



Too Much Vs. Too Little Exercise; What Are the Risks?



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Exercise and Health

- We know that exercise is a powerful medicine for both the treatment and prevention of chronic disease and obesity, and reducing premature death.
 - Proven linear relationship between physical activity and health status.
 - The association between disease and an inactive and unfit way of life persists in every subgroup of the population.
- Too little exercise is THE major public health problem of our time.


The Classification of Risk Factors for Cardiovascular Disease

- Surrogate outcomes of poor lifestyle choices (hypertension, obesity, cholesterol and diabetes), along with smoking are given “causal” risk factor status for CVD.
- Physical inactivity is generally referred to as a “predisposing” risk factor.
 - Suggesting its influence on disease is entirely due to intensification of the causal factors.
 - Result has been disproportionate focus on drugs (mainly lipid and BP) to treat disease.
 - Research has proven this is incorrect.

The Effect of Exercise on CVD Risk

- Even after accounting for traditional CVD risk factors (BP, DM, lipids, weight), the inverse relationship between PA & CVD risk persists.
 - ~59% of the reduction in CVD risk with exercise is due to reducing Inflammation & Clotting (32.6%), BP (27.1%), lipids (19.1%), BMI (10.1%), A1C (8.9%).
 - *41% of risk reduction due to other unknown mechanisms* (perhaps endothelium function and remodeling or LV structure and function).
 - Effect of *weight loss* is only on traditional risk factors.

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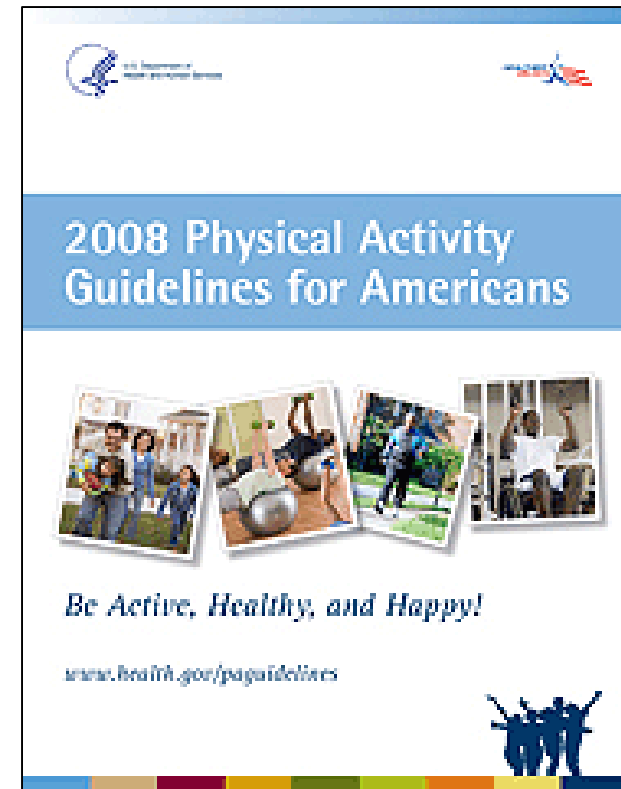
Exercise is Medicine for the Primary and Secondary Prevention of:

- Diabetes mellitus
- Cancer (breast and colon)
- Hypertension
- Depression
- Osteoporosis
- Dementia
- Coronary Artery Disease
- Lower death rate from all causes

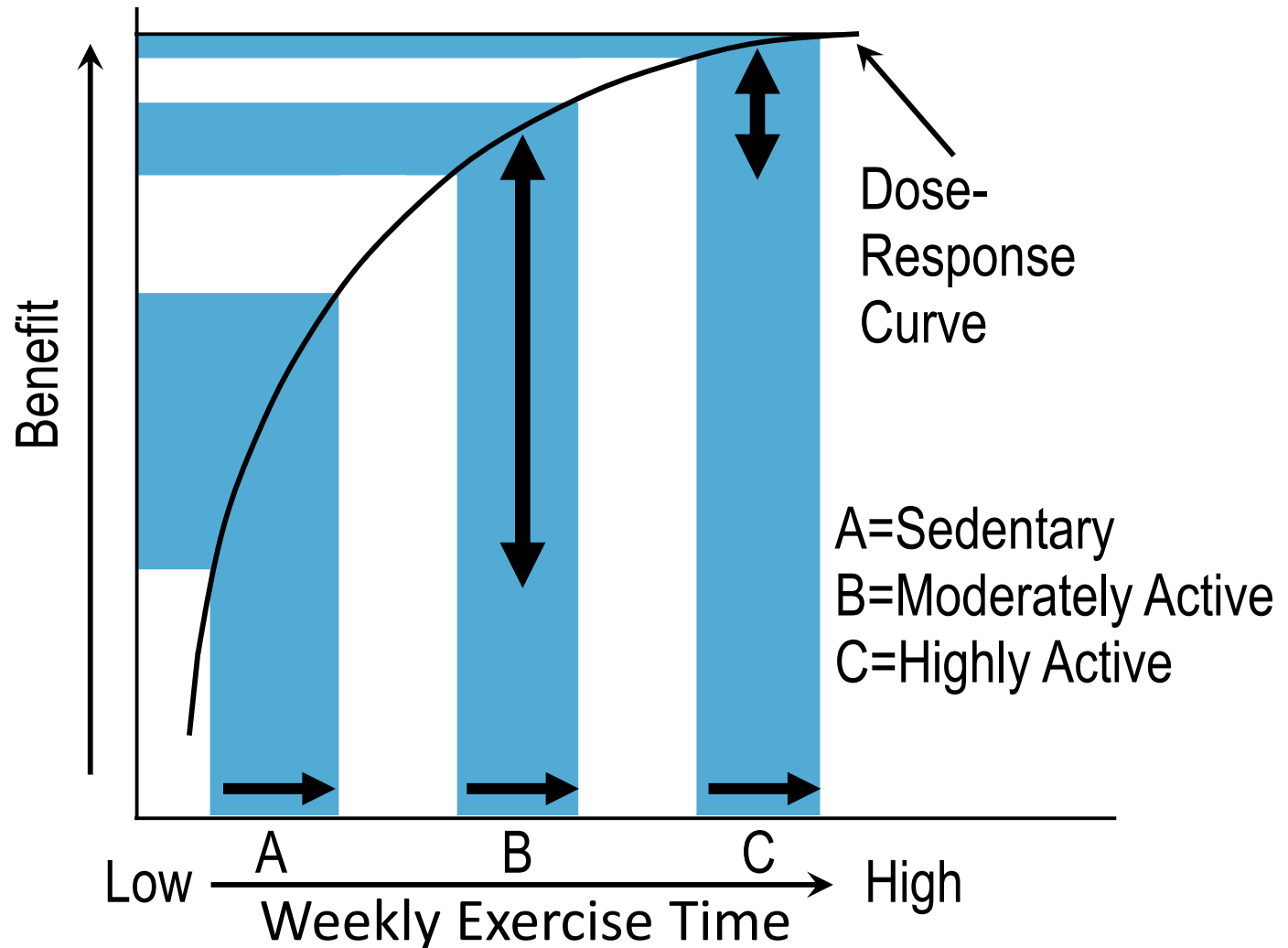
How Much Exercise Do we Need?

US Physical Activity Guidelines

- 150 minutes per week of moderate exercise (like a brisk walk) in adults.
 - 30 minutes walking on 5 days per week.
 - Three 10 minute bouts as good as 30 min sustained.
- 75 minutes per week of vigorous exercise (like jogging).
- 60 minutes per day in kids (half at vigorous intensity).



