

Move It or Lose It!

Exercise, the Life Extender

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OLLI

Tennis: My Second Love

It's not the "love of my life", but tennis is right up there among my passions

However, I often tell folks "I don't play tennis for fun - it's doctor's orders"

- I'm only half joking

Certainly I feel my best when I get in my regular game, and lousy when I don't

But will it help me live longer?

Exercise and Health

It's common knowledge that exercise is "good for you"

Yet, many folks don't avail themselves of this benefit

Why?

- Maybe they don't know just how valuable it is, or can't find an activity they enjoy enough to make it a regular part of their lives

My goal is to motivate you to find and take up regular physical activity, for your health's sake

FAQs about Exercise and Health

How strong is the evidence that regular exercise has a favorable effect on health and longevity?

How large is the effect?

Is a certain type or amount required to reap the benefit?

What are the risks of exercise?

Can you exercise too much for your own good?

Measuring Exercise

Physical activity is "work", in the technical sense of the word

Work is a force acting through a distance

- Force: Small apple (100 g) under gravity (9.8 m/s^2) weighs ~ 1 newton (weight is the force on an object due to gravity)
- Work: Lifting that apple 1 m uses 1 joule (J) of work (energy)

Power is the rate of doing work

- Measured in watts (W)
- $1 \text{ W} = 1 \text{ J/s}$

Measuring Exercise

Energy use and exercise are also measured in watts

However, larger people use more energy than smaller individuals

It's necessary to standardize energy use and exercise by body size (weight, or body surface area)

Therefore, the MET was created

- Metabolic Equivalent Task, or just metabolic equivalent

MET defined

The power consumed / produced by a person sitting at rest

- The fuel (glucose, fat, etc) used by the brain, liver, muscles, heart, kidneys and other organs and tissues for baseline functioning
- Heat is generated as the by-product of that energy utilization

$$1 \text{ MET} = 1 \text{ Cal/kg-hr} = \sim 58.2 \text{ W/m}^2$$

MET Facts

Average person (70 kg=154 lbs, 5'5") has
BSA of 1.7 m²

1 MET = 100 W for average person

- Light bulb
- Small appliance such as TV

1 MET = 70 Cal/hr for average person

Activity in METs

The intensity of an activity is the total energy expenditure during that activity measured in METs

- 1-1.5: sedentary; 1.6-2.9: light; 3-6: moderate; >6: vigorous

Cumulative activity measured in MET-h/wk

- Example: Walking 3 mph (3.3 MET) 20 minutes a day
- $7.7 \text{ MET-h/wk} = 3.3 \text{ MET} \times 1/3 \text{ h/day} \times 7 \text{ day/wk}$
- 7.5 is the recommended minimum (2008 Physical Activity Guidelines for Americans)

Activity Intensities

Light <3.0 METs*	Moderate 3.0–6.0 METs*	Vigorous >6.0 METs*
Walking—slowly = 2.0	Walking—very brisk (4mph) = 5.0;	Walking/Hiking (4.5mph)= 7.0 Jogging at 6 mph = 10.0
Sitting—using computer = 1.5	Cleaning—heavy = 3.0–3.5 (washing windows, vacuuming, mopping)	Shoveling = 7.0–8.5
Standing—light work = 2.0–2.5 (cooking, washing dishes)	Mowing lawn = 5.5 (walk power mower)	Carrying heavy loads = 7.5
Fishing—sitting = 2.0 Playing most instruments = 2.0–2.5	Bicycling—light effort (10–12 mph) = 6.0 Badminton—recreational = 4.5 Tennis—doubles = 5.0	Bicycling fast (14–16 mph) = 10.0 Basketball game = 8.0 Soccer casual = 7.0 Tennis—singles = 8.0

Calories Burned During Exercise

How many additional Calories would a 70 kg person expend while playing doubles tennis for two hours?

- Average energy expenditure during doubles tennis is 5 METs
- Additional expenditure above basal is 4 METs (that is, 5-1)
- Additional Calories expended for 70 kg person is 70 Cal/MET-hr times 4 METs times 2 hrs, or 560 Calories

Activity Intensities

2011 Compendium of Physical Activities

- Developed by NIH support as a multi-institutional collaboration, hosted at Arizona State U. School of Nutrition and Health Promotion
- Lists MET values for 821 activities (561 measured)
- Grouped by categories such as occupational, sports, conditioning, household and so on

<https://sites.google.com/site/compendiumofphysicalactivities/home>

Health Effects of Exercise

All the following are effects of physical activity supported by statistically significant research results; with regular exercise you can:

