Review article

# Can athletes' health be protected on a budget? The challenge to small international federations and/or small national Olympic committees

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## ABSTRACT

This article on protecting athletes' health on a budget – the challenge to small International and National Sports Federations (ISFs and NSFs) and/or small National Olympic Committees (NOCs)- is an eminence based medical opinion. We recommend a Pre-Participation Examination (PPE) as the main pillar of protecting athlete health at all levels of performance. A low-budget approach has to consider what is included and what is excluded initially. In our view, it should include a medical history, physical examination and a 12-lead resting ECG. Laboratory tests of a basic degree are at the discretion of the examing physician.

The purpose of this article is to stress the pivotal role of the PPE for identifying diseases, illness or injury before they occur. It may also be used to build a rapport with the athlete. The evidence base is limited on this subject, but some references are provided. Hopefully, informed by some suggestions in this article, more targeted research can be done.

The PPE is an opportunity for identifying potential risk factors and health problems in athletes. Sport and physical activity that place large loads on metabolic systems and skeletal structures can cause disease and injury, as well as unmask pre-existing, but clinically asymptomatic, illness and injury. In practice, the content and structure of the PPE varies widely. There is currently no uniform mechanism for collecting important information on injury and illness, and, because of that, its efficacy has not been fully investigated. There are different levels of a PPE and our references show that, over the years a budget does not prevent us from obtaining useful information for clinical and research purposes. As we achieve more harmony in the PPE, this will become even more likely. This latter consideration is why the search for a standard electronic PPE that can be compared across many centers and practices is on-going.

The question is whether a budget can be set for health care? The answer is "yes". This is

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sometimes forced upon a small NSF, ISF or NOC and must be done to get the "best bang for the buck". It is important that basic good clinical practice is followed by an experienced sport medicine physician performing the PPE for the best results. This, in a phrase, would be an emphasis on history, physical examination, a 12-lead resting ECG and some office-based tests. Further means that promise maximum beneficial effects on health while being of low cost is advice on nutrition and psychological assistance in dealing with injuries.

There will be a need for further hospital-based tests, even though only in a small percentage of athletes, to follow up on findings. This has to be considered when developing a PPE programme and cost transfer models should be investigated and proposed.

**Keywords:** sports medicine, athlete health, pre-participation examination

## INTRODUCTION

Protecting athletes' health has become a major theme for sports organisations and particularly International Sports Federations (ISFs) and National Olympic Committees (NOCs) over recent years with the International Olympic Committee being a major proponent. There are several avenues to achieving this objective and for less popular sports, or small ISFs and NOCs, costs are an essential consideration in determining their approach.

In this article, we propose a low-budget approach to protecting athlete health consisting of a Pre-Participation Examination based on history, physical examination, basic laboratory tests and resting ECG which can be complemented by nutrition advice and psychological support for greater benefit. The expenses for the former should in fact be further reduced the more it is used and the more standardized approaches and tools are consecutively developed.

### The Pre-Participation Examination (PPE)

The PPE should consist of an individualized history and physical examination by an experienced trained sport medicine physician putting an emphasis on an athlete's history of reported symptoms and signs as pointed out by Lollgren et al[1] and Roberts et al[2]. A simple self-administered history [(PAR-Q), Table 1][3] will usually be less useful than a supervised history (Table 2), but is better than no history.

**TABLE 1. Canadian Society for Exercise Physiology www.csep.ca/forms**

**Self administered PPE (valid for 12 months) (ref. 1.) Physical Activity readiness-Questionaire (Canada). PAR-Q**

- Has your doctor ever said that you have a heart condition and that you should only do
- Physical activity recommended by a doctor?
- Do you feel pain in your chest when you do physical activity?
- In the past month have you had chest pain when you were not doing physical activity?
- Do you loose your balance because of dizziness or do you ever loose consciousness?
- Do you have a bone or joint problem (back, knee, hip) that could be made worse by a change in your physical activity?
- Is your doctor currently prescribing drugs (e.g. water pills) for your BP or a heart condition?
- Do you know of any other reason why you should not do physical activity?

If YES to one or more questions see your doctor before exercise.
If NO to all questions only start exercise if you have no infection or may be pregnant.

