


Preparticipation Evaluation & ECG in Athletes


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Disclosures

- **No disclosures**

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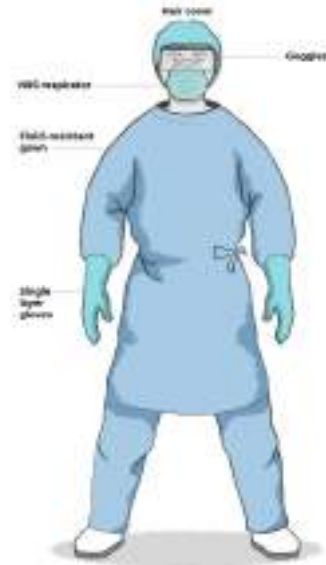


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PPE?



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Objectives

- **Understand what preparticipation physical evaluation**
- **Identify the main medical barriers to sport participation**
- **Learn the basics about ECG**
- **Review the current standards for sport ECG**

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Preparticipation Physical Evaluation

Up to 70% of children in US participate in organized sport

The goals of the PPE are:

- Maximize safe participation
- Identify and rehabilitate old injuries
- Medical problems
 - life-threatening complications (HCM)
 - need treatment before participation (DM)
 - interfere with performance (Asthma)



NOT intended to replace the well child or comprehensive physical

Can be entry point to medical care



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Minnesota- MSHSL

2022-2023 SPORTS QUALIFYING PHYSICAL EXAMINATION MEDICAL ELIGIBILITY FORM Minnesota State High School League

Student Name: _____ Birth Date: _____
 Address: _____
 Home Telephone: _____ Mobile Telephone: _____
 School: _____ Grade: _____

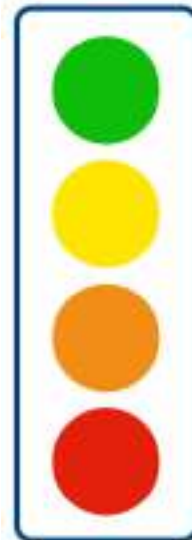
I certify that the above student has been medically evaluated and is deemed medically eligible to: (Check Only One Box)
 (1) Participate in all school interscholastic activities without restrictions.
 (2) Participate in any activity not crossed out below.

Sport Classification Based on Contact		
Collision Contact Sports	Limited Contact Sports	Noncontact Sports
Basketball Baseball Cycling Driving Football Gymnastics Ice Hockey Judo Alpine Skiing Swimming Wrestling	Basketball Field Hockey High Jump Pole Vault Figure Skating Swimming Tennis Volleyball	Bowling Curling Cross Country Running Cue Sports Fencing Golf Shooting Skiing Tennis Track

Sport Classification Based on Intensity & Environmental		
Intensity Class	Environmental	Other
Class 1 Class 2 Class 3 Class 4	Class 1 Class 2 Class 3 Class 4	Class 1 Class 2 Class 3 Class 4

(3) Require additional evaluation before a final recommendation can be made.
 Additional recommendations for the school or parents: _____

(4) Not medically eligible for: All Sports Specific Sports
 Specify: _____



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Usually for 3 years

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Preparticipation Physical Evaluation

65-75% of Medical and MSK conditions elicited from history

Cardiovascular

syncope, chest pain, short of breath, dizziness
family history
exam: BP, HR, P, Auscultation

Musculoskeletal

recurrent, recent or current injuries
exam: UE, spine, LE

Allergies



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Preparticipation Physical Evaluation

