

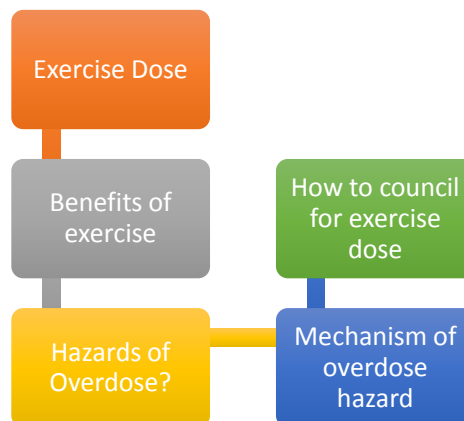
Exercise Overdose

How much is too much?

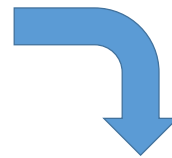
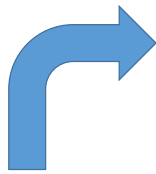
Hussien Heshmat, MD
Cardiology Department
Cairo University



Outline

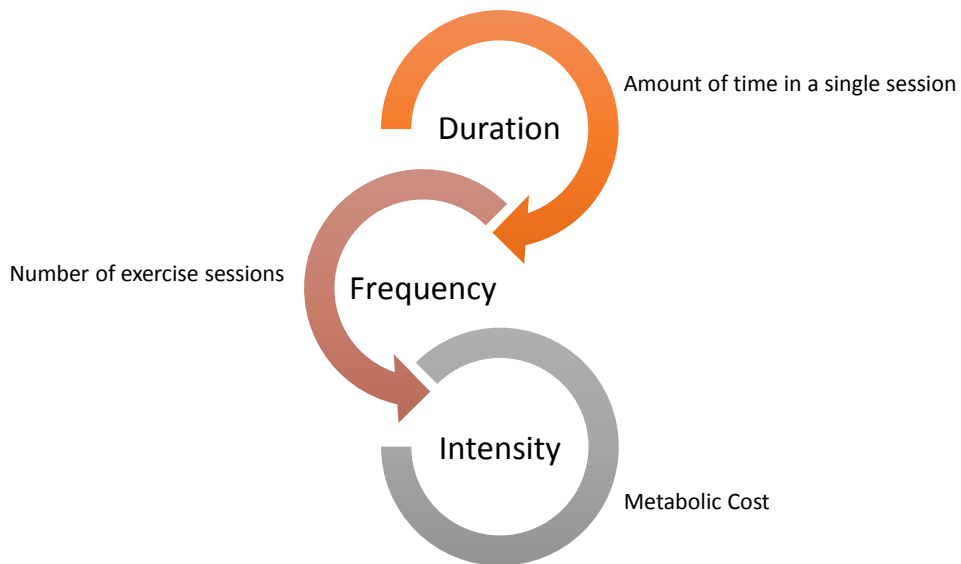


Physical Activity -- Exercise





What is Exercise Dose?

