“Spectator Risks at Sporting Events”

by

James E “Tripp” Winslow

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Approved by:

Content Reader: Adam Goldstein, MD, MPH

Second Reader: William Williamson, MPH
Introduction

Over 15 million Americans attend professional sporting events every year, and many million more attend minor league affiliates of these teams [1, 2]. In recent years, interest has increased concerning injuries to spectators at these sporting events. Injuries have occurred to spectators across different sporting events and in many different ways. Spectator death and injury have occurred in hockey, baseball [3, 4], and by race cars that have broken apart[5]. Despite the known risk of mortality and morbidity to spectators, little scientific information exists to quantify the risk to spectators at sporting events or to discuss ways to reduce these risks. Many spectators may falsely assume that they are safe at such events, or that the owner/operators of sporting venues are insuring their safety and will take responsibility if the spectator is injured.

This literature review will examine the different types of spectator injuries, discuss mechanisms of injury, examine the legal risks, and make suggestions for further research.

Spectator Injuries at Professional Sporting Events

Baseball

Baseball is one of the oldest spectator sports in the United States. Over the last century little has changed in how fans view the game. In the last few decades many have felt that injuries to spectators have been increasing. This has not been based on any epidemiological data. One reason many feel this might be the case is that athletes are getting stronger and equipment is improving [3]. During this review no comprehensive studies were found regarding the risk spectators face at baseball games.
By reviewing news media reports, it appears that since 1970, at least five spectators have died at professional baseball games[3]. While there are a multitude of anecdotal examples of spectator injuries, many of which are serious, there is no comprehensive listing, either by stadium or by division type, of the number or severity of spectator injuries occurring at baseball games. There is a limited discussion of spectator injuries at baseball games in the legal literature. By studying the court cases a glimpse into the types of injuries can be obtained. The court cases also give insight into whether the spectator or the owner/operator of the venue assumes responsibility in case of spectator injury.

[1] The majority of baseball injuries to spectators traditionally occur from baseballs leaving the field at high velocity and entering the spectator viewing areas. The most vulnerable of these areas are down the first or third base lines, or directly behind home plate. Pitched baseballs frequently are thrown at speeds approaching 100 miles per hour, with hit baseballs traveling at similar speeds. More rarely, injuries occur by a flying projectile such as a broken bat or by spectators falling out of the stands onto the field or from an upper deck to a lower one.

[5] Injured spectators at baseball games normally fail to win damages for serious injury from the owner/operators of the venue. Nationally, plaintiffs who take property owner negligence cases to trial win 37% of the time[6]. In contrast, except in “extraordinary” circumstances, spectators injured by objects from the field almost never win damages from the ballpark [3]. Most courts operate under the premise that the spectator “assumes the risk” of attending a baseball game. In other words courts feel that it should be obvious to the spectator that a baseball can hit them. This is why the back of many baseball tickets carry a warning declaring that there are inherent dangers in attending the game [3]. Spectators at most other professional sporting events fall under this same “assumption of risk” idea. The language in a
WARNING! DESPITE ENHANCED SPECTATOR SHIELDING MEASURES PUCKS MAY STILL FLY INTO THE SPECTATOR AREA. SERIOUS INJURY MAY OCCUR, STAY ALERT AT ALL TIMES AND AFTER PLAY STOPS. IF STRUCK, IMMEDIATELY ASK USHER FOR DIRECTIONS TO MEDICAL STATION. HOLDER VOLUNTARILY ASSUMES ALL RISK AND DANGER INCIDENTAL FOR WHICH THE TICKET IS ISSUED, WHETHER OCCURRING PRIOR TO, DURING, OR AFTER THE EVENT, INCLUDING BUT NOT LIMITED TO, THE DANGER OF BEING INJURED BY THROWN, BATTED, KICKED, SHOT PUCKS, RAQUESTS, AND OTHER OBJECTS OR EQUIPMENT, OR BY OTHER SPECTATORS OR PLAYERS, OR BY ENTERING A MOSH PIT. HOLDER VOLUNTARILY AGREES THAT THE MANAGEMENT, FACILITY, LEAGUE,..., AND ALL THEIR RESPECTIVE AGENTS,..., AND EMPLOYEES ARE EXPRESSLY RELEASED BY THE HOLDER FROM ANY CLAIMS ARISING FROM SUCH CASES.