Dose-Response Curve for Exercise



Exercise is Medicine

*Running and Walking are 2 great formulations;
but what is the optimal dose of each?*



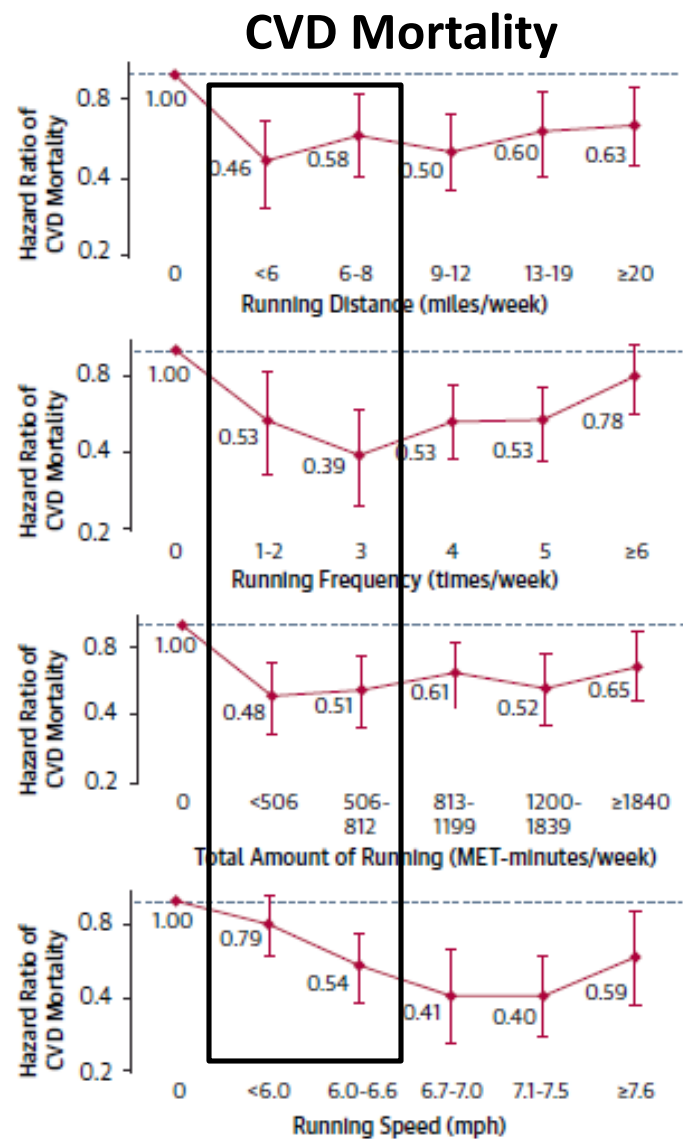
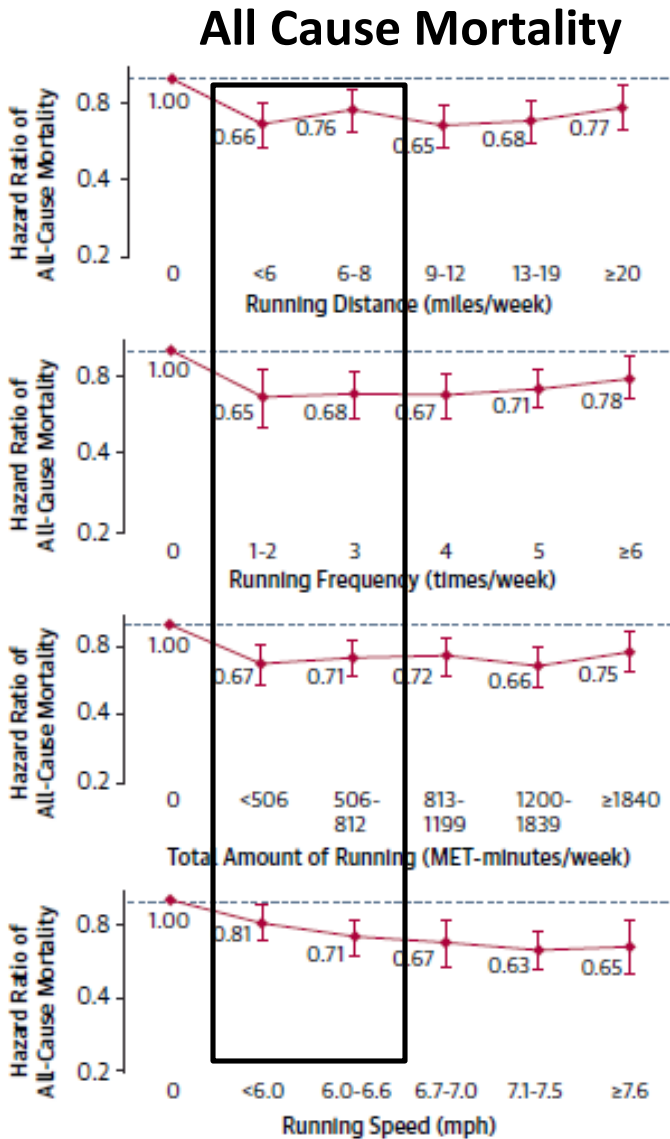
What is the Optimal Dosing Range for Runners?

- 2 studies help shed light on the answer to that question.
 - Lee D-C, Pate RR, Lavie CJ, Sui X, Church TS, Blair SN. Leisure-time running reduces all-cause and cardiovascular mortality risk. *J Am Coll Cardiol.* 2014;64(5):472-481.
 - Schwartz RS, Kraus SM, Schwartz JG, et al. Increased coronary artery plaque volume among male marathon runners. *Mo Medicine* 2014;111(2):85-90.

Affect of Leisure-time Running on All-cause and Cardiovascular Mortality Risk

- Most data on PA and mortality focused on moderate intensity (walking).
- Examined association of running with all-cause and CV mortality risks in 55,137 adults, 18 to 100 yrs. (mean 44 yrs., 26% female); ACLS data.
 - Compared non-runners to runners in 5 quintiles of **distance** (miles/wk), **frequency** (times/wk) , **amount** (METS-min/wk) and **speed** of running (mph).
 - Also looked at effects of a change in running habits over time in sub-group (20,647) who had ≥ 2 exams.

HRs of All-Cause and CV Mortality by Running Distance, Frequency, Total Amount, and Speed



