Exercise is Medicine

"Life is like riding a bicycle. To keep your balance, you must keep moving."

---Albert Einstein (1879-1955)

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Director, Human Performance Lab,
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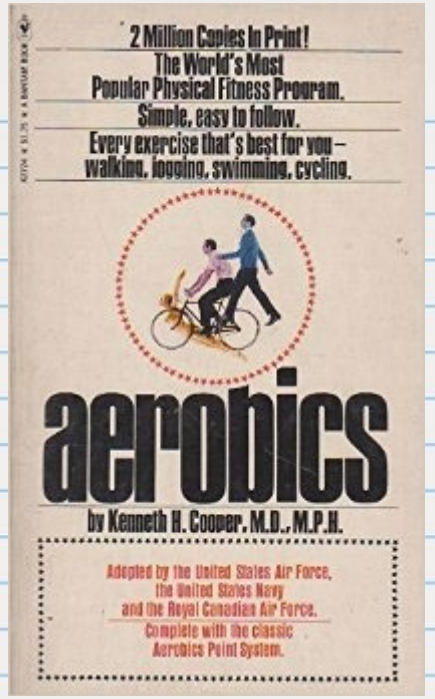
Key Guidelines for Adults

- Adults should **move more and sit less** throughout the day. **Some physical activity is better than none.** Adults who sit less and do any amount of moderate-to-vigorous physical activity gain some benefits.
- For substantial health benefits, adults should do at least ***150 minutes*** *(2 hours and 30 minutes) to* ***300 minutes*** *(5 hours) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) to 150 minutes (2 hours and 30 minutes) a week of vigorous-intensity aerobic physical activity*, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Preferably, aerobic activity should be spread throughout the week.

Key Guidelines for Adults (cont.)

- Additional health benefits are gained by engaging in physical activity beyond the equivalent of 300 minutes (5 hours) of moderate-intensity physical activity a week.
- Adults should also do muscle-strengthening activities of moderate or greater intensity and that involve all major muscle groups on 2 or more days a week, as these activities provide additional health benefits.

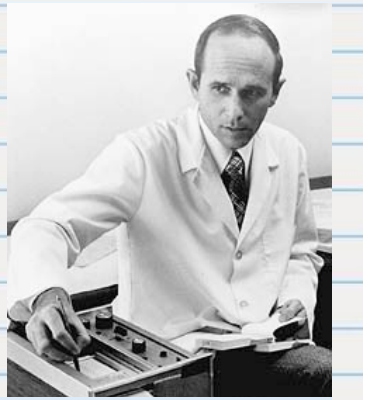


Muscular Fitness

Total Fitness

Aerobic Fitness

Charles Atlas, Mid-1900s



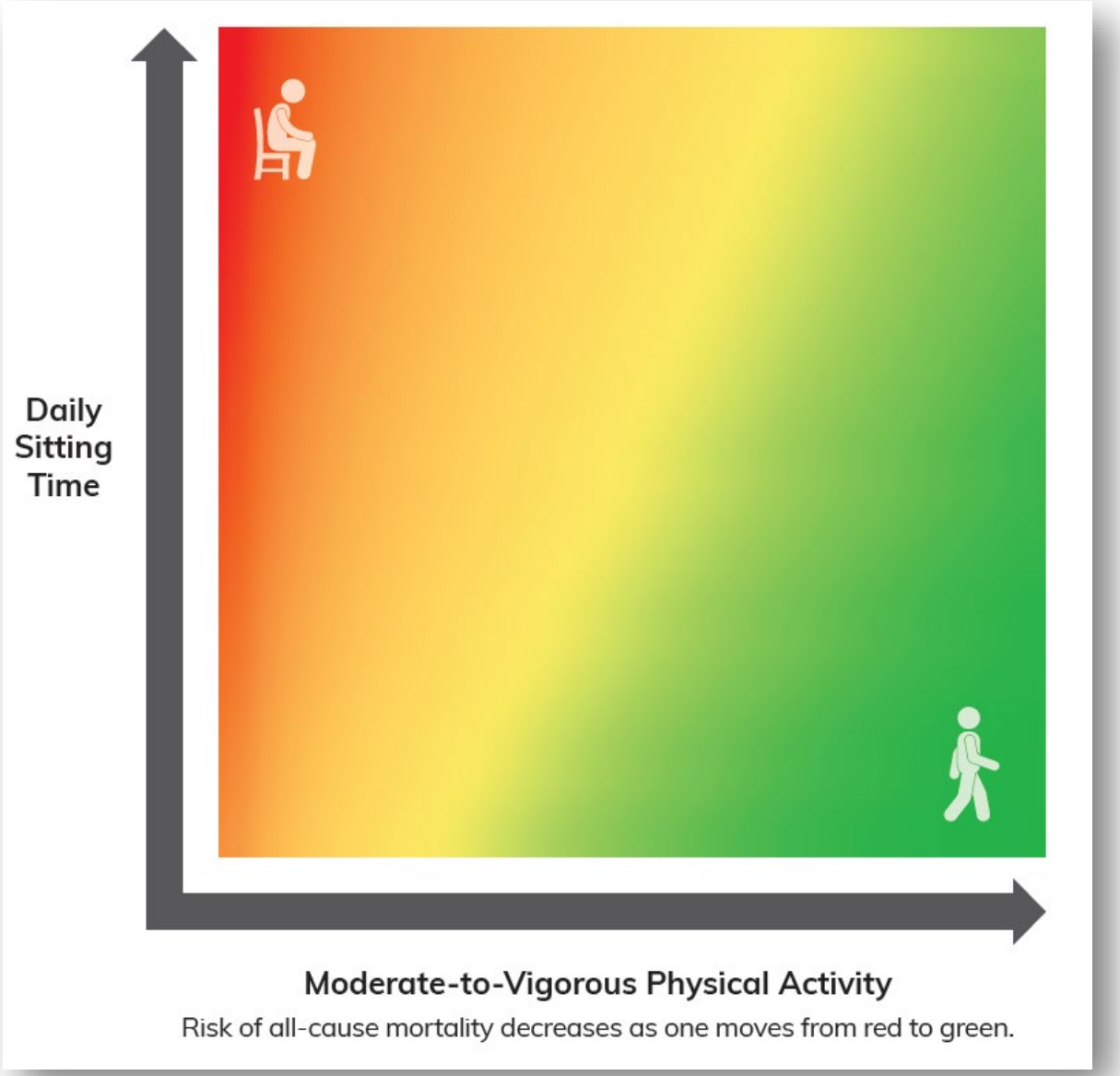
Ken Cooper, 1968

Your Exercise Program Should Build Fitness In 3 Ways:

- **Aerobic fitness:** A fit heart and lung system that is built up from regular, vigorous whole-body activity such as swimming, cycling, running, uphill walking, basketball, soccer, and other similar sports, intense manual labor.