Normally if a court decides that a fan understands the risk of attending a game, and if the court finds that the spectator assumed that risk, then the court will find for the owner/operator. The courts usually analyze several factors when deciding if a fan has assumed the risk. The closer the spectator is to the playing surface the higher the likelihood that they have assumed the
risk. Did the injury occur during the game? Has the spectator been to a game before? Most courts seem to feel that if the spectator is close to the playing surface, then they have assumed more risk. The criteria involving prior attendance at games exist because if the spectator has been to a previous game, it is assumed that the spectator should be more familiar with the inherent dangers.

Legal criteria about whether the game was in progress exist because if the game is not in progress then the spectator has less reason to expect that projectiles might leave the playing area. Normally if these criteria are even partially met, then the spectator or the spectator's family will not win an award. An important point to note here is that the above criteria do not define the risk faced by the spectator. The courts assume that by fulfilling the criteria the spectator should be able to make an educated decision regarding the level of risk.

These criteria also apply to minors if the court judges that the minor in question can appreciate the danger. However, if the minor cannot appreciate the danger, then the criteria may not hold. In the City of Atlanta v. Merritt, an eight year old boy was struck by a foul ball. No information was available regarding the injury. The court found that the eight year old was unable to appreciate the danger involved. This is important because for a person to assume the risk, the person must be able "to make an intelligent choice as to whether the advantage outweighs the risk and to voluntarily assume that risk" [7]. The courts do not give an age cut off for this and seem to address this issue on a child by child basis. [11][10][11]

An additional factor that sometimes determines risk is the presence of distracting events. In Lowe v. California League of Professional Baseball, a man was struck in the face by a ball. The man was momentarily distracted when the tail of the team mascot hit him. When the man turned, a ball struck him in the left side of his face and caused serious injuries. The man sued,
claiming that the distraction of the team mascot led to his injury. The court ruled for the plaintiff because it stated that the stadium operator

"had a duty not to increase the inherent risks to which spectators at professional baseball games are regularly exposed and which they assume." [8]

Ironically, it does not appear that the selling of concessions or other "normal" activities in the stands constitute increased "legal" danger despite similar risks to spectators [8][13].

For the last three decades, the accepted practice to protect spectators from baseball injuries is to place protective netting behind home plate to prevent balls from hitting spectators sitting in that area. Presumably, protective baseball nets must have reduced the number of serious injuries, either from balls being thrown by pitchers into the stands or more frequently by foul balls flying backwards too rapidly for fans to get out of harms way. Protective netting behind home plate is variable. Many professional stadiums have protective netting that extends above home plate and backwards to protect fans from any foul balls hit behind the home plate area. Some stadiums simply have protective netting above home plate, leaving fans sitting behind the plate at risk of injury to high pop fouls behind the plate. There are no regulations governing fan screening at minor league games, and netting practices vary greatly.

According to James C. Kozlowski, a law professor at James Madison University, the guidelines for protective screening were set down in Akins v. Glen Falls City School District [9].

"owners and operators of ball fields must only provide screening for the area of the field behind home plate where the danger of being struck by a ball is greatest. In addition, such screening must be of sufficient extent to provide adequate protection for as many spectators as may reasonably be expected to desire such seating in the course of an ordinary game"[10]
It is interesting to note that this opinion was made despite the lack of any epidemiologic data delineating the extent of risks. Nor is there data to determine what percentage of spectators would “reasonably be expected to desire such seating in the course of an ordinary game”.

A factor that determines liability is the amount of protective shielding used. The courts have stated that there must be sufficient protected seating for those who desire it [11]. Fans injured while sitting in protected areas can more often hold the venue operator liable [7]. The reason for this is that the spectator decided not to assume the risk because the spectator chose to sit in the protected area. Most courts feel that a spectator should be able to assume a reasonable level of safety if they are sitting in a protected area. If a fan is not sitting in the protected area then a court normally sees the spectator as assuming the risk [11]. Different baseball venues interpret the size of the zone of danger differently. Some venues provide protective screening for the length of both foul lines while others only cover the area directly behind home plate. This is confirmed when viewing online pictures of minor league parks across the nation[12].

