A SURVEY OF CERTIFIED ATHLETIC TRAINERS:

THE REPORT OF SKIN INFECTION INCIDENCE

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

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ABSTRACT

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The purpose of this study was to evaluate the common types of skin infections occurring in United States athletes within the past year and the types of athletes that are most likely to contract them. Surveys were constructed online and with the National Athletic Trainers' Association (NATA) help sent out to 1,000 athletic trainers. A total of 151 athletic trainers completed the survey reporting 213 athletes with skin infections. Data analysis consisted of using Chi Square to test the frequencies, with a significance level set at $p < 0.05$. The results revealed a significant difference between the different types of skin infections, the level of competition and sports most affected, and among the most common method of contraction. However, there was no significance found between males or females having a higher probability to contract skin infections. MRSA was the most reported type of skin infection, having a high incidence rate in almost every level of competition, and mostly reported in football players. Ringworm was the second most reported skin infection, with a high number reported in high school athletes, and a high prevalence in wrestlers. Participants reported that the average length of time to report was < 1 – 2 days and that the most common method of contraction was person to person (76) next to "unknown" (77). In conclusion, while additional research needs to be completed to understand the trends in the different sports teams and methods of contraction, this research agreed with most of the current literature available. Additionally, as the number of these types of skin infections

continue to increase, education for athletes, coaches, and health professionals is imperative to prevent skin infections from spreading.

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TABLE OF CONTENTS

LIST OF TABLES

Table **Page**

CHAPTER I

INTRODUCTION

Skin infections plague athletes every year causing a loss in practice and competition times. Skin infections tend to affect athletes more than non-athletes due to the nature of sports (Adams, 2001; Pickup & Adams, 2007). Wrestling and football, especially, seems to be the most affected by skin infections because of the nature of their sport and the person to person contact that occurs. However, all sports can be affected by skin infections including basketball, volleyball, soccer, and swimming. There are many types of skin infections each varying in severity, location, and signs and symptoms. Not all athletes and coaches understand the severity of skin infections and how to prevent contraction. Athletes, coaches, and health professionals in athletics need to understand the signs and symptoms of skins infections, how skin infections are spread, and how to prevent contraction. By doing this the health of athletes will be better protected and will prevent time loss from participation. Therefore, by correctly educating coaches, health professionals, and athletes about the different types of skin infections we may be able to better control and prevent the continued spread of skin infections.

Statement of Purpose

The purpose of this study was to evaluate the common types of skin infections occurring in United States athletes within the past year and the types of athletes that are most likely to contract them.

Research Questions

1) What was the most common type of skin infection observed?

2) Were males or females more likely to contract skin infections?

3) What was the average length of time it took an athlete to report a skin infection?

4) Which level of competition reported the most infections?

5) Which sports were the most affected by skin infections?

6) What was the most common method of contraction?

Limitations

1) All the data was determined by the compliance of the athletic trainers completing the survey.

2) The data was based on what the athletic trainer remembers for that specific case.

3) The data may not be conclusive for an exact model of specific groups (i.e. male or female, Division I or II, etc).

4) The honesty of athletic trainers participating in the study.

5) Small sample size in each level of competition.

Definition of Terms

Axilla – space in the underside of the shoulder, under the arm; armpit (Bernier, 2005).

Cantharidin – a topical ointment used to create blisters in the treatment of warts and molluscum contagiosum (Silverberg, Sidbury, & Mancini, 2000).

Curettage – the cutting away of unwanted material from areas of chronic infection (Silverman & Lucky, 2003).

Dermatophytes – fungus that can cause a parasitic skin infection (Cuppett & Walsh, 2005).

Erythema – redness or inflammation of the skin or mucous membrane resulting from dilation of the superficial capillaries (Cuppett & Walsh, 2005).

Furuncle – inflammation of the skin containing pus caused by a bacterial skin infection (Bernier, 2005).

Infection – an invasion of the body by a pathogen (Bernier, 2005).

Papule – a small solid raised skin lesion less than 1cm in diameter (Adams, 2003).

Pediculicide – any of a group of drugs that kill lice (Cuppett & Walsh, 2005).

Perianal – the area around the anus (Porche, 2006).

Scale – a compact portion of the outermost layer of the epidermis (Cuppett & Walsh, 2005).

Vesicle – a small bladder or blister containing clear fluid up to 5 mm in diameter (Cuppett & Walsh, 2005).

CHAPTER II

REVIEW OF LITERATURE

Skin infections affect athletes in many different sports, mainly contact sports such as wrestling, football, and rugby. There are many types of skin infections that can cause disqualifications or time away from participation. The five main types of skin infections are general skin infections, parasitic, viral, fungal, and bacterial (Cuppett & Walsh, 2005). Given that there are so many different types of skin infections, athletes, coaches, and health professionals must be able to correctly identify and minimize transmission.

General Skin Conditions

General skin conditions often observed are urticaria (hives) and various types of dermatitis. Urticaria, or hives, is a common skin condition caused by the release of histamine. Females tend to be affected by urticaria more so than males with 31-53% of urticaria patients being males (Kozel & Sabroe, 2004). The causes of hives are wide, ranging from foods, drugs, and allergens such as pollen, mold, and animal dander. Other triggers are internal diseases, physical stimuli such as exercise, cholinergic agents, cold, sun exposure, skin diseases, hormones, and genetic predisposition (Katelaris, 2002). Hives are distinguished by red, very itchy lesions on the skin that can vary from 2mm to very large areas (Greaves, 2000). Hives can be treated with antihistamines and prevented by finding the cause or allergen (Greaves, 2000; Katelaris, 2002). However, it is often not possible to find a cause, even in acute cases < 50% causes are found (Kozel & Sabroe, 2004).

Dermatitis is another type of general skin infection, defined as "inflammation of the skin". There are numerous causes of this condition. The two reported by Adams (2001,

2002) are allergic contact dermatitis and irritant contact dermatitis. Allergic contact dermatitis is often caused by allergic reactions to various athletic equipment, topical analgesics, or adhesive tape, among other causes. (Moritz et al., 2007). Conversely, irritant contact dermatitis has nothing to do with the immune system or allergic reactions. It is caused primarily from any type of chemical reaction to the skin or irritant substance such as fiberglass found in hockey sticks or chemicals in swimming pools (Adams, 2001, 2002; Kockentiet & Adams, 2007). One study from the United Kingdom reported 20 people who bought furniture from the same company reported rash patterns consistent with contact dermatitis within 3 weeks to 9 months after purchasing their furniture. The rash patterns only presented in areas that contacted the furniture, such as the arms, hips, buttocks, and in instances of recliners, the face. The authors concluded that because there were not more reports of similar rashes that the cause was because of allergic rather than irritant (Williams, Coulson, Susitaival, & Winhoven, 2008). The most common dermatitis and inflammatory skin disease is eczema, most commonly seen in children. In Europe the prevalence of childhood chronic eczema is 15-20% of children 7 to 18 years old (Hoare, Li Wan Po, & Williams, 2000). Eczema consists of erythema, scales, and vesicles. Eczema has different causes including genetic predispositions and contact allergic reactions, and can vary in severity. In the chronic stage, thickened skin occurs with increased skin markings. The recommended method to treat eczema is to remove the allergen, prevent scratching, and control the inflammation using topical corticosteroids (Brown & Reynolds, 2006; Cuppett & Walsh, 2005; Meyers, 2009). The final common type of dermatitis is psoriasis. Psoriasis is a genetic, chronic, and recurring disorder. Frequently beginning in childhood, it is a silvery, white plaque with surrounding erythema and distinct borders. It is

most commonly observed around the elbows, knees, scalp, fingernails, toenails, and occasionally the joints (Cuppett & Walsh, 2005; Icen et al., 2009). The incidence rate of psoriasis in different population varies between 0 and 12%, with a 2.8% rate in the western populations (Icen et al., 2009). In one study, the incidences of psoriasis increased from 50.8 per 100,000 in 1970-1974 time periods to 100.5 per 100,000 in 1995-1999 time periods. The overall incidence rate also reported more males than females; however, females had a higher incidence rate in the later part of their lives (Icen et al., 2009). Treatment is fairly complicated and involves the use of topical steroids, UV light, and steroid injections (Cuppett & Walsh, 2005). With general skin infections athletes often can return to participation as long as there are no further signs of a significant infection present or complications.

Parasitic Infections

Parasitic infections are the second type of common skin infections affecting athletes. The two most common types of parasitic skin infections are pediculosis and scabies. Pediculosis is caused by lice and found in three different forms: head lice, body lice, and pubic lice (Cuppett & Walsh, 2005). The main symptom of head lice is intense itching of the scalp with the appearance of nits or lice larva. Adult lice are the most likely to travel from person to person and infections are spread through air movement or by the sharing of infected personal items such as hats, helmets, combs, towels, bedding, or other items (Takano-Lee, Edman, Mullens, & Clark, 2005). This typically affects young girls ages 3-12 (Ko & Elston, 2004). Treatments include the use of topical medications, the use of a comb to remove the lice eggs, and washing of all bedding and recently worn clothing at a high temperature. Body lice are found on the body as well as in clothing and bedding.

Research has stated that body lice lives, for an average of 18 days, with females laying 270-300 ova in their lifetime. Nits incubate for 8-10 days and mature in about 2 weeks (Ko & Elston, 2004). Body lice are often caused by poor hygiene and crowded environments. Symptoms include itching and presentation of a rash, typically around the groin, waist, and thighs. Treatment includes changing clothes, bathing, and washing clothing and blankets in boiling water regularly, the use of delousing powder, or as in one research study the use of an oral medication (Foucault et al., 2006). Pediculosis pubic ("pubic lice" or "crabs") and scabies are parasites that live on or within the skin and are typically spread through sexual contact (Bignell, 2005). Pubic lice, also known as "crabs", are generally found in the genital area and are primarily spread through sexual contact. The main symptom is intense scratching of the genital area with the appearance of lice and nits in the pubic hair. In one case study symptoms did not appear until 2 weeks after sexual contact (Chuh, Lee, Wong, Ooi, & Zawar, 2007). Treatments include the use of topical medication or shampoos, followed by the use of combs to remove the nits, and the washing of clothing in high temperatures (Orion, Marcos, Davidovici, & Wolf, 2006). In order for athletes to return to competition, for any type of lice, all signs of lice and nits must be gone. The NCAA recommends that athletes be treated with pediculicide and re-examined for complete extermination (no further signs or symptoms of lice) prior to return (Cuppett & Walsh, 2005; NCAA, 2008).