- **Muscular fitness:** Strong and enduring muscles that are developed from near-daily calisthenics (e.g., push-ups, sit-ups, chin-ups, leg squats), weight lifting, and intense manual labor (e.g., chopping wood, digging, carrying loads).

- **Healthy body weight:** An optimal amount of body fat this is earned through careful eating and at least one hour of physical activity each and every day.

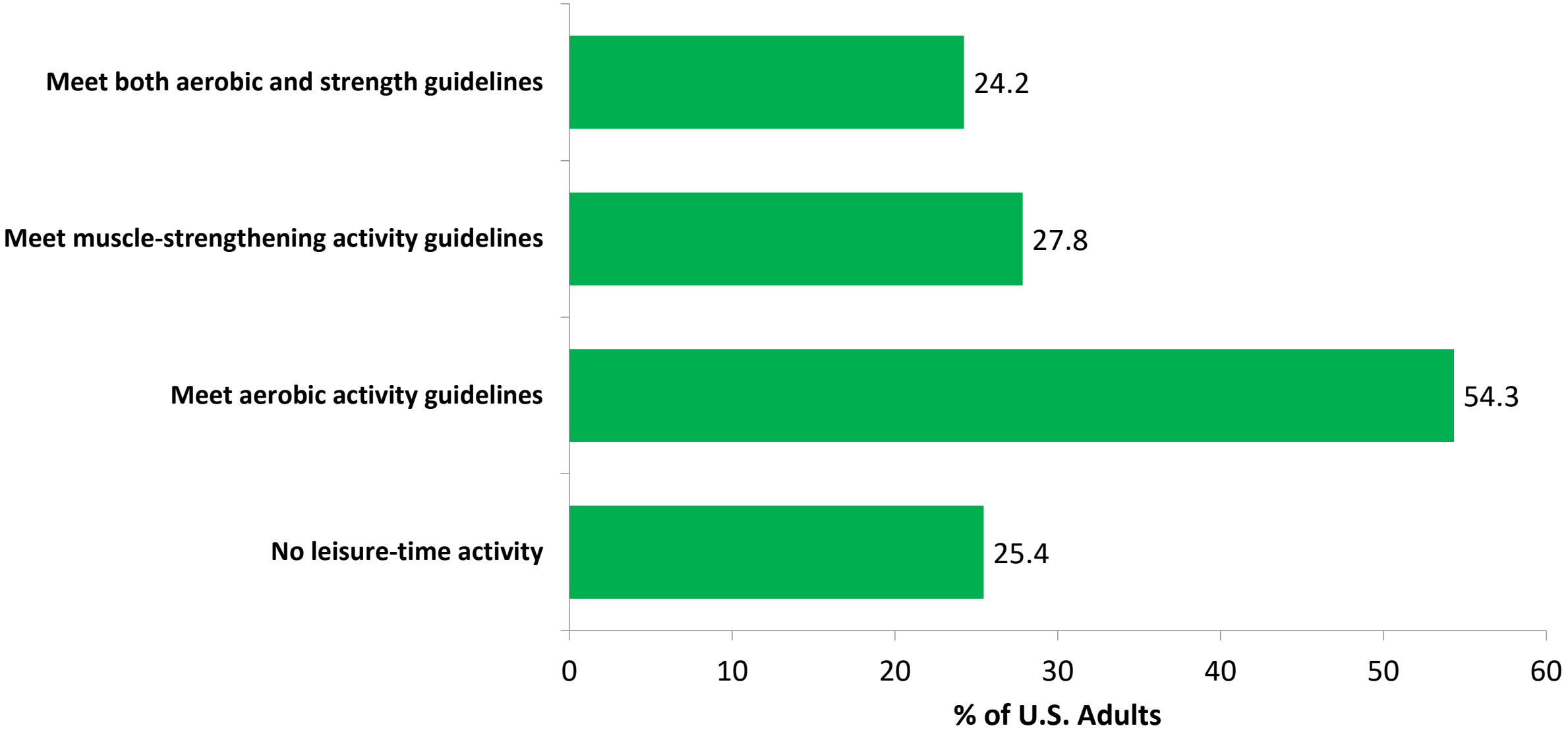


Adults should move more and sit less throughout the day. Some physical activity is better than none. Adults who sit less and do any amount of moderate-to-vigorous physical activity gain some health benefits.

U.S. Department of Health and Human Services. *Physical Activity Guidelines for Americans, 2nd edition*. Washington, DC: U.S. Department of Health and Human Services; 2018.

Current Activity Levels of American Adults

Only 24.2% of adults meet guidelines for both aerobic and muscle-strengthening activity. Aerobic guidelines: 150 min/wk of moderate activity or 75 min/wk of vigorous activity, or equivalent combination.



