Prevention of Head and Neck Injuries at the High School Level of Football: Implementation Levels and Perceived Importance of Established Recommendations

Jill D. Heikkila

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BY

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THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

Masters in Physical Education

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1995

YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING THIS PART OF THE GRADUATE DEGREE CITED ABOVE

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ABSTRACT


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The occurrence of head and neck injury in football has prompted various authorities to outline recommendations which can be used as a guideline for the prevention of such injuries. The seven recommendations included for study in this research were classroom education of athletes, correct technique emphasis, enforcement of established rules, conditioning of neck musculature, medical coverage of events, athletic training services, and the proper fit of helmets. The primary purpose of this study was to determine whether coaches of high school football programs were implementing the commonly cited recommendations for preventing head and neck injuries. In addition to levels of implementation, both ratings of importance and the relationship between perceived importance and implementation were measured for each recommendation.

One hundred and two coaches (54% of the sample) across the state of Illinois responded to mailed questionnaires which elicited data on whether they implemented each recommendation into their football program and how important they felt each recommendation was in preventing head and neck injuries. Frequency counts were used to describe levels of implementation and ratings of importance for each recommendation. Chi square analysis was used to determine whether perceived importance affected the implementation of each recommendation.

Findings revealed very high levels (near 100%) of implementation for correct technique emphasis, rule enforcement, and neck strengthening. Levels of implementation
for classroom education and athletic training services were somewhat lower, yet still around 80%. Levels of implementation for medical coverage of events and proper helmet fit were significantly lower, 28% and 61% respectively. The highest levels of rated importance were among those recommendations with the highest level of implementation, those being technique emphasis, rule enforcement, and neck strengthening. However, proper fit of helmets was also perceived as very important. Perceived importance was considerably lower for classroom education, athletic training services, and medical coverage of events. When the relationship between implementation and importance was studied for each individual recommendation, classroom education, rule enforcement, and neck strengthening showed a strong significant difference in levels of implementation between those who rated importance differently. This finding suggests that perceived importance by the coach may have been a strong determinant in whether these recommendations were implemented. Chi square analysis could not be performed for technique emphasis due to the lack of varied responses for both implementation and perceived importance. There was no statistically significant difference in levels of implementation of athletic training services, proper fitting of helmets, and medical coverage between those who rated their importance differently. These findings suggest that there may be stronger determinants than importance of whether the latter recommendations were implemented.
ACKNOWLEDGEMENTS

This research could not have been completed without the assistance and support of many people. I especially wish to acknowledge the following:

Dr. Robert Doyle, for the continuous support and encouragement and the wisdom of a long career in athletic training.

Dr. Phyllis Croisant, for the invaluable statistical assistance and organizational advice. Her commitment and patience in teaching students to perform research is exceptional.

Dr. Kevin Lasley, for helping me to keep focused and offering great insight into this research effort.

Dr. Peter Bonutti and staff, for lending both financial support as well as technical assistance.

Most of all, to my mother and father, for their love, acceptance, and support which makes each goal that I set for myself attainable.
# TABLE OF CONTENTS

ABSTRACT ................................................................. ii
ACKNOWLEDGEMENTS .............................................. iv
TABLE OF CONTENTS .................................................. v
LIST OF TABLES ............................................................ vii

## CHAPTER 1 INTRODUCTION ............................................. 1
  Significance of Study .............................................. 5
  Statement of the Problem ............................................ 5
  Research Hypothesis ................................................ 5
  Delimitations .......................................................... 6
  Limitations ............................................................ 6
  Basic Assumptions .................................................. 6
  Definition of Terms ................................................ 7

## CHAPTER 2 REVIEW OF LITERATURE ................................. 8
  Introduction ............................................................ 8
  Objectives .............................................................. 8
  Nature of the Injury ................................................. 9
    Injury Spectrum .................................................... 9
    Description of Injury Types ..................................... 10
  Mechanism for Injury ............................................. 11
  Population at Risk .................................................. 12
  Impacts on the Incidence of Head and Neck Injuries in Football ......... 12
    Classification of Injury Types ................................ 12
    Patterns of Incidence .......................................... 13
  Recommendations for Continued Progress ................................ 16

## CHAPTER 3 METHODS AND PROCEDURES ............................ 25
  Introduction .......................................................... 25
  Subjects .............................................................. 25
  Development of Research Instrument .................................. 26
  Procedure for Data Collection ........................................ 26
  Analysis of Data .................................................... 27

## CHAPTER 4 RESULTS AND DISCUSSION ............................. 28
  Introduction .......................................................... 28
  Demographics ........................................................ 28
  Representation of Data ............................................ 28
  Results and Discussion ............................................. 31
  Classroom Education .............................................. 31
CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS 38
  Summary ................................................................. 38
  Conclusions ............................................................. 40
  Practical Use of Findings ........................................... 41
  Recommendations for Further Study ........................... 42

REFERENCES ................................................................. 43
APPENDIX ................................................................. 45
LIST OF TABLES

Table 1 Levels of Implementation ........................................ 30
Table 2 Ratings of Importance ............................................. 30
Table 3 Relationship Between Implementation and Importance ........................................ 30
CHAPTER ONE
INTRODUCTION

The incidence of head and neck injuries in football has received abundant attention in the field of research due to the nature of the sport and the consequences of these types of injuries. Football is the one team sport that has made it into the most hazardous of activities group considering injury to the head and neck (Cantu, 1988). According to Schneider, "there is probably no better experimental or research laboratory for human trauma in the world than the football fields of our nation" (Schneider, 1973). Statistical data showing the incidence of head and neck injury in football has been gathered since the earliest days of football. Pioneers in this field of research such as Schneider, have layed a foundation for later researchers such as Torg, Mueller, and Cantu to continue to report the incidence of head and neck injury in football. Due to the efforts of these researchers and other organizations involved, a body of research has been developed allowing the monitoring of patterns showing increases and decreases in incidence of head and neck injuries in football.

Currently, deaths occurring as a result of head and neck injuries are at the infrequent yet persistent level (Clarke, 1990). Because of the severity associated with these types of injuries, they cannot be ignored because they are infrequent. In addition to fatalities, there has also been a generally decreasing trend in catastrophic injuries which are those resulting in either transient or permanent neurological damage. However, it is much harder to establish levels of incidence for potentially threatening although not acutely serious injuries. Furthermore, current research shows evidence of possible chronic and cumulative damage resulting from head and neck injury. Therefore, all injury types must be continually monitored for fluctuation and the emergence of new potential problems.
The collection of injury data is a key to injury prevention. Based upon the patterns of incidence shown, researchers have strived to identify the causal factors for fluctuating levels of injury and initiate action to make competition safer and prevent injuries from occurring. Experts in the field have formulated preventative recommendations based on sound scientific methodology in attempt to control fluctuation and provide the lowest risk possible for the occurrence of head and neck injuries. In addition to frequency of occurrence, continued research has allowed for a greater understanding of the nature of these types of injuries, how they occur, who is at greatest risk, and awareness of the hazards inherent to the game of football. Due to these efforts, participation in football has been made safer for thousands of athletes.

Based on sound scientific research by authorities in the field, the following recommendations have been made in order to continue the decreasing trend and to avoid possible increases in head and neck injuries. The majority of recommendations are widely accepted within the research community, albeit with slight variations. Some researchers have proposed additional recommendations based on their findings. Following are the most commonly cited recommendations for preventing head and neck injuries.

1. **Classroom Education.** The athlete should know, understand, and appreciate the risk of serious injury. The best means for educating the athlete involves taking the athletes into a classroom environment and educating them about mechanisms of injury, severity, prognosis, incidence, and proper contact techniques (Heck, Weis, Gartland, & Weis, 1994).

2. **Technique Emphasis.** Coaches should consistently teach correct technique regarding the initiation of contact. However, Torg (1985) states that "it is not sufficient for coaches to refrain from teaching techniques utilizing the top or crown of the helmet as a primary point of contact, coaches must teach players not to use such techniques". It can be inferred from this statement that players must understand why they must use correct technique in order to avoid head and neck injury. In addition to teaching correct
technique, it is necessary to put special emphasis on injury prevention factors involved with proper tackling to reinforce the importance of correct technique. This emphasis should be repeated a minimum of four times throughout the season (Heck et al., 1994).

3. Rule Enforcement. Rules play an important role in participation safety and injury prevention. The rules regarding initiation of contact, which shall be specifically outlined in the proceeding chapter, are the emphasis of this study. It is essential that these rules be enforced during both practice and game situations (Allman, 1985).

