WORLD ATHLETICS

World Athletics Health Promotion Policy Paper

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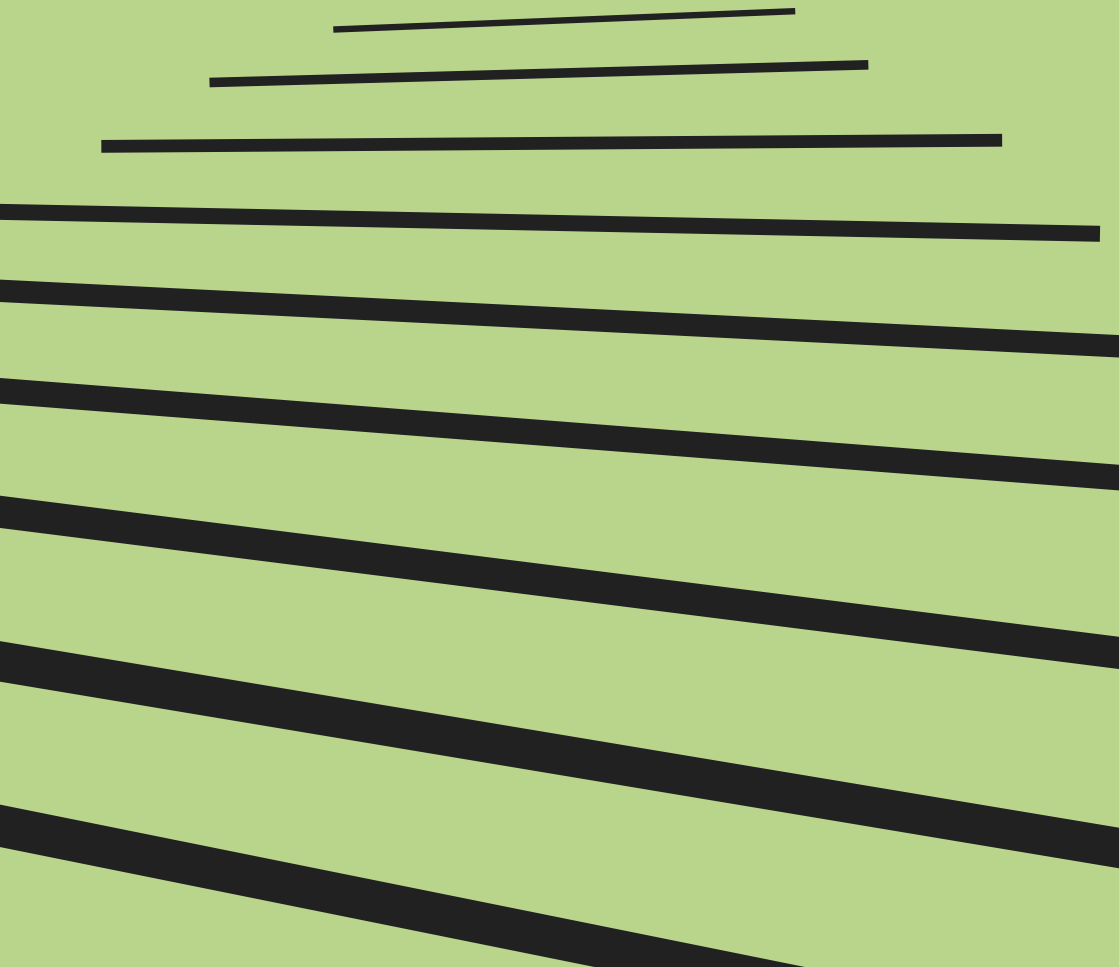

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Sports participation is fundamental from a health-promoting perspective. There is no doubt that regular physical activity reduces the risk of premature mortality. Nevertheless, the evidence suggests that although sports participation is beneficial, injuries and illnesses are possible and significant side effects. Moreover, training and competition can unmask underlying, often unknown, cardiac diseases and risk of sudden cardiac death (SCD).

World Athletics' Competition Rules comprehends a Chapter entitled Medical Rules. This chapter encompasses a set of medical provisions to be adopted by Athletes, Member Federations and Organizers. Indeed, Articles 49.1, 50.1 and 50.2 strongly encourages Athletes and Member Federations to use their best efforts to ensure that Athletes are competing in a state of physical health compatible with elite level competitions in Athletics.

Periodic Health Evaluation

The importance of a pre-participation medical evaluation (PPME) has been acknowledged by the International Olympic Committee, National and International Sports Federations [1,2]. These institutions have recognized the role of preventive strategies in safeguarding athletes' health and have taken the responsibility for the implementation of these measures. A comprehensive pre-participation medical examination should include all aspects of health such as mental health, cardiovascular health, musculoskeletal health, nutrition and dietary habits etc. Furthermore, international cardiac and sports medicine scientific societies advocate for a periodic pre-participation evaluation of athletes on ethical, medical and legal grounds.

