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Original Research

Hand and Wrist Injuries in Competitive United States Fencers: A Survey-Based Study of Injury Patterns and Mechanisms

Katharine Holmes, MD, [*] Ashley Titan, MD, [†] Peggy Chin, DC, DACBSP, [‡] Lindsay Bottoms, PhD, [§] Amy Ladd, MD, [‖] Sanjeev Kakar, MD, [¶] Subhro Sen, MD [#]

[*] *Mount Sinai School of Medicine, Department of Physical Medicine and Rehabilitations, New York, NY*
[†] *Ohio State University School of Medicine, Department of Plastic Surgery, Columbus, OH*
[‡] *USA Fencing Association, Colorado Springs, CO*
[§] *University of Hertfordshire, Department of Physiology, Hatfield, United Kingdom*
[‖] *Stanford University Medical Center, Department of Orthopedic Surgery, Stanford, CA*
[¶] *The Mayo Clinic, Department of Orthopedic Surgery, Rochester, MN*
[#] *Stanford University Medical Center, Department of Surgery, Division of Plastic Surgery, Stanford, CA*

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Purpose: Fencing is a technical Olympic sport requiring precise hand and wrist control, yet upper-extremity injury patterns remain poorly characterized. This study aimed to describe the prevalence, distribution, mechanisms, and types of hand and wrist injuries among competitive US fencers.
Methods: A cross-sectional, survey-based study was conducted among competitive members of USA Fencing. A questionnaire assessed demographics, fencing experience, and injury history, including injury location, type, and mechanism. Descriptive statistics were used, and chi-square tests with respondent-level permutation, to account for respondents reporting multiple injuries, evaluated differences across weapon type, sex, and competitive level.
Results: A total of 638 fencers responded, with 57.2% reporting at least one hand or wrist injury. Among 368 analyzed injuries reported by 281 respondents, the wrist (20.7%) and thumb (18.2%) were the most commonly affected sites. The most frequent injury types were sprains (17.9%), tendonitis (14.1%), and lacerations/punctures (9.8%). Acute injuries predominated (58.2%), followed by overuse injuries (26.4%). Injury patterns differed by weapon, with sabre fencers demonstrating a higher proportion of thumb injuries and acute mechanisms, while épée and foil showed more distributed injury patterns. Sabre fencers were also more than twice as likely as épée or foil fencers to report a thumb injury (25.3% vs 8.6% and 10.2%). Injury type and mechanism differed by competitive level, with higher-level fencers exhibiting more overuse injuries and lower-level fencers more acute injuries. No significant differences were observed by sex.
Conclusions: Hand and wrist injuries are commonly reported among responding fencers and are concentrated in the wrist and thumb, reflecting the sport's biomechanical demands. Injury patterns differed by weapon and competitive level but not by sex, suggesting that discipline-specific mechanics and training exposure are key drivers of injury risk. These findings highlight the need for targeted, weapon-specific prevention strategies and improved clinical awareness of fencing-related upper-extremity injuries.

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Fencing is a dynamic Olympic combat sport characterized by rapid attacks, defensive blade actions, and explosive lower-extremity movements. Athletes compete in three disciplines, épée, foil, and sabre, each with distinct rules governing the target area, scoring mechanics, and tactical strategy.[1,2] Despite these differences, all forms of fencing require precise manipulation of

K.H. and A.T. contributed equally to this manuscript.

Corresponding author: Ashley Titan, MD, Department of Plastic Surgery, 915 Olentangy River Rd Suite 3200, Columbus, OH 43212
E-mail address: ashley.titan@osumc.edu (A. Titan).

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the weapon through coordinated movements of the fingers, hand, and wrist. Fine motor control of the weapon is essential for executing technical actions, such as parries, disengages, feints, and attacks, while maintaining rapid reaction times during bouts. Consequently, the hand and wrist are central to both offensive and defensive fencing performance.