GENERAL QUESTIONS	
1. Do you have any concerns that you would like to discuss with your provider?	9/14
2. Has a provider ever denied or restricted your participation in sports for any reason?	9/14
3. Do you have any ongoing medical issues or recent illness?	9/14
HEART HEALTH QUESTIONS ABOUT YOU	
4. Have you ever passed out or nearly passed out during an after exercise?	9/14
5. Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise?	9/14
6. Does your heart ever race, flutter in your chest, or skip beats (irregular beats) during exercise?	9/14
7. Has a doctor ever told you that you have any heart problems?	9/14
8. Has a doctor ever requested a test for your heart? (for example, electrocardiogram (ECG) or echocardiogram)	9/14
9. Do you get light-headed or feel shorter of breath than you usually during exercise?	9/14
10. Have you ever had a seizure?	9/14
HEART HEALTH QUESTIONS ABOUT YOUR FAMILY	
11. Has any family member or relative died of heart problems or had an unexpected or unexplained sudden death before age 35 years (including drowning or unexpected drowning)?	9/14
12. Does anyone in your family have a genetic heart problem such as hypertrophic cardiomyopathy (HCM), Marfan syndrome, arrhythmogenic right ventricular cardiomyopathy (ARVC), long QT syndrome (LQTS), short QT syndrome (SQT), Brugada syndrome, or catecholaminergic polymorphic ventricular tachycardia (CPVT)?	9/14
13. Has anyone in your family had a pacemaker or an implanted defibrillator before age 30?	9/14
14. Have you ever had a stress fracture or an injury to a bone, muscle, ligament, joint, or tendon that caused you to miss a practice or game?	9/14
15. Do you have a burn, muscle, ligament, or joint injury that bothers you?	9/14
MEDICAL QUESTIONS	
16. Do you cough, wheeze, or have difficulty breathing during or after exercise?	9/14
17. Are you wearing a hearing aid, a hearing device, your glasses, or any other device?	9/14
18. Do you have joint or tendon pain or a painful edge or horn on the great toe?	9/14
19. Do you have any hearing aids (either or both that come and go, including hearing or hearing-resistant Bluetooth devices (HROD))?	9/14
20. Have you had a concussion or head injury that caused confusion, a prolonged headache, or memory problems?	9/14
21. Have you ever had numbness, tingling, weakness in your arms or legs, or been unable to move your arms or legs after being hit or falling?	9/14
22. Have you ever become ill while exercising in the heat?	9/14
23. Do you or does someone in your family have a seizure, fall, or disease?	9/14
24. Have you ever had or do you have any problems with your eyes or vision?	9/14
25. Do you worry about your weight?	9/14
26. Are you trying to or has anyone recommended that you gain or lose weight?	9/14
27. Are you on a special diet or do you avoid certain types of foods at food groups?	9/14
28. Have you ever had an eating disorder?	9/14
FEMALE ONLY	
29. Have you ever had a menstrual period?	9/14
30. How old were you when you had your first menstrual period?	
31. When did your most recent menstrual period?	
32. How many periods have you had in the past 12 months?	



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Further assessment needed?

Cardiac exam/family history

Multiple concussion history

Mental health concerns

Female and Male athlete triad- (menstrual cycle/hormones, eating disorders, bone density)

Recurrent injuries (stress fractures)

3-13% require further assessment

0.3-1.3% are limited

Physical Health Questionnaire Version 4 (PHQ-4)
 Over the past 2 weeks, how often have you been bothered by any of the following problems? (Circle response.)

	Not at all	Several days	Over half the days	Nearly every day
Fasting nervous, anxious, or on edge	0	1	2	3
Not being able to stop or control worrying	0	1	2	3
Little interest or pleasure in doing things	0	1	2	3
Feeling down, depressed, or hopeless	0	1	2	3

(If the sum of responses to questions 1 & 2 or 3 & 4 are 0, evaluate.)



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Special Considerations

Discuss vaccines, safety, alcohol, drugs, sex
 - more difficult at mass PPE events

Vision difficulty

Solitary kidney, testicle or eye

Down syndrome- cervical xray

Marfan syndrome- echo

NSF- Supplements

Skin form and weight certification- wrestling



Further reading →



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The HEART of the talk



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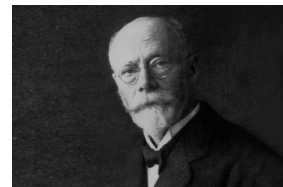
What is an electrocardiograph?

1895: Dr. Willem Einthoven (Netherlands) 3 limb leads

1934: Dr. Frank Wilson (Michigan) V1-V6

1942: Dr. Emanuel Goldberger (New York) aVR, aVL, aVF

Often now: ECG but sounds like EEG (electroENCEPHALOgraphy)

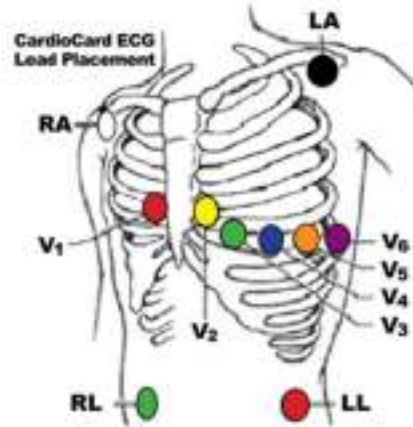
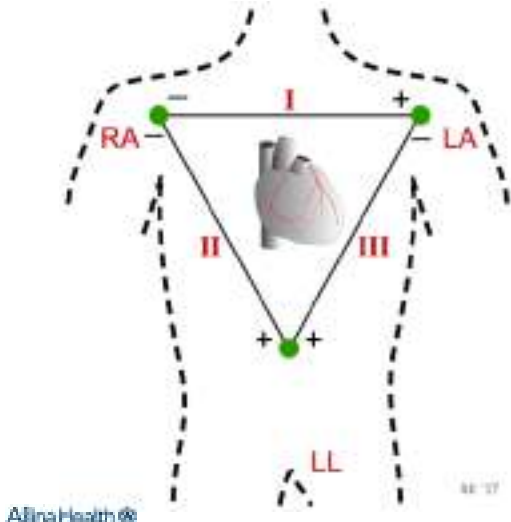