Scabies, caused by the mite *Sarcoptes scabiei*, is typically spread through direct contact (hand holding), sexual contact, or sharing infested clothing or bedding (Orion et al., 2006). Signs and symptoms are intense itching typically around the wrist, finger web spaces, nipples, or in the genital region. Small red papules and pustules usually appear in a

linear shape (Orion et al., 2006). Treatments include the use of a topical cream applied to the body from the neck down, the washing of bedding and clothing in hot water, and the cleaning of furniture and floors. The NCAA Wrestling Rules state that athletes may return to play after a negative prep for scabies appears (NCAA, 2008).

Viral Infections

Viral infections are considered to be one of the most challenging skin infections in athletics. Viral infections, especially herpes, have been reported in epidemic proportions in wrestlers and rugby players (Adams, 2002). This is because the infection is highly contagious and can rapidly spread through an entire team if not treated early (Cuppett & Walsh, 2005; Prentice, 2003). The types of viral infections reported most often are the herpes viruses (labias, gladiatorum, and zoster), molluscum contagiosum, and human papilloma viruses (Adams, 2000, 2001).

Herpes Simplex Virus (HSV)

The herpes simplex virus (HSV) is typically seen as cold sores, genital herpes, and herpes gladiatorum (or herpes rugbeiorum in rugby players) (Adams, 2001). The herpes viruses include more than 80 different types, 8 of which are known to infect humans. The herpes simplex viruses are incurable, and have lifelong recurrent infections that persist throughout a person's lifetime (Fatahzadeh & Schwartz, 2007). There are two HSV's, HSV1 and HSV2. In a National Health and Nutrition Examination Survey comparing prevalence of HSV1 and HSV2 from 1999-2004 with those from 1988-1994 results revealed that there has actually been a decrease in prevalence in both types. HSV1 decreased from a prevalence of 62% in 1988-1994 to 57.7% in 1999-2004. In addition, HSV2 decreased from prevalence of 21% in 1988-1994 to 17% in 1999-2004. HSV1 is

commonly seen above the waist and often presents as cold sores. The HSV2 generally found below the waist with the most common type of HSV2 being genital herpes (Xu, Sternberg, Kottiri, McQuillan, Lee, et al., 2006).

Herpes simplex gladiatorum is most often observed in the head, neck, and extremities (Prentice, 2003). In athletics, wrestlers and rugby players have been documented to have herpes gladiatorum in epidemic proportions, affecting up to one-third of wrestlers and rugby players (Adams, 2001). Herpes gladiatorum occurs in 2.6% of high school wrestlers, 7.6% collegiate wrestlers, and in Division I college wrestlers, 20-40% are affected. One study of an outbreak documented 73% of the lesions on the head, 42% on the extremities, and another 28% on the trunk. Wrestlers especially are at risk for recurrent herpes because of the stresses that are placed on the body due to the nature of their sport, which weakens the body's immune system, causes recurring outbreaks (Adams, 2002). In a NCAA study of collegiate men's wrestlers from 1993-1994 through 2003-2004 reported that of all (n = 1151) the documented skin infections occurring during practices 40.5% were herpes simplex (NCAA, 2008).

The HSV is spread primarily through the mucous membrane or abraded skin of an uninfected person to the lesions or mucosal secretions of an infected person (Fatahzadeh & Schwartz, 2007). Contact sports such as football, wrestling, rugby, and basketball have a greater prevalence of infections because of the direct physical contact and skin trauma in those sports. Skin trauma presents an entrance for the virus to enter and cause infection (Adams, 2001; Turbeville, Cowan, & Greenfield, 2006). Some authors (Adams, 2001; Turbeville et al., 2006) disagree about whether or not infections can arise from inanimate items such as wrestling mats or equipment. Adams (2001) reports that wrestlers have an

increased risk because of the frequent "lock-up" positions, with continuous bodily contact, during competition and abrasions, or "mat burns", causing open sores for the virus to enter.

Outbreaks of HSV look like distinct, grouped vesicles on a red base or in oral herpes they appear as multiple round, superficial oral ulcerations (Cuppett & Walsh, 2005; Fatahzadeh & Schwartz, 2007). Tingling, hypersensitivity, or pain occurs prior to the outbreak (Prentice, 2003). In addition, mild flu-like symptoms have been known to appear one to two days prior to an outbreak (Turbeville et al., 2006). After the rash outbreak additional symptoms including fever, chills, headache, fatigue, weight loss, sore throat, and generally feeling ill may occur (Adams, 2001, 2003; Prentice, 2003; Turbeville et al., 2006). Treatment for HSV includes the administration of 7-10 days of antiviral drugs such as Acyclovir, Valacyclovir, or Famcyclovir (Brady & Bernstein, 2004). Research has supported the belief that wrestlers should take Valacyclovir as a prophylactive to prevent herpes outbreaks (Adams, 2001, 2002, 2003; Turbeville et al., 2006). Outbreaks usually resolve in 10 to 14 days (Prentice, 2003). Prevention of the herpes simplex virus includes thorough "skin checks" in wrestling, use of nonabrasive equipment to reduce abrasions, and showering with antibacterial soap and laundering of all towels daily (Adams, 2001, 2003; Cuppett & Walsh, 2005; Turbeville et al., 2006).

According to the NCAA Wrestling Rules Handbook (2008) wrestlers with herpes are only allowed to return to play if they, "...have no moist lesions; all lesions must be dried and surmounted by a firm adherent crust" (NCAA, 2008, pg 56). They must also have been on antiviral therapy for at least 120 hours prior to the time of the competition, and no wrestler with active herpes infections is allowed to cover the infection in order to participate. In addition, wrestlers with first time infections must be free of systemic

symptoms of viral infection (i.e. fever, fatigue, etc) and must not have had any new blisters within 72 hours prior to the skin exam (NCAA, 2008). The National Federation of State High School Associations (NFHS) rules for wrestling with herpetic lesions differ in that all lesions must be scabbed over with no discharge and no new lesions within 48 hours of competition. First time infected wrestlers are not allowed to compete until a minimum of 10 days has passed with no systemic symptoms occurring. Wrestlers with recurrent herpes outbreaks require a minimum of 120 hours of oral anti-viral treatments (NFHS, 2008). High school rules and regulations also differ from state to state. Some states, such as Minnesota, require a full seven days of anti-viral treatments before contact (Cuppett & Walsh, 2005).

Molluscum Contagiosum

Molluscum contagiosum is a poxvirus caused by the molluscipox virus (Dohil, Lin, Lee, Lucky, Paller et al., 2006). Infections are usually seen in the face, trunk, arms, legs, and genital areas (Cuppett & Walsh, 2005; Dohil et al., 2006). Molluscum contagiosum is more contagious than warts (Prentice, 2003) and is spread by direct contact activities such as wrestling, swimming decks, and gymnastics (Cuppett & Walsh, 2005; Dohil et al., 2006). Molluscum contagiosum appears as a small, flesh or white colored dome shaped papules measuring 2 to 5 mm in size (Watanabe et al., 2000). The lesions can resolve on their own within 12 weeks, but in some instances where there are a large grouping of them it can take 12-18 months. Once a person has been infection, they usually develop immunity and will not contract it again (Gould, 2008). However, athletes in contact sports may require more aggressive therapy destructive methods such as liquid nitrogen and cantharidin or surgical removal curetting with an extractor or needle may also be needed to

ensure the lesions are no longer contagious (Silverman & Lucky, 2003). Prevention of molluscum contagiosum includes early treatment to prevent spread and potential epidemic outbreaks (Adams, 2001, 2003). Return to participation requires the lesions to be covered; if not the area must be curetted or removed before return to play (NCAA, 2008). The NFHS states that wrestlers may return to play 24 hours after removal of the lesions (NFHS, 2008).

Human Papilloma Virus

Verruca is caused by the human papilloma virus (HPV) and is the most common of all viral infections in athletes (Adams, 2003). The most common type of HPV is the verruca or wart. There are at least 80 known subtypes of HPV (Berman & Weinstein, 2000). Verruca plantaris and verruca vulgaris are located on the feet (plantar wart) and hands (common wart) (Adams, 2003; Cuppett & Walsh, 2005; Prentice, 2003). Research has reported that HPV verruca cutaneous and anogenital warts are estimated to affect 7-10% of the European population and 1% in the American population (Lai, Doyle, Bluhm, & Johnson, 2006). Women, especially sexually active women, are reported to have 70% higher lifetime risk to contract the virus than men (Elbasha, Dasbach, & Isinga, 2008). Verruca warts occur through direct contact with objects such contaminated shower floors or pool decks (Adams, 2001, 2003) through skin lesions, abrasions, or other sites of trauma, as well as being sexually transmitted as with genital warts (Cuppett & Walsh, 2005; Prentice, 2003). Verruca vulgaris warts, or common warts, appear as rough, dome shaped papules located around the fingers, hands, knees, or elbows. Verruca plantaris, or plantar warts, appear as callused, internally growing papules with sloping sides and a central depression (Lipke, 2006). Underneath the surface of the wart some have small black dots or

thromboses capillaries (Adams, 2001, 2002, 2003; Cuppett & Walsh, 2005; Prentice, 2003). Prevention of verruca warts includes good hygiene, keeping the feet dry, and wearing sandals on pool decks and in shower facilities (Adams, 2001, 2002, 2003; Cuppett & Walsh, 2005). Treatments to remove warts include salicylic acid, liquid nitrogen, and with more difficult cases, blunt dissection and laser treatment (Akarsu, Ilknur, Dermirtaşoğlu, & Özkan, 2006). Return to play for athletes with verruca warts is typically very good. Most lesions can be covered adequately enough to continue playing, however, in rare cases of athletes with verruca digitate (facial warts) who cannot adequately cover their face with a mask may be disqualified (NCAA, 2008).

