

ANNUAL SURVEY OF FOOTBALL INJURY RESEARCH

1931 - 2012

Frederick O. Mueller, Ph.D.
Chairman, American Football Coaches Committee on Football Injuries

Bob Colgate
Director of Sports and Sports Medicine of the National Federation of State High School
Associations

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American Football Coaches Association, Waco, Texas
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The National Federation of State High School Associations,
Indianapolis, Indiana

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INTRODUCTION

In 1931 the American Football Coaches Association initiated the First Annual Survey of Football Fatalities. The original survey committee was chaired by Marvin A. Stevens, M.D., of Yale University, who served from 1931-1942. Floyd R. Eastwood, Ph.D., Purdue University succeeded Dr. Stevens in 1942 and served through 1964. Carl S. Blyth, Ph.D., University of North Carolina at Chapel Hill was appointed in 1965 and served through the 1979 football season. In January 1980, Frederick O. Mueller, Ph.D., University of North Carolina at Chapel Hill was appointed by the American Football Coaches Association and the National Collegiate Athletic Association to continue this research under the new title, **Annual Survey of Football Injury Research**.

The primary purpose of the Annual Survey of Football Injury Research is to make the game of football a safer and, therefore, a more enjoyable sports activity. Because of these surveys the game of football has realized many benefits in regard to rule changes, improvement of equipment, improved medical care, and improved coaching techniques. The 1976 rule change that made it illegal to make initial contact with the head and face while blocking and tackling was the direct result of this research.

The 1990 report was historic in that it was the first year since the beginning of the research, 1931, that there was not a direct fatality in football at any level of play. This clearly illustrates that data collection and analysis is important and plays a major role in injury prevention.

Data Collection

Throughout the year, upon notification of a suspected football fatality, immediate contact is made with the appropriate officials (coaches, administrators, physicians, athletic trainers). Pertinent information is collected through questionnaires and personal contact.

Football fatalities are classified for this report as direct and indirect. The criteria used to classify football fatalities are as follows:

Direct - Those fatalities which resulted directly from participation in the fundamental skills of football.

Indirect - Those fatalities that are caused by systemic failure as a result of exertion while participating in a football activity or by a complication which was secondary to a non-fatal injury.

In several instances of reported football fatalities, the respondent stated the fatality should not be attributed to football. Reasons for these statements are that the fatality was attributed to physical defects that were unrelated to football injuries.

Past reports showed 1,800,000 participants in all levels of football. New participation numbers gathered by the National Operating Committee for Standards in Athletic Equipment (NOCSAE), NFHS, and USA Football show the following: The National Federation of State High School Associations (NFHS) has estimated that there are approximately 1,100,000 high school player's grades 9-12. Research also indicates there are 100,000 post high school players including the National Football League (NFL), National Collegiate Athletic Association (NCAA), National Association of Intercollegiate Athletics (NAIA), National Junior College Athletic Association (NJCAA), Arena Football, and Semi-professional football. USA Football estimates there are three million youth football players in the United States. These figures give an estimate of 4,200,000 total football participants in the United States for the 2012 football season.

Dr. Mueller compiled and prepared the survey report on college, professional, and sandlot levels, and Mr. Bob Colgate of the National Federation of State High School Associations assumed responsibility for collecting and preparing the senior and junior high

school phase of the study. Sandlot is defined as non-school football, but organized and using full protective equipment.

At the conclusion of the football season, both reports are compiled into this **Annual Survey of Football Injury Research**. This report is sponsored by the American Football Coaches Association, the National Collegiate Athletic Association, and The National Federation of State High School Associations.

Acknowledgments

Medical data for the 2012 report were compiled by Dr. Robert C. Cantu, Chairman, Department of Surgery and Chief, Neurosurgery Service, Emerson Hospital, in Concord, MA. Dr. Cantu is a Past-President of the American College of Sports Medicine and is the Medical Director for the National Center for Catastrophic Sports Injury Research at the University of North Carolina at Chapel Hill.