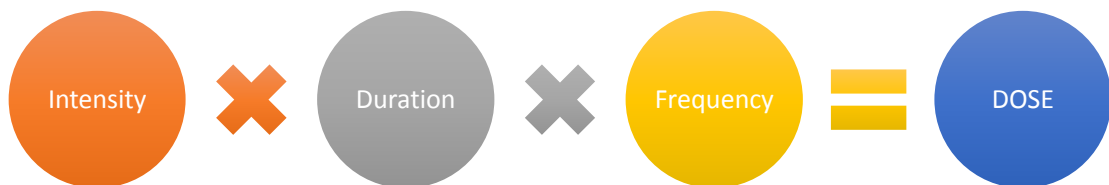


Intensity = Metabolic Cost

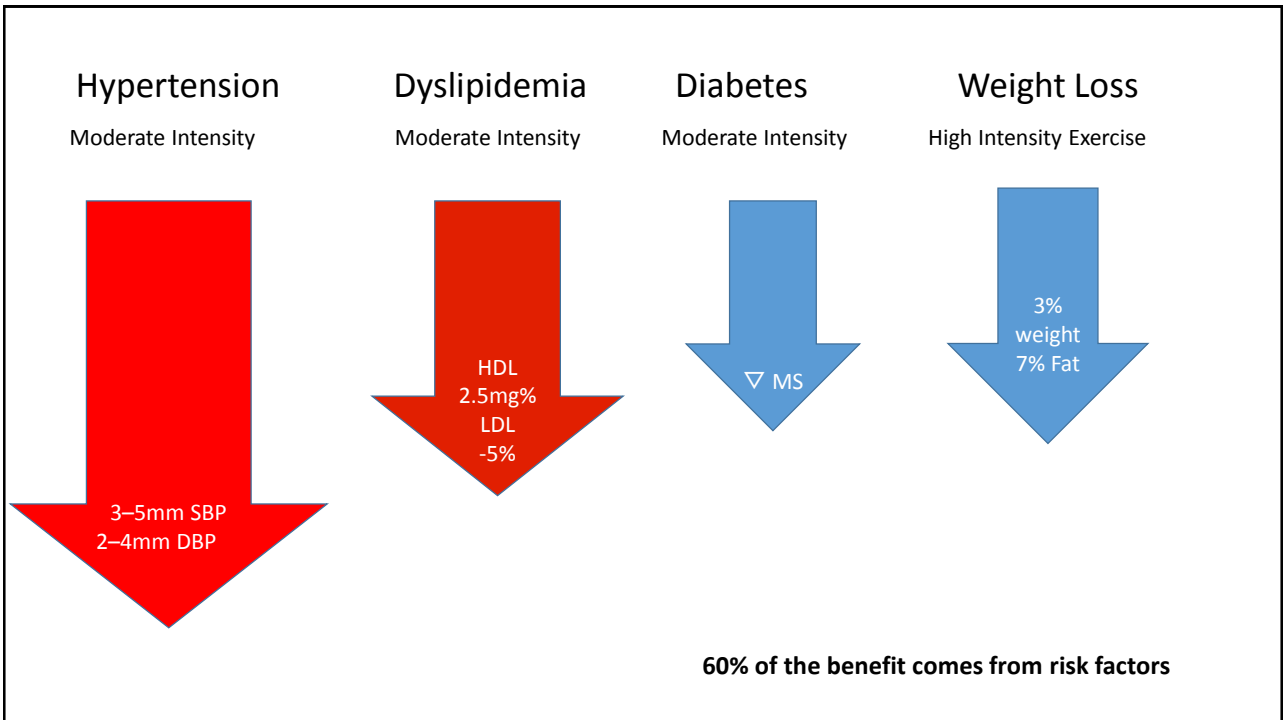
Absolute intensity: energy required to perform activity	
Kilocalories/time: 1 L O ₂ consumption=5 kcal	Not defined
MET: 1 MET=3.5 mL O ₂ consumption/kg-min = quiet sitting	Sedentary: 1-1.5 METs Low: 1.6-2.9 METs Moderate: 3.0-5.9 METs High: >6.0 METs

Relative intensity: percentage of maximal exercise capacity	
Percent of V _{O₂}	Very light: <25% Light: 25%-44% Moderate: 45%-59% Hard: 60%-84% Very hard: 85%-99% Maximal: 100%
Percent of maximal heart rate	Very light: <30% Light: 30%-49% Moderate: 50%-69% Hard: 70%-89% Very hard: 90%-99% Maximal: 100%
Rate of perceived exertion	Borg Scale: Very light: <10 Light: 10-11 Moderate: 12-13 Hard: 14-16 Very hard: 17-19 Maximal: 20

