

ANNUAL SURVEY OF FOOTBALL INJURY RESEARCH

1931 - 2009

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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 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.

Participation numbers were updated in the 1989 report. The National Federation of State High School Associations has estimated that there are approximately 1,500,000 high school, junior high school, and non-federation school football participants in the United States. The college figure of 75,000 participants includes the National Collegiate Athletic Association, the National Association of Intercollegiate Athletics, the National Junior College Athletic Association, and an estimate of schools not associated with any national organization. Sandlot and professional football have been estimated at 225,000 participants. These figures give an estimate of 1,800,000 total football participants in the United States for the 2009 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 2009 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 three fatalities directly related to football during the 2009 football season. Two fatalities were in high school football and one in sandlot football. (Table I)
2. The rate of direct fatal injuries is very low on a 100,000 player exposure basis. For the approximately 1,800,000 participants in 2009, the rate of direct fatalities was 0.17 per 100,000 participants.
3. The rate of direct fatalities in high school and junior high school football was 0.13 per 100,000 participants. The rate of direct fatalities in college was 0.00 per 100,000 participants. (Table III)
4. Most direct fatalities usually occur during regularly scheduled games. In 2009 one direct fatality occurred in a game, and two in practices.
5. The 2009 survey shows that one of the injuries took place in May, one in September, and one in October.
6. The major activities in football would naturally account for the greatest number of fatalities. In 2009 one fatality occurred while being tackled, one being blocked, and one in a collision. (Table V)
7. In 2009 two fatalities resulted from injuries to the brain, and one to commotio cordis. (Table VI)
8. In many cases football cannot be directly responsible for fatal injuries (heat stroke, heart related and so forth). In 2009 there were 15 indirect fatalities. Twelve were associated with high school football, two with college football, and one with sandlot football. The high school

indirect deaths were three heat stroke, two heart related, two associated with asthma attacks, one due to natural causes, and the cause of four was unknown. The two college indirect deaths were one heat related and one sickle cell death. The one sandlot death was heart related. (Tables II & VIII)

### **Discussions And Recommendations**

After a slight rise in the number of 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 2009 data continues the trend of single digit direct fatalities that started in the 1978 football season. 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 2009 indirect fatalities show an increase of two when compared to the 2008 data.

### **Head and Neck Injuries**

Past efforts that were successful in reducing fatalities to the levels indicated from 1990 through 2009, and the elimination of direct fatalities in 1990, 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 six of the head and neck deaths have been brain injuries (68). 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 so that participants will be able to hold their heads firmly erect when making contact.
2. Coaches should drill the athletes in the proper execution of the fundamental football 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 the player's equipment is properly fitted, particularly the helmet.
5. 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 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. 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 contact 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), 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 2009 there have been 123 heat stroke cases that resulted in death (Table IV). **The 2009 data show three cases of heat stroke death at the high school level and one at the college level. 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 42 football players die from heat stroke (31 high school, 8 college, 2 professional, and one sandlot). Every effort should be made to continuously educate coaches concerning the proper procedures and precautions when practicing or playing in the heat.** Since 1974 there has been a dramatic reduction in heat stroke deaths with the exception of 1978, 1995, 1998, when there were four each year, and 2000, 2006, and 2008 when there were five each year. There were no heat stroke deaths in 1991, 1993, 1994, 2002, and 2003. All coaches, trainers, and physicians should place special emphasis on eliminating football fatalities that result from physical activity in hot weather.

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 used.

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 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 2009 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 Associations.
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 both coaches and medical staff.

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, and so forth).
10. Coaches should continue to teach and emphasize the proper fundamentals of blocking and tackling to help reduce head 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. 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**

A 16 year-old high school football player was injured and died on May 11, 2009. The injury happened in a practice session when the player was tackled after catching a swing pass. The tackler hit the injured player in the chest, which caused the injury. The injury was diagnosed as commotio cordis (blow to the chest which stops the heart beat). The player was an 11<sup>th</sup> grader and was 5' 10" and 175 lbs.

A 17 year-old high school football player was injured on 9/25/09 and died on 9/27/09. Cause of death was a brain injury. He was a junior defensive back who collapsed on the sideline after a hard collision. The player had three surgeries and cause of death was a subdural hematoma.

