

Helping Athletic Cardiac Rehab Patients Go the Distance...Again

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Disclosures

No relevant disclosures



What this Presentation **Is** and **Isn't**

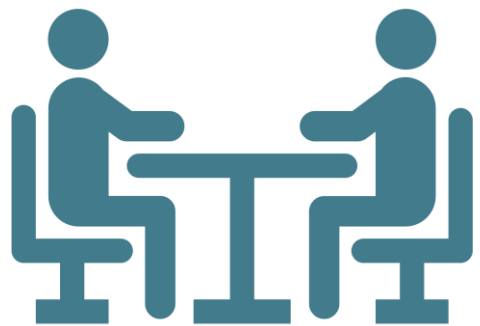
- ✓ Help you ensure safe return to activity
- ✓ Help you confidently push patients
- ✓ Encourage program policy flexibility
- ✗ Isn't a presentation with examples of pro athletes
- ✗ Will not turn you into an elite performance coach



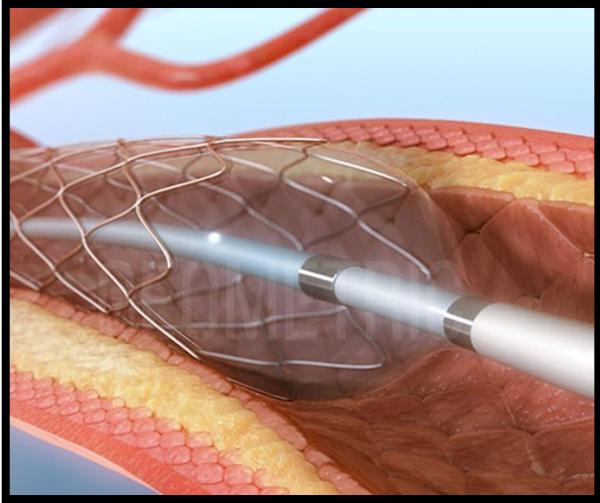
Outline

- Considerations before starting CR
- Exercise testing
- Exercise prescription (Ex R_x)
- Special considerations - sternotomy
- Translating experiences to other patient populations





Returning to Activity



Return to Activity

- Maximal exercise testing and evaluation of left ventricular function.
 - *Post-PCI, symptom limited exercise testing should be considered within 1-2 weeks.*
 - *Post-CABG patients should be deferred until the surgical wounds are appropriately healed (approximately 3-4 weeks).*

Returning to Activity

Risk Category	LV EF	Residual Coronary Stenosis	Exercise- Induced Ischemia [#]	Exercise- Induced Arrhythmia	Exercise Tolerance [*]
Minimally Increased	≥50%	<50%	None	None	Normal
Substantially Increased	<50%	≥50%	Positive	V Tach	Decreased

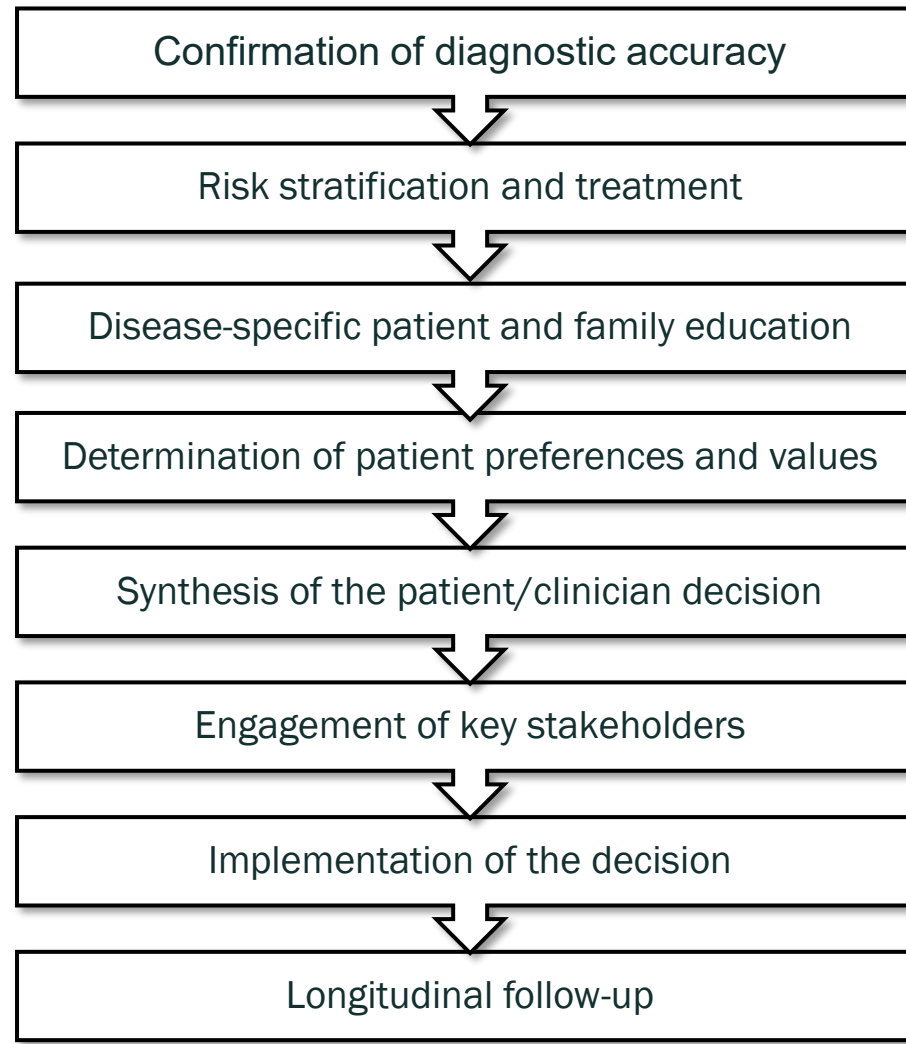
*Individuals <50 years of age, 10 METs; 50-59 years of age, 9 METs; 60-69 years of age, 8 METs

[#]Exercise-induced angina or dyspnea, ischemic electrocardiographic changes, ischemia observed on non-invasive testing

