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Microbial Skin Infections in Contact Sports: Epidemiology and Prevention

Rahib K. Islam¹ and Kazi N. Islam²

ABSTRACT

Microbial skin infections are a major yet often underestimated concern in contact sports, posing health and performance risks for athletes. This narrative review examines the epidemiology, risk factors, and preventive strategies for three predominant infections—methicillin-resistant *Staphylococcus aureus* (MRSA), dermatophytic tinea, and herpes gladiatorum—across contact sports such as wrestling, rugby, mixed martial arts (MMA), and American football. Literature from PubMed and Web of Science, along with CDC and NCAA reports, was reviewed to assess infection prevalence and control measures. Wrestling showed the highest incidence of herpes gladiatorum, while rugby and football reported notable MRSA and tinea outbreaks linked to close physical contact and shared facilities. Key transmission factors include skin abrasions, inadequate hygiene, contaminated equipment, and inconsistent adherence to preventive guidelines. Effective prevention requires routine athlete screening, rigorous personal and environmental hygiene, targeted pharmacologic prophylaxis, and athlete education. Although existing guidelines from sports authorities provide valuable frameworks, gaps remain in standardization and implementation across sports. Future research should focus on antimicrobial resistance trends, rapid screening tools, and behavioral interventions to enhance compliance. Strengthening coordinated hygiene protocols and evidence-based preventive strategies is essential to safeguard athlete health and maintain competitive integrity.

Keywords: MRSA outbreaks, Herpes gladiatorum, Dermatophytic tinea infections, Contact sports infection epidemiology, Athlete hygiene interventions

Introduction

Microbial skin infections represent a critical yet often underestimated concern in the context of contact sports, presenting significant health, economic, and competitive challenges for athletes and organizations alike.¹ Due to close physical interactions, frequent skin-to-skin contact, and shared training environments, athletes participating in contact sports are particularly susceptible to infections such as methicillin-resistant *Staphylococcus aureus* (MRSA) and dermatophytic fungal infections (tinea) and herpes gladiatorum caused by herpes simplex virus type 1 (HSV-1).² These infections not only cause acute discomfort and performance impairment but can also lead to prolonged absence from training, potential complications, and outbreaks that affect entire teams or sporting events.³

In recent decades, reported outbreaks of MRSA, tinea, and herpes gladiatorum in wrestling, rugby, and mixed martial arts (MMA) have highlighted the importance of comprehensive epidemiological surveillance and preventive strategies.⁴ Wrestling, for instance, has historically faced significant issues with herpes gladiatorum, a viral condition that necessitated dedicated screening and management protocols.⁵ Similarly, rugby has confronted challenges with MRSA outbreaks and recurrent fungal infections associated with equipment and shared spaces, emphasizing the universal nature of these microbial threats across various contact disciplines.⁶

Despite the known risks, consistent adherence to preventive practices remains variable, partly due to gaps in athlete education, unclear guidelines, and inconsistent screening methods.⁷ Therefore, a critical review of the current epidemiology of these infections, evaluation of existing preventive strategies, and identification of optimal practices are needed. This narrative review aims to compare the rates of MRSA, tinea, and herpes gladiatorum across prominent contact sports, critically assess current screening, hygiene, and prophylaxis measures, and ultimately inform evidence-based recommendations to protect athlete health and performance.

Methods

Purpose and Review Design

This article is a narrative review that integrates illustrative empirical reports, surveillance summaries, and governing-body recommendations on microbial skin infections in contact and collision sports. The aim is to provide clinicians, trainers, and team physicians with practice-oriented guidance—not to exhaustively catalog every published outbreak.

Literature Identification

We adopted a targeted search-and-snowball strategy:

- **Databases searched:** PubMed/MEDLINE and Web of Science (latest search → June 15, 2025).
- **Core search string (PubMed):** (wrestling OR rugby OR “martial arts” OR “American football” OR judo) AND (MRSA OR “methicillin-resistant *Staphylococcus*” OR tinea OR dermatophyte OR “herpes gladiatorum” OR “skin infection”)
- **Gray sources and citation chasing:** Centers for Disease Control and Prevention (CDC) athlete-MRSA pages, National Athletic Trainers’ Association (NATA) statements, and reference lists of key reviews.

