LEHIGH VALLEY HEALTH NETWORK

Sports Cardiology: Adolescent and Adults

Matthew W. Martinez, MD FACC
Sports Cardiology Medical Director
Team Cardiologist - New York Jets
League Cardiologist – Major League Soccer

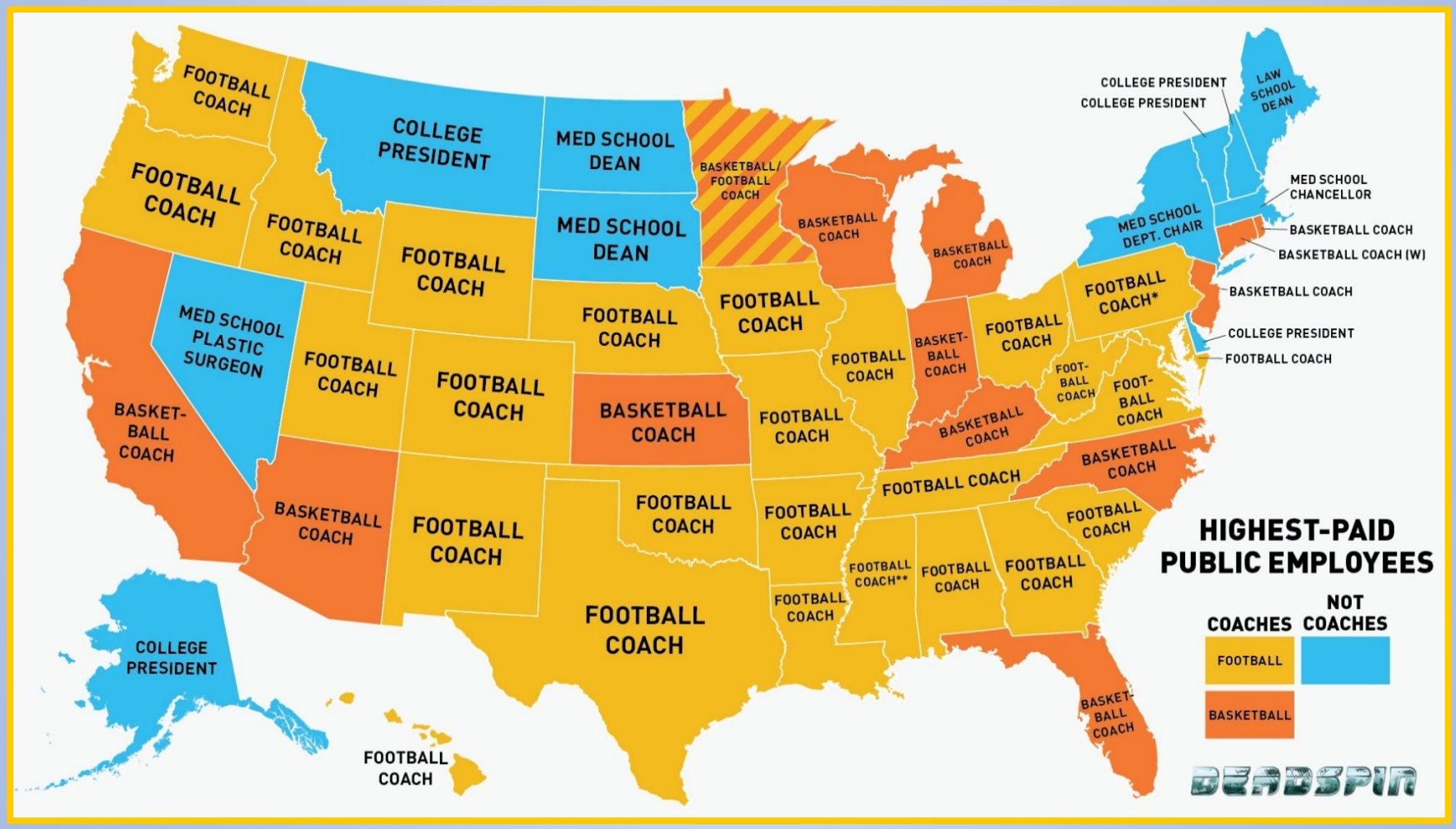
I have no commercial interests nor financial relationships with any manufacturer of any product or class of products that are discussed in this educational activity or which is a commercial supporter of this activity.

The Changing Face of the American Athlete - Youth

The Changing Face of the American Athlete – High School

The Changing Face of the American Athlete - Collegiate

WE LOVE SPORTS IN THE US



Heat

Nutrition

Concussion

First Aid

Cardiac Arrest Legislation

Act # 59

"Janet's Law"

Reprinted
January 31, 2014

HOUSE BILL No. 1290

DIGEST OF HB 1290 (Updated January 30, 2014 2:20 pm - DI 71)

Citations Affected: IC 16-18; IC 20-30; IC 20-34; IC 21-18; IC 25-1.

Synopsis: Health of student athletes. Adds athletic trainers to the definition of "health care provider" for purposes of laws concerning hospitals and public health measures. Requires the department of education to disseminate guidelines, information sheets, and forms to school corporations, charter schools, public schools, and accredited nonpublic schools to inform and educate coaches, student athletes, and parents and legal guardians of student athletes of the nature and risk of sudden cardiac arrest. Requires that a form acknowledging receipt of the information sheet must be returned to the student athlete's coach each year before beginning practice for an athletic activity. Requires that a student athlete who is suspected of experiencing a symptom of sudden cardiac arrest must be removed from the athletic activity at the time the symptom is identified. Provides that the student athlete may not return to practice and play until the student athlete's parent or legal guardian has been informed and the parent or legal guardian has provided permission for the student to return to practice and play. Requires the commission on higher education to disseminate guidelines, information sheets, and forms to a postsecondary

Sudden Cardiac Arrest Prevention Act

Scholastic Student Athlete Safety Act


LEE STILL WINLESS, BUT PHILLIES POUND METS, 10-6 SPORTS

The Philadelphia Inquirer philly.com

Thursday, May 31, 2012 ★ 2012 Pulitzer Prize Winner ★ $1

Signing bill for student safety

Matters of the Heart: NJ Schools Must Comply With New Cardiac Emergency Regulations

by SHANA T. DON *on* SEPTEMBER 9, 2014

Students aren't the only ones headed back to school this fall. New Jersey municipalities and school districts are

STRATEGIC PRIORITIES

1. Cardiac health
2. Concussion
3. Doping and substance abuse
4. Mental health
5. Nutrition, sleep and performance
6. Overuse injuries and periodization
7. Sexual assault and interpersonal violence
8. Athletics health care administration
9. Data-driven decisions

Cardiovascular Care Checklist of Best Practices for NCAA Member Institutions

This checklist can be used as a resource when evaluating institutional cardiac care plans. The checklist has been designed to help institutions become better informed and educated about the best practices that are endorsed in the Interassociation Consensus Document on Cardiovascular Care of College Student-Athletes.

Pre-Participation Evaluation of Student-Athletes

For the Game. For the World.

Comparison of Screening Strategies for Elite Athletes

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

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

Athlete Cardiac Remodeling

Endurance

Strength Activities

Sustained ↑ CO

4 to 5 times rest

↑ ↑ ↑ HR & ↑ SV

Vasodilation

Repetitive↑ SBP

Systolic BP > 200 mmHg
Skeletal Mus. Contraction
Vasoconstriction

Volume Challenge

Pressure Challenge

Courtesy of A Baggish et al

Athlete cardiac changes

Left Chamber Dilation

Physiologic Eccentric or cLVH

Myocardial Thickening

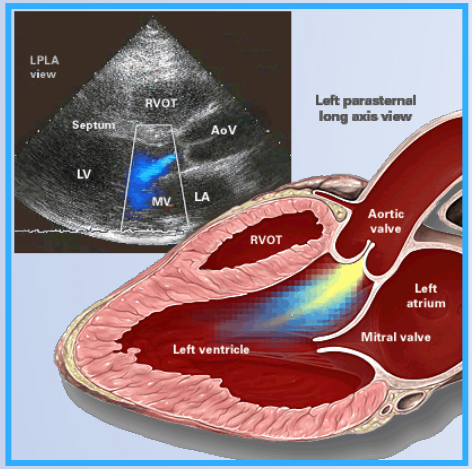
Physiologic Eccentric or cLVH

Right Chamber Dilation

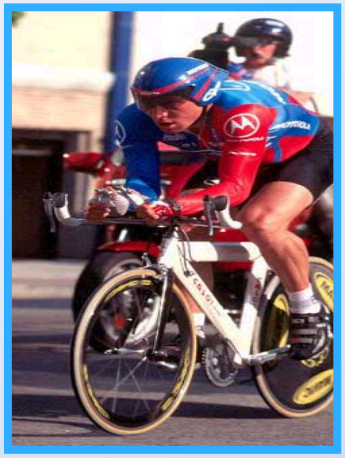
Physiologic RV Dilation

Cardiac Remodeling

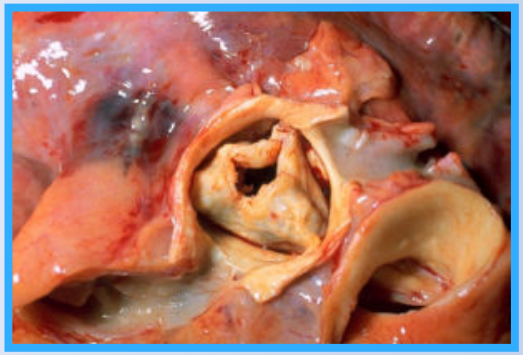
Aortic Regurgitation



Volume Challenge

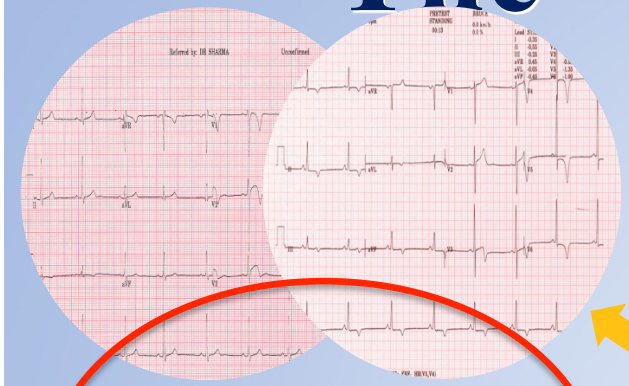


Aortic Stenosis

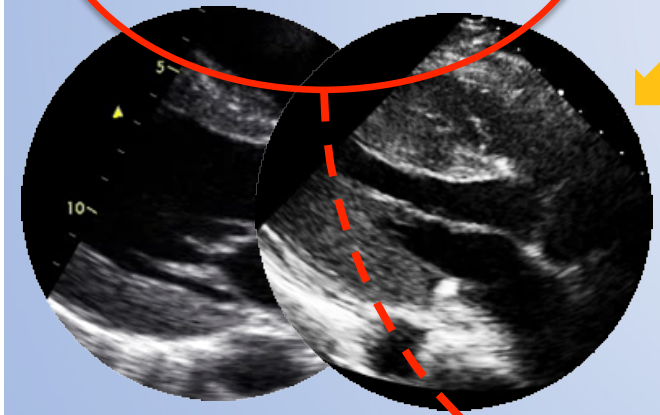


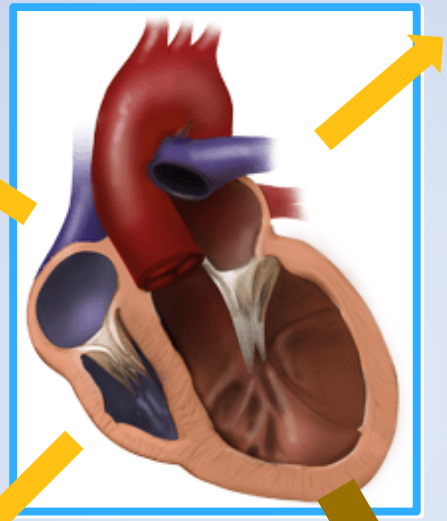
Pressure Challenge

The "Athlete's Heart"



Physiology vs. Pathology





Electrical

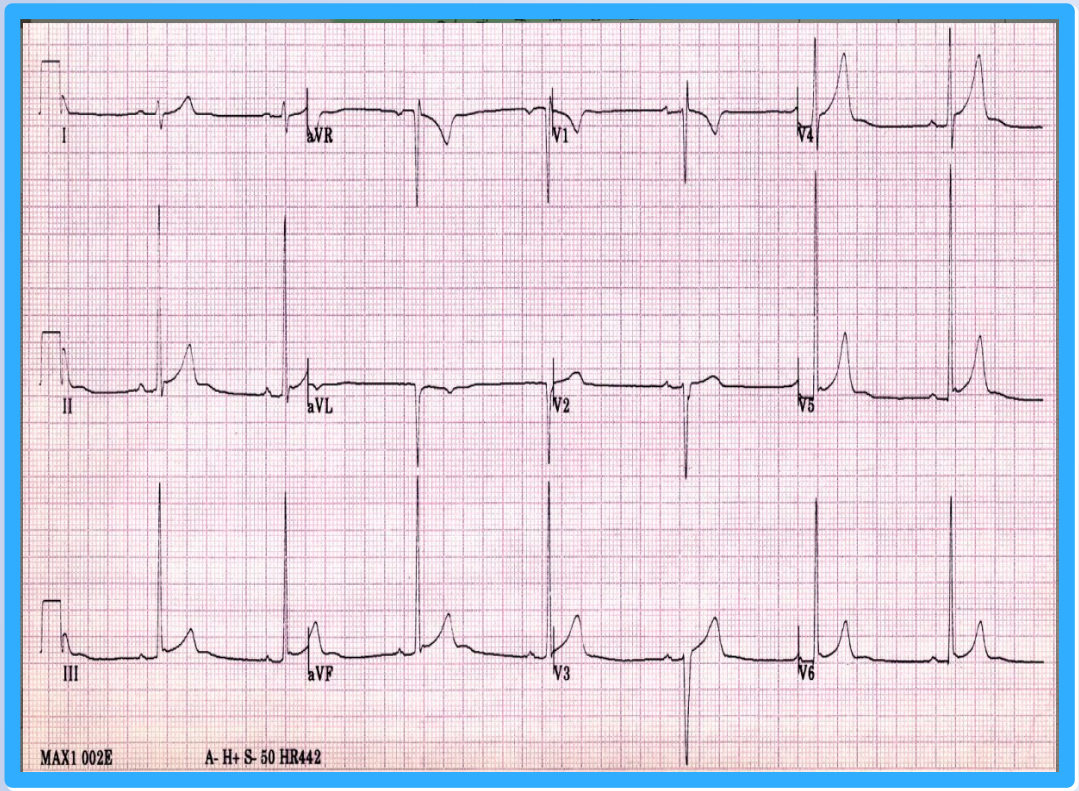
- *Sinus bradycardia*
- *Voltage for chamber enlargement*
- *Repolarisation anomalies*

- *Increased cavity size*
- *Increased wall thickness*

Structural

Differentiation is crucial!