Adapted from Thompson et al. JACC. 2015;66:2406-11

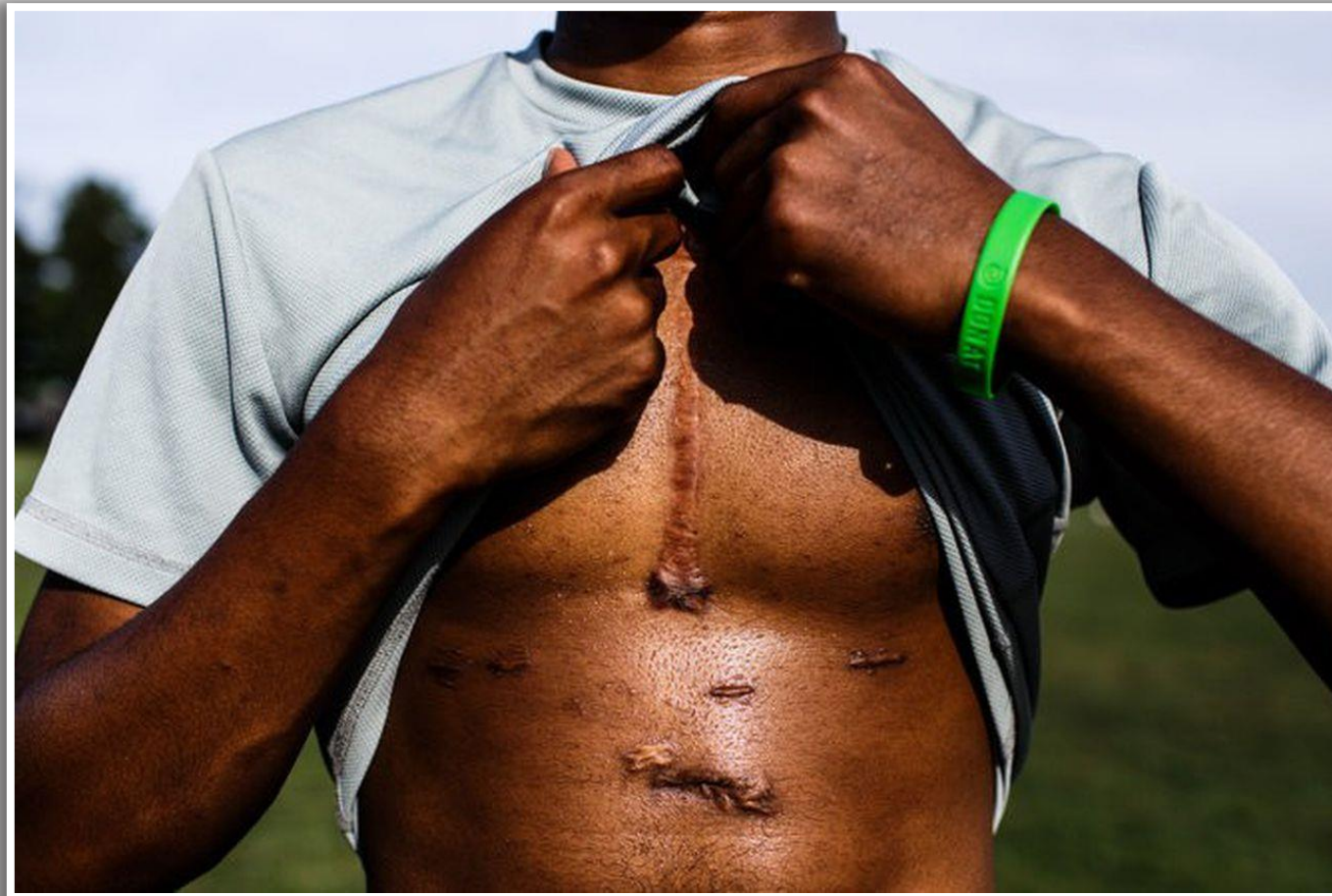


Shared Decision Making



Baggish et al. *Curr Sports Med Rep*. 2019 Mar;18(3):76-81





STERNAL PRECAUTIONS AFTER CARDIAC SURGERY

Introduction

An important part of your recovery from cardiac surgery is learning how to move safely and how to gradually return to your daily activities. A therapist will meet with you and your caregiver to help you learn how to safely proceed in various aspects of your recovery.

Basic Principles

1. **Follow your sternal precautions at all times (8-10 weeks).** Your surgeon will let you know when these precautions can be stopped.
 - NO pushing or pulling (e.g., no pushing up from a chair or opening a heavy door).
 - NO lifting more than 5 pounds (the weight of a half gallon of milk).
 - NO lifting one arm above your head (you can lift both hands above your head at the same time).
 - NO reaching behind your back (e.g., no tucking in your shirt, putting your wallet in your back pocket, pulling your trousers up from behind or reaching behind for toilet hygiene).



2. Pace yourself. Plan your day to include activity and rest.
3. Rest one hour after meals before doing exercise and strenuous activities. This allows time for proper digestion and decreased workload on the heart.
4. Avoid excessive heat or cold.

Sternal Instability Scale

Grades of Motion

- | | |
|---|--|
| 0 | Clinically stable sternum (no detectable motion) – normal |
| 1 | Minimally separated sternum (slight increase in motion upon special testing upper limbs, trunk*) |
| 2 | Partially separate sternum – regional (moderate increase in motion upon special testing*) |
| 3 | Completely separated sternum – entire length (marked increase in motion upon special testing*) |

* Special testing includes shoulder flexion (unilateral/bilateral), trunk lateral flexion or rotation, coughing and opposing movements of the upper limbs (e.g., flexion, abduction and external rotation of one upper limb accompanied by extension, adduction and internal rotation of the other upper limb).

High Risk: Sternal Complications

2 – 4 weeks

Conservative Activity Guidelines

- No lifting, pushing, or pulling >10lb
- No shoulder abd. of flex. >90° when UE weighted
- Shoulder AROM in pain free range
- No scapular retraction past neutral
- Avoid active trunk flex. & rot. with supine ↔ sit
- No UE use with sit ↔ stand
- Apply sternal counter pressure (splinting) with coughing & Valsalva
- No driving

2 weeks

No

Normal Healing

Yes

Moderate Risk

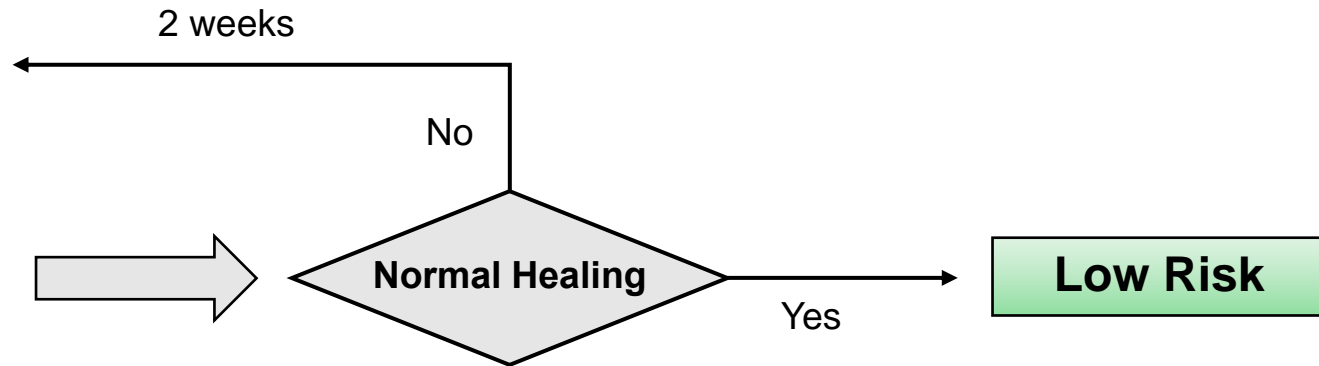
Normal Healing

- Improvement in sternal pain
- No reported clicking/popping of sternum
- No crepitus on palpation
- Complete cutaneous healing
- No signs/symptoms of infection