4. Preparation for Competition. Preparation for competition should include both a physical conditioning program and a neck strengthening program (Allman, 1985). It is universally accepted that a neck exercise program will minimize the risk of neck injury (Cantu, 1988). Strengthening of the neck enables the athlete to hold his head firmly erect while making contact (Mueller & Cantu, 1991).

5. Athletic Training Services. In addition to medical coverage of games, there must be access to medical services on a regular basis. Each team should strive to obtain an athletic trainer on staff who is prepared and qualified to deal with sport-related injuries as well as to assist coaching staff in the areas of injury prevention and education (Mueller, 1991).

6. Medical Coverage of Events. Most researchers concur that there should be both practice and game coverage by qualified medical personnel. Proper medical care will ensure that injuries are dealt with in the proper manner and with the highest regard for the athlete's safety.

7. Equipment. Reid and Reid (1984) suggests that only quality equipment be used. It is important for each athlete to have the proper selection and fit of equipment as well as instruction on the proper use of equipment, especially helmets (Allman, 1985). Other important considerations include checking the helmets for damage or deterioration due to use, periodical reconditioning by a helmet reconditioner certified by the National Athletic Equipment Reconditioners Association, and presence of a warning label and
NOCSAE stamp (Allman, 1985). The proper fit of football helmets will be the focus of this recommendation for the purpose of this research. Helmets should be individually selected and fit for each athlete.

8. Preparticipation Examinations. A pre-participation examination including a complete medical history revealing any incidence of previous head and neck injuries or problems is essential before allowing an athlete to participate in football (Mueller, 1991). It is best to have a designated team physician, who will receive the majority of referrals and will be available for onsite coverage of games, perform the pre-participation examination. This is important because it will allow the physician to be acquainted with each individual athlete in order to provide the best level of care in the event of injury.

Other recommendations were less often cited yet remain important. Only those players who are physically suited for participation in football should be selected (Reid & Reid, 1984). It is also important to give consideration in matching of participants on the basis of skill level, experience, maturity, size, and age (Heck et al, 1994). Finally both Reid and Reid (1984) and Anderson (1993) discuss the importance of the attitudes of the coaches, players, and officials in preventing head and neck injury. Coaches must temper the desire to win with concern for safety. Players must avoid reckless behavior, accept responsibility for protecting opponents from undue injury, and must avoid being overconfident in the level of protection afforded by their equipment, particularly the helmet. Officials must vigilantly both watch and penalize for inappropriate techniques displayed by competitors. (Reid & Reid, 1984).

The following most commonly cited recommendations will be the basis of data collection for this study: classroom education of athletes, correct technique emphasis, enforcement of established rules, conditioning of neck musculature, medical coverage of events, athletic training services, and the proper fit of helmets.
Significance of Study

Various researchers have attributed many of the decreases in incidence to one or several of the recommendations. However, very little research exists on whether the most commonly cited recommendations are being implemented by high school football programs. In order to continue progress in the area of reducing and possibly eliminating sources of risk for head and neck injuries, there must be emphasis on preventative measures that are presently recommended and continued research that reveals the weaknesses in current preventative measures. (Mueller, 1991).

Statement of the Problem

The primary purpose of this study is to determine whether high school football programs are implementing the most commonly cited recommendations. While attempting to accomplish the purpose of this research, several sub-problems arise. Since coaches are largely responsible for designing their football programs, it is essential to determine whether or not a coach is aware of the importance which must be placed on implementing each recommendation. However, a recommendation may not be implemented simply because it is deemed important. The relationship between importance and implementation must be substantiated with factual data.

Research Hypothesis

Both the levels of implementation for preventative recommendations and the importance placed on each recommendation may not be optimal in many high school football programs. Furthermore, the level of importance placed on each recommendation may be a determinant in whether or not that recommendation is implemented.
Delimitations

Below are the delimitations that were imposed on the study:

1) The study relies solely upon the knowledge of the head coach as to whether the recommendations are being implemented. Recommendations such as pre-participation examinations were excluded from this study based on the fact that the head coach may have limited knowledge of what the physician includes in the pre-participation examination. Questions asked were designed to be easily answered by the head coach without having to seek information from various sources in attempt to answer the questions.

2) Due to constraints regarding both resources and time, questionnaires were sent to only one third of the high school football programs within the state of Illinois.

Limitations

Below are the limitations which may affect the applicability of the findings:

1) Due to financial restraints, only one questionnaire was mailed to each of the selected coaches. The questionnaires were followed up by reminder post cards to encourage response. Additional mailings of the questionnaire may have resulted in a larger number of respondents.

2) The questionnaire used to collect data was specifically designed for this study and thus, relies heavily upon face validity.

3) Questionnaires were mailed out shortly after the end of the 1994 football season to attempt to increase response rate, which it probably did. However, the deadline to get the surveys out was made at the sacrifice of performing a pilot study.

Basic Assumptions

Below are some of the assumptions which act as the premises for data collection in this study:
1) Based upon the assurance of confidentiality, it was assumed that coaches will answer the questions honestly and without regard for consequence of their answers.

2) It was assumed that coaches can distinguish between correct and incorrect techniques for initiating contact when questioned on the emphasis of such technique.

3) It was assumed that coaches will have knowledge of what "spearing" entails when direct use of the term was made within the questionnaire.

4) It was assumed that coaches will have a general knowledge of what proper conditioning of neck musculature includes when questioned about the incorporation of such conditioning within their program.

Definition of Terms

Bell ringer - A fairly common occurrence of minor head trauma most often associated with a Grade I concussion in which mild symptomology clears soon after injury with no acute medical consequences.

Catastrophic - Classification of injury in which there is transient neurological impairment (serious catastrophic injury) or permanent neurological impairment (non-fatal catastrophic injury).

Concussion - A shaking or agitation of the brain within the skull resulting from either a direct blow to the head or a sudden deceleration of the body.

Head Butting - The intentional act of using the helmet, specifically the frontal portion, in initiating contact with an opponent.

Hematoma - A collection of blood localizing in the area of the brain tissue.

Intracranial Hemorrhage - Bleeding within the skull as a result of a blow to the head.

Paraplegia - Paralysis affecting only the lower portion of the body including the legs.

Quadriplegia - Paralysis affecting all four limbs.

Spearing - The intentional or unintentional use of the top of the helmet in initiating contact with the opponent.
CHAPTER TWO
REVIEW OF LITERATURE

Introduction

Joint efforts of the medical community and the researchers involved in compiling data on the incidence of head and neck injuries in football has provided a thorough understanding of the nature of such injuries and epidemiological overview of patterns of such injury throughout the history of football. Based upon these findings, researchers have made several recommendations to reduce the risk for occurrence of head and neck injury. The recommendations considered for this study include classroom education, technique emphasis, rule enforcement, neck conditioning, athletic training services, medical coverage of events, and fitting of helmets. However, despite the efforts that have been made, these injuries continue to occur. The importance of implementing the currently accepted recommendations cannot be underestimated.

Objectives

The first objective of this chapter is to communicate an understanding of what head and neck injuries in football entail. Both the nature of such injuries and the medical consequences of such injuries will be emphasized. In addition it is necessary to understand how these injuries occur and who is at greatest risk for sustaining a head or neck injury. Before we can take measures to prevent such injuries, we must understand the injury with which we are dealing.

The second objective of this chapter is to provide a review of the factors that have impacted incidence levels of head and neck injuries in the past. Incidence levels have been generated by various research injury data which show increases and decreases in occurrence. When a significant increase is shown in the data, efforts are made to identify
the causative factor and reduce the effect of that factor. By examining how past trends have been impacted, one can appreciate the need for continual formation of recommendations.

The third and final objective of this chapter is to provide a description of how head and neck injuries can be prevented. The aforementioned recommendations are discussed at length in order to provide insight into how one can maximally reduce the risk for head and neck injury. Unfortunately, little research evidence exists to show whether the recommendations are being implemented. However, several studies provide indicators of whether or not recommendations are being implemented.

Nature of the Injury

Injury spectrum. In attempt to define head and neck injuries, terms such as catastrophic, fatality, and acutely serious have been used. However, these are not the only possible outcomes of a head and/or neck injury. Injuries can most accurately be described in terms of an injury spectrum of graded severity (Clarke, 1990). The spectrum ranges from fatal injuries to minor incidents such as a "bell-ringer" to the head. It is important to note that all levels of injury must be treated with respect for a negative outcome.

Gerberich, Priest, Boen, and Straub (1983) point out that except for the very serious and fatal injuries, little documentation exists regarding potentially serious acute and chronic injuries. In a study done by Albright, Moses, Feldish, Dolan, and Burnmeister (1976), 32% of 108 college freshman football recruits revealed previous cervical spine injury through history taking and radiographic findings. They concluded that these injuries probably occurred during high school football years. Because, they were assumed to be insignificant at the time, these injuries probably went unreported. When discovered at a later date, some discluded the athlete from further participation. In addition, there is evidence of possible cumulative effects from repeated minor concussions (Shell, Carico, &
Patton, 1993). An effort must be made to report all head and neck injury regardless of placement on the injury spectrum.