Selection Approach

Because this is a narrative synthesis, we purposefully selected studies that (i) collected primary data on incidence, prevalence, or outbreak control in contact sports athletes or (ii) issued sports-specific guidelines on prevention and return-to-play (RTP). Reviews, basic-science papers, and nonsports clinical studies were used only as background.

Data Extraction and Presentation

For each empirical study, we recorded country/setting, sport, pathogen, design, sample size, and the headline quantitative outcome (e.g., attack-rate reduction, prevalence). Governing-body documents were summarized in a separate table highlighting their key recommendations. No formal risk-of-bias tool was applied; instead, methodological limitations are discussed contextually in the section “Risk Factors for Transmission.”

Epidemiology of Skin Infections in Contact Sports

Overview of Microbial Skin Infections

MRSA is a gram-positive bacterium recognized for its resistance to beta-lactam antibiotics, posing substantial treatment challenges.⁸ MRSA frequently colonizes the skin and nasal mucosa, leading to superficial infections, such as abscesses and cellulitis, but can progress to severe systemic infections if not promptly managed.⁸ In sports settings, transmission primarily occurs via skin-to-skin contact, contaminated equipment, or shared training surfaces, resulting in localized outbreaks that threaten athlete health and disrupt competitive seasons.⁹

Dermatophytic fungal infections (Tinea) encompass a range of superficial fungal conditions primarily caused by *Trichophyton*, *Microsporum*, and *Epidermophyton* species.¹⁰ Among athletes, common manifestations include tinea corporis (ringworm), tinea pedis (athlete’s foot), and tinea capitis (scalp ringworm).¹¹

These infections thrive in warm, moist environments typical of locker rooms and shared facilities, spreading readily through direct contact or via contaminated surfaces and equipment.⁷

Herpes gladiatorum, caused predominantly by HSV-1, is characterized by painful vesicular eruptions typically occurring on the face, neck, or torso. Primarily identified in wrestling populations, herpes gladiatorum spreads swiftly through direct skin-to-skin contact, particularly during competition or sparring, resulting in notable outbreaks that necessitate rigorous containment measures.¹²

Sports-Specific Infection Rates

Wrestling

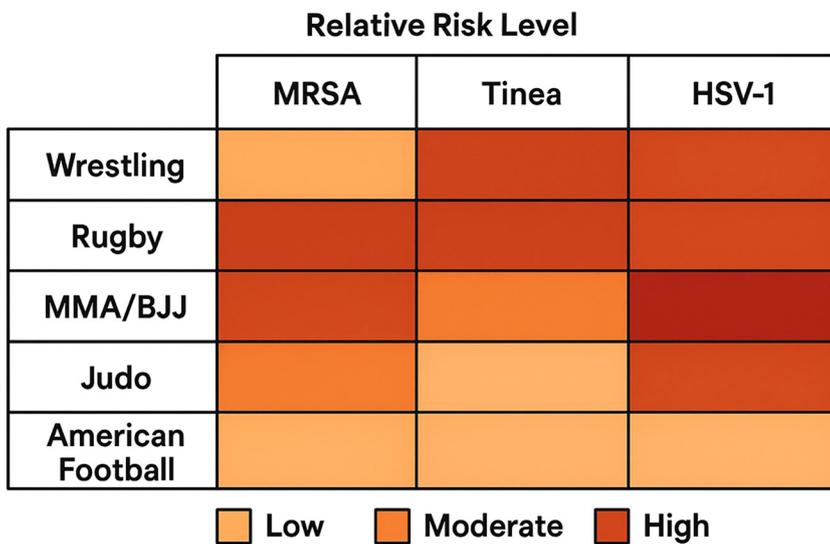
Wrestling consistently reports high rates of microbial skin infections, notably herpes gladiatorum.⁵ Outbreak incidence has ranged widely, with up to 30% prevalence reported in certain high school and collegiate wrestling teams during outbreaks.⁵ MRSA has also emerged as a substantial threat, with isolated outbreaks demonstrating attack rates from 5% to 15% among affected teams.¹³ Tinea infections, particularly tinea corporis, are commonly documented, affecting between 10% and 25% of wrestlers at varying points during competitive seasons, influenced heavily by mat hygiene and skin abrasion frequency.¹⁴

