## Coaches Care

*Reducing Cardiovascular Risks in Your Athletes*

By Lauren Evans with David Young, MD

Every coach has a connection with heart problems and running, whether it is through personal experience, in their own self-education journey, or even just hearing about it in the news. However, recent research has shown that the numbers are even more shocking than coaches may think. **Out of a group of 250 – 300 kids, there is one young person who has a heart condition placing them at risk of sudden cardiac death during exercise.** (Fuller, 2016) This means that at any track meet you attend in the spring where there are 300 student-athletes competing, one has a heart condition. In fact, sudden cardiac death (SCD) is the leading cause of death in athletes during sport. (Drezner, 2013) This article aims to shed light on this topic and to clarify what we can do as coaches to minimize the terrible occurrences of cardiac events in running events.

I started my research with a tragedy that occurred to a runner on his journey to qualify for the Olympics in Beijing. The runner was Ryan Shay, and the coach was the legendary distance running coach, Dr. Joe Vigil.

Coach Vigil was gracious enough to talk with me about cardiac issues in runners. I am indebted to him for his willingness as always to educate and to share information. (Thank you, Coach!)

Upon prompting Coach Vigil about cardiac issues in runners, he began by discussing some history. He brought up the topic of the Tarahumara Indians in Mexico. This is the tribe that was featured in the book *Born to Run*, a story that is widely credited with setting off the second running boom. The people in this tribe cover miles and miles each day, sometimes up to 100 miles. Vigil says, “They have no cardiologists, no medications, no state-of-the-art testing, no training plans. And, they have been doing this for centuries, even millennia.”

Then, in a related story, it was widely publicized when an American, and one of the main characters in *Born to Run*, Micah True, sadly passed away while on a run in the mountains of New Mexico. Micah spent much of his adult life living like the Tarahumara; yet, he suffered a fatal heart attack on a regular daily run.

Fast forward to the Olympic Trials of 2008. Joe Vigil was coaching the tough runner I referred to, Ryan Shay. Vigil had been working with Shay for years and had seen his pupil run unbelievable tempo runs of 30 miles at 5:00 pace. Shay was at the 5-mile mark of the Olympic Trials Marathon in New York City, running at an easy pace for him, when he collapsed and died from cardio myopathy. Some of the best doctors in the world could not revive him.

Shay, per the guidance of Coach Vigil, had undergone a battery of precautionary tests, the same ones that all of Vigil’s athletes undergo. These include four blood panels quarterly, an electrocardiogram (referred to hereafter as EKG), and a VO2 Max Test. In addition, Coach Vigil has his athletes take their resting heart rate and wear heart rate monitors daily.

With these precautions, how could this happen? This is a question we ask today, but one that

Vigil has asked for years.

Together we can learn from each other about ways to minimize risks for our athletes. In this article, I hope to present:

- a brief understanding of the numbers and the physiology of cardiovascular risks in running,
- three populations with different cardiac risks
- ways to mitigate cardiovascular health risks in your athletes, and
- encouragement to coaches, parents, athletes, and doctors to work together toward further research and education about this topic.

**Application to the coached population and the numbers**

An article published in the New England Journal of Medicine in 2012 calculated that incidence of cardiac arrest is 1 per 184,000 participants during long distance running races. The article also showed that incidence of sudden cardiac death is 1 per 259,000 participants. **However, when it comes to solely male runners, the numbers are much more dire: 1 death per every 50,000 participants.** Looking at a different athletic population, male NCAA basketball players, the rates rise to potentially 1 avoidable death per every 3,000 players (all credit to Kim, et all, The New England Journal of Medicine, 2012).

This issue is important. These numbers are high already, **but they have been getting worse in the last 15 years**. This is likely due to the fact that more people are running for the first time. For example, according to Running USA, there were nearly 14 million finishers of running races in 2011, up from 5.2 million in 1991. Furthermore, the number of marathon finishers over age 55 more than doubled during that time. Knowing this, it becomes increasingly crucial to develop a plan of action and education to keep participants as safe as possible from cardiac events.