**Description of injury types.** Often times head and neck injuries are inseparable at first because where there is enough force to produce a neck injury, head injury must also be considered and vice versa. However, when the two entities are separated, distinctly differing injury patterns are seen (Clarke, 1990). For the purposes of this research, description of injury types will be separated for head and neck injury.

Head injuries are most commonly described in terms of intracranial hemorrhage and concussion. Intracranial hemorrhage can be divided into four types (epidural, subdural, intracerebral, and subarachnoid) on the basis of where the bleeding occurs (Cantu, 1988). It is not the purpose of this research to provide in depth medical explanations of each type of intracranial hemorrhage. However, it is important to acknowledge that each type may have differing onset, progression, and medical treatment. One problem presented is that of detecting delayed presentation of subdural hematomas. Delayed presentation may not become apparent for up to several months after initial insult (Root, Jordan, & Zimmerman, 1993). In addition, current research suggests cumulative effects from repeated episodes of minor trauma (Shell et al., 1993). Thus, after any event in which trauma to the head may have occurred, medical attention must be attained.

Concussion is a categorization of brain injury which is defined as "a usually temporary loss of consciousness in the post-traumatic state accompanied by little, if any, gross brain damage" (Reid & Reid, 1984). Whereas, intracranial hemorrhage indicates bleeding within the skull, concussion indicates agitation of the brain (Arnheim, 1993). Concussion is the most frequent type of head injury in football (Cantu, 1988). They are graded from minor to severe. The biggest threat with concussion is that of second impact syndrome in which an athlete sustains a second impact while still symptomatic from the first. This can result in fatal brain swelling (Torg, 1991).
Neck injury, at worst, consists of vertebral displacement, subluxation and/or fracture. If the spinal cord is compromised, paralysis may result. The major concern with a cervical spine injury is the possibility of an unstable fracture that may produce quadriplegia immediately or with repeated insult (Cantu, 1988). In the athlete who is unconscious, the inability to state that the neck hurts or lack of protective musculature spasm must be considered before any movement of the athlete occurs (Cantu, 1988). Movement of an injured athlete with possible neck injury can worsen the injury. Neck injuries may also be muscular or ligamentous in nature. It is important that the athlete with a strained neck muscle not play until pre-injury strength levels are regained so that the neck musculature may provide maximum protection to the bony elements.

**Mechanism for injury.** "Before preventative measures can be implemented, identification of the mechanisms involved in the production of the particular injury is necessary" (Torg, 1990). Mechanisms of injury have been debated greatly within the literature, however, Torg (1990) is largely responsible for identifying the mechanism known as axial loading, which has stood the test of scrutiny and remained as the leading cause for cervical spine injuries in the sport of football. Axial loading is defined as the receipt of impact to the top of the head with the neck in thirty degrees of flexion. In this position, the vertebrae are described as a segmental column. When an axial load is implied, energy is absorbed first by the discs resulting in compressive deformation. When maximum deformation occurs, continued energy output results in angular deformation and buckling with consequent failure of discs and/or bony elements of the cervical vertebrae. This may result in subluxation, facet dislocation, or fracture-dislocation at one spinal level (Torg, 1990). The athlete is susceptible to injuries stemming from this mechanism when he drops his head before impact. The acceptance of this mechanism has disputed the myth that cervical injuries are "freak" accidents.

Injury to the brain is a result of either forces to the resting movable head or a moving head impacted against an unyielding object leading to a disruption of the neural
tissue (Cantu, 1988). The act of head butting or ramming, defined as making contact with the frontal portion of the helmet, is largely accountable for many of the head injuries.

**Population at risk.** Athletes at all levels of competitive football are at risk for head and neck injuries. However, the highest rate of incidence occurs at the high school level (Torg, Vegso, Sennett, & Das, 1985; Mueller, Blyth, & Cantu, 1989). During 1977 through 1987, 86 of the 105 permanent cervical cord injuries occurred in high school athletes. In this same period 73 of the 105 injuries were incurred while athletes were playing defense. In addition, 80 of the 105 involved the act of tackling or being tackled, and 25 of the 105 involved tackling with the head down. Thirty five of the 105 injuries were to defensive backs (Mueller et al., 1989). Torg's research shows similar results for the 1971 through 1975 period. Fifty two percent of the permanent cervical quadriplegics incurred their injuries as a result of spearing. Seventy two percent of these injuries occurred while attempting to make a tackle. Fifty two percent were defensive backs (Torg et al., 1985). Thus, it is evident that the population at greatest risk is the high school athlete who plays defensive back and tackles with his head down or as the initial point of impact.

However, any athlete is at risk and should not be overlooked because of the position he plays. Results of a study done by Heck (1992) identified a high level of ball carrier spearing with or without concurrent defensive spearing. By reviewing videotapes of a New Jersey high school football team during one season, he found an incidence of 18.6 counts of ball carrier spearing per game with 9 counts of concurrent defensive spearing per game. In addition, 43% of the plays that involved ball carrier spearing also involved concurrent defensive spearing (Heck, 1992).

**Impacts on the Incidence of Head and Neck Injuries in Football**

**Classification of injury types.** It is essential to understand how head and neck injuries are classified to understand the reported incidence of such injuries. In addition, it
is necessary to have a basic understanding of the factors involved in the various types of head and neck injuries.

Much of the early research documented only the incidence of fatal head and neck injuries. From 1931 to 1970, Schneider reported the incidence of direct fatalities as a result of head and neck injury (Schneider, 1973). When Torg initiated the National Head and Neck Injury Registry, he defined four classifications of head and neck injury including: 1) intracranial hemorrhage, 2) intracranial hemorrhage resulting in death, 3) cervical spine fractures, subluxations, and dislocations, and 4) cervical spine fracture-dislocation with permanent quadriplegia. In order to be included in the data of the Registry, an injury must have either required hospitalization for greater than 72 hours, involved a fracture, dislocation, or subluxation, or resulted in paralysis or death (Torg et al., 1985). In 1977 when Mueller et al. began their research, they used catastrophic, defined as those injuries that resulted in permanent brain or spinal cord disability, to describe non-fatal injuries (Mueller & Cantu, 1991). In 1984, Mueller et al. made an attempt to distinguish between types of catastrophic injury. Injury classifications for catastrophic injury were either nonfatal, including those injuries which resulted in permanent severe functional neurological disability, or serious, including those injuries which resulted in transient but not permanent functional neurological disability (Mueller & Cantu, 1990).

Patterns of incidence. Schneider was responsible for collection of injury research data throughout the earliest days of football. Several causative agents were identified as a result of this data (Schneider, 1973). The increasing trend of head injuries up to the mid 1960's and early 1970's was largely accounted for by the crude construction of the football helmet (Torg, 1985).

Schneider was largely responsible for initiating the evolution of the modern football helmet. In the 1920's, non-padded leather headgear was worn. In the 1940's a crude inner suspension system was added to the leather helmet. In the 1950's, the leather helmet was replaced by a rigid outer helmet with some type of inner suspension system.
The face mask portion of the helmet also evolved from a "single bar" design to a "double bar" and the "middle vertical line" bar design. In 1961 after reviewing mechanisms involved in serious injuries, Schneider advocated the following changes in helmet structure. First, the use of a more resilient material for helmets to permit more deformation and more gradual deceleration of the head was suggested. Second, he advised that the face guard should be made of solid plastic material and should be shortened and placed closer to the face. This suggestion was made in effort to make the face guard less accessible for the opponent to grab, to cut down on the leverage available if backward thrust is employed, to permit better vision due to less of the visual field being cut, and to provide less overriding surface of the bar which might injure the opponent's face. Third, the development of the chin strap was suggested. Lastly, he advocated a flap of moderately firm sponge rubber or some other material to be incorporated into the back of the helmet so that its posterior margin will not administer a serious knife-like blow to the cervical spine when severe hyperextension of the cervical spine occurs. As a result of these suggestions, continued improvements in the suspension system, adaptation of materials, and shaping of the helmet were made (Schneider, 1973).

Another causative factor responsible for injury to the head and neck in early days of football was the use of spring loaded dummies for tackling and blocking drills. These devices travelled on a suspended railing so that when players attacked the dummy, the dummy sprang back with forces of 100 to 300 pounds. In response to the danger evidenced by use of these devices, the NCAA banned their use due to "an apparent undue risk of head or neck injury" (Torg, 1991).