Athlete's EKG



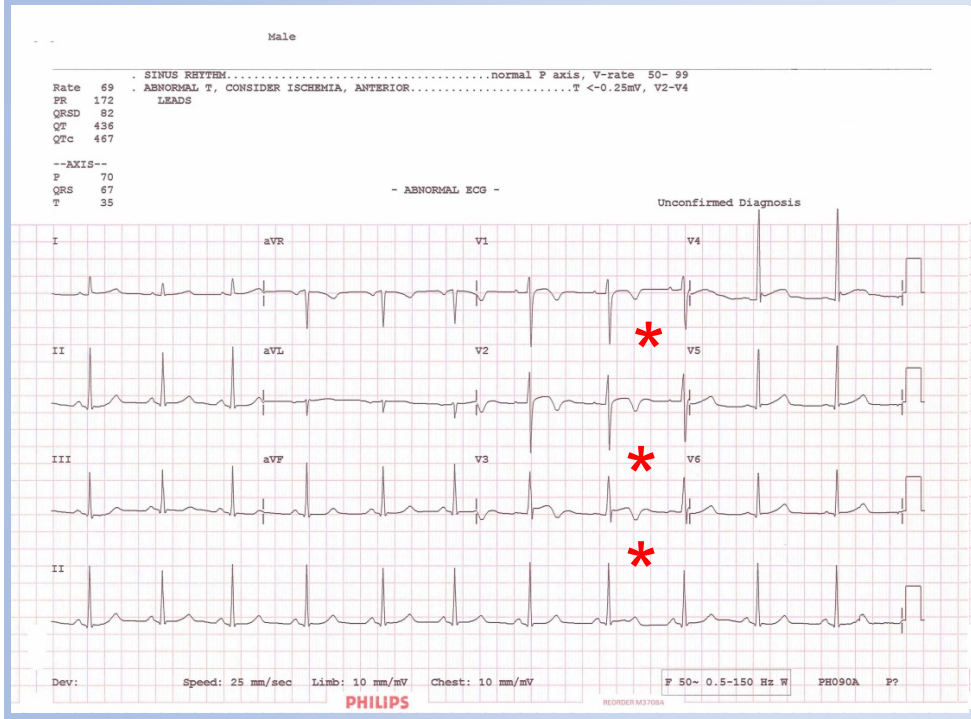
Vagotonia

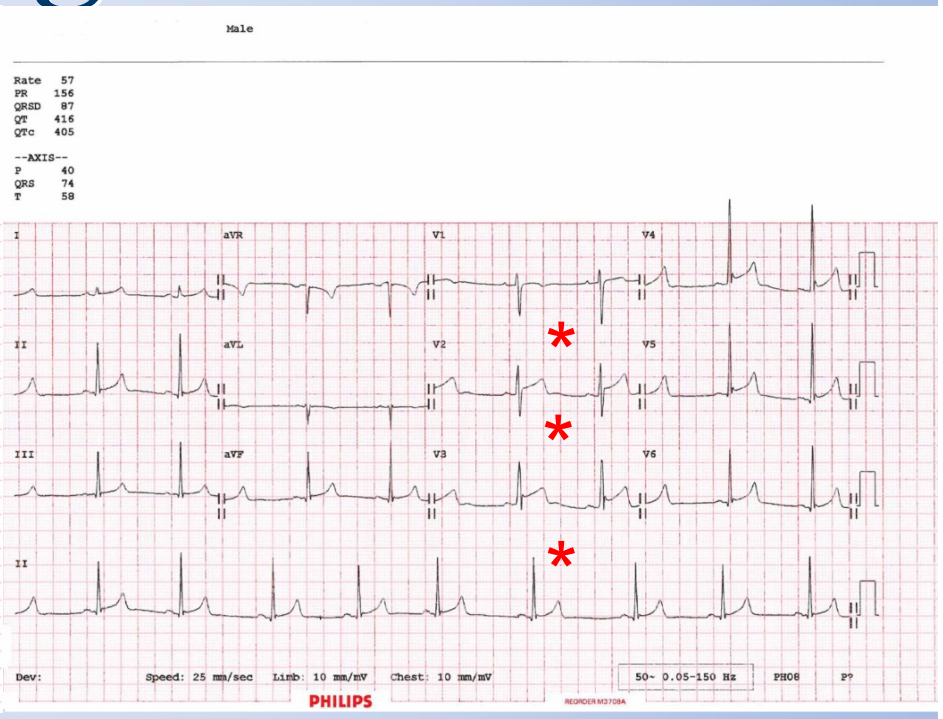
Sinus bradycardia
Sinus arrhythmia
First degree AVB
ST-elevation
Tall T waves

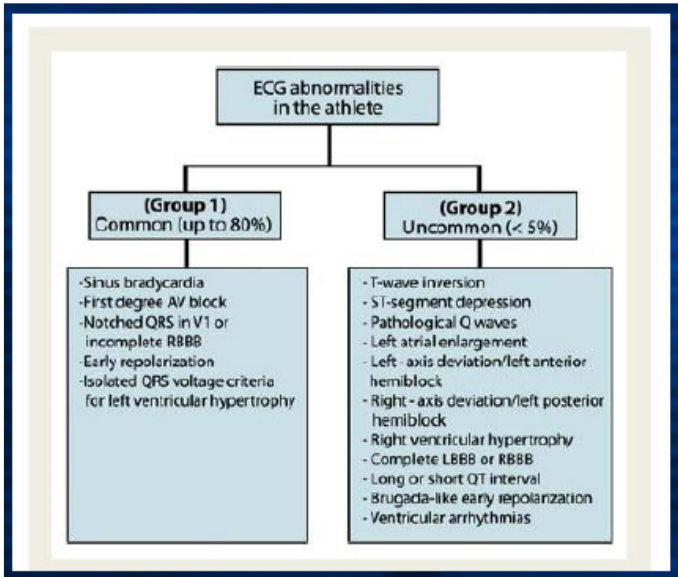
Increased chamber size

Left ventricular hypertrophy
Incomplete RBBB
Left atrial enlargement
Right atrial enlargement

Detraining reverses changes







ESC criteria, Corrado 2010

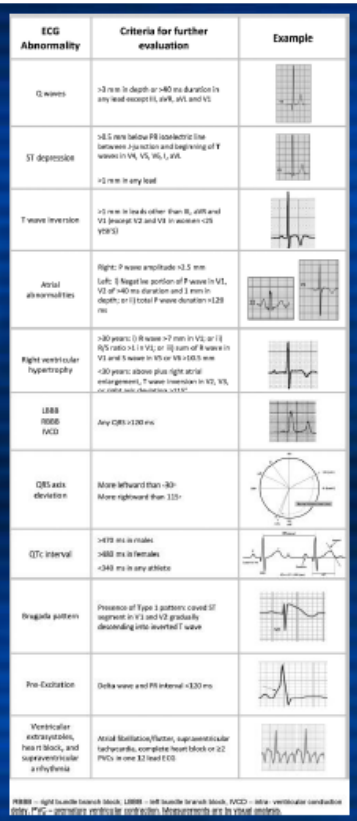


Table 1 Abnormal ECG findings in athletes

Abnormal ECG finding	Definition
T-wave inversion	>1 mm in depth in two or more leads V2–V6, II and aVF, or I and aVL (excludes III, aVR and V1)
ST segment depression	≥0.5 mm in depth in two or more leads
Pathologic Q waves	>3 mm in depth or >40 ms in duration in two or more leads (except for III and aVR)
Complete left bundle branch block	QRS ≥120 ms, predominantly negative QRS complex in lead V1 (QS or rS), and upright monophasic R wave in leads I and V6
Intraventricular conduction delay	Any QRS duration ≥140 ms
Left axis deviation	−30° to −90°
Left atrial enlargement	Prolonged P wave duration of >120 ms in leads I or II with negative portion of the P wave ≥1 mm in depth and ≥40 ms in duration in lead V1
Right ventricular hypertrophy pattern	R–V1+S–V5>10.5 mm *AND* right axis deviation >120°
Ventricular pre-excitation	PR interval <120 ms with a delta wave (slurred upstroke in the QRS complex) and wide QRS (>120 ms)
Long QT interval*	QTc≥470 ms (male) QTc≥480 ms (female) QTc≥500 ms (marked QT prolongation)
Short QT interval*	QTc≤320 ms
Brugada-like ECG pattern	High take-off and downsloping ST segment elevation followed by a negative T wave in ≥2 leads in V1–V3
Profound sinus bradycardia	<30 BPM or sinus pauses ≥ 3 s
Atrial tachyarrhythmias	Supraventricular tachycardia, atrial-fibrillation, atrial-flutter
Premature ventricular contractions	≥2 PVCs per 10 s tracing
Ventricular arrhythmias	Couplets, triplets and non-sustained ventricular tachycardia

Note: These ECG findings are unrelated to regular training or expected physiological adaptation to exercise, may suggest the presence of pathological cardiovascular disease, and require further diagnostic evaluation. *The QT interval corrected for heart rate is ideally measured with heart rates of 60–90 bpm. Consider repeating the ECG after mild aerobic activity for borderline or abnormal QTc values with a heart rate <50 bpm.

Seattle Criteria BJSM 2013, Drezner

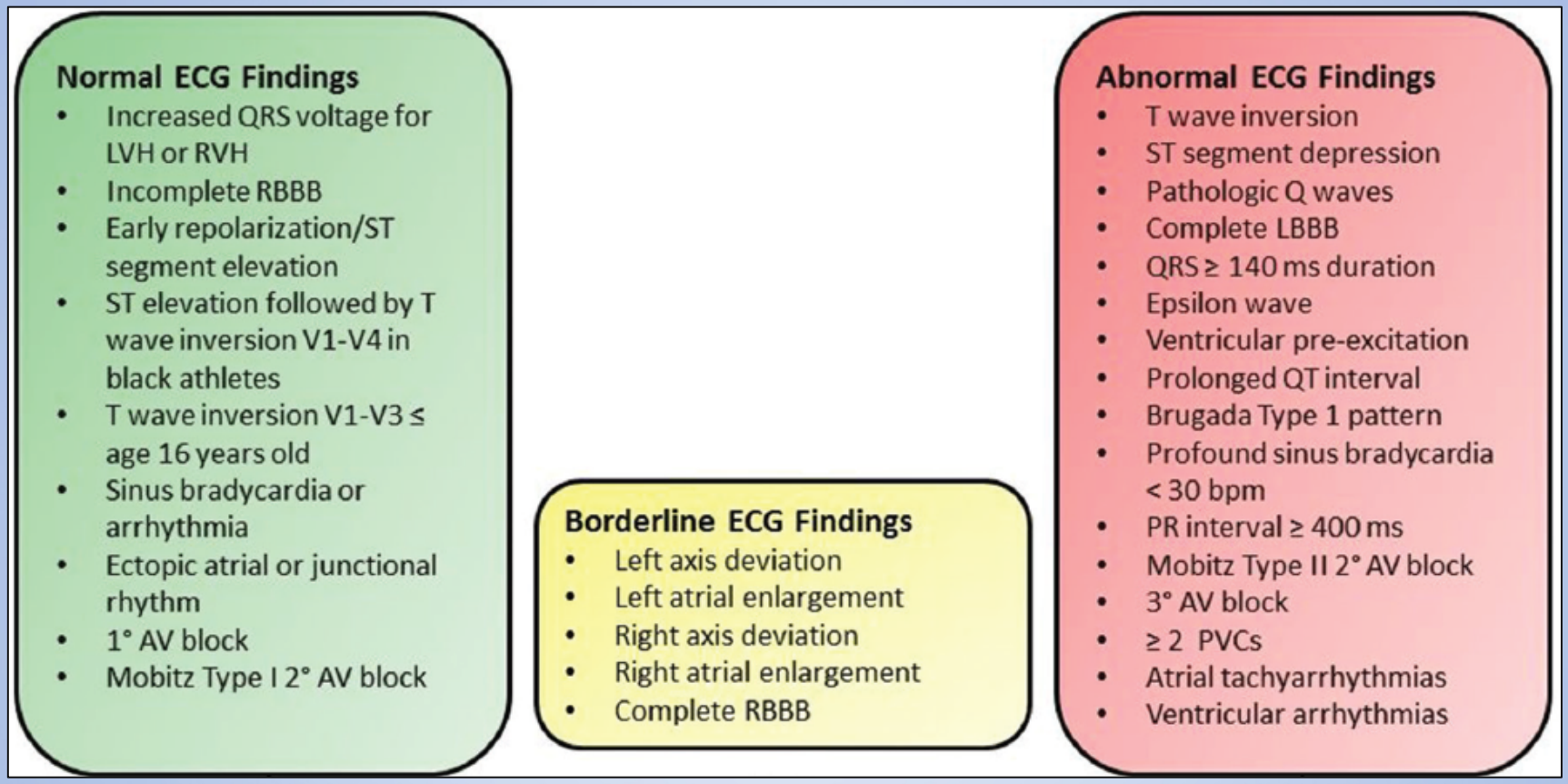
Ref: Uberoi, et al. Circulation 2011, 124:746-757

European Heart Journal (2017) **00**, 1–19
doi:10.1093/eurheartj/ehw631

CURRENT OPINION

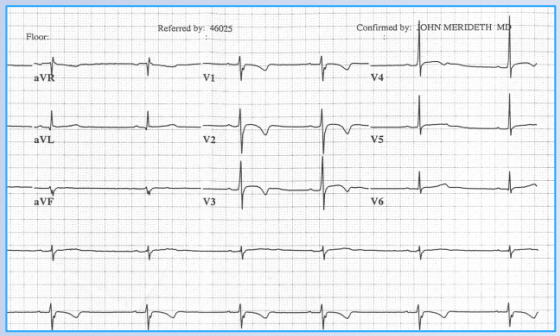
International recommendations for electrocardiographic interpretation in athletes

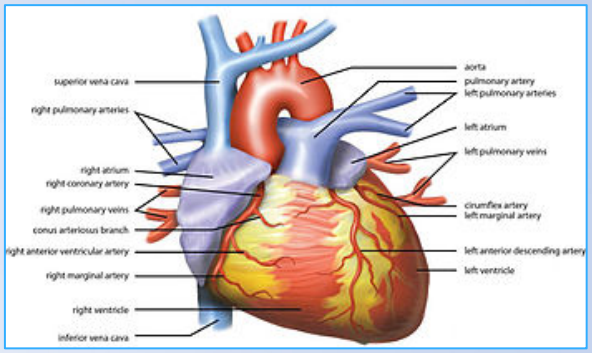
Sanjay Sharma[1]*†, Jonathan A. Drezner[2]†, Aaron Baggish[3], Michael Papadakis[1], Mathew G. Wilson[4], Jordan M. Prutkin[5], Andre La Gerche[6], Michael J. Ackerman[7], Mats Borjesson[8], Jack C. Salerno[9], Irfan M. Asif[10], David S. Owens[5], Eugene H. Chung[11], Michael S. Emery[12], Victor F. Froelicher[13], Hein Heidbuchel[14,15], Carmen Adamuz[4], Chad A. Asplund[16], Gordon Cohen[17], Kimberly G. Harmon[2], Joseph C. Marek[18], Silvana Molossi[19], Josef Niebauer[20], Hank F. Pelto[2], Marco V. Perez[21], Nathan R. Riding[4], Tess Saarel[22], Christian M. Schmied[23], David M. Shipon[24], Ricardo Stein[25], Victoria L. Vetter[26], Antonio Pelliccia[27], and Domenico Corrado[28]



Sheikh N Circulation. 2014; 129: 1637-1649.

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)

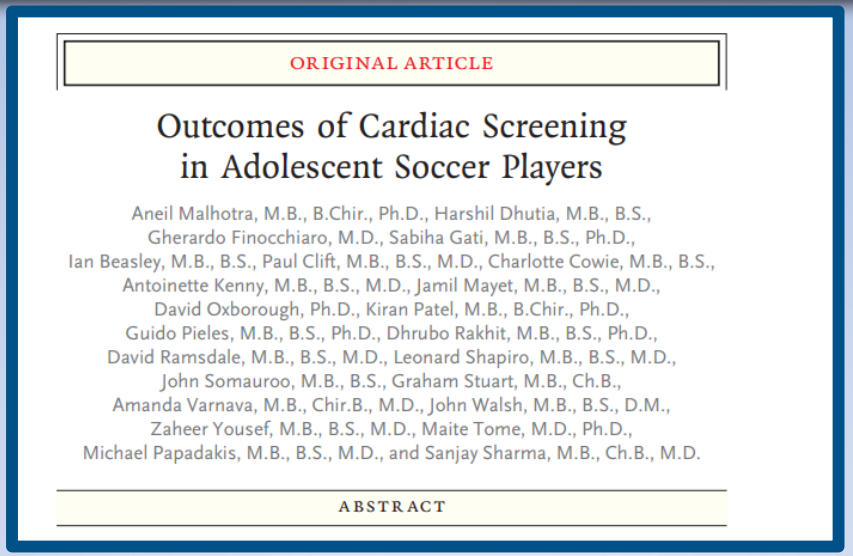
Chandra et al: JACC 61:1027, 2013

The good, the bad and the uncertain

	Prevalence	Specificity	Utility
HCM	+++	+++	Good
LQTS	+	++/+++	OK
ARVC	+	+	Poor
Anomalous coronaries	++/+++	-	Poor
Brugada	+	++	Poor

The good, the bad and the uncertain

	Prevalence	Specificity	Utility	Impact
HCM	+++	+++	Good	?
LQTS	+	++/+++	OK	?
ARVC	+	+	Poor	?
Anomalous coronaries	++/+++	-	Poor	?
Brugada	+	++	Poor	?