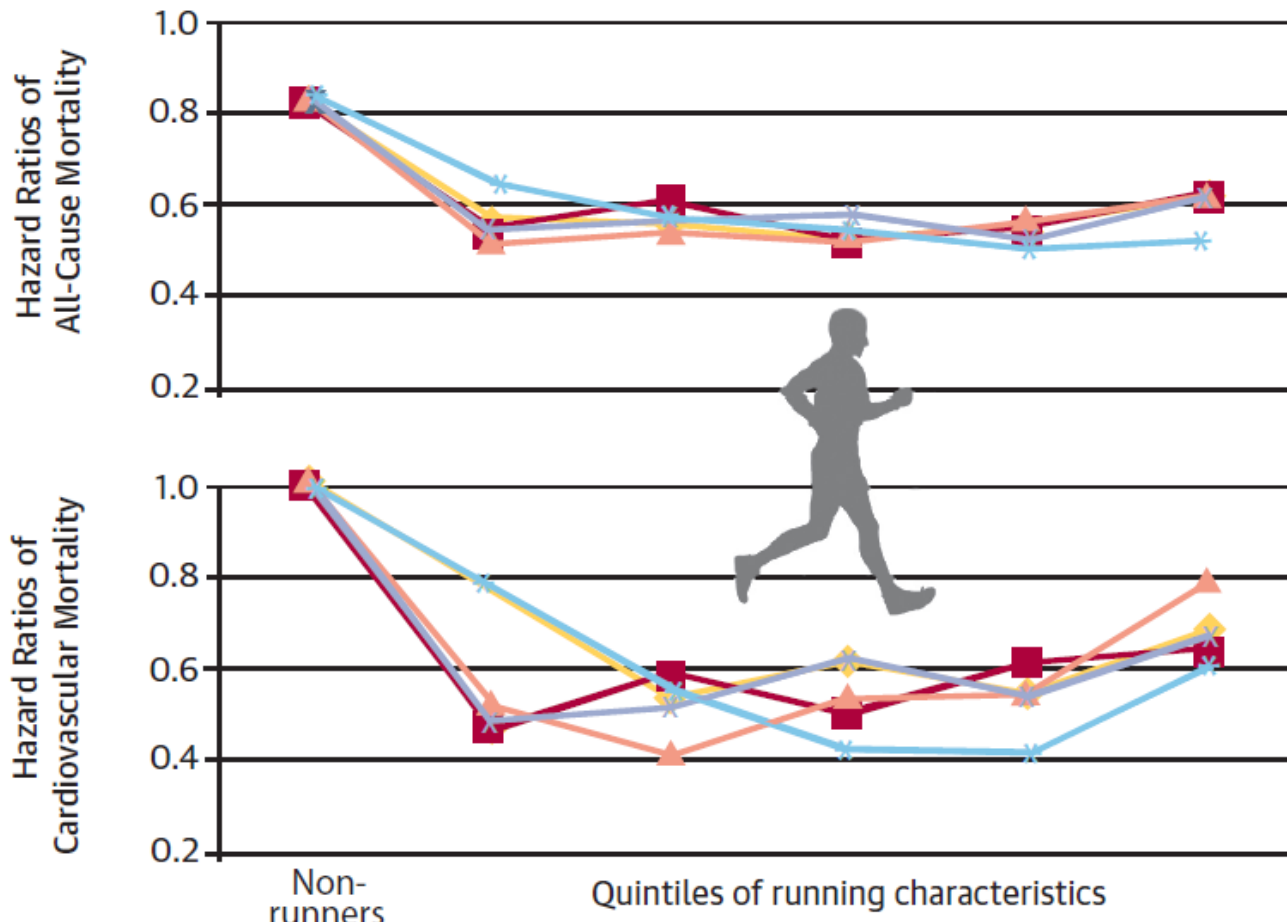
Distance

Frequency

Time

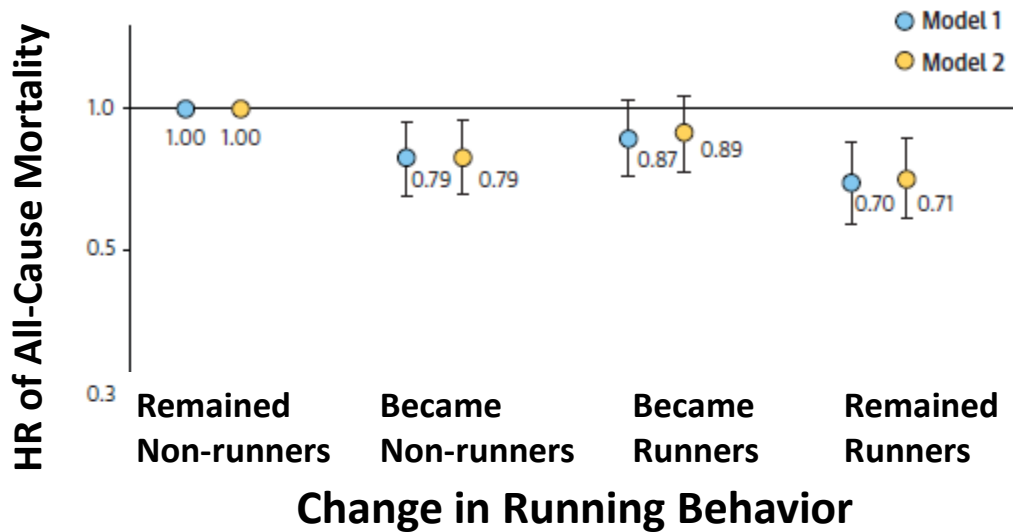
Speed

Running Reduced All-Cause and CV Mortality Risk



Characteristic	0	1	2	3	4	5	6
Time (min/wk)	0	<51	51-80	81-119	120-175	≥176	
Distance (miles/wk)	0	<6	6-8	9-12	13-19	≥20	
Frequency (times/wk)	0	1-2	3	4	5	≥6	
Total amount (MET-min/wk)	0	<506	506-812	813-1199	1200-1839	≥1840	
Speed (mph)	0	<6.0	6.0-6.6	6.7-7.0	7.1-7.5	≥7.6	

HRs of All-Cause and Cardiovascular Mortality by Change in Running Behaviors



Model 1 adjusted for age, sex, exam year and interval btw exams.
Model 2 added smoking, alcohol and PA other than running



Lee, et al, *J Am Coll Cardiol*, 2014

Running Study Conclusions

- Runners had consistently lower risk of all-cause and CVD mortality compared with non-runners.
- Running even at lower doses or slower speeds was associated with significant mortality benefits.
 - 30-59 min per week (5-10 min per day) gave significant benefit!
- Persistent running over time was more strongly associated with mortality reduction, but any history of running gave benefit.

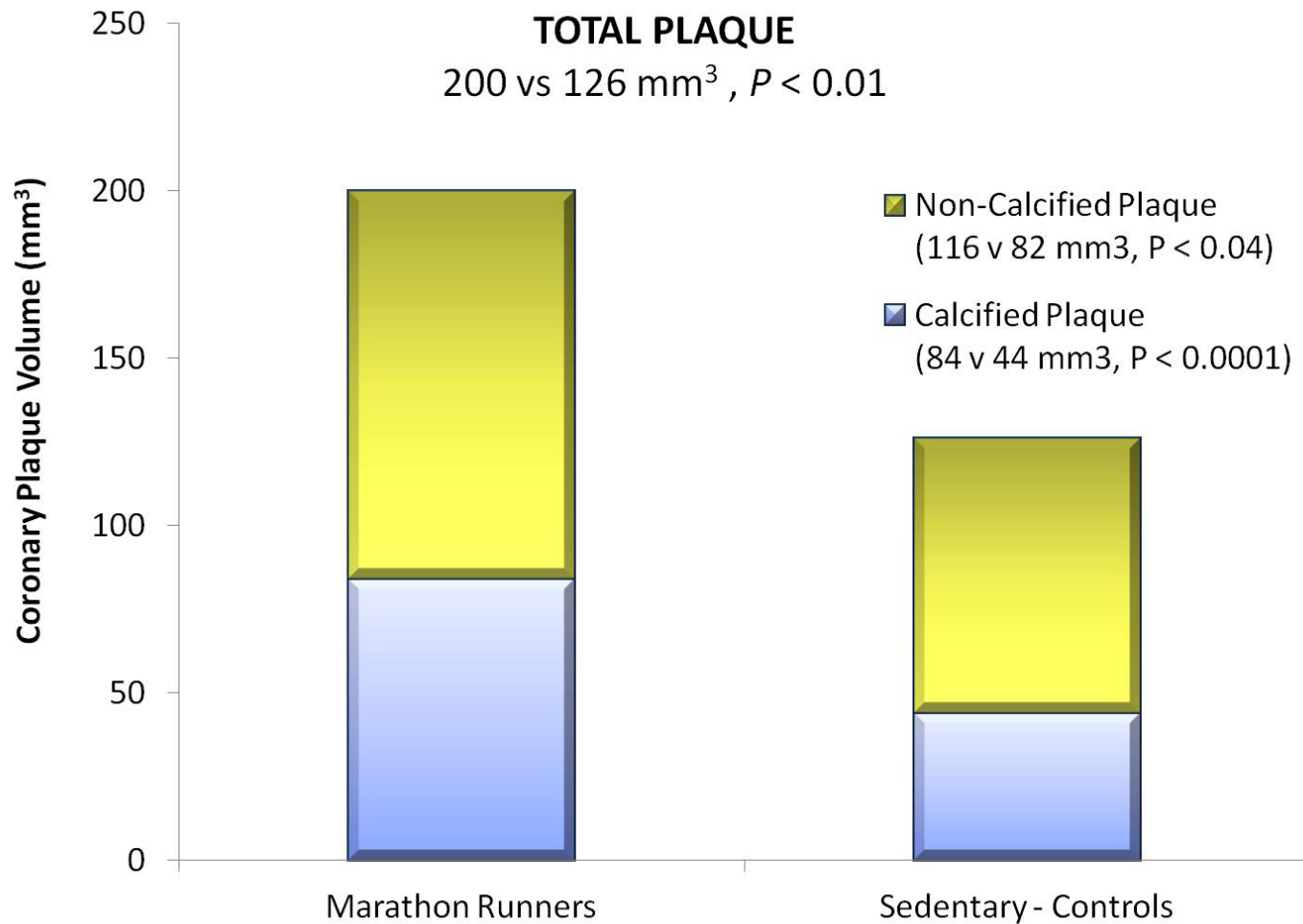
Coronary Artery Plaque Volume Among Male Marathon Runners.

- Most assume marathon running is good for heart health, but many studies suggest otherwise.
- Observational study comparing coronary calcium scores using high sensitivity CCTA in 2 groups of men average age 56-59 yr:
 - 50 male marathon runners (at least 25 marathons done over 25 years).
 - 23 male sedentary controls matched for age and CAD risk factors.
 - Controls had higher resting pulse, weight and BMI, as well as higher rates of high cholesterol, Hypertension and diabetes.