The injury research data generated by Schneider from a period of 1959 to 1963 has been used as a comparison basis for the research done by Torg from 1971 to 1975. A decrease in intracranial hemorrhage and death between the two periods was largely the result of the improved protective capabilities of the helmet. However, a concomitant increasing trend in cervical spine injuries was evidenced. The increased protection of the
head led to the degradation of contact techniques in which the head was used more purposefully in initiating contact. Tackling and blocking techniques now emphasized placing the head into the chest of the opponent. The result was an increase in the number of cervical spine injuries as a result of initiating contact with the helmet (Torg et al., 1985).

During the 1971 to 1975 time period, Torg was responsible for identifying the previously discussed axial loading mechanism. This identification refuted the idea that cervical spine injuries were "freak" accidents and enforced the belief that they could be largely preventable. In 1976, rule changes were formulated which attempted to restrict using the head as the initial point of contact. In 1980, the National Federation of High School Athletics Association implemented the following rules. "No player shall intentionally strike a runner with the crown or top of the helmet" (Rule 9, Section 1, Article 2-N). "Spearing is the deliberate use of the helmet in an attempt to punish the opponent" (Rule 2, Section 24). "No player shall deliberately use his helmet to butt or ram an opponent" (Rule 9, Section 1, Article 2-L). (Torg, Quedenfeld, Moyer, Truex, Spealman, & Nichols, 1977). Following the rule changes there were efforts to educate both coaches and athletes on the dangers associated with improper initiation of contact, and coaching efforts to install good football fundamentals in their players.

As a result of the rule changes and an increased awareness of keeping the head out of contact, a decreasing trend in incidence of both cervical spine injuries and resultant permanent quadriplegia was shown in high school football. In 1976, there were 86 cases of fracture/dislocation/subluxation and 25 cases of cervical spine injury resulting in permanent quadriplegia. By the third season played under the rule changes, the number of both cases was reduced by approximately half (Torg et al., 1985).

During the same time period (1976-1984), unfortunately the incidence of intracranial hemorrhage did not share the same decreasing pattern of incidence as cervical spine injuries. Although this incidence had decreased from earlier data, in 1976 there were 10 cases of intracranial hemorrhage and in 1984 there were 16 cases of intracranial...
hemorrhage. However, the death rate from cerebral injuries remained low, most probably due to improved medical care (Torg et al., 1985). In addition, the National Operating Committee on Standards for Athletic Equipment developed safety standards for the football helmet which went into effect at the high school level in 1980 (Mueller, 1991).

Head injury may continue to be a more problematic area of injury than that of cervical spine injury. Mueller and Cantu report 30 counts of fatality due to head injury from the fall of 1982 to the spring of 1988, with a minimum of 27 of these occurring at the high school level (Mueller & Cantu, 1990). From 1984 to 1988, Mueller and Cantu report 15 cerebral injuries resulting in permanent disability at the high school level. In addition, 3 cases of subdural hematomas with no resultant permanent disability were reported in 1988 alone (Mueller & Cantu, 1991).

There are limitations imposed on injury research data which may not allow an accurate depiction of less severe yet potentially threatening injuries. Those injuries which do not result in permanent disability may go unreported, particularly at the high school level. Adding to present confusion is the incidence of delayed and chronic affects of intracranial hemorrhage. Furthermore, there is a lack of clarity in describing certain types of injuries, particularly concussion, which makes reporting of incidence even more difficult. Although there has been tremendous success with preventative efforts thus far, there is a need for continuing research. The risk of head or neck injury associated with participation in football cannot be quantitatively expressed at the present time. Thus, there is an even greater need for implementation of recommendations for prevention of any head and neck injury.

**Recommendations for Continued Progress**

Just as the previously mentioned external factors have influenced patterns of head and neck injury, it is the hope that the current recommendations will have a positive effect on future patterns of incidence. For in the words of Mueller "one thing we don't want to
do is go back to those high numbers" (National Center for Catastrophic Sports Injury
Research's study (cited by Ramotar, 1991)). The recommendations, which are the subject
of collected data for this study, include classroom education of athletes, correct technique
emphasis, enforcement of established rules, conditioning of neck musculature, athletic
training services, medical coverage of events, and the proper fit of helmets.

1. Classroom Education. Education and awareness of what constitutes a
dangerous activity is an obvious pathway to reducing the risk of serious injury (Anderson,
1993). Teaching the athlete the correct technique for initiating contact is not enough.
Unless the athlete understands why the act must be performed in a certain way, he may
rely on the easiest or most natural way to accomplish the task. "Although coaches are
teaching players to tackle with their heads up, many players persist in lowering their heads
before contact" (Torg, 1985). A lack of understanding of the injury prevention basis for
tackling with the head up is one logical reason for why an athlete may persist to display
inappropriate technique. In addition, the athlete must be able to appreciate the risk for
injury with inappropriate technique. In presenting classroom education, emphasis should
be put on the mechanisms of injury, the severity of injury, the prognosis of injury, and the
proper contact techniques. Many resources are available to assist in the education process
including video presentations, posters, and lecture materials. Only through classroom
education can an athlete truly know, understand and appreciate the risks involved (Heck et
al., 1994).

Very few studies have attempted to measure whether the athlete is receiving this
education. Thesis work done by Gerberich in 1977 at the University of Minnesota
attempted to ascertain the provision of athlete education in high school football programs.
Unfortunately, publication of findings did not include this aspect of her study (Gerberich et
al., 1983).

2. Technique Emphasis. Torg et al. (1985) attributes the downward trend of head
and neck injuries partially to improved coaching techniques of blocking and tackling. The
teaching of correct technique is very important. In addition, attention focused on factors involved in correct technique with specific regard to preventing neck injury must be emphasized. These factors along with their underlying injury prevention basis are further explained. First, correct technique must include keeping the head up in order to see how the impact is about to occur and prepare accordingly. With the head up, the neck is in extension which allows the force to be absorbed by the neck musculature rather than dissipated within the bony elements. Also, contact should be made with the shoulder, keeping the head out of contact (Heck, 1992). In addition, the hips should be kept under the center or gravity to prevent the act of spearing (Adams, 1987).

Correct technique requires tremendous discipline of the athlete (Heck et al., 1994). "This technique must be practiced until a player overcomes the powerful instinct to protect his eyes and face by lowering his head at contact" (Heck, 1992). Unintentional spearing may result from instinct accompanied by a lack of repetition of correct technique.

The stress resulting from awareness of a pending impact initiates a physiological response of the body referred to as the general adaptation syndrome. During the general adaptation syndrome, all body systems are prepared to react; however, of particular interest in the case of an athlete preparing for impact, is the reaction of the neuromuscular system. The neuromuscular system reacts through a pre-programmed response or stored motor patterns allowing rapid voluntary muscular contraction. The pre-programmed response must be developed by performing repetitions that are similar to the impact. Two key points relating to the ability to respond to impact are the awareness of the pending impact and the availability of a pre-programmed response. Both of these factors allow an athlete to respond with a decreased reaction time and a greater muscle tension in order to maximize his ability to respond to impact and thus, afford him a greater level of protection from injury (Reid & Reid, 1984). Therefore, not only is the technique involved of concern, but also repetition of the technique.
Teaching should include both demonstration and practice (Heck, 1992). Correct technique should be taught during both tackling and blocking (Allman, 1985). Teaching of blocking and tackling during drills should be done initially at a half speed simulation of the technique. This allows the athlete to get a feel for the desired technique and enables the coach to both correct faulty technique and respond to any questions regarding the drill or technique (Adams, 1987). Correct technique should be taught throughout the season and emphasized at least four times during the season (Heck et al., 1994). During emphasis, attention to injury prevention factors must be made. In addition, the specific rules regarding the initiation of contact should be reinforced (Adams, 1987).

3. Rule Enforcement. Enforcement of injury preventative rule changes is essential in both games and practices (Allman, 1995). Of particular emphasis are the 1976 rule additions banning the use of techniques involving spearing and head butting in which initial contact is made with the head.

Coaches are responsible for enforcing rules in all practice sessions. An attempt must be made to correct players' technique whenever poor technique is demonstrated. In addition, coaches must have a strict enforcement policy for dealing with players who continue to display improper technique (Heck et al., 1994).

