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# The Evaluation and Prevention of Sudden Cardiac Death Among Endurance Athletes: The RACE for LIFE Initiative

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In the fall of 2007, during the US Olympic Men's Marathon Trials in New York City, Ryan Shay collapsed and died without warning. Apparently healthy and one of the most highly trained and conditioned endurance athletes on the planet, there was little warning or reasoning to explain his death. It was later determined his death was caused by a heart abnormality but little additional information was discovered that might help us understand why the fatal cardiac event happened or how we might have been able to prevent it. In October 2009, three men, ages 26, 36, and 65, died during or shortly after running the Detroit marathon (5). These deaths represent a rare, but tragic and devastating, occurrence among endurance sport participants. Research, education, and personal review are needed in an effort to prevent as many deaths as possible.

Sudden cardiac death among endurance athletes, or during endurance exercise/events, is quite uncommon. One investigation (1) showed that .006% of endurance athletes experienced adverse cardiac events during, or shortly after, endurance sport participation. While occurrences are rare, and the benefits of regular cardiovascular exercise generally outweigh the risks of cardiac complication (2) successful intervention of even one preventable death is well worth our investment in educational and prevention efforts. Endurance athletes can take added precautions to reduce their risk of sudden cardiac death by conducting regular personal health inventories, and do their part in preventing some adverse reactions to endurance training and/or performance, ensuring safe and enjoyable participation in their chosen sports.

There may be no substitute for a regular, thorough history and exam by a physician, preferably one familiar with

sudden cardiac death among athletes, to ensure any identifiable risk factors are identified and addressed. Such an exam is strongly suggested for all levels of competitive endurance athletes on a yearly basis, even if the athlete is asymptomatic or has high fitness levels. It is strongly recommended that high school and collegiate sports programs work with their physician and their athletes to ensure that an appropriate history and exam is being conducted and any risk factors addressed.

Unfortunately, generally the earliest symptom of a cardiac problem among endurance athletes is sudden death. The identification of the underlying pathology suggests participation in the sport itself is often not the cause of death, rather a trigger of pre-existing abnormalities (2). Efforts are needed to identify those abnormalities prior to tragic expression during sport or training. As work continues to more accurately predict or identify the likelihood of sudden cardiac death, we should consider some of the potentially detectable risk factors for cardiac injury. They include (2):

- Any cardiovascular condition
- Inherited cardiomyopathy
- Abnormal heart rhythm
- Connective tissue disorder
- Aortic dysfunction
- Hypertension
- Abnormal heart rate for age
- Abnormal ECG
- Family history of sudden cardiac death, especially <50 years of age
- Lipid abnormalities
- Drug use or abuse

- Sickle cell disease or trait
- History or symptoms of fatigue, chest pain, shortness of breath
- Recent or current infection

As part of the RACE for LIFE Initiative, a research and educational program sponsored by the RACE Rx Academy of Exercise Sciences, a brief questionnaire has been created in an attempt to identify some of the risk factors related to adverse cardiac events among endurance athletes. This questionnaire was developed by a group of health care professionals, exercise scientists, coaches, and endurance athletes. While it was not designed to be the sole source of risk evaluation, the questionnaire can be used by organizers of endurance events or by individual athletes to begin examining participation risk. It is our hope this list of questions may prompt athletes to seek medical evaluations if they have an elevated risk or health history that may suggest the need for further preventative measures.

There are also several preventable issues that may trigger a serious cardiac event during endurance exercise or competition. Overexertion and heat-related illnesses are two factors that may be controllable and heavily influenced by preventative measures. The available evidence indicates there is an increased risk of acute coronary event mainly in individuals who do not exercise regularly prior to the endurance event (3). It is recommended that individuals participate in consistent, periodized exercise training for at least 6 months prior to participating in an endurance event. Many participants, mainly recreational athletes, may not train sufficiently leading up to an endurance event. For these individuals, the stress of the event is heightened as their relative work intensity may be much higher, and their physiological systems less tolerant, during the event. Others, usually highly driven competitive athletes, may train excessively prior to an event resulting in over-reaching or over-training, a state that results in less than optimal performance and potentially elevated risk for an adverse cardiac event. Both groups would benefit from a progressive, periodized training regimen leading up to the competition.