Rugby

Rugby athletes experience significant MRSA exposure, driven primarily by repeated skin abrasions, close bodily contact, and shared clothing or equipment.¹⁵ Prevalence rates in rugby have ranged from 5% to as high as 12% during documented outbreaks, particularly at collegiate and professional levels.¹⁶ Tinea pedis and corporis are prevalent due to common showering and locker room environments, with studies indicating infection rates from 10% to 20% in competitive rugby teams.⁶ Although herpes gladiatorum is less frequent in rugby than wrestling, isolated outbreaks do occur, particularly among scrum forwards, due to the intensive face-to-face and body contact.¹⁷

Other Contact Sports (e.g., Judo, MMA, and American Football)

Judo and MMA, given the close-contact nature and extensive skin exposure, frequently report fungal and bacterial infections, particularly MRSA and tinea corporis.¹⁸ MMA, specifically Brazilian jujitsu athletes, have documented MRSA carriage rates exceeding 15% in certain training facilities, likely attributable to intensive mat contact and high skin abrasion rates.¹⁹ American football, while reporting lower rates of herpes gladiatorum, shows persistent MRSA outbreaks, often associated with shared equipment, such as pads and helmets, with documented prevalence ranging from 3% to 10%.²⁰ Fungal infections, notably tinea pedis, have also been consistently reported at rates comparable to rugby.¹⁰ Relative risk prevalence, although estimates and aiming to serve as a visual representation of the data and not precise data, is found in Figure 1.



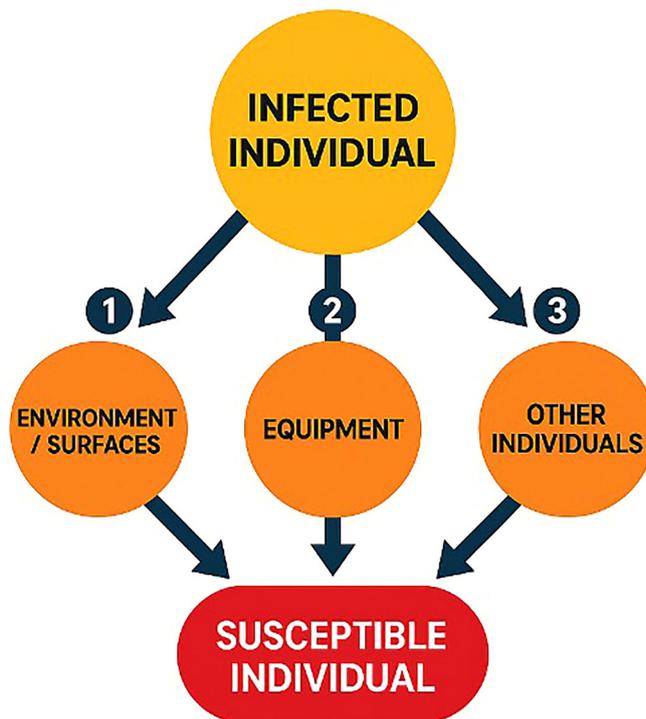
*Based on literature ranges

Fig 1 | Heat map visualizing prevalence of the infections found in contact sports participants/athletes. Colors indicate relative prevalence categories, not pooled effect sizes. This is not quantitative data and is meant to serve as a visual representation

