Youth Sport Specialization, training volume, and injury history. Associations with balance, strength, and movement patterns

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Project "The Science of Healthy Sport for Children and Youth"

GDAŃSKI UNIWERSYTET MEDYCZNY

The project is funded under the program "Social Responsibility of Science – Science Promotion and Sport Promotion" by the Ministry of Education and Science and carried out by the Medical University of Gdańsk (Department of Immunobiology and Environmental Microbiology).

Społeczna Odpowiedzialność Nauki

Minister Nauki

More info (Polish language):
https://informator.gumed.edu.pl/260c198

Methods

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- **Custom-Designed Personal Questionnaire and Interviews, Including:**

Injury history (number, type, and location)

Training-related information (volume)

Sport experience

Age of initiation in the main sport

- **Sport Specialization Scale** based on the **DELPHI Consensus** (Bell et al., 2021; Jayanthi et al., 2018)

Have you ever quit another sport to focus on your main sport?	Is your main sport significantly more important to you than other sports?	Do you train in your main sport for more than 8 months in a year?

Variables	Total (n=235)	Specialisation		
		Low (n=38)	Moderate (n=125)	High (n=72)
Sex **Boys** **Girls**	142 (60%) 93 (40%)	22 (58%) 16 (42%)	76 (61%) 49 (39%)	44 (61%) 28 (39%)
Age	12.33 (1.83)	10.96 (1.84)	12.53 (1.81)	12.72 (1.53)
Experience in main sport	4.85 (2.58)	3.81 (2.43)	5.30 (2.57)	4.62 (2.50)
Weekly training volume main sport	8.96 (4.21)	6.37 (4.46)	9.34 (4.06)	9.66 (3.88)
Weekly training volume all sports	11.50 (4.69)	8.25 (5.39)	11.86 (4.08)	12.61 (4.61)
Geografical Factor **Urban** **Rural**	185 (79%) 50 (21%)	35 (92%) 3 (8%)	100 (80%) 25 (20%)	50 (69%) 22 (31%)
Dominant Extremity **Right** **Left**	200 (85%) 35 (15%)	34 (89%) 4 (11%)	107 (86%) 18 (14%)	59 (82%) 13 (18%)
InjuryHistory **Yes** **No**	86 (37%) 149 (63%)	9 (24%) 29 (76%)	50 (40%) 75 (60%)	27 (38%) 45 (62%)
InjuryHistory>1 **Yes** **No**	11 (5%) 224 (95%)	0 (0%) 38 (100%)	9 (7%) 116 (93%)	2 (3%) 70 (97%)

