International Society for Snowsports Medicine

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Inawashiro – Fukushima

JAPAN

March 13th-17th

Snow Sport Injuries in Paralympic Athletes

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traumatologia i medicina
d'esports d'hivern
Dr. Aleix Vidal i col·laboradors

Baqueira-Beret Medical Center 2005 - 2015




Hypothesis:

Snow Sport Injuries are related to Sport Speciality, Age, Gender and Training in both Non-Impaired and Impaired Population




The History of Ski

- **1850-1860**: **First Ski Races** in the province of Telemark (Norway)

- **1868**: Sondre Norheim (Norway) creates the **Sidecut Skis**, narrower underfoot.

- **1880**: Norway, first **skis more flexible** and resistant made from hickory wood.

The History of Ski

- **1887**: **Norwegian immigrants settle in USA** (Wisconsin and Minnesota)

- **1905**: A **French Army Alpine Unit**, produces the first series of Telemark style skis in Briançon, France.

- **1928:** Rudolph Lettner of Salzburg (Austria) introduces the **Segmented Steel Edge**

The History of Ski

- **1924**: **Winter Olympic Games** in Chamonix (France).

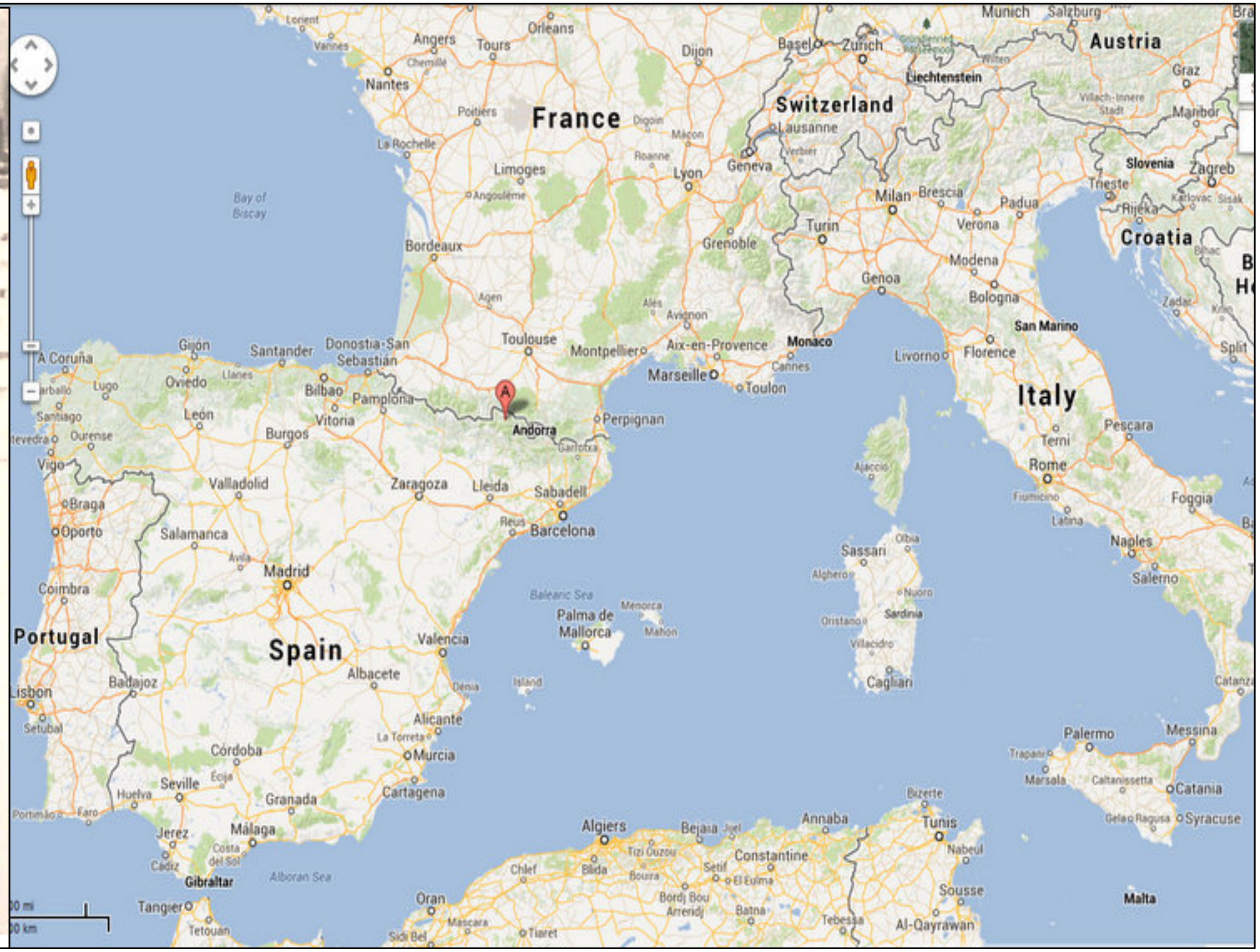
- **1936**, the Games were interrupted by **World War II**.

The History of Ski

SITEMSH
Société Internationale de Traumatologie
et Médecine des Sports d'Hiver

- **1955**, a group of Trauma surgeons from Alpine Countries began to **Observe, Collect and Study Ski Injuries**

1957


France
Spain
Portugal
Italy
Switzerland
Austria
Croatia
Slovenia
Liechtenstein
Monaco
San Marino
Andorra
Bay of Biscay
Balearic Sea
Alboran Sea
Nantes
Angers
Tours
Orleans
Dijon
Basel
Zurich
Munich
Salzburg
Graz
Maribor
Zagreb
Trieste
Rijeka
Lausanne
Geneva
Lyon
Grenoble
Limoges
La Rochelle
Poitiers
Bordeaux
Toulouse
Montpellier
Aix-en-Provence
Marseille
Toulon
Cannes
Perpignan
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Brescia
Verona
Padua
Modena
Bologna
Genoa
Livorno
Florence
Terni
Rome
Pescara
Foggia
Naples
Salerno
Sassari
Sardinia
Cagliari
Palermo
Messina
Catania
Syracuse
Malta
Tunis
Sousse
Al-Qayrawan
Annaba
Constantine
Bejaia
Algiers
Oran
A Coruña
Gijón
Santander
Donostia-San Sebastián
Bilbao
Pamplona
Vitoria
Oviedo
León
Burgos
Lugo
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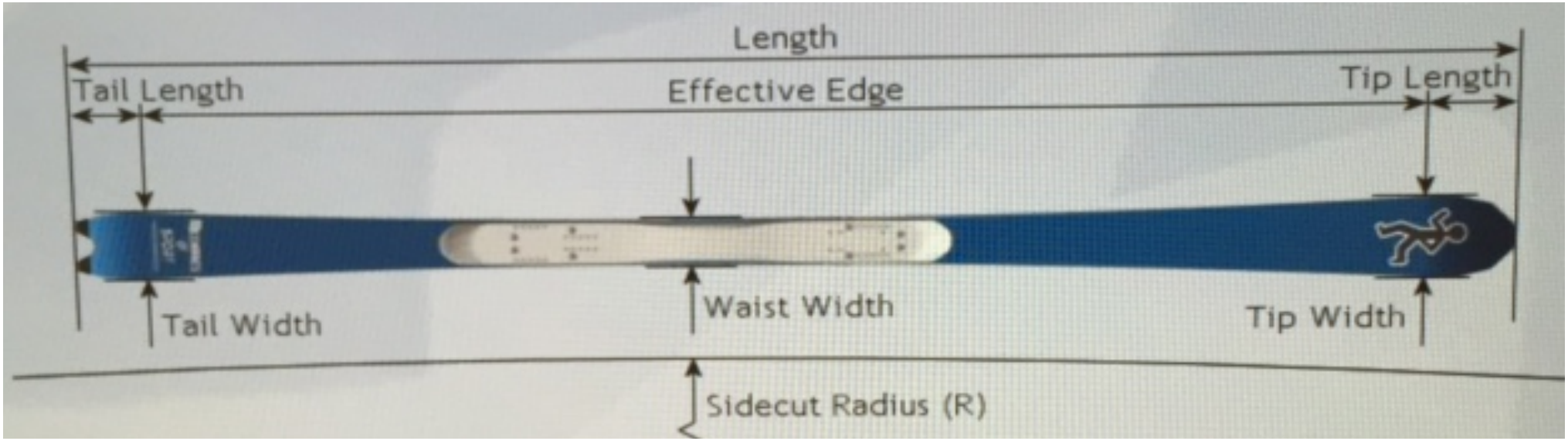
Vigo
Braga
Oporto
Valladolid
Zaragoza
Lleida
Sabadell
Barcelona
Salamanca
Madrid
Coimbra
Valencia
Palma de Mallorca
Menorca
Albacete
Badajoz
Lisbon
Setubal
Alicante
Murcia
Cartagena
Córdoba
Seville
Granada
Huelva
Faro
Jerez
Málaga
Gibraltar
Tangier
Tetouan

The History of Ski

- **1976**: First **Paralympics Winter Games** in Örnsköldsvik (Sweden).
- **1992**: Winter Paralympics were the first Winter Games to **use the same facilities as the Winter Olympics**.