Summary

1. There were two fatalities directly related to football during the 2012 football season. Both of the fatalities were in semi-professional football. There is only one other year where there were no direct fatalities in high school and college football and that was in 1990. (Table I)
2. The rate of direct fatal injuries is very low on a 100,000 player exposure basis. For the approximately 4,200,000 participants in 2012, the rate of direct fatalities was 0.04 per 100,000 participants.
3. The rate of direct fatalities in high school (grades 9-12) was 0.00 per 100,000 participants. The rate of direct fatalities in college was 0.00 per 100,000 participants. The rate for all other areas of football was 0.06 per 100,000 participants. (Table III)
4. Most direct fatalities usually occur during regularly scheduled games, and in 2012 this was true with both direct semi-professional fatalities occurring in games.

5. The major activities in football would naturally account for the greatest number of fatalities. In 2012 one of the semi-professional players was hit by a blindsided block on a punt return and the second player was involved in a helmet-to-helmet collision. (Table V)

6. In 2012 one of the semi-professional players died from commotio cordis and the second from a brain injury. (Table VI)

7. In many cases football cannot be directly responsible for fatal injuries (heat stroke, heart related and so forth). In 2012 there were 13 indirect fatalities. Nine were associated with high school football and four with college football. The high school indirect deaths were one from heat stroke, four heart related, two from asthma, one from lightning, and the cause of one was unknown. Sickle cell trait could have been involved in a number of the indirect deaths, but this information was not available at the time of this writing. (Tables II & VIII)

Discussions/Recommendations

After a slight rise in the number of direct football fatalities during the 1986 season, the 1990 data revealed the elimination of direct football fatalities. That was the first time since 1931 that there have been no direct football fatalities at any level of play. The 2012 data continues the trend with no direct football fatalities in high school, college, or youth football. There were two at the semi-professional level. The data illustrates the importance of data collection and the analysis of this data in making changes in the game of football that help reduce the incidence of serious injuries. This effort must be continued in order to keep these numbers low and to strive for the elimination of football fatalities. Indirect injuries have been in double figures since 1999 with the exception of 2003 and 2007. The 2012 indirect fatalities show an increase of one when compared to the 2011 data. Updated numbers show a decrease of five when compared to the 2009 data.

Head and Neck Injuries

Past efforts that were successful in reducing fatalities to the levels indicated from 1990 through 2012, and the elimination of direct fatalities in 1990 and at the high school, college, and youth levels in 2012 should again be emphasized. Rule changes for the 1976 football season that eliminated the head and face as a primary and initial contact area for blocking and tackling is of utmost importance. The original 1976 rule defined spearing as “the intentional use of the helmet (including the face mask) in an attempt to punish an opponent.” In the new 2005 definition in the rules “intentional” has been dropped. The new rule states “spearing is the use of the helmet (including the face mask) in an attempt to punish an opponent”. A 2006 point of emphasis covers illegal helmet contact and defines spearing, face tackling, and butt blocking. High school rule changes effective during 2006-07 stated that at least a 4-point chinstrap shall be required to secure the helmet, and all mouth guards must be colored, not white or clear. Also rule revisions regarding illegal helmet contact were made in February 2007. The committee placed butt blocking, face tackling, and spearing under the heading of “Helmet Contact – Illegal” to place more emphasis on risk-minimization concerns. Examples of illegal helmet contact that could result in disqualification include illegal helmet contact against an opponent lying on the ground, illegal helmet contact against an opponent held up by other players, and illegal helmet-to-helmet contact against a defenseless opponent. **Coaches who are teaching helmet or face to the numbers tackling and blocking are not only breaking the football rules, but are placing their players at risk for permanent paralysis or death. This type of tackling and blocking technique was the direct cause of 36 football fatalities and 30 permanent paralysis injuries in 1968. In addition, if a catastrophic football injury case goes to a court of law, there is no defense for using this type of tackling or blocking technique.** Since 1960 most of the direct fatalities have been caused by brain and neck injuries, and in fact since 1990 all but seven of the

head and neck deaths have been brain injuries (72). We must continue to reduce head and neck injuries.

