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# Bacterial Skin Infections in Wrestling and Other Combat Sports: Diagnosis, Prevention and Return-to-Play Criteria-A Narrative Review

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**Abstract**

**Background:** Bacterial skin infections are a health concern in wrestling and other combat sports, where close physical contact, skin trauma, and shared equipment may facilitate transmission.

**Aim:** To summarize the epidemiology, clinical presentation, diagnosis, management, and prevention of bacterial skin infections in wrestling and other combat sports, and to compare National Collegiate Athletic Association (NCAA) and National Federation of State High School Associations (NFHS) wrestling return-to-play criteria.

**Material and methods:** This narrative review draws on selected publications identified through PubMed and supplementary guidance from sports governing bodies, public health organizations, and clinical resources. One author assessed and selected publications, and findings were synthesized narratively by topic.

**Results:** The conditions reviewed include impetigo, bacterial folliculitis, furuncles, carbuncles, cutaneous abscesses, erysipelas, cellulitis, and infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA). Clinical assessment is central to diagnosis, while microbiological testing supports pathogen identification and antibiotic selection when indicated. Prevention combines early recognition, wound care, personal hygiene, and environmental cleaning. Return-to-play decisions require assessment of lesion status, treatment duration, and the applicable organization's rules.

**Conclusions:** Carriage and surface-contamination findings must be distinguished from clinical infection outcomes. Reports of combined outbreak interventions do not establish the effectiveness of individual measures, and evidence from other athletic populations cannot be directly generalized to all combat sports. Further studies should assess clinical infection rates and time lost from sport following preventive interventions.

**Keywords:** Bacterial skin infections; Wrestling; Combat sports; *Staphylococcus aureus*; MRSA; Infection prevention; Return to play

## 1. 1. Introduction

Skin infections are an important health concern in wrestling and other combat sports, where close skin-to-skin contact and repeated skin trauma create opportunities for transmission [1,2]. Bacterial infection risk is further associated with uncovered abrasions, shared personal items, and inadequate hygiene [3]. These conditions make early recognition and prevention particularly relevant in training and competition settings.

Bacterial skin infections can disrupt athletic participation and contribute to team outbreaks. *Staphylococcus aureus*, including methicillin-resistant strains (MRSA), is of particular concern because it can cause skin and soft tissue infections and, occasionally, invasive disease [1]. Delayed or inaccurate diagnosis may contribute to outbreaks, medical complications, and time lost from sport [3]. Prevention therefore requires coordinated measures involving athletes, coaches, and healthcare personnel, including skin examinations, wound care, personal hygiene, and appropriate cleaning of shared facilities and equipment [1,2,3].

This narrative review aims to summarize the epidemiology, risk factors, clinical presentation, diagnosis, and management of bacterial skin infections in wrestling and other combat sports. It also examines preventive measures and compares NCAA and NFHS wrestling return-to-play criteria, while distinguishing evidence specific to combat sports from findings obtained in other athletic populations.

## 2. Materials and Methods

### 2.1. Search Strategy

A literature search was conducted in PubMed without publication date restrictions. Additional materials were obtained from the official websites of the National Collegiate Athletic Association (NCAA) and the National Federation of State High School Associations (NFHS), particularly documents concerning skin infections and eligibility to participate in wrestling. Public health guidance from the Centers for Disease Control and Prevention (CDC) and clinical resources from DermNet and the MSD Manual were also consulted.

### 2.2. Eligibility Criteria

Sources were selected for their relevance to bacterial skin infections in wrestling and other combat sports, including epidemiology, risk factors, clinical presentation, diagnosis, treatment, prevention, and return-to-play criteria. Studies involving other athletic populations were included when they provided relevant context, with their populations explicitly identified.

### 2.3. Selection of Publications

One author assessed and selected publications for inclusion. Findings were synthesized narratively and organized by topic. Where only an abstract was available, its use was restricted to information explicitly reported in the abstract.