Dehydration begins to place the heart in a compromised position as it attempts to handle the physiological demands of endurance exercise. One of the physiological changes that occur as an athlete becomes dehydrated is a reduction in blood volume. With less blood volume, specifically plasma volume which is primarily water, blood viscosity increases (gets thicker). Thicker blood is more difficult to circulate requiring the heart to contract with much greater force with each beat; and more often each minute. These demands can result in overexertion on the cardiac muscle, even at workloads that would not commonly be considered risky. Electrolyte imbalances may also put endurance athletes at risk of sudden cardiac death.

Athletes can reduce their risk for adverse cardiac complications by consuming adequate, appropriate liquids before, during, and after endurance events. Proper hydration is influenced by body size, exercise intensity and duration, heat, elevation, and humidity. Basic recommendations for fluid intake include 500ml consumed 2 hours prior to exertion, followed by another 500ml about 15 minutes prior to prolonged exertion. Consumption of 120 – 180ml every 15 – 20 minutes is then suggested during exertion, especially in hot and humid conditions (4). Water absorption in the gut is aided by the coupled transport of water and glucose. Therefore, the composition of fluids is important for in-competition fluid intake. It is recommended (4) that fluid solutions should contain some carbohydrate (20 – 60 g/L) and some sodium (20 – 60 mmol/L). Most commercial sports drinks contain between 60 – 80 g/L.

In conclusion, it is our hope that the deaths of some of our friends, running mates, and associates will spawn a moment of reflection among the endurance community, both to remember those who have suffered tragic and untimely deaths and to consider our own risk potential for cardiac damage during exercise or competition. If we consider our personal risk factors and remind our training mates to do the same, seek regular evaluations from a health care professional, train

properly, and ensure that we properly hydrate ourselves, we will be taking significant steps to avoid and identify possible problems before they result in tragic outcomes. ■

## References

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3. Corrado D, Basso C, Schiavon M, and Thiene G.(2006). Does sports activity enhance the risk of sudden cardiac death? *Journal of Cardiovascular Medicine*. 7: 228 – 233.
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Figure 1.



## RACE for LIFE INITIATIVE

## HEALTHY RACE QUESTIONNAIRE

To foster safe and healthy participation in endurance training and events, honestly answer each of the following questions:

- 1 - Have you ever been diagnosed with a heart condition? \_\_\_\_\_
- 2 - Have you ever felt pain in your chest or shortness of breath when you exercise? \_\_\_\_\_
- 3 - In the past month, have you had chest pain or shortness of breath when not exercising? \_\_\_\_\_
- 4 - Do you have high blood pressure? \_\_\_\_\_
- 5 - Do you have a family history of heart disease? \_\_\_\_\_
- 6 - Have you ever fainted, felt light headed, or dizzy during or after exercise? \_\_\_\_\_
- 7 - Are you currently taking medication for a heart condition? \_\_\_\_\_
- 8 - Have you ever noticed a rapid heart rate (> 100 bpm) or irregular heart rate while lying in bed? \_\_\_\_\_
- 9 - Have you ever noticed your heart rate not slowing down when you stop exercising? \_\_\_\_\_
- 10 - Have you ever had pneumonia or severe bronchitis? \_\_\_\_\_
- 11 - Has your physician ever told you that you have an enlarged heart? \_\_\_\_\_

It is always a good idea to get a regular physical check-up by your physician. If you answered yes to any of these questions, it is recommended that you consult your physician regarding your potential risks prior to participating in vigorous exercise and competition. In addition, to minimize risks of cardiovascular problems, it is recommended that you participate in a consistent training regimen for at least 6 months prior to participating in an endurance competition.