Reasons Why Adults Do Not Exercise

- Not enough time (#1 reason)
- Too inconvenient
- Lacked motivation
- Exercise not enjoyable
- Exercise was boring
- Feared being injured
- Lacked confidence in ability to stick with an exercise program

Ways to Increase Lifestyle Physical Activity

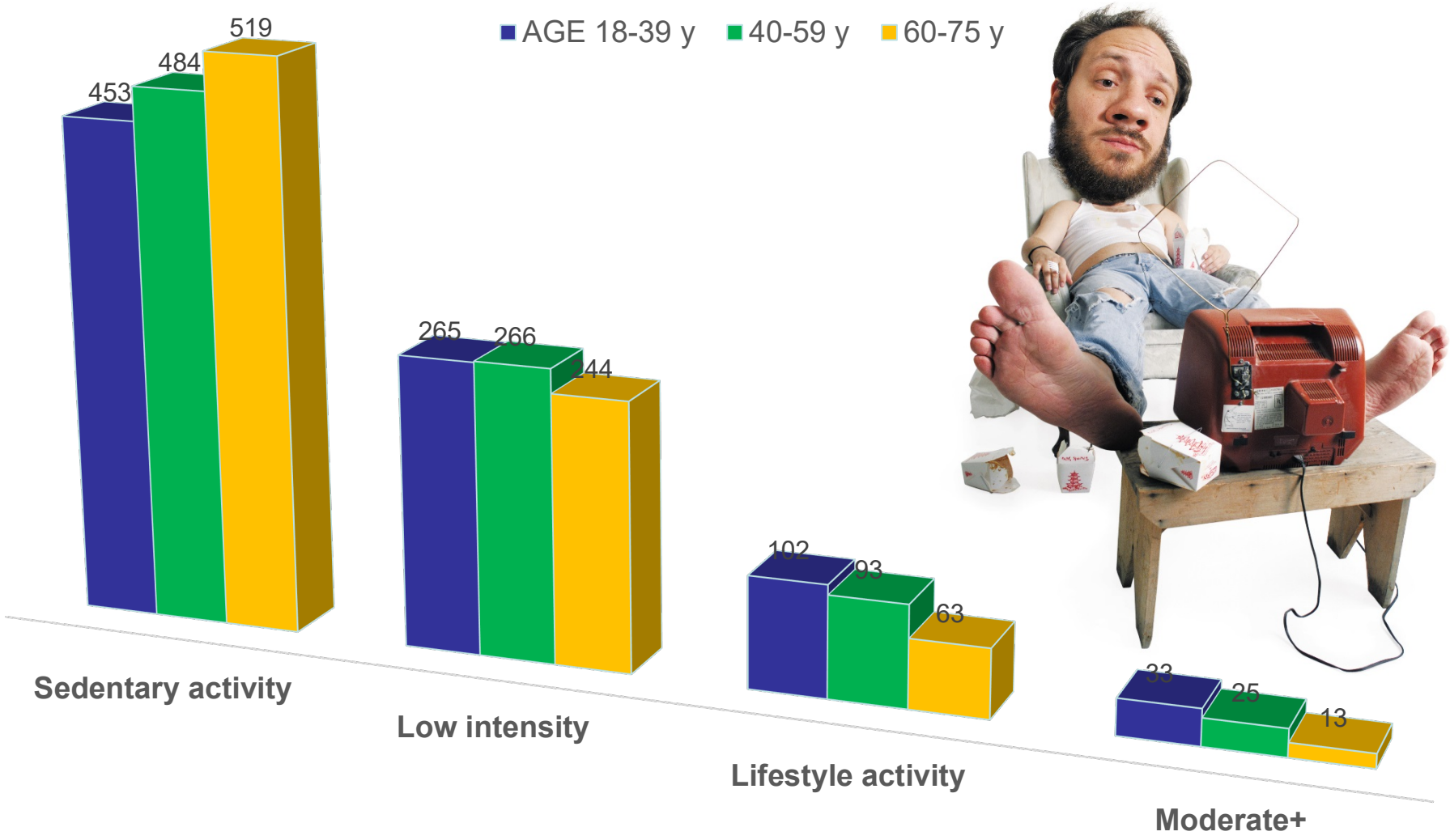
- Walk, cycle, jog, or skate to work, school, or the store
- Park the car farther away from your destination
- Get on or off the bus several blocks away
- Take the stairs instead of the elevator or escalator
- Walk the dog
- Play sports with the kids
- Take fitness breaks instead of coffee breaks
- Perform gardening, landscaping, or home repair activities
- Avoid labor-saving devices as much as practical
- Take a walk after supper instead of watching TV

Move More and Sit Less

2018 Physical Activity Guidelines for Americans

- **Sedentary behavior** refers to any waking behavior characterized by a low level of energy expenditure (less than or equal to **1.5 METs**) while sitting, reclining, or lying.
- Sedentary behavior is a highly prevalent behavior in the U.S. population. Children and adults spend approximately **7.7 hours per day** (55% of their monitored waking time) being sedentary.
- There is a strong relationship between time in sedentary behavior and the **risk of all-cause mortality and cardiovascular disease mortality in adults**.

Minutes Per Day, Accelerometer Data, US Adults (N=2925)



U.S. adults are sedentary 7.6 to 8.6 h/day.

Am J Epidemiol 2010;171:1055–1064

Standing Duration and All-Cause Mortality

Prospective study of 221,240 adults (45 y age and older) followed from 2006 to 2012. Results not influenced by BMI, physical activity, or gender. *Prev Med 2014;69:187-91.*

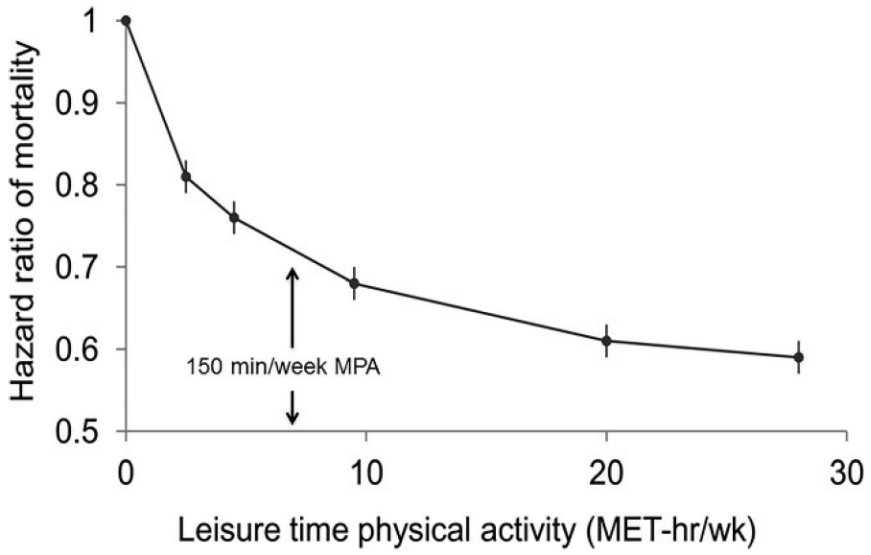
Benefits of Physical Activity for Adults and Older Adults
2018 Physical Activity Guidelines for Americans