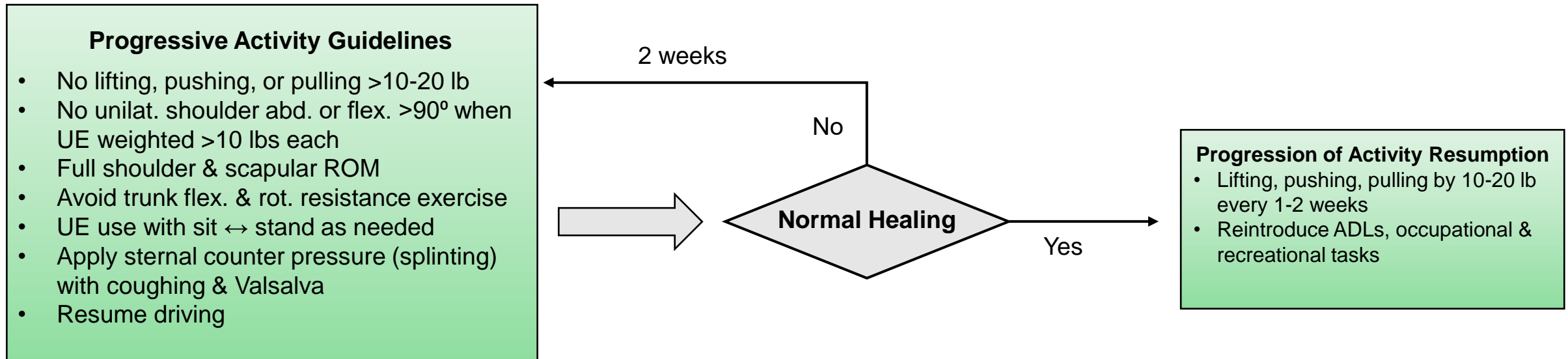
Moderate Risk: Sternal Complications

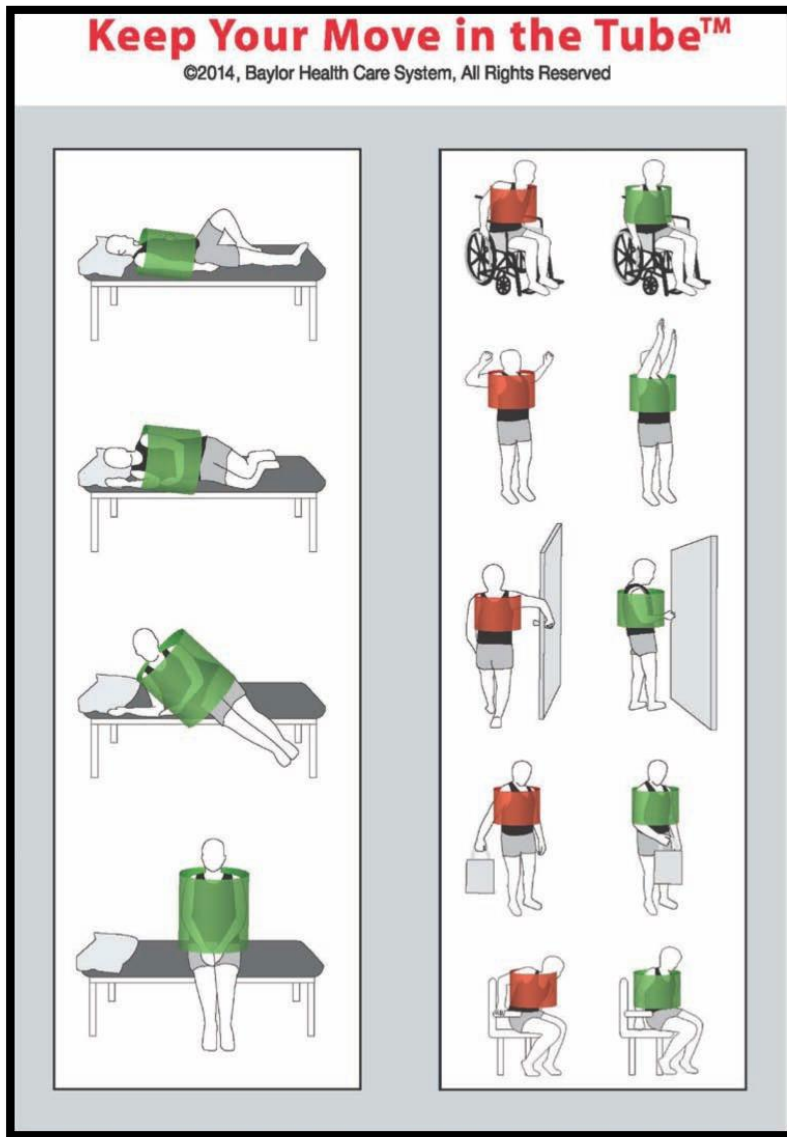
Moderate Activity Guidelines

- No lifting, pushing, or pulling >10lb
- No unilat. shoulder abd. or flex. >90° when UE weighted >5 lbs
- Shoulder AROM in pain free range
- Avoid active trunk flex. & rot. With supine ↔ sit
- UE use with sit ↔ stand keeping shoulders in neutral position
- Apply sternal counter pressure (splinting) with coughing & Valsalva
- No driving if first 2 weeks



Low Risk: Sternal Complications





Is it any better than usual care?

Holloway et al. *Phys Ther.* 2020;100(7):1074-83

- No significant differences in Sternal Instability Scale, pain rating, pain frequency, perceived sternal instability, difficulty with functional mobility, length of stay, and discharge disposition
- Less difficulty with functional mobility

Gach et al. *PM R.* 2021 Dec;13(12):1321-30

- The odds of discharge to home, versus to inpatient rehabilitation or skilled nursing facility, were ~3 times higher for KMIT
- Higher odds of demonstrating “independent” functional status
- No difference in sternal wound complications

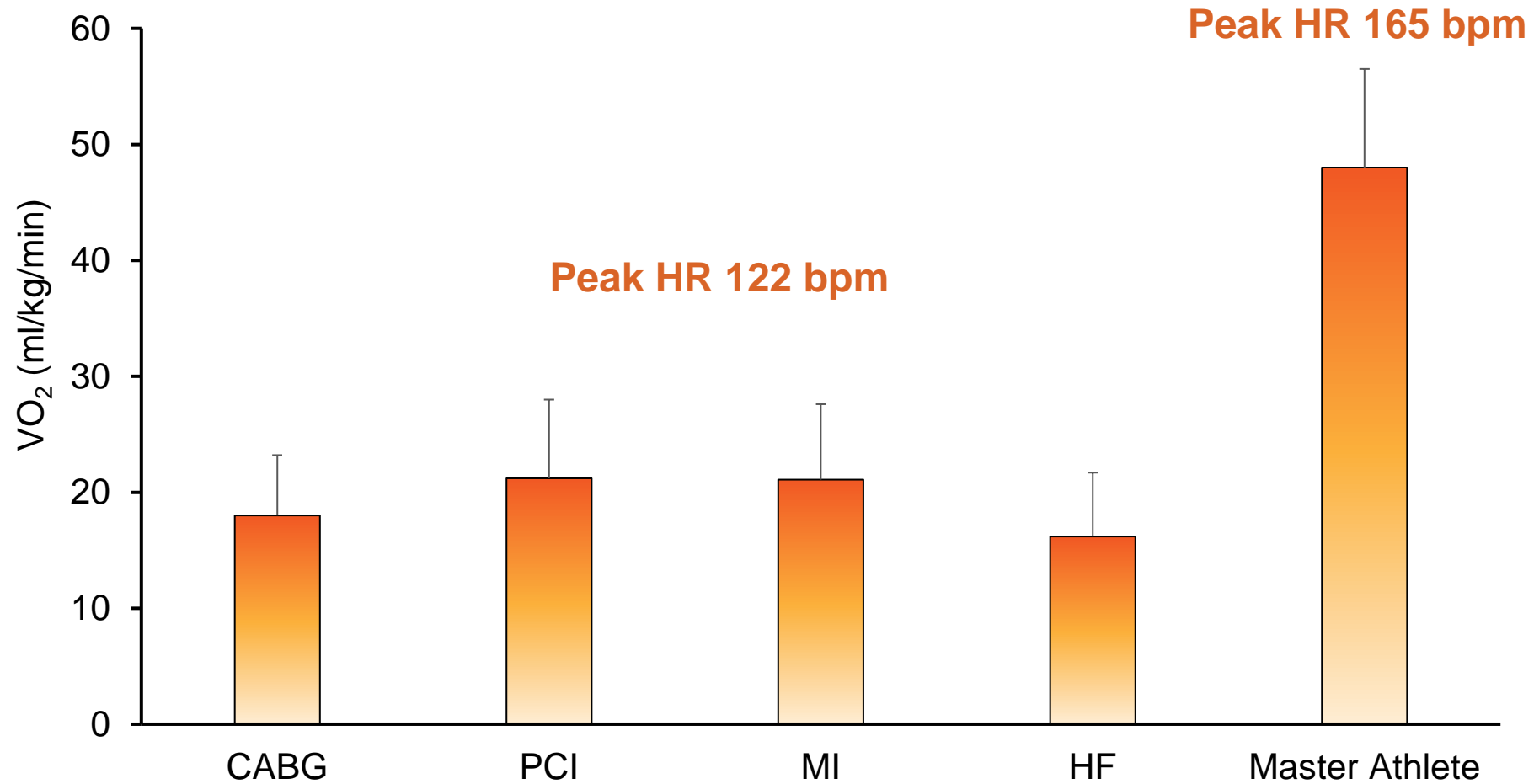




Vs.