The IOC in a Consensus Statement provided further recommendations for periodic health evaluation (PHE). The PHE should be a useful tool for continuous athlete health monitoring. The PHE should serve several purposes: comprehensive assessment of the athlete's current health status and risk of future injury or disease to name a few. Furthermore, PHE typically, is the entry point for medical care of the athlete. This is an extremely useful tool for regular evaluation and monitoring of athletes' health and wellbeing. Important aspects not to be missed are:

- SCD and the detection of risk factors and groups
- Non-cardiac medical problems,
- Risk factors for musculoskeletal injuries,
- Specific medical concerns of the female athlete (e.g. relative energy deficiency syndrome etc.);
- Mental health and wellbeing, sleeping disorders, risky behaviours

The main purpose of the PHE is to screen for behaviours, injuries and medical conditions that may place an athlete at risk for safe participation. Subsequently, if PHE evidence indicates that an athlete is at serious risk, the physician should strongly discourage the athlete from continuing training or competing until the necessary medical measures have been taken.

World Athletics Health and Science Department fully endorses IOC recommendations on PHE. A fundamental part of it is the Pre-Participation Medical Examination (PPME). We strongly recommend that every participant in athletics competitions undergoes PHE by a sports physician, starting with a PPME.

In 2004, the IOC already focused on the problem of possible health risks connected with exercise, sometimes resulting in sudden death in apparently normal healthy athletes. More than 90% of sudden deaths in competitive athletes are due to cardiovascular problems, and less than 10% to other causes (traumatic, respiratory, cerebrovascular or neurological diseases, drug abuse, etc.) [3].

1. Cardiovascular system

International elite athletes participating in World Athletic Series events, represent the population competing at the highest levels within athletics. Nevertheless, reaching such astonishing performances does not guarantee the absence of serious, sometimes life threatening, cardiovascular diseases [4], that might lead to a sudden cardiac death (SCD). The incidence of SCD in young athletes is generally accepted to be 1:50,000 per year. Although the rate is fortunately relatively low, hereditary and congenital abnormalities of the heart are the leading causes of non-accidental death in young athletes [5,6]. The only effective strategy to reduce the incidence of sudden cardiac death in sport is early identification of subjects harbouring unknown cardiovascular conditions.

The cardiac PPME should include a thorough medical and family history, physical examination and a 12-lead ECG. The PPME approach has proven to be effective when it includes also diagnostic procedures, in particular a 12-lead rest electrocardiography (ECG) recording. The most persuasive evidence supporting the efficacy of early identification that includes also a 12-lead rest electrocardiography (ECG), comes from a large Italian study of 42,386 competitive athletes aged 12-35 years, with 26-year follow up [7]. **The study demonstrated a reduction in the incidence of SCD from 3.6/100.000 person-years to 0.4/100.000 person-years, representing a 90% reduction in mortality**. In a systematic review/meta-analysis of 15 studies comparing screening strategies in 47.137 athletes, the sensitivity/specificity of ECG was 94%/93%, history 20%/94% and physical examination 9%/97%, to identify CVD associated with SCD [8]. This is not surprising as most athletes are asymptomatic before SCD and most diseases associated with SCD during sport are not associated with physical signs [9]. In another study, researchers have described the demographics of 134 young athletes with SCD. Of 115 young athletes who died suddenly and who had had a standard PPME without the 12-lead ECG, only 4 (3%) were suspected of having a heart disease, and the abnormality responsible for the death was correctly identified in only 1 athlete (0,9%) [10].

Most of these deaths in athletes <35 years of age are due to several congenital or acquired cardiac malformations. The vast majority of deaths in middle-aged athletes >35 years are due to unsuspected atherosclerotic coronary artery disease.

Based on the official recommendations of the IOC Medical Commission, introduced in Lausanne, on December 10th 2004, the 2009 IOC Consensus Statement, IAAF 2013 Competition Medical Guidelines, and further advancing from those documents, World Athletics Health and Science Department recommends:

Cardiac pre-participation evaluation at the beginning of the competitive season for all participants to identify athletes at risk and reduce the possibility of SCD.

The evaluation should include:

1. Personal history,

2. Family history,

3. Physical examination, and

4. 12-lead rest ECG.

Selected cases with positive personal history, family history of potentially inherited cardiac disease, or positive physical/clinical or ECG findings in step 1, will require further evaluation by a sports-cardiology specialist to qualify the athlete for sport participation. Further evaluation may include trans-thoracic echocardiography, maximal exercise testing with 12 lead ECG, and 24-hour ECG monitoring, cardiac magnetic resonance imaging (c-MRI). Additionally, non-invasive screening of family members may provide valuable information about inherited cardiovascular disease.

