ANNUAL SURVEY OF FOOTBALL INJURY RESEARCH

1931 - 2008

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

and

Bob Colgate
Assistant Director of the National Federation of State High School Associations

Prepared for:

American Football Coaches Association, Waco, Texas
National Collegiate Athletic Association, Indianapolis, Indiana
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 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 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 2008 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 2008 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 seven fatalities directly related to football during the 2008 football season. All seven fatalities were in high school 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 2008, the rate of direct fatalities was 0.39 per 100,000 participants.

3. The rate of direct fatalities in high school and junior high school football was 0.47 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 2008 five direct fatalities occurred in games, one in practice, and one in a scrimmage game.

5. The 2008 survey shows that three of the injuries took place in August, three in September, and one in October.

6. The major activities in football would naturally account for the greatest number of fatalities. In 2008 three fatalities happened while tackling, one while being tackled, one being blocked, and two in a collision. Three of the brain fatalities involved tackling, one being tackled, and one being blocked. (Table V)

7. In 2008 five fatalities resulted from injuries to the brain, one to an abdominal injury, and one to a chest injury. (Table VI)

8. In many cases football cannot be directly responsible for fatal injuries (heat stroke, heart related and so forth). In 2008 there were 13 indirect fatalities. Seven were associated with high school football, three with college football, and three with sandlot football. The high school indirect deaths were four heat stroke and three heart related deaths. The three college indirect deaths were two heat related and one sickle cell death. All three of the sandlot deaths were heart related. (Table II)

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. The 2008 data continues the trend of single digit direct fatalities that started in the 1978 football season. There was a decrease from nine direct fatalities in 2001 to six in 2002, three in 2003, five in 2004, three in 2005, one in 2006, four in 2007, and a slight rise in 2008 to seven. 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 2008 indirect injuries show an increase of four when compared to the 2007 data.

Head and Neck Injuries

Past efforts that were successful in reducing fatalities to the levels indicated from 1990 through 2008, 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 rules 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. 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. Of the five brain injuries in 2008, two were diagnosed as second impact syndrome. Players with second impact syndrome received an initial concussion and returned to play before being fully healed.

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 shows 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 2008 there have been 120 heat stroke cases that resulted in death (Table IV). **The 2008 data show four cases of heat stroke death at the high school level and two at the college level. The six heat stroke deaths accounted for the third highest number since the eight in 1970, and seven in 1972. 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 39 football players die from heat stroke (29 high school, 7 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 and 2006 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 <u>unlimited quantities</u> to the athletes. <u>GIVE WATER REGULARLY</u>**. 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 2008 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 without permission from the proper medical authorities.

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.

CASE STUDIES DIRECT FATALITIES

HIGH SCHOOL

A 17 year-old high school football player was injured on 8/22/08 during a practice session. He was making a one-on-one tackle at the time and contact was made with his head to the shoulder pads of his opponent. He was unconscious after the hit and was taken to the hospital. The accident took place on 8/22/08 and he was in a coma for four days and died on 8/26/08. Cause of death was a subdural hematoma.

A 15 year-old high school football player was injured during a game on 8/22/08. He was a linebacker and was blocked by a pulling lineman. Helmet to helmet contact was made by the pulling lineman. He was taken to a hospital, had surgery, and died on 8/24/08 after being taken off of life support. Cause of death was a subdural hematoma.

A 15 year-old high school football player was injured during a junior varsity game on 8/29/08 and died on 8/30/08. He was playing wide receiver at the time and was involved with a collision with two opposing players. The injury was a lacerated liver and he died of internal complications.

A 16 year-old high school football player was injured during a game scrimmage against another school. He was hit in the chest by an opponent and died a short time later at the hospital. Autopsy results failed to identify the cause of death.

A high school sophomore football player was injured during a game on 9/12/08 and died on 9/16/08. He was a defensive back tackling the ball carrier at the time of the injury. Contact was made with the legs of the ball carrier. Cause of death was a brain injury.

A 16 year-old high school football player was injured during a game on 9/19/08 and died later the same day. He collapsed on the sideline after being tackled while running the ball. He received a concussion in practice two days before the game and did not have clearance from a physician. Cause of death was a brain injury due to second impact syndrome.

A 16 year-old high school football player was injured during a game on 10/13/08 and died on 10/15/08. He was playing the linebacker position making a tackle during a junior varsity game. He suffered a concussion three weeks before the fatal injury. Cause of death was a subdural hematoma with possible second impact syndrome. He was cleared by a physician to return to play after the initial concussion.

CASE STUDIES INDIRECT FATALITIES

HIGH SCHOOL

A 17 year-old high school football player was injured on 8/14/08 and died on 8/15/08. He was participating in a practice session in full pads from 4:30 PM to 7:00 PM in 103 to 104 degree heat. He also participated in a light morning practice that same day. The county coroner ruled the death to be related to an electrolyte imbalance from drinking too much water after working in the heat for a long period. Actual cause of death is known as hyponatremia. He is listed in this report as a heat related death.