**TABLE 2. There are 12 key questions in the physician supervised history**

1. Do you see a physician regularly for any particular medical problem
2. Medicines: Does the athlete take any over the counter, other non-prescription or prescribed medication? Note potential side effects
3. Allergies: Is the athlete allergic to any medication or bee stings.
4. RT: Does the athlete have asthma (Wheezing), hay fever or coughing spells after exercise? This suggests asthma and may call for spirometry tests.
5. CVS: Has anyone in the athlete's family died suddenly before the age of 50 years. Is there a hx of dyspnea, fatigue, palpitations, chest pain or syncope.
6. Dizzy: Has the athlete ever passed out during exercise or stopped exercising because of dizziness? Vertigo or vital organ system abnormality must be thought through like cardiac, vascular or neurological systems etiologies.
7. CNS: Does the athlete has a history of concussion, convulsions and how often. Is the athlete's sleep pattern normal?
8. GU: Age of onset and frequency of menstruation, urinary incontinence and /or frequency.
9. Does the athlete have only one of any paired organ (eyes, kidneys, testicles, and ovaries)?
10. Is the athlete familiar with nutritional and psychological advice. Are they on a vegetarian diet?
11. Has the athlete ever broken a bone, had to wear a cast, or had an injury to any joint?
12. Does the athlete wish to discuss anything further with the physician?

***History within the PPE:*** The history should contain the medical history, the family history with an emphasis on premature sudden cardiac events in the family and the history of symptoms during previous sports activities. In addition, the sports physician should ask for possible congenital connective tissue or cardiac diseases, e.g. Marfan's syndrome, and for effort-related symptoms like dyspnoea, chest pain, dizziness, syncope and palpitations. Congenital diseases with higher risks are, for example all cardiomyopathies (CMP), especially hypertrophic CMP, but also hypertension and electrical heart diseases such as channelopathies or Wolfe-Parkinson-White syndrome (WPW).

Obviously, current symptoms and complaints have to be inquired about and scrutinized. After pain, fatigue is the second commonest symptom reported by athletes. Overtraining, cardiac disease, asthma, anemia, sleep disorders and relative energy deficiency syndrome must be considered in a fatigued athlete.

***Physical examination*** should consider signs of Marfan's Syndrome with signs of being tall compared to their peers (e.g. in basketball players), long thin fingers and toes, eye lens dislocation, heart valve murmurs of aortic insufficiency and deformed thoracic cage. Cardiac auscultation has to be done in the supine and standing position to better hear a possible systolic murmur due to Hypertrophic Obstructive Cardiomyopathy (HOCM), mitral valve insufficiency or prolapsed valve. Blood pressure measurements are performed in the sitting position and peripheral pulses (carotids, femoral and radial artery) should be checked (coarctation of the aorta), followed by lung auscultation and abdominal palpitation.

Airflow obstruction in a patient with a history of exercise-induced wheeze, dyspnea or chest tightness is suggestive of asthma and will require pulmonary function tests[4]. Because of the high an incidence of 3-50% of asthma in sport, the examining SM physician should have a low threshold to perform spirometry. Ideally, this will start with office spirometry pre- and post-bronchodilator



European Journal of Sports Medicine

before physiological and/or pharmacological challenge tests or hypoxic voluntary hyperventilation tests are considered.

Lymph nodes in neck and groin should be checked and the testes palpated for a possible tumor in young males (needs supervision).

The documentation of replies in the history and all findings of the physical examination have to be documented in a uniform and standardized way. There is a need for such standardization as outlined by Wingfield et al[5]. This ideally will progress to an electronic form on a tablet or other electronic device which greatly facilitates standardization.

If we can implement an electronic PPE with a central data repository, Roberts et al[2], maintain that we can then begin to answer the following key questions that may improve athlete outcomes:

What is the prevalence of general medical conditions in athletes compared to non-athletes?
What is the prevalence of disorders that primarily affect athletes?
Does the prevalence of athlete-related disorders change with age?
Should the exam vary with age and / or sex?
Are there low-, medium-, and high-risk sports activities with differing PPE requirements?
At what interval should the exams be completed (every1, 2, 3, or 4 or more years)?
Should exam intervals be based on level and/or risk of sports participation?
How do we research the issues to direct future exams and care for athletes?
Can the PPE be used to reduce both sport-related and all-cause death and injury?
Where and how do we implement programming with a human-centered and evidence-based approach?

## The resting ECG

While having a low specificity, history and physical examination are classical tools of each physician and belong to the mandatory medical armamentarium of Good Clinical Practice (GCP). Unfortunately, a clinical exam (history and physical examination) will be performed by only 47% of physicians in Europe, with slightly higher numbers in Germany, but still not a satisfactory number of 100%.[6] This basic tool therefore needs to be promoted and supported as an essential component of a PPE. Importantly, the history and clinical findings should always be complemented by a 12-lead resting-ECG to increase the yield of the screening.

***ECG, history and physical examination*** on their own may often have false positive findings. For example, false positives with physical examination alone would lead to further testing, if not combined with the ECG. When combined with an ECG at rest, fewer false positives occur (14.5 vs. 2.8 %)[7].

High rates of false positive findings in the ECG interpretation of athletes have been a major problem over recent years. Sensitivity and specificity of ECG have remarkably increased using specific evaluation criteria for athletes (Seattle criteria, and more lately the "refined" criteria). A new set of international criteria are due in early 2016 for publication. An automatic evaluation of the resting 12-lead ECG by a computer program, based on the Seattle criteria, is now commercially available. This has made the interpretation more reliable then by a physician's visual analysis alone.