Several suggestions for reducing head and neck injuries are as follows:

1. Athletes must be given proper conditioning exercises that will strengthen their necks in order to be able to hold their heads firmly erect when making contact.
2. Coaches should drill the athletes in the proper execution of the fundamental skills, particularly blocking and tackling. **Contact should always be made with the head-up and never with the top of the head/helmet. Initial contact should never be made with the head/helmet or face mask.**
3. Coaches and officials should discourage the players from using their heads as battering rams when blocking and tackling. The rules prohibiting spearing should be enforced in practice and in games. The players should be taught to respect the helmet as a protective device and that the helmet should not be used as a weapon.
4. All coaches, physicians, and trainers should take special care to see that players equipment is properly fitted, particularly the helmet.
5. When a player has experienced or shown signs of head trauma (loss of consciousness, visual disturbance, headache, inability to walk correctly, obvious disorientation, memory loss), he should receive immediate medical attention and should not be allowed to return to practice or game without permission from a physician.
6. A number of the players associated with brain trauma complained of headaches or had a previous concussion prior to their deaths. The team physician, athletic trainer, or coach should make players aware of these signs. Players should also be encouraged to inform the team physician, athletic trainer, or coach if they are experiencing any of the above mentioned signs of brain trauma.

7. Coaches should never make the decision whether a player returns to a game or active participation in a practice if that player experiences brain trauma.
8. In 2008 the National Federation of State High School Associations stated in a concussion management recommendation the following: no athlete should return to play the same day of a concussion and must receive clearance from a medical professional before resuming practice or games. A 2010 change in the concussion rule states that any player who exhibits signs, symptoms, or behaviors consistent with a concussion shall be immediately removed from the game. The rule also requires that the clearance to return to play be issued by an appropriate health-care professional. The NFHS Football Rules Book has a special section “Suggested Guidelines for the Management of Concussion”. The NCAA Committee on Competitive Safeguards and Medical Aspects of Sports in a December 2009 meeting recommended that an athlete would be sidelined for at least the rest of the day if he/she loses consciousness or shows other worrisome symptoms during competition. The panel also recommended sidelining an athlete with less severe concussion-related symptoms until cleared by a doctor.

A major concern is second impact syndrome where an athlete who has not recovered from a concussion is returned to play and receives another severe hit. This situation most often results in death.
9. **Game officials (referees) should call all illegal helmet contact in games. If they call all illegal helmet contacts the number of concussions and catastrophic injuries may be reduced. Coaches will no longer teach improper techniques and players will no longer use their helmeted heads if they know a penalty will be called. At the present time officials are not calling all illegal helmet contact.**

Another important effort has been and continues to be the improvement of football protective equipment. It is imperative that old and worn equipment be properly renovated or discarded and continued emphasis placed on developing the best equipment possible. Manufacturers, coaches, trainers, and physicians should continue their joint and individual efforts toward this end.

The authors of this research are convinced that the current rules which eliminate the head in blocking and tackling, **coaches teaching the proper fundamentals of blocking and tackling**, the helmet research conducted by the National Operating Committee on Standards for Athletic Equipment (NOCSAE) (which has continued putting millions of dollars into concussion research), excellent physical conditioning, proper medical supervision, and a good data collection system have played the major role in reducing fatalities and serious brain and neck injuries in football. This is best illustrated by Table IX and Graph I which shows the increase in both brain and cervical spine fatalities during the decade from 1965-1974. This time period was associated with blocking and tackling techniques that involved the head as the initial point of contact. The reduction in brain and cervical spine injuries is shown in the decade from 1975-1984. This decade was associated with the 1976 rule change that eliminated the head as the initial contact point in blocking and tackling. There is no doubt that the 1976 rule change has made a difference and that a continued effort should be made to keep the head out of the fundamental skills of football. Data from the decade 1985-1994 continues to illustrate the reduction in brain and neck fatalities. A concern is that the data from 1995-2004 show an increase in brain fatalities over that of 1985-1994. There has been an increase of 11 brain deaths during the decade 1995-2004, which is an increase of 2.1% over 1985-1994. The decade from 2005-2014 will have to be watched closely.