Results

- Male marathon runners had higher:
 - Total plaque volume (200 vs 126 mm²)
 - Calcified plaque volume (84 vs 44 mm²)
 - Non-calcified plaque volume (116 vs 82 mm²)
 - Lesion area and length, number of lesions per subject, and diameter stenosis did not reach statistical significance
- Despite the fact that the marathon runners showed improvement in traditional CV risk factors (lipids, glucose and BMI)

Marathoners showed increased plaque

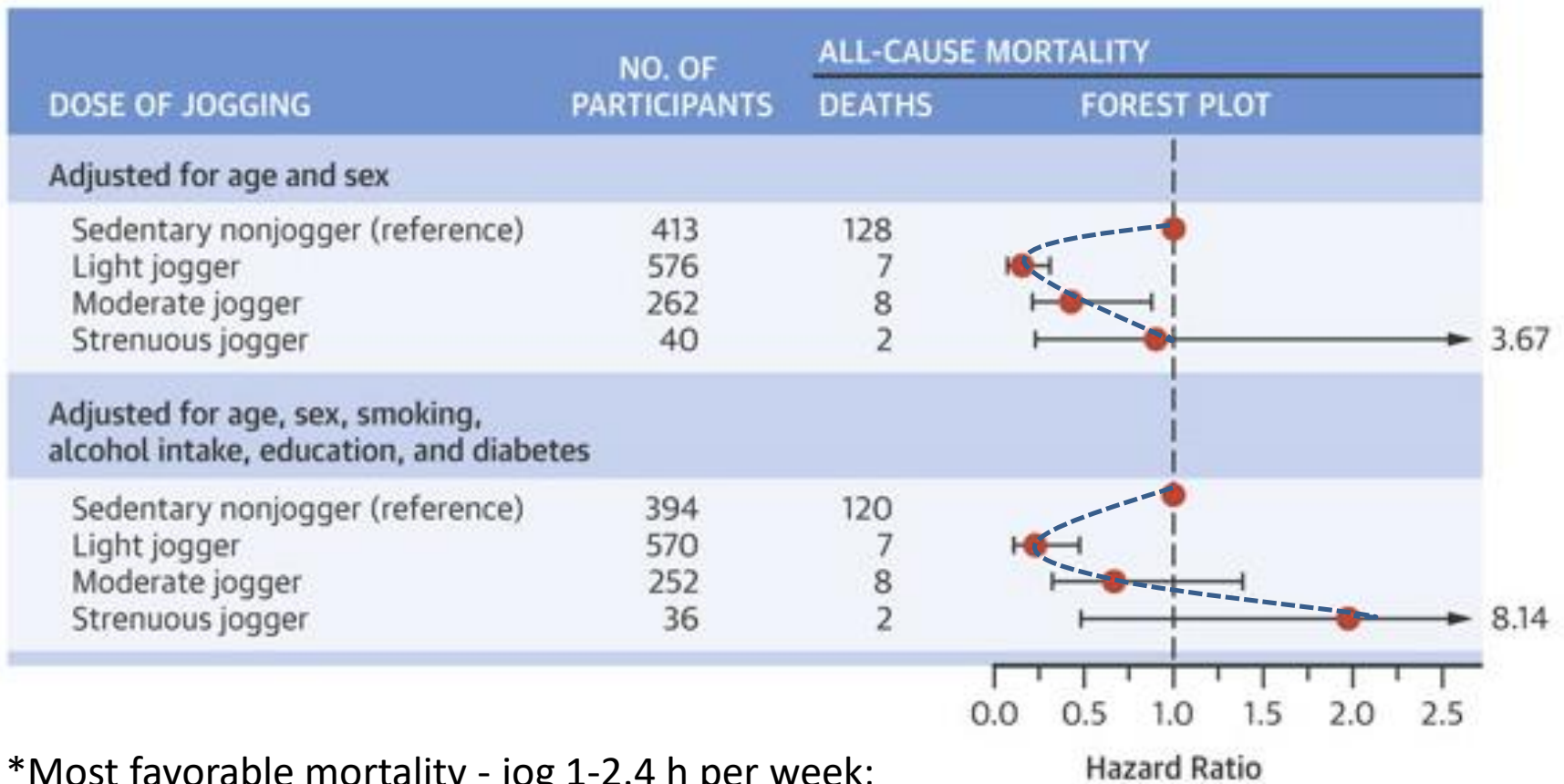


Marathon Study Conclusions

- Long-term male marathon runners may have paradoxically increased coronary artery plaque volume.
- Various observational studies have shown dramatic mortality reductions in runners compared with sedentary controls, but the effect seems to follow a U-shaped curve.
- Lowest mortality shown with:
 - Jogging 1-2.5 hours 3x per week at moderate pace, benefit goes away >2.5 hrs. (O’Keefe, Heart, 2013).
 - Jogging 5-20 miles per week; benefit goes away beyond 25 miles per week. (O’Keefe, Heart, 2013).

Dose of Jogging and *Long-Term Mortality*: The Copenhagen City Heart Study

1,098 healthy joggers; 3,950 healthy non-joggers; Prospectively followed 12 years.

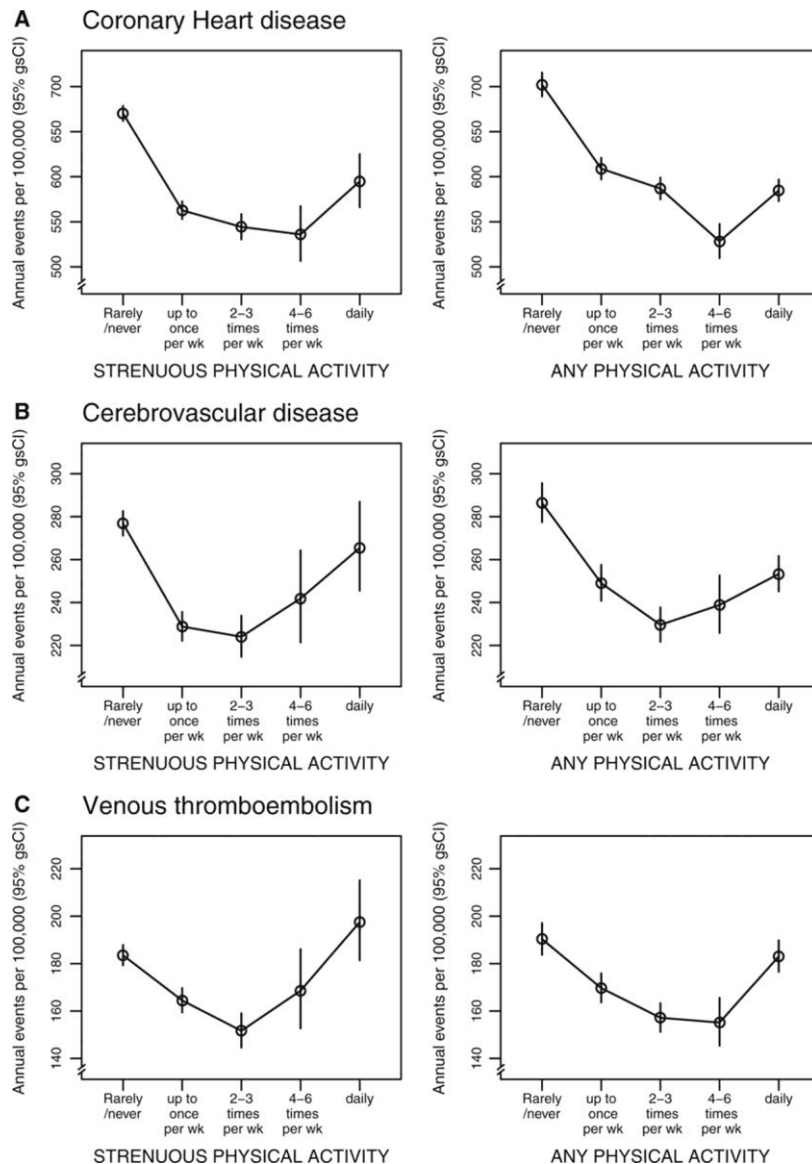


*Most favorable mortality - jog 1-2.4 h per week;
2-3x per week; slow to avg. pace

Schnohr, P. et al. J Am Coll Cardiol. 2015; 65(5):411-9.