The History of Ski

- **1990:** Elan and Kneissl build prototypes of skis with different geometry, leading to the generation of current **carving or parabolic skis**.



Baqueira Beret Ski Resort

1992 - 2015

58.142 Snow Sport injuries seen at Baqueira M.C.

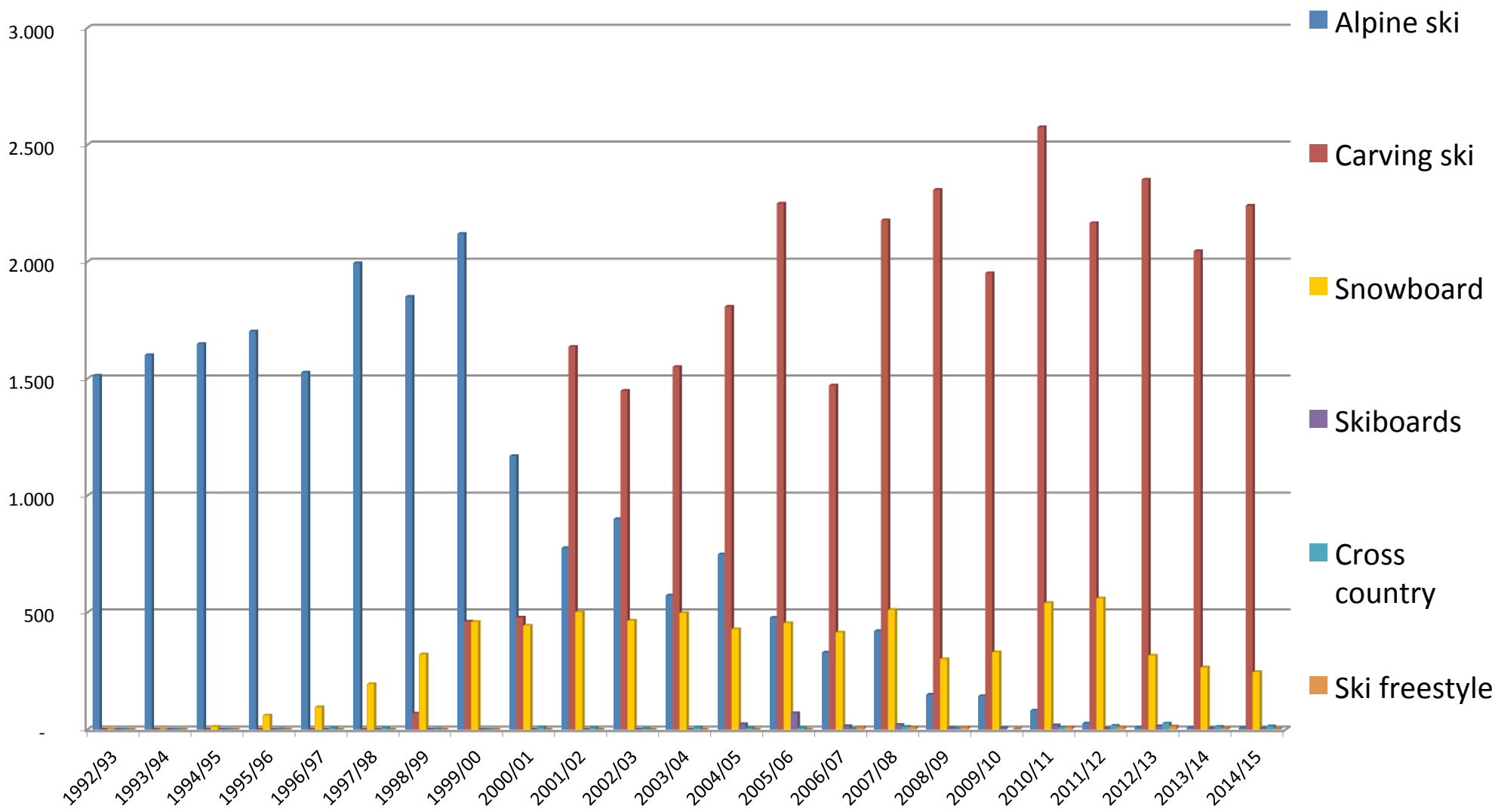
Incidence of Injuries

- 92/93 ... 506.000 visitors — 3.54 / thousand
- 93/94 ... 551.192 visitors — 3.45 / thousand
- 94/95 ... 596.389 visitors — 3.18 / thousand
- 95/96 ... 609.271 visitors — 2.62 / thousand
- 96/97 ... 508.295 visitors — 3.01 / thousand
- 97/98 ... 650.363 visitors — 3.49 / thousand
- 98/99 ... 771.287 visitors — 3.57 / thousand
- 99/00 … 864.188 visitors — 3.52 / thousand
- 00/01 … 537.652 visitors — 3.92 / thousand
- 01/02 ... 830.927 visitors — 3.52 / thousand
- 02/03 ... 788.827 visitors — 3.57 / thousand

Incidence of Injuries

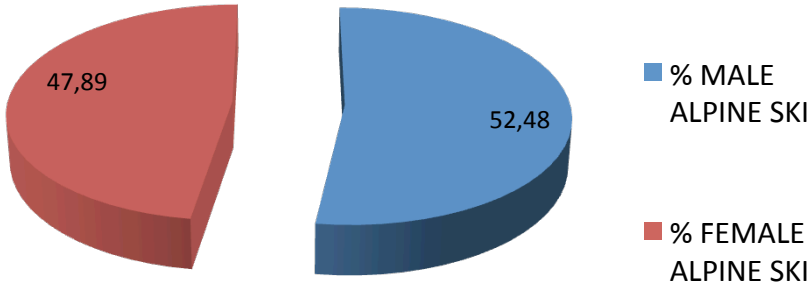
- 03/04 ... 771.770 visitors 3.41 / thousand
- 04/05 ... 907.310 visitors 3.32 / thousand
- 05/06 ... 894.172 visitors 3.64 / thousand
- 06/07 ... 558.180 visitors 4.02 / thousand
- 07/08 ... 750.499 visitors 4.20 / thousand
- 08/09 ... 812.336 visitors 3.42 /thousand
- 09/10 ... 767.951 visitors 3.17 /thousand
- 10/11 ... 776.274 visitors 4.17 /thousand
- 11/12 ... 765.191 visitors 3.64 /thousand
- 12/13 ... 784.339 visitors 3.48 /thousand
- 13/14 ... 772.555 visitors 3.03 /thousand
- 14/15 ... 793.822 visitors 3.17 /thousand

