

USA Triathlon Fatality Incidents Study

USA Triathlon, as the National Governing Body for the sport in the United States, views the safety of our members as a core imperative. Event-related fatalities have captured the attention of our community, raising safety concerns among athletes, family members and other supporters, event organizers, sponsors, community leaders, and the medical community. Over the past several months, we have conducted a careful review of the collective experience with fatalities at USA Triathlon-sanctioned events from 2003 through 2011. Our objectives were to attempt to bring clarity, identify potential patterns and underlying causes, and investigate opportunities to make any future improvements in event safety.

A five-member Medical Review Panel was convened, inclusive of three physicians and two race directors with broad experience in triathlon, and particular interest or expertise in the issue of race safety. This group reviewed information for 45 cases and assembled its findings into a preliminary report. Much of the assembled data is presented in the following pages. The preliminary report was shared first with the attendees of the USA Triathlon Race Directors Symposium in January 2012 and more recently with a Review Group that was assembled to solicit specific feedback. This Review Group included representatives from the broader triathlon community—athletes, coaches, event organizers, risk management experts, and medical professionals.

About Triathlon

Triathlon is an endurance sporting event that involves completion, sequentially, of swimming, cycling, and running. The length or duration of the swimming, cycling, and running legs of a race can vary considerably. In the Olympic-distance version of triathlon, the swimming leg is 1,500 meters, the cycling leg is 40 kilometers, and the running leg is 10 kilometers. Shorter races are often called sprint races. Longer triathlon races include the long distance (1.2-mile swim, 56-mile bike, 13.1-mile run) and the ultra distance (2.4-mile swim, 112-mile bike, 26.2-mile run). It is important to note that even a sprint race is an endurance event, with most participants requiring more than one hour to complete the race.

In recent years, there have grown to be many offshoots of triathlon. There are now off-road triathlon events, where the cycling and running legs are conducted on soft-surface trails. Aquathlon involves a two-leg race, with swimming and running portions. Aquabike involves a two-leg race, with swimming and cycling portions. Duathlon involves a three-leg race, with running followed by a cycling portion, followed by another running portion. Winter triathlon involves a three-leg race, with running, mountain bike, and Nordic skiing legs. Along with triathlon, these other race formats comprise the family of multisport events.



Information Reviewed

The Panel was asked to review information about fatalities that occurred at USA Triathlon-sanctioned events between 2003 and 2011. Sanctioned events included training camps and clinics as well as races of all sanctioned formats (e.g., triathlon, off-road triathlon, duathlon, aquathlon, and aquabike). There were no fatalities at youth events and no information about youth events was reviewed.

All of the information reviewed was provided to the Panel directly by USA Triathlon. At this point, we have not collected additional information.

Information reviewed included:

- For each participant fatality:
 - Age
 - Gender
 - Name, date, format, and length of USA Triathlon-sanctioned event
 - A brief narrative of the circumstances of the fatality
- About USA Triathlon events:
 - Membership numbers, by year
 - Event participation numbers, by year (since 2006)
- USA Triathlon sanction requirements
- Contemporaneous press accounts of the fatalities

Information that was not available for review included:

- About the victims
 - Detailed medical history (i.e., medical conditions)*
 - Detailed accounts of medical treatment(s) provided at the event or during/after transport to the hospital*
 - Official autopsy findings, if any*
 - Experience level with triathlon or endurance sport in general
- About the events
 - Information about the safety plan in place for the event
 - Medical resources on site for the event
 - Water temperature during the swim leg
 - Water conditions during the swim leg

** In some cases, limited second-hand information about victim's medical history, medical treatment, and autopsy findings were available, but we recognize that this information may not be accurate or complete.*

Highlights of the Data

The popularity of triathlon has increased tremendously from 2003 through 2011. In those nine years, nearly 23,000 sanctioned events were held, involving more than three million participants. In 2011, the most recent year reviewed, there were 4,334 events that involved 537,317 participants.



Table 1. USA Triathlon Member Counts (Annual and One-Day).

Year	Annual and One-Day Members
2003	193,262
2004	230,294
2005	262,703
2006	293,663
2007	336,356
2008	342,201
2009	441,060
2010	461,008
2011	483,602

Figure 1. Number of USA Triathlon-Sanctioned Events.