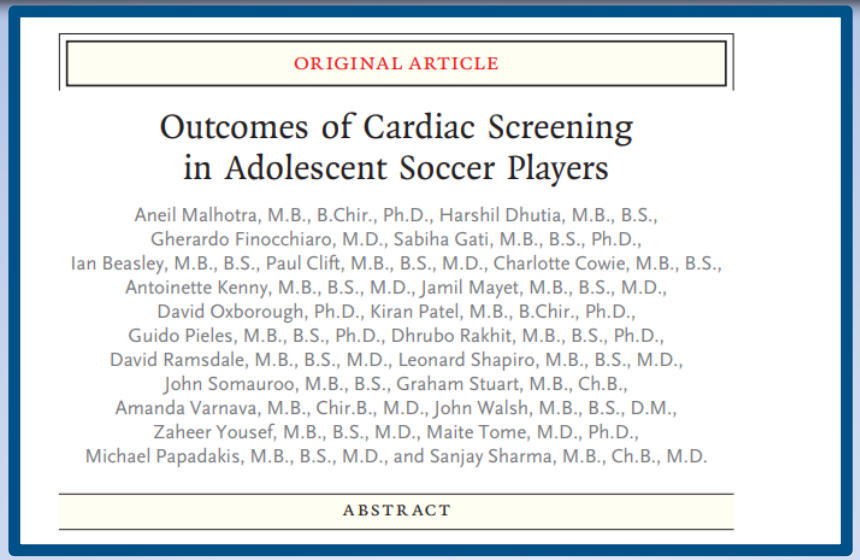
ORIGINAL ARTICLE

Outcomes of Cardiac Screening in Adolescent Soccer Players

Aneil Malhotra, M.B., B.Chir., Ph.D., Harshil Dhutia, M.B., B.S., Gherardo Finocchiaro, M.D., Sabiha Gati, M.B., B.S., Ph.D., Ian Beasley, M.B., B.S., Paul Clift, M.B., B.S., M.D., Charlotte Cowie, M.B., B.S., Antoinette Kenny, M.B., B.S., M.D., Jamil Mayet, M.B., B.S., M.D., David Oxborough, Ph.D., Kiran Patel, M.B., B.Chir., Ph.D., Guido Pieles, M.B., B.S., Ph.D., Dhrubo Rakhit, M.B., B.S., Ph.D., David Ramsdale, M.B., B.S., M.D., Leonard Shapiro, M.B., B.S., M.D., John Somauroo, M.B., B.S., Graham Stuart, M.B., Ch.B., Amanda Varnava, M.B., Chir.B., M.D., John Walsh, M.B., B.S., D.M., Zaheer Yousef, M.B., B.S., M.D., Maite Tome, M.D., Ph.D., Michael Papadakis, M.B., B.S., M.D., and Sanjay Sharma, M.B., Ch.B., M.D.

ABSTRACT

- 11,168 English 15-17yr old soccer player
- Mandatory H&P, Exam, ECG and Echo
- 20 yr study period
- 225 (2%) with congenital, valve disorders
- 42 (0.38%) with findings assoc with SCA



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ABSTRACT

23 died

8 deaths from cardiac causes

7 (88%) due to cardiomyopathy

-2 with HCM played AMA – died

6 were not identified by screening

Table 3. Characteristics of Athletes with Sudden Cardiac Death.

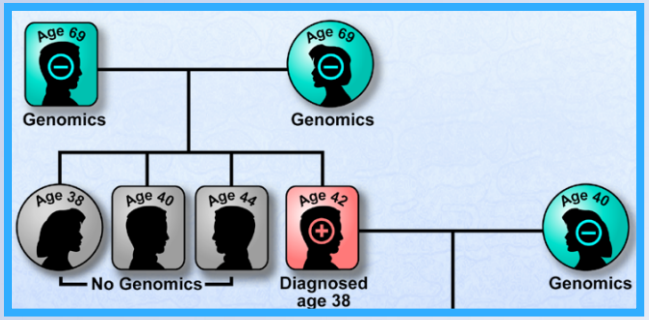
Athlete No.	Sex and Age	Race*	Years from Screening to Death	Diagnosis	Initial Screening Result	Blind Reading (Reviewer 1)	Blind Reading (Reviewer 2)
1	M, 16.8 yr	Black	0.1	Idiopathic left ventricular hypertrophy	Negative	Negative	Negative
2	M, 16.6 yr	Mixed	1.0	Hypertrophic cardiomyopathy	Abnormal ECG and echocardiogram	NA	NA
3	M, 16.6 yr	Black	3.3	Hypertrophic cardiomyopathy	Negative	Negative	Negative
4	M, 16.3 yr	Black	7.7	Dilated cardiomyopathy	Negative	Negative	Negative
5	M, 17.0 yr	White	7.9	Arrhythmogenic right ventricular cardiomyopathy	Negative	Negative	Negative
6	M, 17.2 yr	White	9.7	Arrhythmogenic right ventricular cardiomyopathy	Negative	Negative	Negative
7	M, 15.7 yr	White	11.5	Hypertrophic cardiomyopathy	Abnormal ECG and echocardiogram	NA	NA
8	M, 16.8 yr	White	13.2	Sudden arrhythmic death syndrome	Negative	Negative	Negative

* Race was reported by the athlete or the parent or guardian.

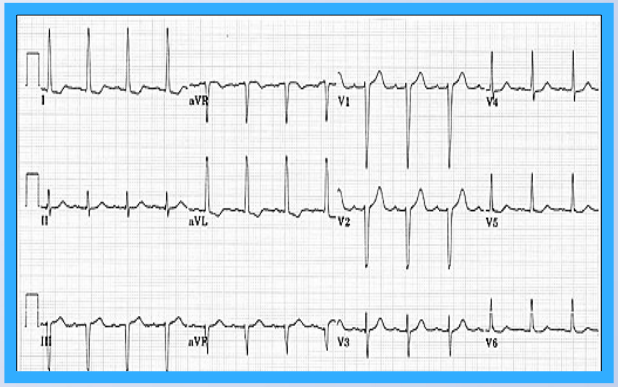
Challenges with screening

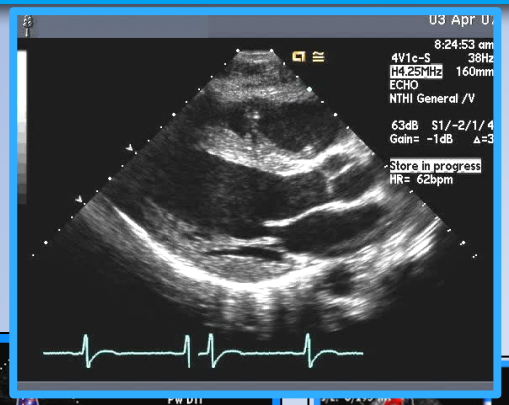
- Outcome goals?
  - Safety, Diagnosis, Optics, Liability/risk?
- Age to start? How often? Repeat?
- Cost and time
- Expertise
  - Who, when
  - How will you handle the findings?

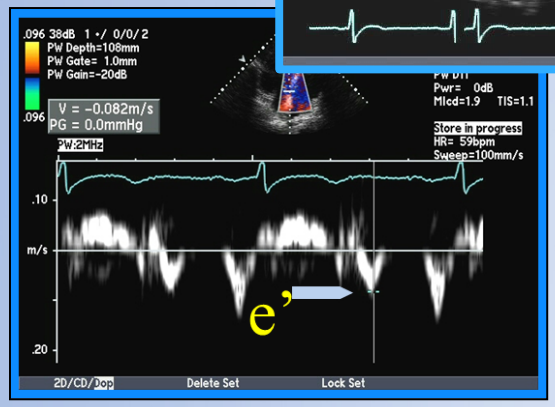
Evaluation of the athlete

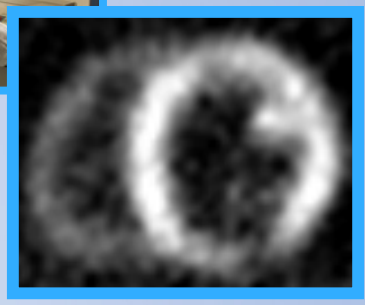


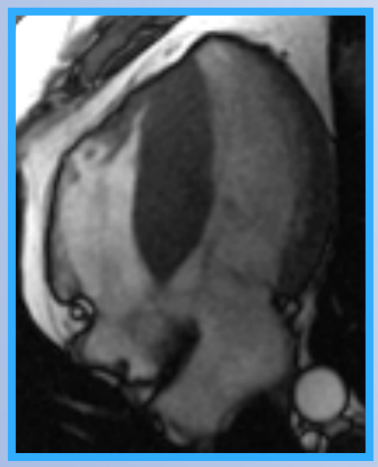
History

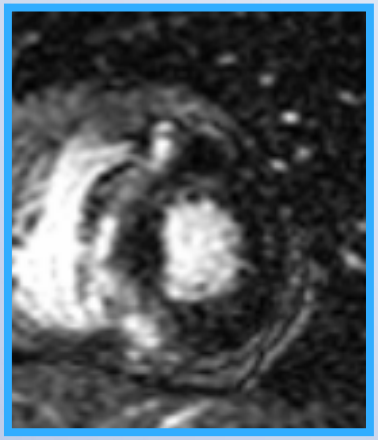


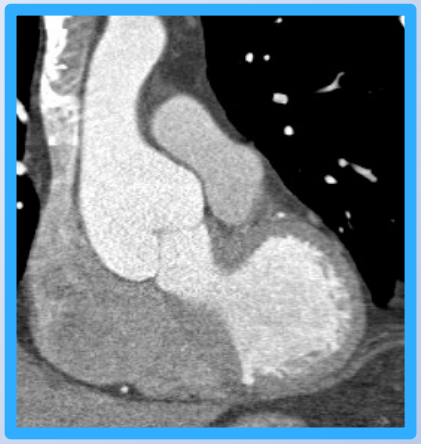




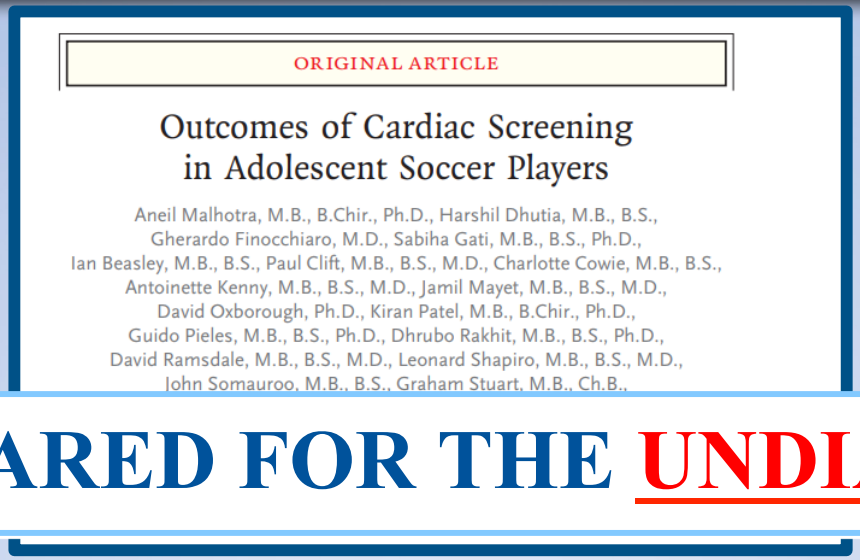








Cardiac changes in the athlete are unique



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BE PREPARED FOR THE UNDIAGNOSED

23 died

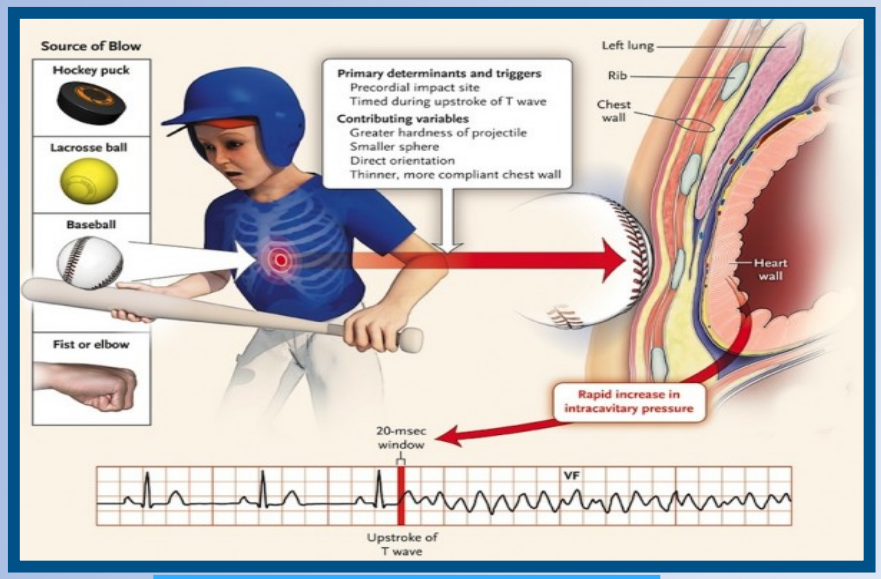
8 deaths from cardiac causes

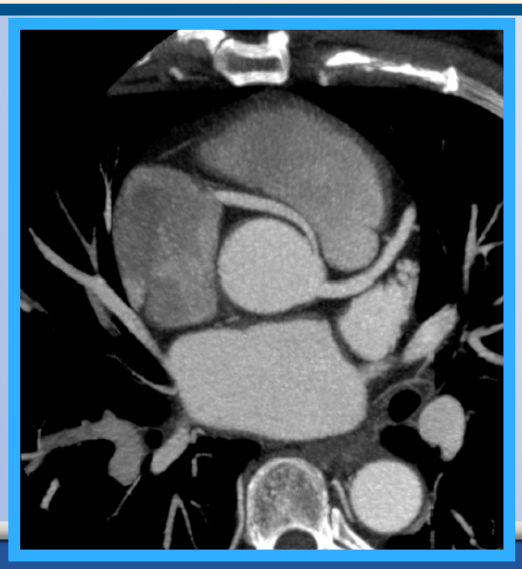
7 (88%) due to cardiomyopathy

-2 with HCM played AMA – died

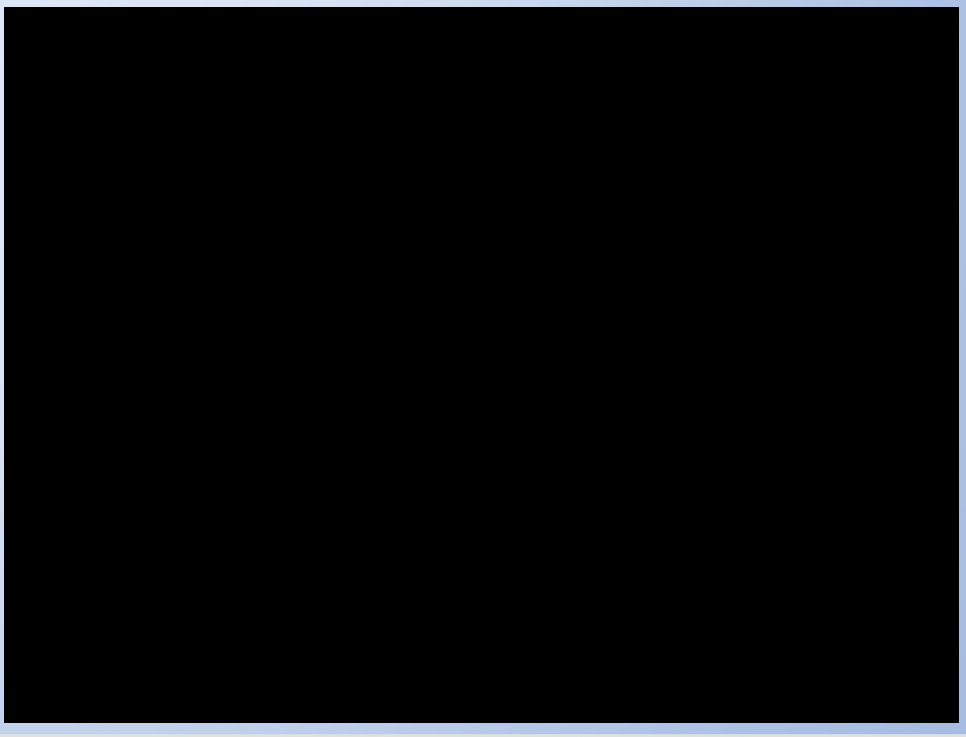
6 were not identified by screening

NO perfect screening process





Initial Arrhythmic Event



BE PREPARED FOR THE CORRECTED

Table 1. Clinical Features and Outcomes in Athletes with Cardiac Conditions That Are Associated with Sudden Cardiac Death.*

