International Symposium on Safety in Baseball/Softball

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Earl F. Hoerner
Francis A. Cosgrove
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The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution of time and effort on behalf of ASTM.

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Foreword

This publication, *International Symposium on Safety in Baseball/Softball,* contains papers presented at the symposium of the same name held in Atlanta, Georgia, on December 6, 1995. The symposium was sponsored by ASTM Committee F08 on Sports Equipment and Facilities and Subcommittee F08.26 on Baseball and Softball Equipment. The symposium chairmen were Earl F. Hoerner and Francis A. Cosgrove.

Overview

Baseball and softball, two of America's most popular pastimes, are undergoing very significant, if not radical, changes. The rapidly growing numbers of players of all ages, with a wide range of skill levels; the new generation of hi-tech bats and balls; the obsolescence of older playing fields; the growing sophistication of coaching, training, and conditioning of players; the importance of routine ball field maintenance; and the appropriate management of baseball and softball programs are having a significant impact on player and spectator safety at all levels of baseball and softball play.

Because of the growing concern for baseball/softball safety issues, ASTM, in conjunction with its F8 Committee on Sports Equipment and Facilities, sponsored for the first time the International Symposium on Safety in Baseball and Softball. The symposium's mission: to review the state of the art and science of new products, materials, technology, epidemiology, and program operations that are baseball/softball specific.

The call for papers precipitated a significant response, resulting in a truly inter-disciplinary symposium that produced a collection of papers that will add valuable information to the growing body of baseball/softball safety-specific literature. The papers published herein present state of the art and science on such subjects as: the physics of baseball/softball equipment (bats, balls, bases, etc.); advances in protective equipment; baseball/softball field design; operations and maintenance; and the epidemiology of baseball/softball injuries.

The information presented in this volume will provide interested baseball/softball parties with new recommendations, guidelines, and suggestions on how baseball and softball programs, equipment, and facilities can be made safer. Whether you are concerned with the scientific intricacies of bat and ball research or how to best manage baseball/softball programs, this publication will offer the reader a unique opportunity to find, under one cover, the most current and diverse collection of baseball/softball safety-related data and information available.

Many of the findings expressed by the authors will have important ramifications for the improvement of the safety of baseball and softball. For example, current research on the liveliness qualities of bats and balls will result in *liveliness value guidelines* that will enable manufacturers to produce bats and balls designed for the dimension(s) limitations of playing fields and the skill levels of baseball and softball players. Other baseball/softball specific research is producing a new generation of protective equipment designed to protect the face and chest of players other than the catcher. These new products, and a host of others, will make significant contributions toward reducing serious injury and incidents of death to baseball/softball players.

While the papers presented in this publication are "leading edge," there is still much to do to improve safety in baseball and softball. Significant work still remains on safety research on bases and their relationship to player sliding skills, and baseball/softball infield maintenance. The collection, reporting, and on-going analysis of baseball/softball injury data requires serious attention in order to develop reporting systems that more accurately identify the specific nature, severity, and causes of baseball/softball injuries. National demographic changes and their impact on baseball and softball now and into the next century must be monitored and accurately assessed if baseball/softball associations, program planners, facility operators, and equipment manufacturers are to respond effectively to the changing

baseball/softball player marketplace. The aging baby boom generation and the dramatic growth of female softball players of all ages are two obvious (demographic) segments of our society that are significantly impacting the games of baseball and softball, and they will continue to do so well into the next century.

The information presented in the following papers represents the findings, opinions, and recommendations of physicians, educators, scientists, equipment manufacturers, architects, lawyers, program operators, inventors, advocates, and baseball/softball players. They came together in a highly focused forum dedicated exclusively to the safety issues related to baseball and softball, and, as a result, ASTM is proud to present this unique compendium of papers, arranged in random order, that will add exclusive, valuable information to the growing body of research literature dedicated to the improvement of safety in baseball and softball.

