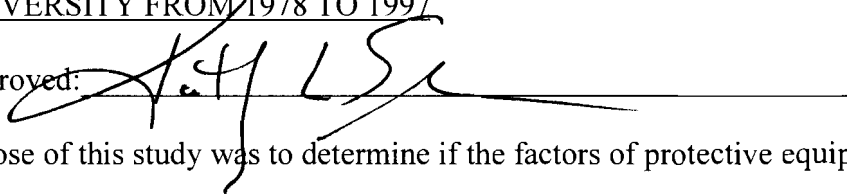


AN ABSTRACT OF THE THESIS OF

Jamie D. Dolieslager for the Master of Science in Physical Education presented on April 14, 1999.

Title: AN EXAMINATION OF THE FACTORS THAT EFFECTED FREQUENCY OF INJURY AND DAYS LOST FROM INJURY IN FOOTBALL AT EMPORIA STATE UNIVERSITY FROM 1978 TO 1997

Abstract approved:

A handwritten signature in black ink, appearing to read 'Jamie D. Dolieslager', is written over a horizontal line. The signature is stylized and cursive.

The purpose of this study was to determine if the factors of protective equipment, coaching changes, and win/loss records were related to the frequency of injury and days lost from injury in football at Emporia State University between 1978 to 1997. Participants were all injured football players who missed more than one day of the season. Injuries were classified into 36 different categories and analyzed using Chi-square. Results indicated no significant difference in injury frequency and in the number of days lost because of those injuries prior to and after the advances in helmets. There was no significant difference for shoulder injury frequency between open cell shoulder pads and closed cell shoulder pads, but a significant difference was found in the total number of days lost from shoulder injuries between the two types of shoulder pads. There was also a significant difference among the four head coaches for the total injury frequency and total number of days lost. There was no significant difference in the total number of days lost from injuries between winning and losing season.

AN EXAMINATION OF THE FACTORS THAT EFFECTED
FREQUENCY OF INJURY AND DAYS LOST FROM INJURY
IN FOOTBALL AT EMPORIA STATE UNIVERSITY FROM 1978 TO 1997

A Thesis

Presented to

The Division of Health, Physical Education and Recreation

EMPORIA STATE UNIVERSITY

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by

Jamie D. Dolieslager, A.T., C.

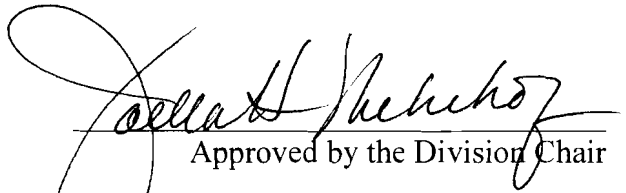
May, 1999

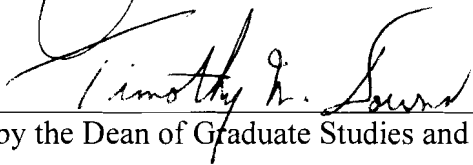
7/15/99
1/1/99
I

Copyright 1999

Jamie D. Dolieslager

ALL RIGHT RESERVED


Approved by the Division Chair


Approved by the Dean of Graduate Studies and Research

ACKNOWLEDGMENTS

I would like to extend my sincere appreciation and gratitude to my committee members: Dr. Kathy Ermler, Dr. Joella Mehrhof, and Dr. Kenneth Weaver for all of their expertise, support, guidance, patience, and inspiration throughout the course of this study. I would like to express a special thanks to Dr. Kathy Ermler for chairing my committee and most of all for her encouragement, patience and belief in my abilities. Thank you for the countless hours of reading, rereading and for the suggestions you gave.

I would also like to express a special thanks to Dr. Kenneth Weaver, for his expertise and statistical design advise. Thank you for always having an open door and taking time to answer all of my questions.

I would also like to extend a special thank-you to my mentor, John Baxter, for all of his help in providing me with the necessary information and for his guidance in writing my thesis. His expertise was greatly appreciated.

Words of appreciation are also expressed to my friends at Emporia State University. Without your support and encouragement this project would not have been completed. Finally, I would like to thank Corwin and Harriet Dolieslager, and the rest of my family, for being supportive, loving parents, brothers, and sisters and helping in anyway possible throughout the years.

TABLE OF CONTENTS

	<u>Page</u>
ACKNOWLEDGMENTS.....	ii
TABLE OF CONTENTS.....	iii
LIST OF TABLES.....	iv
	<u>Chapter</u>
1 INTRODUCTION.....	1
2 METHOD.....	15
3 RESULTS.....	22
4 DISCUSSION.....	31
5 REFERENCES.....	42
APPENDICES.....	45
Appendix A: Letter of Permission to John Baxter.....	46
Appendix B: Original NAIRS Form.....	48
Appendix C: Thirty-six Classifications of Injuries.....	50
Appendix D: Time Line of Improvements Made in Protective Headgear.....	52
Appendix E: Years of Helmet Usage.....	55
Appendix F: Years of Shoulder Pad Usage.....	57
Appendix G: Coaches Tenures and Win/Loss Records.....	59

LIST OF TABLES

Page

Table 1: Descriptive Statistics of the Total Number of Injuries, Total Days Lost, Number of Shoulder Injuries, Shoulder Injury Days Lost, Number of Head Injuries, Total Number of Head Injury Days Lost by Year.....	23, 24
Table 2: Descriptive Statistics for Total Number of Injuries, Total Number of Days Lost, Number of Shoulder Injuries, Shoulder Days Lost, Number of Head Injuries, Total Number of Head Injury Days Lost by Coach.....	25
Table 3: Descriptive Statistics on the Total Number of Injuries and Total Number of Days Lost by Winning and Losing Seasons.....	26
Table 4: Descriptive Statistics for the Number of Shoulder Injury Frequencies and Total Number of Days Lost from Shoulder Injuries for Open and Closed Cell Shoulder Pads.....	27
Table 5: Descriptive Statistics on the Number of Head Injury Frequencies and The Total Number of Days Lost from Head Injuries by Helmet Equipment Changes.....	28

CHAPTER 1

INTRODUCTION

Historically, sports in the United States have enjoyed a popularity that is unmatched by any other pastime. Sports are a part of broadcast, print, and electronic mass media. When events occur in the sports world, the media direct the viewers' focus to the aspects that will captivate their attention. One aspect of sports the media continue to highlight is the amount and severity of athletic injuries.

Injuries are significant in sports because they play a major role in determining the outcome of a game or even a season. When a quarterback is injured and unable to play for the remainder of the season, a team suffers. Furthermore, if two or three starting players sustain a significant injury during any part of the season, the entire team is affected.

Due to the number, size, and strength of players and the quality of the game, football experiences a large number of injuries. A concerted effort has been made by governing bodies, coaches, athletic trainers and physicians to reduce the number of injuries associated with football. While injuries may never be completely eliminated in football, it continues to be critical to find ways of reducing the overall number of injuries. Continually looking for ways to reduce injuries will ultimately benefit the athletes and the sporting world.

Prevention is the first consideration related to football injuries. The factors associated with the prevention of football injuries include using the most effective protective equipment, obeying and following the rules adopted for the game of football, and realizing the effect of competitive pressure.

Improvements in protective headgear, shoulder pads and other pads have decreased the number of fatalities and serious injuries associated with football (Mueller & Blyth, 1986). However, in order to continue to reduce the number of fatalities and catastrophic injuries that occur in football, improvements made in the development of protective equipment need to continue. Additional studies need to examine the effectiveness of current equipment in reducing head and neck injuries.

Rule changes over the past 20 years have decreased the number of catastrophic injuries (Mueller & Blyth, 1986). However, a continual need exists to interpret and enforce the rules associated with injury reduction. Efforts on behalf of rule committees, coaches, players, and officials to interpret, teach, implement, and enforce the rules is needed for a reduction of injury frequency to occur.