Condition, Sex, and Age	Race†	History and Examination	ECG Result	Echocardiography Result	LGE on Cardiac MRI	Exercise Test Result	Genetic Test Result‡	Outcome
BAV								
M, 26 yr	Black	Dyspnea, diastolic murmur	Left axis deviation	Fusion of right and left coronary cusps and severe aortic regurgitation; LVEDD, 60 mm	No	Terminated prematurely because of fatigue	NA	Underwent corrective surgery and returned to play
M, 17 yr	White	Negative	Normal	Fusion of right and noncoronary cusps with mixed aortic valve disease; diameter of aortic root at sinuses of Valsalva, 53 mm	No	Normal	NA	Underwent corrective surgery and returned to play
M, 16 yr	White	Diastolic murmur	Normal	Fusion of right and left coronary cusps and severe aortic regurgitation; LVEDD, 63 mm	No	Normal	NA	Underwent corrective surgery and returned to play
CAA								
M, 26 yr	White	Negative	Normal	Left coronary artery arising from right sinus of Valsalva	NA	Positive for myocardial ischemia	NA	Underwent corrective surgery and returned to play
M, 15 yr	White	Negative	Normal	Right coronary artery arising from left sinus of Valsalva with adverse course.	NA	Normal	NA	Underwent corrective surgery and returned to play

2005

Unless your heart is perfect or the genome stays quiet,
NO COMPETITIVE SPORTS except perhaps class IA sports.

2015

A comprehensive evaluation,
risk stratification,
optimally treated,
and appropriately informed,
Return-to-Play may be possible!

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

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

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.

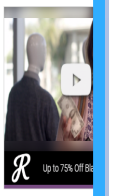
In the past week, the MLS cardiology consultant and a heart specialist at MedStar Georgetown University Hospital examined Kamara and determined that he could resume playing soccer, United General Manager Dave Kasper said Tuesday.

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)

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

ted Press



More from Fox News

- Emergency Action Plans (EAP)
  - Hands only CPR
- Automatic External Defibrillators

New guidance on preventing sudden cardiac death in athletes published

NCAA, medical specialists recommend all universities have well-rehearsed emergency action plan for sudden cardiac arrest

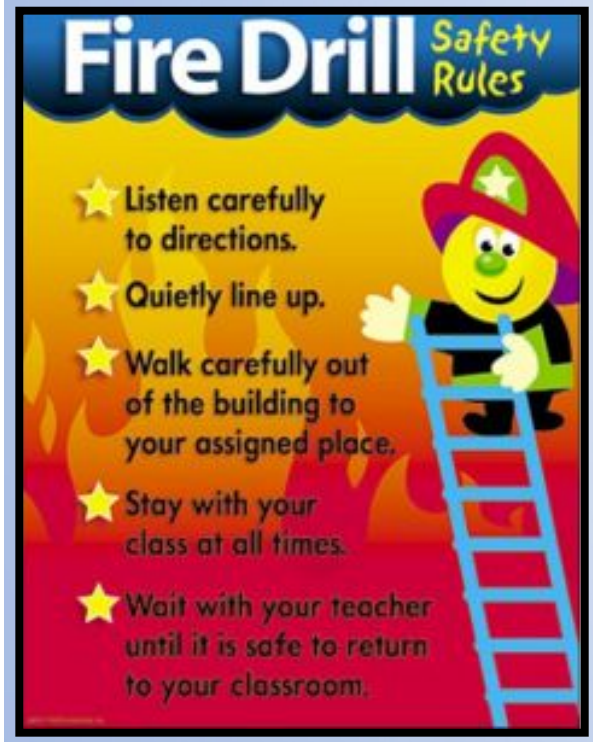
April 15, 2016 9:37am

A major finding of the task force was the need to streamline how cardiac arrest in student-athletes is recognized and responded to. It was recommended that all universities have a written emergency action plan for treatment of cardiac arrest that is well-rehearsed, with different protocol for treatment during a practice versus during a game/championship event since treatment during a game can be vastly different due to traffic delays and access problems for emergency medical services.

The task force recommended that the emergency action plan include training anticipated responders, establishing an emergency communications system, ensuring automated external defibrillators are easily accessible and properly charged, integrating on-site response protocols with the local emergency management system, and practicing and reviewing the plan at least annually.

http://www.ncaa.org/about/resources/media-center/news/new-guidance-preventing-sudden-cardiac-death-athletes-published

Fire Drill


Fire Drill
Safety Rules
Listen carefully to directions.
Quietly line up.
Walk carefully out of the building to your assigned place.
Stay with your class at all times.
Wait with your teacher until it is safe to return to your classroom.


FIRE
DRILL


FIRE
ALARM
PULL DOWN

What is your plan for Sudden Cardiac Arrest?

- CALL for help
- CPR
  - Are you trained?
  - When should you start CPR?
- Automated External Defibrillator (AED)?
  - Do you have one?
  - Do you know where it is?
  - How to use it?

Cardiac Arrest "Drill"

Design your plan

Personnel, Equipment, Communication, Responder Role

Who calls 911

Starts CPR

Gets the AED

MLS Cardiac Arrest Plan

EMERGENCY ACTION PLAN

- Piloted at MLS All-Star 2012 and MLS Cup 2012
- MLS Playoff teams completed and submitted a venue specific emergency plan
- **ALL** clubs complete as part of their preseason process
- Personnel, Equipment, Communication, Responder Role

STADIUM EMERGENCY ACTION PLAN

Saturday, December 1st – 4:55pm ET (1:55pm PT)

Address:

Home Depot Center
18400 Avalon Blvd. Suite 200
Carson, CA 90746

Emergency Personnel:

Contact Information			
Position	Name	Cell	Location During Match
Head Athletic Trainer	Armando Rivas	(714) 397-1277	Sideline
Assistant Athletic Trainer	Kurt Andrews	(310) 720-3862	Sideline
Head Team Physician	Bert Mandelbaum	(310) 429-9000	Sideline
Team Physician	Byron Patterson	(310) 995-5583	Sideline

MLS Cardiac Arrest Plan

TIME OUT PROTOCOL

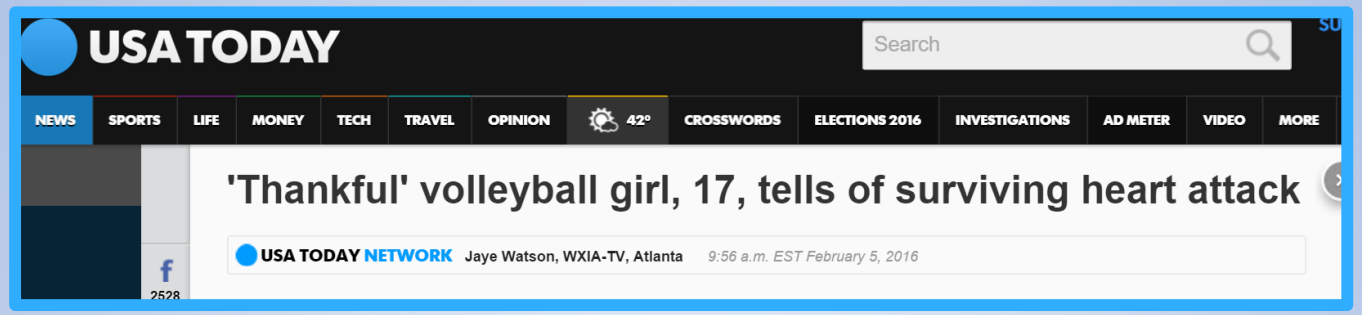
- Improves communication, preparedness, and coordinated response to correctly assess and assist injured athlete
- Cardiopulmonary event protocol
- Outlines the role of first responders in an emergency situation
  - Athletic Trainer(s)
  - Physician(s)
  - EMT(s)
  - Paramedic(s)

Start CPR – Immediately!

Call for help/911!

Use a unique sign for
Cardiac Arrest
Get the AED

Stabilize the patient on the field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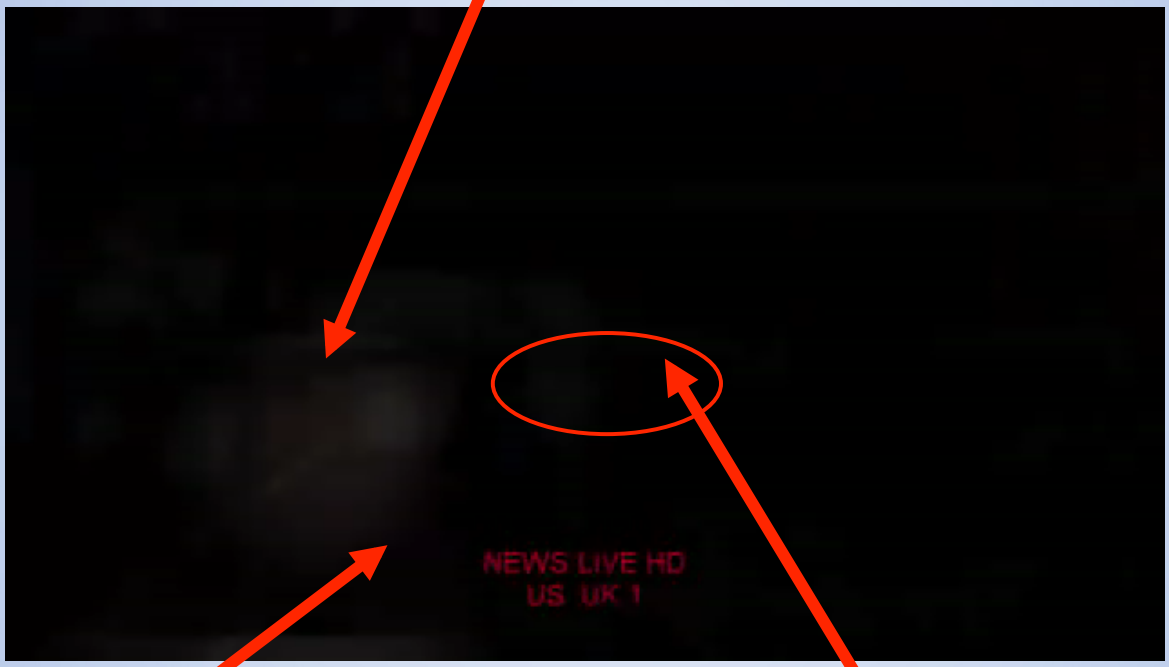
'Thankful' volleyball girl, 17, tells of surviving heart attack
USA TODAY NETWORK
Jaye Watson, WXIA-TV, Atlanta
9:56 a.m. EST February 5, 2016
2528

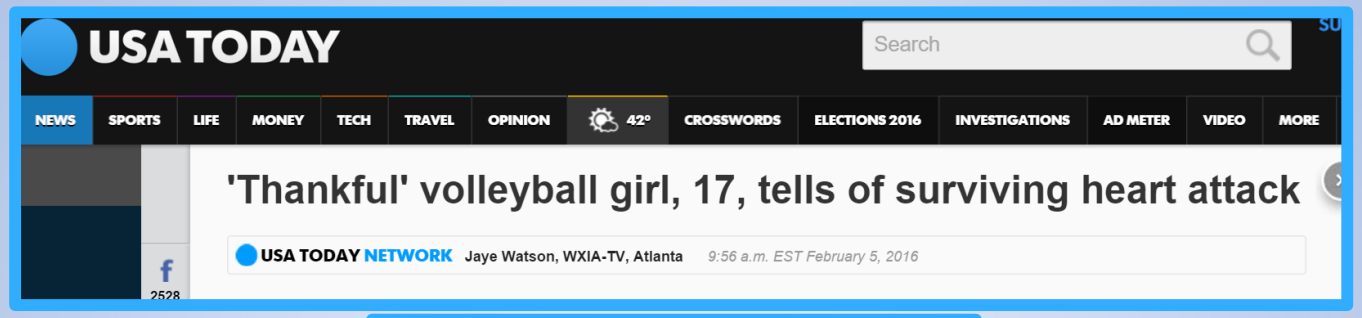

NEWS LIVE HD
US UK 1

CPR is started early and ongoing



AED

One person in charge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2528


'Thankful' volleyball girl, 17, tells of surviving heart attack
usatoday.com
10
10
Inspirational Quotes @Inspire_Us 3h
Dad Plays Baby A Lullaby & What Happens Next Took Our Breath Away!
faithreel.com/dad-plays-baby...
Home
Notifications
Moments
Messages
Me

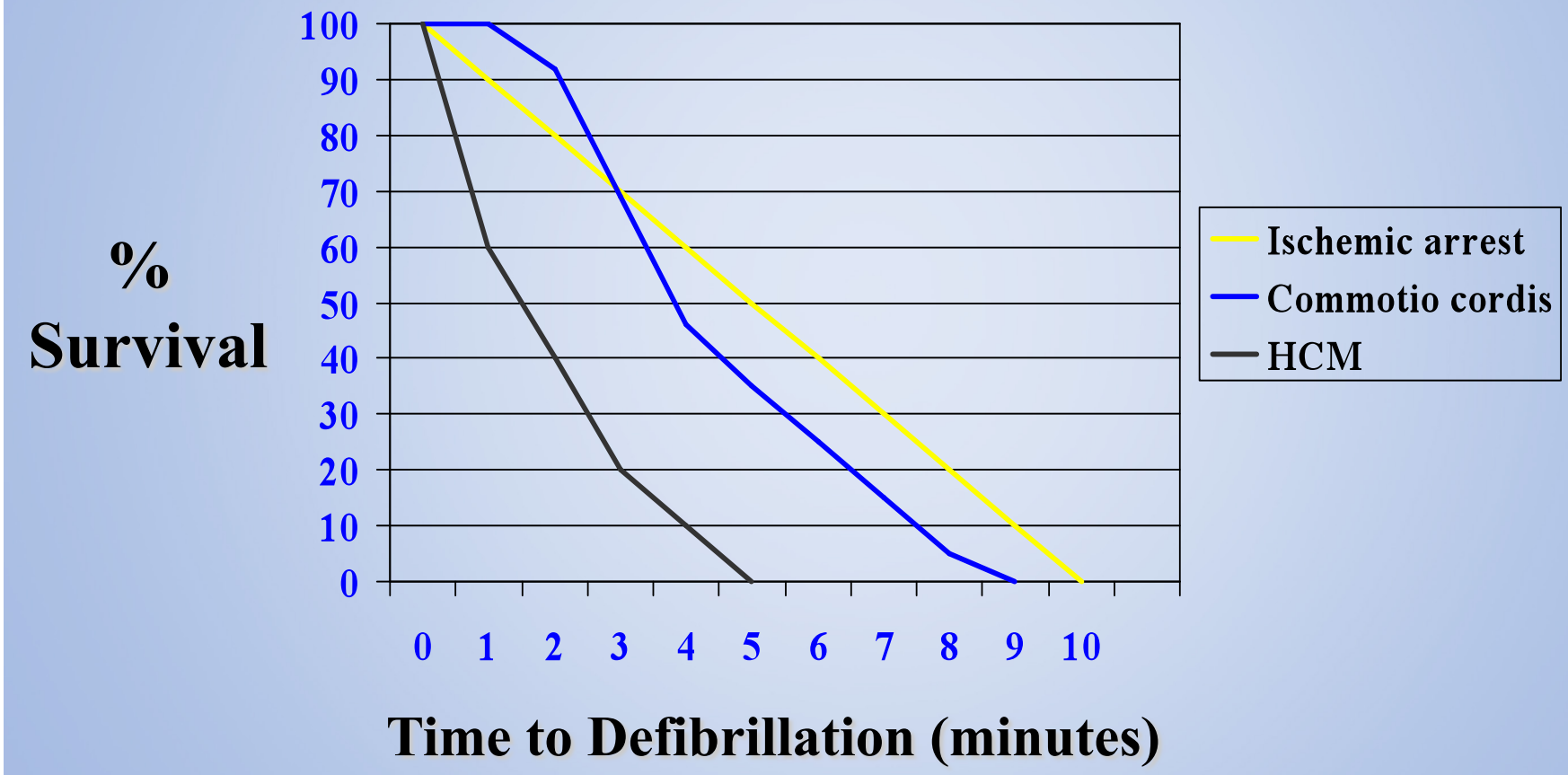
Sudden Cardiac Arrest "Drill"

The Chain of Survival

Time is limited ->

an immediate organized response is crucial.

