National University Heart Centre, Singapore
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Cardiac Rehabilitation for Athletic Individuals

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JurongHealth Jurong Medical Centre

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National University Heart Centre, Singapore

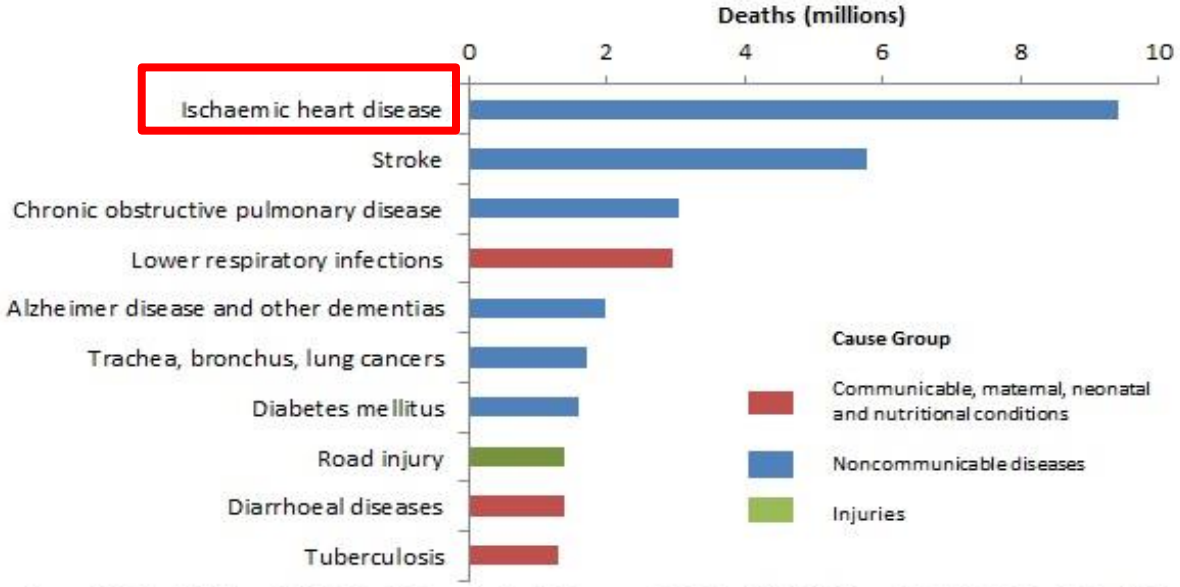
National University Centre for Oral Health, Singapore

National University Polyclinics

Scope

- Global burden of heart disease
- Physical activity trends
- Overview of CR
- A happy problem
  – Principles of CR in athletes
- Classification of sport
- Existing guidelines
- Exercise testing & prescription
- HIIT vs MICE
- Practical advice

Top 10 global causes of deaths, 2016



Source: Global Health Estimates 2016: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva, World Health Organization; 2018.

CVD is the **leading cause of death and disability** worldwide

It kills **17.5 million** people a year

It causes **1/3 of all global deaths** and **1/2 of all NCD related deaths**

I eat cheap greasy food so I can save for my cardiologist bills in the future.

Athletic individuals are *not immune* to heart disease

GROWTH IN POPULARITY OF MARATHON RUNNING

Runrepeat.com

THE WORLDWIDE **GROWTH** FROM **2009 TO 2014** WAS

13.25%

ASIA **92.43%** | USA **13.92%** | EUROPE **10.30%**

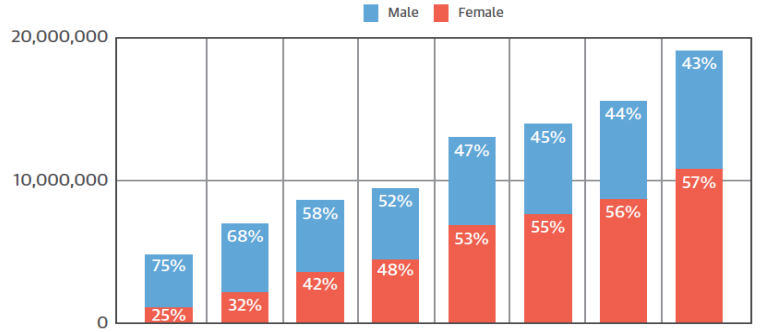
+7.80% MEN'S GROWTH

+26.90% WOMEN'S GROWTH

Top & Bottom Performing Countries

- RUSSIA (300%)
- CHINA (259,47%)
- PHILIPPINES (211,90%)
- ARGENTINA (161,80%)
- INDIA (154,78%)
- AUSTRALIA (84,24%)
- PORTUGAL (64,72%)
- BRAZIL (40,42%)
- SPAIN (25,30%)
- JAPAN (23,45%)
- FRANCE (22,15%)
- USA (13,92%)
- CANADA (10,88%)
- UK (-5,47%)
- GERMANY (7,59%)
- ITALY (-23,14%)
- FINLAND (-29,47%)
- SWITZERLAND (-32,59%)

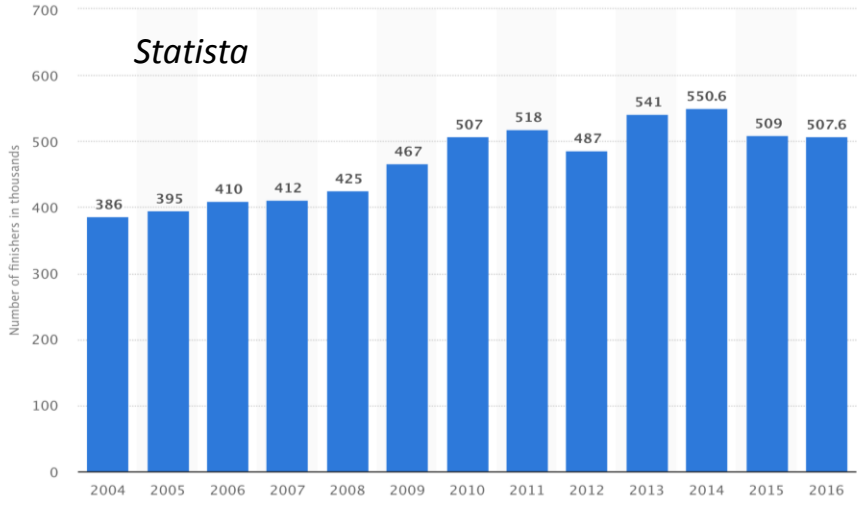
FIGURE 2 Increasing Numbers of U.S. Athletes Complete Running Races



	1990	1995	2000	2005	2010	2011	2012	2013
Female	1,199,200	2,215,500	3,619,600	4,494,400	6,929,000	7,685,700	8,699,000	10,844,200
Male	3,597,800	4,708,000	4,998,400	4,947,600	6,071,000	6,288,300	6,835,000	8,180,800

Runningusa.org

Statista



What is a CARDIAC REHABILITATION Program?

Cardiac Rehabilitation Programs Typically Consist Of The Following 5 Components:

1 Regular Exercise

From supervised activities, to a daily walk in the park, the idea is to get moving.

2 Adopt a Heart Healthy Diet

This includes meals that are low in salt, and rich in whole grains, fruits, vegetables, low fat meats and fish.

3 Reduce Stress

Learn to control your daily stress through relaxation techniques, recreation, music and other various methods.

4 Medical Therapy

Follow your doctor's instructions carefully and take your medications on schedule.

5 Stop Smoking

Most cardiac rehab programs offer methods to help you kick this harmful habit.