### **SANDLOT**

A ten year-old youth football player died from a brain injury on 10/8/09. He was participating in a kick-off drill when he collapsed, but the exact activity which caused the injury was unknown. Cause of death was listed as an acute subdural hematoma.

## **CASE STUDIES INDIRECT FATALITIES**

### **HIGH SCHOOL**

A 16 year-old high school football player collapsed at practice on 7/28/09 and died on 7/29/09/. The player was 6' tall and weighed 330 lbs. and was participating in the first day of two a day practices. Cause of death from the autopsy was heat stroke. Body temperature at the time of death reached 111 degrees. The autopsy also stated that the player's weight played a role in his death. Temperature was in the 70s with high humidity.

A 16 year-old high school football player collapsed on July 2, 2009 while participating in voluntary conditioning drills with his high school football team. He died on July 5, 2009.

According to the autopsy report the cause of death was heat stroke. Temperature at the time was 81 degrees and the players were not wearing football equipment.

A 13 year-old middle school football player died in his sleep on 8/25/09, the morning after his first football practice. The temperature on the first day of practice was over 100 degrees and the practice lasted between 1 1/2 and 2 hours. Players wore helmets, shorts, and shirts, but no protective equipment. Cause of death was heat stroke.

A 16 year-old high school football player collapsed during a morning practice on the 4<sup>th</sup> day of practice – 8/12/09. He was participating in stretching exercises after only 4 or 5 minutes on the field. Autopsy results gave the cause of death as an inherited heart disease.

A high school senior died during a football game on 8/21/09. Cause of death was cardiac arrest. He was a defensive tackle. An AED was used by the rescue squad, but was unable to start his heart.

A 16 year-old high school football player collapsed during a junior varsity game on 11/21/09. He was taken off of life support on 11/24/09. There was no autopsy and was ruled a natural death. The physician did not believe it was a direct death related to trauma.

A 12 year-old junior high school football player died during an asthma attack after practice. The death happened on August 3, 2009.

An 18 year-old high school football player died on 9/4/09 from an asthma attack following a game. He collapsed during the game and was said to have a history of bronchial asthma.

**THE FOLLOWING FOUR CASES ARE LISTED AS INDIRECT BUT THE CAUSE OF DEATHS ARE UNKNOWN AT THIS TIME.**

A high school football player collapsed during a JV game on 10/16/09. He died on 10/17/09. He was a running back and was said to have taken a big hit during the game, but at the time of this writing the cause of death was unknown.

A 14 year-old high school football player collapsed at practice during a game on 9/14/09 and died at the hospital on 9/15/09. As of 12/2/09 the cause of death has not been determined.

A senior high school football player collapsed at practice on 10/20/09 and died the same day. There was an autopsy but as of 12/3/09 there has been no report as to the cause of death.

A high school football player collapsed during a game on 9/11/09 and died in the hospital. There was no contact when he collapsed. There was an autopsy but the coroner was unable to determine the cause of death without more test results. As of this writing the cause of death was unknown.

### **FOLLOWING TWO CASES INDIRECTLY DUE TO FOOTBALL AND THE PLAYERS SURVIVED**

A 15 year-old high school football player collapsed during a game on 8/14/09. The collapse was heart related and he was revived with the use of an AED.

A 14 year-old high school football player was struck by lightning during practice on 8/12/09/. He was administered CPR and with the use of an AED he was revived. He was in the hospital for eight days and has recovered. The lightning bolt went through the player and left a two inch hole in the asphalt.

### **NOT FOOTBALL**

A 16 year-old high school football player collapsed and died at a restaurant after practice on 9/15/09. Cause of death was bi-lateral pneumonia and was not related to football.

### **COLLEGE**

A college football player was participating in a voluntary summer conditioning program when he complained of cramps during wind sprints. He later died at the hospital on 7/8/09. Cause of death was sickle cell trait. There was an athletic trainer on site at the time.



An 18 year-old college freshman football player collapsed at practice on 8/12/09 and died on 8/14/09. The coroner's report stated death was caused by heat and exertion.