Improvements in protective equipment and the recognition of competitive pressures are considered to be factors associated with injury prevention, particularly catastrophic injuries in football. However, even with significant changes in this area, little or no research has examined the factors that are related to injury prevention in football. It is the intent of this study to determine if the factors of protective equipment, coaching changes, and win/loss records were related to the frequency of injury and number of days lost from injury in football at Emporia State University between the years of 1978 to 1997.

Statement of Problem

Over the past 20 years, new developments have been made in the area of protective equipment for the game of football. New rule developments have also been implemented to improve safety standards and to decrease the frequency of

football injuries. However, to date very little research has examined whether these changes and improvements have any relationship to injury rates in football. Coaching changes and overall win/loss records may also have an impact on the total frequency of injury and the days lost from those injuries. Research does not indicate if these factors determine injury frequency outcomes or if they effect number of days lost from injury.

Statement of Purpose

The purpose of this study was to determine if the factors of protective equipment, coaching changes and win/loss records were related to the frequency of injury and number of days lost from injury in football at Emporia State University between the years of 1978 to 1997.

Hypotheses

1. There was no difference in injury frequency and the number of days lost because of those injuries prior to and after the advances in helmet/shoulder pad equipment.
2. There was no difference among the four different head coaches at Emporia State University and the frequency of injury or the number of days lost from those injuries during their tenure.
3. There was no differences between the total number of injuries and the total number of days lost from injuries during winning/losing seasons.

Definitions

The following terms occur frequently throughout the study and are formally defined to provide a common base of understanding.

1. Injury – any athlete complaint that required the attention of an athletic trainer or physician. An accident causing an athlete to miss all or part of a single game or practice. All head injuries, regardless of severity, reported to the athletic trainer.
2. Time Loss – a determined amount of time missed (either in a practice or a game setting, including one day, not including the day of the initial injury) due to an injury.
3. Minor Injury – an injury requiring an athlete not to miss any days from activity.
4. Mild Injury- an injury requiring an athlete to miss one to seven days.
5. Moderate Injury – an injury requiring an athlete to miss 8 to 21 days.
6. Severe Injury – an injury requiring an athlete to miss 22 or more days.
7. Catastrophic injury – an injury that causes permanent disability, dismemberment, or death.
8. Injury Rate – total number of injuries divided by the total number of participants. Also referred to as injuries per athlete.
9. Inseason – the beginning of training camp through the last day of the season.

10. Winning Season – a percentage of .500 or above as calculated by a proportion of the number of games won divided by the total number of games.
11. Losing Season – a percentage of .499 or below as calculated by a proportion of the number of games lost divided by the total number of games.
12. Gadd Severity Index – measurement used to determine the amount of violent energy a helmet can sustain during a direct trauma.
13. Suspension Helmet – protective head gear in which the head is held in place by using a strapping mechanism.
14. In-Line Foam – protective head gear in which the head is held in place by a series of foam pads within the helmet shell.
15. Air-Helmet – protective head gear in which the head is held in place by a series of balloon-like bladders which hold a desired amount of air designed to customize fit a player.
16. Closed-Celled pads – shoulder pads consisting of small layers of foam underlying a plastic shell.
17. Open-Celled pads - multi-layered shoulder pads that use high-density foam, memory foam, and air chambers for padding and protection.

Statement of Significance

This investigation will provide an overview of injuries sustained while participating in football at Emporia State University over the past 20 years. The analysis and interpretation of the data will provide useful information, suggest ways to decrease injury occurrences, and illustrate recent trends in injuries. As a result, this study will expand the knowledge base of the coaching and the athletic training

fields. It may also benefit athletic directors in the ordering and reconditioning of protective equipment.

An analysis of the data indicated whether the continued improvements being made in protective equipment have had any impact on reducing injury frequency. In analyzing each season, this study sought to determine if coaching changes and win/loss records of a team have an impact on the frequency of injury. Application of the information gathered from these data could serve as an educational resource for the coaching profession. Insight gained from the examination of this data will provide other medical professionals with possible factors that contribute to injury frequencies.

Review of Literature

The purpose of this study was to determine if the factors of protective equipment, coaching changes and win/loss records were related to the frequency of injury and number of days lost from injury in football at Emporia State University between the years of 1978 to 1997. The review of literature examined the historical development and evolution of protective equipment in football. The review of literature also examined the effect of win/loss records on the number of injuries sustained in football at Emporia State University between the years of 1978 to 1997.

Helmets

Football fatalities and serious injuries have concerned people for many years. In 1905, President Theodore Roosevelt threatened to ban football if violence and serious injuries continued (Mueller & Blyth, 1980). At that time, some colleges prohibited

football while other college coaches and faculty members changed rules to eliminate some of the dangers related to participation in football.

Head harnesses were the earliest versions of helmets, dating back to the early 1900s. They were made of soft leather and were initially designed to cover the ears. These helmets were criticized for blocking communication between players on the field. Between 1915 and 1917, the first helmet offering full head protection and holes in the earflaps was developed. These helmets were still made of soft leather, but did offer limited suspension (Gaffney, 1995).

During the 1920s and 1930s, helmets were designed using harder leather and some fabric cushioning for increased protection. Gaffney (1995) stated, “Helmets also moved from the previous flat-top shape to a more teardrop shape in order to fit the skull better. By adopting the helmet’s teardrop shape the skull could receive the impact of a blow to slide to one side rather than being absorbed head-on” (p. 78). Gaffney also stated, “The granddaddy of helmet innovations came in 1939, when the John T. Riddell Co., of Chicago, Illinois, introduced the first plastic football helmet. In 1940, Riddell was credited with adding the first face mask, also plastic, and moving the helmet strap from the Adam’s apple to the chin” (p. 80). The plastic helmet did have performance improvements, but due to lack of materials during World War II, some of the early models were not well made. In fact, in 1948, these plastic helmets were banned from the National Football League (NFL). Riddell quickly made adjustments in the type of synthetics used in construction and, in 1949, plastic helmets were reinstated in the NFL.

With the implementation of the plastic helmet came the need for research and testing of these helmets. In the middle 1940s, Cornell Aeronautical Laboratory (CAL), sponsored by the federal government, researched padding materials and the development of protective headgear for a number of different uses including football (Dye, 1959). Following CAL's research, the New York State Athletic Commission began a project aimed at reducing the hazard to the head after being knocked out in a boxing contest. CAL later took this research and classified helmets into two categories. The first category included those helmets in which the head was held in position within the hard shell of the helmet by padding materials. The second category included those helmets in which the head was held in position by a strap suspension system (Dye, 1959,).

Helmet shells were made from many different types of material, ranging from flexible rubber-like plastics to stiff phenolic-bound fiberglass or steel (Dye, 1959). Initially, leather and vulcanized fiber were common materials used in football helmets. Some helmets included a strapping mechanism to keep the helmet in place while others did not have this strap. In 1957, at the request of the chairman of the American Medical Association Committee on Sports Injuries, Dye (1959) developed a set of recommendations for a minimum standard for protective headgear in order to:

1. Reduce the magnitude of the blow to the head.
2. Distribute the remaining force received by the head over as wide an area as possible.
3. Prevent lacerations and abrasions to the scalp (p. 371).

From these initial developments of protective equipment, the efforts to reduce injuries sustained in football have taken precedence over other sports.

During the 1960s, football fatalities reached an all-time high (Mueller & Blyth, 1980). Two trends related to injuries were the severe head and neck injuries, as well as the lawsuits that followed these injuries. The Annual Survey of Football Fatalities, established in 1931, revealed that 36 football fatalities during 1968 were associated with head or neck trauma (Mueller & Blyth, 1980). Litigation against helmet manufacturers increased during this time. One such lawsuit resulted in a 5.3 million dollar settlement against Riddell, Inc. (Cushing, 1980).

