Critical appraisal of 'The effectiveness of screening history, physical exam, and ECG to detect potentially lethal cardiac disorders in athletes: a systematic review/meta-analysis.

18 June 2015

Harmon A, Zigman M, Drezner J. J. Electrocardiology 48(2015) 329-338.

Background

This is a critical appraisal of the above paper which is set in the context of screening of athletes to identify those at risk from sudden cardiac death. The authors have published extensively on this topic and are proponents of screening. Although a number of appraisal tools exist for the medical literature, none could be identified for diagnostic test accuracy reviews either via a web search or in discussion with the head of the Cochrane DTA initiative. An appraisal checklist has been prepared and used – the checklist is available as Appendix 1 below.

A. <u>Are the results of the review valid</u> ?

1. Did the review address a clearly focused question?

The review question is posed in the title of the paper as: The effectiveness of screening history, physical exam, and ECG to detect potentially lethal cardiac disorders in athletes'. The inclusion criteria were: the study reported on the outcomes of CV screening in athletes using history, physical exam and ECG, this were based on the American Heart Assn recommendations or similar(not specified), ECGs had to be interpreted using modern standards defined as attempting to account for the physiologic changes of training on the athlete heart

2. Did the authors look for the appropriate sort of papers?

They sought articles examining the efficacy of screening with history and physical exam (based on AHA guidelines) and ECG

Is it worth continuing?

3. Do you think the important relevant studies were included?

The search was conducted on six databases: Medline, Embase, CINAHL, SportDiscus, Cochrane Library and PEDro. The search dates were Jan 96 to Nov 14. Only English language papers were included. Fifteen studies were included in the review.

4. Did the authors do enough to assess the quality of included studies ?

The authors applied an unproven quality assessment of seven criteria, all were given equal weight:

- description of how participants were selected,
- whether sample is representative of the population,
- data collected prospectively,
- current testing method,
- CV history and examination according to AHA,
- outcomes reported by individual tests (history, physical exam, ECG), abnormal screening tests were evaluated by appropriate diagnostic test.

The results reported that the quality assessment ranged from 5-7 and the quality criteria by study are not presented separately. The authors report that 10 of the 15 studies did not have a representative sample. Also 9 of the 15 studies used older criteria than AHA. These issues together with the restrictive inclusion criteria raise concerns about the reliability of the results.

5. If the results of studies have been combined, was it reasonable to do so ?

The results were combined but the fact that 10/15 of the studies were not a representative sample and that the overall age range was 5-39 years suggest that the results need to be interpreted cautiously.

B. <u>What are the results</u> ?

6. What is the overall result of the review ?

For ECG, sensitivity was reported as 94% (95%CI 79%-98%) and specificity as 93% (95%CI 90%-96%). Not surprisingly ECG is more likely to indicate disease than either history or physical exam. Likelihood ratios for ECG are reported as above 10 for the positive and below 1 for the negative. This also suggests that ECG is more effective at detecting CV disease than the other tests and less likely to deliver false negatives. The authors report that ECG identified one abnormality in every 294 athletes but the numbers are higher for specific cardiac abnormalities such as hypertrophic cardiomyopathy (HCM) stated to be 1 in 500 and thought to be the leading cause of death in athletes.

7. How precise are the results ?

The authors provided 95% confidence intervals

C. <u>Will the results help my local situation</u> ?

8. Can the results be applied locally ?

These results imply that both history and physical exam are not effective at identifying athletes at risk. The study shows a false positive rate of 6% (range 2% to 21%). Using the authors own figures, and worse case, to identify 100 abnormalities 29,400 athletes would need to be screened. Of these 100, approximately 6 (range 2-21) would be false positives. Assuming a cost of an ECG and report at £100 then the cost per identified anomaly would be £31,000. For HCM the cost would be over £50,000 per detected HCM abnormality.

9. Were all important outcomes considered ?

The authors looked for the main outcomes associated with SCD. They were unable to identify any reports of coronary artery abnormalities, this would not normally be pick up on ECG but by history

10. Are the benefits worth the harms and costs ?

Although ECG is shown to be more effective that other tests at detecting potentially lethal cardiac abnormalities, it cannot be used alone but requires also medical history and a physical exam. Using the data in the report, and assuming a cost of an

ECG and report at £100 then the cost per identified anomaly would be approximately £31,000

Summary

The systematic review by Harmon et al examined the effectiveness of screening, physical exam and ECG to detect potentially lethal cardiac disorders in athletes. The key word is 'potentially' as not all detectable abnormalities translate into morbidity or even mortality. The conduct of the review generally follows acceptable methods however the studies included do not meet the inclusion criteria laid down by the authors, and the assessment of the quality of included studies is based on the authors own criteria and the results of the quality assessment are not made available to readers. Based on the authors data, detection of abnormities is associated with a cost of approximately £31,000 for any cardiac issue or approximately £50,000 for HCM. In addition although the authors state that ECG is superior to the physical exam and family history they recognise that these tests do have value in identifying potential problems and so cannot be discounted as of little value. The cost of these tests need to be added to the estimated costs of ECG.

Phil Wiffen
Oxford Systematic Review Services
June 2015

Appendix 1

Ten questions to make sense of a DTA review

Adapted from Oxman AD et al Users Guide to the Medical Literature VI How to use an overview. JAMA 1994; 272 (17): 1367-71 and the CASP diagnostic test study checklist (May 13). QUADAS-2 Whiting et al. Annals of Int Med.155(8)pp529-37

For each question answer : YES, NO or DON'T KNOW

A. Are the results of the review valid ?

1. Did the review address a clearly focused question ?

e.g. the population, test, reference standard, setting and target condition

2. Did the authors look for the appropriate sort of papers ?

Did they deal with the issues and have appropriate study design relevant to diagnostic tests ?

Is it worth continuing ??

3. Do you think the important relevant studies were included ?

Look for search methods, reference list use, unpublished studies and non English language

4. Did the authors do enough to assess the quality of included studies ?

Look for evidence of an assessment of study quality. This should include items such as how participants were selected, whether sample is representative of the population, data collected prospectively, current testing method. Assessing risk of bias is not yet fully developed in DTA studies

5. If the results of studies have been combined, was it reasonable to do so ?

Were all participants included in the analysis?

B. <u>What are the results</u> ?

6. What is the overall result of the review ?

Is there a clear numerical expression? Have the authors calculated sensitivity and specificity? The reporting of positive or negative predictive values should be appraised negatively.

7. How precise are the results ?

Have the authors reported 95% Confidence intervals ?

C. <u>Will the results help my local situation</u> ?

8. Can the results be applied locally ?

9. Were all important outcomes considered ?

10. Are the benefits worth the harms and costs ?

Think about the effects of false positives and false negatives

Phil Wiffen May2015 (phil.wiffen@ndcn.ox.ac.uk)