Compared with many other Olympic sports, fencing has a relatively low overall injury risk. Epidemiologic studies have reported low rates of time-loss injuries in competitive fencing events, reflecting the effectiveness of modern equipment standards and safety regulations.[1,3] Most fencing injuries are associated with repetitive lunging, rapid directional changes, and blade contact during bouts.[2,4] Prior research has therefore focused largely on lower-extremity injuries, which occur frequently because of the repetitive lunge and recovery movements required during fencing.[4–6]

Although serious injuries are uncommon, the upper extremity remains vulnerable during fencing activity. Blade contact between opponents, defensive parries, and repeated weapon manipulation expose the hand and wrist to both acute trauma and repetitive stress. Additionally, the only part of the body that is not covered in protective gear is the back hand, leaving it vulnerable to trauma. Several reports have documented penetrating hand injuries associated with blade contact or equipment failure, illustrating the unique injury mechanisms that can occur in fencing despite the sport's extensive safety regulations.[7] In addition, repetitive gripping of the weapon and frequent wrist motion during blade work may predispose athletes to overuse conditions involving the fingers, wrist, and forearm.[8,9]

Despite the importance of the hand and wrist in fencing performance, relatively little research has specifically characterized injuries affecting these anatomical regions. Most epidemiologic investigations of fencing injuries either group upper-extremity injuries broadly or focus on severe or unusual injury mechanisms rather than common injury patterns.[10,11] As a result, the distribution, mechanisms, and types of hand and wrist injuries among fencers remain poorly described.

Improved understanding of these injuries is important for several reasons. First, impairments affecting finger dexterity, grip strength, or wrist mobility may substantially impact performance in a sport that relies heavily on fine motor control. Second, identifying common injury mechanisms may help guide preventive strategies such as targeted conditioning programs, technique modifications, or equipment design improvements. Finally, many physicians who evaluate fencing athletes may be unfamiliar with the sport's specific injury patterns and mechanisms, making clearer epidemiologic descriptions valuable for clinical diagnosis and management.

This study aimed to describe the prevalence, mechanisms, anatomical distribution, and laterality of fencing-related hand and wrist injuries among respondents to a survey of competitive fencers of all levels. In addition, injury characteristics were examined across weapon disciplines, sex, and competitive rating to identify potential differences in injury patterns within this cohort.

Methods

Study design and participants

This cross-sectional, survey-based study evaluated hand injuries among fencers. Institutional Review Board approval was obtained (eProtocol #69811), with classification as minimal risk under expedited review. All participants provided informed consent electronically before survey participation. Fencers aged 18 years or older listed as "Competitive Members" within the USA Fencing database (N = 20,639 members) were invited to participate in a web-based platform survey (Qualtrics). Two reminder emails were sent out over the period of 1 month to encourage participation. Eligibility was limited to individuals aged 18 years or older. Participation was voluntary, and responses were collected anonymously. To assess the representativeness of the sample, aggregate demographic data (sex and weapon) of USA Fencing members were obtained from USA Fencing.

Survey instrument and data collection

The 27-item survey instrument was developed by the study team to assess fencing-related hand injuries. The questionnaire included items on demographics (including age, self reported sex etc), fencing background (years of experience, weapon, rating, hand dominance), and injury history. Participants were asked whether they had sustained a hand or forearm injury related to fencing and, if so, to provide details regarding the injury. These included the injured hand (front vs back), age at injury, anatomical location, injury type, and mechanism. Additional questions assessed diagnosis, treatment, time lost from fencing, and recovery outcomes. Both structured (multiple-choice) and free-text responses were collected, allowing participants to elaborate on injury characteristics and mechanisms. Primary outcomes included injury location, injury type, and injury mechanism.

Statistical analysis

Because survey items were optional, missing data were present across variables. Analyses were conducted using available-case (pairwise) methods, such that respondents with missing data for a given variable were excluded only from analyses involving that variable. As a result, denominators vary across analyses and are reported for each table and comparison. No imputation was performed.

Descriptive statistics were used to summarize participant characteristics and injury patterns. Continuous variables are reported as mean ± standard deviation, and categorical variables are presented as counts and percentages. Comparisons of categorical variables were performed using chi-square tests. Because some respondents reported more than one injury, P values were calculated using a permutation test (10,000 permutations) that kept all injuries from the same respondent together. Injuries of unknown type or mechanism were excluded from testing, and injury types reported fewer than 10 times were combined for analysis. These analyses were used to evaluate differences in injury location, injury type, and injury mechanism across weapon type (épée, foil, and sabre), sex, and competitive rating level. For rating comparisons, participants were grouped into higher-level fencers (A/B/C) and lower-level fencers (D/E/unrated). This grouping was selected because A/B/C classifications correspond to Division I—eligible competitors within USA Fencing and therefore represent a relatively distinct higher-performance cohort, whereas D/E/unrated fencers generally compete outside the Division I level. Grouping categories improved subgroup sizes for statistical analysis. As a supplementary analysis, each injury location and type was also compared as a yes/no outcome per respondent using chi-square or Fisher exact tests, with Benjamini–Hochberg correction for multiple comparisons. All statistical tests were two-tailed, and $P < .05$ was considered statistically significant. Analyses were conducted using R version 4.3.2 (R Foundation for Statistical Computing).