Speciality Related Injuries

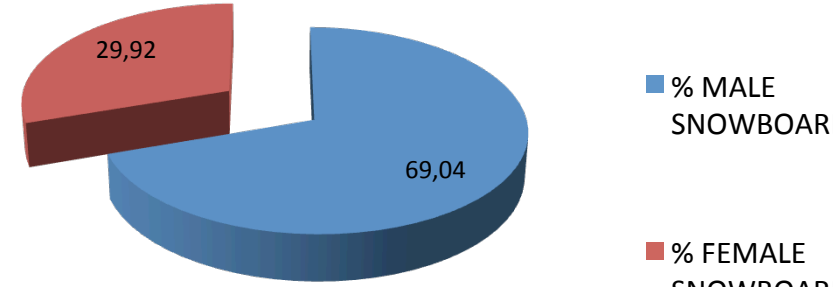


Probability of Injuries

Distribution by Gender



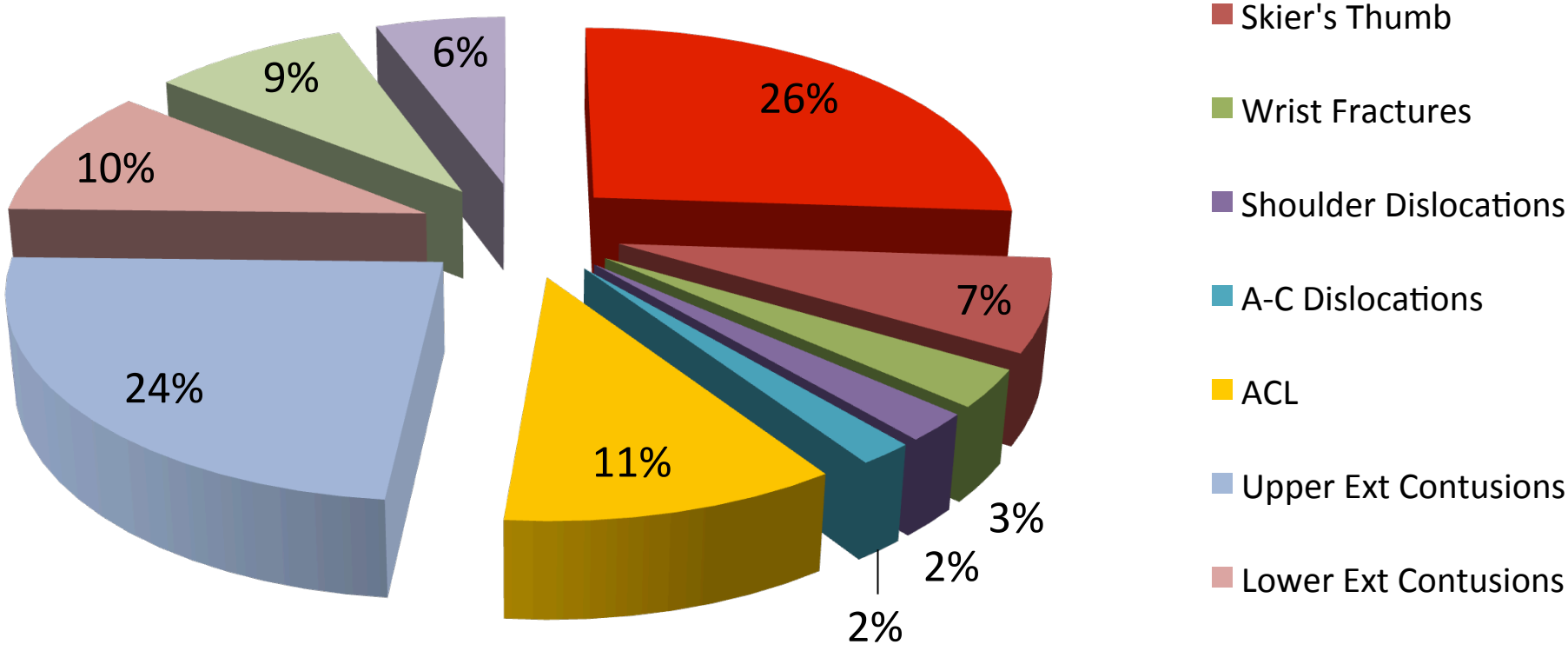
Mean Age: 34,8



Mean Age: 27,5

Types of Injuries

Most common injuries





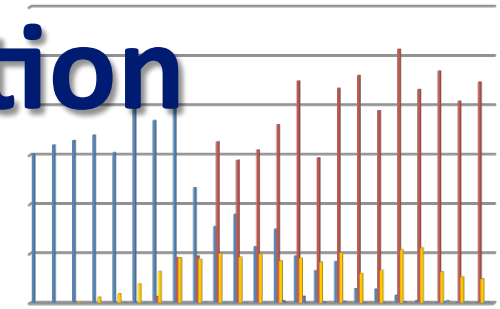

Hypothesis:

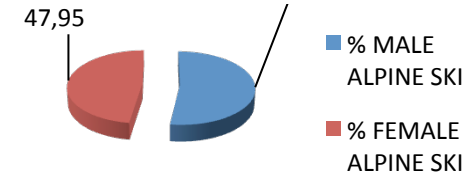
Snow Sport Injuries are related to Sport Speciality, Age, Gender and Training for both Non-Impaired and Impaired Population

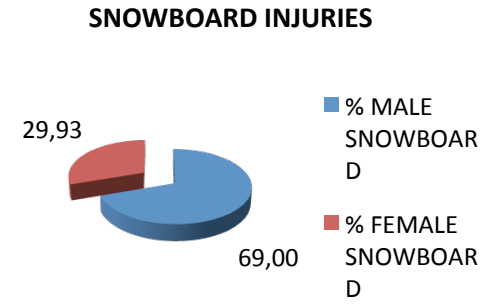


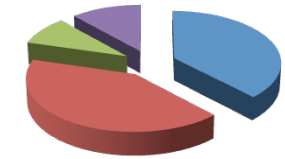

Non Impaired Population

- Sport Speciality Yes
- Age Yes
- Gender Yes
- Training ?









?

Evolution

Injuries

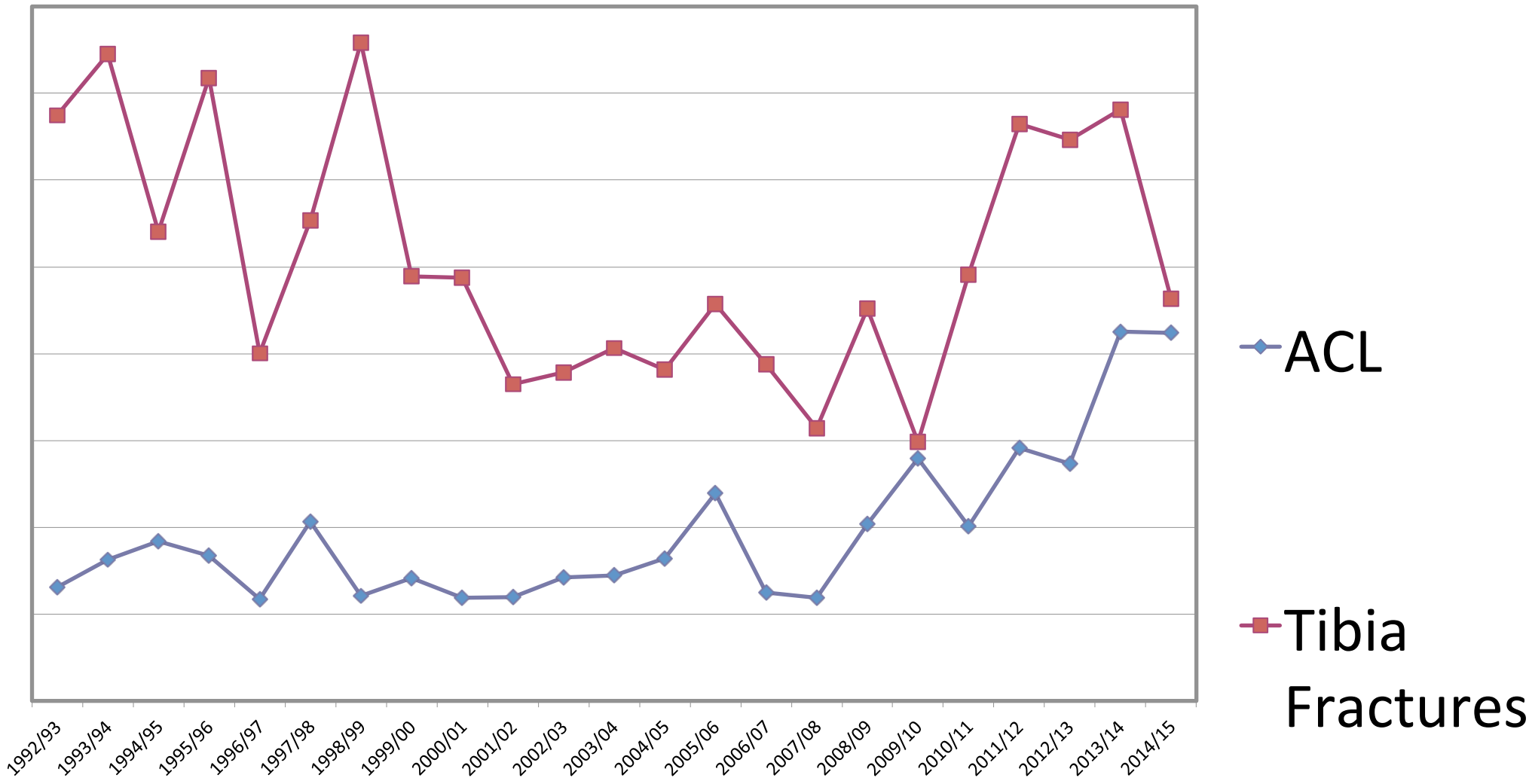
How do we know that Evolution and Technology affects in some way the Incidence of Snow Sport Injuries ?




Lets take a look at the Evolution of 4 diagnosis we have been following for 23 consecutive seasons:

Anterior Cruciate Ligament in the Knee
Tibia Fractures
Skier's Thumb
Head Trauma

Evolution of Injuries: Ant.Cr.Lig. / Lower Extremity Fractures

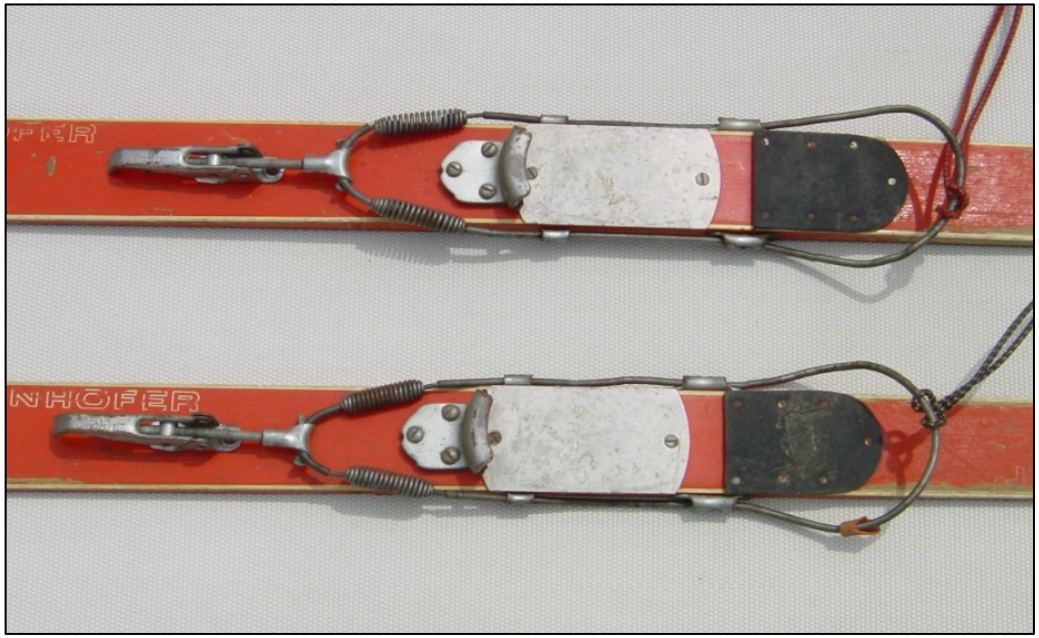


Knee Injuries

"Competitive alpine skiing is considered to be a sport with a high injury risk. Injury rates per competition season and **per 100 World Cup (WC) athletes were reported to be 36.7, with the knee being the most frequently affected body part.**