Survival vs. Time to Defibrillation



Survival Following SCA Student Athletes

- Historical - poor
- 2000-2006 survival trends for exercise-related SCA
  - 11% survival (Drezner 2008)

(Drezner 2009)

Survival Following SCA Student Athletes

- Historical - poor
- 2000-2006 survival trends for exercise-related SCA
  - 11% survival (Drezner 2008)
- National Registry for AED Use in Sports July 2006 to June 2007
  - 14 cases in HS student-athletes
  - 9 of 23 survivors HS student-athletes
  - 64% survival in HS athletes (Drezner 2009)

Survival Following SCA at Sporting Events

The NEW ENGLAND JOURNAL of MEDICINE

CORRESPONDENCE

Mobile Automated External Defibrillator Response System during Road Races

93% Survival

Researchers in Japan developed a rapid mobile AED system to provide early CPR & AED intervention for runners who have cardiac arrest during road races. In 251 races, 28 of 30 runners who had a cardiac arrest were successfully resuscitated.

NEJM

Mobile Automated External Defibrillator Response System ...

Correspondence from The New England Journal of Medicine — Mobile Automated External Defibrillator Response System during Road Races

nejm.org

N Engl J Med 2018; 379:488-489

Signs of cardiac arrest:

Sudden non-contact collapse, passed out athlete

Non-contact collapse

Call 911
Activate EAP
Retrieve AED

Hands-Only-CPR and AED

Continue until EMS arrives

Take Home points

Cardiac Screening

is a work in progress

- Best practices are still developing
- Each sport, gender, geography is different
- Make sure you have the expertise
- How will you handle what you find?

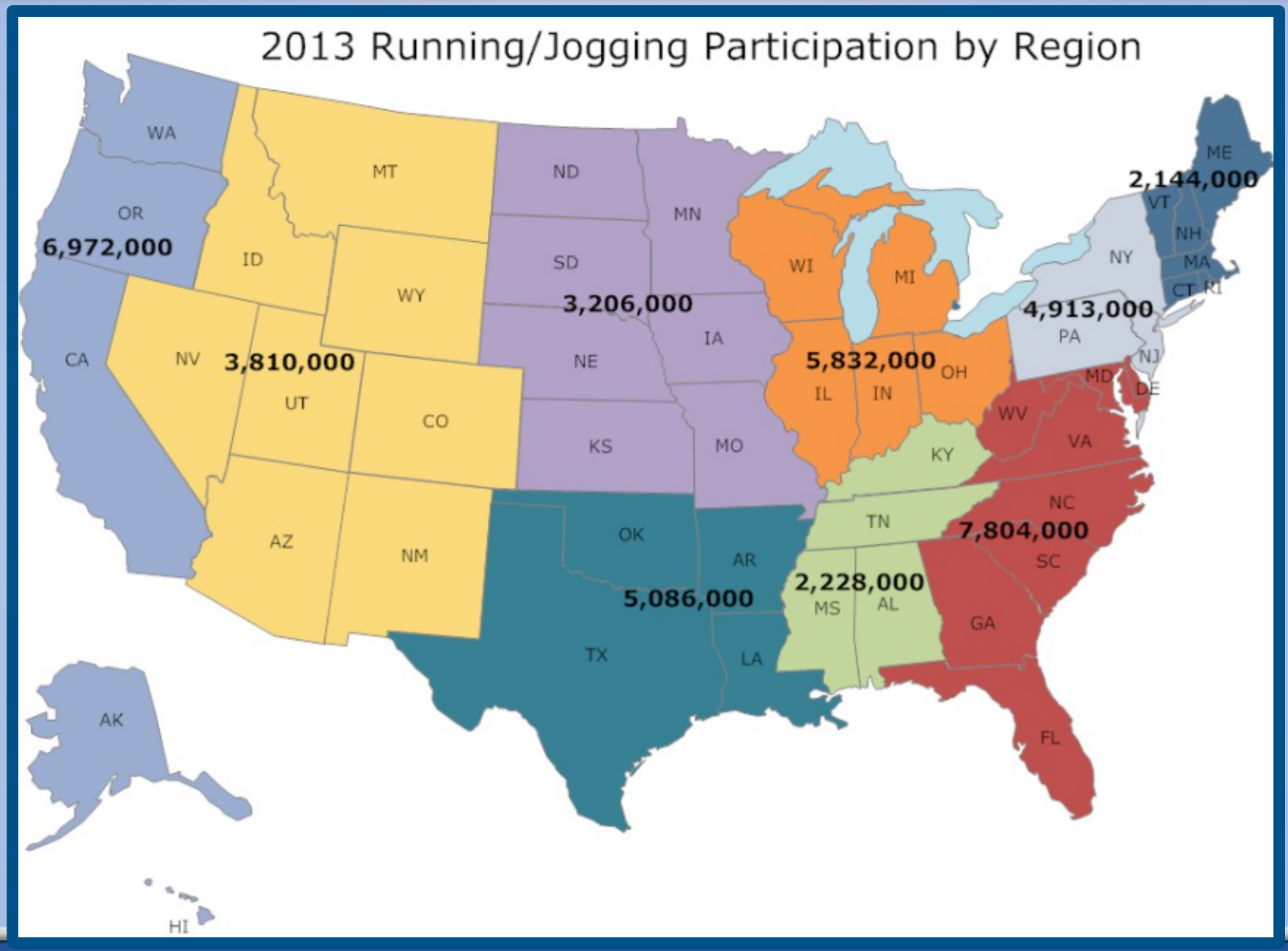
Take Home points

- Evaluating athletes is important
  - Only one part of cardiac safety
  - No screening evaluations will be perfect
- Athlete on field Cardiac Care
  - EAP and AED availability are is critical
  - Be prepared for the undiagnosed

THE CHANGING FACE OF THE AMERICAN ATHLETE

Fitness Athlete

Masters Athlete


2013 Running/Jogging Participation by Region
WA
OR
6,972,000
CA
ID
NV
MT
WY
UT
AZ
CO
NM
3,810,000
ND
SD
NE
KS
MN
IA
MO
3,206,000
OK
TX
AR
LA
5,086,000
WI
MI
IL
IN
OH
5,832,000
KY
TN
MS
AL
2,228,000
NY
PA
4,913,000
WV
MD
DE
NJ
VA
NC
SC
GA
FL
7,804,000
ME
VT
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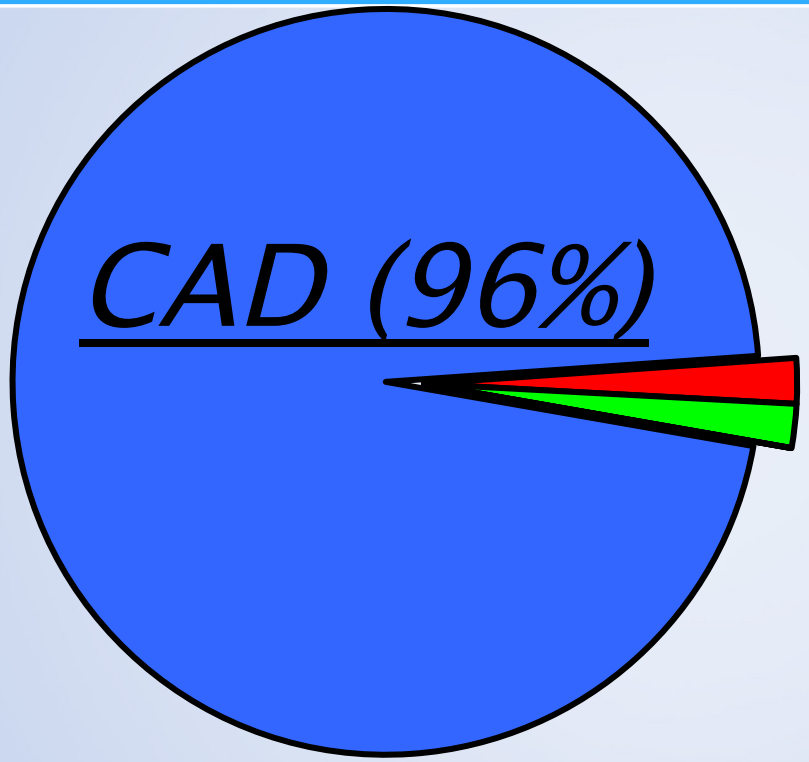
RI
2,144,000
AK
HI

CV Causes Sudden Death
Older (Ages 31-65) Athletes



Coronary artery anomalies (2%)

Hypertrophic cardiomyopathy (2%)

Waller B: Exercise and the Heart, 1985

38 y/o Caucasian male, Recreational marathon runner

- History of hyperlipidemia
- ***Meds***: Lipitor 20 mg daily (recently started)
- ***Social History***: No tobacco, illicit drugs; only rare alcoholic beverage
- ***Family History***: No history of cardiomyopathy, early CAD, sudden cardiac death; +hyperlipidemia

Hyperlipidemia: Diagnosed in his 20's with "unhealthy dietary habits" (high LDL-C by report was 228), *was* on simvastatin.

- Changed lifestyle habits and began running.
- Was off statins until a few months before marathon as LDL had increased over the last several years (LDL-C 185)

Running History

Engaged in long-distance recreational running for approximately 15 years

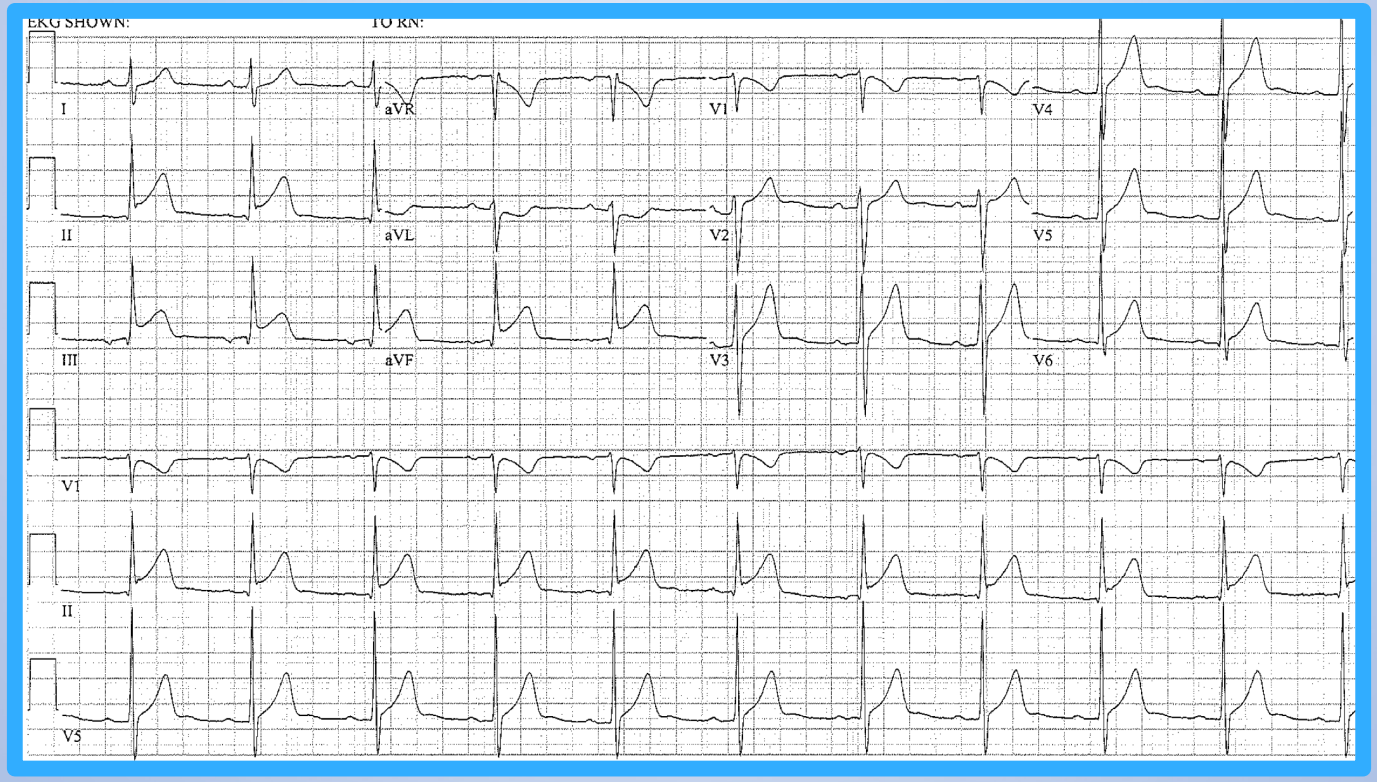
- This was his 5th marathon, PR: 3:25

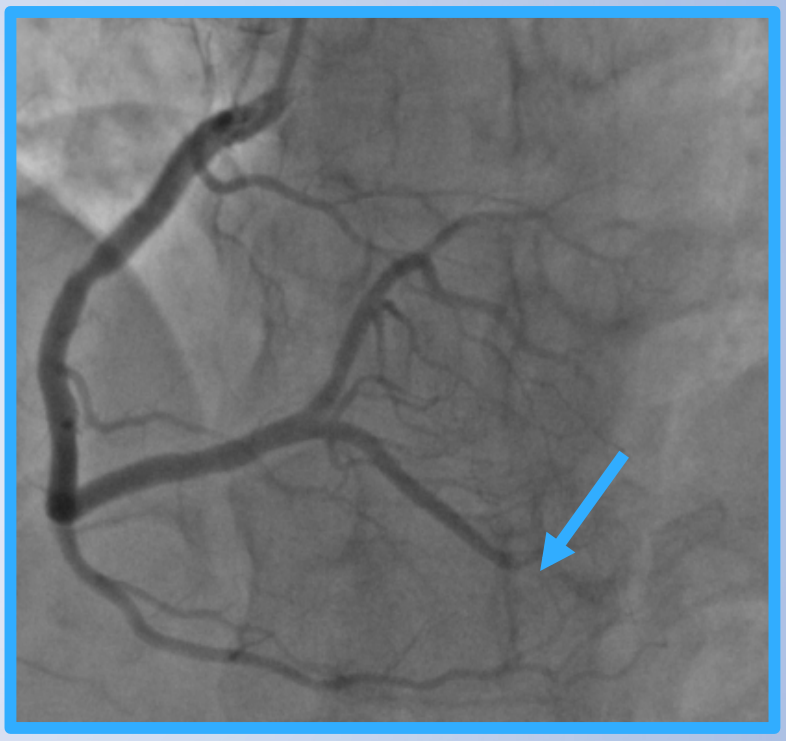
- Well trained, engaged in a 20 week training program, maximum mileage 40-50 miles per week

- No issues with his pre-marathon preparation

- Completed NYC marathon with a new personal best 3:15
- No issues until immediately after finish

- ~1 hour after returning home (~2 hours after race), complained of left sided intense chest pressure, left arm numbness, diaphoresis
  - Called 911
  - EMS arrives





Troponin-I Trend: 3 -> (21.2 -> 57.3 -> 195)

What are the management strategies?