The American Heart Association already recommends cardiac screening for all athletes as necessary and ethical, but only by physical examination and personal history. But, since the physician is ideally already seeing the patient, the addition of an ECG would add little time and cost. Telemetric (or telephonic) transmission services may further overcome the argument against an ECG as part of the PPE in large land or remote areas.

The knowledge of the sports medicine physician may have to be increased by education in ECG interpretation, and this is increasingly addressed by International courses and web-based learning.

The selective data capturing at the time of screening might soon be amended by more continuous monitoring that is actually being done by the athletes themselves. A multitude of fashionable devices and easy-to-use Apps allow for permanent recording of different physiological parameters – at basically no cost. Athletes might for example observe and record their early morning heart rate. A rise in the morning heart rate is suggestive of infection or overtraining. The use of such wearable technology will add more objective information to the subjective history findings and surely play an increasingly important role in the future.

## Laboratory tests

A set of basic laboratory tests should be done as part of the history, physical examination and resting ECG and include

***Urine:*** an inexpensive urine sticks to show urogenital infection or renal problems.
***Blood count:*** A low haemoglobin and haemoglobinopathies are screened for.
***An ESR or CRP*** to exclude systemic inflammation (might necessitate further tests)
***If indicated:*** Se Ferritin, TSH may be indicated if the athlete is complaining of fatigue.

## Radiological screening tests

A chest radiograph is not indicated for primary screening a young patient. More sophisticated, invasive and expensive radiological tests to further investigate findings during history and physical examination might however become indicated. In order to keep costs at a minimum, these must only be ordered by physicians knowledgeable of when the result will alter the management of the athlete.

## The PPE Visit as an Opportunity

We believe by adding during the PPE visit advice on nutrition and some psychological support, especially to facilitate injury rehabilitation, we are delivering a comprehensive Sports Medicine consultation for the athlete on a budget who did not show any conspicuous findings in the history, physical examination, laboratory tests and resting ECG. That in no way implies that individual hospital consultations, tests or further dietetic, psychological or paramedical advice should not be sought if deemed necessary based on the PPE results.

### *Sport Nutrition advice*

Taking the time to educate athletes on nutrition is a low cost measure that might greatly benefit their wellbeing, health and performance. The perfect food does not exist, so only a varied diet that meets the athlete's energy needs will allow a balanced supply of all nutrients. Regular educated eating habits will maintain energy levels and will prevent hunger, over-eating and mood swings. Portion size will be determined by the energy needs. The least processed foods are those with the most nutrients. Most foods need a balanced diet to assist absorption.

### *Hydration*

Before, during and after physical activity, it is necessary to ingest oral fluids to replenish the fluid lost. A liquid or semi-liquid diet, are the safest way to recover from physical activity stress. The athlete should be told never to wait until they become thirsty. They should drink continuously during the day in small volumes, and in high volumes when exercising. Hydration is also needed to cool the body. Since water makes up 60% of total body weight, weight loss of as little as 2 kg in a 70 kg person after an event is a sign of poor hydration during that event. A measure of the specific gravity of urine is the best office method of determining hydration. The color, frequency and volume of the urine passed are also a clue to hydration.



European Journal of Sports Medicine

### *Recovery foods*

These need to be started immediately at the end of a training session. They include carbohydrates (CHO), protein and fluids. The least processed CHO are the best and include wholegrain CHO, others include potatoes, rice and noodles.

The correct choice of food for the correct macronutrients (Carbohydrates, proteins and lipids), is essential and is more important than the choice of micronutrients (vitamins, mineral salts and antioxidants, present in fruits and vegetables).

### *Conventional ideal diet*

Scientific communities and scientific evidences have currently concluded that a correct diet should include CHO 50-60% of total energy intake, with preference for foods with a low glycaemic index and increasing the intake of fruit and vegetables. Each gram of carbohydrates provides 4 kcal. Lipids should be no more than 30% of total energy intake. Each gram produces 7 kcal. Most lipids should be monosaturated and polyunsaturated. Polyunsaturated lipids are essential as they only enter the body via the diet. They can protect against inflammation. Proteins ideally make up 10-20% of total calories, and one should choose vegetable proteins and fish instead of meat. It is necessary to aim for an intake of 0.8-1.0 g/kg of body weight to ensure the protein needs are met (important with vegetarians). Protein supplies 4 kcal/g but should not be the most important source of calorie intake.

### *Bone strength*

This is partially dependent on gravity related exercises. The important micronutrients are calcium and Vitamin D. Some dairy foods like low fat milk and yogurt today have added Vitamin D and Calcium. Exposure to sunlight is required to build vitamin D in the skin.