What You Will Likely Find



Peterman et al. *JCRP*. 2023;43(2):115-121

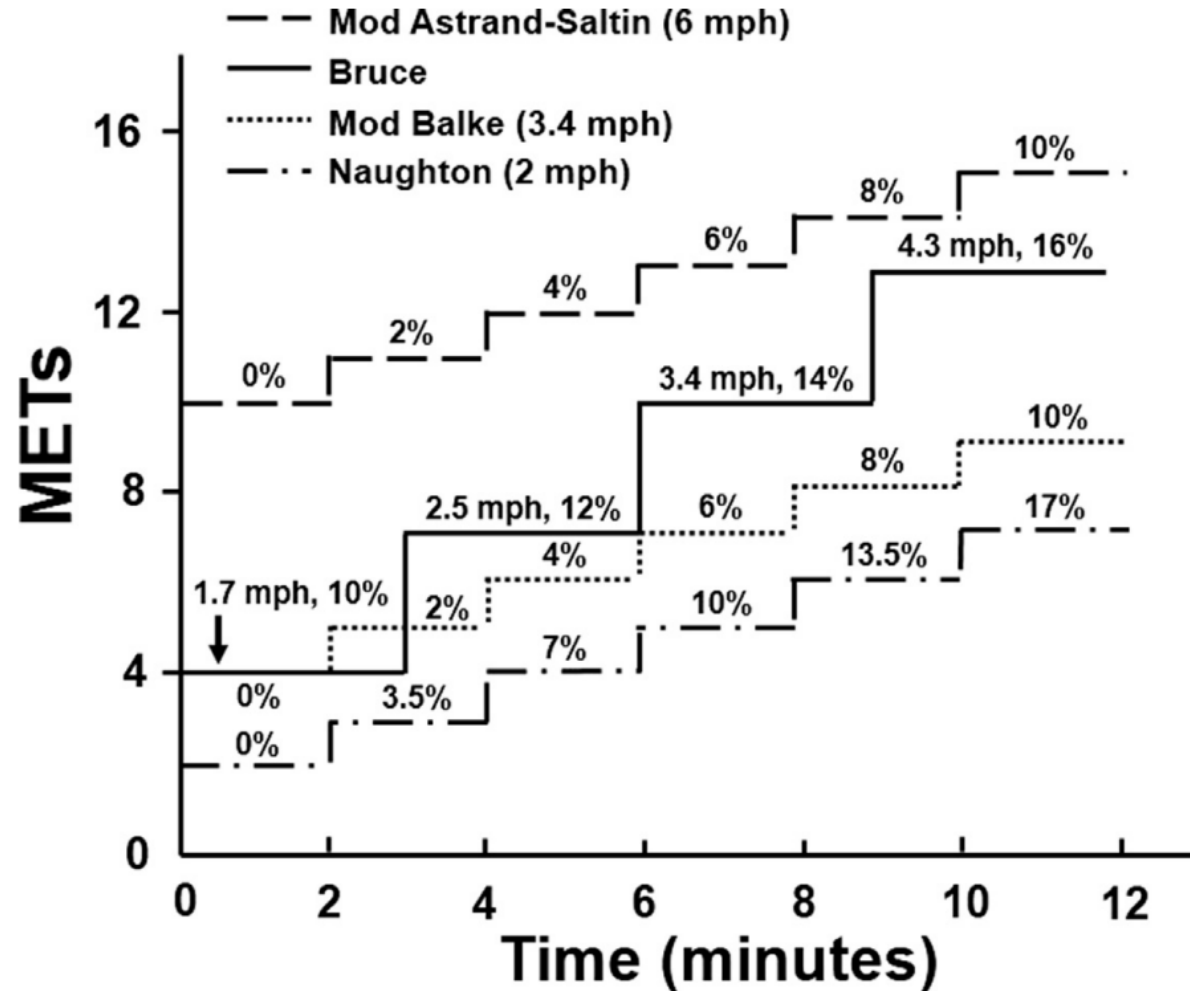
Maessen et al. *MSSE*. 2017,49(1):21-28



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Submaximal Exercise Test



Sarma et al. *Cardiol Clin.* 2016;34(4):603-608



Submaximal Exercise Test

1. Pick a brisk speed (RPE = 12-13)
2. Increase grade by 2% every 2-3 minutes
3. Record HR, BP, RPE by the end of each stage
4. Termination criteria
 - Patient request
 - Symptoms
 - Exaggerated BP response (SBP >250 and or DBP >115)
 - Abnormal HR response
 - RPE 15-16
5. Cooldown





General Ex R_x Approach



Training Volume

Frequency × Intensity × Time

Intensity × Time



Intensity × Time



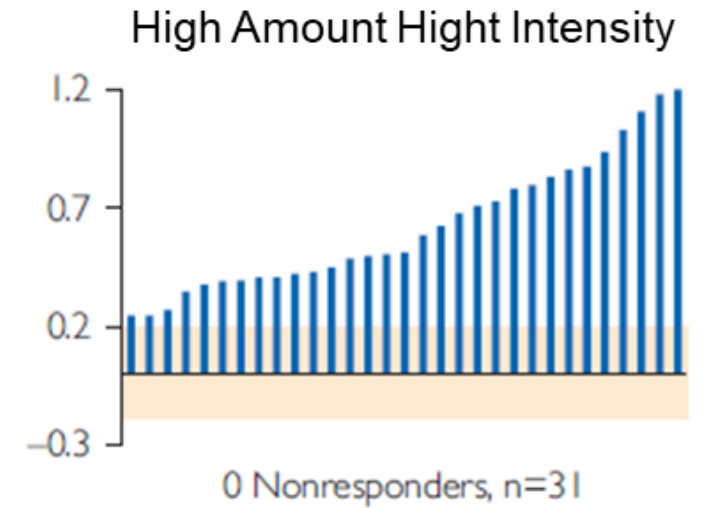
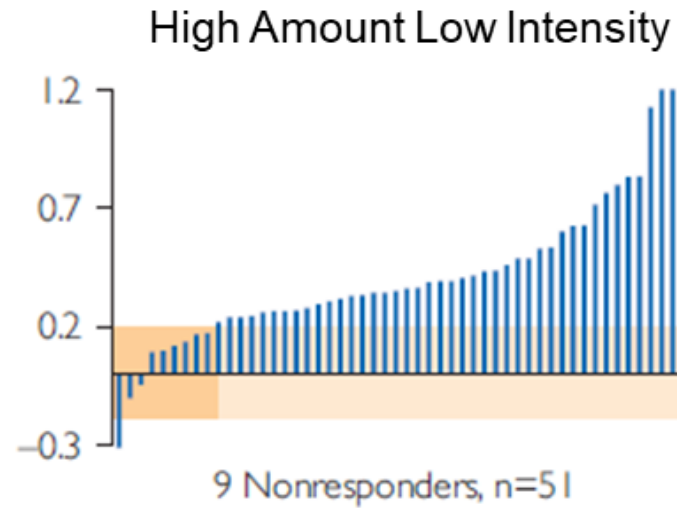
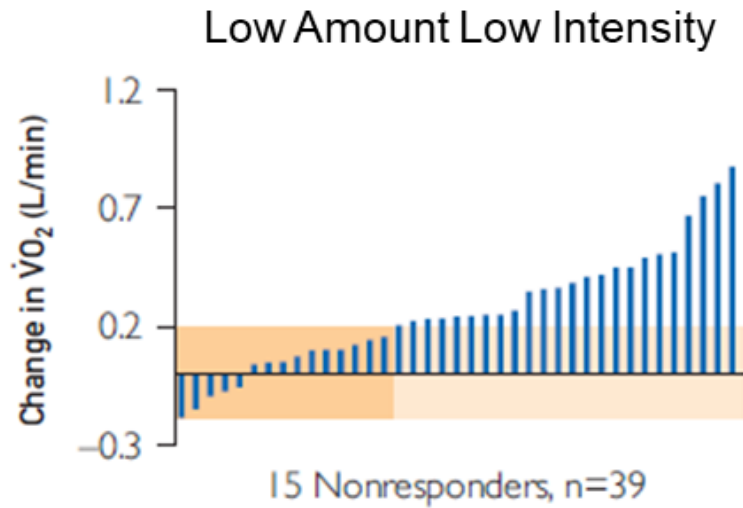
Intensity × Time