In 1986, Blanca Coronel suffered a broken jaw from a foul ball. She was behind home plate about three feet away from the edge of a protective screen. The trial court ruled for the plaintiff. The case was appealed. The appeals court found that the stadium was not under the obligation to fence in the entire spectator area. The court stated that

"spectators accept the inherent dangers in a sporting event and assume the risk of injury insofar as such risks are obvious and necessary" [10]

It sent the case back to the trial court for a jury to determine if there was sufficient protective seating and if the stadium had given clear warning about the danger of objects leaving the field. In this case the court upheld the presumption that the spectator assumes risk. It did hold that a jury should decide if there is sufficient protective screening and if the spectator has been appropriately warned of the risks. This case is interesting because it states that a jury of peers
could best determine if the criteria of sufficient screening and spectator understanding of risks are met.

Courts may find for the plaintiff if the plaintiff is in an area where they would not logically assume the risk of being hit by a ball. In Evelyn Jones v. Three Rivers Management Corp. the court found for the plaintiff. The plaintiff was hit in the eye by a baseball while standing in a walkway that opened into the viewing area. The court found that she reasonably expected to be in a protected area when this happened [13]. This is because the walkway is not a viewing area and should be an area where the spectator has not assumed an inherent risk.

Injuries from objects other than baseballs, such as fractured baseball bats that go into the stands, are less frequently described but potentially equally devastating. At a professional baseball game in Canada, a 39 year old woman was struck by a bat. She was sitting in the third row on the right side of the batter’s box. She suffered a 7cm laceration to her head, a nondepressed skull fracture and a small epidural hematoma which did not require operative treatment. There was right cerebral temporal pole contusion, pneumocephalus, and a third cranial nerve palsy. She required 11 days of hospitalization [14]. While there was no information about any legal proceedings which may have resulted from the above case, and while Canadian law generally treats spectator assumption of risk similar to American law [9], some courts feel that a bat leaving the playing field constitutes an extraordinary circumstance that may make the venue operator liable. For example, a California Court found in favor of one plaintiff who was struck by a bat because it felt that it was not common knowledge that bats might fly into the stands [15]. In 1994, a six year old child had her jaw broken by a baseball bat at a Detroit Tiger’s game. Alyssia Benejam was sitting close to the field on the third base line when a bat fragment curved around a net and struck her [16]. In court the family claimed that
the injury had caused a deficit in the use of her arms. A lower court awarded the family a million dollars. The Court of Appeals overruled this judgment. The court of appeals stated that

"A baseball stadium owner is not liable for injuries to spectators from projectiles leaving the field during play if safety screening has been provided behind home plate and there are a sufficient number of protected seats to meet ordinary demand." [16]

Thus, the court said that the operator had no obligation to warn spectators because the risk, even from bat injuries, is "well known" [17]. In this case, the court even went further by stating that most fans want to be involved in the game in "an intimate way", are "hoping that they might come into contact with some projectile from the field", and that fans are aware of the risks and "welcome that risk to some extent"[16].

Some states have laws regarding who is responsible for spectator safety at baseball games. The Illinois Baseball act is typical of the laws that exist in many states. It says,

"The owner or operator of a baseball facility shall not be liable for any injury to the person or property of any person as a result of that person being hit by a ball or bat unless: (1) the person is situated behind a screen, backstop, or similar device is defective (in a manner other than width or height) because of the negligence of the owner or operator of the baseball facility; or (2) the injury is caused by willful and wanton conduct, in connection with the game of baseball, of the owner or operator or any baseball player, coach or manager employed by the coach or operator."

Other state laws are similar to the Illinois law [17].

Operators of major league baseball stadiums appear resistant to institute more safety measures, often citing expense as one reason for not placing more protective netting. Another reason given is that protective netting tends to make spectators feel less a part of the game[16]. No information exists about spectators' perceptions on the tradeoffs of safety versus risks.