Table 1 | Empirical results of contact sports

#	Author (Year)	Country/Setting	Sports	Pathogen(s)	Design level	N (Athletes)	Main Quantitative Outcome(s)	Headline Finding
1	Anderson BJ (2008)	USA/Minnesota state season	Wrestling	HSV-1	Outbreak report	≈120	Competition suspension contained > 90% of exposed wrestlers	Early case-finding + acyclovir stopped statewide HG spread
2	Anderson BJ et al. (2016)	USA/28-day camp	Wrestling	HSV-1	Prospective cohort	2793	HG incidence over 28 days	Daily valacyclovir ↓ outbreak risk by 89%
3	Fritz SA et al. (2012)	USA/Missouri HS coaches	Multisport contact	CA-MRSA and SSTI	Cross-section survey	1642	Coach-reported SSTI incidence	Written SSTI policy linked to lower incidence (26% vs. 34%, $p = 0.03$)
4	Herzog MM et al. (2017)	National Collegiate Athletic Association (NCAA) surveillance	Wrestling	Mixed (viral > bacterial > fungal)	Prospective surveillance	87 athletes/78,720 AEs	Incidence 14.2/10,000 AEs	Viral rate 1.7× bacterial, 2.1× fungal
5	Bachmeyer C and Buot G (2013)	France/clinic case	MMA	<i>T. tonsurans</i>	Case report	1	Lesion culture + KOH	First French MMA tinea gladiatorum case—12 lesions arms/neck

TRANSMISSION PATHWAYS

**Fig 2 | Transmission pathways of how an individual can be affected via the environment**

Collectively, these data underscore the widespread nature and significant variability of microbial skin infections across contact sports, highlighting the necessity for tailored epidemiological surveillance and targeted prevention strategies. A table of the empirical studies discussing our results can be visualized in Table 1.

Risk Factors for Transmission

Understanding the factors contributing to microbial skin infections in contact sports is critical to implementing effective preventive measures. Risk factors can broadly be categorized into athlete-specific, environmental, and societal factors.

Athlete-Specific Factors

Athletes participating in contact sports frequently sustain minor abrasions, cuts, and friction-induced skin injuries, creating entry points for pathogens.²¹ Continuous physical interaction significantly elevates the likelihood of pathogen transmission between competitors.²² Additionally, individual variations in personal hygiene practices—including inconsistent showering post-training or inadequate hand hygiene—further exacerbate infection risk.²³ Athletes with preexisting skin conditions, impaired immune function, or chronic skin disruptions (e.g., eczema, psoriasis) are particularly vulnerable to colonization and infection.²⁴

Environment-Specific Factors

Environmental conditions associated with training and competition facilities significantly impact microbial transmission.²⁵ Poorly maintained mats, contaminated locker rooms, and shared training equipment provide ideal reservoirs for MRSA, dermatophytes, and HSV-1.² Frequent sharing or inadequate sanitation of uniforms, towels, protective gear (helmets, shoulder pads), and footwear significantly amplifies transmission potential.²⁶ Inadequate ventilation, warm and humid indoor training environments, and overcrowding further encourage fungal proliferation and persistence of viral particles, increasing the frequency of tinea and herpes gladiatorum outbreaks.²⁷ A visual representation of the transmission pathways can be found in Figure 2.

Societal Factors

Broader societal dynamics, including antibiotic stewardship and public health awareness, substantially influence infection prevalence and control.²⁸ Increasing antibiotic resistance, particularly with MRSA, complicates treatment options and underscores the urgency of preventive interventions.²⁹ Moreover, variability in athlete and coaching staff education concerning recognition and early reporting of infections influences transmission dynamics.⁹ Limited awareness or neglect of preventive hygiene protocols, screening policies, and inadequate compliance with public health guidelines contribute to persistent outbreaks despite existing recommendations.

Addressing these multifaceted risk factors requires a coordinated strategy encompassing athlete education, rigorous environmental hygiene, and robust public health policies.

Preventive Strategies

Effective prevention of microbial skin infections in contact sports requires a multifaceted approach encompassing athlete screening, rigorous hygiene practices, and targeted pharmacologic and nonpharmacologic prophylaxis.