Fungal Infections

There are 250,000 species of fungi identified. Of these, only 150 are known to affect humans (Cuppett & Walsh, 2005). Fungal infections are very common among athletes, most commonly in wrestlers. Adams (2002, p. 310) states that in wrestlers alone, "24-77% of individuals in wrestling teams are infected [by fungal infections]". One study reported that 10-20% of people worldwide have an estimated lifetime risk for a fungal infection (Abanmi, Bakheshwain, El Khizzi, Zouman, Hantirah, et al., 2008). In another study of 5544 people within a 7 year study 18.5% males were reported with fungal infections, whereas only 11% females were reported with skin infections (Maraki, Nioti, Mantadakis, & Tselentis, 2007). Fungal infections are seen on skin, hair, nails, and most often on the scalp, face, extremities, trunk, groin, and feet (Cuppett & Walsh, 2005). This review will examine the most common superficial types: tinea corporis, tinea pedis, tinea capitis, tinea cruris, and tinea versicolor. All tinea infections are named according to the body part affected (Cuppett & Walsh, 2005).

Tinea Corporis

Tinea corporis is also known as *tinea gladiatorum, trichophytosis gladiatorum, tinea corporis gladiatorum*, and most commonly "ring worm" (Adams, 2001, 2003). There are three different types of dermatophytes species that cause tinea corporis: *Microsporum canis, Epidermophyton,* and *Trichophyton rubrum*, the most common being *trichophyton tonsurans* or *T. tonsurans* (Kohl & Lisney, 2000). *T. tonsurans* is the most commonly reported fungal infection among wrestlers (Turbeville et al., 2006). This is because the tinea corporis fungus is most prevalent in hot, humid environments such as those found in wrestling rooms (Hand & Wroble, 1999). Frequently the organisms causing tinea corporis in non-wrestlers are the *trichophyton rubrum* and sometimes *T. tonsurans,* causing at least 40% of all tinea corporis cases each (Adams, 2003). Tinea corporis has occurred in epidemic proportions. On some high school wrestling teams, 24-77% of all wrestlers have been documented to have cases of tinea corporis (Adams, 2001, 2002, 2003; Turbeville et al., 2006). Another documented study by the NCAA (2008) reported that 22.1% of all skin infections observed in men's collegiate wrestling practices from 1993-1994 through 2003-2004 was tinea corporis or ringworm (NCAA, 2008). Tinea corporis is transmitted by skin-to-skin contact through open wounds (Hand & Wroble, 1999; Kohl & Linsey, 2000). Some believe fomites such as wrestling mats, towels, or other inanimate object could also be a cause, but the research in this area is limited (Hedayayi, Afshar, Shokohi, & Aghili, 2007; Kohl & Lisney, 2000; Turbeville et al., 2006). Wrestling is the ideal place for this infection to spread. Common open wounds from mat burns, abrasions, and scrapes provide ideal openings for the infection to enter, as well as dark, damp, and humid conditions in the clothing and wrestling rooms which allow the fungus to develop (Adams, 2001, 2003;

Cuppett & Walsh, 2005; Hand & Wroble, 1999). At the beginning of the infection, it appears as a solid erythematous patch, which eventually spreads outward. The rash progresses to scaly, well-defined plaques with a central clearing (Broomhead, 2007). The lesions are typically located on the head, neck, and upper extremity; and may itch (Adams, 2001, 2002, 2003; Cuppett & Walsh, 2005; Kohl & Lisney, 2000). Prevention of tinea corporis involves the use of good hygiene on the part of the athlete and regular skin checks to identify of infection in others. Washing the body with hot soap and water immediately after practice and laundering practice clothes and gear daily help to control the transmission of this infection (Adams, 2002, 2003; Cuppett & Walsh, 2005; Kohl & Lisney, 2000). Other methods include the use of prophylactive medication, Itraconazole 200mg, which has been successfully used to prevent the number of tinea infections (Hazen & Weil, 1997). Kohl and Lisney (2000) also reported success in the prophylactive use of Fluconazole 100mg. Treatments for non-inflammatory tinea corporis typically involve topical or oral antifungal medications. If the antifungal cream is unsuccessful the use of oral medications such as Terbinafine, Itraconazole, and Fluconazole are used (Gupta et al., 2004; Kohl & Lisney, 2000; Thomas, 2003). Return to play with tinea corporis is within three days of topical antifungal treatment. Wrestlers with multiple active lesions or those who have lesions in areas that cannot be properly covered will be disqualified (NCAA, 2008).

Tinea Pedis

Tinea pedis, also known as "athlete's foot" is the most common of fungal infections because shoes provide the dark and moist condition the infection needs to thrive. Increased contact with swimming pools decks, athletic shoes, and sports equipment put athletes at a higher risk for infection (Adams, 2001, 2002, 2003; Cuppett & Walsh, 2005; Field &

Adams, 2008). Tinea pedis presents as three different types: moccasin-like scale (lateral aspects of the foot), inflammatory (medial aspect of the sole), and interdigital. Research has revealed that tinea pedis affects the third and fourth toes clefts in 73.3% and 70% of cases (Field & Adams, 2008). The species of dermatophytes that cause tinea pedis are *trichophyton rubrum,* which causes the moccasin-like scale and interdigital types, and *trichophyton mentagraphytes*, which typically causes the inflammatory type and is seen predominately in the swimmers (Field & Adams, 2008). Prevention for tinea pedis includes wearing synthetic socks to wick away moisture from the foot, helping the feet stay dry. Wearing sandals or removing shoes frequently will also help in the prevention of tinea pedis (Adams, 2001, 2002, 2003; Cuppett & Walsh, 2005). Treatments consist of applying topical antifungal cream twice daily for mild infections. Oral medications may be necessary for severe infections (Gupta et al., 2004; Thomas, 2003). Reoccurrences are common in athletes because of the moisture in athletes' tennis shoes providing an area for fungus to grow (Adams, 2003).

Tinea Capitis

Tinea capitis, also known as "scalp ringworm" occurs most commonly in children and is spread by infected individuals, pets, or soil (von Laer Tschudin et al., 2007). It is caused by *T. tonsurans* and not all individuals who carry the tinea capitis infection have symptoms. In one study in London 209 participants all with tinea capitis were screened for asymptomatic carriage of the fungus. Of the 209, only 7.2% had clinically evident disease with symptoms while 44.5% had asymptomatic fungal carriage on the scalp (White, Higgins, & Fuller, 2007). Researchers believe that asymptomatic tinea capitis may lead to further transmission and spread of tinea corporis and other tinea infections (Magill,

Manfredi, Swiderski, Cohen, & Merz, 2007). Women and young girls appear to be the most likely to contract the fungal disease (White et al., 2007). According to Cuppett and Walsh (2005), the infection begins in the scalp and progresses to the hair shaft, with black dots appearing caused by the breaking of the hair follicles. There may be a raised inflammatory response to the fungus. The fungus may cause a small bald area in the hair or infect the entire scalp if not treated (von Laer Tschudin et al., 2007). Prevention involves avoiding the use of other peoples' combs, brushes, hats, and other headgear. Regular cleaning of any headgear and laundering of all clothing, bedding, and towels of a roommate or family member known to have tinea capitis is also recommended (Cuppett & Walsh, 2005). The oral medications Griseofulvin is typically the recommended medication for tinea capitis, however, Itraconazole and Fluconazole have also been successful (Gupta et al., 2004). The NCAA recommends two weeks of medication before returning to wrestling. In other non-contact sports, it is up to the discretion of the physician (NCAA, 2008).

Tinea Cruris

Tinea cruris, or "jock itch", is caused by *Trichophyton rubrum, Trichophyton mentagrophytes,* or *Epidermophyton floccosum.* The infection is typically found on the inner thighs, inguinal folds, and buttocks (Porche, 2006). In a seven year study of 5544 people, of the 604 fungal infection cases reported only 7.6% of them were with tinea cruris (Maraki et al., 2007). It appears as itchy, scaly, erythematous plaques on the inner thighs and groin region (Adams, 2003; Cuppett & Walsh, 2005). It can be spread by contaminated clothing, towels, or person to person and most commonly affects men. Tight fitting clothing, warm summer months with high humidity and moisture, obesity, and corticosteroid use are all predisposing factors (Porche, 2006). Athletes need to dry

themselves completely and wear loose-fitting clothing as much as possible to decrease the moisture in the area (Adams, 2003; Cuppett & Walsh, 2005). Treatments include drying completely after showers, topical antifungal ointments, frequently changing clothing, and the laundering of clothes in hot water (Cuppett & Walsh, 2005).

Tinea Versicolor

Tinea versicolor, also known as pityriasis versicolor, is a common yeast infection in adolescents and young adults caused by the organism *Malassezia.* The yeast is part of the normal skin flora. Tinea versicolor occurs when the yeast becomes infected. Tinea versicolor starts as small, round, fine powdery scaly discolorations (Mellen, Vallee, Felman, & Fleischer, 2004). Later, these areas will not tan (Cuppett & Walsh, 2005). Lesions are frequently found on the back, upper arms, and trunk, where there is a higher density of sebaceous glands. It is not contagious and is observed most commonly in areas of high humidity and in individuals who have prolonged use of topical corticosteroids (Cuppett & Walsh, 2005). In a study on 503 patients with tinea versicolor the onset of the infection began between 20-29 years of age, with 21.1% having a family history of tinea versicolor. Higher rates of recurrence and longer duration were seen in patients with family histories (He, Du, Yang, Zhou, Li, et al., 2008). Treatments include the use of a selenium sulfide lotion (Selsun Blue shampoo) or a ketoconazole cream or shampoo. The use of these products can also be used in the prevention of re-infection (Cuppett & Walsh, 2005; Gupta et al., 2004; Mellen et al., 2004).