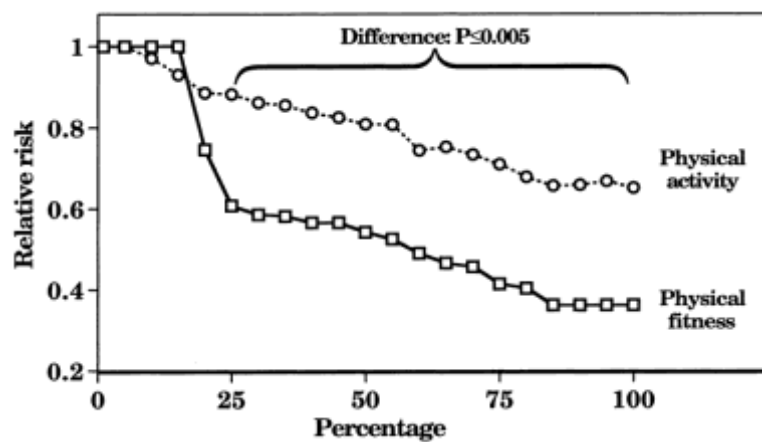
Dose Calculation



Minutes/week of given intensity

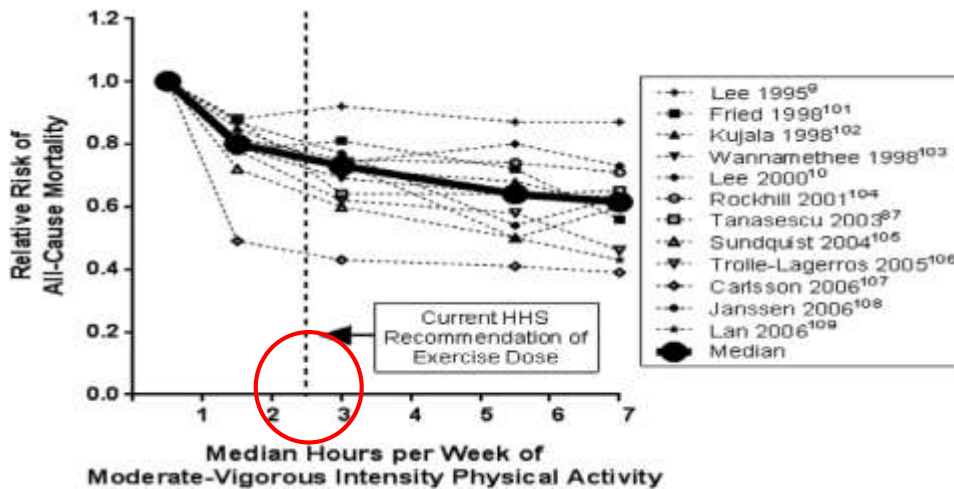


Dose-response curves for physical activity and physical fitness in relation to CVD



Williams PT, MSSE 2001;33:754-761

Best Dose?



Physical Activity Guidelines Advisory Committee Report, 2008. US Department of Health and Human Services.

Recommendation



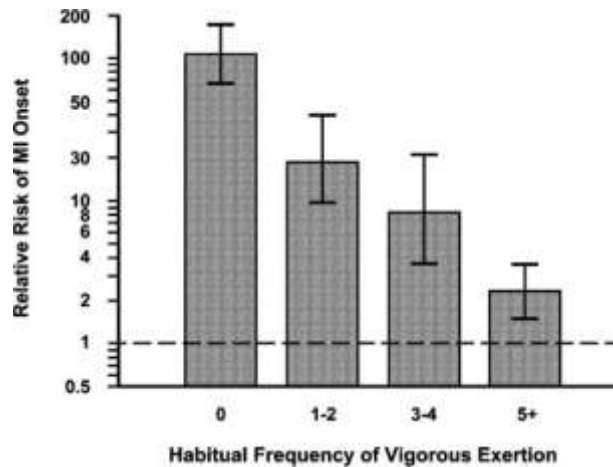
450 to 900 MET-min/week
3500 calories/week



