NATIONAL CENTER FOR SPORTS SAFETY

SAVING CHILDREN, PREVENTING YOUTH SPORTS INJURIES

SENATE FILE 446, SPORTS INJURY PREVENTION

RECOMMENDATIONS FOR SPORTS INJURY PREVENTION:

SAFETY EQUIPMENT FOR PARTICIPATION AND TRAINING FOR EMPLOYEES, COACHES AND VOLUNTEERS

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January 8, 2014

Clerk of the Iowa Senate
Clerk of the Iowa House of Representatives
Iowa Capital
Des Moines, Iowa 50319

RE: Iowa Senate File, 446

Sports Injury Prevention: This division establishes a muncipal youth sports injury prevention study to make recommendations regarding how cities can most effectively prevent sports-related injuries in children participating in muncipal youth sports programs. The National Center for Sports Safety (NCSS) is requested to administer the study in coordination with the Iowa Department of Public Health and other interested parties. The study must include recommendations for safety equipment for participants and training for employees and volunteers to be required by cities as part of muncipal youth sports programs. The center is requested to submit a report on its findings and recommendations to the general assembly by January 10, 2014.

Dear Iowa General Assembly:

The National Center for Sports Safety (NCSS), a 501-(C) 3 non-profit founded in 2001, can site numerous examples of tragedies in sports due to injury, many like the example of Gabby Taylor, from Minnesota.

December 17, 2009, is the date that changed The Taylors' life. Gabby's injury could have been prevented, had she communicated with her coach and if the coach had recognized the signs and symptoms, her injury could have possibly been minimized. "Is that coach qualified?" This is the emerging social question that is sparked by many parents.

Because there are so many stories like Gabby's, the National Center for Sports Safety has a call to action to educate coaches on sports safety techniques and skills, so that they will gain the knowledge and confidence to prevent and respond to injuries and emergency situations appropriately until professional help arrives.

In response to the invitation by the Iowa Legislature in SF446, the National Center for Sports Safety is pleased to submit the following study on effectively preventing sports-related injuries in children participating in municipal youth sports programs.

At the request of the Iowa Legislature, the National Center for Sports Safety has provided information that shows the need and opportunity for sports safety education for youth and park and recreation coaches, volunteers, parents, league administrators, etc. in the State of Iowa and will ultimately help protect the youth athletes. If we can help save one life, it will be well worth the effort!

With interest from organizations, such as the Iowa Park and Recreation Association and League of Cities, the National Center for Sports Safety is providing this report to the General Assembly for their consideration.

The study is a comprehensive research report on sports injury prevention and sports safety topics established by statistical data research and third-party position statements to support all materials discussed.

An executive summary, followed by an abstract, introduction, report on sports safety equipment, report on sports safety educational topics, conclusion, tables, appendicies, and works cited have all been included in this narrative.

As requested in SF 446, the study presents recommendations for training of employees, volunteers, and coaches in municipal youth sports programs. The NCSS has the ability, resources and expertise to provide the recommended medical education on the basics of sports safety to prevent sports injuries in municipal youth sports programs.

If there are questions, please contact the National Center for Sports Safety office at 866-508-6277 or visit the website at www.sportssafety.org.

Sincerely,

Kathryn Gwaltney, MBA
Executive Director

EXECUTIVE SUMMARY

December 12, 2013

RE: Iowa Senate File, 446

Sports Injury Prevention: This division establishes a munincipal youth sports injury prevention study to make recommendations regarding how cities can most effectively prevent sports-related injuries in children participating in munincipal youth sports programs. The National Center for Sports Safety (NCSS) is requested to administer the study in coordination with the Iowa Department of Public Health and other interested parties. The study must include recommendations for safety equipment for participants and training for employees and volunteers to be required by cities as part of munincipal youth sports programs. The center is requested to submit a report on its findings and recommendations to the general assembly by January 10, 2014.

Enclosed is an executive summary on sports injury prevention provided by the National Center for Sports Safety (NCSS), as requested by the Iowa Legislature.

A further in-depth report, which includes statistical data, research and third party position statements to support all materials discussed, will be presented for the general assembly's review on January 10, 2014.

We hope this information will speak volumes on the need for sports safety education for youth and park and recreation coaches in the State of Iowa and to help protect the youth athletes of the state.

If there are questions prior to the release of the final report, please contact the NCSS office at 866-508-6277 or visit the website at www.sportssafety.org .

Sincerely,

Kathryn Gwaltney, MBA
Executive Director

December 17th, 2009. On this date, Gabby Taylor's life was changed in an instant when she experienced a cheerleading accident that resulted in the paralysis of her right arm.

It was just a normal day in Minnesota; Gabby woke up, rushed to the bus, focused on her school work then attended practice. They practiced a cheerleading stunt at the last minute, hoping to perfect it prior to an upcoming competition. The first time the stunt was performed, the flyer landed on Gabby's neck region, the pain was searing, but she "shook it off." The second time the stunt was performed, she knew something was wrong, but was not able to sit out in fear of losing her spot on the team. The third time the stunt was performed was the last time she had full motion of her right arm. The repetition of the flyer landing on her neck had caused a severe nerve injury that would change her life forever.

On October 10, 2013, a 17 year-old female high school student from Alabama was playing soccer at the city's recreation fields when she and another player went for the ball and collided. The other player hit her in the chest with his head, and the girl collided, causing her heart to go into an irregular rhythm. First responders tried to revive her, but her life ended at a local hospital.

Gabby's injury could have been prevented had she communicated with her coach and listened to her body's natural pain signals. In addition, if the coach had recognized the signs and symptoms, her injury could have possibly been minimized. Had an automatic external defibrillator (AED) been available and administered within minutes, the life of the Oneonta, Alabama soccer player could have potentially been saved.

The cost of a human life is simply incalculable to a family, a team, a coach, and a community, but there is a natural inherent increase in the risk of injury that can occur when involved in physical activity. The benefits of exercise are numerous and have been demonstrated in the reduction of many diseases including cardiovascular disease and diabetes, two of the leading causes of death in the world.

Sports, a form of exercise, can be attributed to improving grades at school, teaching responsibility and commitments, setting goals, and working together as a team. These are all life lessons that are priceless and promote physical activity, but with hundreds of thousands more participating in exercise and organized sports at the youth and high school levels each year (according to SafeKids USA in 2011, there were an estimated 38 million children playing on sports teams throughout the United States, an increase from 30 million in 2010 reported by the National Institute of Health), the rate of injuries continues to grow significantly, causing many physicians and other healthcare providers to investigate how a national campaign can end this from becoming an epidemic in youth sports injuries. The Center for Disease Control (CDC) reports that sports and recreation injuries account for over 2.6 million visits to hospital emergency rooms each year. This year, SafeKids Worldwide stated that 1.35 million children reported to emergency departments throughout the United States as a result of sports related injuries in 2012. This 2012 data equates to one-child being evaluated in United States Emergency Departments every 25 seconds. Unfortunately, this does not accurately account for sports injuries seen in primary care and specialist physician offices, physical therapy clinics, athletic training rooms, and emergent care facilities.

In 2009, 66 member hospitals of the National Electronic Injury Surveillance System (NEISS) reported that there were 1,060,823 injuries associated with youth and high school football. The top five football related injuries for ages 7-17 years of age were fracture/dislocation, sprain/strain, contusion, laceration, and traumatic brain injury. One year prior, authors Collins and Comstock released a study on baseball injuries for the high school-aged athlete. The top five injuries related in high school baseball were ligament sprains, muscle strains, contusions, fractures, and concussions.

Remember this: Most sports injuries are preventable, yet SafeKids Worldwide reported in 2012 that at least one in three adolescents is injured playing team sports, some with serious, life-impacting consequences.

As parents continue to see and hear of deaths and sports injuries in their communities through the news media, they are going to question now as never before, the welfare of their children during sports activities and practices. If a national sports safety campaign does not continue to grow, the number of children who receive multiple injuries over the course of their athletic 'careers' will likely increase and could potentially cause permanent damage.

Whether caused by the sport itself, or external factors such as environmental/weather elements, prevention of an injury or minimizing the severity is due in part to lifesaving skills that involve emergency planning, injury recognition and management of the injury. Basic education and supplies for administering lifesaving skills including first-aid, cardiopulmonary resuscitation (CPR) and automated external defibrillators (AEDs), has been shown to save the lives of those involved with, and who participate in sports. Just as by having a fire extinguisher readily available at a location can stop widespread damage, by placing an AED in local youth sports facilities, the incidence of death could considerably be diminished. By educating coaches on prevention and sports safety, youth athletes' emergency room visits and missed days at school could be prevented. Educating on sports safety techniques and skills will help coaches gain the knowledge and confidence to prevent and respond to injuries and emergency situations appropriately until professional help arrives.

There must be a qualified response: the means to educate those responsible for athletes, such as coaches, volunteers, and parents. The National Center for Sports Safety (NCSS) stands ready to educate through use of the PREPARE sports safety course and other areas of opportunity.

Aside from common sports related injuries such as sprains, strains, contusions, etc., an epidemic concern is the increase in overuse youth sports injuries. Overuse injuries can be attributed to an increase in participation with minimal rest, athletes who specialize in a particular sport without rest and who may participate on more than one team simultaneously during the same season(s), poor warm-up and cool-down prior to and post a sporting event, poor training technique, and poor progression while developing basic skills. Managing these athletes in sports, and educating parents, coaches, volunteers, sports administrators, and athletes on the importance of cross-training and rest can all help in reducing overuse injuries, all of which has previously not been associated with coaching responsibility, but should in order to reduce these life-long injuries.

Unfortunately, not all sports injuries have favorable outcomes. The National Center for Catastrophic Injury Research defines catastrophic injuries as an injury resulting in a brain or spinal cord injury, or skull or spine fracture, caused by a direct or indirect injury, resulting in serious injury, non-fatal injury, or a fatality. From the 1982-1983 school year through the 2010-2011 school year, data reveals there were 1,079 total high school athletes suffering from catastrophic related injuries resulting in unfortunately, 170-fatalities. Initial steps taken immediately during the emergency and the management of each situation are critical in order to reduce these staggering outcomes.

There are approximately 225,000 youth coaches representing youth leagues throughout the State of Iowa, with each coach touching the lives of Iowa's youth athletes every day. Volunteers willingly devote their time to coach, but are also accountable for providing a safe playing field or court and should become properly educated in sports safety and injury prevention. Most volunteers have not had specific training on how to coach or any training in sports safety education and with a higher than expected turnover rate of volunteer coaches in youth leagues across the country, a basic lifesaving course (CPR), coupled with sports safety education, are critical to saving an athlete's life

According to the Iowa Park and Recreation Association, there are 125 members of this association. The number of youth athletes associated with each park and recreation department is staggering. If there are six core sports per department, with four to five different age groups per sport and 12 athletes per team with approximately 30 teams per sport per age group, the number of athletes is close to 1.3 million at risk for injury! There were an additional 140,000 Iowa high school athletes in the 2012-2013 school year, as stated by the National Federation of High Schools.

The Iowa Hospital Association reported from 2010-2012, a minimal decrease in sports related injuries seen in the emergency department for various sports-related activities such as walking, running, and specific sports and athletic-related injuries. This could possibly be attributed to injuries not seen at the emergency department, but potentially seen in other healthcare facilities, a decrease in athletic participation in youth and high school level sports as a result of the recession in the economy, or possibly through an increased local and national awareness of youth athletic injuries. On the local level, the NCSS, a 501-C3 non-profit, was able to educate Iowa youth coaches in a classroom setting through the NCSS PREPARE program in 2009, 2011 and 2012 to help bring awareness about injury prevention and sports safety. To continue the decrease of sports-related injuries reported by the Iowa Hospital Association, the NCSS is requesting to provide NCSS resources to the youth sports industry in Iowa.

Since 2000, awareness for youth sports injuries has gained momentum both nationally and internationally. In 2001, the NCSS began to dedicate all resources on promoting through education and research the importance of injury prevention and safety at all levels of youth sports. NCSS focuses on decreasing the number and/or severity of injuries through developing and teaching sports safety courses and collecting, analyzing and researching injury data. If a sports safety national campaign does not continue to grow, the number of children who receive multiple sports injuries over the course of their athletic 'careers' will likely increase and could potentially cause permanent damage.

In order to meet some of the strategic objectives of our organization, we need to educate the public about the number, severity and commonality of sports injuries. Essentially, this is our platform.

Within our mission, we emphasize our desire to take a proactive approach to preventing injuries through education. The vision of NCSS is to standardize the level of care available to athletes on and off the playing field. By educating youth coaches in sports safety techniques and skills, they will gain the knowledge and confidence to prevent and respond to injuries and emergency situations appropriately until professional help arrives.

NCSS founder Dr. Lawrence Lemak says it best, “There is not one parent who would drop their child off at a local pool if there were not a certified lifeguard on duty. That same standard of care should be available for every sports facility in this country.”

Our goal is simple: the more people who understand that many of the sports injuries and fatalities are preventable and can be reduced by education, the greater the need will be for our PREPARE sports safety course and our resources that will help activate injury prevention, emergency planning, and stabilizing injuries until a medical professional arrives.

While all injuries have their level of severity, being able to recognize signs and symptoms, and provide the first steps in providing care can be the difference in life, and death. Through education and awareness, the initial management of injuries is often what leads to an encouraging outcome. Realistically, a healthcare professional may not be onsite during a practice or game, therefore, the importance of coaches, parents, and volunteers trained in emergency recognition is imperative for the athlete’s safety. First-aid and sports safety training should not replace the need for emergency services, but rather be a vital step in providing effective and rapid intervention until a medical professional arrives.

A majority of current research on athletic related injuries and injury prevention techniques focus on professional, collegiate, and high school aged athletes, with little to no research focusing on youth-aged athletes and their short and long-term effects on youth development at the national, state, and local levels. Because there is little data and research available on the youth level, our duty at NCSS is to help provide knowledge for those involved in all aspects of youth level sports. The NCSS PREPARE course brings you up to speed on everything from emergency plans, to when to use ice versus heat, to what you do when a child is unconscious. A three-hour investment gives a coach, parent, and volunteer peace of mind and confidence that they can keep the players safe.

With 13 physicians, 12 certified athletic trainers, and the remaining professionals in the sports industry profession, the PREPARE course was authored by over 30 delegates from across the country and is updated every 24 months in order to offer the most valuable information to coaches and to ensure the educational modules are up-to-date with the most current research. Content development is important to the NCSS to further educational opportunities for coaches, including information outside of the current PREPARE course. In addition, content updates continue to lend credibility to the NCSS program and what is offered to the target audience.

The PREPARE course is delivered through an online platform/infrastructure called a Learning Management System or LMS. A LMS is an information system that administers e-

learning courses and keeps track of student progress. It can be used to monitor the effectiveness of the education and training, and to record participant data. This program provides a centralized learning environment to ensure consistency in material, is available 24/7 via the web, and adds a key component for tracking the participant's progress.

Below is a brief summary of the NCSS PREPARE LEVEL 1 course content. Each topic mentioned was voted and agreed upon by the authors of the course. All topics were considered vital for the benefit of the athlete's safety, and based upon research, statistics, and position statements from third-party sources and experts in their respective fields. Please note, in the final research paper to be presented in January of 2014 to the Iowa Legislature, the NCSS will explain in further depth the importance of each topic below.

Module	Module Name	Purpose
1.	Emergency Action Plan	Define and develop, and activate an emergency action plan. Outline, in writing, the actions that will occur should an emergency arise. Effectively managing an injury scene.
2.	Heat & Cold Illness	Education on the prevention, recognition, and management on heat and cold related illnesses. Taking precautions when exercising in extreme environmental conditions.
3.	Emergency Recognition	CPR guidelines. Assess vital signs; identify the signs and symptoms of shock to take appropriate actions. Differentiate between emergency and non-emergency situations.
4.	Medical Considerations & Pre-existing Conditions	Monitor medical considerations (allergic reaction, diabetes, asthmatic reaction, seizure, sickle cell, etc.) to identify criteria indicating that an athlete should or should not return to play.
5.	Principles of First Aid	Guidelines for Universal Precautions when caring for an athlete. Distinguish between different types of wounds and how to treat them. Identify the signs and symptoms of a wound infection with appropriate steps for wounds and blisters. Staph infections and MRSA, acute and chronic injuries.
6.	Head, Neck & Face Injuries	Recognize the signs and symptoms of a possible head, neck, or facial injury. Learn the appropriate action for an athlete with a suspected head, neck or facial injury. Recognize and manage the signs and symptoms of a concussion. Methods to prevent head and neck injuries.
7.	Warm-up & Cool-down	Explain the rationale for an adequate warm-up before exercise and cool-down period after exercise. Choose exercises for the warm-up and cool-down periods. Overview on overuse injuries and overtraining.

A call to action: Sports play an important role in American society. Sports “is not just a game,” it can positively teach life lessons and impact a child’s life. Our culture says sports are an important part of personal development. While sports serve as a “social glue” bonding athletes together, sports also cause injuries and even death.

“Is that coach qualified?” This is the emerging social question that is sparked by incidents occurring all over the nation. Because so many sports-related injuries are preventable, it is the duty of the National Center for Sports Safety to educate the public. NCSS stands ready to expand the PREPARE course to the scale of the need. Ultimately, the beneficiaries of this program will impact millions of young athletes, coaches, parents and families that gather at these facilities to play or watch their sport of choice.

Reducing sports related injuries through education, while continuing to build character and healthy lifestyles in today’s youth and future adult leaders, will hopefully reverse the rising epidemic in youth sports injuries.

If NCSS can prevent just one fatality or injury, it will be worth the effort.

APPENDICIES

TABLES

ACKNOWLEDGEMENTS

A special thank you to the following individuals and organizations who have helped NCSS compile data, gather information, and provide insight for this report:

Iowa Athletic Trainers Society

Troy Kleese, LAT, ATC, Chair for Government Affairs Committee

Iowa Department of Public Health

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Iowa Hospital Association

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Iowa Park and Recreation Association

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ABSTRACT

According to SafeKids USA in 2011, there were an estimated

38 million

children playing on sports teams throughout the United States,[22] an increase from 30 million in 2010 reported by the National Institute of Health. [23]

The benefits of exercise are numerous and have been demonstrated in the reduction of many diseases including cardiovascular disease and diabetes, two of the leading causes of death in the world.