Results

Participant characteristics

The survey invitation was distributed to 32,451 eligible USA Fencing competitive members. Across the initial distribution and reminder emails, there were 32,451 total email deliveries, with 20,639 opens (64%), 985 clicks (3%), 116 bounces (1%), and 22 unsubscribes (1%). Overall, 619 respondents completed the survey, corresponding to a response rate of approximately 3% of those who opened the email (Table 1). Respondents had a mean age of 46.9 ± 18.7 years and had been fencing for a mean of 18.7 ± 16.0 years. Among those reporting an injury with available age data (n = 228), the mean age at injury was 38.2 ± 18.1 years. Most participants were unrated (46.9%), with the remaining distributed across E (11.0%), D (10.2%), C (11.9%), B (9.7%), and A (9.6%) ratings. The majority of respondents were male (63.0%), followed by female (34.2%), with 2.0% preferring not to state their sex and 0.8% missing sex data. Compared with the adult USA Fencing membership, the sex distribution of respondents was similar (64.8% vs 68.0% male among those reporting male or female sex), whereas épée fencers were over-represented (50.3% vs 40.8%) and sabre fencers under-represented (17.7% vs 24.9%).

Over half of participants (57.2%) reported sustaining a hand or wrist injury, whereas 39.8% reported no injury and 3.0% were unsure. Of the respondents who reported or were unsure of an injury, 281 provided details on at least one injury, yielding 368 injuries in total. Seventy-eight respondents (27.8%) reported more than one injury. Injury location, type, and mechanism are therefore described at the injury level, with statistical tests accounting for multiple injuries from the same respondent.

Table 1
Participant Characteristics

Characteristics	Survey Respondents	USA Fencing Adult Members*
	N; mean ± SD	N; mean ± SD
Age (y)	609; 46.9 ± 18.7	—
Years fencing	619; 18.7 ± 16.0	—
Age at injury (y)	228; 38.2 ± 18.1	—
	N (%)	N (%)
Rating		
Unrated	299 (46.9)	—
E	70 (11.0)	—
D	65 (10.2)	—
C	76 (11.9)	—
B	62 (9.7)	—
A	61 (9.6)	—
Missing	5 (0.8)	—
Sex		
Male	402 (63.0)	10,093 (68.0)
Female	218 (34.2)	4,746 (32.0)
Prefer not to say	13 (2.0)	—
Missing	5 (0.8)	—
Weapon		
Épée	319 (50.0)	6,010 (40.8)
Foil	203 (31.8)	5,060 (34.3)
Sabre	112 (17.6)	3,663 (24.9)
Missing	4 (0.6)	—
Dominant hand		
Left	111 (17.4)	—
Right	525 (82.3)	—
Missing	2 (0.3)	—
Any injury reported		
Yes	365 (57.2)	—
No	254 (39.8)	—
Not sure	19 (3.0)	—
Time lost from fencing (among injured)		
Yes	70 (19.2)	—
No	94 (25.8)	—
Not specified	201 (55.1)	—

SD, standard deviation.
* Data provided by the USA Fencing National Office on May 6, 2024. No other data were available for comparison.