The National Operating Committee on Standards in Athletic Equipment (NOCSAE) was formed in 1969 to direct research in the area of injury reduction. The primary purpose of NOCSAE was to conduct research and establish legitimate standards for protective equipment. These standards require all new and reconditioned helmets to meet and pass the established Gadd Severity Index (GSI) of 1500 GSIs for concussion tolerance (Hodgson, 1975). “The standard was not intended to guarantee a player’s safety when wearing a helmet – only that the helmet shell and interior padding met certain impact performance criteria” (Cushing, 1980, p. 101). As a result of the establishment of this standard, the number of helmet manufacturers declined. The number of helmet models offered by manufacturers declined from 85 in 1972 to 25 in 1992 (NOCSAE Manual, 1993).

The National Football Head and Neck Injury Registry (NFHNIR) was established in 1971 by Dr. Joseph Torg (Swenson, Lauerman, Blanc, Donaldson, & Fu, 1997). Injury comparisons were made on injury data from 1959-1963 to data from 1971-1975. Results indicated a 66 percent reduction in concussions and a 42 percent decrease in the number of deaths from these injuries. However, results also indicated

a 204 percent increase in cervical spine fractures. The improved helmet design had reduced head injuries, but changes in playing technique placed the cervical spine at greater risk, since the top of the head was used as the initial point of contact (Torg, Vegso, O'Neill, & Sennett, 1990).

In 1976, NOCSAE committees were established to introduce rule changes to the sport of football. These changes included prohibiting the initial contact in the offensive and defensive techniques in blocking and tackling to be initiated with the head. Spearing is the intentional use of the helmet in an attempt to punish an opponent. Face tackling is driving the face mask, frontal area, or top of the helmet directly into the runner. Butt blocking is a technique involving a blow driven directly into an opponent with the face mask, frontal area, or top of the helmet as the primary point of contact either in close line play or in the open field (Heck, 1995). In 1979, the NCAA implemented rules prohibiting face tackling, butt blocking, and spearing. In 1980, the National Federation of High School Athletics implemented the same rules in order to improve the game of football and protect the high school athletes from injuries. The implementation of the spearing and tackling rules has decreased the number of catastrophic injuries in football (Heck, 1992).

The 48th Annual Survey of Football Injury Research reported a drastic decline in the number of fatalities from football. There were 14 deaths in 1960, 25 in 1965, 36 in 1968, 29 in 1970, 15 in 1975, and an all-time low of 4 in 1979. In 1979, three fatalities occurred in high school and one in college (Mueller & Blyth, 1980). Mueller and Blyth (1980) reported the reasons for the decreased number of football fatalities were:

1. A major effort to reduce football fatalities and injuries on behalf of many individuals and organizations.
2. In 1976, the NCAA and the National Federation of State and High School Associations (NFSHSA) implemented rule changes that prohibited 'butt blocking and spear tackling.
3. The National Operating Committee on Standards for Athletic Equipment (NOCSAE) established a football helmet standard that was accepted by the NCAA for the 1978 season and by the NFSHSA for the 1980 season.
4. Physical conditioning programs were improved and complete physical examinations were emphasized (p. 54).

NOCSAE went on to take educational responsibilities to further the standard previously set. These responsibilities included working with equipment manufacturers, establishing rule making committees, and training athletic directors, coaches, athletic trainers, physicians, and players. NOCSAE realized the implementation of helmet standards alone would not curb the incidence of catastrophic head and neck injuries. Smith, Smoll, and John (1993) conducted a study that assessed the effectiveness of NOCSAE warning labels on football helmets. This study sought to determine if 308 high school football players could remember the warning label at two different times during the season: preseason and postseason. Results indicated 26% adequately recalled the potential for head and neck injury after the preseason. After a full season of exposure to NOCSAE warning signage in the locker room and dressing facilities, results did not indicate a significant increase in the recall of the helmet warning label.

Shoulder Pads

The developments in protective headgear led to improvements in shoulder pads. Manufacturers of shoulder pads have produced new equipment to protect the cervical spine and shoulder joint. They have developed two types of shoulder pads: flat and

cantilevered. The flat style shoulder pads were designed for players requiring greater shoulder mobility. In flat shoulder pads, the amount of padding is reduced to allow for a less inhibited range of motion. Cantilevered pads were designed for the positions that require the greatest amount of collision contact. Increased padding and a raised epaulet provide greater shock absorption for blocking and tackling (Gieck, & McCue, 1980).

During the 1930s, the implementation of closed cell shoulder pads was a major improvement in football equipment. While not many improvements have been made in the shoulder pad area, manufacturers did change the basic design with open celled shoulder pads. Open celled shoulder pads are multi-layered pads that use high-density foam, memory foam, and air chambers for padding and protection. The different types of foam are layered and covered with plastic to absorb forces of energy. The closed cell pads served the same basic purpose, but the plastic shell only covers one layer of foam.

Deppen, Nobel, Walker, & Dorgan (1992) conducted a study on closed-cell and open-cell shoulder pads. Participants were exposed to impact forces in field and laboratory tests. Results indicated the greatest force was placed on the acromion process. The open-cell air system, when compared to closed-cell system, resulted in lower peak impact forces. The use of this open-celled system could ultimately decrease the number of contusions that result from impact forces. However, the use of open-celled shoulder pads may not decrease the number of shoulder subluxations or dislocations.

Other Protective Equipment

There have been other types of pads and protective equipment implemented in the game of football. Cervical collars, as well as rib, hip, thigh, knee, elbow, forearm, wrist, and hand pads have been used to protect areas that are exposed to direct trauma. While all of these pads aid in protection, mouth guards were implemented in collision sports to act as a trauma reducing shock absorber. Mouth guards absorb some of the energy directed to the head. This absorption of energy reduces the likelihood of sustaining concussions or neck injuries (Wilkinson and Powers, 1986).

In 1978, the National Collegiate Athletic Association, (NCAA) made mouth guards mandatory for all college football players. NCAA rule 1.4.4 mandates all players wear professionally manufactured equipment not altered to decrease protection, including an intraoral mouthpiece that covers all upper jaw teeth. Following the implementation of this rule change, studies in Great Britain challenged previous studies showing the occurrence of head and neck injuries were not reduced in wearers of mouth guards as opposed to non-wearers of mouth guards (Blignaut, Carstens, & Lombard, 1987).

Kuebker, Morrow, & Cohen (1986) conducted a study on mouth guards. They found a significant number of mouth guards did not properly fit the football team members. Therefore, the mouth guards were not reducing the number of concussions or neck injuries. This study also indicated the needs of black athletes were not being met due to the inadequacies in the mouth formed mouth guards currently available. The authors concluded that the largest available model of mouth guard did not satisfy the NCAA safety requirement for mouth guards.

Win/Loss Records

Canale, Cantler, Sisk, and Freeman (1981) conducted a study at Memphis State University from 1975 to 1979 to determine the probability of an individual sustaining an injury during his playing career. The researchers emphasized the probability of each participant sustaining an injury for one, four, and five years, as well as the probability of the injuries occurring to a specific team. They also studied different player positions, in relationship to game and practice settings, in both winning and losing seasons. The researchers hypothesized that the number of injuries sustained during losing seasons would be significantly greater than during winning seasons. However, they found participants sustained fewer injuries during the worst losing season than in any other season.

Summary

The purpose of this study was to determine if the factors of protective equipment, coaching changes and win/loss records were related to the frequency of injury and number of days lost from injury in football at Emporia State University between the years 1978 to 1997. This literature review highlighted changes made in the area of the development of protective equipment and the implementation of new rules, which helped reduce catastrophic injuries in football. Shoulder pads, mouth guards, and other protective equipment were also investigated. There was no information found relating coaching turnover to injury frequency or time lost from injury. Win/loss records were reviewed in relationship to injury frequency and time lost from injury.