Control your weight

Reduce your risk of cardiovascular disease

Reduce your risk for type 2 diabetes and metabolic syndrome

Reduce your risk of some cancers

Strengthen your bones and muscles

Improve your mental health and mood

Improve your ability to do daily activities and prevent falls, if you're an older adult

Increase your chances of living longer

<http://www.cdc.gov/physicalactivity/basics/pa-health/index.htm>

Physical Activity & Mortality

National Cancer Institute Cohort Consortium

Subjects: 661,137 (44% men) in 6 cohorts

Follow-up: 14.2 yrs

Events: 116,686 deaths

Age: 62 (median)

Physical activity: 8 MET-h/wk (median)

Physical Activity & Mortality

JAMA Intern Med. 2015 June 1; 175(6): 959–967. doi:10.1001/jamainternmed.2015.0533.

Leisure Time Physical Activity and Mortality: A Detailed Pooled Analysis of the Dose-Response Relationship

Hannah Arem, Ph.D.¹, Steven C. Moore, Ph.D.¹, Alpa Patel, Ph.D.², Patricia Hartge, Sc.D.¹, Amy Berrington de Gonzalez, D.Phil¹, Kala Visvanathan, M.B.B.S., M.P.H.³, Peter T. Campbell, Ph.D.², Michal Freedman, J.D., Ph.D.¹, Elisabete Weiderpass, M.D., M.Sc., Ph.D.^{4,5,6,7}, Hans Olov Adami, M.D., Ph.D.^{4,8}, Martha S. Linet, M.D.¹, I-Min Lee, M.B.B.S., Sc. D.^{9,*}, and Charles E. Matthews, Ph.D.^{1,*}

Physical Activity & Mortality

The most-active individuals were:

- Younger
- Never smokers
- Lower body mass index
- Married
- Fewer co-morbidities