From the cases reviewed above, it seems that most of the serious injuries suffered by fans involve the head and maxillofacial region. This makes sense because the head and face are the most exposed areas of spectators' bodies. Given that baseballs are hard, dense, and fast flying
objects, it makes sense that they are able to cause significant injury. It is helpful to potentially quantify two elements of the risk involved: the reaction time that an average spectator may have to get out of the way of a foul ball and the potential impact of that ball.

Utilizing physics, one can calculate the reaction time available to a spectators sitting behind third base when a ball is batted towards them. Many stadiums are designed so that the stands are 60 ft (18.29 M) behind the foul line[18, 19]. Third base is 90 ft (27.43 M) from home plate [20]. Using Pythagorean’s Theorem, (see figure 2) the distance of the spectator from home plate can be calculated as 108 ft (32.9 M). Current NCAA rules are designed so that the maximum speed of a batted ball is 97 miles/hour (43.4 M/s)[21]. This means that once a ball is batted a spectator seated behind third base may have only 0.76 seconds to see and react to a ball batted in their direction. If that ball hits them then the amount of force would equal \( \frac{1}{2} mv^2 \).

Given that a baseball weighs approximately 0.145 kilograms and has a speed of 43.4 M/s, this would mean that a person could be struck with 136 joules of energy. A 7.0 kg (15.4 lb) object dropped from a height of 2 meters (6.6 ft) would have the same kinetic energy on impact.
The above numbers are not the result of actual observations. While they are calculations, they do seem to indicate that there is very little time for a spectator to recognize a dangerous ball and react. Given that many spectators are engaged in multiple activities such as eating, buying concessions, or talking to friends, 0.76 s does not seem sufficient time to take evasive action.

The legal criteria cited above also make major assumptions about risk that are not substantiated by data. For instance, no published studies exist to determine if spectators are aware of, understand, or agree with the assumption of risk concept which is printed on the back of their tickets. A spectator attending one or more prior games may or may not be aware of the different types of possible injuries. Since there is no research that looks at the frequency, location or types of injuries, it appears difficult to believe spectators could be adequately informed. The risks would not even appear to be the same, since the velocity of baseballs pitched and hit at major league levels is higher than that at minor leagues or lower levels. Is
there a standard “safe distance” between the first and third base lines and the stands, allowing fans a split second more opportunity to fend off balls? Remarkably, there is no mention or data of the role that alcohol consumption by spectators may play in the presence or absence of injuries, despite the known relationship between alcohol use and injury severity across a host of behaviors[22].

It appears even less tenable that a minor could appreciate these risks given the competing elements of speed and excitement, elements known to increase youth experimentation with risky behaviors[23]. To say that fans “welcome a risk” is to deny the competing reality that fans “appreciate being safe”. While all fans desire a “souvenir” baseball, it requires a leap of faith unsubstantiated by data to suggest that they would sacrifice their own personal safety or that of their family for such an opportunity. Thus, from a public health viewpoint, it is difficult to see how the majority of spectators at professional baseball events can have a clear grasp of injury risks or legal ramifications assumed at such events.

[14][23][10][17, 18][19][20]

**Hockey**

Hockey is a sport similar to baseball in that spectators are in close proximity to rapidly moving projectiles. Hockey Pucks can reach speeds of 150 km/hr, roughly the same speed reached by baseballs [4]. Hockey Pucks weigh approximately 5.75 ounces (0.163 kg) and are frozen before play [24]. Obviously, these fast moving, dense objects can cause significant injury and demand quick reaction times for spectators. As with baseball, this can lead to an inherent danger for spectators.

Not surprisingly, many injuries have occurred to hockey spectators. As with baseball most of these injuries involve the head and face. In March 2002, a 13 year old girl, who was
sitting 100 ft (30.48 M) from the playing area [3], died of injuries after being injured by a hockey puck [4]. News stories stated that she died from “an injury to an artery in her neck”[25]. This was the first spectator death in the National Hockey League (NHL) in 85 years. A study done by two Emergency Medicine doctors found that during 127 hockey games, there were 122 people injured by pucks. Of these, 90 required stitches [3]. This study was mentioned in the news media but could not be found in the medical literature, so no information about its study design or validity is known.