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Electrocardiography

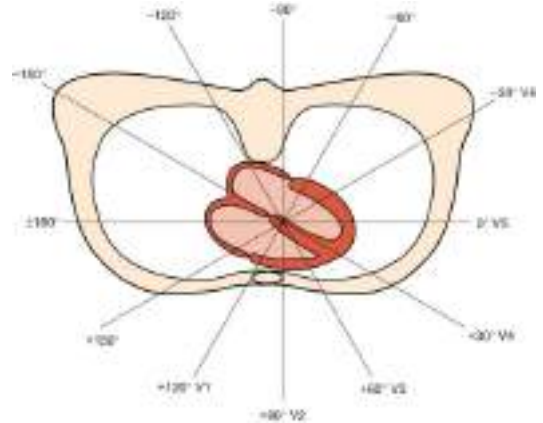
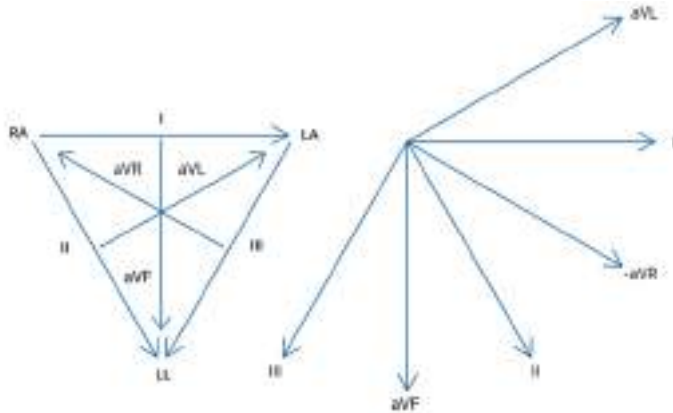
Where to put the leads?



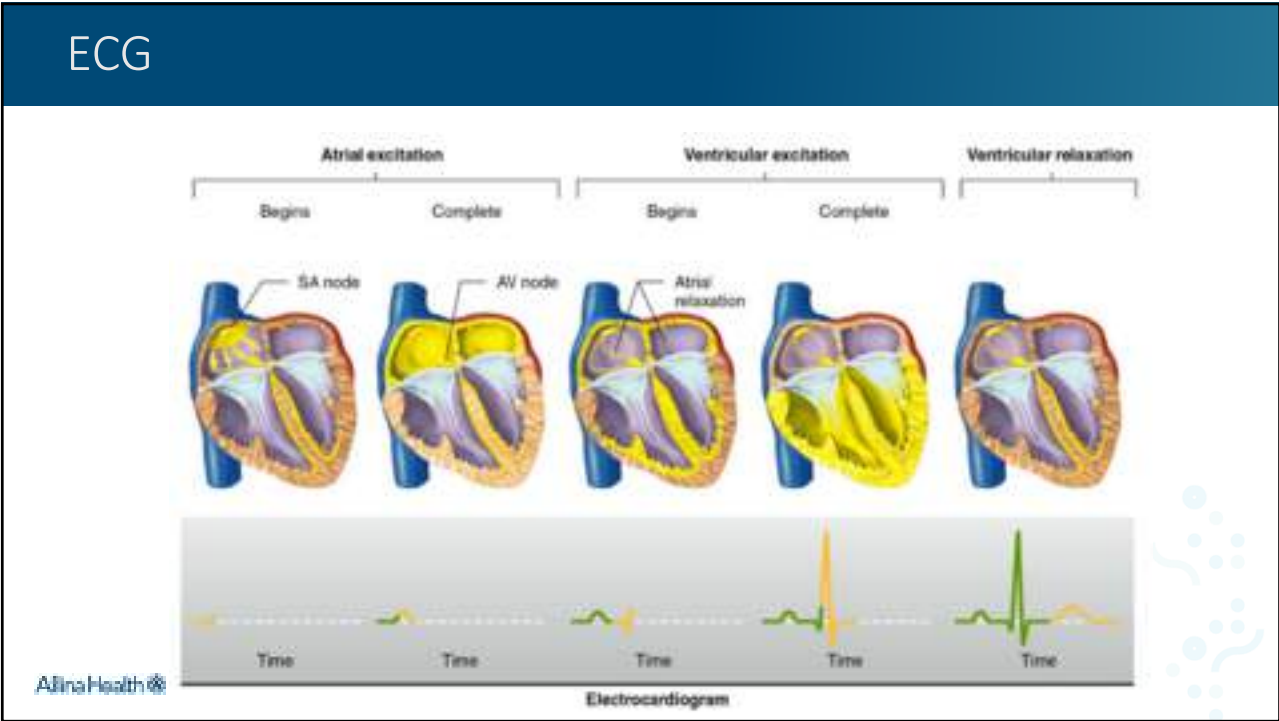
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12 lead ECG