1 - > How do a manage an athlete recovering from an MI? Statins in a runner?

2 - > How long do they need meds?

3 - > When can they run again?

Treat to Reduce Risk of Events

- DAPT (dual antiplatelet therapy)
- Low Dose Beta Blockade as Tolerated
  - Warn Re → Sudden Cessation
- Look for an ACE / ARB Excuse

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 8: Coronary Artery Disease

1. Restrict Competition ≥ 3 mos After ACS, PTCA, CABG
2. Perform an EXT on Medical Regimen
3. Measure LV Function

- Allow the muscle to heal
  - Risk stratify them

High Risk

(any 1 of the following)

- Impaired LV systolic function at rest (i.e., ejection fraction less than 50%)
- Exercise-induced anginal pain, pathological dyspnea (angina equivalent) or syncope
- Exercise-induced myocardial ischemia or complex ventricular arrhythmias
- Residual hemodynamically significant stenosis of a major coronary artery

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 8: Coronary Artery Disease

1. Restrict Competition ≥ 3 mos After ACS, PTCA, CABG
2. Perform an EXT on Medical Regimen
3. Measure LV Function
4. Pursue Aggressive Risk Reduction

JACC: CARDIOVASCULAR IMAGING
© 2011 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
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VOL. 4, NO. 9, 2011
ISSN 1936-878X/$36.00
DOI:10.1016/j.jcmg.2011.06.013

CVN Interview

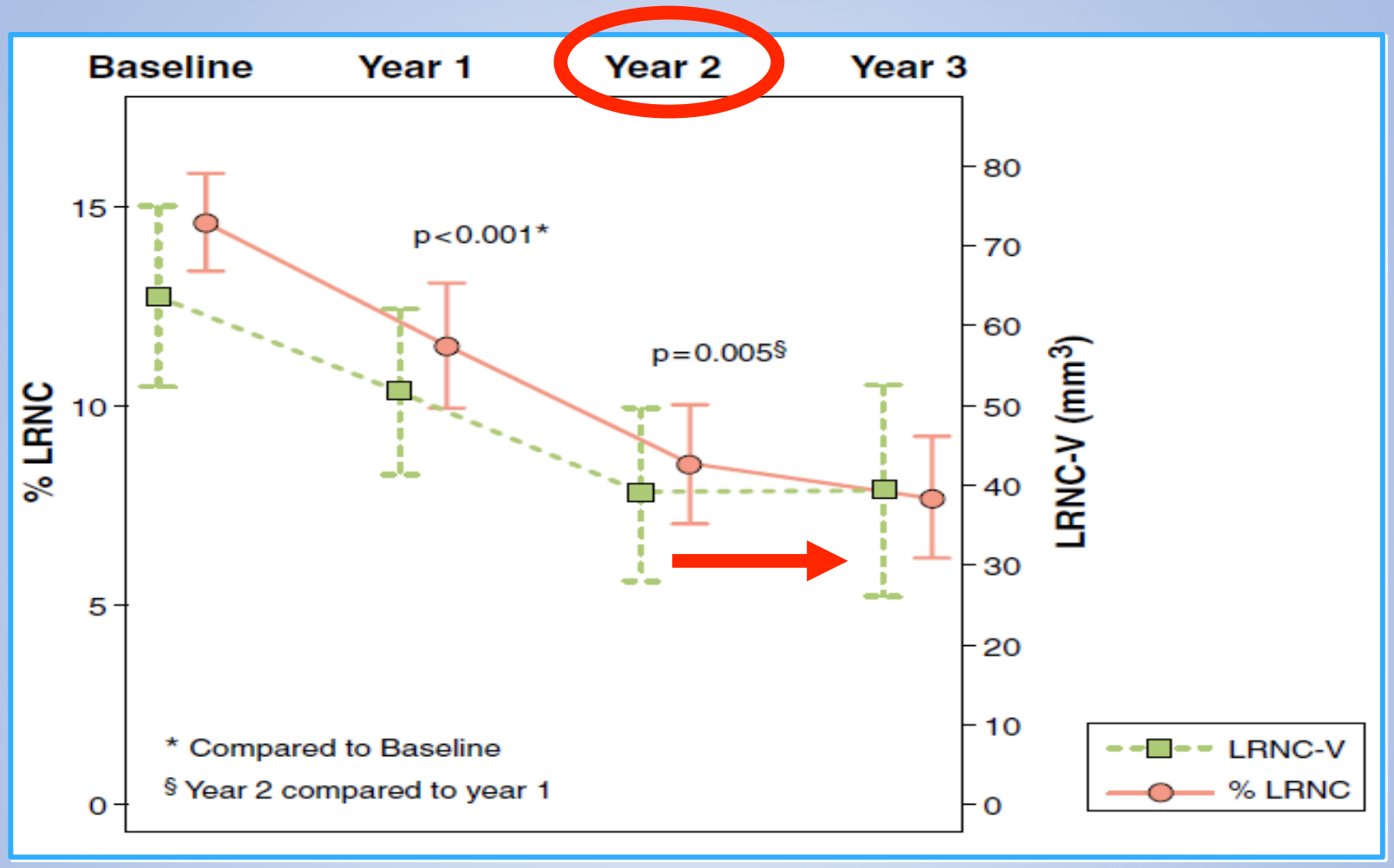
MR Imaging of Carotid Plaque Composition During Lipid-Lowering Therapy

A Prospective Assessment of Effect and Time Course

Xue-Qiao Zhao, MD,* Li Dong, MD,† Tom Hatsukami, MD,‡ Binh An Phan, MD,*
Baocheng Chu, MD, PHD,† Andrew Moore, BS,* Trevor Lane, BS,*
Moni B. Neradilek, MS,§ Nayak Polissar, PHD,§ Duane Monick, MD,‖ Colin Lee, MD,¶
Hunter Underhill, MD,† Chun Yuan, PHD†

Seattle and Yakima, Washington; and Boise, Idaho

- 84 Subjects With Coronary or Carotid Disease - 33 With Measureable Plaque Lipid
- 3 Yrs. of **Intensive** Lipid Therapy
- With Statins, Niacin, Bile Sequestrant Resins



LRNC=Lipid Rich Necrotic Core

Review

A systematic review of the time course of atherosclerotic plaque regression

Adam M. Noyes [a], Paul D. Thompson [b,*]

- Systematic review of studies analyzing atherosclerotic regression on lipid therapy
- 31/50 studies demonstrated ***plaque regression*** in carotid (11), coronary (16), and aortic (4) vascular beds on statins
- Average of **19.7 months**
- Average reduction in LDL-C was 40% (in studies demonstrating regression)
- Higher regression with increased LDL reduction and higher dose statin therapy

Treat to Reduce Risk of Events

- ✓ DAPT (dual antiplatelet therapy)
- ✓ Low Dose Beta Blockade as Tolerated
  - Warn Re → Sudden Cessation
- ✓ Look for an ACE / ARB Excuse
- Aggressive Lipid Treatment -
  - → She/He Levels Are Too High for them

Less Plaque Cholesterol

Less Inflammation

Fewer WBCs

Less Matrix Metalloproteinase

? Less chance of plaque rupture

Less Plaque Cholesterol

Less Inflammation

Fewer WBCs

Less Matrix Metalloproteinase

? Less chance of plaque rupture

Suggest:

18 months to 2 Years of Intensive Lipid Therapy

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 8: Coronary Artery Disease

- It is Reasonable To:

1. Restrict Competition ≥ 3 mos After ACS, PTCA, CABG
2. Perform an EXT on Medical Regimen
3. Measure LV Function
4. Pursue Aggressive Risk Reduction
5. Allow Adults to Participate in Decision
6. Discuss risk based available data

Case Presentation

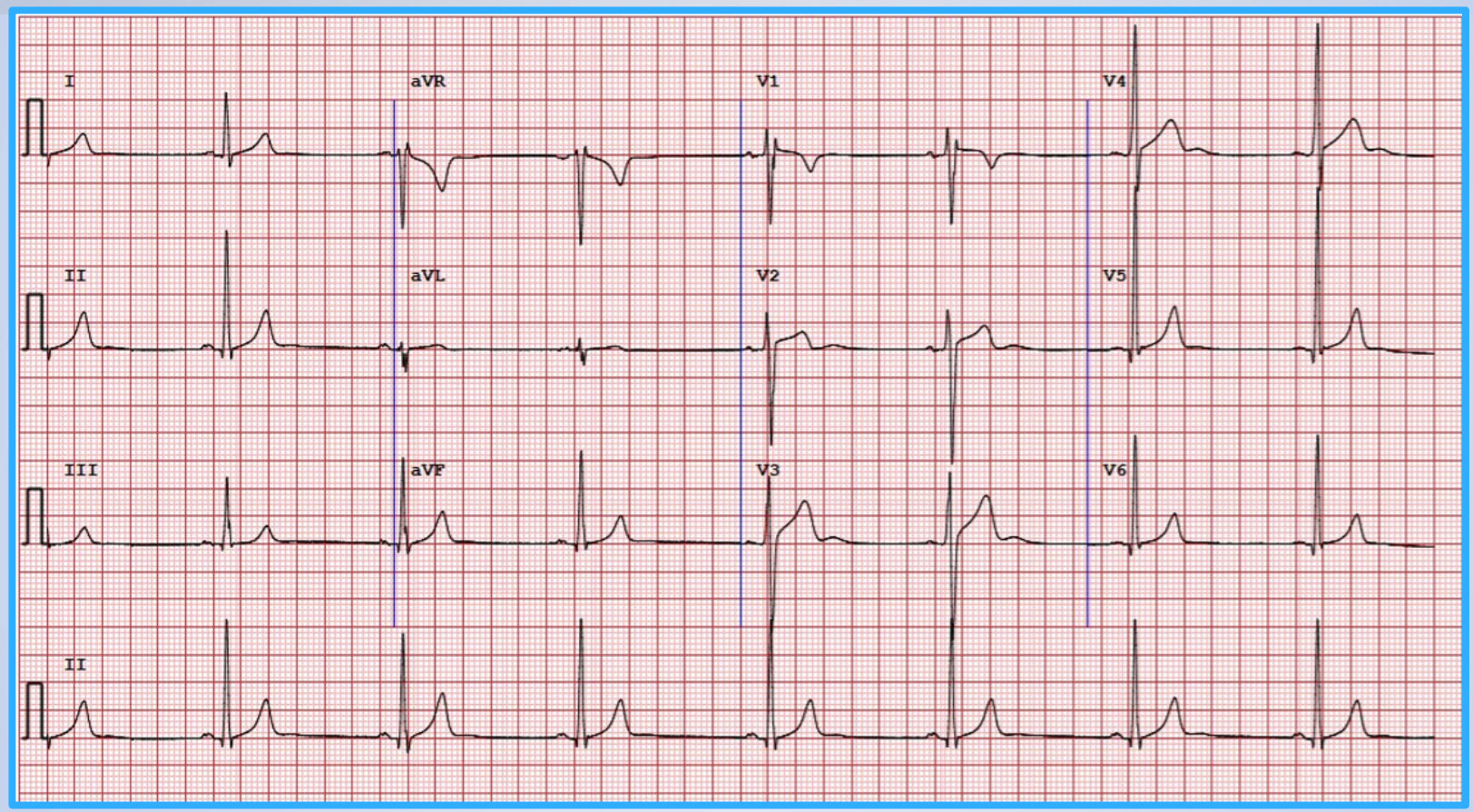
- 50-year-old man
- Marathoner -
- > 15 events lifetime

- No symptoms
- No CV risk factors

Case Presentation

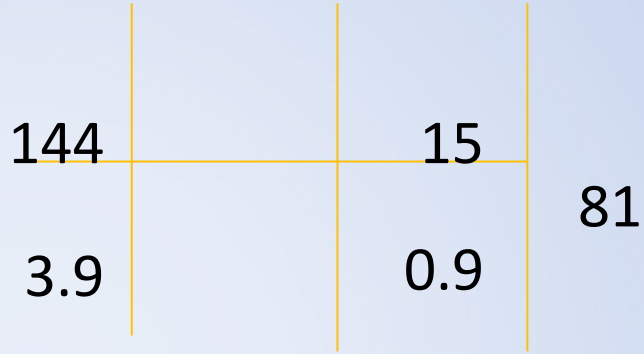
- Family history of CAD
  - Multiple family members with CAD
  - Earliest with a heart attack at age 60

Case Presentation



Diagnostic Tests

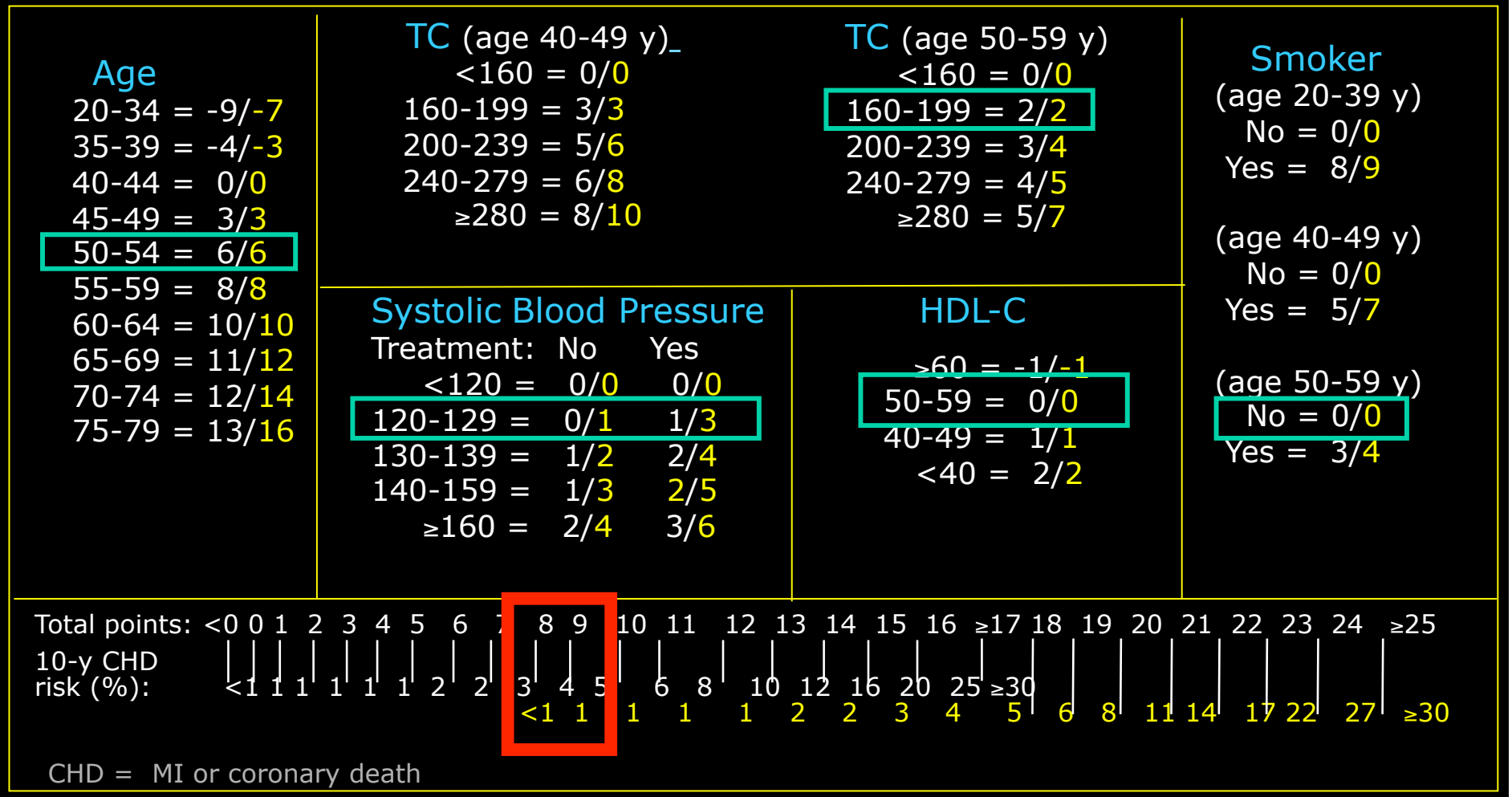
- Labs:



- TC - 188, TG = 80, LDL = 116, HDL = 56
- HR – 52 Resting BP = 122/76

Framingham Global Risk Assessment

Cumulative Point Scale for Estimating 10-Year CHD Risk in Men and Women (Framingham point scores)



Adapted from NCEP ATP III *JAMA*. 2001;285:2486-2497.