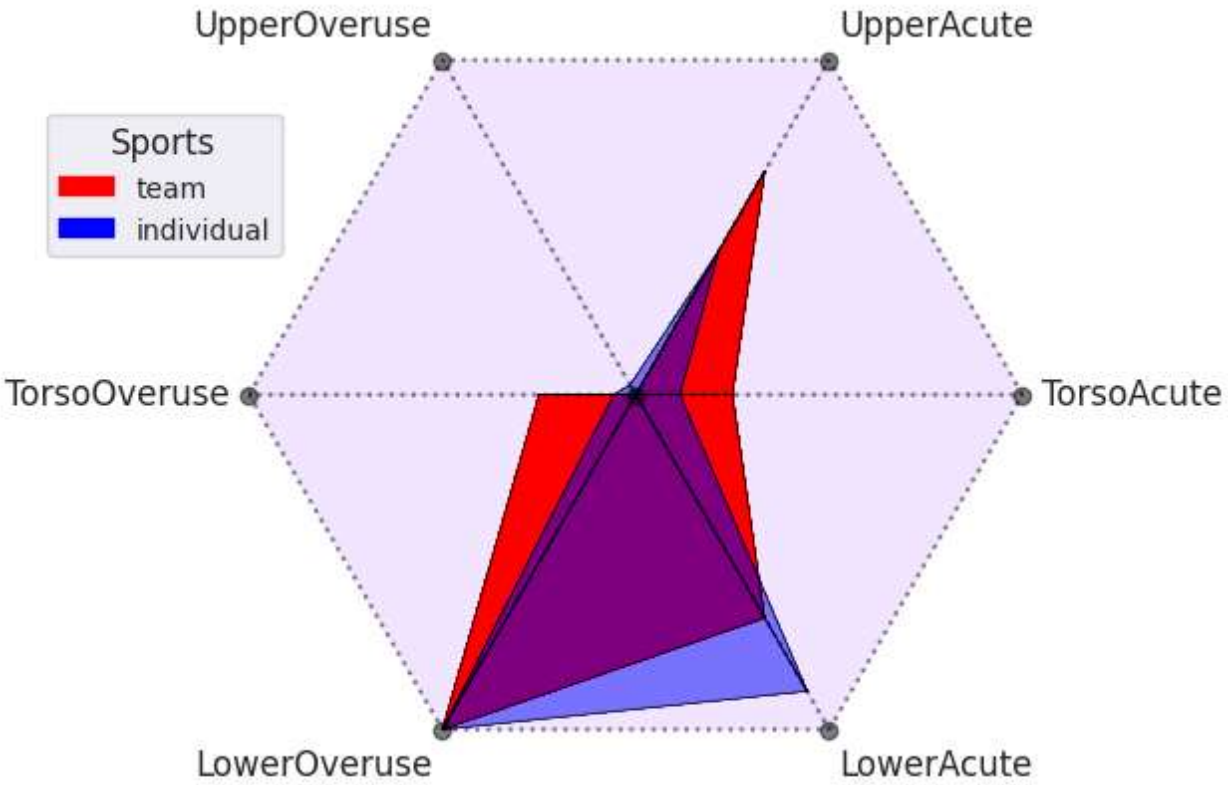
Asymmetry index 1	Low	Moderate	High	p-value
ANT_{YBT}	4.94 (9.04)	4.24 (5.42)	4.40 (4.88)	.866
PM_{YBT}	3.19 (5.81)	3.99 (6.42)	4.02 (3.01)	.638
PL_{YBT}	2.92 (4.65)	3.79 (5.04)	4.60 (5.43)	.494
$COMP_{YBT}$	2.26 (6.15)	2.81 (3.88)	2.73 (3.01)	.748
$HAbd_{HHD}$	1.69 (2.68)	1.99 (2.43)	1.61 (2.12)	.571
KF_{HHD}	6.54 (10.56)	7.02 (7.92)	6.03 (10.32)	.967
KE_{HHD}	2.70 (4.41)	4.02 (4.58)	4.16 (5.60)	.389
AP_{HHD}	14.04 (15.74)	9.68 (16.68)	9.84 (13.96)	.526
Asymmetry Index-9				
ANT_{YBT}	-1.03 (9.77)	-1.94 (8.42)	3.22 (10.52)	.0485* ^
PM_{YBT}	-2.98 (8.73)	0.55 (5.82)	-1.64 (5.89)	.066
PL_{YBT}	-0.26 (5.24)	1.02 (6.26)	0.48 (6.33)	.725
$COMP_{YBT}$	-0.23 (6.96)	0.61 (4.77)	-0.26 (4.05)	.678
$HAbd_{HHD}$	-3.07 (14.72)	1.43 (13.25)	-0.52 (13.26)	.319
KF_{HHD}	5.61 (13.18)	3.83 (12.76)	4.37 (14.12)	.844
KE_{HHD}	1.52 (11.67)	3.10 (14.36)	1.80 (16.64)	.706
AP_{HHD}	6.13 (18.29)	6.16 (13.82)	3.19 (16.58)	.502