Sports, a form of exercise, can be attributed to improving grades at school, teaching responsibility and commitments, setting goals, and working together as a team. There is no price tag for these life lessons and positively, sports promote physical activity.

While involvement in such activities promotes physical fitness, it also leads to a risk of injury and with hundreds of thousands more participating in exercise and organized sports at the youth and high school levels each year, the rate of injuries continues to grow significantly, causing many physicians and other healthcare providers to investigate how a national campaign can end this from becoming an epidemic in youth sports injuries.

Whether caused by the sport itself, or external factors such as environmental/weather elements, prevention of an injury or minimizing the severity is due in part to lifesaving skills that involve emergency planning, injury recognition and management of the injury. Basic education and supplies for administering lifesaving skills including first-aid, cardiopulmonary resuscitation (CPR) and automated external defibrillators (AEDs), has been shown to save the lives of those involved with, and who participate in sports.

Aside from common sports related injuries such as sprains, strains, contusions, etc., an epidemic concern is the increase in overuse youth sports injuries. Overuse injuries can be attributed to an increase in participation with minimal rest, athletes who specialize in a particular sport without rest and who may participate on more than one team simultaneously during the same season(s), poor warm-up and cool-down prior to and post a sporting event, poor training technique, and poor progression while developing basic skills. Managing these athletes in sports, and educating parents, coaches, volunteers, sports administrators, and athletes on the importance of cross-training and rest can all help in reducing overuse injuries, all of which has previously not been associated with coaching responsibility, but should in order to reduce these life-long injuries.

Volunteers willingly devote their time to coach, but are also accountable for providing a safe playing field or court and should become properly educated in sports safety and injury prevention. Most volunteers have not had specific training on how to coach or any training in sports safety education and with a higher than expected turnover rate of volunteer coaches in youth leagues across the country, a basic lifesaving course, coupled with sports safety education, are critical to saving an athlete's life.

INTRODUCTION

In the United States[1] and Internationally[2], heart disease, chronic lower respiratory disease, strokes and diabetes consistently compose the top reasons of death globally. If changes in habits and healthy lifestyles are adopted at younger ages, the reduction of death from these diseases may subsequently decrease as well.[3]

Exercises and activity has long been sought in the prevention of many diseases. [4-10] Unfortunately, with any increase in activity or exercises, there is an inherent increase risk for injury, subsequent increase in time-loss from activity, [11-17] increase associated with cost of injury, [18-21] and decrease in physical and increase mental health changes.

Sports are an activity that involves physical exertion and serve as a "social glue" bonding athletes together. Research indicates that there has been a steady increase in the involvement of youth aged persons in organized and unorganized sports over the years. In the United States, it is accepted that a youth is any individual who is 18-years old and younger. While there are variances in age descriptions between youth and adolescence, for the purpose of this paper, and in examining published research, we are defining a youth-aged athlete as a person 18-years and younger who participates in formal organized sports.

In 2011, SafeKids USA estimated that 38 million children play on sports teams throughout the United States,[22] an increase from 30 million in 2010 by the National Institute of Health.[23] Since the 1983-1984 school year, a yearly study conducted by The National Federation of High School Association (NFHS), reports a steady increase in athletic participants each year, with a 10-year (2003-2004 through 2012-2013) average increase of 1.24% annually. Of the 7,713,577-NFHS athletes participating in the United States during the 2012-2013 school year, 140,939-Iowan NFHS student-athletes make up 1.9% of the total, and consistently rank 18th in participation of sports during a 6-year window. [24-29]

140,939
Iowa High School athletes in the 2012–2013 School Year -NFHS [24-29]

Due to the increase in participation, the rate of injuries continues to grow significantly. The Centers for Disease Control and Prevention estimates in 2002, 1.9 million children were treated by hospital emergency departments for sports related injuries. [23] In 2009, more than 2.6 million children under the age of 19 were seen in emergency departments throughout the United States as a result of injuries suffered through sports and recreational activities. [30] In 2013, SafeKids Worldwide stated that 1.35 million children reported to emergency departments throughout the United States as a result of sports related injuries in 2012. [21] This 2012 data equates to one-child being evaluated in United States Emergency Departments every 25 seconds. Unfortunately, this does not accurately account for sports

> "This 2012 data equates to one-child being evaluated in United States Emergency Departments **every 25 seconds**. [21]"

injuries seen in primary care and specialist physician offices, physical therapy clinics, athletic training rooms, and emergent care facilities.

A majority of current research on athletic related injuries and injury prevention techniques focus on professional, collegiate, and high school aged athletes, with little to no research focusing on youth-aged athletes and their short and long-term effects on youth development at the national, state, and local levels. Since 2000, awareness for youth sports injuries has gained momentum both Nationally [21, 22, 31-40] and Internationally.[41, 42] These stakeholders have recommended the importance of participating injury data surveillance studies to improve gaps in clinically relevant research, to promote the importance of injury prevention programs, to improve education and training for those individuals involved in youth sports and recreation, to make improvements on the healthcare and healthcare system responsible for care for these individuals, and to creatively improve regulations to help promote a safer and more adequate environment to youth sports and recreational athletes.

Not including those seen by primary or acute care offices or by physician specialists visits, approximately 7,100 athletes will visits hospital emergency departments each day. [31] The United States Consumer Product Safety Commission, through the National Electronic Injury Surveillance System (NEISS) [43] reports for athletes ages 11 and younger, during a 5 year reported period, 2008-2012, football, basketballs, baseball, soccer, gymnastics, softball, cheerleading, wrestling, volleyball and ice hockey represented the top 10 sports reported to emergency departments who utilize the NEISS. Representing 98.7% of all injuries for athletes 11-years and younger, these sports represented 22.2% of the 6,149,688 injuries reported over 5 years.

*During a 5 year reported period (2008-2012) for ages 11 and younger, football, basketball, soccer, baseball, gymnastics, softball, cheerleading, wrestling, volleyball and ice hockey represented the **top 10 sports** reported to emergency departments who utilize the NEISS. [43]*

In 2009, 66 member hospitals of the National Electronic Injury Surveillance System (NEISS) reported that there were 1,060,823 injuries associated with youth and high school football. The top five football related injuries for ages 7-17 years of age were fracture/dislocation, sprain/strain, contusion, laceration, and traumatic brain injury. [44] One year prior, authors Collins and Comstock released a study on baseball injuries for the high school-aged athlete. The top five injuries related in high school baseball were ligament sprains, muscle strains, contusions, fractures, and concussions. [45]

Youth sports injuries documented in the State of Iowa by the Iowa Hospital Association reported from 2010-2012, a minimal decrease (2.74% from 2010 to 2011 and a 13.40% decrease from 2011 to 2012, with an overall decrease in hospital reported injuries of 16.30% during a three-year period) [46] in sports related injuries seen in the emergency department for various sports-related activities such as walking, running, and specific sports and athletic-related injuries. This could possibly be attributed to injuries not seen at the emergency department, but potentially seen in other healthcare facilities, a decrease in athletic participation in youth and high school level sports as a result of the recession in the economy, or possibly through an increased local and national awareness of youth athletic injuries.

Sports at all levels suffer common injuries including sprains, strains, fractures, dislocations, contusions, abrasions and concussions amongst other injuries. [11-17, 44, 47-77] While acute injuries are difficult to prevent, over half of all overuse injuries are preventable with proper awareness, progression of training, incorporation of rest, communication and education. [78-80] With more and more athletes participating year-round and/or participating in simultaneous teams during the same seasons, youth and adolescent aged athlete injuries are silently becoming an epidemic. [81, 82] Youth athletes are susceptible to overuse injuries associated with an increase in activity, with minimal or limited rest during the period of child development. [80]

Overuse injuries can be attributed to an increase in participation with minimal rest, athletes who specialize in a particular sport without rest, who may participate on more than one team simultaneously during the same season(s), poor warm-up and cool-down prior to and post a sporting event, poor training technique, and poor progression while developing basic skills. Managing these athletes in sports, and educating parents, coaches, volunteers, sports administrators, and athletes on the importance of cross-training and rest can all help in reducing overuse injuries, all of which were previously not associated with coaching responsibility, but should in order to reduce these life-long injuries.

Unfortunately though, not all sports injuries have favorable outcomes. A catastrophic injury is defined as an injury resulting in a brain or spinal cord injury, or skull or spine fracture, caused by a direct or indirect injury, resulting in a serious injury, non-fatality injury or fatality. [83-85] From the 1982-1983 through the 2007-2008 school year, high school data collected by the National Center for Catastrophic Injury Research reports 163,388,022-athletes participating in high school athletics (NFHS), resulting in 154-fatalities, 405 non-fatal injuries and 421-injuries (n=980 total catastrophic injuries) during this reporting period. [83, 86] Cumulating annually, 2010-2011 data reports an additional 13,485,524-athletes participating in high school athletics (NFHS), resulting in 1,079-total athletes suffering from catastrophic related injuries during this time period (170-fataltlies, 467-non-fatal injuries and 441-serious injuries. [87] Initial steps taken immediately during the emergency and the management of each situation are critical in order to reduce these staggering outcomes.

According to the Iowa Park and Recreation Association, there are 125-members of this association, making up approximately 84% of all organized sports teams throughout the state. [88] If there are six core sports per department, with four to five different age groups per sport and 12 athletes per team with approximately 30 teams per sport per age group, the number of athletes is close to 1.3 million at risk for injuries! [88]

The importance of educational awareness with regards to injury and injury management is needed. There are approximately 225,000 youth coaches representing youth-leagues (non-high school sports) across the state of Iowa, with an estimated 30% turnover each year. [88] Volunteers willingly devote their time to coach, but are also accountable for providing a safe playing field or court and should become properly educated in sports safety and injury prevention. Most volunteers have not had specific training on how to coach or any training in sports safety education and with a higher than expected turnover rate of volunteer coaches in youth leagues across the country, a basic lifesaving course (CPR), coupled with sports safety education, are critical to saving an athlete's life.

While some recreation and park employees involved in youth-league organized sports are full-time, a majority of administrators, and more importantly, coaches, consider coaching and managing youth-league teams as a secondary position, and may have little to no medical educational background to help minimize minor or significant injuries.

Proper steps should always be taken to prevent such injuries when at all possible. The importance of proper on-site equipment, training and education is critical in the initial steps of any injury. After thoroughly examining available published research and data, The National Center for Sports Safety, at the request of the Senate Committee on Appropriations for the state of Iowa, [89] make its recommendations for required sports-safety equipment for participants and educational training for those employees and volunteers working with youth-aged athletes.

PART II: SPORTS SAFETY EQUIPMENT FOR PARTICIPANTS

INTRODUCTION

Published in 1989, Mary Newman, [90] identified three principles to increase survivability during emergency cardiac situations which (1) included early access to care, (2) early cardiopulmonary resuscitation and (3) early defibrillation. Updated over the year, [91-93] the American Heart Associations' Chain of Survival now includes a fourth-chain to increase survival rates during sudden cardiac emergencies; (1) the importance in immediate recognition of cardiac arrest and activation of the emergency response system, (2) early cardiopulmonary resuscitation (CPR) with an emphasis on chest compressions, (3) rapid defibrillation, (4) effective advanced life support and integrated post-cardiac arrest care plan, to improve survivability rates following a sudden cardiac incident. [93]

Heart disease is the leading cause of death in the United States, ahead of cancer and chronic lower respiratory diseases. Each year, an approximate 600,000 will pass away from heart disease, [1] with another 200,000-450,000 [94-97] suffering sudden cardiac arrests episodes throughout the United States. Sudden cardiac arrest (SCA) is defined as a sudden, unexpected loss of heart function, breathing and consciousness. [98] Sudden cardiac death (SCD) is defined as a death which is abrupt, unexpected, due to a cardiovascular cause, whether congenital or from external trauma. [99] Sudden cardiac death caused by congenital heart defects may include hypertrophic cardiomyopathy, coronary artery anomalies, increased ventricular mass, and myocarditis. [98, 100-102] The American Heart Association estimates approximately 95-percent of all persons suffering from sudden cardiac arrest will die before reaching the hospital. [103]

A majority of all sudden cardiac arrest cases involve persons over the age of 55, [97, 104-106] an age range associated more commonly with parents, grandparents, league administrators, coaches, and possibly officials/referees. In young athletes, the risk for sudden death in athletes is approximately one death in 200,000-300,000 annually. [107] Accounting for 56% of all sudden death in young athletes, hypertrophic cardiomyopathy (36%) and congenital coronary artery abnormalities (17%) were the most common congenital causes. [108] Due in part to the increase cost, and increase significance of false-positives, a complete pre-participation exam screening, with a thorough health-history and basic cardiac screening can help in identifying red-flag pre-disposing factors, and the possible need for further evaluation. [109-111]

Sudden cardiac death in young athletes caused by trauma are commonly associated with a blunt trauma to the chest/heart region (22%) [108] such as in cases of Commotio Cordis (3%), [108] and are most common in sports such as baseball, softball, ice hockey, football, soccer, and lacrosse. [112] Since 2001, a total of 128-confirmed cases (78%) citing commotio cordis were 17-years and younger. Regardless of age, there have been 107 (87%) cases of commotio cordis as a result of athletic participation (recreational [28-deaths] or competitive [79-deaths]). Of these athletic based deaths, 67 (62.6%) took place during youth leagues, junior high and high school activity. With a high incident of death following trauma, survivability has been reported in only 28% of cases. [112] Of survivability cases, proper recognition with resuscitation was given within three-minutes of incident, and when available, defibrillation was administered early [113] by an automated external defibrillator (AED).

While there is currently no peer-reviewed research focusing on call-to-arrival for emergency medical services times, the average call-to-arrival time in the United States is approximately six- to ten-minutes, [114] but can be upwards of 30-45 minutes depending on the location (urban vs. rural), Emergency Medical Services (EMS) staffing situations (paid vs. volunteer), and other current ongoing medical emergencies. This demonstrates the importance of onsite readily available trained first responders who are able to recognize signs and symptoms of emergencies, provide first aid, initiate cardiopulmonary resuscitation (CPR) and when available, initiate early defibrillation.

With an estimated 75-80% of all out-of-hospital cardiac arrest incidents occurring outside of medical facilities, [103] the importance of first-aid, cardiopulmonary resuscitation and early defibrillation education is greater than ever, as these skills could prevent 25% of pediatric sudden deaths [99].

Often times, parents and/or guardians place the responsibility of their child's safety in their athletic league administrator or coaches' hands. Coupled with risk minimizing steps, basic education and supplies for administering lifesaving skills including first-aid, CPR and an AED (early defibrillation), has been shown to save the lives of those involved with, and who participate in sports and allows administrators and coaches to become responsible first responders by promoting a safe playing environment to all of those who participate when an emergency arises.

With an estimated **75-80%** of all out-of-hospital cardiac arrest incidents occurring outside of medical facilities, [103] the importance of first-aid, cardiopulmonary resuscitation and early defibrillation education is **greater than ever**, as these skills could prevent 25% of pediatric sudden deaths. [99]

Just as by having a fire extinguisher readily available at a location can stop widespread damage, by placing an AED in local youth sports facilities, the incidence of death could considerably be diminished. By educating coaches on prevention and sports safety, youth athletes' emergency room visits and missed days at school could be prevented. Educating on sports safety techniques and skills will help coaches gain the knowledge and confidence to prevent and respond to injuries and emergency situations appropriately until professional help arrives.

By ***educating*** coaches on prevention and sports safety, youth athletes' emergency room visits and missed days at school could be ***prevented.***

With more and more states looking to reduce spending, and athletic leagues and associations looking to make sports more affordable and safer, the need for sports safety resources are essential.

FIRST-AID

While all injuries have their level of severity, being able to recognize signs and symptoms, and provide the first steps in providing care can be the difference in life, and death.

Through education and awareness, the initial management of injuries is often what leads to an encouraging outcome.

With an increased availability of healthcare workers and first-aid supplies in healthcare and hospital settings, the initial management of injuries often leads to encouraging outcomes compared to that of the uncertainty of organized or recreational sports leagues. As these healthcare professionals may not be onsite during practices and games, the importance of having administrators and coaches onsite who are trained in first-aid, who are able to recognize injuries and provide immediate care is imperative. It is important to understand that first-aid training should not replace the need for emergency services should an emergency situation arise, [115] but rather a vital step in providing effective and rapid intervention until further advanced trained personal arrive. Initial response and care can help improve the prognosis of injuries resulting in improved outcomes and survival rates.

While most organized youth leagues and high schools require some form of emergency training and first-aid, research dictates otherwise, as past studies have demonstrated a lack of coaches at the youth level who are currently certified in first-aid and/or cardiopulmonary resuscitation (CPR). In a 2002 study that examined United Kingdom (UK) youth soccer coaches, found that 61% of coaches were not currently first-aid certified, [116] which is similar to findings of a 2010 study in the United States with soccer coaches that reported 73% and 79% of surveyed coaches were not currently first-aid or CPR certified. [117]

Studies focusing on evaluating principle knowledge of first-aid [116-120] and situational first-aid [116, 117, 121] have reported poor passing rates. With low passing rates, investigators in these studies have suggested future research focus on a wider variety of sports (coaches), testing coaches with sports specific scenarios and cases, modifying current educational content delivery to incorporate different learning styles and situational training to improve practical situational outcomes.

The initial cost for consumable and durable medical supplies, and educational content for first-aid can range from $430-$1,434.00 (TABLE 1). Regular updating of supplies will vary based on their usage and expiration date, and should be similar to that of the Cunningham study of $15-40 (TABLE 1). [116] Durable medical supplies should only need to be replaced if not regularly maintained or in the case of an overabundance of use. Formal refresher educational training in first-aid is required every two-three years. While different, general sports supplies such as athletic tape, cutters, sunblock, etc., is included in this section, as they are common supplies associated together. The cost for these general sports supplies range from $187-$644.00 (TABLE 2), and will require replacement based on usage and expiration dates.