## 3. Epidemiology and Risk Factors

### 3.1. Frequency of Bacterial Skin Infections Among Athletes

High school wrestlers had the highest incidence of skin infections, with 349 reported cases and an incidence rate of 28.56 per 100,000 athlete-exposures [4]. Bacterial infections were the most common category among wrestlers, accounting for 184 cases and 53.8% of infections with an identified category [4]. Among collegiate NCAA wrestlers, 29 bacterial skin infections were reported, representing 25.9% of all skin infections and an incidence rate of 3.68 per 10,000 athlete-exposures [5]. Overall, 74.1% of all skin infections recorded among collegiate wrestlers resulted in at least 24 hours of time loss from sport [5]. In the high school study, only infections resulting in at least one day of restricted participation met the study's reporting criteria [4].

### 3.2. Risk Factors in Wrestling and Other Combat Sports

Transmission of *Staphylococcus aureus* among athletes occurs primarily through direct skin-to-skin contact with an infected or colonized athlete [6]. In a longitudinal study, collegiate athletes participating in contact sports acquired *S. aureus* colonization significantly faster than athletes participating in non-contact sports (HR 1.61; 95% CI 1.02-2.55) [7]. A history of *S. aureus* infection was also associated with increased odds of MRSA carriage (OR 5.35; 95% CI 1.51-18.87) [7]. Available review evidence suggests that direct contact between athletes plays a greater role in transmission than contact with training mats or other fomites [6]. Additionally, tight-fitting training apparel may contribute to folliculitis in areas where clothing fits tightly, while body shaving may also increase the frequency of this condition [2].

In a cross-sectional study of Italian contact sport athletes, sharing sports equipment was associated with higher odds of *S. aureus* carriage (OR 2.08; 95% CI 1.01-4.30), whereas showering immediately after training was associated with lower odds (OR 0.42; 95% CI 0.20-0.86) [8]. These associations concern colonization rather than clinical infection and do not establish causality.

### 3.3. Colonization With *Staphylococcus aureus* and MRSA

In a prospective study, nasal and oropharyngeal swabs were collected at enrollment and monthly thereafter to assess carriage of methicillin-susceptible and methicillin-resistant *Staphylococcus aureus* [7]. The investigators defined persistent carriage as positive results at ≥80% of sampling time points, intermittent carriage as at least one positive result but at <80% of time points, and non-carriage as exclusively negative results [7]. Among the 377 participants, 90 (23.87%) were classified as non-carriers, 200 (53.05%) as intermittent carriers, and 87 (23.08%) as persistent carriers of *S. aureus* during follow-up of up to 18 months [7]. Compared with intermittent carriers, persistent carriers were significantly more likely to have simultaneous nasal and oropharyngeal colonization rather than nasal colonization alone [7]. A separate analysis of the same cohort found higher odds of MRSA carriage in summer than in winter (OR 1.70; 95% CI 1.23-2.35) [9]. Ten participants developed 12 abscesses, of which seven yielded MRSA and two yielded MSSA; the remaining three yielded no pathogen [9]. These findings concern collegiate athletes from other disciplines, as wrestlers were not included.

In a cross-sectional study of 238 Italian athletes participating in nine contact sports, including several combat disciplines, *S. aureus* carriage was detected in 101 participants (42.4%), while MRSA carriage was identified in three (1.3%) [8]. Sampling included the anterior nares, oropharynx, and fingers; 43 of the 101 carriers (42.6%) were colonized exclusively in the oropharynx, indicating that nasal sampling alone would have missed these carriers [8].

In a cross-sectional study of 300 French athletes from several sports, including wrestling and martial arts, *S. aureus* carriage was detected in 183 participants (61.0%), while only one (0.3%) carried MRSA [10]. Throat-only carriage occurred in 57 athletes, accounting for 31.1% of *S. aureus* carriers and further highlighting the limitations of nasal sampling alone [10]. These figures describe the entire study population rather than combat-sport athletes specifically.

