Age

Conclusion

- Age is a risk factor for injury in the subgroups of 15-17 years in skiing

Risk factor: Age



The age subgroup of 15-17 years in skiing sustain the highest prevalence of injuries ($p<0.005$)

Risk factor: Gender

Conclusion

- Gender is a risk factor for an injury in age subgroup 15-17 (females) in skiing and in 11-14 (males) in boarding

Risk factor: Ability

Conclusion

- Beginners skiers (especially in the subgroup of 11-14 years) and moderate and expert snowboarders had the highest risk for injuries

Risk factor: Experience

Conclusion

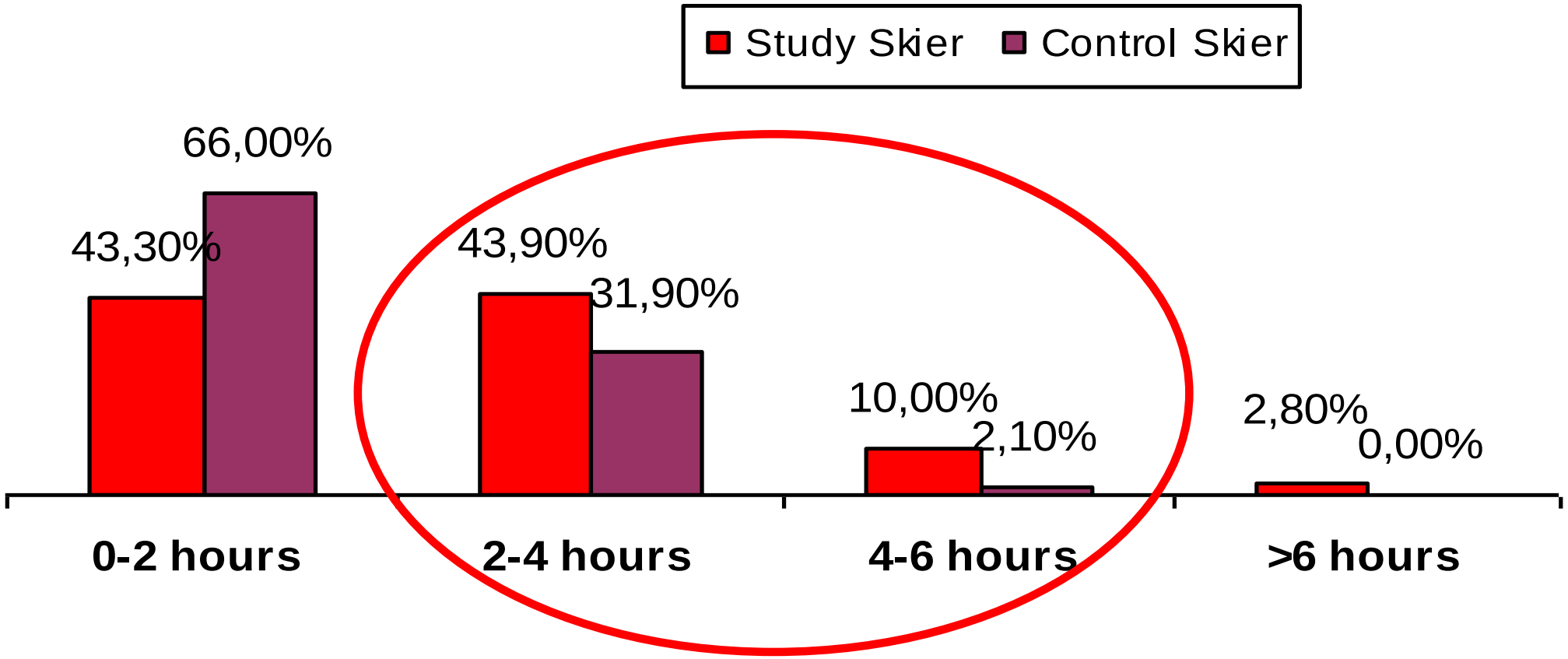
- 1st day young skiers (<11) are at high risk of sustaining an injury. The same happen to the more experienced snowboarders