Cardiac conditions eligible for CR

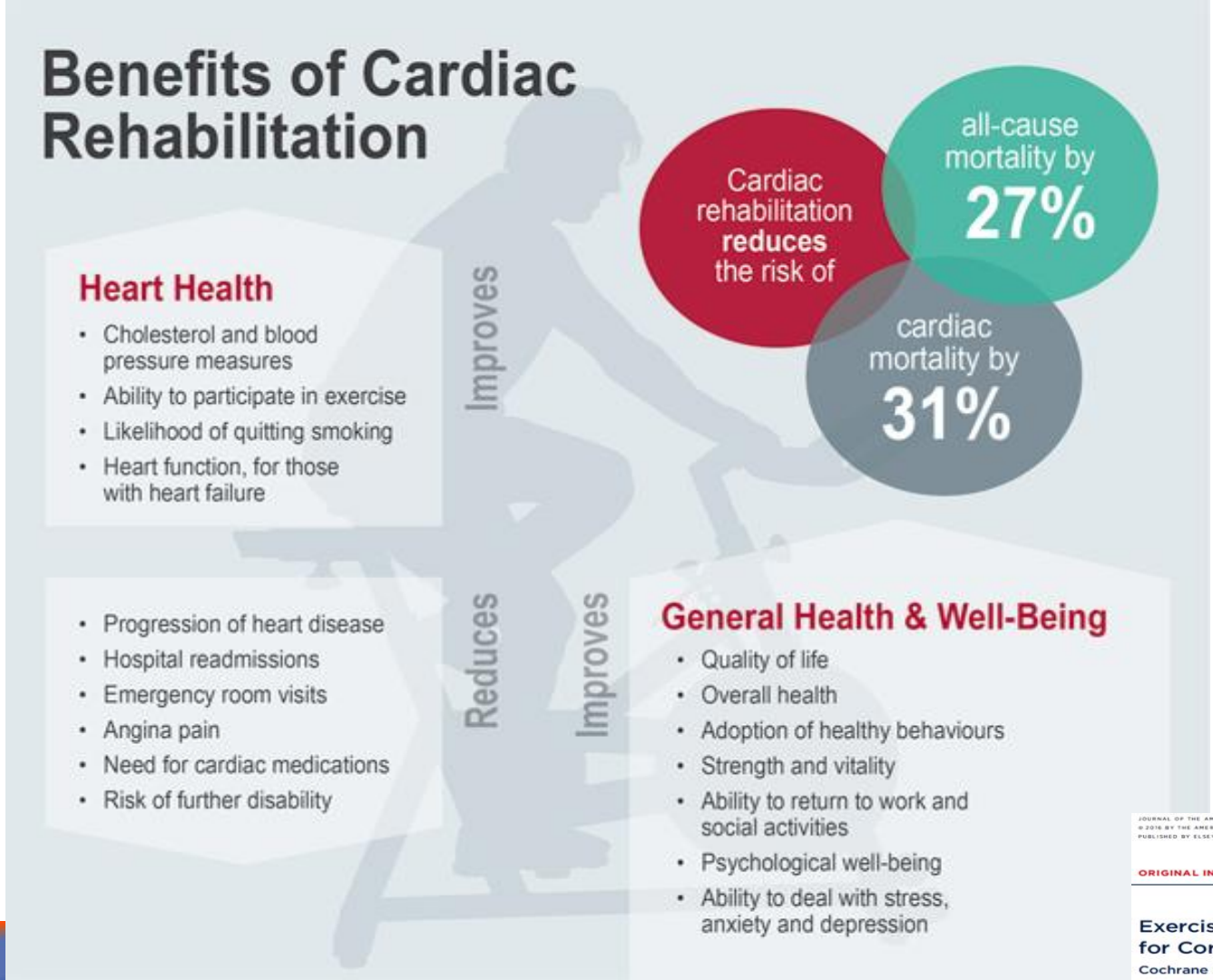
Box 1: Patient groups who benefit from cardiac rehabilitation*

- Patients with acute coronary syndrome—including ST elevation myocardial infarction, non-ST elevation myocardial infarction, and unstable angina—and all patients undergoing reperfusion (such as coronary artery bypass surgery, primary percutaneous coronary intervention, and percutaneous coronary intervention)
- Patients with newly diagnosed chronic heart failure and chronic heart failure with a step change in clinical presentation
- Patients with heart transplant and ventricular assist device
- Patients who have undergone surgery for implantation of intra-cardiac defibrillator or cardiac resynchronisation therapy for reasons other than acute coronary syndrome and heart failure
- Patients with heart valve replacements for reasons other than acute coronary syndrome and heart failure
- Patients with a confirmed diagnosis of exertional angina

*According to NICE, Department of Health, BACPR, and European guidelines[1-12]

Class I recommendation (various international cardiac societies/associations)

Benefits of Cardiac Rehabilitation



Heart Health

- Cholesterol and blood pressure measures
- Ability to participate in exercise
- Likelihood of quitting smoking
- Heart function, for those with heart failure

- Progression of heart disease
- Hospital readmissions
- Emergency room visits
- Angina pain
- Need for cardiac medications
- Risk of further disability

General Health & Well-Being

- Quality of life
- Overall health
- Adoption of healthy behaviours
- Strength and vitality
- Ability to return to work and social activities
- Psychological well-being
- Ability to deal with stress, anxiety and depression

Based on almost 40 years of research involving more than 14,000 patients

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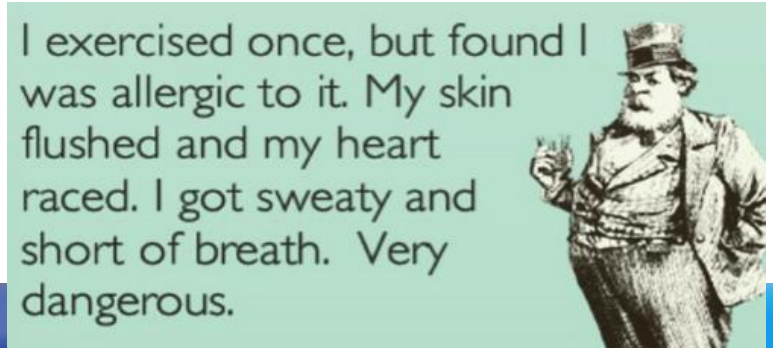
ORIGINAL INVESTIGATIONS

Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease

Cochrane Systematic Review and Meta-Analysis

Safety of exercise-based CR

- **Excellent** safety profile
- Most lethal complications: ventricular arrhythmia, myocardial infarction, cardiac arrest
- Incidence rate from 1 in 300,000 to 1 in almost 800,000 patient-hours



BOX 3.5 Contraindications to Exercise Testing

ABSOLUTE

- A recent significant change in the resting electrocardiogram (ECG) suggesting significant ischemia, recent myocardial infarction (within 2 d), or other acute cardiac event
- Unstable angina
- Uncontrolled cardiac dysrhythmias causing symptoms or hemodynamic compromise
- Symptomatic severe aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolus or pulmonary infarction
- Acute myocarditis or pericarditis
- Suspected or known dissecting aneurysm
- Acute systemic infection, accompanied by fever, body aches, or swollen lymph glands

RELATIVE[a]

- Left main coronary stenosis
- Moderate stenotic valvular heart disease
- Electrolyte abnormalities (*e.g.*, hypokalemia or hypomagnesemia)
- Severe arterial hypertension (*i.e.*, systolic blood pressure [SBP] of >200 mm Hg and/or a diastolic BP [DBP] of >110 mm Hg) at rest
- Tachydysrhythmia or bradydysrhythmia
- Hypertrophic cardiomyopathy and other forms of outflow tract obstruction
- Neuromotor, musculoskeletal, or rheumatoid disorders that are exacerbated by exercise
- High-degree atrioventricular block
- Ventricular aneurysm
- Uncontrolled metabolic disease (*e.g.*, diabetes, thyrotoxicosis, or myxedema)
- Chronic infectious disease (*e.g.*, HIV)
- Mental or physical impairment leading to inability to exercise adequately

[a]Relative contraindications can be superseded if benefits outweigh the risks of exercise. In some instances, these individuals can be exercised with caution and/or using low-level endpoints, especially if they are asymptomatic at rest.