Heat Stroke

A continuous effort should be made to eliminate heat stroke deaths associated with football. Since the beginning of the survey through 1959 there were five cases of heat stroke death reported. From 1960 through 2012 there have been 133 heat stroke cases that resulted in death (Table IV). **The 2011 data show five cases of heat stroke death at the high school level and none in youth, professional or college football, but the 2012 data show a reduction to one. This is a trend that must continue. There is the possibility that a number of these heat stroke cases may also involve sickle cell trait, but at this time the data is not available. There is no excuse for any number of heat stroke deaths since they are all preventable with the proper precautions. Since 1995 there have been 52 football players die from heat stroke (41 high school, 8 college, 2 professional, and one sandlot). In the past ten years (2003-2012) there have been 31 heat stroke deaths as compared with the previous ten years (1993-2002) when there were 21. These are amazing numbers and every effort should be made to continuously educate coaches concerning the proper procedures and precautions when practicing or playing in the heat.**

In addition to the above listed deaths due to heat stroke (with one in 2012), there are a number of cases where the athlete recovers. One such case in 2010 took place in Kentucky where six players from one school were taken to the hospital with heat exhaustion symptoms and one being kept overnight for observation. In another case a North Carolina coach made his players wear winter caps during August practice to acclimatize to the heat. None of the players suffered heat related problems, but medical experts stated that this type of practice was dangerous. In Oregon two dozen football players from one team went to the hospital complaining of sore and swollen muscles – including three who required surgery – suffering from a syndrome called rhabdomyolysis which occurs when athletes who have not been training have a sudden increase in the intensity of workouts during early practices. Heat and dehydration can trigger rhabdomyolysis.

Heat stroke and heat exhaustion are prevented by careful control of various factors in the conditioning program of the athlete. When football activity is carried on in hot weather, the following suggestions and precautions should be taken:

1. Each athlete should have a complete physical examination with a medical history and an annual health history update. History of previous heat illness and type of training activities before organized practice begins should be included.
2. Acclimatize athletes to heat gradually by providing graduated practice sessions for the first seven to ten days and other abnormally hot or humid days. Obey the rules pertaining to when full football uniforms may be worn.
3. Know both the temperature and the humidity since it is more difficult for the body to cool itself in high humidity. Use of a sling psychrometer is recommended to measure the relative humidity and anytime the wet-bulb temperature is over 78 degrees practices should be altered.
4. Adjust activity level and provide frequent rest periods. Rest in cool, shaded areas with some air movement and remove helmets and loosen or remove jerseys. Rest periods of 15-30 minutes should be provided during workouts of one hour.
5. Provide adequate **cold** water replacement during practice. **Water should always be available and in unlimited quantities to the athletes. GIVE WATER REGULARLY.** Athletes should drink water before, during, and after practice.
5. Salt should be replaced daily and liberal salting of the athletes' food will accomplish this purpose. Coaches should not provide salt tablets to athletes. Attention must be directed to water replacement.
7. Athletes should weigh each day before and after practice and weight charts checked in order to treat the athlete who loses excessive weight each day. Generally, a two to

three percent body weight loss through sweating is safe, and a five percent loss is in the danger zone.