Risk factor: Hours of skiing

Conclusion

- Fatigue may play a role in injuries for young skiers

Risk factor: Hours of skiing



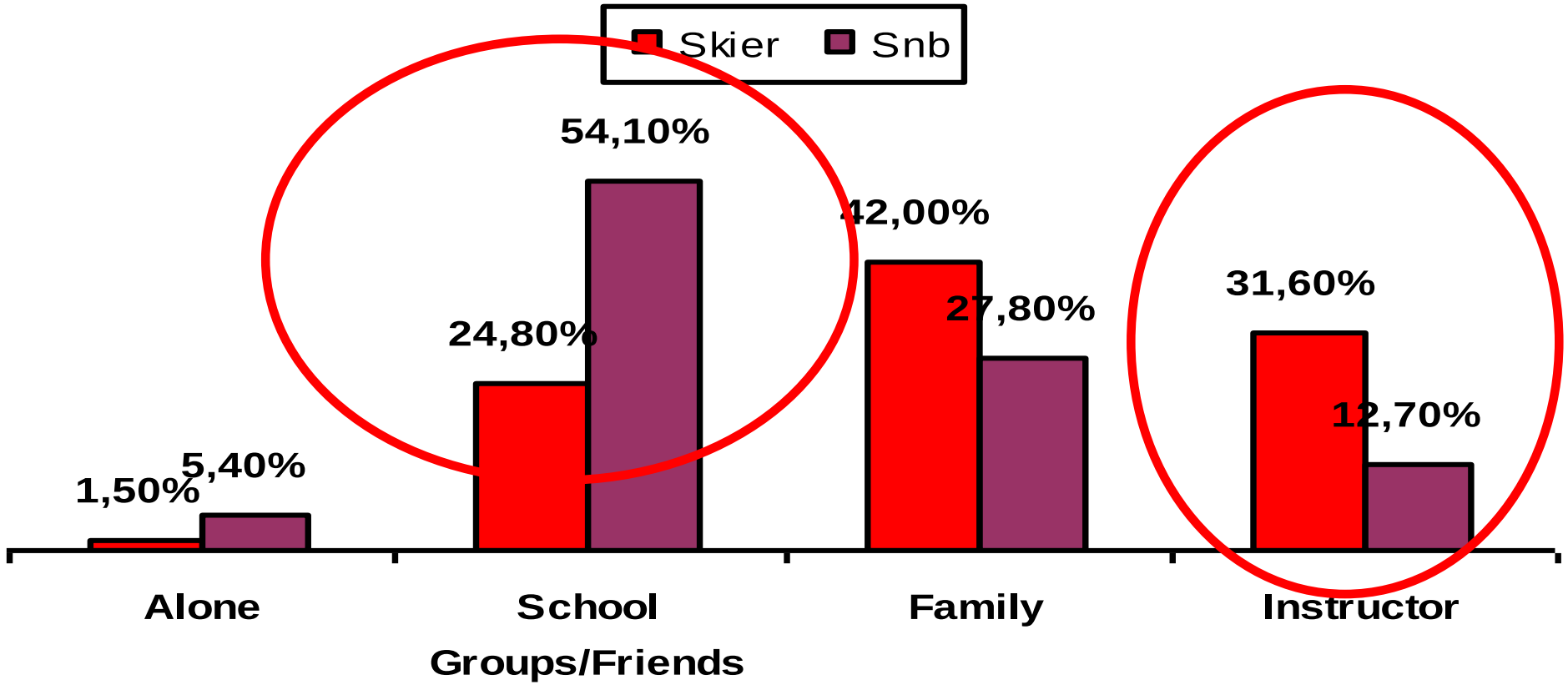
Fatigue is a relative risk factor for an injury in young skiers