Modified from (11) cited 2007 June 15. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12356646

The amazing potential of cardiac rehabilitation

Marathon Running After Myocardial Infarction

Terry Kavanagh, MD, D Phys Med, FRCP(C); Roy H. Shephard, MD,
(*JAMA* 229:1602-1605, 1974)

Patient	Times: Half-way, min	Times: Full Distance, min
7	144	. . .*
4	123	272
3	140	304
5	140	315
2	140	283
1	130	299
8	130	311
6	140	287
Average, all patients	135.9	295.8*

OCALA ★ STAR-BANNER

25 CENTS DAILY 50 CENTS SUNDAY VOLUME 41, NO. 229, 119TH YEAR Ocala, Florida, Wednesday, April 17, 1985

Heart Transplant Recipient Runs Marathon

Bryan Price, 45, ran the Boston Marathon with the heart of a 16-year-old, thanks to a transplant just over a year ago.

Price, of Caldicot, Wales, said he did it "to make other transplant patients more confident."

He finished Monday in five hours and 57 minutes, said his doctor, Terence Kavanaugh. The winner crossed the line in 2:14:5.

"Oh, I'm feeling absolutely fine today ... I've got a little bit of stiffness in the calves. I thought I'd have more than that," Price said Tuesday.

It was his first marathon. Asked if he planned to run another, he said, "I've done one. My ambition is done. We'll have to see."

Kavanaugh said Price has trained since May 1984, four months after his transplant, and now jogs up to 60 miles a week.

1st Copy

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The Straits Times

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EXCLUSIVE GERMAN CLOCKS

Est. 1845 WEDNESDAY, APRIL 17, 1985 40 CENTS M.C. (P) No. 95/1/85

Young at heart, this marathon man

BOSTON, Tues. — Welshman Bryan Price, 45, ran the Boston Marathon with the heart of a 16-year-old — a heart that became his in a transplant a little more than a year ago.

Price was believed to be the first heart-transplant patient to complete a marathon when he crossed the finishing line yesterday in five hours and 57 minutes, his doctor, Terence Kavanaugh, said.

"It was harder than what I thought it would be. It was very hard and especially the last mile," Price said.

Asked if he planned to run another marathon, Price said, "I've done one. My ambition is done. We'll have to see. It's up to this team of people monitoring me...They're the bosses."

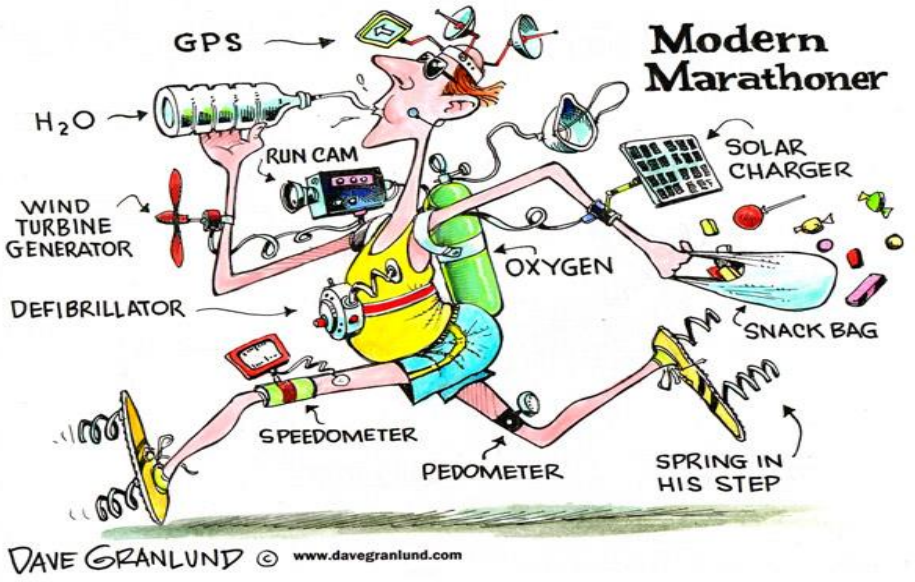
He referred to the Toronto rehabilitation pilot project. He is one of about 50 cardiac patients in a British programme based on the Canadian project, which Dr Kavanaugh helps supervise.

Price said he undertook a training programme of about 11 months with the Toronto project.

"Their first idea was to rehabilitate me so I could get about," he said. "I decided I would like to have a go at the marathon if it was okay with them."

First ***heart transplant*** patient to run Boston marathon (1985)

