Shared Decision Making in Athletes – Has the Data Changed risk?"

Matthew W. Martinez, MD FACC

Sports Cardiology Medical Director

HCM Medical Director

Team Cardiologist - New York Jets

Cardiologist – Major League Soccer, NFL Medical committee, NBPA, JETS

@mmartinezheart

ATLANTIC HEALTH SYSTEM

I have no commercial interests nor financial relationships with any manufacturer of any product or class of products that are discussed in this educational activity, or which is a commercial supporter of this activity.

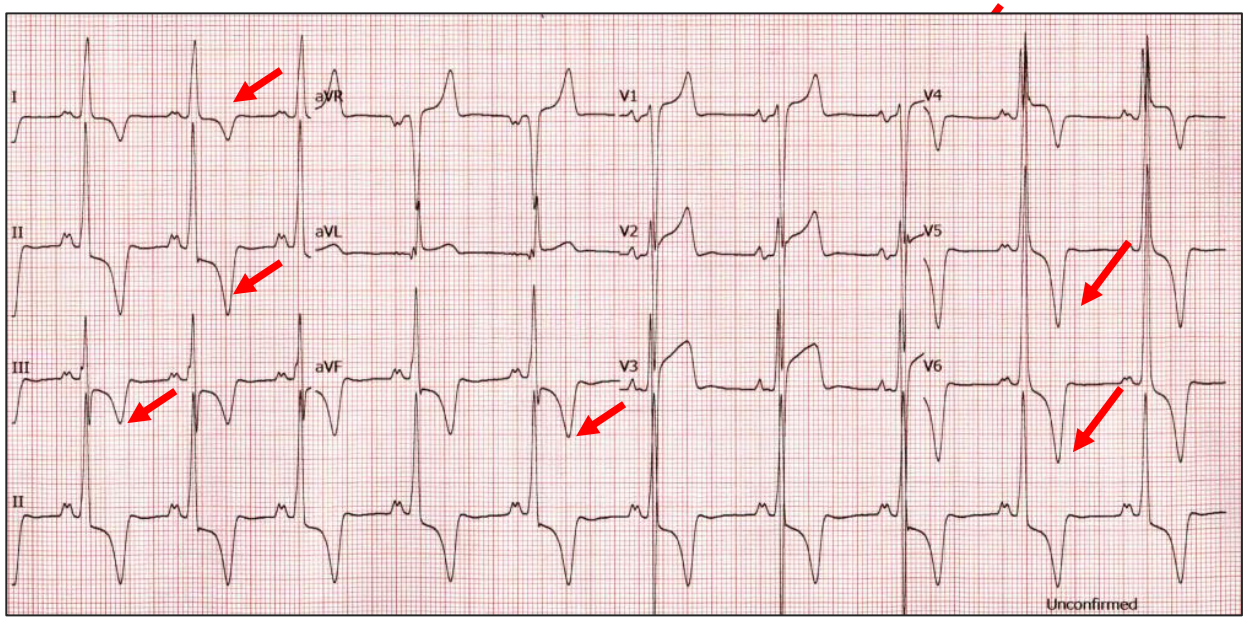
Case Presentation

17 y.o elite Caucasian Female
American Soccer midfielder

Asymptomatic.
No prior syncope, CV limitations.
No family hx of cardiomyopathy or sudden cardiac arrest.

Preparticipation screening evaluation including ECG.
ECG was abnormal.

Electrocardiogram



Sinus bradycardia
Normal QTc
TWI II, III, aVF, V3-V6

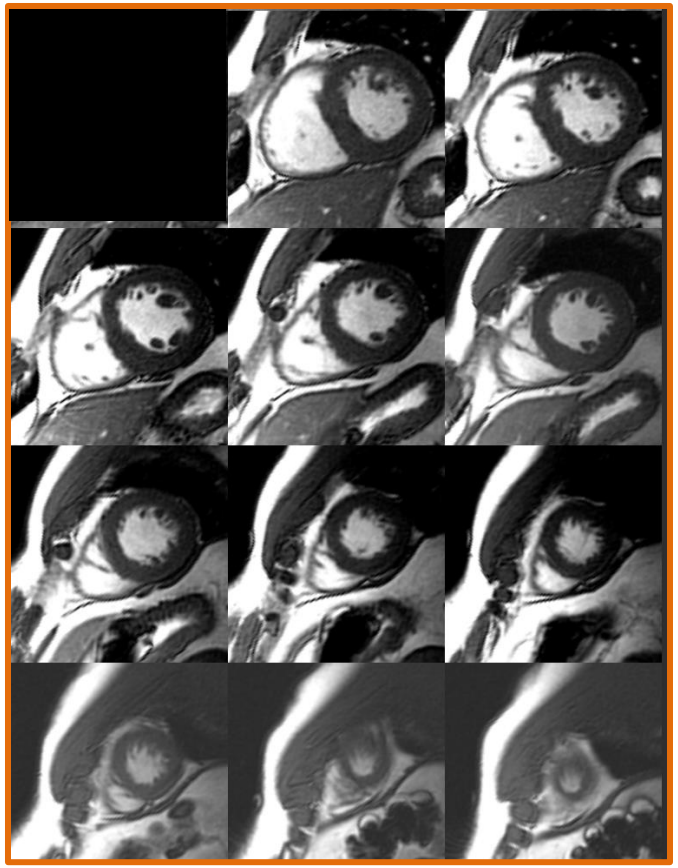
No prior ECG

Referred for ECHO

ATLANTIC HEALTH SYSTEM

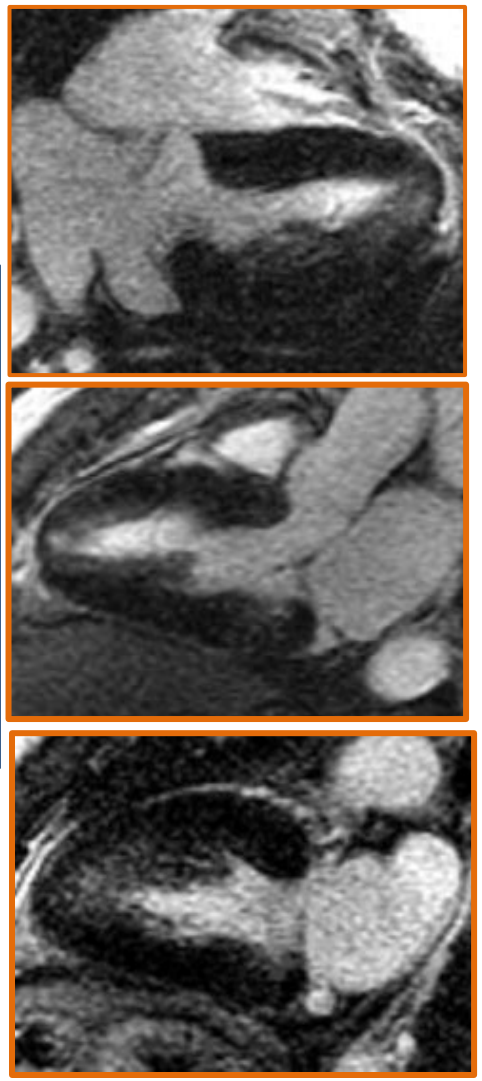
ECHO

- Normal biventricular size and function.
- LVEF = 65%.
- Normal wall motion. No valve disease: SAM or MVP. Abnormal diastolic function
- 17mm septal thickness.
- **Exercise Echo –** 16minutes + sprints; no arrythmias or obstruction, Normal HR and BP response
- **48hr Ambulatory monitor**: Rare PVCs



CMR

- LVEF = 75%.
- No SAM
- 18mm septum
- No LGE/scar

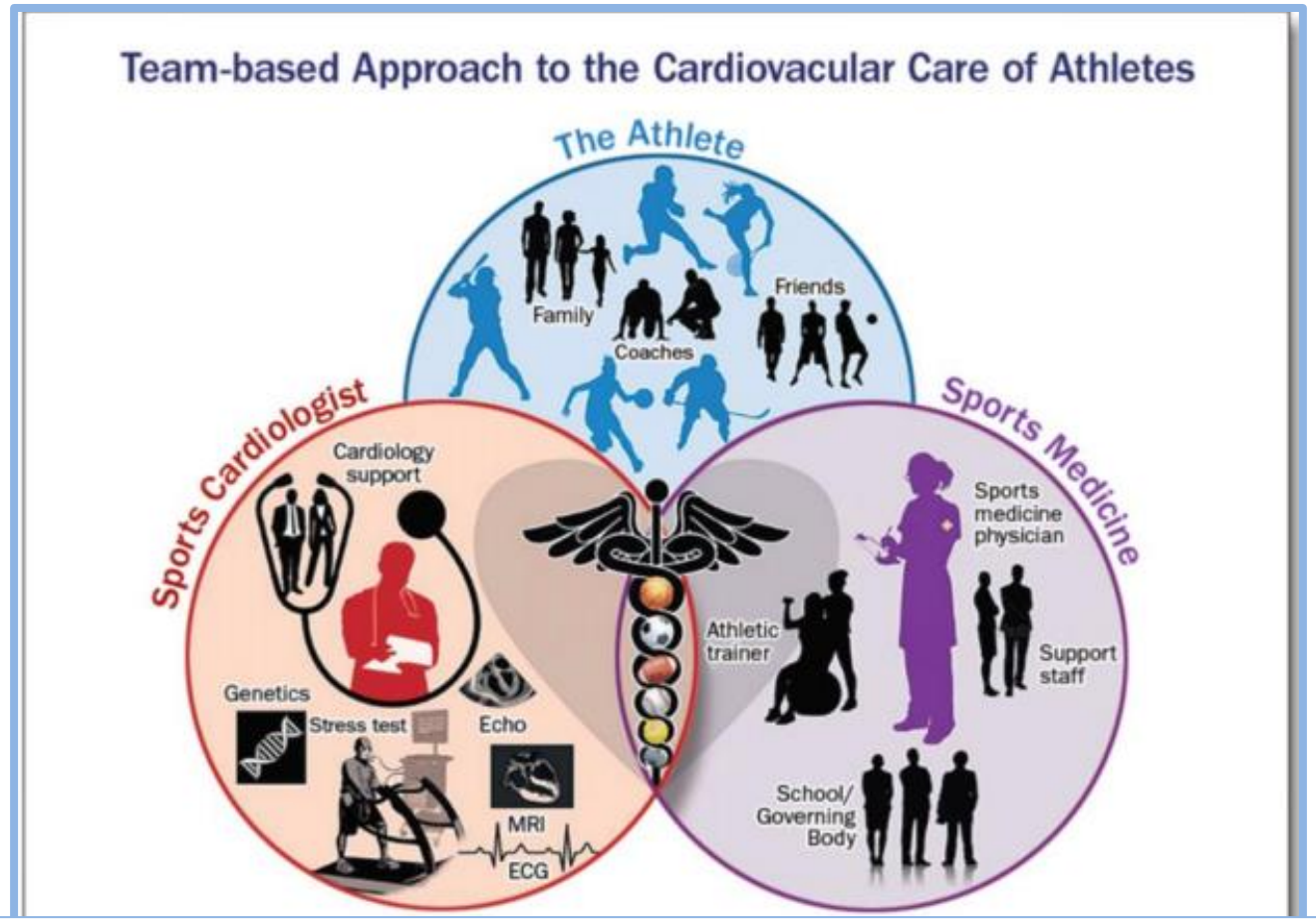


Athlete with SCA Risk

Would YOU allow this athlete with screening-based, incidentally detected HCM (asymptomatic) to continue with his/her competitive sport?

1. YES
2. NO
3. MAYBE

Cardiac Care of the Athlete

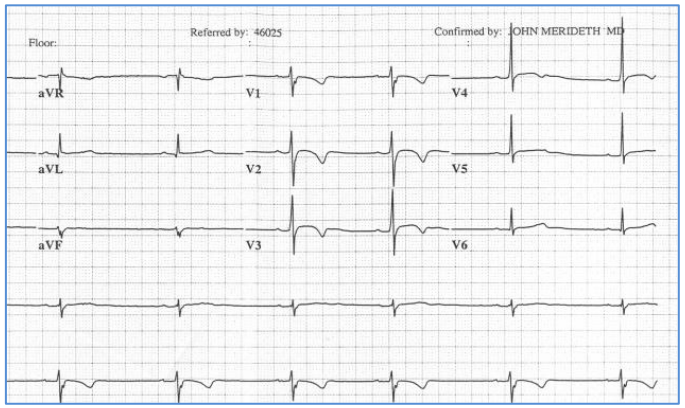


Multidisciplinary Athlete-Centered Care ("Athlete Care Team") in Evaluating and Managing Athletes at Risk of SCD

ATLANTIC HEALTH SYSTEM

Emery MS, Kovacs RJ. Sudden cardiac death in athletes. JACC Heart Fail 2018;6:30-40

Sudden Cardiac Death in *Young* Athletes



Structural Abnormalities

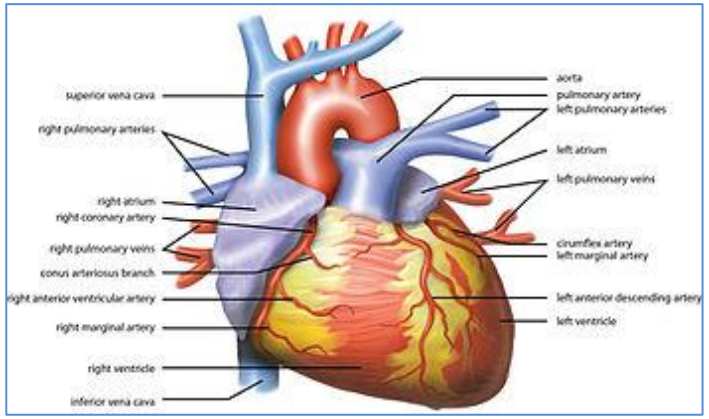
Hypertrophic cardiomyopathy
RV cardiomyopathy
Artery anomalies
Marfan syndrome
Valve disease

Electrical Abnormalities

Wolff Parkinson White syndrome
Long QT syndrome
Brugada syndrome
CPVT

Acquired Abnormalities

Infection (myocarditis)
Trauma (commotio cordis)
Drugs
Environment (heat/cold)



ATLANTIC HEALTH SYSTEM

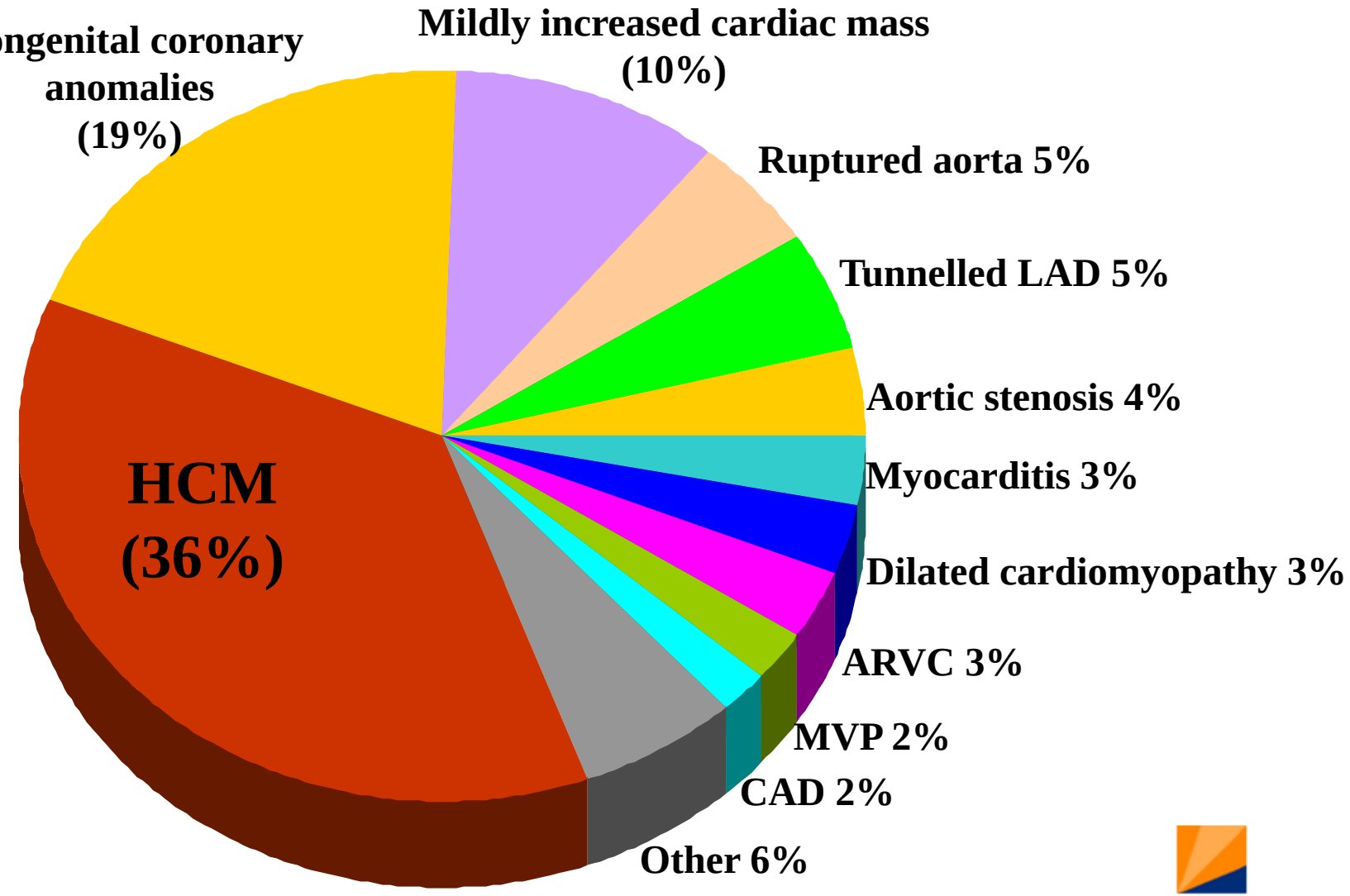
Traditional etiologies of SCD in Athletes (<40 years)

1980 - 2005

Multiple updates:
2007, 2009, 2016

N = 2406
Confirmed CV deaths = 840+

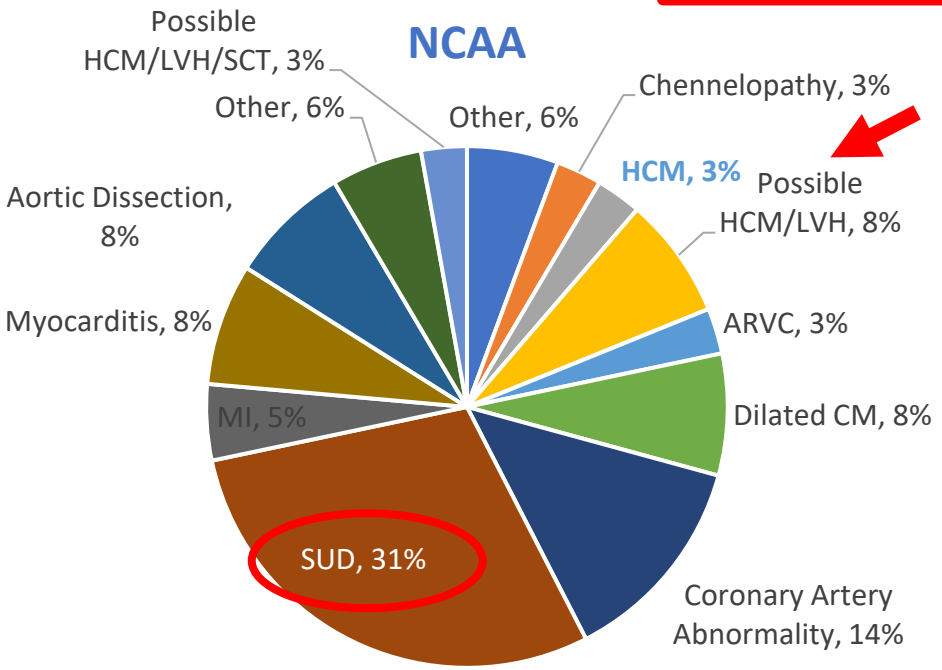
The data and message remains largely unchanged

