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INTERNATIONAL NETWORK OF WRESTLING RESEARCHERS (INWR)

ADVANCING OUR SPORT THROUGH KNOWLEDGE

FAIRE PROGRESSER NOTRE SPORT PAR LA CONNAISSANCE

ПРОДВИЖЕНИЕ НАШЕГО СПОРТА ЧЕРЕЗ ЗНАНИЕ

PROGRESO PARA NUESTRO DEPORTE MEDIANTE CONOCIMIENTO

International Journal of Wrestling Science

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Editor's Comments

Comments from the Editor in Chief

This issue is released as we approach the interesting culmination of the wrestling competition calendar. Interesting for two reasons: 1) the adjustment of the time and location of the Senior World Championships, which will now be held in Astana, Kazakhstan, October 24th-November 1st due to the tensions in the Middle East, and 2) the return of Russia to the competition.

There is a variety of interesting topics in this issue with authors from 11 countries. Milorad Dokmanac & Kristijan Slaćanac provide a comprehensive scoring analysis from the Greco-Roman World Championship from the Senior, U23, U20 and U17 in 2025.

David Curby and David Lopez discuss the evolution of qualification processes for the Olympic Games and propose a modification for the scoring system used in the Ranking Series based on strength of opposition.

Murad Cabbarov presents a new approach to computing the Most Successful Wrestler index.

Dr Eckart D. Diezemann discusses Long-Term Health Effects on the Musculoskeletal System Expected from Olympic Wrestling.

Amir Hafezikhah presents innovative competitive formats that should be considered for wrestling.

Omer Kaynar presents a unique biomechanical analysis of universal helical movement patterns in wrestling and nature.

Ahmed Farhan Ali Al-Tamimi studied the historical evolution of Olympic wrestling regulations (1896–2024).

Two special sections are included:

- 1) Dr. Babak Shadgan, Chair of the UWW Medical, Prevention and Anti-Doping Commission requested the publication two of their position papers regarding the health of wrestlers – Concussion Policy; and Guidelines for the Prevention, Detection, and Management of Skin Conditions in Wrestlers.
- 2) Essays for young coaches a from a coach and scientist, Ramazan Savranbaşı.

Finally, we remember two friends and colleagues we have recently lost - Robert “Bobby” Douglas Mehmet Kutlu.

Sincerely yours in the advancement of Wrestling,

David Curby

David Curby EdD
Director of the International Network of Wrestling Researchers
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20-year-old Keyvan GHAREHDAGHI (JPN) stops Olympic champ Razambek JAMALOV (UZB) enroute to the Asian Championship

On the Cover: Photo from UWW showing 20-year-old Keyvan GHAREHDAGHI (JPN) stops Olympic champ Razambek (UZB) enroute to the Asian Championship

COMPETITIVE EFFICIENCY ACROSS AGE CATEGORIES (SENIOR; U23; U20; U17) IN GRECO-ROMAN WRESTLING: ANALYSIS OF PERFORMANCE INDICATORS AT THE WORLD CHAMPIONSHIPS – 2025

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ABSTRACT

This report presents a comprehensive analysis of competitive performance across all age categories (U17, U20, U23, Seniors) in Greco-Roman wrestling, based on data collected from the 2025 World Championship competitions. The aim was to identify age-related patterns in technical–tactical efficiency, scoring structure, positional contribution, and match intensity, in order to support evidence-based long-term athlete development and coaching strategies.

The analysis reveals a clear developmental progression from high-intensity, open wrestling at the U17 level toward more controlled and efficiency-oriented performance in older age categories. Match intensity, expressed as points per minute (WQ), was significantly higher in U17 compared to all other age groups, with a pronounced decrease observed during the transition to U20. From U20 to Senior level, WQ values stabilized, indicating that further performance development is driven primarily by tactical control and execution efficiency rather than by increased technical output or diversity.

The first scoring action was strongly associated with match outcome across all age categories, confirming the importance of early initiative and positional control at the elite level. The findings identify the U20 age group as a critical transitional phase in athlete development and emphasize the need for age-specific performance benchmarks and training priorities.

This report provides practical insights for United World Wrestling (UWW), national federations, and coaches, supporting the alignment of competitive demands with long-term development models and the optimization of training focus across all age categories.

INTRODUCTION

Modern elite wrestling is characterized by continuous changes in competition rules, tactical trends, and performance demands across all age categories. As a result, understanding how technical–tactical efficiency and match dynamics evolve throughout the athlete development pathway has become a key priority for international federations, national teams, and coaches.

While previous research has predominantly focused on senior-level wrestling, considerably less attention has been paid to the developmental progression from cadet to senior categories, particularly through the use of objective, competition-based performance indicators. This lack of longitudinal, competition-driven evidence limits the ability of coaches and federations to design age-appropriate training models and performance benchmarks. World Championships provide a unique and standardized context for such analyses, as they represent the highest competitive level within each age category (U17, U20, U23, Seniors) and reflect current global trends in wrestling performance.

A systematic analysis of technical–tactical actions, scoring structure, positional dominance (standing versus parterre), and match intensity allows for a comprehensive understanding of how wrestling performance evolves with age and competitive maturity.

Greco-Roman wrestling (GR) has distinct characteristics compared to the other two Olympic styles, and previous analyses have identified a decline in both efficiency and attractiveness of GR wrestling relative to Freestyle (FS) and Women's Wrestling (WW). Therefore, the primary aim of this report is to analyze and compare competitive performance in Greco-Roman wrestling across all age categories using detailed technical–tactical indicators and match intensity metrics derived from World Championship competition data. Particular emphasis is placed on:

- differences in scoring structure,
- the contribution of wrestling positions to total points scored,
- the distribution of technical and non-technical points,
- wrestler efficiency expressed as points per minute (WQ/min),
- key performance actions and techniques that differentiate age categories.

By identifying stable patterns and critical transition points within the athlete development pathway, this report seeks to provide practical, evidence-based insights for coaches, performance analysts, and decision-makers within United World Wrestling (UWW). The findings aim to support long-term athlete development strategies, optimize age-specific training priorities, and contribute to the continuous improvement of elite wrestling performance.

METHODS

Data Source

The analysis was based on official match data from United World Wrestling (UWW) World Championships across four age categories: U17, U20, U23, and Seniors. All data were obtained from the official UWW Public Data Access (PDA) platform (<http://uww.io/wpar>). Only Greco-Roman wrestling matches were included in this report. All performance data were derived from official match results and competition records.

NUMBER WRESTLERS (WCH 2025. –SEN; U23; U20; U17) / Table “A”

Sn	CHAMPIONSHIP	GR	FS	WW	TOTAL
1.	U17 CHAMPIONSHIP WORLD	246	233	183	662
2.	U 20 CHAMPIONSHIP WORLD	231	231	186	648
3.	U23 CHAMPIONSHIP WORLD	255	241	189	685
4.	SENIOR CHAMPIONSHIP WORLD	278	293	205	776
	TOTAL =	1010	998	763	2.771

NUMBER MATCHES (WCH 2025. –SEN; U23; U20; U17) / Table “B”

Sn	CHAMPIONSHIP	GR	FS	WW	TOTAL
1.	U17 CHAMPIONSHIP WORLD	288	275	218	781
2.	U 20 CHAMPIONSHIP WORLD	272	272	220	764
3.	U23 CHAMPIONSHIP WORLD	299	282	224	805
4.	SENIOR CHAMPIONSHIP WORLD	320	339	241	900
	TOTAL =	859	829	662	2.350

NUMBER TAG/ACTIONS (WCH 2025. –SEN; U23; U20; U17) / Table “C”

Sn	CHAMPIONSHIP	GR	FS	WW	TOTAL
1.	U17 CHAMPIONSHIP WORLD	1287	1451	991	3729
2.	U 20 CHAMPIONSHIP WORLD	1345	1644	1113	4102
3.	U23 CHAMPIONSHIP WORLD	1373	1699	1127	4199
4.	SENIOR CHAMPIONSHIP WORLD	1444	1876	1149	4469
	TOTAL =	5449	6670	4380	16.499

The previous three tables present the basic information on four World Championships held in 2025: Seniors, U23, U20, and U17. In order to collect all the data required for this analysis, a video review of 2,350 matches was conducted (Table “B”) across all four age categories. All matches were analyzed, involving a total of 2,771 wrestlers (Table “A”). Overall, 16,499 technical actions were recorded across all matches at these four World Championships (Table “C”).

Based on this extensive database, a large number of meaningful insights into the characteristics of wrestling matches at the World Championships were obtained. Numerous high-quality comparative and expert analyses were conducted according to various parameters across all four age categories.

On the basis of the obtained results, specific conclusions were drawn and practical recommendations were formulated. These are presented at the end of this analysis and are of significant importance for each of the four age categories.

Performance Indicators

Each bout was analyzed using a standardized set of performance indicators, including:

- technical–tactical variables (techniques executed in standing and parterre positions),
- scoring actions classified as technical and non-technical points,
- positional contribution to total points scored (standing position versus parterre),
- match duration and total number of points scored per minute of match time,
- match intensity and wrestler efficiency expressed as points per minute (WQ/min).

In addition, specific scoring situations (e.g., first scoring action) and their relationship with the match result

Data Processing

Performance indicators were calculated at both the wrestler and match levels and subsequently grouped by age category. To ensure comparability across age groups, selected indicators were expressed in relative or standardized forms (e.g., points per match, points per minute). Non-parametric statistical procedures (Kruskal–Wallis test) were applied to assess differences between age categories where appropriate. Data processing and analysis were conducted using the Python programming language with standard analytical libraries (Pandas, NumPy, Matplotlib).

Analytical Approach

Comparisons between age categories were performed to identify patterns and developmental changes in competitive performance. Non-parametric statistical methods were applied where data distributions deviated from normality. Results are presented through a combination of descriptive statistics, graphical visualizations, and selected inferential analyses to support interpretation. The focus of the analysis was not on individual athletes or teams, but on identifying global developmental trends characterizing each age category at the World Championship level.

RESULTS AND DISCUSSION

Development pathway of Greco-Roman wrestling performance (U17–Seniors)

The developmental transition from the U17 level to Senior competition is characterized by a gradual decrease in match intensity, expressed as points per minute (WQ/min), accompanied by a shift from parterre-oriented scoring toward standing wrestling and tactically induced points (Chart 1). This trend reflects increasing match control, efficiency, and strategic maturity at the elite Senior level.

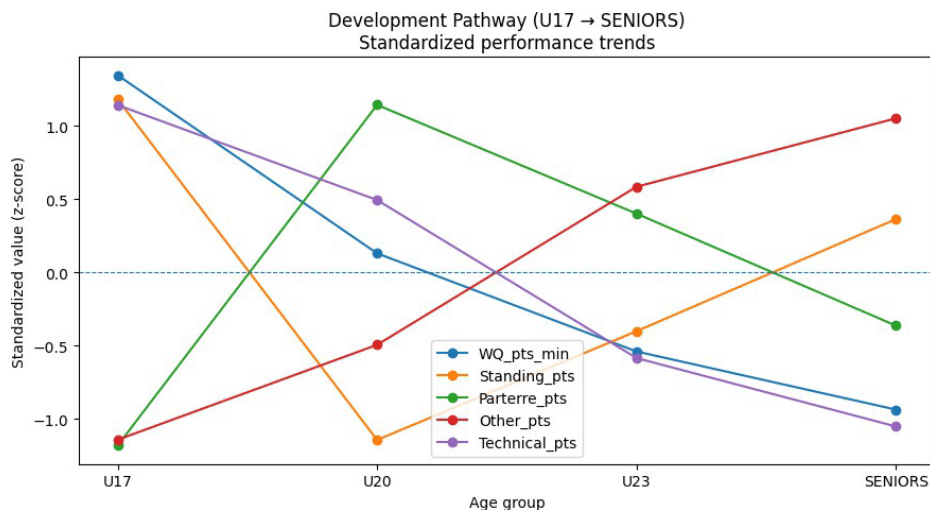


Chart 1. Development pathway by each age group (senior, U23, U20, and U17)

Match Intensity (WQ – Points per Minute)

A continuous decline in match intensity (WQ) was observed with increasing age category. Younger wrestlers tend to adopt a higher-risk approach, characterized by increased activity, a greater number of technical errors, and lower levels of tactical control. In contrast, Senior wrestlers demonstrate a slower competitive tempo, greater selectivity in attacking actions, and superior overall match control. This shift indicates a transition from activity-volume-based scoring toward performance models focused on efficiency and an optimal risk–reward balance in point scoring.

Standing vs. Parterre Scoring Contribution

A clear positional shift in scoring contribution was identified across age categories. Parterre scoring reaches its peak at the U20 level and gradually decreases toward the Senior category. Conversely, the contribution of standing wrestling increases progressively with age, becoming dominant at the Senior level. While U20 wrestlers score the highest number of points from parterre situations, Senior wrestlers rely increasingly on standing exchanges, reflecting enhanced positional control and tactical maturity.

Technical vs. Non-Technical Points

A pattern similar to the standing–parterre relationship was observed in the distribution of technical versus non-technical points. As age category increases from U17 to Seniors, the relative share of technical points decreases, while the proportion of non-technical points increases. This trend is largely attributable to the ability of Senior wrestlers to generate scoring opportunities through passivity calls, step-out situations, and sustained tactical pressure, effectively forcing opponents into errors rather than relying solely on direct technical execution wrestling techniques.

Key Developmental Transitions

- **U17 → U20 (Technical base and volume)** - This stage is characterized by the development of technical foundations and automatized actions, particularly in parterre situations. High match intensity (WQ) and a greater volume of scoring actions reflect an emphasis on technical execution wrestling techniques and constant activity.
- **U20 → U23 (Match control and reduced aggressiveness)** - This represents a critical transitional phase, marked by a reduction in aggressive volume-based wrestling and a growing emphasis on match control. Performance development at this stage is driven by improved attack selection and the effective transfer of parterre dominance into standing situations.
- **U23 → Seniors (Winning with control and reduced risk)** - At the Senior level, performance is defined by high standing efficiency, the ability to force passivity and step-out situations, and advanced management of match rhythm. Tactical leadership, score protection, and risk minimization become central elements of competitive success.

TOTAL POINTS PER TECHNIQUE CLASS IN % (PERCENTAGE)

Out of 20 scoring segments identified in match analysis, five segments accounted for more than 5% of total points scored across all matches (Chart 2). Of particular concern is the fact that only three of these segments represent wrestling techniques, while the remaining two are non-technical scoring actions resulting from penalties, namely **passivity** and **step-out** situations.

When examining the contribution of these five segments across the full sample, their combined share of total scoring ranges from **61.46% in the U17 category to 68.43% at the Senior level**. This indicates an increasing concentration of scoring within a limited number of actions as age and competitive maturity increase.

Table 1 presents an overview of all technical–tactical variables (a total of 20 segments) across the age categories, expressed as percentages (%). Based on the data in this table, a detailed comparison of the scoring structure across different age categories can be performed. The table highlights the percentage distribution of points scored through dominant wrestling techniques as well as other scoring actions that are not classified as wrestling techniques (top five), across all segments and all matches in Greco-Roman wrestling for the four age categories.

Table 1. Overview of all technical-tactical variables by age category in percentage (%)

Sn	AGE CATEGORY WRESTLING TECHNIQUE - GR	SEN	U23	U20	U17	AVERAGE
1.	GUT WRENCH	22.17	21.95	25.30	24.19	23.40
2.	PASSIVITY	18.51	16.18	14.51	14.30	15.88
3.	TAKE DOWN	9.49	10.41	8.23	10.49	9.66
4.	LIFTS – SUPLEX	9.99	9.14	10.27	6.63	9.01
5.	STEP OUT	8.27	8.66	7.89	5.85	7.67
6.	SUPLEX THROW	3.27	4.59	3.42	7.54	4.71
7.	HIP TURNING THROV	4.11	3.76	3.55	6.68	4.53
8.	STANDING COUNTER	3.02	3.94	4.42	4.33	3.93
9.	FORWARD BEDING THROV	3.11	2.45	5.03	4.72	3.83
10.	SHOULDER TURNING THROW	3.95	3.15	2.95	2.60	3.16
11.	PARTERRE COUNTER	2.35	3.15	3.29	2.21	2.75
12.	TURN OVER	1.85	2.10	2.69	2.08	2.18
13.	STANDING CHALLENGE	2.69	1.40	1.82	2.12	2.01
14.	LIFTS – REVERSE GRIP	2.56	1.62	0.87	1.30	1.59
15.	PARTERRE CAUTION	1.09	2.36	0.95	1.56	1.49
16.	STANDING CAUTION	1.64	1.27	1.60	1.43	1.49
17.	PARTERRE CHALLENGE	1.09	1.88	1.30	0.74	1.25
18.	FRONT HEAD LOOCK	0.59	1.22	0.43	1.13	0.84
19.	TAKE DOWN HEAD TO HEAD	0.25	0.79	1.39	0.09	0.63
20.	NEGATIVE WRESTLING	0.00	0.00	0.09	0.00	0.02

Legend: red color – best result; green color – worst result;

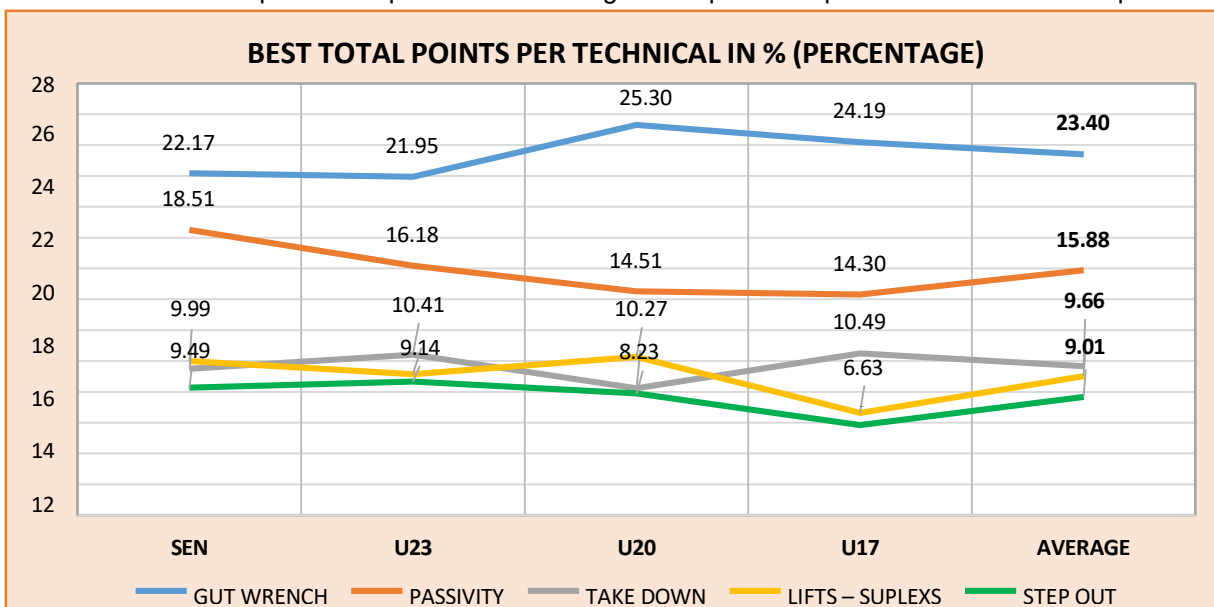
Comparison of the Top Five Scoring Actions (Technical and Non-Technical Points)

Across all age categories, **GUT WRENCH** is the most frequently applied scoring technique. On average, nearly **one in every five points (23.40%)** is scored using the gut wrench. This technique is more prevalent in the U17 and U20 categories compared to U23 and Seniors. One of the main reasons for this trend lies in the high static and dynamic strength requirements needed for effective gut wrench defense, which are significantly more developed in older wrestlers.

With regard to **PASSIVITY**, its contribution to total points scored ranges from **14.30% to 18.51%** in all age categories. The lower proportion observed in **U17 (14.30%)** compared to **Seniors (18.51%)** can be explained by greater tactical maturity at the Senior level. Senior wrestlers tend to manage risk more conservatively, while **U17** wrestlers rely more heavily on standing techniques—such as **suplex throw, hip turning throw, and standing counters**—to generate scoring opportunities before passivity situations arise.

The **TAKE DOWN** technique is most prevalent in the U17 category (**10.49%**), while the lowest percentage of points scored via this action is observed in U20 (**8.23%**). This pattern reflects the greater emphasis on open standing exchanges and direct technical execution in younger age groups. The **LIFT-SUPLEX** technique shows the highest prevalence in the **U20 category (10.27%)**, with only slightly lower values observed in U23 and Senior wrestlers. The lowest frequency of this technique is found in **U17 (6.63%)**. Successful execution of lift-suplex actions requires substantial strength to elevate the opponent from the parterre position, a physical capacity that is still underdeveloped in the youngest age group. For **STEP OUT** situations, a higher proportion of points is observed in older age categories (**U23 and Seniors**). While younger wrestlers place greater emphasis on executing wrestling techniques, older wrestlers increasingly apply tactical strategies aimed at scoring points with minimal risk, using mat control and positional pressure to force step-out situations.

Graph 2. The five most represented points for wrestling techniques and points for non-technical points by age



categories (in %)

SCORING PATTERNS BY WEIGHT CATEGORIES

When examining points scored across weight categories, it can be concluded that wrestlers competing in the **67 kg** weight category demonstrate the broadest technical repertoire and achieve the highest number of points through a diverse range of wrestling techniques in three age categories (**Seniors, U23, and U20**). In the **U17** category, wrestlers in the **48 kg** weight category show the highest performance in as many as four different wrestling techniques compared to other weight categories (Table 2).

Table 2. Highest number of won point by technics, weight category and age group

No	AGE CATEGORY	SEN		U23		U20		U17		TOTAL POINTS	AVERAGE POINTS
		Cat/kg	pts	Cat/kg	pts	Cat/kg	pts	Cat/kg	pts		
1	GUT WRENCH	130	64	87	76	97	66	92	88	294	73.50
2	PASSIVITY	87	63	67	52	72	44	60	49	208	52.00
3	LIFTS – SUPLEX	67	45	77	37	60	46	60	45	173	43.25
4	TAKE DOWN	72	36	82	32	55	28	55	34	130	32.50
5	STEP OUT	77	35	55	31	67	38	92	19	123	30.75
6	SUPLEX THROW	72	22	67	24	67	12	80	32	90	22.50
7	HIP TURNING THROV	60	20	97	18	82	22	48	20	80	20.00
8	FORWARD BEDING THROV	60	20	130	12	72	24	71	20	76	19.00
9	LIFTS – REVERSE GRIP	67	34	63	10	67	12	48	10	66	16.50
10	SHOULDER TURNING THROW	67	20	97	14	60	12	110	14	60	15.00
11	TAKE DOWN HEAD TO HEAD	55	2	67	6	130	10	48	34	52	13.00
12	TURN OVER	55	16	60	8	55	14	60	10	48	12.00
13	FRONT HEAD LOOCK	0	0	67	14	130	4	48	12	30	7.50

When points are analyzed according to the highest number of points scored by technique and weight category, the following patterns emerge:

- For the **GUT WRENCH** technique, which accounts for the highest number of points overall, dominance is observed primarily in **heavyweight** categories (**130 kg, 97 kg, and 87 kg**), as well as in the **U17** category at **88 kg**.
- **PASSIVITY** points are most prevalent in middleweight categories (**67 kg, 72 kg, and 87 kg**), while in the **U17** category they are most pronounced in the **60 kg** weight class.
- The **LIFT-SUPLEX** technique is most frequently applied in **middle (67 kg and 77 kg) and lighter** weight categories (**60 kg**). In the **U17** category, the highest number of points scored with this technique was recorded in the **55 kg** weight class.
- The **TAKE DOWN** technique is most prevalent in **middleweight** categories among **Seniors and U23** wrestlers (**72 kg and 82 kg**), while in the **U20** category the highest number of points from this technique were recorded in the **55 kg** weight class. In the **U17** category, the greatest number of points from **take-down** actions was also observed at **55 kg**.
- For **Seniors and U23**, the highest total number of points was recorded in **middleweight** categories (**77 kg and 67 kg**). In contrast, **U20** wrestlers achieved the highest total points in the **55 kg** weight class, while in **U17** the highest number of points was observed in the **92 kg** category.

WQ/min - TOTAL PER AGE CATEGORY

The **WQ/min index** represents one of the most important indicators in the analysis of wrestling match quality, as it reflects the number of points scored per minute (pts/min). Higher values of this index indicate more dynamic, attractive, and spectator-friendly wrestling. The WQ/min values obtained in this analysis (Chart 3) are in line with expectations.

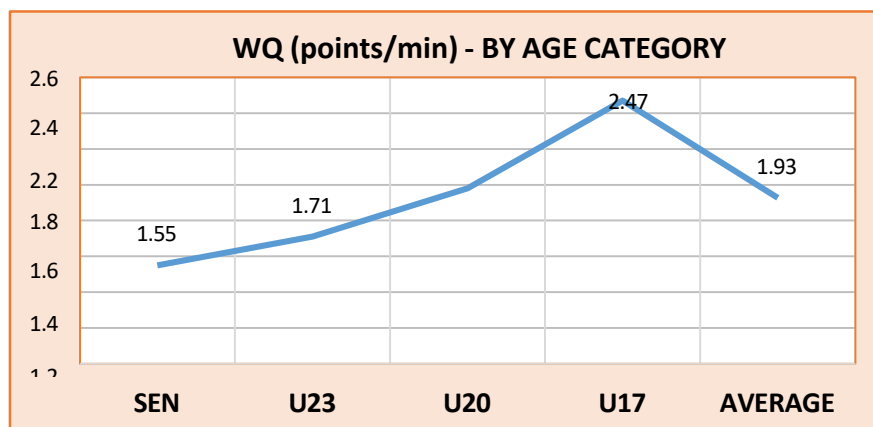


Chart 3. WQ – points / minutes by age category – GR

The lowest number of points per minute was recorded in the **Senior** category (**1.55 pts/min**). Each successive younger age category demonstrated a higher WQ index, with the highest value observed in the **U17** category, where an exceptionally high index of **2.47 points per minute** was recorded.

As age increases, the level of tactical preparation for matches also increases, leading wrestlers to engage less frequently in high-risk situations and to attempt fewer high-amplitude techniques. In contrast, **younger wrestlers are more prone to risk-taking and more frequently attempt throwing techniques**. An additional factor contributing to the lower number of points per minute in older age categories is the substantial difference in strength compared to U17 wrestlers. With increasing strength, wrestlers are better able to neutralize opponents and more effectively prevent scoring actions against them.

Compared to the other two Olympic wrestling styles (Freestyle and Women's Wrestling), Greco-Roman wrestling demonstrates a **significantly lower WQ/min** index across all four age categories

POINTS IN PERCENTAGE (%): STANDING POSITION / PARTERRE POSITION

The results indicate that, on average, **57.49%** of points are scored from the **standing position**, with the largest contribution coming from points scored through **PASSIVITY** (15.88% of points, Chart 2). Analysis of the first point scored from passivity (all age groups combined) shows that the win rate after scoring the first point is 69.9%. Logistic regression analysis revealed that scoring the first point is a strong predictor of match outcome. Wrestlers who

scored the first point had significantly higher odds of winning the match (**OR = 7.63, 95% CI: 5.67–10.25, p< 0.001**), increasing their chances of victory by approximately 7.6 times.

The observed differences in points scored from standing and parterre positions fall within the expected range, except in the U20 age category, where a significantly higher proportion of points was scored from the parterre position (Chart 4). This can be explained by the fact that, in the U20 category, two wrestling techniques—**GUT WRENCH** and **LIFT-SUPLEX**—are considerably more prevalent compared to the other three age groups.

The **Chi-square test** revealed a **statistically significant association between age category and the distribution of points between standing and parterre positions** ($\chi^2 = 14.54$, $df = 3$, $p = 0.002$). This suggests that the relative contribution of standing and parterre scoring differs depending on developmental stage, reflecting changes in match structure and tactical emphasis associated with age. The relationship between points scored from standing and parterre positions changes with age, **indicating a gradual shift in tactical priorities as wrestlers progress toward senior-level competition.**

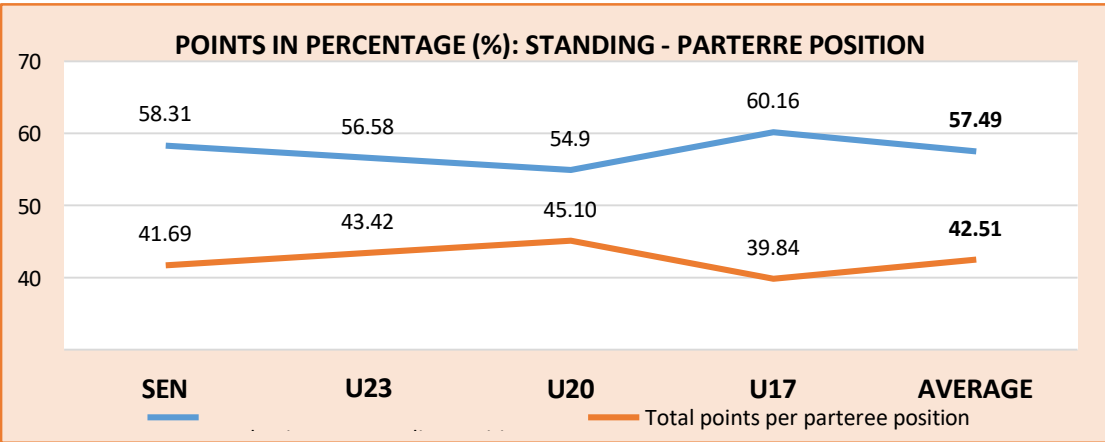


Chart 4. Standing – parterre position ratio (%) by age groups

POINTS IN PERCENTAGE (%): TECHNICAL POINTS / OTHER POINTS

The results fall within the expected range. In the senior category, the highest degree of tactical maneuvering is observed, resulting in a large proportion of points being scored from passivity and the opponent stepping out of the mat. Specifically, **33.29% of points in seniors do not originate from wrestling techniques but from penalty points** (passivity, stepping out, challenges, etc.). In contrast, in the youngest **U17** age group, the highest proportion of points is scored **from wrestling techniques**, reaching **74%**, which aligns with expectations (Chart 5).

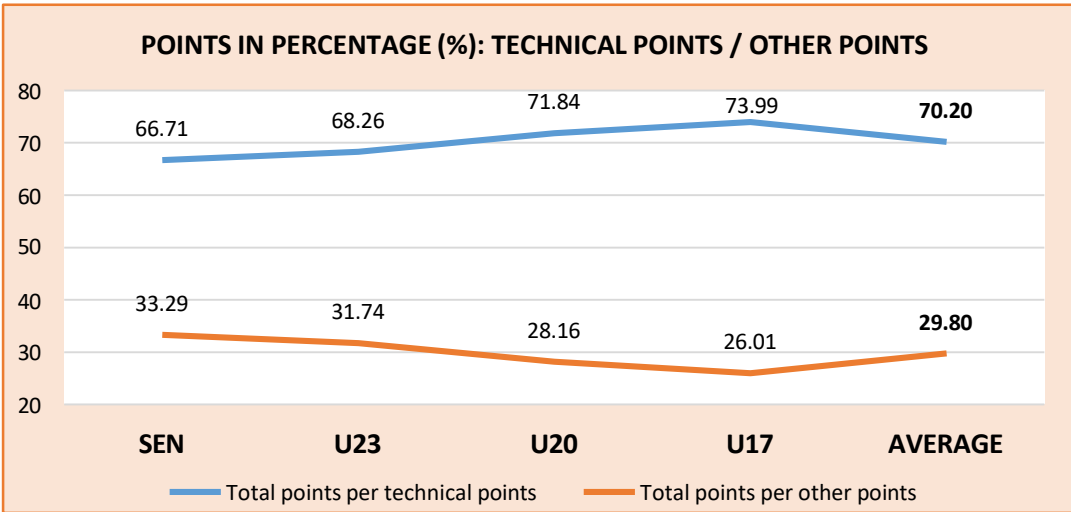


Chart 5. Technical – other points ratio (%) by age groups

Chi-square analysis revealed a statistically significant association between age category and the share of technical versus non-technical points ($\chi^2 = 36.81$, $df = 3$, $p < 0.001$). Although the effect size was small (**Cramér's V = 0.063**), the results indicate consistent changes in the scoring structure with age, showing a gradual increase in the relative contribution of non-technical points at higher competitive levels in older age categories. While technical actions remain the primary source of points across all age groups, the relative importance of non-technical points increases with age, highlighting the growing role of **tactical control and match management** in senior-level competitions.

PERCENTAGE OF MATCHES BY WAY OF WINNING

The obtained data (Table 3) indicate that, in the **senior category**, the **highest proportion of matches concluded after the full 6 minutes of combat** was recorded (**63.4%**), comprising **55.0%** at VPO1 and **8.4%** at VPO, which are points wins with or without a point scored by the defeated wrestler.

Table 3. Type of winning by age groups (%)

AGE GROUPS	VPO1	VSU	VPO	VFA	VSU1	VIN	VFO	VCA
SENIORS	55.0	22.5	8.4	6.3	5.9	1.6	0.3	0.0
U23	49.8	27.1	5.7	6.0	8.4	1.0	1.7	0.0
U20	42.6	30.9	5.1	8.5	12.1	0.0	0.4	0.4
U17	53.1	20.5	9.4	8.0	7.3	1.0	0.3	0.3
AVERAGE	50.1	25.3	7.2	7.2	8.4	0.9	0.7	0.2

Legend: **VPO1** - VICTORY BY POINTS (With point(s) scored by the opponent); **VSU** - VICTORY BY TECHNICAL SUPERIORITY (Without any point scored by the opponent); **VPO** - VICTORY BY POINTS (Without any point scored by the opponent); **VFA** – VICTORY BY FALL (Victory by fall); **VSU1** - VICTORY BY TECHNICAL SUPERIORITY (With point(s) scored by the opponent); **VIN** - VICTORY BY INJURY (If an athlete is injured before or during a bout); **VFO** - VICTORY BY FORFEIT (If an athlete doesn't show up on the mat); **VCA** - VICTORY BY 3 CAUTIONS (3 cautions given to the opponent during a bout)

The highest proportion of **victories by fall (VFA 5-0)** was recorded in the **U20** age category (**8.5%**). This category also showed the highest proportion of victories by technical superiority without the opponent scoring points (**VSU 4-0**) (**30.9%**), as well as the highest proportion of victories by technical superiority with the opponent scoring points (**VSU1 4-1**) (**12.1%**).

In the **U17** age category, the highest proportion of victories by points without the opponent scoring technical points under penalty (**VPO, 3-0**) was observed (**9.4%**). Additionally, matches in which opponents scored technical points under penalty (**VPO1, 4-1**) accounted for **53.1%**.

It was also observed that **1.6%** of senior matches ended with a **victory due to injury (VIN 5-0)**.

NATIONAL TEAM PERFORMANSE – MOST WIN POINTS / FIRST 3. NATIONS

When considering the most successful teams based on the **total points scored** across the four age categories (Table 4), the national teams of **Iran** stand out, ranking among the top three teams in all four age groups. In the senior, **U20**, and **U17**, Iran achieved the highest number of points, while in the **U23** it ranked second.

The **UWW team** ranked among the top three teams in three age categories. It is important to note that the UWW team included wrestlers from two countries (**RUS** and **BLR**), which resulted in more than 10 wrestlers per age category in this selection, affecting the overall total points scored.

The most frequently used techniques in terms of points scored among all nations are: **GUT WRENCH**, **PASSIVITY**, and **TAKE DOWN**.

Table 4. The three best national selections by age category and the three most common techniques (according to points won)

AGE GROUP	NATION	1st technique	bestpts	2nd technique	bestpts	3th technique	bestpts	TOTAL pts
SENIORS	IRI	take down	54	gut wrench	42	step out	32	243
	UWW	gut wrench	42	passivity	39	lift - suplex	30	191
	AZE	lift - suplex	33	passivity	24	gut wrench, take down	22	150
U23	IRI	gut wrench	68	take down	50	passivity	30	262
	UWW	gut wrench	42	passivity	40	take down	20	228
	KAZ	gut wrench	38	lift - suplex	21	step out, take down	20	154
U20	UWW	gut wrench	130	take down	32	passivity	29	306
	IRI	gut wrench	58	passivity	28	lift - suplex	27	224
	AZE	lift - suplex	58	passivity	27	gut wrench	16	186
U17	IRI	gut wrench	50	take down	34	passivity	30	203
	KAZ	gut wrench	72	take down	24	passivity	21	197
	UZB	gut wrench	54	passivity	21	lift - suplex	20	197

When examining the frequency of executed actions in Table 5, it can be observed that, based on frequencies (considering the three most prevalent parameters per team), the **gut wrench** was the most frequently applied technique across **all national teams**. **Passivity** ranked second, with a total frequency of 10. exceptions were the **Iranian** senior national team and the **Kazakhstan U23** team, for which passivity did not appear among the three most frequently used techniques. A substantial number of frequencies among the top three techniques was also recorded for the **take-down**, which was observed 8 times out of a possible 12.

When considering the total number of points scored, the **gut wrench** stands out markedly, accounting for a total of 602 points. A **notable negative finding** is the **very high number** of points scored through **passivity**, totaling 289 points. The **take-down** ranked third, with 256 points scored.

Table 5. Frequency and points scored as 1st, 2nd, and 3rd technique across age groups

	Technics	1st best techn.		2nd best techn.		3th best techn.		TOTAL freq.	TOTAL pts
		Freq.	Pts.	Freq.	Pts.	Freq.	Pts.		
1.	TAKE DOWN	1	54	4	140	3	62	8	256
2.	GUT WRENCH	9	554	1	42	2	16	12	602
3.	LIFT - SUPLEX	2	91	1	21	3	77	6	189
4.	PASSIVITY	0	0	6	179	4	110	10	289
5.	STEP OUT	0	0	0	0	2	32	2	32

IRAN

In three age categories, **the highest number of points was scored using the GUT WRENCH technique** while in the senior category the **highest number of points was scored with the TAKE DOWN** technique. For most of the top-performing teams Iran, points scored for **PASSIVITY** rank third in the total points; in contrast, for most other nations passivity points rank second. Notably, in the **senior** category the **STEP OUT** segment ranks third in terms of total points scored. (Charts 6,7,8,9).

UWW

Data were analyzed for a total of **56 wrestlers** across the four age categories, whereas for other nations a total of 40 wrestlers were analyzed (10 per age category). UWW wrestlers scored the highest number of points with the **GUT WRENCH** technique in three age categories. Points for **PASSIVITY** rank second across all three age categories (seniors, U23, and U20). In the senior category, points scored with **LIFT-SUPLEX** from the parterre position rank third. (Charts 6,7,8).

AZE and KAZ

The AZE and KAZ national teams rank among the top three teams in two age categories. In the AZE team, the highest number of points in the senior and U20 categories was scored using **LIFT-SUPLEX** from the parterre position, with points for **PASSIVITY** ranking second. A characteristic of **KAZ wrestlers** is that their most effective technique is **GUT WRENCH** in the **U23** and **U17** categories, with a significant number of points also scored with **TAKE DOWN**. (Charts 6,7,8,9).