THE EDITORS

Contents

Rita H. Glassman[1]

TRADITION BOUND RESISTANCE HINDERS YOUTH BASEBALL SAFETY

REFERENCE: Glassman, R.H., "Tradition Bound Resistance Hinders Youth Baseball Safety," International Symposium On Safety In Baseball/Softball, ASTM STP 1313, Earl F. Hoerner and Francis A. Cosgrove, Eds., American Society for Testing and Materials, 1997.

ABSTRACT: The National Youth Sports Safety Foundation, formerly the National Youth Sports Foundation For The Prevention Of Athletic Injuries, a non-profit 501 (C) (3) educational research organization dedicated to reducing the number and severity of injuries youth sustain in sports activities, has been involved in injury prevention efforts in youth baseball since 1989. During that time the Foundation has worked both at the national and local level joining other organizations in their efforts to promote youth baseball safety. However, one vital issue yet to be addressed effectively is the number of deaths due to impact with a baseball or softball. While injury prevention interventions have been identified and continue to be developed, the lack of acknowledgment that the deaths are a health issue and a barrier dubbed "tradition bound resistance" have hindered injury prevention efforts.

KEY WORDS: baseball, softball, safety equipment, statistics, injury prevention, youth, adolescent, child

INTRODUCTION

Each year millions of children don their sports equipment at younger and younger ages encouraged by their parents to play baseball, the country's favorite past time. As young as age 4, they are signed up to learn sports skills, make new friends, and have fun. However, this most popular sport has the highest number of deaths of any youth sport with the least amount of safety equipment mandated [1]. Since 1973, it has been reported that 65 children age 5-14 have lost their lives due to impact with a hard baseball or softball [2]. In addition, the Consumer Product Safety Commission staff estimated almost half of all the emergency room treated injuries to children in organized play resulted from being struck by a ball, which is approximately 48,000 injuries per year [3]. Injury prevention efforts have been undertaken by several national organizations, but they seem to have been hampered for a multitude of reasons including a phenomena dubbed "tradition bound resistance".

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INJURY PREVENTION EFFORTS

Many organizations have been involved in advocating youth baseball safety. Two medical organizations, The American Academy of Pediatrics (AAP) [4] and the American Academy of Pediatric Dentistry [5] have addressed youth baseball safety in position statements on the subject. The American Academy of Facial Plastic and Reconstructive Surgery has petitioned the Consumer Product Safety Commission to adopt a consumer product safety standard requiring that all protective batting helmets intended to be used by children under the age of 15 be manufactured with a face guard that conforms to Standard F910 of the American Society for Testing and Materials [6]. The National Youth Sports Coaches Association (NYSCA) [7] held a program entitled, the National Summit For Safety In Youth Baseball And Softball in September of 1991. Dixie Baseball [8] has mandated face protection, and Little League Baseball [9] has pioneered the use of helmets. USA Baseball [10], the national governing body of the sport, has set up a medical and safety committee and recently established the framework for a surveillance system to track injuries. The Consumer Product Safety Commission (CPSC) [11] has convened two round table discussions on the subject; one in 1993 and the other in 1994, and has announced they plan to publish guidelines on youth baseball safety in 1996 based on research they have initiated [12].

The National Youth Sports Safety Foundation [13], formerly the National Youth Sports Foundation for the Prevention of Athletic Injuries convened a consensus meeting to determine the merits of using softer baseballs and softballs to prevent injuries. It also surveyed national youth baseball organizations and professional baseball regarding their support for injury prevention interventions in youth baseball. In addition the Foundation published a baseball injuries fact sheet, a baseball safety equipment resource list, and a report entitled, Baseball & Softball Deaths of Youth Struck By a Ball.

Each spring as the youth baseball season begins, national media focuses on the injury problem and available prevention measures. Despite all these efforts, last year more than six children lost their lives due to impact with a hard baseball or softball--the highest number of deaths in one year since 1983 [14].