$$Index\ 1 = \frac{B}{A} \cdot 100 (1)$$

$$Index\ 9 = \frac{(A - B)}{\max(A, B)} \cdot 100 (2)$$

	Dominant Extremity				Non-Dominant Extremity			
	Training volume main		**Training volume all**		**Training volume main**		Training volume all	
YBT (n=111)								
	r	r□	r	r□	r	r□	r	r□
ANT	-.118	-.109	-.024	-.023	-.159	-.118	-.130	-.019
PM	.050	.022	-.001	-.015	-.124	-.124	-.182	-.120
PL	-.030	-.008	-.086	-.036	.037	.051	-.013	-.015
COMP	-.059	-.051	-.070	-.037	-.191*	-.188*	-.175	-.153
HHD (n=173)								
HAbd	.212*	.183*	.131	.123	.040	.031	-.021	-.022
KE	-.001	-.028	.046	.025	.002	-.004	.089	.071
KF	.208*	.230*	.185*	.193*	.163*	.189*	.170*	.145
AP	-.004	-.006	.009	.004	.067	.086	.049	.075
FMS (n=111)								
	Training vol main				Training vol all			
Total score	.206*		.192*		.215*		.207*	

Table 3. Correlation analyses (Pearson and Spearman) between training volume (main and all sports) and sport performance divided into dominant and non-dominant limbs.


UpperOveruse
UpperAcute
Sports
team
individual
TorsoOveruse
TorsoAcute
LowerOveruse
LowerAcute

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Sports specialization and injury patterns between team and individual youth sports. The project "Science of healthy sports for children and adolescents„

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IV Konferencja Naukowa „Interdyscyplinarne spojrzenie na Nauki o Zdrowiu"
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Specjalizacja, trening, kontuzje

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- **The Earlier, the Better?"**
  Early specialization is often linked to improved short-term performance—but also to increased injury risk, burnout, and psychosocial or nutritional issues.
- **"The More, the Better?"**
  Training guidelines emphasize the "age-based rule" (training hours per week ≤ athlete's age) to avoid overtraining and imbalance.
- **Injury History and Consequences**
  Previous injuries are a known risk factor for future injury, reduced performance, and prolonged recovery trajectories.

(AAP, AOSSM, AMSSM), Jayanthi i wsp. 2011, 2013, 2015, Brenner JS 2016, Sabato i wsp. 2016, Rose i wsp. 2008, Grimmer i wsp. 2000, Pasulka i wsp. 2017, Myer i wsp. 2015 i inni

Aims

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Youth engaged in **individual sports** tend to show **higher levels of specialization**, **greater training volume**, and potentially **increased injury risk**—as suggested by Pasulka et al. (2017). This pattern raises concerns about the long-term consequences of early, high-volume, single-sport training, particularly in non-team settings.

The study was approved by the Bioethics Committee for Scientific Research at the Medical University of Gdańsk (approval no. NKBBN/241/2023).

Projekt „*Musculoskeletal Injuries, Sports Performance, Sports Specialization, and Quality of Life in Young Athletes*", który został **zarejestrowany w bazie ClinicalTrials** (https://clinicaltrials.gov/study/NCT06325228)

Hypotheses

- Athletes participating in **individual sports** are more likely to specialize in a single discipline than those engaged in **team sports** (Pasulka et al., 2017).
- **Specialized athletes** in individual sports report a **higher training volume** compared to specialized athletes in team sports (Bell et al., 2016).
- The **number of athletes training their main sport more hours per week than their age** is expected to be greater in individual sports (Jayanthi et al., 2015).
- The **prevalence of injury history** is higher among youth athletes in individual sports than in team sports (Pasulka et al., 2017).

Methods

GDAŃSKI UNIWERSYTET MEDYCZNY

- **Custom-Designed Personal Questionnaire and Interviews, Including:**

Injury history (number, type, and location)

Training-related information (volume)

Sport experience

Age of initiation in the main sport

- **Sport Specialization Scale** based on the **DELPHI Consensus** (Bell et al., 2021; Jayanthi et al., 2018)

Have you ever quit another sport to focus on your main sport?	Is your main sport significantly more important to you than other sports?	Do you train in your main sport for more than 8 months in a year?