Intensity × Time



Training Volume



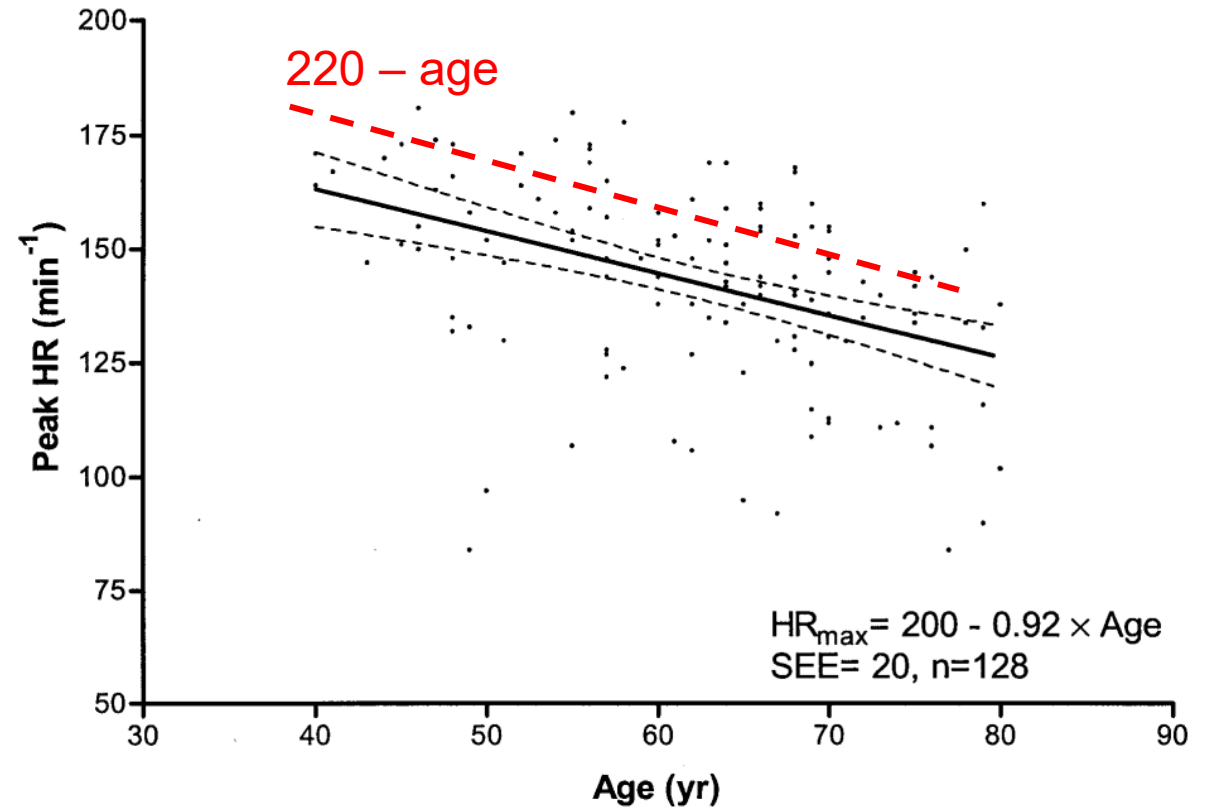
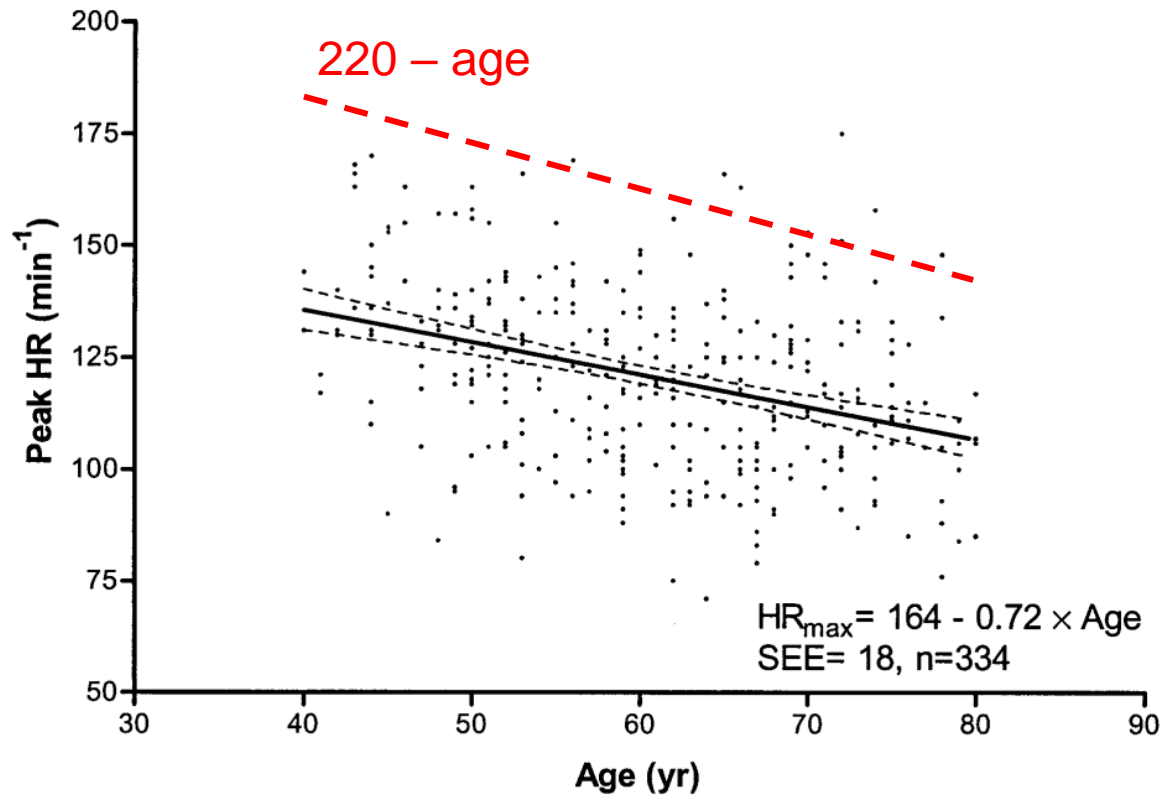
Ross et al. *Mayo Clin Proc.* 2015;90(11):1506-1514



Setting Intensity

Intensity	%HRR	%HR _{max}	RPE (6-20)
Very light	<30	<57	<9
Light	30-39	57-63	9-11
Moderate	40-59	64-76	12-13
Vigorous	60-89	77-95	14-17
Near maximal	≥90	≥96	≥18