Citing prior research, the authors of the review note that athletes colonized with community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA) were approximately seven times more likely to develop a bacterial skin infection than their non-colonized counterparts

[6]. In a one-year study of 126 collegiate athletes participating in men's American football and women's lacrosse, nasal MRSA carriage ranged from 4% to 23% across the athletic season [11]. Five athletes developed skin and soft tissue infections, including one with recurrent MRSA furunculosis, but the increase in carriage was not accompanied by an outbreak [11].

## 4. Clinical Presentation and Diagnosis

### 4.1. Impetigo

Impetigo is a superficial bacterial skin infection that can present with vesicles, pustules, and erosions covered by honey-colored crusts [2]. For microbiological evaluation, the Infectious Diseases Society of America (IDSA) recommends Gram staining and culture of pus or exudate from skin lesions to identify *Staphylococcus aureus* and/or beta-hemolytic streptococci. However, treatment without these tests is considered reasonable in typical cases [12].

### 4.2. Bacterial Folliculitis

Bacterial folliculitis typically manifests as small pustules around hair follicles [2]. The diagnosis is usually clinical, although confirmation can be obtained by sending bacterial swabs for microscopy, culture, and antimicrobial susceptibility testing [13].

### 4.3. Furuncles, Carbuncles and Skin Abscesses

A furuncle is a deep infection of a single hair follicle, with suppuration extending into the dermis and subcutaneous tissue [12]. It presents as a painful, warm, erythematous nodule that may be firm or fluctuant [13]. A carbuncle involves several adjacent hair follicles, with multiple openings draining pus [13]. A cutaneous abscess is a localized collection of pus within the dermis and deeper skin tissues [12]. It typically presents as a painful, tender, erythematous, fluctuant nodule, often with an overlying pustule and surrounding edema [12].

A furuncle is usually diagnosed clinically [13]. For carbuncles and cutaneous abscesses, Gram staining and culture of pus are recommended, although treatment without these tests is reasonable in typical cases [12].

### 4.4. Cellulitis and Erysipelas

Cellulitis involves the deep dermis and subcutaneous tissue and presents with poorly defined, spreading erythema, warmth, tenderness, and swelling [14,15]. Erysipelas affects the superficial dermis and typically presents as a raised, well-demarcated, smooth, bright-red plaque with edema and warmth [15]. Both conditions are diagnosed primarily through history and physical

examination [14,15]. Additional laboratory testing may be considered in patients with fever, chills, or worsening skin lesions [15].

### 4.5. MRSA Infections

*S. aureus* skin infections, including those caused by MRSA, commonly present as painful, erythematous, swollen, warm lesions that may drain pus and be accompanied by fever [16]. Lesions may occur in hair-bearing areas or where clothing and equipment irritate the skin [17]. Clinical appearance alone cannot reliably distinguish MRSA from other bacterial causes; laboratory testing is required to confirm MRSA as the causative pathogen [16,17].

Laboratory differentiation of MRSA from MSSA relies on testing the susceptibility of *S. aureus* isolates to cefoxitin or oxacillin using validated phenotypic methods [18]. Additional methods include PCR detection of the *mecA* gene or immunological detection of PBP2a; a positive result for either marker or resistance demonstrated by a recommended phenotypic method identifies the isolate as MRSA [18].

## 5. Clinical Management

### 5.1. Principles of Treatment

Table 1. Treatment of common bacterial skin infections

| Infection | Topical treatment and wound care | Systemic treatment: indications and agents | Procedures and supportive care | References |
|---|---|---|---|---|
| **Impetigo** | Mupirocin, fusidic acid, or retapamulin [19]. | Extensive or severe infection, large bullae, or impracticality of topical treatment [20]. Oral dicloxacillin or cephalexin for MSSA infections [12,20]; amoxicillin-clavulanate is also listed as an option [20]. | Removal of crusts to facilitate the action of topical antibiotics [15]. | [12,15,19,20] |
| **Bacterial folliculitis** | Antiseptic cleansers, such as chlorhexidine. Topical antibiotics include erythromycin, clindamycin, mupirocin, or fusidic acid; courses should be limited to no more than 7 days to reduce the risk of antimicrobial resistance [13]. | Oral or intravenous antibiotic therapy is indicated for extensive or severe infections [13]. Oral cephalexin is listed as a treatment option for staphylococcal folliculitis [15]. | Warm compresses to relieve itching and pain; analgesic and anti-inflammatory medications for pain relief [13]. | [13,15] |