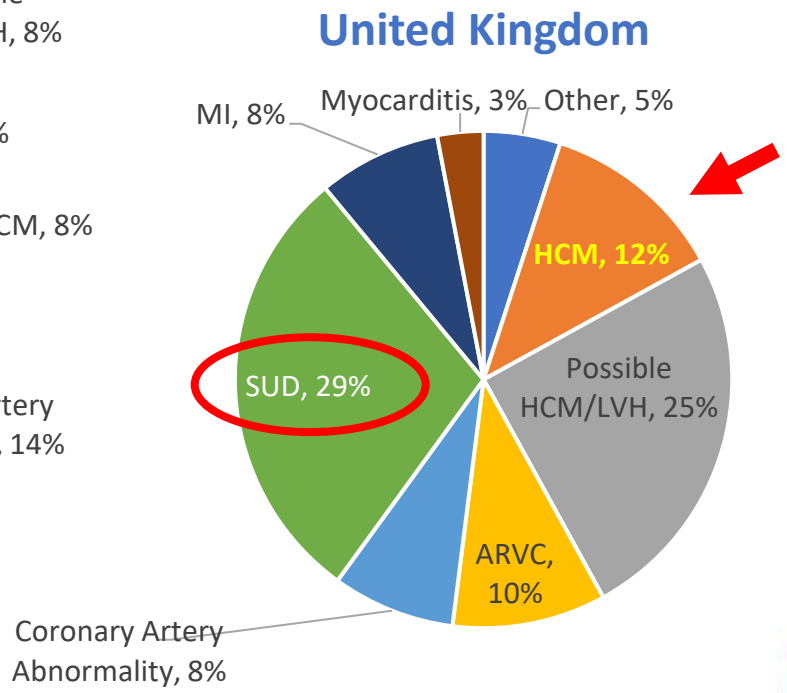


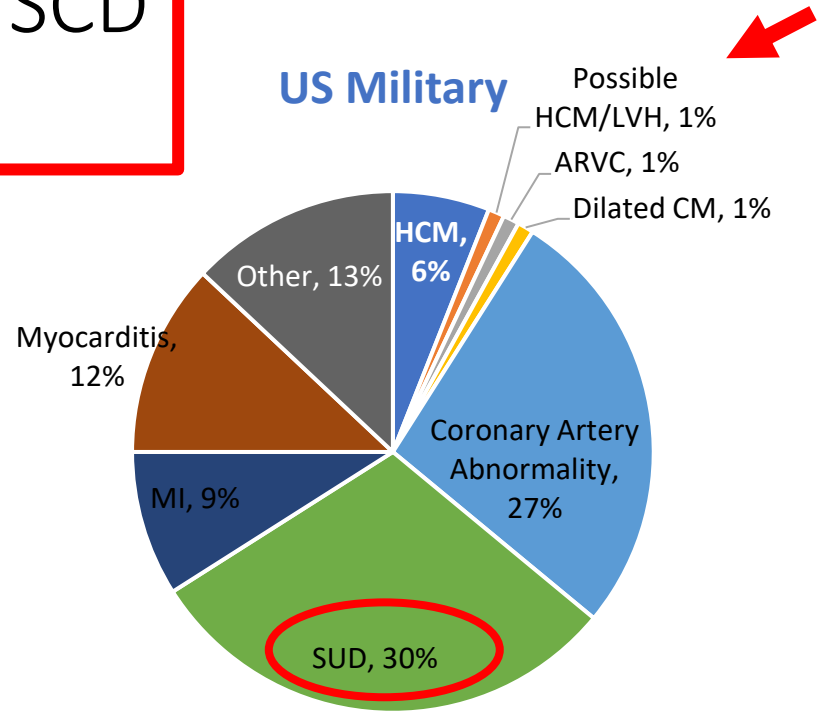
Maron BJ et al. *Circulation.* 1996;94:850-56.

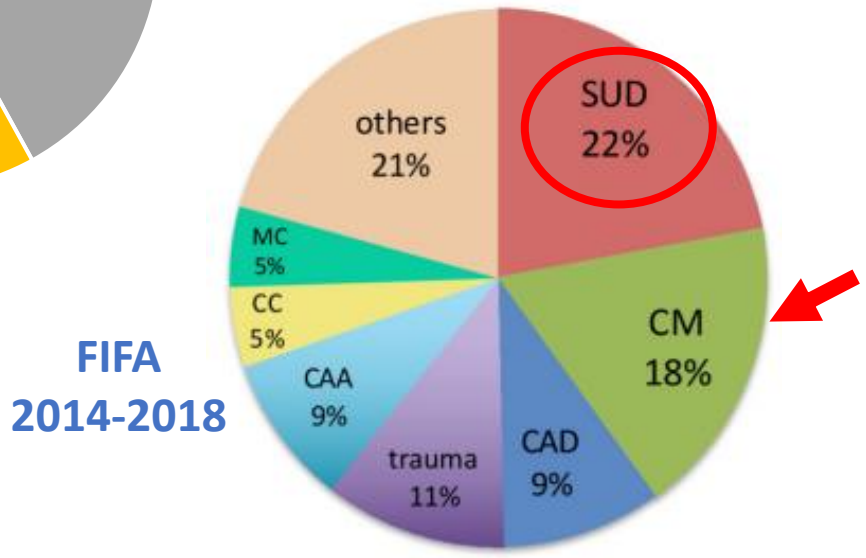
ATLANTIC HEALTH SYSTEM

Contemporary Estimates of SCD - > challenge prior data



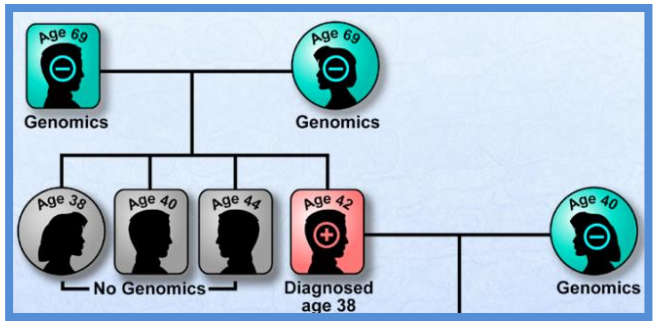




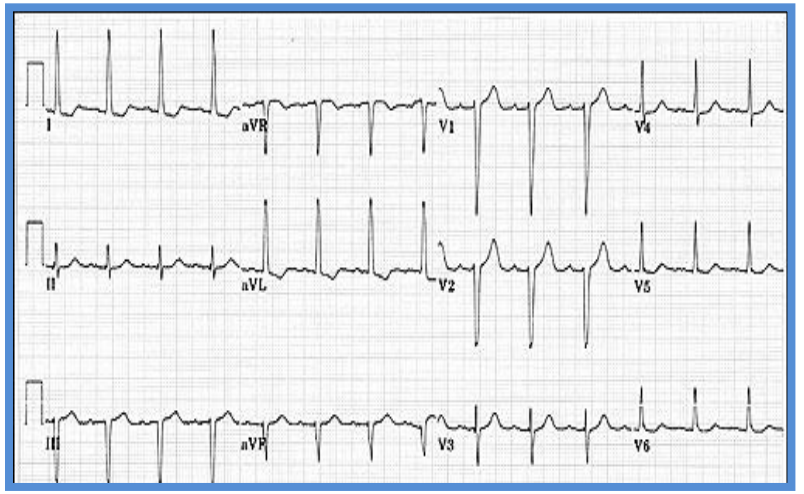


Eckart RE et al. Ann Intern Med. 2004;141:829-834.
Harmon KG et al. Circ Arrhythm Electrophysiol. 2014;7:198-204.
De Noronha SV et al. Heart. 2009;95:1409-1414.

Athlete Evaluation

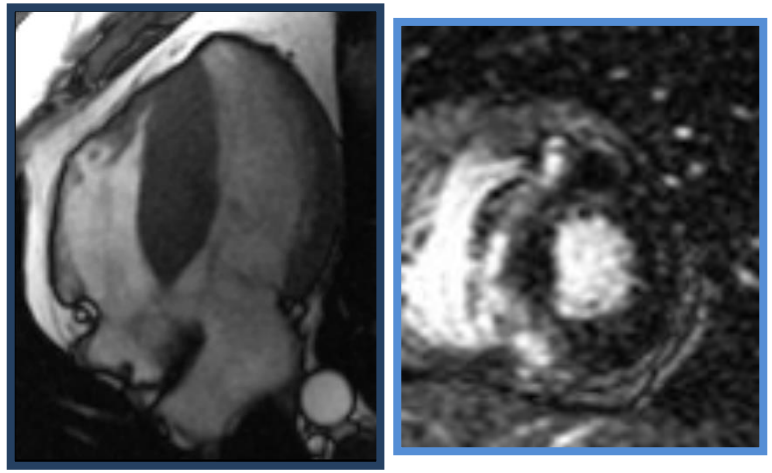


History

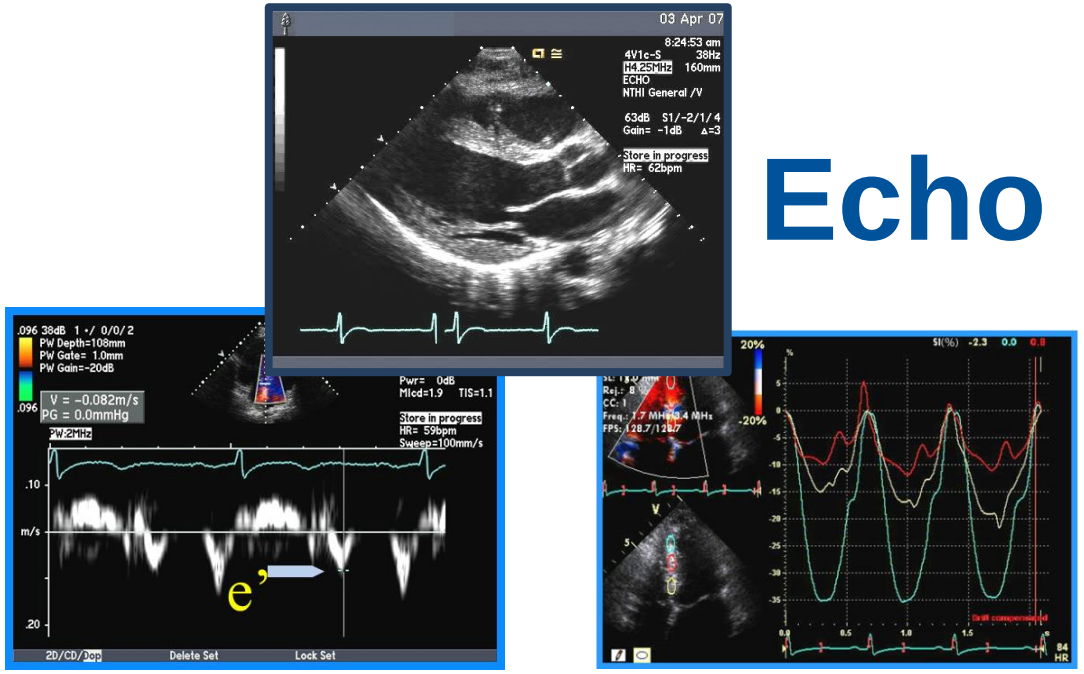


ATLANTIC HEALTH SYSTEM

Athlete Evaluation



MRI



Echo

ATLANTIC HEALTH SYSTEM

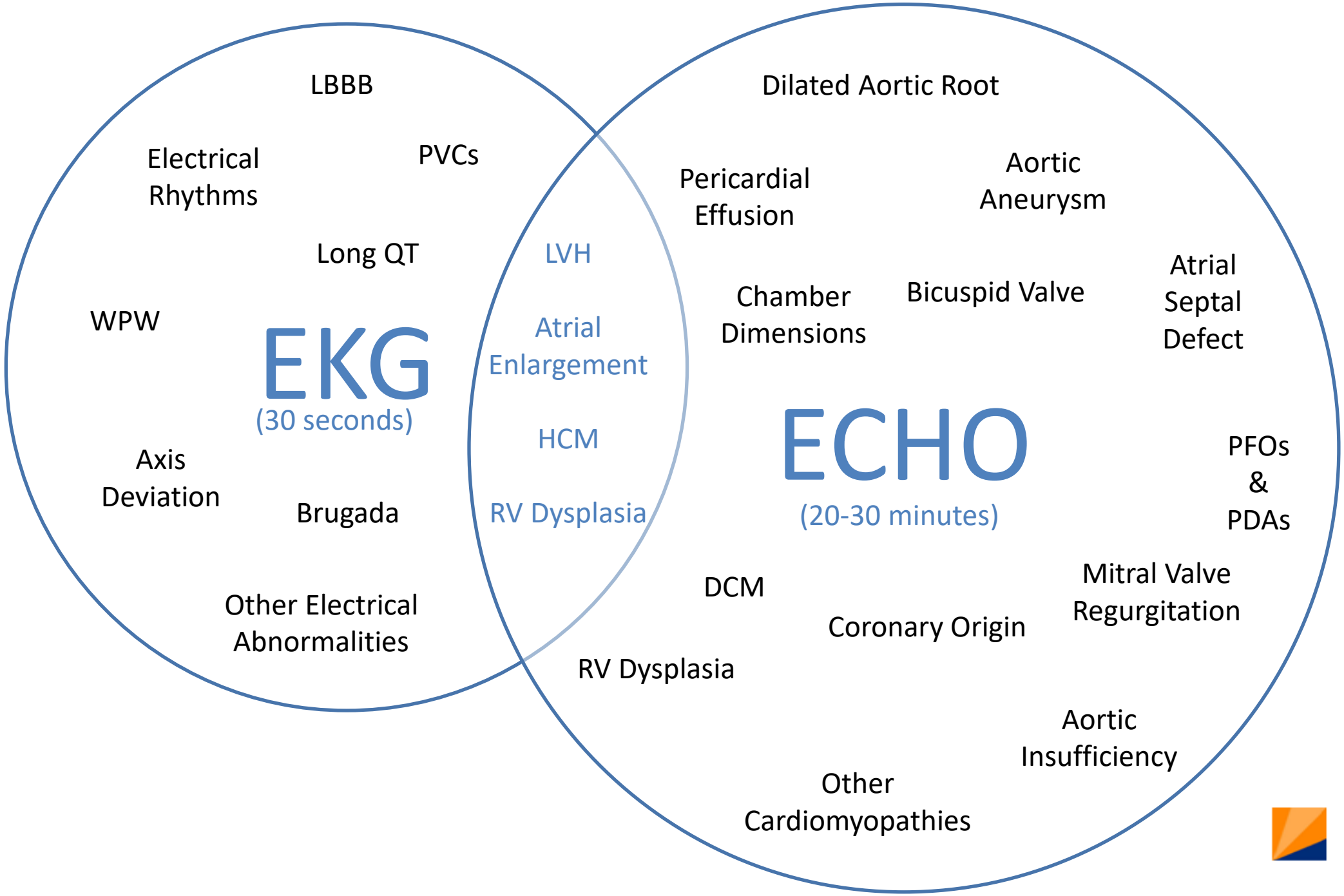
Comparison of Screening Strategies for Elite Athletes

	IOC/ USOC	FIFA	MLB	MLS	NBA/ WNBA	NFL	NHL	Premier League
Combine			X		X	X	X	
H&P	X[ι]	X[ι]	X	X	X	X	X[ι]	X
ECG	X	X	X	X^	X	X	X	X^
Echo		X		X	X	X		X^
Stress test ECG	X*	X*						
Stress Echo					X			
Additional Testing As needed	X	X	X	X	X	X	X	X

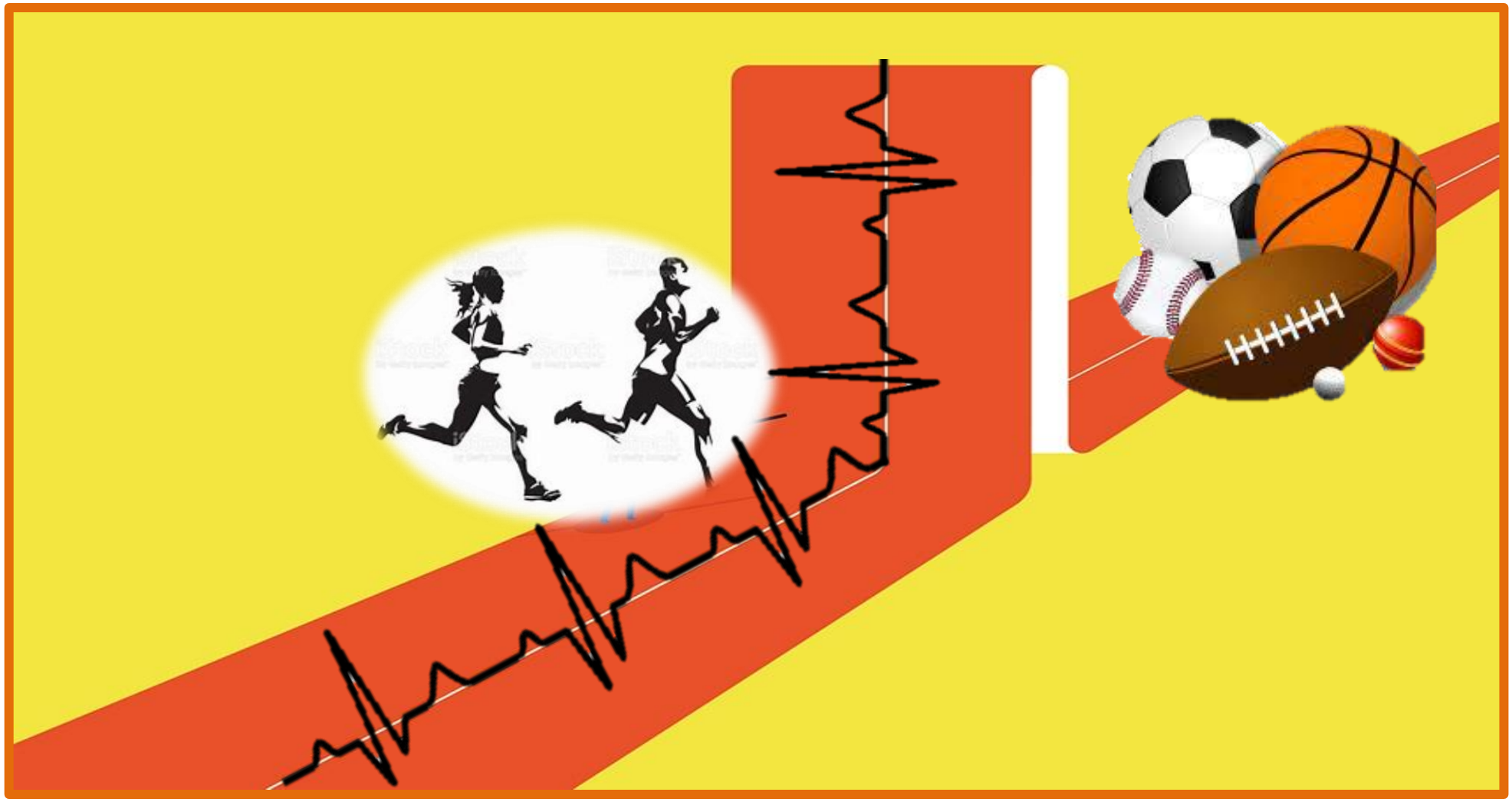
ι Unique H&P; others use AHA
^ Every 2 years
* Stress ECG if >35 years old

ATLANTIC HEALTH SYSTEM

Screening findings: EKG vs ECHO



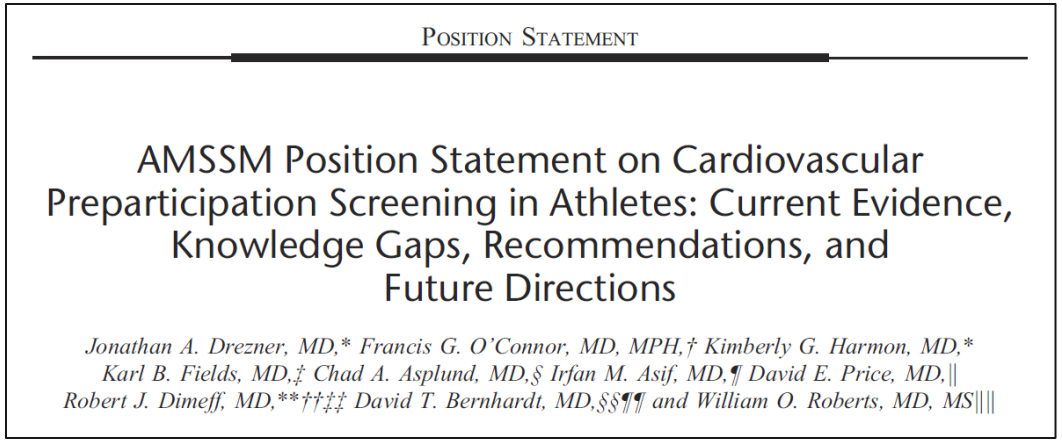
Barriers to Participation



ATLANTIC HEALTH SYSTEM

Screening

- Goal: Early identification of cardiac conditions at risk for sudden cardiac arrest & death (SCA/D)
- Optimal strategy unclear
- AMSSM: ”assist the individual physician in assessing the most appropriate screening strategy unique to their athlete population, community needs and resources”
- ”mitigating risk through individualized, patient-centered and disease-specific medical management.”