THE WALL STREET JOURNAL.

SPORTS | November 27, 2012, 8:02 p.m. ET

One Running Shoe in the Grave

New Studies on Older Endurance Athletes Suggest the Fittest Reap Few Health Benefits

Running can take a toll on the heart that essentially eliminates the benefits of exercise. "Running too far, too fast and for too many years may speed one's progress toward the finish line of life," concludes an editorial to be published in the British journal Heart.

Can you exercise too much?

IN DEPTH

Exercise and fitness

Exercise and death: Am I safer on the couch?

Last Updated October 4, 2006

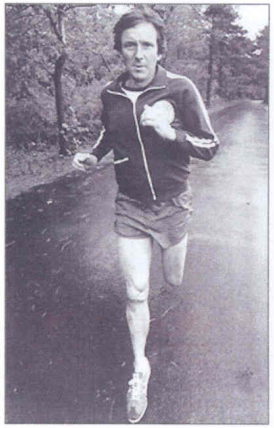
CBC News

the event.

A year earlier, a 42-year-old man from Guelph, Ont., died a couple of kilometres before the finish. The cause of his death was never released, but a heart attack is suspected.

Two years earlier, an experienced marathoner died running the Toronto marathon. An autopsy showed a congenital heart defect that had previously gone undetected.

"To complete a half marathon demands regular exercise and discipline to get out there and train. More so for the full marathon distance," Jay Glassman, race director for the Toronto Marathon, told CBC News. "There are obvious stresses on your heart but in all the cases that we've experienced over the past five years, we know those gentlemen were in good shape and had regularly exercised."



Jogging guru Jim Fixx is shown in this 1980 file photo. (CP Photo)

However, being in top physical shape won't necessarily protect you from heart disease.

Perhaps the highest profile running death was that of Jim Fixx, the journalist-turned-fitness guru who was credited with giving birth to the first running boom in the 1970s.

Fixx was an overweight smoker before he took up running. His blood cholesterol levels were elevated. He had also experienced several warning symptoms, which he chose to ignore and had refused the option of undergoing an exercise stress test

SPORTS |

One Running Shoe in the Grave

New Studies on Older Endurance Athletes Suggest the Fittest Reap Few Health Benefits

1) Are athletes at risk for **CAD**?

2) Can and how to return athletes to sport with known **CAD** ?

Exercise modifies CV Risk Factors

JAMA 1985

The Effects of Aerobic Exercise on Plasma Catecholamines and Blood Pressure

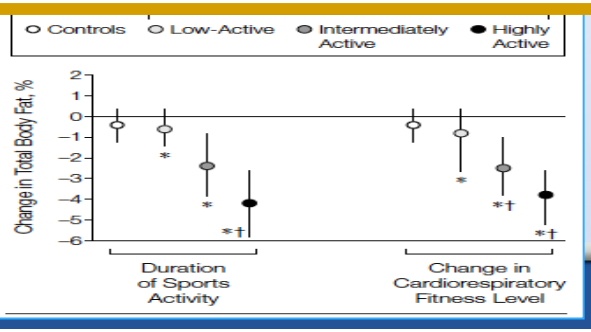
NEJM 2002

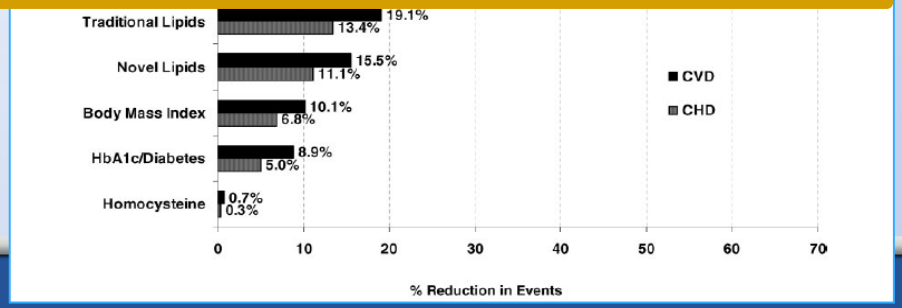
EFFECTS OF THE AMOUNT AND INTENSITY OF EXERCISE ON PLASMA LIPOPROTEINS

Your Prescription for Health

Exercise is Medicine™

www.ExerciseIsMedicine.org





Can you exercise too much?

Endurance runners at risk for calcified coronary plaque

March 15, 2010

American College of Cardiology 59th Annual Scientific Sessions

See Also

Controlling BP, cholesterol may halve risk for heart disease ...

Longer duration of obesity tied to higher risk for coronary ...

Certain antibiotics may increase risk for statin toxicity in older ...

ATLANTA – Runners of multiple marathons appear to have more calcified plaque in their coronary arteries than those who are not endurance athletes.

A new study found that long-term endurance running in marathon runners was associated with significantly increased calcified coronary plaque volume compared with non-marathon runners (274 mm^3 vs. 169 mm^3), according to data presented at the American College of Cardiology 59th Annual Scientific Sessions.

"The results were surprising, and extremely counterintuitive," **Jonathon G. Schwartz, MD,** of the department of internal medicine at University of Colorado, Denver, said in a press release. "Not only were elite runners just as likely as sedentary people to have calcium plaque in their coronary arteries, they actually appear to have more."

Coronary artery calcium and exercise

EUROPEAN SOCIETY OF CARDIOLOGY®

European Heart Journal (2008) **29**, 1903–1910
doi:10.1093/eurheartj/ehn163

Running: the risk of coronary events†

Prevalence and prognostic relevance of coronary atherosclerosis in marathon runners

- Conventional FRS underestimates risk of marathon runners.
- Higher CAC rates (>100) in marathon runners when compared with FRS-matched controls (36.1 vs. 21.8%, P< 0.01)

Coronary artery calcium and exercise

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- Higher CAC rates (>100) in marathon runners when compared with FRS-matched controls (36.1 vs. 21.8%, P< 0.01)
  - **A *zero* CAC score was more frequent in marathon runners than in age-matched controls**

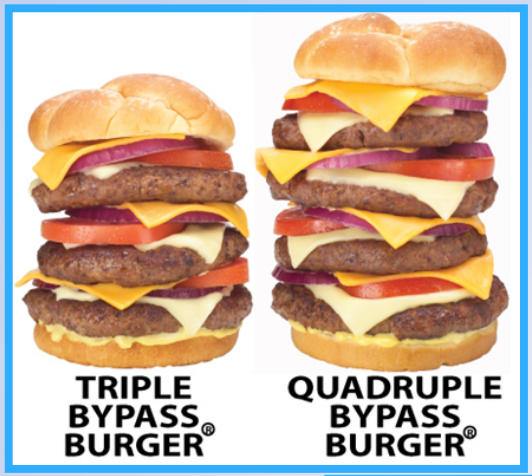
Running: the risk of coronary events†

Prevalence and prognostic relevance of coronary atherosclerosis in marathon runners

Table 4 Risk factors and test results of participants with events during follow-up

Risk factors/test results at baseline	Subjects with an event during follow-up				Normal range[a]
	1	2	3	4	
Age (years)	66	64	55	62	
BMI (kg/m^2)	22.5	24.6	22.0	22.0	<25
Systolic blood pressure (mmHg)	110/61	105/67[b]	153/96 ✓	138/82 ✓	<120/80
History of hypertension	No	Yes ✓	No	Yes	No
Total cholesterol (mg/dL)	344 ✓	201	233	240	<240
LDL cholesterol (mg/dL)	170	116	98	131	<160
HDL cholesterol (mg/dL)	109	60	100	65	>40
Smoking status	Former ✓	Never	Former ✓	Former ✓	Never
10-year Framingham risk score (%)	8	7	6	10	The lower the better
CAC score (Agatston units)	874	472	171	128	zero CAC
CAC percentile rank	86	81	73	60	zero CAC
Myocardial LGE	Yes	No	Yes	Yes	No
Resting heart rate (b.p.m.)	48	58	63	42	50–100
Weekly MET	4241	4806	8296	5054	
Marathons completed (no.)	14	22	65	140	
Findings on invasive angiography	Three-VD	Two-VD	Myocardial bridge/ One-VD	Three-VD	
Type of event	VT during exercise, stent	Stent/ CABG	Stent	VT during exercise, CABG	

Exercise does not make you bulletproof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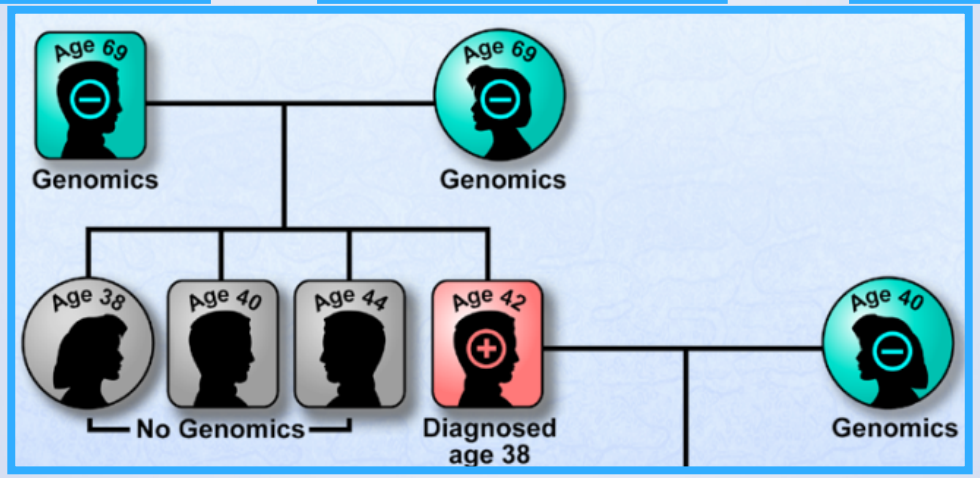
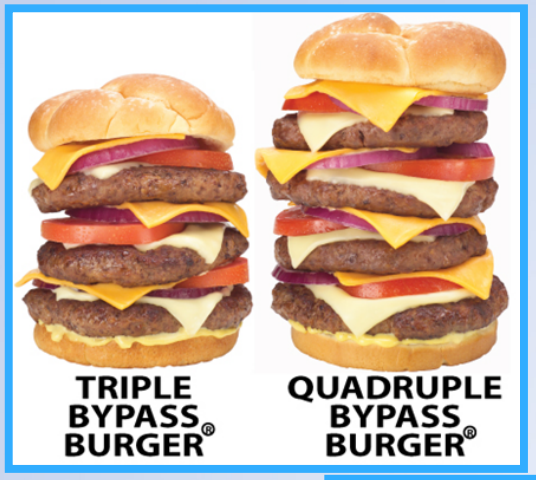

Age 69
Genomics
Age 69
Genomics
Age 38
Age 40
Age 44
No Genomics
Age 42
Diagnosed age 38
Age 40
Genomics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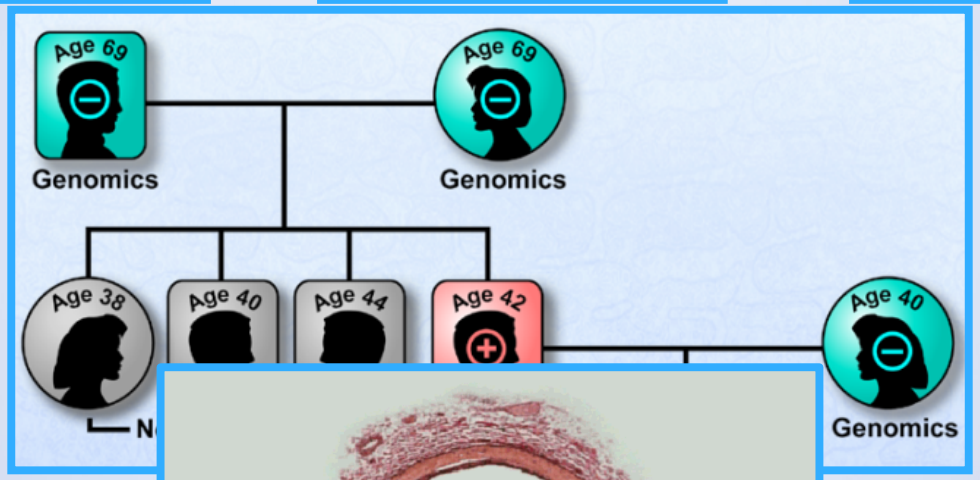
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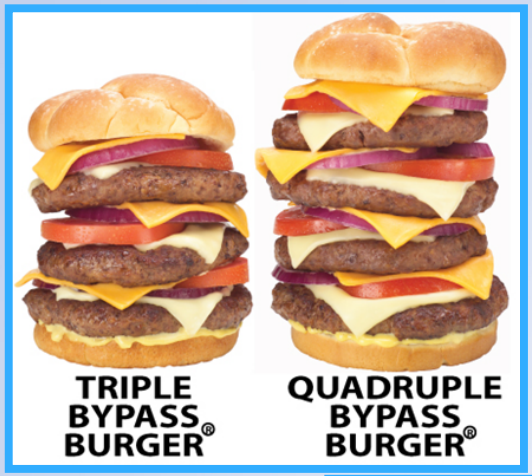
Genomics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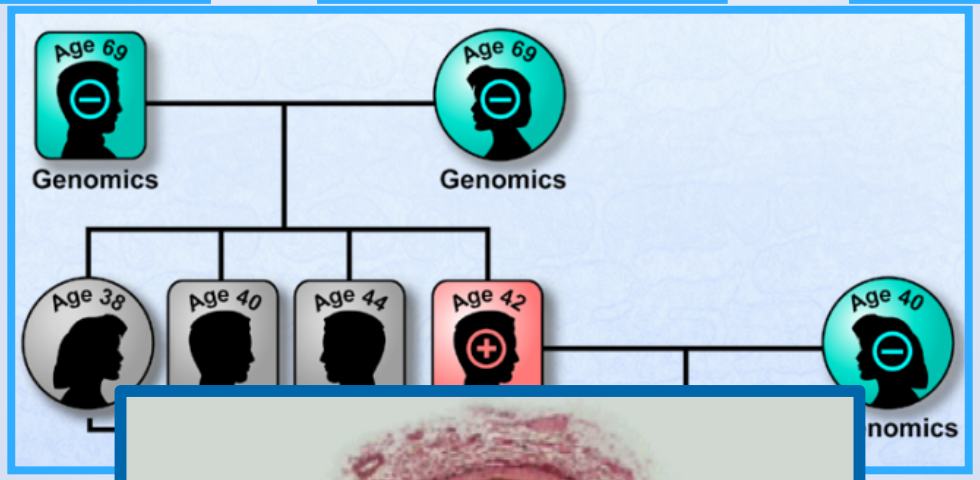
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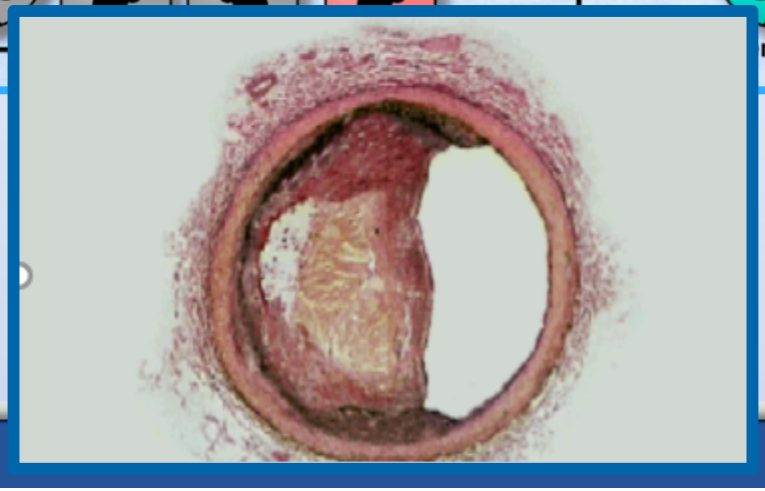