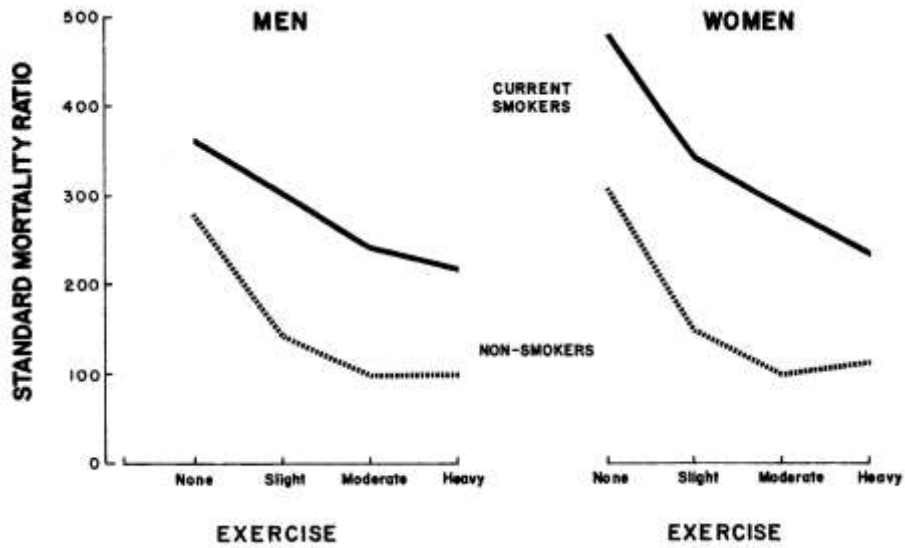
Collapse of Pheidippides



Vigorous Exertion and AMI

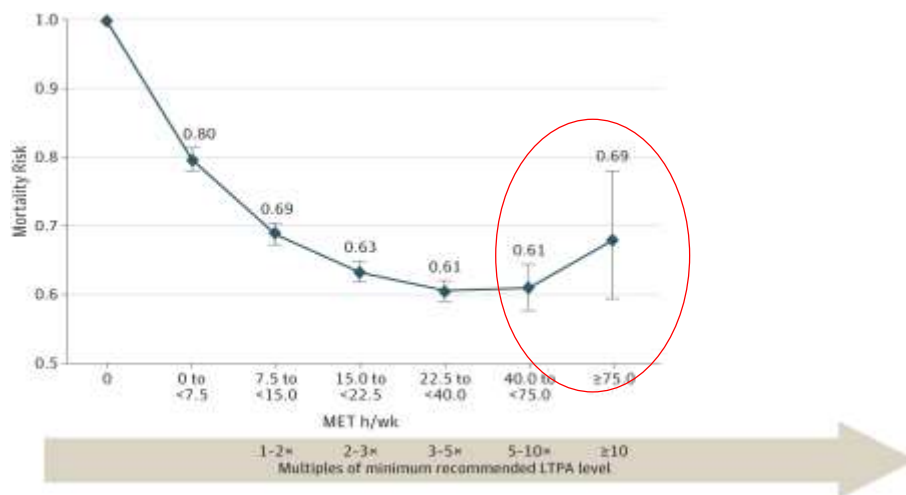


Am J Med Sports. 2005;4:99-102.