POSITION STATEMENT

AMSSM Position Statement on Cardiovascular Preparticipation Screening in Athletes: Current Evidence, Knowledge Gaps, Recommendations, and Future Directions

Jonathan A. Drezner, MD, Francis G. O'Connor, MD, MPH,† Kimberly G. Harmon, MD,* Karl B. Fields, MD,‡ Chad A. Asplund, MD,§ Irfan M. Asif, MD,¶ David E. Price, MD,‖ Robert J. Dimeff, MD,**††‡‡ David T. Bernhardt, MD,§§¶¶ and William O. Roberts, MD, MS‖‖*

AMSSM
AMERICAN MEDICAL SOCIETY FOR SPORTS MEDICINE

Purpose of Cardiovascular Screening

- Historically, athletes with Cardiovascular disease had been advised against competitive sport participation
  - 2011 ACCF/AHA HCM Guidelines
  - 2015 AHA/ACC Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities

"Athletes with a probable or unequivocal clinical expression and diagnosis of CV disease (ie, HCM) should not participate in most competitive sports, with the exception of those of low intensity (class IA sports). This recommendation is independent of age, sex, magnitude of LV hypertrophy, particular sarcomere mutation, presence or absence of LV outflow obstruction (at rest or with physiological exercise), absence of prior cardiac symptoms, presence or absence of late gadolinium enhancement (fibrosis) on CMR, and whether major interventions such as surgical myectomy or alcohol ablation have been performed previously." (2015 AHA/ACC Guidelines)

Recommendations for Athletes

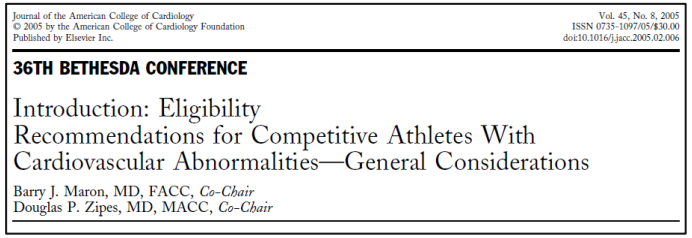
European Heart Journal (2005) 26, 1422–1445
doi:10.1093/eurheartj/ehi325

ESC Report

Recommendations for competitive sports participation in athletes with cardiovascular disease

A consensus document from the Study Group of Sports Cardiology of the Working Group of Cardiac Rehabilitation and Exercise Physiology and the Working Group of Myocardial and Pericardial Diseases of the European Society of Cardiology

Antonio Pelliccia[1*], Robert Fagard[2], Hans Halvor Bjørnstad[3], Aris Anastassakis[4], Eloisa Arbustini[5], Deodato Assanelli[6], Alessandro Biffi[1], Mats Borjesson[7], François Carrè[8], Domenico Corrado[9], Pietro Delise[10], Uwe Dorwarth[11], Asle Hirth[3], Hein Heidbuchel[12], Ellen Hoffmann[11], Klaus P. Mellwig[13], Nicole Panhuyzen-Goedkoop[14], Angela Pisani[5], Erik E. Solberg[15], Frank van-Buuren[13], and Luc Vanhees[2]



Journal of the American College of Cardiology
© 2005 by the American College of Cardiology Foundation
Published by Elsevier Inc.

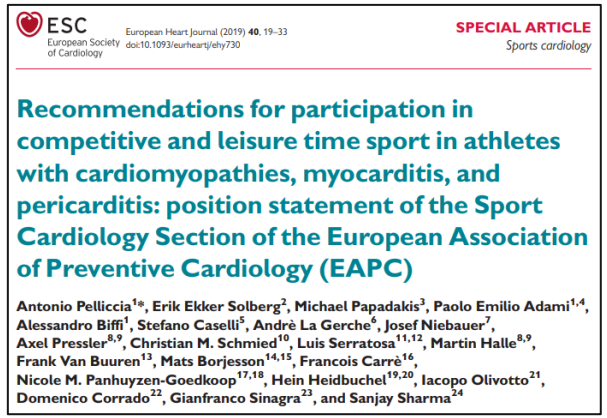
Vol. 45, No. 8, 2005
ISSN 0735-1097/05/$30.00
doi:10.1016/j.jacc.2005.02.006

36TH BETHESDA CONFERENCE

Introduction: Eligibility Recommendations for Competitive Athletes With Cardiovascular Abnormalities—General Considerations

Barry J. Maron, MD, FACC, *Co-Chair*
Douglas P. Zipes, MD, MACC, *Co-Chair*

2005



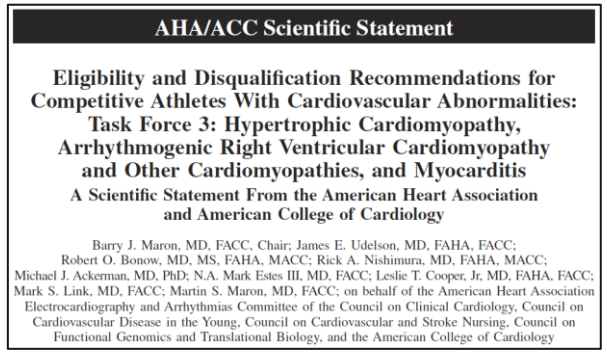
ESC European Society of Cardiology
European Heart Journal (2019) 40, 19–33
doi:10.1093/eurheartj/ehy730

SPECIAL ARTICLE
Sports cardiology

Recommendations for participation in competitive and leisure time sport in athletes with cardiomyopathies, myocarditis, and pericarditis: position statement of the Sport Cardiology Section of the European Association of Preventive Cardiology (EAPC)

Antonio Pelliccia[1*], Erik Ekker Solberg[2], Michael Papadakis[3], Paolo Emilio Adami[1,4], Alessandro Biffi[1], Stefano Caselli[5], Andrè La Gerche[6], Josef Niebauer[7], Axel Pressler[8,9], Christian M. Schmied[10], Luis Serratosa[11,12], Martin Halle[8,9], Frank Van Buuren[13], Mats Borjesson[14,15], Francois Carrè[16], Nicole M. Panhuyzen-Goedkoop[17,18], Hein Heidbuchel[19,20], Iacopo Olivotto[21], Domenico Corrado[22], Gianfranco Sinagra[23], and Sanjay Sharma[24]

2019



AHA/ACC Scientific Statement

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 3: Hypertrophic Cardiomyopathy, Arrhythmogenic Right Ventricular Cardiomyopathy and Other Cardiomyopathies, and Myocarditis

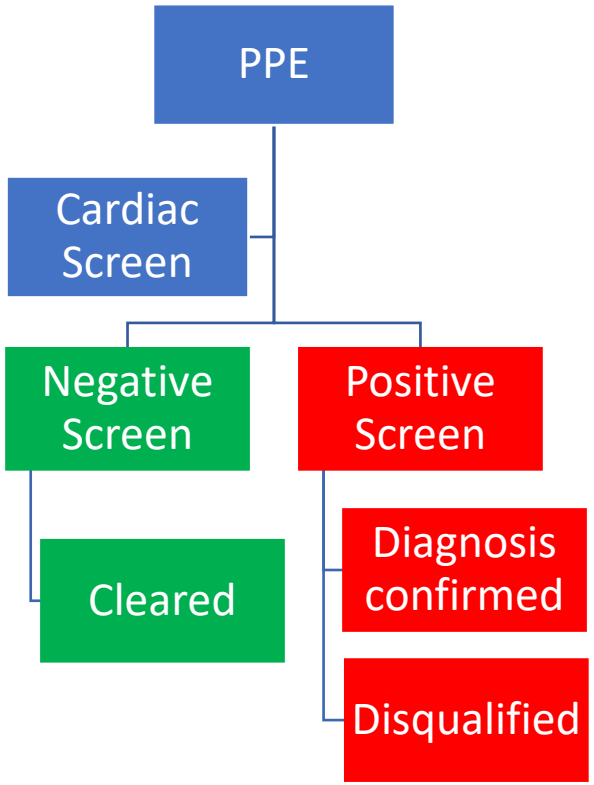
A Scientific Statement From the American Heart Association and American College of Cardiology

Barry J. Maron, MD, FACC, Chair; James E. Udelson, MD, FAHA, FACC; Robert O. Bonow, MD, MS, FAHA, MACC; Rick A. Nishimura, MD, FAHA, MACC; Michael J. Ackerman, MD, PhD; N.A. Mark Estes III, MD, FACC; Leslie T. Cooper, Jr, MD, FAHA, FACC; Mark S. Link, MD, FACC; Martin S. Maron, MD, FACC; on behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology

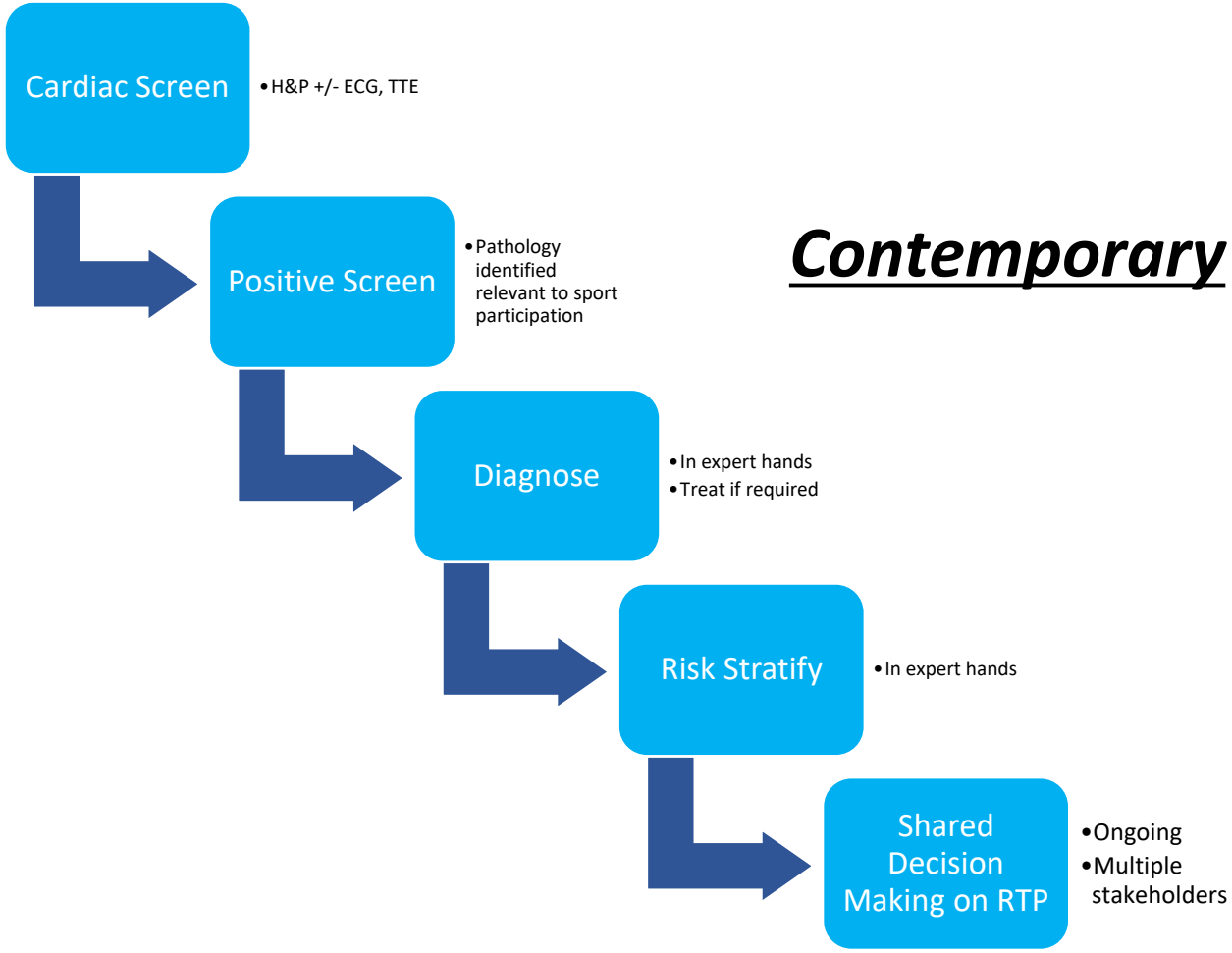
2015

Guidelines now indicate we need more than yes or no.
-> Advocate risk assessment

Paradigm Shift in Sports Cardiology



Traditional



Contemporary

ATLANTIC HEALTH SYSTEM

Some young athletes with heart disease cleared to play under new recommendations

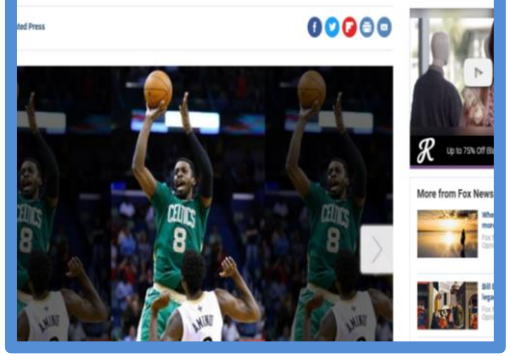
By AMERICAN HEART ASSOCIATION NEWS

Michigan DT Maurice Hurst, potential first-round pick, cleared to play after heart condition diagnosis

Frank Schwab
Shutdown Corner March 22, 2018

Follow

For 4 NBA players with serious heart ailments, a fraternity has helped get them through it



Baylor's Jared Butler medically cleared to play in NBA: Sources

By Shams Charania and The Athletic Staff
July 17, 2021 Updated 7:21 PM EDT

8 Comments

Soccer

Cleared by cardiologists, Sierra Leone's Alhaji Kamara joins D.C. United

By Steven Goff
May 10, 2016

D.C. United has acquired Alhaji Kamara, a forward from Sierra Leone whose career was jeopardized by a heart condition this winter.

In the past week, the MLS cardiology consultant and a heart specialist at MedStar Georgetown University Hospital examined Kamara and determined that he could resume playing soccer, United General Manager Dave Kasper said Tuesday.

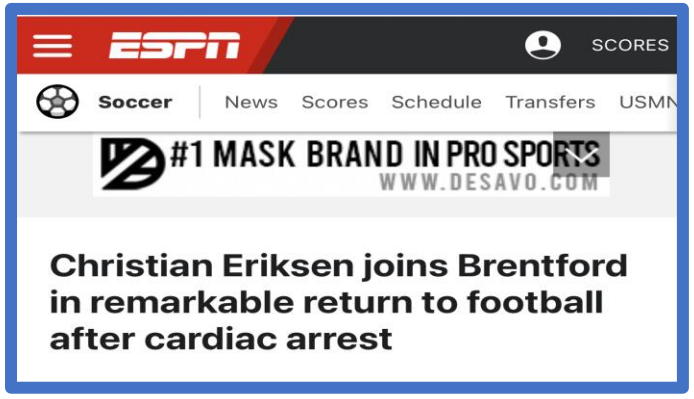
With medical clearance, United finalized a deal with Kamara's previous employer, IFK Norrkoping of Sweden. D.C. did not pay a transfer fee but will compensate the Swedish team if Kamara, 22, meets performance incentives or is sold in the future.