Moderate vs Strenuous PA and CVD Risk

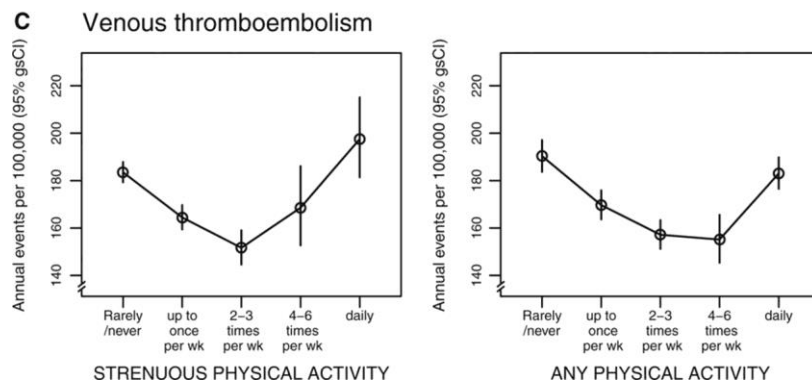
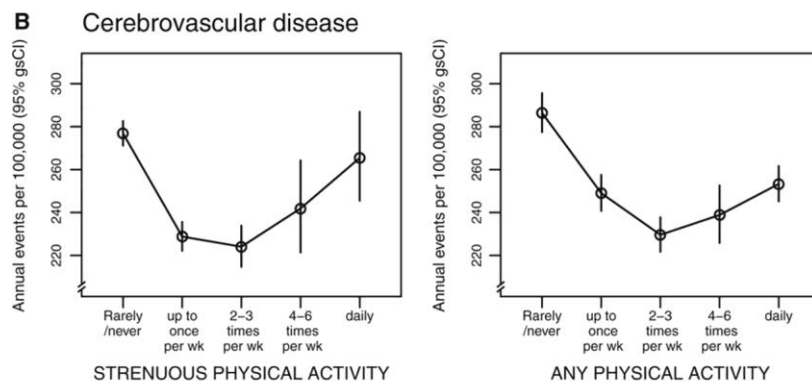
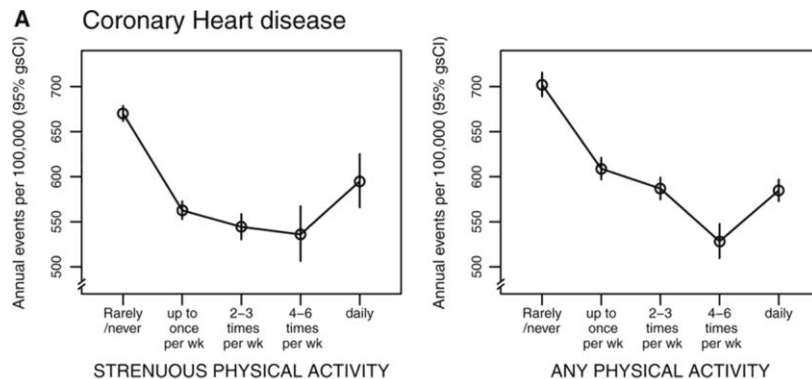
The UK Million Women Study



- Prospective cohort study
- 1.1 million women
 - Age 50 to 64
 - Self reported PA
 - 9 years follow-up
 - 49,113 CHD events
 - 17,822 CVA events
 - 14,550 VTE events
 - Controlled for BMI, smoking, Etoh and SES.

Moderate vs Strenuous PA and CVD Risk

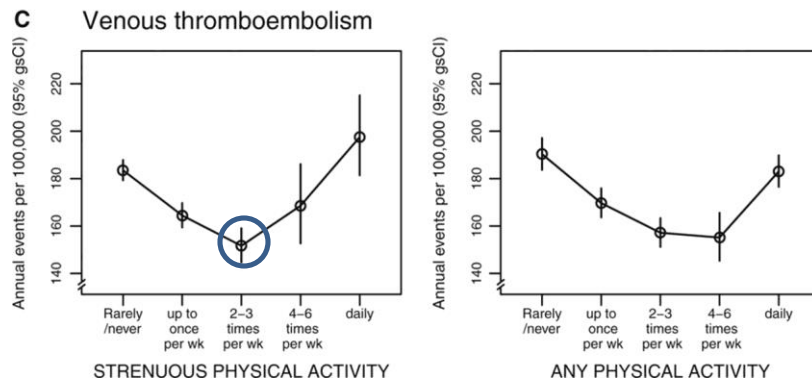
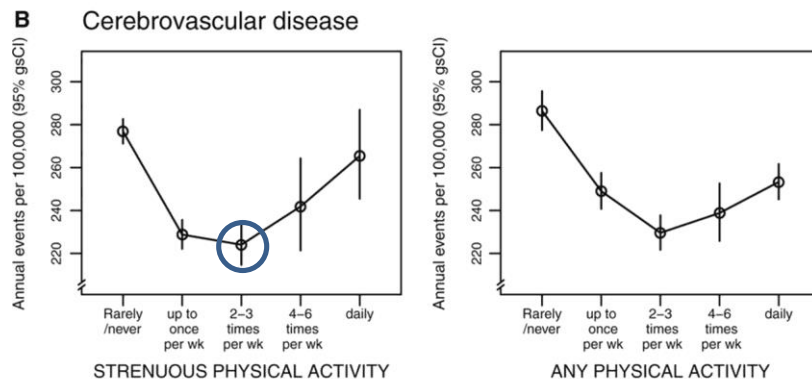
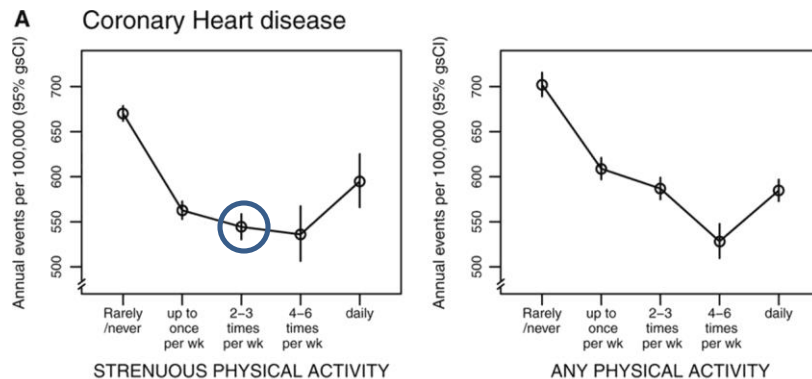
The UK Million Women Study