CARDIOPULMONARY RESUSCITATION

The loss of human life is counted in minutes, with a seven- to ten-percent decrease in life for every minute CPR is not initiated. [103] The two major components of CPR, mouth-to-mouth and chest compressions, were first described in 1740 and in 1891. [96, 122] Today, CPR is still considered the 2nd step [123] in the Chain of Survival described by Mary Newman in 1989. [90] When correctly recognized by bystanders, research has shown that lay person first-responders can correctly perform chest compressions-based CPR (versus conventional CPR), with successful results at the onsite of sudden cardiac emergency.[124]

Recent evidence suggests the importance of lifesaving education on a broad spectrum education level to be the most successful in the event of sudden cardiac emergencies. Through mass training and education in a variety of settings from 2001-2010, including elementary school curriculum, mandatory CPR courses for driver's licenses, distribution of CPR self-instruction training kits, and a general CPR course education at a national level in Denmark (DK), bystander CPR rates (21.1% to 44.9%), and the rate of patients survival to the hospital (7.9% to 21.8%) increased. This study also reported an increase in 30-day and one year survival rate increases from 3.5% (each) to 10.8% and 10.2% respectively. [105, 125]

The initial cost for consumable supplies and educational content for cardiopulmonary resuscitation will range from $27-$63.00 (TABLE 3). Formal refresher educational training in CPR is required every two-three years. Updating and maintaining of supplies can range based on usage and expiration dates of supplies.

In equipment intensive sports (football, ice hockey, field hockey, etc.), it is imperative that consideration be given to reliable equipment removal tools in the event of an emergency to initiate CPR. While helmets, shoulder pads, and other protective equipment are all similar, the tools required to remove them during an emergency may differ. Obtaining dual sets and backups is critical in the event of primary tool failure, and helps increase response times to airway access during emergencies. Including power and manual screwdrivers, shears, other specific designed equipment removal tools, and quick release facemask tools, will range from $73-$176.00 (TABLE 4).The replacements of these tools is less common, and can be minimized with proper care between training and actual usage.

AUTOMATED EXTERNAL DEFIBRILLATORS

When sudden cardiac arrest occurs, current research has shown that out-of-hospital care survivability can improve with the quick recognition of signs and symptoms, the initiation of cardiopulmonary resuscitation, availability to early defibrillation and the rapid response of trained advanced life-support personnel.

The utilization of automated external defibrillators has been a widely accepted means of immediate treatment following sudden cardiac arrest. Entities who have adopted this resource include the American College of Emergency Physicians, American College of Sports Medicine, American Heart Association, American Red Cross, American Orthopaedic Society of Sports Medicine, National Athletic Trainers' Association, National Association of EMS Physicians, National Heart, Lung and Blood Institute, and Occupational Safety and Health Administration. [126-132] Sports organization such the National Collegiate Athletic Association, [133] National Federation of High Schools, [134] USA Baseball, [135] US Lacrosse, [136] have also accepted the usage of automated external defibrillators during sudden cardiac arrests. Additionally, the following countries have acknowledged usage of automated external defibrillators including Canada, [137] United Kingdom, [138] and Europe. [139]

AED education and repeatability in research has been successfully demonstrated by lay-people [140] in a variety of ages [141] with little training. The availability and usage of AED's to save lives in a variety of settings has been reported in such settings as casinos and with security officers, [142] patrol cruises with police officers, [143] in communities and public places by lay and

trained first responders, [144, 145] in airports by workers and lay first responders [146] and in high schools. [147]

While the benefit of AED's in a variety of settings has been repeatedly demonstrated, the initial cost of initiating an AED program causes some groups some concern. In cost limiting situations and settings, solutions such as increasing community awareness of emergency signs and symptoms and the educational knowledge and willingness to provide initial care can all help towards a positive outcome.

The initial cost of an automated external defibrillator, supplies, and formal training are between $1,625.00-$3,700.00 (TABLE 5). Formal refresher educational AED training is required every 2-3 years. Maintenance cost can vary and is based on usage, expiration dates of supplies, regular maintenance, and storage, with prices ranging from $329.00 to $765.00 (TABLE 5) every two to three years.

CONCLUSION

Supplies for administering first-aid, CPR and AED should be maintained onsite and at all practices and games, available for immediate deployment, regularly maintained by designated league administrators and/or coaches. Reviewing the emergency action plan regularly and rehearsing scenarios is beneficial for practical retention of those who will first respond to an injury. [148]

In total, the cost of first-aid, general sports safety, CPR and AED supplies will range from $2,300-$6,900 (TABLE 6). Replacement and regular maintenance of supplies and equipment can vary based on usage, expiration dates, etc., and may be between $340.00-$800.00 (TABLE 6).

As part of a well-designed emergency action plan, the utilization of first-aid, cardiopulmonary resuscitation, and automated external defibrillation can aid a successful outcome when sports injuries occur or during sudden cardiac arrests incidents. [147, 149-152]

PART III: EDUCATIONAL TRAINING CONTENT

INTRODUCTION

With a high coaching turnover rate at the youth and recreational leagues each year (estimated 33%), [88] the emphasis on educational content for these league administrators, coaches, and volunteers should be maximal in educational course content but minimal in time requirements, as many individuals have primary and/or secondary work and family responsibilities. Coupled with the lifesaving skills of first-aid, cardiopulmonary resuscitation and automated external defibrillators, sports safety educational content should contain information pertaining to action planning, environmental concerns, injury recognition and injury prevention.

Through this knowledge, those involved in athletics can take responsibility and help in the reduction of unnecessary loss of life and injuries associated with athletic participation throughout youth and recreational level of athletics.

Because educational content for league administrators, volunteers, and coaches is crucial to the reduction of unnecessary injuries and loss of life on the youth-sports level, our duty at NCSS is to help provide knowledge for those involved in all aspects of youth level sports. The NCSS PREPARE course brings coaches current on everything from emergency plans, to when to use ice versus heat, to what to do when a child is unconscious. A three-hour investment gives a coach, parent, and volunteer peace of mind, and confidence that they can keep the players safe.

With 13 physicians, 12 certified athletic trainers, and the remaining professionals in the sports industry profession, the PREPARE course was authored by over 30 delegates from across the country and is updated every 24 months in order to offer the most valuable information to coaches and to ensure the educational modules are up-to-date with the most current research. Content development is important to the NCSS to further educational opportunities for coaches, including information outside of the current PREPARE course. In addition, content updates continue to lend credibility to the NCSS program and what is offered to the target audience.

All topics listed in the following information below is considered vital for the benefit of the athlete's safety, and based upon research, statistics, and position statements from third-party sources and experts in their respective fields. The NCSS endorses each topic mentioned and provides content in the NCSS PREPARE course for the following injury and illness prevention methods, management of injuries and illnesses, and stabilization of said injuries and illnesses.

ACTION PLANNING

Athletic leagues and organizations have an obligation to provide appropriate standards for providing care during times of need. [153] In the previous section, the importance of prior planning in cases of life threatening incidents (first-aid, cardiopulmonary resuscitation and early defibrillation) was demonstrated. Emergency and action planning however extends into other facets of athletics due to environmental concerning injuries, both nonemergency and emergency injuries in athletics and specification in all venues and sporting events. Through the National Incident Management System, Federal Emergency Management Agency (FEMA) defines an

incident as an occurrence, natural or manmade, that requires a response to protect life or property. [154]

An incident action plan, commonly referred to in athletics as an emergency action plan, is the pre- and well-planned steps taken by those involved in an incident or injury to minimize the severity of injury and loss of life, and includes the coordination of resources, the immediate availability of supplies, means of communication, and appropriate personnel who are working to support a common objective(s) and goal(s). When creating an action plan, it is important to involve all league and emergency response personnel representatives who may become involved in an emergency. These representatives may include, but not limited to, league administrators, facility/grounds supervisors, league medical supervisors, emergency medicine services, police and fire department services, and hospital or emergency department services. Due to their professional experiences and backgrounds, information from the respective individuals will help create a smooth action plan when an actual incident occurs.

Aspects of a well working plan may include identifying personnel and creating a chain of command, identifying means and maintaining lines of communication during an incident, assigning specific roles and responsibilities, and identifying proper steps for providing care depending on the specific action plan, all during a time of need.

Venue and sport specific, the plan should be documented, rehearsed, critiqued and reviewed by all those involved prior to full implementation. Additionally, the legal counsel of the association should review the plan. As changes occur, the plan should formally be revisited and updated annually at a minimum to provide the best care, and should include such changes as personnel, roles and responsibilities, communication methods, facilities, and availability of onsite equipment and supplies.

At a minimum, the plan should be rehearsed prior to the start of another athletic year, and routinely practiced to improve the effectiveness of each delivered step. While building venue specific action plans sound like a daunting task, numerous resources are available to help promote a safe playing environment and may include your local emergency medical system and authorities, police and fire departments, the local medical hospital facility(s), other athletic based programs at the high school and collegiate level, and professional published statements by FEMA [154] and the National Athletic Trainers' Association. [153]

ENVIRONMENTAL CONCERNS

While not all injuries are preventable, injuries caused by the environment factors such as cold, heat, lightning and tornado related injuries and fatalities can be minimized through prior action planning, educational awareness and recognition, and activity modification.

COLD

While cold injuries and illnesses are closely associated with seasonal based winter sports, cold injuries and illnesses are more common in those who participate in late fall sports and early spring sports. [155] Although cold-related illnesses have been reported in this literature, few have been reported in the general athletic population [156, 157] with more cited in military personnel [158-161] publications and general population as case studies. [162, 163] From 1979 through 1998, 13,970-deaths have occurred as a result of hypothermia. [164] From 1999 through

2002, The Centers for Disease Control and Prevention reported 4,607-deaths as a result from hypothermia, which occurred more frequently between the months of October through March (83%). [163]

In all cases of cold-related illnesses, predisposing medical conditions *(i.e. as exercises-induced bronchospasm. cardiovascular disease*), special populations *(i.e. children, persons over 50-years old, gender, ethnicity*), environmental factors (*i.e. low air temperature, wind, humidity, precipitation and immersion*), and non-environmental factors (i.*e. history of previous cold injuries and injury, clothing/layering, current medication and supplementation, and nutrition/hydration status*) [155, 157, 165, 166] can lead to an increased risk for developing these illnesses and subsequent related injuries.

Action planning, educational awareness and modification of activity should be utilized to prevent cold weather related injuries during practices and games. Recognition of these injuries by league officials, coaches, athletes and parents/guardians and immediate initial care can limit the severity of these injuries while promoting more successful cold weather injury outcomes.

Especially during the months between October through March, healthcare professionals, especially those involved in emergency medicine response services and departments, should be aware of the increased risk factors of cold weather illnesses and injuries, and advanced treatment of these conditions. [164]

HEAT

In the western hemisphere, the increase of heat and humidity is more prevalent during the late-spring through late-fall months. During this time of year, athletes of all sports, levels of fitness, and condition take advantage of outdoor physical activity to train, practice, and compete. The U.S. Consumer Product Safety Commission National Electronic Injury Surveillance System (NEISS) nationally estimates, 54,983 (1,518-actual) heat-related injuries occurring in the United States from 1997 through 2006. Of these injuries, 47% (26,171-national estimation; 750-actual cases) occurred in age's 19-years and younger, with 75.5% (41,538-national estimation; 1,191-actual cases) of all cases reported during sports and exercises. [167]

The presence of heat and humidity during exercises can negatively affect athletes who may have predisposing medical conditions *(i.e. asthma, cardiovascular disease, diabetes, spinal cord injuries, sickle cell*), are considered a special population *(i.e. children, persons over 50-years old, gender, ethnicity*), environmental factors (*i.e. ambient air temperature, relative humidity, wind and the amount of radiant heat*), and non-environmental factors *(i.e. acclimatization to the heat, history of previous heat illnesses and injury, clothing/layering, current medication and nutrition/hydration status*). The aforementioned may require these athletes to require more supervision, general awareness, more progression through activities, more frequent breaks, onsite and readily available shaded and cooling areas, and immediate medical treatment. [167-171]

As the severity of heat related injuries can quickly progress, prior action planning, educational awareness, and modification of activity is critical to prevent the incidence of such injuries during practices and games. Recognition of heat related injuries, and immediate initial care can limit the severity of these injuries, and promote more successful outcomes by league officials, coaches, athletes and parents/guardians. Healthcare professionals, especially those

involved in emergency medicine response services and departments should be aware of the increased risk factors of hot weather illnesses and injuries and advanced treatment of these conditions, especially the warmer and more humid months.

LIGHTNING

The National Weather Service estimates that more than 400-people are struck by lightning annually, resulting in approximately 70-deaths each year. [172] From 2006-2012, 238-people were reported to have been struck, and died as a result of lightning strikes in the United States. [173] Of these fatalities, 152-deaths involved people participating in leisure activity which included water-related activities, outdoor daily and weekly routines/activities and sports participation. Related to sports participation, 29-deaths occurred while participating in soccer (41%), golf (28%), running (17%), baseball (10%) and football (3%). In this study, the authors cite the inclination to cancel or postpone activity, a lack of awareness of approaching or developing storms, vulnerability of activity, and the ability and willingness to get to a safe place quickly. Each is considered as a potential risk factor which could lead to a higher incident rate for lightning strike injuries and mortalities if not corrected.

In another study, Holle [174] examined lightning deaths from 2003 through 2012. In his findings, the United States reported 349-deaths associated with lightning strikes. Resulting from lighting strikes, Iowa recorded three-deaths (0.8%), ranking in at 33rd in the United States. This is significantly less than the States of Florida (52-deaths), Texas (24-deaths), Colorado (24-deaths), North Carolina (18-deaths), Georgia (17-deaths), New Jersey (13-deaths) and Alabama, Missouri, Ohio and Pennsylvania (11-deaths each).

Curran and Holle [175] examined lightning fatalities, injuries and damages in the United States from 1959 through 1994. In their findings, Storm Data, a publication by the National Oceanic and Atmospheric Administration, concluded during a 30-year period, 3,239-deaths, 9,818-injuries and 19,814-property-damage occurred as a result of lightning. Broken down by region, the Northern Plains (ND, SD, NE, MN, and IA) accounted for 190-deaths, with Iowa accounting for 34% (65) deaths in this region as a result of lightning strikes. Regionally, lightning strikes occurred mostly in the months between April and October. Throughout the United States most lightning casualties were reported in other/non reported locations (40.4%) [Northern Plans Region 38.6%] followed by open fields and ballparks (26.8%) [Northern Plans Region 27.1%] followed by under trees (13.7%) [Northern Plans Region 14.8%].

Based on a straight yearly average of deaths resulting from lightning strikes, a decrease in deaths per year from 107.9 in Curran and Holle's data (1959-1994), to 34.9-deaths per year in Holle data (2003-2012) to 34.0-deaths per year in Jenseniurs Jr data (2006-2012) can be observed. This decrease in deaths per year may be attributed to new partnerships between the National Weather Service and Eclectic Power Research Institute in the 1980's and 1990's, the development of the National Lightning Detection Network, the National Weather Service general lightning awareness campaigns which began in early 2000, affordability of products, services and technology, and an increase in general community and public awareness regarding inclement weather.

League administrators, coaches, and volunteers should take advantage of educational resources such as lightning safety position statements by the National Athletic Trainers'

Association [176, 177] and awareness information and assistance by the National Weather Service, [173] in reducing lightning related injuries and deaths. Information includes the need for establishing a lightning-specific emergency action plan, increase lightning and general weather awareness, identifying safe and unsafe locations from lightning, criteria for postponement and resumption of activity, large event planning, first-aid and personal safety, and notification of participants of lightning danger.

TORNADO

More common during the late spring and summer months and lasting until the late summer and fall months, [178] tornadoes can strike with little to no notice and cause severe injuries, fatalities and property damage.

Excluding Alaska, tornadoes have occurred and been reported in every state in the United States, as well as occurrences in other countries such as Europe, Asia, Australia, South America and Africa. [179] Specific to the mid-west and southeast, Florida and Tornado Alley annually report high tornado activity throughout the year. The National Oceanic and Atmospheric Administration (NOAA), identifies tornado alley as the area in central Texas, westward to eastern Colorado, northward to northern Nebraska and Iowa and even reaching as high as eastern South Dakota, and eastward to Ohio, and the states between. [179, 180]

The occurrence of tornado and athletics is not commonly reported in available literature. From 1950 through 2007, there have been 50,445 tornadoes in the United States, resulting in 4,860 fatalities, and 82,062 injuries. [181] Data collected by National Oceanic and Atmospheric Administration on tornado activity for the general public reports (2001-2012), [182] the United States averages annually 1,297-tornadoes, resulting in approximately 98.83-deaths each year. Data from National Oceanic and Atmospheric Administration shows the state of Iowa averages 57-tornadoes per year and one-fatality accounted for during a ten-year period (2001-2010) (Table 7), which is an increase in the number of tornadoes in the state during a 30-year period (1981-2010) [182] of 48-torndaos, which resulted in one-fatality.

With no studies available reporting injury or death, as a result of tornadoes, a similar approach to other weather related injuries can be utilized to reduce injury and death to athletic leagues and communities. As tornadoes can occur with little to no warning, action planning and consideration must be given to proper working and early warning detection systems, and reasonably close tornado-safe shelters for athletes and spectators. A common consideration often neglected by decision-making individuals for athletics is the access and availably of responding emergency medical services in the event of inclement weather to their event.

Environmental injuries caused by cold and hot weather, lightning, and tornadoes should continue to decrease as weather models further develop and technology continues to improve and become more affordable with more resources.

Utilizing appropriate venue and weather specific action plans, along with educating those involved in athletics in injury recognition, appropriate initial care following injury, and modification of activity can help reduce unnecessary injuries caused by environmental weather conditions. Safe-shelters must be available to all of those involved in athletics, be immediately available, and be a reasonable distance from the athletic grounds should weather patterns abruptly change.

Persons involved with athletics must take responsibility and willingness to delay, cancel or postpone athletic activity in the event of impending inclement weather.

INJURY RECOGNITION

The Center for Disease Control and Prevention revealed a plan in 2012, aimed at preventing injuries and promoting safety of children and adolescents in the United States.[183] 2.6 million sports and recreational injuries were evaluated by emergency departments in 2009. [32] Unfortunately, this does not accurately account for those individuals who sought medical

2.6 million sports and recreational injuries were evaluated by emergency departments in 2009. [32]

care from their primary care and other specialist physicians, physical therapy clinicians, athletic trainers and other healthcare professionals.

Injuries as a result of athletic participation and activity cannot be thought of as *what if*, but rather when and how often. Successful outcomes of any injury relies on administrators, coaches, parents and athletes to correctly identify non-emergency and emergency injury(s), initiate the correct response (action planning), clear communication during the injury process, and providing immediate care following its initial occurrence with necessary follow-up.