Bacterial Infections

Bacterial infections are caused the bacteria *Staphylococcus aureus* or *Streptococcus pyogenes.* These two infections are responsible for the majority of all bacterial

dermatological conditions with Staphylococcal infections being the most common (Kirkland & Adams, 2006). A healthy person has several types of bacterial and fungal organisms on their skin. Infection occurs when there is a break in the skin where the organisms begin to secrete toxins or interfere with function (Cuppett & Walsh, 2005). The most common bacterial infections in athletics include impetigo, folliculitis, furuncles or boils, abscesses, and carbuncles (Kirkland & Adams, 2006). An athlete may carry the *S. aureus* bacteria within their nasal passage. Approximately 25 – 30% (80 million) of the U.S. population is colonized in the nose with the staph bacteria at a given time, with 1.5% (4.1 million) of those people being colonized with methicillin-resistant *Staphylococcus aureus* (MRSA) (NCAA, 2008). For athletes with reoccurring infections, nasal cultures may be beneficial in helping to eradicate future infections (Adams, 2003; Cuppett & Walsh, 2005).

Impetigo

Impetigo is a highly contagious skin infection caused by the *S.aureus* or *S.pyogenes* bacteria with *S. aureus* being the most common. In a CDC National Estimate of *S. aureus* completed from 1999-2005 reported a 2% prevalence of impetigo in 2005 (Jhung, Banergee, Fridkin, Tenover, & McDonald, 2008). Conversely, in a NCAA Injury Surveillance program from 1993-1994 through 2003-2004 men's collegiate wrestling reported that 14.2% of all skin infections observed during practices were impetigo (NCAA, 2008). Athletes are at high risk for contracting impetigo because of the skin-to-skin contact, cuts and abrasions caused by sports, sweating (allows bacteria into open sores), and the warm and humid temperatures in locker rooms and practice facilities (Adams, 2001, 2003; Cuppett & Walsh, 2005). Impetigo presents as a well-defined erythematous, yellow-

crusted, scaling plaques, on the face, trunk, and extremities. According to George and Rubin (2003) there are two types of impetigo: bullous (or vesicles/blisters) and nonbullous. The bullous impetigo first appears with a moist, red skinned, "burn-like" appearance and progresses to a soft small to large vesicles filled with clear or yellow fluid. It typically affects the face, buttocks, and trunk. Nonbullous appears as a yellow or honey crusted lesion on a red base and affects exposed areas such as the face and extremities. Over 70% cases are nonbullous (George & Rubin, 2003). The impetigo vesicles eventually erupt spilling the fluid that can cause the infection to spread to other parts of the body and others (Cuppett & Walsh, 2005). To prevent the spread of infection, any equipment that may have come in contact with the infected person should be sanitized on a daily basis (Cuppett & Walsh, 2005). Also, athletes with active infections (lesions that are still moist) should be isolated and not be allowed to participate (Adams, 2001, 2002, 2003). Treatments for small lesions include topical antibiotics applied after washing with soap and water to remove the crusts. Oral antibiotics are recommended for larger lesions (Adams, 2001, 2002; Cuppett & Walsh, 2005; George & Rubin, 2003). Topical warm water soaks can also be used (Adams, 2001, 2003). Impetigo cannot be covered to allow play so the return to competition timeframe depends on complete resolution of crusted, infected, and exposed areas. In wrestling, the athlete must not have had any new lesions appear in 48 hours prior to a meet, have been antibiotic therapy for 72 hours, and must not have any moist and draining lesions (NCAA, 2008).

Folliculitis

Folliculitis is another bacterial infection caused by the bacteria *Pseudomonas aeruginosa* and *S.aureus*. This infection occurs within the hair follicles and most

commonly found on the face, chest, axilla, buttocks, groin, and legs (Luelmo-Aguilar & Santandreu, 2004). The *Pseudomonas* ("Hot Tub" folliculitis) infection is caused by poorly maintained or under-chlorinated hot tubs, swimming pools, saunas, water slides, etc (Yu, Cheng, Wang, Dunne, & Bayliss, 2007). The infections are found on any part of the body that has been immersed in the contaminated water. The *S. aureus* infection can be caused by nicks with a razor blade or friction from equipment (Cuppett & Walsh, 2005). Folliculitis appears as small, painful, itchy, red (or green) papules or bumps within the hair follicles (Adams, 2001, 2002, 2003; Cuppett & Walsh, 2005; Luelmo-Aguilar & Santandreu, 2004). Prevention of the *S. aureus* bacterial infection includes good hygiene and changing razor blades often. To prevent *Pseudomonas* infections, the maintenance of all pool, hot tubs, baths, etc. should be kept up. In addition, any abrasions and cuts should be covered before entering the water (Adams, 2001, 2002, 2003; Cuppett & Walsh, 2005). Treatments include topical or oral antibiotics that cover both *S. aureus* and *S. pyogenes.* Keeping the area clean, washing all clothing, and changing razor blades daily should also benefit the athlete (Luelmo-Aguilar & Santandreu, 2004). For the *Pseudomonas* or "hot tub" folliculitis treatment is not needed, as the infection spontaneously resolves within 7 to 10 days (Cuppett & Walsh, 2005), however, according to a case study by Yu et al. (2007) oral antibiotics were prescribed and all lesions cleared after five days. Pools or hot tubs with known bacteria should be drained and disinfected (Adams, 2001, 2002, 2003). Athletes with the *Pseudomonas* infection may return to play without any restrictions, however, all other athletes with folliculitis must not have had any new lesions appear in 48 hours prior to a meet, been on antibiotic therapy for 72 hours, and not have any moist and draining lesions (Cuppett & Walsh, 2005; NCAA, 2008).

Furuncles, Abscesses, and Carbuncles

Furunculosis is similar to folliculitis in that the bacteria *S.aureus* cause an infection of the hair follicle; however, the furunculosis infection is much deeper into the hair follicle cavity and contains pus. During this infection a furuncle (or boil) develops in a pre-existing folliculitis site and expands creating a walled-off abscess, or collection of pus in a cavity (Luelmo-Aguilar & Santandreu, 2004). If the infection begins to spread, a carbuncle forms, consisting of multiple sites or groups of furuncles (Cuppett & Walsh, 2005). These lesions appear as deep, tender, red, papules that enlarge and become extremely painful (Adams, 2001, 2002, 2003). Conversely, unlike with furuncles, carbuncles symptoms include fever and feelings of illness or discomfort (Stulberg, Penrod, & Blatny, 2002). Prevention of this infection includes good hygiene, sanitizing equipment and clothing on a daily basis when a person has an infection, and covering active infections (Adams, 2003). For reoccurring infections nasal cultures may be necessary to determine *S. aureus* carriers (Cuppett & Walsh, 2005). Treatments include the isolation of the infected athlete, warm compresses or hot packs several times during the day, oral and/or topical antibiotics. In some cases the incision and evacuations of the abscess is necessary (Adams, 2001, 2002, 2003; Cuppett & Walsh, 2005; Duong, Markwell, Peter, & Barenkamp, 2009). Return to play is the same as impetigo and folliculitis. The important part is that no new lesions have arisen and all lesions are dry and crusted (Cuppett & Walsh, 2005; NCAA, 2008).

Methicillin-Resistant Staphylococcus Aureus

It has become critical to identify what type of *Staphylococcus aureus* strain is involved because new strains, such as methicillin-resistant *S. aureus* (MRSA), have appeared and are very difficult to treat and eliminate (Beam & Buckley, 2006). This is a

dangerous bacterial infection that has been known to lead to hospitalization and in a few instances, death. MRSA tends to spread through skin to skin contact but is believed to possibly spread through a common source or inanimate object, such as a wrestling mats, equipments, or infected clothing (Adams, 2000, 2001; Turbeville et al., 2006). In the past, MRSA was found almost exclusively in hospitals, but in the recent years there has been a dramatic rise in cases among people who are in close proximity to infected individuals, such as what commonly occurs within athletic teams (Beam & Buckley, 2006). In a published research study of three Division I collegiate football programs, of the 491 total football players 33 (6.7%) were diagnosed with MRSA infections. Each presented differently originally as abscesses (70%), cellulitis (16%), folliculitis, impetigo, and necrotizing fasciitis. 90% required surgical drainage and 27% received intravenous antibiotics (Bowers, Huffman, & Sennett, 2008). Over 300,000 hospitalizations are related to MRSA, with 12 million estimated outpatient (i.e. physician offices, emergency and outpatient departments) visits for suspected staph and MRSA in the U.S. each year (NCAA, 2008). Treatment for MRSA requires drainages of the abscesses either spontaneously or after an incision and oral medications to which that particular bacterial type is susceptible. In addition, application of a topical ointment, cleaning the lesions daily, and surrounding the area with antibacterial ointment or soap to prevent spreading is also recommended (Cohen, 2005).

Knowing the different types of skin infections is only part of understanding skin infections. Understanding how skin infections are spread is just as important in knowing how to avoid contracting skin infections. There are three ways to spread infections in sports: person to person (i.e. direct contact or skin to skin), common source (i.e. athletic

equipment, water bottles, or locker rooms), or vector transmission (i.e. coughing, sneezing, or breathing upon a person) (Turbeville et al., 2006). In athletics the most common way of spreading skin infections is person to person contact, however, coming into contact with infected objects such as equipment or clothing does occur. Contact sports, such as wrestling, football, and rugby are especially at risk due to the nature of their sports. This is because of the abrasions and lesions that occur during these sports. Abrasions and lesions, and direct contact with infected opponents or teammates, provide skin infections the ideal opportunity to enter the body and infect. Athletics tend to make this method of contraction the prime method for infection to spread.

Athletes, at all levels of competition, fight skin infections that can be detrimental to their health and athletic participation. With further research into the causes and methods of contraction athletes, coaches, and health professionals may be able to prevent further health issues and competition time lost for athletes. Based on this review of literature it was determined that impetigo, warts, MRSA, herpes simplex virus, and ringworm are the most prevalent skin conditions affecting athletes. For that reason these specific conditions were chosen to be the focus of this study.

CHAPTER III

METHODOLOGY

The purpose of this study was to evaluate the common types of skin infections occurring in United States athletes within the past year and the types of athletes that are most likely to contract them.

Research Questions

1) What was the most common type of skin infection observed?

2) Were males or females more likely to contract skin infections?

3) What was the average length of time it took an athlete to report a skin infection?

4) Which level of competition reported the most infections?

5) Which sports were the most affected by skin infections?

6) What was the most common method of contraction?