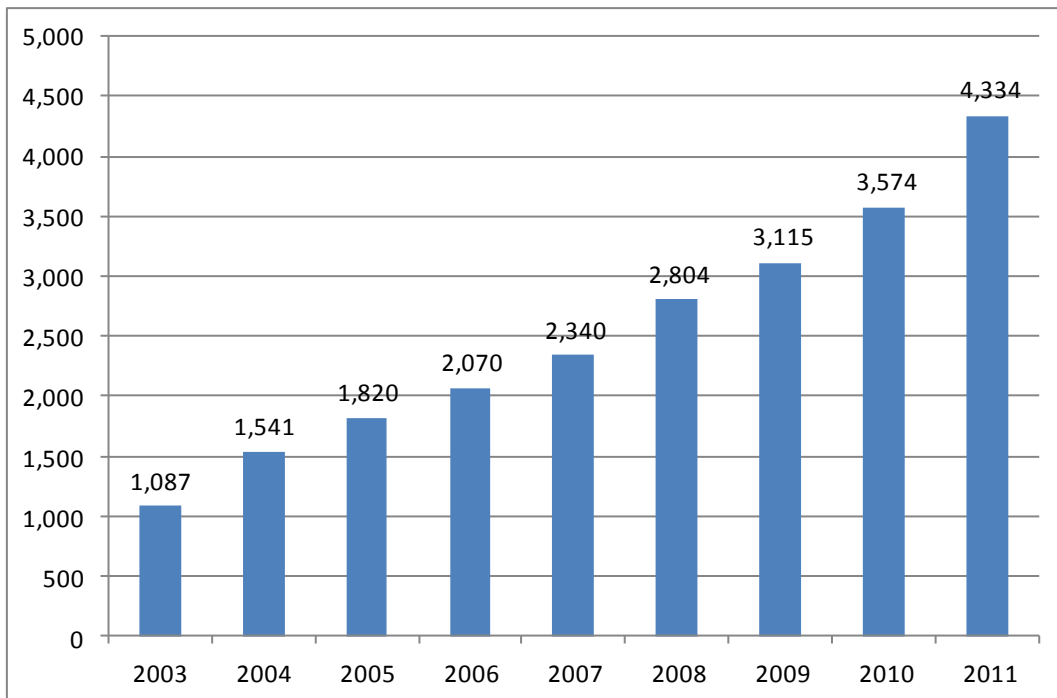


Table 2. Participation in USA Triathlon-Sanctioned Races *

Year	Number of Finishers
2003	Not available
2004	Not available
2005	Not available
2006	276,458**
2007	342,612**
2008	358,000**
2009	477,000
2010	521,374***
2011	537,317***

* Includes triathlon, duathlon, aquathlon, off-road triathlon. Participation numbers include finishers reported to USA Triathlon by race directors for the purpose of national rankings. The participation numbers do not include participants who dropped out of a race without finishing, race finishers who were not reported to USA Triathlon for individual athletes; or participants in sanctioned camps or clinics.

** From Harris KM et al. [4]

*** Also includes aquabike data beginning in 2010.

This review represents the largest-ever study of triathlon event-related fatalities.














































There were 45 fatalities during the 2003-11 study period. Included in this group was a single non-athlete spectator who died from injuries sustained in a bike crash and one athlete who died at a USA Triathlon-sanctioned training clinic, both in 2011. Excluding those two deaths, the overall fatality rate for competing triathletes was approximately one per 76,000 participants.

The athlete victims included nine women and 35 men, ranging in age from 24 to 76 years old.

Among the 43 race-related athlete deaths, five were traumatic, caused by injuries sustained in cycling crashes; the remaining 38 deaths were non-traumatic. Of the 38 non-traumatic fatalities, 30 occurred during the swim, three occurred during the bike, three occurred during the run, and two occurred after an athlete had completed a race.



Table 3. Summary of Fatalities.

Year	Number of Fatalities	Type of Fatalities
2003	1	
2004	2	 
2005	7	      
2006	3	  
2007	6	     
2008	8	       
2009	3	  
2010	3	  
2011	12	           
TOTAL	45	