Injury locations: overall and by weapon, sex, and level

A total of 368 analyzable injury entries reported by 281 respondents were included in the injury-level analyses of location, type, and mechanism across weapon type, sex, and competition level (Table 2, Fig. 1). Overall, the most common injury locations were the wrist (20.7%) and thumb (18.2%), followed by the midhand/palm (13.0%) and index finger (12.8%). Injury location differed significantly by weapon ($\chi^2 = 42.92$, $P < .001$). Sabre fencers had a notably higher proportion of thumb injuries (36.5%) compared to épée (13.7%) and foil (14.8%), while index finger injuries were most common in épée (17.1%) and relatively rare in sabre (1.6%). Midhand/palm injuries were more frequent in épée (14.3%) compared to other weapons. When each respondent was counted once, sabre fencers were more than twice as likely to report a thumb injury as épée or foil fencers (25.3% vs 8.6% and 10.2%; adjusted $P = .007$; Table S1, available on the Journal's website at www.jhsgo.org). No significant differences in injury location were observed by sex ($\chi^2 = 14.25$, $P = .089$), although wrist injuries were more common among female fencers (26.5% vs 17.0%), and index finger injuries were more frequent in males (16.6% vs 6.6%). Similarly, injury location did not differ significantly by competition level ($\chi^2 = 6.21$, $P = .644$), with broadly similar distributions across rating groups.

Injury types: overall and by weapon, sex, and level

A total of 368 injuries were analyzed by injury type across weapon, sex, and competition level (Table 3). Overall, the most common injury types were sprains (17.9%), tendonitis (14.1%), and unknown injuries (13.0%), followed by lacerations/punctures (9.8%), bone contusions (9.2%), and contusions (8.7%). Injury type differed significantly by weapon ($\chi^2 = 45.49$, $P = .003$). Sprains were most common in épée (22.3%) compared to foil (12.5%) and sabre (17.5%), whereas tendonitis was more frequent in épée (18.3%) than in foil (13.3%) and sabre (3.2%). Sabre fencers had a higher proportion of laceration/puncture injuries (14.3%), and both sabre (14.3%) and foil (14.1%) fencers had a higher proportion of contusions than épée fencers (2.9%). When each respondent was counted once, contusions remained more common among foil (9.7%) and sabre (6.9%) fencers than épée fencers (1.9%; adjusted $P = .023$; Table S1). Foil fencers reported the highest proportion of unknown injury types (18.0%).

No significant differences in injury type were observed by sex ($\chi^2 = 9.95$, $P = .512$). Although descriptive differences were noted, females reported slightly higher proportions of tendonitis (17.6% vs 11.7%) and nerve injuries (6.6% vs 3.1%), while males demonstrated somewhat higher proportions of strains (8.1% vs 2.9%) and unknown injury types (15.2% vs 8.8%). Injury type differed significantly by competition level ($\chi^2 = 20.54$, $P = .047$). Higher-level fencers reported greater proportions of tendonitis (16.2% vs 12.8%) and trigger finger (9.5% vs 2.7%), whereas lower-level fencers reported greater proportions of contusions (12.3% vs 3.4%), laceration/puncture injuries (11.4% vs 7.4%), and unknown injury types (15.1% vs 10.1%).

Injury mechanism: overall and by weapon, sex, and level

A total of 368 injuries were analyzed by mechanism across weapon, sex, and competition level (Table 4). Overall, acute

Table 2
Injury Location: Overall and by Weapon, Sex, and Level*

Injury Location	Overall (N = 368)	Épée (n = 175)	Foil (n = 128)	Sabre (n = 63)	Female (n = 136)	Male (n = 223)	Higher (n = 148)	Lower (n = 219)
Index finger	47 (12.8%)	30 (17.1%)	16 (12.5%)	1 (1.6%)	9 (6.6%)	37 (16.6%)	21 (14.2%)	26 (11.9%)
Middle finger	37 (10.1%)	22 (12.6%)	12 (9.4%)	3 (4.8%)	14 (10.3%)	22 (9.9%)	18 (12.2%)	19 (8.7%)
Multiple fingers	28 (7.6%)	7 (4.0%)	16 (12.5%)	5 (7.9%)	12 (8.8%)	15 (6.7%)	13 (8.8%)	15 (6.8%)
Ring finger	22 (6.0%)	8 (4.6%)	11 (8.6%)	3 (4.8%)	8 (5.9%)	13 (5.8%)	7 (4.7%)	15 (6.8%)
Small finger	14 (3.8%)	4 (2.3%)	9 (7.0%)	1 (1.6%)	4 (2.9%)	9 (4.0%)	4 (2.7%)	10 (4.6%)
Thumb	67 (18.2%)	24 (13.7%)	19 (14.8%)	23 (36.5%)	28 (20.6%)	38 (17.0%)	23 (15.5%)	44 (20.1%)
Midhand/palm	48 (13.0%)	25 (14.3%)	15 (11.7%)	8 (12.7%)	13 (9.6%)	35 (15.7%)	16 (10.8%)	31 (14.2%)
Wrist	76 (20.7%)	40 (22.9%)	22 (17.2%)	13 (20.6%)	36 (26.5%)	38 (17.0%)	35 (23.6%)	41 (18.7%)
Forearm	29 (7.9%)	15 (8.6%)	8 (6.2%)	6 (9.5%)	12 (8.8%)	16 (7.2%)	11 (7.4%)	18 (8.2%)
Overall *P* value			<.001		.089		.644	