Alhaji Kamara (Norrkoping)

NBA NHL

Clint Dempsey cleared to play again after heart problems

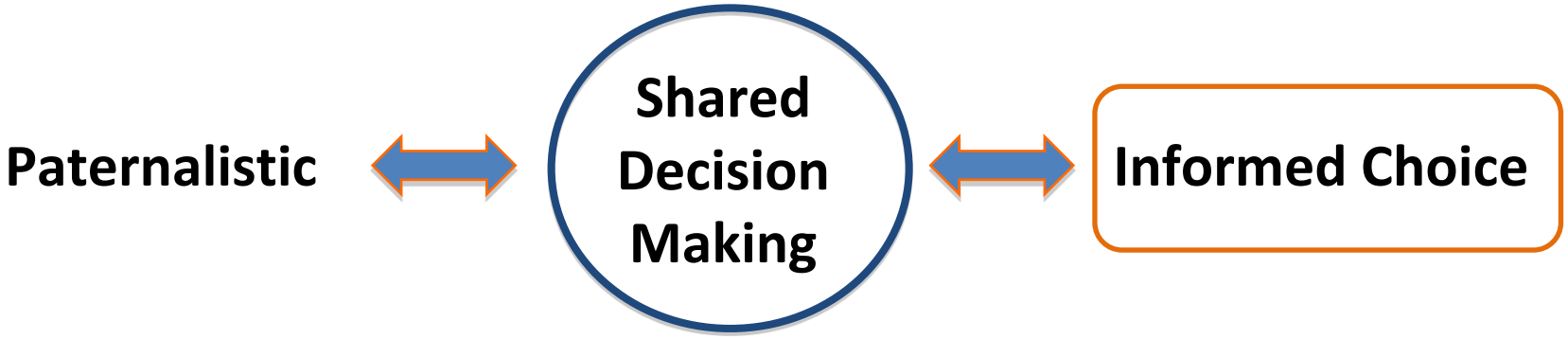
- Seattle Sounders striker missed end of last season with medical condition
- Dempsey says he hopes to make return to US national team soon



Christian Eriksen joins Brentford in remarkable return to football after cardiac arrest

Shared Decision Making

SDM is an approach where clinicians and patients make decisions together using the best available evidence.
(Elwyn et al. BMJ 2010)



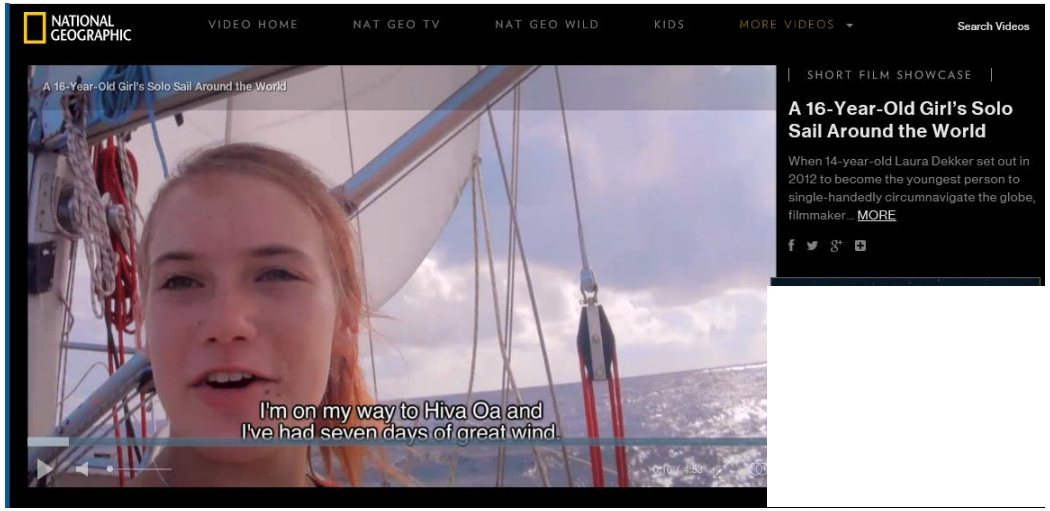
Patient well informed (Knowledge)

Knows what's important to them
(Patient values elicited)

Decision consistent with values

ATLANTIC HEALTH SYSTEM

Spectrum of comfort with risk



Would you let your 16 year old daughter (or son) sail around the world by herself?

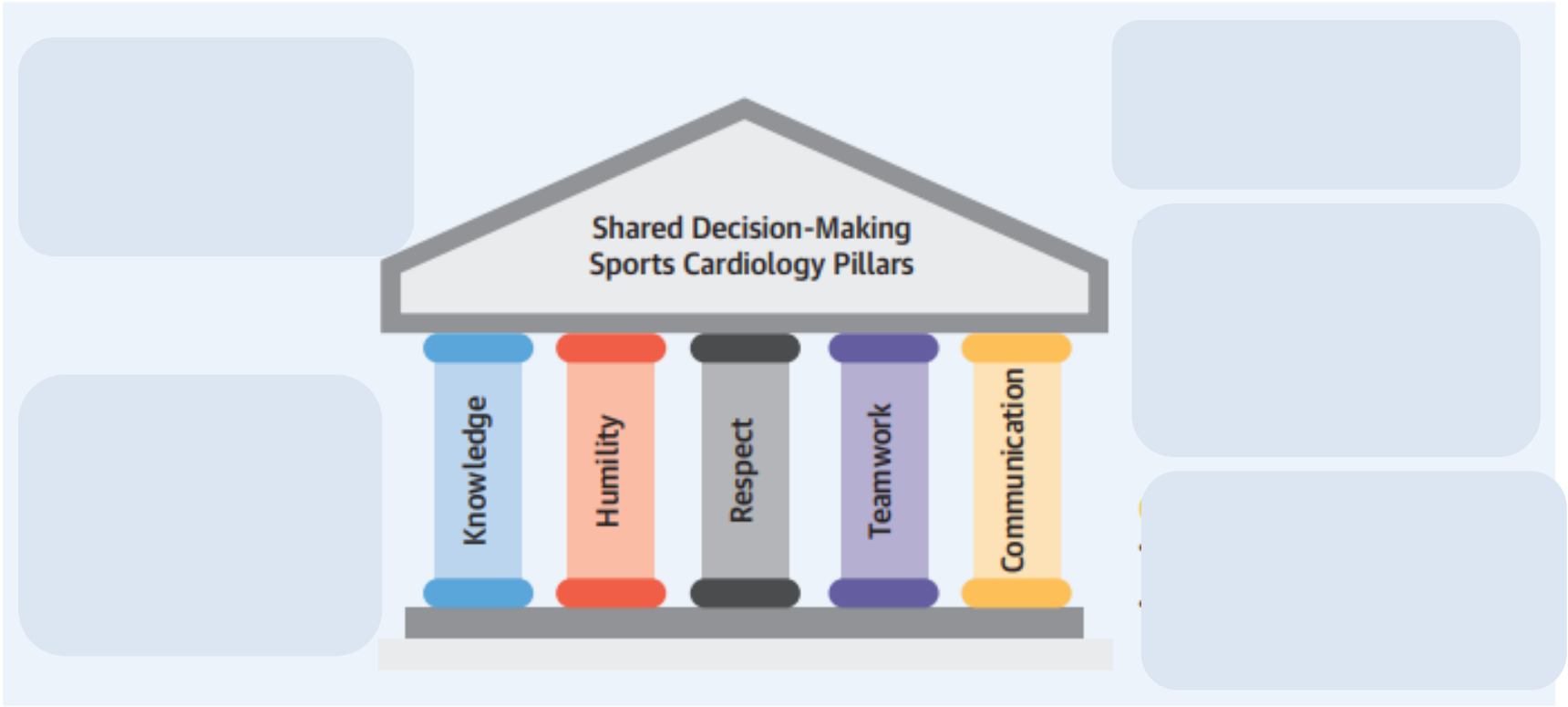
1) **Yes**

2) **No**

ATLANTIC HEALTH SYSTEM

SDM in Sports Cardiology

FIGURE 3 SDM Sports Cardiology Pillars



An illustration of the 5 pillars that make up a prescribed method of shared decision-making (SDM) that includes the required points to guide the patient-physician discussion.

Martinez, M.W. et al. J Am Coll Cardiol. 2021;78(14):1453-1470.

ATLANTIC HEALTH SYSTEM

CLINICAL SCIENCES

clinical commentary

The medical care of competitive athletes: the role of the physician and individual assumption of risk

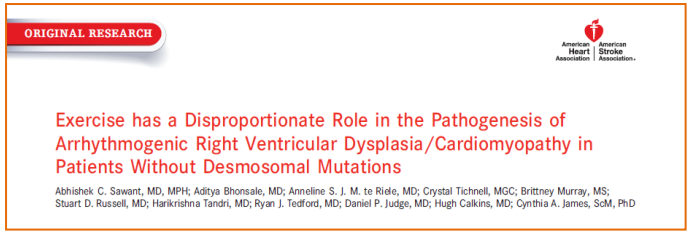
BENJAMIN D. LEVINE and JAMES STRAY-GUNDERSEN

Institute for Exercise and Environmental Medicine,
Presbyterian Hospital of Dallas,
The Baylor/UT Southwestern Sports Science Laboratory, and
The University of Texas Southwestern Medical Center at Dallas

LEVINE, B. D. and J. STRAY-GUNDERSEN. The medical care of competitive athletes: the role of the physician and individual assumption of risk. *Med. Sci. Sports Exerc.*, Vol. 26, No. 10, pp. 1190–1192, 1994.

Shared Decision-Making ≠ Low Risk for All

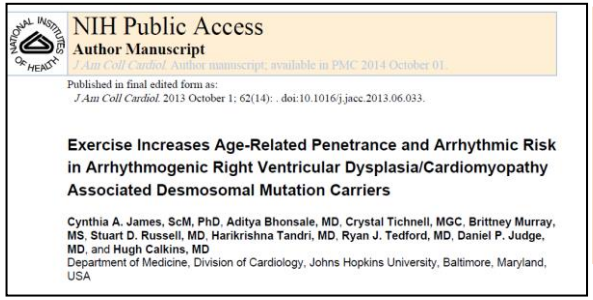
Exercise and Arrhythmogenic RV Cardiomyopathy



ORIGINAL RESEARCH

Exercise has a Disproportionate Role in the Pathogenesis of Arrhythmogenic Right Ventricular Dysplasia/Cardiomyopathy in Patients Without Desmosomal Mutations

Abhishek C. Sawant, MD, MPH; Aditya Bhonsale, MD; Anneline S. J. M. te Riele, MD; Crystal Tichnell, MGC; Brittney Murray, MS; Stuart D. Russell, MD; Harikrishna Tandri, MD; Ryan J. Tedford, MD; Daniel P. Judge, MD; Hugh Calkins, MD; Cynthia A. James, ScM, PhD

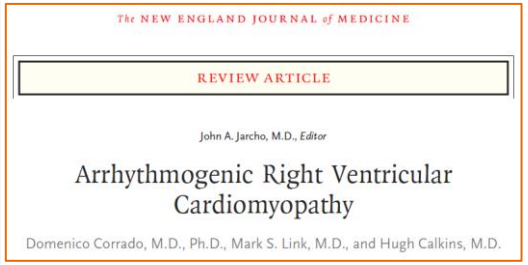


NIH Public Access
Author Manuscript
J Am Coll Cardiol. Author manuscript; available in PMC 2014 October 01.

Published in final edited form as:
J Am Coll Cardiol. 2013 October 1; 62(14): . doi:10.1016/j.jacc.2013.06.033.

Exercise Increases Age-Related Penetrance and Arrhythmic Risk in Arrhythmogenic Right Ventricular Dysplasia/Cardiomyopathy Associated Desmosomal Mutation Carriers

Cynthia A. James, ScM, PhD, Aditya Bhonsale, MD, Crystal Tichnell, MGC, Brittney Murray, MS, Stuart D. Russell, MD, Harikrishna Tandri, MD, Ryan J. Tedford, MD, Daniel P. Judge, MD, and Hugh Calkins, MD
Department of Medicine, Division of Cardiology, Johns Hopkins University, Baltimore, Maryland, USA



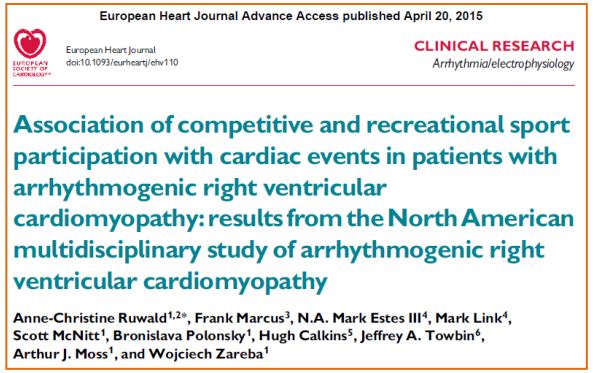
The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

John A. Jarcho, M.D., *Editor*

Arrhythmogenic Right Ventricular Cardiomyopathy

Domenico Corrado, M.D., Ph.D., Mark S. Link, M.D., and Hugh Calkins, M.D.



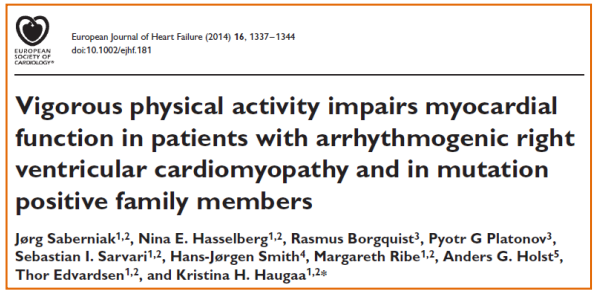
European Heart Journal Advance Access published April 20, 2015

European Heart Journal
doi:10.1093/eurheartj/ehv110

CLINICAL RESEARCH
Arrhythmia/electrophysiology

Association of competitive and recreational sport participation with cardiac events in patients with arrhythmogenic right ventricular cardiomyopathy: results from the North American multidisciplinary study of arrhythmogenic right ventricular cardiomyopathy

Anne-Christine Ruwald[1,2*], Frank Marcus[3], N.A. Mark Estes III[4], Mark Link[4], Scott McNitt[1], Bronislava Polonsky[1], Hugh Calkins[5], Jeffrey A. Towbin[6], Arthur J. Moss[1], and Wojciech Zareba[1]



European Journal of Heart Failure (2014) 16, 1337–1344
doi:10.1002/ejhf.181

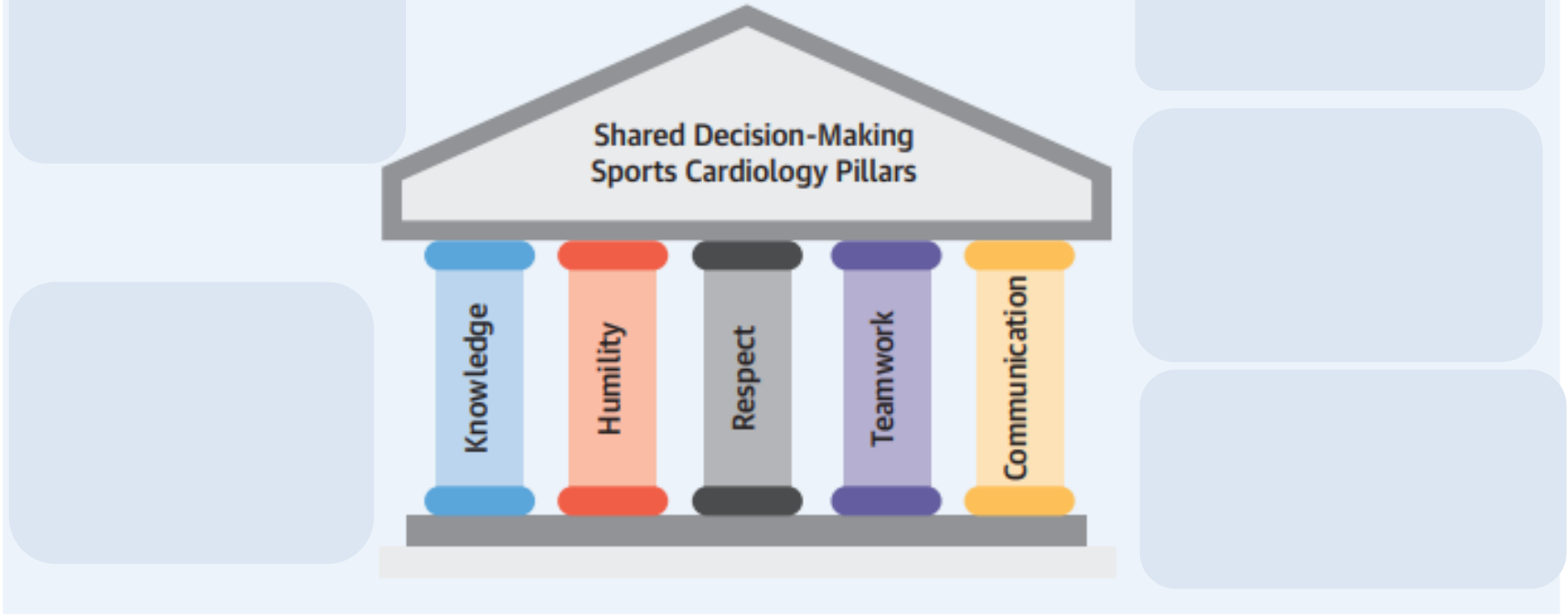
Vigorous physical activity impairs myocardial function in patients with arrhythmogenic right ventricular cardiomyopathy and in mutation positive family members

Jørg Saberniak[1,2], Nina E. Hasselberg[1,2], Rasmus Borgquist[3], Pyotr G Platonov[3], Sebastian I. Sarvari[1,2], Hans-Jørgen Smith[4], Margareth Ribe[1,2], Anders G. Holst[5], Thor Edvardsen[1,2], and Kristina H. Haugaa[1,2*]

Exercise increases the risk of ventricular arrhythmias and worsens RV function

ATLANTIC HEALTH SYSTEM

4. Document: Discussed risk and potential for harm even with an AED. Plan for surveillance → ?change in risk.



Who makes the final decision?

Martinez, M.W. et al. J Am Coll Cardiol. 2021;78(14):1453-1470.

Who makes the final decision?

All parties in agreement:
Expert Provider, Patient, Family and the University/Institution

FindLaw Caselaw United States US 7th Cir. KNAPP v. NORTHWESTERN UNIVERSITY

KNAPP v. NORTHWESTERN UNIVERSITY

Print 305 Font size: A A Reset

United States Court of Appeals,Seventh Circuit.

Nicholas KNAPP, Plaintiff-Appellee, v. NORTHWESTERN UNIVERSITY, an Illinois not-for-profit corporation, and Rick Taylor, Defendants-Appellants.

No. 96-3450.