8. Clothing is important and a player should avoid using long sleeves, long stockings and any excess clothing. Never use rubberized clothing or sweatsuits.
9. Some athletes are more susceptible to heat injury. These individuals are not accustomed to work in the heat, may be overweight, and may be the eager athlete who constantly competes at his capacity. Athletes with previous heat problems should be watched closely.
10. It is important to observe for signs of heat illness. Some trouble signs are nausea, incoherence, fatigue, weakness, vomiting, cramps, weak rapid pulse, flushed appearance, visual disturbances, and unsteadiness. Heat stroke victims, contrary to popular belief, may sweat profusely. If heat illness is suspected, seek a physician's immediate service. Recommended emergency procedures are vital. Plan should be in writing and all personnel should have copies.
11. An increasing number of medical personnel are using a treatment for heat illnesses that involves immersing the athlete in ice water. This technique will help bring down the body temperature and has proven to be effective. Some schools have plastic outdoor swim pools filled with ice water available at practice facilities.
12. The National Athletic Trainers Association also has a heat illness position statement on their web site with recommendations for prevention.

Recommendations

Specific recommendations resulting from the 2012 survey data are as follows:

1. Mandatory medical examinations and medical history should be taken before allowing an athlete to participate in football. The NCAA recommends a thorough medical examination when the athlete first enters the college athletic program and an annual health history update with use of referral exams when warranted. If the physician or coach has any questions about the athlete's readiness to participate, the athlete should not be allowed to play. High school coaches should follow the recommendations set by their State High School Athletic Association.
2. All personnel concerned with training football athletes should emphasize proper, gradual, and complete physical conditioning. Particular emphasis should be placed on neck strengthening exercises and acclimatization to hot weather.
3. A physician should be present at all games and practice sessions. If it is impossible for a physician to be present at all practice sessions, emergency measures must be provided. Written emergency procedures are recommended for coaches, medical staff, and everybody associated with the program, including players.
4. All personnel associated with football participation should be cognizant of the problems and safety measures related to physical activity in hot weather.
5. Each institution should strive to have a certified athletic trainer who is a regular member of the faculty and is adequately prepared and qualified.
6. Cooperative liaison should be maintained by all groups interested in the field of Athletic Medicine (coaches, trainers, physicians, manufacturers, administrators, and so forth).
7. There should be strict enforcement of game rules, and administrative regulations should be enforced to protect the health of the athlete. Coaches and school officials must support the game officials in their conduct of the athletic contests.
8. There should be a renewed emphasis on employing well-trained athletic personnel,

providing excellent facilities, and securing the safest and best equipment possible.

9. There should be continued research concerning the safety factor in football (rules, facilities, equipment, etc.).
10. Coaches should continue to teach and emphasize the proper fundamentals of blocking and tackling to help reduce brain and neck fatalities. **KEEP THE HEAD OUT OF FOOTBALL.**
11. Strict enforcement of the rules of the game by both coaches and officials will help reduce serious injuries. Be aware of the 2005 rule change to the 1976 definition of spearing, and to the 2007 high school rules concerning illegal helmet contact.
12. When a player has experienced or shown signs of head trauma (loss of consciousness, visual disturbances, headache, inability to walk correctly, obvious disorientation, memory loss), he should receive immediate medical attention and should not be allowed to return to practice or game that day, and in future games or practices without permission from a physician.
13. The number of indirect heart related deaths has increased over the years and it is recommended that schools have automated external defibrillators (AED) available for emergency situations.
14. A more recent concern for indirect deaths in football players is sickle cell trait. A recent article mentioned that up to 13 college football players have died after a sickling collapse. The article also mentioned that most athletes do not know their sickle cell status even though screening is done at birth. A recent survey of NCAA Division I-A schools found that 64% screen their athletes for sickle cell trait. On August 1, 2010 the NCAA mandated that all Division 1 athletes be tested for the sickle cell trait. The National Athletic Trainers' Association has a statement on their web site – Consensus

Statement: Sickle Cell Trait and the Athlete. The statement includes precautions applied to athletes with sickle cell trait.