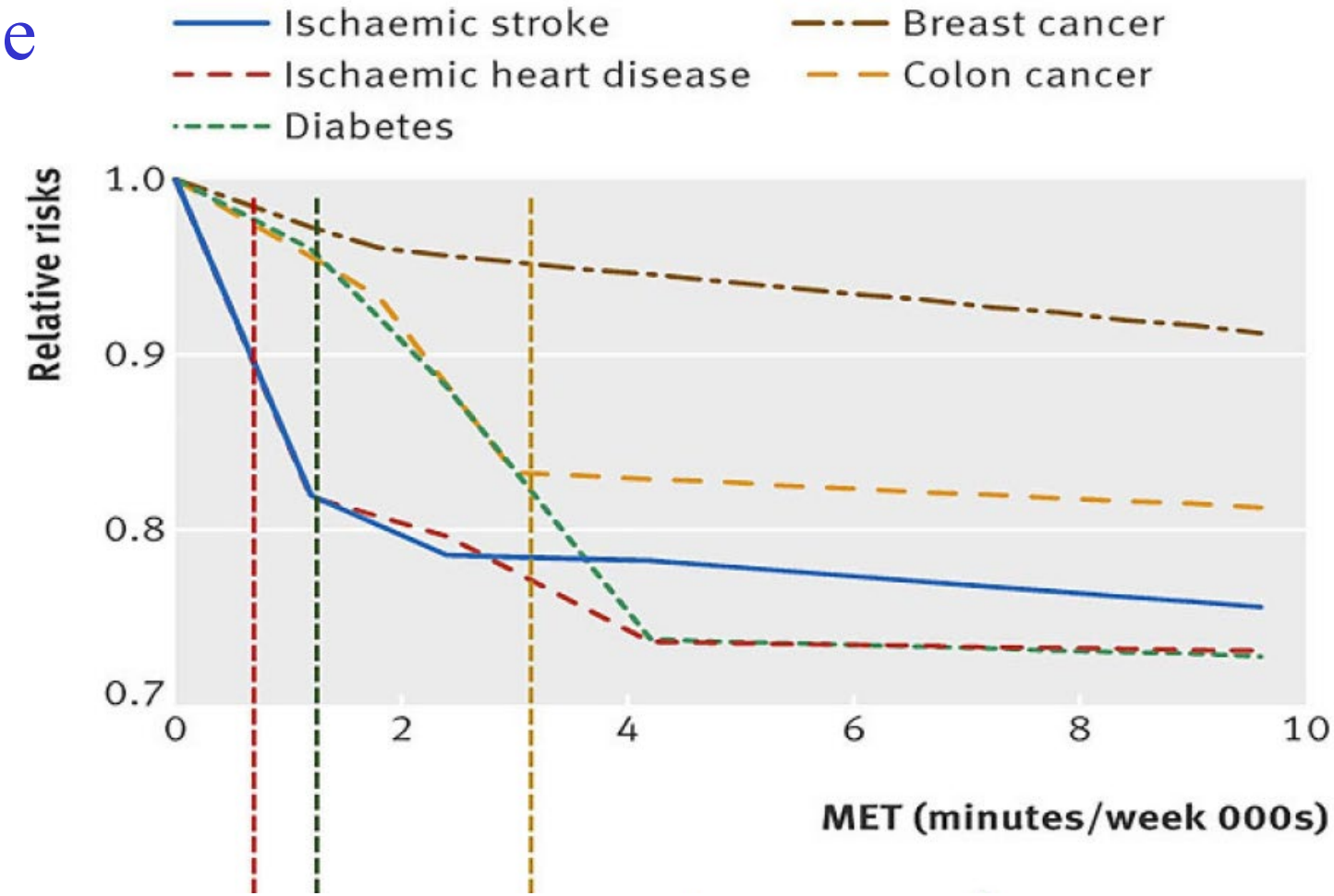
- Lower risk of all-cause mortality and cardiovascular disease mortality
- Lower risk of hypertension
- Lower risk of type 2 diabetes
- Lower risk of adverse blood lipid profile
- Lower risk of cancers (bladder, breast, colon, endometrium, esophagus, kidney, lung, stomach)
- Improved cognition and reduced risk of dementia (including Alzheimer's disease)
- Improved quality of life, reduced anxiety and depression, and improved sleep
- Slowed weight gain, weight loss (when combined with reduced calorie intake)
- Improved bone health
- Improved physical function
- Lower risk of falls and related injuries (older adults)

Moore et al. PLoS Med 2012;9(11):e1001335. Association of leisure time physical activity with mortality during follow-up in pooled data from six prospective cohort studies in the National Cancer Institute Cohort Consortium, comprising **654,827 individuals, 21–90 y of age**. Adjusted survival, 40+ years of age. 7.5 MET-hr/wk is equivalent to brisk walking (3 METS) 2.5 h per week on average.

Exercise and Heart Disease

Meeting the 2008 PA guidelines reduces mortality and CVD risk to about 75% of the maximal benefit; risk drops even more with greater amounts---with no risk.