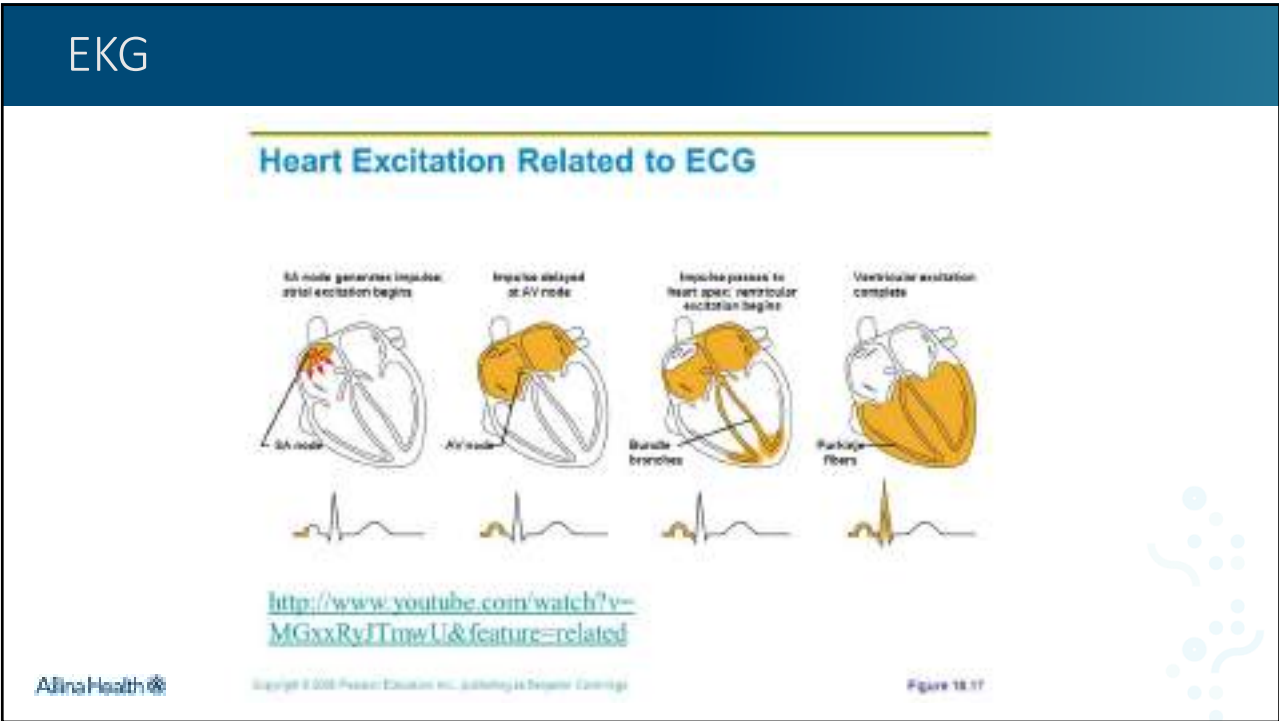
But only 9 stickers?



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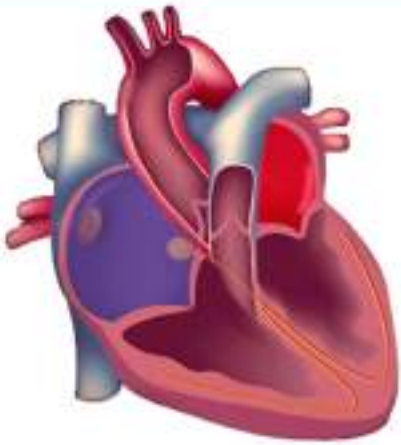
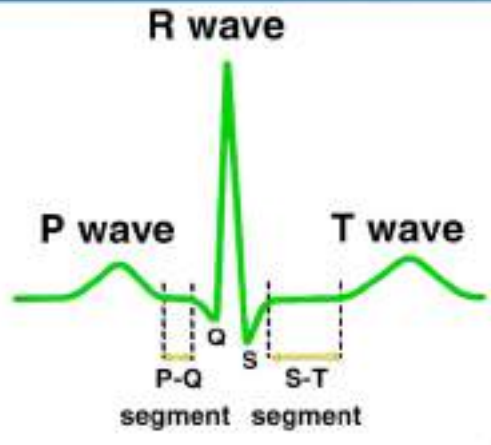