Recommended by American Academy of Family Physicians, American Academy of Pediatrics, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine and the American Osteopathic Academy of Sports Medicine is the utilization of pre-participation physical exams (PPE) [184, 185] as a means of injury recognition, management and prevention.

In most cases the PPE, [186] includes general health demographics (height, weight, blood pressure, visual screening etc.), followed by a general medical and orthopedic assessment. Through this evaluation, the detection of any previous unknown underlying conditions or potential problems could be identified, requiring the modification, restriction of activity until further follow-up, and reintegration into activity.

If an athlete is returning to sport after an orthopedic-based injury, a correct progression for return to play and/or brace or other equipment modifications can be created to allow safe return to activity. Protocol can be created with the physician, parent/guardian and the athlete to incorporate the specific demands the sport(s) places on the individual.

If the athlete has a medical condition(s) such as allergies and anaphylaxis reactions, [187-195] asthma, [149, 196-205] diabetes, [9, 10, 149, 206-208] epilepsy, [209] and sickle cell, [210-218] etc., an appropriate plan of medical care can be developed with the physician, parent/guardian and the athlete to incorporate the specific demands the sports places on the individual and may include any medications, restrictions and modifications, or need for medical follow-up.

As league administrators, coaches, and volunteers will be onsite during practices and competition, it is imperative for parents to communicate with these individuals the athlete's specific medical action plan so the athlete can fully participate based on their limitation(s), restriction(s), and modification(s). Bracing and the appropriate medication(s) should also be considered to be onsite and available for the athlete to use in order to avoid emergency

situations. A written copy of this plan should also be submitted with any other league mandated paperwork, waivers, and insurance requirements.

INJURY RECOGNITION: NON-EMERGENCY INJURIES

For some injuries, medical follow-up is required immediately after incident to prevent permanent disfigurement, disability and lasting injury, while others can follow-up with their primary care physician or therapists in the subsequent day(s) following.

The reduction and management of non-emergency based injuries relies heavily upon the ability to immediately recognize injuries when they occur, provide appropriate initial care and treatment after they occur, and properly progress these individuals back into activity is critical to the success of returning athletes back into the game without the possibility of reoccurring episodes.

A majority of all athletic-centric epidemiology studies are derived from emergency departments, or specific clinical settings (professional, collegiate, and secondary/high school), with no current available studies that focus on injuries from the clinical setting of youth and recreational based sports. In the professional, collegiate, and secondary/high school levels of athletic competition and in emergency department data, the occurrence of sprains, strains, abrasions, contusions, fractures, dislocations, subluxations and concussions have been demonstrated. (APPENDIX A-H) Specific injuries, such as those to the face, [219, 220] nose, [221] eyes, [222-224] teeth and jaw, [225-228] and organ system [229-232] have also been reported to occur in athletics in a wide assortment of sports.

Not included in these epidemiology studies, is the occurrence of skin infections, which occurs throughout all athletes, teams, leagues and communities. Approximately one- in every three-people throughout the United States will have a skin disease at any time. [233] From 1922 through 2005, skin infections remain the leading cause of infection in athletes (56%). [234]

While the sport of wrestling is synonymous with skin infections due in large to its common occurrence, environmental favorability factors, transmission accessibility during activity, and rules governing athletic participation during periods of infection, skin infections, however, can occur in all sports, especially if the sports require contact with other athletes, crowded locker room conditions and hygiene deficiencies. Common sports associated with these conditions are football, rugby, and basketball, and any other sport that shares common equipment such as baseball and softball.

A 16-year (1988/90-2003/04) epidemiology study of collegiate wrestling programs throughout the United States found herpes simplex (40.5%) the most common infection, followed by fungal infections [ringworm] (22.1%), impetigo (14.2%), bacterial skin infection (10.7%), other types (7.7%) of infections followed by herpes zoster [chicken pox] (4.8%). [75]

When comparing high school and collegiate wrestling epidemiology statistics, a 2005-2006 study [76] reported a stronger occurrence of skin infections in collegiate wrestlers (20.3%) as compared to high school wrestlers (8.5%). When examined closer, collegiate wrestling physician notes were provided in 79% of all cases which included a proper diagnosis. The top five-skin infections in collegiate wrestlers were herpes (47.1%), impetigo (36.8%), tinea corpus (7.4%), cellulitis (5.9%), and methicillin-resistant staphylococcus aureus (2.9%). High school

aged wrestler's physician notes were provided in 83% of cases reported, however only one-third included a proper diagnosis. The top three-skin infections in high school wrestlers were impetigo (30%), herpes (20%), and ringworm (20%).

In 2000, a year-long high school wrestling study focusing on common injury patterns in high school wrestlers was studied. Of the 14-participating Cincinnati, Ohio high schools (418-wrestler athletes), authors indicated 19-skin infections occurring during the season long study, with impetigo being the most commonly diagnosed. [74]

An infection once thought to occur in hospitals, methicillin-resistant staphylococcus *aureus* (MRSA) is now considered a 'superbug' [240] effecting areas outside the hospital and in the community at large. Staphylococcus aureus was first described in 1882, [235] and evolved into its penicillin based medication resistance (MRSA) in 1961. [236] MRSA resistance to penicillin based antibiotics has thought to be the result of regular and overuse of antibiotics over the years. [237]

The prevalence of MRSA has been reported in numerous countries [238] including the United States. When examining United States hospitals from 1975 through 1991, it was revealed that 66,132 cases of staphylococcus aureus occurred, of which, 6,986 (11%) cases demonstrated resistance to methicillin-based antibiotics. Cases of staphylococcus aureus resistant to methicillin-based antibiotics increased from 1975 (2.4%) to 1991 (29%). [239]

MRSA is commonly transmitted through crowded conditions, frequent skin-to-skin contact, compromised skin (i.e. openings in the skin such as lacerations or abrasions), containment items and/or surfaces and a general lack of cleanliness, [240, 241] which consequently, and unfortunately are commonly associated with today's athletic programs and athletes. Not excluding any level of athletics, outbreaks of MRSA have been cited from the professional ranks of the NFL [242] all the way through the collegiate [243-246] and high school [247-249] levels.

After examining available research, a 2006 literature review of infectious disease outbreaks in competitive sports [234] revealed the herpes simplex virus and staphylococcus aureus occurring most frequently, and occurring most commonly in sports such as wrestling, rugby and football. Other infectious outbreaks included enterovirues (i.e. common cold) (19%), tinea (i.e. ringworm) (14%), streptococcus pyogenes (i.e. pharyngitis/strep throat, impetigo) (7%), and hepatitis A and B virus (7%).

> **League administrators, coaches, parents, athletes and healthcare professionals alike, *must be aware* of the signs and symptoms of common skin infections such as herpes, tinea/fungal infections, impetigo, cellulitis, bacterial infections and MRSA to help in the *prevention of transmission*.**

While no studies appear in literature that examines youth-aged athletes and the prevalence of skin infections, other clinical setting have demonstrated their existence. League administrators, coaches, parents, athletes and healthcare professionals alike, must be aware of the signs and symptoms of common skin infections such as herpes, tinea/fungal infections, impetigo, cellulitis, bacterial infections and MRSA to help in the prevention of transmission. And minimize skin infection outbreaks. Regardless of the infection, educational

knowledge and awareness are critical for league administrators, coaches, parents, athletes and the healthcare community.

INJURY RECOGNITION: EMERGENCY INJURIES

Merriam-Webster defines an emergency (medical) [250] as an unforeseen combination of circumstances or the resulting state that calls for immediate action and such as sudden bodily alteration is likely to require immediate medical attention.

While not all injuries are preventable, the outcomes for all injuries can be dictated by the ability to immediately recognize the injury and situation, the immediate initiation of an appropriate action plan, deliver applicable initial care, and the rapid response of advanced medical care.

An abrasion or laceration not cleaned, covered, and monitored can result in the possible development of a more serious infection such as MRSA or the poor management of a participation integration plan of athletes who have such conditions as allergic reactions, asthma, diabetes, and sickle cell. Each is considered an example of non-emergency injuries and conditions becoming emergency situations requiring immediate medical attention.

Action planning, awareness, recognition of an injury or illness, initial care for fractures and dislocations, weather related injuries, general medication conditions, cases of cardiac arrest, and spine related and catastrophic injuries [85] is imperative for league administrators, coaches, parents/guardians, athletes and healthcare workers to limit severity and provide better-quality outcomes. [251-255]

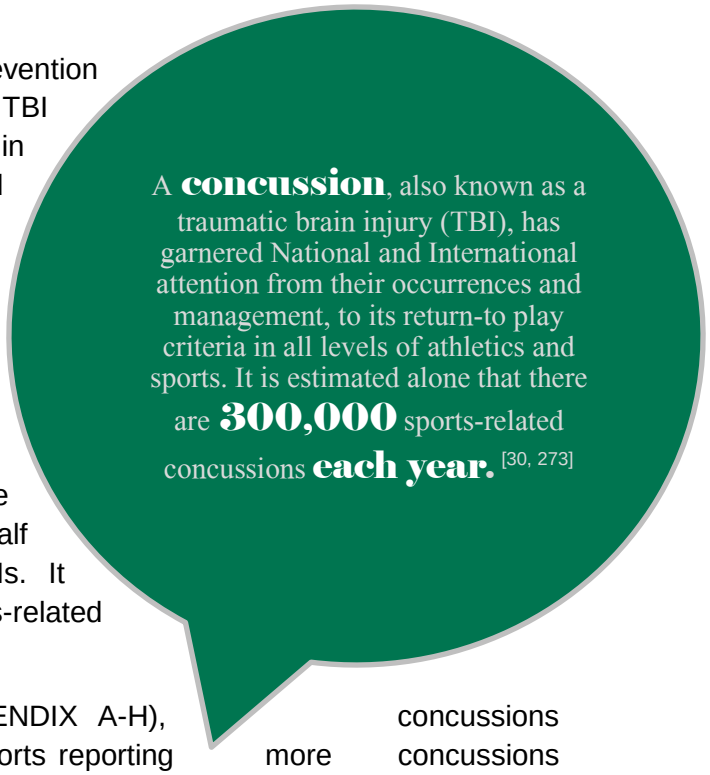
Onsite management, stabilization and maintenance of the circulation, airway and breathing are essential during emergency injuries, including cases of neurovascular compromise and spine trauma and injury. [256] Technical skills, ability and proficiency for league administrators, coaches, and volunteers is critical during the management of airway and spine management in equipment and helmet intensive sports [251] such as football, [257-262] and ice hockey. [219] Requiring the technical skill, ability, and proficiency [264-268] in the action plan for emergency injuries, is the transition of the injured athlete(s) and/or spectator(s) from the playing field/surface and stands, to a stable and ridged surface, which is critical for transportation to advanced medical facilities. [263]

Management of circulation, airway and breathing, stabilization, and the need for advanced medical care is commonly seen in cases of spine trauma and injury. While 52% of all cervical spine injuries resulted from motor vehicle accidents, a review of cervical spine injuries in children, [269] reported 27% of cervical spine injuries occurred during sporting activities, most commonly reported in football (eight), followed by diving (five), soccer (three), wrestling (three), and basketball, trampoline, and sledding (each two). Of all cervical spine injuries reported in this study (103), all sports-related injuries involved children nine- through 19-years of age. Other cases of cervical spine injury described in the literature, occurred most commonly in children above the age of ten, and involved motor vehicle accidents, followed by sports and recreational injuries. [270, 271]

Those managing and treating spine-related injuries, must always consider the possibility of head injury cases of unconscious athletes and people, which could include fractures, hemorrhaging, and concussions.

A concussion, also known as a traumatic brain injury (TBI), has garnered national and international attention from their occurrences and management, to its return-to-play criteria in all levels of athletics and sports.

The Centers for Disease Control and Prevention estimates that 1.7-million people will sustain a TBI annually throughout the United States, resulting in death (52,000), hospitalization (275,000) and emergency department evaluation and release (1.365-million). [272] The estimation of TBIs does not accurately account for TBIs evaluated by other healthcare professionals, or go unreported or evaluated. Reports by the CDC indicate that children (zero-fourteen-years old), older adolescents (15-19-years old) and older adults sustain the greatest amount TBIs than any other age group, with children (zero-14-years old) making up half (473,947) of all emergency department visits for TBIs. It is estimated alone that there are 300,000 sports-related concussions occur each year. [30, 273]



As the literature has demonstrated (APPENDIX A-H), concussions have been documented in all sports, with some sports reporting more concussions than others. [274] The mismanagement and/or continued participation of unreported concussive signs and symptoms followed by an additional episode of head trauma can result in Second Impact Syndrome, [275, 276] which carries a high morbidity (100%) and mortality rate (50%) [277] following trauma.

With an increase emphasis on reducing concussive injuries, national and international medical and research leaders met with a goal of improving safety and the health for athletes affected by concussive injuries. Meeting for the first time in 2001 (in Vienna), [278] in 2004 (in Prague), [279] 2008 (in Zurich), [280] and in 2012, (in Zurich) [281] this group is continuing to strive to improve concussion evaluation, management and treatment.

With more studies examining the short- and long-term effects of concussions becoming available, [282-286] and different evaluation [287-291] methods and treatment techniques [292, 293] being created and modified based on research, future care and continued research can emphasize reducing their occurrence [294, 295] and minimizing signs and symptoms experienced after participating from this cumulative and debilitating injury. [296, 297]

Educational awareness is essential for the reduction of concussions. Disregarding its occurrences and severity, league administrators, coaches, parents and athletes must be aware of the signs and symptoms of a concussion, the importance of reporting these injuries when they occur, and proper progression when appropriate.

Head injuries caused by equipment should fall under league administrators, coaches, parents/guardians and most importantly, the athletes who wear or use it. While league administrators, coaches, and volunteers have a responsibility of teaching proper technique and foster good sportsmanship, parents/guardians and athletes have a responsibility not to waiver against poor technique and to practice good sportsmanship.

When properly reported, healthcare professionals evaluating these individuals must be knowledgeable and able to identify concussion signs and symptoms, aware of the latest means for evaluating and managing concussions, communicate with parents/guardians and athletes effectively regarding proper management, and correctly progress these individuals back into activity when appropriate.

INJURY PREVENTION

The prevention and reduction of athletic based injuries involves and requires the collective efforts of league administrates, coaches, parents/guardians, athletes and the healthcare community for success. Onsite basic prevention involves the elimination of pre-disposing features such as poor facility conditions, removal or the alteration of objects that could lead to the harm of athletes and its participants, faculty modification to allow primary and secondary access directly into the venue and spectator areas without impediment for responding medical services and care, teaching athletes correct technique and enforcing the rules.

Requiring pre-participation examinations helps identify previous unknown injuries, illness and conditions, updating the management and care for those known injuries, illness and conditions and helping physicians develop a professional relationship with the families and athletes who participate in athletics.

Involving appropriate and knowledgeable healthcare professionals in the education of prevalent and common athletic-based injuries is critical for league administrators, coaches, parents and athletes to increase awareness for potential injuries. [21] In order to allow athletes to take responsibility for their level of health, an environment must be established and maintained so athletes feel comfortable communicating and reporting injuries without the risk of punishment or belittlement by coaches, teammates, and parents/guardians. [21]

The next level of injury prevention for orthopedic and muscular related injuries may be as simple as the implementation of a proper warm-up, cool-down, and flexibly program, which are commonly neglected by athletes and athletic teams throughout the country due to the belief of time constraints.

Supported by the American College of Sports Medicine, [298] the National Strength and Conditioning Association, [299] the American Academy of Orthopaedic Surgeons (AAOS), [300] injury prevention can be as simple as correctly warming-up and cooling-down the body before and after exercises and implementing a flexibility program. Other studies have also demonstrated the importance of a proper warm-up and/or cool-down and flexibly programs as a means to prevent orthopedic and muscular related injuries. [301-306]

From an injury point of view, coaches must be able to recognize athletic-based injuries and to be able to take the initial steps to provide appropriate care. After initial care has been provided, parents and athletes must take the necessary follow-up steps to continue care and treatment, including but not limited to, following-up with a knowledgeable physician(s), and care by therapists, if necessary. When the athlete is permitted to return-to-play, they should be progressed back into activity per the instructions of the physician and/or designee, and communicated by the parent/guardian through the treating physician or therapists to prevent further injury or to prevent chronic injury(s) from occurring.

FROM AN INJURY POINT OF VIEW, COACHES MUST BE ABLE TO RECOGNIZE ATHLETIC BASED INJURIES AND TO BE ABLE TO TAKE THE INITIAL STEPS TO PROVIDE APPROPRIATE CARE.

On a larger scale, injury prevention may require monitoring the occurrence of injuries and their relationship to activity and injury. When trends are observed, appropriate changes can be aimed at reducing these injuries, whether the implementation of a warm-up and cool-down program, activity modification, rules and equipment modification and/or the implementation of a preventive exercise program.

In the 1990's, anterior cruciate ligament (ACL) sprains became fireside topic amongst league administrators, coaches, parents, athletes and the healthcare community. Today, approximately 80,000-100,000 people will tear their ACL each year, [307-309] and are more likely to occur in women as compared to men (3-4:1), [307, 310] are more common in sports such as basketball, soccer, lacrosse and skiing, [311, 312] and occurring by means of non-contact (58%-70%) activities. [313, 314]

Over the years, through proper documentation, continued research on mechanisms of injury, injury prevention exercises, and monitoring trends of changes, programs such as FIFA 11+1 [315, 316] and Santa Monica ACL PEP, [317] have become popular and effective for the prevention of ACL sprains in today's athletes.

With the rise of injuries throughout all levels and types of sports, other prevention programs have been created to reduce injuries such as overuse shoulder injuries in throwers, [318] golfers, [319] and tennis. [320] Where some are more susceptible to particular injuries, (*i.e. rowing with back and forearm injuries, swimming with shoulder injuries and ice hockey with groin injuries*), injury prevention programs are key to reduce the occurrence of injuries, and avoid time loss away from athletics, is regularly used in athletes from the professional level all the way through the collegiate and high school levels.

While larger scale injury prevention programs sound like an overwhelming responsibility, healthcare professionals knowledgeable in injury evaluation, management and injury prevention can be key resources in designing, monitoring, and modifying programs as needed.