| Infection | Topical treatment and wound care | Systemic treatment: indications and agents | Procedures and supportive care | References |
|---|---|---|---|---|
| **Furuncle / carbuncle** | Topical antiseptics, such as povidone-iodine or chlorhexidine cream, and covering the lesion with gauze [21]. | Fever, other systemic signs of infection, or impaired host defenses are indications for antibiotic therapy as an adjunct to drainage [12,22]. Oral dicloxacillin or cephalexin are options for MSSA infections [12]. For carbuncles that fail to respond to initial antibiotic treatment, an agent active against MRSA is recommended [12]. For MRSA treatment, see Section 5.2. | Warm, moist compresses may facilitate spontaneous drainage of small furuncles. Incision and drainage are recommended for large furuncles and carbuncles [12,22]. | [12,21,22] |
| **Cutaneous abscess** | After drainage, apply an absorbent gauze dressing and reassess the wound and change the dressing after 24-48 hours. Continue gentle wound cleansing and regular dressing changes. Routine packing of the abscess cavity is not necessary [23]. | Following incision and drainage of an uncomplicated abscess, consider oral trimethoprim-sulfamethoxazole (TMP-SMX) or clindamycin. This is a conditional recommendation requiring discussion of the potential benefits and adverse effects with the patient. TMP-SMX is preferred because of its lower risk of diarrhea [24]. Antibiotic therapy after drainage is indicated in patients with significant associated cellulitis, septic thrombophlebitis, deep, multiple or recurrent abscesses, systemic signs and symptoms, immunosuppression, or a facial abscess located above the upper lip and below the eyebrows [23]. | Incision and drainage with evacuation of pus and disruption of loculations within the abscess cavity [23]. | [23,24] |

| Infection | Topical treatment and wound care | Systemic treatment: indications and agents | Procedures and supportive care | References |
|---|---|---|---|---|
| **Erysipelas / cellulitis** | Care of skin breaks that serve as portals of entry and treatment of predisposing skin conditions, including fissuring, scaling, and maceration of the interdigital toe spaces, to reduce recurrence [12]. The reviewed sources provide no recommendations for topical antibiotics or antiseptics as adjunctive treatment of erysipelas or cellulitis itself [12,15] | Mild infections without systemic signs: an oral antibiotic active against streptococci, such as penicillin V or cephalexin [12,15]. For infections with systemic signs requiring intravenous therapy, options include penicillin G, cefazolin, or ceftriaxone [12]. Severe infection or failure of outpatient treatment warrants hospitalization and individualized antibiotic selection. For MRSA coverage, see Section 5.2 [12]. | Elevation of the affected limb to reduce edema [12,15]. Incision and drainage if an abscess coexists [12,15]. Suspected necrotizing infection requires urgent surgical consultation [12]. | [12,15] |

### 5.2. Management of Suspected MRSA Infection

IDSA recommends MRSA-active antibiotics for carbuncles and cutaneous abscesses when initial antibiotic therapy has failed, host defenses are markedly impaired, or systemic inflammatory response syndrome (SIRS) is accompanied by hypotension [12]. In nonpurulent cellulitis, empirical coverage of both MRSA and streptococci is recommended in the presence of penetrating trauma, MRSA infection elsewhere, nasal MRSA colonization, injection drug use, or SIRS [12]. When oral antibiotic therapy is indicated for suspected or confirmed MRSA folliculitis or abscesses, options include doxycycline or trimethoprim-sulfamethoxazole (TMP-SMX) [25]. If streptococcal coverage is also required, oral options include clindamycin alone or a β-lactam, such as amoxicillin, combined with either doxycycline or TMP-SMX [12]. For patients with furuncles or carbuncles who are immunocompromised or have sepsis, intravenous MRSA-active treatment options include vancomycin, daptomycin, linezolid, and ceftaroline [22]. Antibiotic selection should be guided by culture and antimicrobial susceptibility results when available [25].