Risk factor: Company

Conclusion

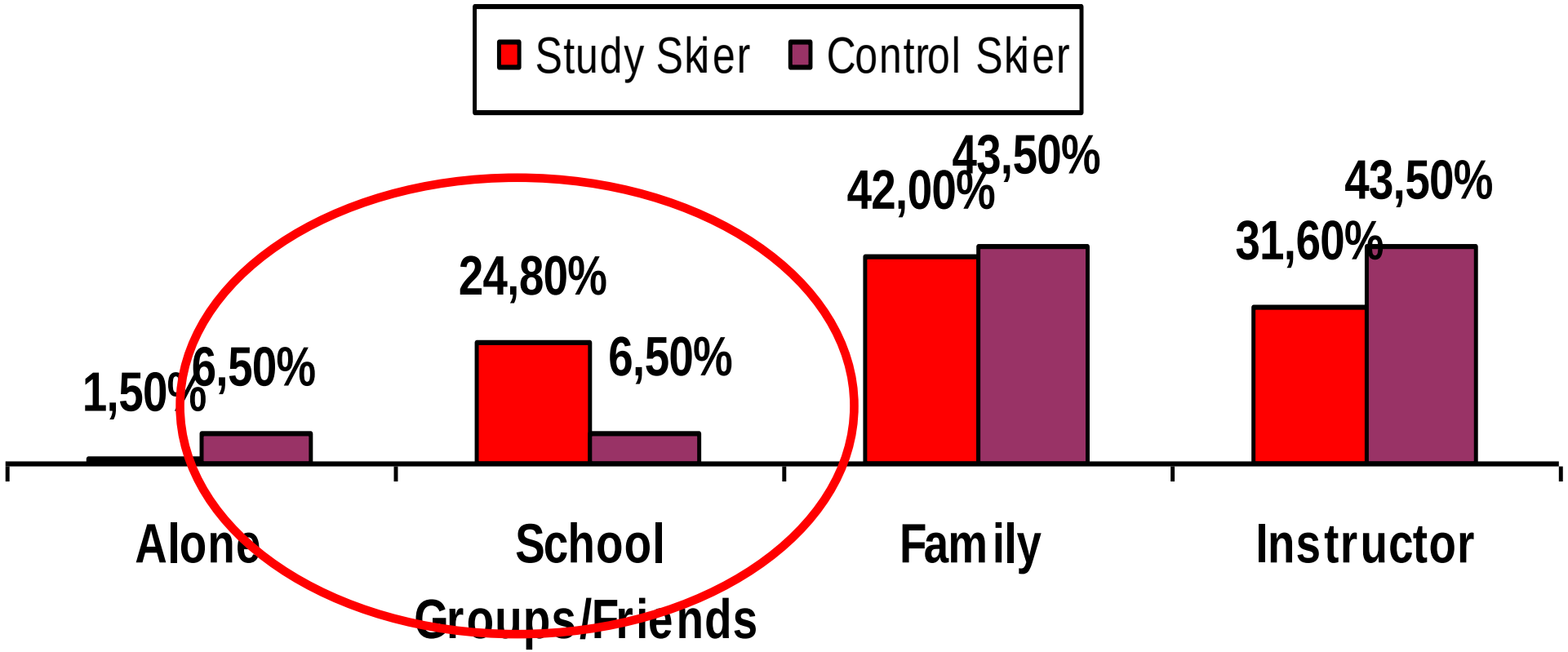
- School groups may be risk factor for injuries for young skiers and boarders

Risk factor: Company



Skiers are more often injured when are skiing with an instructor and snowboarders with friends