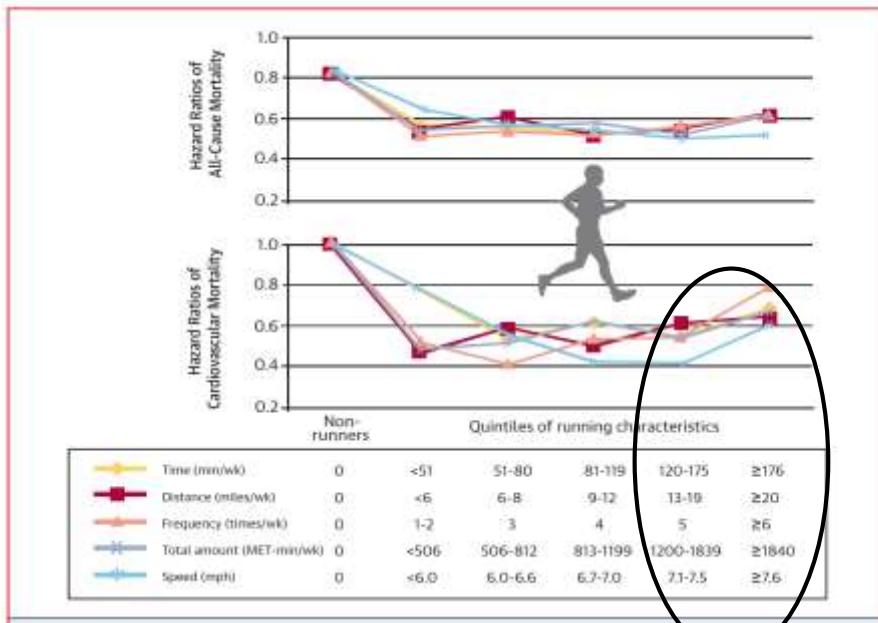


Garfinkel et al, Cancer 1988;62:1844-1850

Leisure time physical activity and mortality

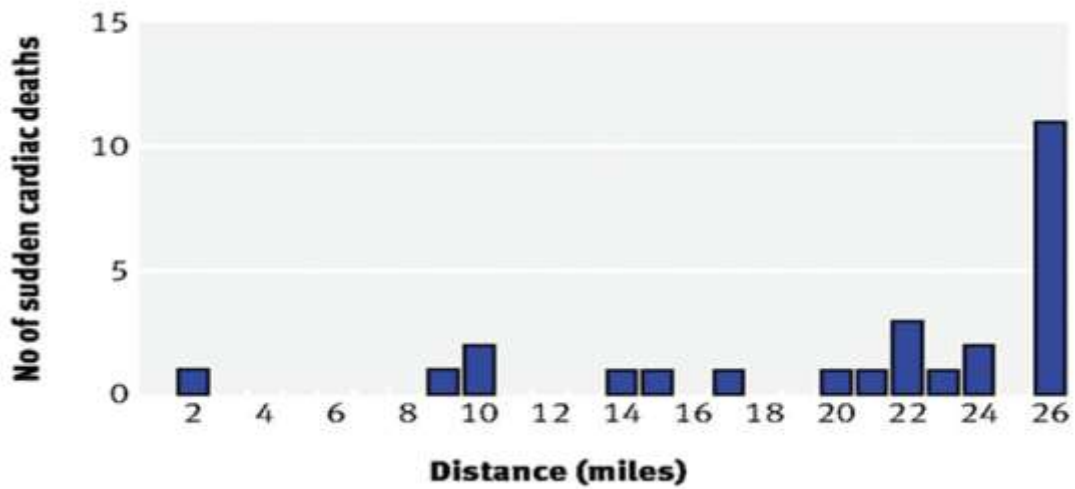


JAMA Intern Med. 2015;175(6):959-967



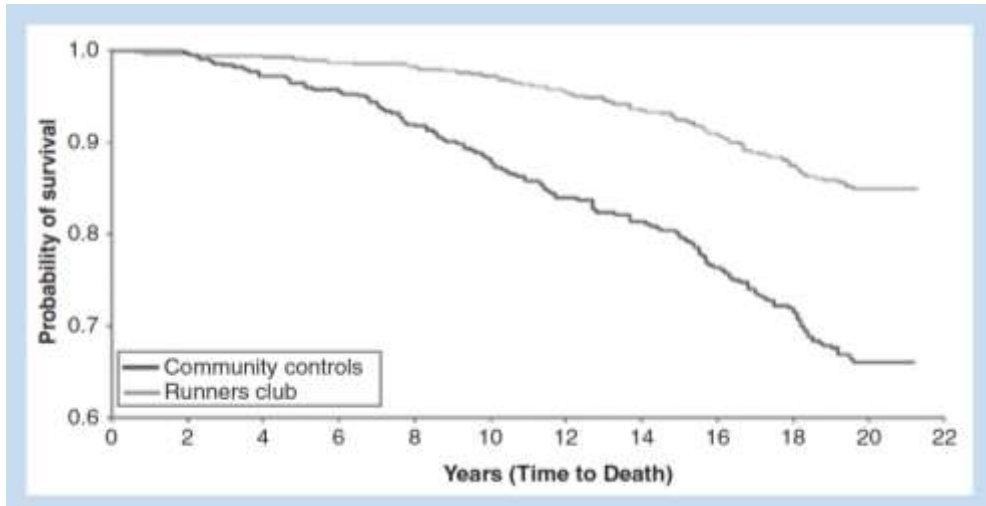
J Am Coll Cardiol 2014;64:472-81