Wyniki

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	total	team	individual	p-value
Participants	280	192	88	
Male sex, N (%)	164 (58.6)	134 (69.8)	30 (34.1)	
Age, y	12.35 ± 1.74	12.94 ± 1.45	11.07 ± 1.62	**<.001**
Experience main sport, y	4.81 ± 2.51	5.04 ± 2.63	4.30 ± 2.14	**.014**
Geographic Factor **Urban** **Rural**	 204 (72.9) 76 (27.1)	 125 (65.1) 67 (34.9)	 79 (89.8) 9 (10.2)	**<.001**

	soccer	**handball**	**swimming**	**gimnastics**	**basketball**	rugby	chess	taekwondo	motocross	karate
Participants, N (%)	103 (**40.6**)	57 (22.4)	38 (15.0)	27 (10.6)	19 (7.5)	3 (1.2)	3 (1.2)	2 (0.8)	1 (0.4)	1 (0.4)
Male sex, N (%)	92 (**89.3**)	26 (45.6)	17 (44.7)	0 (**0.0**)	7 (36.8)	3 (100.0)	2 (66.7)	0 (0.0)	1 (100.0)	1 (100.0)

	TOTAL	TEAM	INDIVIDUAL	p-value	p-value (with adjustments)
Sports Specialization (0, 1, 2, 3)	2.12 ± 0.72	**2.23 ± 0.65**	1.88 ± 0.80	**<.001**	
High (3)	85 (**30.4**)	66 (34.4)	19 (21.6)	**.032**	.258
Moderate (2)	151 (53.9)	110 (57.3)	41 (46.6)	.096	.619
Low (0, 1)	44 (15.7)	16 (8.3)	28 (31.8)	**<.000**	**.022**