Risk factor: Company in skiing



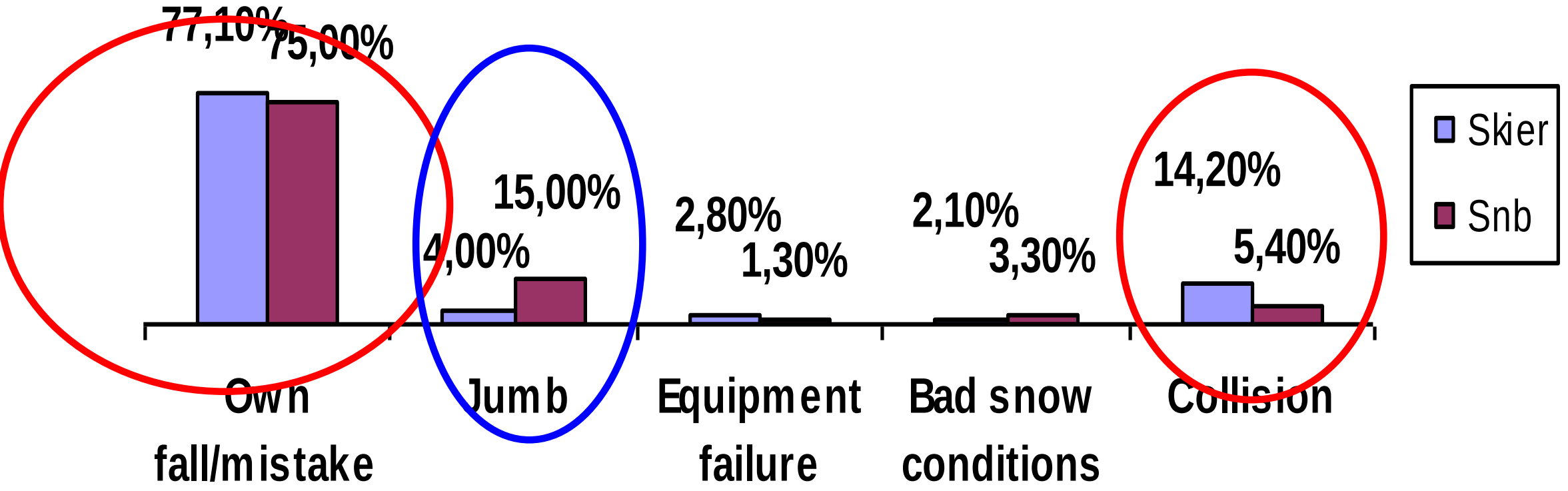
But only skiing with friends (school groups) is a risk factor for an injury in young skiers

Risk factor: Equipment

Conclusion

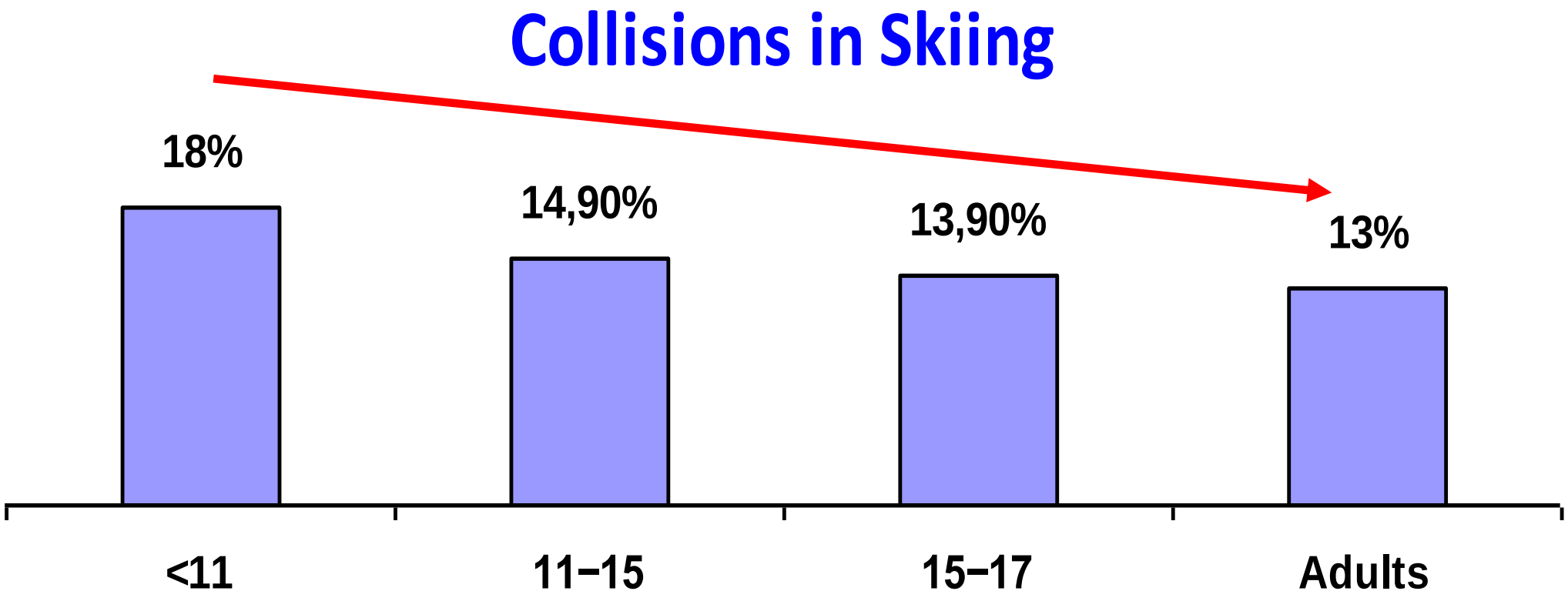
- Rented equipment is a risk factor for injury among young (<11) skiers