Marathon Runners

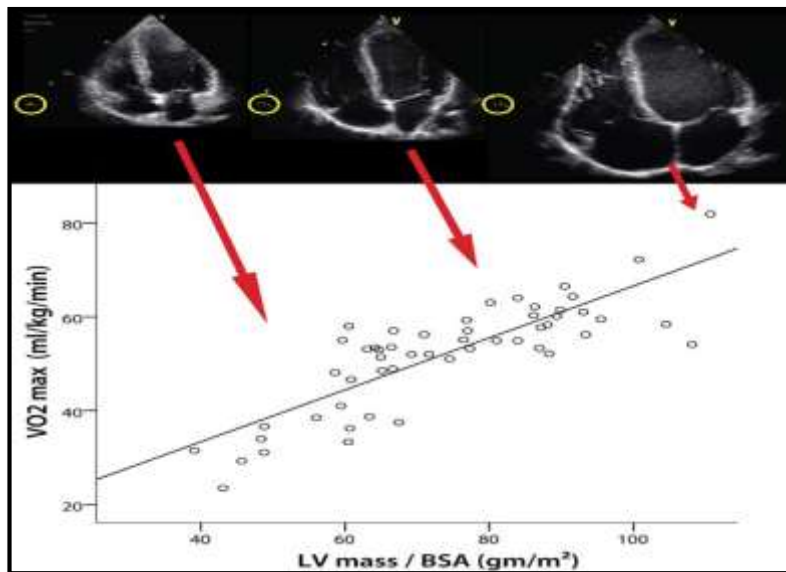


BMJ. 2007;335:1275-1277.

Athletes Always Win!



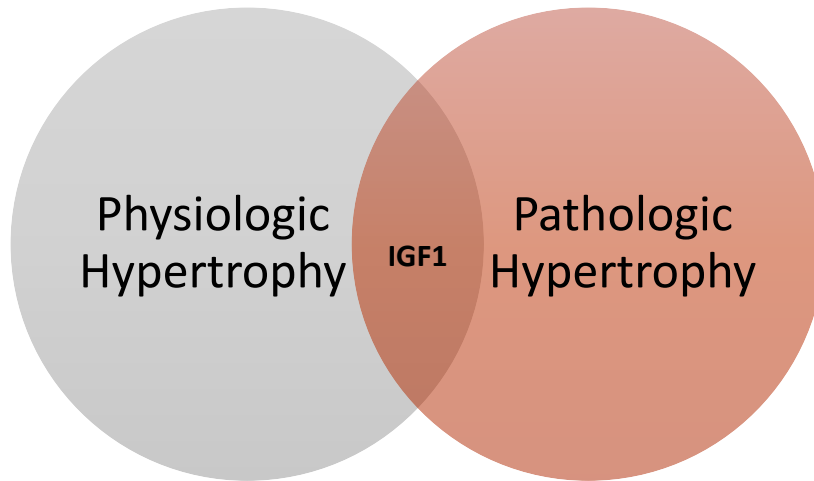
Arch Intern Med. 2008;168(15):1638-1646



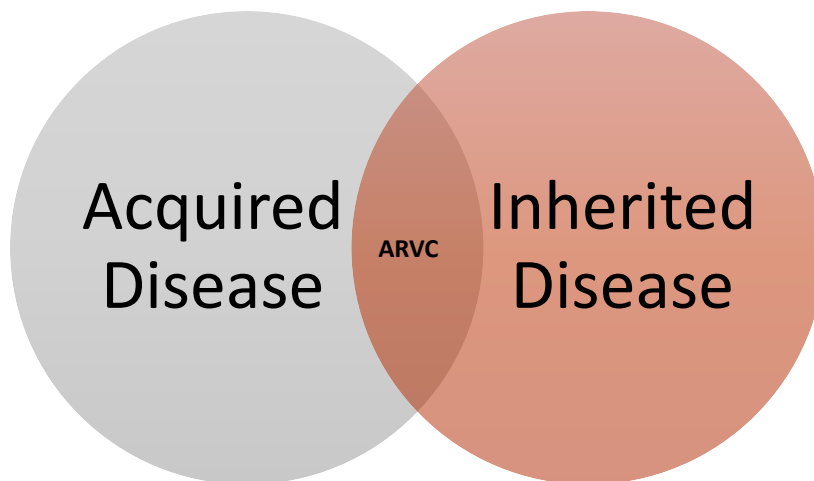
Dose : Remodeling

Circulation. 2014;130:992-1002.)

