

A Scientific Statement From the American Heart Association and American College of Cardiology

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This document addresses medical issues related to trained athletes with cardiovascular abnormalities. The objective is to present, in a readily useable format, consensus recommendations and guidelines principally addressing criteria for eligibility and disqualification from organized competitive sports for the purpose of ensuring the health and safety of young athletes. Recognizing certain medical risks imposed on athletes with cardiovascular disease, it is our aspiration that the recommendations that constitute this document will serve as a useful guide

to the practicing community for clinical decision making. The ultimate goal is prevention of sudden death in the young, although it is also important not to unfairly or unnecessarily remove people from a healthy athletic lifestyle or competitive sports (that may be physiologically and psychologically intertwined with good quality of life and medical well-being) because of fear of litigation. It is our goal that the recommendations in this document, together with sound clinical judgment, will lead to a healthier, safer playing field for young competitive athletes.

*On behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology.

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HISTORICAL CONTEXT

There have been 3 prior documents, all sponsored by the American College of Cardiology (ACC) (1-3), that addressed eligibility and disqualification criteria for competitive athletes with cardiovascular diseases: Bethesda Conferences 16 (1985), 26 (1994), and 36 (2005), published and used over a 30-year period. Each of the 3 initiatives (and the present American Heart Association (AHA)/ACC scientific statement) were driven by the tenet that young trained athletes with underlying cardiovascular abnormalities are likely at some increase in risk for sudden cardiac death (usually on the athletic field) compared to nonathletes or competitive athletes without cardiovascular disease (4-8).

All 3 Bethesda Conferences and the present derived AHA/ACC document provide expert consensus recommendations. These insights use 1) the experience and expertise of the panelists (i.e., individual and collective judgments, using the “art of medicine”) and 2) available scientific evidence that estimates the medical risk in athletes with underlying acquired, genetic, and congenital heart abnormalities imposed by the unique lifestyle of engagement in competitive sports.

These insights can be applied to decision making for temporary or permanent disqualification versus eligibility of athletes with probable or conclusive evidence of cardiovascular disease; however, the scientific data supporting many of the recommendations in this document are unavoidably limited, as evidenced by the frequent assignment of a Level of Evidence C. Nevertheless, each of the 3 prior Bethesda Conferences has served the practicing community well, offering clinicians a consensus reference document that is potentially helpful in resolving predictably difficult clinical dilemmas. It is our expectation that the present conservative AHA/ACC scientific statement will follow in that tradition. The final document was approved by all participants and assigned outside reviewers.

IMPETUS FOR THE PRESENT DOCUMENT

There are a number of factors that support the decision to update the 36th Bethesda Conference here (3). First, sudden cardiac deaths in young healthy athletes remain tragic and counterintuitive events, subject to persistently high public visibility, emotion, and media scrutiny, with potential legal liability considerations. Therefore, a strong impetus remains to identify high-risk athletes to reduce their exposure to sudden death risk. Indeed, there is an ever-expanding population of competitive athletes, including those participating in new and emerging organized sports. Second, cardiovascular medicine changes rapidly. As evidence of this, in the almost 10 years since

publication of the 36th Bethesda Conference (3), new conditions associated with sudden death in the young have been recognized, and knowledge of the responsible diseases and inherent risks of sudden cardiac death in the young has evolved (4-8). As a result, some selected areas of the 36th Bethesda Conference may have become obsolete, and novel issues not previously addressed, have emerged. Third, an increasing number of adults with congenital heart disease and cardiomyopathies are now being recognized (often with surgical palliation or correction) who wish to engage in competitive athletics and require contemporary recommendations. In addition, the increasing penetration into cardiovascular practice of implantable devices (e.g., pacemakers and cardioverter-defibrillators) has created greater numbers of physically active young people with genetic heart diseases who have had devices implanted and who may aspire to participation in competitive athletics. Recently, there has been greater deployment of automatic external defibrillators at athletic events in recognition of sudden death risk in young athletes. Finally, the practicing cardiovascular community deserves and expects the most up-to-date information on which to make important clinical decisions regarding eligibility versus disqualification of competitive athletes.