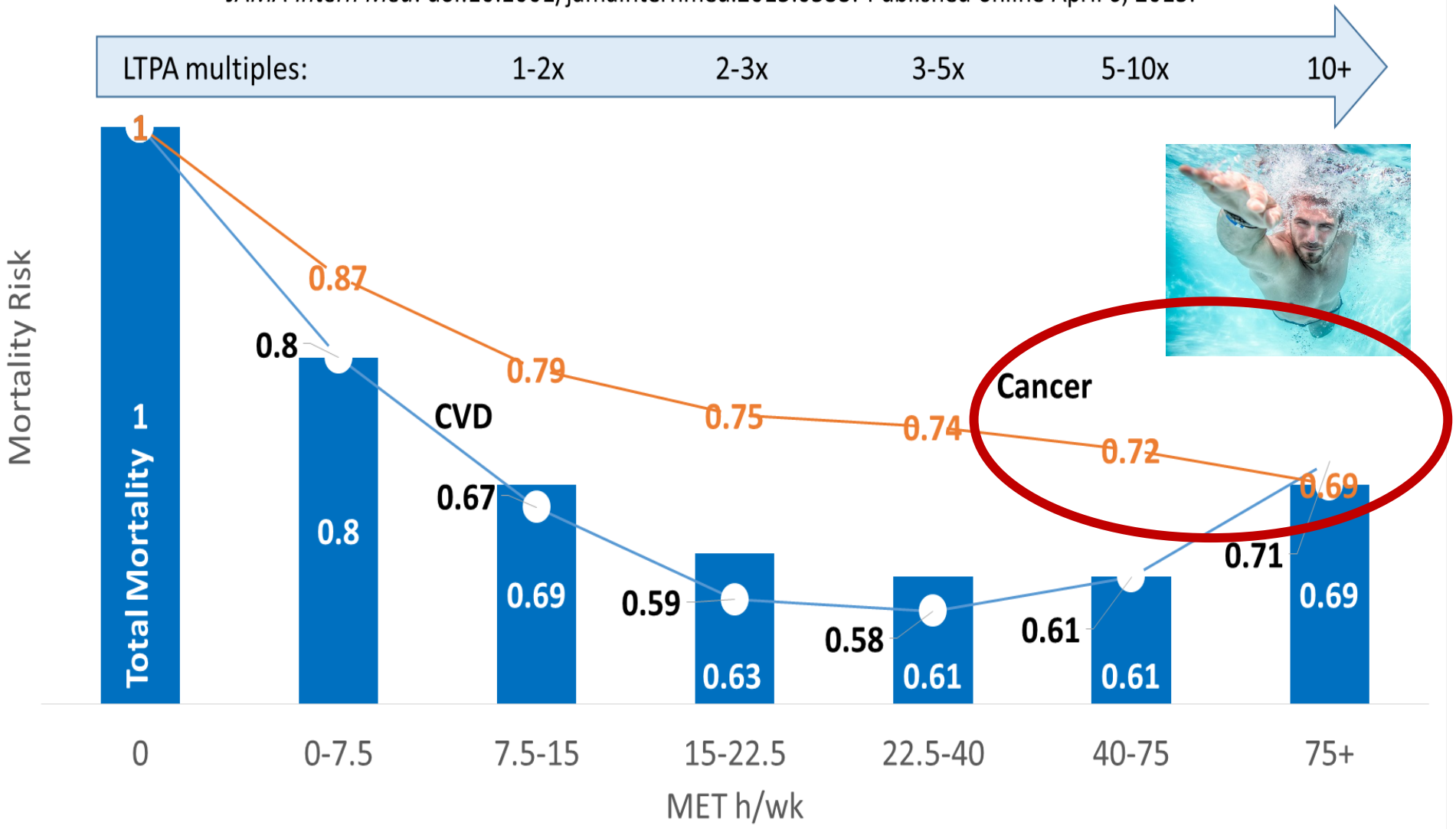
Physical activity guidelines

Med. Sci. Sports Exerc., Vol. 51, No. 6, pp. 1270–1281, 2019

LEISURE-TIME PHYSICAL ACTIVITY (LTPA) & MORTALITY DOSE RESPONSE

Pooled data, 661,137 participants, 14.2 follow-up years, 116 686 deaths.

JAMA Intern Med. doi:10.1001/jamainternmed.2015.0533. Published online April 6, 2015.



American Heart Association (AHA) Ideal Cardiovascular Health Metrics

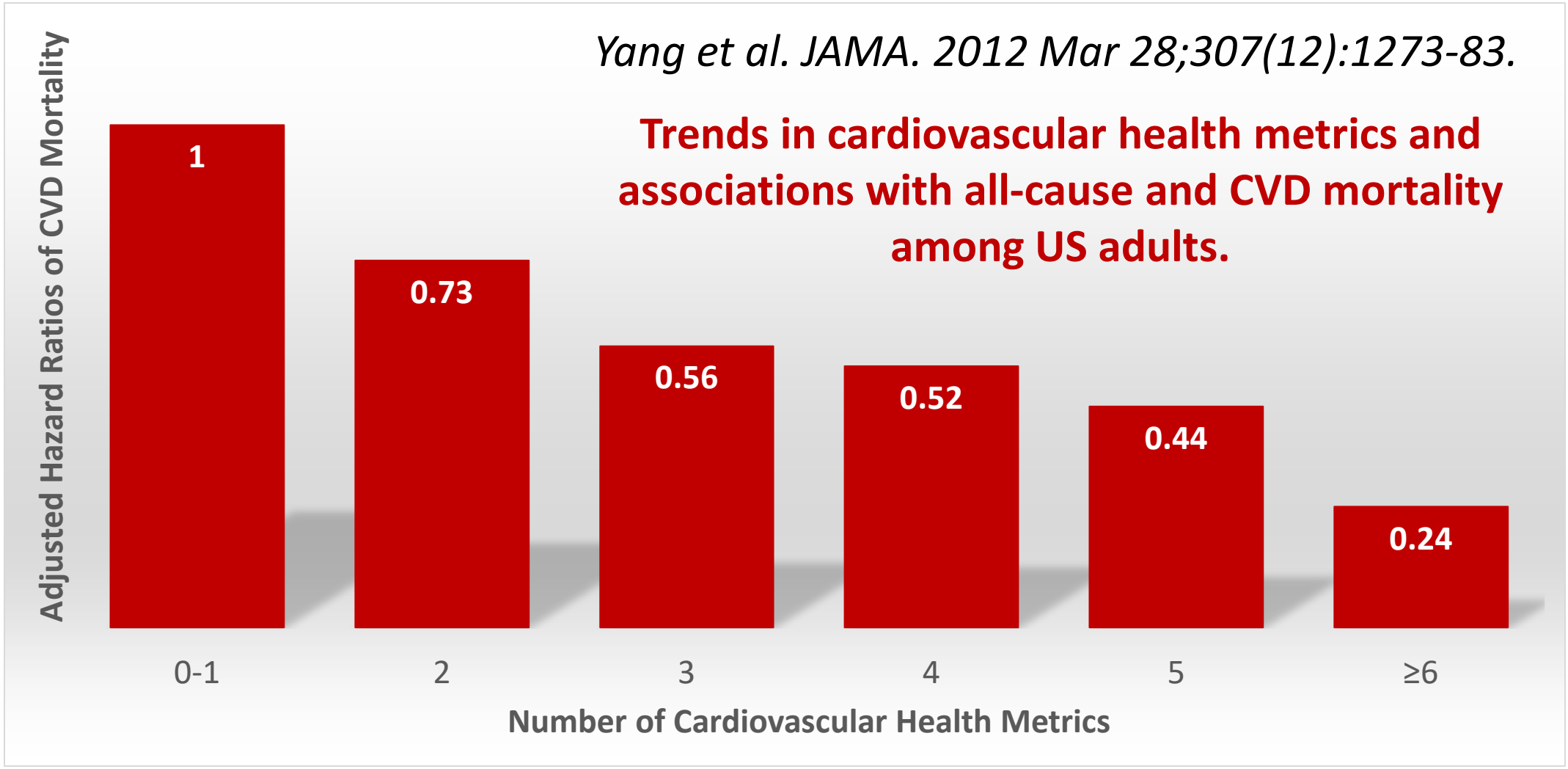
Circulation. 2010;121:586–613; JAMA. 2012;307:1273-83.