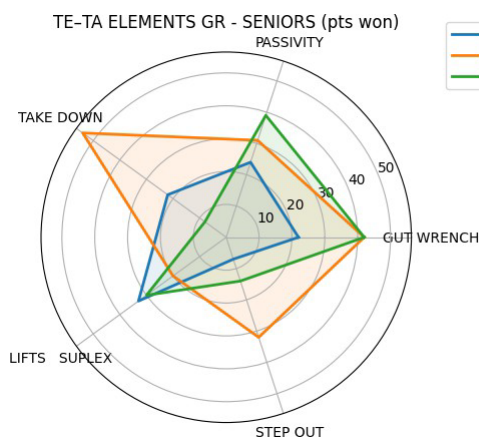


Chart 6. Visual comparison – SENIORS

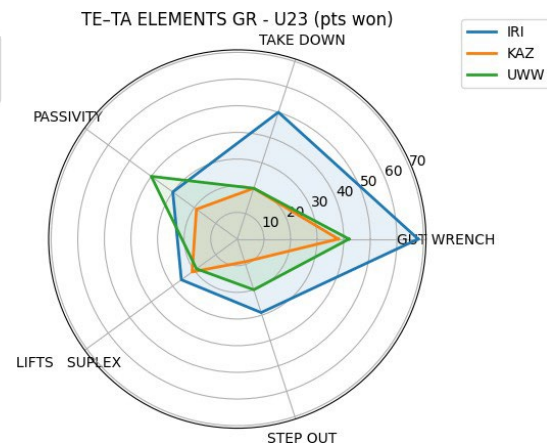


Chart 7. Visual comparison – U23

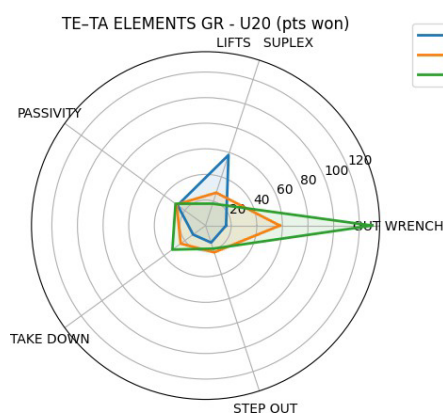


Chart 8. Visual comparison – U20

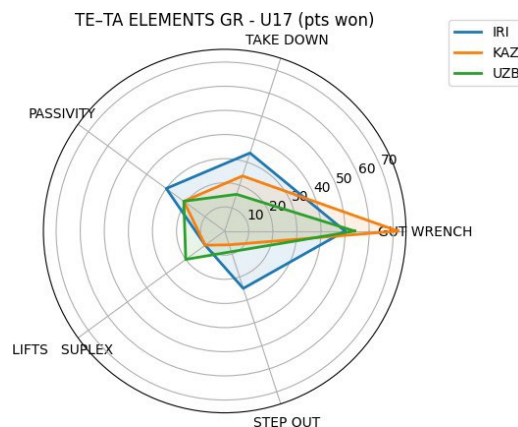


Chart 9. Visual comparison – U17

REVIEW OF % POINTS „ALL MATCHES“, „MEDAL MATCHES FINALS I-II, III-V“, „ALL MATCHES OF WINNERS – GOLD MEDALIST“

The analysis of matches by competition phases (“all matches,” “medal matches I–II and III–V,” and “all matches of winners—gold medalists”) in Greco-Roman wrestling showed that the **gut wrench** was the most frequently

executed technique across all phases and age categories (Table 6), accounting on average for **23.06%** of all points scored across all age categories and across the three competition phases that were analyzed separately.

Across all age categories, points awarded for **passivity** ranked second in frequency, with an average of **16.79%** of all points scored across all age categories and across the three competition phases analyzed.

Two wrestling techniques—the **take-down** (average **12.25%** of all points scored) and **parterre lifts and throws (lift-suplex)** (average **10.24%** of all points scored)—ranked third in terms of the number of points scored.

- The highest proportion of points scored with **GUT WRENCH** in **medal matches** (I–II and III–V places) was observed in the U20 age category, accounting for **27.89%** of points.
- The highest proportion of points for **PASSIVITY** in **medal matches** was observed in the **U23** category, amounting to **20.09%** of points.
- The highest proportion of points scored with **LIFT–SUPLEX** in **medal matches** was observed in the U20 category, accounting for **10.36%** of points.
- The highest proportion of points scored with **TAKE DOWN** was observed in **matches of gold medalists**, who scored **15.87%** of their points using this technique.

Table 6. Review of % points „all matches“, „medal matches finals I-II, III-V“, „all matches of winners – gold medalist“

AGE GROUPS	COMPETITION PHASE	%,	I - best	%,	II - best	%,	III - best
		points	technique	points	technique	points	technique
SENIORS	ALL MATCHES	22..17	GUT WRENCH	18..51	PASIVITY	9..99	LIFT SUPLEX
	MEDAL MATCHES FINALS	20..75	GUT WRENCH	18..26	PASIVITY	12..45	TAKE DOWN
	ALL MATCHES OF WINNERS	19..87	GUT WRENCH	19..87	PASIVITY	14..74	TAKE DOWN
U23	ALL MATCHES	21..95	GUT WRENCH	16..18	PASIVITY	10..41	TAKE DOWN
	MEDAL MATCHES FINALS	23..36	GUT WRENCH	20..09	PASIVITY	10..28	TAKE DOWN
	ALL MATCHES OF WINNERS	20..32	GUT WRENCH	17..78	PASIVITY	15..87	TAKE DOWN
U20	ALL MATCHES	25..30	GUT WRENCH	14..51	PASIVITY	10..27	LIFT SUPLEX
	MEDAL MATCHES FINALS	27..89	GUT WRENCH	13..55	PASIVITY	10..36	LIFT SUPLEX
	ALL MATCHES OF WINNERS	20..11	GUT WRENCH	17..66	PASIVITY	10..33	LIFT SUPLEX
U17	ALL MATCHES	24..19	GUT WRENCH	14..30	PASIVITY	10..49	TAKE DOWN
	MEDAL MATCHES FINALS	21..80	GUT WRENCH	15..41	PASIVITY	12..03	TAKE DOWN
	ALL MATCHES OF WINNERS	24..04	GUT WRENCH	15..35	PASIVITY	11..76	TAKE DOWN

When examining the frequency of executed actions in **Table 7**, it can be observed that, based on frequencies (considering the three most prevalent parameters according to points scored from wrestling techniques and other scoring actions), the **GUT WRENCH** was the most frequently applied technique across all competition phases, with **12** frequencies. **PASSIVITY** ranked second, also with **12** frequencies, consistently occupying the second position across all phases.

A substantial number of frequencies among the top three techniques was also recorded for the **TAKE-DOWN**, which occurred **8 times**, as well as for the **LIFT–SUPLEX** technique, which was recorded **4 times**.

Table 7. Frequency of 1st, 2nd and 3rd technique for all matches, medal matches finals and all matches of winners

	TECHNIQUE	I best technique	II best technique	III best technique
1	GUT WRENCH	12		
2	PASIVITY		12	
3	TAKE DOWN			8
4	LIFT - SUPLES			4

TECHNIQUES EXECUTION BY TIMELINE (ALL MATCHES)

The analysis of technique execution over time was conducted for the three wrestling techniques that score the highest number of points across all matches (Table 9). This segment of the match should be considered separately for the senior, U23, and U20 age categories, where matches last 6 minutes (360 seconds), compared to the U17 category, where matches last 4 minutes (240 seconds).

Table 8. Timeline of technique execution by age groups (all matches)

AGE GROUP	0-360 SECOND	1-Nbr. points	I best technique	2-Nbr. points	II best technique	3-Nbr. points	III best technique
SEN	0-60 second	56	TAKE DOWN	40	SHOULDER TURNING THROW	34	GUT WRENCH
	61-120 second	272	GUT WRENCH	258	PASSIVITY	117	LIFT - SUPLEKS
	121-180 second	86	GUT WRENCH	46	STEP OUT	32	TAKE DOWN
	181-240 second	140	PASSIVITY	72	GUT WRENCH	36	STEP OUT
	210-300 second	50	LIFT - SUPLEKS	48	GUT WRENCH	38	TAKE DOWN
	301-360 second	29	STEP OUT	28	STANDING CHALLENGE	22	TAKE DOWN
U23	0-60 second	58	GUT WRENCH	50	TAKE DOWN	36	HIP TURNING THROW
	61-120 second	266	GUT WRENCH	222	PASSIVITY	108	LIFT - SUPLEX
	121-180 second	62	GUT WRENCH	48	STEP OUT	36	TAKE DOWN
	181-240 second	117	PASSIVITY	56	GUT WRENCH	42	TAKE DOWN
	210-300 second	48	GUT WRENCH	34	LIFT - SUPLEKS	32	TAKE DOWN
	301-360 second	26	STEP OUT	24	STANDING CHALLENGE	16	STANDING COUNTER
U20	0-60 second	64	GUT WRENCH	46	TAKE DOWN	33	STEP OUT
	61-120 second	336	GUT WRENCH	199	PASSIVITY	129	LIFT - SUPLEX
	121-180 second	48	GUT WRENCH	46	LIFT - SUPLEKS	28	STEP OUT
	181-240 second	108	PASSIVITY	76	GUT WRENCH	31	STEP OUT
	210-300 second	52	GUT WRENCH	28	LIFT - SUPLEKS	27	STEP OUT
	301-360 second	32	FORWARD BENDING THROW	26	STANDING COUNTER	23	STEP OUT

U17	0-60 second	176	PASSIVITY	128	GUT WRENCH	64	TAKE DOWN
	61-120 second	298	GUT WRENCH	72	LIFT - SUPLEKS	70	TAKE DOWN
	121-180 second	121	PASSIVITY	88	GUT WRENCH	52	TAKE DOWN
	181-240 second	56	TAKE DOWN	44	GUT WRENCH	42	SUPLEX-THROW
	210-300 second	X	X	X	X	X	X
	301-360 second	X	X	X	X	X	X

GREEN	Most points in that minute of the match
BLUE	Fewest points in that minute of the match

GENERAL CONCLUSION

As shown in Table 8, the highest number of points per single wrestling technique across all age categories is scored in the **second minute of the match**, with the exception of the **U17** category, where the highest number of points is scored in the **first minute**. This difference can be explained by the fact that matches in the U17 category last a total of **four minutes**. In **U17** matches, the highest number of points is scored in the first minute because referees award a passivity point after **45 seconds**, after which wrestlers frequently score points from the parterre position.

In the **Senior, U23, and U20** age categories, the **fourth minute** of the match ranks second in terms of the number of points scored. This is an expected finding, given that passivity is awarded after **35–40 seconds** from the beginning of the second period, which corresponds to the fourth minute of the match.

First minute of the match

Out of the **12 analyzed segments**, the wrestling techniques **GUT WRENCH** and **TAKE DOWN** stand out as the most frequently executed in the first minute across all four age categories. Exceptions include **SHOULDER TURNING THROW** in **seniors**, **HIP TURNING THROW** in **U23**, and **STEP OUT** in **U20**.

Second minute of the match

Across **12 analyzed segments**, the most frequent techniques in three age categories are **GUT WRENCH**, **PASSIVITY**, and **LIFT–SUPLEX**. The only exception is the **U17** category, where a significant number of points in the second minute were scored using **TAKE DOWN**.

Third minute of the match

Across **12 segments**, **GUT WRENCH** and **TAKE DOWN** are the most prominent techniques in **all four age categories**, while the **STEP OUT** segment stands out in three age groups (**seniors, U23, U20**). In **U17**, the highest number of points in the third minute was scored for **PASSIVITY**, which is expected given that the match lasts 2 + 2 minutes.

Fourth minute of the match

Out of **12 analyzed segments**, only **GUT WRENCH** is prominent across **all age categories**. In **three age categories (seniors, U23, U20)**, **PASSIVITY** accounts for the highest number of points. In **U17**, the highest number of points in the fourth minute was scored using **TAKE DOWN, GUT WRENCH, and SUPLEX**.

Fifth minute of the match

Out of **9 analyzed segments**, two techniques stand out across three age categories (**seniors, U23, U20**): **GUT WRENCH** and **LIFT–SUPLEX**. In **seniors**, **GUT WRENCH** is the most frequently executed technique in the fifth minute. In **U20**, **STEP OUT** also stands out in terms of points scored in this minute.

Sixth minute of the match

Out of **9 analyzed segments**, only **STEP OUT** is prominent across the three age categories (**seniors, U23, U20**). Notably, in seniors and **U23**, a significant number of points were scored through **STANDING CHALLENGE** and **TAKE DOWN**. In **U20**, the highest number of points in the sixth minute was scored with **FORWARD BENDING THROW**. In both **U23** and **U20**, a large number of points were scored using **STANDING COUNTER**. The reason for the high number of points for a lost challenge in the last minute of a match is because coaches very often throw a challenge for no reason out of anger that their wrestler lost the match.

MOST SUCCESSFUL WRESTLER (MSW)

Based on the analysis of the most successful champions by age category, data were obtained identifying which wrestlers were most successful according to six main criteria:

- Number of points scored in relation to total match duration;
- Number of classification points lost in relation to the total number of matches;
- Number of points scored in relation to total match duration;
- Number of classification points lost in relation to the total number of matches;
- Total duration of all matches contested by champions;
- Total number of matches contested by champions.

Out of the four age categories, **Iranian wrestlers (IRI)** were the most successful in three categories (**seniors, U23, and U17**). Only in the U20 category was the most successful wrestler from **Uzbekistan** (Table 9).

Considering the **MSW index**, the best wrestler in Greco-Roman style was the **U23** champion, **FAROKHISENJANI JAVAD (IRI)**, with an index of **8.05**. This wrestler competed in five matches totaling **10.07 minutes**, during which he scored **44 technical points** and conceded only **1 point**. He also earned **20 classification points**, conceding only **1 classification point**, meaning that all five matches were won by **technical superiority**.

Table 9. Review of the most successful wrestler (MSW) by age groups

AGE GROUPS	Wrestler	NAT	WEIGHT/CAT	MSW INDEX
SENIORS	ESMAEILI GHOLI	IRI	67 kg	5.67
U23	FAROKHISENJANI JAVAD	IRI	87 kg	8.05
U20	KHALMAKHANOV AYTJAN	UZB	63 kg	5.35
U17	MOHAMMADI BEHNAM	IRI	92 kg	5.68

WINNERS (CHAMPIONS) / WIN- LOST POINTS

Table 10 presents, by age category, the techniques used by champions to score the highest number of points in each age group, classified as the **most successful technique**, **second most successful technique**, or **third most successful technique**.

Across all four age categories, champions scored the highest proportion of points using the **gut wrench** technique, ranging from **22.00% (U17)** to **27.92% (Seniors)**.

Table 11 presents, by age category, the techniques through which champions conceded the highest number of points in each age group, also classified as the **most**, **second most**, or **third most significant** technique.

Across all four age categories, champions conceded the highest proportion of points due to **passivity**, ranging from **26.51% (U20)** to **49.58% (Seniors)**.

Percentage (%) of Points WIN by Champions

Table 10 also presents, by age category, the distribution of points scored by champions from wrestling techniques and other scoring actions, categorized into **three dominance levels**, expressed as percentages (%):

- **1st Dominant Technique:**

Across all four age categories, champions scored the highest proportion of points using the **GUT WRENCH** technique, ranging from **22.00% (U20)** to **27.92% (Seniors)**.

- **2nd Dominant Technique:**

Across all four age categories, champions in three age groups scored the highest proportion of points using the **TAKE-DOWN**, ranging from **12.99% (U17)** to **16.73% (Seniors)**.

- **3rd Dominant Technique:**

Across all four age categories, champions in three age groups scored the highest proportion of points from **PASSIVITY**, ranging from **12.34% (U17)** to **14.45% (Seniors)**.

Table 10. Overview of the frequency of the 1st, 2nd and 3rd technique by points won

AGE GROUPS	Points Won	1.-%	1 best technique	2.-%	2 best technique	3.-%	3 best technique
SENIORS	Points Won	23.57	GUT WRENCH	16.73	TAKE DOWN	14.45	PASSIVITY
U23	Points Won	23.31	GUT WRENCH	16.54	TAKE DOWN	13.91	PASSIVITY
U20	Points Won	22.00	GUT WRENCH	13.67	PASSIVITY	12.67	LIFT-SUPLEX
U17	Points Won	27.92	GUT WRENCH	12.99	TAKE DOWN	12.34	PASSIVITY

Percentage (%) of Points LOST by Champions

Table 11 presents data by age category on the points conceded by champions through wrestling techniques and other scoring actions, classified into **three dominance levels** and expressed as percentages (%).

- **1st Dominant Technique:**

Across all four age categories, champions conceded the highest proportion of points from the **GUT WRENCH** technique, ranging from **22.00% (U20)** to **27.92% (Seniors)**.

- **2nd Dominant Technique:**

Across all four age categories, champions conceded the highest proportion of points from **SUPLEX THROW** in the **U23** category (**16.33%**), while the lowest proportion within this rank was observed in the **Senior** category (**12.24%**) from the **front head lock** technique.

- **3rd Dominant Technique:**

Across all four age categories, champions conceded points in two age categories from **STEP-OUT** situations and the **GUT WRENCH** technique. The highest proportion of step-out points was recorded in the **U23** category (**12.24%**), while the lowest was observed in the **Senior** category (**8.16%**).

Frequency of Executed Actions

Points WON:

Based on frequency analysis (considering the three most frequent outcomes in points scored from wrestling techniques and other scoring actions), the **GUT WRENCH** is the absolutely dominant technique by which champions win points in all their matches with a frequency of four. The second most effective technique in terms of points scored was the **TAKE-DOWN**, with a frequency of three. The third segment was **PASSIVITY**, also with frequency of three (Table 12).

Points LOST:

Based on frequency analysis (considering the three most frequent outcomes in points conceded from wrestling techniques and other scoring actions), champions conceded the highest number of points across all four age categories in all their matches, with a frequency of four. This means that **PASSIVITY** accounted for the largest proportion of points conceded across all age categories. The second highest category of points conceded was **STEP-OUT**, with a frequency of three. The third segment included both the **GUT WRENCH** and **STEP-OUT**, each with a frequency of two (Table 12).

Table 11. Overview of the frequency of the 1st, 2nd and 3rd technique by points lost

	LOST pts	%	1 best technique	%	2 best technique	%	3 best technique
SENIORS	LOST POINTS	48.98	PASSIVITY	12.24	FRONT HEAD LOCK	8.16	STEP OUT
U23	LOST POINTS	38.78	PASSIVITY	16.33	SUPLEX THROW	12.24	STEP OUT
U20	LOST POINTS	35.29	PASSIVITY	13.24	STEP OUT	11.76	GUT WRENCH
U17	LOST POINTS	26.51	PASSIVITY	14.46	STEP OUT	9.64	GUT WRENCH

Table 12. Overview of the frequency of the 1st, 2nd and 3rd techniques (frequencies) for all matches of gold medal winners (champions)

WON – LOST pts	TECHNIQUE	I best technique	II best technique	III best technique
WION POINTS	GUT WRENCH	4	0	0
	PASSIVITY	0	1	3
	TAKE DOWN	0	3	0
	LIFT-SUPLEX	0	0	1
LOST POINTS	GUT WRENCH	0	0	2
	PASSIVITY	4	0	0
	FRONT HEAD LOCK	0	1	0
	SUPLEX THROW	0	1	0
	STEP OUT	0	2	2

KEY FINDINGS

1. Wrestling efficiency (WQ) decreases with age

Wrestlers under 17 years of age demonstrated the highest wrestling efficiency (points per minute), with a statistically significant decline observed when moving to the U20 age group. From U20 onwards (U20, U23, seniors), match intensity remained relatively stable, indicating a shift from high-tempo wrestling toward controlled and strategically oriented performance.

2. Transition phase occurs around age 20

The most pronounced developmental change was observed between the U17 and U20 age groups. This transition phase is characterized by reduced scoring tempo, improved tactical control, and more selective use of offensive actions.

3. Standing wrestling remains dominant across all age categories

In all age groups, the majority of points were scored from the standing position. However, the relative contribution of parterre actions increased in the U20 and U23 categories before slightly decreasing at the senior level.

4. Technical points decrease with age

The proportion of points scored through technical actions decreases with age, while points from PASSIVITY, STEP OUT, and CAUTION show a relative increase. This reflects pronounced tactical control and match management, particularly in senior age categories.

5. Limited age-related differences in most techniques

For most individual technical-tactical actions, no significant differences were observed across age groups. This suggests that the overall technical repertoire remains relatively stable, while effectiveness and contextual application of techniques develop with age.

6. Selected techniques show clear developmental patterns

A small number of techniques (e.g., TAKE DOWN; HEAD TO HEAD; SUPLEX) exhibited significant age-related differences, highlighting their importance in differentiating competitive performance at higher levels.

7. Scoring the first point strongly affects match outcome

Across all age categories, wrestlers who scored the first point had a significantly higher probability of winning the match. This effect remained consistent across all age groups, emphasizing the importance of early initiative in the bout, but also the new rule that the winner is the wrestler who wins the first point if the score is 1-1.

8. Considering the temporal parameters of matches by minute.

It can be concluded that the first minute of the match is of exceptional importance. The highest number of points in the first minute is scored using the TAKE-DOWN and GUT WRENCH techniques. This implies that coaches should take these data into account when planning training sessions. In Greco-Roman wrestling, during the second minute of the match, points scored with the GUT WRENCH and points awarded for PASSIVITY prevail significantly.

9. Analyzing the main characteristics of champions' results,

A basic conclusion can be drawn: champions achieve most of their victories through the GUT WRENCH and TAKE-DOWN techniques. A substantial proportion of points is also scored due to the opponent's PASSIVITY. Champions concede most points due to PASSIVITY and STEP-OUT situations. Based on these data, it is possible to develop a technical–tactical combat model with the best wrestlers.

IMPLICATIONS FOR UWW & COACHES

Strategic implications for UWW

- Competition analysis should be integrated into coach education programs to support evidence-based decision making;
- This and similar analyses can serve as valuable tools for modifying wrestling rules, particularly to reduce the proportion of points from passivity and enhance the attractiveness and effectiveness of the Greco-Roman style;
- Data from this or similar analyses can be useful for preventing injuries and enhancing athlete safety during matches.

Long-term wrestler development

The results confirm that competitive development in Greco-Roman wrestling follows a nonlinear trajectory, with a clear transitional phase occurring around the age of 20. Therefore, training models should be adapted to reflect the specific demands of each age and weight category, rather than prematurely applying senior-level performance expectations (early specialization in U17).

Coach focus by age category

- **U17** – Encourage offensive initiative and high wrestling tempo, accept greater variability and error rates as part of development, and focus on technical diversity rather than result control;
- **U20** – Gradually reduce unnecessary “point wastage” and develop match management skills;
- **U23** – Refine efficiency of key techniques and emphasize control of rhythm and tempo;
- **Seniors** – Focus on precision, timing, and efficiency, capitalize on opportunities to score the first point, and maintain balance between standing dominance and maximizing parterre technique effectiveness. Special attention must be paid to the development of static and dynamic strength in order to better defend against gut wrenches.

Training Focus

- **Scoring the First Point in a Match** – Practice pre-planned actions from grips (e.g., attacks on one hand then the other, double-hand attacks, etc.) during the first 20–30 seconds;
- **Mat Control and Step-Out Situations** – Mark a smaller circle on the mat with tape and conduct training within this limited area to improve wrestlers’ spatial awareness and control. On the standard mat, use only the inner circle (7 m diameter), considering the wrestler out of bounds if they step into the passivity zone;
- **Perfection in Dominant Techniques** – Increase repetitions and practice special techniques individually (“specials”) in both standing and parterre positions;
- **Match Outcome and Pace Management** – Conduct training matches with pre-defined scores (e.g., 4:0 or 1:1) to simulate defending or chasing points. There is a different way of conducting the match if the score is 0-4 or if the score is 1-1 and the wrestler loses the match;
- **Minimizing Technical Errors** – Use video analysis to identify critical mistakes and focus training on correcting specific details (e.g., lowering the elbow, adjusting posture or head position).

Training Methodology

- **Highly Specific Sparring Simulations of Tournament Format** – Simulate a tournament once every two weeks during training to enhance stress adaptation. It is necessary to respect the break time between matches of 20 minutes, which can be shortened to 12-15 minutes, as an overload in training compared to real competition);
- **Targeted Tactical Micro-Analysis** – After micro-analysis, simulate attacks or defenses tailored to specific opponents;
- **Individualized Technical Program** – Adjust techniques and workload according to each wrestler’s abilities;
- **Energy Efficiency and Recovery** – Use active recovery after match simulations (light running, jump rope, treadmill, resistance band stretching, etc.).

Development of Key Technical Segments

Priority Techniques (All Age Groups) – Practice techniques identified as dominant for each age group to improve both offense and defense, enhancing overall performance and efficiency:

- **Gut Wrench**
- **Take down**
- **Lift suplex**
- **Step out Control**
- **Tactics for Forcing Opponent's Passivity**

Training should focus on increasing execution success, multiple entries and throws of the same technique ("specials"), linking techniques in sequences, and practicing combinations (two techniques in a single action).

Training for Scoring the First Point

Since scoring the first point significantly increases the likelihood of victory, it is recommended to:

- **Planned Initial Attacks** – The highest intensity must be present at the end of the first minute of the match and this must be shown in the period from 45 seconds to 75 seconds of the first round;
- **Develop "Start Strategies"** – For different types of opponents (strategy for a taller and shorter opponent, for a faster opponent, for a stronger opponent, strategy for a wrestler who does good counter holds, etc.);
- **Initial Match Situation Drills** – Simulate the beginning of the match in the first 15 seconds, how and in what way to impose your fighting style 10-20 times in training, focusing on the work of the arms and legs in this period, as well as not giving the opponent the opportunity to score points in the first seconds of the match;
- **Aggressive Hand and Clinch Control** – Spend as much time as possible in training in offensively favorable and defensively unfavorable positions.

Development of Parterre Performance

The study confirms the high importance of ground wrestling, especially in the younger categories. Based on that, it is necessary to pay more attention to work in the parterre in the training process:

- Each wrestler must master at least two reliable parterre techniques ("specials");
- **Gut Wrench Defense** – Focus on appropriate parterre movement, and develop both static and dynamic strength;
- **Specific Development of Static and Isometric Strength**, especially for U17 wrestlers.

Development of Standing Wrestling and Mat Control

With age, the importance of standing wrestling increases:

- **Footwork and Distance Control** special attention should be paid to the development of reaction speed in younger age categories, the development of leg coordination, the development of agility and the correct position of the legs;
- **Clinch and Opponent Hand Control** – Spend significant training time in the clinch;
- **Step-Out Tactics** – to practice circular techniques by returning to the center, and in the offensive sense to practice placing the legs in a wide stance with the lowering of the center of gravity of the body and intense and coordinated work of the arms and legs, to move forward and push the opponent out of the circle;
- **Situational Sparring in Limited Space** – Situational bobs in a small space, e.g. area with a diameter of 5 or 7 meters (not counting the passivity zone as an integral part of the arena);
- **Specialized Techniques** – It is necessary to work on practicing one type of special technique for the back (take down) and one special technique from the group of wrestling techniques - throws.

Conditioning by Age Category

- **U17** – General motor skills, speed, agility;
- **U20** – Maximum strength and explosiveness;
- **U23** – Specific endurance and strength;
- **Seniors** – Optimization of energy efficiency (work on fitness preparation) and proper regeneration of seniors between two matches, as well as regeneration between two competitions.

Tactical Education of Athletes

It is recommended to systematically implement:

- Video analysis;

- Individual tactical planning;
- Opponent analysis;
- Match strategy planning based on available data;
- Integration of artificial intelligence (AI) for strategy preparation against targeted opponents.

Organization of Long-Term Development

The training system should:

- Follow a progression from technical breadth to tactical efficiency;
- Avoid prematurely enforcing the senior model in younger categories, especially U17;
- Allow individualization according to each wrestler's characteristics and weight class;

Organization of the Training Process

The training plan should ensure:

- Gradual progression of workload from U17 to Seniors;
- Balanced technical, tactical, conditioning, and strength work;
- Individual development plans for each wrestler;
- Continuous evaluation throughout the wrestler's career.

Role of the Coach

The coach must:

- Monitor training status through various testing methods;
- Plan the athlete's long-term development;
- Individualize training as much as possible;
- Continuously analyze both their wrestler's and opponents' performance;
- Develop and monitor psychological stability before, during, and after competitions;
- Continuously update knowledge and skills in all aspects of training and competition.

OLYMPIC QUALIFICATION FOR WRESTLING: HISTORICAL BACKGROUND AND A PROPOSAL FOR MODIFICATION OF RANKING SERIES SCORING USING STRENGTH OF OPPOSITION

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ABSTRACT

The aim is to provide the background and rationale for the use of qualification processes for participation in the Olympic Games with a focus on wrestling. Describe the evolution of the process used in wrestling, along with a description of the process for Los Angeles, 2028. Finally, we make a proposal for use in the allocation of points in the ranking series in these competitions, taking into account the quality of the athletes attending the event and awarding points based on the level of opponents faced.

HISTORY AND BACKGROUND

In the early days of the Modern Olympic Movement there was no consideration for qualification. With the establishment of the International Olympic Committee (IOC) in 1894 by Pierre de Coubertin, there were no IOC-wide quotas. Participation was coordinated through emerging National Olympic Committees (NOCs), which were responsible for selecting and funding athletes based on national eligibility and amateur standards. There were no caps on national team sizes.

Subsequent early Games expanded scope without formal quotas, as NOCs handled athlete nominations subject to IOC and International Federation (IF) approval for event-specific standards. The London Games of 1908 was the first official Olympics where athletes competed for their countries and marched into the stadium behind their respective national flags. It was the first time too that National Trials were held to select the representatives from each country (Voigt, 2021)

The 1956 Melbourne Game had 3,183 athletes from 72 countries with IFs standardizing event quotas—e.g., maximum 3 entrants per nation in many individual track events.

In the 1970s and 1980s, the International Olympic Committee (IOC) grappled with the escalating scale of the Summer Games, as decolonization and the addition of new sports drove participant numbers upward—from approximately 6,000 athletes in 1976 to over 8,000 by 1988. The 1990s saw the breakup of the Soviet Union and the breakup of Yugoslavia and the subsequent increase in the number of participating countries—prompting reforms to curb "gigantism" and venue overload.

See Table 1 for the costs associated with the increased scale of the Games, and Table 2 for the increases in the number of participants.

Table 1. Estimated Cost of Hosting the Olympics (in constant 2022 dollars, excluding infrastructure projects such as airports, roads and rail.)

Year	City	Cost	Overrun
1988	Seoul	Estimated \$4B	
1992	Barcelona	\$11.6B	266%
1996	Atlanta	\$4.7B	151%
2000	Sydney	\$5.2B	90%
2004	Athens	\$3.1B	49%
2008	Beijing	\$8.3B	2%
2012	London	\$16.8B	76%
2016	Rio de Janeiro	\$23.6B	352%
2021	Tokyo	\$13.7B	128%
2024	Paris	\$8.7B	115%

Source: Council on Foreign Relations

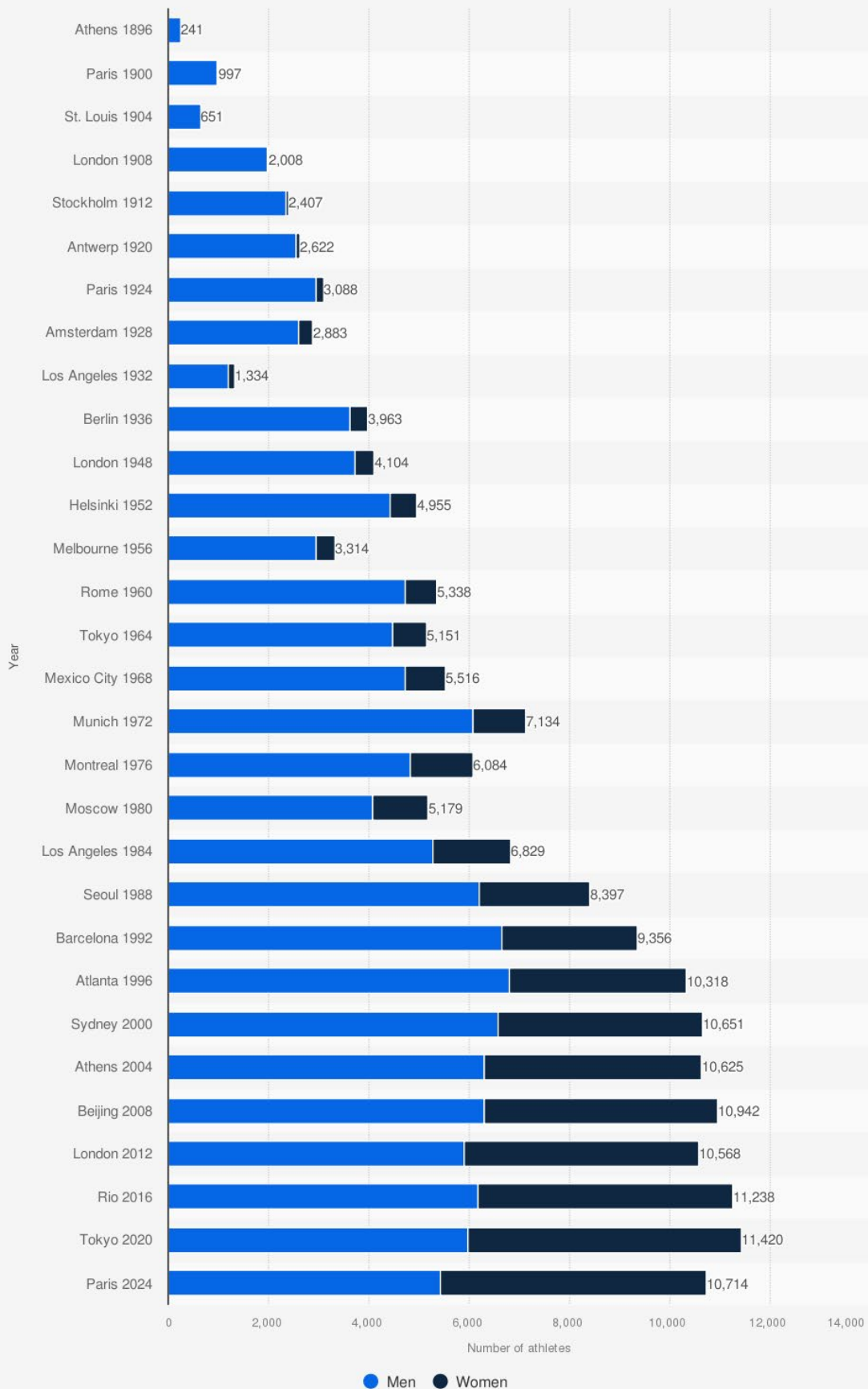


Table 2. Number of Male and Female Athletes Participating in the Summer Olympic Games From 1896 to 2024 (Source: Statista.com)

“Gigantism” in the Olympic Games was seen with escalating costs (see Table 1) and unsustainable development. Attempts to shrink the Olympics could be seen in efforts to control the number of athletes through quotas and qualification tournaments, reducing weight classes and even eliminating entire sports from its program. Boxing, weightlifting and wrestling have been long-standing sports in the Olympic program, and over the years, expanded their weight classes. At their peaks boxing had 12 classes, weightlifting and wrestling had 10. Both judo and taekwondo are relative newcomers, judo joined the Olympic program in 1964 and taekwondo in 2000. There had been a tremendous growth of the Olympic Games in the number of disciplines, events within disciplines and the number of athletes.

A quota was first put in place for the 1992 Barcelona Olympic Games that set limits on the number of competitors to 18 per weight class 360 wrestlers in 20 weight classes. The process was conducted through a qualification system whereby athletes qualified a weight class for their country through designated competitions. This created a reduction from Seoul 1988, where there were no restrictions, which had the all-time high of 429 wrestlers in 20 weight classes in two styles.

This procedure continued through the 1996 Games in Atlanta with the same 10 weight classes with up to 19 wrestlers per weight class with 401 total wrestlers.

Towards the end of the 20th century this rapid growth of the Olympics and international sport were feeling new social pressures. Beginning in 1997 we see a decline in the number of wrestling weight classes from 10 to 8, then to 7 in 2002. This trend continued through 2016 with weight classes in the Olympic Games reduced to 6. Two major forces were at work here: 1) The need to reign in the explosive growth of the Olympic Games; and 2) The drive for gender equity in sport.

In 2014, the International Olympic Committee (IOC) adopted Olympic Agenda 2020, among the goals was

- limit both the number of events and athletes at the Summer Games in order to control the growing size of the Games and the resulting managerial challenges;

This strategic plan influenced quota allocations by prioritizing sustainability, reducing overall athlete numbers, and promoting broader participation while maintaining competitive integrity. (IOC. Olympic Agenda 2020 drives progress and change. 11 December 2020).

This framework led to a cap of 10,500 athletes for the Paris 2024 Games, a reduction of 592 from Tokyo 2020's quota. Reductions came primarily from Weightlifting (76), Boxing (34) and Swimming (26) (IOC EB approves Olympic Qualification System Principles for Paris 2024. 16 October, 2021).

Stricter per-event caps were initiated, stabilizing athlete totals around 10,000 for the 1996 Atlanta and 2000 Sydney Games despite. The 1999 IOC 2000 reforms, capped Summer Games at 300 events (later adjusted to 280 maximum), forcing federations to tighten qualification criteria and quota formulas for sustainability (IOC: Recommendations for IOC reform finalized. 29 October, 1999).

Sydney 2000 saw a reduction to 8 weight classes with 18 to 20 wrestlers per weight class with 314 total wrestlers.

Athens 2004 saw a major change with the addition of women's wrestling, with 4 weight classes, and 12- 14 wrestlers in each class. Men's weight classes were reduced to seven, with 20-22 competitors per class. A total of 342 wrestlers.

Beijing 2008 maintained 7 weight classes for the two men's styles and 4 classes for women (17-18 wrestlers per bracket) and a total of 344 wrestlers.

London 2012 had the same 7 weight classes for the two men's styles and 4 classes for women (17-18 wrestlers per bracket) and a total of 344 wrestlers.

Rio de Janeiro 2016 experienced major changes as a result of the tumult that arose in 2013 when the IOC initially dropped wrestling from the Olympic Programme. All three styles were set to 6 weight classes, with 18-20 wrestlers per bracket.

Wrestling was dealt a major blow in 2013 when the International Olympic Committee voted to remove wrestling from the Olympics, citing poor internal governance and gender equity concerns. (IOC: IOC Executive Board recommends 25 core sports for 2020 Games, February, 2013). The reaction of wrestling world was quick. The IF changed its name from Fédération Internationale des Luttes Associées (FILA) to United World Wrestling; a new president was elected; the entire membership of FILA held a three-day Extraordinary Congress May 18 in Moscow; This Congress acted to improve on the three major areas of concern; rules of the sport, internal governance and gender equity. (UWW. 125th Session of the IOC, Buenos Aires, Argentina: How Wrestling Got Here. September 1, 2013)

The Extraordinary Congress was a success. An improved governance structure was announced, and recommended to the IOC that the number of women's weight classes be increased, and on August 9, 2013 the IOC Executive Board acted on this request and added two weight classes to the women's Olympic program, and announced that women's freestyle would include six weight classes in the 2016 Olympics. In order to achieve this, the men's disciplines of freestyle and Greco-Roman were reduced by one weight class, from seven to six each. This action reflects the high value that the International Olympic Committee placed on gender equity within its sports on the Olympic program. Wrestling was reinstated for the 2020 Games in an IOC meeting in 125th IOC Session in Buenos Aires.

Women in Olympic Combat Sport

Another key focus was advancing gender equality to enhance inclusivity, with female athlete participation rising from 44.2% at London 2012 to 48.8% at Tokyo 2020, facilitated by adding or expanding women's events in sports like athletics and reducing male-only slots accordingly. Women joined combat sport in the Olympics when women were added to the Judo program in 1992 and have enjoyed the same number of weight classes (7) as men since that time. Taekwondo was added for both men and women in 2000 with 4 classes for each. Women's Wrestling was added in 2004 with 4 classes. Women's Boxing was added in 2012 with 3 classes. Gender equity was attained in Paris.

For Paris 2024, the IOC enforced full gender parity for the first time, mandating equal quota places for men and women across all sports, supported by increasing mixed-gender events to 22 from 18 in Tokyo. These changes, approved in coordination with international federations, aimed to balance representation without inflating total quotas, though some federations reported challenges in reallocating spots to meet the 50/50 split.

The Olympic quota allocation system is the structured process governed by the International Olympic Committee (IOC) and international sports federations whereby participation spots in Olympic events are distributed to National Olympic Committees (NOCs), enforcing maximum entry limits per nation per discipline to curb dominance by elite sporting powers while incorporating merit-based qualification and exceptional provisions for underrepresented countries.

Tension Between Inclusivity and Merit

Developed through sport-specific qualification frameworks approved by the IOC, the system assigns quotas primarily via results from world championships, continental tournaments, and ranking lists, Total athlete participation remains capped, such as the core quota of 10,500 for the Los Angeles 2028 Games,

A key component involves universality places, reserved quotas awarded by the IOC's Tripartite Commission to NOCs averaging eight or fewer individual-sport athletes across recent Games like Rio 2016 and Tokyo 2020, enabling eligible nations—primarily from Africa, Oceania, and smaller Asian or American contingents—to field competitors in sports such as athletics, aquatics, and archery upon meeting minimal technical thresholds, thus prioritizing continental balance and global inclusivity over unqualified exclusion.

Universality Places are a lifeline to athletes from underrepresented National Olympic Committees. They are designed to increase the diversity of participating nations across the sports programme of the Olympic Games. While some nations may qualify dozens, or even hundreds, of athletes for the Olympic Games, others are left with very few athletes once qualification is complete in each sport. Universality Places are available in the qualification systems of select sports for nations with traditionally small delegations (IOC. What are Universality Places and who can obtain one? May, 2024).