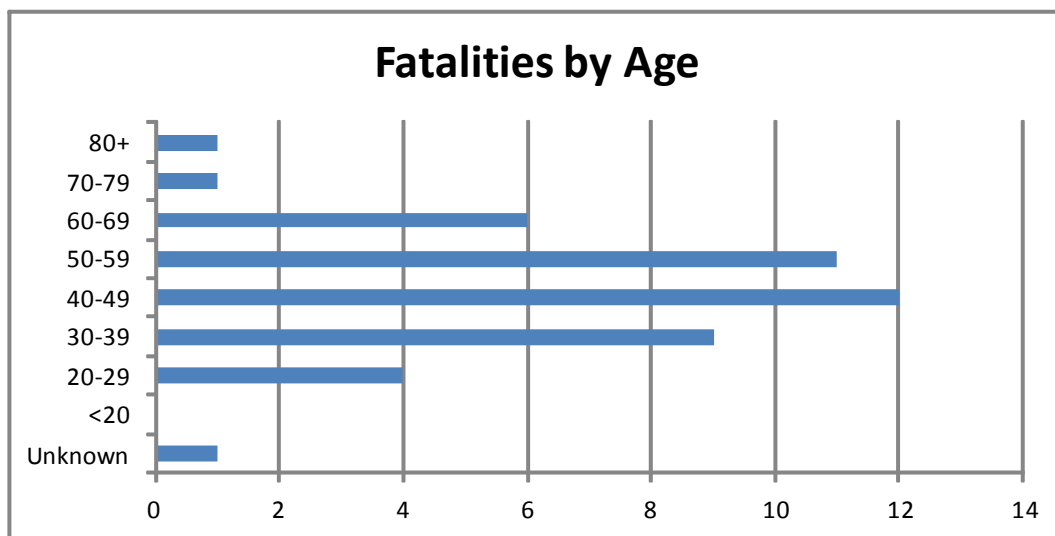
-  Fatality occurred during the swim portion of an event
-  Fatality occurred during the bike portion of an event
-  Fatality occurred during the run portion of an event
-  Fatality occurred after the victim completed the race
-  Fatality was a spectator at a race

Table 4. Overall Race-Related Fatality Rates.

Year	Approximate Fatality Rate
2003	N/A*
2004	N/A*
2005	N/A*
2006	1 per 92,000
2007	1 per 57,000
2008	1 per 45,000
2009	1 per 159,000
2010	1 per 173,000
2011	1 per 54,000
AVERAGE 2006-2011	1 per 76,000

* Accurate participation numbers are not available, so it is not possible to calculate a fatality rate

Figure 2. Age Distribution of Fatalities.



Traumatic Deaths

Five traumatic deaths occurred as a result of cycling crashes during triathlon races. The circumstances surrounding these accidents are varied. In one case, a rider lost control of the bicycle during a descent and crashed. In another, two riders collided resulting in a fatal crash. In the remaining three instances, there was a collision between a motor vehicle and the cyclist.

Information regarding the victims' specific injuries, treatment provided on-scene or after transport to the hospital, and exact causes of death were not available.

Non-Traumatic Deaths

Swimming-Related Fatalities – 31

One athlete died during a short (quarter-mile) swim at a triathlon clinic. The immediate cause of death was cardiac arrest.

There were 30 swimming-related fatalities at races: one in an aquathlon event and 29 at triathlon events. The fatalities occurred in races that took place in the months of March through November. These races included a range of swim distances: 16 sprint races with swim distances ranging from 400 yards to 900 meters; eight Olympic-distance races with a swim of 1,500 meters; two long-distance races with a swim of 1.2 miles; one race with a swim of 1.5 miles; and three ultra-distance races with a swim of 2.4 miles.

Four victims were participants as swimmers for relay teams. The remaining 26 victims were individual participants in races.

A variety of swim venues were represented among the race fatalities: five in the ocean; 13 in a lake; six in a bay or gulf; and six in a river. There were no fatalities associated with events that used a swimming pool as a race venue.

A variety of swim start methods were involved in these races: three with time-trial starts (with participants starting individually at 2-5 second intervals); two with mass starts; and 25 with typical wave starts with a range of 40-150 athletes per wave.

Complete information about wetsuit use by the victims was not available.

The vast majority of the victims was rescued from the water and received CPR and advanced life support measures at the scene. In two cases, there was a delay of up to several hours before the missing participants were found. In these cases the victims were pronounced dead at the scene.

Detailed autopsy information was not available for review, although available data indicates the swimming fatalities appear to be caused by episodes of sudden cardiac death (SCD).

Bike-Related Fatalities – 3

Two athletes collapsed with cardiac arrest during the bike portion of triathlon races and could not be resuscitated. A third athlete became distressed during the bike portion of a triathlon, was transported to a hospital and found to have severe hyperthermia (elevated body temperature due to failed thermoregulation), and later died of multi-organ failure.

Run-Related Fatalities – 5

Three athletes collapsed with cardiac arrest during the run portion of a triathlon race. All of these athletes received CPR at the scene but could not be resuscitated.

Two additional athletes suffered cardiac arrest *after* completing a triathlon and are included here as run-related fatalities.