CONCLUSION

In the educational training content above, the responsibility of reducing sports-related injuries through action planning, awareness of environmental concerns, the ability to recognize

injuries and provide initial care, and implement steps falls upon everyone involved in youth and recreational-based athletics. Together, league administrators, coaches, parents/guardians, athletes and healthcare professionals are responsible for decreasing the youth-aged athlete injury epidemic.

CONCLUSION

While current research specific to youth-aged athletics is limited, the occurrence and prevalence of athletic related injuries at all other levels of athletic competition have been demonstrated. Based on emergency room studies, and data and estimations by the Centers for Disease Control and Prevention, SafeKidsWorldWide and other national and international healthcare medical professional associations, healthcare professionals, parents/guardians and policy makers have indicated the need to reverse the epidemic of youth sports-related injuries.

In order to reduce and prevent sports-related injuries in children participating in municipal youth sports programs, at the request of the General Assembly Committee on Appropriations of the State of Iowa, the National Center for Sports Safety recommends [89] league administrators, coaches, and volunteers must undertake lifesaving educational training and attain appropriate supplies for performing first-aid, cardiopulmonary resuscitation, and automated external defibrillation.

Caused by athletics and environmental conditions, action planning can play a pivotal role in determining the outcome and successfulness of non-emergency and emergency injuries. Whether non-emergency or emergency in nature, being able to understand their causes, the ability to identify injuries at their occurrence, and providing initial treatment and follow-up is critical for the progression and return to activity and/or activities of daily living.

League administrators, coaches, athletes, parents/guardians and healthcare professionals all have a responsibility to recognize and prevent injuries. While the primary audience for this educational content is intended for league administrators, volunteers, and coaches, the successfulness of true athletic injury prevention relies on the integration of athletes, parents/guardians and healthcare professionals. Remember this: Most sports injuries are preventable, yet SafeKids Worldwide reported in 2012, that at least one in three adolescents are injured playing team sports, some with serious, life-impacting consequences. [33]

In order to demonstrate the effectiveness of these recommendations, data gathered at the local association and municipal level, must be accurately collected, analyzed and reported. Results from this epidemiological data can be compared to that of other data and estimations published to demonstrate its short- and long-term successfulness.

Examining changes in awareness, knowledge retention, and application of skills, as they are related to the changing rate of athletic injury should also be examined in all individuals involved with athletics, as a means of demonstrating successfulness, and if necessary, as a means of demonstrating the need to change or modify educational course content or means of delivery. As prevention programs are initiated and implemented, the effects of youth-aged injury prevention programs can be compared to that of other injury prevention programs reported at other levels athletic competition.

While league administrators, volunteers, and coaches must take an active role in the reduction and prevention of sports-related injuries, the involvement and active role of athletes, parents/guardians, and healthcare professionals is critical to the overall success of any program and community.

APPENDIX A: BASEBALL/SOFTBALL EPIDEMIOLOGY

APPENDIX A: BASEBALL/SOFTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Baseball/Softball

Author(s)	Powell, Barber-Foss	Lyman, Fleisig	Comstock, Yard, Knox, Manring
Study	Injury Patterns in Selected High School Sports: A Review of 1995-1997 Seasons	Baseball Injuries	Summary Report: High School RIO™ Internet-Based Surveillance of Injuries Sustained by US High School Athletes 2005-2006
Year	1999	2005	2006
Period of Study	1995-1997	Epidemiology Review of Literature	2005-2006
Population	Varsity Athletes only	7,584,397/15 years; 505,626/avg (Youth) 4,965/10 years; 497/avg (High School)	100 Randomly Selected RIO™ High Schools
Schools/Teams	246 High Schools	Not Specified	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Baseball & Softball	Baseball	Baseball & Softball
Athletic Exposure	311,295 AE Boys 258,754 AE Girls	Not Specified	162,931 AE (Base) 119,554 AE (Soft)
Injuries	861 Actual (Base) 910 Actual (Soft)	19,966- Injuries/15 years; 1331.07/avg (Y) 978- Injuries/10 years; 9/avg (HS)	60,296* [203 Actual] (Base) 54,411* [133 Actual] (Soft)
Rate of Injuries (Rate/Athletic Exposures)	2.8-Injuries per 1000, AE 3.5-Injuries per 1000, AE	0.27-9.5- Injuries per 100 athletes (Y) 0.74- Injuries per 1000 adolescent age (Y) 0.17-0.62- Injuries per 1000 AE (Y) 1.22-19.4- Injuries per 100 athletes (HS) 0.18- Injuries per 1000 AE (HS)	1.25- Injuries per 1,000 AE (Base) 1.11- Injuries per 1,000 AE (Soft)
Top Injuries	Type of Injury	Most Common Injuries*	(Competition) [Practice]
1	General Trauma (30.7%) Base (27.6%) Soft	Abrasions	Strain/Sprains (48%) [48%] Base (56%) [53%] Soft
2	Sprains (20.6%) Base (23.8%) Soft	Fractures	Contusion (18%) [10%] Base (16%) [11%] Soft
3	Strains (31.2%) Base (32.2%) Soft	Sprains/Strains	Fracture (18%) [13%] Base (18%) [11%] Soft
4	Fracture (8.8%) Base (8.4%) Soft	Lacerations	Other (13%) [26%] Base (13%) [15%] Soft
5	Musculoskeletal (6.6%) Base (3.8%) Soft		Concussion (6%) [3%] Base (5%) [10%] Soft
		*Injuries listed in order of most common	*Annual National Estimates

APPENDIX A: BASEBALL/SOFTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Baseball/Softball

Author(s)	Comstock, Yard, Collins	Collins and Comstock	Comstock, Yard, Collins
Study	Summary Report: High School Sports-Related Injury Surveillance Study, 2006-2007	Epidemiological of High School Baseball Injuries in the United States, 2005-2007	Summary Report: National High School Sports-Related Injury Surveillance Study, 2007-2008
Year	2007	2008	2008
Period of Study	2006-2007	2005-2007	2007-2008
Population	100 Randomly Selected RIO™ High Schools	High School Baseball Players	100 Randomly Selected RIO™ High Schools
Schools/Teams	Throughout the United States	100-High Schools	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Baseball & Softball	Baseball	Baseball & Softball
Athletic Exposure	162,931 AE (Base) 119,554 AE (Soft)	341,883 AE	186,264 AE (Base) 144,954 AE (Soft)
Injuries	203- Injuries (Base) 133- Injuries (Soft)	431- Injuries	44,760*- Injuries [173-Actual] (Base) 63,316*- Injuries [187-Actual] (Soft)
Rate of Injuries (Rate/Athletic Exposures)	1.25- Injuries per 1000 AE 1.11- Injuries per 1000 AE	1.26- Injuries per 1000 AE	0.93- Injuries per 1,000 AE (Base) 1.29- Injuries per 1,000 AE (Soft)
Top Injuries	(Competition) [Practice]	All Injuries, All Body Sites	(Competition) [Practice]
1	Strain/Sprains (45%) [48%] Base (48%) [53%] Soft	Ligament Sprain (21%)	Strain/Sprains (47%) [54%] Base (36%) [30%] Soft
2	Fracture (18%) [13%] Base (18%) [11%] Soft	Muscle Strain (20%)	Contusion (17%) [7%] Base (27%) [15%] Soft
3	Contusion (18%) [10%] Base (16%) [11%] Soft	Contusion (16.1%)	Fracture (20%) [7%] Base (7%) [14%] Soft
4	Other (13%) [26%] Base (13%) [15%] Soft	Fracture (14.2%)	Other (15%) [32%] Base (24%) [37%] Soft
5	Concussion (6%) [3%] Base (5%) [10%] Soft	Concussion (3.5%)	Concussion (1%) [0%] Base (6%) [4%] Soft
	*Annual National Estimates		*Annual National Estimates

APPENDIX A: BASEBALL/SOFTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Baseball/Softball

Author(s)	Comstock, Yard, Collins, McIlvain	Comstock, Collins, McIlvain	Krajnik, Fogarty, Yard, Comstock	
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2008-2009	Summary Report: National High School Sports-Related Injury Surveillance Study 2009-2010	Shoulder Injuries in US High School Baseball and Softball Athletes, 2005 2008	
Year	2009	2010	2010	
Period of Study	2008-2009	2009-2010	2005-2008	
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	74-High Schools	
Schools/Teams	Throughout the United States	Throughout the United States	74 High School Teams	
Location	Throughout the United States	Throughout the United States	Throughout the United States	
Sport	Baseball & Softball	Baseball & Softball	Baseball	Softball
Athletic Exposure	185,622 AE (Base) 141,008 AE (Soft)	162,530 AE (Base) 123,016 AE (Soft)	528,147 AE	399,522 AE
Injuries	39,869*- Injuries [144-Actual] (Base) 49,831*- Injuries [146-Actual] (Soft)	64,053*- Injuries [134-Actual] (Base) 67,862*- Injuries [138-Actual] (Soft)	91- Injuries	40- Injuries
Rate of Injuries (Rate/Athletic Exposures)	0.78- Injuries per 1,000 AE (Base) 1.04- Injuries per 1,000 AE (Soft)	0.82- Injuries per 1,000 AE (Base) 1.12- Injuries per 1,000 AE (Soft)	1.72- Injuries per 10,000 AE	1.00- Injuries per 10,000 AE
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	Only Shoulder Injuries	
1	Strain/Sprains (36%) [42%] Base (41%) [39%] Soft	Strain/Sprains (35%) [35%] Base (49%) [48%] Soft	Muscle Strains (35%)	Muscle Strains (35%)
2	Other (22%) [27%] Base (18%) [22%] Soft	Other (19%) [26%] Base (21%) [16%] Soft	Tendonitis (13%)	Tendonitis (16%)
3	Contusion (19%) [17%] Base (15%) [12%] Soft	Fracture (21%) [23%] Base (5%) [16%] Soft	Ligament Sprain (10%)	Ligament Sprain (10%)
4	Fracture (17%) [12%] Base (12%) [15%] Soft	Contusion (17%) [15%] Base (9%) [14%] Soft	Tendon Strain (9%)	Tendon Strain (9%)
5	Concussion (6%) [2%] Base (14%) [12%] Soft	Concussion (8%) [1%] Base (16%) [6%] Soft	Contusion Dislocation Inflammation (8% ea.)	Contusions Dislocation Torn Cartilage (5% ea.)
	* Annual National Estimates	*Annual National Estimates		

APPENDIX A: BASEBALL/SOFTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Baseball/Softball

Author(s)	Comstock, Collins, McIlvain	Comstock, Collins, Corlette, Fletcher	Comstock, Collins, Currie
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2010-2011	Summary Report: National High School Sports-Related Injury Surveillance Study 2011-2012	Summary Report: National High School Sports-Related Injury Surveillance Study 2012-2013
Year	2011	2012	2013
Period of Study	2010-2011	2011-2012	2012-2013
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/Teams	Throughout the United States	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Baseball & Softball	Baseball & Softball	Baseball & Softball
Athletic Exposure	164,130 AE (Base) 129,861 AE (Soft)	163,418 AE (Base) 118,407 AE (Soft)	182,376 AE (Base) 127,172 AE (Soft)
Injuries	46,796*- Injuries [133 Actual] (Base) 52,700*- Injuries [122 Actual] (Soft)	43,590*- Injuries [135 Actual] (Base) 91,053*- Injuries [173 Actual] (Soft)	49,747*- Injuries [161 Actual] (Base) 58,124*- Injuries [147 Actual] (Soft)
Rate of Injuries (Rate/Athletic Exposures)	0.81- Injuries per 1,000 AE (Base) 0.94- Injuries per 1,000 AE (Soft)	0.83- Injuries per 1,000 AE (Base) 1.46- Injuries per 1,000 AE (Soft)	0.88- Injuries per 1,000 AE (Base) 1.15- Injuries per 1,000 AE (Soft)
Top Injuries	(Competition) [Practice}	(Competition) [Practice]	(Competition) [Practice]
1	Sprain/Strains (40%) [41%] Base (40%) [32%] Soft	Strain/Sprains (35%) [34%] Base (40%) [40%] Soft	Strains/Sprains (42%) [51%] Base (42%) [60%] Soft
2	Other (19%) [25%] Base (12%) [23%] Soft	Other (21%) [40%] Base (8%) [18%] Soft	Other (22%) [24%] Base (12%) [22%] Soft
3	Concussion (15%) [10%] Base (15%) [17%] Soft	Concussion (20%) [10%] Base (25%) [17%] Soft	Concussion (12%) [5%] Base (17%) [8%] Soft
4	Contusion (13%) [4%] Base (16%) [13%] Soft	Contusion (14%) [7%] Base (17%) [17%] Soft	Contusion (14%) [14%] Base (21%) [5%] Soft
5	Fracture (13%) [20%] Base (17%) [15%] Soft	Fracture (10%) [9%] Base (10%) [8%] Soft	Fracture (10%) [6%] Base (8%) [5%] Soft
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

APPENDIX B: BASKETBALL EPIDEMIOLOGY

APPENDIX B: BASKETBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Basketball

Author(s)	Powell, Barber-Foss	Starkey	Comstock, Yard, Knox, Manring
Study	Injury Patterns in Selected High School Sports: A Review of 1995-1997 Seasons	Injuries and Illnesses in the National Basketball Association: A 10-Year Perspective	Summary Report: High School RIO™ Internet-Based Surveillance of Injuries Sustained by US High School Athletes 2005-2006
Year	1999	2000	2006
Period of Study	1995-1997	1988/89-1997/98	2005-2006
Population	Varsity Athletes only	3,843-Professional Basketball Players	100 Randomly Selected RIO™ High Schools
Schools/Teams	246-High Schools	25-NBA Teams	Throughout the United States
Location	Throughout the United States	United States (NBA Teams)	Throughout the United States
Sport	Basketball (Boys and Girls)	Men's Basketball	Basketball Data Only
Athletic Exposure	444,338 (Boys) 394,143 (Girls)	200,012-Total Practice Minutes	218,342 AE (Boys) 186,161 AE (Girls)
Injuries	1,933-Injuries (Boys) 1,748-Injuries (Girls)	9,904-Injuries (All) 4,277-Injuries (Game)	101.105*-Injuries (416-Actual) Boys 110,891*-Injuries (392-Actual) Girls
Rate of Injuries (Rate/Athletic Exposures)	4.8- Injuries per 1000 AE (Boys) 4.4- Injuries per 1000 AE (Girls)	21.4/1000 AE (Forwards) 21.3/1000 AE (Guards) 21.0/1000 (Centers)	1.9- Injuries per 1,000 AE (Boys) 2.0- Injuries per 1,000 AE (Girls)
Top Injuries	Type of Injury	Type of Injury	Type of Injury
1	Sprains (44.8%) Boys (45.2%) Girls	Sprain (20.9%)	Sprain/Strain 55.7% Boys 60.9% Girls
2	General Trauma (24.8%) Boys (20.3%) Girls	Upper Respiratory Infection (16.7%)	Other/Unknown 16.5% Boys 11.8% Girls
3	Strains (15.1%) Boys (17.7%) Girls	Strain or Spasm (16.2%)	Contusion 12% Boys 5.6% Girls
4	Fracture (8.6%) Boys (6.8%) Girls	Inflammatory (15.3%)	Fracture 11.2% Boys 48.6% Girls
5	Neurotrauma (1.7%) Boys Musculoskeletal (4.0%) Girls	Contusion (11.8%)	Concussion 3.4% Boys 16.5% Girls
			*Annual National Estimates

APPENDIX B: BASKETBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Basketball

Author(s)	Agel, Olson, Dick, Arendt, Marshall, Sikka		Dick, Hertel, Agel, Grossman, Marshall		Comstock, Yard, Collins
Study	Epidemiology of Collegiate Women's Basketball Injuries 1988/89-2003/04		Epidemiology of Collegiate Men's Basketball Injuries 1988/89-2003/04		Summary Report: High School Sport-Related Injury Surveillance Study 2006-2007
Year	2007		2007		2007
Period of Study	1988/89-2003/04		1988/89-2003/04		2006-2007
Population	NCAA Division 1,2,3 Institutions		NCAA Division 1,2,3 Institutions		100 Randomly Selected RIO™ High Schools
Schools/ Teams	113-sponsoring programs		110-sponsoring programs		Throughout the United States
Location	Throughout the United States		Throughout the United States		Throughout the United States
Sport	Women's Basketball		Men's Basketball		Basketball Data Only
Athletic Exposure	134,786 AE (Practices) 45,295 AE (Games)		140,678 AE (Practices) 45,294 AE (Games)		204,897 AE (Boys) 102,831 AE (Girls)
Injuries	6,665-Injuries (Practices) 3,556-Injuries (Games)		7,833- Injuries (Practices) 4,211- Injuries (Games)		96,670 * (359-Actual) Boys 102,831* (358-Actual) Girls
Rate of Injuries	3.99- Injuries per 1000 AE (Practice) 7.68- Injuries per 1000 AE (Games)		4.3- Injuries per 1000 AE (Practice) 9.9- Injuries per 1000 AE (Games)		1.75- Injuries per 1,000 AE (Boys) 2.09- Injuries per 1,000 AE (Girls
Top Injuries	Practice	Games	Practice	Games	(Competition) [Practice]
1	Ankle Sprain (23.6%)	Ankle Sprain (26.6%)	Ankle Sprain (26.8%)	Ankle Sprain (26.2%)	Sprain/Strain (57%) [60%] Boys (56%) [51%] Girls
2	Knee Derangement (9.2%)	Knee Derangement (15.9%)	Knee Derangement (6.2%)	Knee Derangement (7.4%)	Contusion (12%) [66%] Boys (9%) [7%] Girls
3	Upper Leg Strain (5.0%)	Concussion (6.5%)	Hip Strain (4.4%)	Contusion (3.9%)	Fracture (12%) [11%] Boys (7%) [8%] Girls
4	Unspecified (4.3%)	Unspecified (2.7%)	Patella, Patella Tendon (3.7%)	Concussion (3.6%)	Other/Unknown (12%) [21%] Boys (19%) [29%] Girls
5	Patella, Patella Tendon (4.0%)	Patella, Patella Tendon (2.4%)	Low Back Strain Upper Thigh Strain (3.6% ea.)	Patella, Patella Tendon (2.4%)	Concussion (7%) [2%] Boys (9%) [5%] Girls
					*Annual National Estimates