Population

One thousand athletic trainers, who were all members of the National Athletic Trainers' Association (NATA), were surveyed on skin infection incidences occurring between August 2008 and May 2009. After the survey was constructed by the researcher and approved by the NDSU IRB (Appendix A) and proposal committee, permission was then needed from the Mid-American Athletic Trainers' Association (MAATA) Secretary. Using the NATA email request forms (Appendix B and C), a copy of the IRB form and proposal was sent to the MAATA Secretary. After approval from the MAATA secretary, permission was granted by the NATA to receive email addresses of NATA members. A limit of only 1,000 email addresses was given because of a NATA policy regarding student research. The NATA Systems Coordinator searched for the selection of 1,000 random

selected email addresses. A request to participate in this study was emailed, which included a link to the survey to be completed. The athletic trainers surveyed included high school, club, professional, college, and clinic settings.

Instrumentation

Survey Monkey was used to develop the survey, as well as collect the data online. Prior to sending out the survey to the participants, the online survey was sent to a panel of ten experts in the field of athletic training to review the survey for content and face validity based on their knowledge and understanding of skin infections. Of the ten, eight athletic trainers responded and changes in the survey were made based their recommendations. These changes included adding "NCAA" to the beginning of the Division I, II, and III competition levels, adding "Recurrent Condition" to the "Suspected Method of Contraction" section, as well as extending the time frame to report from August 2008 - April 2009 to August 2008 - May 2009.

Procedure

The survey constructed by the investigator asked participants questions about the history of their athletes who contracted skin infections (Appendix D). Following the approval of the survey and request forms, inviting emails were sent out to the NATA members on June 12, 2009 (Appendix E). A reminder email was then sent out again on July 1, 2009 (Appendix F). The participants were asked to recall any incidences of individual cases of skin infections from the previous year. This information was used to complete the survey. All was data was collected in a manner that protected the confidentiality of the participants' school, athletes, or names. Participants could record up to eight individual cases. Data was then collected on July 9, 2009, three weeks after

sending out the initial email. Seventeen of the first 1,000 emails were considered "Undeliverable" and were returned back to the sender. After the reminder email was sent out, 22 emails were considered "Undeliverable" and were sent back to the sender. There were also 11 participants who responded to the researcher via email to state that they were no longer working in the field with athletes and would be unable to respond to the survey.

Data Analysis

Data was collected via Survey Monkey and returned in an excel spreadsheet format. North Dakota State University statistical consultant, Li Cao, assisted in performing all data analysis. Since the data collected was in a frequency format, Chi Square (SAS® Release 9.2, 2008, SAS Institute Inc., Cary, NC) was determined the best option to use to analyze all the data. Data was evaluated using Chi Square to analyze the significant differences among types of skin infections, gender, gender and skin infections, methods of contractions, length of time to report, the level of competition and the type of skin infection. Significance was set at $p < .05$.

CHAPTER IV

RESULTS

The purpose of this study was to evaluate the common types of skin infections occurring in the United States' athletes within the past year (August 2008-May 2009) and the types of athletes that are most likely to contract them. The results of this study may help to determine if an emphasis on educating athletes, coaches, and medical personnel on skin infections might help to prevent the spread of infection.

The statistical findings allowed the researcher to answer the following research questions: What was the most common type of skin infection observed? Were males or females more likely to contract skin infections? What was the average length of time it took an athlete to report a skin infection? Which level of competition reported the most infections? Which sports were the most affected by skin infections? What was the most common method of contraction?

Results

There were a total of 213 athletes reported with skin infections by the 151 (16% return rate) athletic trainers who responded to this survey. The test for frequency of the most common type of skin infections, yielded the following results: 74 (34.74%) cases of MRSA, 53 ringworm (24.88%), and 41 "other" were reported (19.25%). A significant difference between the various types of skin infections (χ^2 (5, N = 213) = 88.77, p = .0001) was found (Table 1).

In the test of relationship between genders and skin infections observed, 167 (78.4%) of the athletes were male and 46 (21.6%) were female. However, the Chi Square

test evaluating the association between gender and type of infection showed no significance between genders (χ^2 (5, N = 213) = 9.46, p = .0918) to contract a skin infection (Table 2).

Table 1. Frequency of Type of Skin Infection

Condition	Frequency	Percent
MRSA	74	34.74
Ringworm	53	24.88
Other	41	19.25
Impetigo	21	9.86
Herpes Simplex Virus	15	7.04
Warts	9	4.23

χ^2 (5, N = 213) = 88.77, p = .0001

Table 2. Association of Gender and Type of Skin Infection

Frequency Percent Row Pct Col Pct	Herpes Simplex Virus	Impetigo	MRSA	Other	Ringworm	Warts	Total
Female	2 .94 4.35 13.33	1 .47 2.17 4.76	15 7.04 32.61 20.27	13 6.10 28.26 31.71	11 5.16 23.91 20.75	4 1.88 8.70 44.44	46 21.60
Male	13 6.10 7.78 86.67	20 9.39 11.98 95.24	59 27.70 35.33 79.73	28 13.15 16.77 68.29	42 19.72 25.15 79.25	5 2.35 2.99 55.56	167 78.40
Total	15 7.04	21 9.86	74 34.74	41 19.25	53 24.88	9 4.23	213 100.00

χ^2 (5, N = 213) = 9.46, p = .0918

According to this study, a significant difference was found (χ^2 (3, N = 208) = 116.65, p = .0001) for the amount of time it takes an athlete to report a skin infection with the most frequently reported time of < 1 – 2 days (102 athletes reported). In addition, athletic trainers reported that 78 cases were reported within 3 – 5 days. Not all athletic trainers answered this question (n = 208) (Table 3).

Table 3. Frequency of Length of Time to Report (Days)

Time	Frequency	Percent	Cumulative Frequency	Cumulative Percent
< 1 - 2	102	49.04	102	49.04
3 - 5	78	37.50	180	86.54
6 - 8	13	6.25	193	92.79
> 8	15	7.21	208	100.00

χ^2 (3, N = 208) = 116.65, p = .0001

Relative to level of competition, there was a significant difference in the frequency of skin infections (χ^2 (35, N = 213) = 69.72, p = .0004). According to the data, MRSA (n = 74) was reported at a much higher percentage (34.74%) than any other infection in almost all competition groups. Herpes Simplex Virus had 15 (7.04%) reported cases, impetigo had 21(9.86%) reported cases, "other" had 41 (19.25%) reported cases, ringworm had 53 (24.88%) reported cases, and warts had 9 (4.23%) reported cases. However, the higher percentage of MRSA could be the reason for the significant difference. In addition, it was reported that athletes in high school have a higher percentage of ringworm infections (n = 40; 37.04%), while athletes in Division II reported a higher percentage of impetigo (n = 5; 41.67%) (Table 4).

Table 4. Frequency of Skin Infection by Level of Competition

Frequency Percent Row Pct Col Pct	Herpes Simplex Virus	Impetigo	MRSA	Other	Ring worm	Warts	Total
Clinic Setting	1 0.47 50.00 6.67	0 0.00 0.00 0.00	1 0.47 50.00 1.35	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	2 0.94
High School	5 2.35 4.63 33.33	11 5.16 10.19 52.38	27 12.68 25.00 36.49	21 9.86 19.44 51.22	40 18.78 37.04 75.47	4 1.88 3.70 44.44	108 50.70
Junior College	1 0.47 8.33 6.67	2 0.94 16.67 9.52	7 3.29 58.33 9.46	1 0.47 8.33 2.44	0 0.00 0.00 0.00	1 0.47 8.33 11.11	12 5.63
NCAA Division I	3 1.41 9.68 20.00	1 0.47 3.23 4.76	15 7.04 48.39 20.27	7 3.29 22.58 17.07	2 0.94 6.45 3.77	3 1.41 9.68 33.33	31 14.55
NCAA Division II	0 0.00 0.00 0.00	5 2.35 41.67 23.81	4 1.88 33.33 5.41	0 0.00 0.00 0.00	3 1.41 25.00 5.66	0 0.00 0.00 0.00	12 5.63
NCAA Division III	4 1.88 16.00 26.67	0 0.00 0.00 0.00	12 5.63 48.00 16.22	3 1.41 12.00 7.32	6 2.82 24.00 11.32	0 0.00 0.00 0.00	25 11.74
Other	0 0.00 0.00 0.00	1 0.47 9.09 4.76	3 1.41 27.27 4.05	6 2.82 54.55 14.63	1 0.47 9.09 1.89	0 0.00 0.00 0.00	11 5.16
Professional	1 0.47 8.33 6.67	1 0.47 8.33 4.76	5 2.35 41.67 6.76	3 1.41 25.00 7.32	1 0.47 8.33 1.89	1 0.47 8.33 11.11	12 5.63
Total	15 7.04	21 9.86	74 34.74	41 19.25	53 24.88	9 4.23	213 100.00

χ^2 (35, N = 213) = 69.72, p = .0004

Wrestling reported the most infections with 73 (34.43%) cases, football was second with 66 (31.13%) reported cases, and "other" was third with 35 (16.51%) reported cases. A significant difference (χ^2 (8, $N = 212$) = 271.11, $p = .0001$) was found between the different sports reported (Table 5).

Table 5. Frequency of Sport

Sport	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Wrestling	73	34.43	73	34.43
Football	66	31.13	139	64.56
Other	35	16.51	174	82.07
Basketball	16	7.55	190	89.62
Volleyball	14	6.60	204	96.22
Softball	3	1.42	207	97.64
Gymnastics	2	0.94	209	98.58
Hockey	2	0.94	211	99.52
Track & Field	1	0.47	212	100.00

χ^2 (8, $N = 212$) = 271.11, $p = .0001$

Comparing type of sport to skin infection, football reported in the largest number of MRSA with 39 or 54.17% of all reported cases. Football also had 12 reported cases in "other" or 30.77% of all "other" reported athletes. Among "other" sport athletes, athletic trainers reported 12 (30.77%) cases of "other" skin infections. Wrestling had a large amount of reported skin infections with 10 cases of herpes simplex (58.82% of all herpes reported cases), 11 cases of impetigo (57.89% of all impetigo reported cases), 10 cases of

MRSA (13.89% of all MRSA reported cases), and a very large number of ringworm with 39 reported cases (68.42% of all ringworm reported cases) (Table 6).