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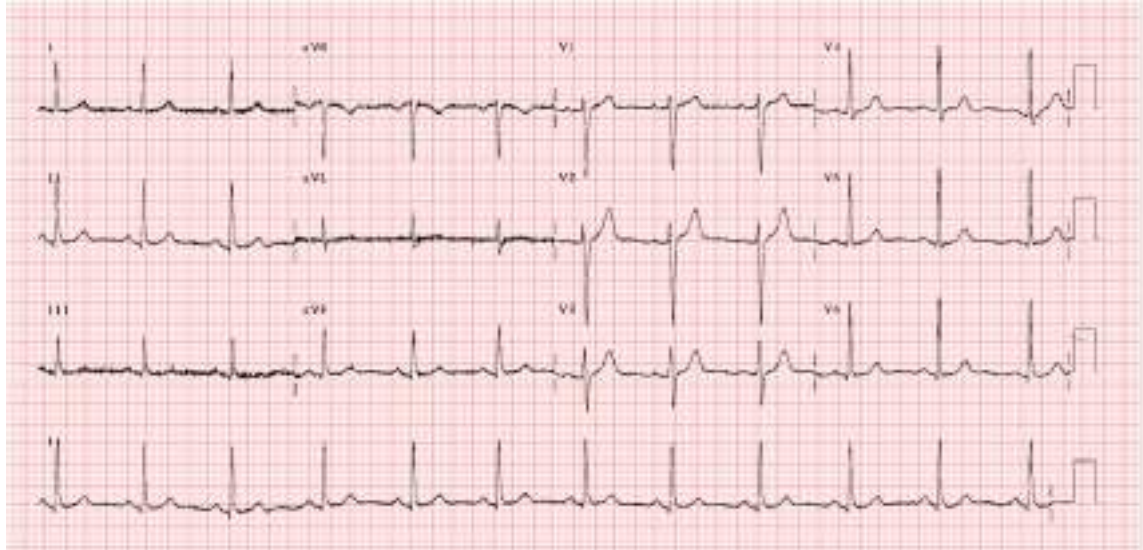
ECG

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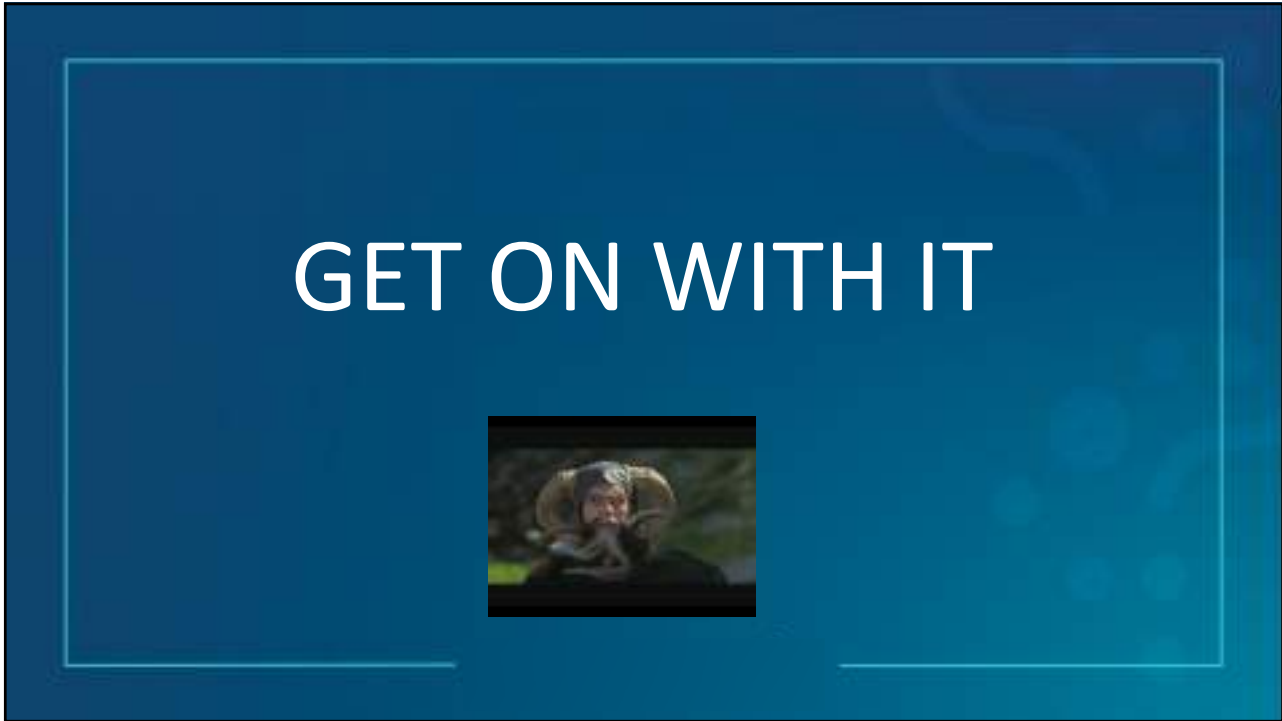
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ECG- Normal 12 lead