Decided: November 22, 1996

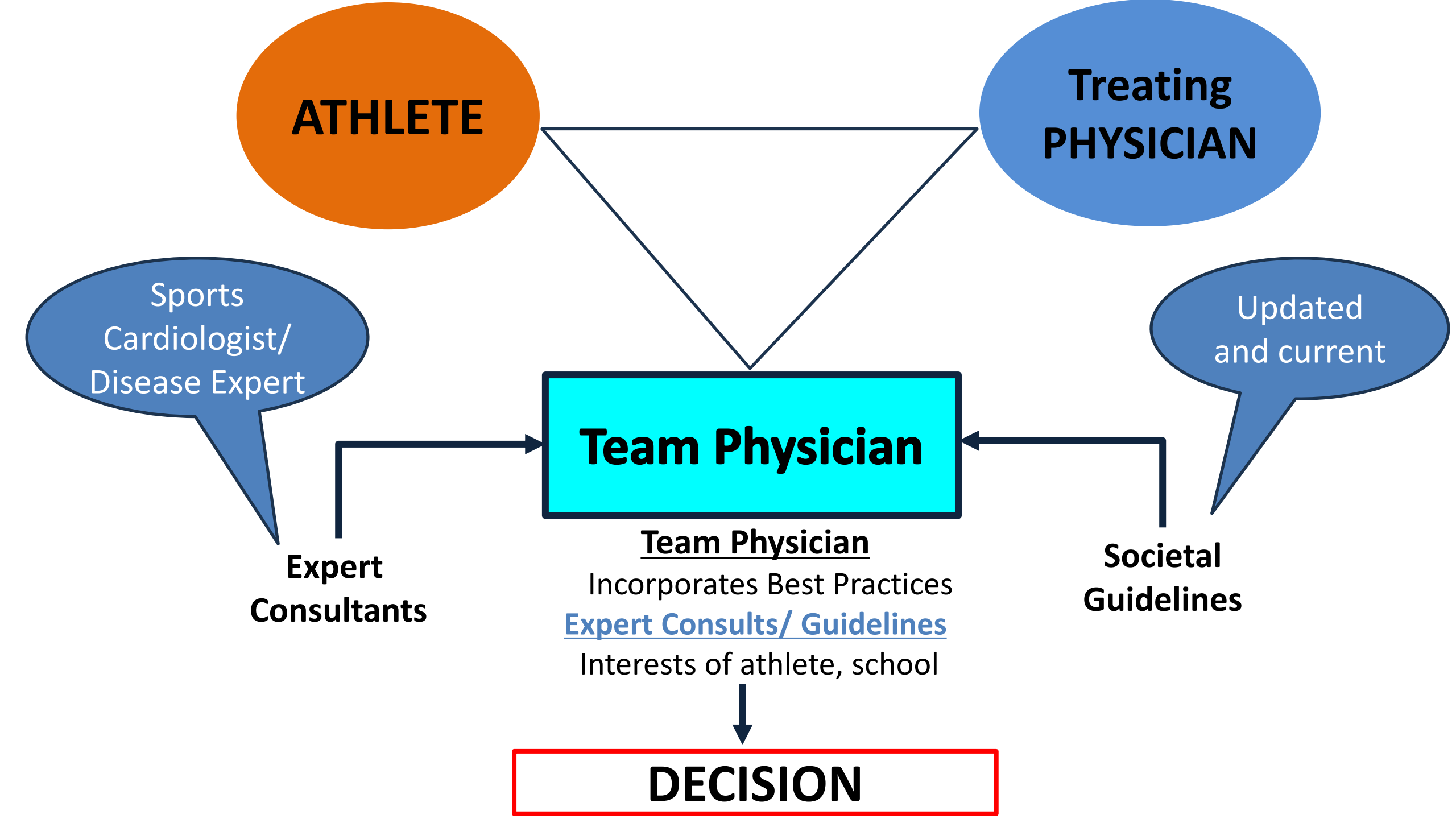
In closing, we wish to make clear that we are not saying Northwestern's decision necessarily is the right decision. We say only that it is not an illegal one under the Rehabilitation Act. On the same facts, another team physician at another university, reviewing the same medical history, physical evaluation, and medical recommendations, might reasonably decide that Knapp met the physical qualifications for playing on an intercollegiate basketball team. Simply put, all universities need not evaluate risk the same way. What we say in this case is that if substantial evidence supports the decision-mak[illegible] here Northwestern-that decision must be respected.

Shared Decision Making

cases involving risk of future injury, a school's perception of the threat of such injury cannot be based on unfounded fears or stereotypes; it must be based on objective evidence. Chiari, 920 F.2d at 317. But here, where Northwestern acted rationally and reasonably rather [illegible] paternalistically, no Rehabilitation Act violation has occurred. The Rehabilitation Act [illegible] replace, reflexive actions to actual or perceived handicaps with acti[illegible] Arline, 480 U.S. at 284-85, 107 S.Ct. at 1129.

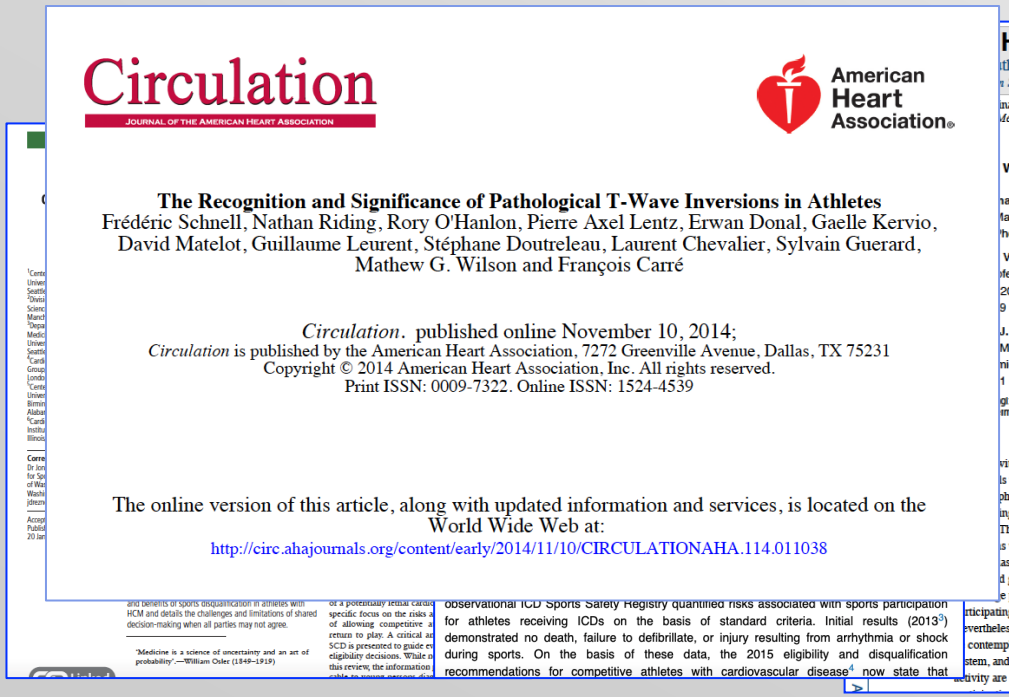
Based on evidence, expert review. NOT – because I said so.

ATLANTIC HEALTH SYSTEM


ATHLETE
Treating PHYSICIAN
Sports Cardiologist/ Disease Expert
Updated and current
Team Physician
Expert Consultants
Team Physician
Incorporates Best Practices
Expert Consults/ Guidelines
Interests of athlete, school
Societal Guidelines
DECISION

Evolving Science re: Cardiovascular Conditions:

- What are the risks of exercise in specific conditions?
- Consider the denominator
- Address the knowledge gaps



Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association

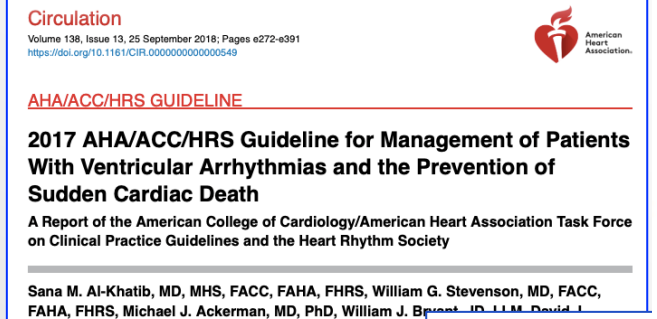
The Recognition and Significance of Pathological T-Wave Inversions in Athletes

Frédéric Schnell, Nathan Riding, Rory O'Hanlon, Pierre Axel Lentz, Erwan Donal, Gaelle Kervio, David Matelot, Guillaume Leurent, Stéphane Doutreleau, Laurent Chevalier, Sylvain Guerard, Mathew G. Wilson and François Carré

Circulation. published online November 10, 2014;
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/early/2014/11/10/CIRCULATIONAHA.114.011038



Circulation

Volume 138, Issue 13, 25 September 2018; Pages e272-e391
https://doi.org/10.1161/CIR.0000000000000549

American Heart Association.

AHA/ACC/HRS GUIDELINE

2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death

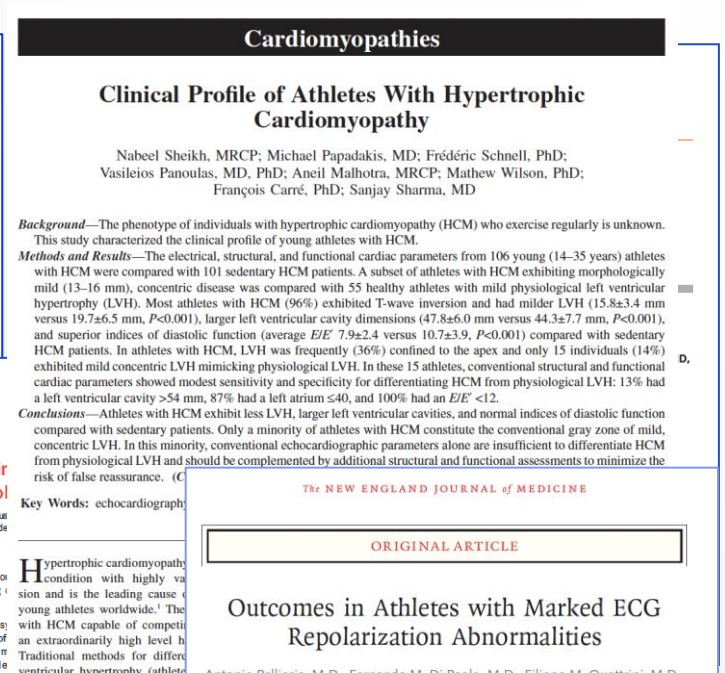
A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society

Sana M. Al-Khatib, MD, MHS, FACC, FAHA, FHRS, William G. Stevenson, MD, FACC, FAHA, FHRS, Michael J. Ackerman, MD, PhD, William J. Bryant, JD, LLM, David J. Callans, MD, FACC, FHRS, Anne B. Curtis, MD, FACC, FAH
MD, FACC, FAHA, Timm Dickfeld, MD, PhD, FHRS, Michae
FHRS, Gregg C. Fonarow, MD, FACC, FAHA, FHFSA, Anne
Christopher B. Granger, MD, FACC, FAHA, Stephen C. Har
A. Hlatky, MD, FACC, FAHA, José A. Joglar, MD, FACC, FA
Daniel D. Matlock, MD, MPH, Robert J. Myerburg, MD, FAC
FACC, FAHA, FHRS

ORIGINAL RESEARCH

Cardiac Events Durir
in Children and Adol

Kristina D. Chambers, BA; Virginie Beaus
D; Vassilios Bezzeride



Cardiomyopathies

Clinical Profile of Athletes With Hypertrophic Cardiomyopathy

Nabeel Sheikh, MRCP; Michael Papadakis, MD; Frédéric Schnell, PhD; Vasileios Panoulas, MD, PhD; Aneil Malhotra, MRCP; Mathew Wilson, PhD; François Carré, PhD; Sanjay Sharma, MD

Background—The phenotype of individuals with hypertrophic cardiomyopathy (HCM) who exercise regularly is unknown. This study characterized the clinical profile of young athletes with HCM.

Methods and Results—The electrical, structural, and functional cardiac parameters from 106 young (14–35 years) athletes with HCM were compared with 101 sedentary HCM patients. A subset of athletes with HCM exhibiting morphologically mild (13–16 mm), concentric disease was compared with 55 healthy athletes with mild physiological left ventricular hypertrophy (LVH). Most athletes with HCM (96%) exhibited T-wave inversion and had milder LVH (15.8±3.4 mm versus 19.7±6.5 mm, $P<0.001$), larger left ventricular cavity dimensions (47.8±6.0 mm versus 44.3±7.7 mm, $P<0.001$), and superior indices of diastolic function (average E/E' 7.9±2.4 versus 10.7±3.9, $P<0.001$) compared with sedentary HCM patients. In athletes with HCM, LVH was frequently (36%) confined to the apex and only 15 individuals (14%) exhibited mild concentric LVH mimicking physiological LVH. In these 15 athletes, conventional structural and functional cardiac parameters showed modest sensitivity and specificity for differentiating HCM from physiological LVH: 13% had a left ventricular cavity >54 mm, 87% had a left atrium ≤40, and 100% had an E/E' <12.

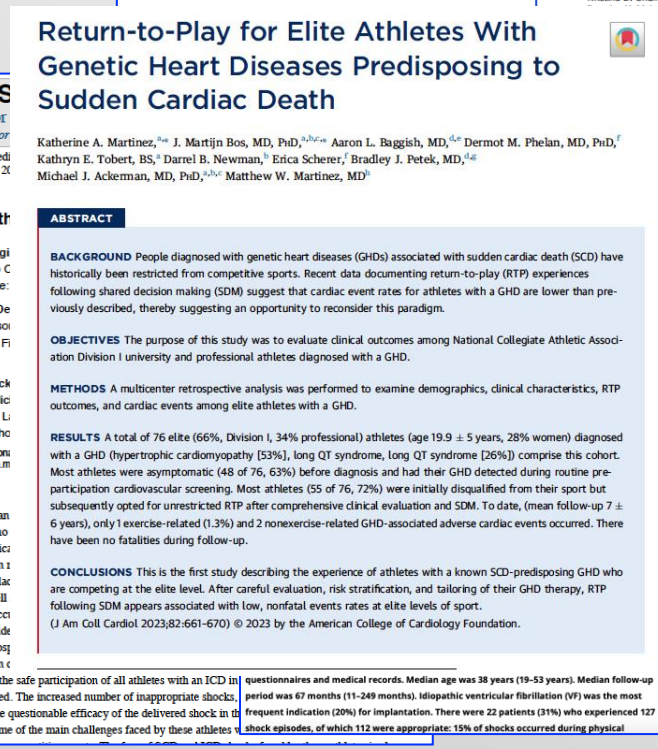
Conclusions—Athletes with HCM exhibit less LVH, larger left ventricular cavities, and normal indices of diastolic function compared with sedentary patients. Only a minority of athletes with HCM constitute the conventional gray zone of mild, concentric LVH. In this minority, conventional echocardiographic parameters alone are insufficient to differentiate HCM from physiological LVH and should be complemented by additional structural and functional assessments to minimize the risk of false reassurance. (C

Key Words: echocardiography

Hypertrophic cardiomyopathy condition with highly va sion and is the leading cause young athletes worldwide.[1] The with HCM capable of competi an extraordinarily high level h Traditional methods for differ ventricular hypertrophy (athlete relied on parameters derived fro and healthy athletes.[2-5] Anecdo such algorithms[2] may not be di with HCM.[6-8]

See Clinical P

This study sought to charact young athletes with HCM diag tion cardiovascular evaluation



Return-to-Play for Elite Athletes With Genetic Heart Diseases Predisposing to Sudden Cardiac Death

Katherine A. Martinez,[a,*] J. Martijn Bos, MD, PhD,[a,b,c,*] Aaron L. Baggish, MD,[d,e] Dermot M. Phelan, MD, PhD,[f] Kathryn E. Tobert, BS,[a] Darrel B. Newman,[b] Erica Scherer,[f] Bradley J. Petek, MD,[d,g] Michael J. Ackerman, MD, PhD,[a,b,c] Matthew W. Martinez, MD[h]

ABSTRACT

BACKGROUND People diagnosed with genetic heart diseases (GHDs) associated with sudden cardiac death (SCD) have historically been restricted from competitive sports. Recent data documenting return-to-play (RTP) experiences following shared decision making (SDM) suggest that cardiac event rates for athletes with a GHD are lower than previously described, thereby suggesting an opportunity to reconsider this paradigm.

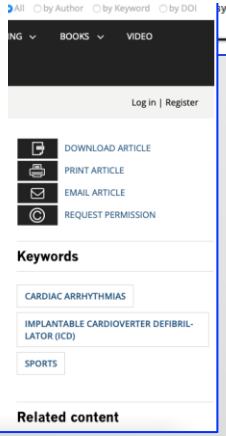
OBJECTIVES The purpose of this study was to evaluate clinical outcomes among National Collegiate Athletic Association Division I university and professional athletes diagnosed with a GHD.

METHODS A multicenter retrospective analysis was performed to examine demographics, clinical characteristics, RTP outcomes, and cardiac events among elite athletes with a GHD.

RESULTS A total of 76 elite (66%, Division I, 34% professional) athletes (age 19.9 ± 5 years, 28% women) diagnosed with a GHD (hypertrophic cardiomyopathy [53%], long QT syndrome, long QT syndrome [26%]) comprise this cohort. Most athletes were asymptomatic (48 of 76, 63%) before diagnosis and had their GHD detected during routine pre-participation cardiovascular screening. Most athletes (55 of 76, 72%) were initially disqualified from their sport but subsequently opted for unrestricted RTP after comprehensive clinical evaluation and SDM. To date, (mean follow-up 7 ± 6 years), only 1 exercise-related (1.3%) and 2 nonexercise-related GHD-associated adverse cardiac events occurred. There have been no fatalities during follow-up.

CONCLUSIONS This is the first study describing the experience of athletes with a known SCD-predisposing GHD who are competing at the elite level. After careful evaluation, risk stratification, and tailoring of their GHD therapy, RTP following SDM appears associated with low, nonfatal events rates at elite levels of sport.

(J Am Coll Cardiol 2023;82:661-670) © 2023 by the American College of Cardiology Foundation.



BOOKS VIDEO

Log in | Register

DOWNLOAD ARTICLE
PRINT ARTICLE
EMAIL ARTICLE
REQUEST PERMISSION

Keywords

CARDIAC ARRHYTHMIAS
IMPLANTABLE CARDIOVERTER DEFIBRILLATOR (ICD)
SPORTS

Related content

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Outcomes in Athletes with Marked ECG Repolarization Abnormalities

Antonio Pelliccia, M.D., Fernando M. Di Paolo, M.D., Filippo M. Quattrini, M.D., Cristina Basso, M.D., Franco Culasso, Ph.D., Gloria Popoli, M.D., Rosanna De Luca, M.D., Antonio Spataro, M.D., Alessandro Biffi, M.D., Gaetano Thiene, M.D., and Barry J. Maron, M.D.

ABSTRACT

BACKGROUND

Young, trained athletes may have abnormal 12-lead electrocardiograms (ECGs) without evidence of structural cardiac disease. Whether such ECG patterns represent the initial expression of underlying cardiac disease with potential long-term adverse consequences remains unresolved. We assessed long-term clinical outcomes in athletes with ECGs characterized by marked repolarization abnormalities.

METHODS

From a database of 12,550 trained athletes, we identified 81 with diffusely distributed and deeply inverted T waves (≥2 mm in at least three leads) who had no apparent cardiac disease and who had undergone serial clinical, ECG, and echocardiographic studies for a mean (±SD) of 9±7 years (range, 1 to 27). Comparisons were made with 229 matched control athletes with normal ECGs from the same database.

RESULTS

Of the 81 athletes with abnormal ECGs, 5 (6%) ultimately proved to have cardiomyopathies, including one who died suddenly at the age of 24 years from clinically undetected arrhythmogenic right ventricular cardiomyopathy. Of the 80 surviving athletes, clinical and phenotypic features of hypertrophic cardiomyopathy developed in 3 after 12±5 years (at the ages of 27, 32, and 50 years), including 1 who had an aborted cardiac arrest. The fifth athlete demonstrated dilated cardiomyopathy after 9 years of follow-up. In contrast, none of the 229 athletes with normal ECGs had a cardiac event or received a diagnosis of cardiomyopathy 9±3 years after initial evaluation (P=0.001).

classified by 2 electrophysiologists.