* Values are n (%) of injuries within each group. Analyses are injury-based: 368 injuries were reported by 281 respondents, and 78 respondents reported more than one injury. Because injuries from the same respondent are not independent, *P* values were obtained from chi-square tests with respondent-level permutation (10,000 permutations): group labels were shuffled between respondents, while all injuries from the same respondent were kept together. Injury location differed significantly by weapon ($\chi^2 = 42.92$, $P < .001$) but not by sex ($\chi^2 = 14.25$, $P = .089$) or level ($\chi^2 = 6.21$, $P = .644$). Higher level = A/B/C; lower level = D/E/unrated. Denominators vary because some respondents did not report weapon, sex, or rating.

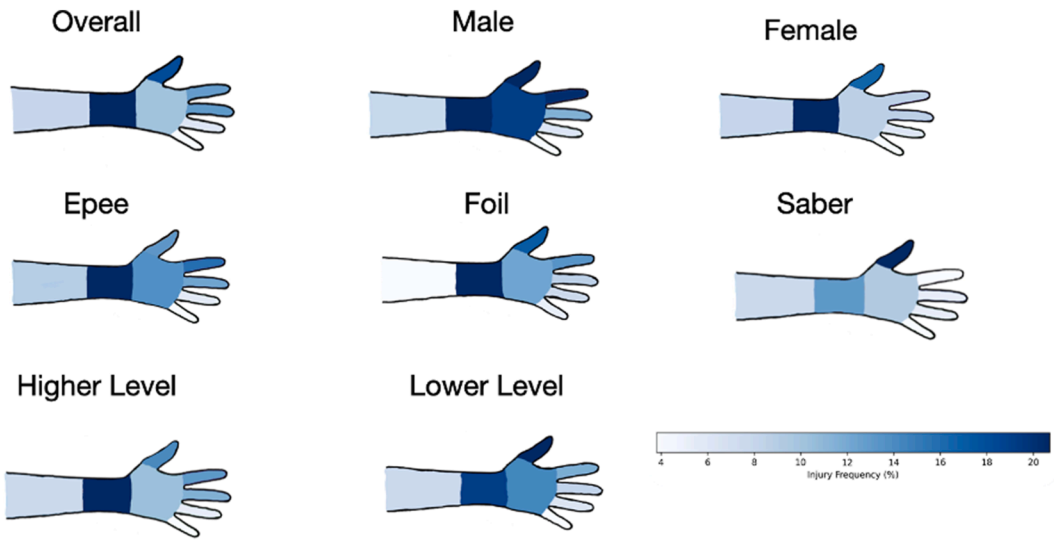


Figure 1. Injury-level analysis of location, type, and mechanism across weapon type, sex, and competition level.