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Euro 2020

Christian Eriksen
June 12, 2021

CPR and defibrillation
on field

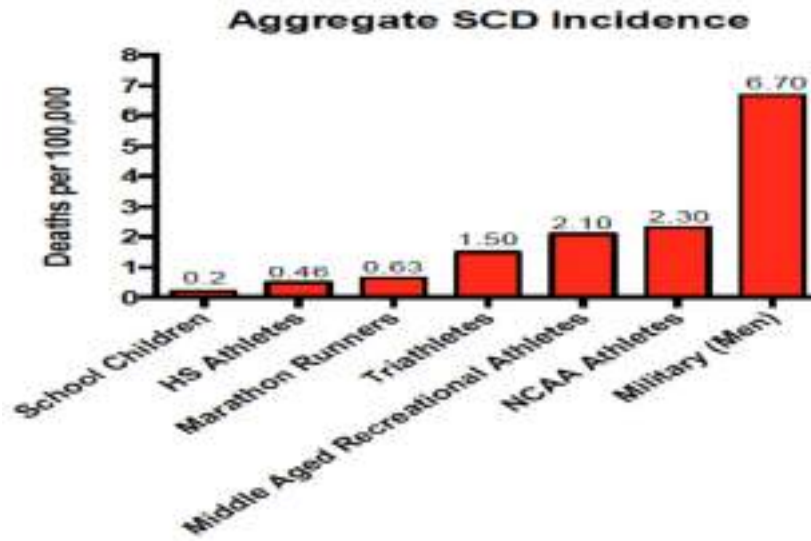
Subsequent internal
defibrillator

Playing this World Cup!

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Sudden Cardiac Death (SCD)



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1 Baggish

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How do we prevent SCD?

2010: European Society of Cardiology guidelines

2013: Seattle Criteria

2014: Refined Criteria

2017: International Criteria →

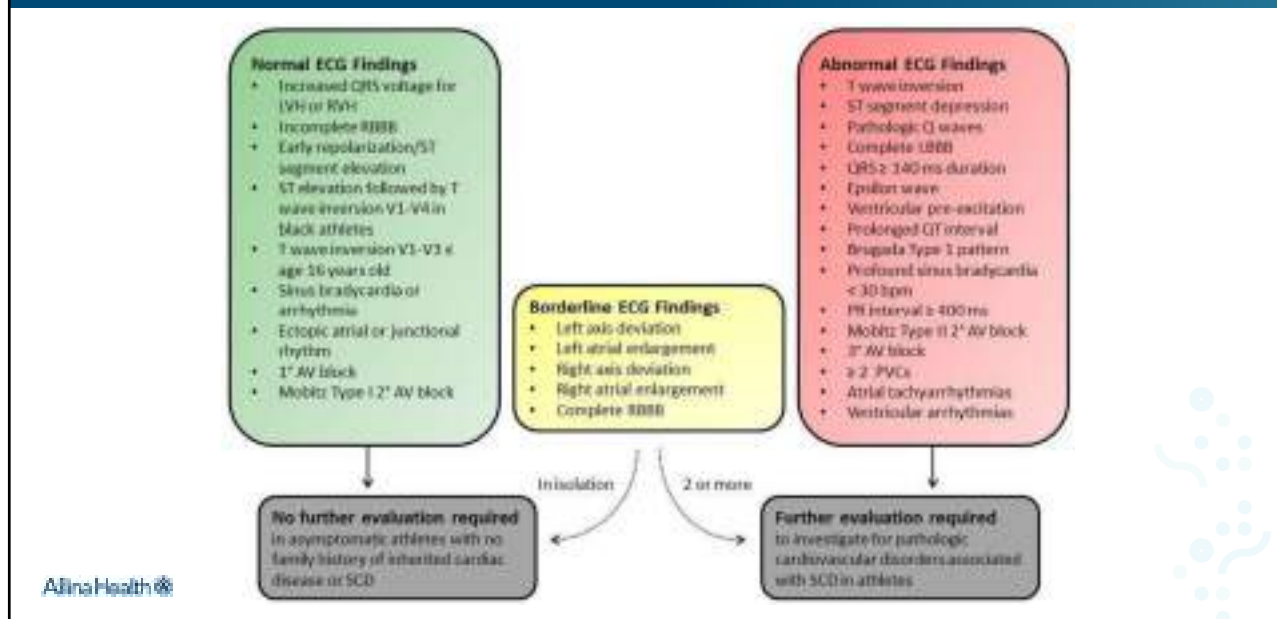
International criteria for electrocardiographic interpretation in athletes: consensus statement