Moving forward in this article, I will address the underlying physiology of the heart, the changes to the heart that can be caused by exercise, and what coaches can do to help protect their athletes' hearts.

**Physiology**

**(Please note, the following section in italics is written by and credited to David Young, MD)**

*The cardiovascular adaptations that occur in response to exercise are sport specific. Depending upon the physiologic demands of the sport, the observed cardiac anatomical changes are: 1) to increase the thickness of the heart's main pumping chamber the left ventricle, 2) to increase the volume of the heart chambers, or 3) a combination of both. In endurance athletes, the primary adaptation is to increase the volume of all four cardiac chambers without significantly increasing the thickness of the left ventricle. The reason for this physiologic change is that it allows the athlete to increase the stroke volume which is the volume of blood ejected with each heartbeat. This is important because the performance of the heart, which is measured by the cardiac output, is a function of the stroke-volume multiplied by the heart rate. At rest a normal cardiac output is typically around 5 liters per minute but can increase 6-8 fold in response to exercise. Can you imagine an athlete's heart can pump 30-40 liters of blood per minute? This substantial augmentation of the cardiac output is necessary to meet the increased metabolic demands of endurance athletics. As stated above, the cardiac output is also determined by the heart rate. In endurance athletics,*

*however, the augmentation of cardiac output is more of a function of increased stroke-volume rather than an increase in heart rate.*

*An athlete's heart rate is primarily controlled by the autonomic nervous system. This consists of two branches, the sympathetic nervous system and the parasympathetic nervous system. As an athlete begins to exercise there is increased effect on the heart from the sympathetic nervous system, which, through the release of neurotransmitters such as norepinephrine, leads to an increase in heart rate. Think of the sensation of a rapid heartbeat you get when startled. This is a direct response to activation of the sympathetic nervous system. Conversely, when an athlete is at rest there is a predominance of input from the parasympathetic nervous system. In fact, the more conditioned an athlete becomes the more parasympathetic influence is noted at rest. This is why athletes tend to have a slower resting heart rate compared to non-athletes.*

*In summary, what is important for coaches to know is that there are significant cardiac physiologic changes that occur in endurance athletes. These changes are normal, sport specific, and do not necessarily represent a pathologic cardiac state. However, it is important to state that many times differentiating a normal physiologic response to exercise versus a potential pathologic cardiac condition in an athlete can be difficult. There is substantial overlap between benign cardiac remodeling and a number of pathologic cardiac conditions. Athletes tend to present with abnormal resting electrocardiograms, cardiac rhythm disturbances, and many other cardiac symptoms that are benign, but in a non-athletic individual could represent a significant cardiac condition. If significant concern exists with an athlete, he or she should be advised to immediately stop training and seek appropriate medical care. In many cases the athlete will be monitored closely, with the hope being that the cessation of training will allow the heart to return to a normal physiologic state indicating the absence of an underlying cardiac condition.*

**So what do we do with this information? We need awareness, education, and to take appropriate precautionary and cautionary steps.**

**Categorizing Cardiac Events**

The loss of Ryan Shay is unfortunately one of the better-known cases of sudden cardiac death, but there are tragically many more instances of runners who pass away every year. These tragedies seem to happen to three categories, and I will split the discussion in three ways to highlight these categories. The first is the younger runner under age 35, who may have undetected heart abnormalities, like Ryan Shay. The second group is made up of the older experienced athlete, like Micah True. This group is currently experiencing heart-disease symptoms including atrial fibrillation and atrial flutter, likely caused by the stresses of years spent as an endurance athlete. In this group, I am not generally talking of cardiac death, but rather of the presence of symptoms that mimic heart disease and can worsen over time, increasing the chances of morbidity and mortality in the athlete. Finally, the third group is the older runner who may have spent years being sedentary and decides to start running in order to improve his or her fitness. This athlete may already have underlying heart conditions and heart disease before he or she even starts.