### 5.3. Decolonization

For recurrent *S. aureus* infections, IDSA suggests considering a five-day regimen of intranasal mupirocin twice daily, daily chlorhexidine body washes, and daily decontamination of towels, bed linen, and clothing, although the supporting evidence is limited [12].

During an outbreak of Panton-Valentine leukocidin (PVL)-positive MSSA skin infections in a professional rugby team, all 51 members underwent a five-day decolonization regimen consisting of intranasal mupirocin 2% twice daily and chlorhexidine body washing, alongside hygiene measures [26]. Further abscesses occurred after this intervention. A subsequent ten-day decolonization course targeting eight players, combined with renewed hygiene education, was followed by no further reported person-to-person transmission [26]. This outbreak report does not establish the independent effectiveness of decolonization or justify its routine use in all athletes [26].

## 6. Prevention of Transmission

### 6.1. Personal Hygiene

CDC recommends frequent hand hygiene, using soap and water when hands are visibly soiled, and showering immediately after exercise [17]. Athletes should wash uniforms, clothing, and

towels after each use and dry them completely in a dryer, following garment care instructions. Towels, bar soap, razors, clothing, and ointments from shared open containers should not be shared [17]. Cuts and wounds should remain covered with clean, dry dressings until healed, with hand hygiene performed after dressing changes [17]. In a study involving 151 high school wrestlers, teams were randomly assigned to soap-and-water wipes, 70% isopropyl alcohol wipes, or no additional intervention during two tournaments. Soap-and-water wipes were associated with lower odds of skin infection (OR 0.089; 95% CI 0.01-0.75), whereas the difference for alcohol wipes was not statistically significant (OR 0.44; 95% CI 0.11-1.69); however, the available abstract does not specify whether the infections were bacterial [27].

### 6.2. Cleaning of Mats and Sports Equipment

CDC recommends cleaning shared athletic equipment after each use and allowing it to dry before reuse, with particular attention to surfaces that contact bare skin [28]. Cleaning and disinfection should follow equipment manufacturers' instructions. Disinfectants should be effective against *Staphylococcus aureus* and used according to the product label, including the specified dilution and contact time [28].

During wrestling competitions, mats treated with residual disinfectants had a 76.3% lower mean bacterial colony count than those treated with nonresidual products (437.25 versus 1,844.50; $p = 0.05$) [29]. These findings indicate reduced bacterial contamination of mats; the study did not assess whether this translated into fewer skin infections among athletes [29]. In a single-university study involving football players and wrestlers, MRSA was recovered from 4 of 39 environmental samples (10%) collected in wrestling facilities [30]. Following improvements in cleaning and disinfection procedures, disinfected wrestling mats tested negative [30]. However, the study did not establish direct transmission from contaminated surfaces to athletes [30].

In a study of four athletic training rooms at two high schools and two colleges, a program combining hand hygiene, surface disinfection, and education was associated with a 94.7% reduction in total bacterial surface counts [31]. MRSA and VRE (vancomycin-resistant enterococci) contamination decreased from 24% of sampled surfaces before intervention to none detected at the end of the study [31]. These findings demonstrate reduced environmental contamination but do not establish a reduction in infection rates among athletes [31].

### 6.3. Screening and Early Recognition

The National Athletic Trainers' Association (NATA) recommends daily skin examinations by athletic trainers before practices and competitions, alongside daily self-inspection by athletes [19]. Athletes should promptly report cuts, abrasions, and suspicious lesions, particularly those associated with pain, redness, swelling, warmth, or pus [17,19]. Suspected infectious lesions warrant same-day medical assessment, with affected athletes separated from teammates pending evaluation when a contagious skin disease is suspected [19]. These examinations aim to identify visible lesions and should not be equated with microbiological screening for asymptomatic MRSA carriage**.**

In a Missouri survey of 1,642 coaches and athletic directors, 61% of those answering the relevant question reported receiving MRSA educational materials, while 32% reported that their school had written guidelines for managing skin and soft tissue infections [32]. Respondents aware of such guidelines less frequently reported infections among their athletes than those reporting no written policy (26% vs 34%; $p = 0.03$) [32]. This association does not establish causality, as infections were reported by coaches and athletic directors and diagnoses were not independently verified [32].