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About the RACE for LIFE INITIATIVE: This initiative, supported by RACE Rx Academy of Exercise Sciences, is aimed at developing and promoting activities to increase the health and safety of endurance athletes. In 2007, Ryan Shay collapsed during the US Olympic Men's Marathon Trials in New York City. Ryan died of a sudden and fatal cardiac event while running the race. His death was tragic, but the influence of his life was, and is, far-reaching. His wife, Alicia, now guides the RACE for LIFE INITIATIVE as we seek to detect potential health risks and prevent serious injuries among endurance athletes. With our work we pay tribute to those athletes who have suffered death or disability, and seek to support them and their family/friends through difficult times. Read more at <http://www.race-rx.com/memorial-research.php>

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Figure 2.

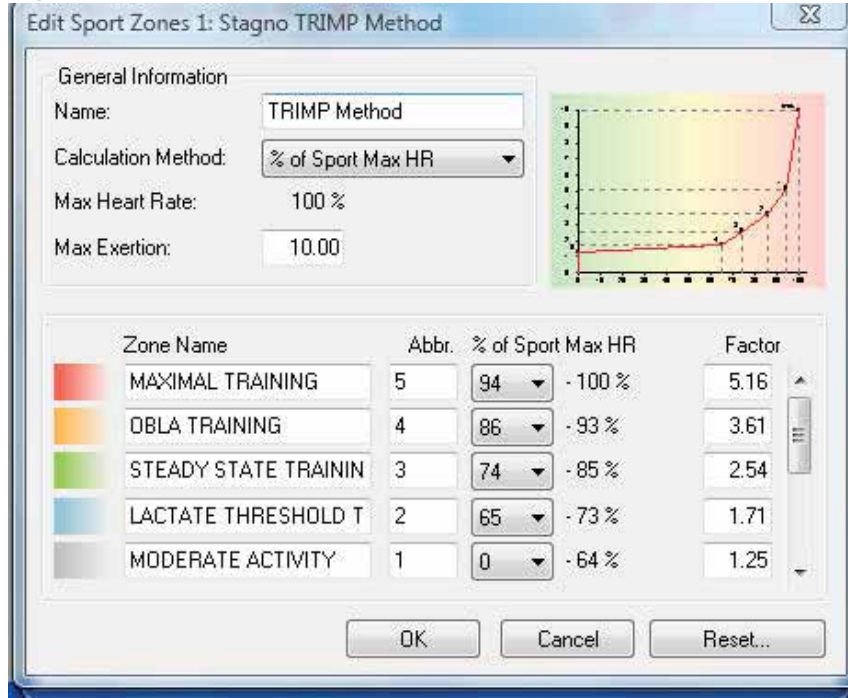


Figure 3.

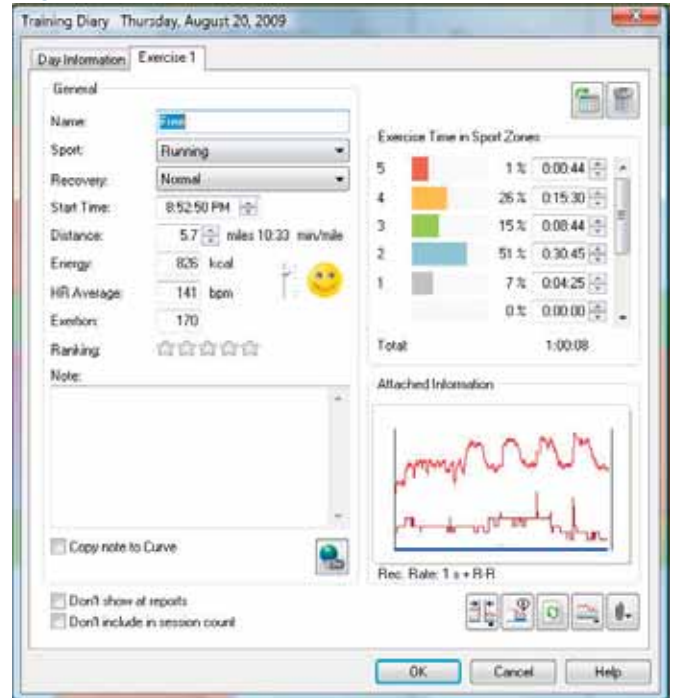


Figure 4.