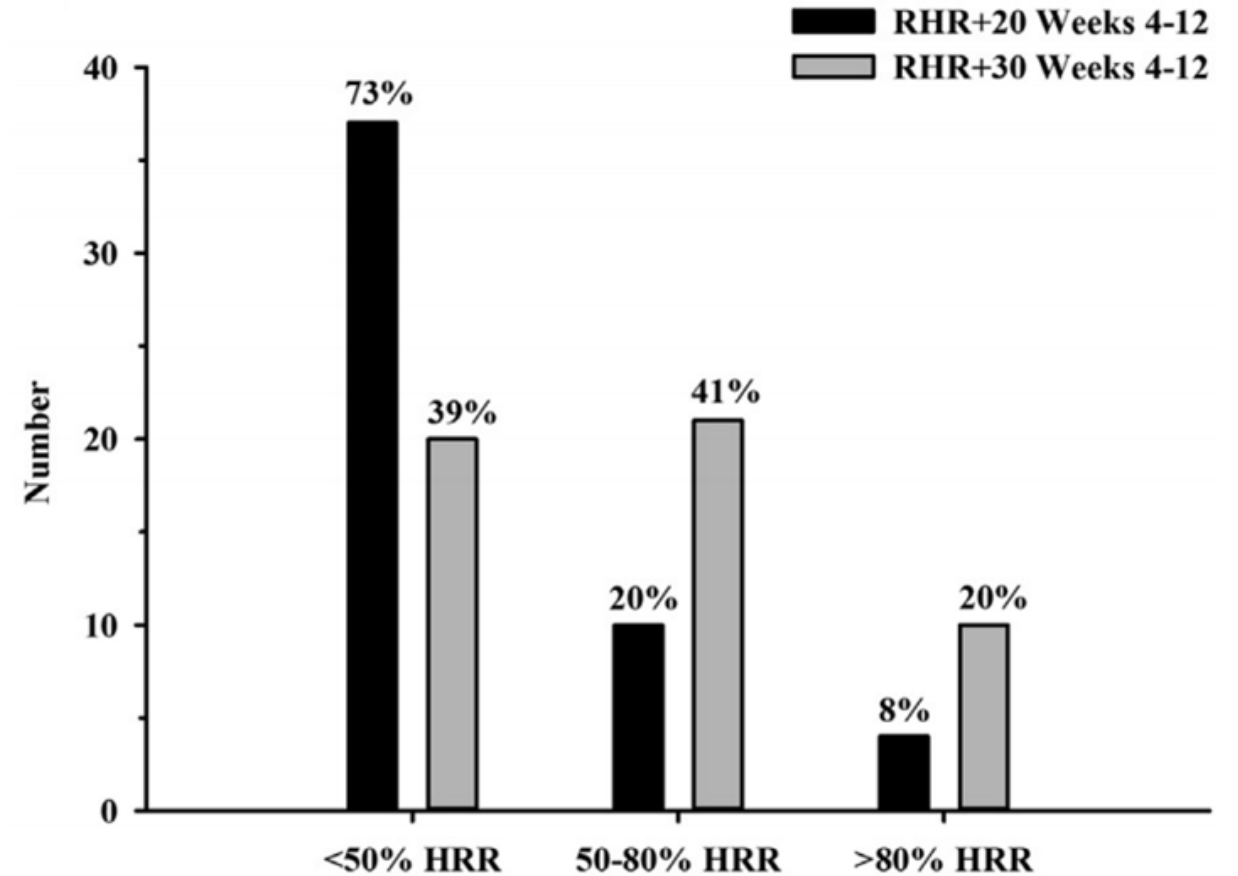
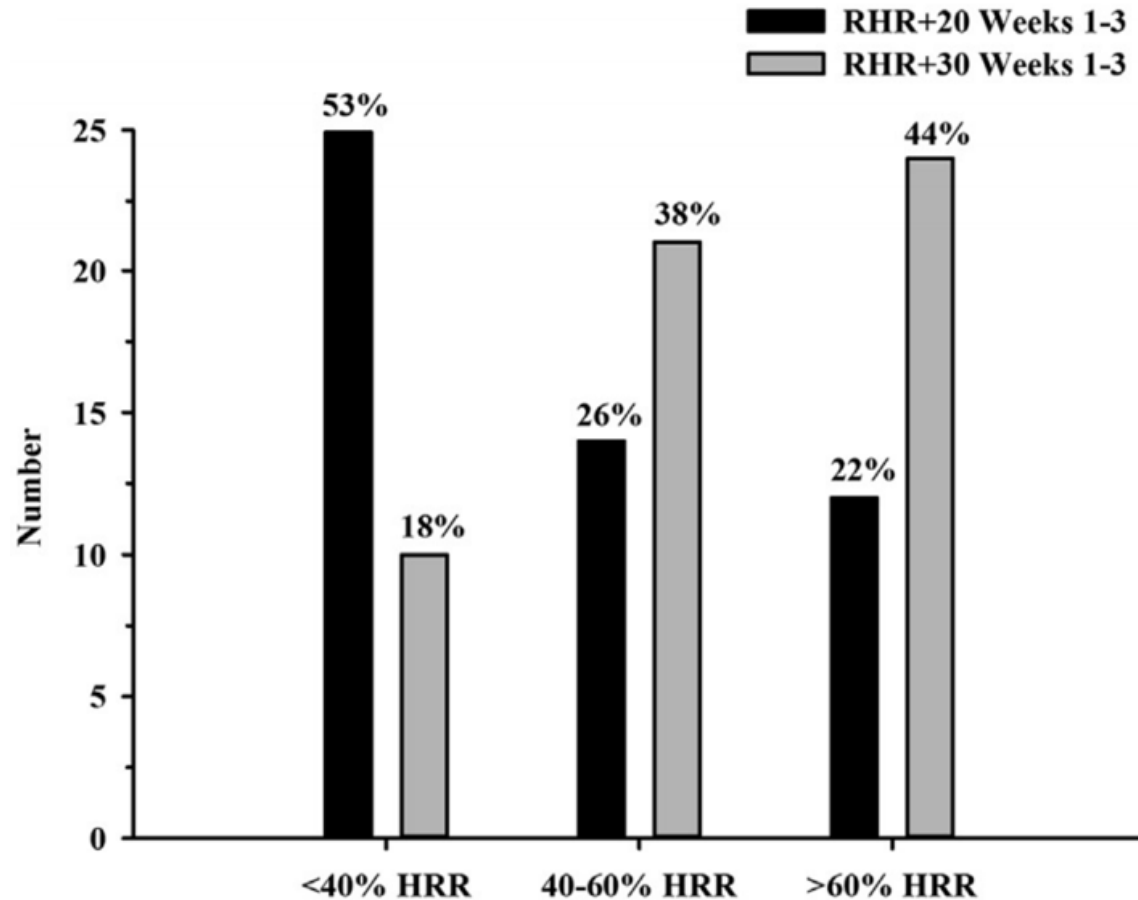
Caution!



Brawner et al. *Am Heart J.* 2004;148(5):910-4



+20 – 30 Method



Reed et al. *Can J Cardiol.* 2017;33:777-784



Talk Test

Moderate-intensity Activity

Can talk but not sing during the activity

Vigorous-intensity Activity

Not be able to say more than a few words without pausing for a breath.