Innovative safety equipment has been developed by many manufacturers to prevent injuries. Helmets, which were mandated many years ago for batters by some leagues, have been joined by: softer baseballs and softballs to reduce the severity of an injury; protective face equipment, face guards, C flaps to protect against oralfacial injuries; chest protectors, batting vests, and heart guards to prevent cardiac arrest due to impact with a ball; and safety bases to prevent lower extremity injuries due to sliding. Of these products, the helmet, face guard (which is attached to a helmet for which an ASTM Standard has been written), and safety bases have definitely been proven effective. Soft baseballs most likely decrease head injury, but the effect of cardiac injury is uncertain. More research is needed for chest protectors, batting vests, and heart guards. This equipment, however, has not been warmly received or accepted for many different reasons.

INJURY PREVENTION BARRIERS

Working in the trenches since 1989 with youth baseball groups, the National Youth Sports Safety Foundation has encountered many different barriers to the concept of safety equipment, and other general safety measures such as a written emergency plan in case of injuries. The Foundation is flooded by requests from concerned parents around the country who would like their leagues to adopt the equipment; however, they need assistance in convincing league administrators that the equipment is necessary. The Foundation is constantly faced with arguments which abound by traditionalists as to why safety equipment should not be mandated:

- The statistics do not warrant safety equipment.

- The equipment has not been proven to be effective.
- The equipment may in fact increase the incidence or severity of injury.
- The equipment does not play the same.
- No standards have been developed for the equipment.
- The equipment will change the sport.
- The national office says the safety equipment is not necessary.

The Garden City Telegram, Garden City, KS, published an article on February 5, 1992, entitled, **"Baseball, or safe ball?"** It began," It might look like a baseball, smell like a baseball and fly like a baseball, but in some people's opinion, it's not a baseball." In the Los Angeles Times on Monday May 8, 1995, there appeared an article entitled, **"Safety Ball Strikes Out in Laguna Niguel."** It began with a bullet which said, "Sports: A Little League chapter's refusal to use the ball has caused a heated debate among parents." And USA Today featured an article on Thursday, August 23, 1990 entitled, **"Debate: Protection vs. tradition. Safety equipment has hard time gaining acceptance".** It began by saying, "In youth baseball, safety seems to be clashing with the sport's traditions."

In addition, the Foundation has encountered many communities who have chosen not to learn about the safety equipment or have safety presentations because they fear greater liability if they find out about it and it isn't implemented.

Cost of the equipment is also a barrier to its implementation. At a recent conference entitled, **Commotio Cordis** which was held on May 17, 1995, in Denver, Colorado, Dr. Reginald Washington, a pediatric cardiologist from Presbyterian St. Luke's Medical Center stated, "the cost of safety equipment for each team must be considered in relationship to the number of deaths, number of participants, and the cost to society. Four chest protectors for a team would cost approximately $200. There are five million children participating in youth baseball with an average of several deaths each year. This is an issue to be dealt with before recommendations are made"[15].

The National Youth Sports Safety Foundation recently reviewed Consumer Product Safety Commission data on baseball and softball deaths due to impact with a baseball or softball from the years 1973-1994 of children age 5-14, and published the data in a report entitled, "Baseball & Softball Deaths of Youth Struck By a Ball". The report includes an overview of the data, a summary by year and by age, and case synopsis. Evaluations of death certificate files, accident investigations and reported incidents revealed 85% of the deaths were to children 12 and under. Fifty-five percent of the deaths were due to impact with a hard baseball or softball to the chest area, and 31% were to the head [16]. Tables 1-10 illustrate the data.