CHAPTER 2

METHOD

The purpose of this study was to determine if the factors of protective equipment, coaching changes and win/loss records were related to the frequency of injury and number of days lost from injury in football at Emporia State University between the years 1978 to 1997. This chapter discusses the methods and procedures used in this study. Information on population, procedures, and the statistical design is also discussed.

Participants

The participants in this study were male collegiate football players at Emporia State University who participated in the varsity football program between the years 1978 to 1997. Since this study focused on injury frequency and number of days lost from injury, only the injured athletes who participated in football at Emporia State University were included.

Accessible Population

The accessible population for this study was all athletes who participated in the traditional season of football at Emporia State University between the years 1978 to 1998. The mean roster size of the Emporia State University football team for the past 20 years has been approximately 70 student athletes. Emporia State University is a small midwestern school located in Emporia, Kansas. Emporia State University is a Division II, NCAA school, with approximately 6,000 students.

Procedures

Permission to conduct this study was obtained from John Baxter, Head Athletic Trainer at Emporia State University. A letter of permission was written to John Baxter asking permission to use the archival data that he had collected between the years of 1978 to 1998 (Appendix A). Mr. Baxter has used the data as a general overview of each year's injuries, injury frequencies and number of days lost from injuries sustained while participating in football at Emporia State University.

Prior to the 1977 football season, John Powell, from NAIRS (National Athletic Injury Reporting System), an injury surveillance committee, asked John Baxter to participate in an injury/illness study, and Mr. Baxter agreed. He completed the NAIRS injury/illness survey and sent it back to the committee for analysis at the end of the season.

The original NAIRS form was used for the 20 year injury surveillance study (Appendix B). This form includes a space for the athlete's name, the sex of the athlete, the type of sport, the type of activity, the date of injury, the date returned from injury, and the classification of the injury. There were 36 different categories of injuries used in this study (Appendix C).

In order for participants to be included in the study, they had to be injured during a traditional pre-season practice, a regular season practice, or during a competition. The initial injury needed to hold them out of activity for at least one day of activity, not including the day of the initial injury. If the athlete lost a day's activity due to an injury sustained during pre-season, practice or competition, he would have been entered into the survey. This information was taken from the daily injury log and the

coach's report. The date of the injury was also recorded. Athletes were identified by their name and injury classification (Appendix C).

A follow-up report included the date the athlete was allowed to return to full contact or when he would have returned to full contact if the season had not ended. If the injury was classified as a season ending injury, the date of return would be the last day of the traditional football season.

For the purpose of this study, all injuries were classified by injury type and by the severity of injury. Minor injuries were classified as injuries in which an athlete did not miss one day of activity. Mild/moderate injuries were classified as injuries causing an athlete to miss at least one day of activity and up to three weeks of inactivity. Severe injuries were classified as injuries that caused the athlete to miss three or more weeks of activity. There were no catastrophic injuries reported in the 20 years of this study. All of the statistical procedures for this study excluded all minor injuries and added moderate and severe injuries together. By classifying moderate and severe injuries together, total injury frequency was determined.

The researcher developed a time line of different types of protective headgear used from 1978 to 1997. Three major equipment manufacturers were contacted by telephone. These manufacturers included Riddell All-American, Douglas, and Schutt. Each manufacturer gave a brief historical background of its product. The president of Riddell All-American, Don Gleisner, was very helpful in developing a time line of improvements made in protective headgear (Appendix D). In addition to this information, the researcher contacted Mr. Baxter to develop a time line of the

implementation of the protective equipment used at Emporia State University during this same period.

A timeline of the implementation of protective equipment including helmets and shoulder pads was made using the dates received from the Mr. Gleisner and Mr. Baxter. Years were grouped together into two categories: 1975 through 1985 when there was a combination of in-line foam (Pac 3 helmets) and air helmets (AF2) and 1986 through 1997 when all helmets were air helmets (AF2) (Appendix E). The total number of head and neck injuries prior to and following the implementation of in-line foam and air helmets was analyzed.

Two groups were also determined for years of shoulder pad equipment: 1978 through 1994 when there was a combination of closed-cell and open-cell shoulder pads and 1995 through 1997 when only open-cell shoulder pads were being used (Appendix F). The average number of shoulder injuries prior to and following the implementation of open-celled pads was analyzed.

Emporia State University Sports Information Director J.D. Campbell and Assistant Sports Information Director Mason Logan were contacted to establish a time line for the football coaching changes at Emporia State University during the years 1978 to 1998. Four coaches headed the varsity football program during these years (Appendix G). Coaches were classified as Coach 1, Coach 2, Coach 3, and Coach 4. Coach 1 coached for four years, but due to the timing of this study, only his final season was included in the study. Coach 2 coached for four years. Coach 3 coached for 12 years. Coach 4 coached for four years. Confidentiality and experimental control was maintained by not identifying the coach's names.

Observed injury frequencies were compared to expected injury frequencies for each coach. Observed days lost were compared to expected days lost under each coach's tenure. To compensate for the different number of years each coach headed the players at Emporia State University a proportion of time was computed. The tenure of each coach was divided by the total years of the study. For example, if a coach was employed for four years at Emporia State University, his frequency of injury and total number of days lost would only reflect those four years. Therefore, those four years were divided by the total number of years to provide each coach with a ratio of injuries that should have occurred under his tenure (four years / twenty years = a ratio of 1/5 of the total injuries during the coach's tenure).

Mr. Campbell and Mr. Logan were also contacted to establish the overall win/loss record for the 20 year study (Appendix G). The overall win/loss records of individual coaches were not analyzed, but rather the frequency of injury and number of days lost from injury during all winning and losing seasons was examined. There were 10 winning seasons and 10 losing seasons in the 20 year study.

The overall winning seasons was compared to the overall losing seasons. Observed frequency of time loss was compared to expected time loss during winning and losing seasons. A proportion was implemented to compensate for the unequal years of winning seasons and losing seasons. (Number of winning seasons/total number of seasons = proportion of winning seasons. Number of losing seasons/total number of seasons = proportion of losing seasons).

Statistical Design

Twenty years of data collected by Mr. Baxter were used for this study. The purpose of this study was to determine if the factors of protective equipment, coaching changes, and win/loss records were related to the frequency of injury and time loss from injury in football at Emporia State University between the years 1978 to 1997. The dependent variables were frequency of injuries and the number of days lost from injuries. The independent variables were developments in protective equipment, coaching changes, and win/loss records.

The first hypothesis stated there was no difference in injury frequency and the number of days lost because of those injuries prior to and after the advances in helmet/shoulder pad equipment. The changes in helmet/shoulder pad equipment were analyzed using chi-square.

The second hypothesis stated there was no difference among the four different head coaches at Emporia State University and the frequency of injury or the number of days lost from those injuries during their tenure. The frequency of injury as it related to coaching turnover was analyzed using chi-square.

The third and final hypothesis stated there was no difference between the total number of injuries and the total number of days lost from injuries during winning/losing seasons. This hypothesis was analyzed using chi-square.

All data were analyzed at the $p < .05$ level of significance. Rejecting the null hypothesis indicated

1. There was a difference in injury frequency and the number of days lost because of those injuries prior to and after the advances in helmet/shoulder pad equipment.
2. There was a difference among the four different head coaches at Emporia State University and the frequency of injury or the number of days lost from those injuries during their tenure.
3. There was a difference between the total number of injuries and the total number of days lost from those injuries during winning/losing seasons.

Summary

The purpose of this study was to determine if the factors of protective equipment, coaching changes, and win/loss records were related to the frequency of injury and number of days lost from injury in football at Emporia State University between 1978 to 1997. The participants were injured football players at Emporia State University from 1978 to 1997.