Cardiac CT

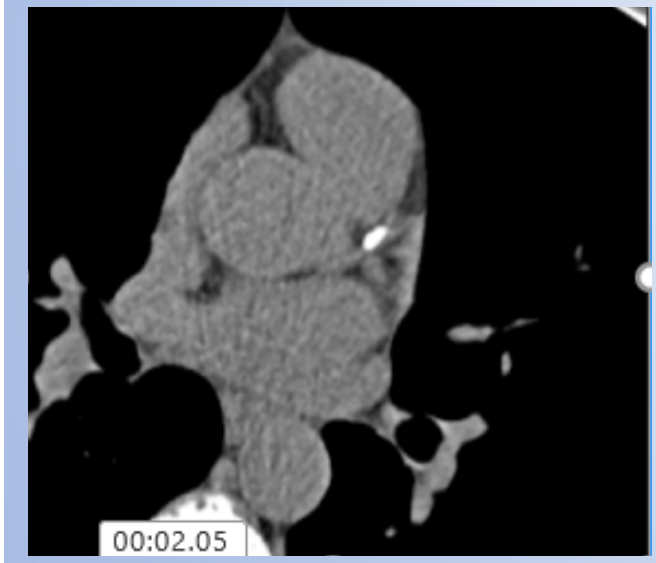
Coronary Calcium

- Agatston score: weighted sum
- CAC indicates plaque burden
  - Calcification is one aspect of atherosclerosis
- CAC does not indicate % stenosis

55 yo

Calcium score ZERO

49 yo

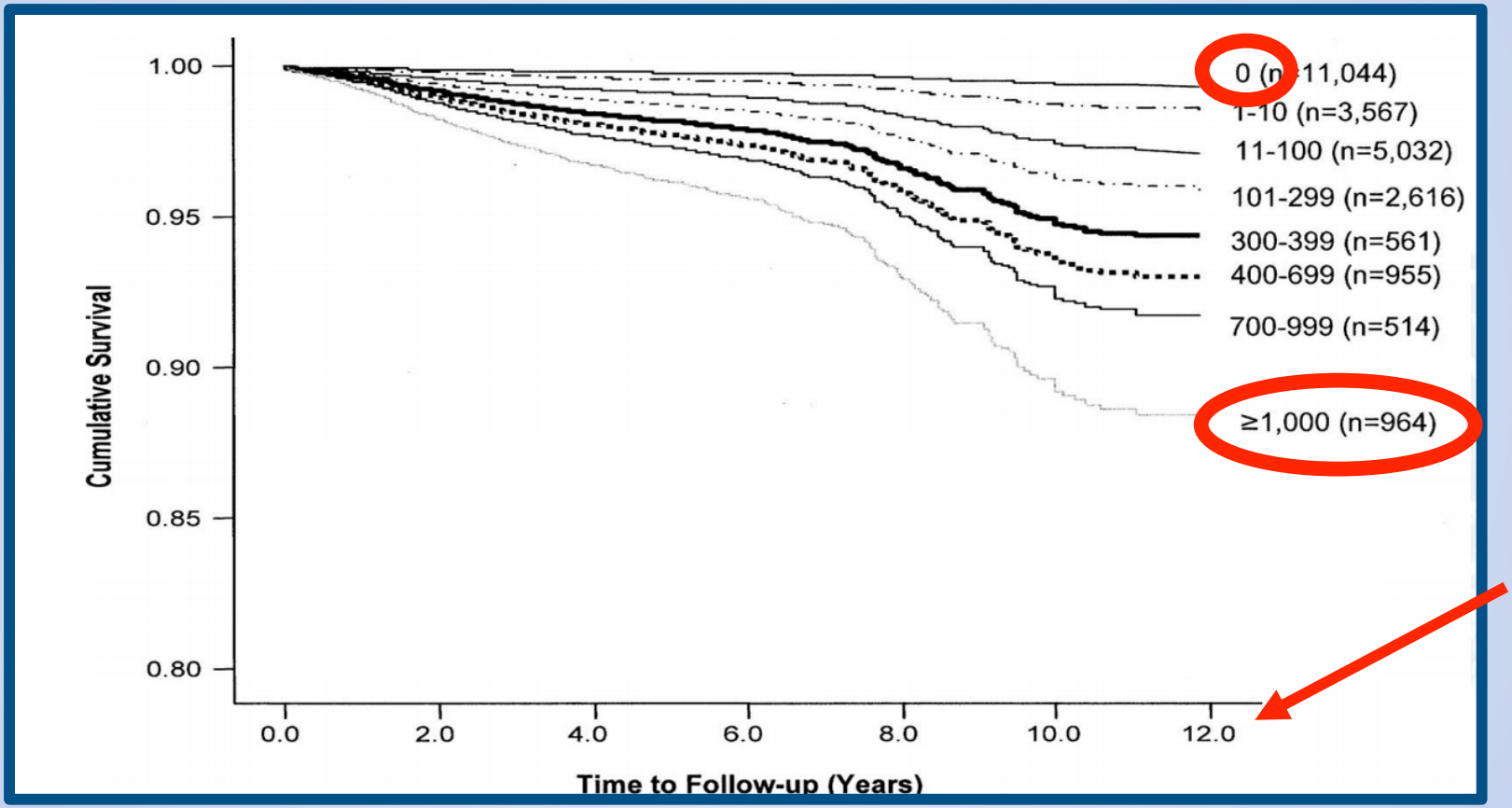


Calcium score >100

48 yo

Calcium score >400

CAC and prognosis



Budoff MJ et al JACC 2007

Coronary Artery Calcification

- **Do athletes have more CAC? → Probably**
  - **Is exercise causative? → probably not**
    - Cross sectional data only
      - Bias → selection bias
      - Confounding and unmeasured risk factors
        - Accrued Lifetime Risk
        - Dietary History
        - Events prior to becoming a runner

- **Does CAC carry same prognosis in athletes as non-athletes? ⟶**

- **Does treatment guided by CAC in athletes change outcomes →**

JAMA Cardiology | Original Investigation

Association of All-Cause and Cardiovascular Mortality With High Levels of Physical Activity and Concurrent Coronary Artery Calcification

Laura F. DeFina, MD; Nina B. Radford, MD; Carolyn E. Barlow, PhD; Benjamin L. Willis, MD, MPH; David Leonard, PhD; William L. Haskell, PhD; Stephen W. Farrell, PhD; Andjelka Pavlovic, PhD; Katelyn Abel; Jarett D. Berry, MD; Amit Khera, MD, MSc; Benjamin D. Levine, MD

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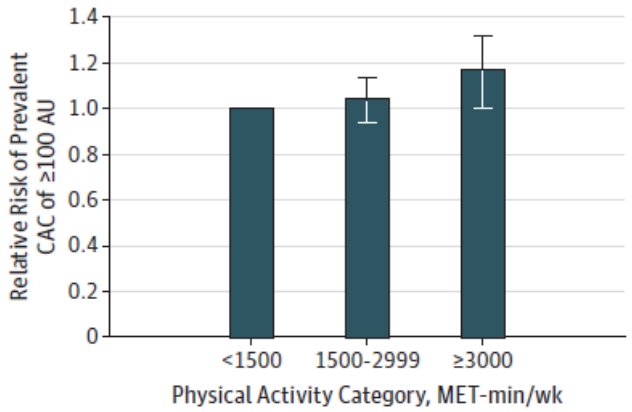
- 21,758 men without prevalent cardiovascular disease (CVD).
- Observation study of those with physical activity and a CAC.
- Self-reported physical activity by METs (min/wk) categorized
- >3000 (n = 1561),1500 to 2999 (n = 3750), and less than 1500 (n = 16 447)
- CAC scores were less than 100 or over 100 AU
- Mean 10yr follow up

Table 1. Baseline Characteristics of 21 758 Generally Healthy Men by Physical Activity Level and CAC Categories[a]

Characteristic	Physical Activity Category, MET-min/wk								All Men (N = 21 758)
	CAC <100 AU				CAC ≥100 AU				
	<1500 (n = 12 413)	1500-2999 (n = 2902)	≥3000 (n = 1129)	*P* Value for Trend	<1500 (n = 4034)	1500-2999 (n = 848)	≥3000 (n = 432)	*P* Value for Trend	
Age, mean (SD), y	49.5 (7.1)	49.2 (7.0)	50.0 (7.2)	.97	58.7 (8.5)	57.9 (8.2)	58.9 (8.5)	.10	51.7 (8.4)
White, No. (%)	11 196 (90.2)	2616 (90.1)	1021 (90.4)	.07	3681 (91.2)	775 (91.4)	390 (90.3)	.07	19 679 (90.4)
Current smoker, No. (%)	1874 (15.1)	306 (10.5)	136 (12.0)	<.001	583 (14.5)	98 (11.6)	47 (10.9)	<.001	3044 (14.0)
Statin use, No. (%)	1590 (12.8)	302 (10.4)	131 (11.6)	<.001	1346 (33.4)	287 (33.8)	114 (26.4)	.046	3770 (17.3)
Calcium level, mean (SD), mg/dL	9.2 (0.4)	9.2 (0.4)	9.2 (0.4)	.046	9.2 (0.4)	9.2 (0.4)	9.2 (0.4)	.04	9.2 (0.4)
Framingham Risk Score, mean (SD), %	8.7 (5.4)	7.4 (4.7)	7.6 (4.8)	<.001	13.5 (8.0)	11.5 (6.9)	12.3 (7.4)	<.001	9.5 (6.3)
Physical activity level, mean (SD), MET-min/wk	473.8 (469.2)	2077.9 (416.7)	4618.2 (2431.5)	<.001	430.7 (470.2)	2087.1 (422.4)	4646.9 (2187.9)	<.001	1040.6 (1399.6)
Physical activity, mean (SD), min/wk	104.0 (115.8)	334.4 (179.2)	712.8 (447.8)	<.001	105.2 (157.6)	353.8 (136.2)	766.5 (415.0)	<.001	189.4 (247.5)
Lifetime physical activity, mean (SD), y	18.1 (13.3)	22.8 (13.6)	25.5 (13.6)	<.001	20.1 (15.2)	26.0 (15.1)	30.2 (16.3)	<.001	20.5 (14.2)
CAC score, mean (SD), AU	11.3 (22.7)	10.3 (21.5)	11.5 (22.2)	.42	736.1 (975.9)	680.9 (865.2)	806.7 (1119.9)	.92	187.4 (572.1)
Calcification volume score, mean (SD)	11.0 (28.7)	10.2 (18.2)	11.5 (18.6)	.32	442.9 (539.8)	410.4 (488.1)	474.0 (592.4)	.91	128.3 (572.1)
No. of calcification lesions, mean (SD)	1.1 (2.1)	1.0 (1.7)	1.2 (2.7)	.41	12.5 (12.8)	11.8 (9.8)	12.1 (8.6)	.33	4.2 (8.2)
Cardiorespiratory fitness, mean (SD), MET	11.0 (1.9)	12.4 (2.0)	12.9 (2.3)	<.001	10.1 (2.0)	11.4 (2.1)	11.8 (2.2)	<.001	11.2 (2.1)
$\dot{V}O_2$max, mean (SD), mL/kg/min	38.6 (6.8)	43.3 (7.0)	45.1 (8.0)	<.001	35.4 (6.9)	40.1 (7.4)	41.3 (7.8)	<.001	39.2 (7.4)
$\dot{V}O_2$max ≥50 mL/kg/min, No. (%)	571 (5.3)	439 (16.9)	246 (24.7)	<.001	68 (2.2)	65 (9.2)	48 (13.4)	<.001	1437 (7.7)

Figure 2. Relative Risk of Prevalent Coronary Artery Calcification (CAC)



Data are stratified by physical activity category in metabolic equivalent of task (MET)–minutes/week in 21 758 generally healthy men. The model was adjusted for age, body mass index, levels of glucose and cholesterol, systolic blood pressure, and smoking status. The error bars represent the 95% CIs. AU indicates Agatston units. *P* = .006 for trend.

Table 2. All-Cause and Cardiovascular Disease Mortality in 21 758 Generally Healthy Men by Physical Activity Category and CAC Category

	Physical Activity Category, MET-min/wk						
	CAC <100 AU			CAC ≥100 AU			
Outcome	<1500 (n = 12 413)	1500-2999 (n = 2902)	≥3000 (n = 1129)	<1500 (n = 4034)	1500-2999 (n = 848)	≥3000 (n = 432)	All Men (N = 21 758)
Mean (SD) follow-up time, y	10.5 (4.3)	9.8 (4.3)	9.6 (4.4)	10.8 (4.3)	10.5 (4.2)	[illegible] (4.3)	10.4 (4.3)
Total follow-up, y	130 060.6	28 491.3	10 782.9	43 544.1	8912.4	4424.0	226 215.3
All-cause deaths							
No. of deaths	282	42	14	343	52	26	759
Incidence per 1000 person-years	2.2	1.5	1.3	7.9	5.8	5.9	3.4
CVD deaths							
No. of deaths	50	7	[illegible]	102	11	[illegible]	180
Incidence per 1000 person-years	0.4	0.2	[illegible]	2.3	1.2	[illegible]	0.8

Abbreviations: AU, Agatston units; CAC, coronary artery calcification; CVD, cardiovascular disease; MET, metabolic equivalent of task.

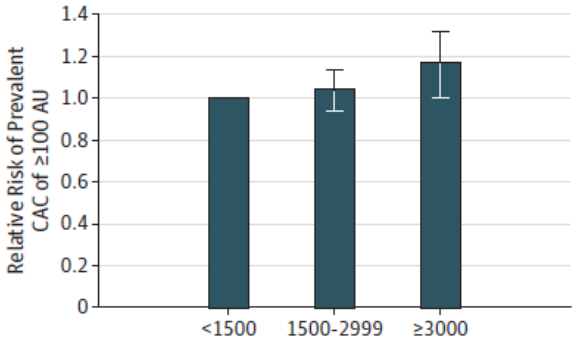
Exercise and CAC

- 1) Lower CAC is Better, ZERO is best
- 2) Exercise does not prevent atherosclerosis

Exercise and CAC

- 1) Lower CAC is Better, ZERO is best
- 2) Exercise does not prevent atherosclerosis
- 3) If you have elevated CAC
  - control risk factors and increase fitness
- 4) No need to stop (or even cut back) on exercise just because of CAC

Figure 2. Relative Risk of Prevalent Coronary Artery Calcification (CAC)



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Abbreviati

Table 3. Hazards for All-Cause and CVD Mortality in 21 758 Generally Healthy Men by CAC and Physical Activity Category

Physical Activity Category, MET-min/wk	CAC Category, HR (95% CI)			
	<100 AU		≥100 AU	
	Age-Adjusted	Fully Adjusted[a]	Age-Adjusted	Fully Adjusted[a]
All-cause mortality				
<1500	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
1500-2999	0.73 (0.53-1.01)	0.78 (0.56-1.07)	0.82 (0.62-1.10)	0.87 (0.65-1.17)
≥3000	0.55 (0.32-0.94)	0.52 (0.29-0.91)	0.72 (0.49-1.08)	0.77 (0.52-1.15)
CVD mortality				
<1500	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
1500-2999	0.69 (0.31-1.52)	0.66 (0.29-1.51)	0.58 (0.31-1.09)	0.66 (0.36-1.23)
≥3000	0.45 (0.11-1.83)	0.39 (0.08-1.79)	0.75 (0.36-1.54)	0.80 (0.39-1.64)

Take home points

- Exercise is safe and improves CV risk
  - Exercise does not eliminate CAD risk
- Post infarction therapy can be tailored to the athlete
  - usual care is employed for at least 18 months
- Assessment of ischemia, LV function and symptoms are key to determine risk

Thank you

Matthew_w.Martinez@lvhn.org

507-358-4993