Cause of injury



Most injuries occurred during “free riding”

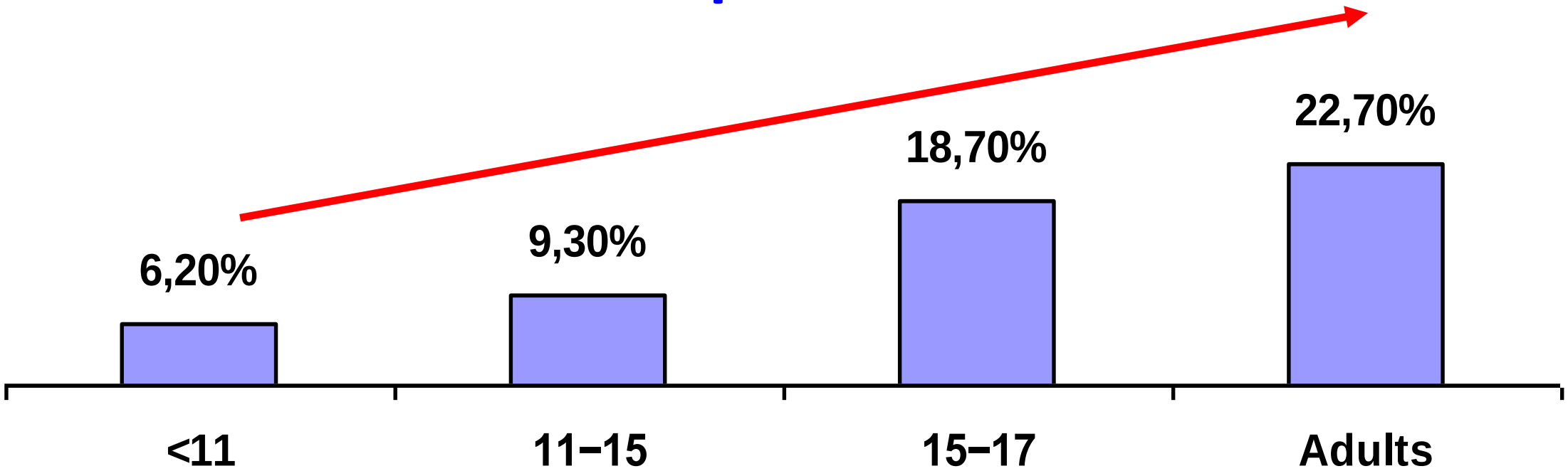
Cause of injury



As the age increases the possibility for a skier to sustain a collision decreases

Cause of injury

Jumps in Snb



As the age increases the possibility for a snowboarder to get injured because of a jump increases also

Conclusions

- Children are not small adults.
- The overall rate of injuries for children and adolescents is higher than adults
- Children sustain more fractures than adults

Conclusions

- Children skier sustain more head injuries than adults, but young snowboarders sustain more concussions

- Children skier have the double and Snb the triple the possibility to sustain a wrist injury than adults

Conclusions

- Knee (mainly ligament related) injuries are more common among children and adolescents, especially in alpine skiing in all age groups, than adults.

- Female sustain a higher prevalence of knee ligament injuries than males in both sports.

Conclusions

- The target groups are in skiing: the age 15-17, the beginners and the 1st day skiers and in snowboard: the age 11-14, the moderate and more experienced snowboarders.

- Fatigue and rented equipment may pl
injuries for young skiers.

Conclusions

- Targeting also on the school groups can lead to the decrease of these injuries in both sports.

Thank you for your attention