**The Younger Athlete**

Sudden cardiac death in anyone is tragic, and stories of these events in a young person under the age of 35 are especially heart-wrenching. In the younger athletes, hard numbers for

athletes affected are difficult to come by for reasons out of the scope of this paper. The incidence rate appears to be around 1 death per 100,000-200,000 young athletes per year. (JACC, 2014) While this seems like a very small number, when you consider there are about 8 million high school and college athletes in the United States at any given time, this lines up with the estimate of 100 young athletes dying every year in the United States. (JACC, 2014) Also, remember that it has been found that about 1 out of every 300 athletes has a heart condition that could be made worse by exercise. (Fuller, 2016)

It is critical to outline risk factors per population so the coach can be aware. Here is a chart showing incidence of sudden cardiac death (SCD) in the American general adolescent population. Please take some time to read through the chart in order to notice the differences in risk for varying populations:

| Population | Incidence of SCD per 100,000 Person or Athlete Years |
|---|---|
| General population (12 – 19 years of age) | 6.37 (1) |
| MSHSL athletes (12 – 19 years of age) | 0.24 (2) |
| MSHSL athletes (12 – 18 years of age) | 0.70 (2) |
| NCAA athletes (exercise-related) | 1.37 (3) |
| NCAA athletes | 2.28 (4) |
| NCAA male athletes | 3.02 (5) |
| NCAA black athletes | 5.65 (5) |
| Male NCAA Division 1 basketball athletes | 31.99 (5) |

(1) All SCD in adolescents: athlete, and non-athlete, and regardless of activity.
(2) Includes only SCDs occurring during Minnesota State High School League (MSHSL) sponsored game or practice.
(3) Includes SCDs occurring in all MSHSL age athletes, regardless of activity level at time of SCD.
(4) Includes only SCDs occurring during exertion in NCAA athletes.
(5) Includes all NCAA athletes SCDs, whether occurring during competition, practice, sleep, or when the athlete is off with injury.
(A special credit to the Journal of American Cardiology and Atkins, Roberts, Maron, and Harmon for the research presented in this table.)

In the younger athlete, it appears that underlying heart conditions are overwhelmingly the cause of sudden cardiac death. These conditions include long-QT syndrome, hypertrophic cardiomyopathy (a dangerous and deadly enlargement of the heart), and Marfan syndrome. (Note: I advise the reader to continue their education on cardiac conditions by reading up on these conditions as specifics will not be covered in this paper. Good sources for continuing education can be found in the bibliography.) Most of these heart conditions are inherited, and others may be a result of lifestyle. Pressures on young people are high today and most do not know how to deal with these pressures. According to Dr. Vigil, “they are living someone else’s life,” and the emotional stress on kids from both internal and external pressures can be too high and affect the core of their being, their heart.

The devastating impact of even relatively infrequent sudden deaths in young athletes offers justification for restriction from competition to reduce the risk related to unsuspected cardiac disease when absolutely necessary. In order to find out when it is necessary to restrict an athlete from competition, the athlete needs to undergo some specific questioning and testing to determine the risk level. For athletes in whom cardiovascular disease has been identified (either by pre-participation screening or under other circumstances), important considerations arise with respect to the appropriate formulation of eligibility and disqualification decisions for competitive sports. The 2015 Scientific Statement from the American Heart Association and

American College of Cardiology offers expert panel recommendations and clear benchmarks for clinical practice, largely focused on amateur competitive athletes. Panel recommendations for athletic eligibility are based on the premise that intense sports training and competition increase risk for sudden death or disease progression in susceptible athletes with heart disease. This risk can be reduced or minimized by either temporary or permanent withdrawal from sports.

Regarding pre-participation screening, there are two schools of thought. The first is to create a widespread testing program similar to the widespread testing program in the Veneto Region of Northern Italy, which I will explain. The other school of thought is that these tests cause more harm than good with false alarms and high expense.