Officials are responsible for enforcing rules in game situations. Heck et al. (1994) affirms that the official plays an important part of rule enforcement during games and can have a potentially large impact on reducing the incidence of spearing. However, officials have been criticized for their "laissez-faire" attitude in penalizing athletes for rule violations (Adams, 1987). In the study done by Heck in 1992, he states that "officials in this study did not exercise their power because not even one spearing penalty was called throughout the 1989 season" (Heck, 1992). In 1994, Heck re-iterated this belief saying that the officials were not calling the penalties with enough frequency to have a large impact on reducing the incidence of spearing. In 1995, Heck published findings of a survey of high school officials' which measured their level of rule enforcement. The level
of enforcement was very low as evidenced by 45% of the officials not calling any spearing penalties and 42% calling only one to two penalties during the 1992 football season (Heck, 1995). Based upon similar observations, Cantu claims that referees who are not calling the rules as written should be held responsible for resultant injury and death (Ramotar, 1991).

4. **Neck Strengthening.** A strong neck is a must in football to prevent catastrophic injury (Finamore, 1992). Neck strengthening can be performed with either four-way neck machines or with manual resistance provided by fellow teammates. Ideally, the neck strengthening program should be year-round. If not, the program should allow adequate time for strength gains prior to participation which is advised as four to six months before the season starts. During the season, neck strengthening should be performed at least one day per week to maintain strength levels. (Heck et al, 1994). A study done by Finamore on high school strength and conditioning programs revealed that 40% of the programs surveyed reported that the neck was the body area most emphasized during injury preventative exercises (Finamore, 1992).

Strength testing of the neck musculature has also been advocated as an injury prevention tool. Cantu advocates the development of a neck profile to measure strength levels. Athletes with neck injuries, including purely muscular, should not be allowed to return to competition until they can perform to the level of their neck profile (Cantu, 1988). Finamore (1992) advises that this strength testing be done before training, before the season competition begins, and after winter training.

5. **Medical Coverage.** Gerberich et al. (1983) attempted to define cervical trauma on the basis of symptoms indicating possible spinal trauma and found that often, medical personnel were not responsible for returning an athlete to play. Onsite medical coverage is essential in both identifying signs and symptoms of head and/or neck trauma and initiating the proper course of action. When a player shows signs of head or neck trauma, he should receive medical attention before being allowed to return to play in both practice
and game situations (Allman, 1985). In the study done by Gerberich (1977), 73% of those athletes showing spinal trauma returned to play the same day. In addition, 71% of players with neck pain were responsible for returning themselves and 21% were returned to play by the coach. Most importantly, 40% of those with neck pain reported being examined by no one and 18% by the coach (Gerberich et al., 1983).

Heck et al. (1994) state that medical coverage should include a certified athletic trainer at all practices and an athletic trainer, ambulance, and physician at all games. The athletic trainer's role is important in identifying signs and symptoms and initiating the proper care (Arnheim, 1993). The athlete often times will not report signs and symptoms and thus it becomes important for the athletic trainer to keep a watchful eye out for those athletes. In the case of an athlete down on the field, the athletic trainer is prepared for such injuries and can often times prevent a more negative outcome of the injury. The athletic trainer should also document occurrences of any head trauma, including mild, in order to have history on such occurrences available for medical personnel (Root, 1993). Ultimately, it is the physician's decision on whether an athlete can return to participation. Since few high schools have designated team physicians, it is not uncommon for any doctor who happens to be present at a game to be called upon in the event of an injury, a very unsatisfactory arrangement (Adams, 1987). This medical doctor may be practicing in a different area of specialty and may not be aware of the athlete's history of previous injury.

6. Athletic Training Services. The role of the athletic trainer in the sports medicine field has rapidly expanded from that of the person who tapes ankles and hands out ice bags. With the rapid growth of professional preparation and responsibility of those with careers in the field of athletic training, an increased level of respect has been awarded those who fulfill the expectations of an athletic trainer. Athletic trainers function not only in the capacity of providing initial evaluation and care following injury, but also play a large role in the prevention of injury.
The athletic trainer can be an invaluable resource in assisting the coaches to develop and implement the preventative recommendations. An athletic trainer is educated in the area of head and neck injury and thus, is an ideal individual for presenting the education to the athletes (Heck, 1992). In addition, athletic trainers on the sidelines of practice can assist the coach in recognizing improper contact techniques when demonstrated by the athlete. Other areas in which athletic trainers have been specifically educated include proper training and conditioning of an athlete, which is helpful in proper neck conditioning, and proper fitting of protective equipment such as the football helmet (Arnheim, 1993).

Unfortunately, many schools do not have the financial support to hire an athletic trainer as full-time staff (teacher/athletic trainer or full-time athletic trainer). Another option is to contract out for athletic training services from an area clinic or hospital. In a study of athletic trainer availability in all classes of Michigan high schools, only 41% reported having athletic training services for at least one sport during the year. Of these athletic trainers, 70% were NATA certified. In addition, school size/class was major determinant in whether or not the schools had athletic training services. (Lindaman, 1992)

7. Helmet Fitting. Due to the establishment of safety standards to ensure helmet integrity, most of the present focus regarding helmets has been directed at the proper fit of football helmets. Proper helmet fit is essential in injury prevention. In one study that checked the fit of helmets in 33 Wisconsin high schools, 3403 fitting errors were observed in 1671 helmets. The most common fitting error was inadequate or excessive clearance above the eyebrows (McGuine, 1994). Those responsible for fitting helmets should have knowledge of the following guidelines.

Individuals should strictly follow the guidelines set by the manufacturer for fit and never allow the athlete to fit themselves (Heck et al., 1994). At the time of fitting the athlete should wet their hair to mimic the sweating during play. In addition, any changes in hair style can affect the fit of the helmet. The athlete's head size and shape will
determine the approximate size as specified by the manufacturer's sizing chart. After the proper helmet is selected, the player should be instructed on how to put it on. Once in place, the chinstrap should be fastened and checked to ensure that equal tension is felt on each side of the chin cup to keep the mouth closed and jaw stabilized (Allman, 1985). When the following conditions are met, the helmet is considered a good fit: 1) the helmet should fit snugly on the player's head with no gaps between the pads and the head, 2) the posterior aspect should cover the base of the skull, 3) the front edge should set 3/4" above the player's eyebrows, 4) the ear holes should be aligned, 5) it should not shift when the helmet is moved from side to side and forward to back, 6) it should not recoil on impact when pressure is applied in a downward direction of the top of the helmet, 7) the cheek pads should be snug against the sides of the face, and 8) the face mask should be attached securely and three fingers widths from the nose. In addition, the suspension system which is either padded or air/fluid filled, showed be routinely inspected (Arheim, 1993).

To ensure proper fit, those responsible for fitting should view video tapes or instructional pamphlets provided by the manufacturer. Ideally, the athletic trainer should assist and supervise in the helmet fitting procedures.

Summary

In summary, implementation of the recommendations is necessary from an injury prevention standpoint. As evidenced throughout the history of football, there have been significant fluctuations in the levels of different types of head and neck injuries due to both the inherent risks associated with the sport of football and to evolutions in the game which have created external factors impacting trends of injury. It is not profound to speculate based on the information presented, that there exists a potential for further fluctuation. In addition, no level of head and neck injury is acceptable as long as they continue to occur resulting in devastating medical consequences. Unfortunately, it is doubtful that these
injuries will ever be non-existent. Thus, a continued effort for preventative measures is well warranted. In the proceeding chapters, implementation of the recommendations will be investigated to determine whether currently accepted criteria are being utilized to offer the maximum level of protection against the risk for head and neck injuries. Based on this investigation, weaknesses will be identified and suggestions for targeting these weakness will be made.
CHAPTER THREE

METHODS AND PROCEDURES

Introduction

The problem under investigation is three-fold. First, it is necessary to determine whether each of the established recommendations for preventing head and neck injury is being implemented by high school football programs. In addition, it is necessary to determine what level of importance is placed upon each of the recommendations. And finally, it must be determined whether importance can affect implementation of the recommendations. By identifying the practices of the coaches and the perceived importance of the practices along with the relationship between importance and implementation, weaknesses can be determined in the preventative measures. Once the weaknesses are determined, efforts can be directed toward minimizing and eliminating the sources of weakness.

Information regarding the subjects, instrument utilized, procedure for data collection, and analysis of the data gathered for this study will be presented in the following pages.

Subjects

Head coaches of high school football programs were chosen to provide the information pertaining to their football programs. Of the 561 high school football programs across the state of Illinois, 188 were selected as a systematic random sample from a list arranged by zip code. The names and addresses of the high schools used for this study were obtained from the recruiting records of the football coaching staff at
Third, participants who returned the questionnaire were promised both results of the study and a copy of the current recommendations for preventing head and neck injuries. Last, a stamped, self-addressed return envelope was provided.

The instruction paragraph directed the participants to complete all questions, unless instructed otherwise, based on information from their 1994 football season. It was requested of the coaches to try to return the questionnaire within two weeks after receipt. This allowed adequate time for return of the survey information before schools recessed for Christmas break.

