# There is No Reason to Adopt ECGs and Abandon American Heart Association/American College of Cardiology History and Physical Screening for Detection of Cardiovascular Disease in the Young

Barry J. Maron, MD; Paul D. Thompson, MD; Martin S. Maron, MD

In this issue of the *Journal of the American Heart Association* (*JAHA*), Williams et al have presented a large retrospective observational study addressing methods for screening young healthy competitive student-athletes for cardiovascular disease.[1] Their proposed strategy adds the 12-lead ECG, which the authors have advocated for several years,[2–4] to the time-honored targeted history and physical screening examination recommended by the American Heart Association (AHA) and the American College of Cardiology.[5–7] Inferences are drawn about the screening efficacy of each of these 2 approaches.

Williams et al[1] assembled data from a large nonconsecutive cohort of high school athletes and other students, adding to the ongoing controversy surrounding the value of universal ECG screening for cardiovascular diseases in competitive athletes. This practice of ECG screening has been mandated in Italy for >40 years (Figure 1),[8] but remains the subject of substantial scientific controversy, including the fact that the most common cause of sudden death (SD) in the Italian data is arrhythmogenic right ventricular cardiomyopathy and not hypertrophic cardiomyopathy (HCM), which is the most common cause of SD in the US athlete population.[9,10] For a variety of reasons, ECG screening has met repeated opposition in societal guidelines from the US cardiology community, and published in *Circulation* on 3 occasions over 25 years,[5–7] most recently just 5 years ago.[7]

We should underscore that all participants in this debate agree that the purpose of broad-based screening of asymptomatic young student-athletes is identification of those cardiovascular diseases that increase the risk for SD, either on the athletic field or elsewhere.[9,10] A variety of genetic and/or congenital cardiovascular diseases have been shown to be responsible for these tragic but uncommon events, and with structurally normal hearts distinctly uncommon.[11]

However, we must dispute the conclusions and recommendations of Williams et al[1] to adopt the ECG and abandon the standard history and physical for screening athletes, based on their own data presented herein and substantial evidence from other sources.[7] Notably, the authors have repeatedly criticized[4] the 14-point AHA/American College of Cardiology recommended strategy of history and physical examination for a perceived lack of sensitivity in identifying cardiac disease. However, close inspection of their own *JAHA* data[1] reveals that most of their subjects with disorders associated with SD were, in fact, identified by history-taking or physical examination (10 of 16 [63%]; ie, by heart murmur or excessive exertional dyspnea or chest pain). The 10 athletes with a positive history or physical examination included the only 3 screened students ultimately identified with structural heart disease (ie, 2 with HCM and 1 with anomalous coronary artery, also the most common causes of SD in young athletes in the United States).[9,10]

These primary care authors[1] not surprisingly demonstrated the capability of 12-lead ECGs for identifying Wolff-Parkinson-White (preexcitation pattern) and possibly the long-QT syndrome. Nevertheless, ECGs alone were responsible for these primary diagnoses in only 2 of the 5003 students screened, or <0.1%, and remarkably the long-QT syndrome and Wolff-Parkinson-White syndrome represent 80% of the 16 students considered to have important cardiac disorders.

However, as cardiologists examining these data, we would underscore that asymptomatic Wolff-Parkinson-White syndrome or long-QT syndrome alone are not of sufficient clinical magnitude to solely justify the resources and energy necessary to sustain mandated ECG screening for all high

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*From the HCM Institute, Tufts Medical Center, Boston, MA (B.J.M., M.S.M.); and Division of Cardiology, Hartford Hospital, Hartford, CT (P.D.T.).*

**Correspondence to:** Barry J. Maron, MD, HCM Institute, Tufts Medical Center, 800 Washington St, Boston, MA 02111. E-mail: barrymaron1@gmail.com