The current qualification system for wrestling does not include any universality quotas. For the Los Angeles 2028 Games, direct Universality quotas are excluded from the main allocation and only surface during the reallocation of unused quota places. The Olympic Games Tripartite Commission of the IOC appointed four Universality Places for

athletes competing in wrestling events at the 2016 Olympic Games in Rio de Janeiro. The selection includes wrestlers from Cambodia, Haiti, Honduras and Palau. (UWW: Four Universality places for wrestling awarded by IOC to Cambodia, Haiti, Honduras, Palau. May 25, 2016)

A fundamental principle of the Olympic quota allocation system is the use of Merit-Based Qualification Criteria. Merit-based qualification criteria form the core of the Olympic quota allocation system, emphasizing athletic excellence through objective performance metrics established by each sport's international federation (IF), subject to International Olympic Committee (IOC) approval. International Federations (IFs) employ standardized ranking systems to allocate Olympic quotas, primarily through objective performance metrics derived from competition results, which ensure merit-based selection while adhering to IOC-approved caps per nation and event.

In individual combat sports such as judo, taekwondo, wrestling, boxing, and fencing, quota allocation prioritizes performance at designated qualifying events organized by the respective international federations, with strict limits to ensure one athlete per nation per weight class or category to promote broad participation and prevent dominance by single nations.

2024 PARIS Process for 288 Wrestlers

To qualify for the Paris Games, wrestlers will get three events. -- the 2023 World Championships, the continental qualifiers in 2024, and the 2024 World Olympic Qualifiers, the last chance for wrestlers to earn a spot.

There are a total of 18 weight classes. One weight class will have 16 wrestlers and each nation will be able to field a maximum of one wrestler per weight. Overall, 288 quotas will be awarded for the '24 Olympics.

Any wrestler born on/before December 31, 2006, is eligible to compete and qualify for the Paris Olympics. According to the updated system, the National Olympic Committees that participated in the '23 senior continental championships will be allowed to participate in the '23 World Championships which is the first qualification tournament [with the same number of athletes per style].

Earlier, 108 quotas were awarded at the World Championships [six per Olympic weight] but UWW has decided to reduce it to 90 quotas [five per Olympic weight]. At the 2023 World Championships, all four medalists [gold, silver, and two bronze] will secure the quota for their nation. The fifth spot will be decided with a bout between the wrestlers who lost their bronze medal matches. The winner of this wrestle-off gets a quota for the '24 Games.

In the second phase, 144 wrestlers will qualify for the Paris Games through the continental quotas. The top two wrestlers in each Olympic weight class will get one spot each for their NOCs. Athletes who earned a quota at the '23 Worlds will not be eligible to participate in the continental qualifiers unless they participate in a different style. For continental qualifiers, a NOC/NF can only send the same number of wrestlers that participated in the '24 senior continental championships.

The third and final phase will see the World Olympic Qualifiers offer three quotas in each Olympic weight class instead of the two it offered previously. A total of 54 wrestlers can qualify for the tournament. Apart from the 36 finalists across three styles, the bronze medal winners will also have a chance to get a quota for their country. An additional wrestle-off will be held between the two bronze medal winners and the wrestler who wins the quota wrestle-off will take the trip to Paris.

Any country can send its wrestlers to this event barring the wrestlers who won quotas in phases one and two. UWW's vision to update the qualification was to give fair chance to wrestlers who failed to reach the finals at the World Olympic Qualifiers. This also makes the repechage equally important as the semifinals. If there are any unused quotas due to withdrawal, doping offense, or non-participation, the quota will be transferred to the next best wrestler of that weight category of the tournament. (UWW approves updated Paris Olympics qualification process. September 2022).

LOS ANGELES 2028 Process for 288 Wrestlers

United World Wrestling has overhauled the qualification process for the Olympic Games. Beginning with the 2028 Los Angeles Olympics, the 16 wrestlers who qualify per weight class will earn their spots through four routes: the World Championships, Continental Qualifiers, the World Olympic Qualifier, and the UWW Rankings.

The **first phase of qualification** will be the 2027 World Championships that will award 72 quotas for the Olympics. Each medalist [gold, silver, two bronzes] in the 18 Olympic weight classes will earn LA 2028 spots for their respective National Olympic Committees (NOC).

The **second phase** will be the UWW Rankings in which the first three wrestlers of the rankings, not qualified in the first phase, will obtain one quota place for their NOC for the LA28 Olympic Games. The UWW Rankings will include the seven main events organized before the LA28 Olympic Games:

- 2027 Senior Continental Championships*
- 2027 Ranking Series (3 events)
- 2027 Senior World Championships
- 2028 Ranking Series (1 event)
- 2028 Senior Continental Championships*

**UWW may include Continental Games for ranking but will only consider best two out of three continental results.*
This means that 54 more wrestlers will earn Olympic quotas for their respective NOCs.

Phase three for qualifying will include the Continental Qualifiers -- Europe, Asia, Pan-America, and Africa & Oceania. These tournaments will award two quotas per weight class.

Top two wrestlers, the finalists, in each of the 18 Olympic weights will earn LA 2028 quotas for respective NOCs. A total of 144 wrestlers will be awarded at these continental events.

The **fourth and final phase** of qualification will be the World Olympic Qualifier which will offer 18 quotas. The gold medal winners in each of the 18 Olympic weight classes will earn the spot for their respective NOCs.

Only the countries that did not obtain a quota place during the previous three phases may participate in the World Olympic Qualifiers. The participating countries may only send two wrestlers across all styles at the World Qualifier.

OG qualifying system now include indirect qualification by accumulating points in Ranking Series events, World and Continental Championships. (UWW Announces New Olympic Qualification Process for LA 2028. February, 2026).

RANKING RULE BOOK (UWW. UWW Ranking Rule Book. January 2026

https://cdn.uww.org/2025-12/uww_ranking_rule_book.pdf

The United World Wrestling Ranking is the men's and women's elite ranking consisting of the best wrestlers competing in a World Series of events.

This Ranking is used to:

- Determine the best Athletes of the year
- Determine the 4 top seeds in each weight category for the Senior Continental Championships
- Determine the 8 top seeds in each weight category for the Olympic Games, Senior World Championships This ranking is compiled after each competition that is part of the Ranking System.

For each wrestler, only the points obtained at the World Championships, plus his/her other 5 best (top scored) results at the World Ranking events of the year are counted towards the determination of the best Athletes of the year title. These results are converted into ranking points (see below) and the Athlete of the year titles will be awarded to the wrestlers with the most accumulated points. This title will be awarded to each weight category. The three first athletes per weight category will receive a prize money, which is defined at the beginning of each year.

The 1st of January, United World Wrestling will remove all the points EXCEPT the points of the World Championships and /or the Olympic Games. In this way, the new ranking will start with the ranking of the last World Championships and /or the last Olympic Games.

Events included in the Ranking System

- The Olympic Games (A)
- The Senior World Championships (A)
- The Senior Continental Championships (B)
- The Continental and Regional Games for which United World Wrestling has an agreement with (C)
- The UWW Selected Ranking Series (C)

Points allocation

The awarded points go to the athlete, in the category in which he participated. Therefore, if the athlete changed his weight category between two events included in the Ranking System, the points will be awarded into the category in which the athlete competed in that particular event. Please note that an athlete ranked at the bottom of the ranking, without rank (Disqualification – Forfeit) won't receive any points.

Each rank will provide the following number of points, based on the concerned events:

Ranking	LEVEL A	LEVEL B	LEVEL C
1 st place	40 000	10 000	8 000
2 nd place	32 000	8 000	6 400
3 rd place	26 000	6 500	5 200
4 th place*	23 200	5 800	4 640
5 th place	20 000	5 000	4 000
6 th place**	18 800	4 700	3 760
7 th place	13 200	4 400	3 520
8 th place	12 000	4 000	3 200
9 th place	10 500	3 500	2 800
10 th place	9 300	3 100	2 480
11 th place	4 000	1 000	800
12 th place	3 200	800	100
13 th place	2 400	600	75
14 th place	1 600	400	50
15 th place	800	200	25
16 th place	400	100	13

**If a weight category only has one bronze medal (by example Nordic System)*

***If we have only one 5th place in a weight category (by example Doping issue)*

If the Olympic Games and the Senior World Championships (not applicable when it is a Senior World Championships for the non-Olympic weight categories) are organized **the same year**, additional points will be given to the Olympic Medalists. It means:

1st place at the Olympic Games 8000 additional points
 2nd place at the Olympic Games 6400 additional points
 3rd places at the Olympic Games 5200 additional points

The number of participants will also determine the calculation:

- If a weight category counts 1 participant, no point will be allocated at all.
- If a weight category counts between 2 and 5 participants, the points of the table will be reduced in half and only the 3 first will be awarded by these half points.
- If a weight category counts between 6 and 12 participants, NO additional point will be given.
- If a weight category counts between 13 and 16 participants, 3000 additional points will be given to all wrestlers in the category*.
- If a weight category counts more than 16 participants, 5000 additional points will be given to all wrestlers in the category*.

**Except the athletes without Ranking point (17th place and lower) and the Disqualified or forfeited athletes*

2. Ranking criteria in case of a tie between athletes

In case of a tie in the ranking between two or more athletes, we will determine the best of them following these criteria:

- Rank at the Olympic Games (if organized the concerned year)
- Rank at the last Senior World Championships
- Highest number of participations in the ranking events* of the concerned year
- Highest number of Gold Medals in the ranking events* of the concerned year
- Highest number of Silver Medals in the ranking events* of the concerned year
- Highest number of Bronze Medals in the ranking events* of the concerned year
- The most classification points in the ranking events* of the concerned year
- The most match won by superiority in the ranking events* of the concerned year
- The most technical points scored in the ranking events* of the concerned year
- The least technical points given in the ranking events* of the concerned year

PROPOSAL FOR THE MODIFICATION OF SCORING FOR THE RANKING QUALIFICATION PROCESS

Review of UWW Ranking Points Allocation Across Continental and Ranking Series Events

This section examines whether participation size or the number of matches required to win gold can serve as an adequate basis for differentiating the competitive value of UWW events across continents. The analysis indicates that neither bracket size nor minimum wins to gold consistently reflects the empirical strength of the field. By contrast, an opposition-quality approach appears better able to distinguish meaningful differences in competitive demand between events and weight classes. On that basis, the report outlines a practical framework centered on a weight-class opposition quality metric and discusses two policy directions for consideration: adjusting continental bonuses through an opposition-quality indicator, and strengthening the relative ranking value of Ranking Series events when their brackets systematically exceed continental events in competitive quality.

UWW has raised a policy question of practical importance: how to refine the ranking points system so that it better reflects the competitive value of results obtained in different events, particularly when participation patterns vary across continents. At the center of this question lies a reasonable initial premise: if some continental brackets require more wins to reach the top of the podium, perhaps this should be reflected in points allocation. The present review evaluates that premise and explores whether a more precise and operational alternative can be developed. The evidence reviewed here suggests that the relationship between bracket size, number of bouts to gold, and actual competitive challenge is not sufficiently stable to support a robust adjustment system on its own. A more promising path is to quantify the quality of the field itself rather than relying primarily on the size of the field.

Why bracket size and wins to gold are not enough

A first analytical step is to recognize a structural property of tournament brackets: bracket size does not translate linearly into the number of wins required to secure first place. As illustrated in Figure 1, several bracket sizes may demand the same number of victories to win gold, despite differing substantially in the number of athletes entered. This already limits the usefulness of wins to gold as a stand-alone proxy for event difficulty.

This issue becomes more apparent when continental events with clearly different competitive reputations show similar central values in bracket size and matches to gold. As example, Figure 2 showcases Asian and African events in Women's Wrestling, displaying comparable median win-to-gold demands despite evident differences in expected competitive depth. The point is not that participation is irrelevant. Rather, it is that participation alone does not discriminate well enough.

The same concern is reinforced when the analysis moves from median summaries to weight-class comparisons (Figure 3). Equivalent or nearly equivalent bracket sizes at a given weight do not necessarily correspond to equivalent competitive demand. In some cases, one continental champion may require more wins than another without this implying that the underlying field was stronger. The number of required wins may vary in ways determined more by bracket architecture than by field strength.

Bracket size does not translate linearly into matches to gold

Different bracket sizes can require the **same number** of wins to gold.

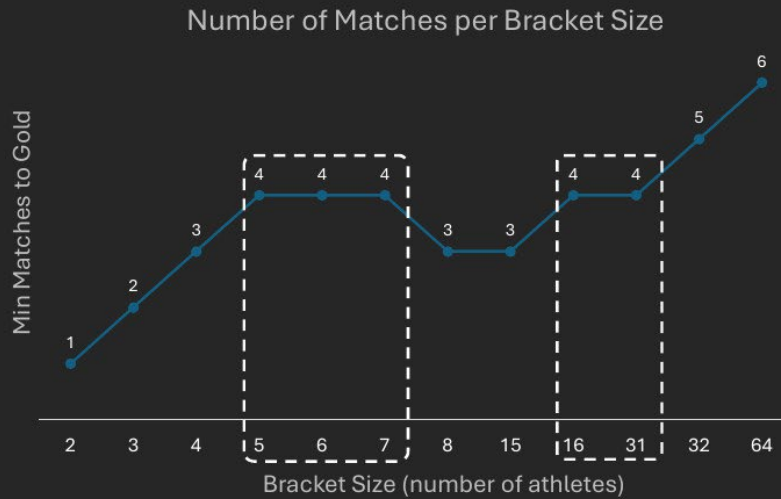


Figure 1. Bracket size does not translate linearly into matches to gold.

Similar win-to-gold demands appear in continents with very different perceived competitive levels.

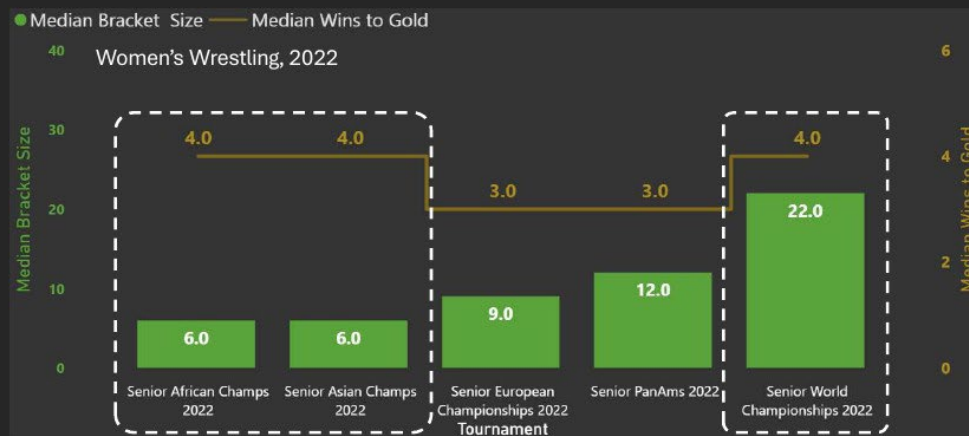


Figure 2. Similar win-to-gold values can emerge in continental events with different competitive depth.

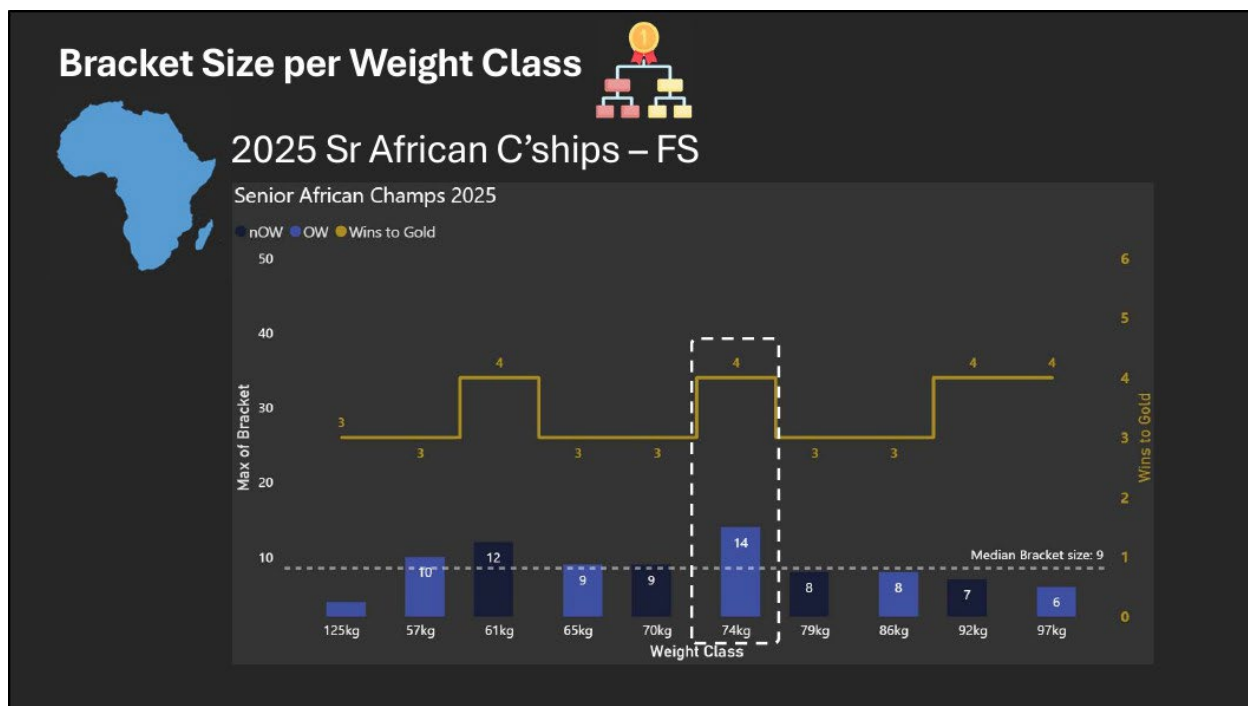


Figure 3. Weight-class comparisons show that bracket size alone does not represent field strength reliably.

The case for an opposition-quality approach

Once the limits of bracket-size logic are acknowledged, the analytical task becomes one of identifying a metric that better reflects the quality of opponents present in each weight class. In performance analysis literature, this falls within the broader concept of opposition quality. Many sophisticated approaches are available in sport analytics, but they are often difficult to operationalize for policy use, difficult to communicate to stakeholders, or overly dependent on complex historical models.

For the present purpose, the advantage lies in finding a measure that is both analytically defensible and operationally manageable. The framework proposed moves in that direction by linking opposition quality to athletes demonstrated competitive consistency over time rather than to single-event outcomes.

International Winning Consistency (IWC) as the athlete-level basis

The proposed solution begins with International Winning Consistency (IWC), defined as the median number of wins obtained by an athlete across ranking-level tournaments within a rolling two-year window. Conceptually, IWC is valuable because it does not overreact to one isolated result. Instead, it reflects the recurring ability to win matches at the international level.

This is an important improvement over event-specific placement alone. A very high IWC reflects sustained success across events and therefore signals that the athlete meaningfully strengthens the field of any bracket in which she or he competes. By contrast, an athlete with a prominent isolated result but much less consistent follow-up performance would contribute differently to the competitive strength of the field.

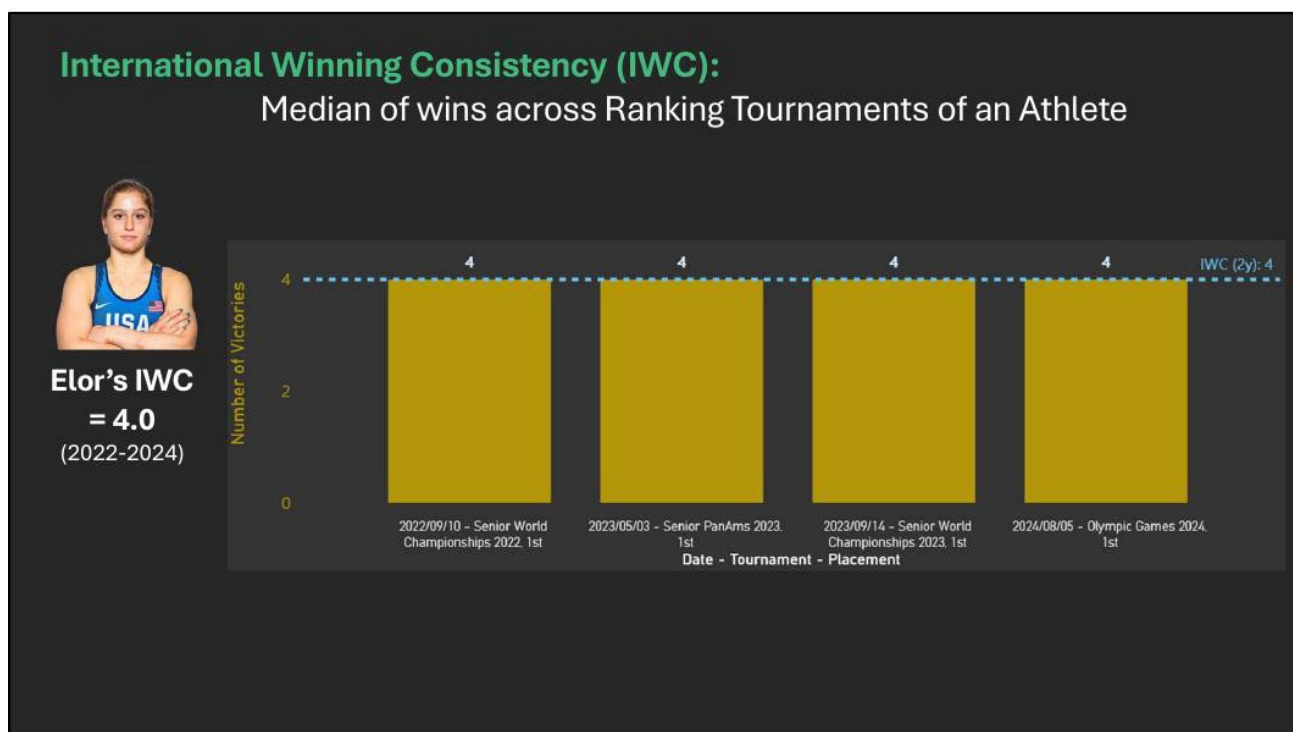


Figure 4. IWC reflects sustained competitive consistency rather than isolated success.

From athlete quality to weight-class quality: OPPQw

Building from IWC, the analysis introduces a weight-class metric labeled Opponent Quality of the Weight Class (OPPQw). First, athletes are classified as competitive athletes when their two-year rolling IWC reaches or exceeds a threshold of 2.0 wins per tournament as working criterion. This threshold is not presented as the only possible choice, but as a practical one that differentiates athletes with recurrent winning capacity from the broader field.

Second, the number of competitive athletes in a bracket is divided by the minimum number of wins required to secure gold. The resulting value estimates the concentration of proven competitive opponents distributed across the route to first place. This formulation is useful because it avoids two common errors: equating larger brackets with stronger brackets, and equating additional matches with greater competitive quality.

How to Quantify **Opposition Quality** of a Weight Class?

$$\text{OPPQw} = \frac{\text{Number of Competitive Athletes}}{\text{Minimum Matches to Gold}}$$

Figure 5. OPPQw is defined as competitive athletes divided by minimum matches to gold.

Illustrative evidence that OPPQw differentiates better

The examples in Figures 6 and 7 suggest that OPPQw distinguishes events more meaningfully than bracket size alone. In one Women's Wrestling comparison, raw bracket sizes appear relatively similar, but once athletes with stronger competitive profiles are highlighted, the difference between fields becomes substantially clearer. One region shows competitive athletes distributed across all weight classes, often with more than one such athlete per bracket, whereas another shows a much lower concentration.

Additional examples from 2025 also show how OPPQw can differentiate continental and world-level fields. In selected weight classes, the World Championships show the strongest field, while the relative ordering among continents varies by weight in ways that align more closely with observed competitive depth than participation size alone.

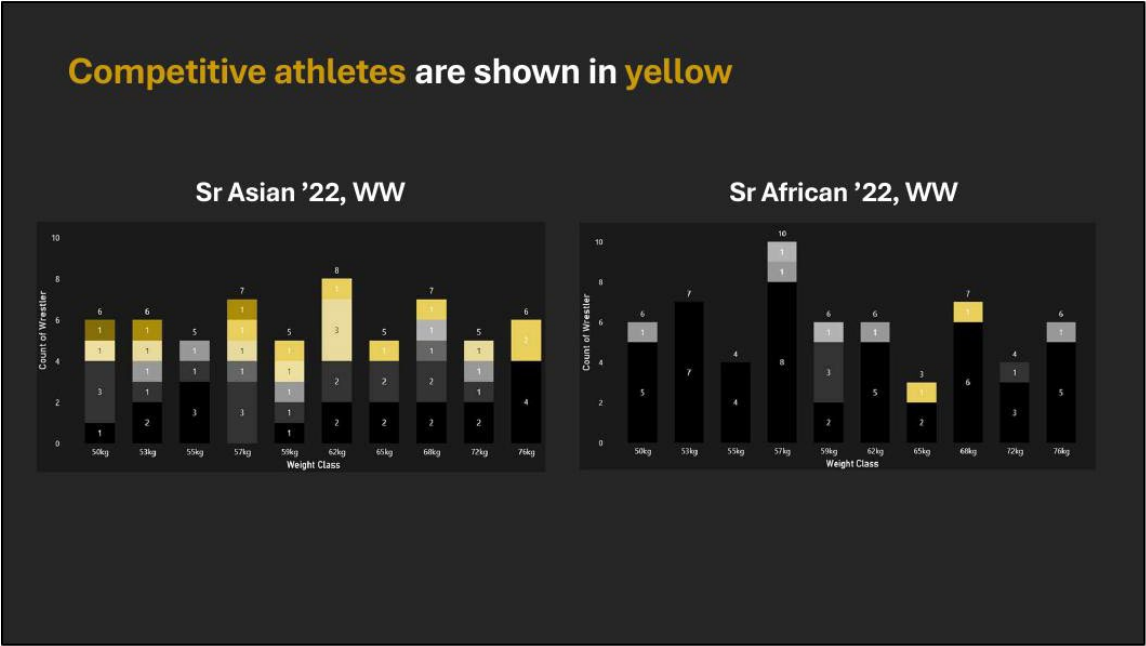


Figure 6. Similar bracket sizes can mask substantial differences in the distribution of competitive athletes.



Figure 7. In WW 53 kg at the 2025 Sr Worlds, OPPQw differentiates field strength more clearly than participation totals alone.

A first policy application: opposition-quality adjustment within continental events

Once OPPQw is established, it can be used as the basis for refining how ranking points are attributed within continental championships. The most immediate application would be to preserve UWW's existing base structure while reconsidering the current bracket-size bonus in favor of an opposition-quality-based bonus.

Conceptually, this is a strong proposal because it preserves continuity in the current system while improving its sensitivity to real differences in field strength. The exact thresholds and bonus values shown in Figure 8 and applied in Figure 9 should be interpreted as an initial model rather than as fixed recommendations. Their main value is demonstrative: they show how a points adjustment could reward athletes not simply for winning a bracket of a certain size, but for succeeding in a bracket that contains a greater density of proven international performers.

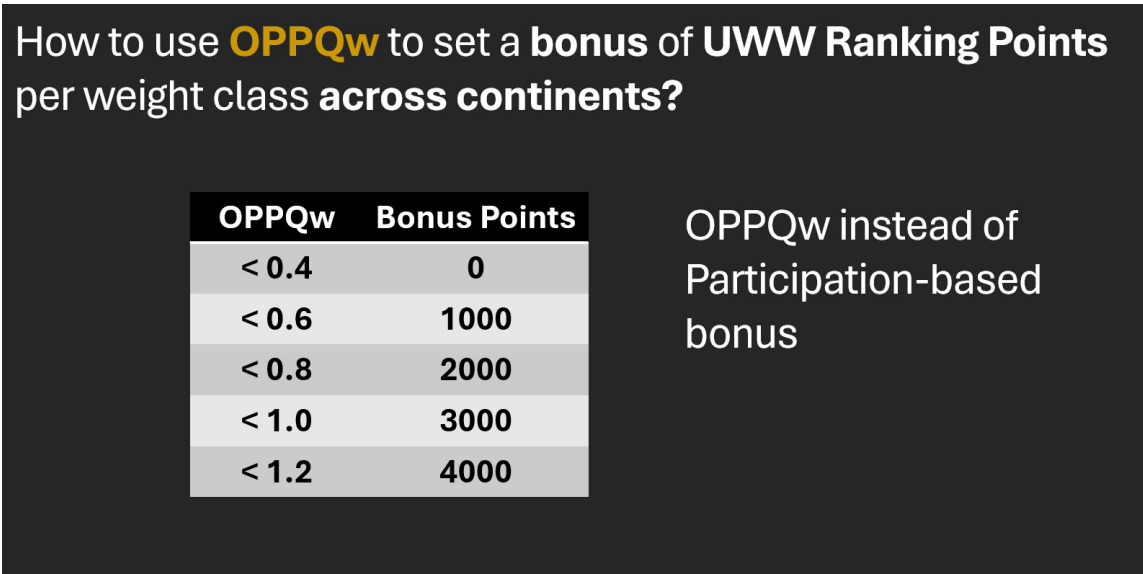


Figure 8. Example of Points Bonus based on Opposition Quality of the Weight class (OPPQw).

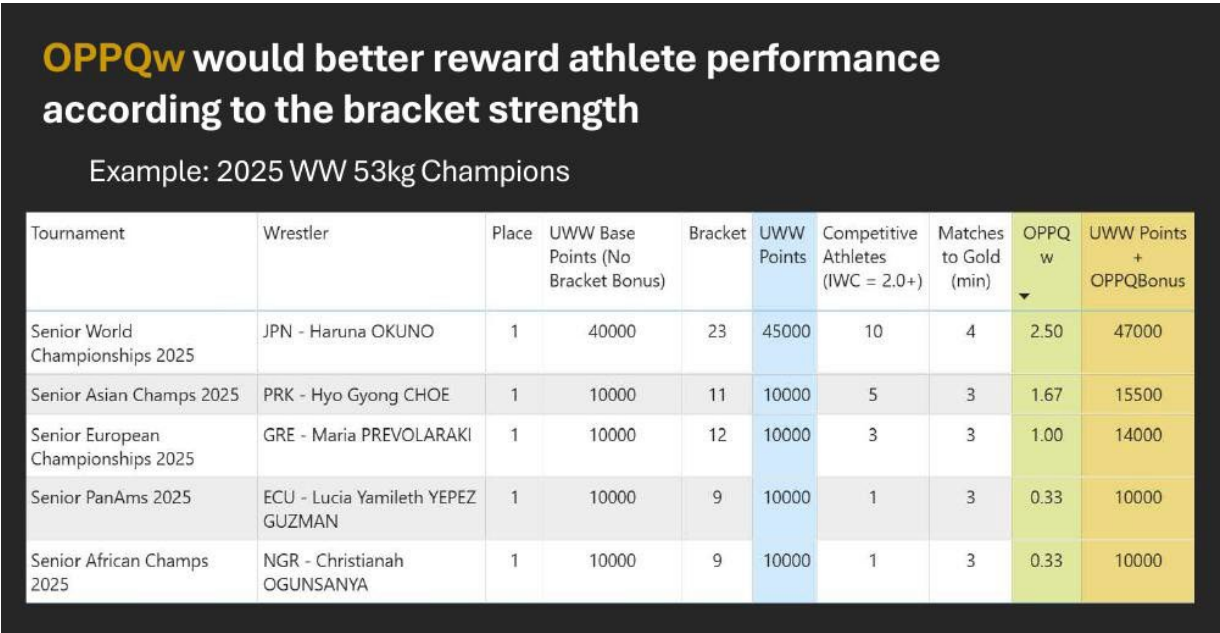


Figure 9. Example from WW 53 kg: an OPPQw-based approach differentiates continental champions by bracket strength.

A broader finding: Ranking Series events often show stronger brackets than continental events
A particularly important finding emerging from the analysis is that Ranking Series tournaments frequently display stronger brackets than continental championships, at least when assessed through median OPPQw in the examples provided (Figure 10). This has direct implications for the relative valuation of event categories.

Key finding when exploring the OPPQ metric: **Ranking Series (RS) tournaments** often have **stronger brackets** than Continentals

Example: 2025 Ranking Series Events, FS, Median OPPQ

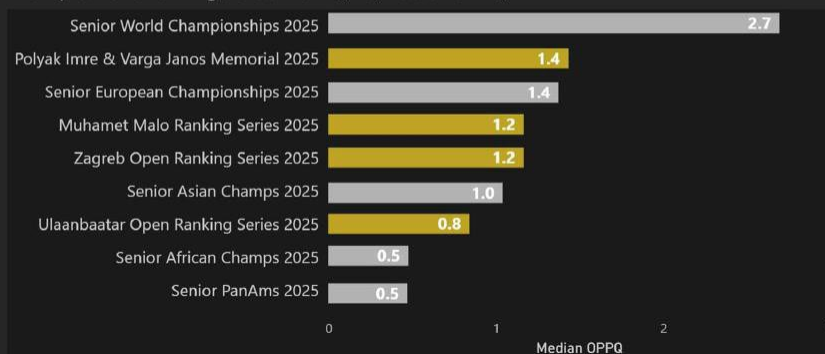


Figure 10. In the sample reviewed, Ranking Series events often exceed continental championships in median OPPQw.

If Ranking Series events regularly show stronger field quality than some continental events, yet remain less accessible or less attended for some regions, then the points structure attached to those events becomes an important lever for participation incentives. The participation summaries reproduced below from the 2025 International Season (Figures 11 and 12) suggest substantial declines in the number of participating nations and unique athletes from continental championships to Ranking Series events for specific regions. These patterns do not, by themselves, establish causality, but they do support further policy consideration.

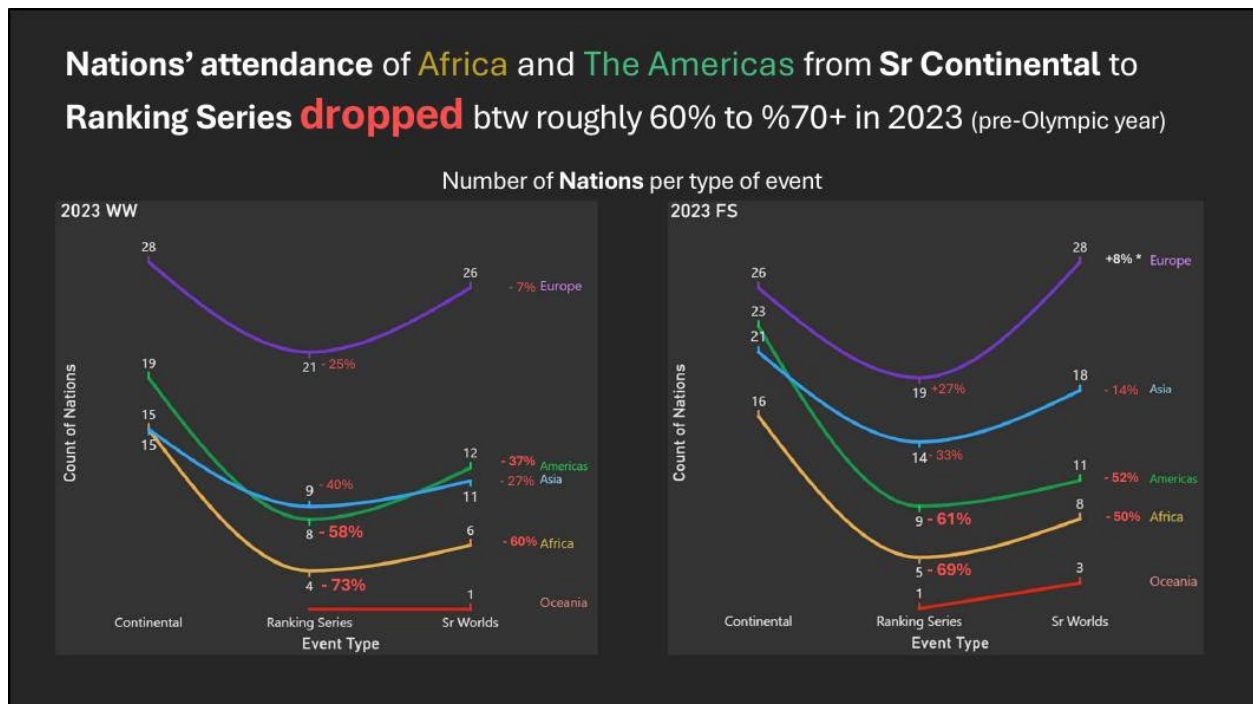


Figure 11. The number of participating nations declines sharply from continentals to Ranking Series events in some regions.

While Europe and Asia show smaller to no drop on number of athletes from Continentals to RS, **Africa** and **The Americas** **dropped** by 35%+ to 65%+

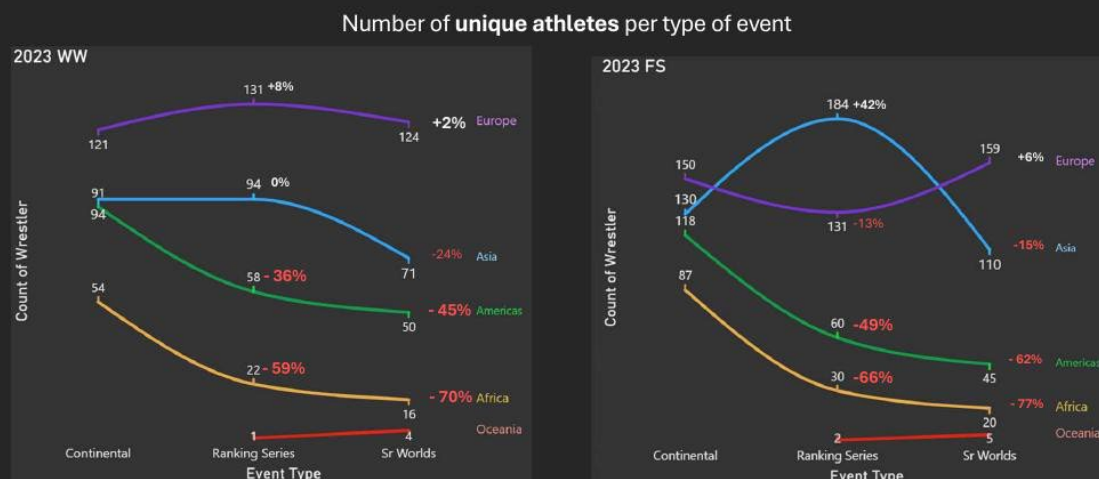


Figure 12. A similar contraction pattern appears when participation is examined through unique athletes.

Policy directions for consideration

Two policy directions emerge from the evidence reviewed here. The first is to replace the current continental bracket-size bonus with an opposition-quality bonus based on OPPQw. This option offers continuity, interpretability, and stronger alignment between points and bracket strength. It could be introduced gradually and validated over time.

The second is to increase the relative ranking value of Ranking Series events if the stronger competitive quality observed in these events is confirmed across broader samples. This could take the form of a category revision, so that Ranking Series events are valued above continental championships, or of an opposition-quality adjustment applied directly to Ranking Series events so that stronger brackets are reflected in the effective points awarded. Both directions are compatible with UWW's constructive objective: not to overturn the present framework, but to improve its capacity to reflect competitive reality and to support the intended participation incentives across the calendar.

Proposal 1:
Category swap
(RS as Category B,
Continental as C)

Proposal 2:
Use a **unified**
Opposition Quality
Metric for RS
tournaments

Figure 13. The two policy directions can be framed either as category revision or as unified opposition-quality adjustment.

CONCLUSION

The present review supports a clear conclusion: bracket size and minimum wins to gold are insufficient as principal tools for calibrating the competitive value of wrestling events across regions. They describe aspects of competition system and tournament structure, but they do not consistently represent field strength.

An opposition-quality approach offers a more analytically grounded alternative. By using a rolling measure of athlete-level competitive consistency (IWC) and translating it into a bracket-level indicator (OPPQw), UWW would gain a framework that differentiates events according to the strength of the field rather than the size of the field alone.

From a policy standpoint, the main application is to reconsider participation-based continental bonuses and replace them with an opposition-quality adjustment. At the same time, the analysis also raises a broader strategic question about the relative value of Ranking Series events, especially when those events appear to provide stronger brackets but remain less attended by some regions. Together, these findings provide a constructive basis for the next phase of refinement in the UWW ranking points system.