A significant association (χ^2 (3, N = 212) = 53.24, p = .0001) was noted for the suspected method of contraction. According to the results, the most commonly reported method of contraction was "Unknown", with 36.32% (n = 77) of the athletes being unaware of how they contracted their skin infection. The second most reported method of contraction was "Person to Person" or direct contact with an infected person at 35.85% (n = 76). "Common Source" and "Recurrent Condition" were the least reported methods of contraction at 22.17% and 5.66% (n = 47 and n = 12) (Table 7). No response for method of contraction was given on one athlete.

Table 6. Frequency of Sport by Skin Infection Condition

Frequency Percent Row % Column %	Herpes Simplex Virus	Impetigo	MRSA	Other	Ring worm	Warts	Total
Basketball	1 0.47 6.25 5.88	1 0.47 6.25 5.26	4 1.89 25.00 5.56	5 2.36 31.25 12.82	5 2.36 31.25 8.77	0 0.00 0.00 0.00	16 7.55
Football	3 1.42 4.55 17.65	3 1.42 4.55 15.79	39 18.40 59.09 54.17	12 5.66 18.18 30.77	4 1.89 6.06 7.02	5 2.36 7.58 62.50	66 31.13
Gymnastics	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 0.47 50.00 1.39	0 0.00 0.00 0.00	1 0.47 50.00 1.75	0 0.00 0.00 0.00	2 0.94
Hockey	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 0.47 50.00 1.39	1 0.47 50.00 2.56	0 0.00 0.00 0.00	0 0.00 0.00 0.00	2 0.94

Table 6. Continued.

Other	3 1.42 8.57 17.65	3 1.42 8.57 15.79	9 4.25 25.71 12.50	12 5.66 34.29 30.77	6 2.83 17.14 10.53	2 0.94 5.71 25.00	35 16.51
Softball	0 0.00 0.00 0.00	1 0.47 33.33 5.26	1 0.47 33.33 1.39	1 0.47 33.33 2.56	0 0.00 0.00 0.00	0 0.00 0.00 0.00	3 1.42
Track & Field	0 0.00 0.00 0.00	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 0.47 100.00 2.56	0 0.00 0.00 0.00	0 0.00 0.00 0.00	1 0.47
Volleyball	0 0.00 0.00 0.00	0 0.00 0.00 0.00	7 3.30 50.00 9.72	4 1.89 28.57 10.26	2 0.94 14.29 3.51	1 0.47 7.14 12.50	14 6.60
Wrestling	10 4.72 13.70 58.82	11 5.19 15.07 57.89	10 4.72 13.70 13.89	3 1.42 4.11 7.69	39 18.40 53.42 68.42	0 0.00 0.00 0.00	73 34.43
Total	17 8.02	19 8.96	72 33.96	39 18.40	57 26.89	8 3.77	212 100.00

Table 7. Suspected Method of Contraction

Method of Contraction	Frequency	Percent	Cumulative Frequency
Unknown	77	36.32	77
Person to Person	76	35.85	153
Common Source	47	22.17	200
Recurrent Condition	12	5.66	212

χ^2 (3, N = 212) = 53.24, p = .0001

In summary, there were 213 athletes reported with a significant difference was found between the different types of skin infections, 74 (34.74%) cases of MRSA, 53 (24.88%) cases of ringworm, and 41 "other" (19.25%) cases reported ($p = .0001$). No significant difference was found regarding either gender getting skin infections. The average length of time to report skin infections has most athletes (102) reporting skin infections within < 1 – 2 days, with 78 athletes reporting skin infections within 3 – 5 days. The sports most affected by skin infections were wrestlers (73) with ringworm (39 cases) and football (66 athletes) with MRSA (39 cases). The most common method of contraction reported was 77 reported "unknown" cases next to person-to-person contact (76 or 35.85%).

CHAPTER V

DISCUSSION, CONCLUSION, AND FURTHER RESEARCH

The purpose of this study was to evaluate the common types of skin infections occurring in the United States' athletes within the past year (August 2008-May 2009) and the types of athletes that are most likely to contract them. The results of this study may help to determine if an emphasis on educating athletes, coaches, and medical personnel on skin infections might help to prevent the spread of infection.

The statistical findings allowed the researcher to answer the following research questions: What was the most common type of skin infection observed? Were males or females more likely to contract skin infections? What was the average length of time it took an athlete to report a skin infection? Which level of competition reported the most infections? Which sports were the most affected by skin infections? What was the most common method of contraction?

Discussion

Research of this emphasis is new to the field of athletic training. The investigator was unable to find any previous research studies similar to this one that surveyed certified athletic trainers from all types of levels of competition in all types of sports. Therefore, while comparisons to previous research are difficult, some comparisons can be made.

In the study of the most common type of skin infection this particular research study and previous research on ringworm are similar. Previous research on incidences of ringworm in high school athletes supports the results of this study. High school wrestlers have been reported to have high numbers of incidences. Some research reports that 24-77% of individual high school wrestlers are affected (Adams, 2000, 2002; Hedayati et al., 2007;

Kohl & Linsey, 2000). According to the current study, 37.04% of the total number of high school athletes reported with skin infections was with ringworm.

The high incidence of MRSA being reported in all athletic setting is surprising but is still in agreement with the research being reported throughout the published research. The number of MRSA incidences seems to continuously be increasing in the published research and the results from the current research agree with other literature (Beam & Buckley, 2006; Cohen, 2005; Gardam, 2000; Turbeville et al., 2006). In a published research study of three Division I collegiate football programs, of the 491 total football players 33 (6.7%) were diagnosed with MRSA infections (Bowers et al., 2008). In 2007, a CDC survey reported that 53% of high school athletic trainers had treated MRSA in football players (CDC, 2009). The present survey results reported that 25% of all high school athletes' skin infection incidences were MRSA, whereas, 34.74% of all athletes reported with skin infections of MRSA.

The number of "other" types of skin infections is not surprising because only the most common types of skin infections were listed in the survey. For example, there are many different types of tinea infections other than tinea corporis or ringworm as listed. Also, there are other types of viral infections other than warts and herpes simplex virus such as molluscum contagiosum. There are many other types of bacterial infections besides impetigo and MRSA, and a wide variety of general skin conditions. Some of the "other" conditions that were mentioned within the "Extra Comment" (Appendix G) sections provided in the survey were suspected allergic contact dermatitis from different cleaning solutions being used on football equipment. Several *Staphylococcus aureus* infections were

reported that were negative for MRSA, as well as *Streptococcus pyogenes* infections. There was also a suspected spider bite reported.

The results to answer the question of whether females or males are more likely to contract skin infections the proved to be of interest. The number males to females reported is not surprising to the researcher because of the higher number of male dominated contact sports, such as wrestling, football, and rugby, which are believed to be at higher risk for skin infections (Turbeville et al., 2006). Still, the results of the data are surprising in that the statistical results showed no trend that either sex was more likely to get skin infections (χ^2 (5, N = 213) = 9.46, p = .0918). This area has very limited research especially in regards to athletics. One literature review in 2006 compiled the frequencies of which sports had reported outbreaks and, according the results, males in contact sports had the most infections. However, female volleyball players and cheerleaders were involved in one outbreak study (Turbeville et al., 2006). In one study, Looker, Garnett, and Schmid (2008) researched the prevalence of HSV2 globally and found that more women carried the herpes simplex virus than men. However, the results from this study reported that males had more herpes simplex virus incidences than females (13 vs. 2; 86.67% vs. 13.33%). Conversely, these results could very well be because of the higher number of males reported with skin infection incidences than females (167 males to 46 females reported). Verruca, or warts, is caused by the Human Papilloma Virus (HPV). One study reported that women, especially sexually active women, are more likely to have HPV than men, with women having a 70% lifetime risk to contract the virus (Elbasha, Dasbach, & Insinga, 2008). In our study 9 athletes were reported contracting warts: 4 females compared to 5 males. This is fairly close, considering the large difference in males to females being reported. Impetigo is

another type of skin infection where our results showed another largely dominating response of males over females (20 males compared to 1 female). Impetigo is an infection, which according to previous studies, is something that affects athletes who have close skin-to-skin contact, such as wrestling, football, and rugby, all mostly male dominated sports (Adams, 2001). Therefore, the results of this research study seem to agree with former research.

There is limited published research regarding length of time needed to report skin infections; however, some comparisons can be made with our research. Bacterial infection research note that some skin infection signs and symptoms can be seen within 8-48 hours after coming into contact with an infected object (Adams, 2001, 2003). Other published research on viral infections, especially HSV, reported that symptoms began several days to two weeks after exposure (Adams, 2001). Turbeville et al. (2006) reported that initial HSV infections start with mild, flu-like symptoms, and rashes and vesicles began 1 to 2 days later. Fungal infections may be asymptomatic and may not appear at time of infection so the research on this is very limited (Turbeville et al., 2006). In comparison our data does seem to concur, with a significant difference (χ^2 (3, N = 208) = 116.65, p = .0001) of 102 cases reporting in < 1 – 2 days, followed by 3 – 5 days to report. This compares to published research in taking several days to two weeks for symptoms to appear.

Comparing all our documented cases on the specific types of skin infections provided similarity to published research. In one published study of herpes simplex virus (HSV) the HSV1 strain is known to affect 57.7% of people in the United States, while the prevalence of HSV2 is 17% of people in the United States (Xu et al., 2006). Our results reported only 15/213 or 7.04% of athletes with skin infections had herpes simplex virus. A

study done by the CDC from 1999-2005 reported a National Estimate of *S. aureus* at 2% of impetigo in 2004 (Jhung, Banerjee, Fridkin, Tenover, & McDonald, 2008). Our research reported an impetigo prevalence of 9.86% of all athletes (n = 21). In a study of emergency departments, 76% of all individuals (320 of 422) presenting with skin/soft tissue infections were found to be caused by *S. aureus* with 59% of all infections being caused by MRSA (249 of 422) (Moran et al., 2006). The results of our research study showed that 74/213 (34.74%) of athletes reported had documented cases of MRSA. In the research on fungal infections, 10-20% of people worldwide have an estimated lifetime risk for a fungal infection (Abanmi et al., 2008). Our research reveals that 24.88% (n = 53) of all reported athletes have documented cases of ringworm. Lai, Doyle, Bluhm, & Johnson, 2006 stated that cutaneous and anogenital warts are estimated to affect 7-10% of the European population and 1% in the American population, which compares to our research with 9 reported cases (4.23%).