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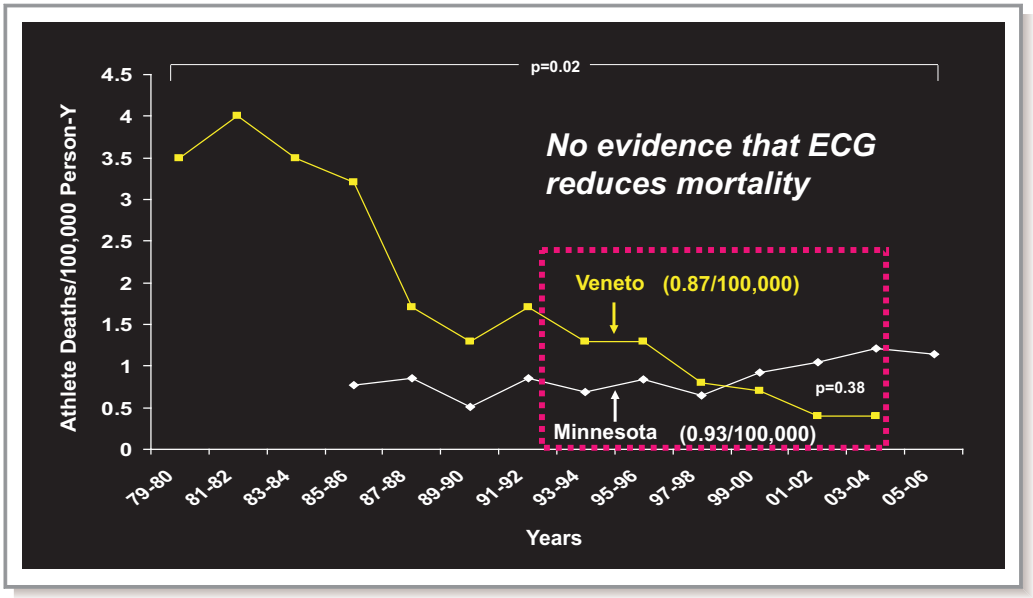


**Figure 1.** Plots comparing annual athlete mortality per 100 000 person-years in Veneto region of Italy (with ECGs and history/physical) and in Minnesota (with only history and physical). There is no statistically significant mortality difference between Italy and Minnesota. Italian mandatory national preparticipation screening began in 1981 (arrow).

school athletes in the United States.[12] Also, notably, a recent Mayo Clinic study reported that long-QT syndrome was a virtually nonexistent cause of SD in young athletes and does not require disqualification from competitive sports.[13]

It should be underscored that AHA/American College of Cardiology expert panels, composed of cardiovascular specialists, have consistently rejected the notion of mandated broad-based universal (including national) screening that relies on the 12-lead ECG,[5–7] given the many limitations, which include the following: unacceptable numbers of false positives that overwhelm the screening system with expensive downstream noninvasive testing; false negatives that defeat the very reason for such screening initiatives; logistical challenges in reliably interpreting ECGs in large populations (eg, for QT-interval duration); overall cost burden; and, finally, the failure to demonstrate that ECG screening reduces cardiovascular mortality[7,14] (Figure 1).

Williams et al[1] selectively used diagnostic echocardiography in only 22% of study participants, and the selection criteria for this testing are unclear. Consequently, the authors may well have underestimated the number of students in their population with structural heart disease (eg, HCM). Knowledge of the false-negative ECG rate is critical to the merit of any ambitious screening initiative. Indeed, we have previously shown in a cohort of competitive athletes studied with echocardiography that the 12-lead ECG was associated with a 10% false-negative diagnostic rate for HCM that left a significant number of patients undiagnosed by the ECG alone.[15]

In this regard, Williams et al[1] were able to identify 2 cases of HCM (both by history and physical examination). However, by extrapolating from the estimated prevalence of HCM in the general population (1:500 to 1:200)[16] 5 to 10 cases would have been expected in such a study population of 5000. Failure to identify all students with conditions such as HCM would leave some without the benefit of treatments that could significantly alter the natural course of their disease.[17] In addition to these false negatives, the number of false positives in this analysis remains uncertain. This is a concern given that a presumptive HCM diagnosis in a young person can create confusion, anxiety, fear of SD risk,[17] and inappropriate exercise restriction or sports disqualification, as well as a cost burden resulting from noninvasive testing, including echocardiography and magnetic resonance imaging.[7]

On the other hand, we are pleased that Williams et al[1] included in their survey population a sizeable proportion of physically active students (≈30%) who were *not* competitive sports participants. Indeed, 3 of 16 individuals (19%) identified with cardiovascular abnormalities in this study were active only in dance, martial arts, and Reserve Officers' Training Corps.