Table 3
Injury Type: Overall and by Weapon, Sex, and Level*

Injury Type	Overall (N = 368)	Épée (n = 175)	Foil (n = 128)	Sabre (n = 63)	Female (n = 136)	Male (n = 223)	Higher (n = 148)	Lower (n = 219)
Arthritis†	1 (0.3%)	1 (0.6%)	0	0	0	1 (0.4%)	0	1 (0.5%)
Bone contusion	34 (9.2%)	18 (10.3%)	8 (6.2%)	8 (12.7%)	13 (9.6%)	20 (9.0%)	14 (9.5%)	20 (9.1%)
Contusion	32 (8.7%)	5 (2.9%)	18 (14.1%)	9 (14.3%)	15 (11.0%)	17 (7.6%)	5 (3.4%)	27 (12.3%)
Dislocation†	2 (0.5%)	1 (0.6%)	1 (0.8%)	0	1 (0.7%)	1 (0.4%)	1 (0.7%)	1 (0.5%)
Fracture	24 (6.5%)	11 (6.3%)	10 (7.8%)	3 (4.8%)	10 (7.4%)	13 (5.8%)	13 (8.8%)	11 (5.0%)
Laceration/puncture	36 (9.8%)	17 (9.7%)	10 (7.8%)	9 (14.3%)	13 (9.6%)	23 (10.3%)	11 (7.4%)	25 (11.4%)
Nerve injury	16 (4.3%)	8 (4.6%)	7 (5.5%)	1 (1.6%)	9 (6.6%)	7 (3.1%)	7 (4.7%)	9 (4.1%)
Other†	5 (1.4%)	1 (0.6%)	1 (0.8%)	3 (4.8%)	4 (2.9%)	1 (0.4%)	0	5 (2.3%)
Sprain	66 (17.9%)	39 (22.3%)	16 (12.5%)	11 (17.5%)	23 (16.9%)	42 (18.8%)	27 (18.2%)	39 (17.8%)
Strain	24 (6.5%)	15 (8.6%)	7 (5.5%)	2 (3.2%)	4 (2.9%)	18 (8.1%)	12 (8.1%)	11 (5.0%)
Tendon injury†	6 (1.6%)	2 (1.1%)	2 (1.6%)	2 (3.2%)	1 (0.7%)	5 (2.2%)	3 (2.0%)	3 (1.4%)
Tendonitis	52 (14.1%)	32 (18.3%)	17 (13.3%)	2 (3.2%)	24 (17.6%)	26 (11.7%)	24 (16.2%)	28 (12.8%)
Tenosynovitis†	2 (0.5%)	0	0	2 (3.2%)	1 (0.7%)	1 (0.4%)	2 (1.4%)	0
Trigger finger	20 (5.4%)	12 (6.9%)	8 (6.2%)	0	6 (4.4%)	14 (6.3%)	14 (9.5%)	6 (2.7%)
Unknown‡	48 (13.0%)	13 (7.4%)	23 (18.0%)	11 (17.5%)	12 (8.8%)	34 (15.2%)	15 (10.1%)	33 (15.1%)
Overall *P* value			.003		.512		.047	

* Values are n (%) of injuries within each group. Analyses are injury-based, and *P* values were obtained from chi-square tests with respondent-level permutation (10,000 permutations), as described in Table 2.

† Injury types reported fewer than 10 times were pooled into one "other/rare" category for testing.

‡ Unknown injury types were excluded from testing. Injury type differed significantly by weapon ($\chi^2 = 45.49$, $P = .003$) and level ($\chi^2 = 20.54$, $P = .047$) but not by sex ($\chi^2 = 9.95$, $P = .512$).

Table 4
Injury Mechanism: Overall and by Weapon, Sex, and Level

		Acute, n (%)	Overuse, n (%)	Unknown, n (%)	*P*
	Overall	214 (58.2)	97 (26.4)	57 (15.5)	
Weapon	Épée	96 (54.9)	53 (30.3)	26 (14.9)	.003
	Foil	70 (54.7)	38 (29.7)	20 (15.6)	
	Sabre	48 (76.2)	4 (6.3)	11 (17.5)	
Rating	Higher level	74 (50.0)	50 (33.8)	24 (16.2)	.013
	Lower level	139 (63.5)	47 (21.5)	33 (15.1)	
Sex	Female	82 (60.3)	39 (28.7)	15 (11.0)	.732
	Male	128 (57.4)	55 (24.7)	40 (17.9)	
	Prefer not to say	4 (80.0)	0 (0.0)	1 (20.0)	

*Values are n (%) of injuries within each group. *P* values were obtained from chi-square tests with respondent-level permutation (10,000 permutations), as described in Table 2. Unknown mechanisms and "prefer not to say" respondents were excluded from testing. Injury mechanism differed significantly by weapon ($\chi^2 = 15.61$, $P = .003$) and level ($\chi^2 = 7.84$, $P = .013$) but not by sex ($\chi^2 = 0.16$, $P = .732$).

injuries were the most common (58.2%), followed by overuse injuries (26.4%) and unknown mechanisms (15.5%). Unknown mechanisms were excluded from statistical testing. Injury mechanism differed significantly by weapon ($\chi^2 = 15.61$, $P = .003$). Sabre fencers reported a markedly higher proportion of acute injuries (76.2%) and fewer overuse injuries (6.3%) compared to épée (54.9% acute, 30.3% overuse) and foil (54.7% acute, 29.7% overuse). Injury mechanism differed significantly by competition level ($\chi^2 = 7.84$, $P = .013$). Lower-rated fencers (D/E/unrated) had a higher proportion of acute injuries (63.5%), whereas higher-level fencers reported more overuse injuries (33.8%). No significant differences were observed by sex ($\chi^2 = 0.16$, $P = .732$). Supplementary Table S2 (available on the Journal's website at www.jhsgo.org) further demonstrated distinct injury patterns between the front (weapon) and back hands.