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A MORE OBJECTIVE AND UNIVERSAL APPROACH TO COMPUTING THE (MOST SUCCESSFUL WRESTLER (MSW) INDEX: A MODEL INCORPORATING COMPETITION TIER, OPPONENT STRENGTH, AND RECENCY

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ABSTRACT

This paper analyses the structural shortcomings of the MSW (Most Successful Wrestler) index currently used in the analytical practice of United World Wrestling (UWW) and proposes a more objective, universal alternative. The existing formula introduced by Slačanac and Dokmanac (2024), $MSW = CP \text{ diff} + WQ$, measures only the internal efficiency of a single tournament: it does not account for the prestige tier of the competition, the ranking position of the opponent, or the recency of the result. The practical consequence is striking — a minor Ranking Series tournament is capable of receiving the same index value as the Olympic Games.

Drawing on the comparative analysis of four mature ranking systems — ATP/WTa in tennis, FIDE Elo in chess, FIFA SUM in football, and OWGR in golf — we propose a four-component composite model: $MSW^* = \Sigma(\tau \cdot \delta \cdot \sigma \cdot \rho)$, where τ is the competition-tier coefficient, δ is the dominance coefficient, σ is the opponent-strength factor, and ρ is the time-decay factor. Empirical computations on 14 bouts of Indian wrestler Sujeet SUJEET (IND, 65 kg freestyle, UWW Rank #1 — 2026) across four consecutive tournaments demonstrate how the new index corrects a rank inversion: although the old MSW rates his two Ranking Series performances (6.82 and 6.07) above the Asian Championships (4.04), the new MSW^* correctly places the Continental Championship (12.60) first.

Keywords: *wrestling analytics, MSW index, UWW ranking, composite ranking model, Elo, ATP, FIFA SUM, sports metrics*

INTRODUCTION

Wrestling is one of the oldest sports in the modern Olympic programme, and United World Wrestling (UWW) governs its freestyle, Greco-Roman, and women's disciplines internationally, shaping its analytical foundations. Over the past decade, wrestling analytics has shifted from video analysis toward quantitative metrics, and federation decisions — selection, seeding, financial rewards — increasingly rest on numerical indicators.

The concept of Wrestler Quality (WQ, points scored per minute) introduced by Tünnemann (2004) laid the methodological foundation of this field. Building on this concept, Slačanac and Dokmanac (2024) formulated the MSW (Most Successful Wrestler) index using data from the Paris 2024 Olympic Games. As the index entered practical use, however, important gaps in its structure became apparent: it aggregates only the internal statistics of a single tournament and cannot place competitions of different prestige on a single, fair scale.

The purpose of this paper is to rebuild the MSW index so that it simultaneously captures where the victory occurred (competition tier), against whom (opponent strength), how (dominance level), and when (recency). The methodology combines ranking models proven in international sport with wrestling's distinctive classification-points system.

ANALYSIS OF THE EXISTING MSW SYSTEM

The current formula

According to the definition given by Slačanac and Dokmanac (2024), the MSW index is computed as the sum of two differences:

$MSW = CP \text{ diff} + WQ$

where CP diff is the difference between classification points won and lost per match, and WQ is the difference between technical points scored and conceded per minute. Both components contribute to the index in a positive

direction: a high classification advantage (e.g., victory by fall) and high per-minute efficiency together yield a higher MSW value. For the Paris 2024 gold medalists, the index range was 2.88–6.63.

UWW classification points

A structural element essential for the new model is UWW's match-level classification points (International Wrestling Rules, Article 41), which establish a qualitative hierarchy of bout outcomes:

Code	Winner : Loser	CP	Type of victory
VFA/VCA	5 : 0	5 / 0	Fall, disqualification, injury
VSU	4 : 0	4 / 0	Technical superiority (opponent 0 points)
VSU1	4 : 1	4 / 1	Technical superiority (opponent scored)
VPO	3 : 0	3 / 0	Victory by points (opponent 0)
VPO1	3 : 1	3 / 1	Victory by points (opponent scored)

Principal shortcomings of the existing system

- **Failure to account for competition tier.** This is the core limitation. The MSW measures only intra-tournament efficiency. Three technical-superiority wins at a low-tier Ranking Series tournament carry the same CP/WQ values as the identical results at an Olympic final. UWW's own official ranking acknowledges an A/B/C tier distinction, but MSW does not internalize it.
- **Failure to account for opponent strength.** A 3:1 victory over the reigning world champion has the same index value as a 3:1 victory over an unranked opponent. Yet from Elo (1978) onward, every mature ranking model has placed opponent strength at the center.
- **Absence of a time factor.** The index provides a static value for a single tournament; it does not reflect form changes across seasons or the principle that recent results are more informative than older ones.
- **No contextual evaluation of defeats.** A narrow defeat to a world champion and a fall against an unranked wrestler differ on CP/WQ, but the contextual weight of the defeat (opponent strength) is not embedded in the system.

RANKING SYSTEMS IN OTHER SPORTS

We analyzed four mature ranking systems that have stood empirical scrutiny. Each addresses a specific design problem: ATP/WTa formalizes tournament prestige; Elo, opponent strength; FIFA SUM, match importance; OWGR, time decay.

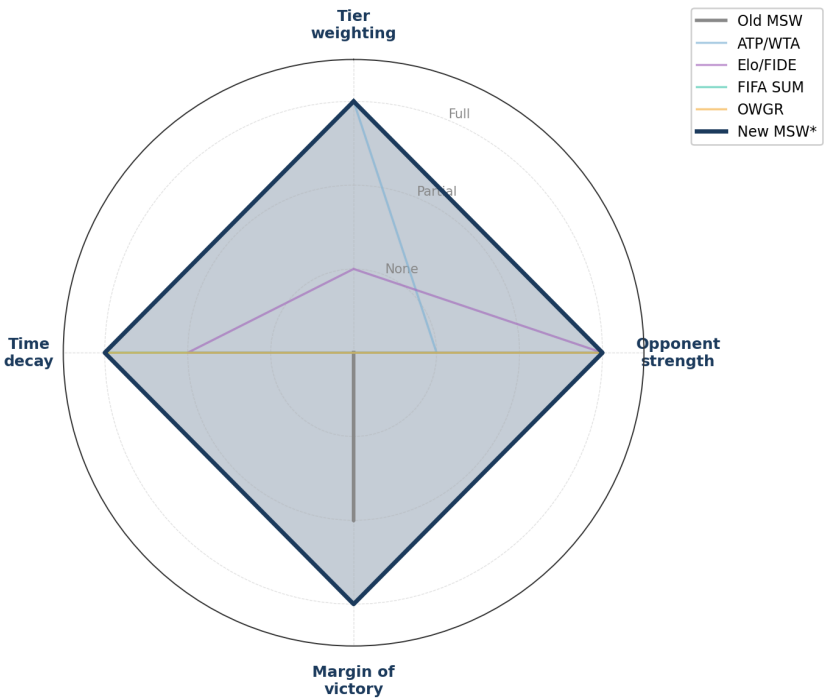


Figure 6 — Comparison of ranking systems across four design dimensions.

The ATP/WTa tennis system expresses tournament prestige through a multi-tier coefficient: a Grand Slam champion earns 2000 points, a Masters 1000 champion 1000, ATP 500 — 500, ATP 250 — 250. This is the clearest example of tier differentiation in world sport. The Elo system (Elo, 1978; FIDE, 2024) embeds opponent strength mathematically: the expected outcome $E = 1/(1+10^{((R_{opp} - R_{self})/400)})$, with rating updates proportional to the K-factor. The FIFA SUM model (in force since 2018) integrates both match importance (I) and expected outcome (We): $P = P_{prev} + I \cdot (W - We)$. OWGR combines time decay with field strength: full value for the first 13 weeks, then 91 weeks of gradual decay.

THE PROPOSED MSW* MODEL

The core formula

The proposed model is composite and multiplicative in character: the value of each bout is computed as the product of four factors and then summed over the evaluation window.

$$MSW^* = \sum_i (\tau_i \cdot \delta_i \cdot \sigma_i \cdot \rho_i)$$

where n is the number of bouts in the evaluation window; τ_i is the competition-tier coefficient; δ_i is the dominance coefficient (positive for wins, negative for losses); σ_i is the opponent-strength factor; and ρ_i is the time-decay factor ($0 < \rho \leq 1$). The multiplicative structure captures the interaction of the four factors: a dominant win at a top-tier competition against a strong opponent earns an exponentially higher value.

Competition-tier coefficient (τ)

Calibrated on the basis of UWW's A/B/C distinction and the proportional logic of ATP:

Competition category	τ coefficient
Olympic Games	10.0
World Championships	8.5
Continental Championships (European / Asian / Pan-American)	6.0
Continental and Regional Games	5.0
Ranking Series / Grand Prix tournaments	4.0
Other international tournaments	2.5
National championships / local tournaments	1.0

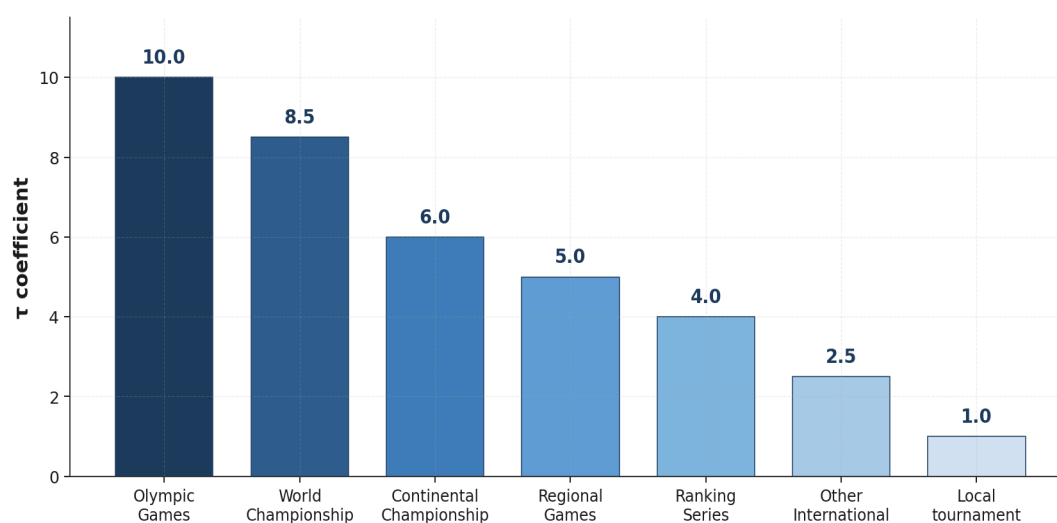


Figure 1 — The competition-tier coefficient (τ) scale, analogous to ATP's 2000/1000/500/250 structure.

Dominance coefficient (δ)

Normalized on the basis of UWW's classification points (5/4/3). Negative δ values apply to the context of defeat and are not symmetric — the loss penalty is slightly smaller than the corresponding win reward to encourage active competition:

Outcome type	δ (win)	δ (loss)	UWW CP
Fall / DSQ (VFA)	+1.00	-0.70	5 : 0
Technical superiority, opp. 0 (VSU)	+0.85	-0.50	4 : 0
Technical superiority, opp. scored (VSU1)	+0.75	-0.45	4 : 1
Victory by points, opp. 0 (VPO)	+0.60	-0.35	3 : 0
Victory by points, opp. scored (VPO1)	+0.50	-0.30	3 : 1

Opponent-strength factor (σ)

A transparent table based on the opponent's world ranking. For more precise applications, σ can also be computed as a continuous variable via an Elo-style formula: $\sigma_i = 0.6 + 0.9 \cdot E_i$, where $E_i = 1/(1+10^{((R_{\text{opp}} - R_{\text{base}})/400)})$.

Opponent status	σ coefficient
Reigning Olympic/World champion, ranked #1–3	1.50
Ranked #4–8	1.25
Ranked #9–20	1.00
Ranked #21–50	0.80
Unranked / >50	0.60

Time-decay factor (ρ)

Following the OWGR model — full value for the first 6 months, then exponential decay with half-life $H = 18$ months:

$\rho = 1.0$, if $\Delta t \leq 6$ months

$\rho = 0.5^{((\Delta t - 6) / 18)}$, if $\Delta t > 6$ months

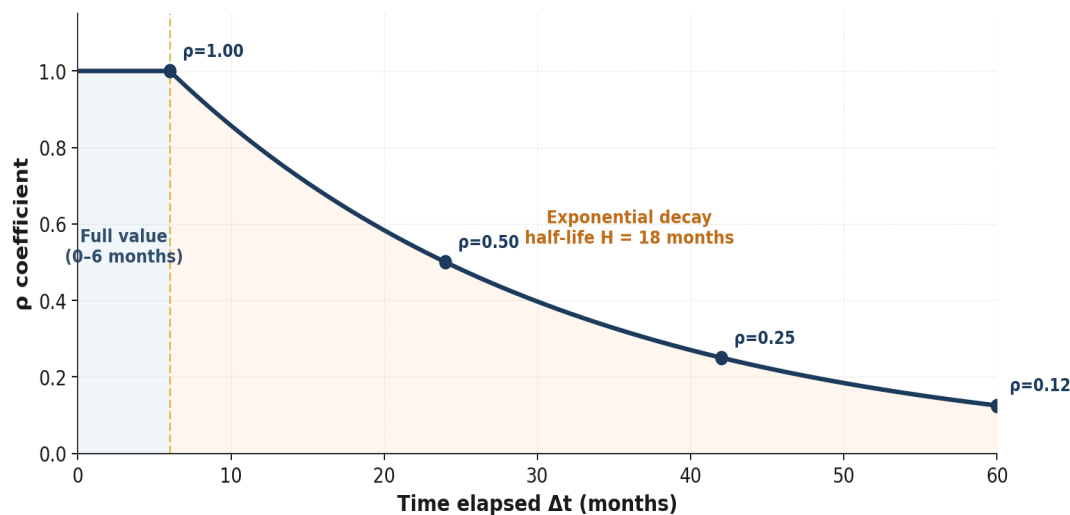


Figure 3 — The time-decay curve $\rho(\Delta t)$. Plateau for the first 6 months; exponential decay afterward.

Sensitivity map

The heat map below shows how the same technical-superiority win (VSU, $\delta = +0.85$) takes on different values depending on the combination of competition tier and opponent strength. A win against an unranked opponent at a local tournament yields $V = 0.51$ points; the same result at the Olympics against the world's #1 opponent yields $V = 12.75$ — twenty-five times higher.

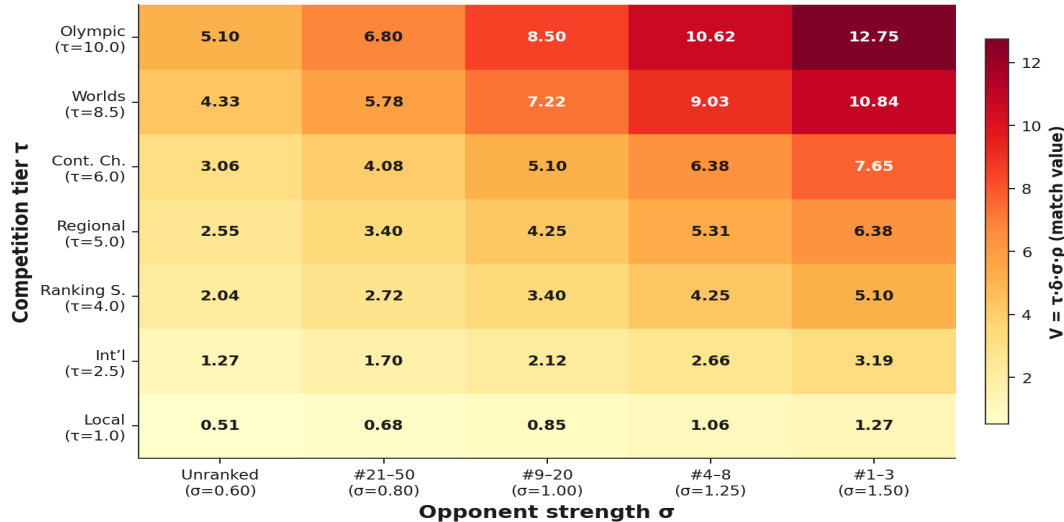


Figure 4 — Value of a single VSU win across $\tau \times \sigma$ combinations ($\delta = 0.85$, $\rho = 1.0$).



CASE STUDY: SUJEET (IND), 65 KG

Sujeet SUJEET (IND) — UWW Rank #1 (2026), 65 kg freestyle. Photo: uww.org
 Sujeet Kalkal is one of India's leading wrestlers in the 65 kg freestyle category, the 2025 U23 World Champion and the world's number-one ranked wrestler in this weight class in 2026. In the 2026 season he has compiled an unblemished record of fifteen wins and zero losses. His four tournaments from 2025–2026 — the World Championships, two Ranking Series events, and the Continental Championship — make him an ideal case study for comparing MSW and MSW*, since all four UWW competition tiers are represented.

Match-level data

The following table summarizes Sujeet's 14 bouts across the four tournaments (source: uww.org/athletes/sujeet-sujeet, last accessed 2026):

Tournament	Opponent	Score	Outcome	CP	Tier	Opp. rank
Asian Ch. 2026	Kakharov (KGZ)	10–0	VSU	4 : 0	Continental	#9–20
Asian Ch. 2026	Kudiev (TJK)	7–2	VPO1	3 : 1	Continental	#4–8
Asian Ch. 2026	Jalolov (UZB)	8–1	VPO1	3 : 1	Continental	#4–8
M.Malo 2026	Avdyli (ALB)	16–4	VSU1	4 : 1	Ranking S.	>50
M.Malo 2026	Zakashvili (GEO)	10–0	VSU	4 : 0	Ranking S.	#21–50
M.Malo 2026	McKenna (USA)	11–0	VSU	4 : 0	Ranking S.	#9–20
M.Malo 2026	Babazade (AZE)	10–0	VSU	4 : 0	Ranking S.	#21–50
Zagreb 2026	Arsamerzouev (FRA)	10–0	VSU	4 : 0	Ranking S.	>50
Zagreb 2026	McKenna (USA)	11–0	VSU	4 : 0	Ranking S.	#9–20
Zagreb 2026	Nemati (IRI)	3–0	VPO	3 : 0	Ranking S.	#4–8
Worlds 2025	Acar (TUR)	15–5	VSU1	4 : 1	Worlds	#21–50
Worlds 2025	Kim (PRK)	9–2	VPO1	3 : 1	Worlds	#9–20
Worlds 2025	Amouzad (IRI)	5–6	LOSS VPO1	1 : 3	Worlds	#1–3
Worlds 2025	Woods (USA)	5–7	LOSS VPO1	1 : 3	Worlds	#9–20

The old MSW computation

Following the formula of Slaćanac and Dokmanac (2024), CP W/m, CP L/m, CP diff and WQ are computed separately for each tournament. Time values are taken from UWW Arena data and live blog reports (e.g., the Sujeet–Kakharov bout lasted 3 min 22 s, source: UWW Day 5 live blog, April 2026):

Tournament	CP W/m	CP L/m	CP diff	WQ	MSW	Rank
Asian Ch. 2026 (Cont., $\tau = 6.0$)	3.33	0.67	2.67	1.37	4.04	1st
M.Malo 2026 (Rank. S., $\tau = 4.0$)	4.00	0.25	3.75	3.07	6.82	1st
Zagreb 2026 (Rank. S., $\tau = 4.0$)	3.67	0.00	3.67	2.40	6.07	1st
Worlds 2025 (World Ch., $\tau = 8.5$)	2.25	2.00	0.25	0.58	0.83	8th

A striking fact emerges: under the old MSW, Sujeet's strongest performances appear to be the Ranking Series tournaments (6.82 and 6.07), with the Asian Championships ranked only third (4.04). The World Championships (0.83) sit at the bottom — understandable given the two defeats there, but the system in no way recognizes that the World Championships are a higher-prestige competition than the Ranking Series.

The new MSW* computation

Now let us compute the same 14 bouts with the new $MSW^* = \sum(\tau \cdot \delta \cdot \sigma \cdot \rho)$ formula. Since every bout occurred within the past 12 months, $\rho = 1.0$. The per-bout value $V = \tau \cdot \delta \cdot \sigma \cdot \rho$ is shown in Figure. 5.

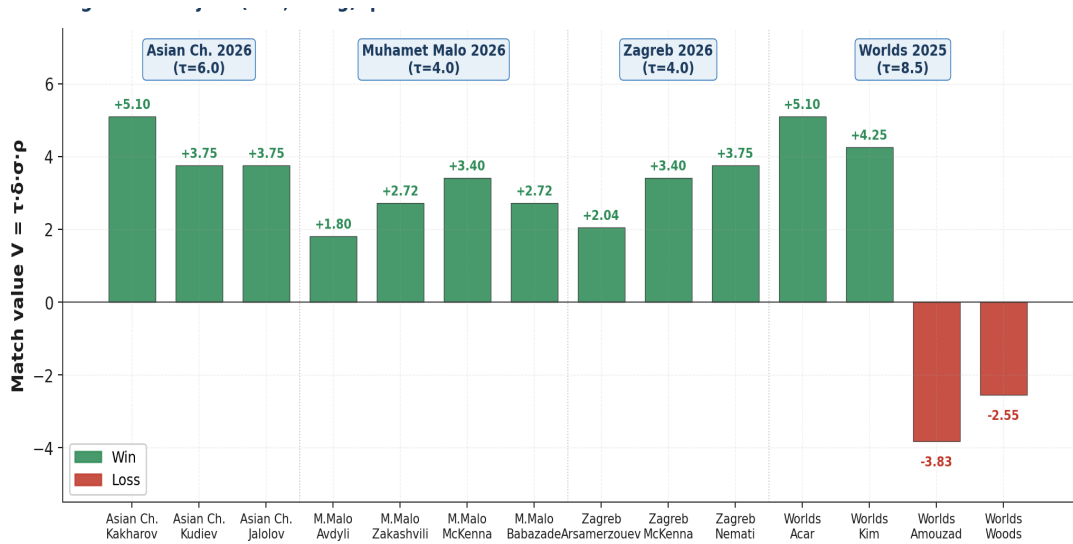


Figure 5 — Per-bout contribution to Sujeet's MSW*. The two World Championship losses carry substantial negative weight, but the system also recognizes their contextual significance.

Comparison and the rank inversion

The table and chart below compare Sujeet's ranking across the four tournaments under both indices. The old system identified Muhamet Malo (Ranking Series, 6.82) as his strongest performance; the new MSW* correctly elevates the Asian Championships (12.60) to first place. This demonstrates the system's core objective.

Tournament	Tier	Result	Old MSW	Old rank	New MSW*	New rank
M.Malo 2026	Ranking S.	1st place	6.82	1st	10.64	2nd
Zagreb 2026	Ranking S.	1st place	6.07	2nd	9.02	3rd
Asian Ch. 2026	Continental	1st place	4.04	3rd	12.60	1st
Worlds 2025	World Ch.	8th place	0.83	4th	2.97	4th

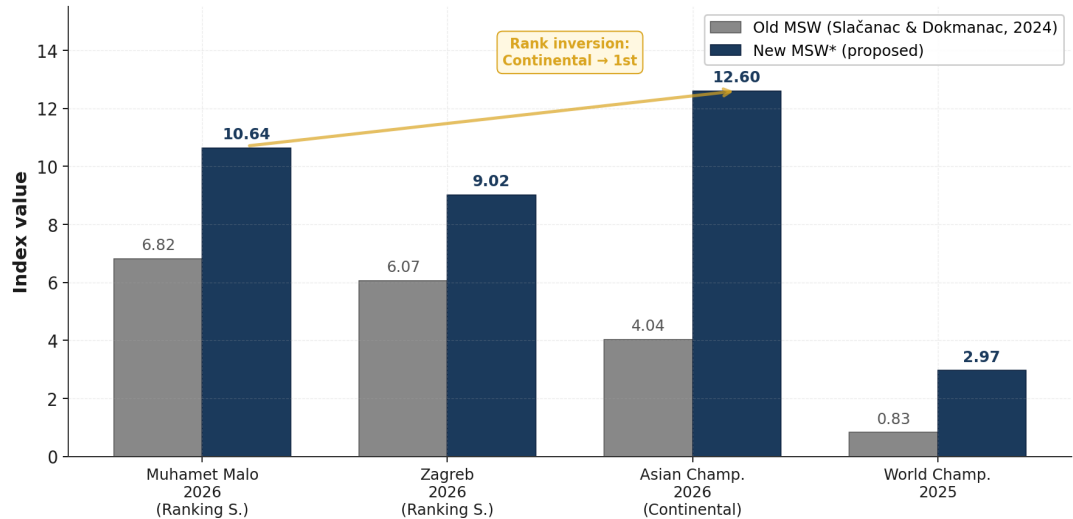


Figure 6 — Old MSW vs new MSW* for Sujeet. The rank inversion: the Asian Championships moves from 3rd to 1st place.

At the same time, the World Championships' index value rises from 0.83 to 2.97 (a 3.6× increase), because the wins there were earned against world-class opponents, and the defeats came narrowly against the actual reigning world champion, Amouzad. This contextual enrichment is the system's principal objective.

Sensitivity to competition tier

Had the same three wins (Asian Championships 2026 bouts) occurred at different competition levels, the MSW* values would shift as follows:

Competition tier (hypothetical)	τ	New MSW*	Old MSW
Olympic Games	10.0	21.00	4.04
World Championships	8.5	17.85	4.04
Continental Championship (actual)	6.0	12.60	4.04
Ranking Series	4.0	8.40	4.04
Local tournament	1.0	2.10	4.04

The old MSW remains an invariant 4.04 in every case — this is the central defect the new model resolves.

DISCUSSION

The proposed MSW* index addresses the four principal shortcomings of the existing system: tier differentiation via τ , opponent strength via σ , dominance level via δ , and recency via ρ . At the same time, the model remains fully consistent with UWW's existing classification-points system — the δ coefficients are taken directly from the 5/4/3 structure of Article 41. This is an approach that respects current official rules and eases the institutional path forward.

The model's principal advantage is its modular and calibratable structure. The τ , δ , σ , and ρ coefficients can be refined by the UWW Technical Commission on the basis of empirical data. A limitation worth noting is that the σ

factor requires a reliable opponent-ranking base; UWW's current ranking data are sufficient for this, although historical completeness may be limited for older tournaments.

For empirical validation we recommend the following tests: (a) verification of MSW*'s correlation with the official UWW annual ranking (expected Pearson $r > 0.80$); (b) out-of-sample predictive accuracy across consecutive tournaments at least 10 percentage points above the 67% baseline established by Bigsby and Ohlmann (2017).

CONCLUSIONS AND RECOMMENDATIONS

Although the existing MSW index is a valuable first step in wrestling analytics, its failure to account for competition tier, opponent strength, and recency makes it inadequate as a universal ranking instrument. The proposed four-component composite MSW* index — $MSW^* = \Sigma(\tau \cdot \delta \cdot \sigma \cdot \rho)$ — combines best practices proven in world sport with wrestling's distinctive classification-points system. The empirical computations on Sujeet SUJEET demonstrate that the new index ranks performances more objectively and fairly, particularly by correctly distinguishing top-tier achievements from lower-tier tournament results.

Phased implementation recommendations:

- 1. Pilot phase (0–3 months):** Backtest the MSW* index on complete UWW Arena data from a full Olympic cycle (Tokyo 2020 + Paris 2024); verify correlations with the old MSW and the official UWW ranking.
- 2. Calibration phase (3–9 months):** Optimise τ , δ , σ coefficients against actual outcomes; test a continuous Elo-style variant for σ .
- 3. Full deployment (9–18 months):** Activate the ρ time-decay factor and publish a cross-season "Wrestler of the Year" ranking based on MSW*.
- 4. Governance:** Submit coefficient values for approval by the UWW Technical Commission and institutionalize periodic review at each Olympic cycle.

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ARE LONG-TERM HEALTH EFFECTS ON THE MUSCULOSKELETAL SYSTEM EXPECTED FROM OLYMPIC WRESTLING?

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INTRODUCTION

"Great sport begins at a point where it has ceased to be healthy" was once famously said by Bertolt Brecht, a German dramatist, poet and storyteller. In sports medicine we know that high-performance sports can lead to damage to the musculoskeletal system. To what extent does this apply to Olympic Wrestling?

Wrestling was part of the program in the ancient Olympic Games and has remained to the present day. Wrestling places a high demand on the athlete's physical condition and requires a high level of speed and athleticism. It requires a healthy cardiovascular system, healthy metabolism and a healthy musculoskeletal system. Therefore, wrestling can cause a lot of sports-specific stress during a wrestler's career. The question, however, can this lead to irreversible long-term damage?

General aspects

To better classify possible causes of long-term damage in wrestling, it is helpful to differentiate between two factors(1):

Endogenous Factors which come from the athlete's genetic makeup. These include family disposition including talent and coordinative capabilities, axis ratio of the extremities, mobility and stability of the joints, stress resistance of the cartilage, bodyweight and height

These factors are not always objective and measurable. Any remarkable findings during the orthopedic examination of young wrestlers must be investigated to be able to estimate the risk of sporting activity as early as possible. If we find any abnormality, we need to discuss this with parents and coaches. Endogenous factors cannot always be separated from exogenous factors, and they affect all sports.

Exogenous Factors this mainly involves the risk of sports-specific injuries and the sport-specific stress of wrestling.

I. Sport-specific stress of wrestling

The following descriptions are based on the author's vast experience in clinical and sports-medicine activities. This experience includes being team physician to the freestyle national team of the German Wrestling Federation (DRB) for 18 years, followed by 10 years as a member of the Medical Commission of "Federation Internationale des Lutttes Associees" (FILA). In addition, the author treated veterans of the "Südbadischen Ringerverbandes" (SBRV) and thus gained considerable insight into the health in athletes after the end of their active careers.

In classifying sports-specific stress, the intensity and duration of exposure must be taken into consideration. A wrestling career usually begins anywhere between the ages of 6-14. It often does not end until the athlete is in their thirties. Some athletes then enter competitions for veterans at the national and international level. Thus, the musculoskeletal system is often exposed to stress by training and competing for over 25 years. In other types of sports, such as rhythmic gymnastics, figure skating and regular gymnastics, sports careers are often over at a time when great international success can still be achieved in wrestling. This must be considered when long-term damage is investigated.

What is also important to note is that both in training and in competition, the musculoskeletal system is put under more stress in certain maneuvers by the weight of the opponent, who in most cases is performing synchronous movements (Figure1). Due to this extra weight, the kinetic energy absorbed on landing on the elastic mat is more than doubled. These landings cause intensive stress of the osteoligamentary structures and the joint cartilage. The resultant ground reaction force may be several times the athlete's bodyweight. We must not forget the explosiveness produced by the strength of the muscles with which the actions take place in wrestling. Although this effect has not been studied in detail in the sport of wrestling, we can use a comparison in gymnastics, where force was measured on landing from a height of 170 cm, these values were 5.1-6.2-fold of the athlete's own bodyweight (2). The athletes' musculoskeletal system must slowly become adapted to such mechanical stress.



Figure 1 Common throw in wrestling

These extreme stresses draw our attention to the following conditions: Scheuermann's disease, spondylolysis, spondylolisthesis, scoliosis and congenital hip dysplasia. These are contraindications for performance-related training and competition in wrestling. If the individual is pain-free, these findings may only be discovered in time by regular sports-orthopedic examinations. This is the only way to eliminate predisposing factors in time to prevent long-term damage (1,3). It is up to the sports physicians to try and guarantee that only healthy children participate in regular training. Experience has shown that many young athletes often change the type of sport or withdraw completely from sports activities. Thus, the initial examination is meaningful, and this must be done after one year of regular training at the latest (3,4). Cooperation is needed based on trust between the parents, the sports physician and the responsible trainer.

THE SPINE IN WRESTLING

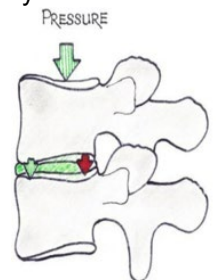
Anatomical aspects

The spine is the central supporting element in the human body. It is not a fixed column but a mobile chain of elements which is stressed both statically and dynamically. To cope with the stresses, it is encased in a strong band system which provides stability and limits certain movements. The muscles have the function of keeping the spine upright against gravity and guarantee stability and mobility in the torso. This network of stabilizing bonds, tendons and muscles tenses the spine like the rigging of a sailing ship which keeps the mast upright. The mobility of the spine differs in the various segments. The increased level of mobility in the cervical and lumbar spine decreases the stability of the spine in these segments, thus increasing the likelihood of injury.

Problem zones are present in the areas in which a very mobile spinal segment absorbs considerably less mobile segment (e.g. cervicothoracic, thoracolumbar, lumbosacral). Signs of attrition are most often observed here due to high mechanical stress.

Biomechanical aspects

The following biomechanical aspects must be considered to better understand the demands which wrestling places on the spine. Knowledge of spinal stress resistance makes it easier to evaluate possible mechanical overloading. This is the only way for us to understand the mechanisms of damage resulting from sports activities and initiate required changes. The spine prefers to have stress pressure exactly in the middle of the intervertebral disc, in the form of compression stress.



The vertebral body takes the main load. The vertebral joints only take around 10% of this load. The lowest resistance is found at the lateral edges of the posterior areas (Figure 2). Increased flexion of the spinal column, lifting and carrying weights, and actions in which the weight of the upper body is greatly accelerated or decelerated lead to high stress of the spinal structures. The energy necessary to cause a fracture of a vertebra increases considerably from the cervical to the lumbar spine (2). Hyperextension loads in combination with torsion loads appear to lead increasingly over time to degenerative changes in the thoracolumbar region and around the lumbar vertebrae (2,5).

Stress on the spine in everyday life

Confirmed scientific knowledge in orthopedics, biomechanics and industrial science have shown that lifting and carrying loads (everyday burdens) have an effect predominately on the spine. Industrial medicine has developed basic rules for lifting and carrying loads to prevent structural damage to the overall motor apparatus, with emphasis on the spine. These have proven useful in everyday life (Figure 3):

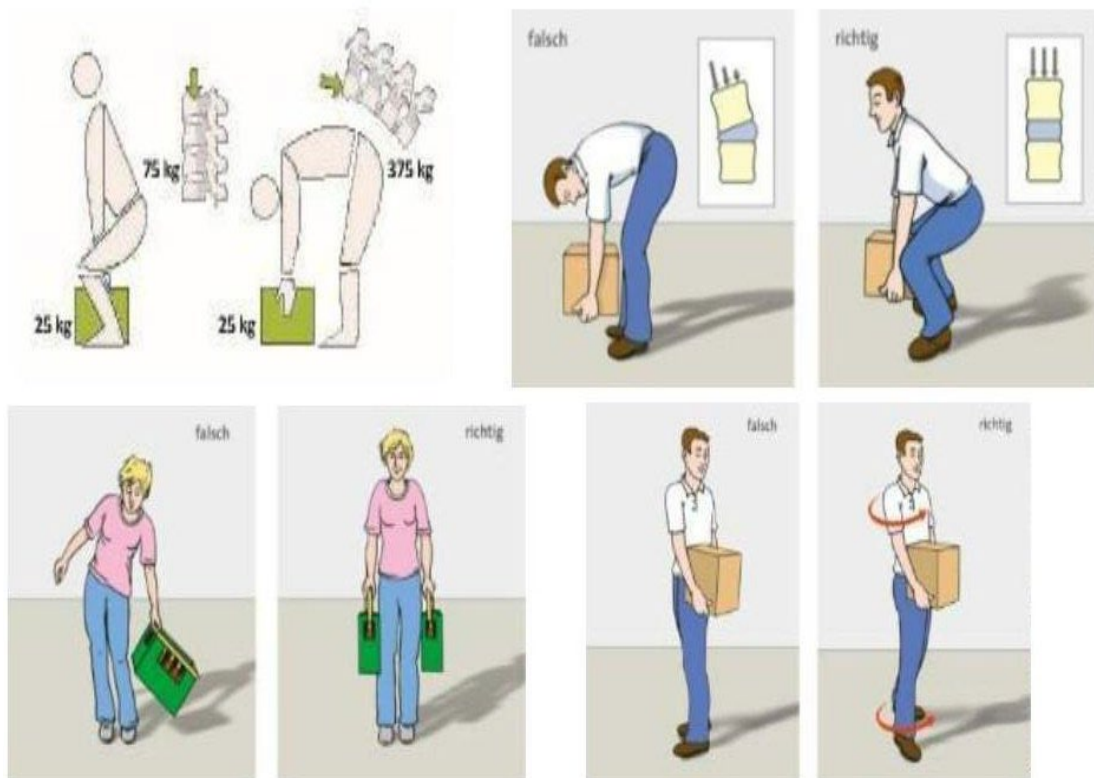


Figure 3. Correct and incorrect loading of the spine in everyday life. (Modified from BGHW, Bernhard Zerwahn, Germany)

Stress on the spine in wrestling

What sport-specific stresses on the spine are to be expected in athletes in wrestling? Can they be coordinated with the basic rules for lifting and carrying in everyday life to prevent structural damage to the motor apparatus? First, let's look at some typical and frequently repeated actions and techniques.

Reclination (Bending Back)

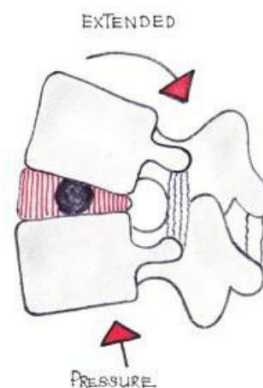


Figure 4. Drawing: H-E. Werber

In this action the main load is on the posterior part of the vertebral body and the vertebral joints. Remember, the lowest resistance is found at the lateral edges of the posterior areas. There is also an increased tensile load on the ventral parts of the intervertebral disc and the ventral ligaments. And we have a double load: our own bodyweight plus opponent's bodyweight.

Flexion

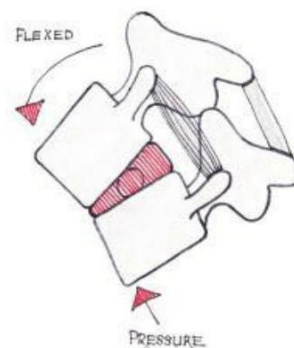


Figure 5. Drawing: H-E. Werber

In this action we also have load on the ventral spinal column structures with double weight, and an increased tensile load on the dorsal parts of the intervertebral disc and dorsal ligaments.

Reclination and Rotation



Figure 6

In this action we have hyperextension as well as rotation. A very stressful load on the spine. And we have a double load: Own body weight plus opponent's body weight. Since this situation shown above frequently occurs in wrestling, one can imagine that this may lead to premature degenerative changes of the spine.

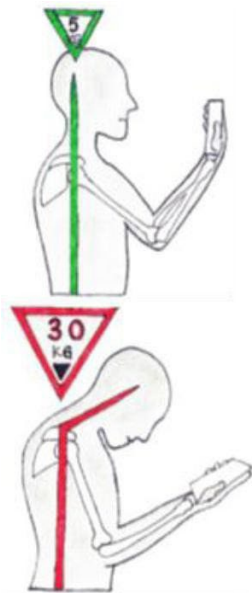


Figure 7. Cervical Spine (Drawing: H-E. Werber)

Cervical Spine: Maximal flexion, reclination, lateral tilting and compression. And what about the cervical spine? A head weighs about 5kg. When tilting forward, the load on the spine increases about six-fold (1,2,3,5). A situation we often have in wrestling. These are just two examples of many extreme loads on the cervical spine in wrestling.

As shown above, there are actions in wrestling in which maximal reclination (Figure 4), maximal flexion (Figure 5) and maximal reclination with rotation (Figure 6) of the entire spinal column occur. In the cervical spine, we observe maximal reclination, flexions, lateral tilting and compressions (Figure 7), loads which would be very difficult to coordinate with the basic everyday rules for the prevention of structural damage to the spinal column (Figure 3). Various studies underline an increased danger to the spine due to these intensive sports loads (3,5,6). In extreme cases, hyperflexion, coupled with a great axial load can cause a slipped disc, even if there are no apparent degenerative changes. Wrestling has led to paraplegia.

Spinal damage often develops because of repeated micro-trauma, like falls, congestion or compressions. This gives rise to the question: Do the constant unfavorable loads in wrestling "hollow out" the spine over 30 years too?

What role do muscles play?

Wrestlers must be able to tolerate enormous force from their opponents. So, they need a powerful and protective "muscle corset" (transverse abdominis) (7). This is essential for the stability of the spinal skeleton. A good, well-balanced training regime of the abdominal and back musculature will help prepare the athlete to better withstand unfavorable spinal column stress. This can reduce long-term damage and the risk of injury (1,3,5).

Long-term health effects on the spine in wrestling

The spine is involved in all the wrestler's actions and techniques. It is a complicated structure and thus susceptible not only to injuries, but also to chronic degenerative diseases. These are observed quite often in the spine of athletes as they get older (8,9). During the author's own experience with veteran wrestlers there were many who were diagnosed and treated with long-term conditions related to the spine. Two examples are illustrative (Figure 8, 9).