CHAPTER 3

RESULTS

The purpose of this study was to determine if protective equipment, coaching changes and win/loss records for football were related to the frequency of injury and number of days lost from injury at Emporia State University between the years of 1978 to 1997. Chi-square was used to determine the significance of all three hypotheses. All Chi-squares were examined at the $p < .05$ level.

Injuries were categorized into total number of head/shoulder injuries and the total number of days lost from head and shoulder injuries. Descriptive statistics of the total number of injuries, total number of days lost, number of shoulder injuries, shoulder injury days lost, number of head injuries, and total number of head injury days lost, categorized by year, are presented in Table 1. Descriptive statistics for the total number of injuries, total number of days lost, number of shoulder injuries, shoulder injury days lost, number of head injuries and total number of head injury days lost, categorized by coaches tenures, are presented in Table 2. Descriptive statistics on the total number of injuries and the total number of days lost, divided by winning and losing seasons, are presented in Table 3. Descriptive statistics on the number of head injury frequencies and total number of days lost from head injuries, divided by helmet equipment changes, are presented in Table 4. Descriptive statistics for the number of shoulder injury frequencies, and total number of days lost from shoulder injuries, divided by open and closed cell shoulder pads, are presented in Table 5.

Table 1

Descriptive Statistics of Total Number of Injuries, Total Number of Days Lost, Number of Shoulder Injuries, Shoulder Injury Days Lost, Number of Head Injuries, Total Number of Head Injury Days Lost by Year

Year	TIF	TDL	SHIFRQ	SHIDL	HIFRQ	HIDL
1978	134	1095	10	51	19	158
1979	98	789	12	71	13	77
1980	107	859	13	74	6	17
1981	81	937	10	107	4	28
1982	94	947	6	47	7	61
1983	77	686	8	74	2	22
1984	120	1267	13	117	4	47
1985	83	852	8	152	4	40
1986	106	1241	13	126	6	25
1987	79	1040	11	204	8	44

Year	TIF	TDL	SHIFRQ	SHIDL	HIFRQ	HIDL
1988	67	872	5	34	4	98
1989	68	1138	9	82	3	47
1990	51	742	6	69	0	0
1991	102	990	19	270	4	34
1992	52	869	9	228	2	10
1993	71	928	13	126	5	25
1994	77	932	5	101	4	114
1995	81	926	12	143	4	24
1996	90	1162	8	187	11	261
1997	100	969	8	168	12	95

Note.

TIF = Total Number of Injury Frequencies

TDL = Total Number of Days Lost

SHIFRQ = Number of Shoulder Injury Frequencies

SHIDL = Total Number of Days Lost from Shoulder Injuries

HIFRQ = Number of Head Injury Frequencies

HIDL = Total Number of Days Lost from Head Injuries

Table 2

Descriptive Statistics for Total Number of Injuries, Total Number of Days Lost,Number of Shoulder Injuries, Shoulder Injury Days Lost, Number of Head Injuries,Total Number of Head Injury Days Lost by Coach

Coach	1		2		3		4	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
TIF	134	N/A	95	11	79	21	90	10
TDL	1095	N/A	883	74	963	182	1019	126
SHIFRQ	10	N/A	10	3	10	4	9	2
SHIDL	51	N/A	75	25	132	70	166	22
HIFRQ	19	N/A	8	4	4	2	9	4
HIDL	158	N/A	46	28	43	33	127	122

Note.

TIF = Total Number of Injury Frequencies

TDL = Total Number of Days Lost

SHIFRQ = Number of Shoulder Injury Frequencies

SHIDL = Total Number of Days Lost from Shoulder Injuries

HIFRQ = Number of Head Injury Frequencies

HIDL = Total Number of Days Lost from Head Injuries

Table 3

Descriptive Statistics on Total Number of Injuries and Total Number of
Days Lost by Winning and Losing Seasons

Season	N	TIF		TDL	
		<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Winning	10	78.50	19.70	964.50	146.75
Losing	10	95.30	20.04	959.60	173.42
Total	20	86.90	21.18	962.05	156.38

Note.

TIF = Total Injury Frequency

TDL = Total Days Lost

N+C11 = Years

Descriptive Statistics on Number of Head Injury Frequencies and Total Number of Days Lost from Head Injuries by Helmet Equipment Changes

Helmet Equipment Change	<u>N</u>	HIF		HDL	
		<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Pac-3 and Air	8	7.38	5.76	56.25	45.76
Air	12	5.25	3.52	64.75	71.77
Total	20	6.10	4.53	61.35	61.42

Note.

HIF = Head Injury Frequency

HDL = Head Days Lost

N = Years

Table 5

Descriptive Statistics for Number of Shoulder Injury Frequencies, and Total Number of Days Lost from Shoulder Injuries for Open and Closed Cell Shoulder Pads

Shoulder Equipment Change	<u>N</u>	SIF		SDL	
		<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Open and Closed Cell	17	10.00	3.66	113.71	66.31
Open Cell	3	9.33	2.31	166.00	22.07
Total	20	9.90	3.45	121.55	64.19

Note.

SIF = Shoulder Injury Frequency

SDL = Shoulder Days Lost

N = Years

Frequency counts were analyzed whenever necessary to ensure equivalent comparisons. Frequencies were analyzed using this Chi-square formula:

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

Hypothesis 1 stated there would be no difference in injury frequency and in the number of days lost because of those injuries prior to and after the advances in helmet/shoulder pad equipment. There was no significant difference in the number of head injury frequencies, $\chi^2(1, \underline{N} = 122) = .36$, and no significant difference in the number of days lost from head injuries from the helmet changes that occurred during the 20-year study, $\chi^2(1, \underline{N} = 1,227) = .60$. There was no significant difference for shoulder injury frequencies between different types of shoulder pads, $\chi^2(1, \underline{N} = 177) = .93$. However, there was a significant difference between days lost from shoulder injuries and different shoulder pads used during the 20-year study, $\chi^2(1, \underline{N} = 2,431) = 9.76$.

Hypothesis 2 stated there was no difference among the four different head coaches at Emporia State University and the frequency of injury or the number of days lost from those injuries during their tenure. The total frequencies of all 36 categories of injuries sustained during the years of each coach's tenure were totaled. There was a significant difference among the four coaches and the total injury frequency, $\chi^2(3, \underline{N} = 1,738) = 17.03$. There was a significant difference among the four coaches and the total number of days lost, $\chi^2(3, N = 18,305) = 24.27$.

Hypothesis 3 stated there was no differences between winning and losing seasons and the total number of injuries or the total number of days lost. There was no

significant difference in the total number of injuries between winning and losing seasons, $\chi^2(1, N = 1,738) = 1.62$. There was no significant difference in the total number of days lost from injuries between winning and losing seasons, $\chi^2(1, N = 18,305) = .012$.

There was a significant difference found in the number of days lost from shoulder injuries in the years prior to and after shoulder pad equipment changes at Emporia State University between the years 1978 to 1997. There was also a significant difference found in the frequency of injuries and total number of days lost from injuries compared to coaches' tenures. Finally, there was no significant difference found in the frequency or number of days lost from injury during winning and losing seasons.

CHAPTER 4

DISCUSSION AND FUTURE STUDY

The purpose of this study was to determine if the factors of protective equipment, coaching changes and win/loss records were related to the frequency of injury and number of days lost from injury in football at Emporia State University between the years of 1978 to 1997.

Hypothesis 1 stated there was no difference in injury frequency and the number of days lost because of those injuries prior to and after the advances in helmet/shoulder pad equipment. Results indicated there was no significant difference between the Pac-3 helmets and the Air (AF2) helmets or between the open and closed cell shoulder pads and the frequency of shoulder injuries. There was no significant difference between the Pac-3 helmets or the Air (AF2) helmets and the number of days lost from head and neck injuries throughout the 20 year study. There was a significant difference found between open and closed cell shoulder pads and the number of days lost from shoulder injuries.