No Black and White



No Black and White



The Right Ventricle

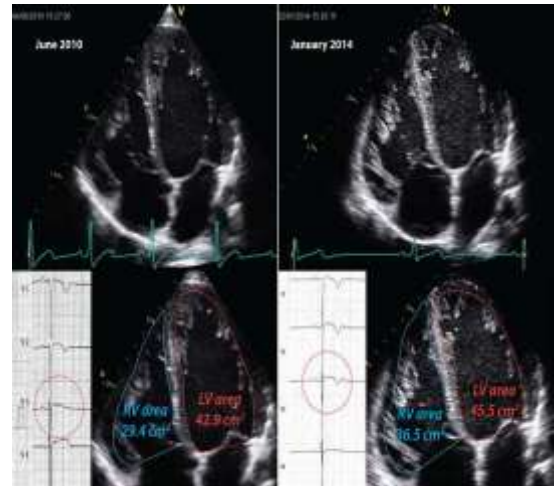
Exercise

++ PA pressure > ++ ABP

++ RV load

Repetitive Stress → RV foci

Repetitive Stress → ARVC



Circulation. 2014;130:992-1002

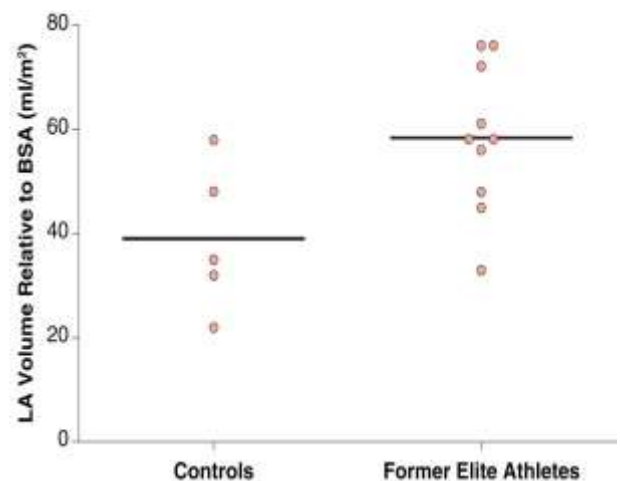
The Atria

++ CO 40
liters/min

Residual LA volume
>200ml

Atrial dilatation

Atrial arrhythmia



JACC: Cardiovascular Imaging May 2016, 9 (5) 630-632

Coronaries?

Parathormone activation

Calcium Release

Shear Stress exercise

Calcium Deposition

? Plaque stabilization

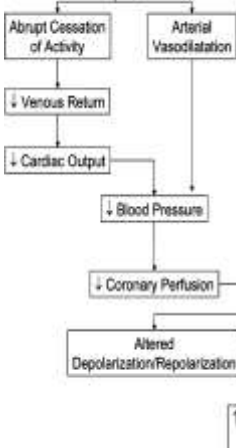
Table 1 Distribution of coronary artery calcification (CAC) measures in the three groups

	Participants of the Heinz Nixdorf Recall Study			P-value group I vs. group II	P-value group I vs. group III
	Marathon runners (group I) (n=5)	Age-matched controls (n=5) (group II)	Controls matched for age and risk factors (2-1) (group III)		
log(CAC + 1) (mean ± SD)	4.1 ± 1.6	4.9 ± 3.3	3.8 ± 3.4	0.28	0.02
CAC (Q1[median/Q3])	0/0/2/17	3/38/97	0/12/78	0.36	0.02
zero CAC (%)	20.0	18.4	21.5	0.01	0.30
CAC > 75th percentile (%)	25.0	24.2	14.8	0.85	0.01
CAC 0 to <10	40.74	24.61	48.61		
CAC 10 to <100	23.15	29.05	29.63	0.52	0.02
CAC 100 to <400	23.15	23.86	13.43		
CAC ≥400	13.96	13.54	8.33		

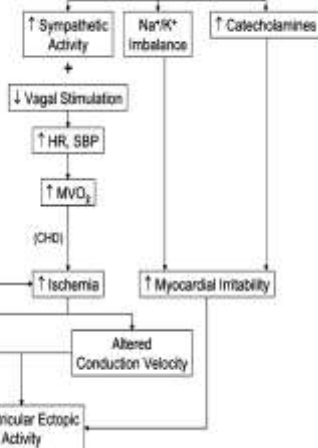
Comparison in continuous or binary measure adjusted for matching factors (age for group I/group II, age, body mass index, hypertension risk, smoking status for group I/group III)