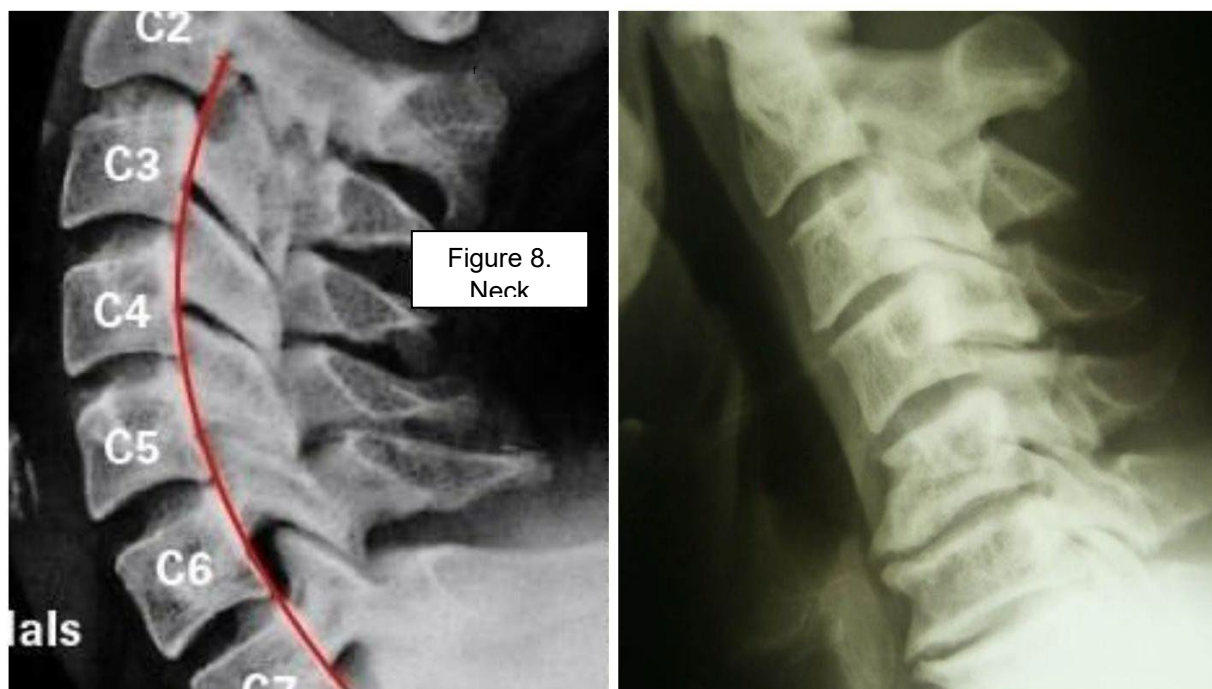


Figure 8 shows the cervical spine of multiple German National Champion at the age of 50: On the right we see significant degenerative changes (Spondylarthrosis, Spondylosis, Osteochondrosis) the lordosis is eliminated, and mobility is reduced. He also complains permanently about sensitivity disorders in the arms and is regularly treated with physiotherapy. For comparison on the left, on age-appropriate cervical spine.



Figure 9 Lumbar Spine

Figure 9 shows the same former German elite athlete and his lumbar spine on the right. L4 vertebra glides ventrally, there is instability, degenerative spondylolisthesis and osteochondrosis. Remember that in sports with hyperextension load combined with rotational load, degenerative changes are found around the lumbar spine, which can show progression even after the end of sports activities.

The next question we need to answer is: Do former wrestlers really have degenerative changes in their spine more often than the normal population of the same age?

We know that quite a few wrestlers complain of back problems during their career and even more so afterwards, but back problems are also widespread in the rest of the population. Studies of degenerative changes of the spine in former elite wrestlers are not well documented in the literature. Only a few references on the topic were found:

Ludin, Hellstrom et al. (8,10) report: "In mole wrestlers, gymnastics, soccer and tennis (age 27– 39 years), radiologically degenerative changes were found more frequently compared to a control group (28 non-athletes of comparable age) particularly in breast and lumbar spine. Despite significantly more radiological abnormalities among the athletes, they did not report higher frequency of back pain than the non-athletes". Athletes generally have a well- balanced musculature of the trunk which can compensate these bony "weaknesses". This explains the fewer complaints. After the end of the career, this can change rapidly with a weakening musculature. Former wrestlers also tend to have very high pain tolerance.

Granhed et al. (11) evaluated and compared 32 retired wrestlers (ages 39 – 62 years) with low back pain and 13 retired heavyweight lifters (ages 40 to 61 years) to a corresponding group of 716 men (ages 40 - 47 years). Low back pain was higher among the wrestlers (59%) compared to both the lifters (23%) and the control group (31%).

Rossi et al. (6) found 390 cases of lumbar spondylolysis in 3132 competitive athletes. 29.82 % of these were wrestlers.

Grant (cited in Bowerman,12) describes degenerative spondylosis in the cervical spine of male wrestlers ages 31 to 68.

Sudzilovskii and Khromov (13) also describe morphological changes in the cervical segment of the spine in subjects practicing wrestling.

In the author's view, the results of these studies should be taken seriously. Further studies in active or former elite wrestlers are necessary to assess the individual athlete's risk of degenerative changes of the spine and to recommend preventive measures. The goal of our sports medicine activities should be to accompany the athletes through their sporting careers, keeping injuries and the risk of long-term damage as low as possible. **But what options are there to prevent long-term damage to the spine in wrestling? What influence do we have as sports physicians?**

We must insist that sports-orthopedic examinations are performed regularly to disclose possible endogenous factors early on. We have only limited influence on the exogenous factors, or on injuries of the musculoskeletal system. The athletes require a strong, well-trained musculature of the abdominal trunk without any deficits. Injuries must be completely healed before normal training is recommended.

Our youngsters must be slowly introduced to wrestling-specific loads by experienced coaches. The tissues of the growing organism need time to adapt. The youngsters need coaches who can assess their resilience and carry out an appropriate level of training for them. A trainer entrusted with children also needs basic knowledge of the shape and function of the musculoskeletal system. Coaches and trainers should consider the mechanical stresses of the musculoskeletal system caused by sporting activities and their possible consequences (2,14). Age-appropriate individual load limitations in training are only possible in this way. Sports injuries and long-term damage can be prevented in this way.

If we wanted to forbid all the unfavorable loads on the spine in wrestling, it would be the end of the sport. No-one wants that, so we must find another way. Let us consider what we can do in training to help prevent long-term damage.

About two-thirds of sport activities fall within training (personal message,14). A large part of training is sport-specific with a corresponding proportion of unfavorable loads on the spine, as described above. Figure 10 shows some examples of extreme loads on the spine in **training** provided by David Curby, Editor-in-Chief of the International Journal of Wrestling Science. The exercises serve as warm-up and preparation for training and competition.

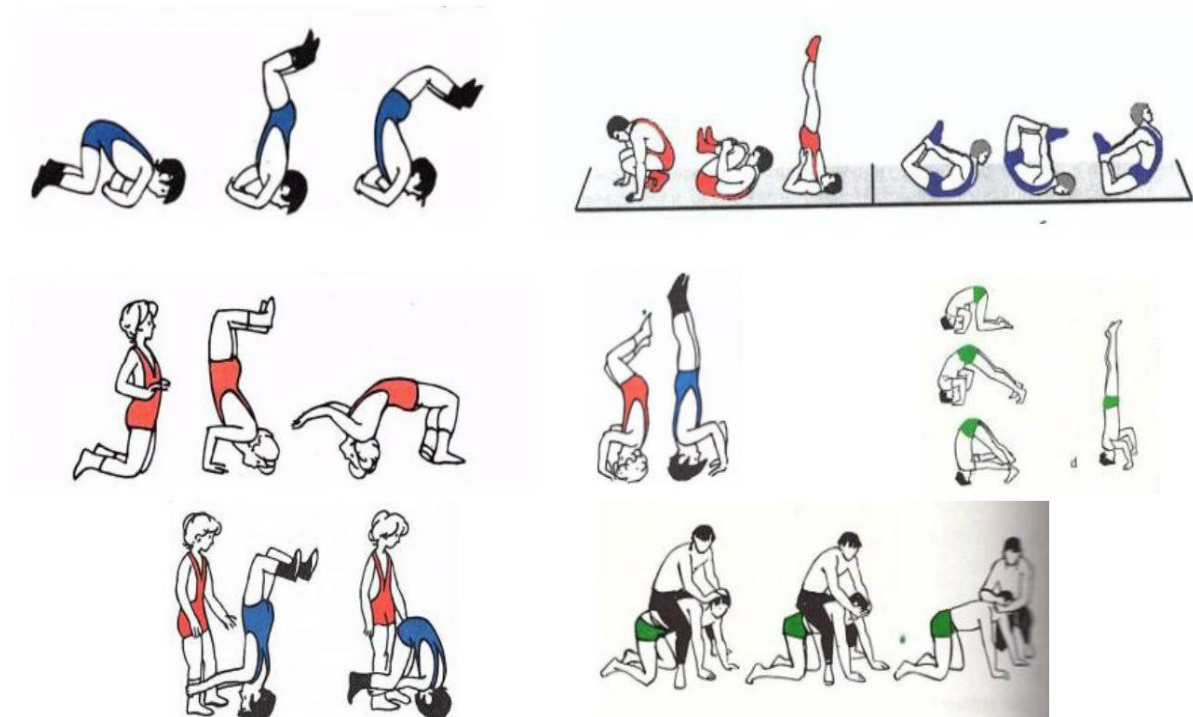


Figure 10 Warm up exercises which put stress on the spine (Modified from David Curby 2019)

These exercises are meant to help train mobility and strengthen the muscles under sport-specific conditions. We should ask ourselves: Are these exercises still up to date? Do we really need them or are there alternatives nowadays? We should consider alternatives and not stick to antiquated exercises for the sake of tradition. Reduction of spinal loads by alternative strength & flexibility training on suitable equipment is necessary to develop strength of the musculature. Only then can abnormally loads on the spine in wrestling be reduced. We should try, in cooperation with sports scientists and coaches, to question the old methods, so better ones can arise. We should try to develop recommendations for the creation and implementation of on age-appropriate program of the neck and back for strength and flexibility development that is based on science and medicine.

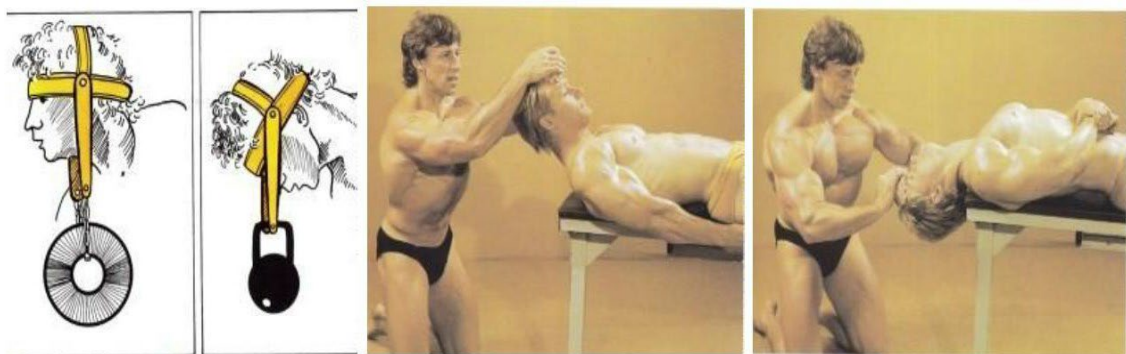


Figure 11. Neck Strengthening. (Modified from: Hartmann, Tunnemann: Das große Buch der Kraft, Sport Verlag Berlin 1990)

Figure 11 is from from the former GDR. The authors thought about alternative methods for strengthening neck muscles? (15)



Figure 12.

In Figure12 the modern strength training machines developed by Kieser are a further development of the ideas of Hartmann and Tünnemann (16). Unlike in the exercise shown in Figure10, the shoulder-neck musculature is strengthened and stretched in the sitting position. This cancels the additional weight load of the neck by one's own bodyweight or the bodyweight of the training partner. Abnormal loads on the cervical spine like those in competition can thus be reduced.

THE EXTREMITIES IN WRESTLING

Anatomical aspects

Unlike the spine which is the central supporting element of the human body, the extremities have various tasks. The upper extremities represent maximum mobility, and the lower extremities are designed for on upright position and motion.

The shoulder girdle connects **upper extremities** with the torso via three joints. Of these, the shoulder joint is our most mobile joint. It is controlled and stabilized exclusively by the musculature. This makes it susceptible to injury and long-term damage can arise from this. The elbow joint consists of three joint parts. The forearm can be flexed and extended toward the upper arm. The unique types of movement of the joint construction enables the supination and pronation of the hand. The wrist consists of several joint parts which form a functional unit. They enable flexion, extension and spreading movements. The complex design of the upper extremities in connection with muscles and tendons guarantees a broad scope of movements. This is what makes many of the techniques in wrestling possible.

The pelvic girdle connects the **lower extremities** with the torso. Thanks to its hardness and stability, it gives the human body a safe stance and upright posture. The pelvic girdle, hip joint, along with the knee joint, bear the greatest part of our bodyweight and are most frequently affected by arthrosis. The bodyweight is distributed in the feet among the ankle, the middle foot and the forefoot. The arches of the feet act like shock absorbers and provide for appropriate pressure distribution in the joints. Without these joints, people could neither jump, run, stand or walk, capabilities which are important not only in everyday life, but in sports as well. All these movements are coordinated by interactions between muscles in the upper and lower thighs. This is particularly important for the knee joint, since it is very unstable due to its bony construction.

What applies to the torso is also true for the extremities: well-trained musculature should stabilize, reduce shock and thus protect against injuries and long-term damage (2).

Biomechanical aspects

Landings, even when they are cushioned by the wrestling mat are a high mechanical stress to both the lower and upper extremities (Figure 14). These intensive stresses affect the bones just as much as the joint cartilage and muscle-tendon complex. The opponent's weight makes things worse. For this reason, the degree of mechanical stress, as already pointed out, should be borne by physiologically adapted structures. The adaptation processes need time, even for the structures of the extremities. If this is not considered, there is a danger of exceeding the failure boundary with injuries and resultant late-onset damage (2,14).

Mechanical stress on the upper extremities and long-term health effects in Wrestling

The upper extremities, which do not have to bear loads, only rarely show pronounced attrition after the end of an athletic career (1). Reports on long-term damage are rare in literature. *Steinbrück* (17) analyzed approximately 35000 sports injuries in all disciplines over 25 years. 21.8% of the athletes reported complaints in the upper extremities, 44.9% of these were wrestlers. This comes as no surprise, when one considers the stress to which the upper extremities are exposed to wrestling (Figure 13,14).

The shoulder joints are exposed in wrestling to extreme tension loads due to overextension (Figure 13). If leverage stress is added, luxation may result. Moreover, the athlete attempts to reduce the fall to the mat with outstretched arms as a reflex. This results in compression loads (Figure 14). And again, we have double load: Own bodyweight plus the opponent's bodyweight.

Acromioclavicular-joint arthrosis may appear as a late sequela of these frequent contusions in the shoulder girdle area. These may lead to persistent and therapy-resistant complaints. If the possibilities offered by conservative therapy have been exhausted, *Jägemann* recommends resection arthroplasty of the lateral ends of the clavicle under preservation of the coracoclavicular ligament (18). In addition, insertion tendinopathy in the shoulder girdle area is also observed as late sequela, which often are subsumed under the general term "Periarthritis humeroscapularis". They are the result of frequent microtraumatizations in the form of sprains and contusions during training and competition (Figure 13, 14).



Figure 13

As a result of fall and fall-prevention reactions (see Figure 14), we find distortions, fractures and luxations in the **elbow joint**. It is the wrestler's problem joint in the upper extremities (18). In addition to osteochondrosis dissecans, we also find arthrosis with concomitant limitation of mobility as late sequelae.

Chronic complaints in the **hand and finger joints** are found mostly in the carpometacarpal joint of the thumb. A result of falls with fall-defense reactions (Figure14) are often ligament injuries, which may lead to chronic complaints and swelling (18).



Figure 14

Mechanical on stress on lower extremities and long-term health effects in wrestling

Intensive physical loads, coupled with a high risk of injury, lead to attrition in the large joints of the lower extremities (19,20). The loads consist primarily of high axial compressions combined with rotation loads. Another factor is that the athlete often engages in this sport for more than 25 years. Remember: these joints bear double body weight in many actions. Studies by Lequesne support this assumption (21). Logically, Böhm and Kiahashemi found chronic damage in the large joints of the lower extremities with an age-dependent increase in the 54 wrestlers in their follow-up examinations (9).

The influence of endogenous factors which were not promptly recognized is considerable, especially in the hip. The same applies for axis deviations of the extremities. They are considered to be pre-arthritic deformities (22). Figure 15 shows the leg axes of wrestlers recorded during medical examinations. The question arises whether the intensive sport-specific load during growth, when growth plates are not yet closed, have an influence on the axis ratios or are there other causes? To what extent do wrestling activities influence the leg axis can only be clarified by prompt and regular sport-orthopedic examination



Figure15. Leg Axes of wrestlers (Photos: Dr. Diezemann)

Hip joint

Jägemann (18) reports on secondary coxarthrosis, which he found among wrestlers because of slipped capital femoral epiphysis. The typical age of disease onset is between 10 and 14, boys are three times more affected than girls. Coxarthrosis in former wrestlers was also found among the authors' patients. There is little in the literature about whether coxarthrosis occurs more frequently in wrestlers than in the normal population (19). In various throwing techniques, the athlete is lifted and lands from whatever height on his pelvis, often on the greater trochanter. Remember in section III; a large ground reaction force may arise, despite the elastic mat, which can exceed the bodyweight by a considerable margin (2). These massive mechanical loads, which occur more frequently in training may lead to microtrauma in the hip joint (joint cartilage). It is plausible that coxarthrosis may develop due to this.

Knee joint

As in other types of sports, the knee joint is the problem joint in the lower extremities due to its anatomy. A lot of factors point out that injuries to the knee joint may play a decisive role in the development of long-term damage. As overload damage, we observe chondromalacia patellae as an early precursor of knee arthrosis. *Nolte-Löffler* found chondromalacia patellae in 26.3 % of 57 wrestlers in follow-up examinations (23). This is not unexpected when we think of the extreme loads of the knee joint in many repetitive actions (see Figure 16). A study of former Finnish national team athletes concluded that coxarthrosis and gonarthrosis predominate in strength sports (19,20). *Böhm* und *Kiahashemi* came to similar results (9). Nonetheless, we must ask ourselves: Do former wrestlers really have degenerative changes of their knees more often than the normal population of the same age? The literature mentioned give some hints this may be the case but further scientific studies would be desirable.

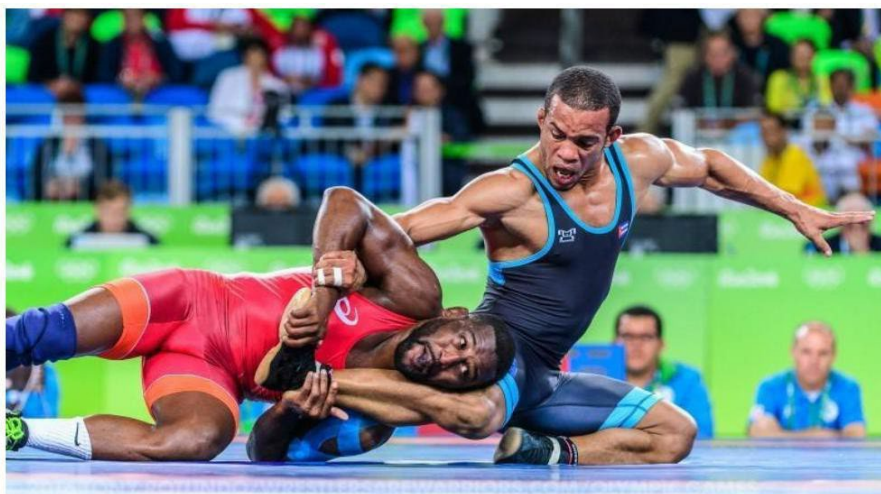


Figure 16. Stress to the Knee

CONCLUSIONS

A lot makes it appear that the quote from Bertolt Brecht applies even to Olympic Wrestling. It can result in long-term damage to the musculoskeletal system. In wrestling, there is unfavorable loading of the motor apparatus, especially the spine and the joints of the lower extremities. These loads are not limited to competitions. They occur much more frequently during training. **What possibilities do we have to reduce these loads?** (24)

A healthy musculoskeletal system is the pre-requisite to wrestling. This should be checked by regular sport-orthopedic examinations. A well-trained, balanced muscle apparatus can offset many of the unfavorable loads. Such unfavorable loads cannot be avoided in competition. This places additional responsibility on the referees. They must recognize forbidden actions which might cause injury in split second timing. Even a move in that direction must be recognized and immediately stopped. Late damage can, after all, result from such injuries.

We have made some suggestions in regard to training. What additional possibilities we may have must be discovered by further studies. Sports physicians, sports scientists, coaches and athletes should look for solutions together.

Conflict of interest

There are no conflicts of interest declared.

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TACTICAL AND GOVERNANCE INNOVATIONS IN WRESTLING: COMPARATIVE INSIGHTS FROM TEAM-BASED FORMATS IN COMBAT SPORTS

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ABSTRACT

This article examines the potential of team-based formats to enhance the strategic, institutional, and media dimensions of wrestling. Drawing on comparative case studies of the Davis Cup (tennis), the World Judo Team Championships, NCAA wrestling, and the Chess Olympiad, it identifies how mechanisms such as team identity, collective scoring, lineup strategy, and governance innovation can transform individual sports into collective spectacles. Building on these insights, the article introduces the Strategic Elimination Wrestling Competition Format (SEWCF), a novel model featuring three wrestlers per weight class, private lineup declarations, substitution logic, and the Golden Fall rule. The SEWCF is presented as an integrative framework that preserves the essence of one-on-one combat while embedding new tactical and narrative layers. The analysis highlights the strategic benefits for United World Wrestling (UWW) and national federations, outlines opportunities for pilot programs, and emphasizes the institutional conditions required for adoption. By combining comparative evidence with a conceptual proposal, the study contributes to both the theory and practice of governance innovation in combat sports.

Keywords: Wrestling, competition formats, governance innovation, team-based sports, SEWCF, comparative sport analysis

INTRODUCTION

Wrestling, one of the oldest Olympic sports, has traditionally been contested in an individual format where championships in each weight class are decided by the performance of a single athlete. While this tradition is deeply rooted, the individual-centered structure of wrestling presents several limitations: limited opportunities for emerging athletes, minimal tactical involvement for coaches, and difficulties in attracting broader audiences due to the sport's limited narrative appeal.

By contrast, in recent decades many individual sports have moved toward team-based formats. Examples such as the Davis Cup in tennis, the World Judo Team Championships, NCAA wrestling, and even the Chess Olympiad illustrate that integrating team logic into individual sports can generate greater strategic depth, stronger media appeal, and enhanced institutional cohesion. This global trend suggests that innovative formats can both increase the attractiveness of a sport and create more equitable opportunities for athletes.

This article, drawing on comparative evidence and theoretical perspectives on sport governance, introduces and analyzes the **SEWCF model**—a format designed to preserve the essence of one-on-one combat while adding new tactical and team-oriented dimensions. The aim is to demonstrate how this model can address the limitations of the traditional structure while aligning wrestling with the institutional and media demands of modern sport.

LITERATURE REVIEW

The literature on competition formats in combat sports highlights the growing significance of team-based innovations in traditionally individual disciplines. Prior research has examined athlete psychology, governance structures, and institutional reforms in contexts such as judo, wrestling, and collegiate dual meets, while comparative studies extend to other individual-to-team transitions like tennis. Yet, this body of work remains fragmented, setting the stage for identifying gaps and justifying conceptual models such as the SEWCF format.

Team-Based Formats in Combat Sports

Research on athlete psychology has consistently shown that participants in individual sports, including combat disciplines such as judo and wrestling, tend to experience higher levels of depressive symptoms and competitive anxiety compared to team sport athletes (Reardon et al., 2019). This vulnerability has been attributed to the heightened personal pressure, fear of failure, and maladaptive perfectionism inherent in one-on-one formats. However, preliminary evidence suggests that team-based competition structures—such as national team events or collegiate dual meets—may partially mitigate these psychological stressors by distributing responsibility across multiple athletes and enhancing social support mechanisms (Bu et al., 2024).

In combat sports with weight-sensitive demands, team formats also introduce unique psychological challenges. Collective weigh-ins and shared weight management strategies may exacerbate risks for disordered eating, with prevalence estimates ranging from 0–19% among men and 6–45% among women (Reardon et al., 2019). Anxiety and coping strategies in judo competitors, for instance, show that women, older athletes, and low-performance groups report higher anxiety levels, while task-oriented coping remains the preferred stress response, potentially transferable to team events such as the Judo World Team Championships (Hogrefe et al., 2018). Moreover, moral decision-making attitudes appear to differ between athletes in individual combat sports (e.g., wrestling) and those in team sports (e.g., basketball), with variables such as sport experience and parental education shaping attitudes toward cheating and fairness (Arslan et al., 2018).

Audience dynamics represent another important dimension. While detailed studies of modern team-based formats like the Davis Cup, World Judo Team Championships, or NCAA Duals remain scarce, ethnographic research illustrates the cultural power of traditional combat sport spectacles. For example, Senegalese wrestling (“Lamb”) demonstrates how symbolic meaning, ritual elements, and community involvement transform individual contests into large-scale collective events, drawing massive audiences and embedding sport within national identity (Biveghe Assoumou & Wane, 2018).

Finally, team identity in combat sports has been most evident in national and collegiate structures, where collective goals and stable medal performance reinforce cohesion and solidarity. Analyses of Russian national wrestling teams from 1993–2016 reveal consistent medal success (60–77% at European Championships), which in turn reinforced team cohesion and long-term program stability (Latishev et al., 2018). In youth and developmental contexts, team-based structures are further associated with stronger social bonds and moral development than individual formats, suggesting broader psychosocial benefits of adopting collective models in combat sports.

2.2. Event Design and Sport Governance

Research on event design and sport governance in combat sports has increasingly focused on fairness, strategic complexity, and governance flexibility as central dimensions of institutional innovation. In terms of fairness, recent reforms in judo have emphasized transparency, accountability, and equity. The International Judo Federation’s *Sport and Organisation Rules* (2021–2025) introduced updates on refereeing standards, gender equality, and anti-doping measures, all of which have been cited as mechanisms to ensure fair competition in the World Judo Team Championships (International Judo Federation, 2021). Surveys indicate gradual improvements in gender balance among national federations between 2019 and 2020, particularly through the promotion of women coaches and equitable competition conditions (Women’s Sports Foundation, 2022). In wrestling, the NCAA’s rule changes in 2022–2023, which allowed freshmen to participate in up to five unattached matches without exhausting eligibility, have been recognized as an equity-oriented reform designed to reduce unfair eligibility losses (NCAA, 2022). Broader reports on corruption in sport have identified boxing and karate as high-risk combat disciplines, with the *Global Report on Corruption in Sport* (UNODC, 2021) advocating stronger transparency and accountability mechanisms, echoing financial governance reforms from other sports.

Strategic complexity has been documented in the management of stakeholder networks, commercialization, and geopolitical pressures. Grassroots boxing initiatives in Italy, such as *boxe popolare*, have transformed local gyms into welfare hubs, complicating traditional relationships between coaches, athletes, and communities (Frontiers in Sociology, 2021). In wrestling, NCAA conference realignments in 2024–2025, such as Arizona State’s move to the Big 12, illustrate how institutional restructuring creates new layers of governance complexity in dual meets, requiring coordination between federations, universities, and sponsors (NCAA.com, 2023). Judo diplomacy at Tokyo 2020 has been studied as a case of governance complexity where anti-discrimination policies and political sanctions—such as the suspension of Iran’s federation—became part of the sport’s global positioning (Dubinsky, 2023). These

cases demonstrate how combat sports governance increasingly requires multi-level negotiation to balance athlete welfare, institutional legitimacy, and commercial interests.

Governance flexibility has been highlighted through institutional adaptations, pilot formats, and sustainability initiatives. The IJF calendar and rule updates between 2022 and 2025 incorporated hybrid events and observer programs, reflecting adaptability to shifting global conditions (IJF, 2022). Karate's inclusion in the Tokyo 2020 Olympic Games represented a governance pilot that combined cultural branding with competitive innovation (Dubinsky, 2023). In wrestling, NCAA reforms such as the redshirt rule (2022) and the new allocation system for the 2025 national championships are cited as examples of flexible governance that addresses athlete development and conference realignments (NCAA, 2025). At a broader level, the proposal for an International Council for Sports Governance (ICSG) advocates flexible, heterarchical models to manage transnational issues such as doping, corruption, and climate change (International Journal of Sport Policy and Politics, 2023). These findings suggest that governance flexibility is essential for adapting competition formats in combat sports to evolving global expectations, ensuring both institutional resilience and competitive sustainability.

Identified Research Gap

Despite increasing scholarly interest in martial arts and combat sports, significant gaps remain in the study of **team-based competition formats**. One major shortfall concerns the limited exploration of how team dynamics affect mental health and performance outcomes. Systematic reviews indicate that participation in martial arts and combat sports (MA&CS) is associated with improved self-esteem and reduced aggression in individual practitioners (Vertonghen et al., 2024). However, little attention has been paid to collective experiences such as shared stress, group resilience, or collective coping strategies in team competitions like the World Judo Team Championships or NCAA wrestling duals. Moreover, there is a scarcity of longitudinal studies examining the long-term effects of team participation in combat sports, especially in comparison with traditional team sports, where such research is more common. These gaps extend into governance and inclusion, as the potential of team-based innovations to improve athlete wellbeing and equity remains underexplored.

A second gap lies in the lack of **integrative theoretical frameworks**. Although psychological research on combat sports has expanded, it remains fragmented across localized studies and rarely provides a unified conceptual approach. Existing frameworks often address individual wellbeing but fail to capture the interaction between psychological, social, and performance dimensions in team environments. For example, Figueiredo (2025) highlights the phenomenological dynamics of fighting as central to individual development but does not extend these insights to collective structures. Scholars argue that robust theoretical models are needed to account for mediators such as training load, role differentiation, and contextual pressures—factors that strongly shape team cohesion and performance in wrestling or judo. Calls have been made for interdisciplinary frameworks that combine psychology, sociology, and sport science to create standardized measures for evaluating team-based wellbeing in combat sports (Di Marino & Ciaccioni, 2025).

Finally, scholars emphasize the **need for conceptual proposals** to address these shortcomings. Innovative models are recommended to clarify combative experiences in team transitions, drawing on phenomenological or biopsychosocial perspectives (Figueiredo, 2025). The Strategic Elimination Wrestling Competition Format (SEWCF) represents one such proposal, aiming to balance individual skill with team strategy while enhancing fairness, sustainability, and athlete wellbeing. Other conceptual contributions stress the role of emotional intelligence and trust in fostering team cohesion and “performable happiness,” suggesting their potential application to team-based combat sports (Kim & Kim, 2018). Ethical and regulatory frameworks are also advocated to reduce risks, with pilot programs for inclusion and wellbeing serving as important testbeds. Overall, the literature lacks robust theoretical and empirical foundations for understanding team formats in combat sports, underscoring the value of conceptual innovations like the SEWCF.

Theoretical Framework

Strategic Complexity: Tactical Roles for Coaches and Athletes

The SEWCF introduces a level of tactical decision-making largely absent from traditional wrestling formats. Lineup declarations, reserve substitutions, and the Golden Fall mechanism convert the coach from a passive advisor into an active strategist (Hafezikhah, 2025). This reconfiguration parallels team-oriented sports such as volleyball and boxing, where in-game decisions significantly alter outcomes (Wang & Bradbury, 2021). Wrestlers also acquire layered roles: beyond executing individual techniques, they become contributors to a collective sequence where momentum, psychological resilience, and role differentiation matter. This dynamic fosters richer analytical depth for both practitioners and spectators, aligning wrestling with broader trends of strategy-driven sport entertainment.

Governance Innovation: Balancing Reform and Institutional Legitimacy

From a governance perspective, adopting team-based structures requires reconciling innovation with the institutional legitimacy of long-standing traditions. Wrestling has historically been cautious toward reform, but comparative evidence from judo and NCAA wrestling demonstrates that carefully staged institutional changes can enhance sustainability and spectator appeal (Literature Review, 2025). Governance flexibility—through pilot programs, transparent evaluation, and rule adaptation—is critical to managing resistance and ensuring athlete welfare (Shilbury, O’Boyle, & Ferkins, 2016). The SEWCF offers a governance laboratory: it modernizes competitive logic while preserving the core value of one-on-one combat, thus maintaining cultural legitimacy within the Olympic movement (Hafezikhah, 2025).

Equity and Inclusion: Broader Participation and Shared Pressure

The individual-based model restricts participation to national champions, sidelining many world-class athletes. The SEWCF counters this by allowing three wrestlers per weight class, opening pathways for broader representation (Hafezikhah, 2025). This not only democratizes talent exposure but also redistributes competitive pressure across multiple athletes, reducing performance anxiety and promoting psychological fairness (Hafezikhah, 2025). Moreover, gender equity and youth development initiatives—already tested in sports like judo—can be integrated into the SEWCF framework, offering a structural mechanism to advance inclusion agendas (Women’s Sports Foundation, 2022).

Narrative Value: Designing Matches with Comeback Potential and Layered Tension

Sports thrive on narrative tension, and the SEWCF explicitly designs for it. With each weight class unfolding as a best-of-three mini-series, matches acquire rhythm, suspense, and multiple entry points for spectators (Hafezikhah, 2025). The Golden Fall rule, in particular, ensures that outcomes remain uncertain until the final moment, akin to last-minute goals in football or tie-breaks in tennis. This narrative layering creates opportunities for storytelling, live commentary, and media branding, enhancing wrestling’s marketability. In this sense, the SEWCF is not merely a competition format but a narrative device—structuring tension, redemption, and collective stakes into the very logic of the sport (Hafezikhah, 2025).

Comparative Case Studies

To evaluate the potential of team-based innovations in wrestling, it is essential to examine parallel developments in other sports that have successfully bridged the gap between individual and collective competition. The following four case studies—Davis Cup tennis, the World Judo Team Championships, NCAA collegiate wrestling, and the Chess Olympiad—offer diverse insights into how team formats generate strategic depth, enhance audience engagement, and challenge governance structures. Together, these cases provide a comparative foundation for assessing the applicability and adaptability of the SEWCF model in wrestling.

Davis Cup (Tennis)

The Davis Cup stands as one of the most prominent examples of how team identity can be embedded into an otherwise individual sport. While tennis usually highlights the achievements of individual athletes, the Davis Cup reframes performance within the collective aspirations of a national team. This shift in meaning fosters a sense of solidarity among players and supporters, transforming individual matches into symbols of national pride. Empirical evidence suggests that team formats such as the Davis Cup can enhance both motivation and performance by increasing accountability and shared responsibility (Koning & Koolhaas, 2018).

A defining feature of the Davis Cup is the strategic sequencing of matches. Team captains must decide the order of singles and doubles players, balancing individual strengths against anticipated lineups from the opposing side. These tactical decisions add layers of psychological tension, as early wins or losses strongly influence the mental landscape of subsequent matches. Unexpected defeats by top-seeded players can place disproportionate pressure on teammates, creating fertile ground for dramatic comebacks and emotionally resonant narratives. The sequencing mechanism therefore generates not only sporting outcomes but also a rhythm of suspense that sustains audience engagement across the multi-day event.

Nevertheless, the Davis Cup model also presents clear limitations when considered for combat sports such as wrestling. The inclusion of doubles matches in tennis introduces strategic variety that has no direct parallel in wrestling. Furthermore, the extended scheduling and physical demands of Davis Cup ties differ significantly from the high-intensity, short-duration bouts characteristic of combat sports. For these reasons, while the Davis Cup provides valuable lessons on cultivating team identity and emotional resonance, any adaptation to wrestling must be carefully recalibrated to account for structural and physiological differences.

World Judo Team Championships

The World Judo Team Championships represent the closest structural analogue to wrestling when it comes to implementing a team-based model in a traditionally individual sport. While judo, like wrestling, is fundamentally individual in nature, the International Judo Federation (IJF) has successfully integrated individual contests into a collective scoring system at the team level. Under this structure, each team fields athletes across several weight classes, and the outcome of each bout contributes to the overall team result. This system of collective scoring makes judo the most relevant comparative framework for wrestling (International Judo Federation, 2021).

From a tactical standpoint, team judo introduces critical elements of lineup selection and sequencing. Coaches play a decisive role in determining the order of athletes, shaping the probability of team success based on matchups. At the same time, the collective scoring format ensures that even individual losses are absorbed within a team context, distributing psychological pressure and fostering resilience. These dynamics enhance cohesion and create layered narratives across the competition (Latishev et al., 2018).

In terms of implementation and audience reception, the World Judo Team Championships can be regarded as a relative success. Cultural and media analyses indicate that the format has attracted larger audiences and reinforced symbolic narratives of national identity (Dubinsky, 2023). IJF reports also emphasize that institutional reforms between 2021 and 2025—such as updated refereeing standards, gender equity measures, and organizational innovations—have improved transparency and strengthened fan engagement (International Judo Federation, 2022). Taken together, the judo experience demonstrates that an individual combat sport can be reframed through a team structure without undermining its essential character.

NCAA Wrestling (Duals and Championships)

Collegiate wrestling in the United States (NCAA) provides one of the most institutionalized examples of team scoring in a combat sport. In this model, individual matches are not treated in isolation but are embedded within a broader team scoring system. Victories, defeats, and even the manner of victory—whether by points, technical fall, or disqualification—directly affect the overall team result. In this way, NCAA wrestling demonstrates how an individual-based sport can be sustainably integrated into a collective competitive logic (Smith, 2010).

NCAA wrestling is also culturally significant in the United States. Strong fan loyalty, specialized media coverage, and extensive reporting have embedded collegiate wrestling into the broader identity of American sport and academia. The season-based structure generates long-term narratives, with dual meets between universities building traditions, rivalries, and enduring emotional connections among students, alumni, and local communities (Ecker, 2005). Through regional conferences and the national championships, NCAA wrestling combines local appeal with nationwide media reach, making it a unique hybrid of athletic competition and cultural identity.

Despite these successes, the NCAA model faces barriers to global exportability. First, it is deeply rooted in the cultural and educational infrastructure of the United States, making it difficult to transfer to countries with different academic or sporting systems. Second, the season-based format of NCAA wrestling does not easily align with the international calendar governed by United World Wrestling (UWW). Third, the fan loyalty model—tied to university identity—is not easily replicable in other contexts. However, these barriers do not imply that season-based or decentralized models are impossible in wrestling. Volleyball, for instance, has demonstrated the viability of multi-tier, multi-country leagues that sustain both media appeal and fan loyalty. This suggests that while NCAA wrestling is a uniquely American model, its lessons could inform more flexible and internationally adaptable frameworks for wrestling (NCAA, 2022; NCAA, 2025).

Chess Olympiad and Team Leagues

Chess, as a fundamentally individual discipline, illustrates how collective structures can be successfully overlaid onto individual competition through the Chess Olympiad and various team leagues. In the Olympiad, each team consists of multiple players competing across different “boards,” with the overall team outcome determined by the aggregate of individual results. This board-based scoring system demonstrates a clear transition from individual to team logic, showing that even purely individual sports can be adapted to collective frameworks (FIDE, 2023).

From a tactical perspective, notable parallels exist between team chess and wrestling. In both contexts, lineup decisions significantly affect team outcomes. Just as chess captains decide which players will compete on specific boards, wrestling coaches in models such as SEWCF can strategically determine athlete order and lineup sequencing. This “strategic placement” moves the contest beyond individual skills and introduces dimensions of risk management, momentum building, and collective psychology.

In governance terms, the International Chess Federation (FIDE) has implemented significant innovations in managing global leagues and Olympiads. These include decentralized event models, integration of national and

club teams, and institutional reforms aimed at greater transparency and digital audience engagement (International Journal of Sport Policy and Politics, 2023). Such measures highlight how even a sport with deep traditional roots can reinvent itself through flexible governance and media-oriented strategies.

The lessons from chess are particularly instructive for wrestling and the SEWCF. First, the transition from individual to team-based formats does not undermine the essence of the sport but instead adds new layers of excitement and narrative depth. Second, governance flexibility—as demonstrated by FIDE—can reduce resistance from traditionalists and facilitate the adoption of innovative competition models. Finally, chess underscores the importance of strategic lineup decisions as a bridge between individual competition and collective identity—a mechanism that could serve as the cornerstone of wrestling's transformation under the SEWCF.