According to Baxter (1999), "We see a similar frequency of head injuries and days lost from head injuries over the past 20 years, even though the air helmet is better. When in-line foam helmets were used, Emporia State University was more likely to see second and third degree concussions. Due to the severity of these types of concussions, a result of more days lost per athlete would occur." Today, the medical profession is more conservative with head/neck diagnosis. Medical professionals tend to be more conservative, erring on the side of the patient's health and safety rather than being aggressive and returning an athlete to full competition before

he/she is medically able to participate. The medical profession recognizes headaches as no longer being “part of the game of football,” but rather a symptom of cerebral neurotrauma. Therefore, more time is lost with first degree concussions than in previous years. As a result, there is an increase in the classification of first degree concussions and a decline in the second and third degree concussions.

Improvements made in the predominate use of the Air (AF2) helmets have contributed to the decrease in the number of second and third degree concussions. Alles, Powell, Buckley and Hunt (1980) conducted a summary of football data taken from a NAIRS survey from 1975 to 1979. “NAIRS data showed relatively little year-to-year fluctuation and an overall low frequency of cerebral neurotrauma resulting from participation in football” (p. 99). It is important to note that during the time of Alles and Buckley’s study there were 13 helmets representing eight manufactures being used. When analyzed, no single helmet exceeded the average rate of concussions per year. As time passed, the number of helmet manufactures declined as well as the number of different models of helmets made by manufactures. By 1987, the majority of in-line foam helmets were working themselves out of the game of football and air helmets were becoming a much more popular choice. Zemper, (1989) argued there was a possibility of finding a real difference in the protective ability among the brands of helmets that he tested only in the fourth year of his study (1987). He also stated that there would have to be at least two more seasons of data collection to be able to have any practical significance in the study. While Zemper did not indicate which brand of helmet was tested, the timeline of helmet improvements would indicate the majority of helmets being used in 1987 were the

Air (AF2) helmets.

Injuries to the head and neck can be the most serious injuries of all sports-related injuries. Because the effects of a head injury are not always immediately apparent, taking time to recognize the extent of the damage is important. The implementation of recommended time tables used for the medical treatment of head/neck injuries and a better understanding of head injuries today compensates for the higher number of head/neck injuries recorded during the late seventies. During the late seventies, the 48th Annual Survey of Football Injury Research reported a decline in the number of fatalities in football (Mueller & Blyth, 1980), but did not discuss the severity of the concussions not resulting in fatalities. Baxter (1999) stated: “In the 70’s and 80’s when a player got his ‘bell rung’ he would return to participation because there was not a protocol to follow for head injury, requiring to hold the player out of competition until his symptoms subsided. Today, because of advances in medicine, and the implementation of the recommended time loss tables, there is a specified protocol to follow after a head injury has occurred. This protocol is very strict and specific about when one should be allowed to return to participation.”

John Baxter and the current medical staff at Emporia State University use the Cantu RC guidelines for determining the extent of cerebral neurotrauma (Cantu, 1986). These guidelines provide athletic trainers with a protocol to follow after a head injury has occurred. These specific guidelines were not available to other athletic trainers in the past. Baxter stated: “We had several athletes prior to the air helmets that had headaches attributed to the nature of the game of football. Today those headaches are attributed to contact and directly associated with concussions.”

In the 1997-1998 football season, the NCAA Football Injury Surveillance System reported 232 first degree concussions, 31 second degree concussions, and 3 third degree concussions. Due to better informed medical personal and specific concussion protocols, the treatment of first degree concussions, involves more time loss than in previous years. This could account for not finding any significance in the total number of days lost from head and neck injuries. Baxter (1999) indicates “The sophistication of medicine is what has caused the average number of days lost to remain consistent over the 20 year study.”

No significant difference was found between the open and closed cell shoulder pads and the frequency of shoulder injuries. Baxter (1999) stated “The principle reason for shoulder pads is to prevent contusions; not to prevent sprains, strains and dislocations.” As a result of the inherent instability of the shoulder girdle, no shoulder pad can protect the shoulder joint from anything other than contusion type injuries. Although great changes and improvements have been made in shoulder pad equipment, no shoulder pad will ever prevent all incidences of shoulder injuries. Baxter (1999) concluded, “You can have the best shoulder pads money can buy and still dislocate the shoulder joint.” Deppen, Nobel, Walker and Dorgan (1992) agreed with Baxter stating when open and closed cell systems are compared, open celled systems could ultimately decrease the number of contusions that result from impact forces, but open-celled shoulder pads may not help reduce the number of shoulder subluxations and dislocations. Baxter also noted he had many complaints of sore shoulders when the closed-cell pads were being used. Today, with open celled pads

those complaints have diminished significantly. However, Baxter believed we are not seeing an increase or decrease of shoulder injury frequency for two reasons:

1. Medical diagnosis is more accurate today and the ability to diagnose an injured shoulder and correct the problem with a surgical procedure has improved. Baxter (1999) stated “Open celled shoulder pads helped reduce the number of shoulder contusions, but the number of subluxations and dislocations have not decreased”. This could account for not seeing a decrease in the number of shoulder injuries or the number of days lost from shoulder injuries.
2. During the 1970s and 1980s rule changes, emphasizing not making initial contact with the head, enforced proper hitting and tackling techniques resulting in a decreased number of shoulder injuries during that era. In the mid to late 1980’s, athletes were familiar with proper hitting and tackling techniques, but shoulder injury frequency did not decline. Baxter (1999) contended the reason the frequency of shoulder injuries did not decline was due to the fact athletes were getting bigger, faster, and stronger and they were using their shoulders to direct forceful hits upon their opponents with the shoulder joint, as opposed to hitting with the head. Great emphasis had been placed on not using the head to tackle and block and as a result the shoulder took the blunt of the trauma. This could account for not seeing a decrease in the number of shoulder injuries or in the number of days lost from shoulder injuries.

Hypothesis 2 stated there would be no difference among the four different head coaches at Emporia State University and the frequency of injury or the number of days lost from those injuries during their tenure. A significant difference in the frequency of injuries and total number of days lost from injuries among the coaches' tenures was found. When looking at overall injury frequency among the four coaches at Emporia State University, Coach 1 and Coach 2 had a higher frequency of injuries than Coach 3 and Coach 4. There are four possible explanations for these findings.

1. Type of Players. In the beginning of the study, Baxter stated Emporia State University did not have the financial resources to offer full scholarships that attracted quality athletes. This lack of financial resources resulted in the recruitment of smaller players who did not possess the athletic ability of their opponents. Baxter (1999) stated: "It was not uncommon for our interior linemen to be out-weighed by 45 to 50 lbs. Simply put, other schools were funding bigger and better athletes." After the first five years of the study, financial support was added to the football program and a higher quality of player was recruited. This change resulted in the coaches being able to recruit players in equal size, strength and athletic ability to their competition.
2. Training/Conditioning. Baxter (1999) noted Coach 1 and 2 did not emphasize strength training and cardiovascular conditioning. This lack of emphasis may have contributed to their frequency of injury. Coach 3 spent a great deal of time on cardiovascular conditioning and strength training. Coach 4 emphasized strength training but was not as concerned with cardiovascular conditioning. Overall, Coach 3 had the lowest frequency of injury. Mueller

and Blyth (1986) concluded by implementing physical conditioning programs, one may have helped reduce injuries. “Conditioning is most important in the late stages of the game, when players become tired and are unable to block and tackle properly” (p. 141). Karageaner (1999) stated: “Football linemen tend to have more lower extremity injuries as their weight, body fat percentage, and body mass index increase” (p. 42). When cardiovascular conditioning programs are implemented into a team’s daily workouts, it may decrease the number of overweight athletes, unconditioned athletes and injuries. However, more research is necessary to determine if cardiovascular conditioning actually does decrease overall injury rates.