### *Fruit and vegetables*

These are a major source of anti-oxidants, vitamins and minerals. They must be taken in sufficient amounts to get all the nutritional benefits. They also act as a "filler" when an athlete is hungry.

### *Supplements*

With an ideal diet as outlined above supplements should not be necessary. If a decision is made that a supplement of protein is necessary in the weeks of heavy weight training, the athlete should ensure the product is from a reputable company and ideally endorsed by the International Federation physician or dietician.

A study in the last 10 years showed that supplements randomly taken from the shelf in many countries had an average of 18% contamination with prohibited substances according to the Prohibited List of the World Anti-Doping Agency. Remind the athlete they are responsible for what goes into their body.

### *The art of eating*

The athlete should keep control over the environment where their food is consumed. Food should be consumed ideally in a dining hall. Eating on the "Hoof" is not good for digestion. Athletes also need to protect their food and drinks from contamination. Every meal should be an event that allows sufficient time for absorption afterwards.

### *Psychology support*

Sports injuries are unfortunately a very important part of sports and Sports Medicine. Sports

psychology assistance in dealing with these injuries is a very important part of the sport psychologist role in rehabilitation. The benefits have been proven experimentally.

## *Psychology assistance with injuries*

Sport injuries frequently have profound negative consequences on the physical health of sports participants. They also have the potential to cause a great deal of psychological disturbance through increased anger, depression, anxiety, tension, fear and decreased self-esteem.

Sport injuries often result in an immediate imbalance and disruption to the lives of the injured athletes including loss of health and achievement of athletic potential. Thus, including a component that addresses psychological recovery from a sport injury in the traditional injury rehabilitation program is critical. It assists in preventing and/or reducing negative psychological consequences resulting from the injury and promoting the return to active involvement in sport-related activities.

## *Interventions*

Only six intervention studies specifically addressed the effectiveness of the psychological interventions in the context of rehabilitation from sport injury. These findings showed that psychological interventions, under the supervision of a Sports Psychologist, utilizing guided imagery, goal setting, or relaxation are often associated with decreased negative psychological consequences, improved coping and reduced re-injury anxiety.

***Guided imagery*** was applied in injured athletes along with relaxation and other psychological techniques in order to facilitate increased concentration and vividness specific to a given task. Imagery was traditionally defined as "the process of imaging the performance of a skill with no related overt actions".

***Relaxation*** is another cognitive strategy that has been used to reduce stress, anxiety and mental/physical strain in the studies reviewed. By increasing the athletes' awareness of their physiological and psychological arousal level, relaxation techniques can help injured athletes regulate their levels of arousal for achieving optimal outcomes. Evidence showed that relaxation can reduce the feelings of depression, frustration and anger through lowering heart rate, breathing rate, metabolic rate and blood pressure. One useful relaxation technique often taught to athletes is engaging in deep breathing.

Incorporating goal setting is a technique to reduce psychological distress during the rehabilitation process. Other techniques such as Education Acceptance and Commitment (ACT) sessions, basic micro-counselling skills and written expression have been found to be effective in mitigating the post-injury psychological distress among injured athletes. ACT is a third-wave Cognitive Behavioral Therapy (CBT) approach.

The application of basic micro-counselling skills (psychologist being attentive, active listening, empathy and reflection) by a mental health professional has also been shown to have the effect of enhancing the psychological wellbeing of injured athletes during the rehabilitation process. Through the use of basic micro-counselling skills, injured athletes are provided with emotional and listening support, which are key functions of the counselling process. Similarly to engaging in verbal expression, one of the hallmark elements of "talk therapy", written expression has also been shown to be an effective form of emotional disclosure that contributes to improving the psychological rehabilitation of injured athletes. Expressive writing allows injured athletes to construct written narratives depicting their emotional experiences as well as engage in a self-regulatory process facilitating an increased sense of control over their emotions.



European Journal of Sports Medicine

## CONCLUSION

We consider a PPE as the pillar of protecting athletes' health. The good clinical care for athletes on a budget has an emphasis on the history, physical examination, basic laboratory tests (or biochemical tests) and resting ECG by a sport physician. Minimal use of physiological and biochemical tests and abstaining from any standard radiological tests makes this exercise cost-effective for small ISFs, NSFs and NOCs. A small budget is necessary for follow-up of any abnormality found during the initial screen.

The use of initial advice on nutrition and psychology, especially after injuries, is also part of our recommended low-budget approach. Ensure that the athlete keeps a joy for food and follows a varied diet.

The effectiveness of psychological intervention in reducing post-injury psychological consequences and improving coping during rehabilitation has been demonstrated in the medical literature. Specifically, guided imagery and relaxation were shown to be associated with improved psychological coping and reduced re-injury anxiety. An athlete should know these facts before an injury occurs and seek advice of a Sports Psychologist if an injury occurs.

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