Screening Practices

Routine and precompetition screening are essential preventive strategies, particularly in sports prone to frequent outbreaks, such as wrestling.² Regular skin inspections performed by trained medical staff can detect early lesions suggestive of infection, allowing timely isolation and treatment of affected athletes.³⁰ Guidelines from organizations such as the NCAA recommend mandatory prematch skin checks, especially

in wrestling competitions, significantly reducing herpes gladiatorum outbreaks.³¹ However, routine MRSA screening (e.g., nasal swabbing) remains debated due to cost-benefit considerations, variable sensitivity, and logistical challenges.³² While routine fungal screening is not standard, systematic visual inspections can effectively detect symptomatic tinea infections, preventing spread among athletes.³³ A flowchart of clinical decisions that may aid in screening and returning to play, and a diagnosis aid, can be visualized in Figures 3 and 4.

Personal and Team Hygiene Measures

Individual and collective hygiene practices are critical to reducing infection risk.²³ Athletes should shower immediately after training sessions and competitions using antimicrobial or antifungal cleansers when indicated.³⁴ Proper wound care, including timely cleaning, disinfection, and coverage of abrasions, significantly reduces MRSA transmission.³⁵ Teams must enforce strict equipment hygiene protocols, including regular and thorough cleaning of mats, training gear, uniforms, and communal spaces.²⁶ Specifically, disinfectants effective against MRSA, dermatophytes, and HSV-1 (e.g., chlorine-based or quaternary ammonium compounds) should be systematically employed.³⁶ Education programs for athletes, coaches, and medical personnel emphasizing infection recognition, hygiene principles, and reporting procedures have demonstrated effectiveness in reducing outbreak incidence and severity.³⁷