Nearly all of these non-traumatic deaths stemmed from SCD. The rate of SCD for this study is approximately 1 per 84,000 participants.

There are an estimated 4,300 sports-related SCDs in the U.S. annually, according to a recent scientific report published by the American Heart Association. These occur during all forms of athletic activity. Using this estimate, approximately one-tenth of one percent (0.1%) of all sports-related SCDs occurred during triathlons for the period surveyed. According to a recent scientific report in the *New England Journal of Medicine*, most, but not all, episodes of SCD are thought to be due to an underlying, often unrecognized, abnormal heart conditions such as hypertrophic cardiomyopathy (HCM) or coronary artery disease. The treatment for sudden cardiac arrest is prompt bystander CPR, early defibrillation (within a few minutes), and follow-up hospital care. Even with prompt medical attention the survival rate for sports-related sudden cardiac arrest remains low, at 10-25 percent.

Studies indicate that triathlon's rate of one fatality per 76,000 participants is similar in comparison to the sport of marathon running. A 2010 study on the London Marathon cited one fatality for every 67,414 runners over a 20-year period. A 2008 study examined the Twin Cities and Marine Corps Marathons and cited one fatality for every 75,000 runners since 1976.

Even among all NCAA athletes (triathlon is not an NCAA sport), the annual rate of sports-related SCD is one per 44,000 athletes, according to a recent report in the *Journal of the American Medical Association*.

It is a commonly held belief that the healthy lifestyle of a triathlete more typically prolongs and improves the quality of life. While we do not possess empirical evidence, we do have anecdotal information indicating transformative health gains from members who have overcome drug, alcohol and food addiction, to being liberated from medications for adult-onset diabetes and other 21st-Century diseases associated with a sedentary lifestyle.



Key Findings

1. The fatality rate has fluctuated from year to year, but did not increase as a trend in the most recent years of the study. The lowest fatality rates were observed in 2009 and 2010. However, the absolute number of fatalities has increased in tandem with the increased participation rate.

This law of averages dictates that, as the sport continues to experience tremendous growth (USA Triathlon annual membership more than tripled between 2003 and 2011), the incidence of fatalities in the sport will likely increase as well. It should also be noted that much of the national attention devoted to this issue has arisen mainly due to recent fatalities occurring in major media markets.

2. The fatality rate does not appear to be related to:
 - a. The length of the race
 - b. The type of swim venue (with the exception that no fatalities occurred in a swimming pool)
 - c. The method of swim start (e.g., mass, wave or time trial)
3. The victims appear to have included athletes from a broad range of triathlon experience. Fatalities were not confined to inexperienced triathletes.
4. There is no clear evidence that swimming ability, typical drowning, anxiety/panic, wetsuit-related factors, lack of a warm-up, lack of medical exam or unusual medical problems—e.g., stroke, seizure, syncope, swimming-induced pulmonary edema (SIPE), pulmonary embolism, or bodily trauma – were responsible for deaths during the swim.

As it relates specifically to SIPE, recently a popular theory for cause of death in these cases, we recognize this clinical syndrome and the difficulties of establishing this diagnosis clinically or at autopsy. It is known from scientific reports that this syndrome affects swimmers and divers with progressive shortness of breath and low levels of oxygen in the blood—symptoms that resolve completely with cessation of swimming and removal from the water.

Although we cannot exclude the possibility of a role for SIPE in the victims' deaths, we know of no victim with an antecedent diagnosis of SIPE and we find no information in our review that would establish this diagnosis with certainty in the victims. Out of an abundance of caution, we would therefore advise any athlete who experiences unusual or unfamiliar shortness of breath while swimming to stop and seek immediate assistance.

A Path Forward

Triathlon is not unique among sports activities. Indeed, our experience with event-related fatalities—and, particularly, the issue of sports-related sudden cardiac death—shares many important similarities with the reported experiences in other athletic settings. As we go forward, we must continue to learn not only from our own experience but also from the scientific and broader athletic communities as new, pertinent information becomes available.

Although event-related fatalities may be uncommon, the safety of athletes participating in USA Triathlon-sanctioned events is a paramount concern and deserves our every attention. However, as we discuss strategies to improve race safety and reduce the number of event-related fatalities, there is no obvious “silver-bullet” solution based on the available data.

This includes the fact that detailed autopsy information was not available for review during this study. We do, however, acknowledge previous scientific reports on the autopsy findings in triathlon victims that have shown cardiac abnormalities (e.g., mild left ventricular hypertrophy with ventricular wall thickness of 15-17 mm, coronary artery anomaly) in the majority, with no other explanatory cause for death.