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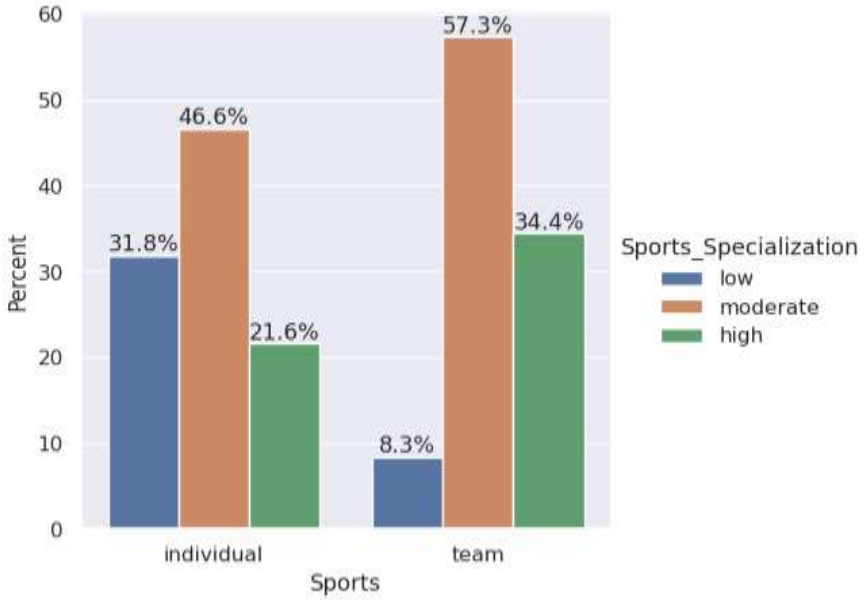
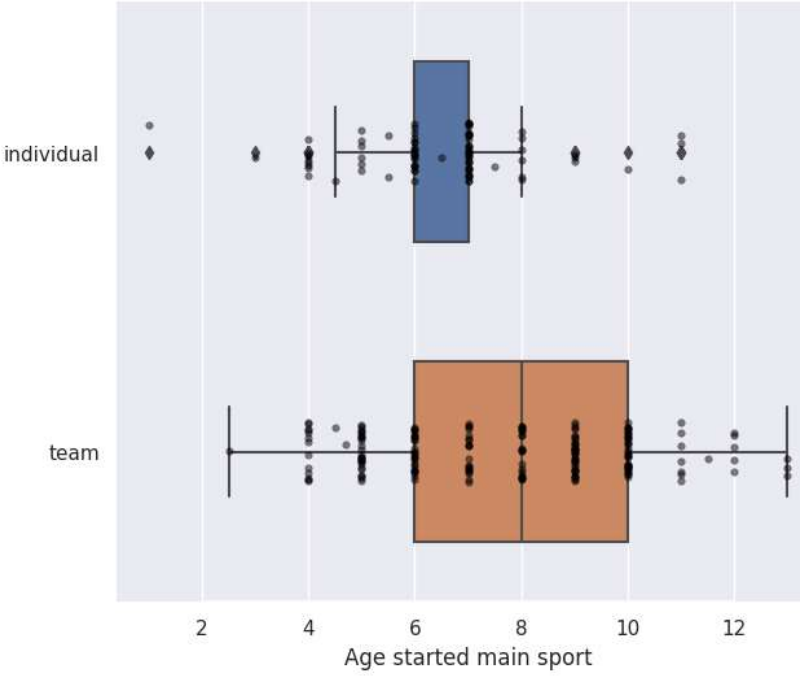
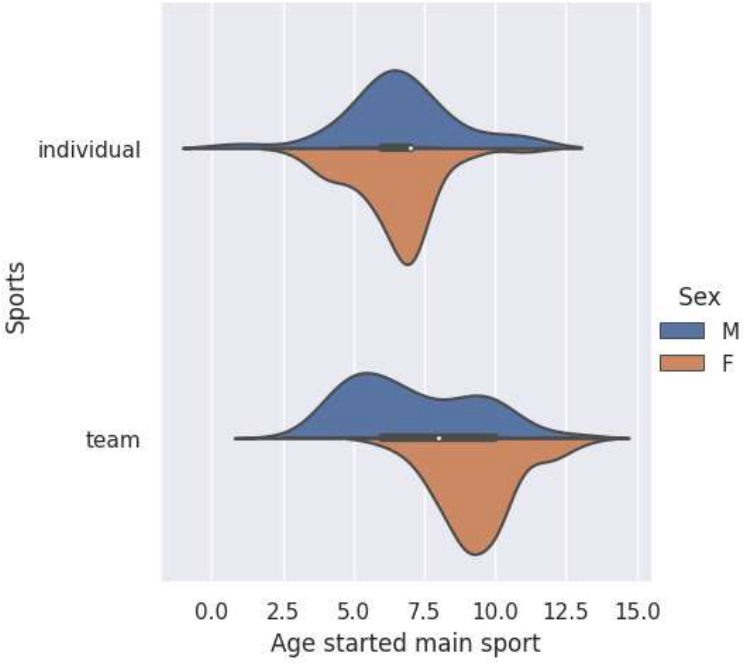
Logistic regression with/without adjustments: (age, sex, training volume)