The SEWCF Wrestling Format in Comparative Perspective

Following the review of comparative cases across different sports, this chapter introduces an innovative competition format for wrestling. The aim is to demonstrate how this structure can draw inspiration from successful models in other disciplines while remaining responsive to the specific characteristics and demands of wrestling.

Overview of the SEWCF Structure

The **SEWCF** is built around the presence of three wrestlers per weight class. Under this structure, the outcome of each weight is determined through a best-of-three system, with an additional reserve athlete eligible to participate. By adding a team dimension to otherwise individual contests, the format both expands opportunities for athlete participation and generates a clearer, more suspenseful structure for audiences (Hafezikhah, 2025).

The core objectives of this innovation are threefold: first, to provide broader opportunities for emerging talents to compete at national and international levels; second, to elevate the role of the coach from a passive advisor to an active tactical designer; and third, to increase media appeal through a competition format that offers rhythm, comeback scenarios, and strong narrative potential. Taken together, the SEWCF blends the logic of individual and team competition, positioning wrestling for a new level of strategic depth, diversity, and media branding (Hafezikhah, 2025).

Tactical Innovations

Private lineup declarations.

One of the key innovations of the SEWCF is the use of hidden lineup submissions with simultaneous disclosure before the match begins. Similar to the Davis Cup in tennis and the Chess Olympiad, this mechanism elevates the coach's strategic role, making outcomes dependent not only on athletes' technical skills but also on tactical decisions in player placement. It also introduces an additional layer of suspense and unpredictability that enhances the format's media appeal (Hafezikhah, 2025).

Substitution logic.

Another innovative feature of the SEWCF draws on the substitution logic used in team chess. In chess, teams often consist of five starters plus one reserve; when a main player is rested, the reserve enters at the bottom of the lineup, and the other players shift upward accordingly. This logic translates effectively to wrestling, where injury risks and recovery needs are more pronounced. By adopting such a system, coaches can maintain overall team balance while gaining tactical flexibility to respond to the dynamic conditions of competition (Hafezikhah, 2025).

Golden Fall.

The "Golden Fall" rule represents the most distinctive tactical mechanism within the SEWCF, adding a dramatic comeback dimension to wrestling contests. If a team loses the first two bouts but its third wrestler secures a victory by fall, a fourth and deciding match is triggered. In practice, this operates much like a last-minute goal in football or a tie-break in tennis, ensuring that outcomes remain uncertain until the final moment. The rule not only highlights the third wrestler as a focal point of team resilience but also enhances the narrative and media value of each contest (Hafezikhah, 2025).

Synthesis and Wrestling-Specific Needs

The **SEWCF** draws upon the strengths of the comparative models discussed earlier and reconfigures them within the specific context of wrestling. From the Davis Cup, it borrows the emphasis on team identity and collective national representation; from the World Judo Team Championships and NCAA wrestling, it adapts the logic of collective scoring and the institutionalization of individual contests within a team framework; and from the Chess Olympiad, it incorporates strategic lineup sequencing and substitution logic. Together, these elements make the SEWCF not merely a new format but an integrative framework that synthesizes diverse sporting experiences and redesigns them in a way that is directly relevant to wrestling (Hafezikhah, 2025).

At the same time, the SEWCF addresses wrestling's unique needs and constraints. Given the sport's high physical intensity and the compressed scheduling of tournaments, lengthy or overly complex formats are impractical. The three-bout structure with the option of a reserve provides both manageability and excitement, while also allowing flexibility in cases of injury or fatigue. Moreover, in an era where digital media amplifies the importance of narrative, mechanisms such as the "Golden Fall" inject a dramatic comeback dimension that enhances wrestling's storytelling potential. In this way, the SEWCF functions not only as a technical reform but as a comprehensive response to the competitive, psychological, and media-related demands of modern wrestling (Hafezikhah, 2025).

Policy and Implementation

Strategic benefits for United World Wrestling (UWW) and national federations.

The implementation of the SEWCF can offer multilayered benefits to UWW and national federations. First, by allowing three athletes per weight class, the format expands opportunities for participation, enabling mid-tier and developing countries to gain broader representation on the international stage. Second, by elevating the role of the coach and embedding tactical complexity into competitions, wrestling moves closer to strategy-driven sports, thereby strengthening its analytical and professional profile. Third, with the three-bout narrative structure and innovations such as the "Golden Fall," the SEWCF enhances wrestling's media and commercial appeal, positioning it as a more competitive product among Olympic sports and more attractive to broadcasters and the IOC.

Opportunities for pilot programs.

Several levels of pilot implementation can be pursued to test the SEWCF in practice. At the national level, the **Takhti Cup** in Iran, as a historically prestigious tournament, could serve as the first platform for experimenting with the format in one or two weight classes. At the regional level, **continental leagues** (e.g., in Asia or Europe) could incorporate the new structure into portions of their competition calendars. For youth categories, **junior tournaments** provide a low-risk environment to evaluate the psychological and developmental impacts of the model. In addition, **exhibition matches** held alongside world-level events could help introduce coaches, referees, and media professionals to the SEWCF. Finally, the **Wrestling World Cup**, which currently operates as a four-team event (the top three from the World Championships plus one combined team), presents an ideal setting for full implementation at the international level, since it is less constrained by logistical and scheduling pressures.

Institutional conditions required for successful adoption.

For the SEWCF to be sustainably integrated into global wrestling, several institutional conditions must be secured. First, **media education** is essential: rules and innovations such as the Golden Fall must be communicated clearly through infographics, instructional videos, and simplified television coverage for general audiences. Second, **referee training** must be conducted systematically, ensuring officials are fully prepared to manage the diverse scenarios the format introduces. Third, from a **logistical perspective**, while the three-bout system may appear time-consuming, in practice the overall duration of tournaments will not exceed that of many comparable sports (e.g., judo or taekwondo). The use of dual mats and shorter intervals between bouts can further streamline operations. Nonetheless, limited infrastructure—including standardized venues, live broadcasting capabilities, and referee technology—remains a challenge that must be addressed. Finally, **institutional flexibility** is critical: UWW and national federations should adopt a phased approach, beginning with pilots in select weight classes before gradually scaling up to full adoption across all divisions and tournaments.

CONCLUSION

Summary of key comparative insights.

The comparative analysis of Davis Cup tennis, the World Judo Team Championships, NCAA wrestling, and the Chess Olympiad demonstrates that individual sports can successfully incorporate team-based dimensions without undermining their core essence. Each case highlights distinct mechanisms—team identity, collective scoring, lineup strategy, and governance innovation—that generate strategic depth and enhance audience engagement. Together, these insights provide a solid foundation for reimagining wrestling through the SEWCF model.

Theoretical and governance rationale for team-based evolution in wrestling.

The SEWCF is not a radical departure from wrestling's traditions but an integrative framework that synthesizes lessons from other sports while responding to wrestling's unique demands. By embedding tactical innovations such as hidden lineup declarations, substitution logic, and the Golden Fall, the format enhances strategic complexity and narrative appeal. At the governance level, it offers UWW and national federations an opportunity to modernize the sport, strengthen institutional legitimacy, and align wrestling with broader trends in global sport governance that prioritize flexibility, equity, and media marketability.

Call for further piloting, research, and stakeholder engagement.

To realize its potential, the SEWCF requires systematic piloting in contexts such as the Takhti Cup, regional leagues, and the Wrestling World Cup. These trials should be accompanied by research on athlete wellbeing, audience reception, and institutional feasibility. Equally important is sustained engagement with stakeholders—athletes, coaches, referees, federations, media partners, and fans—to refine and legitimize the format. By building on comparative lessons and fostering collaborative experimentation, wrestling can take a decisive step toward a more inclusive, strategic, and globally appealing future.

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THE BIOMECHANICAL FOUNDATIONS OF UNIVERSAL HELICAL MOVEMENT PATTERNS IN WRESTLING AND THEIR RELATIONSHIP WITH ATHLETIC PERFORMANCE: A SYSTEMATIC REVIEW

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ABSTRACT

Aim: The objective of this review is to examine the biomechanical foundations of helical (spiral) movement patterns observed across various scales in the universe within the context of wrestling, and to discuss the potential relationships between these structural similarities and athletic performance from an interdisciplinary perspective.

Methods: This study is based on a systematic review encompassing current literature in the fields of physics, astrophysics, biology, anatomy, and sports biomechanics. The fundamental principles of helical organization in physical and biological systems and the rotational and torsional movement patterns in wrestling were theoretically compared.

Findings: Literature findings indicate that spiral organization is associated with common physical principles such as the conservation of angular momentum, optimization of energy transfer, and the maintenance of dynamic stability. The turns, throwing techniques, and multi-axial trunk rotations observed in wrestling are shaped by the simultaneous interaction of angular velocity, acceleration, and centripetal and centrifugal forces. In this process, inter-segmental timing and the control of the center of mass emerge as decisive components of performance.

Conclusion: Structural and functional similarities exist between universal helical movement patterns and biomechanical organization in wrestling. These similarities provide a theoretical framework for optimizing athletic performance in the context of rotational force production and energy transfer. The findings suggest that a helical biomechanical approach can be utilized as an explanatory model in the analysis of wrestling performance.

Keywords: Universe, Helical Movement Patterns, Wrestling, Biomechanics, Performance.

INTRODUCTION

When physical systems in nature are examined, it is observed that spiral and rotational movement patterns are fundamental organizational forms recurring across different scales. From the structural order of galaxies to atmospheric phenomena, and from fluid dynamics to biological structures, spiral cycles are defined as a universal movement principle that optimizes energy transfer and ensures continuity across many natural systems (Bejan & Lorente, 2015; Ball, 2021).

In this context, spiral movement is considered not merely a formal characteristic but a fundamental dynamic governing the functioning of nature. Similar principles of spiral and rotational organization are also clearly observed in the movement structures of living systems. In particular, when the development of biological tissues, the arrangement of musculo-fascial lines, and the movement strategies of organisms are examined, it is observed that a cyclical and rotational organization is dominant rather than linear progression (Myers, 2020). This suggests that the human movement system is also structured in harmony with these universal principles found in nature.

When human movements are evaluated from a biomechanical perspective, it is accepted that force production and transmission occur largely through sequential rotations between segments. Current sports biomechanics literature reveals that the generation, storage, and transfer of angular momentum from proximal to distal segments is the fundamental mechanism determining the speed, efficiency, and coordination of movement (McGill, 2018; Kibler et al., 2019). This spiral kinetic chain organization forms the basis of multi-joint sporting movements. The effective use of rotational forces (torque) plays a critical role in performance, especially in sporting situations that require change of direction, acceleration, and sudden force production.

The sport of wrestling is one of the athletic disciplines where spiral and rotational movement organization is observed most intensely and distinctly. Offensive, defensive, and counter-attack techniques in wrestling are executed by transferring rotational forces centered in the trunk and pelvis to the extremities through a spiral kinetic chain. During the gripping, pulling, turning, and change-of-direction phases, the conservation of angular momentum

and the timing of torque are decisive factors in ensuring technical efficiency and achieving mechanical superiority over the opponent (Horswill, 2018; Mirzaei et al., 2017). However, an examination of the existing literature on wrestling biomechanics reveals that variables such as force production, physiological responses, and joint loading are frequently addressed; yet, studies directly investigating the effects of helical (spiral) movement patterns on athletic performance within a holistic biomechanical framework remain limited (Nilsson et al., 2020; Kons et al., 2023). This situation necessitates a more systematic treatment of spiral movement organization in wrestling at both theoretical and applied levels.

This systematic review aims to synthesize the fundamental organizational principles of helical (spiral and rotational) movement patterns observed in the universe across physical and biological systems through a holistic approach, and to reveal the biomechanical relationship between these patterns and wrestling-specific movement structures. In this context, fundamental mechanisms such as angular momentum generation, centripetal–centrifugal force interaction, and force transmission along the kinetic chain—which are among the decisive components of wrestling performance—will be systematically evaluated from a biomechanical perspective within the framework of universal movement principles.

Accordingly, this study aims to examine the role of the structural and functional continuity exhibited by helical movement patterns on a universal scale in the formation of wrestling-specific technical movements, force production, and movement efficiency through an interdisciplinary perspective. Thus, by integrating the theoretical and mechanical connections between universal movement organization and sports biomechanics, it is intended to provide a comprehensive and holistic biomechanical framework at a conceptual level for the understanding of wrestling performance.

UNIVERSAL HELICAL (SPIRAL) MOVEMENT PATTERNS

In various systems extending from nature to the universe, the emergence of helical structures and movement patterns is remarkable—ranging from the rotational movements of galaxies to the double-helix structure of the DNA molecule, and from the growth orientations of plants to the morphological and biomechanical organization of animals. Although this regularity exists across different scales and functions, it reflects common principles in terms of energy transfer, mechanical stability, and movement efficiency, providing a conceptual foundation for understanding the organization of human movement in sports sciences. On an astrophysical scale, spiral galaxies exhibit helical arm structures shaped by differential rotation and density wave mechanisms, reflecting the dynamic distribution of star-formation regions and the principle of conservation of angular momentum (Dobbs & Baba, 2014; Sellwood & Masters, 2022).

The helical movement pattern is a fundamental concept used in fields such as physics, astrophysics, fluid mechanics, and molecular biology to explain the spatial organization of spiral and helical movements. This concept serves as a critical model, particularly in the dynamic analysis of particle movements in magnetic fields, galactic structures, and biological spiral systems. The term helical (spiral, sarmal, helisel, helezonî) refers to a basic geometric and dynamic principle describing a spiral-shaped structure and movement organization that advances by rotating around an axis in three-dimensional space. In most contexts, the terms "spiral," "sarmal," and "helical" are used synonymously to define the three-dimensional geometric order in a screw form and the movement characteristics specific to this order (Jeong & Kim, 2015). These patterns contribute to the preservation of structural integrity by ensuring a balanced distribution of forces, providing continuity of movement and directional control, optimizing energy transfer, and maintaining the dynamic stability of the system (Lobanov, 2005). In this context, helical organization is considered one of the fundamental determinants of the order of movement and structure in the universe, within a wide continuum extending from molecular structures at the micro-scale to cosmic systems at the macro-scale.

In contrast, this definition has not yet been clearly and systematically conceptualized within the sports literature. Nevertheless, these movement patterns in sports are characterized by the integrated structure of rotational and circular movements directed from top to bottom, bottom to top, right to left, and left to right. This pattern represents a holistic movement organization resulting from the spatial and temporal integration of rotations occurring simultaneously in the frontal, sagittal, and transverse planes.

SPIRAL STRUCTURES IN NATURE

Helical structures represent a universal form of geometric and dynamic organization observed across various scales, from microscopic biomolecules to cosmological systems. The fundamental characteristic of this organization is the simultaneous integration of angular momentum and linear progression, offering significant advantages in terms of regulating energy distribution, enhancing structural stability, and ensuring continuity of motion (Li, Zhang,

& Wu, 2019; Cartwright & Piro, 2021). Similarly, in atmospheric systems such as hurricanes and tornadoes, rotational airflows developing around low-pressure centers form helical movement patterns that optimize energy transfer and dynamic continuity. In this context, helical organization is considered a universal dynamic principle at both cosmic and atmospheric levels, ensuring the regulation of structure and motion (Carroll & Ostlie, 2017). Indeed, spiral structures in nature have served as a source of inspiration for biomimicry-based innovations in engineering (Keskin & Kuşhan, 2020; Gök, 2025). Indeed, aesthetic and high-performance solar panels have been developed by taking inspiration from the sunflower; the "Desert Breath" desert vortex was transformed into an artistic land structure inspired by the form of spiral galaxies; and the Shinkansen, inspired by the aerodynamic beak of the kingfisher, has stood out as a striking example of biomimicry adapting nature's form to the speed and silence of engineering.



Figure 1. Examples of helical organization observed in the universe, nature, and biomimetic designs

While the spiral galaxy structure represents a macro-scale example of rotational order in nature, the aerodynamic beak of the kingfisher bird has contributed to the reduction of flow resistance by inspiring high-speed train nose designs.

While the seed arrangement of the sunflower reflects a spiral organization based on energy and space optimization in nature, this principle has been biomimetically applied in the helical placement of spiral architectural structures and solar panels for the purposes of structural efficiency and maximum energy harvesting. These examples demonstrate that spiral geometry is a fundamental organizational principle in terms of mechanical efficiency, flow optimization, and functional performance in both biological systems and engineering designs.

Helical Movement Structures in Spiral Form in Living Organisms

The prevalence of helical structures in nature is observable across many organisms at both morphological and functional levels. The double helix structure of DNA provides a biomechanical advantage that ensures the storage of genetic information with maximum security in a minimal area, protection against external physical factors, and error-free copying during replication (Watson et al., 2014). Similarly, the helical organization of myocardial fibers in the heart muscle increases pumping efficiency through a torsional contraction mechanism (Sengupta & Narula, 2019). Furthermore, the spiral organization of fascia and muscle chains provides a biomechanical integration that optimizes force transmission between segments (Stecco et al., 2020).

The spiral growth (phyllotaxis) observed in plants and the helical coiling mechanisms in climbing plants are a reflection of the relationship between morphological stability and environmental adaptation (Zhang et al., 2021). These examples demonstrate that the helical structure provides advantages in biological systems in terms of energy economy, load distribution, and durability. While the appearances, movements, and forms of living organisms in nature embody the fundamental dynamics of nature, and particularly the helical movement pattern; humanity has achieved significant breakthroughs in a wide range of fields from science to art, and technology to education by observing these structures, developing life-facilitating solutions. The structural efficiency of DNA, the climbing mechanism of ivy, the microstructures in dragonfly wings, and the hexagonal pattern of honeycombs have been

sources of inspiration for biomimicry-based innovations in many fields, from engineering to architecture and agriculture (Keskin & Kuşhan, 2020).

Similarly, biological examples such as the horns of rams and deer, the slithering movements of snakes, and the tail structures of seahorses demonstrate the prevalence of helical structures in nature at both morphological and functional levels. These spiral morphologies observed in living organisms provide biomechanical advantages that optimize movement efficiency in addition to increasing structural durability (Gould, 1975). In this context, the helical and spiral patterns observed in plants and animals are considered not merely aesthetic formations, but fundamental biological organization principles that emerge as a result of the interaction between evolutionary processes and physical laws, enhancing the environmental adaptation and functional effectiveness of organisms (Niklas, 1994).

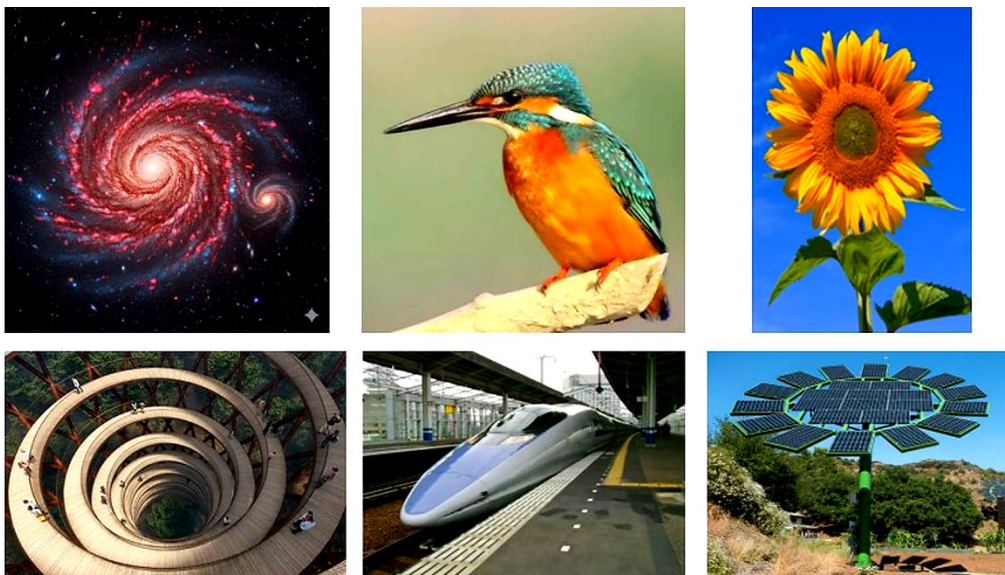


Figure 2. Examples of helical (spiral) organization observed in nature and human anatomy

Rotational flow structures emerging in atmospheric systems such as tropical cyclones and tornadoes constitute typical examples of spiral dynamics on a macro scale. The human hair whorl and the curved structure of ibex horns reflect the natural helical arrangement observed in biological tissues. Furthermore, the physiological curvatures of the spine exhibit a functional spiral organization in terms of load distribution, balance, and movement efficiency. These examples demonstrate that spiral geometry is a fundamental organizational principle for structural durability, energy transfer, and rotational balance in both physical systems and living organisms.

Similarities Between Helical Organization and Biomechanical Foundations in the Human Movement System

Helical organization is observed in structural and functional processes throughout the human body, from the cellular level to the entire organism. The morphological arrangement of cells and their cytoskeletal structures exhibit spiral-oriented mechanical behavior during force production and transmission, while the contraction–relaxation cycles of muscles, the transport of blood through the cardiovascular system, and the peristaltic movements of the digestive system are based on helical and wave-like movement patterns (Lieber, 2018). In particular, the spiral organization of the fascia, muscular, and connective tissue systems facilitates the balanced and efficient transmission of force between body segments (Alberts et al., 2022). Furthermore, the rotational and cross-coordination patterns exhibited by the human body during movement reflect a dynamic and spiral organizational structure rather than a static linear configuration.

In this context, the human body is conceptualized as an integrated biomechanical system that unconsciously employs helical movement patterns during the production, transmission, and control of motion. Helical (spiral) organization is recognized as one of the fundamental biomechanical principles determining the structural integrity and functional efficiency of the human movement system. This organizational pattern is based on the integration of rotational components simultaneously with linear force production, thereby optimizing the continuity of force transmission, mechanical stability, and energetic efficiency.

Beginning at the molecular level with the double-helical structure of DNA and extending to the helical fiber architecture of the myocardium, as well as to the oblique myofascial chains within the musculoskeletal system, this

multiscale spiral organization emerges as a fundamental mechanical strategy that enhances both the durability and functional performance of biological structures (Alberts et al., 2022; Myers, 2020).

At the macroscopic level, particularly within the musculoskeletal system, the observed helical organization enables force transmission not only along linear segments but also effectively through rotational and cross-linked kinetic chains. In this process, the generation, conservation, and coordinated transfer of angular momentum between segments emerge as critical determinants of mechanical efficiency and movement control. During rotational movements, centripetal force contributes to the stabilization of segments around the axis of rotation, whereas centrifugal force functions as the dynamic outward-directed component of motion. The balanced regulation of these forces by the neuromuscular system enhances movement efficiency while ensuring controlled distribution of tissue loading, thereby reducing the risk of injury (Zatsiorsky & Kraemer, 2021). In conclusion, helical organization is regarded as a central biomechanical mechanism that operates within a multilevel continuum extending from molecular structures to integrated motor performance, contributing to the optimization of force transmission, the preservation of mechanical stability, and the enhancement of movement economy. In this respect, helical organization represents not merely a structural characteristic of human movement, but also one of the fundamental determinants of efficient, controlled, and sustainable movement production.

Relationship Between Helical Movement Patterns and Sport Performance

The morphological and functional structure of the human body plays a determining role in the formation of these spiral patterns. Helical patterns are not solely the product of muscular force; rather, they emerge through the integrated interaction of the musculoskeletal system, joint structures, and the nervous system. In particular, the natural curvatures of the spine support the development of rotational and spiral movements through multidirectional oscillations, including lateral and vertical displacements (Gray, 2016; Kerr & Cowin, 2019). This characteristic enables human movement to occur not only along a linear axis but also along a spiral trajectory. Many athletic activities—including walking, running, jumping, rolling, maintaining balance, climbing stairs, and kicking—naturally incorporate helical components (Kerr & Cowin, 2019).



Figure 3: Biomechanical manifestations of spiral and helical movement patterns in wrestling competitions.

The visual evidence demonstrates the integration of body segments across the sagittal, frontal, and transverse planes simultaneously during the execution of technical maneuvers. The natural curvatures of the spine and the multi-directional oscillations of joint structures facilitate the transformation of linear force into a spiral rotation, thereby optimizing force transmission along the kinetic chain. This helical form allows the athlete to establish

dominance in three-dimensional space by utilizing the equilibrium between angular momentum and centrifugal forces, rather than relying solely on muscular strength.

In sport, helical movements can be defined as a multiplanar form of motion in which a part or the entirety of the body simultaneously integrates rotation, vertical displacement, flexion–extension, and lateral or anterior–posterior inclinations within three-dimensional space. This movement pattern reflects a holistic organization emerging from the spatial and temporal integration of rotational and circular components directed from top to bottom, bottom to top, and right to left, occurring concurrently across the frontal, sagittal, and transverse planes. Accordingly, movement ceases to be a linear displacement confined to a single plane; instead, it assumes a three-dimensional structure in which rotational and translational components across different planes are organized within a spiral pattern.

In this context, the fundamental biomechanical mechanisms of helical (spiral and rotational) movement patterns—including angular momentum generation, the balance between centripetal and centrifugal forces, and force transmission along the kinetic chain—will be evaluated within the framework of universal principles of movement and their relationship to athletic performance (McGinnis, 2020).

Angular Momentum

In sport sciences, angular momentum is a fundamental biomechanical quantity that enables athletes to control rotational movements around their own axis, both in the air and during ground contact. Athletes manipulate their rotational velocity by bringing body segments closer to or farther from the axis of rotation, thereby altering the moment of inertia. The magnitude of angular momentum is defined as the product of a system's moment of inertia and its angular velocity ($L = I \cdot \omega$) (Knudson, 2007; Kristensen, Bull, & Andersen, 2004).

For example, figure skaters initiate a spin by pulling their arms toward the body to reduce the moment of inertia. According to the principle of conservation of angular momentum, this reduction in moment of inertia results in an increase in angular velocity. To terminate the spin and regain control, the skater extends the arms outward, increasing the moment of inertia and consequently decreasing angular velocity (Arita et al., 2024). This mechanism is directly related to the conservation of angular momentum and plays a central role in optimizing rotational performance in sports. Similarly, in gymnastics somersaults and twisting jump techniques, the athlete's ability to generate net angular momentum by synchronizing the acceleration of the lower extremities and trunk segments is a key determinant of performance success (Knoll, 2019). Recent studies quantifying the segmental contributions to angular momentum have demonstrated that the contribution of each body segment to the total rotational moment is closely associated with the athlete's rotational efficiency (Yamaguchi, 2025).

Javelin throwing performance is also closely related to the generation and transfer of angular momentum. Studies conducted on elite javelin throwers have shown that maximum linear velocities at joint centers increase progressively from proximal to distal segments, indicating the effective production and transmission of angular momentum throughout the kinetic chain (Antti, Komi, Korjus, Navarro, & Gregor, 1994). However, some studies have reported that the initiation of joint angular motions in the javelin throw does not necessarily follow a strict proximal-to-distal sequence. This finding suggests that the kinetic chain may operate in a flexible manner through the coordinated contribution of different segments, and that angular momentum production is not confined to a single, uniform sequencing pattern (Wagner et al., 2014).

Centripetal and Centrifugal Forces

Circular motion is one of the fundamental concepts of classical mechanics and is defined within the framework of vectorial force interactions. In systems moving along a circular trajectory, the theoretical foundations of centripetal and centrifugal forces are interpreted relative to the chosen reference frame. Centripetal force is the real force directed toward the center of rotation that enables an object to maintain motion along a circular path. This force does not alter the magnitude of velocity but continuously changes its direction, thereby producing centripetal acceleration. Centripetal acceleration is perpendicular to the velocity vector and is always oriented toward the center of rotation. While an object inherently tends to move in a straight line due to inertia, centripetal force constrains this tendency and ensures orbital stability (Garcia-Falgueras, 2016; Hall, 2022). The centrifugal force is a fictitious force defined only within rotating reference frames. In the literature, this effect is referred to as an “imaginary” or “pseudo” force, representing the tendency of an object to move away from the center and creating the perception of an outward push. However, it does not arise from a physical interaction; rather, it is an inertial effect introduced to explain equilibrium conditions within non-inertial rotating reference frames (Tipler & Mosca, 2022; Hamill, Knutzen, & Derrick, 2021).

Although centripetal and centrifugal forces carry different physical meanings depending on the reference frame, they provide a complementary theoretical framework for the dynamic analysis of circular motion. This conceptual distinction has fundamental importance across a wide range of applications, from the evaluation of biomechanical performance in sport to engineering design and mechanical system analysis.

Interaction of Centripetal and Centrifugal Forces in Athletic Movements

In athletic movements involving circular and rotational components, centripetal and centrifugal forces constitute fundamental biomechanical determinants of movement continuity, directional control, and mechanical efficiency. The dynamic interaction of these forces directly influences the spatial organization of movement, postural stability, and the effectiveness of force transmission. Particularly in actions such as change of direction, curve running, and rotational throwing, the athlete maintains movement continuity and performance efficiency by generating sufficient centripetal force while counterbalancing the centrifugal effect (Grimshaw et al., 2019; Suchomel, Nimphius, & Stone, 2016).

For example, in hammer and discus throwing, tension in the implement and coordinated segmental rotation generate the centripetal force required to sustain circular motion. As angular velocity increases, the implement's tendency to move away from the center of rotation reflects the centrifugal effect. In this context, appropriate positioning of the center of mass, optimization of the moment arm, and effective neuromuscular coordination are critical for movement economy and sustained performance.

Similarly, in movements such as the giant swing in gymnastics, spin rotations in figure skating, and curve running in track events, the athlete generates centripetal force through ground reaction force, muscle–tendon tension, and intersegmental force transmission, while simultaneously regulating the centrifugal effect (McGinnis, 2020). The balanced management of these forces represents a fundamental biomechanical requirement for optimizing energy transfer, maintaining movement stability, and maximizing athletic performance.

Kinetic Chain Mechanics and Intersegmental Force Transmission

Force transmission along the kinetic chain in sport is a biomechanical process that begins with the segments in contact with the ground and progresses through a sequential and precisely timed activation from the proximal to the distal segments of the body. This process is characterized by the generation of ground reaction force through the lower extremities, the production of angular momentum within the pelvic and trunk segments, and the subsequent transfer of this momentum to the shoulder, arm, and distal segments. Effective force transmission depends on optimal intersegmental timing (proximal-to-distal sequencing), joint stability, and neuromuscular coordination (Ellenbecker & Aoki, 2020).

In addition, the stretch–shortening cycle, which utilizes the elastic properties of the muscle–tendon unit, facilitates the conservation of mechanical energy and enables its transfer to subsequent segments with greater velocity and force (Groeber, Reinhart, Kornfeind, & Baca, 2019). Through this integrated mechanism, each segment amplifies the momentum generated by the preceding segment, ultimately producing maximal velocity and force at the distal endpoint of the movement. This biomechanical principle represents a fundamental determinant of performance, particularly in rotational and multiplanar activities such as throwing, striking, and wrestling.

Relationship Between Helical Movement Patterns and Performance in Wrestling

Effective technical execution in wrestling depends on the precise timing and directional control of forces generated during ground contact. Ground reaction force is transmitted from the foot through the knee–hip kinetic chain and subsequently transferred to the trunk and upper extremities. When this transfer does not occur in a synchronized manner, energy dissipation increases and technical efficiency is reduced (McGinnis, 2020).

Unlike movements performed against a fixed object, wrestling techniques are executed against a dynamic and actively resisting opponent. This interaction requires the simultaneous regulation of centripetal and centrifugal forces to maintain control, ensure mechanical efficiency, and optimize performance outcomes. The athlete must position their center of mass relative to the opponent's center of mass and optimize the moment arm through appropriate biomechanical alignment. Bringing body segments closer to the axis of rotation (compact positioning) increases angular velocity by reducing the moment of inertia, whereas extending segments away from the axis enhances stability and balance (Blazevich, 2022).

From a biomechanical perspective, the optimization of spiral and rotational mechanics is critical not only for enhancing performance but also for reducing injury risk. Proper synchronization of joint angles and rotational velocity helps distribute compressive and shear forces more evenly across musculoskeletal structures. The knee,

shoulder, and lumbar spine are particularly vulnerable regions in wrestlers due to the high mechanical loads and repetitive rotational stresses characteristic of the sport (Myer et al., 2015; Serner et al., 2019). The optimal balance between segmental stability and mobility contributes to energy conservation and delays the onset of muscular fatigue. The transmission of force along a spiral pathway, rather than a purely linear trajectory, reduces energy dissipation and enables more mechanically efficient technical execution. This biomechanical efficiency supports sustained performance during competitive conditions that require repeated high-intensity efforts.

Biomechanical Foundations of Rotational and Spiral Movements in Wrestling

Wrestling is a high-intensity combat sport characterized by multi-axial rotations, rapid changes of direction, and force production against an actively resisting opponent. Within this context, the biomechanical foundation of performance relies not primarily on linear force production, but rather on the effective utilization of rotational and spiral mechanics. The generation, conservation, and transfer of angular momentum; the development of torsional forces; and the intersegmental synchronization of ground reaction forces during contact with the surface constitute key determinants of technical effectiveness (Blazevich, 2022; McGinnis, 2020).

The effectiveness of the rotational kinetic chain is directly associated with intersegmental coordination. Initiating hip rotation prior to shoulder rotation enhances momentum transfer and enables the generation of greater angular velocity during throwing movements. When this proximal-to-distal sequencing is disrupted, both performance efficiency declines and excessive mechanical loading may occur in the shoulder and lumbar regions, thereby increasing the risk of injury (Serner et al., 2019; Chaudhari et al., 2021).

Techniques in wrestling such as throws, turns, and bridge reversals are executed through the transfer of force generated in the lower extremities and transmitted to the upper segments via trunk rotation. This process relies on the coordinated activation of the oblique abdominal muscles, thoracolumbar fascia, and hip rotators. Spiral myofascial chains facilitate the transmission of ground reaction forces along a helical pathway, thereby maximizing the generation and transfer of angular momentum (Wilke et al., 2018; Stecco et al., 2020). In parallel, rotational momentum plays a critical role in projection techniques such as the suplex and gutwrench. Angular momentum generated from the lower extremities and transmitted through the trunk to the upper extremities provides the rotational force necessary to elevate, rotate, and control the opponent's body (Arita, Ogasawara, Konda, & Nakata, 2024). By rotating the opponent around their own axis, the wrestler generates torque, thereby producing high angular momentum. This mechanical action facilitates the acceleration of force application and disrupts the opponent's defensive stability, enabling the effective execution of the technique (Ackland, Blanksby, & Cross, 2009).

The Role of Centripetal and Centrifugal Forces in Wrestling Biomechanics

According to Newtonian mechanics, any change in the magnitude or direction of an object's velocity requires the presence of a net external force acting on the object. During circular motion, the direction of the linear velocity vector continuously changes, and the net force responsible for this directional change—always oriented toward the center of rotation—is defined as the centripetal force. This force is not an independent force type but rather the resultant of existing forces such as muscular force, ground reaction force, and contact forces. This biomechanical principle is clearly observed in sports characterized by intense rotational interactions, such as wrestling.

When a wrestler rotates an opponent around the axis of their own body, the net force directed toward the center of rotation—namely, toward the wrestler's body—maintains the opponent's circular trajectory and constitutes the centripetal force. Conversely, the opponent's tendency to move away from the circular path due to inertia, as perceived by the athlete during rotational motion, is described as the centrifugal effect (Ackland et al., 2009). As the opponent's mass and angular velocity increase, the magnitude of the centripetal force required to sustain circular motion also increases. Consequently, this biomechanical demand requires the wrestler to generate greater levels of force in order to maintain control over the opponent and execute the technique effectively. In techniques such as the salto, suplex, and lateral throw, the athlete maintains control of the opponent through the centripetal force directed toward the axis of rotation, while simultaneously exploiting the centrifugal effect—the opponent's outward inertial tendency—to enhance technical effectiveness and ensure successful execution.

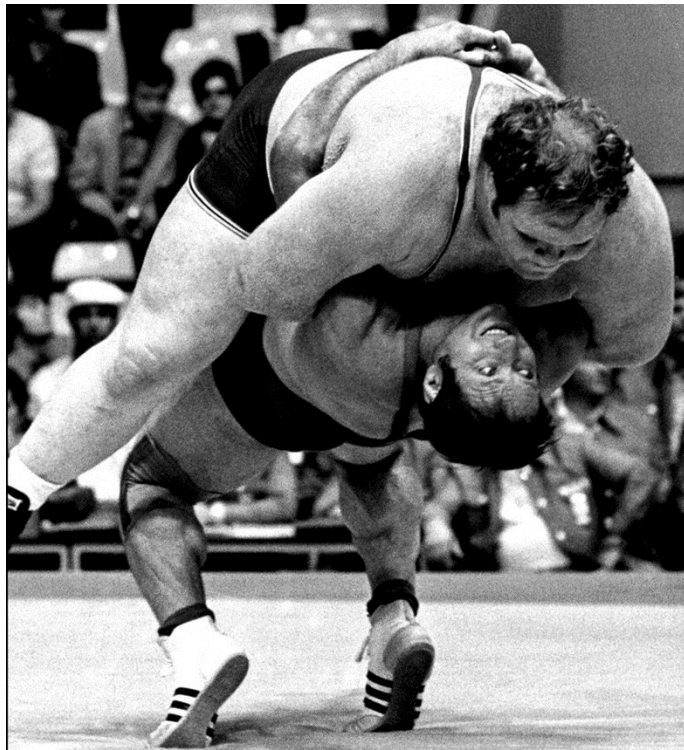


Figure 4: Biomechanical Analysis of Centripetal Force and Angular Momentum in the Suplex Technique

The image illustrates the execution of a suplex, where the wrestler generates a circular arc to rotate the opponent backward. This maneuver demonstrates the application of centripetal force through the upper and lower extremities to keep the opponent's mass close to the rotational axis. By minimizing the radius of rotation, the wrestler effectively reduces the moment of inertia, which, according to the principle of conservation of angular momentum, allows for increased angular velocity and enhanced technical efficiency with lower energy.

In the suplex (salto) technique, the wrestler grasps the opponent from behind, lifts them off the ground, and rotates backward along a circular arc. During this maneuver, the opponent's body performs a pendulum-like motion around the axis of rotation. The combined force components generated through the wrestler's upper extremities, trunk, and lower extremities produce the centripetal force necessary to keep the opponent close to the rotational axis. If the centripetal force is insufficient, or if the radius of rotation (r) becomes excessively large, the centrifugal effect may dominate, leading to uncontrolled displacement of the opponent and a consequent reduction in technical efficiency (Lanshin, 2006).

Similarly, in the gutwrench suplex executed from a par terre position, the wrestler rotates the opponent around their own axis while maintaining a firm grip around the waist. Keeping the opponent closer to the wrestler's body reduces the radius of rotation, thereby decreasing the moment of inertia and permitting an increase in angular velocity. This biomechanical adjustment enhances rotational control and contributes to the effectiveness of the technique. In accordance with the principle of conservation of angular momentum, this mechanical advantage enables the achievement of higher rotational velocity with lower energy expenditure, thereby allowing the technique to be executed more efficiently and effectively (Petrov, 1997).

Research indicates that elite wrestlers lower their center of mass (COM) in order to effectively manage the forces generated during rotational movements. During rotation, to counterbalance the outward inertial tendency produced by the centrifugal effect, the wrestler must maintain the resultant force vector within their base of support and appropriately direct the ground reaction force. Failure to maintain the force vector within the base of support may result in a loss of balance, thereby increasing the risk of uncontrolled descent and loss of positional dominance together with the opponent (Ilişsu, 2020).

Centripetal force plays a critical role in maintaining balance during rotational movements, while the strategic utilization of centrifugal effects can be employed to disrupt the opponent's stability. The deliberate and biomechanically informed application of these mechanical principles not only enhances technical success but also contributes to improved energy efficiency during performance.