“Sweet Spot”
 Strenuous PA; 2-3 times/wk
 Moderate PA; 4-6 times/wk

Moderate vs Strenuous PA and CVD Risk

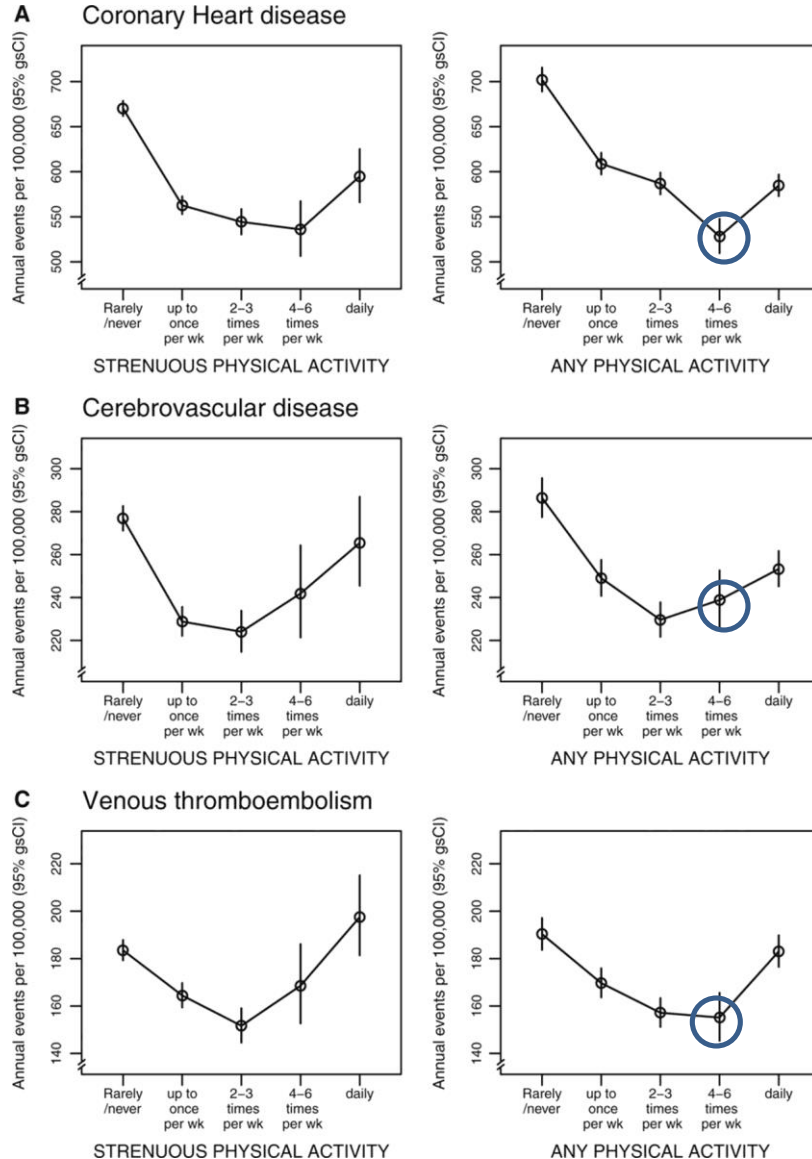
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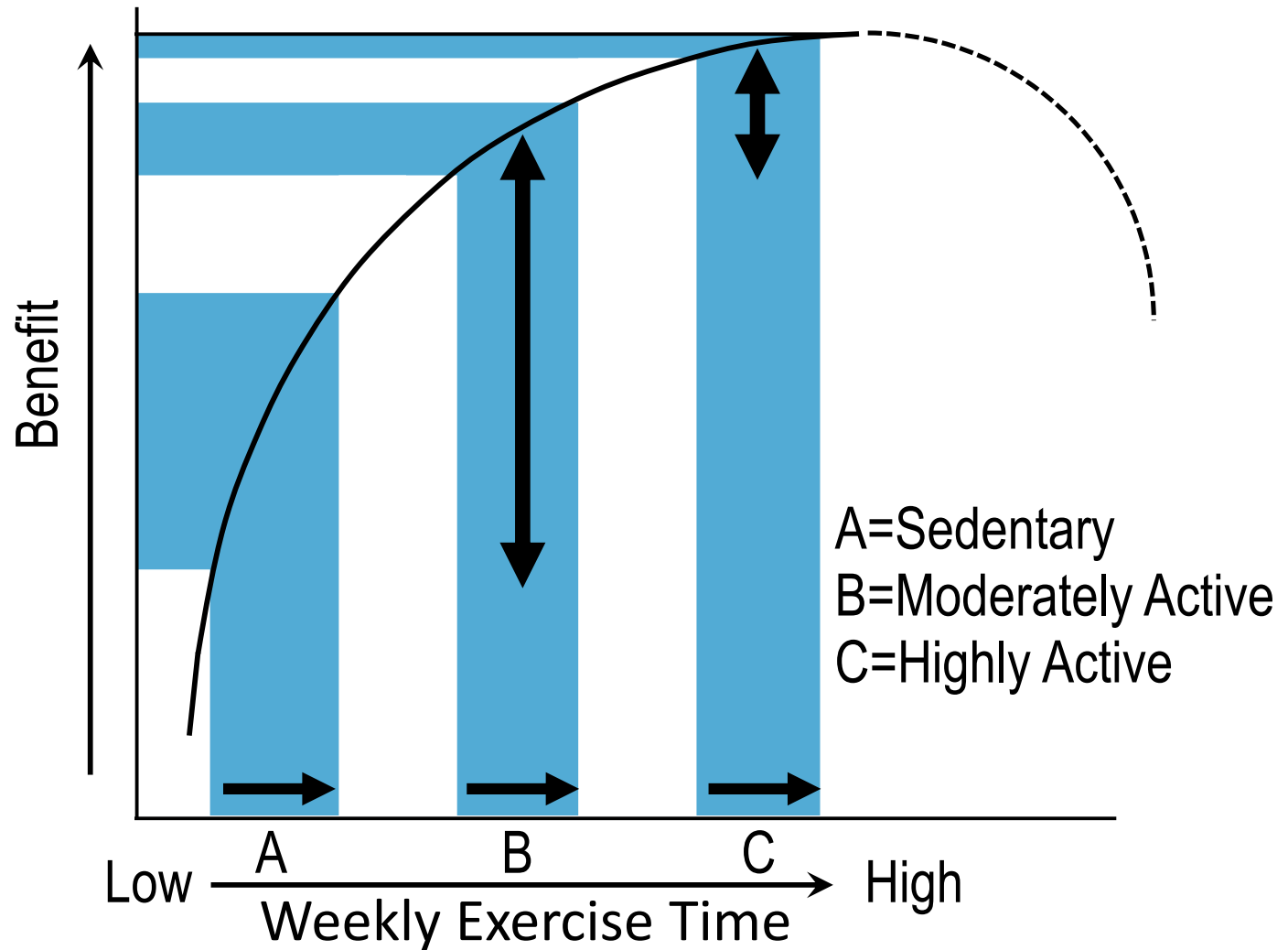
Moderate vs Strenuous PA and CVD Risk

The UK Million Women Study



“Sweet Spot”
 Strenuous PA; 2-3 times/wk
 Moderate PA; 4-6 times/wk

Dose-Response Curve for *Exercise*



Are you surprised?

- Life is about moderation – if a little is good, more is often not better.
- Is Athletes Heart really a harmless adaptation?
 - LV enlargement, EKG changes (T-inv, Q-waves, RBBB) and arrhythmia (brady, junctional, AV block).
 - After extreme endurance exercise common to see leak of CPK, Troponin and BNP.
 - Evidence of myocardial fibrosis/scarring, potentially dangerous rhythms, and accelerated CVD.
- Pheidippides' Cardiomyopathy?

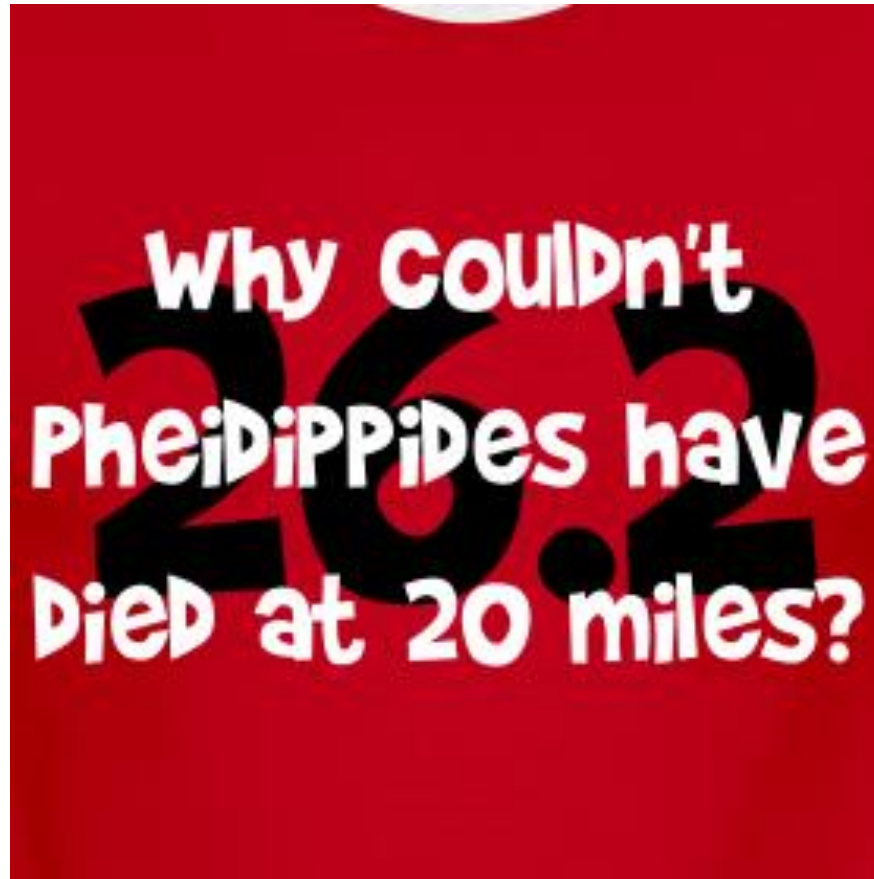
Pheidippides

- Hero of ancient Greece ran 26.2 miles from Marathon to Athens to deliver news of military victory over the Persians.