A Happy Problem: Principles of CR in athletic individuals

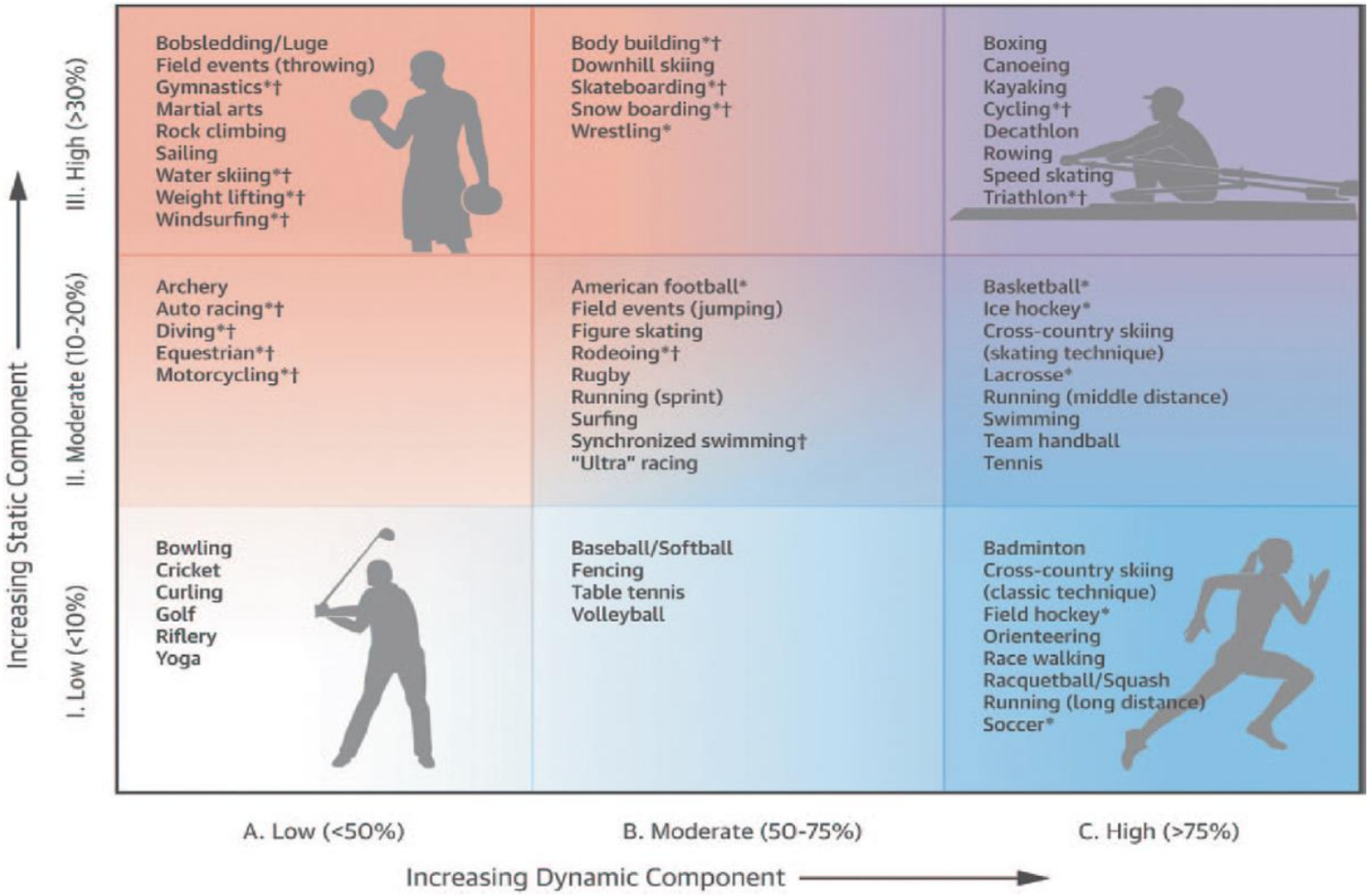


- Target activity/sport

- Underlying cardiac issues
  - Any high risk features?
  - ACC/ESC Recommendations

- Exercise testing
  - Modality
  - How early?
- ACSM guidelines

- High intensity interval training (HIIT)?
- Alternative modalities
- Goal setting
- Managing expectations
- Practical advice



Levine et al. JACC Dec 2015, 66 (21) 2350-2355

Sport Disciplines

Skill

Heart rate	+/++
Blood pressure	+
Cardiac output	+
Volume of training	-
Cardiac remodeling	-

- Archery
- Car/ motor racing
- Curling
- Equestrian
- Golf
- Sailing
- Shooting
- Table Tennis

Power

Heart rate	++
Blood pressure	+++
Cardiac output	++
Volume of training	+
Cardiac remodeling	+

- Alpine skiing
- Bobsleigh
- Discus / javelin
- Shot-putting
- Snowboarding
- Sprinting
- Water skiing
- Weightlifting
- Wrestling

Mixed

Heart rate	++/+++
Blood Pressure	++
Cardiac Output	++/+++
Volume of training	++
Cardiac remodeling	++

- Basketball
- Cricket
- Fencing
- Football
- Handball
- Ice / field hockey
- Rugby
- Soccer
- Tennis
- Waterpolo
- Volleyball

Endurance

Heart rate	+++
Blood Pressure	++
Cardiac output	+++
Volume of training	+++
Cardiac remodeling	+++

- Canoeing
- Cross-country skiing
- Cycling
- Mid-long distance swimming
- Mid-long distance running
- Mid-long distance skating
- Pentathlon
- Rowing
- Triathlon

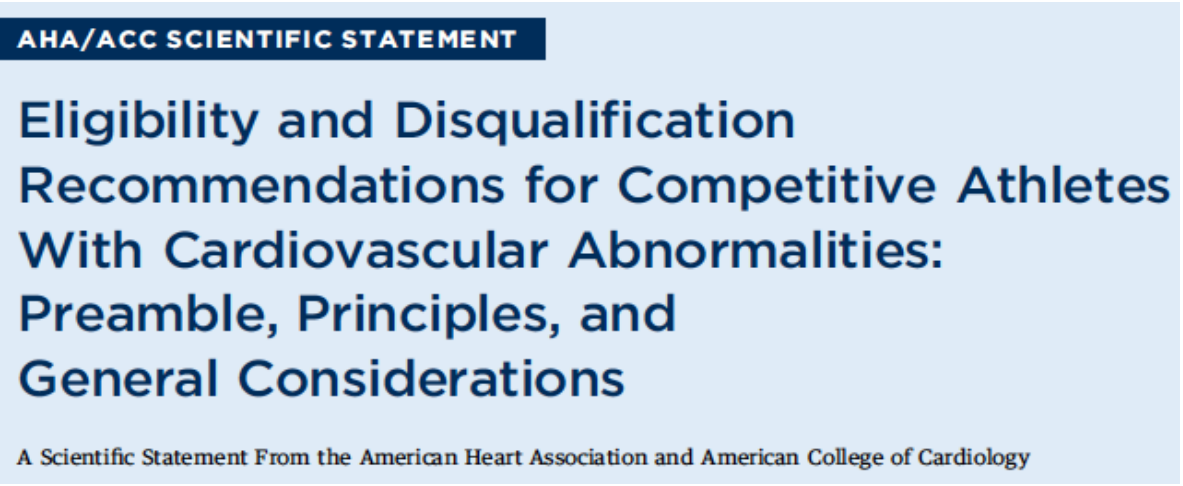
Niebauer et al. EHJ 2018: 39, 3664–3671

Few limitations in correctly selected patients!

Table 5. Evidence-based prescribable aerobic exercise intensity in cardiac patient groups

	Exercise intensity domains			
	Light to moderate	Moderate to high	High to severe	Severe to extreme
Stable angina pectoris	√[a]	√[a]	√[a]	
Chronic CAD				
(no residual ischaemia)	√	√	√	√
PCI	√	√	√	
Pacemaker	√	√		
ICD	√	√		
Chronic AF	√[b]	√[b]		
CABG	√	√	√	
Valve repair/replacement	√	√		
CHF	√	√	√	
LVAD	√			
Heart transplantation	√[c]	√[c]	√[c]	