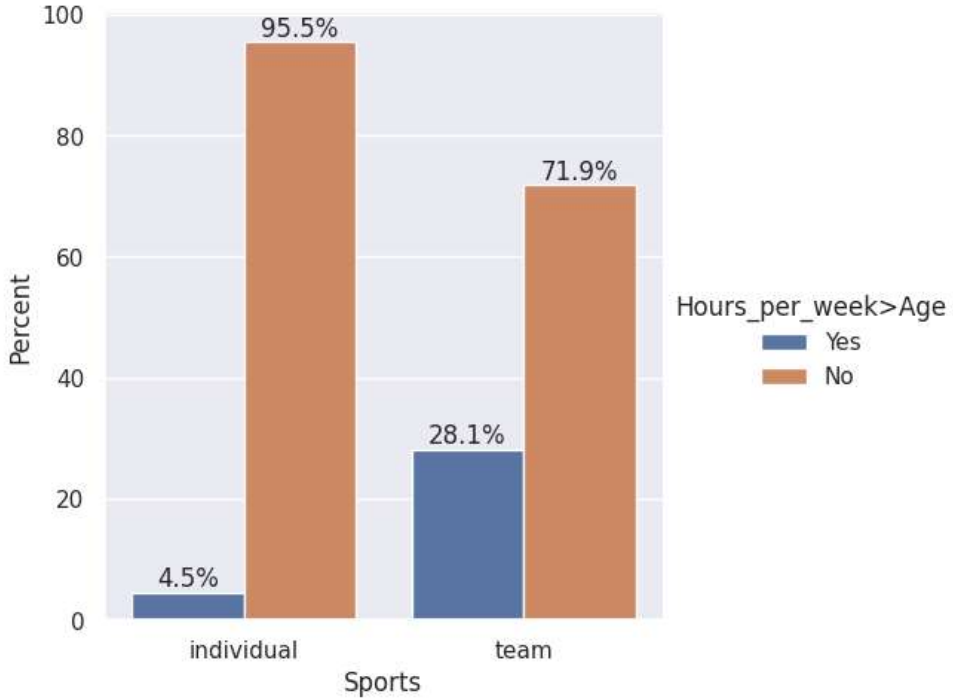
	TOTAL	TEAM	INDIVIDUAL	p-value
Given up a sport for their main, N (%)	98 (35.0)	73 (38.0)	25 (28.4)	.153
Main sport significantly more important than others, N (%)	234 (83.6)	171 (89.1)	63 (71.6)	**<.001**
Months in a year>8	258 (92.1)	182 (94.8)	76 (86.4)	**.028**

	total	team	individual	p-value
Age started main sport, y	7.36 ± 2.19	7.76 ± 2.29	6.49 ± 1.63	**<.001**