"The injury rate was highest for giant slalom,

ACL Injuries and Tibia Fractures

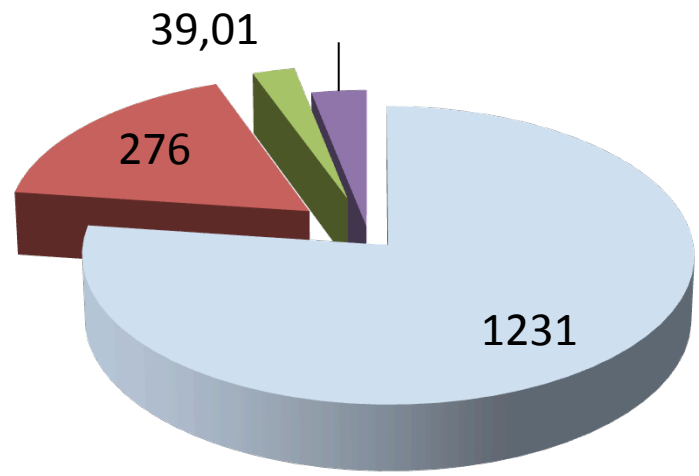


Prevention ? …In the process of investigation

Skier's Thumb

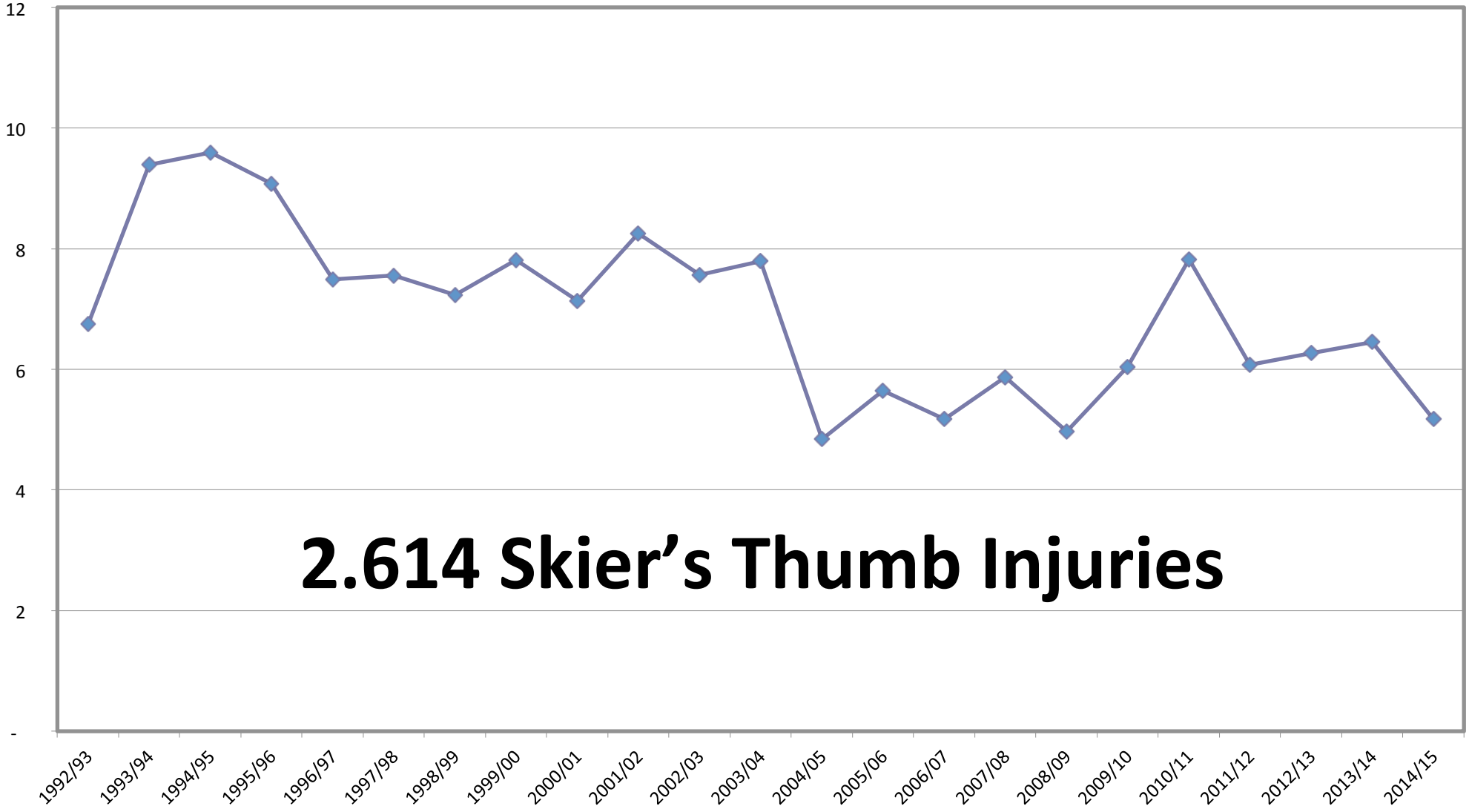
Petitpierre M: Die Wintersportverietzungen. Stutgart,F.Enke Verlag, p.51. 1939

Falls with the Pole in the Hand

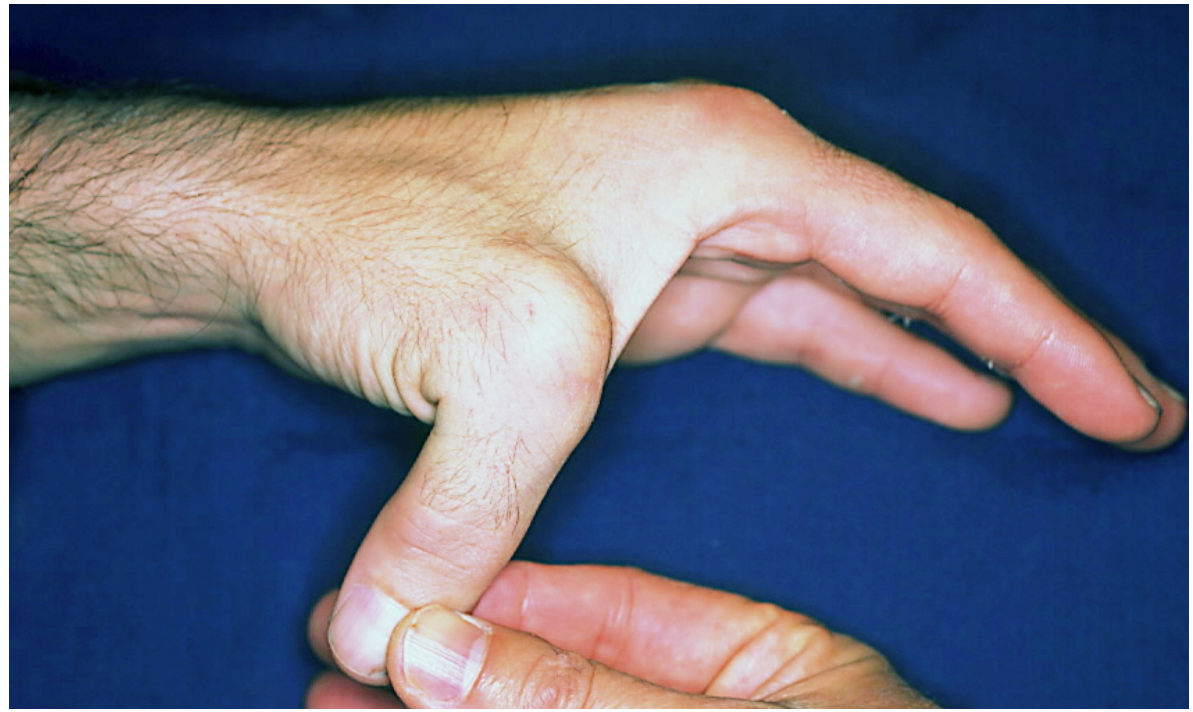


- Ulnar Collateral Metacarpal (E317)
- Radial (e318)
- % Ulnar Collateral Phalange

Skier's Thumb Related to All Injuries



Skier’s Thumb



Prevention ? …In the process of investigation

Head Trauma

- **15% of all injuries**

- **Diagnosis:**

  * Lacerations, abrasions, superficial cuts with no neurological problems

  * Mild concussions

(60% of accidental deaths in winter sports are related to head trauma)

Head Trauma. Evidences

Between seasons 1995-06 and 2009-10:

- * Helmet use increased from 5 to 76%
- * The percentage of head injuries on total injuries decreased by 20%
- * Potentially serious head injuries expressed in MDBI diminished by 64% (from 8.775 to 24.690 days)

(Shealy et al. 2011)

Head Trauma

Prevention ? …In the process of investigation




Impaired & Non Impaired Population in Snow Sport Related Injuries.