### 6.4. Outbreak Management

The American Academy of Pediatrics recommends prompt identification, treatment, and follow-up of infected athletes, together with environmental decontamination and involvement of public health authorities during outbreaks [1]. For MRSA outbreaks, the report also highlights screening players for carriage, decolonization of identified carriers, and reinforcement of personal hygiene [1].

During a PVL-positive MSSA outbreak in a professional rugby team, the investigation included interviews with all 51 team members and screening using nasal, throat, and skin-lesion swabs [26]. Control measures included treatment of active infections, education on wound protection and personal and environmental hygiene, and regular monitoring of adherence by team staff [26]. The authors suggested that an uncovered, untreated abscess contributed to continued transmission despite the initial intervention, highlighting the importance of managing active lesions alongside other control measures [26].

## 7. Return-to-Play Criteria

### 7.1. General Principles

Return-to-play decisions in NCAA and NFHS wrestling require assessment of lesion contagiousness and compliance with the relevant medical clearance requirements [33,34]. Medical documentation records the diagnosis, lesion location, treatment, and earliest return date, but does not guarantee participation. NCAA assigns final clearance to the host-site physician or certified athletic trainer following examination and document review, whereas NFHS permits a designated on-site healthcare professional, when present, to overrule a previous medical release [33,34].

### 7.2. NCAA Criteria

According to the NCAA skin evaluation form, wrestlers with bacterial skin infections, including MRSA, must have no new skin lesions for at least 48 hours, have completed at least 72 hours of antibiotic therapy, and have no moist, exudative, or draining lesions at competition [33]. All criteria must be met; covering active purulent lesions does not permit participation. Final clearance is determined by the host-site physician or certified athletic trainer after examination and review of the medical documentation [33].

### 7.3. NFHS Criteria

Under NFHS guidance, wrestlers with bacterial skin infections such as impetigo or boils may be considered non-contagious when all lesions are scabbed over without oozing or discharge, no new lesions have appeared for 48 hours, and at least 72 hours of oral antibiotic therapy have been completed [34]. Persistent new or draining lesions after this period should prompt consideration of MRSA. Contagious lesions cannot be covered to permit participation; non-contagious lesions may be covered for protection. Medical clearance must be provided by an appropriate healthcare professional authorized by the state association, but may be overruled by the designated healthcare professional at the meet [34].

### 7.4. Comparison of Return-to-Play Recommendations

Table 2. NCAA and NFHS return-to-play criteria for wrestlers with bacterial skin infections

| Criterion | NCAA [33] | NFHS [34] |
|---|---|---|
| **Minimum duration of antibiotic therapy** | At least 72 hours of antibiotic therapy; the route of administration is not specified. | At least 72 hours of oral antibiotic therapy. |
| **Absence of new lesions** | No new skin lesions for at least 48 hours before competition. | No new skin lesions during the preceding 48 hours. |
| **Condition of existing lesions** | No moist, exudative, or draining lesions at the time of competition. | All lesions must be scabbed over, with no oozing or discharge. |
| **Covering lesions** | Active purulent lesions cannot be covered to permit participation. | Contagious lesions cannot be covered to permit participation. Non-contagious lesions may be covered after adequate treatment to protect them from injury. |
| **MRSA-specific considerations** | MRSA is explicitly included in the bacterial infection criteria. | No separate return-to-play criteria are provided for MRSA. MRSA should be considered if new lesions continue to develop or existing lesions continue to drain after 72 hours of treatment. |

NCAA, National Collegiate Athletic Association; NFHS, National Federation of State High School Associations; MRSA, methicillin-resistant Staphylococcus aureus.