CASE STUDIES DIRECT FATALITIES

HIGH SCHOOL

NONE IN 2012

SANDLOT

NONE IN 2012

COLLEGE

NONE IN 2012

PROFESSIONAL

A semi-professional football player was hit in the chest by a blindsided block while covering a kick-off during a game. Cause of death was commotio cordis. He was 31 years old and date of death was May 2012.

A 27 year old semi-professional football player suffered a helmet-to-helmet hit during a game. He suffered a severe concussion and fractured cervical vertebrae. He was waiting to have surgery, but died in his sleep. No other information was available.

CASE STUDIES INDIRECT FATALITIES

HIGH SCHOOL

A 14 year old high school football player collapsed after a football workout on July 19, 2012. After the workout he called home for a ride and was shooting basketball with friends when he collapsed. He was 6' 3" tall and weighed 200 lbs. Cause of death was listed as a congenital heart defect

A 14 year old high school football player collapsed at practice on October 17, 2012 and died at the hospital. Cause of death was an asthma attack.

A 15 year old high school football player died from heat stroke on July 23, 2012 during a 90 minute workout. He was 5' 8" tall and weighed 210 lbs. He was a sophomore offensive lineman and practice did not include wearing pads. Practice was cut short due to the heat and rising temperature. He died the same day at the hospital.

A 15 year old high school football player died on August 17, 2012 several hours after practice. Cause of death according to the autopsy report was a heart attack related to a birth defect.

A 17 year old high school football player died on the first day of practice August 8, 2012. He collapsed during drills (non-contact). It was the second practice of the day and between practices he felt chest pains but did not tell the coach. Cause of death was an enlarged heart.

A 15 year old high school football player collapsed at practice when he was tackled after catching a pass. He lost consciousness after being hit and died during the trip to the hospital. He had a history of asthma and was on medication. The medical examiner ruled the cause of death as bronchial asthma.

An 18 year old high school football player collapsed on the sideline during a game after making a tackle. He was a lineman and was 6'3" tall and weighed 320 lbs. The coroner ruled cause of death was due to a congenital enlarged heart.

A 16 year old high school football player collapsed and died on August 28, 2012. There was no autopsy and no conclusive evidence as to the cause of death.

An 11 year old high school football player was struck by lightning, was in a coma for four days, and died after being taken off life support. He was struck during a practice

session. The school had a lightning detection device, but it did not register any electrical activity. The player was the first one on the field when he was struck.

COLLEGE

A 19 year old Division 1 college football player collapsed during practice on November 7, 2012 and died at the hospital. It was a non-contact practice – helmets but no other pads. He was a freshman defensive back. Cause of death was heart related.

A 22 year old Division 1 college football player collapsed and died on April 6, 2012. Cause of death was an enlarged heart.

A 21 year old Division 1 college football player participated in a workout on February 1 2012, and died the next morning of a massive heart attack.

A 23 year old Division 1 college football player suffered a collapsed lung during a game on August 30, 2012. He had three surgeries and was in a coma for a month. He died on October 21, 2012 when he was taken off life support. Cause of death was a collapsed lung with surgery complications.