DEFINITIONS

As in the 3 Bethesda Conferences (1-3), the basic definition of a competitive athlete remains unchanged: One who participates in an organized team or individual sport that requires regular competition against others as a central component, places a high premium on excellence and achievement, and requires some form of systematic (and usually intense) training. Therefore, organized competitive sports are regarded as a distinctive activity and lifestyle. An important principle concerns whether competitive athletes with either known or unsuspected cardiovascular disease can be expected to properly judge when it is prudent to terminate physical exertion. Indeed, the unique pressures of organized sports do not allow athletes to exert strict individual control over their level of exertion or reliably discern when cardiac-related symptoms or warning signs occur that should dictate termination of the activity.

Furthermore, it is emphasized that these AHA/ACC recommendations should not be regarded as a general overriding injunction against all forms of exercise. Notably, this document is concerned only with organized and sanctioned competitive sports participation, such as most commonly found in middle school, high school, and college (1-3), and not with purely recreational physical activities (9). The panel recognizes and strongly supports the well-documented health benefits of exercise, with

regular physical activities encouraged for those people who have been removed from organized competitive athletics, or who elect to participate in a wide range of recreational sporting activities.

Although the Bethesda Conferences and the present document are largely focused on student-athletes of high school and college age (primarily 12 to 25 years old), the panel recognizes the need to also be more expansive with regard to age of the athletes, that is, that participation in competitive athletics now increasingly begins earlier in a variety of youth sports before high school and continues beyond college. This consideration is also substantiated by the realization that inherited arrhythmia syndromes can impact very young people and that patients with genetic, congenital, or acquired heart diseases now engage in competitive athletics at more advanced ages. However, because systematic preparticipation screening in the United States does not usually begin before high school (4), recognition of cardiovascular disease in such younger athletes is unpredictable.

CAUSES OF SUDDEN DEATH IN ATHLETES

The cardiovascular causes of sudden death in young athletes have been well documented in forensic databases (5-9). These deaths occur in both sexes (although more commonly in males, by 9:1); in minorities, prominently including African-Americans and in a wide range of individual and team sports. In the United States, among people <35 years old, genetic heart diseases predominate, with hypertrophic cardiomyopathy being the most common, accounting for at least one-third of the mortality in autopsy-based athlete study populations (5-7). Congenital coronary anomalies (usually those of wrong sinus origin) are second in frequency, occurring in ≈15% to 20% of cases. Other less common diseases, each responsible for ≈5% or fewer of these sudden deaths, include myocarditis, aortic valve stenosis, aortic dissection/rupture (including cases of the Marfan phenotype), atherosclerotic coronary artery disease, ion channelopathies, and arrhythmogenic right ventricular cardiomyopathy. In addition, commotio cordis (i.e., sudden death caused by blunt, nonpenetrating chest blows, associated with structurally normal hearts) is more common as a cause of sudden death in young athletes than many of the aforementioned structural cardiovascular diseases (10).

Regional variations in the causes of sudden death may exist (6-9). Notable among these, arrhythmogenic right ventricular cardiomyopathy has been reported as the most common cause of sudden death in young athletes based on reports from the Veneto region of Italy (8), whereas this disease is a much less frequent cause of sudden death in U.S. athletes (6). In most athletes,

sudden death occurs in the setting of ventricular fibrillation, with the notable exception of aortic dilation that leads to dissection and rupture. For older athletes (>35 years of age), atherosclerotic coronary artery disease is the predominant cause of sudden death (7), but this occurs less frequently in younger participants.

HOW TO USE THE DOCUMENT

Of the 15 Task Forces that make up this document, 9 are disease (or multidisease) related. As before (1-3), specific recommendations for sports eligibility or temporary or permanent disqualification to reduce sudden death risk are formulated around the classification of sports (Task Force 1), which incorporates the principle that training and competition demands may vary considerably among competitive sports (often within sports as well), that the intensity of conditioning may exceed that of competition, and that different levels of physical activity are likely to impact underlying (and unsuspected) cardiovascular diseases unpredictably and in different ways. Furthermore, it is difficult to accurately grade or take into account exercise intensity in various sports because of a variety of factors, particularly motivational attitudes. Finally, as was the practice in prior Bethesda Conferences 16, 26, and 36 (1-3), the panel advises that sports participation recommendations or decisions be based on probable or confirmed diagnostic evidence for cardiovascular disease and not include diagnoses that are ambiguous, possible, or borderline.