Reciting the Pledge of Allegiance

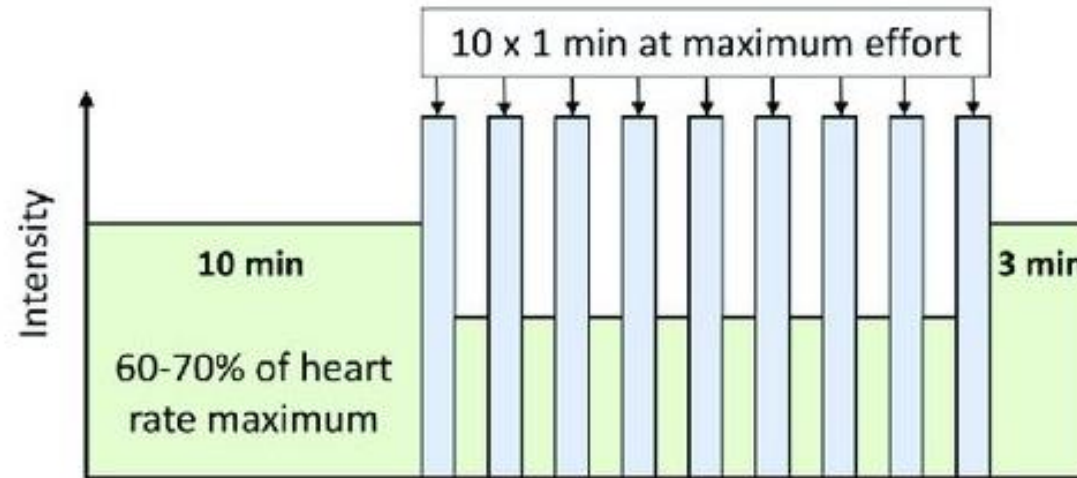
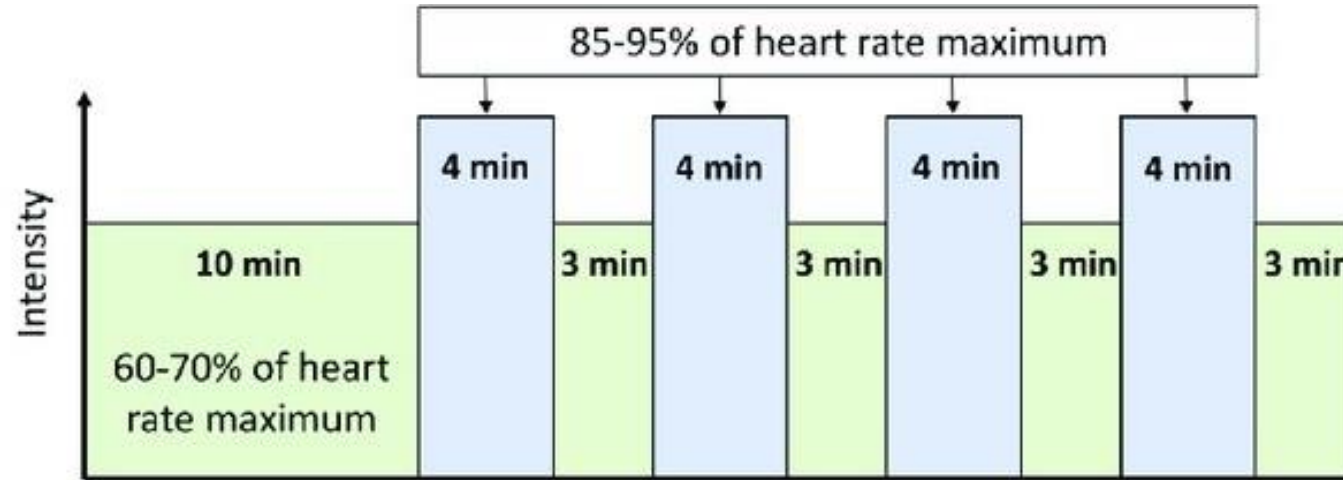
Ask patient, “Can you still speak comfortably?”

“**Yes**” - indicating a positive response = ~70% HRmax (moderate)

“**Not sure**” - indicating an equivocal response = ~77% HRmax (lower vigorous threshold)

“**No**” - indicating a negative response = ~84% VO₂max (upper vigorous threshold)

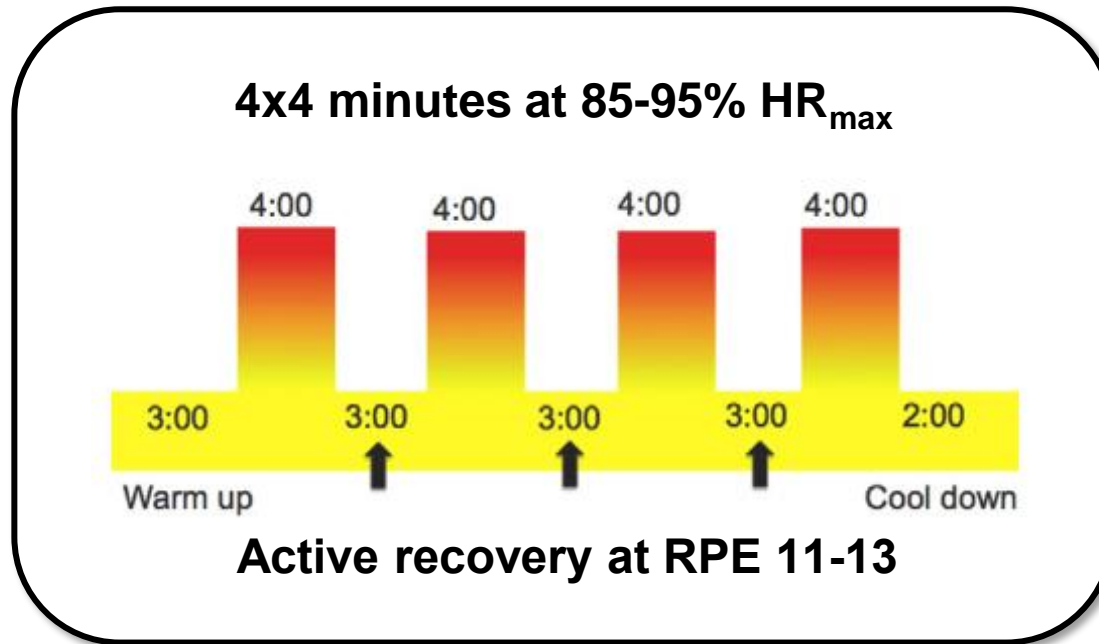
High Intensity Interval Training



Moholdt et al. *BMJ Open*. 2021



High Intensity Interval Training



Rating	Perceived Exertion
6	No exertion
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

Start 4 min interval at an RPE of “hard” → Should finish at “very hard”

1. First HIT, allow entire 4-minute period to reach the HR target zone
2. Subsequent HIT (i.e., 2nd, 3rd, 4th) allow 2-minutes to reach HR target zone
3. Validate HR target zone

Taylor et al. *PCVD*. 2019;62(2)140-146

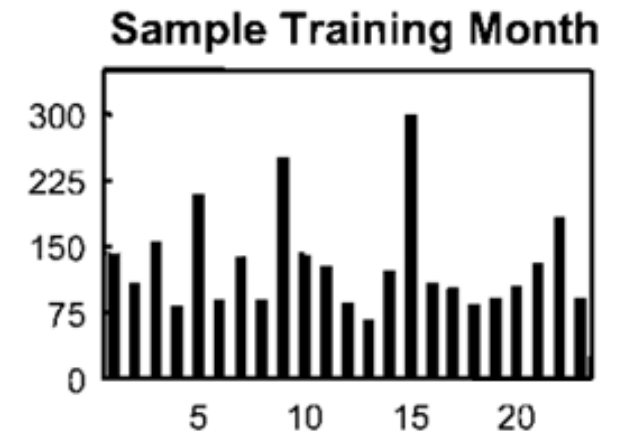
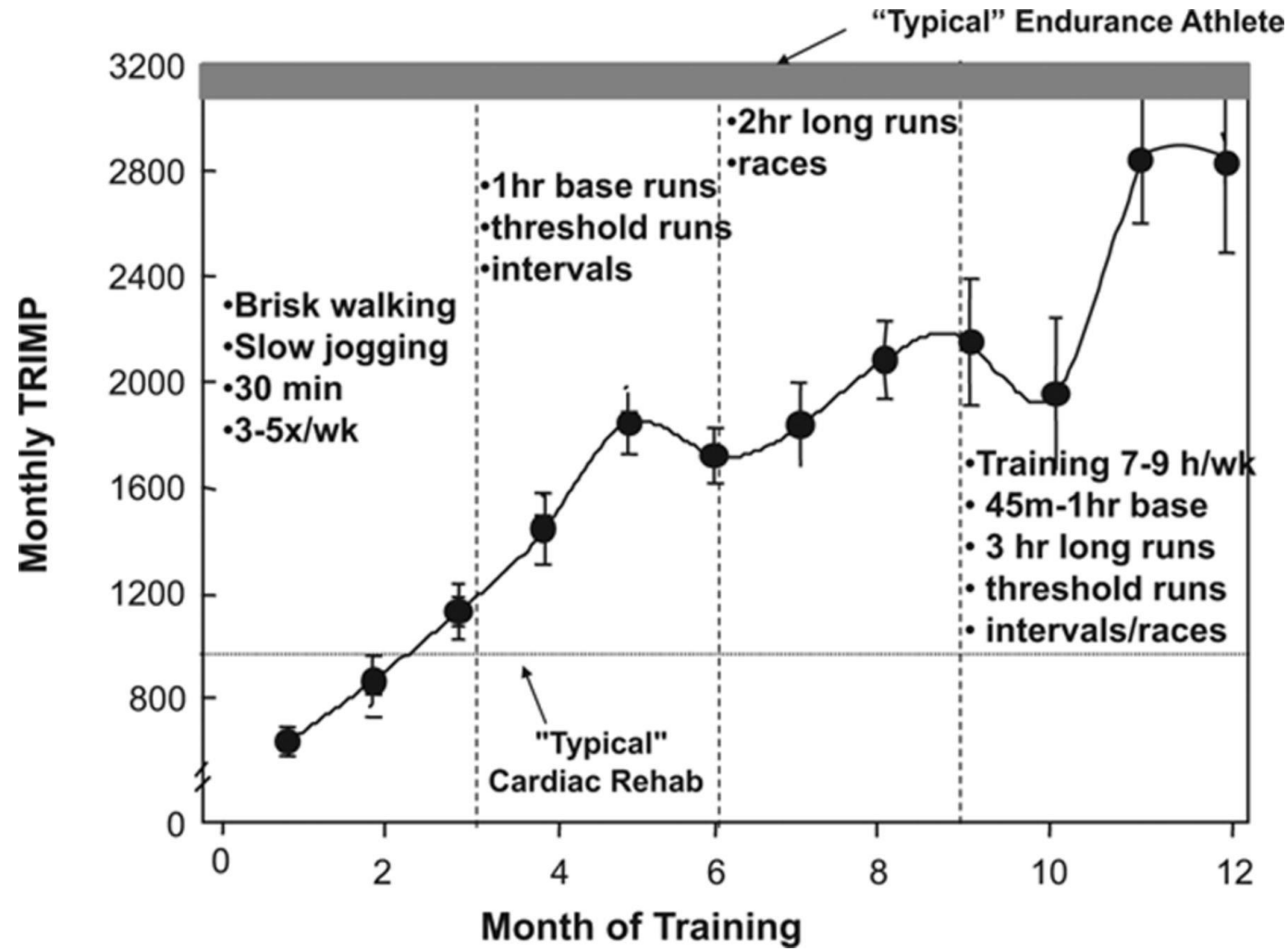