SCREENING & RETURN-TO-PLAY

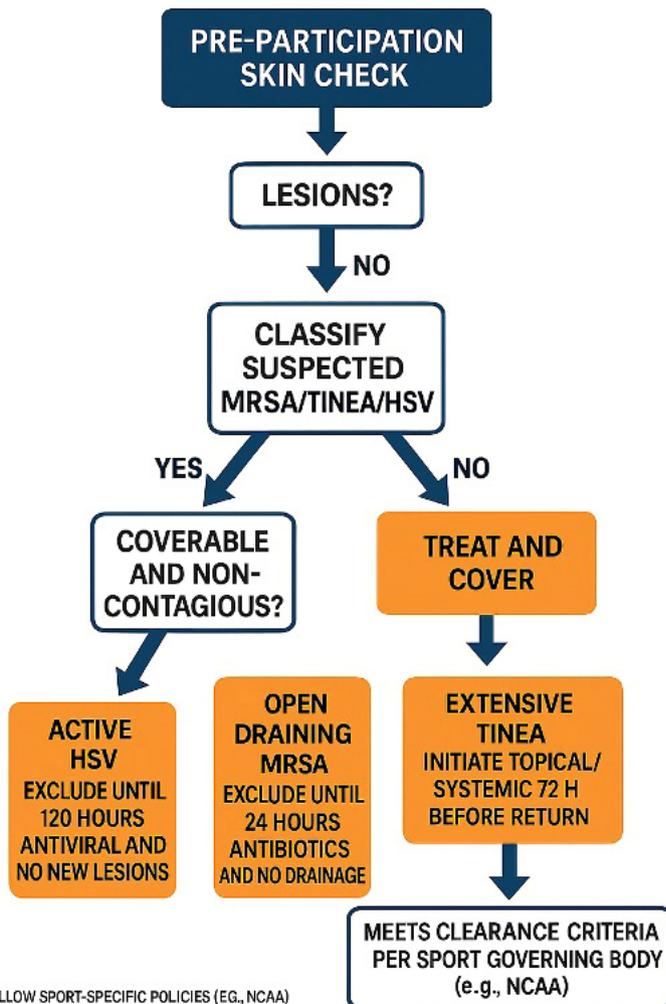


Fig 3 | Screening flowchart

ROADMAP TO DIAGNOSIS

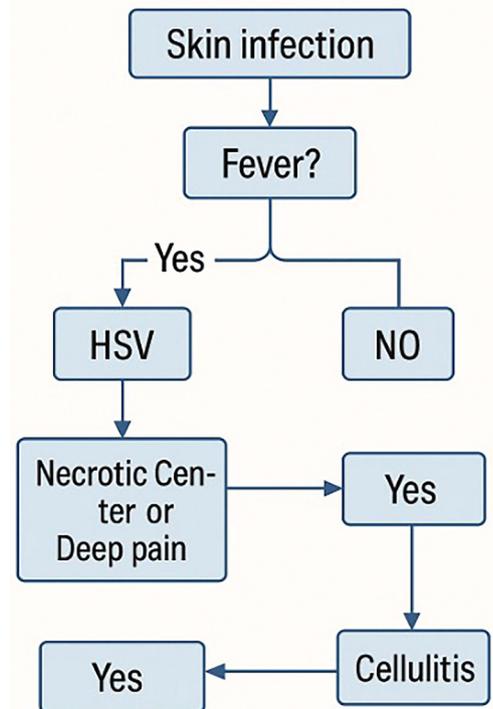


Fig 4 | A clinical diagnosis roadmap to detecting infection

Pharmacologic and Nonpharmacologic Prophylaxis

Pharmacologic prophylaxis remains controversial but potentially valuable in high-risk settings.³⁸ Antiviral prophylaxis (e.g., valacyclovir) can effectively reduce recurrence and transmission of herpes gladiatorum in individuals with recurrent lesions, particularly during peak competition periods.³⁹ Topical antifungal agents, such as terbinafine or clotrimazole, can limit the spread and recurrence of dermatophytic infections when appropriately utilized by teams experiencing frequent outbreaks.¹¹ The routine use of topical or systemic antimicrobials for MRSA prophylaxis is not widely recommended due to concerns regarding antibiotic resistance and limited evidence of sustained effectiveness; instead, emphasis is placed on rigorous hygiene and prompt treatment of identified cases.⁸

Nonpharmacologic preventive measures, such as barrier creams or ointments (e.g., petroleum jelly), may minimize skin abrasions and reduce the risk of infection entry, though evidence remains limited.⁴⁰ Furthermore, educating athletes to recognize early signs of infection and seek prompt medical evaluation is vital to limiting outbreaks and enhancing overall preventive effectiveness.⁴¹

An integrated preventive approach combining vigilant screening, strict hygiene practices, targeted pharmacologic prophylaxis, and thorough education programs is essential to minimize microbial skin infections across contact sports settings.

Recommendations and Guidelines

Guidelines and recommendations from authoritative bodies, including the CDC, the World Health Organization (WHO), and sports-specific associations like the NCAA and International Rugby Board (IRB), provide essential frameworks to mitigate microbial skin infection risks in contact sports.

The CDC and NCAA emphasize rigorous hygiene protocols, advocating immediate showering post-training or competition, strict wound management practices, and routine disinfection of shared equipment and training areas.⁴² The NCAA further mandates precompetition skin checks in wrestling, directly reducing the frequency and scale of herpes gladiatorum outbreaks.⁴³

The IRB provides comprehensive hygiene guidelines recommending routine surveillance for skin conditions, regular educational interventions targeting players and coaches, and detailed equipment sanitation protocols.⁴⁴ Although specific screening for MRSA or dermatophytic fungi is not universally mandated in rugby, the IRB strongly supports targeted education to

ensure rapid recognition and isolation of symptomatic individuals.

Despite robust guidelines, gaps remain in standardized practices across various contact sports, especially concerning MRSA screening, consistent antifungal measures, and broader antiviral prophylaxis implementation. Improved harmonization of guidelines across disciplines, clearer protocols for outbreak management, and expanded education programs addressing antibiotic resistance are critically needed. These guidelines can be visualized in Table 2.

Future recommendations should prioritize the development and dissemination of standardized protocols for hygiene and equipment management across contact sports, clearer guidelines regarding MRSA and fungal infection screening and prophylaxis, regular training and education programs focusing on athletes, coaching staff, and medical personnel, and encouraging research to address evolving antimicrobial resistance patterns and to evaluate emerging preventive strategies.

In summary, effective management of microbial skin infections in contact sports requires adherence to current guidelines, addressing existing gaps in knowledge and practice, and adapting dynamically to new epidemiological insights and emerging health threats.