TABLE 1-- # of Deaths by Sex

Sex	Number of Deaths
M	63
F	2

TABLE 2--Ball Delivery

Pitched Balls	17
Batted Balls	16
Ball Machines	1
NA	31

TABLE 3--Body Parts Impacted & # of Deaths

Body Part Injured	Number of Deaths	Percent
Abdomen/Stomach	1	.01%
Neck/Throat	7	10%
Chest	36	55%
Head	20	31%
NA	1	.01%

TABLE 4--# of Deaths By Type of Activity

Type of Activity	Number of Deaths
Baseball Deaths	61
Softball Deaths	4
Organized Activity	23
Unorganized Activity	22
NA	20

TABLE 5--Chest & Head Injuries

Type	Chest	Head
Organized	9	9
Unorganized	14	4
NA	13	7

TABLE 6--10 & Under Deaths

	Organized	Unorganized	NA
Chest	7	10	8
Head	5	3	3

TABLE 7--12 & Under Deaths

	Organized	Unorganized	NA
Chest	7	13	10
Head	8	4	6

TABLE 8--Death By Age Group

Age	# of Deaths	Percent
8 and Under	23	35%
10 and Under	38	58%
12 and Under	54	83%

TABLE 9--Overview of Deaths by Age, Activity and Body Part Injured

Ages	# of Deaths	Unorganized	Organized	NA	Chest	Head	Abdomen/Stomach	Throat/Neck
5	7	5	0	2	7	0	0	0
6	4	2	0	2	3	1	0	0
7	6	4	0	2	5	0	0	1
8	6	0	5	1	4	2	0	0
9	6	0	4	2	4	2	0	0
10	9	3	4	2	3	5	0	1
11	9	5	1	3	3	4	1	1
12	7	1	2	4	2	3	0	1
13	5	1	2	2	3	0	0	2
14	6	0	4	2	3	2	0	1

TABLE 10--Total # of Deaths by Year

Year	#	Year	#	Year	#	Year	#
1973	2	1979	4	1985	4	1991	2
1974	2	1980	4	1986	2	1992	2
1975	2	1981	1	1987	1	1993	2
1976	3	1982	3	1988	1	1994	6
1977	5	1983	5	1989	4		
1978	6	1984	1	1990	3		

This report was sent to national youth baseball organizations for informational purposes and to query their support for injury prevention efforts. Included in the mailing was a cover letter, a fact sheet on injuries, advocacy information and a survey. The cover letter included the following possible injury prevention strategies:

- *Greater public awareness regarding the dangers of using baseballs and softballs with or near young children.*
- *Utilization of safety equipment*
- *Organized programs having a written emergency plan and an emergency first responder in case of injury.*
- *Teaching children how to move out of the way of a ball. However, problems associated with this concept may include: coaches of youth sports are volunteers and may not know how to teach the skill; children mature at different rates and may not have the ability or agility to learn this skill; and other children may not have the concentration skills necessary to watch the ball.*

The Advocacy Information sheet included the following additional injury intervention information:

> *Safety baseballs and softballs: Softer baseballs and softballs aid skill development and reduce the severity of head and soft tissue injuries. The manufacturers of the balls make no claims regarding chest impact injuries. However, a multi-year public health study published in Japan found no deaths in youth baseball due to impact with a ball since the Japanese Department of Education mandated the use of safety baseballs (Kenko safety baseball) more than ten years ago. There are several manufacturers of softer baseballs and softballs.*
>
> *Helmets with chin straps: Chin straps keep the helmet on the head of a batter as he/she runs the bases. Brain injury cases have been cited by neurosurgeons where helmets have flown off batters heads as they run the bases, leaving them vulnerable to ball impact head injuries.*
>
> *Protective eye and/or face equipment: Baseball is one of the leading causes of sports eye injuries seen in emergency rooms. Protective face guards (certified to ASTM F910) have been recommended for batters and base runners through high school age. In addition, eyewear (certified to ASTM F 803) has been recommended for fielders. The use of sunglasses or eyeglasses not equipped with polycarbonate lenses should be strongly discouraged.*
>
> *Batting vests: It has not yet been determined whether batting vests will prevent chest impact deaths, however they will greatly aid in skill development.*
>
> *Education: The United States is the only country in the major sporting world that does not have a national coaching education program.*

The survey included the following option, *"please contact us regarding additional injury prevention strategies developed by your organization."*

The Foundation received a three page response from USA Baseball dated October 18, 1995, signed by Wanda Rutledge, Deputy Director, which included the following points:

1. The number of deaths cited in the report are misleading to the casual reader. The 65 deaths in 21 years (since 1973) are characterized as a public health issue. Taken on the surface, these just over (3) deaths per year would appear to be a significant number.