## 8. Discussion

Bacterial skin infections in wrestling require consideration of both individual treatment and transmission within teams. Surveillance studies document infections among high school and collegiate wrestlers, but differences in reporting criteria, populations, and exposure measures limit direct comparisons between these settings [4,5]. Findings from other contact sports provide additional context, although their applicability to wrestling and other combat disciplines should be considered separately.

A key distinction is that *S. aureus* carriage is not equivalent to clinical infection. Studies of Italian and French athletes identified substantial oropharyngeal carriage, indicating that nasal sampling alone may miss some carriers [8,10]. However, these findings do not establish a

benefit from routine microbiological screening of all athletes. In collegiate football and lacrosse players, seasonal increases in nasal MRSA carriage were not accompanied by an outbreak, although individual infections occurred [11]. Visual skin examinations and microbiological screening therefore serve different purposes: the former identify suspicious lesions, whereas the latter assess carriage and may support outbreak investigations [1,19].

Environmental studies support the role of cleaning and disinfection in reducing bacterial contamination, but evidence of reduced surface contamination should not be interpreted as direct evidence of fewer clinical infections [29,30,31]. This distinction is relevant when evaluating prevention programs, which commonly combine hygiene education, wound care, environmental measures, and decolonization. In a professional football team in Australia, no further *S. aureus* skin lesions were reported after a combined response involving decolonization advice and changes to equipment and facilities [35]. Similarly, control of a PVL-positive MSSA outbreak in a rugby team followed decolonization and reinforcement of hygiene practices [26]. Neither report establishes the independent effectiveness of any single intervention.

Decolonization consequently requires careful interpretation. IDSA suggests considering it for recurrent *S. aureus* infections, while acknowledging limited supporting evidence [12]. Outbreak reports illustrate its use within broader infection-control programs but do not justify routine decolonization of all athletes [26,35]. Antimicrobial resistance further complicates management. Ožegić et al. identify limited research on antimicrobial resistance (AMR) in sporting environments and emphasize the need for evidence-based guidance addressing antibiotic use and adverse effects in athletes [36]. When available, culture and susceptibility results can support antibiotic selection [25].

Return-to-play decisions represent a separate consideration from treatment alone. NCAA and NFHS wrestling documents combine minimum treatment periods with requirements concerning new lesions and the condition of existing lesions; covering an active contagious or purulent lesion does not by itself establish eligibility [33,34]. Although these frameworks share important principles, their wording and clearance procedures differ. They should therefore be presented as organization-specific wrestling requirements rather than universal rules for all combat sports.

Future research should evaluate clinical infection outcomes alongside carriage and environmental contamination. Studies in individual combat disciplines would help clarify the applicability of findings currently drawn from broader athletic populations. Comparative

evaluations of prevention programs are also needed to determine which components reduce infections and time lost from sport.

## 9. Limitations

This narrative review did not use a systematic search and selection process, and sources were selected by one author, creating a risk of selection bias and omission of relevant studies. Some publications were available only as abstracts, limiting assessment of their methods and findings. The included studies differed in populations, sampling methods, case definitions, and outcome measures, restricting direct comparisons. Several involved athletes from sports other than wrestling or combat disciplines, which limits generalizability. Environmental contamination and bacterial carriage outcomes do not directly establish effects on clinical infection rates, while combined outbreak interventions prevent attribution of outcomes to individual measures. Finally, the NCAA and NFHS return-to-play criteria discussed here apply to their respective wrestling settings and should not be assumed to represent requirements across all combat sports.

## 10. Conclusions

Bacterial skin infections in wrestling and other combat sports require prompt recognition, appropriate treatment, and coordinated measures to limit transmission. Prevention should combine regular skin checks, early reporting of suspicious lesions, wound care, personal hygiene, and cleaning of shared equipment. Decolonization should be considered selectively rather than routinely applied to all athletes. Return to wrestling or other contact sports should follow the applicable organization's criteria and medical assessment, as completion of a minimum treatment period alone does not establish eligibility. Further research should evaluate whether preventive interventions reduce clinical infections and time lost from combat sports.

## Disclosure

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