On December 30, 1994, a follow-up postcard was mailed to all participants who had not yet responded to the survey. Due to financial restraints, a second mailing of the questionnaire was not done. A deadline for return of the questionnaire was set for January 15, 1995.

Analysis of the Data

Analysis of the data in this study was best achieved by using descriptive statistics. Both actual implementation and perceived importance for each recommendation were described using frequency counts and percentages. Each recommendation was considered separately. In addition, the relationship between perceived importance and levels of implementation was studied using chi square analysis. The relationship between whether or not an individual recommendation was implemented and the importance placed on that recommendation was studied separately for each recommendation. By studying the results of these calculations, it was possible to determine which recommendations were currently being implemented and the perceived importance of each. It was also possible to determine whether importance affected implementation of a recommendation.
CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The major focus of this study was to determine whether or not established recommendations for preventing head and neck injuries in football are being implemented in high school football programs in Illinois. In addition, the importance placed on each of the recommendations was determined. Lastly, a relationship between importance placed on a specific recommendation and its implementation level was studied.

Demographics

The subjects for this study were head coaches of high school football programs across the state of Illinois. One hundred and two coaches returned surveys for a response rate of 54%. The head coaches averaged 18.44 (±8.36) years of experience coaching football at any level and 8.16 (±7.56) years of experience in their current position. The coaching staff assisting the head coach with his football duties included an average of 7.57 (±13.56) paid members and 1.40 (±1.25) volunteer members. The head coaches were employed at schools ranging from class 1-A through class 6-A. There was a fairly even distribution of responses from coaches within each class, with an average of 16 coaches per class (minimum of 13, maximum of 22). The number of varsity athletes in each football program averaged 35.41 (±10.92), and the number of athletes participating in junior varsity football averaged 34.80 (±19.10).

Representation of Data

The coaches responded to whether or not they implemented each recommendation by answering yes or no to the specific question for that recommendation (see Appendix A
for actual questionnaire). As shown in Table 1, implementation of all the
recommendations appeared high indicating that the coaches were making some attempt to
prevent head and neck injuries by engaging in each practice. Coaches also responded to
how important they believed a recommendation was in preventing head and neck injuries
by rating each recommendation as very important, important, not very important, or of no
importance. As shown in Table 2, the degree of importance for each recommendation
differed; however, few coaches indicated the recommendations were of no importance.
And finally, a chi square analysis was performed for each recommendation to determine
whether there was a difference in implementation between those who rated importance
differently. As shown in Table 3, three of the analyses showed a significant difference in
implementation rate.
Table 1  
Levels of Implementation

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom Education</td>
<td>82 (80.4%)</td>
<td>20 (19.6%)</td>
</tr>
<tr>
<td>Correct Technique Emphasis</td>
<td>101 (99%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Rule Enforcement</td>
<td>100 (98%)</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Neck Strengthening</td>
<td>98 (97%)</td>
<td>3 (3%)</td>
</tr>
<tr>
<td>Athletic Training Services</td>
<td>80 (79.2%)</td>
<td>21 (20.8%)</td>
</tr>
<tr>
<td>Medical Coverage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physician</td>
<td>60 (58.8%)</td>
<td>42 (41.2%)</td>
</tr>
<tr>
<td>Certified Athletic Trainer</td>
<td>70 (68.6%)</td>
<td>32 (31.4%)</td>
</tr>
<tr>
<td>EMT/Ambulance</td>
<td>79 (77.5%)</td>
<td>23 (22.5%)</td>
</tr>
<tr>
<td>Other</td>
<td>8 (7.8%)</td>
<td>94 (92.9%)</td>
</tr>
<tr>
<td>Helmet Fitting</td>
<td>59 (60.8%)</td>
<td>38 (39.2%)</td>
</tr>
</tbody>
</table>

Table 2  
Ratings of Importance

<table>
<thead>
<tr>
<th></th>
<th>Very Important</th>
<th>Important</th>
<th>Not Very Important</th>
<th>Of No Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom education</td>
<td>45 (44.1%)</td>
<td>33 (32.4%)</td>
<td>22 (21.6%)</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Correct technique emphasis</td>
<td>102 (100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule enforcement</td>
<td>80 (78.4%)</td>
<td>21 (20.6%)</td>
<td>1 (1%)</td>
<td></td>
</tr>
<tr>
<td>Neck strengthening/conditioning</td>
<td>81 (79.4%)</td>
<td>19 (18.6%)</td>
<td>2 (2%)</td>
<td></td>
</tr>
<tr>
<td>Athletic training services</td>
<td>39 (38.2%)</td>
<td>48 (47.1%)</td>
<td>13 (12.7%)</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Medical coverage of games</td>
<td>56 (54.9%)</td>
<td>37 (36.3%)</td>
<td>9 (8.8%)</td>
<td></td>
</tr>
<tr>
<td>Proper fit of helmets</td>
<td>88 (86.3%)</td>
<td>14 (13.7%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3  
Relationship Between Implementation and Importance

<table>
<thead>
<tr>
<th></th>
<th>Chi Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom Education</td>
<td>46.29</td>
</tr>
<tr>
<td>Correct Technique Emphasis</td>
<td></td>
</tr>
<tr>
<td>Rule Enforcement</td>
<td>7.91</td>
</tr>
<tr>
<td>Neck Strengthening</td>
<td>66</td>
</tr>
<tr>
<td>Athletic Training Services</td>
<td>5.69</td>
</tr>
<tr>
<td>Medical Coverage of Events</td>
<td>5.24</td>
</tr>
<tr>
<td>Proper Helmet Fit</td>
<td>5.69</td>
</tr>
</tbody>
</table>

*level of significance=0.05  
**df=3  
***critical chi square=7.82
Results and Discussion

Classroom education. Approximately 80% of the coaches reported providing classroom education acknowledging the dangers and risks of improper contact techniques. In most cases, coaches were responsible for providing the classroom education (93.8%). In some cases there was a joint effort between coaches and other medical personnel to provide this education. Other providers of classroom education included athletic trainers (13.7%), physicians (3.7%), and officials (1.9%).

It is unfortunate that athletic trainers and physicians were not utilized to a greater extent in providing classroom education. On the basis of educational background and training, it seems that a joint effort between coaches and medical personnel would be the optimal means for providing classroom education.

Both the type of resources utilized to provide the classroom education and the extent of material covered are unknown. For example, if the coach answered "yes" to providing classroom education covering the dangers and risks associated with improper contact technique, it could not be determined whether the coach was showing a five minute video or whether he provided a lecture and discussion. Furthermore, did the coach cover the mechanisms, severity, and prognosis of injury in addition to correct contact technique so that the athlete could truly appreciate his risk? If specifics of this recommendation had been included on the questionnaire, the percentage of reported implementation may have declined.

Less than half (44%) of the coaches felt that classroom education was very important for preventing head and neck injuries. This seems surprising due to the fact that the majority reported providing classroom education. The chi square analysis showed a strong relationship between ratings of importance and levels of implementation. There was a significant difference in implementation levels between those who rated classroom education as important and those who did not. Those who considered classroom education important were more likely to implement classroom education than those who
rated importance lower. By both providing coaches with information about how they can
optimize the effectiveness of classroom education and directly linking classroom education
of the athlete with preventing head and neck injuries, perceived importance by the coach
may be increased resulting in higher levels of implementation and improved quality of
classroom education.

Technique emphasis. Almost all of the coaches (99%) reported that they
emphasized and demonstrated correct technique, with regard for the safe initiation of
contact, to their athletes each season. Most (79%) reported the frequency of technique
emphasis as regular intervals throughout the season. However, 22% reported that
technique emphasis was done on a daily basis. There is a differentiation to be made
between teaching and emphasizing correct technique. Teaching includes both
demonstration and repetition of proper technique. Emphasizing includes drawing that link
between correct technique and reduced risk of neck injury by reinforcing the specific
injury prevention factors involved in correct technique, as mentioned in Chapter Two, and
by reminding athletes of specific spearing rules. It is likely that the subjects were confused
between teaching and emphasizing correct technique, particularly those who responded
that technique emphasis was done on a daily basis. I believe the reported implementation
levels for technique emphasis may have been more indicative of levels of teaching correct
technique.

Every coach surveyed indicated that teaching or emphasizing correct technique
was very important. This assessment of importance is shared by Torg, who attributes the
downward trend of head and neck injuries to improved coaching techniques (Torg et al.,
1985). The majority of coaches are undoubtedly teaching proper technique. However,
with knowledge that spearing most likely still exists (Heck, 1995), the question becomes
that of whether the athlete is less likely to spear (either intentionally or unintentionally) or
engage in other improper tackling technique if they are more aware of the injury
prevention basis for proper tackling techniques.
Due to the lack of varied responses (99% yes regarding implementation of technique emphasis and 100% very important regarding the importance of technique emphasis), a chi square analysis determining the relationship between implementation and importance could not be performed.