The following list of spectator injuries was found in the media. In March 1997, a 13 year old boy Canadian sustained a severe head injury which left him disabled [4]. In December 1998, a Canadian mother of a teenage player lost her sight in one eye due to injury from a puck [4]. In January 1999, a nine year old Canadian sustained a skull fracture from a puck injury [4]. In February 2000, a twenty-one year old Canadian died after a head injury from a puck [4]. In January 2002, a fifty-three year old Canadian sustained partial loss of vision from a hockey puck [4]. There have been four other spectator deaths in hockey since 1984, including a nine year old, a ten year old, and a twenty-one year old [3]. The Canada Safety Council has listed spectator safety from hockey pucks as serious concern [4]. It has also asked the Canadian government to develop national guidelines for spectator safety at spectator sporting events [26].

The NHL and other venue operators have responded to this danger by increasing safety devices at hockey venues. The NHL mandated that protective screens around the rink must be at least 5 ft (1.52 M) high[25]. It also mandated protective netting that must stretch from the top of the protective screen to the ceiling[25]. The City of Winnipeg spent $44,000 to place netting around the entire circumference in all its 30 public rinks. This was done after the 53 year old Canadian woman described above led a community campaign to increase hockey spectator
Many people in Canada have argued that the Plexiglas screens around all rinks should be increased from eight feet to sixteen feet [3].

The increase in safety devices came about despite the fact that the legal standards for hockey are similar to those used in baseball. In hockey the following standards are often used: Was the danger obvious so that the patron must have assumed the risk by attending? Was the danger so obvious that the owner or operator were under no duty to warn or protect the spectators? Is the spectator familiar enough with the game to understand the dangers? Is the general public familiar with the game? Are the facilities constructed in accordance with normal standards? Have the standards fallen behind engineering and technical feasibility? Would it have been possible to have constructed additional safety features at a reasonable cost without impeding visibility? How frequent are injuries? [7] As with baseball, few of these criteria address the actual risk to spectators.

Court decisions resulting from suits brought by hockey spectators are also similar to ones brought by baseball spectators. In Sawyer v. State, a thirteen year old was injured by a hockey puck. The court stated that:

“Although she admits to having seen pucks striking the net on her previous visits to the arena and, despite her knowledge that the protective netting had been removed, it cannot be said that a reasonably prudent person of [the plaintiff’s] years, intelligence, and degree of development, would not have fully appreciated the danger and, hence, could have been said to have assumed the risk” [7]

The above case illustrates the same acceptance of inherent risk. Even though the spectator was a minor the court found that in this case she was able to appreciate the dangers involved and could therefore “assume the risk”.

In one case where a woman was struck, the court found for the venue operator. She was in the fourth row behind the protective transparent shield, and the injury took place during the game. The seat was slightly above the level of the barrier. The court found against her because it felt that
because she was so close to the playing surface that she should have been aware of the danger. She had also attended games in the past. [10] This spectator met all of the criteria used by the courts when deciding if a spectator assumed the risk. The court made no finding regarding the actual level of risk that she faced.[27]

Auto Racing

Auto racing is the largest spectator sport in the United States. At National Association for Stock Car Racing events (NASCAR), there are 5.5 million people in attendance each year [2]. The Goodyear Racing Report (a racing industry based group) stated that attendance at all racing events in 1997 was over 16 million people [28]. Spectators at racing events are often in close proximity to cars that are traveling in excess of 200 miles per hour. In order to better protect the drivers during a crash, these cars are designed to fly apart leaving only a reinforced shell around the driver[29]. There are many instances of fans being injured or killed by debris as it leaves the car. Usually all that stands between racing spectators and racecars is a concrete wall that is topped by a strengthened chain link fence. The heights of most oval track fences are from 9 to 22 feet (2.7 to 6.7 M), yet debris can still clear the fences.

Auto racing contrasts sharply with the sports of hockey and baseball regarding spectator injuries and safety. The number of racing fans injured and killed is much higher than that of baseball and hockey. The Charlotte Observer is the only available source that has done a comprehensive review of racing injuries. They did this review by searching the online media databases. It has not been published in print form but is available on the internet [30]. Since 1990, records in the media show 29 spectators dying and 70 spectator injuries occurring at racing events. Six of these deaths involved children. Eleven of the 29 deaths involved spectators being struck by
wheels. Cars actually hitting spectators led to eleven deaths. The remainder died as the result of other debris striking them [30].