Biomechanics of Force Transmission Along the Kinetic Chain and Rotational Momentum in Wrestling

Force transmission along the kinetic chain represents a central biomechanical mechanism in wrestling, particularly during throwing and projection techniques. This process begins in the lower extremity segments that interact with the ground and progresses through a sequential transfer of momentum via the pelvis and trunk toward the distal segments, including the shoulder, arm, and ultimately the opponent's body. In rotational techniques such as hip throws, the lower extremities generate ground reaction forces, while the trunk musculature—including the abdominal and spinal stabilizers—coordinates these forces through proximal-to-distal sequencing, facilitating the efficient transfer of angular momentum to the distal segments (Almansoof, Nuhmani, & Muaidi, 2023). The stretch-shortening cycle, which exploits the elastic properties of muscle-tendon units, further enhances this process by promoting the conservation and efficient transfer of mechanical energy. This integrated mechanism, combined with optimal intersegmental timing and joint stability, enables the wrestler to generate maximal velocity and force at the distal endpoint of the movement, thereby enhancing both performance and technical effectiveness (Sciascia & Cromwell, 2012). Within this framework, rotational and spiral mechanics in wrestling provide a critical biomechanical foundation for both performance optimization and injury prevention. These mechanisms operate through the coordinated production of torsional forces, effective regulation of angular momentum, synchronized transmission of ground reaction forces, and the utilization of optimal biomechanical joint angles. This perspective highlights that wrestling techniques should be understood not solely as tactical actions but as complex biomechanical processes governed by integrated, multiscale mechanical principles.

CONCLUSION

This review demonstrates the fundamental harmony between universal motion patterns and the biomechanical organization of human movement within the context of wrestling. Angular momentum, centripetal and centrifugal forces, force transmission along the kinetic chain, segmental stability mobility balance, and optimal moment arm utilization are identified as the primary biomechanical determinants of wrestling performance. These mechanisms enable the effective production and transfer of force through a helical and rotational organization. Therefore, the development of wrestling performance requires a comprehensive biomechanical framework that integrates helical movement patterns and rotational kinetic chain dynamics.

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THE HISTORICAL EVOLUTION OF OLYMPIC WRESTLING REGULATIONS AND THEIR IMPACT ON COMPETITIVE FAIRNESS AND TECHNICAL PERFORMANCE (1896–2024): A HISTORICAL ANALYTICAL COMPARATIVE STUDY

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ABSTRACT

This study aimed to analyze the historical evolution of Olympic wrestling regulations from the inception of the modern Olympic Games in 1896 to 2024, with particular emphasis on the impact of regulatory changes on competitive fairness and technical performance. The researcher employed a historical analytical comparative approach based on the analysis of official documents issued by the International Olympic Committee and United World Wrestling, in addition to specialized historical and scientific literature (IOC, 2024; UWW, 2024).

The findings indicated that Olympic wrestling regulations have undergone continuous modifications in response to the demands of competitive fairness, technological advancement, and international organizational developments (Olympic Studies Centre, 2024). Major changes included the introduction of weight categories, the development of scoring systems, improvements in refereeing procedures, the implementation of electronic challenge systems, and the restructuring of the international governing body into United World Wrestling in 2014 (UWW, 2024).

The study concluded that the continuous evolution of wrestling regulations represents a fundamental factor in enhancing competitive fairness, improving technical performance, and maintaining the sustainability of Olympic wrestling within the modern Olympic movement (IOC, 2024; Toohey & Veal, 2007).

Keywords: Olympic Wrestling, Historical Evolution, Wrestling Regulations, Competitive Fairness, Technical Performance, United World Wrestling.

INTRODUCTION

Olympic wrestling is one of the oldest organized competitive sports in modern sports history, with its roots deeply intertwined with ancient human civilizations. It was officially included in the program of the modern Olympic Games since the Athens edition in 1896, becoming a cornerstone of the contemporary Olympic movement (International Olympic Committee [IOC], 2024). Over more than a century, this sport has witnessed a continuous series of legal and regulatory developments aimed at balancing the preservation of wrestling's traditional identity with the demands of modern sports progression (Guttmann, 2002).

The legislative evolution of Olympic wrestling rules was not an arbitrary process; rather, it emerged as a response to a complex matrix of political, social, economic, and technological variables, alongside advancements in sports training sciences, refereeing, and athletic administration (Toohey & Veal, 2007). These amendments reshaped the technical and competitive structure of wrestling by developing scoring systems, organizing weight classes, updating refereeing protocols, incorporating modern electronic technologies, and advancing safety and competitive fairness standards (United World Wrestling [UWW], 2024).

In recent decades, Olympic wrestling has undergone profound structural transformations. Most notable were the organizational and regulatory reforms following the 2013 crisis, when the International Olympic Committee proposed removing wrestling from the Olympic program. This prompted the International Wrestling Federation to implement wide-ranging structural reforms, which included updating regulations, developing refereeing systems, and enhancing transparency and sports governance, thereby preserving wrestling's status within the modern Olympic movement (Chappelet & Kübler-Mabbott, 2008; UWW, 2024).

From this standpoint, studying the historical evolution of Olympic wrestling regulations emerges as a scientific framework to understand the relationship between organizational and regulatory progress and its effects on competitive fairness and technical performance, while also analyzing the impact of historical and technological variables on the future of the sport (Olympic Studies Centre, 2024).

RESEARCH PROBLEM

Despite the significant development of Olympic wrestling regulations from 1896 to 2024, most prior literature has focused on descriptive elements or partial historical narratives, lacking a comparative historical analysis that links legal changes to their direct impact on competitive fairness and the technical performance level of wrestlers (Houlihan, 2008).

Furthermore, the multiplicity of legal amendments and the divergence of their historical, organizational, and technological motivations make it difficult to establish a comprehensive scientific framework explaining the correlation between regulatory evolution and the technical progression of Olympic wrestling. This necessitates a comparative analytical historical study to explain this relationship and evaluate its athletic and organizational impacts (Riordan & Krüger, 1999).

Significance of the Research

The significance of the current study is manifested in the following aspects:

1. Documenting the historical evolution of Olympic wrestling regulations during the period (1896–2024) based on approved international sources (IOC, 2024; UWW, 2024).
2. Analyzing the impact of legal amendments on competitive fairness and athletic integrity.
3. Studying the relationship between legal evolution and the technical and tactical development of wrestlers.
4. Providing a scientific framework that can be utilized in developing future sports legislation.
5. Enriching Arabic and foreign scientific literature concerning the history of Olympic wrestling.
6. Providing scientific references for researchers, coaches, referees, and sports decision-makers.

Research Objectives

The current study seeks to achieve the following objectives:

1. Analyzing the historical evolution of Olympic wrestling regulations during the period (1896–2024).
2. Identifying the primary historical, organizational, and technological factors that contributed to the development of the regulations.
3. Studying the impact of legal amendments on achieving competitive fairness.
4. Analyzing the reflections of regulatory evolution on the technical and tactical performance of wrestlers.
5. Evaluating the role of modern technology in developing refereeing systems and tournament management.
6. Presenting a future vision for developing Olympic wrestling regulations in line with modern athletic requirements.

Research Questions

The study seeks to answer the following questions:

1. What are the prominent historical stages that Olympic wrestling regulations passed through during the period (1896–2024)?
2. What historical, organizational, and technological factors contributed to the development of Olympic wrestling regulations?
3. How did legal amendments affect the achievement of competitive fairness?
4. What is the impact of regulatory evolution on the technical and tactical performance of wrestlers?
5. What role does technological advancement play in developing refereeing systems and sports competition management?

Research Scope

- **Temporal Scope:** From 1896 to 2024.
- **Objective Scope:** Studying the historical evolution of Olympic wrestling regulations and their impact on competitive fairness and technical performance.
- **Spatial Scope:** Olympic Games, world championships, and international tournaments accredited by United World Wrestling.

Theoretical Framework and Literature Review

Theoretical Framework

1. Origin and Historical Evolution of Olympic Wrestling

Wrestling is one of the oldest athletic activities known to human civilizations. Archaeological evidence indicates its practice in ancient Sumerian, Egyptian, and Greek civilizations thousands of years BCE (Guttmann, 2002). Since its inception, wrestling has been associated with military, social, and educational values, utilized as a means to prepare warriors and develop physical and mental capabilities.

With the establishment of the modern Olympic movement by Baron Pierre de Coubertin, wrestling was included in the official program of the modern Olympic Games in the 1896 Athens edition, becoming an essential sport in the

contemporary Olympic movement (IOC, 2024). Since that date, Olympic wrestling has experienced a series of organizational, legal, and technical developments designed to strike a balance between maintaining the traditional identity of the sport and meeting modern athletic demands.

2. Concept and Importance of Sports Regulations

Sports regulations are defined as a set of rules, codes, and instructions that govern athletic competitions. They aim to ensure competitive fairness, protect athletes, uphold athletic integrity, and regulate relationships among all parties involved in the sporting process (Houlihan, 2008).

Sports regulations fulfill several vital functions, most notably:

- Achieving fairness and equal opportunities among competitors.
- Regulating technical and skill performance.
- Enhancing athlete safety.
- Developing organizational and administrative dimensions.
- Maintaining the consumer and spectator appeal of sports competitions.
- Promoting transparency and athletic integrity.

Olympic wrestling regulations carry special importance due to the combat nature of the sport, which relies on direct physical contact, thus necessitating highly accurate and effective officiating systems (UWW, 2024).

3. Concept of Competitive Fairness in Sports

Competitive fairness is a core principle underpinning the modern sports movement. It refers to providing equal opportunities for all athletes to compete under unified, transparent rules, free from bias, discrimination, or inequality (Chappelet & Kübler-Mabbott, 2008).

In Olympic wrestling, competitive fairness is determined by several indicators, including:

- Fairness of the scoring system.
- Equity in weight class classifications.
- Competence and neutrality of officiating.
- Effectiveness of the protest and challenge systems.
- Equal opportunities among athletes.
- Enforcement of anti-doping regulations.

Modern legal developments have greatly enhanced these indicators, particularly following the introduction of electronic scoring and video challenge systems (UWW, 2024).

4. Concept of Technical Performance in Olympic Wrestling

Technical performance in Olympic wrestling refers to the level of execution of motor skills, tactics, and legal maneuvers during competition. It encompasses skill, tactical, physical, and psychological domains (Bompa & Haff, 2009).

Technical performance is influenced by several factors, including:

- Rules of competition.
- Scoring system.
- Match duration.
- Quality of refereeing.
- Physical and skill level of the wrestler.
- Technological advancements used in managing competitions.

Recent studies demonstrate that regulatory changes directly dictate the nature of technical performance and the strategic approaches utilized in matches (UWW, 2024).

Literature Review

- **First Study (Guttmann, 2002):** A historical study addressing the evolution of the modern Olympic Games. It aimed to analyze organizational and legal changes in Olympic sports, including wrestling. The results showed that regulatory changes were closely linked to global political, social, and economic developments.
- **Second Study (Toohey & Veal, 2007):** An analytical study addressing the social and organizational dimensions of the Olympic Games. The results confirmed that developing sports regulations represents one of the most critical factors in achieving competitive fairness and promoting sports integrity.
- **Third Study (Chappelet & Kübler-Mabbott, 2008):** Addressed the evolution of sports governance and administration within the International Olympic Committee. The results indicated that legal and structural reforms directly contribute to improving institutional performance and athletic justice.

- **Fourth Study (UWW, 2024):** A series of technical and organizational reports published by United World Wrestling tracking the historical evolution of wrestling rules. The reports confirmed that introducing electronic challenge systems and developing passivity and refereeing rules elevated competitive fairness and enhanced technical performance.

Commentary on Literature Review

Reviewing previous literature reveals that most studies addressed historical, organizational, or social aspects independently. The current study distinguishes itself by systematically linking the historical evolution of Olympic wrestling regulations to their direct impact on competitive fairness and technical performance, utilizing a historical analytical comparative approach spanning from 1896 to 2024.

Research Methodology and Procedures

Research Method

The researcher adopted the **Historical Analytical Comparative Method** due to its suitability for the nature and objectives of the study. This method is widely utilized in sports history research aiming to analyze sports phenomena, events, and legislation over long historical durations, explaining the causes of changes and analyzing their subsequent impacts and outcomes (Thomas et al., 2015).

The historical method was employed to trace the chronological timeline of Olympic wrestling regulations from 1896 to 2024, while the comparative analytical method was utilized to study the impact of legal and structural adjustments on competitive fairness and technical performance, contrasting the different historical eras of wrestling regulations (Creswell & Creswell, 2018).

Research Population

The research population consisted of all historical, organizational, and scientific documents and sources concerning Olympic wrestling regulations from 1896 to 2024, issued by accredited international academic and sports institutions, including:

1. Official documents of the International Olympic Committee (IOC).
2. Archive documents of the former International Federation of Associated Wrestling Styles (FILA).
3. Official documents of United World Wrestling (UWW).
4. Publications of the Olympic Studies Centre.
5. Specialized historical and academic textbooks.
6. Peer-reviewed scientific journals and research papers.
7. Technical and organizational international reports (IOC, 2024; UWW, 2024).

Research Sample

The research sample was chosen using a **Purposive Sampling** method, including all official documents, decrees, and regulations that constituted major turning points in the evolution of Olympic wrestling rules (1896–2024), based on the following criteria:

- Authenticity and credibility of the document.
- Endorsement by official international sports bodies.
- Direct relevance to Olympic wrestling rules.
- Demonstrated impact on competitive fairness and technical performance.
- Verifiability of its data and content.

Data Collection Tools

The researcher relied on a set of scientific research skills appropriate for historical studies, including:

1. **Official Document Analysis:** Analyzing all rules, regulations, and charters issued by the IOC and UWW to identify legal evolutionary stages (IOC, 2024; UWW, 2024).
2. **Historical Content Analysis:** Utilizing qualitative content analysis to categorize legal and regulatory texts based on the main tracks of the study.
3. **Systematic Scientific Review:** Conducting a systematic review of literature and prior studies regarding Olympic wrestling history, sports legislation, competitive fairness, and technical performance.

Research Procedures

- **Phase 1: Source and Document Collection:** Gathering official historical documents, reviewing the archives of the IOC and UWW, and compiling related academic books and scientific papers.

- **Phase 2: Data Classification:** Classifying historical information according to specific thematic domains: weight classes, scoring systems, refereeing systems, passivity rules, electronic challenge systems, electronic officiating, women's participation, and anti-doping.
- **Phase 3: Historical Comparative Analysis:** Dividing the historical progression of wrestling rules into five core stages, as illustrated in Table 1.

Table 1: Historical Evolution Stages of Wrestling Regulations

No.	Stage	Chronological Period	Core Characteristics
1	First Stage	1896–1919	Foundational Phase
2	Second Stage	1920–1969	Organizational and Expansion Phase
3	Third Stage	1970–1999	Technical Modernization Phase
4	Fourth Stage	2000–2012	Technological Evolution Phase
5	Fifth Stage	2013–2024	Comprehensive Modern Reforms Phase

- **Phase 4: Analysis of Competitive Fairness and Technical Performance:** Analyzing the impact of legal adjustments on refereeing justice, equal opportunities, sports integrity, skill execution, tactical performance, strategic maneuvering, and the commercial/spectator appeal of the sport.

Scientific Methods Used in Analysis

The researcher deployed: Historical Analysis, Comparative Analysis, Content Analysis, Descriptive-Explanatory Analysis, Documentary Analysis, and Deductive Analysis. These methods aimed to interpret legal developments and uncover their direct and indirect reflections on competitive fairness and technical performance (Creswell & Creswell, 2018).

Scientific Validity of the Study

To guarantee scientific validity, the researcher relied on primary certified international sources, official documents from global sports entities, peer-reviewed literature, cross-referencing multiple independent sources, and verifying historical incidents from multiple autonomous scientific references.

Research Limitations

The study encountered several limitations: the high frequency of legal amendments across different eras, variations in officiating systems between historical stages, limited availability of certain ancient historical records, and the continuous flux of rules up to 2024. However, the researcher mitigated these effects by strictly adhering to certified official records and rigorous comparative scientific verification.

Historical Comparative Analysis of Olympic Wrestling Regulations (1896–2024)

First: The Foundational Phase (1896–1919)

Wrestling was introduced in the modern Olympic program during the 1896 Athens Games, restricted to Greco-Roman wrestling. At the time, there were no defined weight classes, and refereeing rules or scoring protocols had not achieved contemporary standardization (IOC, 2024). This stage was characterized by an absence of uniform competition standards, causing a clear disparity in competitive fairness due to variations in physical sizes and experience levels. Officiating heavily relied on the subjective expertise of referees without detailed codes (Guttmann, 2002).

Table 2: Analysis of the First Stage

No.	Indicator	Status During the Stage
1	Weight Categories	Non-existent
2	Scoring System	Undefined / Unstructured
3	Refereeing	Subjective / Judgmental
4	Competitive Fairness	Low
5	Technical Performance	Limited

Second: Organizational and Expansion Phase (1920–1969)

This stage witnessed milestone shifts in Olympic wrestling rules. Weight classes were introduced progressively, enhancing the principle of equal opportunity and achieving greater competitive fairness (IOC, 2024). This era also saw the founding of the International Amateur Wrestling Federation (FILA), which worked on standardizing rules governing international tournaments and developing refereeing and tournament management methods (UWW, 2024). These changes improved the technical performance of wrestlers as a result of specialization within specific

weight categories and the emergence of distinct technical and tactical schools in Freestyle and Greco-Roman wrestling (Riordan & Krüger, 1999).

Table 3: Analysis of the Second Stage

No.	Indicator	Status During the Stage
1	Weight Categories	Organized
2	Scoring System	Rudimentary / Initial
3	Refereeing	Semi-standardized
4	Competitive Fairness	Moderate
5	Technical Performance	Evolving

Third: Technical Modernization Phase (1970–1999)

This phase was characterized by extensive restructuring of wrestling laws, including the development of the point-scoring system, adjustment of match duration, and updating technical performance evaluation metrics (UWW, 2024). New methods were introduced to assess technical maneuvers, awarding varying points according to the difficulty and technical quality of the execution, which amplified the role of technical and tactical skills in determining match outcomes (Bompa & Haff, 2009). This reflected positively on competitive fairness by reducing dependence on the personal whims of referees and increasing objectivity (Houlihan, 2008).

Table 4: Analysis of the Third Stage

No.	Indicator	Status During the Stage
1	Weight Categories	Stable
2	Scoring System	Advanced / Developed
3	Refereeing	Organized
4	Competitive Fairness	High
5	Technical Performance	High

Fourth: Technological Evolution Phase (2000–2012)

Olympic wrestling experienced a notable surge in technology application during this period. Electronic scoring systems were introduced, refereeing paradigms were modernized, and match tracking mechanisms were enhanced (IOC, 2024). Additionally, women's wrestling was included in the Olympic program at the 2004 Athens Games, marking a historic milestone that reinforced principles of equality and athletic inclusion (IOC, 2024). These structural updates elevated competitive fairness and enhanced the technical quality of performance for both male and female wrestlers (Toohey & Veal, 2007).

Table 5: Analysis of the Fourth Stage

No.	Indicator	Status During the Stage
1	Weight Categories	Advanced
2	Scoring System	Electronic
3	Refereeing	Partially Electronic
4	Competitive Fairness	Very High
5	Technical Performance	Very High

Fifth: Comprehensive Modern Reforms Phase (2013–2024)

This represents one of the most critical turning points in Olympic wrestling history, featuring comprehensive legal and structural overhauls following the 2013 crisis when the IOC recommended dropping wrestling from the Olympic roster. This sparked a vast structural and legal revolution by the International Wrestling Federation (IOC, 2024; UWW, 2024).

Key reforms included:

1. **Restructuring the International Federation:** Changing the federation's name from FILA to United World Wrestling (UWW) in 2014, coupled with fresh administrative and governance reforms.
2. **Developing Passivity Rules:** Modifying passivity regulations to incentivize offensive wrestling and minimize match stoppages.
3. **Introducing the Electronic Challenge System:** Enabling coaches to contest officiating decisions via on-the-spot video reviews, bolstering transparency and competitive fairness.
4. **Advancing Electronic Officiating:** Utilizing highly sophisticated electronic software to score points and manage matches.

5. **Strengthening Anti-Doping Regulations:** Expanding collaboration with the World Anti-Doping Agency (WADA) and implementing stricter testing protocols (WADA, 2024).

Table 6: Analysis of the Fifth Stage

No.	Indicator	Status During the Stage
1	Weight Categories	Modernized / Optimized
2	Scoring System	Highly Advanced Electronic
3	Refereeing	Fully Electronic
4	Competitive Fairness	Very High
5	Technical Performance	Very High

General Comparative Analysis Across All Historical Eras

Table 7: General Comparative Matrix of All Eras

Era	Chronological Period	Regulatory Level	Development	Competitive Fairness	Technical Performance
1	1896–1919	Foundational		Low	Low
2	1920–1969	Organizational		Moderate	Moderate
3	1970–1999	Technical		High	High
4	2000–2012	Technological		Very High	Very High
5	2013–2024	Comprehensive Reformative		Very High	Very High

The results of the historical comparative analysis demonstrate that the continuous refinement of Olympic wrestling regulations served as a primary driver in strengthening competitive fairness, improving technical performance, boosting the sport's global appeal, and securing its long-term sustainability within the modern Olympic movement (IOC, 2024; UWW, 2024).

RESULTS, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Results

Based on the comparative historical analysis, the study reached the following findings:

1. **Historical Progression:** Olympic wrestling rules transitioned through five major eras, each defined by distinct organizational and technical attributes, cumulatively advancing the game's architecture and strengthening its position in the Olympics (IOC, 2024).
2. **Weight Class Evolution:** The introduction and persistent optimization of weight classes proved essential in achieving the principle of equal opportunity and competitive fairness by minimizing physiological differences among competitors (UWW, 2024).
3. **Scoring System Optimization:** Chronological amendments to scoring mechanisms enhanced objectivity in performance evaluation and minimized human bias, yielding positive impacts on fairness and technical execution (Houlihan, 2008).
4. **Refereeing Advancements:** Enhancing refereeing protocols, particularly through electronic scoring and video challenges, drastically minimized officiating blunders and expanded athletic transparency and integrity (UWW, 2024).
5. **Impact on Technical Performance:** Continuous legal modifications drove the progression of wrestlers' technical, tactical, and strategic performance, expanding the global aesthetic and entertainment value of matches (Bompa & Haff, 2009).
6. **Post-2013 Reform Impact:** The structural and regulatory overhauls executed post-2013 marked a monumental historic turning point that successfully anchored wrestling's longevity on the Olympic program (IOC, 2024; UWW, 2024).

DISCUSSION

The findings demonstrate that the historical evolution of Olympic wrestling laws was not merely a mechanical administrative process; rather, it represented a strategic adaptation to a matrix of athletic, social, political, and technological challenges facing the modern Olympic movement (Toohey & Veal, 2007). The introduction of weight classes directly advanced competitive fairness by satisfying the core Olympic principle of equal opportunity (Chappelet & Kübler-Mabbott, 2008).

Furthermore, shifting gradually toward electronic officiating and video reviews restricted human error and elevated the credibility of decisions, directly reinforcing sports integrity (UWW, 2024). Modern modifications also refined the technical performance of wrestlers by penalizing passivity, incentivizing continuous attacking maneuvers, and

expanding skill diversity during bouts (Bompa & Haff, 2009). Ultimately, this proves that continuous legal adaptation is paramount for any Olympic sport to remain resilient and adaptive to global changes (IOC, 2024).

CONCLUSIONS

In light of the findings, the researcher draws the following conclusions:

1. Olympic wrestling regulations underwent continuous and dynamic historical evolution during the period (1896–2024).
2. Optimizing weight categories directly fostered competitive fairness.
3. Advancing the point-scoring systems elevated objectivity in performance appraisal.
4. Implementing electronic refereeing and video challenges heavily curbed officiating errors.
5. Regulatory evolution reflected positively on the technical and tactical execution of wrestlers.
6. Post-2013 structural adjustments constituted a historic turning point in preserving the sport.
7. Continuous refinement of laws serves as a fundamental pillar for the sustainability of wrestling within the Olympic program.

RECOMMENDATIONS

Based on the conclusions, the researcher recommends:

1. Continuing the periodic review and updating of Olympic wrestling regulations.
2. Boosting the integration of state-of-the-art technology in refereeing and match administration.
3. Designing referee training and certification programs aligned with updated international paradigms.
4. Championing scientific research focused on competitive fairness and technical metrics.
5. Broadening comparative studies between wrestling and other Olympic combat sports.
6. Fostering stronger collaboration between academic institutions and international sports federations.
7. Tailoring coaching and athletic preparation frameworks to mirror recent rule adjustments.

FUTURE STUDIES

The researcher proposes the following future research endeavors:

1. Studying the impact of modern regulatory changes on the physiological indicators of wrestlers.
2. Analyzing the impact of the electronic challenge system on the efficiency of athletic refereeing.
3. Examining the relationship between legal evolution and sports-related injuries in wrestling.
4. Analyzing the future role of Artificial Intelligence (AI) in developing sports refereeing.
5. Conducting comparative analyses between Olympic wrestling regulations and other combat sports.
6. Investigating the impact of legal updates on the tactical performance strategies of elite wrestlers.

General Summary of the Study

The study concluded that the historical evolution of Olympic wrestling regulations during the period (1896–2024) represents a continuous, dynamic process aimed at achieving competitive fairness, optimizing technical performance, elevating athletic integrity, and securing the sport's sustainability within the modern Olympic movement. This underscores the profound importance of constantly auditing sports legislations to align with contemporary global sports demands.

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SPECIAL COMMUNICATION FOR THE HEALTH OF WRESTLERS

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In an effort to publicize and educate the wrestling community regarding the efforts of the UWW Medical, Prevention and Anti-Doping Commission, two important UWW Policy Statements are being included in this issue: the UWW Concussion Policy and the UWW Guidelines for the Prevention, Detection, and the Management of Skin Conditions in Wrestlers

INTRODUCTION

Protecting the health and safety of wrestlers has always been one of the highest priorities of United World Wrestling (UWW). As our understanding of sports medicine continues to advance, it is essential that medical policies and recommendations evolve accordingly, ensuring that athlete care is guided by the best available scientific evidence while remaining practical and applicable across the diverse environments in which wrestling is practiced worldwide. The two documents presented in this issue, the UWW Concussion Policy and the UWW Guidelines for the Prevention, Detection, and Management of Skin Conditions in Wrestlers, represent important milestones in UWW's ongoing commitment to strengthening medical governance, promoting athlete welfare, and supporting consistent, evidence-informed medical decision-making throughout the international wrestling community. Together, they provide sport-specific recommendations addressing two of the most important medical challenges encountered in wrestling, namely sport-related concussion and communicable skin disorders, while reinforcing UWW's commitment to prevention, early recognition, appropriate management, and safe return to training and competition.

These guidelines are the product of a collaborative international effort by the members of the UWW Medical, Prevention, and Anti-Doping Commission, whose expertise, dedication, and thoughtful contributions have been invaluable throughout their development. As Chair of the Commission, I would like to express my sincere appreciation to my colleagues for their outstanding work and commitment to advancing athlete health and safety through evidence-based medical practice. I would also like to thank the International Journal of Wrestling Science for providing an excellent scientific platform for publishing and disseminating these guidelines to the worldwide wrestling community. We hope these documents will serve not only as practical resources for physicians, athletic trainers, coaches, referees, and national federations, but also as living guidelines that stimulate continued research, discussion, and future refinement as new scientific evidence emerges. Ultimately, protecting the health, safety, and long-term well-being of wrestlers remains a shared responsibility, and science must continue to guide that mission.

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CONCUSSION POLICY

United World Wrestling Medical, Prevention and Anti-Doping Commission

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Executive Summary

This policy establishes United World Wrestling's (UWW) unified and sport-specific framework for the recognition, management, and safe return to wrestling following sport-related concussion across all Olympic wrestling disciplines, Freestyle, Greco-Roman, and Women's Wrestling, and all age categories (U15, U17, U20, U23, Senior and Veterans). Concussion represents a significant medical risk inherent to wrestling due to high-velocity throws, takedowns, impacts with the mat and collisions with opponents. To safeguard athletes, the policy mandates immediate removal from participation whenever a concussion is suspected, prohibits same-day return to wrestling, and requires a structured, graduated Return-to-Wrestling protocol under qualified medical supervision. This policy reinforces the independent authority of medical professionals, defines the responsibilities of athletes, coaches, referees, national federations, and establishes minimum rest periods and medical clearance standards. Through consistent global application, mandatory education, and continuous injury surveillance, this policy aims to protect athlete brain health, reduce both short- and long-term neurological risks, and uphold the highest standards of athlete safety across all UWW competitions and training worldwide.

1. PURPOSE OF THE POLICY

- Protect athlete brain health,
- Standardize global concussion recognition, removal from play, and management in wrestling,
- Ensure a safe and medically supervised return to wrestling,
- Reduce long-term neurological risk and complications,
- Provide clear medical and procedural protection for UWW, national federations, coaches, referees and officials.

This policy is mandatory for all UWW-sanctioned competitions, training camps, and events and supersedes any national concussion protocols or guidelines during UWW events. Non-compliance may result in disciplinary action or sanctions against coaches, federations, teams or officials.

2. DEFINITION OF CONCUSSION

A concussion is a traumatic brain injury caused by a direct or indirect force transmitted to the head, face, neck, or body, resulting in a rapid onset of neurological dysfunction that is typically functional rather than structural and therefore may not appear on standard neuroimaging.

- Loss of consciousness is **NOT** required for the diagnosis of concussion.
- During UWW-sanctioned events, decisions made by UWW doctors regarding suspected or confirmed concussion are final, binding, and not subject to protest or appeal.

3. WRESTLING-SPECIFIC MECHANISMS OF CONCUSSION

Concussion in wrestling most commonly results from direct or indirect forces transmitted to the head and/or neck during high-velocity takedowns, throws, and falls to the mat, or from head-to-head and limb-to-head collisions with an opponent.¹⁻⁵ Injury-surveillance and epidemiological studies consistently identify the head/face/neck region as one of the most commonly injured anatomical areas in Freestyle, Greco-Roman and Women's wrestling, with concussions forming a substantial proportion of these injuries.^{2-4,6} Some comparative studies report a higher proportion of head, face, neck injuries and concussions in Greco-Roman athletes than in Freestyle, likely related to the greater use of upper-body throws and high-amplitude techniques.^{3,7,8}

In summary, concussion in wrestling most commonly occurs due to:

- Head impact with mat during Takedowns, Throws, Suplex/overhead techniques
- Head-to-head collision
- Whiplash mechanism from explosive or uncontrolled throws
- Illegal techniques
- Accidental limb-to-head collision (knee, elbow, or hip to head)

High-risk actions include high-amplitude Greco-Roman throws (e.g., reverse lift, grand amplitude techniques), snap-down collisions, poorly controlled double-leg finishes, and fatigued defensive reactions that reduce the athlete's ability to protect the head.

Age-related considerations

- Children and adolescents have increased susceptibility to concussion due to lower neck strength, developing neuromuscular control and ongoing neurological development.
- Veteran athletes might also be more vulnerable due to age-related physiological changes and comorbidities.

4. CONCUSSION RECOGNITION – “RED FLAGS”

Early recognition of concussion is critical to preventing further injury and long-term neurological harm. This section outlines the key visible signs and reported symptoms that must trigger immediate medical evaluation and removal from participation.

Any of the following red flags on the mat or after a bout = suspected concussion:⁹

Immediate Visible Signs:

- Loss of consciousness (even brief, <1 second)
- Blank or vacant stare
- Unsteady or staggering gait
- Delayed or slow-to-rise movement
- Clutching or holding the head
- Disorientation or confusion
- Vomiting
- Seizure or seizure-like-activity

Reported Symptoms:

- Headache or pressure in the head
- Dizziness or balance problems
- Nausea
- Blurred or double vision
- Sensitivity to light or noise
- “Foggy” feeling, slowed or not right
- Confusion or difficulty concentrating
- Memory disturbance

Mandatory referee action

Referees must immediately halt play and summon medical personnel when a red flag is observed.⁹ If in doubt, the athlete must be removed (“If in doubt, sit them out”). Athletes with suspected concussion cannot resume the bout and must undergo medical evaluation.

5. MANDATORY “RECOGNISE & REMOVE” PROTOCOL

Immediate removal from participation following suspected concussion is the cornerstone of athlete brain protection. This section establishes a zero-tolerance policy for continued participation or same-day return to wrestling after a head injury.

If a concussion is suspected:

- The wrestler **MUST** be immediately removed from the bout, mat, training area, or warm-up zone.
- **NO** same-day return to wrestling is permitted under any circumstance, regardless of symptom resolution.

Authority of the decision

This decision is:

- A medical decision only,
- Final and non-negotiable,
- Not overruled by the coach, referee, federation, or athlete,
- Not subject to protest, review or appeal.

Location of the medical assessment:

Following removal, athletes must be transferred to an off-mat medical evaluation area free from noise, distraction and crowd interference. This area is essential for accurate clinical assessment and must be quiet and well-equipped to ensure safe medical treatment.

6. MAT-SIDE MEDICAL ASSESSMENT

All suspected concussions must be assessed using a structured, medically approved process. This section defines who is authorized to perform the assessment and the minimum standards required for safe clinical decision-making.

Authorized personnel

Mat-side concussion assessment is performed only by:

- UWW doctor,
- Certified tournament medical officer,
- Trained healthcare professional under the UWW authority.

Unqualified personnel (coaches, referees, team staff) may assess but not clear the athlete.

Assessment tools

For quick assessment during a bout, the Cognition Recognition Tool 6 (CRT6) is recommended (rapid screening).^{10,11}

Recommended tools after withdrawing from the bout due to suspicion:

- Sport concussion assessment tool 6 (SCAT6 -ages ≥13),
- Maddocks questions,
- Cervical spine assessment.

Required on-site medical equipment:

At all UWW events, the minimum on-site equipment must include a cervical spine board or immobilization device, a light source, a symptom checklist, and standardized UWW concussion documentation forms. Every assessment must be fully documented and uploaded to the Athena system.

Red-flag protocol

If red-flag signs are identified, an emergency hospital transfer is required immediately.

Non-Compliance and Refusal of Medical Assessment

If an athlete, coach, or official **refuses** the mandatory concussion assessment or attempts to obstruct the medical process, including emergency hospital transfer, the following sanctions shall apply:

- The athlete is immediately removed from the competition, with full medical documentation completed.
- The **athlete's annual UWW license shall be immediately suspended**.
- The **national federation shall be sanctioned** in accordance with UWW disciplinary regulations.
- The **national federation must provide formal medical clearance** from an independent specialist before the athlete is eligible to return to training or competition.

Refusal to undergo an assessment constitutes a **serious breach of athlete safety regulations**.

7. RETURN-TO-WRESTLING (RTW) PROTOCOL

Safe return to wrestling requires a structured, graduated progression under medical supervision. This section outlines the mandatory, staged Return-to-Wrestling (RTW) protocol for all athletes following a diagnosed or suspected concussion.

Minimum 6-stage progression

- Each stage must last at least 24-48 hours for U23, senior, and veteran athletes.
- For U15, U17, and U20, progress must be at 48–72-hour intervals if symptom-free.
- If symptoms return, stop immediately and revert to the previous stage the following day. No athlete may skip stages.

Stage 1 – Symptom-limited activity

- Physical and cognitive rest,
- Light daily activity only,
- No training.

Stage 2 – Light aerobic exercise

- Stationary bike,
- Walking or light aerobic movement,
- No resistance training – Heart Rate (HR) <70% of maximum HR; <15 min.

Stage 3 – Wrestling-specific drills (no contact)

- Shadow wrestling – Heart Rate <80% of maximum HR; <45 min,
- Footwork exercises,
- Technique walkthroughs.

Stage 4 – Non-competitive controlled contact

- Controlled clinch work,
- Technical grip sparring,

- No throws, no high-amplitude techniques, no explosive takedowns,
- Heart Rate <90% of maximum HR.

Stage 5 – Full training

- Normal sparring and full wrestling practice,
- Athlete monitored by the medical staff or team for recurrence of symptoms.

Stage 6 – Return to competition

- Requires written medical clearance from a qualified medical doctor experienced in concussion management,
- Clearance must be submitted to the UWW by the national federation before the competition.

All stages must be supervised by a qualified medical professional or team physiotherapist trained in concussion care. Progression may occur only with medical authorization and must be documented.

Return To Wrestling Protocol

Stage	Phase Description	Permitted Activities	Medical Objective
1	Symptom-limited activity	Daily activities that do not provoke symptoms; relative physical and cognitive rest; no training	Recovery of baseline neurological function
2	Light aerobic exercise	Walking, stationary cycling, light swimming; no resistance training; no impact, max Heart Rate less than 70%, session duration less than 15 minutes	Gradual increase in heart rate without symptom recurrence
3	Wrestling-specific drills (no contact)	Shadow wrestling, stance and motion, footwork exercises, light technical drilling without partner contact. Max Heart Rate less than 80%, session duration less than 45 minutes	Reintroduction of wrestling specific movement patterns
4	Non-competitive controlled contact	Upper-body clinch work, grip fighting, controlled positional work; no throws, no high-amplitude technique or no explosive takedowns. Heart rate max less than 90%, session duration less than 60 minutes	Controlled reintroduction of contact and vestibular challenge
5	Full training	Normal wrestling training including full sparring under medical or coaching supervision	Restoration of confidence, physical readiness and functional performance
6	Return to competition	Match competition permitted only after written medical clearance from a qualified medical doctor experienced in concussion management	Confirmation of full medical and competitive clearance

8. MINIMUM REST PERIODS (BY AGE)

Recovery timelines following concussion vary significantly with age, neurological development, and individual health factors. This section establishes minimum rest periods before returning to competition by age category. These timelines do not replace the staged Return-to-Wrestling (RTW) protocol; both requirements must be met.

Age Category and Minimum Time Before Return to Competition:

- | | |
|-----------|-----------|
| • U15 | 21 days |
| • U17 | 21 days |
| • U20 | 14 days |
| • Senior | 7–10 days |
| • Veteran | 7–10 days |

These represent MINIMUM rest periods – not target days. Athletes must progress through the full RTW protocol and obtain medical clearance before competing.

Veteran athletes or those with comorbidities or prior concussion, or in case of persistent symptoms, may require extended recovery periods at the discretion of the treating physician.

9. MEDICAL CLEARANCE REQUIREMENTS

No athlete may return to full training or competition without formal medical clearance after a concussion. This section defines the mandatory clinical conditions and the level of medical authorization required for safe return.

Return to training or competition requires:

- Symptom-free at rest,
- Symptom-free with exertion,
- Normal neurological exam,
- Completion of the full staged RTW protocol.

Signed clearance by a sports physician, neurologist, or doctor with experience in dealing with concussions and their management. Neuropsychological testing or vestibular/oculomotor assessment is recommended for prolonged symptoms (>14 days), recurrent concussion or atypical recovery timelines. Self-clearance, coach clearance, or administrative clearance is strictly prohibited. Only qualified medical professionals may authorize return to participation.

10. REPEAT CONCUSSION & MEDICAL REVIEW

Recurrent concussion significantly increases the risk of prolonged symptoms, impaired neurological recovery and long-term neurological consequences. This section defines thresholds that require specialist medical review and mandatory stand-down periods.

Number of Concussions Mandatory Action:

- 2 concussions within 12 months - Specialist review by a neurologist/sports physician experienced in concussion management,
- 3 concussions over a lifetime - Consider season suspension,
- 2 concussions within 3 months - Mandatory 3-month stand-down from training and competition.

These requirements are designed to protect athlete health, particularly in cases of vulnerable recovery, repeated impacts, or short-interval recurrences, which carry significantly higher risk.

A specialist may impose **longer suspension periods** depending on symptom severity, recovery history, or neurocognitive findings.

11. DATA COLLECTION & SURVEILLANCE

Reliable injury surveillance is essential for improving safety standards, refining medical protocols and guiding future rule development. This section establishes the requirement for systematic reporting of concussions across all UWW competitions.

All confirmed concussions must be recorded in the Athena system and categorized by the following variables:

- Wrestling Style (FS, GR, WW),
- Weight category,
- Age category,
- Mechanism of injury,
- Phase of the bout when the injury occurred.

Additional notes (e.g., illegal moves, recurrence, or mat-side red flags) should be included when relevant.

Consistent and accurate surveillance enables UWW to identify trends, inform prevention strategies, and strengthen athlete protection across all disciplines and age groups.

12. INJURY PREVENTION STRATEGIES

Reducing the risk of concussion requires a combined approach involving athlete preparation, coaching practices, equipment standards, and rule enforcement. UWW-MC recommends the following evidence-informed strategies:

- Neck-strengthening programs to enhance cervical stability and reduce head acceleration during impact,
- Strict enforcement of illegal techniques that increase head and neck injury risk,

- Coaching education on safe landing, falling, and defensive movement patterns,
- Periodic assessment of mat hardness and surface compliance, as well as overall competition - area safety.

These strategies complement medical protocols and contribute to a safer wrestling environment across all age groups and disciplines.

