



Active Voice: Adding the ECG to Pre-Participation Exams for Competitive Athletes

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Unexpected deaths in those considered to be models of good health are sad and very visible because of the popularity of sports. Unfortunately, the public perception is that these deaths are much more common than they actually are. Controversy surrounds the best way to recognize and prevent these deaths, and the tendency has been to add more medical technology to the pre-participation exam (PPE). The following is an assessment of the situation regarding the addition of the electrocardiogram (ECG) to the PPE.

First, regarding the scientific basis:

1. One of the important studies needed to demonstrate the value of adding an ECG to the PPE is a randomized trial. The two available studies comparing athletic deaths before and after ECG screening was implemented ([one in Italy](#) and [one in Israel](#)) are not valid due to wide variations in death statistics from year to year.
2. It is established that the causes of cardiovascular (CV) death in athletes vary widely depending on the local genetic pool. There is limited data regarding the causes because autopsies are not mandated, and when they are performed, they are not standardized. The ECG's test characteristics differ for the various causes, so its efficacy depends upon the causes of CV deaths in the athletic population that is screened.
3. The exact cause and prevalence of athlete CV deaths is uncertain because of the poor surveillance of such deaths.

Second, regarding the ECG:

1. The available commercial ECG interpretive programs are not appropriate for screening athletes. Their statements are often alarming, and their algorithms do not detect some of the conditions of concern.
2. Most physicians have not been trained to interpret the ECGs of athletes.
3. The ECGs of athletes are influenced by age, gender, ethnicity and training modality.
4. The test characteristics for the ECG and the conditions of concern are not well-defined. At best, the ECG is only 50 percent sensitive to the usual causes of CV death in athletes.

Third, regarding legal issues:

1. Good Samaritan laws should be considered for physicians who volunteer their time to screen young athletes and read their ECGs.
2. The rights of high-risk athletes should be clarified with referral to schools and professional teams that have made legal arrangements to allow such individuals to compete.

Fourth, regarding societal issues:

1. Many well-meaning organizations have been formed to enthusiastically call for the expansion of screening programs.
2. Societal pressures based on the assumption that modern medical technologies can work wonders will lead to including the ECG and often echocardiography to the PPE.
3. Screening may be "cost-effective," according to [Wheeler, Annals Int. Med 2010](#), but where will the money come from?

How can the medical community in the U.S. address the above?

1. More Science. A multi-center research program should be a national priority. It would involve selected states or areas where a surveillance protocol could be enacted. College and high school athletes would be enrolled and followed for CV events with the standardized collection of outcome test results and funding for standardized autopsies to include genetic testing. One of the states or areas would be randomly selected for a standardized PPE that includes an ECG and echocardiogram. The data collected during this study could also be used to develop

norms for screening athletes.

2. More Education. The public needs to better understand the limitations of the PPE and medical technology, and physicians need to be educated and certified to screen athletes for CV events.

Even when feeling the most cynical regarding screening, and concluding that it is an impossible “battle against Bayes (theorem),” testing in low-prevalence populations will always lead to more false positives than lives saved. However, I can’t help being moved by these sad and unfortunate deaths. I think this is how most of us feel, particularly those who are parents, and this leads me to believe that societal pressures will cause more technology to be added to the PPE. At Stanford, we have been fortunate to have many health care providers volunteer to screen our athletes with ECGs and echocardiograms, and we are working to improve these screening technologies (e.g. [Gademan 2011](#)).