The other 6 Task Forces deal with a variety of relevant topics and issues surrounding the risks of the athletic field. These include strategies for preparticipation screening (Task Force 2), use of the automatic external defibrillator on the athletic field (Task Force 12), the impact of dietary supplements and performance-enhancing substances (Task Force 11), commotio cordis as an acknowledged new risk of sudden death during sports (Task Force 13), and medical-legal perspectives (Task Force 15). However, we should underscore that it is not possible to foresee and include in this document every conceivable cardiovascular abnormality or clinical situation relevant to athletes. Eligibility and disqualification decisions in those particular situations would be made on a case-by-case basis with individual clinical judgment. Each of the 15 Task Forces is cited independently as a publication in PubMed.

WHO SHOULD USE THIS DOCUMENT?

These recommendations are designed primarily for cardiologists, internists, pediatricians, family medicine physicians, and other practitioners (including team physicians) charged with decision-making responsibilities

related to the eligibility and disqualification of those competitive athletes with cardiovascular disease.

Although this document essentially focuses on disqualification standards for trained competitive athletes, particularly those in organized sanctioned programs, we also recognize that the principles espoused herein may be, if appropriate, useful when translated to physically active people in other circumstances, for example, in occupations such as police officers, firefighters, and pilots (11), as well as to participants in certain recreational sports activities. In this regard, it should be underscored that many people independently choose to engage in recreational physical activities that may in fact involve high-intensity vigorous training at the same level of some competitive athletes. Therefore, the use of this document for decision making will require certain judgments and extrapolations to account for perceived differences in activity between trained competitive athletes in organized sports and some other physically active people. Hence, it may be possible to selectively apply the principles contained in this document to certain sporting activities that do not meet our precise definition of “competitive.” Nevertheless, excessive and unnecessary exercise restrictions for such people with heart disease could potentially create physical and psychological burdens (particularly in young children) and are discouraged (9).

If the underlying medical considerations are similar to high school- and college-aged athletes, the recommendations in this document could be used to guide decisions relevant to professional athletes with cardiovascular abnormalities. However, professional athletes represent a very small and unique subset of all competitive athletes compared with the millions of student-athlete participants and are generally highly compensated adults with employment contracts (12).

ASSESSMENT OF RISKS

Young people participating in competitive sports with cardiovascular abnormalities have limited control when exposed to extreme and unpredictable environmental conditions (associated with alterations in blood volume, hydration, and electrolytes), as a result of the unwavering demands of sport. These circumstances can enhance the risk for potentially lethal arrhythmias and sudden death, given underlying cardiovascular disease. For many athletes, removal from the lifestyle of athletic training and competition will reduce this risk for sudden death or disease progression, even in the absence of established risk factors related to their disease (13). However, appropriate sports disqualification is only one component of risk reduction, and each of the relevant cardiovascular diseases is attached to its own treatment algorithms, which

can include prophylactic implantation of a cardioverter-defibrillator should sudden death risk be judged unacceptably high (14-16).

The present recommendations, formulated with respect to allowable levels of sports activity, can be regarded as generally conservative. Certainly, this is a prudent posture when the available evidence is limited in many decision-making areas. In this regard, the panel acknowledges that the available data support the principle that participation in high-intensity sports is associated with an increased relative risk of sudden death in the setting of some cardiovascular diseases (6-17). On the other hand, this likelihood cannot be determined with certainty for each patient/athlete, and in fact may be low in certain people. However, at present, additional risk-stratifying tools are not available to independently (and more precisely) guide many of these difficult medical decisions in athletes, particularly for diseases such as hypertrophic cardiomyopathy (18).

Thus, it is possible that the recommendations of this consensus panel (as with the 3 previous Bethesda Conferences) (1-3) will occasionally cause some athletes to be unnecessarily withdrawn from competition. This is, of course, unfortunate, because athletes derive considerable self-assurance, confidence, physical well-being, and even on occasion financial security from these activities. Nevertheless, the increased sudden death risk associated with intense sports is a controllable variable (by disqualification from such sports), and we believe the devastating impact on families and communities of even infrequent sudden death events in this young population underscores the wisdom of our conservative recommendations.