LQTS

Return to play? Athletes with congenital long QT syndrome

Jonathan N Johnson,[1] Michael J Ackerman[1,2,3]

BJSM 2013

- Low rate of cardiac events and no deaths in over 650 athlete-years of follow-up

Sports Participation in Genotype Positive Children With Long QT Syndrome

Peter F. Aziz, MD,* Tammy Sweeten, MS,† Ramon L. Vogel, MD,† William J. Bonney, MD,† Jacqueline Henderson, RN,† Akash R. Patel, MD,‡ Maully J. Shah, MBBS†

JACC 2015

- No cardiac events and no deaths in **treatment-compliant** children with LQTS in 755 patient-years of follow-up

Shared Decision-Making in Cardiovascular Disease

ATLANTIC HEALTH SYSTEM

EXERCISE IN GENETIC CARDIOVASCULAR DISEASE

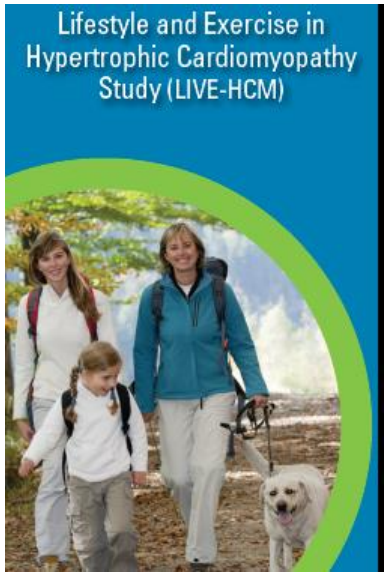
(LIVE-HCM)

Aim 1: Incidence **arrhythmic events** over 3 years
Comparison moderate or vigorous exercisers vs sedentary

Aim 2: **Quality of life**
Comparison moderate or vigorous exercisers vs sedentary

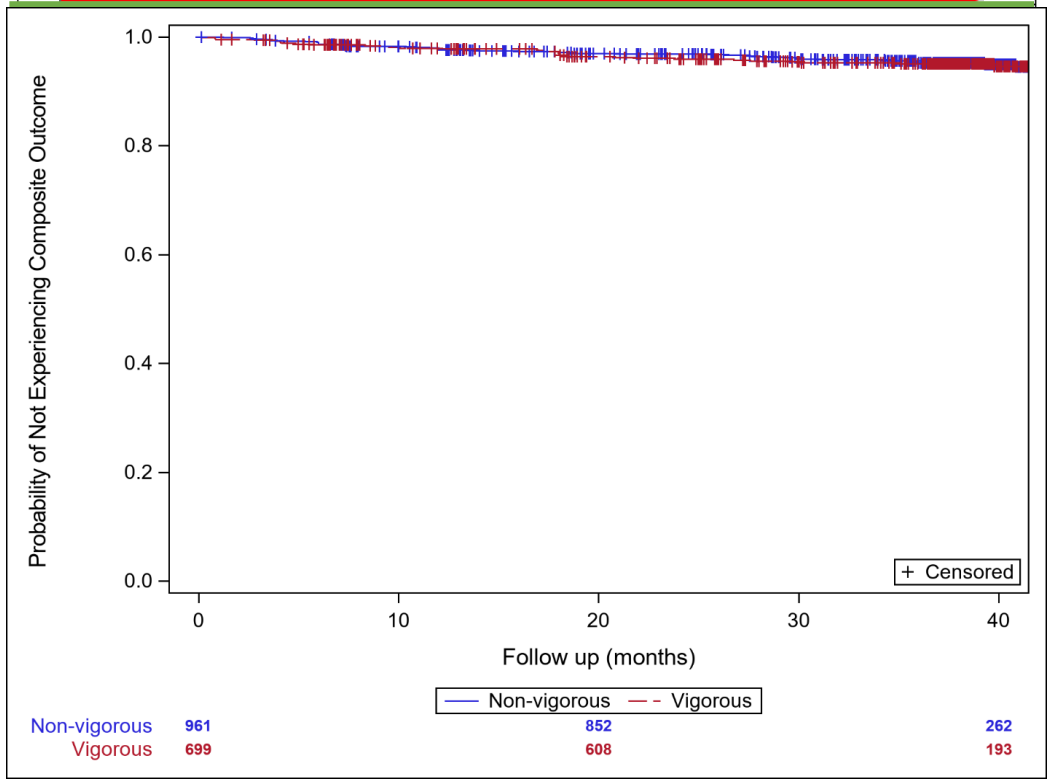
Age 8-60 years, with OR without ICD
Any level exercise

3 years of follow up



NIH R01 HL125918-01

	Non-Vigorous	Vigorous	Total	P alue
	N=961	N=699	N=1660	
TOTAL composite endpoint				
N	44	33	77	
Rate per 1,000 person-year	15.3	15.9	15.6	
(95% CI)	(11.4, 20.5)	(11.3, 22.4)	(12.5, 19.6)	



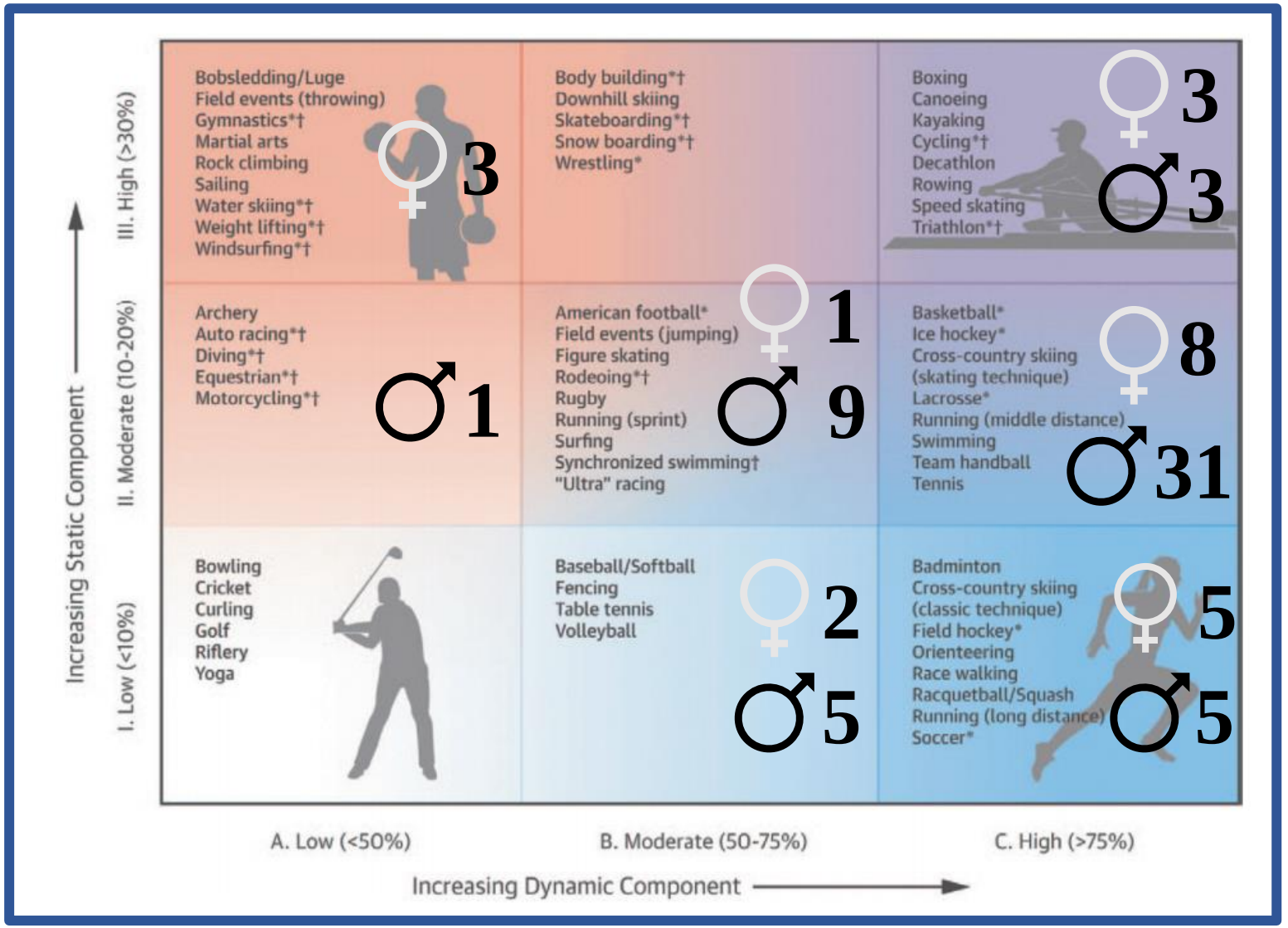
RTP for Elite Level Athletes With Sudden Cardiac Death Predisposing Heart Conditions

Demographics	Total Cohort
Total Number of Athletes	76
Mean Age at Return-to-Play (years)	19.9 ± 5.0
Female (%)	21 (28)
Race (%)	
White	38 (50)
Black	28 (37)
Not Disclosed/Unknown	4 (5)
Other	2 (3)
Asian	1 (1)
Hispanic	1 (1)
Indian	1 (1)
Pacific Islander	1 (1)
Diagnosis (%)	
HCM	40 (53)
LQTS	20 (26)
DCM	5 (7)
Other	5 (7)
ARVC	4 (5)
IVF	2 (3)
Symptomatic Prior to Diagnosis (%)	28 (37)
Syncope	10 (13)
Other	6 (8)
SCA	6 (8)
Irregular Heart Rate / Palpitations	4 (5)
Sustained VT	2 (3)

- 49 (64%) Division I and 27 (36%) professional athletes.
- 55 athletes (72%) were initially disqualified but opted to RTP after comprehensive clinical evaluation and SDM.
- 73 out of 76 athletes (96%) chose to RTP.
- 1 patients (1.3%) had ≥ 1 breakthrough cardiac event (BCE) with exercise, 2 (2.6%) without exercise.
- NO deaths.

K Martinez,, M Martinez JACC 2023

Return-to-Play for Elite Athletes With Genetic Heart Diseases Predisposing to Sudden Cardiac Death



K Martinez,, M Martinez JACC 2023

Return-to-Play for Elite Athletes With Genetic Heart Diseases Predisposing to Sudden Cardiac Death

Demographics	Total Cohort
Total Number of Athletes	76
Mean Age at Return-to-Play (years)	19.9 ± 5.0
Female (%)	21 (28)
Race (%)	
White	38 (50)
Black	28 (37)
Not Disclosed/Unknown	4 (5)
Other	2 (3)
Asian	1 (1)
Hispanic	1 (1)
Diagnosis (	
IVF	2 (3)
Symptomatic Prior to Diagnosis (%)	28 (37)
Syncope	10 (13)
Other	6 (8)
SCA	6 (8)
Irregular Heart Rate / Palpitations	4 (5)
Sustained VT	2 (3)

- 49 (64%) Division I and 27 (36%) professional athletes.
- 55 athletes (72%) were initially disqualified but opted to RTP after comprehensive clinical evaluation

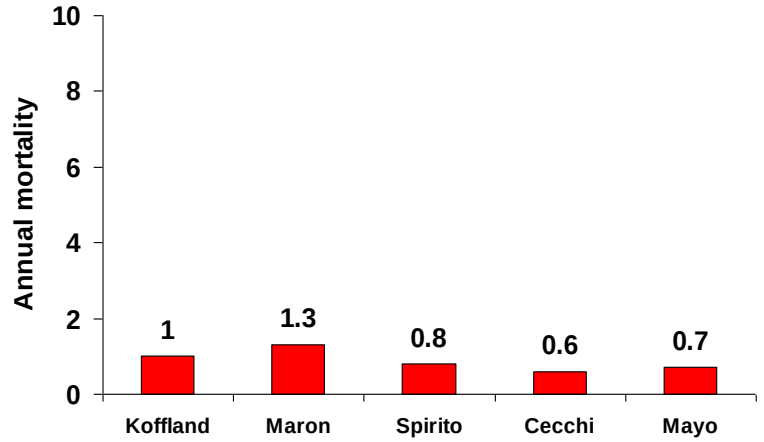
Conclusion:

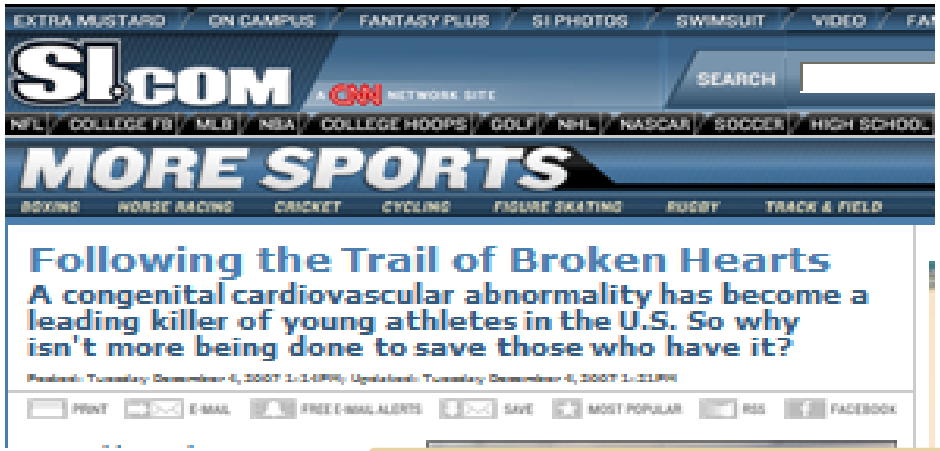
After careful evaluation by an expert, risk stratification, and SDM, an exercise plan can be put into place for Division I and professional athletes to RTP.

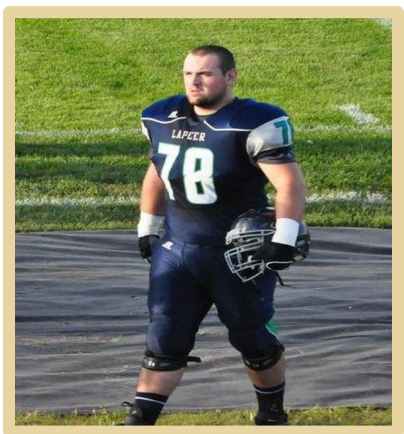
- ose to breakthrough cardiac event (BCE) with exercise, 2 (2.6%) without exercise.
- NO deaths.

Clinical Dilemma

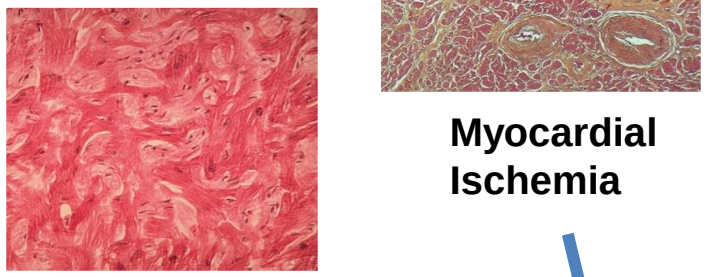
Low Annual Mortality Overall



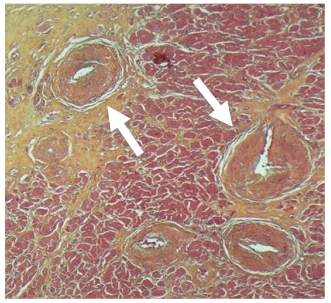




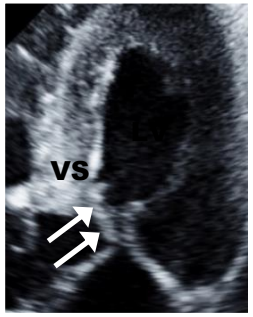
HCM



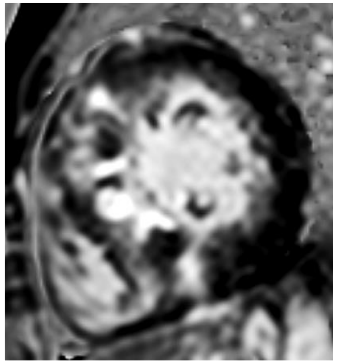
Disorganized Architecture



Myocardial Ischemia



↑ LV Systolic Pressure



Myocardial Scar

Arrhythmic Risk

Clinical Risk Factors for HCM Sudden Cardiac Arrest

Family history of sudden death from HCM
Massive LVH (>30mm)
Unexplained syncope
HCM w/ LV systolic dysfunction (EF <50%)
LV apical aneurysm
Extensive LGE on CMR
NSVT on ambulatory monitor

JAMA Cardiology | Original Investigation

Enhanced American College of Cardiology/American Heart Association Strategy for Prevention of Sudden Cardiac Death in High-Risk Patients With Hypertrophic Cardiomyopathy

Martin S. Maron, MD; Ethan J. Rowin, MD; Benjamin S. Wessler, MD; Paula J. Mooney, RN; Amber Fatima, MD; Parth Patel, MD; Benjamin C. Koethe, MPH; Mikhail Romashko, MD; Mark S. Link, MD; Barry J. Maron, MD

2019

- 2094 patients with HCM. Observational data. Single center
- Mean follow-up 4.7 years
- 12 of 1567 (0.8%) had SCA
- 527 received primary prevention ICDs
- Very low annual mortality. 99% survival without ICD
- 16% experienced device therapy–terminated VT/VF;
- 20 patients w/ ICD interventions -> 85% had LGE

Risk stratification and prevention model averted nearly all SCD

Enhanced ACC/AHA clinical risk factor strategy for predicting SCD events was 95% sensitive

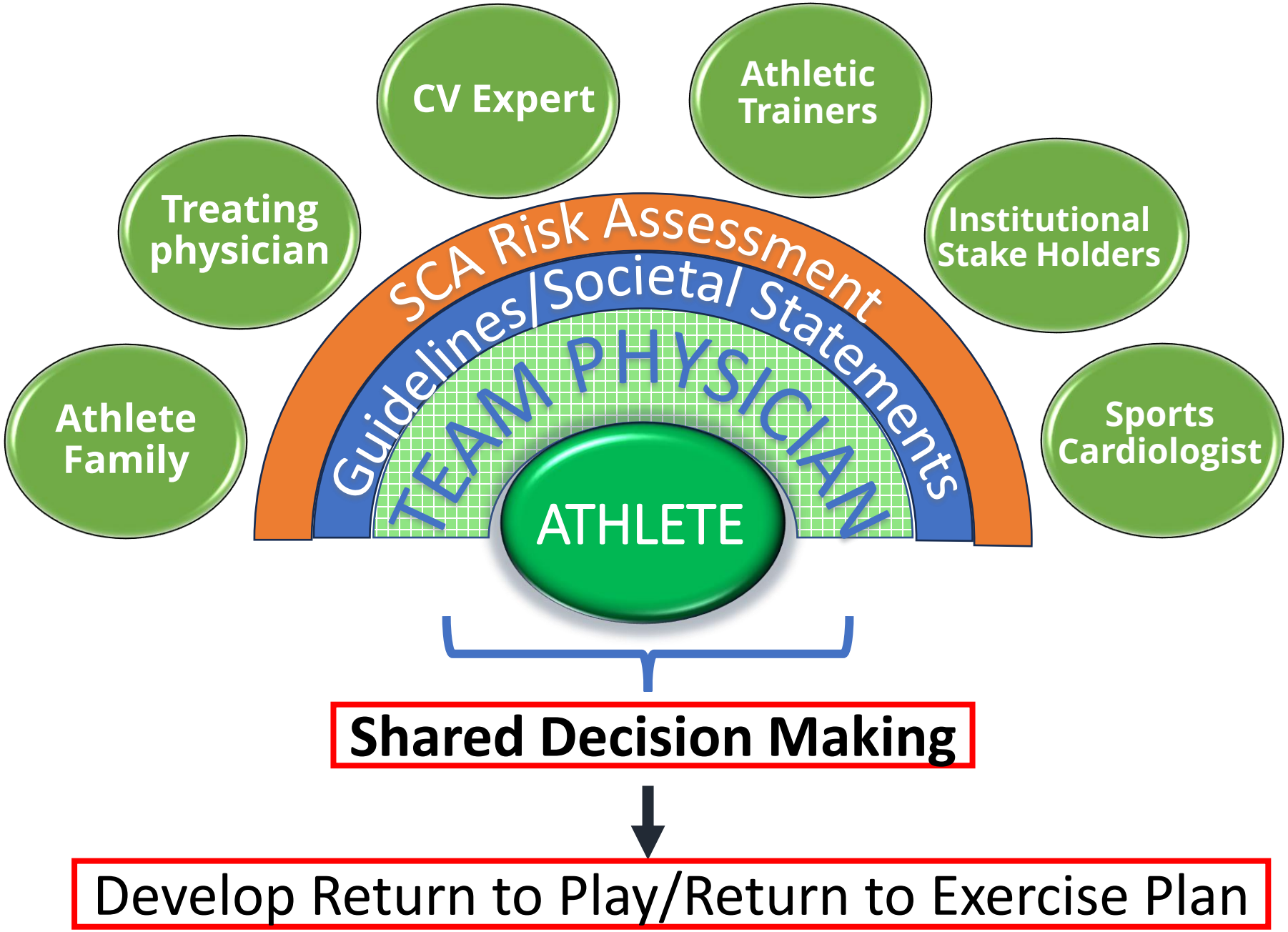
AHA/ACC CLINICAL PRACTICE GUIDELINE

2020 AHA/ACC Guideline for the Diagnosis and Treatment of Patients With Hypertrophic Cardiomyopathy

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines

COR	LOE	RECOMMENDATIONS
1	B-NR	1. For most patients with HCM, mild- to moderate-intensity recreational* exercise is beneficial to improve cardiorespiratory fitness, physical functioning, and quality of life, and for their overall health in keeping with physical activity guidelines for the general population (1-3).
1	C-EO	2. For athletes with HCM, a comprehensive evaluation and shared discussion of potential risks of sports participation by an expert provider is recommended (4).
2a	C-EO	3. For most patients with HCM, participation in low-intensity competitive sports is reasonable (5,6).
2b	C-LD	5. For patients with HCM, participation in high-intensity recreational activities or moderate- to high-intensity competitive sports activities may be considered after a comprehensive evaluation and shared discussion, repeated annually with an expert provider who conveys that the risk of sudden death and ICD shocks may be increased, and with the understanding that eligibility decisions for competitive sports participation often involve third parties (e.g., team physicians, consultants, and other institutional leadership) acting on behalf of the schools or teams (4,7-11).