Many studies have reported a large variability in terms of SCD incidence and underlying causes. The large variability reported in different population studies is also connected to geographical differences existing in disease prevalence. Hypertrophic cardiomyopathy (HCM) is the leading cause of SCD in the USA [5,11,12], whilst in Italy, arrhythmogenic cardiomyopathy (AC) dominates [13]. These geographical differences may be explained by genetic variation, ascertainment bias of identified cases, and different criteria for pathological diagnosis. Furthermore, within the athletic population certain groups seem to be at greater risk. A significant male predominance in SCD among young athletes has been demonstrated. Male athletes have approximately a 3 times higher risk compared to female athletes [14]. Therefore, a tailored approach should be adopted according to the population (sex, age, competing level, event participated), the geographical location (different disease prevalence in different regions), cultural, economic and healthcare system characteristics of each region. Specific interpretation guidelines have been developed to address the differences among target population in terms of physiological variability [15]. Misinterpretation of the benign physiological changes are not rare, in particular when the examination is performed by a physician with poor experience in sports cardiology. False-positive ECG findings can result in unnecessary, expensive further investigations and to sport disqualification. Adopting such guidelines can significantly reduce the amount of false-positive and false-negative and improve the examination accuracy.

1. Personal history

- Syncope or near-syncope
- Exertional chest pain or discomfort
- Shortness of breath or fatigue out of proportion to the degree of physical effort
- Palpitations or irregular heartbeat

2. Family history

- Family history of one or more relatives with disability or death of heart disease (sudden/ unexpected) before age 50
- Family history of cardiomyopathy, coronary artery disease, Marfan syndrome, long QT syndrome, severe arrhythmias, or other disabling cardiovascular disease.

3. Physical examination

Physical examination should be performed according to the best clinical care and should investigate the presence of:

- Musculoskeletal and ocular features suggestive of Marfan syndrome
- Diminished and delayed femoral artery pulses
- Mid- or end-systolic clicks
- Abnormal second heart sound (single or widely split and fixed with respiration)
- Heart murmurs (systolic grade >2/6 and any diastolic)
- Irregular heart rhythm
- Brachial, bilateral blood pressure >140/90 mmHg on more than one reading

4 12-lead rest ECG

The 12-lead ECG should be recorded on a non-training day, during rest, according to best clinical practice. Interpretation of the ECG abnormalities can be categorized according to the "International recommendations for electrocardiographic interpretation in athletes" defined by Sharma et al. into three groups:

Normal ECG findings: the most common in trained athletes (e.g. sinus bradycardia, first degree AV block, incomplete right bundle branch block, isolated QRS voltage criteria for LV hypertrophy) consistent with athlete's age, ethnical origin and level of athletic conditioning, and that do not require additional testing;

Borderline ECG findings: recent evidences suggest that some of the previously considered abnormal findings, can represent normal variants or the results of physiological cardiac remodelling in athletes, thus not representing pathological cardiac disease. Examples of these borderline features are: left or right axis deviation, left or right atrial enlargement, complete right bundle branch block. When these abnormalities are present in isolation, they usually don't require further investigation. Conversely when 2 or more are present further evaluation is required.

Abnormal ECG findings: all other less common ECG abnormalities should be further evaluated to exclude cardiovascular disease.

2. Pulmonary system

Further to the standard prevalence of asthma in the normal population, the incidence of exercise induced asthma or bronchospasm (EIA or EIB), defined as a transient, reversible, and intermittent narrowing of the airways, occurring about 10-15 minutes after intense exercise, has a prevalence up to 15-20% among endurance athletes.

In the presence of asthma or EIA or EIB, different steps are suggested:

- History (both familiar and personal) and clinical evaluation;
- Diagnostic tests including basal pulmonary function tests and one or more of the following broncho-provocation tests: exercise challenge, pharmacological challenge (methacholine), osmotic challenge (mannitol or hypertonic saline), eucapnic voluntary hyperventilation challenge (EVH), and bronchodilator test.
- Skin or blood allergy tests, if any.

Functional pulmonary evaluation remains crucial for a correct diagnosis and for justified treatment, even considering the limits on pharmacological use imposed by WADA rules and the necessity of a previous Therapeutic Use Exemption (TUE), which is mandatory for some bronchodilator drugs.