Currently, almost all high school and college athletes are required to undergo a physical exam by a doctor before being cleared to practice and compete. In accordance with the American College of Preventive Medicine's 2013 position stand, this physical exam involves taking a personal and family history and listening to the athlete's heart with a stethoscope. But as was demonstrated in a 1997 study of 5600 high school athletes, these methods are woefully inadequate at detecting heart defects. Many heart defects don't have any family history and can't be detected via a stethoscope. (Fuller et al)

Other, more accurate tests are available. The two best candidates for large-scale screening of athletes are EKGs and echocardiograms. EKGs involve wires connected to the chest via a sticky conductor, while an echocardiogram is an imaging technique based on the use of an ultrasound.

The question then becomes whether testing works and if it is worth the expense. From personal experience, and via a widespread and decades-long testing program in the Veneto Region of Italy, my opinion is that it works. I grew up in this region and was required just like every athlete there, to have a stress test and EKG before being cleared to participate in any competitions within Italy or to be a part of any national federation sport team. This included beginners up to the professional level. Italian investigators attribute a decline in the rate of sudden cardiac death during sports to their testing. They report an almost 90% decline in the annual incidence of sudden cardiovascular death in competitive athletes (largely owing to reduced mortality from cardio myopathy). This positive change occurred when athletes who were very susceptible to risks were disqualified from participation in competitive sports.

However, decisions to withdraw athletes from sports because of heart disease are complicated by complex societal considerations. These decisions can prove very difficult to implement, particularly when professional sports careers are involved. Many such athletes are highly motivated to remain in the competitive arena. They may not fully appreciate the implications of relevant medical information and may resist appropriate recommendations to withdraw. This does not mean that it is impossible. Just as people are counseled on quitting alcohol, people can practice behavior change, energy redirection, and emotional control to withdraw from sports if it is going to save their lives. We can all agree that at the end of the day, it is worth it to save someone’s life.

Standards requiring or recommending mandatory disqualification from sports are not part of the American healthcare system. It is true that improper over diagnosis of disease symptoms can result in unnecessary disqualification from sports, which is tragic in itself. However, worries

about improper disqualification can be remedied by seeking second and third opinions when disqualification is recommended. Humans make errors and second and third opinions can help. (A cautionary statement: that said, judgment can be impaired due to pressures from the athlete, parents, coaches, and other interested groups, especially when the athletes “shop” for other medical opinions. It is clear that this is a tough area, but just because something is difficult doesn’t mean that it should be avoided.)

In summary, the my opinion is that every athlete under the age of 35 should get an EKG that should be read by an experienced cardiologist who can interpret EKGs in athletes and recommend appropriate subsequent testing when the result of the EKG is abnormal. This has been done and can be implemented safely to save people’s lives.

**The Older Experienced Athlete**

The “older experienced athlete” will be defined in broad terms as an athlete aged 35 and up who has been practicing extreme endurance sports (marathoning, ultramarathoning, and other very long distance events) for over 10 years. In discussing changes to the heart that occur with prolonged extreme endurance activity, it is helpful to start with a continuation of the physiology explanation.

Just as discussed above in the physiology explanation, the athlete’s heart enlarges (stretches) and fatigues due to training. Post-exercise, there can be remaining enlargement of the heart chambers due to the stretching. There can also be reduced pumping ability of the heart, especially of the right atrium and right ventricle, due to fatigue. As with most supercompensation, the athlete’s heart will generally adapt and bounce back after one to three days, but there is concern that within the group of older, experienced athletes who have performed events over and over, the heart may not return to its original shape. (Pasternak, 2017)

The heart releases chemicals after exercise that are the same as those that are released by damaged muscles after a heart attack. This can be alarming to cardiologists. These markers, which increase after hard endurance exercise, suggest damage to the cardiac muscle. Several cardiologists who have experience in treating the long-term endurance athlete have found that these athletes are likely to develop arrhythmias, including atrial flutter and atrial fibrillation. (Arrhythmias are an irregular beating of the heart, which are normally just an annoyance, but can sometimes lead to serious issues including increased risk of heart attack, stroke, and sudden cardiac death.) What happens during atrial fibrillation is the atria (the region of the heart that is supposed to contract first to push blood down to the lower parts of the heart) begin to shake irregularly instead of functioning normally. (Pasternak, 2017)