CONCLUSIONS

This Concussion Policy reflects United World Wrestling's unwavering commitment to protecting the neurological health and long-term well-being of all wrestlers, across every discipline and age category. By defining clear standards for concussion recognition, immediate and mandatory removal from

participation, structured medical assessment, staged return to wrestling, and independent medical clearance, UWW reaffirms that athlete brain health is paramount and supersedes all competitive considerations. Consistent worldwide implementation - combined with mandatory education for coaches, referees, athletes, and medical staff, and with comprehensive injury surveillance - will ensure not only the effective management of concussions but also a meaningful reduction in their incidence, risk and long-term consequences. Through this policy, United World Wrestling continues to uphold the highest international standards of athlete protection and medical governance within the Olympic Movement and reaffirms its commitment to a safer future for all wrestlers worldwide.

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GUIDELINES FOR THE PREVENTION, DETECTION, AND MANAGEMENT OF SKIN CONDITIONS IN WRESTLERS

United World Wrestling
Medical, Prevention and Anti-Doping Commission

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The UWW Medical Commission has developed a comprehensive program to address skin conditions in wrestling. Skin infections account for more lost training and competition time than any other medical problem in the sport. Effective management, therefore, serves two purposes: it treats the affected wrestler and reduces the risk of transmission to teammates and opponents.

There is no definitive data that precisely defines when every type of lesion has stopped shedding infectious organisms. However, a consensus on safe participation has been reached through consultation with dermatology, infectious disease, public health, and primary care experts, combined with an extensive review of the literature on the communicability of specific skin conditions at different stages of disease. On this basis, practical prevention, treatment, and return-to-play regimens have been established.

Goals of Controlling Skin Conditions

1. **Protect wrestlers from communicable skin disorders.**
Most of the conditions described have limited long-term consequences and are rarely life-threatening, but some are associated with significant morbidity. All athletes should be protected from acquiring skin infections from other wrestlers or from contaminated equipment such as mats and protective gear.
2. **Promote early recognition and rapid intervention.**
Encourage athletes, coaches, and medical personnel to identify suspicious lesions early and initiate timely evaluation and treatment, thereby reducing outbreaks and minimizing time lost from training and competition.
3. **Reduce the overall burden of skin outbreaks at events and training centers.**
Implement standard prevention practices that decrease the frequency, severity, and impact of infectious skin conditions across clubs, national teams, and international competitions.
4. **Enable safe and timely participation.**
Wrestlers should be allowed to return to training and competition as soon as it is safe for them, their opponents, and teammates sharing the same mat.
5. **Standardize clinical decision-making.**
Provide clear guidelines to minimize variation in management among health-care professionals completing the Medical Release for Participation with Skin Lesions form. Consistent application of these guidelines should reduce the risk of disease transmission and prevent inequities in decisions about who may or may not compete.
6. **Support professional autonomy under competitive pressure.**
Offer an evidence-informed framework to assist health-care professionals who may face considerable pressure to clear athletes for competition as quickly as possible, whether the athlete is a novice or a world champion.

Key Components of an Effective Program

1. Optimal personal hygiene
2. Athlete and coach education
3. Routine skin checks
4. Appropriate mat disinfection
5. Routine cleaning of equipment beyond the mats
6. Personal equipment and clothing management
7. Access to a health-care provider familiar with wrestling medicine
8. Use of a standardized Medical Release Form for participation with skin lesions

1. Hygiene

Proper hygiene is the most effective and practical strategy for preventing the development and spread of skin infections in wrestlers. Because wrestling involves intense skin-to-skin contact and frequent use of shared training surfaces, meticulous hygiene significantly reduces the risk of bacterial, fungal, and viral transmission.

1.1 Major Infectious Agents in Wrestling Bacterial

- *Staphylococcus aureus* and *Streptococcus* species (particularly Group A β -hemolytic streptococci) are the most common bacterial causes of skin infections.
- Methicillin-resistant *Staphylococcus aureus* (MRSA), a staph variant resistant to methicillin, is increasingly prevalent in contact sports and requires heightened vigilance.

Fungal

- Dermatophyte infections (tinea), most often caused by *Trichophyton tonsurans*, can rapidly invade the skin if not removed soon after exposure.

Viral

- **Herpes simplex virus (HSV-1 and HSV-2):** Approximately 93–97% of herpes gladiatorum cases in wrestlers are caused by HSV-1.
- **Molluscum contagiosum:** Caused by a poxvirus and spread by direct contact.
- **Verrucous warts:** Caused by human papillomavirus (HPV) and commonly spread through repeated skin contact or contaminated surfaces.

More detailed information is provided in Appendix 1.

1.2 Essential Hygiene Practices

- **Immediate post-training cleansing** is the single most important preventive measure. Research shows that fungal spores can invade the skin **within 2–4 hours** if not washed off, highlighting the importance of prompt showering.
- **Shower as soon as possible** after each practice or competition using antibacterial soap. Ensure that all areas commonly exposed during wrestling, face, neck, arms, torso, and legs, are thoroughly washed.
- If shower facilities are unavailable: Use **soap-and-water body wipes** to clean the entire body immediately after the session.
- Shower at the earliest opportunity when facilities become accessible.
- **Use individual towels and personal toiletries;** these should never be shared among athletes.
- **Keep skin clean, dry, and moisturized** to reduce microabrasions that facilitate pathogen entry.
- **Launder practice clothing, towels, and gear after every use**, as microorganisms can persist on fabrics.

2. Athlete and coach education

Education is fundamental to preventing the spread of skin infections in wrestling. Athletes and coaches must understand the common types of skin conditions, their early signs, routes of transmission, and the importance of prompt reporting and treatment. Regular instruction, delivered through team meetings, training sessions, or digital resources, helps reinforce best practices in hygiene, equipment care, and self-monitoring.

Emphasizing early recognition and immediate disclosure of suspicious lesions reduces delays in diagnosis and minimizes the risk of outbreaks within teams or at competitions. Creating a culture where athletes feel comfortable reporting skin concerns without stigma or fear of lost training time is essential for maintaining a safe wrestling environment.

3. Routine Skin Checks

Routine skin checks are a critical component of preventing the spread of infectious skin conditions in wrestling. These examinations should be performed before every practice session and prior to all competitive events. Their purpose is to identify any potentially infectious lesion early, remove the athlete from participation, and ensure timely medical evaluation and treatment.

3.1 Personnel and Competency

Skin checks may be performed by trained coaches, certified athletic trainers (ATCs), physiotherapists, physician assistants, or physicians. Individuals who routinely conduct these examinations quickly become adept at recognizing suspicious lesions and determining when referral to a medical professional is necessary. Health-care providers performing evaluations, whether primary-care physicians, sports medicine clinicians, or

dermatologists, should be familiar with wrestling-specific skin conditions and apply management strategies that both expedite treatment and reduce the risk of transmission.

Non-infectious conditions such as eczema, dermatitis, or superficial abrasions may be covered to allow participation. Any infectious lesion, however, requires the athlete to refrain from training or competition until the lesion has been appropriately treated and the athlete has been cleared or meets the criteria on the *Medical Release Form for Wrestlers to Participate with Skin Lesions*.

3.2 Responsibilities of Coaches, Referees, and Medical Personnel

Coaches, referees, ATCs, and medical staff must feel confident and prepared to perform rapid skin checks. Athletes should be encouraged to self-monitor and promptly report any new or changing skin lesions. Because skin infections are primarily spread through direct skin-to-skin contact, particular attention should be paid to training partners and teammates who have close contact with the affected athlete, as they may already have been exposed.

3.3 Procedure and Required Equipment

A properly performed skin check requires only 15–20 seconds and should always include:

1. Proper lighting
2. Gloves
3. Intense flashlight
4. Magnifying glass
5. Removal of all bandages, pads, braces, and kinesiology tape



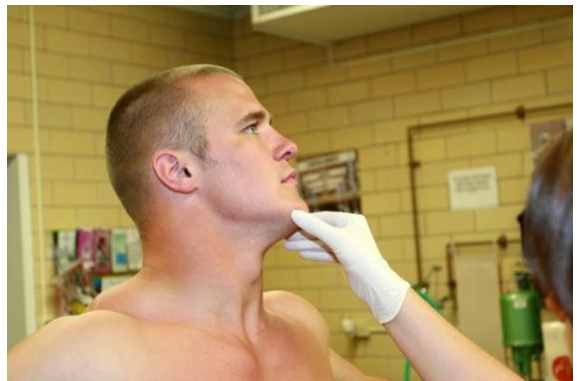
3.4 Areas of Emphasis

While a full-body inspection is essential, the head, face, and neck require special attention, as more than 70% of herpes gladiatorum lesions occur in these regions.

Key examination regions include:

- Forehead and hairline: inspect for vesicles, crusting, or red patches.
- Naso-labial folds and peri-oral area: common sites for herpes labialis ("cold sores").
- Upper extremities and axillae: sweaty, occluded areas where infections may be missed.
- Lower extremities: look for tinea lesions, folliculitis, or abrasions that could become infected.

- Back, posterior neck, and scalp: lift long hair and inspect carefully around the ears and along the hairline.





Event Medical Oversight

At major tournaments, UWW recommends that a physician trained in dermatologic evaluation of wrestlers be available on-site. Those clinicians should be able to perform simple diagnostic procedures when needed, for example, KOH preparation for suspected tinea or a Tzanck smear for suspected herpetic lesions.

Final Clearance Decisions

Because skin lesions may change rapidly, final clearance for participation must be determined at the event itself. Physician notes written days earlier may not accurately reflect the lesion's current appearance or infectious potential. Event-level evaluation ensures consistency, fairness, and athlete safety.

Mat Disinfection and Environmental Cleaning

Although direct skin-to-skin contact is the primary route of transmission for most wrestling-related skin infections, contaminated mats and training surfaces remain significant secondary vectors. Historical data show that up to 20% of wrestling-related medical issues are associated with skin infections, highlighting the essential role of rigorous environmental hygiene in reducing pathogen transmission.

Effective mat disinfection is a **two-step process**:

Removal of surface debris, sweat, and organic material to ensure proper contact between disinfectant and the mat surface.

Application of an appropriate disinfectant to reduce bacterial, viral, and fungal load.

Evidence-Based Best Practices

Use disinfectants with high residual antimicrobial activity.

Studies show that residual disinfectants reduce bacterial loads on wrestling mats by **approximately 76%** compared with non-residual agents.

- **High-residual disinfectants:**
 - Quaternary ammonium compounds
 - Thyme-based (botanical) disinfectants
- **Low-residual disinfectants:**

- 10% bleach solution

Apply the backward-mopping technique.

Dragging the mop behind the cleaner prevents stepping on freshly disinfected areas and reduces re-contamination. Limiting street-shoe traffic on mats further decreases pathogen transfer.

Clean mats frequently during tournaments.

Because of repeated, high-volume usage, all competition and warm-up mats should be disinfected every 4–6 hours during tournaments or multi-session events.

Proper Timing for Mat Cleaning

Regular Training Sessions

- Mats should be cleaned after every training session.
This is the minimum standard, because athletes may train multiple times per day, and the risk of pathogen accumulation increases with sweat, skin contact, and repeated use.
- In high-volume training environments (national teams, clubs with back-to-back sessions), mats should also be cleaned between sessions if different groups use the space consecutively.

Competitions

- Mats must be cleaned between each bout and at regular intervals throughout the event.
- The standard recommended for tournaments is:
 - Quick disinfectant wipe-down after each bout, and
 - Full cleaning and disinfection every 4–6 hours, depending on the intensity and schedule.

Warm-up Mats

- Often overlooked, but they must be cleaned with the same frequency as competition mats:
 - Between sessions during training
 - Every 4–6 hours during competitions

Routine Cleaning of Equipment Beyond Mats

While wrestling mats are the primary surfaces requiring disinfection, many other pieces of equipment can serve as fomites and contribute to the spread of infectious skin conditions if not properly maintained. Any item that comes into repeated contact with the skin, whether during training, warm-up, or conditioning, can harbour bacterial, fungal, or viral pathogens. Routine cleaning should therefore extend to headgear, rash guards, gloves, protective pads, resistance bands, and strength-training equipment, including benches, bars, and grips.

All shared equipment should be disinfected after each training session and more frequently during periods of intense use, such as team camps or tournaments. Personal gear should be washed or wiped down daily and allowed to dry completely, as moisture promotes microbial growth. Athletes should avoid sharing personal items such as towels, water bottles, or training garments. Consistent cleaning practices across both wrestling-specific and general fitness equipment significantly reduce the risk of transmission and contribute to a safer training environment.

Personal Equipment and Clothing Management

Proper management of personal equipment and clothing is essential for minimizing the transmission of infectious skin conditions in wrestling. Athletes should use individual, non-shared gear, including headgear, knee pads, rash guards, and training garments. Sharing personal items, even briefly, can facilitate the transfer of bacteria, fungi, or viruses from one athlete to another.

All training clothing, towels, and personal gear should be washed after every use with hot water and detergent, then thoroughly dried, as moisture promotes microbial growth. Gear that cannot be machine-washed, such as certain pads or protective items, should be disinfected daily using an appropriate antimicrobial product. Athletes should store their equipment in clean, dry bags and avoid leaving damp clothing or gear inside closed containers, lockers, or gym bags where pathogens can proliferate.

Footwear should also be managed carefully: wrestling shoes must be worn only on the mat, never outdoors, to prevent environmental contamination. Clean socks should be worn during all training sessions, and shoes should be allowed to air-dry between uses. By maintaining consistent, responsible

care of personal equipment, athletes significantly reduce their risk of developing or spreading skin infections in the wrestling environment.

Access to a Health-Care Provider Familiar with Wrestling Medicine

Timely access to a qualified health-care provider who is experienced in wrestling medicine is essential for

accurate diagnosis, effective treatment, and appropriate return-to-play decision-making. Wrestling involves unique skin-to-skin contact patterns, high-friction exposures, and sport-specific lesion distributions that differ from those in other athletic environments. Clinicians who understand these patterns are better equipped to distinguish infectious lesions from benign conditions, initiate appropriate therapeutic interventions, and make informed decisions about athlete participation.

Health-care providers involved in the evaluation of wrestlers, whether primary-care physicians, sports medicine specialists, dermatologists, physician assistants, or certified athletic trainers, should receive education in common wrestling-related skin infections and UWW participation criteria. Their role includes not only diagnosing and treating lesions but also advising on prevention strategies, monitoring treatment response, and ensuring that clearance decisions prioritize athlete safety and infection control.

At major competitions or training camps, event organizers should ensure the presence of a medical professional trained in dermatologic assessment of wrestlers. Ideally, this clinician should be able to perform rapid diagnostic tests when needed, such as KOH preparations for suspected fungal infections or Tzanck smears for herpetic lesions. Competent medical oversight supports fairness, protects athlete health, and reduces the risk of outbreaks within teams and events.

Pre-Event Skin Medical Inspection Program and Medical Release Form

A formal Pre-Event Skin Medical Inspection Program is a mandatory component of UWW-sanctioned competitions. It serves as the frontline defense against the introduction and spread of infectious skin conditions. All wrestlers must undergo a standardized skin examination before the official weigh-in, in accordance with UWW Medical Regulations and under the supervision of the UWW Medical Officer. This ensures that every athlete begins competition in a safe, controlled, and infection-free environment.

Organization and Oversight

The inspection program is coordinated by the UWW Medical Officer in collaboration with the event's medical director and designated examiners. Prior to the examination, the UWW doctor:

- Confirms the qualification and readiness of the medical examination team.
- Ensures the availability of a private, properly equipped medical examination space.
- Verifies the presence of female examiners when needed.
- Reviews the medical procedures with the examiners and guides common wrestling-related skin conditions.
- Prepares all required documentation, including the official wrestler list and relevant UWW medical forms.

Examination Procedure

During the examination:

- Athletes must present with short, trimmed nails and all taping, braces, bandages, and headgear removed to permit a complete evaluation.
- Examiners conduct a systematic inspection of high-risk areas, including the head, face, neck, upper torso, and extremities.
- Any suspicious lesion is immediately referred to the UWW Medical Officer for definitive evaluation. They will review any Skin Condition Reports the athlete may have.
- After review and approval, the final results are submitted to the weigh-in supervisor in accordance with UWW procedures.

Skin Condition Report Form for Participation

The UWW Skin Condition Report Form for wrestlers who are allowed to participate with skin lesions is an integral component of the inspection process. This standardized form verifies that a licensed health-care provider has:

- Evaluated the wrestler's skin lesion(s),
- Made an appropriate diagnosis,
- Confirmed that the lesion meets UWW criteria for non-contagiousness or being coverable.
- Cleared the athlete for safe participation.

Athletes with skin conditions must bring their completed form to every practice and every competition that they are cleared for. Coaches, referees, and medical staff must review the form during pre-event checks to verify eligibility before allowing participation.

A copy of the UWW Skin Condition Report Form is included in Appendix 2.

Final Clearance Authority

Although the Medical Release Form provides essential clinical documentation, final clearance for participation rests with the on-site UWW Medical Officer or event medical team. Skin lesions may evolve rapidly, and a wrestler who was cleared days earlier may no longer meet safety criteria at the time of competition. Event medical staff, therefore, have the authority to overturn prior clearances if the lesion appears suspicious or potentially contagious.

Purpose and Importance

The combined system of pre-event medical inspection and standardized medical documentation:

- Ensures uniform application of medical standards across all athletes
- Minimizes the risk of infection outbreaks during tournaments
- Protects athlete health, safety, and competitive fairness
- Reduces ambiguity and pressure on team staff regarding return-to-play decisions
- Strengthens the overall integrity of UWW-sanctioned competitions

Appendix 1 – Common Skin Infections in Wrestling

Skin infections in wrestling are primarily **bacterial, fungal, or viral** in origin. Because wrestling involves close physical contact, particularly around the **head, face, neck, and upper torso**, these regions are the most frequent sites of infection. Early recognition and appropriate management are essential to prevent transmission and ensure athlete safety.

BACTERIAL INFECTIONS

Staphylococcus aureus

Staphylococcus aureus commonly infects hair follicles, leading to **folliculitis**, which appears as small pustules at the base of the hair shaft.

Folliculitis



Deeper involvement may result in:

- **Furuncle (boil):** a localized abscess
- **Carbuncle:** multiple adjacent abscesses forming a larger inflammatory mass



Abscess (Furuncle)



Methicillin-Resistant Staphylococcus aureus (MRSA)

MRSA is a resistant strain of *S. aureus* known for causing rapidly progressive abscesses and painful, swollen lesions.

Diagnosis cannot be made by appearance alone; **culture is required** to differentiate MRSA from non-resistant staph infections.



MRSA

Streptococcus Species (Group A β -Hemolytic Streptococcus)

Group A streptococcal infection typically presents as **cellulitis**, characterized by:

- Diffuse redness
- Warmth
- Firmness
- Tenderness
- Absence of a discrete abscess



Cellulitis



Impetigo

Impetigo is a highly contagious bacterial infection caused by *Staphylococcus* or *Streptococcus* species. It presents in one of two forms:

- **Non-bullous impetigo:** honey-colored crusts over small erosions

Impetigo (non-bullous)



- **Bullous impetigo:** larger blisters filled with serous or purulent fluid



Impetigo (Bullous)



FUNGAL INFECTIONS

Trichophyton tonsurans (Tinea / Ringworm)

Tinea infections occur when dermatophyte fungi penetrate the skin—often within **2–4 hours** after exposure. Common features include:

- Circular, red, expanding lesions with central clearing
- Scaling at the edges
- Predilection for **scalp, face, and trunk**
- No systemic symptoms

Scalp involvement may lead to **hair breakage** as the fungus invades the hair shaft.



Tinea (Ringworm)





Kerion

Kerion is a severe inflammatory reaction to a scalp tinea infection. It appears as a **boggy, swollen mass** with pus and crusting. Scarring and **permanent hair loss** may occur if left untreated.



Kerion



VIRAL INFECTIONS

Herpes Gladiatorum (HSV-1)

Herpes gladiatorum is caused primarily by **Herpes Simplex Virus Type 1 (HSV-1)** and spreads through direct skin-to-skin contact. More than **70% of lesions** occur on the **face, neck, and upper torso**.

Primary Outbreak

- Typically develops **3–8 days after exposure**
- Fever, sore throat, and lymphadenopathy may precede skin involvement
- Clusters of 2–3 mm vesicles on an erythematous base
- It may take **10–14 days** to resolve without treatment

Primary Herpes Gladiatorum



Recurrent Outbreaks

- Smaller, localized lesions
- Usually unilateral due to reactivation from a single nerve ganglion
- Triggered by stress, trauma, or UV exposure
- Prodrome of tingling or “pins and needles.”
- Resolves in **7–10 days** without therapy



Recurrent Herpes Gladiatorum

Molluscum Contagiosum

Caused by a poxvirus, molluscum contagiosum presents as:

- Small (2–3 mm) dome-shaped papules
- Central umbilication (“dimple”)
- Minimal redness
- No systemic symptoms

Spread occurs when lesions rupture and release their central, waxy material.



Molluscum Contagiosum

Verrucous Warts (Human Papillomavirus – HPV)

Warts may be:

- Flat or raised
- Firm, ranging from 3–4 mm to over 1 cm

Located on extremities, especially hands and finger joints
Verrucous Warts



- These areas frequently crack or bleed during training or gripping, increasing the risk of transmission.



Participation Status

All active viral infections disqualify wrestlers from participation until fully resolved.

Under certain conditions, with the approval and supervision of official doctors, and when the lesion is small enough to be fully covered and protected during the competition, the wrestler may be granted permission.

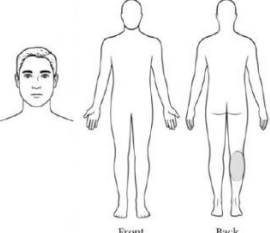
Appendix 2 – Skin Condition Report Form


UWW Medical & Anti-Doping Commission

Skin Condition Report

Date of examination:

First name - Family name:	
Accreditation #	
Nationality:	
Style / Weight category:	
Skin Condition:	
Location:	
Treatment:	
Date treatment started:	
Date athlete can compete:	



Front
Back

Due to continual changes in these skin conditions, the UWW MC tournament physician at the event has the final decision regarding wrestlers' ability to participate.

Minimum treatment guidelines required before returning to wrestling:

Bacterial infections: To be considered "non-contagious," all lesions must be scabbed over and not be moist, exudative, or draining, and no new lesions must have appeared within the preceding 48 hours. Treatment with oral antibiotics for a minimum of 3 days (72 hours), unless MRSA is the cause, in which case 5 days (120 hours) of antibiotics are required.

Herpetic lesions (Simplex, Fever blisters/cold sores, Zoster, Gladiatorum): To be considered "non-contagious," lesions must be dry and covered by a firm, adherent crust and no new lesions occurring in the preceding 72 hours. For Primary outbreaks, wrestlers should be treated with oral antiviral medication and not allowed to compete for at least 10 days. If systemic symptoms such as fever and swollen lymph nodes are present, consider extending the duration to 14 days. Recurrent outbreaks require a minimum of 120 hours of oral antiviral treatment, and lesions must be dry and covered with a firm, adherent crust and no new lesions occurring in the preceding 72 hours.

Tinea Lesions (ringworm, capitis, corporis): To be considered "non-contagious," it must be treated with oral or topical treatment for two days (48 hours) except Tinea capitis, which requires 2 weeks of oral antifungal medication.

Molluscum contagiosum: May compete if treated and covered.

Physicians' Name / Signature:

Stamp:

OBSERVATIONS FROM A COACH AND SCIENTIST: SOME ESSAYS FOR YOUNG COACHES

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ESSAY 1: LOAD AND RECOVERY BALANCE IN SPORTS

(Explained Through a Glass of Water and Sugar Metaphor)

Dear Coach,

I would like to discuss one of the most critical, most sensitive, and yet most frequently misapplied concepts in sports science: the balance between training load and recovery. No matter how well we understand this concept, applying it correctly in the field is never easy. Because this is not only about knowledge; it is also about timing, intuition, and experience. For this reason, I would like to explain this process through a very simple, yet profoundly meaningful metaphor.



A Glass of Water – A Glass of Sugar

Imagine we have two glasses: One is completely filled with water. The other contains the same volume of granulated sugar. Now let me ask you: What happens if we pour all the sugar at once into the full glass of water? The answer is clear: The glass overflows.

Because the system is already full. There is no capacity to handle the new load.

THE EQUIVALENT IN SPORTS



This situation represents a reality we often encounter in training: If the athlete is: Fatigued

- Not fully recovered
- Under nervous system stress

Any additional load applied on top of this:



Does not create improvement



Does not enhance performance
Does not strengthen the system



On the contrary, it leads to:
Injury Performance decline Burnout Overtraining syndrome
In other words... the glass overflows.

SO WHAT IS THE RIGHT WAY?

Let's perform the same experiment differently. Instead of adding all the sugar at once, we add it gradually, in small amounts, with patience and control. After each addition:

- We stir
- We wait
- We allow it to dissolve What happens?

The sugar dissolves into the water. The glass does not overflow, but its content changes.

And most importantly:

The system accepts the load.



SCIENTIFIC EQUIVALENT: ADAPTATION

In sports, this process means:

- Load → Provides stimulus to the organism
- Recovery → The organism rebuilds itself
- Result → Adaptation (development)

The key sentence here is: *Improvement does not occur during training, but during recovery.*

LOAD – RECOVERY BALANCE



Let's clarify the metaphor:

Water = The human organism

- Sugar = Training load
- Stirring = Rest and recovery
- Dissolving = Adaptation
- Overflow = Injury and burnout

THE BIGGEST MISCONCEPTION

The most common mistake in practice is: "If I train more, I will improve more." No!

The correct approach is:

Load + Recovery = Adaptation

Adaptation + Proper Loading = Development

HOW DOES CAPACITY INCREASE?



Even a glass that initially seems full can hold more sugar over time if the process is managed correctly.

What does this mean?

Athlete capacity is not fixed and it can be improved with proper planning.

But this improvement requires:

Patience
Process
Proper timing

THE TRUE ART OF COACHING

Coaching is not just about writing training programs. The real mastery lies in:

- Understanding how full the athlete is today
- Knowing when to apply load
- Recognizing when to stop
- And most importantly: Filling the glass without causing it to overflow.



CONCLUSION

Sudden and uncontrolled loading - Disrupts the system

Planned and patient loading - Develops the system.

And remember: Every athlete is a different glass, and the level of fullness changes every day.

Coaches,

Our role is not only to impose load on athletes, but to determine the right timing and the right amount for their development. Because success does not belong to those who carry the greatest load, but to those who carry the load at the right time.

ESSAY 2: SOME QUESTIONS FOR A WRESTLING SCIENTIST

— You have experienced wrestling both in practice and in the laboratory—that is, in the academic field. Have today's scientific methods surpassed the natural strength of the old-school wrestlers? What truly determines a real champion?

— I practiced wrestling for many years as an athlete. At the same time, I was studying at a sports academy. Naturally, the academic knowledge there guided me toward an academic career. Coming from the mat as an athlete is actually an advantage. You cannot reach theory without practice. Therefore, practice and theory now progress in parallel. If there is no practice, then there is no theory. We cannot reach our goals through theory alone. Our aim, as academics, is to provide new and scientific knowledge to wrestling and to pass this on.

I taught for many years in the coaching (instructor) department and also served as a department chair at Celal Bayar University. Coming from practice is a major advantage. I believe I came through the right path, because as I said, without practice, theoretical knowledge cannot truly be developed.

— When you were focused on the practical side earlier in your career, what motivated you to become an academic, to explain these things, and to delve into human physiology and structure it into an academic framework?

— As an athlete, you strive to succeed. But at the same time, you try to measure and understand that success through anatomy, physiology, exercise physiology, and training science. A mission begins to form—to combine theory and practice. At that time, a lot was expected from us by academics. We were among the early academics in this field. Our ideal was to reach a better level than where we were, and we knew we had to use science to do that.

Wrestling, like sport in general, is a highly integrated discipline. We needed to contribute new conceptual knowledge. The fields I mentioned—anatomy, physiology, exercise physiology, and training science—are the main pillars of our profession. In addition, we benefit from other sciences such as nutrition, sociology, and psychology. In the past, we took around 55 different courses, both theoretical and practical. All of this motivated us, and much was expected from us.

In Turkey, science was still developing in the 1970s, although it had begun in the West in the 1950s. We attended seminars and coaching courses abroad, and later began our academic careers. We had to develop ourselves in many areas. Over time, we went from being seminar participants to becoming the instructors ourselves. After Turkey, I also taught abroad. This gave us confidence.

I conducted research for many years at the sports academy, which later became part of the university system. Since wrestling is a weight-class sport, weight management was a major issue. You must compete at your ideal weight and maintain proper nutrition. Accordingly, you plan and program training based on scientific data. You learn how to structure these plans and pass them on to your students.

I also have about ten years of experience with national teams. I conducted studies on weight cutting, training control, and lactic acid. These studies gained recognition both domestically and internationally. Being involved in early scientific research was a major advantage for us. Our goal was to deliver scientific knowledge to coaches (instructors) and physical education teachers in Turkey and to help advance the field.

— Professor, what path should we follow to become European, world, or even Olympic champions in sports? What advice would you give to young athletes?

— To become an international, European, world, or Olympic champion, you must first start at an early age in a sport that suits you. It is important to identify your talent—whether it is for soccer, volleyball, wrestling, boxing, or judo. Today, talent identification programs are being conducted in our country. Thousands of children are screened through these programs.

We need to provide more children across the country with access to sports—whether it's swimming, athletics, gymnastics, wrestling, or soccer. You have to start correctly from the beginning. Choosing the right sport is crucial. Of course, there are athletes who change disciplines later and still succeed. For example, some wrestlers started in soccer or gymnastics and later transitioned to wrestling successfully.

Still, making the right choice from the start is important. Training programs must also be appropriate for the athlete's age. We should not overburden children at an early age in pursuit of performance. Training must be suitable both physically and mentally.

One essential factor is making them love what they do. Children naturally want to play. You cannot succeed in something you do not love—this applies to any field or profession. Therefore, we must instill a love for sports in children and avoid being overly impatient. At the same time, we must also care about their education and schooling.

We should not aim to produce only champion athletes, but well-developed, intellectual individuals. Athletes who succeed only in sports but lack development in other areas are not an ideal outcome. We want role-model champions—individuals with strong character who contribute positively to society.

— In today's digital age, compared to your childhood, sports like soccer or wrestling were also forms of entertainment. Children didn't play computer games; they saw sports as a form of play. How can we encourage children today, surrounded by computers, phones, and technology, to engage in sports?

— That is a very important question. Everyone has a computer or a phone in their hands. This is a serious issue—perhaps one of the major challenges of our time. Families and parents are genuinely concerned. Children are constantly attached to their devices, day and night. This leads to sedentary lifestyles and increasing obesity, which also affects their school performance.

The greatest remedy—both psychologically and physiologically—is sports. We must guide children toward sports for their physical, mental, and social development. Of course, we cannot reject digital technology entirely; it also has many benefits. It requires its own structured approach.

However, I believe sports is the most beneficial phenomenon of our time with no side effects. Therefore, when organizing programs, we must design them according to children's ages. We can only address this gap through sports. It will help them succeed academically and develop strong character.

Because today, children are not communicating with each other or forming friendships. They are becoming deprived in their relationships with their parents and their social environment. There is also a great deal of misinformation that can mislead them, along with behavioral issues.

In my opinion, sports is the greatest remedy.

ESSAY 3: FAKE IN WRESTLING: THE INVISIBLE INTELLIGENCE OF COMBAT

In everyday language, the word “fake” carries a negative meaning. It represents a breach of trust—something false taking the place of truth. In human relationships, being “fake” signals a deficiency, a weakness of character.

But on the mat...
The same word takes on an entirely different meaning.

In wrestling, many instructors teach technique, build strength, and improve endurance. Yet at the highest level of competition, these are often not the decisive factors. What truly makes the difference is how well an athlete can read the opponent—and how effectively they can deceive them.

This is where the concept of the fake (feint/deception) emerges as the invisible intelligence of wrestling.

A fake is not merely a superficial or false movement. It is a step taken into the opponent's mind. The athlete's goal is not just to execute a move, but to disrupt the opponent's decision-making system—to trigger their reactions at the wrong moment. Because in wrestling, the outcome is often determined by a mental battle before any physical contact occurs.

When an elite wrestler uses a fake, the true objective is this: to reveal the opponent's habits. Every athlete, under pressure, tends to fall back on certain defensive patterns. Some retreat, some drop their level, others freeze or lock up. A fake is the key that unlocks these patterns.

However, one of the biggest mistakes is teaching the fake as if it were just another technique.

The approach of "fake, then attack" turns the athlete into someone who memorizes patterns. But in real wrestling, no opponent responds the same way. Therefore, the fake must be developed not as a memorized sequence, but as a skill of perception and decision-making.

In the correct training approach, the athlete is not taught movements alone, but the ability to recognize and interpret reactions. Training should revolve around questions such as:

How does the opponent respond to this threat?

Which defensive pattern do they repeat?

At what moment do they lose balance?

This approach elevates the athlete from someone who merely applies techniques to someone who controls the dynamics of the match.

Fake training should not rely on repetitive drills alone; it must be developed through variable, decision-based practices. For example:

The athlete is not forced into a specific technique; instead, scoring is based on reading and exploiting the opponent's reactions.

They work with partners who produce different responses from the same position.

Specific drills focus on changing rhythm, patience, and timing.

Because the essence of a fake lies not in the movement itself, but in its timing.

It should not be forgotten that in modern wrestling, everyone is strong and technically proficient. At this level, what creates the difference is not physical superiority, but the ability to solve the opponent mentally.

And the clearest expression of this truth is simple:

An athlete who can use fakes does not merely wrestle.

They control their opponent.

An athlete who cannot use fakes, no matter how strong they are, remains confined to the opponent's game.

ESSAY 4: THE WRESTLING COACH AS FILM DIRECTOR

A director is the artistic and creative leader of a work (film, theater, TV series, documentary, etc.).

In its simplest form a director is the person who decides how the final work will look, how it will feel, and how it will be told.

To elaborate further:

- Interprets the script
- Directs the actors
- Determines the emotional tone of each scene
- Controls elements such as camera angles, lighting, and rhythm
- Coordinates the entire team toward a common goal

In that sense, a director is the coach on the field of the story."

Just as a coach (instructor) guides athletes' performance and builds the intelligence of the game, a director shapes the spirit of the work by guiding the performance of actors and the crew.

If we explain the director through sport, the closest equivalent is: Director = Head Coach (Instructor)

But not just any coach...

A coach who defines not only the outcome of the game, but also its spirit, style, and identity.

Think of it this way:

In a wrestling match, the athlete steps onto the mat. Everyone sees the strength. Everyone sees the technique. But behind it all, there is a mind...

That mind is the coach who operates like a director.

A concrete analogy:

- Athlete = Actor
- Match = Stage
- Training process = Rehearsal
- Tactical plan = Script
- Coach (Instructor) = Director

The critical point is that an athlete can learn the same techniques as others, but what makes the difference is this:

- How they execute it
- When they execute it
- With what mindset and feeling they execute it

And the one who shapes these three elements is the coach who thinks like a director.

This is even clearer in wrestling: Two athletes perform the same technique:

- One simply executes it.
- The other applies it with feeling, at the right moment, with the right strategy.

The second athlete is not a coincidence. There is a "director's mind" behind them.

Final note: Just as a director builds a story on stage, a great coach makes that story unfold on the mat.

IN MEMORIUM

Robert “Bobby” Douglas

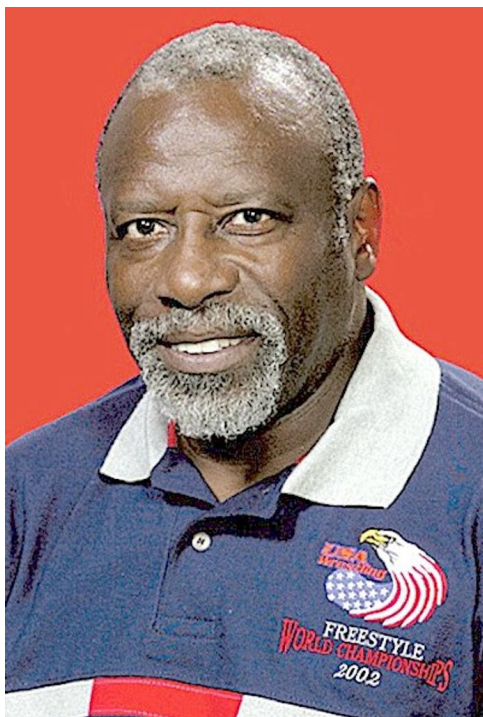
March 27, 1942 – February 23, 2026

Robert Edward Douglas, a trailblazing American Olympic wrestler and one of the most influential figures in collegiate wrestling history, passed away on February 23, 2026, at the age of 83. Douglas's remarkable career spanned decades, leaving a mark as both a decorated athlete and a winning coach. His dedication to the sport broke barriers and inspired countless individuals, solidifying his legacy as a true pioneer.

Born in Bellaire, Ohio, Douglas rose from humble beginnings to achieve national and international acclaim. Douglas graduated from Bridgeport High School in 1961 where he wrestled for legendary Coach George Kovalick, who was like a father to him. Bobby was the first Black American to compete in the Olympics for wrestling in 1964, a significant milestone that paved the way for future generations. His competitive spirit earned him a fourth-place finish at the 1964 Tokyo Games and he later captained the U.S. Olympic freestyle team in 1968. He coached at the Olympic meets in Mexico City and Barcelona.

Douglas earned a silver medal in 1966 and a bronze in 1970 at the World Championships, the same year he was named the USA's outstanding wrestler. Bobby moved seamlessly into coaching, he built powerhouse programs at Arizona State University and Iowa State University. At Arizona State, he led the Sun Devils to their first and only NCAA team national championship in 1988.

His tenure at Iowa State from 1992 to 2006 further cemented his reputation, producing 10 individual NCAA titles and 52 All-America honors, including coaching wrestling legend Cael Sanderson to an undefeated collegiate career and an Olympic gold medal. Douglas was inducted into the National Wrestling Hall of Fame in 1987, among numerous other halls of fame, including the Ohio Chapter of the NWHOF.



IN MEMORIAM

Prof. Dr. Mehmet KUTLU

March 27, 1942 – February 23, 2026

Prof. Dr. Mehmet KUTLU was the Dean of the Faculty of Sport Sciences at Hitit University in Turkey. He passed away on April 29, 2026, at the age of 66. He died after a 5 to 6-month battle with colon cancer and was laid to rest in his hometown of Hasbek, Sarıkaya, Yozgat. Prof. Dr. Kutlu was well-known in both academic and athletic circles as a former national wrestler and the former Head of the Education Board for the Turkish Wrestling Federation. His passing was met with deep sorrow across the university and sports communities.

He was born in 1960 in Yozgat, TURKEY. He graduated from 1982 from Department of Wrestling, Ankara Sports Academy. He got his master's degree from Gazi University in 1986 and from Middle East Technical University in 1990. In 1991, he got his PhD degree from the Department of Physical Education and Sports in Marmara University. He worked as a sportsman and coach between the years 1981-1984 in Ankara Devlet Su Isleri Sports Club. He became the champion among the universities twice in Wrestling in his university years. He was placed at top in competitions in Gymnastics and Weightlifting. He worked as a Physical Educator for a short period in 1983. Between the years of 1984-1993, he worked as a research assistant at the Department of Physical Education and Sports in Middle East Technical University in Ankara. He worked as the head of Department of Physical Education and Sports and Director of Sports Training College of Elazig, Firat University between the years 1993-2002. He was the head of Department of Physical Education and Sports of Kirikkale University between 2004- 2010. He became Assistant Professor in 1993; Associate Professor in 1998 and Professor in 2003. He worked as an executive board member of University Sports Federation and member of Education Committee of Sports for Everybody Federation. He has many international and national research studies. He participated in a course of Sports instruction for Physically Disabled Persons for two months in Japan and worked as a research fellow for six months and participated in the training "Exercises Physiology and Performance Laboratories" in Aberdeen University in Scotland.

Dr. Kutlu was an invited lecturer at our last UWW Scientific Conference in Zagreb 2025.



INSTRUCTIONS FOR AUTHORS

The *International Journal of Wrestling Science* is the only journal dedicated to the study of the world's oldest sport.

The *International Journal of Wrestling Science* is a peer reviewed journal for professionals working in wrestling and wrestling sport science. Issues are published twice a year. Topics include:

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The *International Journal of Wrestling Science* regularly features: Original Papers, Review Articles, Technique Analyses, Scoring Analyses, Case Studies/Profiles and Letters. The Journal publishes on behalf of the International Network of Wrestling Researchers and in association with the sport's international governing body, United World Wrestling (UWW), with its 180 national affiliates. The readership for this Journal is varied and ranges from academics to coaches and other professional practitioners from a range of disciplines and areas of application.

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