Comparison Study of Snow Sport Related Injuries




Data from 94 Impaired Athletes

No.	Season	First Name	SDMS Code	NPC	Sex	Birth Date	Functional Class	Training Competition	Location	Injury Date	Injured body part	Injury Type	Cause	Out of competition	Imaging	Type of snow	Snow	Wind	weather	video	other
10	2011-2012	Kelly	13140	GBR	F	18.05.1995	B3	Training	Super G training Innerkerm Austria	24.02.2012	head face	fracture, concussion									bruises in face, neck and back
11	2011-2012	Timothy	028-046	GBR	M	20.05.1982	LW12-1		London	05.05.2010	hip groin	fracture	no ski related?	>28 days	X-ray	n/a	n/a	n/a	n/a	no	at least 4 months
13	2011-2012	Hiraku	13226	JAP	M	12.07.1987	LW2	Training	Annaberg Salzburg, Slalom Gate Training	13.01.2012	knee	fracture	fall, caught gate, twisted R knee	>28 days		artificial	Ice, soft	no	cloudy	no	fracture tibial plateau R, constructive treatment, 3 months rest
14	2011-2012	Takanori	13246	JAP	M	06.03.1972	LW10-2	Training	Kühtai	26.05.2011	chest	fracture		>28 days	X-ray	artificial	compact	some	cloudy	video	chest L
15	2011-2012	Jong Seork	13254	KOR	M	01.03.1967	LW11	Official training		08.12.2011	shoulder clavicle	joint ligament ?		>28 days	X-ray	artificial	Ice,	some	cloudy	no	acromioclavicular joint injury (rt)Operation, at least 2 months
16	2011-2012	Thomas	13315	SUI	M	07.09.1982	B3	Competition	Swiss Championships	14.06.2011	knee	joint ligament	fall in the gate, twisted knee	>28 days	MRI	natural and artificial	soft, salt used	some	sunny	no	cruciate ligament rupture knee R, R Knee surgery 11.05.2011, one year out
17	2011-2012	Markus	13310	SUI	M	06.10.1971	LW12-1	Competition	Tignes France	24.02.2012	head face	contusion, concussion and skinabrasions lesions of head, face and neck	fall after ext. ski and outrigger	>28 days	US and MRI	natural	soft	no	cloudy	no	whiplash trauma
18	2011-2012	Radomir	070-0025	SVK	M	05.04.1972	B2		WC Arta Terme	26.12.2009?	knee	muscles and tendons		>28 days		artificial	compact	no	sunny	no	Distorsio gen. 1.sin
19	2011-2012	Nathalia	151	SVK	F	04.05.1996	Guide		Super G, Abtenau Austria	19.01.2012	head face	fracture		8-28 days		natural	compact	no	raining	no	orthopedic bracing
20	2011-2012	Scott	13386	USA	M	02.03.1974	LW12-1	Official training	Copper Mountain Colorado	11.01.2011	shoulder clavicle	fracture	outrigger Fall, Training crash	>28 days	X-ray	natural and artificial	compact	some	cloudy	no	comminuted and displaced fractured R clavicle
22	2010-2011	Nicholas		AUS	M	03.04.1986	LW2	Training	Mt Hutt New Zealand	03.09.2009	lower leg achilles tendon	fracture									dista third tibia and fibula fracture R, undergone surgery and metal replacement surgery
23	2010-2011	Allaert	007-0017	BEL	M	03.05.1989	LW12-1			08.10.2010	chest	fracture	car accident Antwerp	at least 5 months	CT, MRI						whiplash, wedge fracture vertebra D1
24	2010-2011	Viviane	013-0134	CAN	F	14.05.1979	B2	Competition	Whistler, Vancouver Games 2010		head face, lower arm	contusion, concussion, joints ligaments	fall at finish, lost guide, smashed fence	>28 days		natural and artificial	ice		sunny	TV	Concussion, post concussion syndrome with daily headaches. Right D1 thumb ulnar coll. Lig sprain. Wrist R scapholunate lig tear grade 3
25	2010-2011	Kimberley	13029	CAN	F	27.01.1981	LW12-1				shoulder clavicle	muscle tendon									surgical repair rotator cuff
26	2010-2011	Morgan	013-0065	CAN	M	05.07.1986	LW-3	Training	Sestiere, Italy	13.01.2011	foot	fracture, contusion	fall after hitting a bump in high speed in freeskiing	>28 days	CT-scan, X-ray	natural and artificial	compact	no	sunny	no	vertical shear fracture tarsale bone R
27	2010-2011	Chris	013-0048	CAN	M	05.05.1972	B3	Training	GS, WC Sestiere, Italy	22.01.2011	lower arm	fracture, joints ligaments	Training at high speed. Fall as right ski hit in a rut	>28 days	X-ray, CT-scan	natural and artificial	compact	no	sunny	no	Left distal radius fracture/ulna styloid fracture/scaphoid and triquetral avulsion fractures/lunate