In talking independently with two cardiologists in my region (Fuller & Young) along with a general practitioner who is director of the medical staff at the Tahoe Rim Trail Endurance Runs (Pasternak), I have found that there is a consensus that there is a connection with abnormal heart arrhythmias and extreme endurance activity. Additionally, nearly all studies on this subject have shown that there is a link between a greater risk of atrial fibrillation for the middle-aged and older endurance athlete when compared to non-athlete controls (Abdulla, 2009). However, there is no consensus on the actual effect on the athlete. Most cardiologists are not sport doctors, and many are unsure if some of the changes are as worrisome as they would be in the normal population. Some research has shown that endurance athletes, while at a 2 – 8 times higher risk than the general population to develop abnormal arrhythmias, tolerate these

arrhythmias much better than non-athletes. (BCMJ, 2016)

Arrhythmias are not the only change that impacts the older endurance athlete's heart. Occasionally, the left ventricle has been shown to remodel whereby the left ventricular cavity becomes enlarged similar to forms shown in cardio myopathy. Research shows that in some cases the heart is not returning to its original shape even when the athlete backs off of his or her activities. In fact, substantial chamber enlargement seems to persist in 20% of retired and deconditioned former athletes after 5 years. (Circulation, 2006) Again, the question becomes whether or not this is dangerous for the athlete's well-being or whether they adapt to these changes in their heart.

An equally controversial issue surrounds whether or not endurance athletes have a higher risk of coronary atherosclerosis, which is a buildup of plaque in the arteries. One study compared 50 men who had run at least one marathon per year for 25 consecutive years versus a group of sedentary men. The runners did have higher coronary calcium scores despite having better blood pressure and cholesterol levels. (Missouri Medicine, 2014)

So what is the overall effect on mortality? A few studies have shown that athletes who are exercising at the highest levels have a slightly higher mortality rate than more recreational athletes. However, overall there seems to be more studies that show a reduced mortality risk for athletes who compete in long endurance events. For example, a Swedish study looking at 73,000 skiers show that skiers had lower mortality compared to non-skiers, including lower deaths from cardiovascular disease and cancer. Similar studies show excellent morbidity and mortality benefits for Olympic athletes and Tour de France cyclists even years after their professional athletic careers. (Pasternak, 2017)

There have been a number of theories about why long-term endurance athletes have a greater risk of cardiac issues but have a lower mortality risk overall. One theory is while exercise may contribute to coronary calcium build up, the calcium build up is denser and is actually causing more plaque stabilization and thus a decreased risk of developing a heart attack.

Overall, the takeaway here is that the older experienced athlete needs to be aware and proactive with their health, specificially with their heart health. It seems that appropriate training can promote safe remodeling of the heart whereas in appropriate stress or over-stresses without appropriate training can cause damage to the heart.

**The Older Inexperienced Athlete**

An alarmingly high percentage of sedentary adults over the age of 35 are showing signs of heart disease. Many are going for their annual doctor's appointment and finding they suffer from early indicators of heart disease, including elevated levels of LDL cholesterol, obesity, shortness of breath during activities of daily living, and even some plaque buildup within their hearts. The reaction to this is to follow a sound diet and to exercise. We are finding as running participation goes up in the United States, this is the group that is making up most of the growth in running. This group is attracted to running for many of the same reasons that long-time runners enjoy it. The sport requires minimal equipment, is convenient, provides for a great workout in a short amount of time, and gives the runner an opportunity to measure improvement and reach their goals.

A problem surfaces when the older inexperienced athlete decides to get started by setting a

big goal rather than by taking small steps as they begin their journey to an active lifestyle. In my personal experience as a coach, a good proportion of the adult athletes who have come to me are new to running. Often their first goal is to run a half marathon or marathon within 3 months. (No joke!) To put this in perspective, finishing times for these races for this group will be between 2:30 – 3:30+ hours for the half and 5 – 7 hours for the marathon. This becomes an extreme endurance event for them when compared to how these events impact other experienced runners.