(Only 4.6% have 6 or 7; 18% have 5 or more).

- Current smoking status: Never or quit
- Body mass index: <25 kg/m^2 for adults or <85th percentile for children and adolescents
- Physical activity: 150 min/wk of moderate or 75 min/wk of vigorous for adults; 60 min/d of moderate to vigorous activity for children and adolescents
- Health diet score: Meet 4 to 5 of AHA identified healthy diet goals
- Total cholesterol: <200 mg/dL for adults; <170 mg/dL for children and adolescents
- Blood pressure: 120/<80 mm Hg for adults; 90th percentile for children and adolescents
- Fasting plasma glucose: <100 mg/dL for adults, children, and adolescents

American Heart Association (AHA) Ideal Cardiovascular Health Metrics: Healthy Diet Score

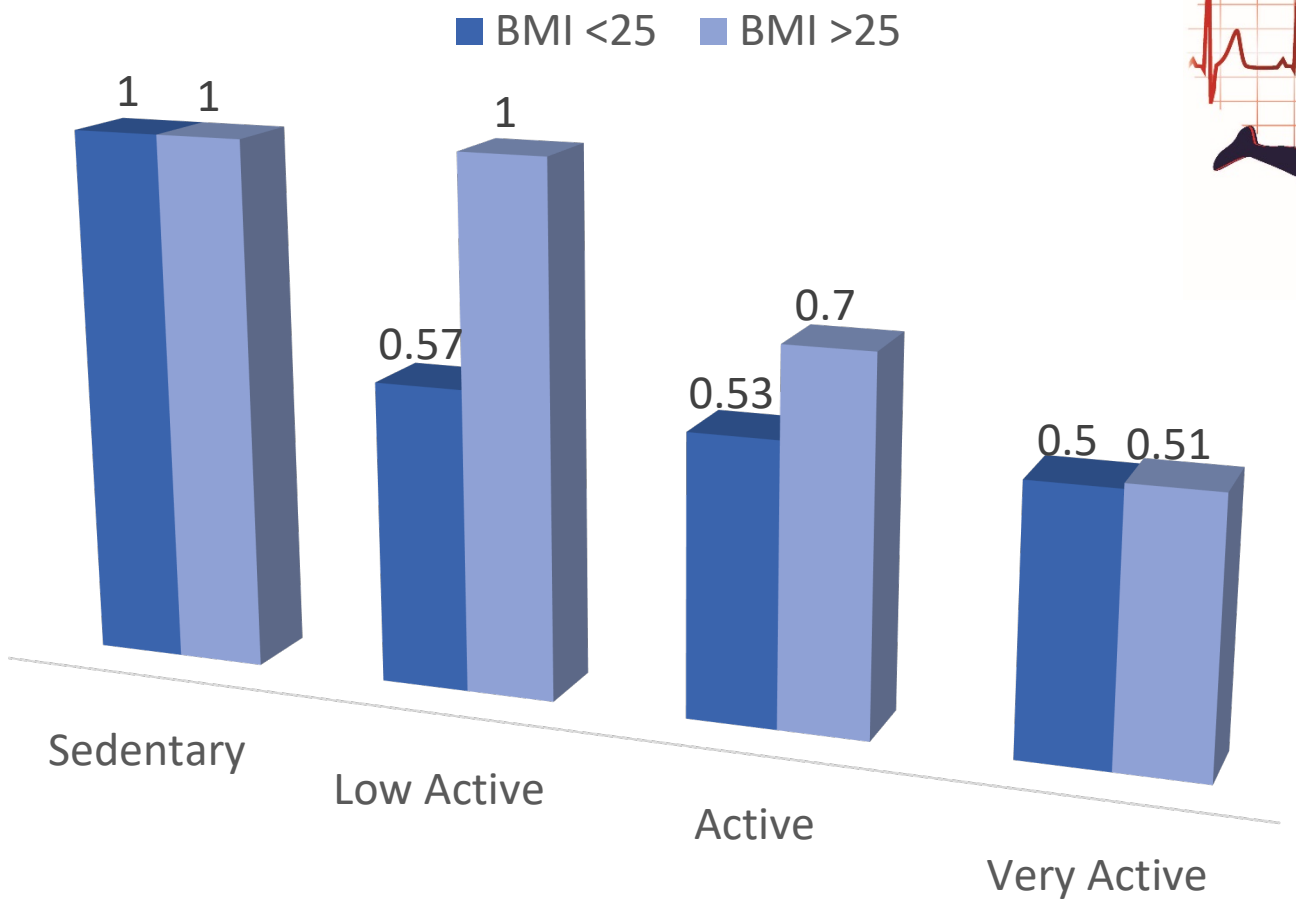
From more extensive recommendations and in context of an energy balanced diet, AHA identified 5 primary dietary goals to serve as a healthy diet score
Basis: 2000-calorie diet
• Fruits and vegetables: ≥4.5 cups/d
• Fish: ≥ two 3.5-oz servings/wk (preferable oily fish)
• Fiber-rich whole grains: ≥ three 1-oz equiv/d
• Sodium: <1500 mg/d
• Sugar-sweetened beverages: ≤450 cal (36 oz)/wk (1/4 of a week's discretionary calories)