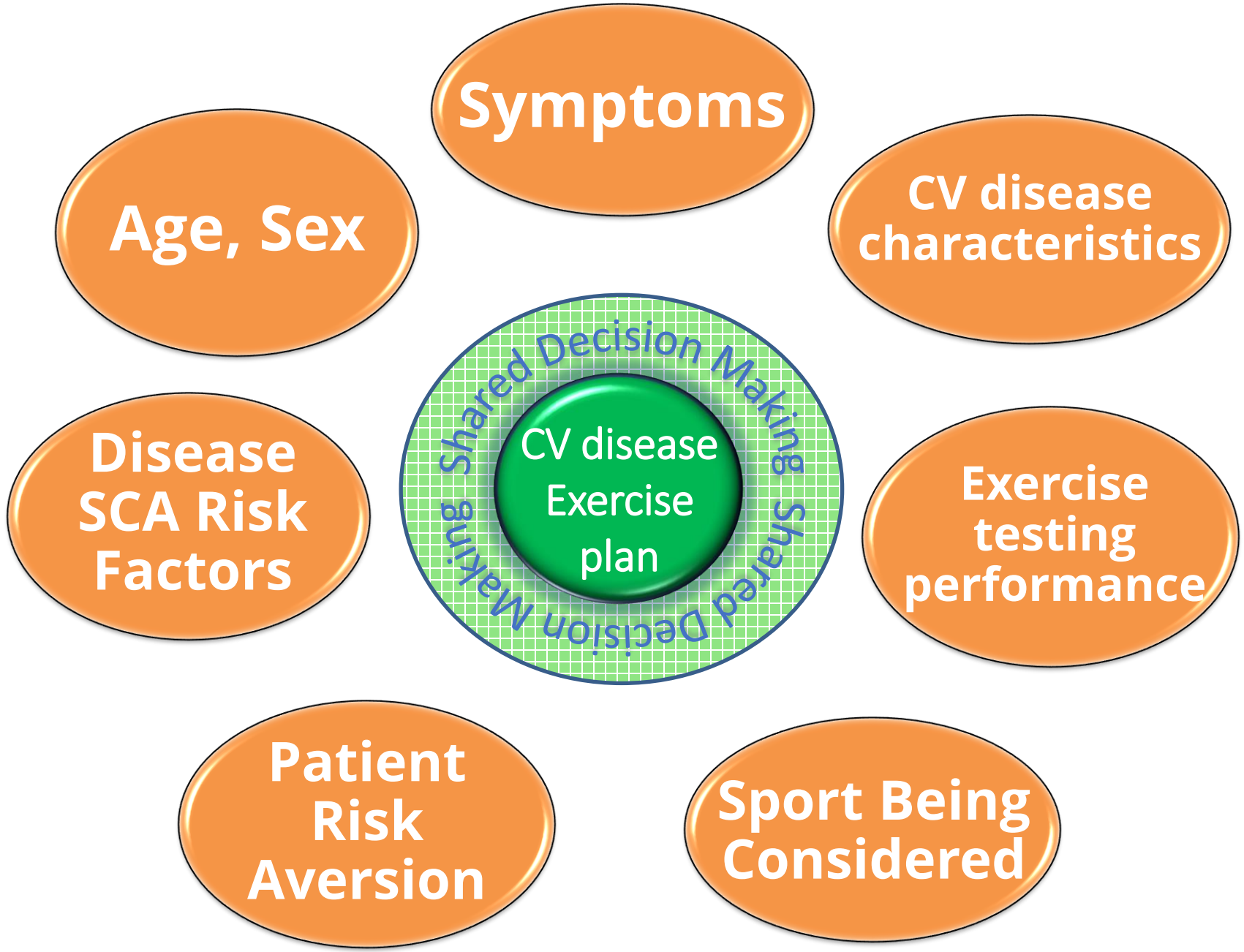
Ommen et al. Circulation. 2020 and 2024;142:e558-e631.


CV Expert
Athletic Trainers
Treating physician
Institutional Stake Holders
Athlete Family
Sports Cardiologist
SCA Risk Assessment
Guidelines/Societal Statements
TEAM PHYSICIAN
ATHLETE
Shared Decision Making
Develop Return to Play/Return to Exercise Plan

Playing with HCM

- Patient/player autonomy in health care decisions is important
- Absolute risk is difficult to quantify for all
- Risk avoidance/acceptance is individual decision

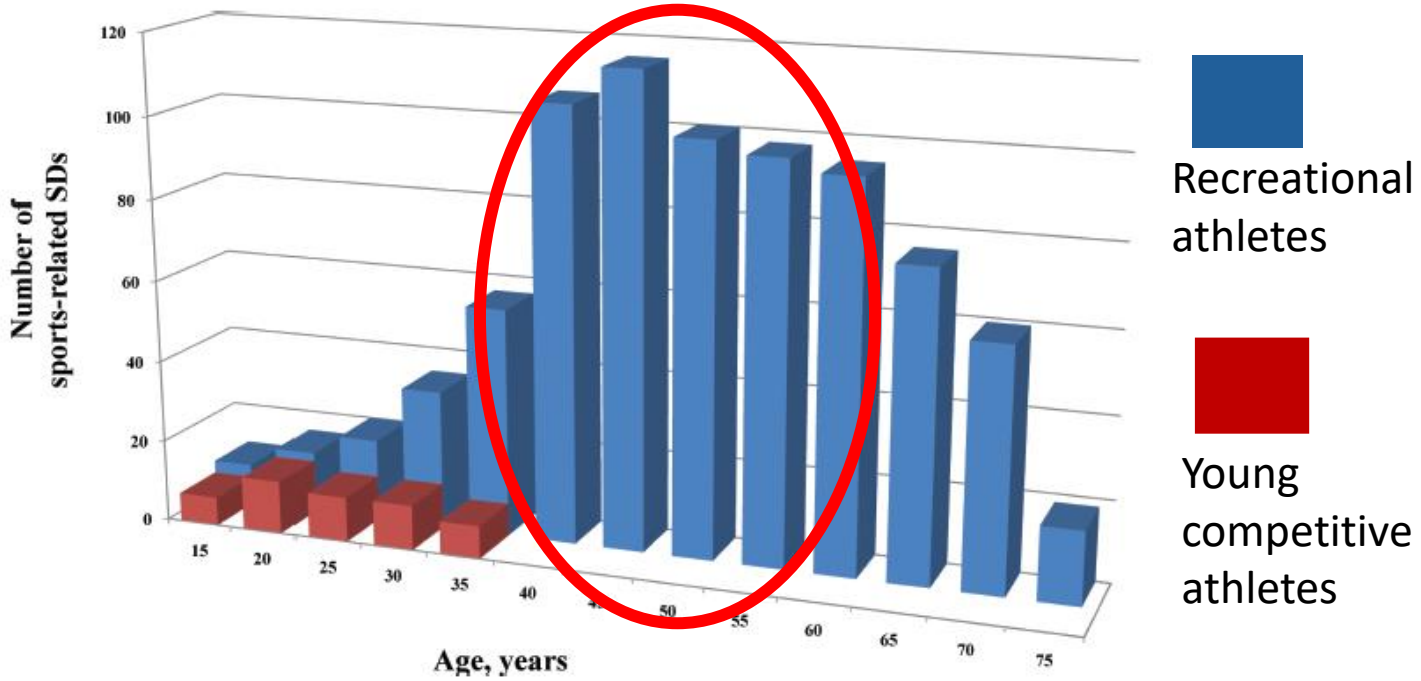
- **Potential harms of disqualification**
  - Loss of self-identity
  - Loss of scholarship/education
  - Loss of income
  - Depression/mental health concerns



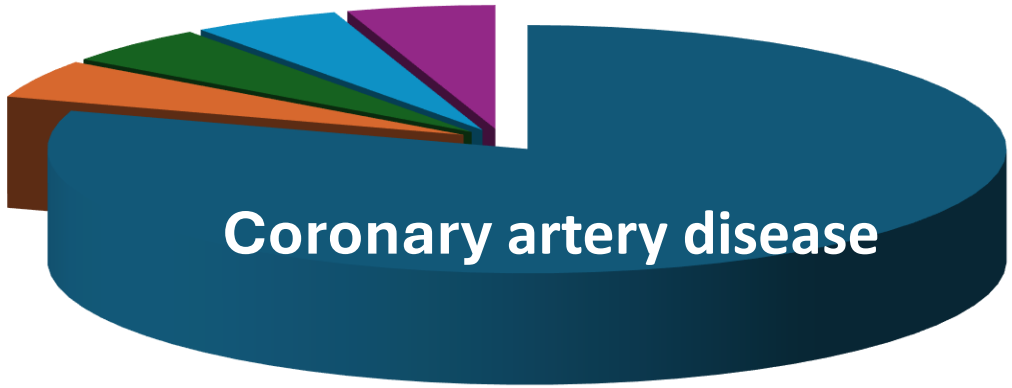
ATLANTIC HEALTH SYSTEM

ATLANTIC HEALTH SYSTEM

The Exercise Paradox



Can trigger myocardial infarction and promote fatal arrhythmias in predisposed individual



Causes of exercise related SCD in the community

Marijion E. Circulation 2011

Identifying Individuals at High Risk of Coronary Artery Disease

Symptoms

Habitual activity level

10-year risk

ASCVD Risk Estimator Plus

HeartScore

EAPC European Association of Preventive Cardiology

Low risk

Mod risk

High risk

V high risk

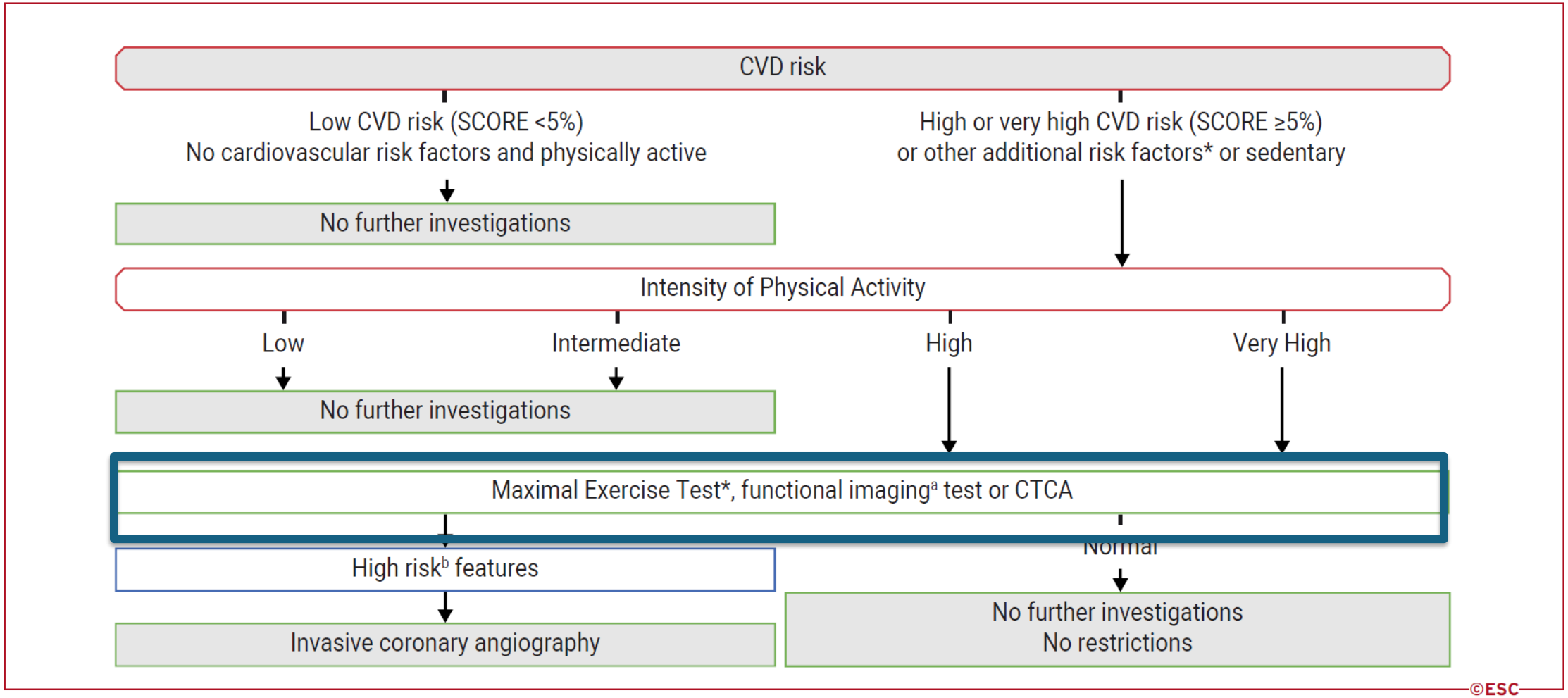
Caveats:

Not validated in Masters athlete

CRF not included in these equations

May overestimate risk in athletes

Proposed algorithm for pre-participation cardiovascular assessment in individuals aged >35 years



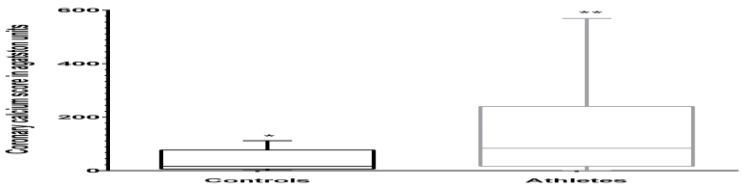
Exercise Stress Testing

Good prognostic value in individuals with angina

Low sensitivity and specificity in asymptomatic individuals

Symptomatic Sens 68% Spec 77%

AsymptomaticSens 46% Spec 16%



Menafoglio et al BJSM 2014

76 athletes had an exercise test

3 already had a diagnosis of cardiac disease.

4 (5.5%) had a positive test.

Subsequent investigation in all 4 failed to show significant coronary artery disease

False positive rate 100%

The Diagnostic Accuracy of Exercise Electrocardiography in Recreational land Competitive Athletes

Van de Sande. Scan J Med Sci Sport 2015

1298 athletes (45 ± 13 years); 88% male

Exercised for 6.6 ± 3.7 hr/week

Low atherosclerotic risk profile

53 (4.1%) positive exercise tests

Data regarding further investigation in 38 athletes (72%): MPS in 35 and CTCA in 3

False positive rate 95%

Coronary Artery Calcium (CAC)/ Coronary Computed Tomography Angiography (CCTA)

- CAC is a surrogate for atherosclerotic volume and a robust predictor of CV morbidity and mortality over and above traditional risk factors.

- CAC score is used for risk stratification and intensifying therapy for recognised risk factors for atherosclerosis.

- CCTA determines the magnitude of atherosclerotic coronary artery disease distribution and quantitative and qualitative plaque analysis.