APPENDIX B: BASKETBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Basketball

Author(s)	Comstock, Yard, Collins, McIlvain	Comstock, Collins, McIlvain	Comstock, Collins, McIlvain
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2008-2009 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2009-2010 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2010-2011 School Year
Year	2009	2010	2011
Period of Study	2008-2009	2009-2010	2010-2011
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/ Teams	Throughout the United States	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Basketball Data Only	Basketball Data Only	Basketball Data Only
Athletic Exposure	236,419 AE (Boys) 191,871 AE (Girls)	201,706 AE (Boys) 168,408 AE (Girls)	207,091 AE (Boys) 168,574 AE (Girls)
Injuries	79,230*-Injuries (319-Actual) Boys 64,933*-Injuries (295-Actual) Boys	85,063*-Injuries (293 Actual) Boys 78,708*-Injuries (266 Actual) Girls	79,762*-Injuries (280 Actual) Boys 83,033*-Injuries (292 Actual) Girls
Rate of Injuries	1.35- Injuries per 1,000 AE (Boys) 1.54- Injuries per 1,000 AE (Girls)	1.45- Injuries per 1,000 AE (Boys) 1.58- Injuries per 1,000 AE (Girls)	1.35- Injuries per 1,000 AE (Boys) 1.73- Injuries per 1,000 AE (Girls)
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	(Competition) (Practice)
1	Sprain/Strain (46%) [50%] Boys (51%) [59%] Girls	Sprain/Strain (49%) [58%] Boys (56%) [55%] Girls	Sprain/Strain (43%) [63%] Boys (44%) [60%] Girls
2	Contusion (11%) [11%] Boys (5%) [7%) Girls	Contusion (11%) [7%] Boys (8%) [10%) Girls	Contusion (12%) [5%] Boys (5%) [4%) Girls
3	Fracture (14%) [7%] Boys (10%) [8%] Girls	Fracture (11%) [10%] Boys (5%) [7%] Girls	Fracture (14%) [9%] Boys (8%) [3%] Girls
4	Other/Unknown (18%) [23%] Boys (17%) [18%] Girls	Other/Unknown (12%) [10%] Boys (15%) [19%] Girls	Other/Unknown (12%) [14%] Boys (17%) [16%] Girls
5	Concussion (8%) [2%] Boys (17%) [8%] Girls	Concussion (17%) [8%] Boys (17%) [9%] Girls	Concussion (19%) [9%] Boys (26%) [18%] Girls
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

APPENDIX B: BASKETBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Basketball

Author(s)	Pappas, Zazulak, Yard, Hewett	Comstock, Collins, Corlette, Fletcher	Comstock, Collins, Currie
Study	Epidemiology of Pediatric Basketball Injuries Presenting in US Emergency Departments: 2000-2006	Summary Report: National High School Sports-Related Injury Surveillance Study 2011-2012 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2012-2013 School Year
Year	2011	2012	2013
Period of Study	2000-2006	100 Randomly Selected RIO™ High Schools 2011-2012	100 Randomly Selected RIO™ High Schools 2012-2013
Population	100 NEISS Hospitals	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/ Teams	Not Specified	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Boys and Girls Basketball (7-17 years old)	Basketball Data Only	Basketball Data Only
Athletic Exposure	Not Specified	208, 696 AE (Boys) 167,052 AE (Girls)	229,897 AE (Boys) 183,137 AE (Girls)
Injuries	325,465 *-Injuries [9,790-Actual)	75,872*-Injuries (292-Actual) Boys 67,280*-Injuries (263-Actual) Girls	85,819*-Injuries (337-Actual) Boys 83,107*-Injuries (336-Actual) Girls
Rate of Injuries	151 per 100,000 Athletic Days (Boys) 124 per 100,000 Athletic Days (Girls)	1.40- Injuries per 1,000 AE (Boys) 1.57- Injuries per 1,000 AE (Girls)	1.47- Injuries per 1,000 AE (Boys) 1.83- Injuries per 1,000 AE (Girls)
Top Injuries	Top Injuries Reported in ED	(Competition) [Practice]	(Competition) [Practice]
1	Ankle Sprain (21.7%)	Sprain/Strain (44%) [51%] Boys (45%) [61%] Girls	Sprain/Strain (42%) [57%] Boys (45%) [53%] Girls
2	Finger Sprain (8.0%)	Contusion (11%) [5%] Boys (12%) [6%) Girls	Contusion (10%) [6%] Boys (9%) [8%) Girls
3	Finger Fracture (7.8%)	Fracture (13%) [5%] Boys (6%) [2%] Girls	Fracture (13%) [8%] Boys (5%) [7%] Girls
4	Knee Sprain (3.9%)	Other/Unknown (14%) [30%] Boys (10%) [19%] Girls	Other/Unknown (19%) [17%] Boys (19%) [17%] Girls
5	Facial Lacerations (3.9%)	Concussion (18%) [9%] Boys (27%) [12%] Girls	Concussion (16%) [17%] Boys (28%) [14%] Girls
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

APPENDIX C: CHEERLEADING EPIDEMIOLOGY

APPENDIX C: CHEERLEADING EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Cheerleading

Author(s)	Jacobson, Gubbard, Redus, Price, Palmer, Purdie, Altena	Schulz, Marshall, Yang, Mueller, Weaver, Bowling	Jacobson, Redus, Palmer
Study	Assessment of High School Cheerleading	Injury Incident in North Carolina High School Competitive Cheerleaders	Assessment of Injuries in College Cheerleading
Year	2004	2004	2005
Period of Study	Not specified	1996-1999	Not specified
Population	High School Cheerleaders (14-18 years old) 425- Cheerleaders	North Carolina High School Sponsoring Cheerleading	Collegiate Cheerleaders (18-23 years old) (only females athletes were chosen) 440 cheerleaders
Schools/ Teams	104 of the largest class division high schools were randomly selected	91- High Schools	30-Random Universities from 62-Universities 23-Universities fully participated
Location	3-state area in the Midwestern United States	North Carolina	6 geographic regions throughout the United States
Sport	Cheerleading	Cheerleading	Cheerleading
Athletic Exposure	Not specified	Not specified	Not specified
Injuries	263- Injuries [Actual]	133- Injuries [Actual]	184- Injuries [Actual]
Rate of Injuries	Not specified	8.7- Injuries per 10,000 AE	Not specified
Top Injuries	Top Injuries by Sites	Top Injuries by Sites	Top Injuries by Sites
1	Ankle (24.4%)	Sprain (32.9%)	Ankle (44.9%)
2	Back (16.1%)	Fracture/Stress Fracture (17.3%)	Wrist/Hand (19.3%)
3	Wrist/Hand (15.6%)	Abrasions/Contusions (12.1%)	Knee (11.9%)
4	Elbow (11.7%)	Strain (15.4%)	Head/Neck (10.2%)
5	Knee (7.8%)	Concussion (6.3%)	Back (9.2%)

APPENDIX C: CHEERLEADING EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Cheerleading

Author(s)	Shields, Smith	Mueller	Shields, Fernandez, Smith
Study	Cheerleading-Related Injuries to Children 5 to 18 Years of Age: United States 1990-2002	Editorial: Cheerleading Injuries and Safety	Epidemiology of Cheerleading Stunt-Related Injuries in the United States
Year	2005	2009	2009
Period of Study	1990-2002	1982-2009*	2006-2007
Population	98-NEISS Hospitals out of 100-NEISS Hospitals	The National Center for Catastrophic Sports Injury Research (NCCSIR) Database	100 Randomly Selected RIO™ High Schools
Schools/ Teams	Throughout the United States	Not Specified	Not Specified
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Cheerleading	Cheerleading	Cheerleading
Athletic Exposure	Not specified	Not Specified	591,266 AE (Overall)
Injuries	223,300*-Injuries [5396 Actual]	Not Specified	338-Stunting Injuries/567-Total Injuries
Rate of Injuries	Not Specified	Not Specified	0.57- Injuries per 1000 AE (Overall) 0.36- Injuries per 1000 AE (All Star) 1.59- Injuries per 1000 AE (College) 0.59- Injuries per 1000 AE (High School) 0.23- Injuries per 1000 AE (Middle School) 0.41- Injuries per 1000 AE (Recreational)
Top Injuries	Top Injuries seen in Emergency Departments	Catastrophic Injuries Data	Stunting-Related Injuries
1	Strain/Sprain (52.4%)	High School Cheerleading (73-catastrophic injuries) [65.2% of all High school female catastrophic injuries]	Strain/Sprain (47.6%)
2	Soft Tissue Injuries (18.4%)	Collegiate Cheerleading (31-catastrophic injuries) [75% of all collegiate female catastrophic injuries]	Abrasions, Contusion or Hematoma (17.2%)
3	Fractures/Dislocations (16.4%)		Other (12.4%)
4	Lacerations/Avulsions (3.8%)		Fracture/Dislocation (9.5%)
5	Concussions/Closed Head Injuries (3.5%)		Laceration/Puncture (6.8%)
	*Annual National Estimates	*Cheerleading not included in first 2-years	

APPENDIX C: CHEERLEADING EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Cheerleading

Author(s)	Shields, Smith	Shields, Smith	Council on Sports Medicine and Fitness
Study	Epidemiology of Cheerleading Fall-Related Injuries in the United States	Cheerleading-Related Injuries in the United States: A Prospective Surveillance Study	Cheerleading Injuries: Epidemiology and Recommendations for Prevention
Year	2009	2009	2012
Period of Study	2006-2007	2006-2007	Review of Literature
Population	100 Randomly Selected RIO™ High Schools	All-Star, College, High School, Middle School, Elementary Schools and Recreational Leagues	Recreational through Collegiate Cheerleading*
Schools/ Teams	Not Specified	803 Cheerleading Teams	Not Specified
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Cheerleading	Cheerleading	Cheerleading
Athletic Exposure	591,266 AE (Overall)	592,634 AE	Not Specified
Injuries	79-Fall Injuries/567-Total Injuries	567-Injuries (Overall)	4,954 Injuries (1980)* 26,786 Injuries (2007)*
Rate of Injuries	13.3- Injuries per 100,000 AE (Overall) 9.3- Injuries per 100,000 AE (All Star) 29.0- Injuries per 100,000 AE (College) 14.7- Injuries per 100,000 AE (High School) 146.2- Injuries per 100,000 AE (Elementary)	1.0- Injuries per 1000 AE (Overall) 0.8- Injuries per 1000 AE (All Star) 2.4- Injuries per 1000 AE (College) 0.9- Injuries per 1000 AE (High School) 0.5- Injuries per 1000 AE (Middle School) 1.5- Injuries per 1000 AE (Elementary) 0.5- Injuries per 1000 AE (Recreational)	1.0- Injuries per 1000 AE (Overall)* 2.4- Injuries per 1000 AE (Collegiate)* 1.5- Injuries per 1000 AE (Elementary School)* 0.9- Injuries per 1000 AE (High School)* 0.8- Injuries per 1000 AE (All-Stars)* 0.5- Injuries per 1000 AE (Recreational)*
Top Injuries	Injury Type (All Injuries)	For All Teams	Top Injuries Based on Published Data
1	Strains/Sprains (54%)	Ankle Strain/Sprain (15%)	Sprains and Strains (53%)*
2	Soft Tissue Injury (21.5%)	Neck Strain/Sprain (7%)	Abrasions, Contusions, Hematomas (13-18%)*
3	Dislocation (7.5%)	Low Back Strain/Sprain (5%)	Fractures/Dislocations (10%)*
4	Concussion/Closed Head Injuries (6.3%)	Knee Strain/Sprain (5%)	Lacerations/Puncture (4%)*
5	Other (5%)	Wrist Strain/Sprain (4%)	Concussion/Head Injuries (3.5-4.0%)*
			*Based on available published literature

APPENDIX D: FOOTBALL EPIDEMIOLOGY

APPENDIX D: FOOTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Football

Author(s)	Torg, Vegso, Sennett, Das	Powell, Barber-Foss	Guskiewicz, Weaver, Padua, Garrett
Study	The National Football Head and Neck Injury Registry	Injury Patterns in Selected High School Sports: A Review of 1995-1997 Seasons	Epidemiology of Concussions in Collegiate and High School Football Players
Year	1985	1999	2000
Period of Study	1971-1984	1995-1997	1995-1997
Population	High School, College and Recreational-Professional	Varsity Athletes only	Collegiate (NCAA D1-D3) and High School 17,549 football players participated
Schools/Teams	Based on the National Football Head and Neck Injury Registry maintained by the University of Pennsylvania Sports Medicine	246 High Schools	242 Schools 125- NCAA (D1-D3) 117- High Schools
Location	Not Specified	Throughout the United States	Throughout the United States
Sport	Football	Football	Football
Athletic Exposure	Not Specified	1,300,446 AE	1,426,836 AE (Overall) 1,037,015 AE-NCAA (D1-D3) 389,821 AE- High Schools
Injuries	924- Total Injuries (Intracranial Hemorrhage, Craniocerebral Deaths, Cervical Spine Fracture/Dislocation/ Subluxation, Permanent Quadriplegia)	7,310- Injuries	1,003 (Overall) 603- NCAA (D1-D3) 400- High Schools
Rate of Injuries (Rate/Athletic Exposures)	Data Broken down per year, per level of competition per injury.	8.1- Injuries per 1000 AE	0.70- Injuries per 1000 AE 0.62- Injuries per 1000 AE (NCAA D1-D3) 1.03- Injuries per 1000 AE (High School)
Top Injuries			Top Symptoms Reported by Athletes
1	Cervical Spine Fracture/Dislocation/ Subluxation (64.39%)	Sprains (31.7%)	Headache (86%)
2	Permanent Quadriplegia (14.5%)	General Trauma (25.2%)	Dizziness (67%)
3	Intracranial Hemorrhage (13.31%)	Strains (21.0%)	Confusion (59%)
4	Craniocerebral Death (7.79%)	Neurotrauma (10.3%)	Disorientation*
5		Fractures (7.5%)	Blurred Vision*
			*Value not disclosed Table [Figure 4)

APPENDIX D: FOOTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Football

Author(s)	Stuart, Morrey, Smith Meis, Ortiguera	Tubeville, Cowan, Owen, Asal, Anderson	Comstock, Yard, Knox, Manring
Study	Injuries in Youth Football: Among Players 9 to 13 Years	Risk Factors for Injury in High School Football Players	Summary Report: High School RIO™ Internet-Based Surveillance of Injuries Sustained by US High School Athletes 2005-2006
Year	2002	2003	2006
Period of Study	September-October 1997 (Single Season)	1998-1999 (2 seasons)	2005-2006
Population	921- Football Players (9-13 years old)	717- Football Players (12-18 years old)	100 Randomly Selected RIO™ High Schools
Schools/Teams	42- Teams in community football league	8- Teams in Oklahoma School District	Throughout the United States
Location	Not Specified	Oklahoma City, OK	Throughout the United States
Sport	Football	Football	Football
Athletic Exposure	328,086 injury exposures	Not Specified	431,242 AE
Injuries	55- Injuries	132- Injuries (over 2-years)	523,368*-Injuries [1,880 Actual]
Rate of Injuries (Rate/Athletic Exposures)	0.17- Injuries per player per 1000 plays	3.20- Injuries per 1000 AE	4.4- Injuries per 1,000 AE
Top Injuries	Injuries by Region of the Body	Top Injuries	Competition and Practice
1	Contusion (60%)	Sprains/Strains (54%)	Strain/Sprains (46.86%)
2	Strains (11%)	Contusions (17%)	Contusion (14.72%)
3	Sprains (5%)	Fractures (11%)	Fracture (11.31%)
4	Fractures (7%)	Concussion (6%)	Other (16.65%)
5	Abrasion Concussion (2% each)	Dislocation (5%)	Concussion (16.65%)
			*Annual National Estimates

APPENDIX D: FOOTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Football

Author(s)	Comstock, Yard, Collins	Comstock, Yard, Collins	Comstock, Yard, Collins, McIlvain
Study	Summary Report: National High School Injury Surveillance Study 2006-2007	Summary Report: National High School Injury Surveillance Study 2007-2008	Summary Report: National High School Injury Surveillance Study 2008-2009
Year	2007	2008	2009
Period of Study	2006-2007	2007-2008	2008-2009
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/Teams	Throughout the United States	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Football	Football	Football
Athletic Exposure	502,098	572,588	588,876
Injuries	574,367* [2,234 Actual]	616,665* [2,392 Actual]	527,321* [2,061 Actual]
Rate of Injuries (Rate/Athletic Exposures)	4.45- Injuries per 1000 AE	4.18- Injuries per 1000 AE	3.50- Injuries per 1000 AE
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	(Competition) [Practice]
1	Strain/Sprains (43%) [44%]	Strain/Sprains (41%) [48%]	Strain/Sprains (39%) [47%]
2	Contusion (21%) [12%]	Contusion (16%) [13%]	Contusion (17%) [11%]
3	Other (15%) [27%]	Other (17%) [20%]	Concussion (16%) [10%]
4	Concussion (13%) [7%]	Fracture (13%) [11%]	Other (16%) [22%]
5	Fracture (8%) [7%]	Concussion (13%) [8%]	Fracture (12%) [10%]
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

APPENDIX D: FOOTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Football

Author(s)	Mello, Myers, Christian, Palmisiano, Linakis	Comstock, Collins, McIlvain	Comstock, Collins, McIlvain
Study	Injuries in Youth Football: National Emergency Department During 2001-2005	Summary Report: National High School Sports-Related Injury Surveillance Study 2009-2010	Summary Report: National High School Sports-Related Injury Surveillance Study 2010-2011
Year	2009	2010	2011
Period of Study	2001-2005	2009-2010	2010-2011
Population	7-17-year old football players	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/Teams	66 NEISS Hospitals out of 100 NEISS Hospitals	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Football	Football	Football
Athletic Exposure	Not Specified	474,929	474,429
Injuries	1,060,832*-Injuries [21,251-Actual]	581,414*-Injuries [1,808-Actual]	483,016*-Injuries [1659-Actual]
Rate of Injuries (Rate/Athletic Exposures)	1.8- Injuries per 1,000 participant per year	3.81- Injuries per 1,000 AE	3.50- Injuries per 1,000 AE
Top Injuries	Total Injuries Seen in ED	(Competition) [Practice]	(Competition) [Practice]
1	Sprain/Strain (29.94%)	Strain/Sprains (38%) [43%]	Strain/Sprains (33%) [43%]
2	Fracture/Dislocation (29.17%)	Concussion (20%) [14%]	Concussion (28%) [17%]
3	Contusion (23.80%)	Other (15%) [21%]	Other (14%) [20%]
4	Traumatic Brain Injury (TBI) (7.11%)	Contusion (15%) [13%]	Contusion (14%) [7%]
5	Laceration (5.71%)	Fracture (12%) [9%]	Fracture (11%) [13%]
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