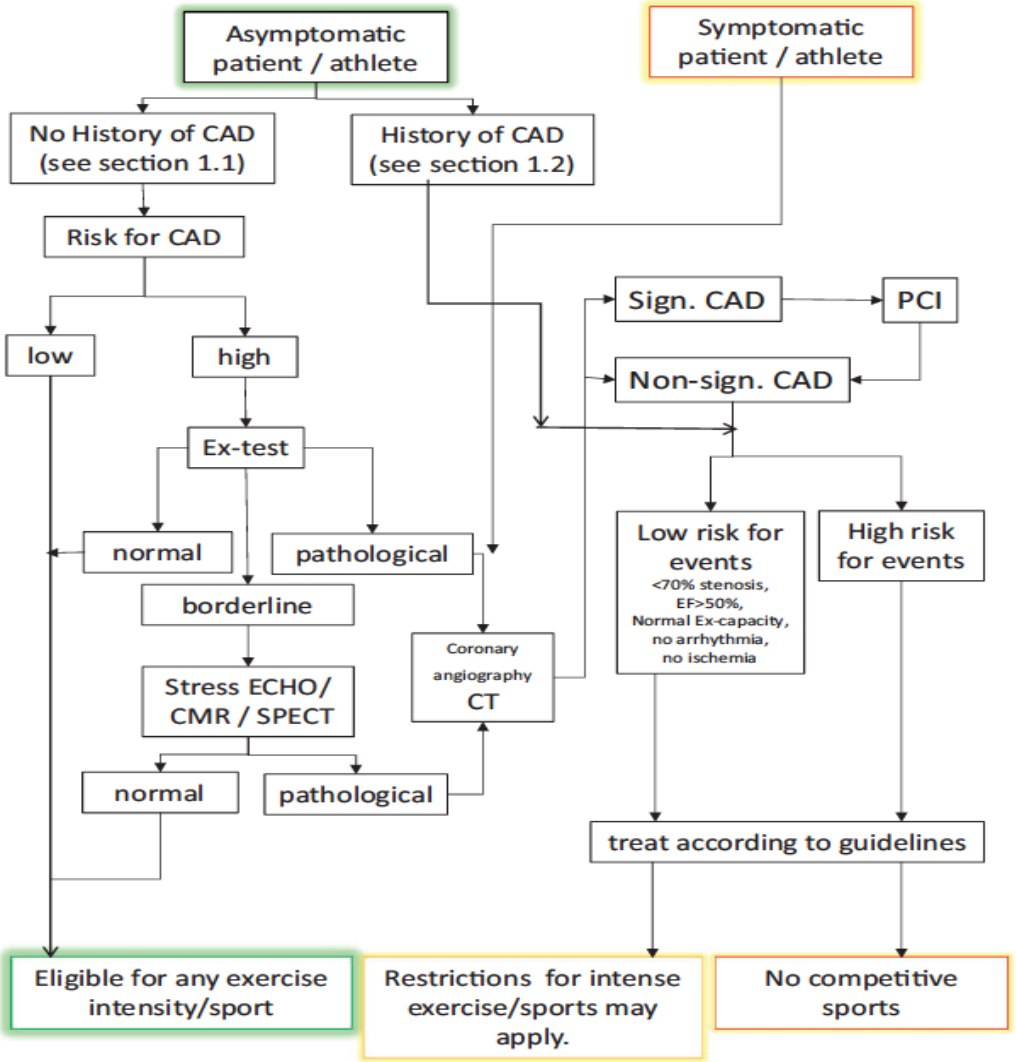
Mezzani et al. Eur J Prev Card. 2012;20(3):442-467.



- LVEF > 50%
- Asymptomatic
- No inducible ischemia
- No electrical instability

It is reasonable for patients with clinically manifest ASCAD to participate in all competitive activities if their resting left ventricular ejection fraction is >50%, they are asymptomatic, and they have no inducible ischemia or electrical instability *(Class IIb; Level of Evidence C)*.

JACC 2015



ESC European Society of Cardiology
European Heart Journal (2018) 0, 1–8
doi:10.1093/eurheartj/ehy408
CURRENT OPINION

Recommendations for participation in leisure time or competitive sports in athletes-patients with coronary artery disease: a position statement from the Sports Cardiology Section of the European Association of Preventive Cardiology (EAPC)

- ≥1 critical coronary stenosis of a major coronary artery >70% or LM >50%
- Ejection fraction <50%
- Exercise-induced ischaemia
- Dyspnoea at low exercise intensity (angina equivalent)
- Relevant ventricular tachyarrhythmias (i.e. NSVT, polymorphic or very frequent VEBs)
- Dizziness or syncope on exertion
- High degree of myocardial scarring on CMR imaging

Borjesson et al EHJ 2018: 0, 1–8

Valvular heart disease

Table 1 Recommendations for participation in competitive sport in relation to type and severity of valve disease in asymptomatic individuals

	Recommendation for sports participation		
Valve lesion	**Mild**	**Moderate**	**Severe**
Mitral regurgitation*	All sports	All sports if LVEDD <60 mm (or <35.3 mm/m^2 in men and <40 mm/m^2 in women) if good LV function, PAP <30 mm Hg and good functional capacity.	May compete in all sports after detailed discussion with physician if LVEDD <60 mm (or <35.3 mm/m^2 in men and <40 mm/m^2 in women) if good LV function, PAP <30 mm Hg and good functional capacity.
Mitral stenosis*	All sport if MVA >2.0 cm^2 and good functional capacity. No collision or body contact sport if anticoagulated for AF.	Low dynamic/static sport if MVA <2.0 cm^2–>1.5 cm^2 and good function capacity.	No competitive sport (except sport with low dynamic and/or static component) if MVA <1.5 cm^2.
Aortic regurgitation*	All sport	All sports if, LVESD <50 mm (male) or <40 mm (female) and good LV systolic function and functional capacity.	May compete in all sport after discussion with physician if LVESD <50 mm (male) or <40 mm (female) and good LV systolic function and functional capacity.
Aortic stenosis*	All sports if AVA >1.5 cm^2 or jet velocity <3 m/s.	Low intensity sport if AVA 1–1.5 cm^2 or jet velocity 3–4 m/s provided good functional capacity and no evidence and no evidence of myocardial ischaemia, arrhythmias or flat blood pressure response.	No competitive sport (except low intensity) if AVA <1 cm^2 or valve jet >4 m/s.

*For mixed valvular disease, the recommendation for the predominant valve lesion should be followed.

Gati S, et al. Heart 2018;0:1–5

Task Force	Entity
1. Classification of Sports: Dynamic, Static and Impact (10)	Classification
	Impact and anticoagulation
2. Preparticipation Screening for Cardiovascular Disease in Competitive Athletes (43)	
3. Hypertrophic Cardiomyopathy, Arrhythmogenic Right Ventricular Cardiomyopathy and Other Cardiomyopathies, and Myocarditis (29)	Hypertrophic cardiomyopathy
	LV noncompaction
	Other myocardial diseases
	Myocarditis
	Arrhythmogenic RV cardiomyopathy
	Pericarditis
4. Congenital Heart Disease (28)	ASD, untreated
	ASD, after repair
	VSD, untreated
	VSD, after repair
	PDA, untreated
	PDA, after repair
	Pulmonic valve stenosis (treated and untreated)
	Aortic valve stenosis, untreated
	Aortic valve stenosis, after correction
	Coarctation of aorta, untreated
	Coarctation of aorta, treated
	Elevated pulmonary vascular resistance
	Ventricular dysfunction after CHD surgery
	Cyanotic CHD, including TOF, unoperated or shunt
	Post-operative TOF
	Transposition, after switch
	Congenitally corrected transposition
	TGA, after arterial switch
	Fontan
	Ebstein anomaly
	Coronary anomalies
5. Valvular Heart Disease (44)	Aortic stenosis
	Aortic regurgitation
	Mitral stenosis
	Mitral regurgitation
	Post valve surgery
6. Hypertension (45)	Hypertension
7. Aortic Diseases, Including Marfan Syndrome (27)	Marfan, other genetic, bicuspid, dilated, dissection, post-operative
8. Coronary Artery Disease (38)	Atherosclerotic disease
	Coronary spasm
	Coronary dissection
	Myocardial bridging
	Kawasaki
	Coronary vasculitis
	Transplant vasculopathy
9. Arrhythmias and Conduction Defects (12)	Sinus bradycardia
	AV block, first degree
	AV block, second degree type I
	AV block, second degree type II
	Complete RBBB
	Complete LBBB
	Congenital AV block
	Acquired complete heart block
	Permanent pacemaker
	Atrial fibrillation
	Atrial flutter
	AVNRT, AVRT, atrial tachycardia
	Premature ventricular contractions
	Nonsustained VT
	Sustained monomorphic VT
	Ventricular flutter, fibrillation, polymorphic VT
	Syncope
	ICDs
10. The Cardiac Channelopathies (11)	Long QT, Brugada, CPVT
11. Drugs and Performance Enhancing Substances (46)	NA
12. Emergency Action Plans, Resuscitation, Cardiopulmonary Resuscitation, and Automated External Defibrillators (18)	NA
13. Commotio Cordis (41)	Commotio cordis
14. Sickle Cell Trait (40)	Sickle cell trait

AHA/ACC SCIENTIFIC STATEMENT

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Preamble, Principles, and General Considerations

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

More detailed exercise testing necessary in athletic individuals

- 6-minute walk test (walking speed)
- Treadmill testing (Maximal heart rate, METS)
- Cardiopulmonary exercise testing (VO2)

- Symptoms, rate of perceived exertion, presence of ischemia / arrhythmia (threshold), BP & HR responses

Exercise testing – how early is safe?