Risk of CVD mortality is inversely related to the number of CVD health metrics in this study of 45,000 individuals in the NHANES mortality study. CVD risk was 76% lower in individuals with six or seven ideal health metrics compared with zero ideal health metrics

RISK ASSESSMENT: www.heart.org/mylifecheck/

Physical Activity Level and Incident Type 2 Diabetes



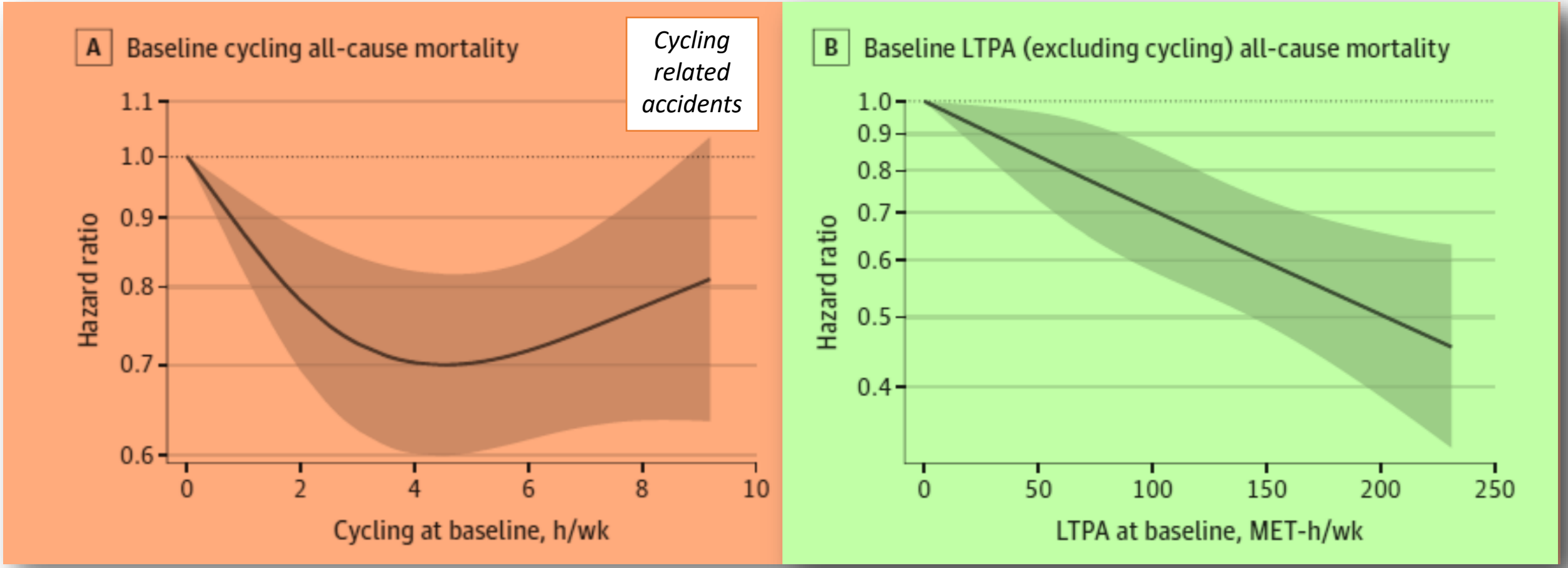
N=6348 adults, 7.9 y, 478 incident cases type 2 diabetes. Higher physical activity associated with substantial reduction in risk of type 2 diabetes. *Med. Sci. Sports Exerc., Vol. 47, No. 4, pp. 751–756, 2015*

Exercise Reduces Mortality and CVD Death Rates in Individuals with Diabetes

***7459 adults with diabetes**, 14.9 years follow-up, 1673 deaths from all causes.*

European Prospective Investigation into Cancer and Nutrition (EPIC) study cohort.

JAMA Intern Med. doi:10.1001/jamainternmed.2021.3836; Published online July 19, 2021.



Exercise: "fifth vital sign" should be recorded in patients' electronic medical records and routine histories.