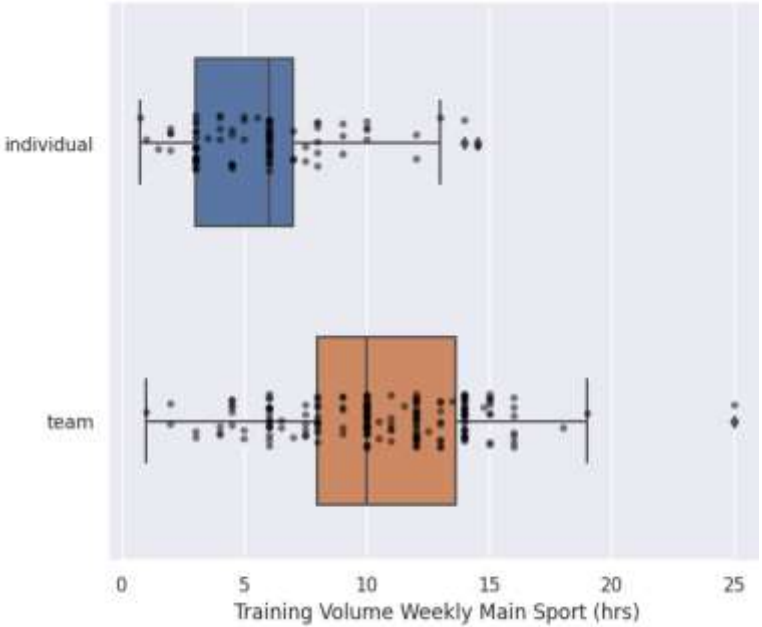


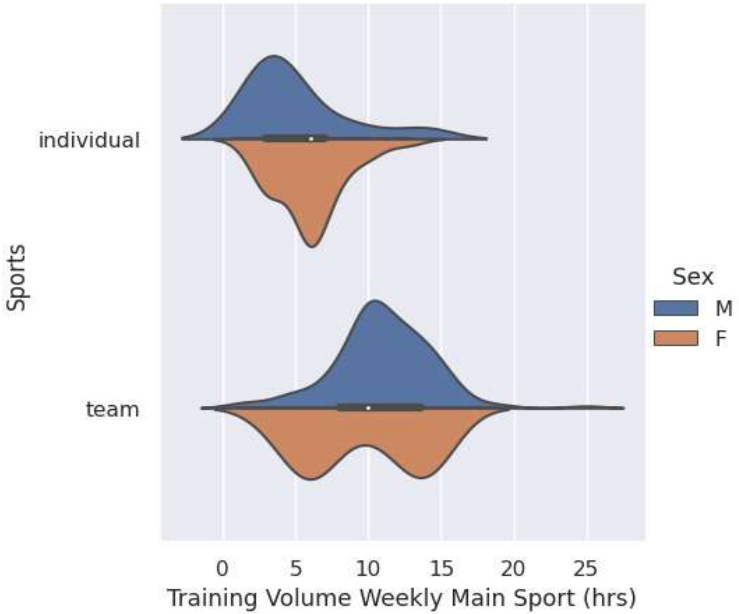


Main sport	total	team	individual	p-value
Hours per week > Age, N (%)	58 (**20.7**)	54 (28.1)	4 (4.6)	**<.001**

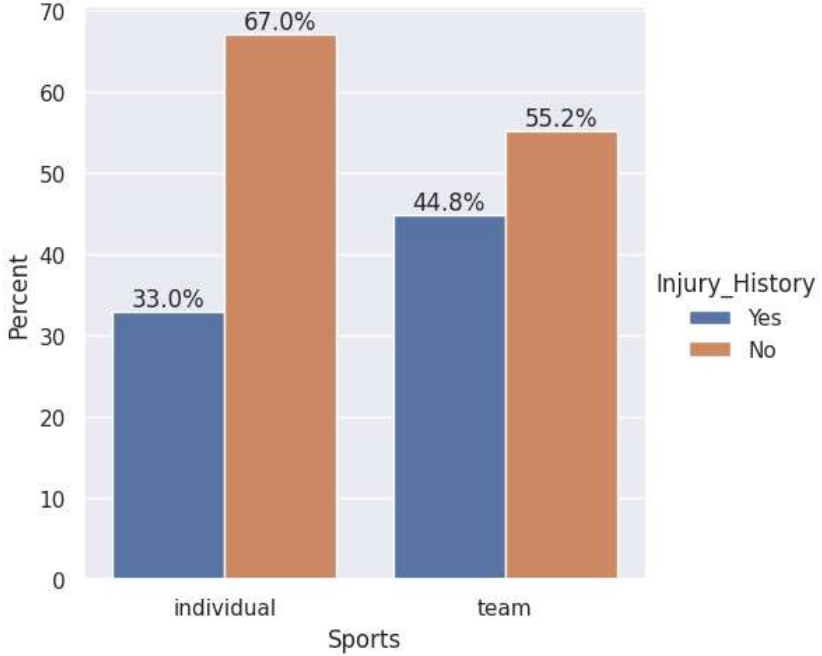


	total	team	individual	p-value
Training Volume Main Sport, h / week	9.02 ± 4.10	10.57 ± 3.62	5.63 ± 2.87	**<.001**
Training Volume ALL Sports, h / week	11.67 ± 4.48	12.92 ± 3.97	8.75 ± 4.22	**<.001**





	total	team	individual	p-value
Injury History (last 12 months)	115 (**41.1**)	86 (44.8)	29 (33.0)	.082
Injury History More Than One (0=no,1=yes)	21 (**7.5**)	18 (9.4)	3 (3.4)	.272



Injury	total	team	individual	p-value	p-value (with adjustments)
Upper	23 (20.0)	15 (17.4)	8 (27.6)	.242	.220
Lower	81 (**70.4**)	65 (75.6)	16 (55.2)	**.040**	.866
Torso	11 (9.6)	6 (7.0)	5 (17.2)	.115	.063
Overuse	53 (43.4)	38 (43.2)	15 (44.1)	1	
Acute	69 (56.6)	50 (56.8)	19 (55.9)		