European Heart Journal (2008) 29, 1903–1910

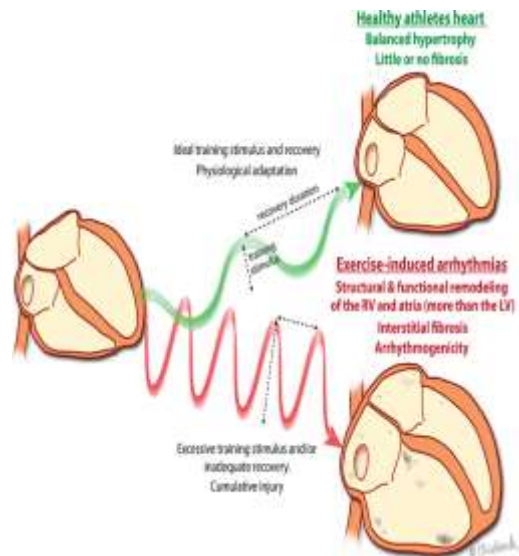
IMMEDIATE POST - EXERCISE



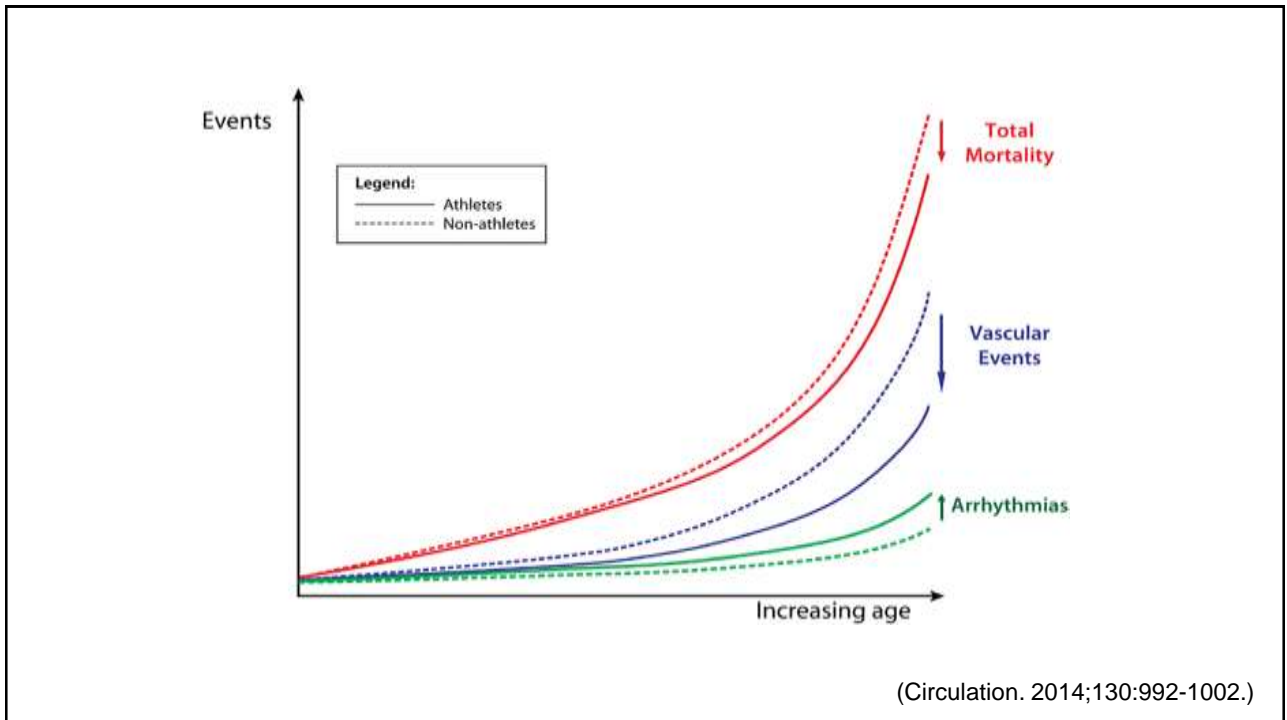
ACUTE EXERCISE STRESS



Circulation. 2007;115:2358-2368



Circulation. 2014;130:992-1002.)



How to Council

Assess PA habits

Fails to reach target

Reaches target

Exceeds Targets

Assess barriers

Musculoskeletal consultation

Positive reinforce

Discuss potential risk

Consider Exercise Test

Warm Up and Cool Down

Acknowledge Exertional Symptoms

Conclusion

- Exercise dose in relative intensity (intensity X duration X frequency)
- Moderate intensity exercise is beneficial
- Law of diminishing returns with more vigorous exercise
- Endurance athletes live longer
- Endurance athletes have slight increased risk of arrhythmia
- RV and atria are potential culprits of injury