2002 Exercise Testing Guideline Recommendation

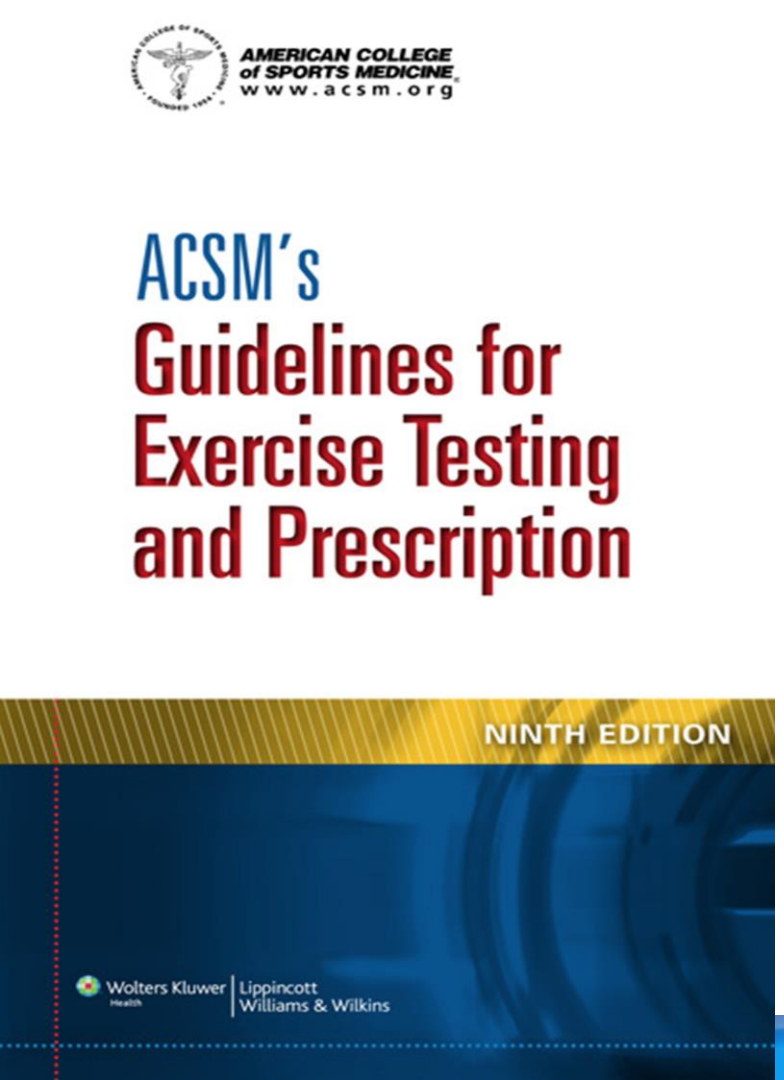
Class I

1. Before discharge for prognostic assessment, activity prescription, evaluation of medical therapy (submaximal at about 4 to 6 days).*

2. Early after discharge for prognostic assessment, activity prescription, evaluation of medical therapy, and cardiac rehabilitation if the predischarge exercise test was not done (symptom limited; about 14 to 21 days).*

3. Late after discharge for prognostic assessment, activity prescription, evaluation of medical therapy, and cardiac rehabilitation if the early exercise test was submaximal (symptom limited; about 3 to 6 weeks).*

Gibbons et al. JACC 2002:1531–40



- **FITT-VP principle**

- Frequency (how often)

- Intensity (how hard)

- Time (duration)

- Type (mode)

- Volume (amount)

- Progression (advancement)

- **For aerobic as well as resistance (strength) training**

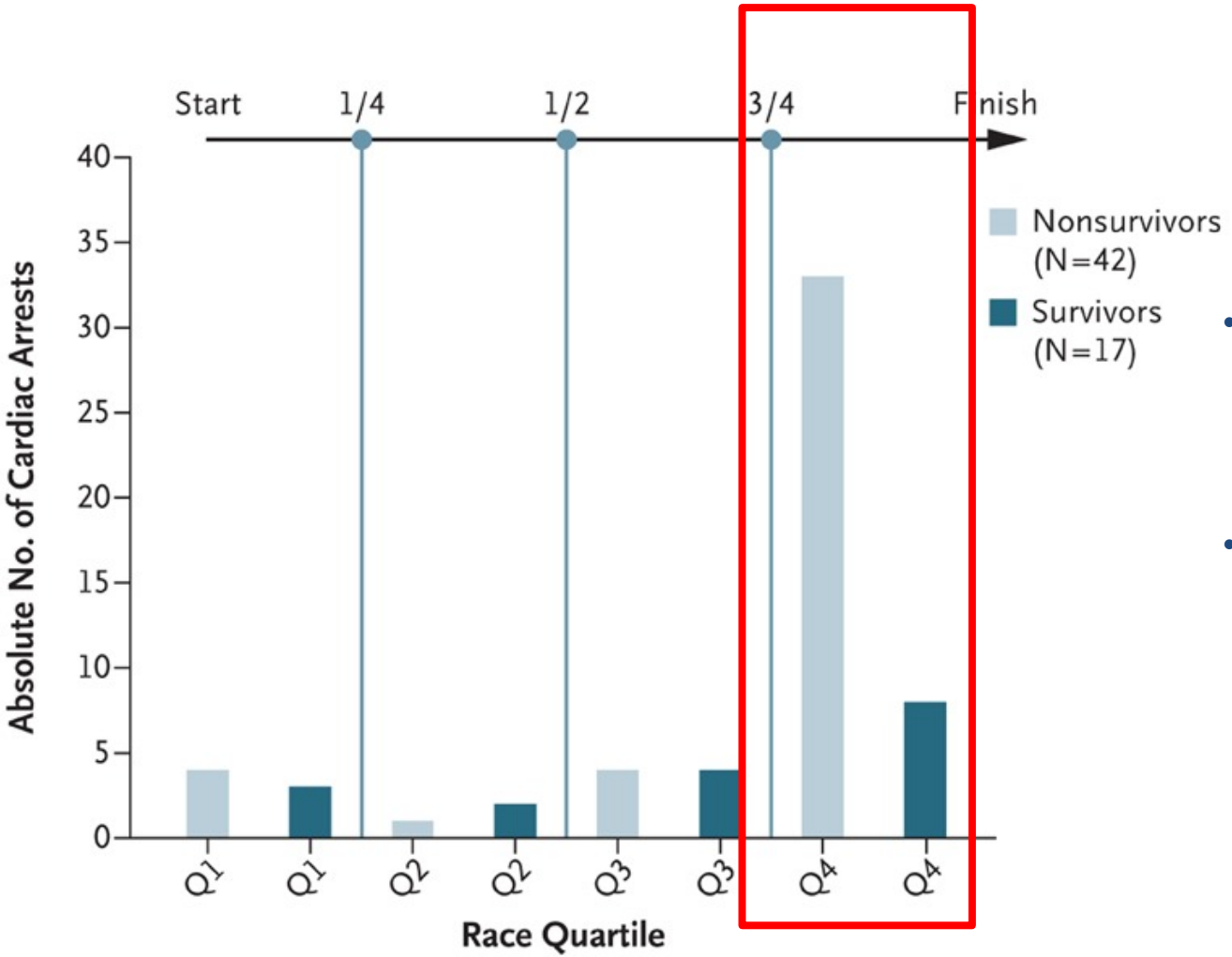
ACSM recommendations for outpatients with CVD