[31]Racecar injuries may be more common at smaller rather than larger tracks. For instance, in 2001, a 64 year old lady in a wheelchair was killed in Ohio while sitting in the grandstands of a racing event [31]. There were also thirteen other injuries. This accident took place at a small community tract when two cars ramped over a guardrail and went into the crowd. This accident took place at one of 90 “short” tracks which carry the NASCAR name by paying a $1200 fee [32].

Not only are the overall number of injuries in racing much higher, but the approach to liability is also different. The speedway operators almost always assume the liability. The reason for this is that the danger posed by airborne racecar debris is greater than that of baseball, reaction time is much less, and the danger area is much larger than the danger area of a baseball stadium. One recent court ruling summed this up well:

“The danger of a foul ball traveling to a seat exists only when a batter swings at a pitched ball, a particular moment in time during which a viewer's attention is normally directed at the batter. The danger of a stone flying from the track is a constant threat during a race when cars are speeding by. A patron watching racecars positioned around the track is not able to remain vigilant against such a danger. Likewise, the proximity of the seating to the track in this case provides little time to react to avoid being struck, even if one was able to see the projectile.” [33]

The larger speedways have also aggressively pursued increased spectator safety. In 1998, three spectators were killed and six injured at a Championship Auto Racing Teams (CART) event in Michigan. The injuries resulted from a tire and other debris that cleared a fence and flew into the crowd. The wall where the accident took place was 4 (1.2 M) feet high and on top of the wall there was an 11 (3.4 M) foot fence. The 15 feet (4.6 M) barrier is considered the norm at most large tracks [29]. Two of the spectators were killed instantly and a third died soon after arrival at the hospital [34]. Six other spectators were taken to local hospitals. The injuries included a
fractured leg, neck pain, and back pain [34]. Victim’s families filed a $10 million dollar wrongful death lawsuit [35]. The speedway responded by increasing the height of the fence by 2½ feet (0.76 M) [36]. This was the first spectator death at that speedway since 1969 [34].

One year after the Michigan fatalities, a similar accident took place at Lowe’s Motor Speedway in Charlotte, NC. This accident took place in May of 1999. It was an Indianapolis Racing League (IRL) event. IRL cars are faster than the NASCAR type vehicles and have exposed wheels. Since the wheels are not enclosed by a fender, they may be more likely to fly into the stands. At this particular event, a wheel went over a 15 foot (4.6 M) tall fence [37]. Three spectators died and 6 were injured [37]. One of the injured included a 9 year old girl who was still in a coma 1 month later [38]. In response to the disaster, Lowe’s Motor Speedway increased the height of the fence to 21 feet (6.4 M), added energy absorbing barriers to the walls, and required wheels to be tethered to the cars [36]. The president of Lowe’s Motor Speedway in Charlotte, one of the largest speedways, when confronted with the fact that 29 spectators had died since 1990 stated,

“This is not acceptable. This is something the industry the industry has to deal with. We have a moral obligation.”[31]

No other comparable published statements were found by any executive from either hockey or baseball.[27][28][29]

[31][32]There is no set safety standard between larger racetracks and smaller community racetracks. There are over 1300 racetracks in the United States, and only 4% of these are considered major racetracks [39]. There are often no set safety standards for drivers or spectators at the smaller tracks [39]. The smaller racetracks often put the spectators much closer to the track, and the walls and fences are often lower. The smaller tracks sometimes also lack the insurance to cover the damages suffered from injured fans. On August 30, 1997, Thomas Parker, a 61 year old
male, was struck by a racecar in Rutherford County, North Carolina. His family attempted to sue the racetrack but dropped the suit because the racetrack had no insurance and limited financial resources. There do not appear to be regulations requiring racetracks to carry liability insurance for their spectators. [29][34][36][37][38][30]

Defining Acceptable risks to spectators

Defining acceptable levels of risk to spectators at sporting events is an unanswered and difficult question. If this question is not answered how can we know what spectators consider to be an acceptable level of risk? One way to do this is by looking at levels of risk that people accept in daily life.