Discussion

In this cross-sectional survey of 619 fencers, over half of respondents reported a prior hand or wrist injury, underscoring the substantial burden of upper-extremity injuries in fencing. In the laterality subanalysis limited to respondents with a single classifiable injury, most injuries involved the weapon hand. Across all injuries, the wrist and thumb were the most commonly affected locations, and acute injuries predominated, although overuse injuries still accounted for approximately one-quarter of cases. Importantly, injury patterns differed significantly by weapon type, with sabre showing a higher proportion of acute injuries, and by competitive level, with higher-level fencers reporting relatively more overuse injuries and lower-level fencers reporting relatively more acute injuries. Taken together, these findings suggest that fencing-related hand injuries are common, concentrated in the weapon hand, and shaped more by weapon-specific demands and level of participation.

Weapon patterns

Notably, injury patterns varied significantly by weapon type and competitive level. This suggests that the biomechanical and tactical demands of each discipline play a key role in shaping injury risk. Sabre fencers demonstrated a markedly higher proportion of thumb injuries and more acute injuries overall, likely reflecting the unique characteristics of sabre, including cutting motions, higher blade velocity, and frequent blade-to-hand contact during offensive and defensive actions. In contrast, épée and foil fencers exhibited a more distributed pattern of injury locations. The higher prevalence of index finger injuries in épée may reflect the fine motor control and point precision required for scoring such as with hand and toe touches and grip mechanics, while the relatively higher proportion of midhand and palm injuries may be related to differing handle types and force transmission during blade engagement. Differences in target area rules and tactical structure may further contribute to these patterns, with each weapon imposing distinct demands on hand positioning and loading.

These findings align with prior work demonstrating weapon-specific injury patterns in fencing, particularly in high-level competition settings.[3] However, direct comparisons remain limited. Many studies fail to specify weapon type, limiting the ability to interpret discipline-specific injury patterns. Nevertheless, available evidence supports differences in injury incidence and patterns across weapons.[3,5,12] These differences are likely driven by underlying variations in movement demands and match structure. Sabre is characterized by rapid, explosive exchanges, whereas épée involves longer, more sustained tactical actions, with foil occupying an intermediate profile shaped by right-of-way conventions and structured engagement patterns.[13,14] Such distinctions likely translate into different neuromuscular loading profiles and mechanisms of injury, with a substantial proportion of injuries arising from intrinsic, noncontact efforts. Additionally, sabre has demonstrated unique risk patterns that have historically prompted modifications in protective equipment standards.[1,3,7] Interestingly, prior epidemiologic studies have reported higher overall injury rates in foil fencers,[12] whereas our findings suggest that injury patterns, rather than overall injury burden, may differ by weapon. This discrepancy may reflect differences in study design, injury definitions, or population characteristics and warrants further investigation. Taken together, these findings highlight the importance of consistently reporting and stratifying by weapon discipline in fencing research. Failure to account for these differences may obscure meaningful variation in injury risk, performance demands, and adaptation. Improved weapon-specific analyses would enhance comparability across studies and support the development of more targeted training, prevention, and rehabilitation strategies.

Competition level patterns

Injury type and mechanism differed significantly by competitive level, with higher-level fencers demonstrating a greater proportion of overuse injuries and lower-level fencers more frequently reporting acute injuries. This pattern is consistent with prior literature showing that experienced athletes are more vulnerable to overuse injuries because of higher training volumes, cumulative exposure, and sport specialization, whereas novice athletes are more susceptible to acute injuries related to less developed motor skills and poorer biomechanics.[15–19] Repetitive loading in specialized athletes can lead to cumulative microtrauma that exceeds tissue recovery capacity, particularly with year-round training.[15] Accordingly, highly specialized athletes demonstrate an increased risk of overuse injury, with risk further elevated in those training >8 months per year or exceeding age-based weekly training thresholds.[20,21] These findings suggest that increasing experience confers physiologic adaptations that reduce acute injury risk but comes with the trade-off of accumulated repetitive stress, resulting in a shift toward overuse injury in more experienced fencers.