3. Musculoskeletal evaluation.

This should consist of a thorough history of current and previous musculoskeletal injuries. To improve the history, self-report forms can be used; these should go into detail for the regions and injury types associated with the sport in question to ensure that no injuries and symptoms are missed. The clinical examination should follow up on any symptoms or injuries reported, consisting of inspection, palpation, range of motion, strength and laxity exams, effusions, muscle testing and relevant functional exams. Additional imaging (e.g. ultrasound, MRI) or more advanced functional tests (e.g. strength tests, balance tests) may be indicated based on history and physical examination.

4. Endocrine, hormonal, metabolic

Based on the provision of appropriate medical monitoring, World Athletics newly approved rule 141 (Rule 3 of the Technical Rule), which aims to clarify and regulate eligibility of Athletes with a difference in sex development (DSD) or transgender athletes to compete in female competition in International Competitions. In fact, the rule also provides guidance for the management of any DSD cases that might arise at the national level, based on the results of a routine pre-participation or other medical examination conducted by an athlete's national federation Medical Officer or other appropriate medical professional. Therefore, World Athletics Health and Science Department strongly recommends to include endocrine/gynaecological assessment as a part of the PPE at national level.

5. Other Systems

Medical conditions in systems other than the cardiovascular and pulmonary systems are also very common in elite athletes. These conditions can occur immediately before competitions, during periods of training in preparation for competitions, and after competitions. A spectrum of medical conditions can occur in athletes across a number of medical systems.

World Athletics Health and Science Department follows the 2009 IOC Consensus on PHE and recommends examining the following systems during the PPME: According to best medical practice guidelines, assessment of non-cardiac medical conditions during a PPME should include an appropriate systematic medical history; a directed physical examination and selected special investigations. Routine investigations that are recommended are urine analysis (males and females), tests for iron stores, etc. Sports Physicians performing PPME should take these important aspects into consideration when examining athletes' health status.

- Allergies
- Dermatology
- Ear, nose and throat
- Gastrointestinal
- Haematology
- Infections and immunology
- Mental health
- Nutrition and energy intake
- Nervous system (neurological)
- Ophthalmology
- Urology/Gynaecology

Financial consideration for implementation of a PPME program

A central argument that limited the implementation of PPME in most countries is connected to the financial implications of this preventive approach. Costs for implementing a PPME program vary greatly between geographical areas and countries. The large variability is mostly related to the national healthcare system organisation and the academic/medical education system. Taking as an example the costs for performing one full cardiac PPME (which includes medical and family history, physical examination and a 12-lead rest ECG) could vary from 30€ in Italy, to 145£ in the UK and even more in other countries. In some countries this preventive strategy is already performed on a regular basis as mandated by national laws. One strategy to reduce the costs of the cardiac PPME and mostly of secondary unnecessary investigations, is the adoption of the most recent interpretation criteria for ECG evaluation. Cost-effectiveness studies from the USA have reported the cost per athlete-life saved to range from $44,000 to $204,000 [16,17]. In a British study of nearly 5000 athletes from 26 different sport disciplines, the adoption of the most recent ECG interpretation criteria was associated with the reduction in the proportion of secondary investigations following screening, thus reducing the costs of ECG screening by nearly 25% without compromising the ability to diagnose serious cardiac diseases [18,19].

Supporting athletes' health and wellbeing through periodical health evaluation

There is no evidence that PPME deters young athletes from participating in competitive sports. On the contrary, periodical health examination promotes safe exercise, is likely to raise awareness on cardiac symptoms, mental health and wellbeing, musculoskeletal unbalances and predisposition to injuries, wrong nutritional habits and supplements use, and to promote a healthier lifestyle.

Another example coming from a cardiac PPME prospective, non-randomized control trial of 952 high school athletes, demonstrated that athletes undergoing ECG screening were likely to be satisfied with their evaluation and felt safe during competition and training [20]. This supports the concept that all athletes should receive a PPME, as it has a positive impact on their athletic life. Furthermore, involving athletes and their families, coaches, team managers and local communities, in the implementation of the PPME program, reassures all parties that athletes' health is promoted and safeguarded.

To summarize, World Athletics Health and Science Department feels that a pre-participation medical evaluation or periodic health evaluation could contribute to:

- Evaluation of athletic population and detection of asymptomatic underlying diseases;
- Prevention of acute unexpected health problems or life threatening conditions;
- Appropriate and precocious management of health conditions;
- Decision on the opportunity to participate in intensive sport activity;
- Support athletes' physical and mental health through regular evaluation and counselling;
- Opportunity for athletes to have continuous medical and health education;
- Evaluation of medication or nutritional products, helpful to avoid unwanted violation of WADA Anti-Doping rules, and, if any, help or suggestions for applications of Therapeutic Use Exemptions.

Note: World Athletics Health and Science Department strongly encourages sports physicians performing PPME to read the 2009 IOC Consensus statement for Periodic Health Evaluation.

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