3. Coaches’ attitude toward injury. Baxter (1999) believed coaching attitudes have had some effect on injury, but the coach’s attitude toward injury may have a greater effect than his coaching style. A coach who has the attitude “There is no such thing as an injury that keeps you from playing” will tend to have players who have less days lost to injury than a coach who has the attitude of “Better to be safe than permanently injured”. Baxter (1999) also stated one reason for Coach 3’s reduction in frequency of injury could have been his refusal to acknowledge an injury in a player.
4. Types of practices. Baxter (1999) believed: “The degree to which they use practices to prepare their players directly effects the frequency of injury rates.” Baxter (1999) stated Coach 1 had “Players who seemed to be fatigued, under-conditioned, nutritionally imbalanced and very undisciplined.” Coach 1 ran high contact practices. When adding the factors of fatigued,

under-conditioned, nutritionally imbalanced players and high contact, intense practices, the result may be high frequency of injuries and days lost.

Coach 2 inherited Coach 1's athletes and their injury rates remained consistently high throughout his tenure. Coach 2 was not blessed with the resources to provide full scholarships to high quality athletes. He worked with Coach 1's athletes for approximately the first two years and did not have the resources to recruit the type of players necessary to be competitive. He was also an intense coach, but tended to conduct many high contact scrimmages during practice during the first two years of his tenure. After realizing he was losing players to injuries that had occurred during practice, and realizing he did not have the number of athletes needed to replace the injured players, Coach 2 decreased the amount of time he spent scrimmaging during practice. Yearly decreases in the total number of injury frequencies may have been a direct result of this action. Coach 3 had an intense desire to win, which was matched with full scholarship athletes. He ran high contact, game like scrimmages. He was also noted to be very strict and disciplined with his players. Baxter (1999) contended "Seeking high quality athletes, enforcing discipline, and implementing excellent strength and conditioning programs may have contributed to the decrease in injury frequency during Coach 3's tenure." Coach 4 complemented the institution's request to increase the number of full scholarship athletes brought into the football program. Although Coach 4 made up his own practice schedule, his assistant coaches were responsible for implementing the skills involved with each drill. He had less intense practices, meaning he conducted practices with a decreased amount of contact compared to Coach 3 and instituted rules about no contact below the waist during

practice. According to Baxter (1999), Coach 4 had a defensive coordinator who was noted for running high-risk collision drills during the end of practice. “Coach 4 ran a drill called the Gauntlet drill that was responsible for many of his head and shoulder injuries.” This drill mandated high velocity contact and unequally sized players initiating contact with each other. This practice might explain why Coach 4 did have an increase in the total frequency of injury as compared to Coach 3.

Hypothesis 3 stated there would be no difference between the total number of injuries and the total number of days lost from injuries during winning/losing seasons. There was no difference in the frequency of injuries or days lost from those injuries during winning/losing seasons. Canale, Cantler, Sisk, and Freeman’s study (1981) found there to be the least amount of injuries during the worst losing season than in any other season of their study. Baxter found the results of this study to be surprising. Baxter expected, as did Canale et al., to find more injuries during losing seasons than winning seasons. One reason for the lack of significant difference in this study might be the winning and losing seasons occurred across all four coach’s tenures. There may have been a difference between winning and losing seasons if individual coaches winning and losing seasons were examined rather than all four of the coaches together.

Summary

In summary, the purpose of this study was to determine if the factors of protective equipment, coaching changes and win/loss records were related to the frequency of injury and number of days lost from injury in football at Emporia State University between the years of 1978 to 1997. Results indicated there to be no significant

difference in protective equipment changes and the frequency of injuries. There was no significant difference in the number of days lost and helmet changes. There was no significant difference in win/loss records and the frequency of injury or days lost from injury. There was a significant difference found in shoulder pad changes and number of days lost as well as changes of coaches and frequency of injury and number of days lost. While many reasons account for the differences, one final fact remains. No other study has been done to investigate Emporia State University's frequency of football injuries or the number of days lost from football injuries. Comparison studies were not available due to the fact that no other institution or football program was under the exact same coaching, advising, or financial duress during the past twenty years. Results of this study would not indicate duplicate results at another institution. It is important to note that over the past twenty years, while Emporia State University had financial burdens, numerous coaching changes, and other determining factors, average frequency rates have not increased.

Future Study

Future research should be directed to more specific research questions such as:

1. Does coaching style effect injury frequency and number of days lost from injury?
2. How does Emporia State Universities yearly average of frequency of football injury and number of days lost from those football injuries compare to other midwestern Division II schools?
3. Does win/loss record have an impact on severity of injuries and the number of days lost because of those injuries?

4. Does injury frequency and days lost from those injuries differ between the regular football season and the spring football season?
5. Is there a difference between starters and nonstarters in the frequency of injury and the total number of days lost from a specific injury?

References

- Alles, W., Powell, J. W., Buckley, W. E. & Hunt, E. E. (1980). Three year summary of NAIRS football data. Journal of Athletic Training, 98-100.
- Baxter, J. A. Personal Interview, March 15, 1999.
- Blignaut, J. B., Carstens, I. L. & Lombard, C. J. (1987). Injuries sustained in rugby by wearers and non-wearers of mouth guards. British Journal of Sports Medicine, 21 (2), 5-7.
- Canale, S. T., Cantler, E. D., Sisk, T. D. & Freeman, B.L. (1981). Chronicle of injuries of an American intercollegiate football team. American Journal of Sports Medicine, 9 (6), 384-389.
- Cantu, R. C. (1986). Guidelines to return to contact sport after a cerebral concussion. The Physician and Sportsmedicine, 14 (10), 75-88/
- Cushing, D. (1980). Helmet reconditioning: Does NOCSAE ensure safety? The Physician and Sportsmedicine, 8 (10), 101-104.
- Deppen, D., Nobel, L., Walker, H. & Dorgan, R. (1993). Force absorption in football shoulder pads: a biomechanical assessment. Journal of Athletic Training, 28 (2), 155.
- Dye, E. R. (1959). Engineering research on protective headgear. American Journal of Surgery, 98 (9), 368-372.
- Gaffney, A. (1995, October). Battle helmets. Popular Mechanics, 78-81.
- Gieck, J. & McCue, F. (1980). Fitting of protective equipment. The American Journal of Sports Medicine, 8 (3), 192-196.

Heck, J. F. (1992). The incidence of spearing by high school football carriers and their tacklers. Journal of Athletic Training, 27 (2), 120-124.

Heck, J. F. (1995). A survey of New Jersey high school football officials regarding spearing rules. Journal of Athletic Training, 30 (1), 63-68.

Hodgson, V. R. (1975). National operating committee on standards for athletic equipment football certification program. Medicine and Science in Sports, 7 (3), 225-231.

Karageanes, S. (1999). Heavier lineman injured more. The Physician and Sportsmedicine, 27 (3), 42.

Kuebker, W. A., Morrow, R. M., & Cohen, P. A. (1986). Do mouth formed mouth guards meet the NCAA rules? Physician and Sportsmedicine, 14 (6), 69-72; 74.

Mueller, F. O. & Blyth, C. S. (1980). Football injury update – 1979 season. The Physician and Sportsmedicine, 8 (10), 53-55.

Mueller, F. O. & Blyth, C. S. (1986). An update on football deaths and catastrophic injuries. The Physician and Sportsmedicine, 14 (10), 139-203.

National Operating Committee on Standards for Athletic Equipment. (1993). NOCSAE Manual [Brochure]. Overland Park, Kansas.