TABLE 1
FATALITIES: DIRECTLY DUE TO FOOTBALL – 1931-2012*

YEAR	SANDLOT	PRO AND SEMIPRO	HIGH SCHOOL	COLLEGE	TOTAL
	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT
**1931-1965	134	72	348	54	608
1966	4	0	20	0	24
1967	5	0	16	3	24
1968	4	1	26	5	36
1969	3	1	18	1	23
1970	3	0	23	3	29
1971	2	0	15	3	20
1972	3	1	16	2	22
1973	2	0	7	0	9
1974	0	0	10	1	11
1975	1	0	13	1	15
1976	3	0	15	0	18
1977	1	0	8	1	10
1978	0	0	9	0	9
1979	0	0	3	1	4
1980	0	0	9	0	9
1981	2	0	5	2	9
1982	2	0	7	0	9
1983	0	0	4	0	4
1984	1	0	4	1	6
1985	2	0	4	1	7
1986	0	0	11	1	12
1987	0	0	4	0	4
1988	0	0	7	0	7
1989	0	0	4	0	4
TABLE 1 CONTINUED					
1990	0	0	0	0	0
1991	0	0	3	0	3
1992	0	0	2	0	2
1993	0	0	3	1	4
1994	0	0	0	1	1

1995	0	0	4	0	4
1996	0	0	5	0	5
1997	0	0	6	1	7
1998	0	0	6	1	7
1999	1	0	4	1	6
2000	0	0	3	0	3
2001	1	0	8	0	9
2002	1	1	3	1	6
2003	1	0	2	0	3
2004	1	0	4	0	5
2005	0	1	2	0	3
2006	0	0	1	0	1
2007	0	1	3	0	4
2008	0	0	7	0	7
2009	1	0	2	0	3
2010	1	0	2	2	5
2011	1	0	2	1	4
2012	0	2	0	0	2
TOTALS	180	80	678	89	1027

TABLE II**FATALITIES: INDIRECTLY DUE TO FOOTBALL - 1931-2012***

YEAR	SANDLOT INDIRECT	PRO AND SEMIPRO INDIRECT	HIGH SCHOOL INDIRECT	COLLEGE INDIRECT	TOTAL INDIRECT
**1931-1965	85	15	159	40	299
1966	0	0	6	2	8
1967	0	0	4	1	5
1968	2	0	8	2	12
1969	3	1	8	3	15
1970	0	0	12	2	14
1971	2	1	7	2	12
1972	0	0	10	1	11
1973	0	0	5	3	8
1974	0	0	5	3	8
1975	2	0	3	3	8
1976	1	0	7	2	10
1977	0	0	6	0	6
1978	0	0	8	1	9
1979	1	0	8	1	10
1980	0	0	4	0	4
1981	0	0	6	0	6
1982	1	0	7	3	11
1983	0	0	6	3	9
1984	0	0	3	0	3
1985	0	0	1	1	2
1986	0	0	6	1	7
1987	0	0	4	3	7
1988	1	0	10	0	11
1989	0	0	9	2	11

TABLE 11 CONTINUED

1990	0	0	3	3	6
1991	0	0	3	1	4
1992	1	0	9	1	11
1993	0	0	8	1	9
1994	1	0	2	2	5
1995	1	0	7	1	9
1996	0	1	10	1	12
1997	1	0	7	0	8
1998	1	0	6	1	8
1999	1	0	11	0	12
2000	0	0	11	2	13
2001	0	2	10	3	15
2002	1	0	7	3	11
2003	1	1	4	1	7
2004	0	0	7	3	10
2005	1	1	8	2	12
2006	2	0	12	2	16
2007	1	1	6	1	9
2008	3	0	7	3	13
2009	2	0	14	2	18
2010	0	0	9	2	11
2011	0	0	11	1	12
2012	0	0	9	4	13

TOTALS **115** **23** **493** **119** **750**

* No study in 1942 ** Yearly totals available from past reports

TABLE III

DIRECT FATALITIES INCIDENCE PER 100,000 – 1931-2012*

YEAR	HIGH SCHOOL	COLLEGE
**1931-1959		
1960	1.78	1.53
1961	1.62	9.23
1962	1.94	0.00
1963	1.94	3.04
1964	2.23	4.56
1965	2.00	1.33
1966	2.00	0.00
1967	1.60	4.00
1968	2.60	6.60
1969	1.64	1.33
1970	1.92	4.00
1971	1.25	4.00
1972	1.33	2.67
1973	0.58	0.00
1974	0.83	1.33
1975	1.08	1.33
1976	1.00	0.00
1977	0.53	1.33
1978	0.60	0.00
1979	0.23	1.33
1980	0.69	0.00
1981	0.38	2.67
1982	0.54	0.00
1983	0.30	0.00
1984	0.30	1.33
1985	0.30	1.33
1986	0.84	1.33
1987	0.30	0.00
1988	0.46	0.00
1989	0.27	0.00