Future Directions and Research Needs

While substantial progress has been made in understanding and managing microbial skin infections within contact sports, significant knowledge gaps and emerging challenges remain. Addressing these will require targeted research, improved surveillance methodologies, and innovative preventive strategies.

First, the evolving landscape of antimicrobial resistance, particularly regarding MRSA, poses a persistent threat to athlete populations. Future research should prioritize longitudinal surveillance studies monitoring antibiotic resistance patterns among MRSA isolates from contact sports athletes. Such studies would inform treatment protocols and guide effective antimicrobial stewardship.

Second, further evaluation of pharmacologic prophylaxis, particularly antiviral medications for herpes gladiatorum and topical antifungals for recurrent tinea, is needed. Rigorous randomized controlled trials examining dosage, duration, effectiveness, and safety profiles could significantly enhance current prophylaxis guidelines and standardize clinical practice.

Third, the development and validation of rapid, cost-effective screening methods for MRSA and fungal pathogens are crucial. Enhanced screening

Table 2 | Recommendations provided by governing guidelines

Body	Year	Sport(s) Covered	Scope	Key Recommendations
NATA	2010	All contact and collision sports	Prevention and RTP	Daily shower with soap, written skin-infection policy, exclude infected athletes until treated and lesions noninfectious.
CDC	2025	Multisport athletes	MRSA prevention	Hand hygiene, wound coverage, no sharing towels/razors, clean gear/facilities after each session.
Alamri Y (Herpes rubiorum review)	2011	Rugby	HSV control and RTP	Screen for lesions, initiate antivirals early, consider tournament-long prophylaxis for players with recurrent outbreaks.

approaches, potentially utilizing point-of-care molecular diagnostics or other rapid microbiological assays, could substantially reduce infection transmission by enabling timely isolation and treatment of infected athletes.

Fourth, behavioral and implementation science research investigating athlete compliance with hygiene protocols and barriers to adherence could enhance the effectiveness of existing preventive guidelines. Comprehensive educational interventions and behavior-change models should be developed and rigorously tested to optimize adoption of recommended hygiene practices.

Lastly, given the diversity and global reach of contact sports, collaborative international research efforts are needed. Multisport epidemiological studies that systematically compare rates of microbial infections and preventive effectiveness across different geographic and cultural contexts would provide robust data to guide international policy recommendations.

Limitations include the review being narrative in nature. Therefore, we were able to include only a small number of primary studies. There may be heterogeneity in the included studies. Lastly, there is a reliance on outbreak reports.

In conclusion, addressing these future research needs is imperative for sustained progress in reducing microbial skin infections in athletes. Continued innovation, vigilance, and interdisciplinary collaboration will be essential to safeguarding athlete health in the evolving landscape of infectious diseases within contact sports.

Conclusion

Microbial skin infections, including MRSA, dermatophytic fungi (tinea), and herpes gladiatorum, represent a persistent public health challenge within contact sports, such as wrestling, rugby, and MMA. Their high prevalence, ease of transmission, and potential for severe outbreaks underscore the critical need for comprehensive preventive measures, rigorous hygiene protocols, and enhanced epidemiological surveillance.

This narrative review has highlighted notable variability in infection rates across sports, driven by athlete-specific, environmental, and societal factors. Effective management strategies must integrate routine athlete screening, stringent personal and environmental hygiene practices, and targeted pharmacologic prophylaxis. However, significant gaps in standardized guidelines and athlete adherence to preventive measures persist, emphasizing the importance of ongoing education and policy refinement.

Future research should focus on addressing emerging challenges, such as antimicrobial resistance, optimizing pharmacologic prophylaxis strategies, and developing rapid, cost-effective screening methods. Additionally, investigating barriers to adherence and promoting international collaboration will help create comprehensive guidelines applicable across diverse sports contexts.

Ultimately, protecting athlete health requires a multidisciplinary approach combining scientific research, public health advocacy, and practical educational initiatives, ensuring that microbial skin infections no longer hinder the health, safety, and competitive integrity of athletes worldwide.

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