57 complete registers

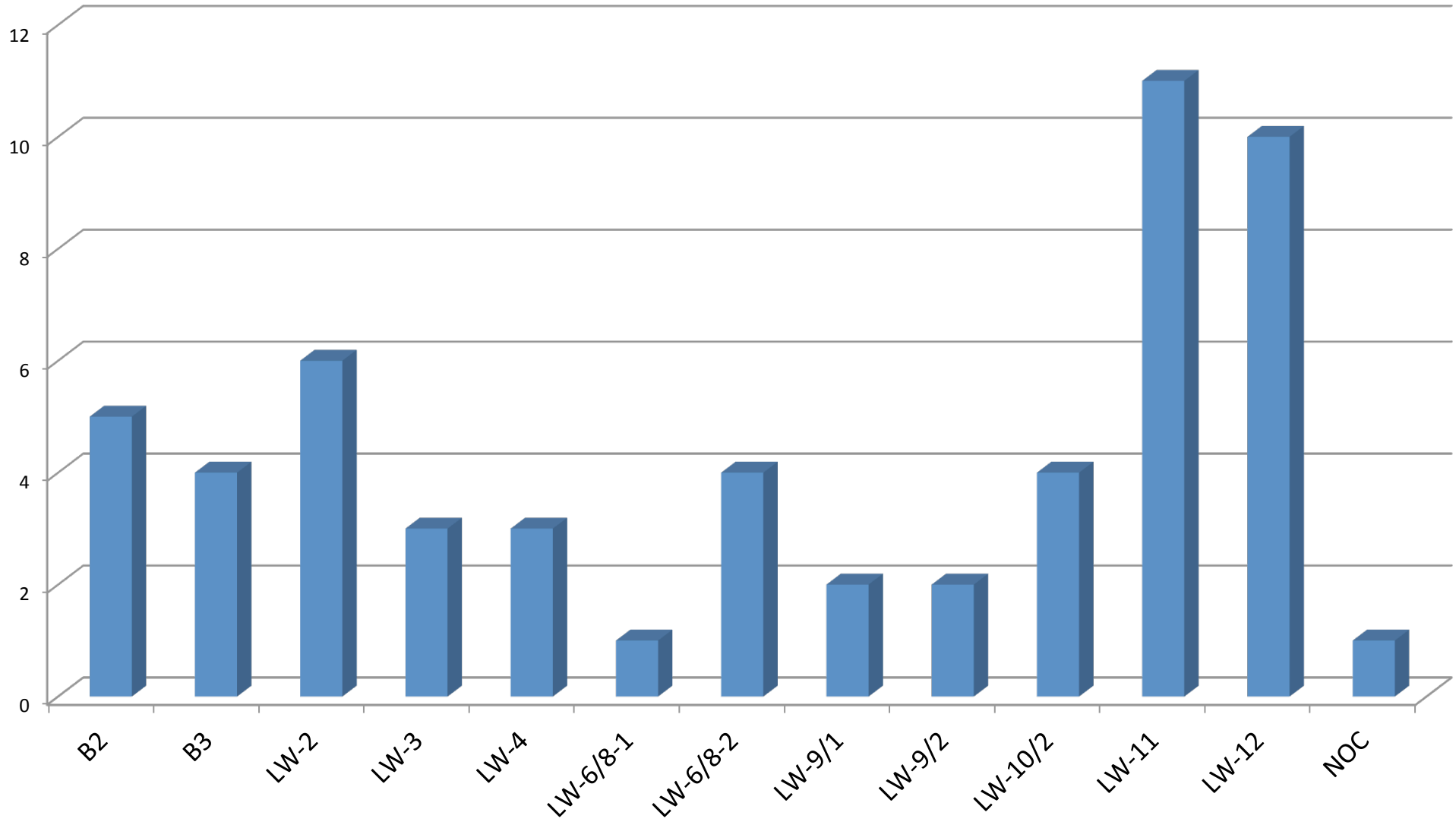
No.	Season	First Name	SDMS Code	NPC	Sex	Birth Date	Functional Class	Training Competition	Location	Injury Date	Injured body part	Injury Type	Cause	Out of competition	Imaging	Type of snow	Snow	Wind	weather	video	other
47	2009-2010	Andrea	013-0071	CAN	F	26.06.1986	LW-2	Competition	Paralympics 2010, Whistler	27.08.2009	head face, knee	concussion, abrasions	fall at full speed at finish, outriggers	>28 days	CT scans head, MRI knee	natural	ice	no	sunny	video, TV?	concussion, quads contusion, dental injury, facial abrasions
48	2009-2010	Joines ✚	013-0056	CAN	F	27.01.1981	LW-12	Training	Training camp Chile	27.08.2009	shoulder clavicle	muscle and tendon	fall sitski uphill outriggers	>28 days	X-ray, MRI	natural	soft	no	cloudy	no	rotator cuff, supraspinatus tendon tear R, operation needed after incomplete recovery with FT
49	2009-2010	Nicolas	027-0045	FR	M	27.06.1968	B2	Competition	Pitztal	27.08.2009	lower leg achilles tendon	muscle and tendon		>28 days	US	natural	ice	strong	sunny	no	muscle tear aponevrose jumeau mollet int
50	2009-2010	Laurent	027-0090	FR	M	27.06.1968	LW10-2	Official training		27.08.2009	shoulder clavicle, chest	muscle and tendon, contusions	fall with outriggers under sitski	8-28 days		natural	compact	some	cloudy and flat light	no	musclotendineus injury shoulder R
51	2009-2010	Denis	027-0026	FR	M	13.07.1962	LW11	Training	Tignes	27.08.2009	hip groin	fracture	fall on back, legs outside the seat	>28 days	X-ray	natural	soft	no	sunny	no	femur fracture R, shoulder
52	2009-2010	Sebastien	027-0082	FR	M	13.10.1983	LW9-2	Training		27.08.2009	knee	joints and ligaments		8-28 days		natural	soft	no	sunny	no	R knee still instable after operation 6 months earlier
55	2009-2010	Luca	040-0159	ITA	M	20.01.1976	LW2	Training	GS training Whistler	27.08.2009	lower leg achilles tendon	fracture	struck gate with tibia		X-ray, MRI	natural	compact	no	snow	no	fracture tibia and fibula L
56	2009-2010	Kenji	041-0071	JAP	M	04.12.1973	LW-11	Training		27.08.2009	shoulder clavicle	joints and ligaments	fall after off-balance landing after small jump	>28 days	X-ray, MRI	natural	soft	no	cloudy	no	L side supraspinatus inj. operation neede
59	2009-2010	Miroslav		SVK	M	19.02.1976	LW4	Training		27.08.2009	knee	joints and ligaments									ASK damage, punctured 60 ml from knee
60	2008-2009	Bernhard	006-0711	AUT	M	25.07.1970	LW6/8-1	n/a		27.08.2009	n/a	other		>28 days						no	
61	2008-2009	Franz	006-0721	AUT	M	11.09.1983	LW4	Training	GS	27.08.2009	lower leg achilles tendon	fracture	outturned knee/foot after crash in deep snow outside the best line GS	>28 days		natural	soft	some	sunny	no	
62	2008-2009	Marina	006-0769	AUT	F	23.07.1981	LW6/8-2	Training		27.08.2009	knee	joints and ligaments		>28 days	MRI, bone sca	natural	soft		cloudy	no	
63	2008-2009	Andreas	006-0726	AUT	M	24.12.1971	LW6/8-2	Training		27.08.2009	lower leg achilles tendon	fracture		>28 days		artificial	compact	no	cloudy, foggy, flat light	no	
64	2008-2009	Markus	006-0727	AUT	M	01.06.1991	LW 9-1	Competition	EC Kühtai	27.08.2009	lower leg achilles tendon	fracture	outturned knee/foot after crash in deep snow outside the best line GS	>28 days		natural	soft	some	cloudy, foggy, flat light, snow	no	
65	2008-2009	Alexandra	013-0098	CAN	F	30.06.1994	LW6/8-2	Training		27.08.2009	lower leg achilles tendon	fracture		>28 days	X-ray	natural	compact	no	sunny	no	Fractured Right Tibia (spiral/comminuted) and fractured
67	2008-2009	Denis	027-0026	FR	M	13.07.1962	LW11	Training - n/a		27.08.2009	pelvis, sacrum, lower back, hip groin, foot	skinlesions, other		>28 days	x-ray	n/a					acute hospitalization for septic shock, fournier Gangren, septicemie, 10 days in coma
68	2008-2009	Jambaque	027-0050	FR	M	14.04.1988	LW9/2	Training		27.08.2009	knee	joints and ligaments	torsion knee R in curve	>28 days		natural	soft		sunny		rupture iterative de plastie du LCA
69	2008-2009	Steven	028-0052	GBR	M	30.08.1966	LW9/2	Training	SG Hintertux	27.08.2009	knee	fracture, muscle and tendon	Right ski caught edge and released athlete fell forward onto right knee	>28 days		natural	compact	some	cloudy	no	lateral Tibula plateaux Fracture 7m long 1m wide 0.5 m deep
73	2008-2009	Hanjörg	040-0172	ITA	M	27.03.1972	LW9	Official		27.08.2009	knee	muscle and tendon		8-28 days	x-ray	natural	soft	some	sunny	no	
74	2008-2009	Jasmin	091-0001	USA	M	28.08.1979	LW11	Competition	Winterpark Co, USA nationals	31.01.2009	shoulder clavicle	fracture	outrigger	>28 days	x-ray	natural	compact	strong	cloudy	no	fracture clavicle L