All jobs have a certain level of risk. One source for this data is the *Journal of Compensation and Working Conditions*. It gives the average risk of dying for all workers in the United States as 4.9 per 100,000 each year. The CDC stated that between 1980 and 1992, 16 workers died everyday and 17,000 were injured [40]. These statistics show that workers do face some risk. Even with these levels of risk, the Gallup organization found in 2002 that 92% of Americans were satisfied with the safety of their workplace[40]. Does this mean that the population thinks that these levels of risk are acceptable, or is the public simply unaware of the level of risk? Should we assume that 4.9 per 100,000 is a level of risk found acceptable by the public?

Perhaps the risks posed by different forms of transportation can be instructive. The risk faced by airline passengers in the year 2000 was 8.4 fatalities/1 million passenger enplanements, or 0.84 per 100,000 enplanements [41]. One would think that this is an acceptable level of risk since air travel is often lauded as the safest form of transportation available. It is a level of risk that is much lower than the risk faced by workers. Does this constitute an acceptable level of risk?
Maybe it would be helpful to compare the risks of motorcycle versus automobile travel. Many people consider automobiles a safe mode of transport, but they consider motorcycles unsafe. The Bureau of Transportation Statistics reports that in the year 2000 there were 1.5 deaths/1 million miles traveled in an automobile[42]. The same organization gives the risk of riding a motorcycle during that period as 27 deaths/1 million miles traveled[43]. Does this illustrate the public's threshold for acceptable risk? This is an example of a known risk that people can either choose or not choose to accept. Since the majority of the population chooses not to ride motorcycles, perhaps this indicates the public's threshold for risk.

Obviously the preceding examples of different risk levels give us no firm answers. They do give some idea of the levels of risk faced by people in different environments and situations. The difference between those situations and those of spectators is that those people have the information to determine the risks. In contrast, spectators must merely try and estimate the risk and then assume that estimated level of risk. It is doubtful if society will ever be able to define acceptable risk levels. That is a question that can only be answered on an individual level.

**Future Research**

Baseball and hockey spectators, unlike racing spectators, assume risk when they attend sporting events. Our legal system has ruled time after time that people who willingly assume risk can not hold the owners of the baseball or hockey venues liable for damages. From the review of the literature it is obvious that there is definitely a risk to attending these events that includes death and serious injury. This literature review seems to demonstrate a significant lack of data about the epidemiology of spectator sporting injuries or knowledge about spectator assumption of risk at sporting events. Only anecdotal examples exist in the news media. No studies have been done which look at the actual incidence of these injuries. It is difficult to believe that a spectator can
fully assume risk when the risk is not known. Given the fact that more and more people each year attend large spectator events, some type of injury surveillance system would be helpful and is clearly needed.

An injury surveillance system could answer many important questions. How many spectators are injured or killed every year? This research question would address the actual risk faced by spectators. It would allow spectators and the parents of small children to make intelligent decisions regarding how safe it is to attend different events. Parents should know that there is at least some risk that their child could be seriously injured at a sporting event. Is the use of alcohol related to injury frequency or severity? Do repeated visits to sporting events raise or lower the likelihood of spectator injury? Another important question would involve the main types of injuries spectators suffer at sporting events. Do most of the injuries consist of minor orthopedic injuries or are there a large number of serious head injuries? Such information would allow sporting venues and clubs to better protect spectators. It could also lead to a change in how the games are played. Perhaps if certain injuries are common then changes could be made to the balls or pucks.

Racetrack operators have already noted that wheels were sometimes flying into stands so wheel tethers were placed on cars.

The only way to answer these questions would be by first conducting prospective studies of sporting events to determine the incidence and types of injuries. These studies should be done at baseball, hockey, and racing events. Nationwide spectator injury surveillance should also be conducted. This will likely be necessary because the actual risk of death at these events might so low that no meaningful statistical information will be collected without a very large sample size. A collaborative effort could easily take place between the sports industry and researchers. Most venues have Emergency Medical Technicians already present so injury data could be collected and
recorded on site, making data collection much easier. Such a study would give epidemiologists access to large datasets for analysis and the sports industry valuable information on how to better protect spectators.
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