In working with this population, the first step is to follow a consistent protocol when starting with runners who fit into this category. This includes a series of questions (which I will outline under the section, “Screening Questions.” Some doctors recommend requiring a physical exam before beginning the program. Finally, cardiologists including Dr. Colin Fuller among others, strongly recommend requiring a treadmill stress test as well, especially in those whose screening questions were positive.

Once cleared for sports, the coach should work with the client to gain their trust. Once trust is established, the coach should talk with this group about reasonable goal setting. More appropriate goals could include finishing a 5k, improving on a time of a 5 – 10k race, or even extending out the time frame for completing the marathon from three months to a year or more. However, in my experience, these athletes often come to the coach having already signed up for the race with their minds made up. Thus, the coach has a decision to make. They could either let the athlete go it alone or help them along their journey in the safest way possible. I generally choose the second route.

**Next Steps**

There are treasure troves of information available about the adaptations of the athlete’s heart to exercise. Yet, there is an incredible need for better data. As we dive in together to minimize cardiovascular risks for our athletes, the first step is to work with each to improve the data with more research in this area. Coaches can help by working with researchers (and even researching themselves) in order to ensure the studies that are conducted are providing useful data.

A suggested next step is to try to build connections in your community with sports medicine doctors and sports cardiologists. These cardiologists will give your athletes the opportunity to make appointments as needed for EKGs or for treadmill stress tests.

Thirdly, it is critical to be able to recognize sudden cardiac arrest or sudden cardiac death and then have a plan of action. Seizure-like symptoms occur in 30 – 40% of cases, including agonal gasping. This is a traumatic event to watch, which could result in a bystander being hesitant to act. (JACC, 2014) Any collapse, even following a trauma, should be considered a sudden cardiac arrest as a cautionary measure before a full diagnosis can be made. The proper steps are to call 911 and to begin CPR. If present, the bystander should get an AED and use it with as little interruption to CPR as possible. There are many AEDs available that coaches can purchase to have available. Make sure you and your athletes know how to use it.

Finally, here is a list of compiled steps that should be followed by each coach in order to promote the safety of their athlete:

- Have a survey for each new athlete to fill out that includes health-related questions,

questions on drug use, and questions on past health history. Questions presented below in this paper can be used, among others.

- Be sure that your athletes have completed a physical, and open the lines of communication between the doctor and the coach.
- Make it clear to your athlete that they must communicate any health-related issues or appointments with you. Keep those lines of communication open.
- Build relationships with local sports medicine doctors and cardiologists in your community to share knowledge, to share information, to learn from each other, and to help care for your clients.
- Set a standard of zero drug use (doping and otherwise). Encourage and require a drug-free environment.
- Encourage or require your athletes under the age of 35 to get an EKG.
- Encourage or require your athletes over the age of 35 to get a treadmill stress test if they have risk factors for heart disease or any cardiac symptoms.
- Know how to perform CPR and use an AED, and stay up to date on your knowledge. Get an AED for your car or in your facility. Train your athletes on how to use an AED and encourage them to know how to do CPR or get CPR certified. Often, if a cardiac event happens to someone, this is the only way you can save his or her life.
- Understand the legal side. Sometimes people are hesitant to act for fear of liability, which is understandable but unacceptable. The more you know, the more you will be willing to act when it comes to saving someone's life.
- Know the risk factors.
    - Is the athlete male?
    - Is the athlete African-American?
    - Does the athlete suffer from sickle-cell anemia? If so, is the athlete at altitude?
    - Has the athlete ever had an episode of syncope (passing out and losing consciousness)? If so, what are the details surrounding this episode?
- Encourage your athletes to have a sound diet.
- Be aware of the emotional state of your athletes and encourage them to practice emotional control. On a scale of 1 – 10, what is the work – life stress for the athlete? Remember that this changes over time, so open communication is key. Encourage the athlete to share specific stressors in their life so the coach can adjust training and racing if necessary.
- Don't hesitate to cut a workout short or change a race schedule if the athlete is sick or unhealthy.
- Using an athlete-centered coaching approach will help you make the right decision for your athlete.