Jonathan A Drezner,¹ Sanjay Sharma,² Aaron Baggish,³ Michael Papadakis,⁴ Matthew G Wilson,⁵ Jostes M Prutkin,⁶ Andre La Gerche,⁴ Michael J Ackerman,^{1,2,3,4,5} Matt Benjamin,^{1,14} Jack C Salerno,¹⁴ Irar M Asif,¹⁵ David S Dwyer,⁶ Eugene H Chung,¹⁶ Michael S Emery,¹⁷ Victor F Froelicher,¹⁸ Heini Holdbuechel,¹⁹ Carmen Adamuz,⁴ Chad A Asplund,²⁰ Gordon Cohen,^{21,22} Kimberly G Harmon,⁴ Joseph C Marek,²³ Silvana Moloss,^{24,25} Josef Niebauer,²⁶ Hank F Peltz,⁷ Marco V Perez,²⁷ Nathan R Riding,⁸ Tess Searel,^{28,29} Christian M Schmitt,³⁰ David M Shipon,³¹ Ricardo Stein,³² Victoria L Vetter,³³ Antonio Pelliccia,³⁴ Domenico Corrado^{35,36}

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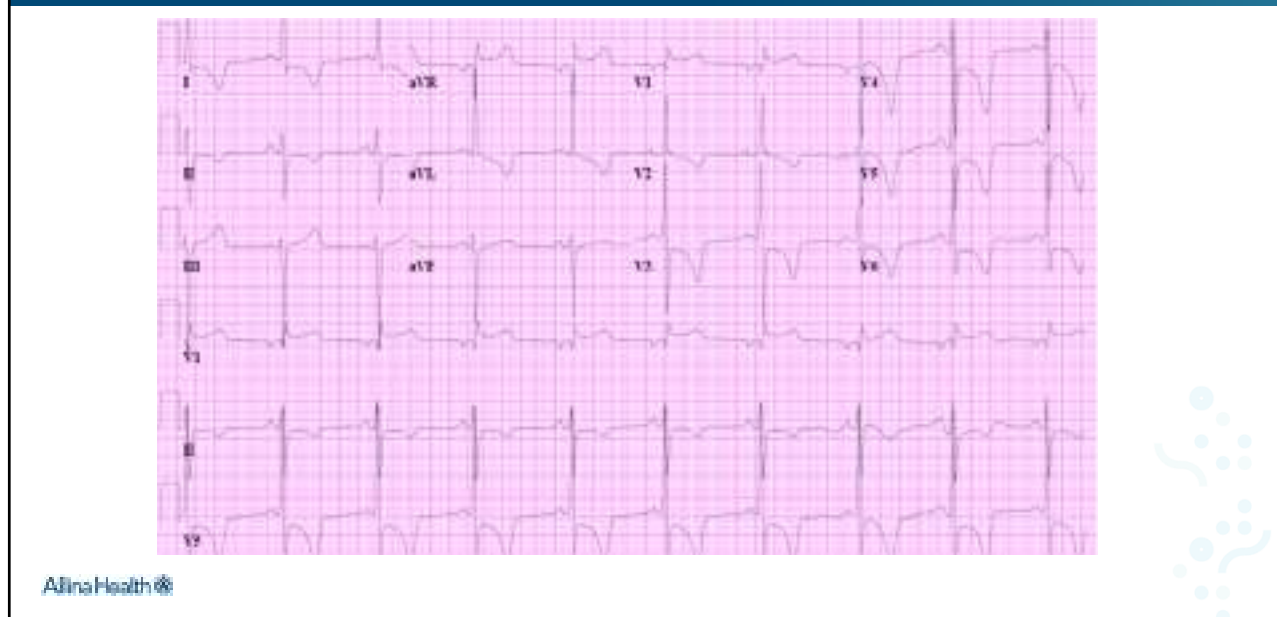
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International Criteria



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Abnormal athlete ECG



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How to study this more?

**ECG INTERPRETATION
IN ATHLETES**

AUSTRALASIAN COLLEGE OF
SPORT AND EXERCISE PHYSICIANS

UW Medicine
Center For Sports Cardiology

The Center for Sports Cardiology
at the University of Washington
in collaboration with the
Australasian College of Sport and Exercise Physicians
are extremely excited to offer open access
worldwide to a new collection of six online
ECG training modules.