APPENDIX D: FOOTBALL EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Football

Author(s)	Comstock, Collins, Corlette, Fletcher	Comstock, Collins, Currie
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2011-2012	Summary Report: National High School Sports-Related Injury Surveillance Study 2012-2013
Year	2012	2013
Period of Study	2011-2012	2012-2013
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/Teams	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States
Sport	Football	Football
Athletic Exposure	469,815 AE	509,158 AE
Injuries	559,069*-Injuries [1,778 Actual]	616,209*-Injuries [1,972 Actual]
Rate of Injuries (Rate/Athletic Exposures)	3.78- Injuries per 1,000 AE	3.87- Injuries per 1,000 AE
Top Injuries	(Competition) [Practice]	(Competition) [Practice]
1	Strain/Sprains (37%) [39%]	Strain/Sprains (38%) [39%]
2	Concussion (22%) [25%]	Concussion (25%) [25%]
3	Other (15%) [18%]	Other (15%) [18%]
4	Contusion (14%) [9%]	Contusion (12%) [10%]
5	Fracture (12%) [9%]	Fracture (10%) [8%]
	*Annual National Estimates	*Annual National Estimates

APPENDIX E: ICE HOCKEY EPIDEMIOLOGY

APPENDIX E: ICE HOCKEY EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Ice Hockey

Author(s)	JØrgensen, Schmidt-Olsen	Yegner, Lorentzon	Pinto, Kuhn, Greenfield Hawkins
Study	The Epidemiology of Ice Hockey Injuries	Ice Hockey Injuries: Incidence, Nature and Causes	Prospective Analysis of Ice Hockey Injuries at the Junior A Level Over One Season
Year	1986	1991	1999
Period of Study	2 years *(Not Specified)*	1988-1989	Not Specified
Population	16-34 years old	Swedish Elite Ice Hockey Players (Male)	22-Ice Hockey players (16-20-year old) *All players were male.*
Schools/Teams	14 Randomly chosen Danish Elite Hockey teams	12-Swedish Elite Ice Hockey Teams	United States Junior A Level Team
Location	Denmark	Sweden	United States
Sport	Ice Hockey	Ice Hockey	Ice Hockey
Athletic Exposure	Not Specified	3,984 player-game hours	83-Injuries per 1,000 player-game hours
Injuries	189-Injuries	285-Injuries	83-Injuries (Overall) 74-Injuries for study
Rate of Injuries (Rate/Athletic Exposures)	4.7-Injuries per player per 1000 hours	53.0-Injuries per 1000 hours for the individual players	138-Injuries per 1,000 game hours
Top Injuries	Types of Injuries	Types of Injuries	Injury Rate (Forwards) [Defensive Men]
1	Contusions (46%)	Strain/Sprain (24.2%)	Sprains/Subluxations/Dislocations (36.2%) [41.7%]
2	Sprains (26%)	Lacerations (23.9%)	Contusion (29.8%) [29.2%]
3	Fracture (14%)	Contusion (18.2%)	Lacerations (14.9%) [20.8%]
4	Strain (15%)	Miscellaneous (9.8%)	Fracture (8.5%) [4.2%]
5	Other Unknown Injuries (25 injuries)	Fracture (9.1%)	Neurologic (2.1%) [4.2%]

APPENDIX E: ICE HOCKEY EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Ice Hockey

Author(s)	Hostetler, Xiang, Smith	Agel, Dompler, Dick, Marshall		Age, Dick, Nelson, Marshall, Dompler	
Study	Ice Hockey–Related Injuries Treated in US Emergency Departments, 2001–2002	Epidemiology of Collegiate Men's Ice Hockey Injuries: 1988/89-2003/04		Epidemiology of Collegiate Women's Ice Hockey Injuries: 2000/01-2003/04	
Year	2004	2007		2007	
Period of Study	2001-2002	1988/89-2003/04		2000/01-2003/04	
Population	98-NEISS Hospitals out of 6100 NEISS Hospitals	NCAA Division 1, 2, 3 Universities with Men's Ice Hockey		NCAA Division 1, 2, 3 Universities with Women's Ice Hockey	
Schools/Teams	Not Specified	31 Men's Ice Hockey NCAA Institutions		11 Women's Ice Hockey NCAA Institutions	
Location	Throughout the United States	Throughout the United States		Throughout the United States	
Sport	Ice Hockey	Men's Ice Hockey		Women's Ice Hockey	
Athletic Exposure	Not Specified	38,820-Practices AE 14,94- Games AE		3,208-Practices AE 1,180-Games AE	
Injuries	32,750*-Injuries (750-Actual)	1966-Injuries (Practices) 4,673-Injuries (Games)		167-Injuries (Practices) 264-Injuries (Games)	
Rate of Injuries (Rate/Athletic Exposures)	Not Specified	1.95-Injuries per 1000 AE (Practices) 16.27-Injuries per 1000 AE (Games)		2.5-Injuries per 1000 AE (Practices) 12.6-Injuries per 1000 AE (Games)	
Top Injuries	Types of Injuries for Athletes 18 and Younger	Practice	Games	Practice	Games
1	Contusion/Abrasions (26.9%)	Hip Strain (13.1%)	Knee Internal Derangement (13.5%)	Concussion (13.2%)	Concussion (21.6%)
2	Fracture (17.5%)	Knee Internal Derangement (10.1%)	Concussion (9.0%)	Hip Strain (12.0%)	Knee Internal Derangement (12.9%)
3	Strain/Sprain (17.3%	Ankle Sprain (5.5%)	AC Joint Sprain (8.9%)	Foot Contusion (7.2%)	AC Joint Sprain (6.8%)
4	Laceration (15.3%)	Concussion (5.3%)	Upper Leg Contusion (6.2%)	Knee Internal Derangement (6.0%)	Ankle Sprain (4.2%)
5	Traumatic Brain Injury (14.1%)	AC Joint Spain (4.4%)	Hip Strain (4.5%)	Patella/Patella Tendon Injury Shoulder Subluxation Upper Leg Strain (3.6% ea.)	Hip Strain (4.2%)
	*Annual National Estimates				

APPENDIX F: SOCCER EPIDEMIOLOGY

APPENDIX F: SOCCER EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Soccer

Author(s)	Powell, Barber-Foss	Comstock, Yard, Knox, Manring	Comstock, Yard, Collins
Study	Injury Patterns in Selected High School Sports: A Review of 1995-1997	Summary Report: High school RIO™ Internet-Based Surveillance of Injuries Sustained by US High School Athletes 2005-2006	Summary Report: High School Sport-Related Injury Surveillance Study 2006-2007
Year	1999	2006	2007
Period of Study	1995-1997	2005-2006	2006-2007
Population	Varsity Athletes only	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/Teams	246-High Schools	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Soccer (Boys and Girls)	Soccer (Boys and Girls)	Soccer (Boys and Girls)
Athletic Exposure	522,602 AE (Boys) 258,754 AE (Girls)	153,400 AE (Boys) 141,106 AE (Girls)	179,519 AE (Boys) 163,378 AE (Girls)
Injuries	1,765-Injuries (Boys) 1,771-Injuries (Girls)	223,386*-Injuries (372 Actual) Boys 193,672*-Injuries (334 Actual) Girls	171,874 *-Injuries (407 Actual) Boys 163,378*-Injuries (410 Actual) Girls
Rate of Injuries (Rate/Athletic Exposures)	4.6-Injuries per 1,000 AE (Boys) 5.3-Injuries per 1,000 (Girls)	2.4-Injuries per 1,000 AE (Boys) 2.4-Injuries per 1,000 AE (Girls)	2.27-Injuries per 1,000 AE (Boys) 2.51-Injuries per 1,000 AE (Girls)
Top Injuries	Top Injuries	Competition and Practice	(Competition) [Practice]
1	Sprains (32.4%) Boys (38.7%) Girls	Sprain/Strain 53.95% Boys 56.05% Girls	Sprain/Strain (39%) [42%] Boys (53%) [59%] Girls
2	General Trauma (29.9%) Boys (24.9%) Girls	Contusion 15.77% Boys 8.19% Girls	Contusion (20%) [17%] Boys (16%) [6%) Girls
3	Strains (22.8%) Boys (22.4%) Girls	Other/Unknown 14.53.5% Boys 13.30% Girls	Other/Unknown (18%) [27%] Boys (12%) [28%] Girls
4	Fractures (8.5%) Boys (5.8%) Girls	Concussion 9.57% Boys 15.19% Girls	Concussion (13%) [4%] Boys (12%) [4%] Girls
5	Neurotrauma (3.9%) Boys (3.2%) Girls	Fracture 6.17% Boys 7.26% Girls	Fracture (10%) [10%] Boys (7%) [3%] Girls
		*Annual National Estimates	*Annual National Estimates

APPENDIX F: SOCCER EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Soccer

Author(s)	Comstock, Yard, Collins	Comstock, Yard, Collins, McIlvain	Comstock, Collins, McIlvain
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2007-2008	Summary Report: National High School Sports-Related Injury Surveillance Study 2008-2009 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2009-2010 School Year
Year	2008	2009	2010
Period of Study	2007-2008	2008-2009	2009-2010
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/ Teams	Throughout the United States	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Soccer (Boys and Girls)	Soccer (Boys and Girls)	Soccer (Boys and Girls)
Athletic Exposure	202,650 AE (Boys) 173,731 AE (Girls)	215,699 AE (Boys) 184,268 AE (Girls)	166,141 Boys 148,798 Girls
Injuries	159,351*-Injuries (355 Actual) Boys 215,850*-Injuries (408 Actual) Girls	149,229*-Injuries (350 Actual) Boys 192,108*-Injuries (381 Actual) Girls	153,485* (291-Actual) Boys 181,158* (298-Actual) Girls
Rate of Injuries	1.75-Injuries per 1,000 AE (Boys) 2.35-Injuries per 1,000 AE (Girls)	1.62-Injuries per 1,000 AE (Boys) 2.07-Injuries per 1,000 AE (Girls)	1.75-Injuries per 1,000 AE (Boys) 2.00-Injuries per 1,000 AE (Girls)
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	(Competition) [Practice]
1	Sprain/Strain (49%) [50%] Boys (49%) [67%] Girls	Sprain/Strain (41%) [50%] Boys (45%) [64%] Girls	Sprain/Strain (29%) [52%] Boys (48%) [55%] Girls
2	Contusion (16%) [8%] Boys (14%) [7%] Girls	Contusion (20%) [4%] Boys (11%) [2%] Girls	Contusion (29%) [10%] Boys (17%) [16%] Girls
3	Concussion (14%) [4%] Boys (14%) [3%] Girls	Fracture (18%) [11%] Boys (7%) [4%] Girls	Concussion (19%) [3%] Boys (17%) [7%] Girls
4	Other/Unknown (11%) [27%] Boys (15%) [18%] Girls	Concussion (12%) [6%] Boys (22%) [5%] Girls	Fracture (13%) [13%] Boys (6%) [3%] Girls
5	Fracture (10%) [11%] Boys (8%) [5%] Girls	Other/Unknown (9%) [29%] Boys (15%) [25%] Girls	Other/Unknown (10%) [22%] Boys (12%) [19%] Girls
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

APPENDIX F: SOCCER EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Soccer

Author(s)	Comstock, Collins, McIlvain	Comstock, Collins, Corlette, Fletcher	Comstock, Collins, Currie
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2010-2011 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2011-2012 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2012-2013 School Year
Year	2011	2012	2013
Period of Study	2010-2011	2011-2012	2012-2013
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/ Teams	Throughout the United States	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Soccer (Boys and Girls)	Soccer (Boys and Girls)	Soccer (Boys and Girls)
Athletic Exposure	168,389 AE (Boys) 143,220 AE (Girls)	161,672 AE (Boys) 136,276 AE (Girls)	173,442 AE (Boys) 146,152 AE (Girls)
Injuries	138,974*-Injuries (262-Actual) Boys 180,254*-Injuries (277-Actual) Girls	172,070*-Injuries (265-Actual) Boys 222,679*-Injuries (330-Actual) Girls	149,049*-Injuries (263-Actual) Boys 190,382*-Injuries (335-Actual) Girls
Rate of Injuries	1.56 -Injuries per 1,000 AE (Boys) 1.93-Injuries per 1,000 AE (Girls)	1.64-Injuries per 1,000 AE (Boys) 2.42-Injuries per 1,000 AE (Girls)	1.52-Injuries per 1,000 AE (Boys) 2.29-Injuries per 1,000 AE (Girls)
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	(Competition) [Practice]
1	Sprain/Strain (39%) [61%] Boys (48%) [58%] Girls	Sprain/Strain (34%) [55%] Boys (51%) [53%] Girls	Concussion (35%) [13%] Boys (38%) [18%] Girls
2	Concussion (29%) [6%] Boys (28%) [4%] Girls	Concussion (34%) [9%] Boys (30%) [12%] Girls	Sprain/Strain (32%) [54%] Boys (39%) [58%] Girls
3	Contusion (12%) [6%] Boys (10%) [4%) Girls	Contusion (18%) [13%] Boys (10%) [5%) Girls	Contusion (14%) [6%] Boys (15%) [3%) Girls
4	Fracture (10%) [2%] Boys (8%) [8%] Girls	Other/Unknown (10%) [15%] Boys (7%) [26%] Girls	Other/Unknown (10%) [26%] Boys (5%) [14%] Girls
5	Other/Unknown (10%) [26%] Boys (6%) [26%] Girls	Fracture (4%) [8%] Boys (2%) [4%] Girls	Fracture (9%) [1%] Boys (3%) [7%] Girls
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

APPENDIX G: WRESTLING EPIDEMIOLOGY

APPENDIX G: WRESTLING EPIDEMOLOGY

Sport Epidemiology Studies by Types of Injuries: Wrestling

Author(s)	Powell, Barber-Foss	Pasque, Hewett	Comstock, Yard, Knox, Manring
Study	Injury Patterns in Selected High School Sports: A Review of 1995-1997 Seasons	Study of High School Wrestling Injuries	Summary Report: High school RIO™ Internet-Based Surveillance of Injuries Sustained by US High School Athletes. 2005-2006
Year	1999	2000	2006
Period of Study	1995-1997	Not Specified *One High School Season*	2005-2006
Population	Varsity Athletes only	418-High School Wrestlers (Actual) 458- High School Wrestlers Overall)	100 Randomly Selected RIO™ High Schools
Schools/Teams	246 High Schools	14 High School Wrestling Team	Throughout the United States
Location	Throughout the United States	Cincinnati, OH Region	Throughout the United States
Sport	Wrestling	Wrestling	Wrestling
Athletic Exposure	522,608 AE	23,473 practice or match exposures during the 3-month season	166,279 AE
Injuries	2910-Injuries [Actual]	219-Injuries	110,889*-Injuries [415 Actual]
Rate of Injuries (Rate/Athletic Exposures)	5.6-Injuries per 1000 AE	6.0-Injuries per 1000 exposures	2.5-Injuries per 1,000 AE
Top Injuries	Type of Injury	Types of Injuries	Competition and Practice
1	Sprains (28.6%)	Muscle Strain (30.6%)	Strain/Sprains 44.52%
2	Strains (23.2%)	Joint Sprain (22.8%)	Other 29.92%
3	General Trauma (20.7%)	Bruise (16.0%)	Fracture 14.86%
4	General Stress (13.0%) boys	Fracture (4.6%)	Contusion 5.81%
5	Fracture (6.3%)	Cartilage Tear Separations (4.6%)	Concussion 4.89%
			**Annual National Estimates

APPENDIX G: WRESTLING EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Wrestling

Author(s)	Comstock, Yard, Collins		Comstock, Yard, Collins	Yard, Collins, Dick, Comstock
Study	Summary Report: High School Sport-Related Injury Surveillance Study. 2006-2007		Summary Report: National High School Sports-Related Injury Surveillance Study. 2007-2008	An Epidemiologic Comparison of High School and College Wrestling Injuries
Year	2007		2008	2008
Period of Study	2006-2007		2007-2008	2005-2006
Population	100 Randomly Selected RIO™ High Schools		100 Randomly Selected RIO™ High Schools	High School and Collegiate Wrestlers
Schools/ Teams	Throughout the United States		Throughout the United States	74 High School Teams 15 NCAA Institutions
Location	Throughout the United States		Throughout the United States	Throughout the United States
Sport	Wrestling		Wrestling	Wrestling
Athletic Exposure	156,094 AE		179,427 AE	Per 1000 AE
Injuries	101,139*-Injuries (392-Actual)		91,625*-Injuries (408-Actual)	387-High School Injuries 258-Collegiate Injuries
Rate of Injuries (Rate/Athletic Exposures)	2.51-injuries per 1,000 AE		2.27-Injuries per 1,000 AE	2.33-Injuries per 1000 AE (High School) 7.25-Injuries per 1000 AE (Collegiate)
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	High School	Collegiate
1	Sprain/Strain (50%) [42%]	Sprain/Strain (48%) [39%]	Strains/Sprains (48.1%)	Strains/Sprains (49.2%)
2	Other/Unknown (26%) [34%]	Other/Unknown (29%) [32%]	Fractures	Dislocation/Subluxation
3	Concussion (9%) [3%]	Concussion (7%) [6%]	Dislocation/Subluxation	Lacerations
4	Contusion (8%) [12%]	Contusion (5%) [9%]	Contusions	Cartilage Injury
5	Fracture (7%) [9%]	Fracture (11%) [5%]	Concussions	Concussion
	*Annual National Estimates		*Annual National Estimates	*NOTE:* Percentages for Strains/Sprains listed in Results. Other Injuries listed in table form without percentages listed