During the course of this study, post-event investigations and analysis showed that none of these unforeseen fatalities were deemed to be the result of unsafe conditions at events, improper rules or policies, or negligence/oversight on the part of the event organizers. At this time, the Review Group makes no recommendations to alter, strike or supplement any current USA Triathlon rules, guidelines or policies.

Instead, the key to success is to attack the issue on a broad front, adopting a host of strategies that, together, might reasonably be expected to prove helpful.

As we consider our path toward improved race safety, we envision a framework of **shared responsibility**, where athletes, event organizers, and USA Triathlon each play an important role. The following chart outlines this framework.

For more information and insight on this issue, we encourage you to visit the online blog of Lawrence Creswell, MD, the leader of this study, at www.AthletesHeart.blogspot.com. Dr. Creswell is a specialist in Cardiac Surgery at the University of Mississippi Medical Center in Jackson, Miss.



Reducing Triathlon-Related Fatalities: Shared Responsibility

Athletes	Event Organizers	USA Triathlon
Responsibility: Show up for the race healthy, fit, and prepared.	Responsibility: Design, plan, and conduct the event with athlete safety as a foremost priority.	Responsibility: Provide tools, resources, education, oversight, and monitoring.
<ul style="list-style-type: none"> <input type="checkbox"/> Visit your doctor for a physical examination with an emphasis on heart health before participating. Unrecognized heart problems are the primary cause of sports-related sudden cardiac death. <input type="checkbox"/> Consult with your doctor about any warning signs during training such as chest pain/discomfort, shortness of breath, light-headedness, or blacking out. <input type="checkbox"/> Your health, fitness level, and preparation should guide your selection of an appropriate race or event. <input type="checkbox"/> Your race plan should be consistent with your health, fitness level, and preparation. <input type="checkbox"/> Choose an event because it places an emphasis on athlete safety, and is sanctioned by USA Triathlon. <input type="checkbox"/> Practice and prepare for open water swim venues. Race day must not be your first exposure to an open-water swim competition. <input type="checkbox"/> Thoroughly review the race's website and all pre-race communications so you are knowledgeable on the timetable for race day arrival and preparations. <input type="checkbox"/> Utilize all checklists and information from the event, USA Triathlon and your coach to mentally prepare for the competition. <input type="checkbox"/> Make certain your equipment is safe and working properly. Make certain your wetsuit fits properly. Get your bike checked before the event. 	<ul style="list-style-type: none"> <input type="checkbox"/> The approved safety plan should account for unique features of an event's location, weather and participants. <input type="checkbox"/> The safety plan should pay particular attention to the possibilities of bike crashes with serious, life-threatening injuries; and sudden cardiac death at any point during the race. There should be rehearsed responses to each of these contingencies. <input type="checkbox"/> The safety plan for the swim portion of an event should be extraordinarily robust so that victims can be identified immediately (within seconds), rescued promptly (within one minute), and CPR and defibrillation can be provided (within minutes). <input type="checkbox"/> The swim course should be designed to meet the goals of quick identification, rescue, and CPR/defibrillation. Looped and close-to-shore courses should be given special consideration. Far-from-shore courses will require additional on-water rescue resources and enhanced communications systems. <input type="checkbox"/> A communication system should be implemented so that on-water rescuers, swim course director, race director, and EMS personnel may coordinate the rescue of a victim of cardiac arrest. <input type="checkbox"/> A mandatory pre-race safety briefing is recommended during which athletes are provided information about the safety plan and reminded about their responsibilities for race safety. 	<ul style="list-style-type: none"> <input type="checkbox"/> Provide education about race-related fatalities, causes, and potential solutions in curricula for coaches, race directors, and officials during respective certification courses and the annual USA Triathlon Race Director Symposium. <input type="checkbox"/> Distribute information about the current review to USA Triathlon members, race directors, coaches, and officials and to the wider triathlon community through its entire communications platform. <input type="checkbox"/> Develop an educational series of webinars on topics such as: athletes and heart health; sports-related sudden cardiac death; pre-race anti-anxiety strategies; pre-race warm-up strategies; swimming-induced pulmonary edema (SIPE); bike maintenance; triathlon race swimming for the new triathlete. <input type="checkbox"/> Develop a set of Best Practices tools for athletes and event directors, including: safety considerations for swim course design; race-day communications for emergency medical responses; guidelines for athlete preparedness for races; pre-race safety checklist for athletes. Make these tools available online. <input type="checkbox"/> Conduct a thorough review of sanctioning requirements, including: on-water rescue personnel requirements; communication systems for emergency response; consideration of tiered system of required support, depending upon swim course design; standards for on-water rescue personnel; deployment of AEDs.