Clinical implications

These findings have important implications for injury prevention and clinical management in fencing. The predominance of

wrist, thumb, and finger injuries suggests a potential role for targeted prevention strategies, including strengthening of the forearm and intrinsic hand musculature, optimization of grip mechanics, and improved protective equipment design. Weapon-specific injury patterns suggest that prevention strategies may need to be tailored to the demands of each discipline. For example, enhanced thumb protection and padding may be particularly relevant for sabre fencers, while interventions targeting repetitive loading may be more applicable to épée and foil athletes.

Limitations

Several limitations should be considered. First, the response rate was low (3%), introducing a substantial risk of selection bias and limiting external validity. Although low response rates are common in survey-based studies of athletic populations, this does not mitigate the potential for nonresponse bias. Accordingly, these findings should be interpreted as describing injury patterns within the responding cohort rather than providing precise population-level prevalence estimates.

Second, all data were self-reported and are therefore subject to recall bias and misclassification. Some respondents reported unknown injury types or mechanisms, limiting the ability to precisely categorize certain injuries. Additionally, injury severity was incompletely characterized, as a large proportion of participants did not specify time lost from fencing, restricting interpretation of functional impact. Third, the cross-sectional design captures retrospective injury reporting at a single time point and therefore precludes causal inference between fencing exposure and injury occurrence. As such, observed associations between weapon type, competitive level, and injury patterns should be interpreted as descriptive rather than causal. Fourth, compared with the adult USA Fencing membership, respondents had a similar sex distribution but included a higher proportion of épée fencers and a lower proportion of sabre fencers. Overall injury estimates may therefore over-represent épée-specific patterns, and estimates for sabre fencers are based on a smaller subgroup.

Taken together, these limitations indicate that the findings are best viewed as exploratory and hypothesis-generating. While selection bias and self-report may influence absolute injury frequencies, the observed patterns, particularly the distribution of injury location, type, and mechanism across weapon and competitive level, are internally consistent, biologically plausible, and aligned with prior fencing literature. These results provide a foundation for future prospective studies incorporating standardized injury surveillance and longitudinal exposure tracking to better define injury risk and inform targeted prevention strategies.

Despite these limitations, this study has several strengths. It includes a large sample of competitive fencers across multiple weapons and rating levels, allowing for meaningful subgroup comparisons. The survey captured detailed information on the injury location, type, and mechanism, providing a comprehensive characterization of hand injuries in fencing. Additionally, statistical analyses accounted for respondents reporting multiple injuries, and key findings were consistent when each respondent was counted only once.

Conclusion

Within this cohort of responding fencers, hand and wrist injuries were frequently reported, with over half of respondents reporting a prior injury and the majority involving the weapon hand. Injuries most frequently affected the wrist and thumb. Injury patterns differed significantly by weapon and competitive level, highlighting the influence of discipline-specific biomechanics and training demands on injury risk. These findings support further investigation into targeted injury prevention strategies, particularly those addressing repetitive loading of the wrist and fingers, optimization of grip mechanics, and protection of the thumb and hand during blade contact. Increased awareness of weapon-specific injury patterns may aid clinicians, coaches, and athletes in early recognition and management of common fencing-related injuries.

Future research should focus on prospective, longitudinal injury surveillance to better characterize incidence and risk factors across fencing disciplines. Biomechanical studies examining grip forces, blade contact dynamics, and neuromuscular loading may further elucidate mechanisms underlying these injuries. Additionally, evaluation of protective equipment design and targeted conditioning programs may help reduce injury burden. Improved reporting and stratification by weapon in future studies will be essential to developing more precise, evidence-based prevention and rehabilitation strategies for fencers.

Ethics declaration

Written informed consent to take part in the study and to publish the article has been obtained from all participants or their legal representatives. The privacy rights of participants have been observed.

This study was performed in compliance with relevant laws, regulatory frameworks and guidelines where the research took place. This study was approved by the Kantonale Ethikkommission Zürich. (Approval No. W939).

Conflicts of Interest

No benefits in any form have been received or will be received related directly to this article.

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