APPENDIX G: WRESTLING EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Wrestling

Author(s)	Comstock, Yard, Collins, McIlvain	Comstock, Collins, McIlvain	Myers, Linakis, Mello, Linakis
Study	Summary Report: National High School Sports-Related Injury Surveillance Study. 2008-2009 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study. 2009-2010 School Year	Competitive Wrestling-related Injuries in School Aged Athletes in U.S. Emergency Departments
Year	2009	2010	2010
Period of Study	2008-2009	2009-2010	2000-2006
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	7-17 year old Wrestlers Males and Females
Schools/ Teams	Throughout the United States	Throughout the United States	96 NEISS Hospitals out of 100 NEISS Hospitals
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Wrestling	Wrestling	Wrestling
Athletic Exposure	180,641 AE	158,440 AE	Not Stated
Injuries	88,996*-Injuries (392-Actual)	80,390*-Injuries (313-Actual)	167,606-Injuries
Rate of Injuries	2.17 injuries per 1,000 AE	1.98-Injuries per 1,000 AE	Not Stated
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	Total % of Injuries (7-11 YO) [12-17 YO]
1	Sprain/Strain (37%) [38%]	Sprain/Strain (50%) [48%]	Sprain/Strains 36.7% (38.7%) [36.6%]
2	Other/Unknown (20%) [24%]	Other/Unknown (14%) [22%]	Fractures 22.4% (25.9%) [22.1%]
3	Concussion (21%) [4%]	Concussion (10%) [9%]	Contusions/Abrasions 15.0% (16.3%) [15.0%]
4	Contusion (4%) [2%]	Contusion (10%) [6%]	Others/Not Stated 8.4% (7.3%) [8.6%]
5	Fracture (12%) [18%]	Fracture (9%) [7%]	Traumatic Brain Injury 6.0% (4.5%) [6.2%]
	*Annual National Estimates	*Annual National Estimates	

APPENDIX G: WRESTLING EPIDEMIOLOGY

Sport Epidemiology Studies by Types of Injuries: Wrestling

Author(s)	Comstock, Collins, McIlvain	Comstock, Collins, Corlette, Fletcher	Comstock, Collins, Currie
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2010-2011 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2011-2012 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2012-2013 School Year
Year	2011	2012	2013
Period of Study	2010-2011	2011-2012	2012-2013
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/ Teams	Throughout the United States	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	Wrestling	Wrestling	Wrestling
Athletic Exposure	147,073 AE	143,849 AE	147,208 AE
Injuries	80,569*-Injuries (296-Actual)	107,992*-Injuries (359-Actual)	85,485*-Injuries (343-Actual)
Rate of Injuries	2.01-Injuries per 1,000 AE	2.50-Injuries per 1,000 AE	2.33-Injuries per 1,000 AE
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	(Competition) [Practice]
1	Sprain/Strain (43%) [35%]	Sprain/Strain (36%) [28%]	Sprain/Strain (38%) [39%]
2	Contusion (21%) [12%]	Concussion (27%) [23%]	Other/Unknown (20%) [19%]
3	Concussion (17%) [14%]	Contusion (22%) [18%]	Concussion (19%) [11%]
4	Fracture (8%) [10%]	Fracture (7%) [7%]	Fracture (14%) [7%]
5	Other/Unknown (3%) [21%]	Other/Unknown (3%) [19%]	Contusion (6%) [18%]
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

APPENDIX H: RIO™ EPIDEMIOLOGY

Appendix H: RIO™ EPIDEMIOLOGY
Sport Epidemiology Studies by Types of Injuries: High School RIO™ Data

Author(s)	Comstock, Yard, Knox, Manring	Comstock, Yard, Collins	Comstock, Yard, Collins
Study	Summary Report: High school RIO™ Internet-Based Surveillance of Injuries Sustained by US High School Athletes 2005-2006	Summary Report: High School Sport-Related Injury Surveillance Study 2006-2007	Summary Report: National High School Sports-Related Injury Surveillance Study 2007-2008
Year	2006	2007	2008
Period of Study	2005-2006	2006-2007	2007-2008
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/Teams	Throughout the United States	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	9 Sports(FB, B/G Soccer, G VB, B/G Bkb, Wres, Base/Softball)	9 Sports (FB, B/G Soccer, G VB, B/G Bkb, Wres, Base/Softball)	9 Sports (FB, B/G Soccer, G VB, B/G Bkb, Wres, Base/Softball)
Athletic Exposure	1,730,764 AE	1,820,367 AE	2,077,780 AE
Injuries	1,480,556*-Injuries [4,350-Actual]	1,472,849*-Injuries [4,716-Actual]	1,419,723*-Injuries [4,799-Actual]
Rate of Injuries (Rate/Athletic Exposures)	2.5-Injuries per 1,000 AE (Overall) 4.6-Injuries per 1,000 AE (Competition) 1.7-Injuries per 1,000 AE (Practice)	2.59-Injuries per 1,000 AE (Overall) 4.88-Injuries per 1,000 AE (Competition) 1.75 - Injuries per 1,000 AE (Practice)	2.31-Injuries per 1,000 AE (Overall) 4.45-Injuries per 1,000 AE (Competition) 1.52-Injuries per 1,000 AE (Practice)
Top Injuries	Total Injuries, Competition, and Practice	(Competition) [Practice]	(Competition) [Practice]
1	Sprain/Strain (51.7%)	Sprain/Strain (57%) [49%]	Sprain/Strain (57%) [49%]
2	Other/Unknown (17.6%)	Other/Unknown (18%) [27%]	Other/Unknown (18%) [27%]
3	Contusion (12.0%)	Concussion (13%) [5%]	Concussion (13%) [5%]
4	Fracture (9.7%)	Fracture (10%) [9%]	Fracture (10%) [9%]
5	Concussion (9.0%)	Contusions (2%) [10%]	Contusions (2%) [10%]
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

Appendix H: RIO™ EPIDEMIOLOGY
Sport Epidemiology Studies by Types of Injuries: High School RIO™ Data

Author(s)	Comstock, Yard, Collins, McIlvain	Comstock, Collins, McIlvain	Comstock, Collins, McIlvain
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2008-2009 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2009-2010 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study 2010-2011 School Year
Year	2009	2010	2011
Period of Study	2008-2009	2009-2010	2010-2011
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/Teams	Throughout the United States	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States	Throughout the United States
Sport	9 Sports (FB, B/G Soccer, G VB, B/G Bkb, Wres, Base/Softball)	9 Sports (FB, B/G Soccer, G VB, B/G Bkb, Wres, Base/Softball)	9 Sports (FB, B/G Soccer, G VB, B/G Bkb, Wres, Base/Softball)
Athletic Exposure	2,112,479 AE	1,763,241 AE	1,764,785 AE
Injuries	1,248,126* (4,255-Actual)	1,359,897* (3,698-Actual)	1,764,785* (3,475-Actual)
Rate of Injuries (Rate/Athletic Exposures)	2.01-Injuries per 1,000 AE (Overall) 4.05-Injuries per 1,000 AE (Competition) 1.26-Injuries per 1,000 AE (Practice)	2.10 - Injuries per 1,000 AE (Overall) 4.19-Injuries per 1,000 AE (Competition) 1.32-Injuries per 1,000 AE (Practice)	1.97-Injuries per 1,000 AE (Overall) 4.10 - Injuries per 1,000 AE (Competition) 1.16-Injuries per 1,000 AE (Practice)
Top Injuries	(Competition) [Practice]	(Competition) [Practice]	(Competition) [Practice]
1	Strain/Sprain (42%) [50%]	Strain/Sprain (42%) [48%]	Strain/Sprain (40%) [48%]
2	Other (16%) [25%]	Concussion (18%) [9%]	Concussion (25%) [13%]
3	Concussion (16%) [7%]	Contusion (16%) [12%]	Other (13%) [23%]
4	Contusion (14%) [8%]	Other (14%) [22%]	Contusion (12%) [6%]
5	Fracture (12%) [10%]	Fracture (10%) [12%]	Fracture (10%) [10%]
	*Annual National Estimates	*Annual National Estimates	*Annual National Estimates

Appendix H: RIO™ EPIDEMIOLOGY
Sport Epidemiology Studies by Types of Injuries: High School RIO™ Data

Author(s)	Comstock, Collins, Corlette, Fletcher	Comstock, Collins, Currie
Study	Summary Report: National High School Sports-Related Injury Surveillance Study 2011-2012 School Year	Summary Report: National High School Sports-Related Injury Surveillance Study.2012-2013 School Year
Year	2012	2013
Period of Study	2011-2012	2012-2013
Population	100 Randomly Selected RIO™ High Schools	100 Randomly Selected RIO™ High Schools
Schools/Teams	Throughout the United States	Throughout the United States
Location	Throughout the United States	Throughout the United States
Sport	9 Sports (FB, B/G Soccer, G VB, B/G Bkb, Wres, Base/Softball)	9 Sports (FB, B/G Soccer, G VB, B/G Bkb, Wres, Base/Softball)
Athletic Exposure	1,733,895 AE	1,874,256 AE
Injuries	1,392,262*-Injures (3,759-Actual)	1,361,896*-Injuries (4,049-Actual)
Rate of Injuries (Rate/Athletic Exposures)	2.17-Injuries per 1,000 AE (Overall) 4.26-Injuries per 1,000 AE (Competition) 1.40 -Injuries per 1,000 AE (Practice)	2.16-Injuries per 1,000 AE (Overall) 4.31-Injuries per 1,000 AE (Competition) 1.34-Injuries per 1,000 AE (Practice)
Top Injuries	(Competition) [Practice]	(Competition) [Practice]
1	Strain/Sprain (41%) [44%]	Strain/Sprain (39%) [47%]
2	Concussion (26%) [18%]	Concussion (27%) [18%]
3	Other (12%) [23%]	Other (13%) [20%]
4	Contusion (12%) [23%]	Contusion (12%) [8%]
5	Fracture (8%) [7%]	Fracture (9%) [7%]
	*Annual National Estimates	*Annual National Estimates

TABLE 1: FIRST-AID SUPPLIES

TABLE 1: FIRST-AID SUPPLIES

Certification & Supplies	Initial Cost *(Initial & Additional)* Low	High	
First-Aid, CPR and AED Certification	See Total Cost Sheet ($50-$100)		Recertification required every 2-3 years
Expendable Supplies			
ACE/Elastic Wrap	$28.65	$66.00	
Alcohol Wipes	$4.00	$8.00	
Antibiotic Ointment *(quantity and sizes vary)*	$5.00	$30.00	
Band-Aids *(assorted sizes and styles)*	$5.00	$15.00	
Biohazard Bags (bags vary)	$20.00	$40.00	
Contact Case	$2.00	$4.00	
Contact Solution	$5.00	$15.00	
Cotton Swabs *(sterile vs. not, quantity vary)*	$8.00	$14.00	
Crutches *(style, size vary)*	$23.00	$140.00	
Eye wash/Saline Solution	$2.00	$5.00	
Gauze *(sterile vs. not, sizes vary)*	$2.00	$7.00	
Gloves *(sizes vary)*	$8.00	$20.00	
Hand Sanitizer *(size and refills vary)*	$5.00	$50.00	
Hydrogen Peroxide	$2.00	$3.00	
Ice Bags *(1500 bags)*	$90.00	$110.00	
Ice Wrap *(per case, sizes vary)*	$47.00	$60.00	
Roller Gauze *(sizes, lengths and quantities vary)*	$11.00	$15.00	
Non-Expendable Supplies			
Biohazard Can *(cans vary)*	$100.00	$255.00	
Biohazard Sharps *(cans vary)*	$5.00	$15.00	
Blanket	$16.00	$20.00	
Blood Pressure Cuffs *(sizes vary)*	$15.00	$25.00	
Slings *(sizes and comfort vary)*	$7.00	$30.00	
Splints *(SAMS, vacuum, immobilizers)*	$6.00	$450.00	
Stethoscope	$7.00	$15.00	
Tweezers	$6.00	$22.00	
Total	***$423.65***	***$1,412.00***	

COST MAY DIFFER BASED ON NEED, NUMBER OF ATHLETIC SITES, ACTUAL USE AND EXPIRATION DATES. THIS SUPPLIES LIST IS NOT ALL CONCLUSIVE.

TABLE 2: SPORTS CARE SUPPLIES

TABLE 2: SPORTS CARE SUPPLIES

Supplies	Initial Cost *(Initial & Additional)* Low	High
Expendable Supplies		
Athletic Tape (per case)	$47.00	$70.00
Insect Repellent	$10.00	$15.00
Pre-wrap (per case)	$44.00	$52.00
Stretch Self Adhesive Tape (per case)	$38.00	$47.00
Sunblock	$11.00	$40.00
Tape Cutters *(includes cost for replacement blades)*	$17.00	$20.00
Non-Expendable Supplies		
Athletic Kit/Bag *(size, shape and demands differ)*	$20.00	$400.00
Total	***$187.00***	***$644.00***

COST MAY DIFFER BASED ON NEED, NUMBER OF ATHLETIC SITES, ACTUAL USE AND EXPIRATION DATES. THIS SUPPLIES LIST IS NOT ALL CONCLUSIVE.

TABLE 3: CARDIOPULMONARY RESUSCITATION SUPPLIES

TABLE 3: CARDIOPULMONARY RESUSCITATION SUPPLIES

CPR Cost

Certification & Supplies	Initial Cost *(Initial & Additional)* Low	High	
First-Aid, CPR and AED Certification	See Total Cost Sheet ($50-$100)		Recertification required every 2-3 years
Expendable Supplies			
CPR Mask/Face Shield	$8.00	$18.00	
Pen/Flash Light	$11.00	$15.00	
Total	***$19.00***	***$33.00***	

COST MAY DIFFER BASED ON NEED, NUMBER OF ATHLETIC SITES, ACTUAL USE AND EXPIRATION DATES. THIS SUPPLIES LIST IS NOT ALL CONCLUSIVE.

TABLE 4: EQUIPMENT REMOVAL SUPPLIES

TABLE 4: EQUIPMENT REMOVAL SUPPLIES

Supplies	Initial Cost *(Initial & Additional)* Low	High
Non-Expendable Supplies		
Assorted Manual Screwdrivers	$20.00	$40.00
Facemask- Cordless Screwdriver	$25.00	$50.00
Facemask- Emergency Shears	$15.00	$50.00
Scissors	$7.00	$30.00
Revolution Quick Release	$6.00	$6.00
Total	***$73.00***	***$176.00***

COST MAY DIFFER BASED ON NEED, NUMBER OF ATHLETIC SITES, ACTUAL USE AND EXPIRATION DATES. THIS SUPPLIES LIST IS NOT ALL CONCLUSIVE.

TABLE 5: AUTOMATED EXTERNAL DEFIBRILLATION SUPPLIES

TABLE 5: AUTOMATED EXTERNAL DEFIBRILLATION SUPPLIES

	Initial Cost		Annual Maintenance & Accessory Updates			
Certification & Supplies	**Low**	**High**	**Supplies**	**Low**	**High**	**Cause for Replacement**
First-Aid, CPR and AED Certification	**See Total Cost Sheet ($50-$100)**					Recertification required every 2-3 years
Expendable Supplies						
Adult Pads	$45.00	$170.00	Adult Pads	$45.00	$170.00	After usage OR after expiration date *(approximately 2-3 years)*
Child Pads	$114.00	$153.00	Child Pads	$110.00	$153.00	After usage OR after expiration date *(approximately 2-3 years)*
Razors *(10pk)*	$6.00	$11.00	Battery	$166.00	$514.00	Dependent on usage OR after expiration date *(approximately 3-4 years)*
Towel *(vary)*	$5.00	$12.00				
Capital Equipment						
AED Box	$240.00	$465.00				
AED's	$1,249.00	$2,995.00				
Total Cost	***$1,614.00***	***$3,636.00***		***$276.00***	***$667.00***	

COST MAY DIFFER BASED ON NEED, NUMBER OF ATHLETIC SITES, ACTUAL USE AND EXPIRATION DATES. THIS SUPPLIES LIST IS NOT ALL CONCLUSIVE.

TABLE 6: TOTAL COSTS FOR CERTIFICATION AND SUPPLIES

TABLE 6: TOTAL COST FOR CERTIFICATION AND SUPPLIES

Certification & Supplies *(Expendable, Non-Expendable & Capital)*		Initial Cost		Annual Maintenance & Accessory Updates		
		Low	**High**	**Low**	**High**	**Cause for Replacement**
First-Aid, CPR, AED Certification		$50.00	$100.00	$50	$100.00	Recertification required every 2-3 years
TABLE 1:	FIRST-AID SUPPLIES	$429.65	$1,434.00			
TABLE 2:	SPORTS CARE SUPPLIES	$187.00	$644.00			
TABLE 3:	CARDIOPULMONARY RESUSCITATION SUPPLIES	$27.00	$63.00			
TABLE 4:	EQUIPMENT REMOVAL SUPPLIES	$73.00	$176.00			
TABLE 5:	AUTOMATED EXTERNAL DEFIBRILLATION SUPPLIES	$1,622.00	$3,666.00	$329.00	$764.50	As indicated by usages or expiration date
	Total	***$2,388.65***	***$6,083.00***	***$329.00***	***$764.50***	

COST MAY DIFFER BASED ON NEED, NUMBER OF ATHLETIC SITES, ACTUAL USE AND EXPIRATION DATES. THIS SUPPLIES LIST IS NOT ALL CONCLUSIVE.

TABLE 7: NATIONAL AND IOWA TORNADO REPORTS AND FATALITIES

TABLE 7: NATIONAL AND IOWA TORNADO REPORTS AND FATALITIES

Year	Tornado Reports (National)	Killer Tornadoes (National)	Tornado Fatalities (National)	Tornado Reports (Iowa)	Tornado Fatalities (Iowa)
2001	1215	23	40	105	2
2002	934	25	55	34	0
2003	1374	16	54	28	0
2004	1817	19	35	119	0
2005	1265	12	38	46	1
2006	1103	25	67	38	1
2007	1096	26	81	42	0
2008	1692	37	126	105	13
2009	1156	10	22	42	0
2010	1282	21	45	52	0
2011	1691	59	553	68	0
2012	939	23	70	20	0
Total	15,564	296	1186	699	17

***Source: www.spc.noaa.gov/climo/torn/STAMTS11.txt**

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