Pheidippides

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A Tale of 2 Patients;

Pick the Heart Patient

- **5'8" Tall**
- **158 lbs.**
- **Never drank alcohol**
- **Low Fat/High Fiber Diet**
- **Marathon Runner**
- **Quit smoking**
- **5'8" Tall**
- **270 lbs.**
- **Heavy drinker**
- **High Fat/Low Fiber Diet**
- **Sedentary**
- **Heavy cigarette and cigar smoker**

Jim Fixx; died age 52 while jogging

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- **Low Fat/High Fiber Diet**
- **Marathon Runner**
- **Former smoker**

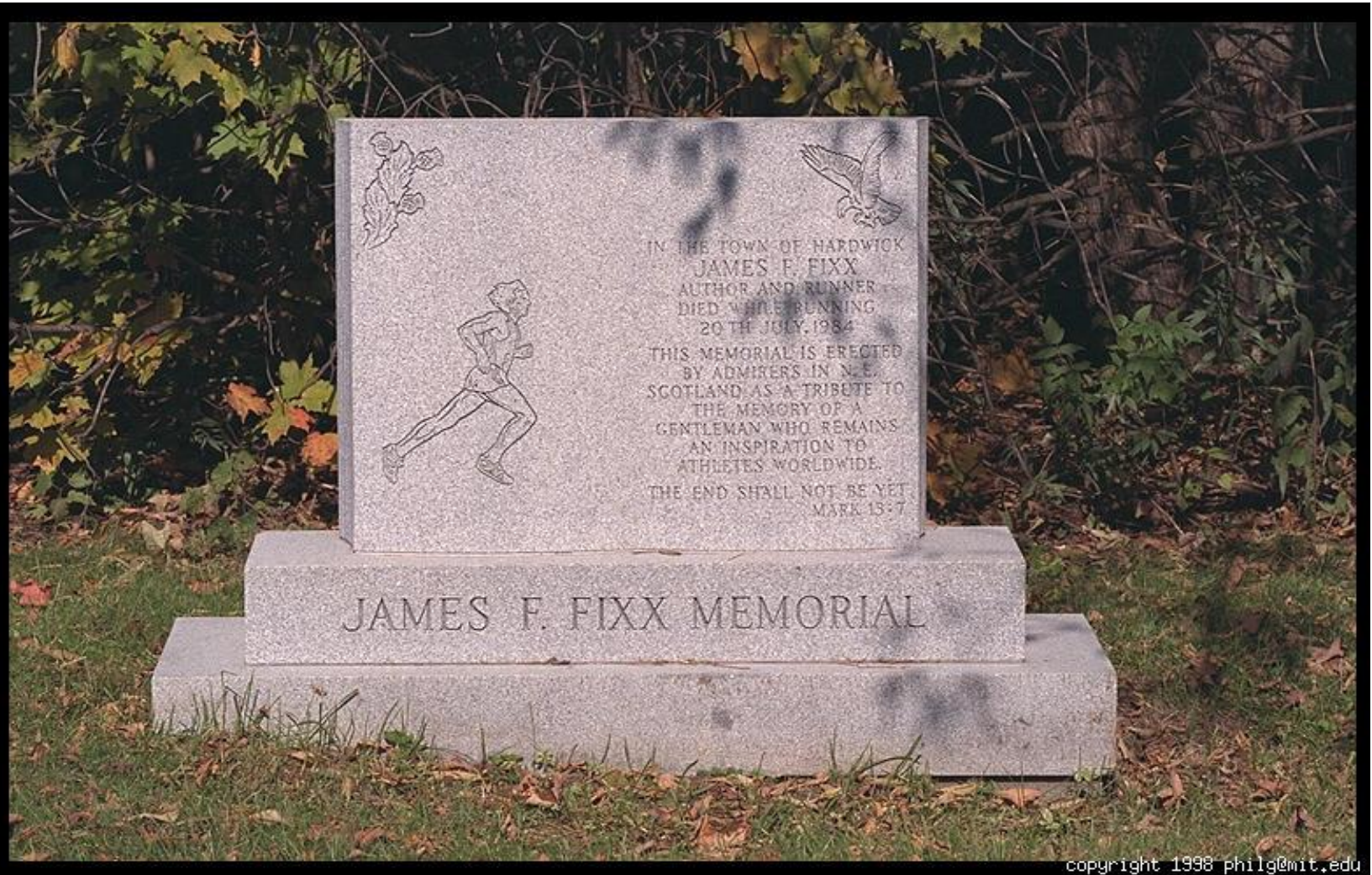


Winton Churchill; died age 90 at home

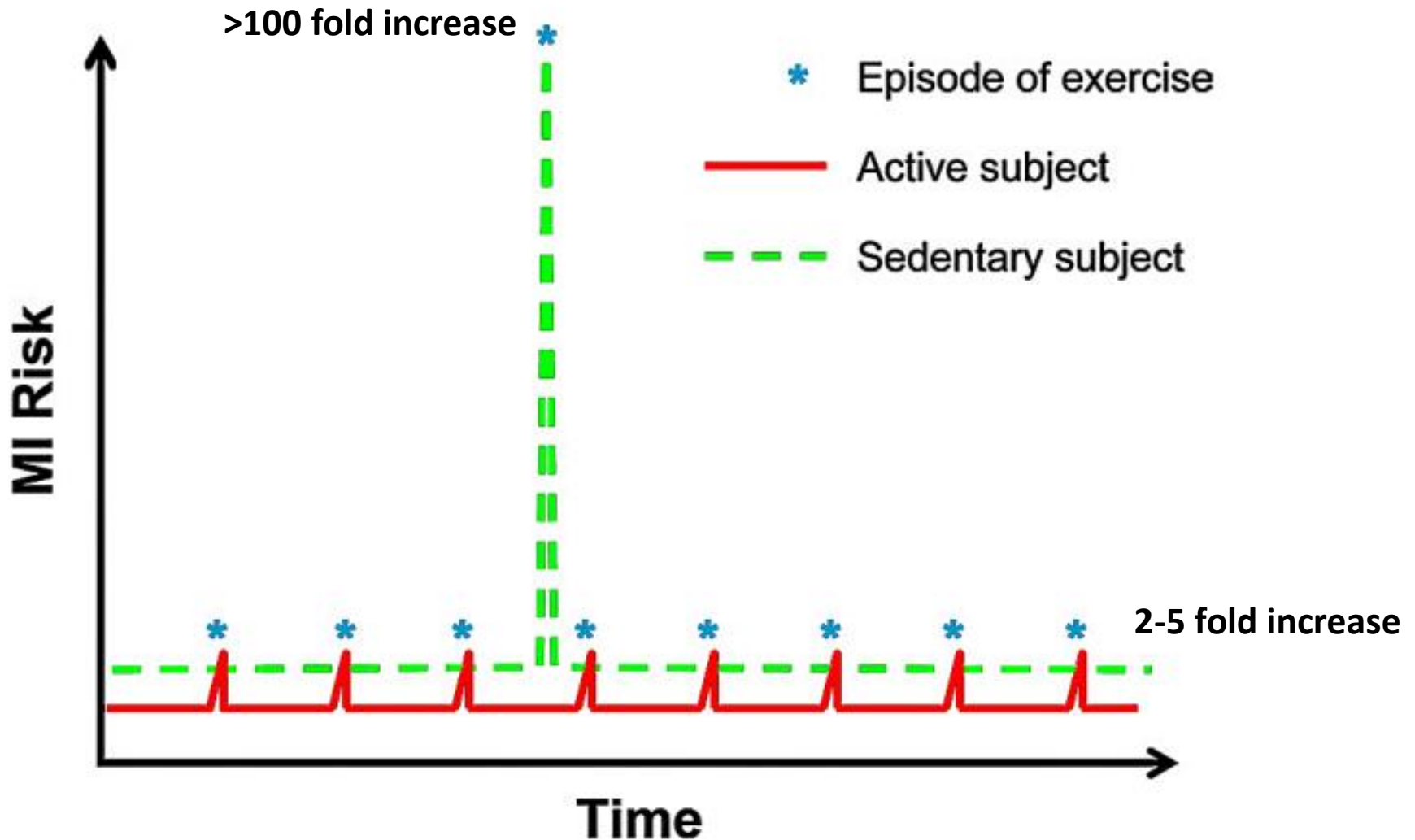


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- **Heavy cigarette and cigar smoker**

Sometimes you cannot
outrun your genes!