However, the report fails to point out that the total number of baseball participants, based on national surveys, is conservatively set at 16.5 million annually (with some 4.5 million in organized national youth baseball programs). Again, on average, these 16.5 million children participate in a minimum of two (2) official games per week, with approximately two (2) to three (3) opportunities at bat. This does not include practice opportunities. This translates to over 1 billion opportunities to be struck by a ball each year. Recognizing the average of three (3) deaths cited in the report, this would mean less than one (1) in one million children die from participation in organized baseball annually. Although any child's death is tragic, these numbers simply do not translate into a public health crisis.

2. Based on the specific report cited, of the 65 deaths that occurred from being struck by a ball, only 22 (or 33.8%) were in organized baseball. The other two-thirds of the incidents occurred at home, in back yards, driveways and vacant lots, outside the protection of any baseball organization's possible mandates.

3. This report makes the assumption that the utilization of certain types of safety equipment and the presence of a written emergency plan would prevent these deaths. USA Baseball, as the only organization collecting overall injury information on baseball, has no scientific evidence to support this assumption. There are conflicting national studies regarding protective batting vests and some indication that their use in combination with the softer core baseballs may actually exacerbate injury when struck in the chest."

A final remark from USA Baseball was the following: *"USA Baseball perceives this report to be misleading."*

DISCUSSION

The Consumer Product Safety Commission has identified youth baseball injuries as a public health concern, and has convened two national meetings to address the issue. In addition, sudden death secondary to chest impact by a baseball or softball was identified as a significant public health issue and a concern as part of the baseball injury problem at a consensus meeting held on January 15, 1994, entitled, The Merits Of Using Softer Baseballs And Softballs To Reduce Injuries.

The report , "Baseball And Softball Deaths Of Youth Struck By A Ball" published by the National Youth Sports Safety Foundation in 1995, was written from statistical data obtained from the Consumer Product Safety Commission. The purpose of the report was to examine total number of deaths, ages of the victims, and case scenarios for public health researchers to determine if injury prevention interventions would be possible. The deaths were clearly categorized by organized and unorganized activity. The importance of the deaths themselves can not be diminished by the number of participants and the opportunities to be hit. Similar arguments could be made for seat belts, helmets or other safety equipment. All measures should be examined to prevent deaths from any cause in youth sports. Japan has demonstrated that the adoption of softer baseballs has eliminated the incidence of accidental death in youth baseball [17]. We should learn from the work of those in other sports and in other countries.

It is the Foundation's understanding that baseball organizations establish standards for manufacturers to produce equipment, including the ball. These balls are distributed through retail outlets and are commonly used in unorganized recreational play as well as organized play. If baseball organizations adopted safety standards relevant to the ball for children 12 and under, it would have an impact on the level of safety in both organized and unorganized baseball.

In case of an accident, an immediate first responder and a written emergency plan will ensure that there will be appropriate care given to a player in the event of an injury. The first few minutes of care after an injury are crucial. If an injury is not identified correctly and the child does not receive the immediate attention that is required, his/her

injury may be exacerbated and recovery time may be increased [18]. In the case of chest impact, a child may have only several minutes to be resuscitated before body systems begin to fail and brain damage occurs [19]. This could be the difference between life and death.

Data are scarce regarding the effectiveness of batting vests to protect against chest impact injuries. The single study reporting conflicting results was reviewed by the participants of the consensus meeting held in 1994 by the National Youth Sports Safety Foundation and those at the commotio cordis conference in Denver. Both groups questioned the validity of the research. In the end, the consensus meeting participants dismissed the work as flawed. The Foundation is not aware of any studies which repudiate the safety benefits of softer baseballs in reducing the risk of head injury. Because 31% of the deaths were caused by impact to the head, there is a high potential for reducing injuries by using the softer ball.