Numerous research studies have been published regarding different sports' skin infections outbreaks, most of them involving wrestling, football, and rugby teams. In a review article by Turbeville et al. (2006), frequencies of outbreaks or clusters of infectious diseases were reported for specific sports. Their results reported football (20 reports, 34% of all reports), wrestling (19, 32%), rugby (10, 17%), soccer (2, 3%), adventure races or Eco-challenges (2, 3%), and then several singles studies in swimming, triathlon, track and field, trekking, gymnastics, basketball, and fencing. The research from the present study agrees with the results found by previous research with wrestling (73, 34.43%) and football (66, 31.13%) being the predominate sports to have reported skin infections.

Previous research on wrestling and ringworm reported that 24-77% of all wrestlers on high school teams contract ring worm (Adams, 2000, 2002; Hedayati et al., 2007; Kohl & Linsey, 2000). In collegiate wrestlers, 22.1% of all skin infections reported between 1993-1994 and 2003-2004 were ringworm (NCAA, 2008). Our research agreed as 39 wrestlers (was 53.62%) of all wrestlers reported a ringworm infections, which was 68.42% of all ringworm reported cases.

MRSA has reported a high prevalence in football players. In 2007, a CDC survey reported that 53% of high school athletic trainers had treated MRSA in football players (CDC, 2009). In addition, a research study of three Division I collegiate football programs, report of 491 total football players 33 (6.7%) were diagnosed with MRSA infections (Bowers et al., 2008). Our research also agreed with this previous research with athletic trainers reporting 39 cases of football players having MRSA. This was 59.09% of all football reported cases and 54.17% of all MRSA reported cases.

According the results of this research study the most suspected common method of contraction was "Person to Person" (n = 76; 35.85%) after "Unknown" (n = 77; 36.32%). This appears to agree with the published research findings stating the most common method of transmission of skin infections is person to person (or direct contact with skin to skin contact) and followed by common source (or infected objects) (Turbeville et al., 2006). Most research tends to state that the most common method of contraction is direct contact or skin to skin contact of an infected person with an uninfected person with an open lesion. This is seen especially in research about herpes simplex virus, MRSA, impetigo, and verruca (or warts) (Adams, 2001; Cohen, 2005; Cuppett & Walsh, 2005; Turbeville et al., 2006). Other research, such as that about tinea infections, especially ringworm, notes

different beliefs about common source, such as towels or wrestling mats (Hedayati et al., 2006; Turbeville et al., 2006). Still other research suspects MRSA could also be transmitted via a common source, such as towels and water bottles (Beam & Buckley, 2006; CDC, 2009; Cohen, 2005).

As the incidence of skin infections was found to be high in this population, education regarding how to stop the spread of infection is beneficial. The following educational information can be used with athletes of these levels to help them understand the seriousness of skin infections and their transmissibility:

- Minor abrasions and superficial wounds should be cleaned with soap-and-water cleansing, using topical antibacterial lubricant, and bandage with clean dry bandages until healed. This should be done before and after activity.
- Clean all equipment such as mats, weight room equipment, water bottles, coolers, ice chests, etc with appropriate germicide prior to and following each practice and game sessions
- Limit contact with known infected person or object.
- Frequent washing with a good-quality soap (liquid soap preferred) or alcohol-based (at least 60% alcohol content) hand rub after coming into contact with an infected person or object.
- Shower immediately after every practice or competition, also preferably before activity in activities that involve close skin contact.
- Do not share bar soaps, razors, towels, water bottles, clothing, brushes, combs, and personal equipment.

- Wear clean, appropriate, non-abrasive clothing for practices and games, and launder and dry daily. Towels and clothing should be laundered and dried daily.
- Protect immune system with regular sleep and proper nutrition.

(CDC, 2008; Howe, 2003)

Conclusion

Skin infections cause many problems among athletes every year and cause losses in practice and competition times. According to the findings in this study, MRSA has a very large prevalence in skin infections in athletes of almost all levels of competition, and especially in football and wrestlers. High school athletes also have a very high incidence of contracting skin infections, especially with MRSA and ringworm. Like previously published research this study agrees that wrestlers have a high incidence of ringworm being contracted in its athletes. Conversely, the result of this study's findings in trends of males and females did not agree with previously published research and there were no trends discovered for either gender to contract skin infections. This population of athletes took less than one to two days report skin infections. Like previously publish research the findings of this study reported that direct contact seems to be the most common method of contraction. In conclusion, more education and research needs to be completed to determine the best ways to avoid large outbreaks and epidemics in athletics. By continuing to do the research on the skin infection incidences athletes, coaches, and health professionals will be better able to educate, control, and prevent the spread of skin infections.

Future Research

Further research in this area will help to understand and prevent the spread of skin infections. More research is needed at different levels of competition, with different types of skin infections, and to determine which sports are most affected. Recommendations for future research include sending out surveys during the school year to help athletic trainers remember as well as hopefully increasing the number of responses. Finally, sending these surveys out to a greater number of athletic trainers or during an athletic training convention may increase the number of responses, helping researchers further understand skin infection types and incidences in specific athletic groups.

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APPENDIX A

IRB APPROVAL LETTER

NDSU NORTH DAKOTA STATE UNIVERSITY

Institutional Review Board
Office of the Vice President for Research, Creative Activities and Technology Transfer
NDSU Dept. 4000
1735 NDSU Research Park Drive
Research 1, P.O. Box 6050
Fargo, ND 58108-6050

701.231.8995
Fax 701.231.8098

Federalwide Assurance #FWA00002439
Expires April 24, 2011

April 20, 2009

Dr. Donna Terbizan
Dept. of Health, Nutrition & Exercise Science
EML

Re: IRB Certification of Human Research Project:

"A Survey of Certified Athletic Trainers: The report of Skin Infections Incidences"
Protocol **#:HE09241**

Co-investigator(s) and research team: **Ashley Wilde**

Study site(s): **online** Funding: **n/a**

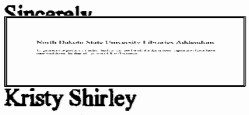
It has been determined that this human subjects research project qualifies for exempt status (category # 2b) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, *Protection of Human Subjects*). This determination is based on the protocol form received 4/15/09 and consent/information sheet received 4/20/09.

Please also note the following:

- This determination of exemption expires 3 years from this date. If you wish to continue the research after 4/19/2012, submit a new protocol several weeks prior to this date.
- The project must be conducted as described in the approved protocol. If you wish to make changes, pre-approval is to be obtained from the IRB, unless the changes are necessary to eliminate an apparent immediate hazard to subjects. A *Protocol Amendment Request Form* is available on the IRB website.
- Prompt, written notification must be made to the IRB of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Any significant new findings that may affect the risks and benefits to participation will be reported in writing to the participants and the IRB.
- Research records may be subject to a random or directed audit at any time to verify compliance with IRB policies.

Thank you for complying with NDSU IRB procedures; best wishes for success with your project.

Sincerely,



Kristy Shirley
Research Compliance Administrator

APPENDIX B

NATA REQUEST FORM #1

NATIONAL ATHLETIC TRAINERS' ASSOCIATION, INC.
RESEARCH STUDY

Contact List Request Form

Request Date: _____ Date Needed: _____

Member Making Request: _____

NATA Member Number [redacted] (Required) Student Member? _ Yes _ No Mailing

Address: [redacted]

City: _____ State: _____ Zip: _____ Phone [redacted] E-Mail

Address: _____ Fax: _____ Title of

Study: _____

Purpose Statement: _____

Institution where Research is Being Conducted: _____

Advisor's Signature (if applicable): _____ Date: _____

Funding Source of Study: _____

** **Please include a copy of your survey instrument, informed consent form, and documentation of approval from your Institutional Review Board (IRB).**

** **Student Members: If you are requesting an email broadcast from the National Office for notification of a web site for your survey, you MUST provide the letter of announcement that you plan on using in the broadcast as well as your current email address.**

Send this form to your District Secretary for processing. Pease allow three to four weeks for delivery.

APPENDIX C

NATA REQUEST FORM #2

National Athletic Trainers' Association

NATIONAL ATHLETIC TRAINERS' ASSOCIATION, INC. RESEARCH STUDY

Contact List Request Form

All Districts or Specific District(s): ALL
State(s), International, Other (specify): ALL US States

Purpose of Mailing List (check all that apply):
Email Survey -Email broadcast service by National Office (max. 1000 recipients available to student members only)_____Name and address file by email attachment to Survey (for non students)

Comma Delimited Text (Excel)

List type: ✓email addresses
postal addresses

Check the member type(s) you wish included:

All Member Types
✓Certified
Associate
Retired Certified
Certified Students
Non-certified Students
Undergraduate Students
International Non-Certified
Certified International

Work Settings:

✓CI	Clinic	PA	Performing Arts
CN	Clinic/Industrial	✓PB	Pro Basketball
CO	Corporate	✓PC	Pro Soccer
CS	College Student	✓PF	Pro Football
GV	Government	✓PG	Pro Golf
✓HC	High School/Clinic	✓PH	Pro Hockey
HF	Health/Fitness	✓PT	Pro Tennis
HO	Hospital	✓PX	Pro Baseball
✓HS	High School	RO	Rodeo
IN	Industrial	SC	Sports Club
✓JC	Junior College	SM	Sales/Marketing
LE	Law Enforcement	✓UC	Univ / College
MJ	Middle/Jr. High	UN	Unemployed
OP	Other Professional	YS	Youth Sports

CONTACT LIST USE AGREEMENT

I certify that the requested NATA mailing list will be utilized by the above-mentioned organization/individual only for mailing of the study specified. I verify that the list will not be duplicated, copied, or reproduced in any manner, but only for the aforementioned one-time use. One-time use does not allow the purchasing/receiving entity to provide NATA's members with a "subscription" or any other product or service that reaches members in any way more than once without the member's individual consent. . The email addresses provided for student members are not to be shared among the recipients of your mailing. You agree that any broadcast email will not contain other recipients' email addresses in the "To:" or "Cc:" field. To send a broadcast email from Microsoft Word, we have provided instructions in the members-only section of the NATA Website. Go to: https://www.nata.org/members/documents/mass_email_instructions_for_nata.pdf. Members agree to abide by policies and procedures of the NATA. Failure to abide by these requirements is a violation of such policies and may subject the user to sanctions by the NATA Ethics Committee.