- **Frequency: ≥3x/week**
- **Intensity:**
  - **40-80% of exercise capacity**
  - **RPE 11-16**
  - **Target HR ~10 beats below ischemic threshold**
- **Time: 20-60 min/session + 5-10 min warm up/cool down**
- **Type: Aerobic + Resistance**

	Relative Intensity			
Intensity	**%HRR or %$\dot{V}O_2R$**	**%HR_{max}**	**%$\dot{V}O_{2max}$**	**Perceived Exertion (Rating on 6–20 RPE Scale)**
Very light	<30	<57	<37	Very light (RPE ≤9)
Light	30–<40	57–<64	37–<45	Very light to fairly light (RPE 9–11)
Moderate	40–<60	64–<76	46–<64	Fairly light to somewhat hard (RPE 12–13)
Vigorous	60–<90	76–<96	64–<91	Somewhat hard to very hard (RPE 14–17)
Near maximal to maximal	≥90	≥96	≥91	≥ Very hard (RPE ≥18)

- HRR method: Target HR (THR) = [($HR_{max/peak}$[a] − HR_{rest}) × % intensity desired] + HR_{rest}
- $\dot{V}O_2R$ method: Target $\dot{V}O_2R$[c] = [($\dot{V}O_{2max/peak}$[b] − $\dot{V}O_{2rest}$) × % intensity desired] + $\dot{V}O_{2rest}$
- HR method: Target HR = $HR_{max/peak}$[a] × % intensity desired
- $\dot{V}O_2$ method: Target $\dot{V}O_2$[c] = $\dot{V}O_{2max/peak}$[b] × % intensity desired
- MET method: Target MET[c] = [($\dot{V}O_{2max/peak}$[b])/3.5 mL · kg^{-1} · min^{-1}] × % intensity desired

- **Common for athletic individuals to push boundaries**
- **Training HR may lean toward more moderate to vigorous intensity**
- **Any symptoms should be taken seriously**



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Cardiac Arrest during Long-Distance Running Races

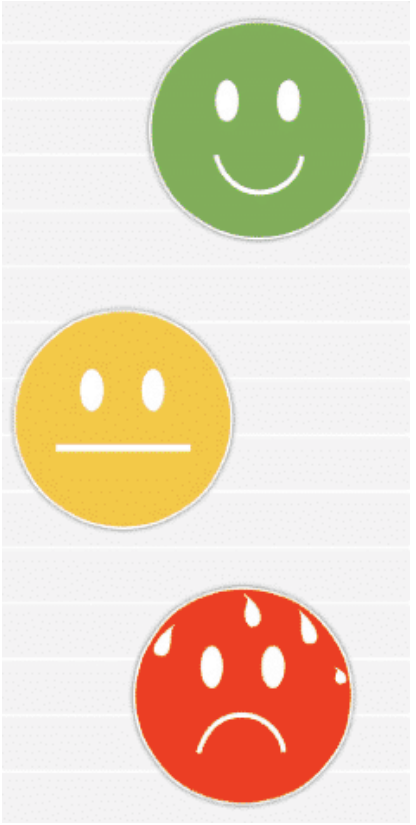
Jonathan H. Kim, M.D., Rajeev Malhotra, M.D., George Chiampas, D.O., Pierre d'Hemecourt, M.D., Chris Troyanos, A.T.C., John Cianca, M.D., Rex N. Smith, M.D., Thomas J. Wang, M.D., William O. Roberts, M.D., Paul D. Thompson, M.D., and Aaron L. Baggish, M.D., for the Race Associated Cardiac Arrest Event Registry (RACER) Study Group

- **Cardiac arrest most common towards the end of long distance races**
- **Multifactorial**
  - environmental factors
  - dehydration
  - electrolyte abnormalities
  - sprinting to the finish

N Engl J Med 2012; 366:130-140

RATE OF PERCEIVED EXERTION (RPE)

BORG RPE	MODIFIED RPE	BREATHING	TRAINING ZONE	% of MHR*	EXERCISE TYPE
6	0	No Exertion	1	50%-60%	Warm up
7		Very Light			
8	1				
9					
10	2	Deeper but comfortable breathing. Able to hold a conversation.	2	60%-70%	Recovery
11					
12	3				
13		Aware that breathing is harder; able to talk but difficult to hold conversation	3	70%-80%	Aerobic
14	4				
15	5	Starting to breathe hard and getting uncomfortable	4	80%-90%	Anaerobic
16	6				
17	7	Deep and forceful breathing. Uncomfortable and not wanting to talk	5	90-100%	VO^2 Max
18	8				
19	9	Extremely hard			
20	10	Maximum exertion			



* % of maximum heart rate

Accurate heart rate monitoring

Table. Concordance Correlation Coefficients for Each Heart Rate Monitor

Device	Agreement With Electrocardiogram: Concordance Correlation Coefficients (95% CI)	
Polar H7	.99 (.987-.991)	
Apple Watch	.91 (.884-.929)	[-27 / +29 bpm]
Mio Fuse	.91 (.882-.929)	[-27 / +29 bpm]
Fitbit Charge HR	.84 (.791-.872)	[-34 / +39 bpm]
Basis Peak	.83 (.779-.865)	[-39 / +33 bpm]