**Conclusion**

The benefits of exercise for cardiac and overall health far outweigh the risks to the heart. We need to continue to promote exercise for all of its benefits. Yet, more can be done to improve cardiovascular risks for athletes. There is no one test, no one method that can prevent sudden cardiac death or sudden cardiac arrest. Rather a combination of testing, education, research, and actions can help prevent cardiac collapse or death among athletes.

Let's circle back with Dr. Joe Vigil. Coach Vigil understandably underwent years of fact-finding with top doctors in the field of cardiology after Ryan Shay's tragic death. After more than six months of research and testing from some of the top doctors in the world, Harvard Medical

Center attributed Shay's passing to an episode of bacterial pneumonia that he had as a kid. This episode left his heart susceptible to an attack later in life.

I asked Coach Vigil about his thoughts on what to do to minimize traumatic cardiac events in athletes. His solution is wide-ranging and is as follows, in no particular order.

1. Every athlete should have an EKG. In addition, higher-level athletes should have blood testing and physiological testing quarterly.
2. Each athlete should take their resting heart rate periodically and compare it to their own personal baseline.
3. Every athlete should practice emotional control. When emotions and stress are high, cardiac episodes are much more likely to happen. As Vigil puts it, "The more one thinks about their problems, the more the sympathetic nervous system is put into over-drive."
4. The coach should always create a thoughtful progression for the athlete to allow their body and mind to adapt to increasing loads in training and demands in racing.
5. The coach should be educated on the risk factors. For example, African American males, especially those with inherited sickle cell anemia and those at altitude, tend to have higher risk for cardiac problems that increase their chance of cardiac death, according to Vigil.
6. Finally, as in Ryan's Shay's case, it is intelligent to ask each athlete if they have had any episodes of pneumonia or cardiac problems that they know of in their past.

All of his steps are in line with the ones I outlined above. I encourage coaches to continue their research in this area, know the warning signs, and work together to minimize cardiovascular risks for their athletes and for themselves as well.

From a coach's and a parent's standpoint, even one death is too many. Together we can work together to potentially save the life of your athlete or your child.

**Screening Questions**
The American Heart Association / American College of Sports Medicine Health / Fitness Facility Pre-Participation Screening Questionnaire

Assess your health needs by marking all true statements with a check mark.

History…you have had:
__ A heart attack
__ Heart surgery
__ Cardiac catheterization
__ Coronary angioplasty (PCTA)
__ Pacemaker / Implantable cardiac defibrillator / rhythm disturbance
__ Heart valve disease
__ Heart failure
__ Heart transplantation
__ Congenital heart disease
*If you marked any of the above statements as true, consult your healthcare provider before engaging in exercise. You may need to use a facility with a medically qualified staff.

Symptoms:
__ You experience chest discomfort with exertion
__ You experience unreasonable breathlessness
__ You experience dizziness, fainting, blackouts
__ You take heart medications
__ You have musculoskeletal problems
__ You have concerns about the safety of exercise
__ You take prescription medications
__ You are pregnant

Cardiovascular risk factors:
__ You are a man older than 45 years
__ You are a woman older than 55 years or you have had a hysterectomy or you are postmenopausal
__ You smoke
__ Your blood pressure is greater than 140 / 90
__ You don't know your blood pressure
__ Your blood cholesterol level is greater than 240 mg / dl
You don't know your cholesterol level
__ You have a close blood relative who had a heart attack before age 55 (father or brother) or before age 65 (mother or sister)
__ You are diabetic or take medicine to control your blood sugar
__ You are physically inactive (i.e. you get less than 30 minutes of physical activity at least 3 days per week)
__ You are greater than 20 pounds overweight

*If you marked two or more of the statements in the above section, consult your healthcare provider before engaging in exercise. You might benefit by using a facility with a professionally qualified exercise staff to guide your exercise program.

**If none of the above is true, you should be able to exercise safely without consulting your healthcare provider in almost any facility that meets your exercise program needs.

(Reproduced from Balady et al, 1998)

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