Applicant Signature [redacted] Date 4/27/09
Approved by (District Secretary)_____ Date _____

APPENDIX D

SURVEY

This is a survey of skin infection incidences as recorded by certified athletic trainers in the National Athletic Trainers Association. You are one of 1,000 certified athletic training members recruited from the NATA to participate in this skin infection study.

Please complete the survey by recording as many skin infection incidences OF ONLY YOUR ASSIGNED TEAM as you can remember from August 2008 - May 2009. Fill out the survey by clicking the buttons and drop down buttons for each question. This survey should take no more than five minutes per athlete. When you return the survey, you are volunteering to participate in our study. Your participation is completely voluntary – in no way will your name be associated with your survey as we evaluate the data. If you have any questions regarding the research, please feel free to contact either of us using the information listed in the email. If you have questions regarding the rights of the research subjects or would like to file a complaint regarding the research, please contact the NDSU Human Research Protection Office at 701.231.8908, or ndsu.irb@ndsu.edu.

Thank you very much for your time and help.

"This student survey is not approved or endorsed by the NATA. It is being sent to you because of the NATA's commitment to athletic training education and research."

1) Level of Competition
a. High School
b. Clinic Setting
c. Professional
d. Junior College
e. NCAA Division III
f. NCAA Division II
g. NCAA Division I
h. Other

2) Sport athletes are in?

a. Football ___
b. Wrestling ___
c. Volleyball ___
d. Basketball ___
e. Track and field ___
f. Gymnastics ___
g. Hockey ___
h. Other ____

3) Gender:
a. Male ___
b. Female ___

4) Age of athlete:
a. <15 ___
b. 15 - 17 ___
c. 18-21 ___
d. 21< ___

5) Location of infection?
a. Trunk (chest, back, abdomen, pelvic area) ____
b. Head (neck, face, hair) ____
c. Arms ____
d. Legs ____
e. Other ____

6) Length of time with signs/symptoms of infection before reporting to ATC or physician?
a. < 1 - 2 days ____
b. 3 – 5 days ____
c. 6 – 8 days ____
d. > 8 days ____

7) Referral to Physician: (number of athletes for each)
a. Yes ____
b. No ____

8) Type of infection diagnosed:
a. Impetigo ____
b. Ring worm ____
c. Herpes Simplex Virus ____
d. MRSA ____
e. Warts ____
f. Other ____

9) Loss of time of play:
a. No loss of time ____
b. < 2 days ____
c. 2 – 4 days ____
d. 5 – 7 days ____
e. 8 – 10 days ____
f. > 10 days ____

10) Length of time of infection?
a. < 3 days ____
b. 3 - 5 days ____
c. 6 – 8 days ____
d. 9 – 11 days ____
e. 12 – 14 days ____
f. >14 days ____

11) Suspected method of contraction:
a. Person to person (i.e. direct contact such as skin to skin or indirect such as blood borne) _____
b. Common source (i.e. athletic equipment or water bottles) ____
c. Vector transmission (i.e. coughing, breathing, or sneezing on a person) ____
d. Unknown _____
e. Recurrent condition

Extra comments or details of case you would be willing to share: (Comment Box)

APPENDIX E

EMAIL SENT TO PARTICIPANTS

Dear NATA Member,

My name is Ashley Wilde, I am currently in the process of completing my Masters of Science degree in Exercise Science at North Dakota State University. My adviser, Dr. Donna Terbizan, and I are conducting a research study to examine the incidence of skin infections among athletic populations in the past year. We are recruiting 1,000 certified athletic training members from the NATA to participate in this study. You will be asked to complete a survey that, to the best of your knowledge, will describe as many skin infection incidences as you can remember from August 2008 to May 2009. The survey should take no more than five minutes per athlete to complete. When you return the survey, you are volunteering to participate in our study. Your participation is completely voluntary - in no way will your name be associated with your survey as we evaluate the data. If you have any questions regarding the research, please feel free to contact either of us using the information listed below. If you have questions regarding the rights of research subjects or would like to file a complaint regarding the research, please contact the NDSU Human Research Protection Office at 701.231.8908, or ndsu.irb@ndsu.edu

Please click on the following link or copy and paste into your web browser to complete this study:

http://www.surveymonkey.com/s.aspx?sm=t2GoBGxZTTKZoglerszdrg_3d_3d

Thank you very much for your time and help,

Ashley Wilde, ATC®, LAT
Graduate Assistant Certified Athletic Trainer
North Dakota State University
(701) 730-6251
Ashley.Wilde@ndsu.edu

Donna J. Terbizan, Ph.D.
Professor, HNES
North Dakota State University
(701) 231-7792
D.Terbizan@ndsu.edu

APPENDIX F

REMINDER EMAIL

Dear NATA Member,

This is just a reminder to help by please completing the skin infection incidence survey sent out on June 12th. Your help will be greatly appreciated and help in completing my thesis, and collecting data on the number of incidences of skin infections. Again, this survey should not take any longer than five minutes per athlete and participation is completely voluntary. By returning the survey, you are volunteering to participate in our study. If you have any questions regarding the research, please feel free to contact either of us using the information listed below. If you have questions regarding the rights of research subjects or would like to file a complaint regarding the research, please contact the NDSU Human Research Protection Office at 701.231.8908, or ndsu.irb@ndsu.edu

Please click on the following link or copy and paste into your web browser to complete this study:

http://www.surveymonkey.com/s.aspx?sm=t2GoBGxZTTKZogIerszdrg_3d_3d

Thank you very much for your time and help,

Ashley Wilde, ATC®, LAT
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APPENDIX G

EXTRA COMMENTS

Athletes are not referred, but it is suggested to seek the medical care of a physician. But, due to funds and lack of insurance, student-athletes do not see a physician.

Athlete went to the doctor on a Friday afternoon, reported to AT on Monday - didn't miss any time due to being treated for 72 hours by the time AT was aware of the condition

Athlete was already out with an injury when he contracted MRSA from his walking boot. We had numerous (13-15) cases that caused us to shit our wrestling room down for one week. It was all herpes simplex along the face, neck, and into the hairline. Because of the large amount of numbers, I will only fill out as one athlete. Each person's treatment and time out was the same time periods you provided.

This athlete and his brother (drilling partner) both developed ringworm at their hairline.

Another athlete a few weeks later on the same team came to me with a very similar looking rash, and about the same spot on his arm as well. Definitely seemed that the two incidents were related, possibly by sharing towels.

Also had impetigo on the same lesion.

It is suspected that this athlete acquired this infection from the turf field we played on that week. He did have an open wound from practice that week that was re-opened during the game. The doctors thought this athlete had cellulitis, but took all the MRSA precautions. They did say there was a possibility that it was MRSA, but were hesitant to give that diagnosis for some reason. This athlete was hospitalized overnight and put on IV antibiotics as a precaution. This is why I didn't answer the question as MRSA, but feel free to classify it as such if need be.

Athlete initially had a floor burn on her knee which developed MRSA it is thought from unwashed knee pads. Infection spread from anterior knee to popliteal fossa.

Athlete had to have surgery on foot, hospitalized for approximately 1 week.

Athlete contracted Strep B (Flesh Eating Disease). Unknown source. Symptoms began as a mild cellulitis, within 12 hours caused inflammation of distal 1/3 of lower leg and foot. Abcest formed within 12 hours. Within 24 hours IV antibiotics and drainage of abcest. Hospitalized for 8 days with IV antibiotics, then upon release from hospital, pick line placed and another 10 days of IV antibiotics on own at home. Following 10 days of IV at home, placed on 10 days of oral antibiotics. Blood cultures performed at time of surgery to drain abcest indicated - for MRSA. Cycles of antibiotics completed, will continue to monitor. Indicated that inflammation may reoccur for approx 6-8 months. Athlete will be allowed to return to full activity within 2-4

weeks following completion of antibiotic regiments.

This athlete was not known for good hygiene practices.

Cause: Shaving

Treated with Bactrum

MRSA in blister on heel of foot.

Athlete contracted the disease after his mom noticed a spot and took him in to the hospital and actually contracted it from the hospital.

Baseball player sliding into 2nd, abrasion on knee developed MRSA.

This athlete was hospitalized and had I/D w/IV antibiotics

Pt. had a fungal infection after plantar warts were removed.

Player had operation on elbow to repair torn tendon; 3 days after being released from the hospital he became severely ill and was admitted back into hospital for MRSA

This athlete has recurring ringworm during wrestling but never comes up during football season. Interesting to me...

Athlete had been seen by Doctor. I noticed his arm and asked. Doctor said it was fine for competition.

This athlete was a cheerleader who had MRSA in the armpit. She likely got the infection from her father who had MRSA the previous week

The infections showed shortly after having a hematoma at the site. A culture was taken and it was a strep infection.

Soccer player - staph infection (not MRSA) on inner thigh

Reoccurring ringworm to the point of this athlete being placed on oral medication for the remainder of the season.

MRSA ruled out, but major boil that had to be packed daily with oral antibiotics prescribed. At first refused to be seen, just wanted antibiotics prescribed over the phone. Sight unseen.

This athlete's condition was diagnosed by the treating physician as a possible spider bite that then became infected.

She had more than one location. She had a place on her face and groin/pelvic area.

Both Mom and daughter had many areas of infection

There was no skin outbreak. This was an internal case. Frozen shoulder with pneumonia. 3 days later a gallon of fluid was in shoulder. Emergency surgery and a 3 week stay in hospital before release.

The shoulder pads were reconditioned and the company had our equipment used a different cleaners and we believe a couple of the athletes had a reaction to it. It cleared with topical treatments.

Athlete never went to physician.

This was diagnosed as staph, however it was not MRSA.

Found the athlete covering the wound himself and asked what happened. He had already gone to MD and diagnosed with a staph infection.

Same as previous athlete.