Physical Activity & Mortality

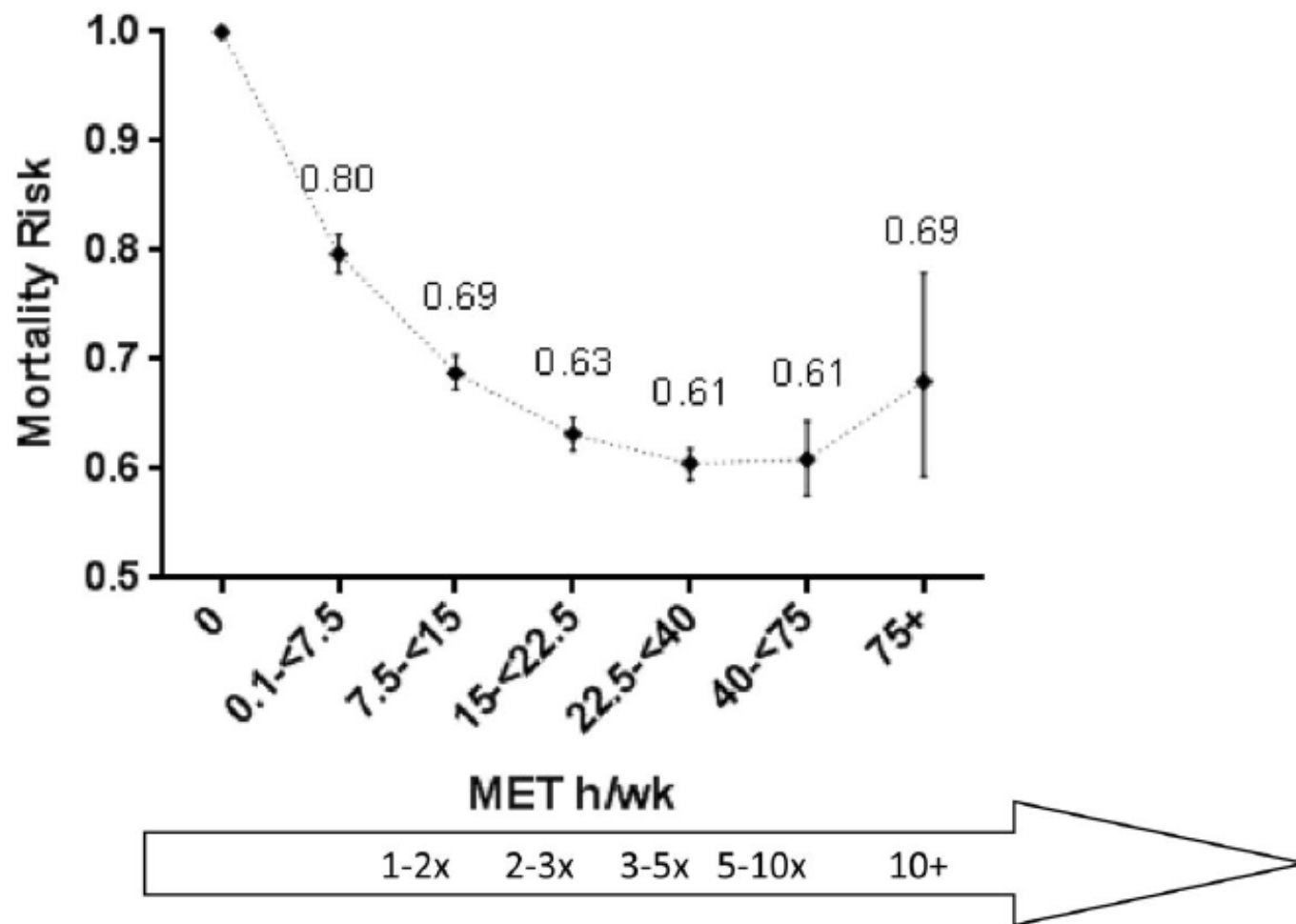


Figure 1. Hazard ratios (HRs) and 95% confidence intervals (CIs) for leisure time moderate- to vigorous-intensity physical activity and mortality^{a-c}

Physical Activity & Mortality

Any physical activity up to recommended minimum (7.5 MET-h/wk) is associated with 20% reduction in all-cause mortality, compared to no activity

Further increased PA is associated with additional reduction, up to maximum 39% reduction at 22.5-40 MET-h/wk

Highest level of activity (>75 MET-h/wk) had slightly less apparent benefit

These results were all after adjustment for other factors, including good risk factors such as lower age, smoking, and BMI

Physical Activity & Mortality

Can we conclude that increased level of physical activity was the cause of lower mortality?

Impossible to prove causality in an observational study

However, there is biological plausibility

- Exercise improves numerous parameters of good health, including lowering cholesterol, improving bone and muscle robustness, lowering blood pressure, and promoting general metabolic fitness

Risks of vigorous physical activity

Potential for arrhythmias and other cardiovascular events during acute or unconditioned extreme exertion

No evidence emerged to suggest this was a significant issue

Physical Activity & Mortality

Was vigorous physical activity more beneficial than moderate PA?

No evidence to support greater benefit of vigorous vs. moderate intensity when analyzed separately

Degree of benefit increased with increasing weekly PA quantity expressed in MET-h/wk

Conclusions

Increasing habitual physical activity is associated with progressively lower all-cause mortality, especially cardiovascular and cancer, up to 40 MET-h/wk

Further increases in PA beyond 40 do not provide additional benefit, though there appear to be no excess risks associated with even the highest intensity and durations

Moderate intensity PA is as beneficial as vigorous PA, as long as total MET-h/wk are accumulated

On the other hand, vigorous PA can accomplish similar results with less investment of time

Convinced? Ready, Set, Go!

Are you already getting enough exercise?

- If so, great! Keep it up!

But if you're not, what will it take?

- Try different activities
- Critically evaluate suitability and enjoyment
- Importantly, do you get enough of a *high* to seek it out, and do it again, and again, and again

Walking

Accounts for nearly half of all exercise undertaken by Americans

Accessible to almost everyone

- Malls are useful in cold or rainy weather

Low impact, safe

More time required to meet activity goal (METs)

- Offset by ease of access

Problematic for those with mobility issues - bad hips, knees, neurologic disorders

Jogging

Next step up from walking

Readily accessible for most

Accomplishes goal (METs) in less time

More prone to injury

More concentration required

Less enjoyable to some

Requires special clothing, shoes

Conditioning

Working out on exercise equipment or in guided group for aerobic exercise or strength training

Higher level of activity allows reaching goal (METs) in shorter time, or working toward higher goal

May require special equipment

- Cost, space impact if installed at home
- Alternatively, joining club or spa

May be more enjoyable with social aspect or higher endorphin release

Dancing

Considerable variety

- Ballroom, swing, country, cajun, square, folk dance are just a few participation dances

Availability varies by location

Cost varies by type and venue

Barriers

- Self-consciousness
- "I have no rhythm"

Sports

Tennis

- A sport one can play at almost any age
- Requires special courts, but they are generally available
- Pickleball is an up-and-coming alternative

Soccer

Basketball

Ultimate Frisbee

Hockey

Swimming

Excellent for those with mobility or lower body joint problems

Requires access to pool, but most communities provide facilities

Most important factor

Find a physical activity that is sustainable

- Enough enjoyment and accessibility to make it a regular habit, year-end and year-out