Results

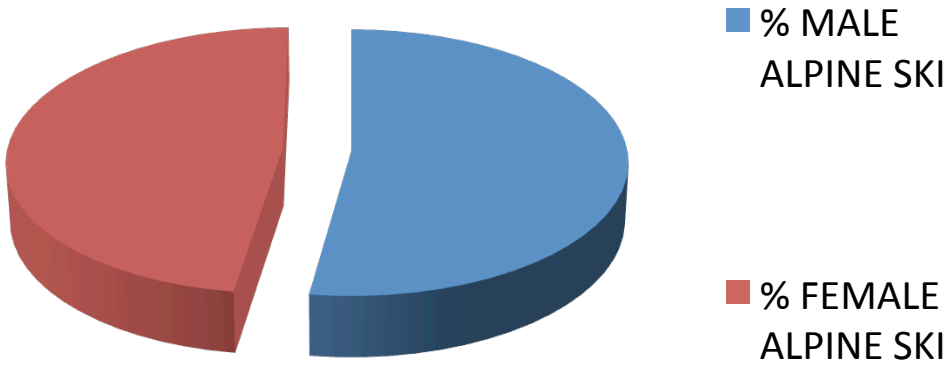



Functional Class

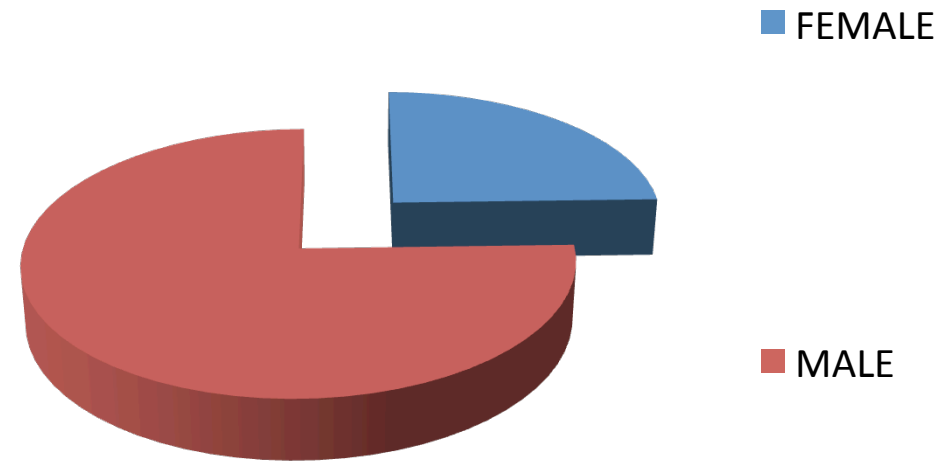


Gender

Non Impaired Population

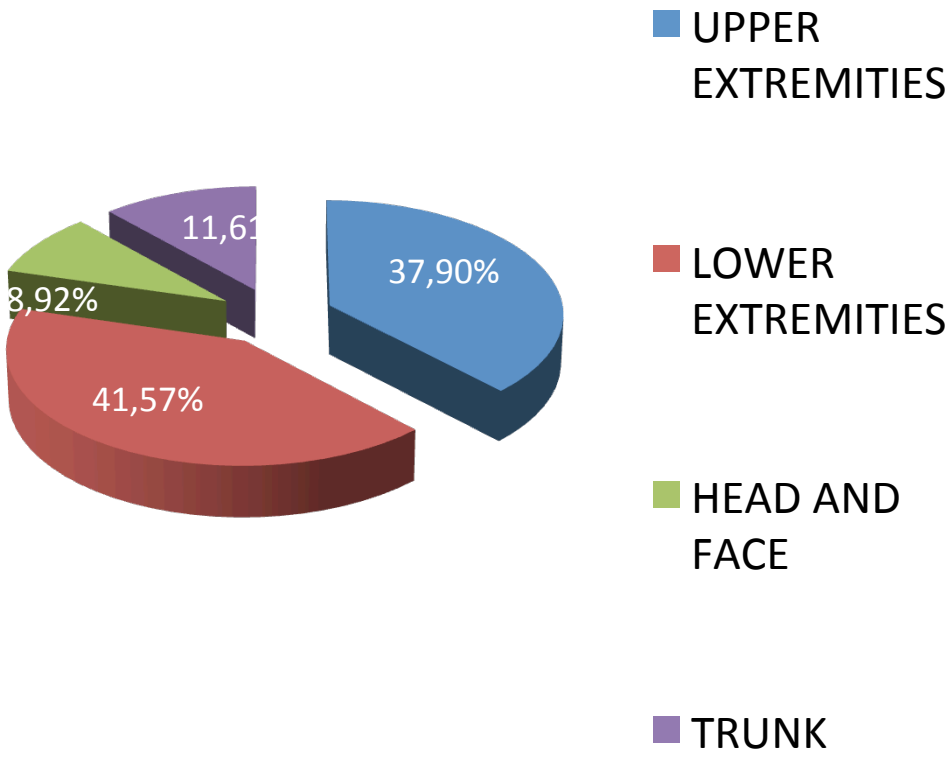


Impaired Population

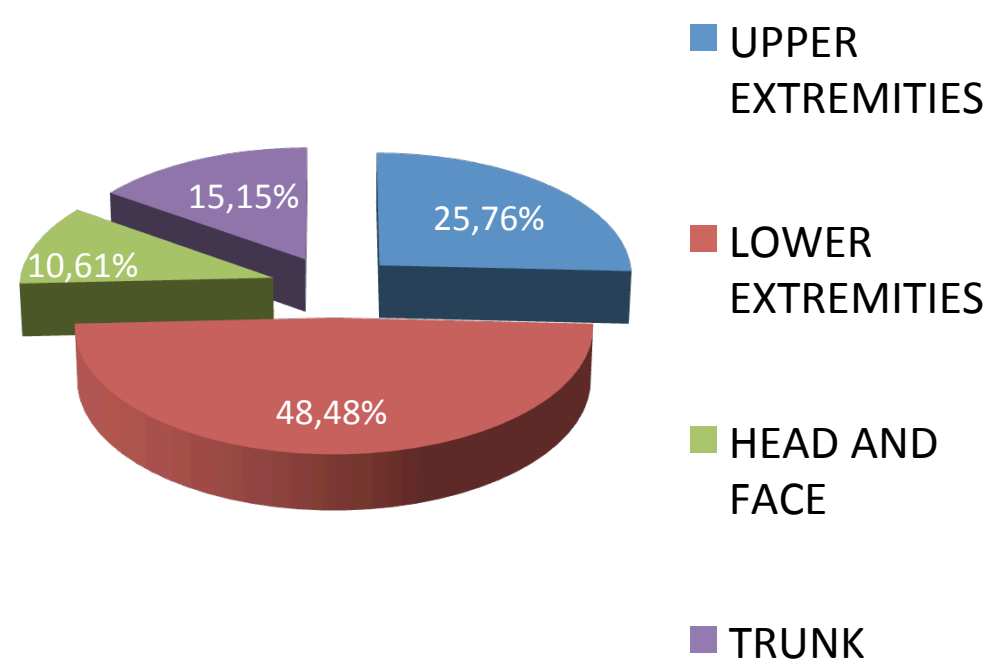


Location

Non Impaired Population

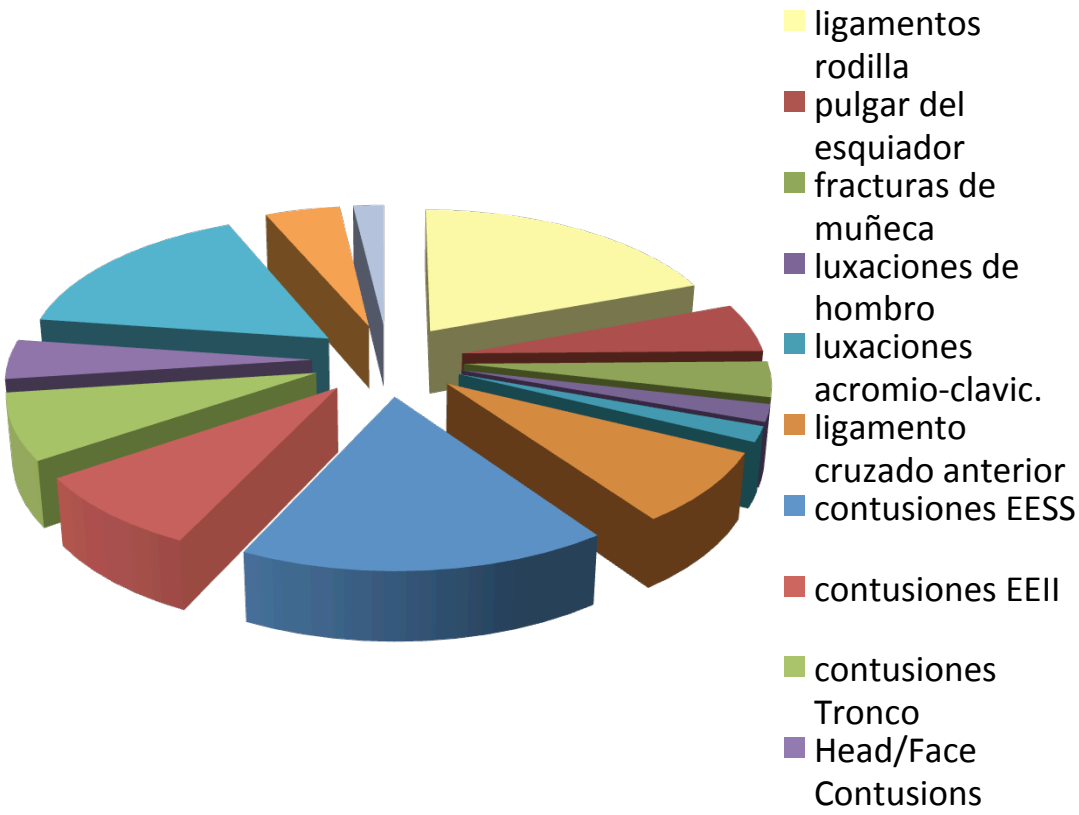


Impaired Population

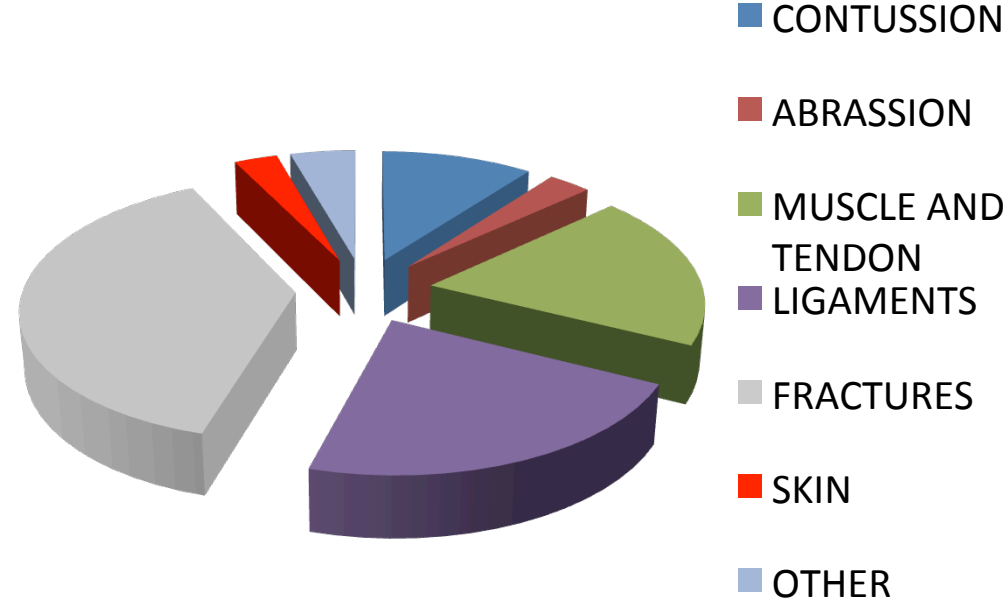


Diagnosis

Non Impaired Population

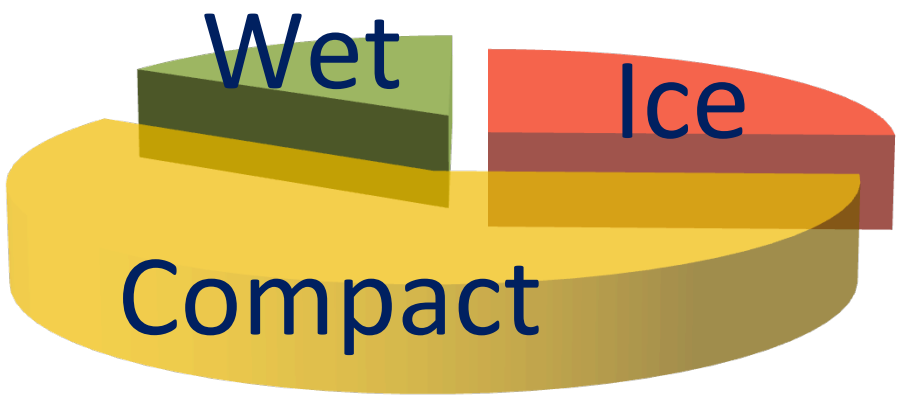


Impaired Population

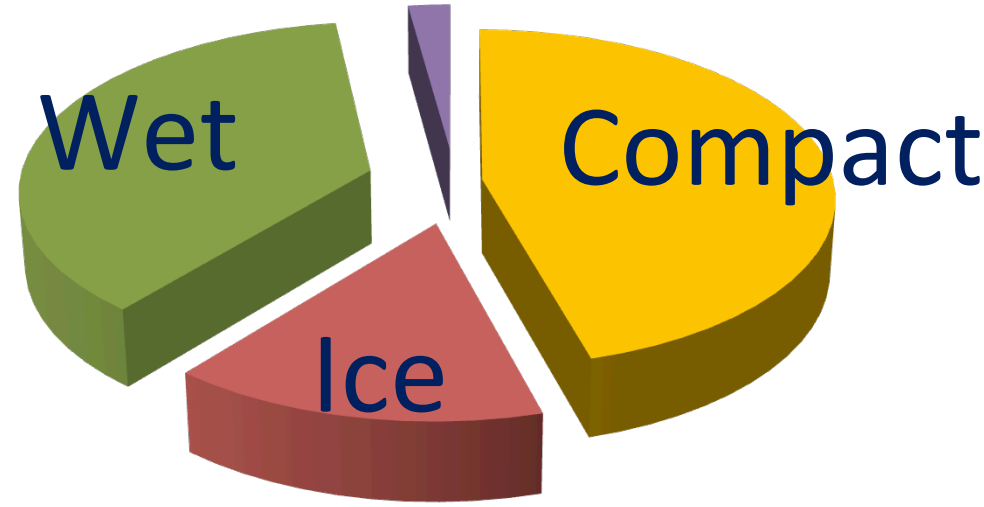


Quality of Snow

Non Impaired Population

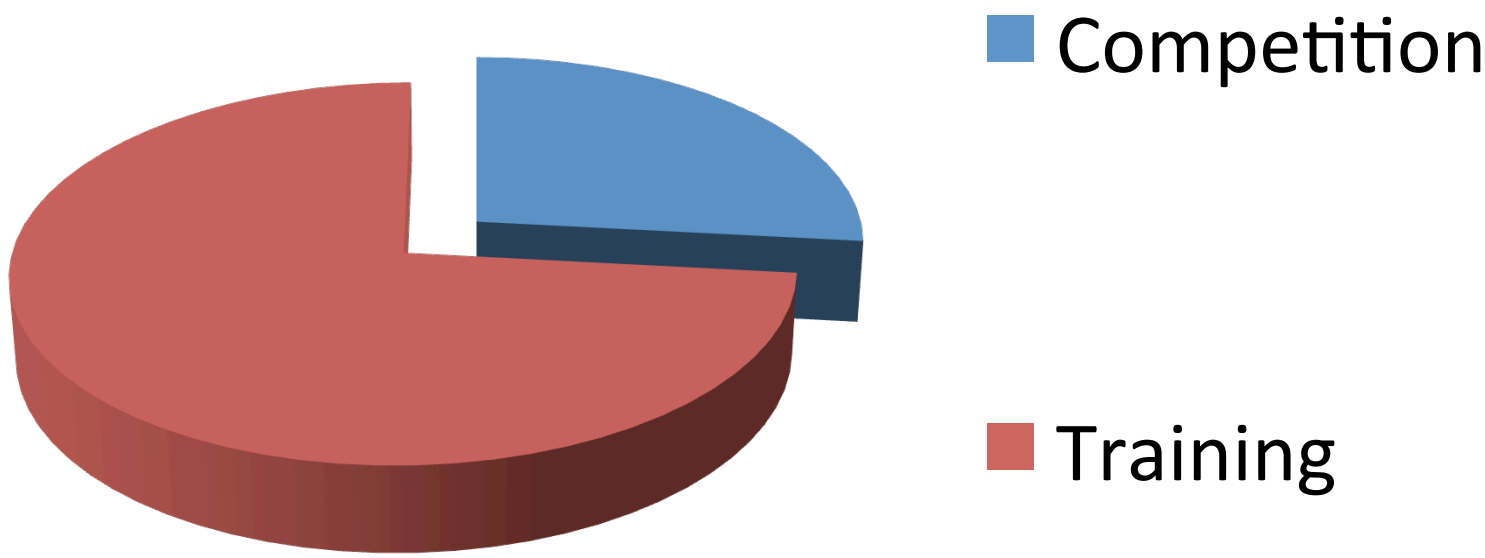


Impaired Population



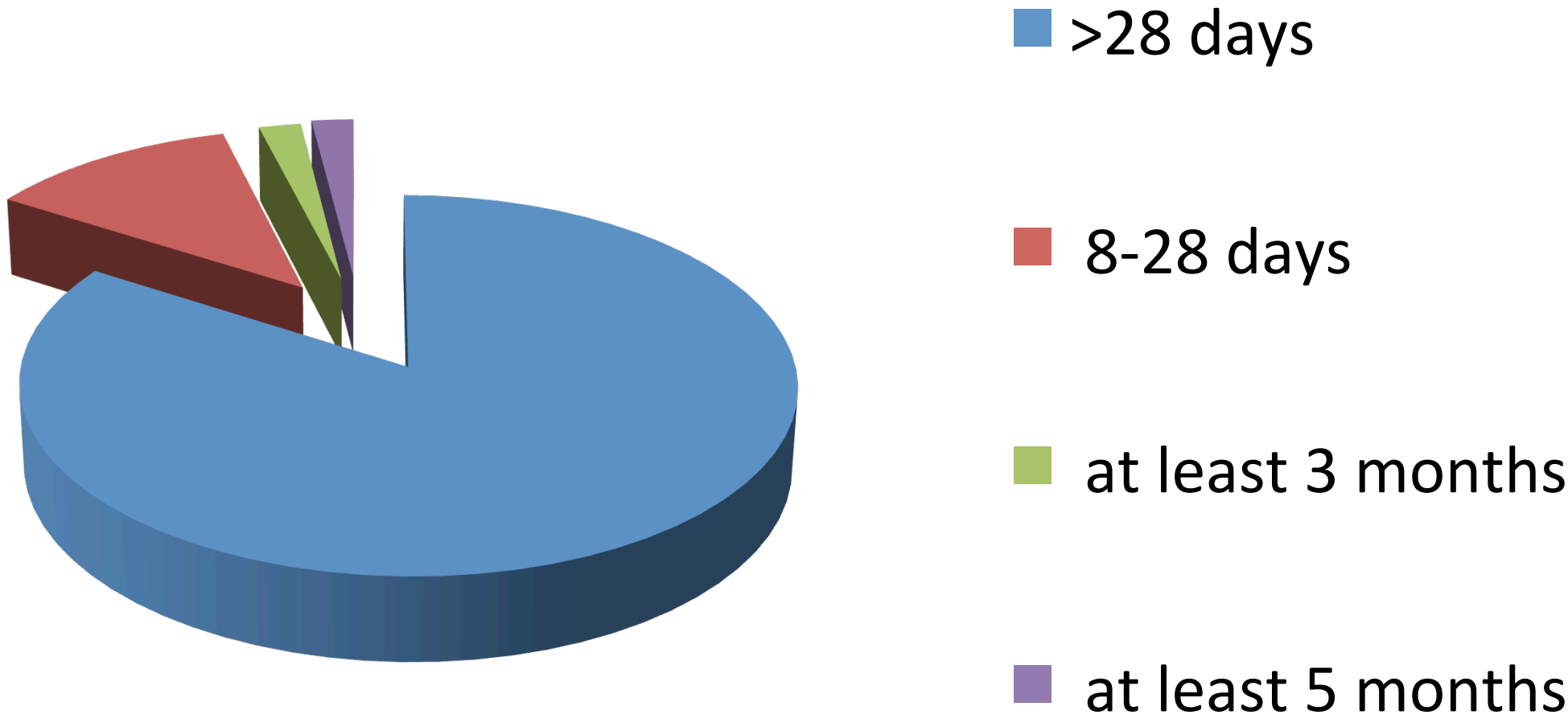
Mechanism of Injury

Impaired Population



Out of Competition

Impaired Population






Conclusions




Conclusions

- Winter Sports are in constant **Evolution**
- Winter Sport Injuries result from **Multivariable Factors**
- Constant change in Techniques, Materials and Individual behavior make **Prevention** a challenge for scientific investigation

Conclusions

- Cause-Effect understanding in Winter Sport Injuries requires precise **Statistics**
- Statistics are based on accurate **Data Collection**
- Doctors, Coaches and Trainers are responsible for careful data collection in order to **Understand and Prevent** Sport Related Injuries

Thank you very much

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Dr. Aleix Vidal i col·laboradors