We have previously promoted the principle that SDs caused by cardiovascular diseases (eg, HCM) occur *more commonly* in young people not engaged in competitive sports, simply because these individuals are *more numerous* than trained athletes and, therefore, as a group create a greater societal SD burden.[18–20] Indeed, catastrophic events are 8-fold more numerous in nonathletes than athletes (and 3-fold more common on the basis of incidence) (Figure 2). To

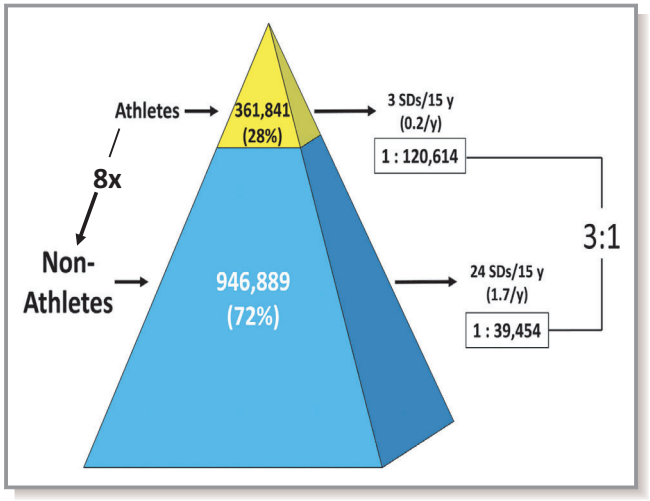


**Figure 2.** Sudden deaths (SDs) are more common in young nonathletes than in competitive athletes. SDs from genetic and/or congenital heart diseases in young people not engaged in competitive sports programs greatly exceeded those in competitive athletes: 3:1 with respect to incidence and 8:1 in absolute numbers (24 nonathletes vs 3 athletes). Forensic data from Hennepin County, Minnesota, 2000 to 2014, adapted from Maron et al.[18]

underscore this point, consider that only ≈30% of high school athletes are involved in sanctioned interscholastic sports and only 2% of college students are engaged in intercollegiate athletics.[18–20]

These observations support the importance of assessing cardiac risk in nonathletes and devoting greater energy and resources to screening young people who are *not* part of competitive sports programs, but nevertheless may be at similar SD risk as are athletes with the same genetic and/or congenital cardiovascular diseases. In this regard, New Jersey recently passed legislation (2015 Well Child Cardiac Exam Bill [S471/A-1473]) requiring a targeted history and physical examination performed as part of all routine medical visits in students <19 years of age, including athletes and nonathletes alike; referral for cardiac evaluation is triggered when ≥1 of the 14 AHA screening items are regarded as positive.[18]

In conclusion, as cardiologists, it is difficult for us to understand the enthusiasm expressed by Williams et al[1] for an unnecessary call to abandon the AHA/American College of Cardiology recommendation for large population screening (and replacement with 12-lead ECGs), and in the process reverse cardiovascular societal policy.[5–7] Large population testing with ECGs is not only impractical, but has never been shown to decrease cardiovascular mortality in such settings (Figure 1). Furthermore, the authors' own data reported herein do not make a compelling case for a major change in the direction of care involving literally thousands of young people.

These data from primary care physicians do, however, support, and are consistent with our expansive vision for screening. That is, we recommend devoting greater energy and resources to targeted history and physical screening (administered as part of routine primary medical care) for asymptomatic young people who have chosen not to enter the competitive athletic arena and, as a consequence, are without access to medical evaluations that could detect the same potentially lethal diseases that afflict athletes. Therefore, we believe that the arbitrary exclusion of at-risk young people from a cardiovascular screening process has ethical implications that impact fairness and equality for the recognition of cardiac disease.

## Disclosures

None.

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