In practice, individual athletes may be encouraged to change their competitive sport involvement from a prohibited high-intensity activity to a more permissible low-intensity one (i.e., usually to class IA). However, the strategy of changing the position in which an athlete competes (e.g., from running back to place kicker in football, or to goalie in hockey or soccer) may be difficult to accomplish in practical terms and therefore should be advised only if the training obligations outside of game situations can be controlled and modified adequately.

RELATION OF AHA/ACC GUIDELINES TO 36TH BETHESDA CONFERENCE

The present AHA/ACC recommendations are intended to update (and are derived from) the prior Bethesda Conferences (1-3). For the most part, the specific recommendations are similar or identical to those in the report on the 36th Bethesda Conference (3). However, selected recommendations of the present AHA/ACC document do in fact deviate from those of the 36th Bethesda

Conference, becoming less restrictive as certain data and observations have emerged since 2005. Nevertheless, numerous “gray areas” persist, for which the assessment of safe versus nonsafe sports participation continues to be uncertain from a medical and scientific perspective, with absolute certainty difficult to achieve for many cardiovascular issues. This may result in differences of opinion among physicians regarding the exercise of clinical judgment in individual cases. Thus, in making certain eligibility or disqualification decisions, some physicians may rely on the more liberal guidelines in portions of the present document, whereas others may take a more conservative approach by adopting the more restrictive recommendations from the 36th Bethesda Conference.

It is also important to underscore that the recommendations in this AHA/ACC document are not intended to establish absolute mandates or the general medical (and legal) standard of care applicable to all cases. These recommendations do not (and cannot) absolutely and arbitrarily replace individual clinical judgment and informed medical reasoning.

The panel recognizes that some practitioners, depending on their perception of risk for specific individual patients, may choose to prudently deviate from the published recommendations in selected clinical situations. Therefore, fully informed athletes with certain conditions may continue to engage in competitive sports in concert with recommendations made by their physician and athletic organization (i.e., high school or college). Individual athletes in the past have taken this option to continue or return to play, and we anticipate this will occur in the future. There will always be tolerance in the system for some flexibility and individual responsibility and choice, after the prevalent uncertainties have been acknowledged.

As with all guidelines, which cannot be regarded as rigid dictum, the specific medical clearance or disqualification recommendation in a particular case is ultimately the responsibility of the managing physician with medically relevant knowledge of the individual athlete-patient. Although neither the 36th Bethesda Conference or the present AHA/ACC recommendations arbitrarily establish the standard of care, these documents nevertheless do provide the framework for good medical practice (19).

It is important to recognize that protection of the athlete's health and avoidance of any unreasonable risks for sudden death during competitive athletics should be considered a priority in exercising individual clinical judgment and making medical recommendations regarding sports participation with a cardiovascular abnormality. The level of importance that the athlete personally attaches to engagement in competitive sports should not be a deciding factor in formulating eligibility recommendations.

Clinicians should also recognize that medical eligibility versus disqualification decisions have become increasingly complex. Also, these decisions may be fraught with potential legal liability risks. Therefore, it is unwise to be unduly influenced by the libertarian (free will) desires of athletes (with an important cardiovascular abnormality) willing to assume medically unreasonable risks to participate in a sport, nor by the managing clinician's personal willingness to comply with the desires of the individual athlete-patient. Finally, it is important to recognize that third-party interests (e.g., on behalf of high schools, colleges, or professional clubs) unavoidably contribute to the complexity in the decision-making process, but these should not outweigh the paramount concern for the athlete's health and safety when making medical eligibility recommendations.

DISCLOSURES

Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers Bureau/Honoraria	Expert Witness	Ownership Interest	Consultant/Advisory Board	Other
Barry J. Maron	Minneapolis Heart Institute Foundation	None	None	None	None	None	None	None
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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be “significant” if (a) the person receives \$10,000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns \$10,000 or more of the fair market value of the entity. A relationship is considered to be “modest” if it is less than “significant” under the preceding definition.

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APPENDIX

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