### **SANDLOT**

A 13 year-old youth football player collapsed at practice on 8/18/09 while running laps. The player was 6' 2" tall and weighed 360 lbs. Cause of death was listed as hypertensive cardiovascular disease.

**TABLE I****FATALITIES: DIRECTLY DUE TO FOOTBALL – 1931-2009\***

<b>YEAR</b>	<b>SANDLOT DIRECT</b>	<b>PRO AND SEMIPRO DIRECT</b>	<b>HIGH SCHOOL DIRECT</b>	<b>COLLEGE DIRECT</b>	<b>TOTAL DIRECT</b>
**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
<b>2009</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>3</b>
<b>TOTALS</b>	<b>178</b>	<b>78</b>	<b>674</b>	<b>86</b>	<b>1016</b>

**TABLE II****FATALITIES: INDIRECTLY DUE TO FOOTBALL - 1931-2009\***

<b>YEAR</b>	<b>SANDLOT INDIRECT</b>	<b>PRO AND SEMIPRO INDIRECT</b>	<b>HIGH SCHOOL INDIRECT</b>	<b>COLLEGE INDIRECT</b>	<b>TOTAL INDIRECT</b>
**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
<b>2009</b>	<b>1</b>	<b>0</b>	<b>12</b>	<b>2</b>	<b>15</b>

**TOTALS**            **114**            **23**            **462**            **112**            **711**

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

**TABLE III**  
**DIRECT FATALITIES INCIDENCE PER 100,000 – 1931-2009\***

<b>YEAR</b>	<b>HIGH SCHOOL</b>	<b>COLLEGE</b>
**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

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

\*\* Yearly totals available from past reports.

Based on 1,500,000 junior and senior high school players and 75,000 college players.

**TABLE IV****HEAT STROKE FATALITIES 1931-2009\***

<b>YEAR</b>	<b>TOTAL</b>
**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
<b>TOTALS</b>	<b>128</b>

\* No study was made in 1942.

**TABLE V**

**DIRECT FATALITIES 2009: TYPE OF ACTIVITY ENGAGED IN**

<b>Type of Activity</b>	<b>Sandlot</b>	<b>Pro</b>	<b>High School</b>	<b>College</b>	<b>Total</b>
Tackled After Catching Pass	0	0	1	0	1
Blocked	0	0	1	0	1
Collision	1	0	0	0	1
<b>TOTAL</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>3</b>

**TABLE VI**

**DIRECT FATALITIES 2009: CAUSE OF DEATH**

<b>Causes</b>	<b>Sandlot</b>	<b>Pro</b>	<b>High School</b>	<b>College</b>	<b>Total</b>
Brain Injury	1	0	1	0	2
Neck Injury	0	0	0	0	0
Commotio Cordis	0	0	1	0	1
<b>TOTAL</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>3</b>

**TABLE VII**

**DIRECT FATALITIES 2009: POSITION PLAYED**

<b>Position</b>	<b>Sandlot</b>	<b>Pro</b>	<b>High School</b>	<b>College</b>	<b>Total</b>
Running Back	0	0	1	0	1
Defensive Back	0	0	1	0	1
Unknown	1	0	0	0	1
<b>TOTAL</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>3</b>

**TABLE VIII**

**INDIRECT FATALITIES 2009: CAUSE OF DEATH**

<b>Causes</b>	<b>Sandlot</b>	<b>Pro</b>	<b>High School</b>	<b>College</b>	<b>Total</b>
Heart Related	1	0	2	0	3
Heat Stroke	0	0	3	1	4
Sickle Cell	0	0	0	1	1
Asthma Attack	0	0	2	0	2
Natural	0	0	1	0	1
Unknown	0	0	4	0	4
<b>TOTAL</b>	<b>1</b>	<b>0</b>	<b>12</b>	<b>2</b>	<b>15</b>

**TABLE IX**  
**HEAD AND CERVICAL SPINE FATALITIES**

<b>Year</b>	<b>Head</b>		<b>Cervical Spine</b>	
	<b>Frequency</b>	<b>Percent</b>	<b>Frequency</b>	<b>Percent</b>
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
<b>TOTALS</b>	510	100.0	117	100.0