**Rule enforcement.** Nearly all of the coaches (98%) reported that they strictly enforced rules banning illegal initiation of contact when displayed by athletes during practice. It is not surprising to have these results when inquiring about rule enforcement practices. It is interesting to speculate as to whether the high levels of rule enforcement indicate that there is indeed occurrence of illegal contact techniques during practice necessitating rule enforcement or if stringent rule enforcement displays an attitude of hypothetical intolerance of illegal contact techniques on the part of the coaches in the event that such action be displayed. A few coaches indicated that there were not any spearing violations occurring which would necessitate rule enforcement. This may be the case since it is possible that spearing or other rule violations are restricted to game situations where competition is more intense. However, to draw a conclusion that spearing does not exist in any situation would be contraindicated since in one study nearly half of the officials believed that spearing does occur frequently (Heck, 1995), and in another study substantial incidence of spearing was evidenced by reviewing game tapes (Heck, 1992).

Although coaches cannot accurately define practices of officials, the findings of this study are similar to self-reported levels of spearing enforcement by officials (Heck, 1995). The majority of coaches in this study (80.4%) responded that they could not recall a spearing penalty being called during the past season.

Most coaches (78.4%) felt that rule enforcement was very important in preventing head and neck injuries. Chi square analysis narrowly surpassed statistical significance revealing that there are differences in implementation levels by those who reported
differing levels of importance. However, a much different relationship may have been identified had "during practice" been specified for rule enforcement importance ratings.

**Neck strengthening.** The majority of coaches (97%) indicated that they incorporated neck conditioning into their strength and conditioning programs. In addition, 79% felt that neck strengthening/conditioning was important in preventing head and neck injuries. This data is similar to the findings of Finamore (1992) which reveal that the neck is the body area most emphasized with regard for injury prevention during high school football strength and conditioning programs. Chi square analysis showed a strong significant difference in implementation levels by those coaches reporting positive vs. negative ratings of importance. Thus, coaches perceiving neck strengthening/conditioning to be important were more likely to implement neck strengthening/conditioning into their programs.

**Medical coverage.** Only 28% of coaches reported that their medical coverage of games included a physician, athletic trainer, and EMT/ambulance on a regular basis. Most often (77.5%) EMT/ambulance services were present at home games, followed by certified athletic trainer (68.6%) and physician (58.8%). Other individuals reported as covering games included chiropractors and physical therapists (7.8%). It is recommended that all three (EMT/ambulance, certified athletic trainer, physician) be present for game coverage. Just over half (54.9%) of the coaches surveyed felt that medical coverage of events was very important in preventing head and neck injuries. Almost all (91.2%) felt medical coverage was either very important or important.

Chi square analysis indicates that there was no significant difference in implementation levels between those who rated medical coverage as important vs. those who felt it was unimportant. It is likely that the biggest determinant of having all three types of medical personnel covering games is the availability of these services, particularly regarding the physician. Physicians are usually not paid to cover games and do so in addition to other obligations. The physicians who offer their services in this manner
usually do so because of the love of the game and to show support for the team. Although the physician may benefit by receiving referrals from injured athletes, parents may choose to have their children seen by the family physician. It is different at higher levels of competition, such as at the college or professional level, because most teams have designated team physicians, an entity that is not as common at the high school level.

Regarding the availability of EMT/ambulance, arrangements are commonly made with the local hospital to provide such services. Of importance is the need to have the services of EMT's available within the scope of their job duties. It is illegal to have an off-duty EMT without an ambulance acting within the scope of the profession.

**Athletic training services.** Most coaches (79%) indicated that they had access to athletic training services on either a full- or part-time basis. The majority of athletic training services provided were for either home game coverage (53.7%) or for weekly visits (47.5%). Only 12.5% indicated that athletic training services were provided for daily practice coverage and 28.7% indicated having an athletic trainer as full-time staff. Other responses such as away game coverage and on an as-needed basis accounted for 21.2% of athletic training services. These findings are high when compared to a study of Michigan high schools in which only 41% reported having athletic training services for at least one sport per year (Lindaman, 1992).

The importance of athletic training services in preventing head and neck injury was ranked rather low. Only 38.2% of coaches reported athletic training services as very important. Although 85% reported ratings of either very important or important, 15% reported ratings of not very important or of no importance. It would have been interesting to gather information regarding certification status and experience of the high school athletic trainer in order to determine whether these may have been possible explanations for low importance ratings. In addition, importance ratings for athletic training services were specific to preventing head and neck injuries. A coach may value his available athletic training services; however, not find them particularly helpful in preventing head
and neck injuries. If the latter were true, increased awareness of the role the athletic trainer can play in providing classroom education, assisting in the fitting of helmets, and other preventative measures may result in both increased involvement of the athletic trainer in these areas and increased importance placed on athletic training services for preventing head and neck injuries.

There was no difference in implementation levels for athletic training services between those who rated importance as high and those who reported importance as lower. Chi square analysis did not show a significant difference; however, levels were approaching significance. If importance made little difference in whether a coach decided to utilize athletic training services, what were some other deciding factors? The most logical factor involves that of cost. The findings of Lindaman (1992) identified cost as one of the major factors influencing whether or not a program will receive athletic training services (Lindaman, 1992). Although reported rates of athletic training services received are higher in this study when compared to the findings of Lindaman, the extent of the services offered may be lacking. As previously mentioned, most of the athletic training services are offered on a weekly visit and/or game coverage basis, a situation commonly occurring when schools contract out for services from an area clinic or hospital. With this extent of coverage, it would be difficult for the athletic trainer to be involved in preventative type duties in addition to injury evaluation and initial care.

**Helmet fitting.** Forty percent of coaches felt that those responsible for fitting helmets were not trained in fitting helmets. Although trained was not defined, I believe this percentage acknowledges a lack in attempt to make sure helmets are correctly fitted among many football programs. If any effort was made to train, such as viewing manufacturer videotapes or recruiting the assistance of an athletic trainer, the most probable response would be yes.

All of the coaches rated the proper fit of helmets as very important or important. The chi square approached significance, despite absence of any statistical difference in
implementing proper fit of helmets between those who rated importance differently. Lack of training has been indicated as a major source for helmet fitting errors in a study of high school football coaches which found that many coaches were unaware of proper fitting procedures (McGuine, 1994). It seems likely that lack of training for coaches may also have been a factor in the findings of this study.
CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

Summary

Authorities in the field of sports medicine have judiciously provided recommendations for preventing the occurrence of head and neck injury in football. Undoubtedly, the safety of the game has been positively impacted by the implementation of these established recommendations. However, the effectiveness of these recommendations must be constantly re-evaluated in order to identify any sources of weakness, particularly in their implementation. It was the purpose of this research to determine whether each recommendation was being implemented at the high school level of football. In addition, it was deemed necessary to determine the importance placed upon each recommendation by those responsible for implementation. Furthermore, simply because an individual perceives a certain practice to be important does not mean that the individual will engage in the practice. Thus, the relationship between rated importance and level of implementation for each individual recommendation was studied to determine whether perceived importance may have played a role in whether a recommendation was implemented.

A systematic random sample of high school football coaches across the state of Illinois was surveyed by questionnaire. A response rate of 54% was obtained. Recommendations studied in this research included those regarding classroom education, technique emphasis, rule enforcement, neck conditioning, athletic training services, medical coverage of events, and helmet fitting. The questionnaire elicited categorical responses of yes or no to determine whether each recommendation was implemented, and scaled responses ranging from very important to of no importance to determine rated importance of each recommendation. Frequency counts were used to determine overall
levels of implementation and perceived importance. Chi square analysis was used to determine whether a difference existed in implementation levels between those who rated importance differently.

Findings revealed very high levels (near 100%) of implementation for correct technique emphasis, rule enforcement, and neck strengthening. Levels of implementation for classroom education and athletic training services were somewhat lower, yet still around 80%. Levels of implementation for medical coverage of events and proper helmet fit were significantly lower, 28% and 61% respectively. The highest levels of rated importance were among those recommendations with the highest level of implementation, those being technique emphasis, rule enforcement, and neck strengthening. However, proper fit of helmets was also perceived as very important. Perceived importance was considerably lower for classroom education, athletic training services, and medical coverage of events. When the relationship between implementation and importance was studied for each individual recommendation, classroom education, rule enforcement, and neck strengthening showed a strong significant difference in levels of implementation between those who rated importance differently. This finding suggests that perceived importance by the coach may have been a strong determinant in whether these recommendations were implemented. Chi square analysis could not be performed for technique emphasis due to the lack of varied responses for both implementation and perceived importance. There was no statistically significant difference in levels of implementation of athletic training services, proper fitting of helmets, and medical coverage between those who rated their importance differently. These findings suggest that there may be stronger determinants than importance of whether the latter recommendations were implemented.
Conclusions

As evidenced by implementation levels, there is need for improvement in implementing established recommendations. Of particular concern is improving the use of classroom education, athletic training services, medical coverage of events, and proper instruction for helmet fitting in order to prevent head and neck injuries. Although data on frequency levels of implementation obtained in this study may not be precisely accurate due to the lack of definition for the extent of implementation, I feel that they are indicative of general trends of implementation within high school football programs.