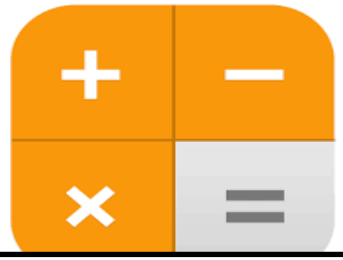
- Increasing utilization of CCTA in middle-aged endurance athletes

Athletes with possible or known CV disease

Assess Symptoms

Assess Risk

Manage Risk



- Blood pressure
- Lipid panel & Novel risk markers
- HgbA1c
- Smoking status
- Family history of early CAD (M <55 yo; F <65 yo)
- Supplement use (e.g., testosterone)

CAC Score:

- If they already have it…
- If not, discuss the pros/cons

Fitness, Coronary Calcification and Cardiac Events

8425 men without cardiovascular disease

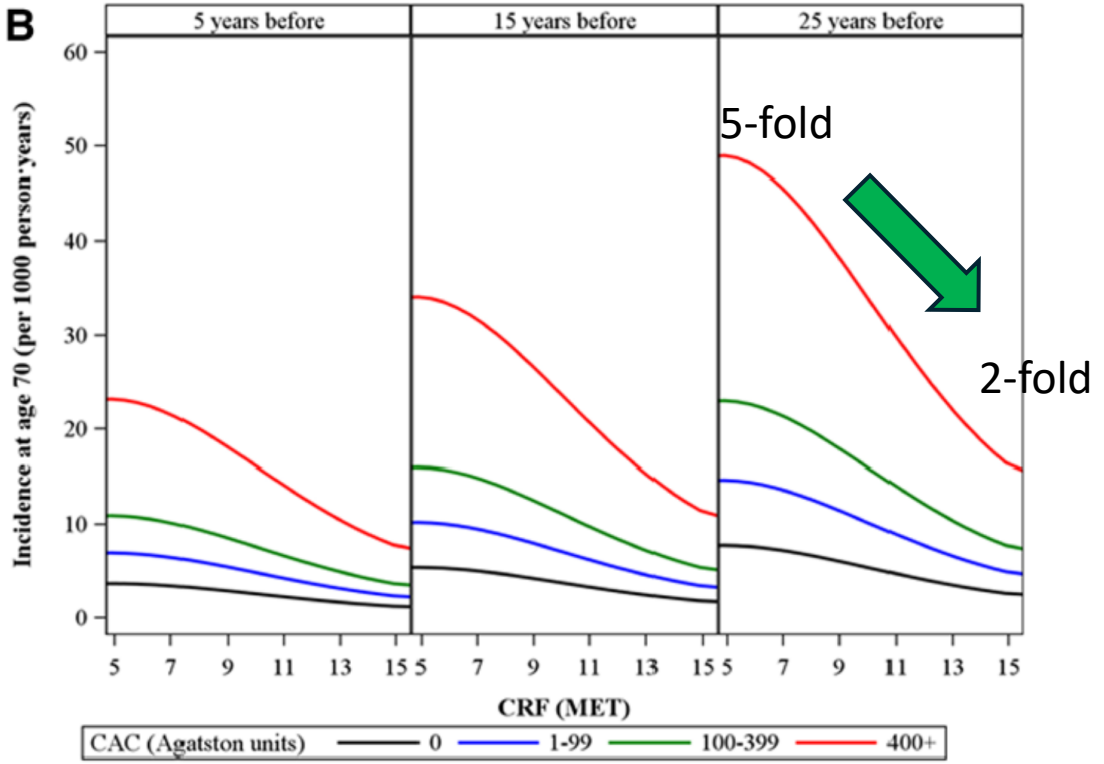
Cardiorespiratory fitness assessment

+

Coronary artery calcium (CAC) score

Follow up 8.4 years

Deaths, Myocardial infarction and stroke in individuals with 4 categories of CAC

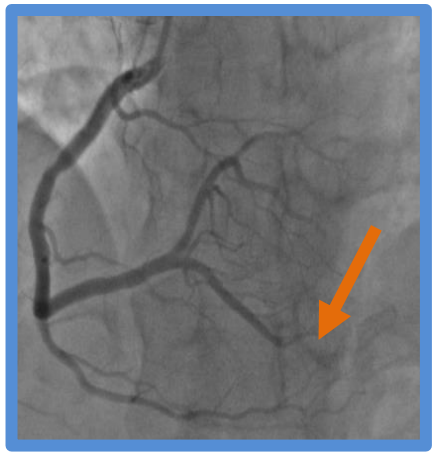


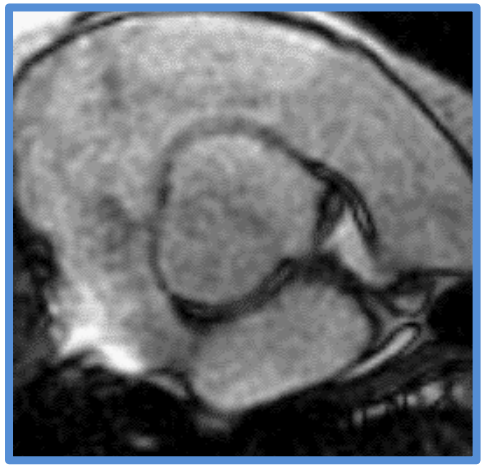
CAC score 0	CAC score 1-99	CAC score 100-399	CAC score ≥ 400
0.9	2.0	2.1	5.9

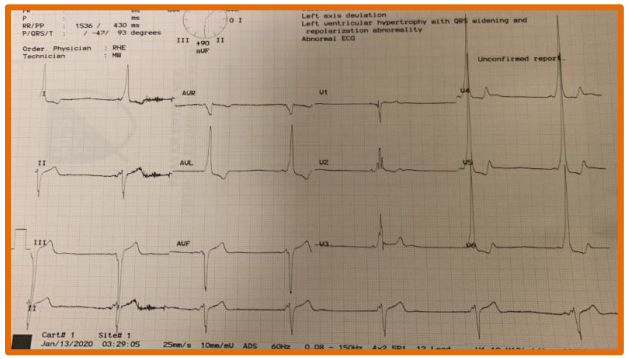
Hard event rates per 1000 person years

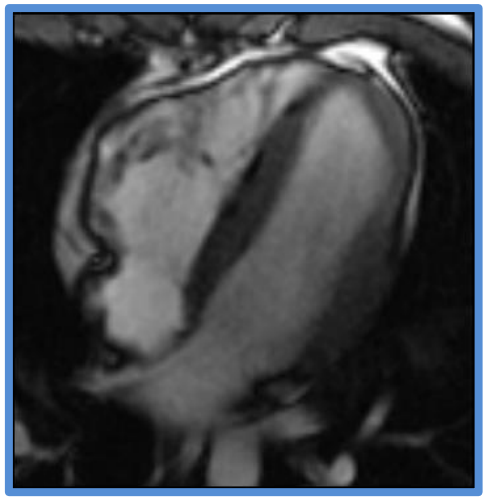
The risk of hard CV events decreased 14% for each MET increase across all CAC scores adjusted for risk factors

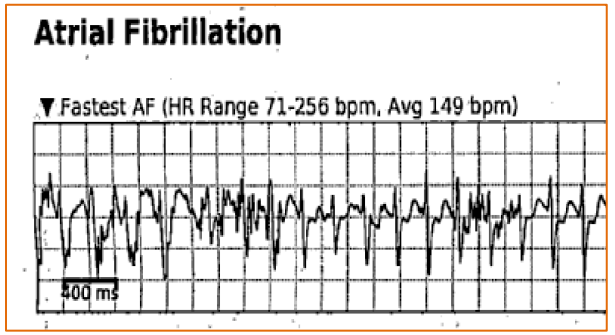
Radford NB. Circulation.2018;137:1888-1895

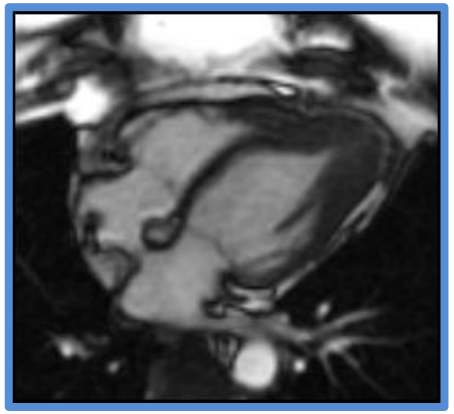




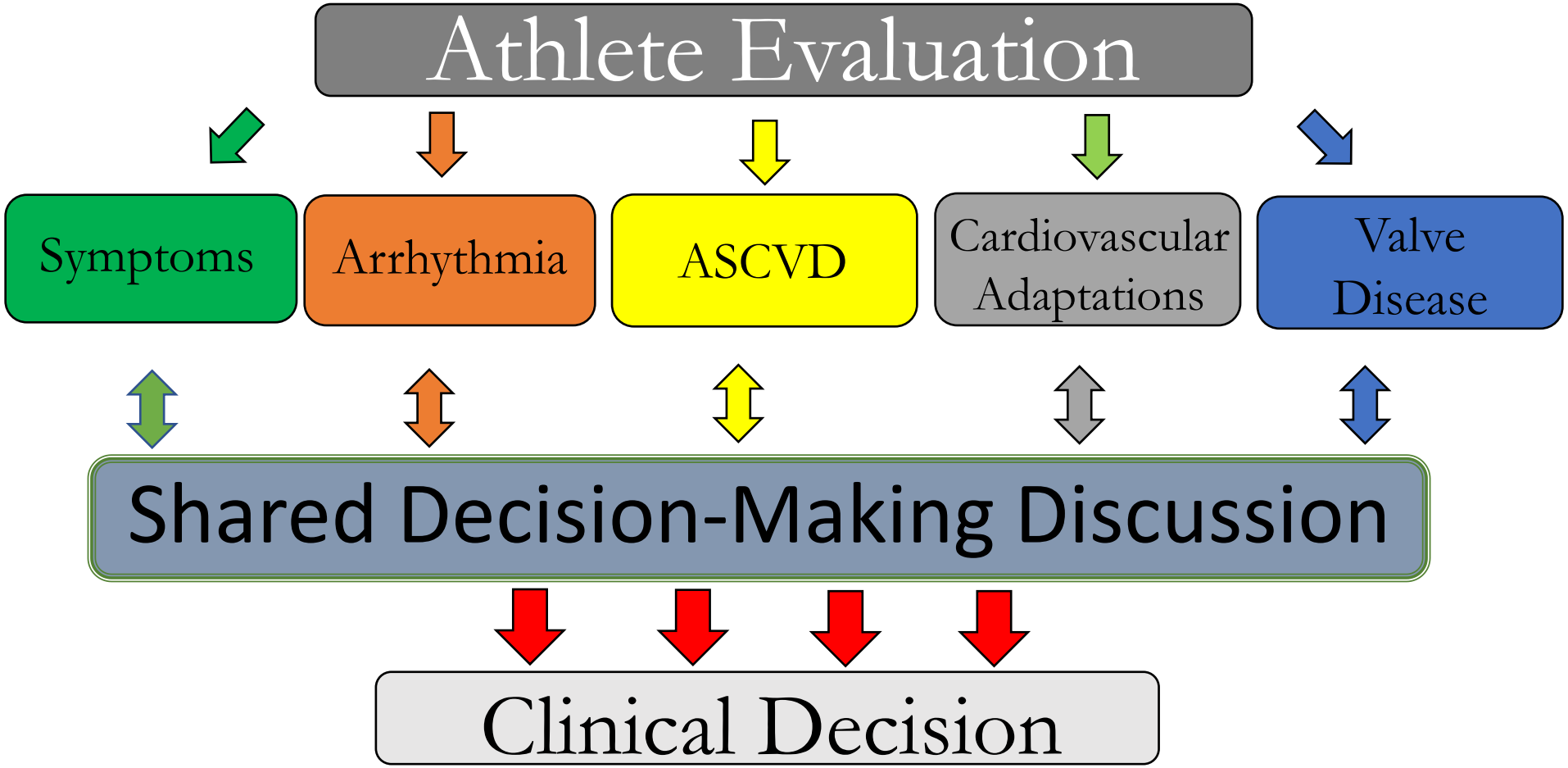








ATLANTIC HEALTH SYSTEM


Athlete Evaluation
Symptoms
Arrhythmia
ASCVD
Cardiovascular Adaptations
Valve Disease
Shared Decision-Making Discussion
Clinical Decision

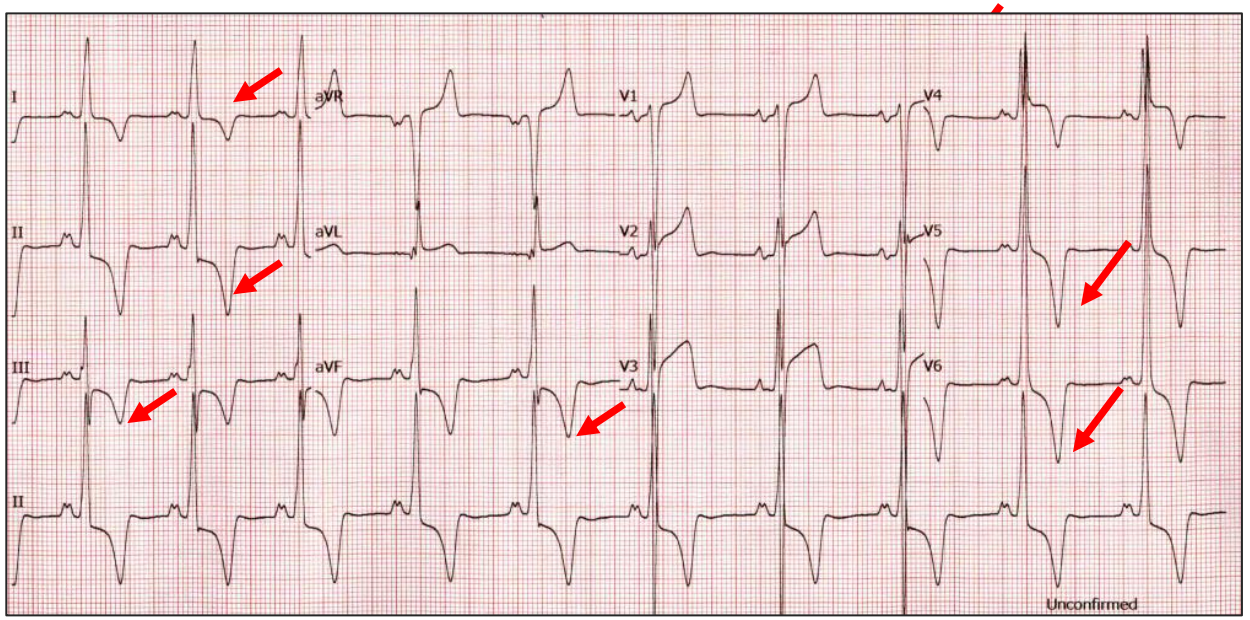
Case Presentation

17 y.o elite Caucasian Female
American Soccer midfielder

Asymptomatic.
No prior syncope, CV limitations.
No family hx of cardiomyopathy or sudden cardiac arrest.

Preparticipation screening evaluation including ECG.
ECG was abnormal.

Electrocardiogram



Sinus bradycardia
Normal QTc
TWI II, III, aVF, V3-V6

No prior ECG

Referred for ECHO

ATLANTIC HEALTH SYSTEM

ECHO

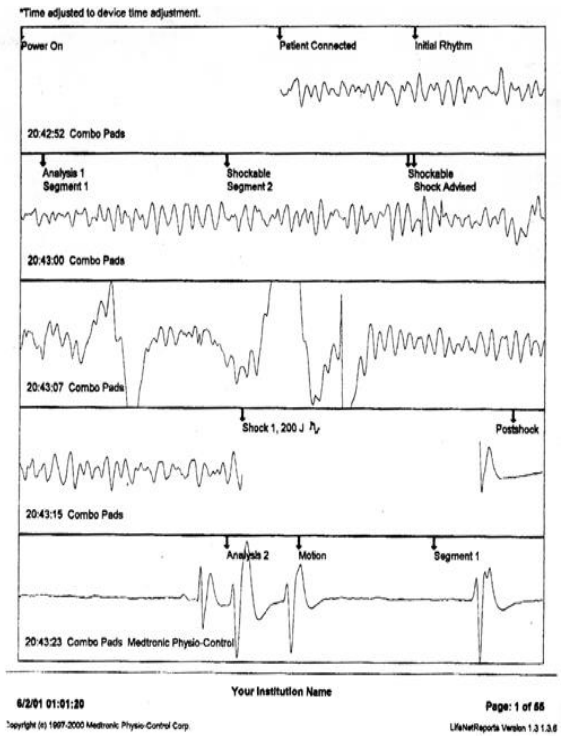
- Normal biventricular size and function.
- LVEF = 65%.
- Normal wall motion. No valve disease: SAM or MVP. Abnormal diastolic function
- 17mm septal thickness.
- **Exercise Echo –** 16minutes + sprints; no arrythmias or obstruction, Normal HR and BP response
- **48hr Ambulatory monitor**: Rare PVCs

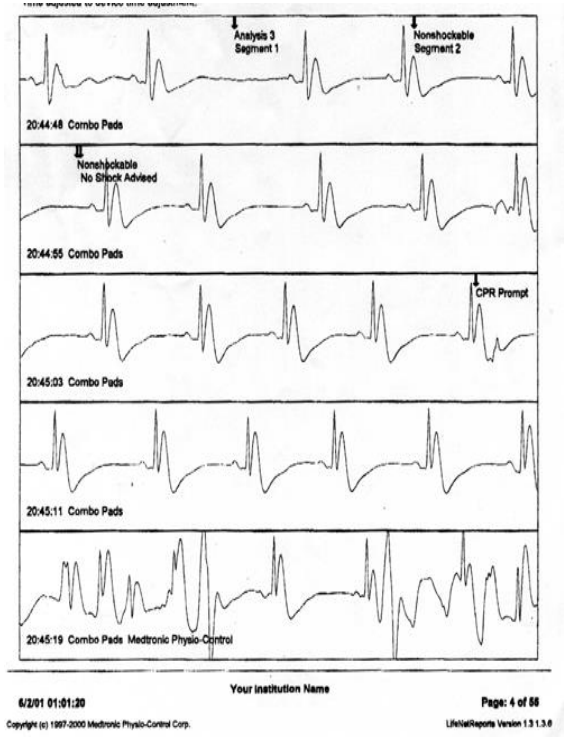
Case

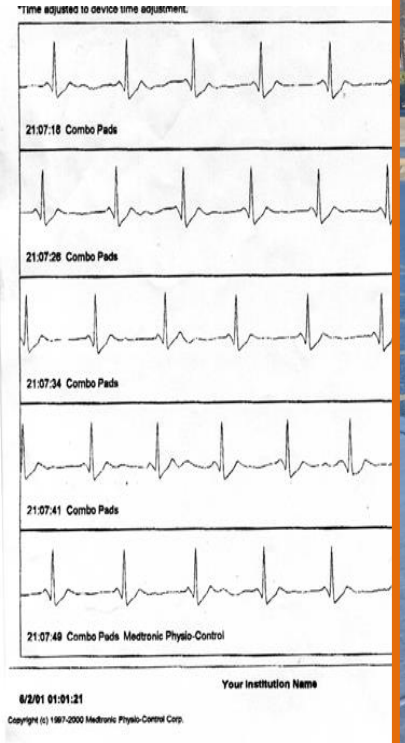
20 y.o Caucasian Female Soccer
No high risk features.

- We discussed her risk and options
- We discussed her current low-risk features
- Importance of ongoing annual surveillance
- After several discussions:
  - She decided not to play

We identify patients at LOW risk for sudden death



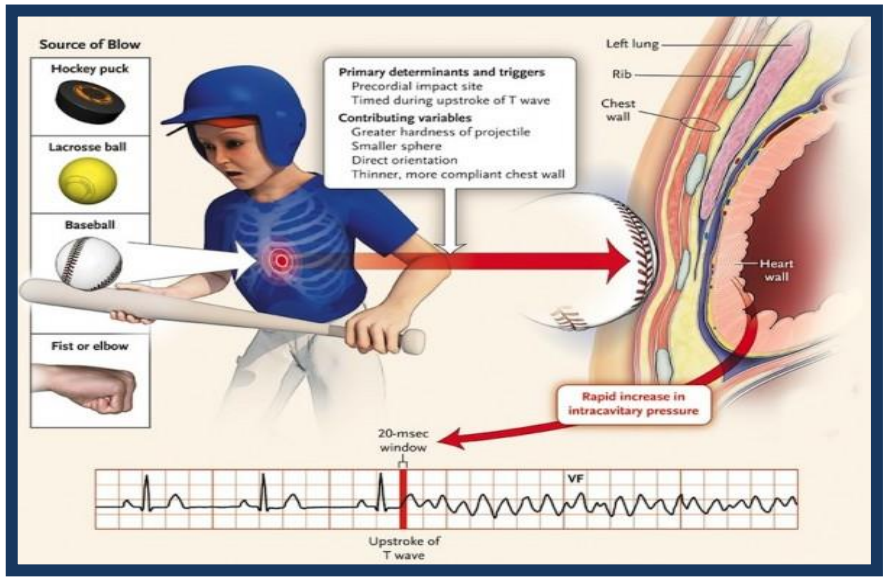




With Permission & By Request

Patients at LOW risk for sudden death can still die suddenly

NO perfect evaluation process



Initial Arrhythmic Event

Low Risk

No Risk

ATLANTIC HEALTH SYSTEM

Sudden Cardiac Arrest Management

Pre-participation assessments are *never* perfect

EAP and AED are still important

Signs of cardiac arrest:

Sudden non-contact collapse, passed out athlete

ATLANTIC HEALTH SYSTEM

Matthew W. Martinez, MD FACC
Matthew.Martinez@atlantichealth.org

Thank you

@mmartinezheart