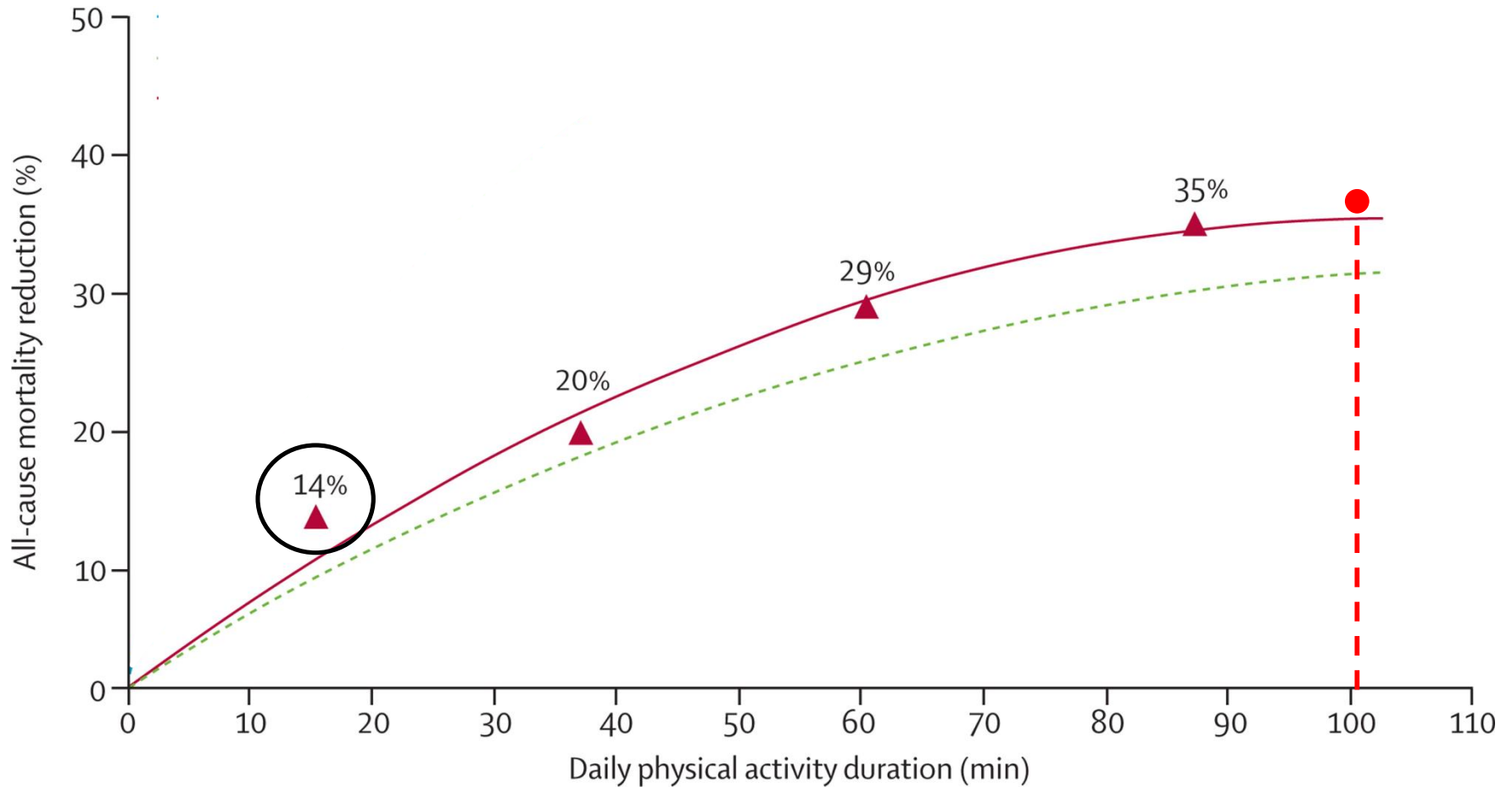
MI Risk with *Exercise*



How much walking do you need?

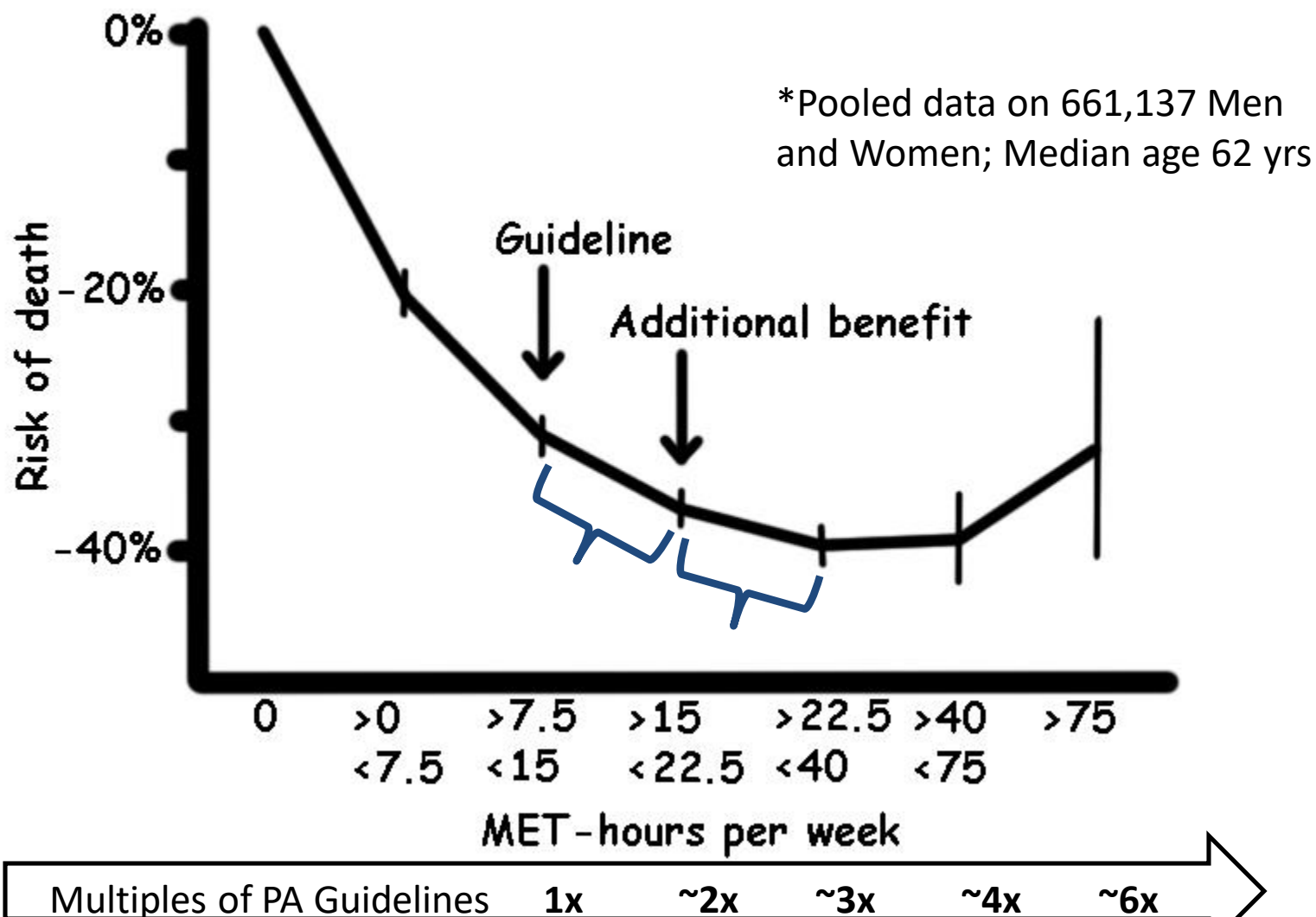
- 416,175 adults in Taiwan; Followed 8.5 years with activity questionnaires; Correlated with mortality rates
- Compared to inactive group, those doing 92 min per week (~15 min per day) walking:
 - Reduced mortality by 14%
 - 3 years longer life expectancy
 - Every 15 min per day walking, further reduced mortality by 4% (up to 100 min per day)
- Applied to both men and women

How much does walking reduce *mortality*?



Wen CP, et al; Lancet, 2011

Leisure Time PA and Mortality; A Detailed Pooled Analysis of the Dose-Response Relationship



Summary

- Exercise is Medicine that can extend life; Running & walking are great formulations.
- Like any medicine, it has an optimal dosage range, as well as sub-therapeutic and toxic ranges.
 - Running as little as 60 min per week (10 min; 6 days a week) has significant benefits.
 - Walking as little as 92 min per week (15 min; 6 days a week) has significant benefits.
 - Running >2.5 hours per week or >25 miles per week does not seem to provide health benefit and may be harmful.
 - Walking beyond 100 min per day does not seem to add benefit.
 - Extreme endurance exercise may be hazardous to heart.

Summary (continued)

- Various studies support the recommendations from the US Physical Activity Guidelines:
 - 150 min per week of moderate exercise (like brisk walk) and 60 min per day in kids.
 - 75 minutes per week of vigorous exercise (like jogging).
- Biggest benefit is going from sedentary to just moderate amounts of exercise.
- Risk of sudden death goes up with exercise, but especially in sedentary individuals.
- Don't forget the significant health benefits from strength and flexibility training.

Thank You!



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Questions?