NCAA Football Injury Surveillance System for Academic Year 1997-1998. August 13, 1998. 1-10. Overland Park, Kansas.

Smith, R. E., Smoll, F. L. & John, J. (1993). Football players' recall of helmet warning label information: implications for behavioral compliance. Applied Cognitive Psychology, 7 (1), 43-52.

Swenson, T. M., Lauerman, W. C., Blanc, R. O., Donaldson, W. F. & Fu, F. H. (1997). Cervical spine alignment in the immobilized football player: radiographic analysis before and after helmet removal. The American Journal of Sports Medicine, 25 (2), 226–231.

Torg, J. S., Vegso, J. J., O'Neill, M. J., & Sennett, B. (1990). The epidemiologic, pathologic, biomechanical, and cinematographic analysis of football-induced cervical spine trauma. The American Journal of Sports Medicine, 18 (1), 50-58.

Wilkinson, E. E. & Powers, J. M. Properties of custom-made mouth-protector materials. (1986). The Physician and Sportsmedicine, 14 (6), 77-81.

Zemper, E. D. (1989). Cerebral concussion rates in various brands of football helmets. Journal of Athletic Training, 24 (2), 133-137.

APPENDIX A

PERMISSION LETTER TO JOHN BAXTER, ATC-R.

Appendix A

November 1, 1998

To: Mr. John Baxter, ATC.
Emporia State University
1200 Commercial
Emporia, KS. 66801

Dear Mr. Baxter,

I would like your permission to use the football time loss and injury frequency data you have kept over the past twenty years for a thesis project. My thesis project will investigate the factors of protective equipment, coaching changes, and win/loss records in relationship to frequency of injury and number of days lost injury. This material will be used solely for academic purposes.

By signing and returning this letter, you are releasing this information to be used in a thesis project while I am attending Emporia State University. I thank you for your willingness to participate in this thesis.

Sincerely,

Jamie Dolieslager, A.T., C.

I (John A. Baxter) give (Jamie Dolieslager)

permission to use the time loss and injury frequency football study. By signing and dating below, I promise to turn over any material that would be beneficial in her study.

DATE: 11/11/98

SIGNED:

John A. Baxter

DATE: 11/11/98

ACCEPTED:

Jamie Dolieslager

APPENDIX B

ORIGINAL NAIRS FORM

APPENDIX C

THIRTY-SIX CATEGORIES OF INJURY CLASSIFICATION

Appendix C

1. Toes
2. Metatarsal Arch
3. Longitudinal Arch
4. Ankle
5. Achilles
6. Lower Leg
7. Knee
8. Quadriceps – Strain
9. Quadriceps – Contusion
10. Hamstring
11. Hip Pointer
12. Groin Strain
13. Gluteus Strain
14. Abdominal – Internal Organ
15. Low Back
16. Ribs
17. Sternum
18. Rotator Cuff
19. Glenoid Humeral
20. Acromioclavicular
21. Sternoclavicular
22. Acromion Contusion
23. Brachial Plexus
24. Cervical Spine – Sprain/Strain
25. Dental
26. Eyes
27. Laceration
28. Brain Concussion
29. Upper Arm
30. Elbow
31. Forearm
32. Hand/Finger/Wrist
33. Heat Exhaustion
34. Illness
35. Infection
36. Fracture

APPENDIX D

TIME LINE OF IMPROVEMENTS MADE IN PROTECTIVE HEAD GEAR

Appendix D

Time line of Improvements Made in Protective Headgear

11/16/98

Don Gleisner: Riddell All-American, President All-American Sports

Mr. Gleisner was contacted about the timeline information on Riddell helmets. He stated that there was not anything published about the release of helmets except old catalogs, but that he could attempt to recall from memory the release of new products.

TK3 (Suspension Helmet) ceased production in 1974 with the passage of NOCSAE requirements. However, the product was still sold on a limited basis until 1978 when it was mandatory for all colleges to have NOCSAE approved helmets. High schools had until 1980 to have NOCSAE approved helmets. Suspension helmets were eligible for NOCSAE approval but the failure rate practically eliminated the need for the product.

PAC4 (In-line foam) first marketed in 1974 with the release of the NOCSAE standard. Not a hot item initially. Began to sell more as the NOCSAE requirement deadline approached. Largest seller until the late 1980's. Air Helmets began to make a surge in the middle to late 1980's.

VSR1(Variable Size Range...Air) first released in the middle 1980's ('84 approx.) Wide spread usage by 1988. Advantage to helmet was it allowed the equipment budget to be spared by adding flexibility to sizing of the helmet.

VSR 3 Basically the same as VSR1 except padding was improved.

VSR 4 Currently the largest selling helmet Riddell makes. Padding improved along with air chambers to strengthen.

AF2 Air helmet much like the VSR4 only with much improved padding and better air cells. Cost more than the VSR4 since it is supposed to offer more thorough protection (Not better, but simply more thorough protection).

WD1 (Fitted helmet....Pro Fit) More like the PAC 3 in-line foam helmets of the '80's. The helmet is designed to offer the most effective protection when fitted properly. Most expensive Riddell helmet. More uniform protection as opposed to the Air helmet.

APPENDIX D CONINUED

11/17/98

Julie Nimmons: President, Schutt Sports

Schutt Sports has been manufacturing helmets since 1987. When the BIKE helmet line, introduced in 1976, was purchased. Prior to 1987, Schutt had been in the business of making face masks for helmets “ as long as football helmets have been around.” Ms. Nimmons was not able to offer any insight into a helmet timeline or any other information. Most of the conversation centered on how helmets cannot prevent catastrophic injury.

Ms. Simmons added that Schutt has been manufacturing shoulder pads for 4 years. They offer anything from cost efficient closed cell pads to open celled pads to combination custom fit styles. Not much has changed here because they have not been manufacturing shoulder pads that long.

APPENDIX E

YEARS OF HELMET USAGE

Appendix E

Years of Helmet Usage

1978-1985	PAC-3 & Air (AF2)
1986-1998	Air (AF2)

APPENDIX F

YEARS OF SHOULDER PAD USAGE

Appendix F

Years of Shoulder Pad Usage

1978-1995	Combination of Closed and Open Cell
1996-1998	Open Cell

APPENDIX G

COACHES TENURES AND WIN/LOSS RECORDS

APPENDIX G

COACHES TENURES AND WIN/LOSS RECORDS

<u>COACH</u>	<u>YEARS AT ESU</u>	<u>RECORD</u>
1	1978	2-8
2	1979	4-6
2	1980	2-8
2	1981	1-9
2	1982	3-7
3	1983	2-8
3	1984	3-7
3	1985	6-4
3	1986	8-2
3	1987	8-2
3	1988	8-2
3	1989	8-2
3	1990	6-4
3	1991	5-5
3	1992	7-3
3	1993	3-7
3	1994	5-5
4	1995	5-6
4	1996	5-6
4	1997	7-4

I, Jamie Dolleslager, hereby submit this thesis/report to Emporia State University as partial fulfillment of the requirements for an advanced degree. I agree that the Library of the University may make it available to use in accordance with its regulations governing materials of this type. I further agree that quoting, photocopying, or other reproduction of this document is allowed for private study, scholarship (including teaching) and research purposes of a nonprofit nature. No copying which involved potential financial gain will be allowed without written permission of the author.

Jamie D. Dolleslager
Signature of Author

May 1999

Date

AN EXAMINATION OF THE FACTORS THAT EFFECTED INJURY
FREQUENCY AND DAYS LOST FROM INJURY IN FOOTBALL AT
EMPORIA STATE UNIVERSITY FROM 1978 TO 1997.

Title of Thesis/Research Project

Barry Cooper
Signature of Graduate Office Staff

May 10, 1999
Date Received

1