Overall, the importance that should be placed upon each recommendation for preventing head and neck injury was present. However, importance was rated lower for classroom education, athletic training services, and medical coverage of events. Of interest is the fact that each of the three preceding recommendations are either not directly provided by the coach (athletic training services and medical coverage of events) or historically have not been (classroom education). Thus, the role that each (athletic training services, medical coverage of events, and classroom education) play in preventing head and neck injuries may be overlooked by the coach. Increasing the awareness of the roles each can play in preventing head and neck injuries may result in a higher level of perceived importance by the coach.

For some of the recommendations (classroom education, rule enforcement, and neck strengthening), importance seemed to make a difference in whether or not the individual recommendation was implemented. Thus, there is a basis in promoting importance of the recommendations among coaches for increasing implementation levels. However, other factors may also intervene in implementation practices, as was the case in which importance appeared to make little or no difference in implementation. For example, a coach may think that physician coverage is very important in preventing head and neck injury but without the availability of a physician, the coverage is very unlikely. In such cases, external factors blocking implementation must be revealed and overcome.
Practical Use of the Findings

The opportunity to apply the findings of this study in order to increase the implementation of established recommendations for the prevention of head and neck injury in high school football programs is present. Overall, levels of implementation for many of the established recommendations appeared high. Existent efforts that are being made by coaches to prevent head and neck injury must be applauded and encouraged. However, some evidence suggested that reported levels of implementation may have been overestimated, particularly when consideration for the specifics of each recommendation were lacking. Thus, coaches must be given the opportunity for self-critique of their efforts. This can be done by providing coaches with a list of current recommendations in enough detail so that they can determine if they are in compliance. In addition, those recommendations with lower levels of implementation, based on the findings of this study, should be emphasized.

The importance perceived by the coach for each recommendation must be addressed since importance seems to play a role in implementation. Efforts to increase perceived importance should be targeted to those recommendations with lower ratings of importance and particularly those with significant differences in levels of implementation between varied ratings of importance. Increasing understanding of the recommendation's role and necessity in preventing head and neck injury seem to be a plausible means for improving perceived importance in such cases. Furthermore, the lack of a statistically significant difference in the relationship between implementation and importance may also be a significant finding. In such cases, perceived importance may not be a determining factor for implementation. Thus, attention should be provided to the previously discussed external factors which may be acting as obstacles to implementation.

The findings of this study were shared with coaches who returned completed questionnaires. Both a listing of the current recommendations along with an abstract of
the study was sent to each coach. It is hoped that this feedback not only provided the coach with an increased awareness of any shortcomings that may be present in current implementation practices, but also provided overall direction for continued progress in the prevention of head and neck injuries in football among the coaching profession as a whole. It is of vital importance that each coach coordinate preventative efforts, draw on the many available resources for provision of the recommendations, and share ideas with fellow coaches regarding the most effective means of implementation of the established recommendations.

Recommendations for Further Study

There must be a continued effort to determine whether or not established recommendations are being implemented within a larger representation of high school football programs. In addition to determining whether or not recommendations are being implemented, further study must attempt to measure the extent to which they are implemented. If efforts are not adequate to meet the intended purpose of implementing the recommendations, then time and effort are largely wasted. I found the need to further clarify the extent of implementation by including more specific information about the recommendation in the questioning process. For example, regarding classroom education, questions such as what is being covered, how the information is being presented, and the timeframes for execution would be important information for determining if the adequate extent of implementation is occurring.

For many of the established recommendations, perceived importance seemed to play a large role in whether they were implemented. However, in other cases, external factors such as cost, time, and availability may have been obstacles restricting implementation levels. Further study must attempt to identify specific reasons for non-compliance with recommendation implementation in order to work toward solutions to overcome non-compliance.
REFERENCES


players. Unpublished manuscript.


Dear Coach;

Your participation in a statewide survey of head coaches at the high school level is needed. I am conducting this study to determine practices regarding prevention of head and neck injuries at the high school level. Due to continuing efforts made by those in the coaching profession over the past few decades, the incidence of these types of injuries has been kept at the infrequent yet persistent level. High schools from all classes across the state have been randomly selected to participate by answering the enclosed questionnaire.

Participation will require about 15 minutes of your time. A brief instruction paragraph has been attached to this letter to help you answer the following questions. The data from this study will be utilized in group mean scores. All data is kept strictly confidential and no institution or individual name will be revealed for any reason throughout the study. Following the completion of this survey and analysis of the data, those who have returned the questionnaires will be sent a summary of the findings as well as a copy of current recommendations on how you can optimally provide prevention of serious head and neck injuries.

Now that the football season has come to a close, I hope you will lend me a few minutes of your time to assist me by participating in this study. Thank you for your time and participation and congratulations on the completion of a great '94 football season. Funding of postage has been provided by Bonutti Orthopaedic Sports Services.

Sincerely,

Jill D. Heikkila, A.T.,C.
APPENDIX

Introductory Paragraph Accompanying Questionnaire

Answer all of the following questions based on the '94 football season. Please do not leave any blank unless instructed to do so. Responses of numbered items require either checkmarks next to appropriate responses or circled items. Once you have completed the questionnaire, please return in the provided envelope. Please try to return within 1-2 weeks after receipt of survey. Once again, thank you for your time and cooperation.
APPENDIX

Questionnaire

SURVEY: THE PREVENTION OF
HEAD & NECK INJURIES

School class: 1A 2A 3A 4A 5A 6A
Number of athletes in football program: Varsity__ JV__
Number of members on coaching staff: Paid__ Volunteer__
Number of years involved in coaching football: ___
*any level, head coach only
Number of years at current position: ___
*head coach only

1. Classroom education (or formal team meetings) on the dangers and risks associated with spearing or other forms of initiating improper contact with the head is provided to athletes each season.

1. YES
2. NO
*If no, proceed to question #3

2. Who presents this classroom education?

1. coaches__
2. physician__
3. athletic trainer__
4. other__(please specify)

3. Correct technique, with regard to the safe initiation of contact, is emphasized and demonstrated to athletes each season.

1. YES
2. NO
*If no, proceed to question #5

4. How often is correct technique emphasized?

1. beginning of season__
2. at regular intervals throughout season__
3. other__(please specify)____________________

5. Rules banning initial contact made with the helmet or face mask when tackling or blocking are strictly enforced during practice when athletes display inappropriate technique.

1. YES
2. NO

6. Do you recall officials penalizing for spearing or initiating contact with the helmet or face mask during the past season?

1. YES
2. NO

7. Proper conditioning of neck musculature is incorporated into strength and conditioning program.

1. YES
2. NO

8. Athletic training services are available on either a part-time or full-time basis.

1. YES
2. NO
*If no, proceed to question #10
APPENDIX A

Questionnaire

9. How often does the athletic trainer provide services?
   1. full-time staff____
   2. weekly visits____
   3. daily practice coverage____
   4. home game coverage____
   5. other (please specify)___________________________

*May choose more than one response

10. Which of the following are regularly present at home football games?
   1. physician____
   2. certified athletic trainer____
   3. EMT/ambulance____
   4. other (please specify)___________________________

11. Those responsible for fitting helmets have been specifically trained in the proper fitting of helmets.
   1. YES  2. NO

******************************************************************************

Please rate the following in terms of how important you feel each is in preventing head and neck injuries by circling the appropriate number of your response.

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<th></th>
<th>VERY IMPORTANT</th>
<th>IMPORTANT</th>
<th>NOT VERY IMPORTANT</th>
<th>OF NO IMPORTANCE</th>
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<td>2</td>
<td>3</td>
<td>4</td>
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<td>2. Correct technique emphasis</td>
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<td>2</td>
<td>3</td>
<td>4</td>
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<td>3. Rule enforcement</td>
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<td>2</td>
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<td>4. Neck strengthening/conditioning</td>
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<td>6. Game coverage by medical professionals</td>
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<tr>
<td>7. Proper fit of helmets</td>
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<td>2</td>
<td>3</td>
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