A 17 year-old high school football player died on 8/12/08 after participating in a high school football scrimmage against another high school. The autopsy report was still not available in December of 2008, but all indications are that the cause of death was heat related. There has been a long investigation going on at the high school and also with the local EMT who visited the athlete's home after a 911 call. This case will be updated as more information is available.

A 15 year-old high school junior varsity football player collapsed at practice on 5/28/08. Cause of death was congenital heart failure.

A 15 year-old high school football player collapsed after practice on 8/20/08. The temperature was 94 degrees and practice started at 4:30 PM and ended at 6:00 PM. The coach stated that they had three water breaks. The athlete's core temperature was 107 degrees. There

was no autopsy, but the coroner called it a heat stroke death. Another player on the team also collapsed, but recovered after two days in the hospital.

A 16 year-old high school football player collapsed at the end of a team camp practice on 7/14/08. He died at the hospital. He was 5'11" tall and weighed 240 lbs. Cause of death was hypertrophic cardiomyopathy.

A 17 year-old high school football player collapsed and died after an off season workout on 5/15/08. Preliminary findings indicate it was a heart related death.

A 16 year old high school football player collapsed during a practice session on 8/26/08 and died on 8/31/08. Cause of death was heat stroke. He was 6'5" tall and weighed 360 lbs. His body temperature at the hospital was 108 degrees. On 8/1/08 he suffered from heat exhaustion and spent two days in the hospital;

COLLEGE

An 18 year-old college football player collapsed and died after the first practice of the year on 8/14/08. The temperature was 89 degrees and the athlete was 6'1" tall and weighed 240 lbs. The practice lasted 1 ½ hours and the players wore shorts and helmets, but no pads. Cause of death was heat related.

A 19 year-old college football player collapsed during an off-season workout on March 18, 2008 and later died at the hospital. Cause of death listed by the medical examiner was dysrhythmia due to acute exertional rhabdomyolysis with sickle cell trait. The case was controversial as related to the care he received after collapsing and to the intensity of the workout.

A 22 year-old college football player died after an off-season workout on May 28, 2008. Cause of death was heat stroke. School officials stated they were unaware of the athlete having sickle cell trait and have begun screening for the condition in light of the recent heat death. The athlete was 6'4" inches tall and weighed 280 lbs.

SANDLOT

A 13 year-old youth football player collapsed and died after running drills on 8/25/08. Cause of death was believed to be heart related.

A 12 year-old youth football player collapsed at practice and later died. Cause of death was heart related.

A 13 year-old youth football player collapsed during a practice session and later died on 7/28/08. He was 6'1" tall and weighed 231 lbs. Cause of death was an enlarged heart.

TABLE I

FATALITIES: DIRECTLY DUE TO FOOTBALL – 1931-2008*

YEAR	SANDLOT DIRECT	PRO AND SEMIPRO DIRECT	HIGH SCHOOL DIRECT	COLLEGE DIRECT	TOTAL 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**
TOTALS	**177**	**78**	**672**	**86**	**1013**

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

TABLE II

FATALITIES: INDIRECTLY DUE TO FOOTBALL - 1931-2008*

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**
TOTALS	**113**	**23**	**450**	**110**	**696**

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

TABLE III

DIRECT FATALITIES INCIDENCE PER 100,000 – 1931-2008*

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

* 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 1931-2008*

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	**6**
TOTALS	**125**

* No study was made in 1942.

TABLE V

DIRECT FATALITIES 2008: TYPE OF ACTIVITY ENGAGED IN

Type of Activity	Sandlot	Pro	High School	College	Total
Tackled Running Ball	0	0	1	0	1
Blocked	0	0	1	0	1
Tackling	0	0	3	0	3
Collision	0	0	2	0	2
TOTAL	**0**	**0**	**7**	**0**	**7**

TABLE VI

DIRECT FATALITIES 2008: CAUSE OF DEATH

Causes	Sandlot	Pro	High School	College	Total
Brain Injury	0	0	5	0	5
Neck Injury	0	0	0	0	0
Internal	0	0	2	0	2
TOTAL	**0**	**0**	**7**	**0**	**7**

TABLE VII

DIRECT FATALITIES 2008: POSITION PLAYED

Position	Sandlot	Pro	High School	College	Total
Running Back	0	0	2	0	2
Wide Receiver	0	0	1	0	1
Safety	0	0	1	0	1
Linebacker	0	0	2	0	2
Lineman	0	0	1	0	1
TOTAL	0	0	7	0	7

TABLE VIII

INDIRECT FATALITIES 2008: CAUSE OF DEATH

Causes	Sandlot	Pro	High School	College	Total
Heart Related	3	0	3	0	6
Heat Stroke	0	0	4	2	6
Sickle Cell	0	0	0	1	1
TOTAL	**3**	**0**	**7**	**3**	**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