The sport of youth hockey took twenty years to mandate safety equipment. Despite the cost of the equipment, participation in the sport has grown steadily. No standards were developed for their protective padding, yet their injury statistics have dropped dramatically [20]. Dr. Alan Ashare, Director of the Sports Safety Committee, USA Hockey, in opening remarks at the Commotio Cordis Conference stated, "We are concerned about protection and injuries, and want to avoid injuries at all cost. People in baseball say it is not a problem. My own personal feeling is that if you have one death, it is a problem"[21].

CONCLUSION

It is in this author's opinion that tradition bound resistance is a significant problem that needs to be addressed. Until this happens many more American children may sustain injuries and perhaps die due to impact with a baseball or softball. These injuries may and should be prevented.

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Susan B. Kyle[1] and Prowpit W. Adler[2]

YOUTH BASEBALL DEATHS AND INJURIES

REFERENCE: Kyle, S.B. and Adler, P.W., **''Youth Baseball Deaths and Injuries,''** International Symposium on Safety in Baseball and Softball, ASTM STP 1313, Earl F. Hoerner and Francis A. Cosgrove, Eds., American Society for Testing and Materials, 1997.

ABSTRACT: There are an average of 3 to 4 deaths per year to children under age 15 in association with baseball (including softball and tee-ball). In 1994, there were an estimated 181,000 baseball-related injuries to this age group. Consumer Product Safety Commission (CPSC) data indicate that the rate of injury was higher among 10 to 14 year olds than among 5 to 9 year olds. In 1994, most injuries to 5 to 9 year olds occurred in the head/neck region; injuries to the face accounted for the highest percent. For the 10 to 14 year olds, head/neck and upper limb injuries each contributed approximately 30 to 40 percent of the injuries; injuries to the face and fingers predominated. A CPSC special survey on how these injuries occur is planned.

KEYWORDS: Sport injuries, baseball, softball, children

The Consumer Product Safety Commission (CPSC) has a current project on baseball (defined to include softball and tee-ball) protective equipment for children under the age of 15. The aim of the project is to reduce the number of deaths and injuries associated with baseball in this age

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group. This paper will review some of the death and injury data relevant to that project and discuss the status of the project.

It should be noted that this paper was prepared by the authors in their official capacities. The views expressed are those of the authors and do not necessarily reflect the views of the Commission. This paper is in the public domain and may be freely copied or reprinted.

DEATH AND INJURY DATA

Deaths

CPSC compiles data on deaths from several sources: death certificates purchased from the states, reports from selected coroners and medical examiners, consumer incident reports to CPSC, and newsclips. From these sources, it is not always possible to determine all the circumstances of the death, such as whether it occurred during organized play and whether protective equipment was in use at the time.

CPSC is aware of an average of 10 to 12 baseball-related deaths of people of all ages each year. This is the highest number of annual deaths among the four major team sports (baseball, basketball, football and soccer). About one-third of these deaths, 3 to 4 deaths a year, occur to children 5 through 14 years of age.

At this point, the agency is aware of 15 baseball-related deaths in 1994: 6 of these deaths were due to ball impact to the chest, 4 were due to ball impact to the head, 3 were due to bat impact, 1 was the result of sliding, and 1 resulted from a stroke after the player was hit in the neck. Nine of these deaths were of children under the age of 15 (6 ball impact to the chest, 2 ball impact to the head, and 1 bat impact to the head).

CPSC is currently aware of 3 deaths in 1995: a 6 year old male died of ball impact to the chest, a 3 year old male died from bat impact, and an 18 year old male died from ball impact to the head.

Injuries

CPSC develops estimates of hospital emergency room-treated injuries associated with consumer products using the National Electronic Injury Surveillance System (NEISS). NEISS is a nationwide system of 100 hospital emergency rooms. These 100 hospitals have been chosen to be a statistical sample and allow calculation of a national injury estimate.