TABLE III CONTINUED

1990	0.00	0.00
1991	0.20	0.00
1992	0.14	0.00
1993	0.20	1.33
1994	0.00	1.33
1995	0.27	0.00
1996	0.33	0.00
1997	0.40	1.33
1998	0.40	1.33
1999	0.27	1.33
2000	0.20	0.00
2001	0.46	0.00
2002	0.20	0.00
2003	0.13	0.00
2004	0.27	0.00
2005	0.13	0.00
2006	0.07	0.00
2007	0.20	0.00
2008	0.47	0.00
2009	0.13	0.00
2010	0.13	2.66
2011	0.18	1.33
2012	0.00	0.00

* **No study was made in 1942.**

** Yearly totals available from past reports.

Based on 1,100,000 players grades 9-12, and 75,000 college players.

TABLE IV

HEAT STROKE FATALITIES 1931-2012*

YEAR	TOTAL
**1931-1954	0
1955	1
1956-1958	0
1959	4
1960-1964	15
1965	6
1966	1
1967	2
1968	5
1969	5
1970	8
1971	4
1972	7
1973	3
1974	1
1975	0
1976	1
1977	1
1978	4
1979	2
1980	1
1981	2
1982	2
1983	1
1984	3
1985	0
1986	0
1987	1
1988	2
1989	2
1990	1
1991	0
1992	1
1993	0
1994	0
1995	4
1996	2
1997	1
1998	4
1999	2

TABLE IV CONTINUED

2000	5
2001	3
2002	0
2003	0
2004	3
2005	2
2006	5
2007	2
2008	5
2009	4
2010	4**
2011	5
2012	1
TOTALS	138

* No study was made in 1942.

** Two were combination of heat and sickle cell trait

TABLE V

DIRECT FATALITIES 2012: TYPE OF ACTIVITY ENGAGED IN

Type of Activity	Sandlot	Pro	High School	College	Total
Blocked KO	0	1	0	0	1
Helmet to Helmet	0	1	0	0	1
TOTAL	0	2	0	0	2

TABLE VI

DIRECT FATALITIES 2012: CAUSE OF DEATH

Causes	Sandlot	Pro	High School	College	Total
Commotio Cordis	0	1	0	0	1
Brain/Neck Injury	0	1	0	0	1
TOTAL	0	2	0	0	2

TABLE VII

DIRECT FATALITIES 2012: POSITION PLAYED

Position	Sandlot	Pro	High School	College	Total
KO Cover	0	1	0	0	1
Defensive Line	0	1	0	0	1
TOTAL	0	2	0	0	2

TABLE VIII

INDIRECT FATALITIES 2012: CAUSE OF DEATH

Causes	Sandlot	Pro	High School	College	Total
Heart Related	0	0	4	3	7
Heat Stroke	0	0	1	0	1
Asthma	0	0	2	0	2
Lightning	0	0	1	0	1
Collapse Lung	0	0	0	1	1
Unknown	0	0	1	0	1
TOTAL	0	0	9	4	13

TABLE IX
HEAD AND CERVICAL SPINE FATALITIES

Year	Head		Cervical Spine	
	Frequency	Percent	Frequency	Percent
1945-1954	87	17.1	32	27.3
1955-1964	115	22.5	23	19.7
1965-1974	162	31.8	42	35.9
1975-1984	69	13.5	14	12.0
1985-1994	33	6.5	5	4.3
1995-2004	44	8.6	1	0.8
TOTALS	510	100.0	117	100.0