Athletes	Event Organizers	USA Triathlon
<ul style="list-style-type: none"> <input type="checkbox"/> During the event, STOP at the first sign of a medical problem such as chest pain/discomfort, breathing difficulties, light-headedness, or unusually high heart rate and seek medical attention. Your life may depend on it. This is particularly important during a race swim, in which rescue poses unique challenges. <input type="checkbox"/> During the event, tend to a fellow athlete who has a medical problem. <input type="checkbox"/> Learn CPR and be prepared to use those skills when needed. Ask your family and other supporters to do the same. <input type="checkbox"/> Visit usatriathlon.org for more information. 	<ul style="list-style-type: none"> <input type="checkbox"/> Provide up-to-date race information to all participants, volunteers and support personnel. Provide spectator information on your website so logistics and other stress inducing details are readily available. <input type="checkbox"/> Design and plan the event to include warm-up opportunities, especially the swim portion. <input type="checkbox"/> Sanction your event with USA Triathlon and follow all rules, guidelines and policies. Visit usatriathlon.org for more information. 	<ul style="list-style-type: none"> <input type="checkbox"/> Conduct ongoing review of each new fatality and “near miss” at the time of occurrence. Develop appropriate data collection tools. Relevant data may include air/water temps, wind/wave conditions, athlete experience, and compliance with safety plan. <input type="checkbox"/> Review new relevant scientific information and data/recommendations from other National Governing Bodies. Review feedback from all constituents. <input type="checkbox"/> Report annually on event fatalities, injuries, and major medical problems so that athletes, race directors, sponsors, and venues can be aware of the potential risks.

About USA Triathlon

Founded in 1982, USA Triathlon is proud to serve as the National Governing Body for triathlon – the fastest growing sport in the U.S. Olympic Movement – as well as duathlon, aquathlon, aquabike, winter triathlon, off-road triathlon and paratriathlon in the United States. USA Triathlon sanctions more than 4,300 races and connects with more than 455,000 members each year, making it the largest multisport organization in the world.

In addition to its work with athletes, coaches, and race directors on the grassroots level, USA Triathlon provides leadership and support to elite athletes competing at international events, including International Triathlon Union (ITU) World Championships, Pan American Games and the Summer Olympic Games. USA Triathlon is a proud member of the ITU and the United States Olympic Committee (USOC).

For more information, please visit www.usatriathlon.org or contact us at:

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About USA Triathlon Sanctioning

USA Triathlon offers sanctioning for multisport events—races as well as camps/clinics—that comply with USA Triathlon’s safety requirements. Applications for event sanctioning must include the following information:

- Detailed and updated course maps
- Course details
- Safety plans
- Volunteer plans
- Traffic control
- Security
- Transition area design
- Emergency and medical plans
- Weather contingency plans
- Rules enforcement
- Ability to confirm athlete’s USA Triathlon membership
- Ability to confirm athlete’s waiver signature

Applications are reviewed and approved by USA Triathlon to ensure that events are both safe and fair.

For race directors, the benefits of USA Triathlon sanctioning include:

- Availability of an affordable, comprehensive insurance program that protects race directors, athletes, volunteers, sponsors, and race staff.
- An opportunity to use USA Triathlon-certified race officials.
- Exposure and advertising opportunities.

For athletes, the advantages of participating in a USA Triathlon-sanctioned event include:

- Assurance that there is an approved safety plan in place for the event
- Inclusion in USA Triathlon’s annual national ranking system
- Ability to qualify for USA Triathlon National Championships
- Excess medical insurance coverage

Athlete participants in USA Triathlon-sanctioned events must be USA Triathlon annual members (\$45) or one-day members (\$12). Athletes must also sign an event waiver before participating in a race or camp/clinic.



References

1. Kim JH, Malhotra R, Chiampas G, et al. Cardiac arrest during long-distance running races. *New Engl J Med* 2012; 366:130-140.
2. Marijon E, Tafflet M, Celermajer DS, et al. Sports-related sudden death in the general population. *Circulation* 2011; 124:672-681.
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4. Harris KM, Henry JT, Rohman E, Haas T, Maron BJ. Sudden death during the triathlon. *JAMA* 2010; 303:1255-1257.