Wang et al. JAMA Cardiology 2016

Progression of exercise

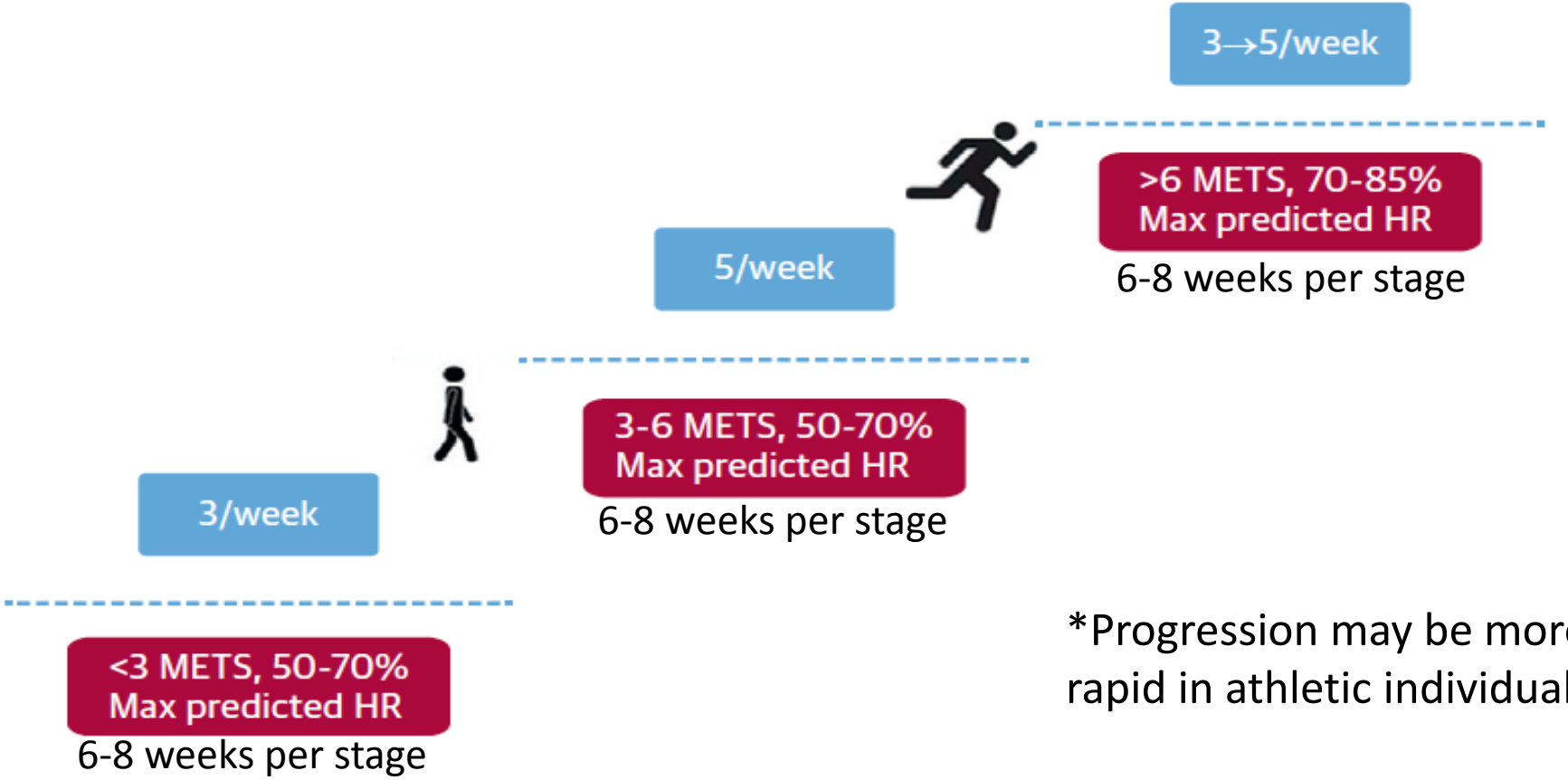
How to gauge readiness for progression?

→ objective: heart rate during exercise BELOW prescribed range
→ subjective: RPE < 11

DO NOT progress when:

- RPE consistently > 14
- HR above training range
- MSK injury / feeling unwell
- new medical status
- new change in medication

A Graded Approach to Exercise Conditioning



*Progression may be more rapid in athletic individuals

HIIT vs. MICE

High Intensity

- Intervals of up to four minutes duration
- ~ 85-95% peak heart rate (HRpeak)
- >85% Heart rate reserve
- >85% VO2 reserve
- RPE ~18

Moderate Intensity

- ≥30 minutes of aerobic exercise (≤80% HRpeak)
- sustainable for the duration of the session
- 40-60% HRR
- 40-60% VO2 reserve

These are relative values that must be individually prescribed

American Heart Association | American Stroke Association.

High-Intensity Interval Training for Patients With Cardiovascular Disease—Is It Safe? A Systematic Review

Michael A. Wewege, BExPhys;* Dohee Ahn, BExPhys;* Jennifer Yu, MBBS; Kevin Liou, PhD; Andrew Keech, PhD

HIIT n = 547
MICT n = 570

- Commonest HIIT protocol: Scandinavian (4x4-min intervals with 3-min recovery intervals); Others: intervals 30 sec to 3 min

- HIIT vs MICT – improvement in:
  - VO2peak
  - Insulin sensitivity and glucose control
  - Body composition
  - Vascular function

- HIIT most appropriate for:
  - Younger pts
  - Less complex CVD (eg, PCI only or NYHA I)
  - Nil/stable symptoms
  - Normal BMI
  - Normotensive
  - Relatively high baseline fitness
  - Recent history of regular vigorous physical activity

- AE: HIIT – 1 major CV event per 11 333 hrs + 1 minor CV AE and 3 non CV AE (primarily MSK) vs MICT – 2 non CV AE

Review

European Journal of Preventive Cardiology

ESC European Society of Cardiology

Nordic walking for individuals with cardiovascular disease: A systematic review and meta-analysis of randomized controlled trials

European Journal of Preventive Cardiology
0(00) 1–18

DOI: 10.1177/2047487317738592
journals.sagepub.com/home/ejpc
SAGE

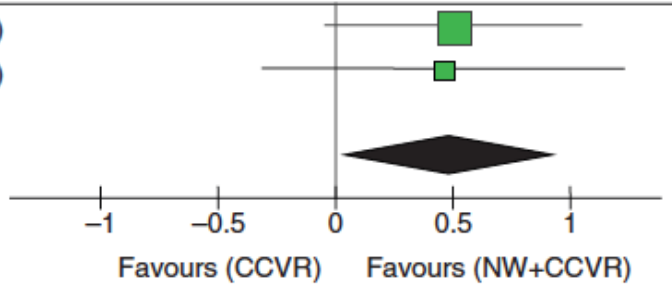
Lucia Cugusi[1], Andrea Manca[2], Tee Joo Yeo[3], Pier P Bassareo[1], Giuseppe Mercuro[1] and Juan C Kaski[4]

Exercise capacity (METs)

Study or subgroup	NW+CCVR Mean	SD	Total	CCVR Mean	SD	Total	Weight	SMD IV, random, 95% CI
Kocur 2009[24]	21.3	25.2	40	7	33.5	20	66.6%	0.50 (−0.04, 1.05)
Wilk 2005[23]	30.3	33.5	20	14.1	36.1	10	33.4%	0.46 (−0.31, 1.23)
Total (95% CI)			60			30	100.0%	0.49 (0.04, 0.93)

Heterogeneity: Tau² = 0.00; Chi² = 0.01, df = 1 ($p = 0.93$); $I^2 = 0\%$

Test for overall effect: $Z = 2.15$ ($p = 0.03$)



Nordic walking is *feasible* and *promising* for individuals with cardiovascular disease

Practical advice for the athlete

- Outdoor sports
- Environmental factors can’t be mimicked during training
  - Temperature
  - Humidity
  - Crowd support – adrenaline
- Race at training pace
- Resist temptation to sprint to finish
- Hydrate/refuel appropriately
- Medication compliance
- Listen to your body (symptoms)
- DO NOT race when ill

50/Caucasian/male
Hyperlipidemia
Angina
PCI to pLAD 80% 2016
Excellent baseline fitness

TMX post PCI (2016)
- MHR 164 (96% pred)
- 15 min (Bruce)
- 17.1 METS

TMX pre-ironman (2018)
- MHR 181 (107% pred)
- 21 min (Bruce)
- 23.7 METS

Conclusion

- Highly motivated patient population
- Compliance is unlikely an issue
- Safety & patient selection is paramount
- Higher likelihood of exceeding exercise prescription
- Go slow to go fast
- Environmental factors play a big part
- Discuss (AND respect) risk-benefit ratios from athlete's perspective

Singapore Prevention & Cardiac Rehabilitation Symposium 2017

Advances in Cardiac Rehabilitation for Improved Health : Special Focus on E-Health

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International Council of Cardiovascular Prevention and Rehabilitation (ICCPR)

World Heart Federation

Stay tuned for SPCRS 2019 (End-October)!

Thank you

@TJ_Yeo

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