GET STARTED

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<https://uwsportscardiology.org/e-academy/>

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Thank you!

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Photos

PPE: https://www.gannett-cdn.com/indepth-static-assets/uploads/master/2917179001/01ec2e41-050b-4595-94d0-81a1957b9d8f-medical-ppev2_ppe1-basic.png
 PPE coach: <https://www.wane.com/wp-content/uploads/sites/21/2021/01/AP20355677278911.jpg?w=2560&h=1440&crop=1>
 Student: <https://www.facebook.com/atlanticwellnesssb/photos/a.752605878127902/1844751655579980/?type=3>
 MN form: <https://www.mshsl.org/sites/default/files/2020-07/2020-21-sqpe-3-25-20.pdf>
 WI Form: <https://www.wiaawi.org/Portals/0/PDF/Forms/PPE-form.pdf>
 EKG GIF: <https://medizy-prod-bucket.s3-eu-west-1.amazonaws.com/img/posts/dd6d4b72-7ef2-4965-ad4b-727ef2296536>
 EKG 18.17 <https://slideplayer.com/slide/6424977/22/images/7/Heart+Excitation+Related+to+ECG.jpg>
 International chart: <https://bism.bmj.com/content/bjsports/54/4/197/F1.large.jpg>
 Ekg lead: <https://i.pinimg.com/originals/7a/e5/b7/7ae5b73c31695c2d9816d3e33c60bd00.gif>
 Ekg lead gif: <http://www.rnceus.com/ekg/lead.gif>
 EKG 12 lead: <https://ecglibrary.com/ecgs/norm.png>
 Ekg Einthoven triangle [a013a-einthoven-triangle.png \(1070x1198\) \(cvphysiology.com\)](https://www.cvphysiology.com/a013a-einthoven-triangle.png)
 Ekg triangle and axis [csm_Goldberger.png \(1140x604\) \(cardiosecur.com\)](https://www.cardiosecur.com/csm_Goldberger.png)
 Precordial leads axis [B9781437702859000107_f010-004-9781437702859.jpg \(502x404\) \(thoracickey.com\)](https://www.thoracickey.com/B9781437702859000107_f010-004-9781437702859.jpg)
 Squat https://media.self.com/photos/5c8686e2b43cf177fa569d97/master/w_320%2Cc_limit/bodyweight-squat-Amanda_001.gif

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References

- 1 Drezner JA, Sharma S, Baggish A, *et al*
International criteria for electrocardiographic interpretation in athletes: Consensus statement
British Journal of Sports Medicine 2017;**51**:704-731.
- 2 Diamond, Alex B. DO*; Narducci, Dusty Marie MD†; Roberts, William O. MD‡; Bernhardt, David T. MD§; LaBella, Cynthia R. MD¶; Moffatt, Kody A. MD||; Nuti, Rathna MD**; Powell, Amy P. MD††; Rooks, Yvette L. MD‡‡; Zaremski, Jason L. MD§§ Interim Guidance on the Preparticipation Physical Examination for Athletes During the SARS-CoV-2 Pandemic, *Clinical Journal of Sport Medicine*: January 2021 - Volume 31 - Issue 1 - p 1-6
doi: 10.1097/JSM.0000000000000892
3. Drezner, Jonathan A. MD; O'Connor, Francis G. MD, MPH; Harmon, Kimberly G. MD; Fields, Karl B. MD; Asplund, Chad A. MD; Asif, Irfan M. MD; Price, David E. MD; Dimeff, Robert J. MD; Bernhardt, David T. MD; Roberts, William O. MD, MS AMSSM Position Statement on Cardiovascular Preparticipation Screening in Athletes, *Clinical Journal of Sport Medicine*: September 2016 - Volume 26 - Issue 5 - p 347-361
doi: 10.1097/JSM.0000000000000382
4. Hergenroeder, Albert. Sports participation in children and adolescents: The preparticipation physical evaluation. Uptodate.com: Accessed 7/27/2022
5. Peterson AR, Bernhardt DT. The preparticipation sports evaluation. *Pediatr Rev*. 2011 May;**32**(5):e53-65. doi: 10.1542/pir.32-5-e53. PMID: 21536775.
6. Wikipedia article electrocardiography <https://en.wikipedia.org/wiki/Electrocardiography>
7. A brief history of the ECG: <http://blog.clinicalmonster.com/2015/07/16/legends-medicine-history-ekg/#:~:text=EKGs%20were%20initially%20used%20to,recognized%20as%20pathognomonic%20for%20MI.>

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