Training Volume

	5k	10k	Half-marathon	Marathon
Avg Runner	15-25 miles	20-30 miles	30-40 miles	35-60 miles
Elite Runner	70-80 miles	80-100 miles	100-110 miles	100-140 miles

Putting Ex R_x in Perspective



Arab-Zadeh et al. *Circ.* 2014;130:2152-2161



Sport Specificity

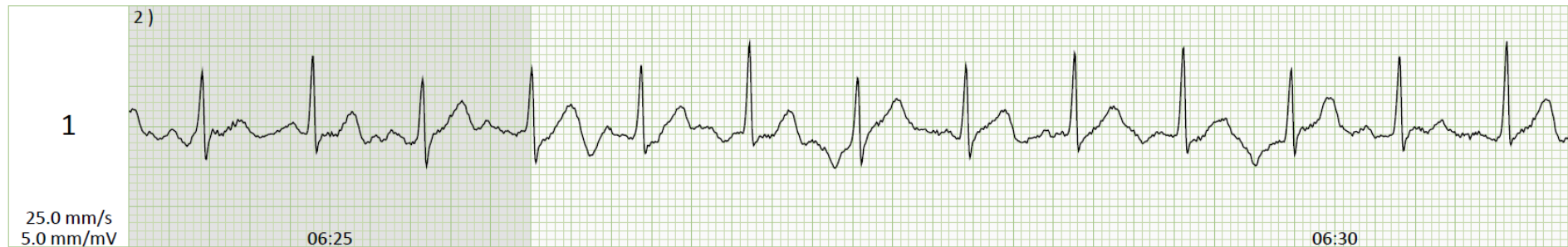


Real World Example

- 66 yr old male
- History of MI and DES to LAD
- Avid life long tennis player
- Activity related anxiety
- Resting HR, BP:
- 6MWT distance: 1,595 ft (486m), 3.3 METs
- 6MWT peak HR: 111 bpm



1) 01:04 - 01:06: Rest 81 bpm



2) 06:24 - 06:26: 6MWT 111 bpm

Session #3

Treadmill: 2.5 mph, 2% = 3.6 METs



3) 16:56 - 17:01: TM 97 bpm

Session #4

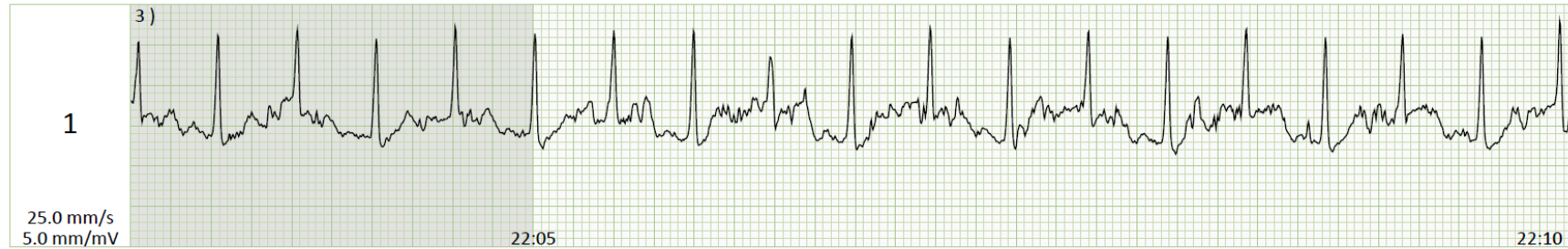
Treadmill: 2.8 mph, 2.5% = 4.1 METs



4) 25:04 - 25:05: Treadmill 125 bpm

Session #15 (14 weeks later)

3.7 mph, 3% = 7.4 METs

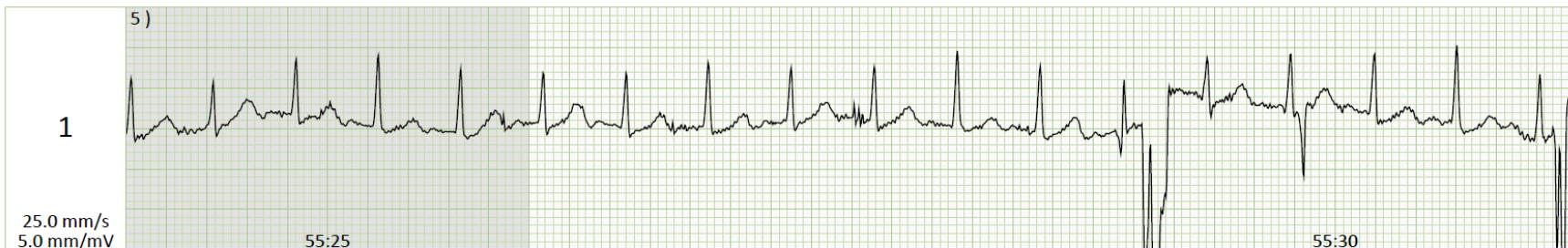


3) 22:03 - 22:05: TM 150 bpm



4) 29:07 - 29:09: Strength/Agility 131 bpm

125 Watts, ~7 METs



5) 55:24 - 55:26: NuStep 147 bpm

Real World Example

- 6MWT improvement from 1,595 ft to 1,800 ft (12.8%)
- 3rd (3.6 METs) – 4th (4.1 METs) session to last session METs (7.4)
- No adverse events or episodes of chest pain
- Normal HR and BP responses – highest SBP 198 on non-med day
- No activity related anxiety
- Regularly plays tennis, active gym goer, outdoor cycling
- Exercise session became much needed psychologic healing time



Take Away's

- Reaching previous training volumes does not happen over night
- Avoid HR cap based on arbitrary policies
- Training should be specific to sport
- Work with athlete to advance exercise training regimen
- Take experience with athletic population and apply to other CR participants



Thank you!

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