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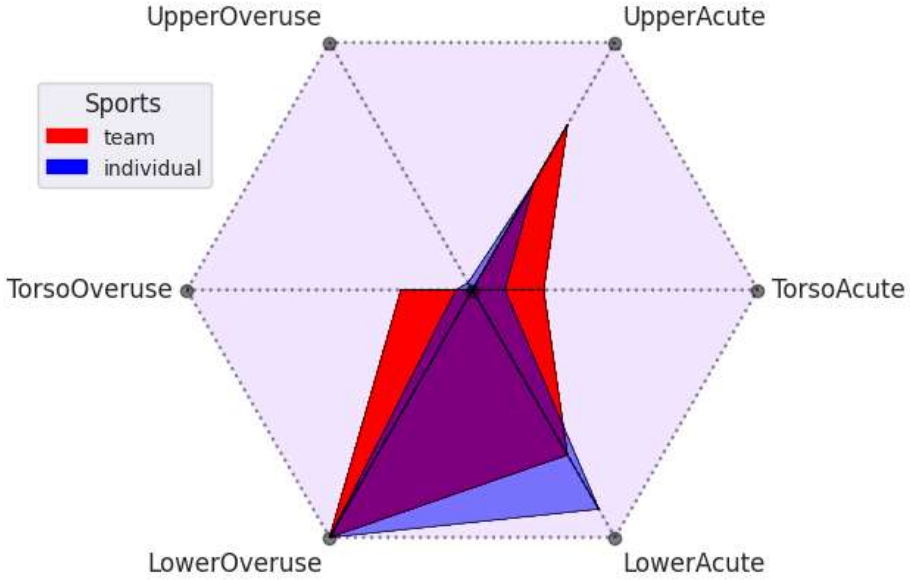
Logistic regression with adjustments: (age, sex, training volume)



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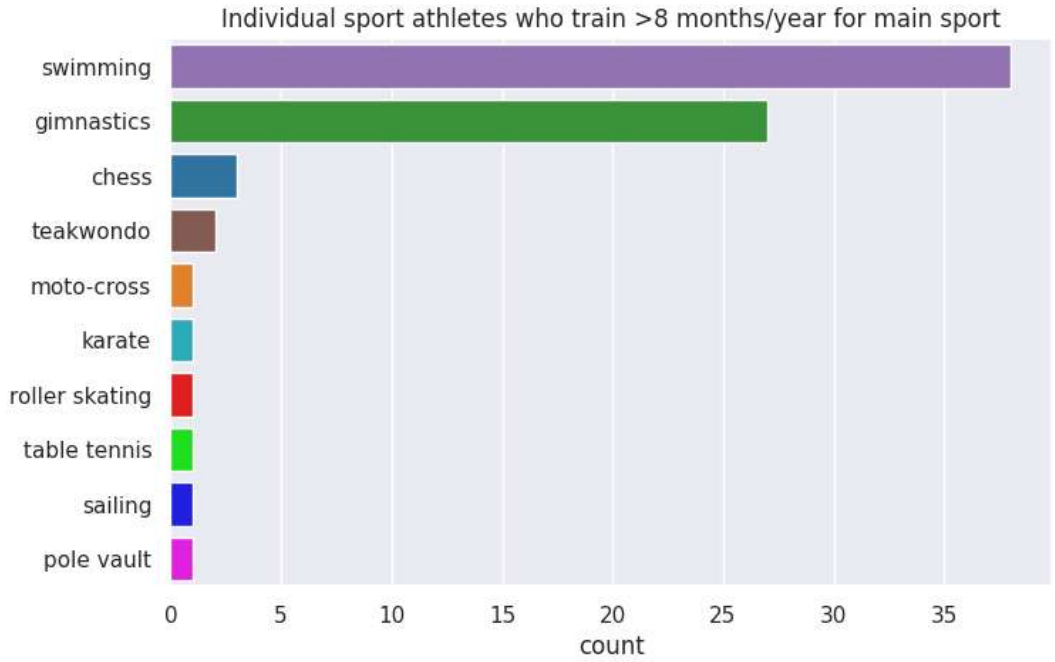
Individual sport athletes who train >8 months/year for main sport
swimming
gimnastics
chess
teakwondo
moto-cross
karate
roller skating
table tennis
sailing
pole vault
0
5
10
15
20
25
30
35
count