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## INTRODUCTION

Electrocardiograms (ECGs) are used regularly in Pre-Participation exams for most athletes in all settings. They are useful when used properly and interpreted accurately for the right information. ECGs have the potential to positively affect the sports medicine world by accurately detecting athletes who possibly have underlying cardiac pathologies. The aim of this review is to identify if ECGs can accurately detect cardiac pathologies in those athletes who are between the ages of 13-25. Challenges and positive experiences are interpreted and highlighted throughout the review.

## OBJECTIVES

The purpose of this study was to determine if Electrocardiograms (ECG) were accurate in detecting cardiac pathologies in athletes ages 23-25.

## METHODS

### Search Strategy

- athletes ages 13-25 OR “young athletes”
- “electrocardiogram”, “ECG”
- “ECG accuracy”, “ECG detecting cardiac pathologies”, ECG accuracy AND detecting cardiac pathologies”

### Databases searched

- Google Scholar
- PubMed
- Science Direct

### Inclusion Criteria

- Young athletes (ages 13-25)
- Athletes participating in sport
- The use of electrocardiograms
- The accuracy of electrocardiograms
- Study must be published within the past 10 years (2012 to current)
- Study must include the assessment of cardiac pathologies

### Exclusion criteria

- Include the general public
- Include those older than 25 or younger than 13.
- Studies that did not utilize ECG’s.
- Studies that assessed other pathologies besides those involving the cardiac system.

## RESULTS

| Study Characteristics                   | [Fudge et al. <sup>1</sup>  | [Price, et al. <sup>2</sup>   | [Williams, et al. <sup>3</sup>   |
|---|---|---|--|
| <b>Study Title:</b>                     | Cardiovascular screening in adolescents and young adults: a prospective study comparing the Pre-participation Physical Evaluation Monograph 4th Edition and ECG   | Electrocardiography-inclusive screening strategies for detection of cardiovascular abnormalities in high school athletes  | Performance of the American Heart Association (AHA) 14-Point Evaluation Versus Electrocardiography for the Cardiovascular Screening of High School Athletes: A Prospective Study   |
| <b>Participants</b>                     | 1339 Participants (male 49%) (female 51%) for this study were chosen through the Nick of Time of Foundation (NOT), a non-profit organization that provides free heart screenings for students, athletes, and young adults.  | 2,017 high school aged athletes were included in the study. The participants were a mixture of both male (71%) and female (29%) athletes from the ages of 14-18 .   | There was a total of 5003 high school students between the ages of 13-19 were screened for this study, only 3620 . Participated in the study. Of the student athletes who participated, 46.2% were female and 53.8% were male.   |
| <b>Intervention investigated</b>        | Cardiovascular screening using Physical eval Monograph 4 <sup>th</sup> edition (PPE-4) and ECG  | ECG use in high school screenings   | ECG vs 14-point evaluation in high school athletes   |
| <b>Inclusion and exclusion criteria</b> | <b>Inclusion:</b> Young athletes (ages 13-25 ) Athletes participating in any sport, electrocardiograms, Accuracy of ECGs.<br><b>Exclusion:</b> none   | <b>Inclusion:</b> Young athletes participating in sport, use of ECGs, accuracy of ECGs.<br><b>Exclusion:</b> Random selection took place except for those that had known cardiac pathologies were excluded from this specific study.  | <b>Inclusion:</b> Young athletes participating in sport, use of ECGs. accuracy of ECGs.<br><b>Exclusion:</b> none  |
| <b>Comparison intervention</b>          | 12-point ECG vs. Evaluation Monograph 4 <sup>th</sup> edition   | none  | ECG vs 14-point evaluation   |
| <b>Outcomes measure</b>                 | Detection of abnormal rates and rhythm of the hearts electrical waves indicating cardiac abnormalities.   | Detection of abnormal rates and rhythm of the hearts electrical waves indicating cardiovascular abnormalities.  | Detection of abnormal ECG tests to detect Cardiovascular pathologies.  |
| <b>Findings/Results</b>                 | ECG has less false-positive rates (5%) compared to the 30% false-positive rate in the PPE-4 questionnaire. <sup>1</sup><br><br>Detection of abnormalities using ECG in the test group was in 5.4% (n=72). <sup>1</sup> The most common abnormalities were T wave inversions (1.5%), Q waves (0.8%), left axis deviation (0.8%), rights ventricular hypertrophy (0.6%), and ventricular pre-excitation (0.4%). <sup>1</sup><br><br>Student non-athletes are more likely than student athletes to report signs and symptoms of cardiac pathologies (p<0.001) <sup>1</sup> | The modern interpretation and use of ECG should be used to help detect cardiac pathologies. <sup>2</sup><br><br>This study revealed a low ECG false- positive rate (2.8%) compared to physical examination (14.5%) <sup>2</sup><br><br>5 primary outcomes were measured and identified by ECG. Hypertrophic cardiomyopathy (n=1), Wolff-Parkinson-White (WPW) (n=4). 4 secondary outcomes were also detected. Bicuspid aortic valve (n=1), aortic root dilation (n=2), and left ventricular hypertrophy secondary to hypertension (n=1). <sup>2</sup> | The ECG should be used over the 14-point eval. The ECG reveals less false-positive rates compared to the 14-point eval. <sup>3</sup><br><br>Of the 3,517 participants, 103 (2.8%) were found to have abnormal ECGs. <sup>3</sup> T- wave inversion (n=20), ST-segments depression (n=5), Pathogenic Q waves (n=25), Complete Right bundle Branch Block (RBBB) (n=2), Left atrial enlargement (n=4), left axis deviation (n=9), right atrial enlargement (n=2), right ventricular hypertrophy (n=2), ventricular pre execution/WPW (n=9), Prolonged QT(n=7), ventricular arrhythmia (n=1), premature ventricular contractions (n=11), sinus tachycardia (n=2), other (n=4) <sup>3</sup><br><br>Sensitivity rates of the ECG vs the 14 point questionnaire (87.5% vs 18.8%) <sup>3</sup><br><br>Specificity rates of the ECG vs the 14 point questionnaire (97.5% vs 75.1%) <sup>3</sup><br><br>Positive predictive value of ECG and 14 point questionnaire (13.6% vs 0.3%) <sup>3</sup><br><br>Negative predictive value of ECG vs 14-point questionnaire (99.9% vs 99.5%)<br><br>Accuracy between the ECG and 14 point= 97.5% vs 74.9%. <sup>3</sup> |
| <b>Level of Evidence</b>                | CEBM level 4  | CEBM level 4  | CEBM level 4   |
| <b>Evidence Quality Score (PEDro)</b>   | PEDro <sup>3</sup> : 6/10   | PEDro <sup>3</sup> : 4/10   | PEDro <sup>3</sup> : 6/10  |
| <b>Support for the answer</b>           | Yes   | Yes   | Yes  |

## RECOMMENDATION

Based on the evidence presented, and using the SORT scale<sup>2</sup>, the grade of B, or moderate quality of information is assigned to to this review.

## CONCLUSION

ECG’s proved very accurate in detecting cardiac pathologies. In the following review, there are studies that used comparison groups. Compared to those groups, the ECG performed better and assisted physicians in diagnosing cardiac pathologies or referring athletes for further evaluation. It must be noted that using ECGs is helpful to detect cardiac pathologies and not solely to diagnose cardiac pathologies. More research is needed to conclude if ECGs can be used to diagnose cardiac pathologies without the use of other modalities or examinations.

## REFERENCES

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