Khan et al. Lancet 2012; 380: 59–64

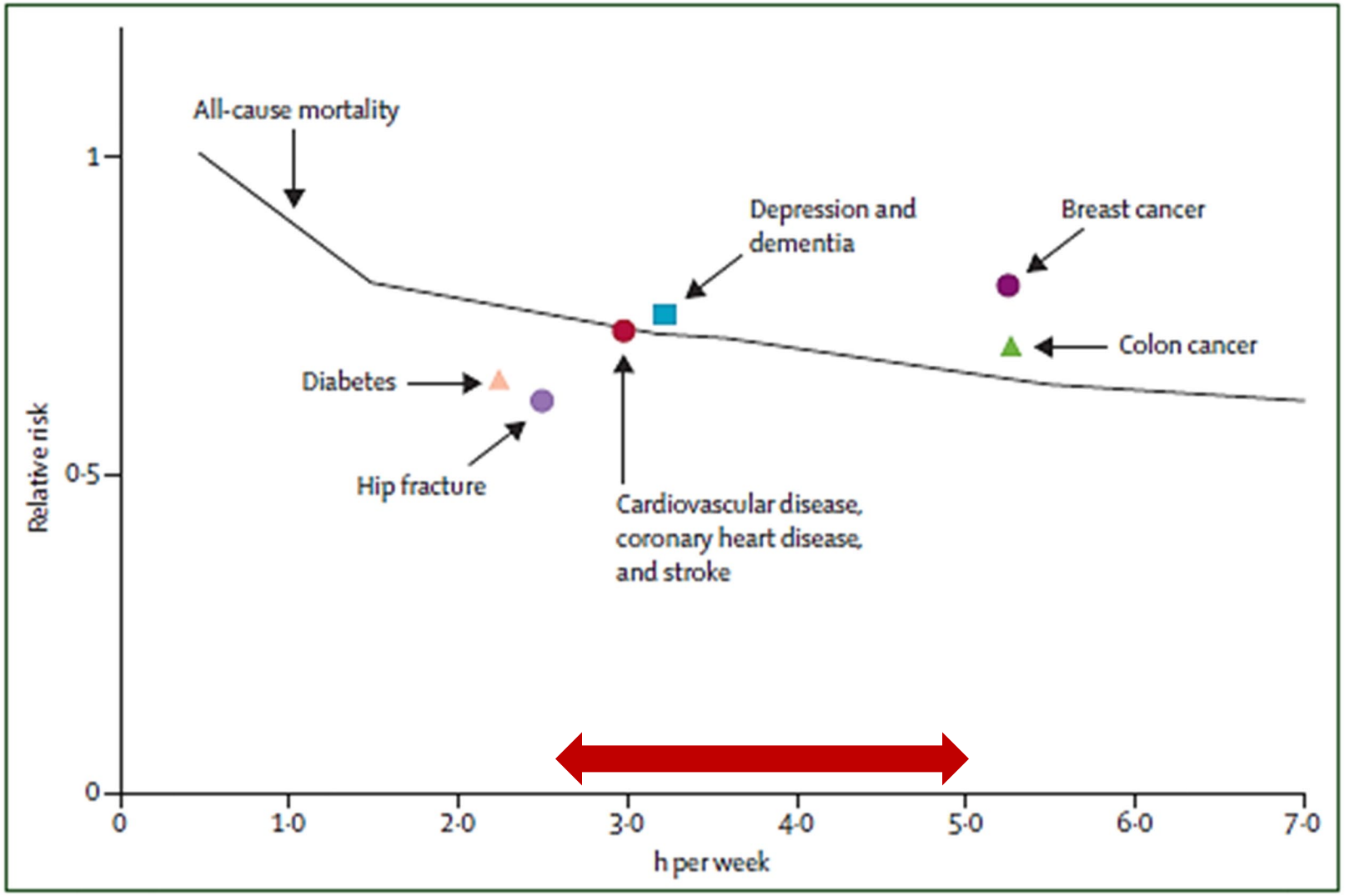


Figure 2: Associations of moderate-to-vigorous physical activity with key health events, including all-cause mortality

Estimated Life Expectancy at Age 50 According to Lifestyle Factors





+14 y

+12.2 y

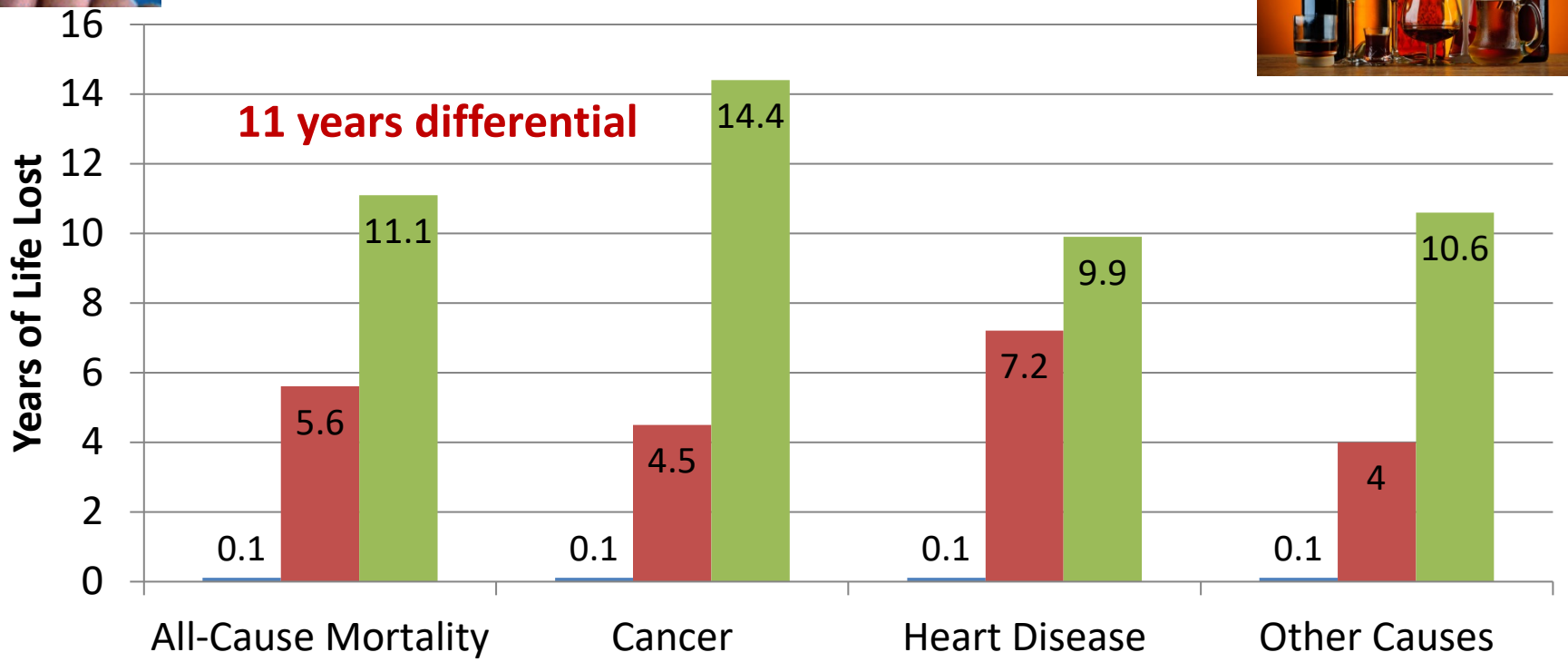
Number of Low-Risk Lifestyle Factors	Male	Female
Zero	29	25.5
One	31.5	27.7
Two	34	30.4
Three	36.7	32.2
Four	38.9	35.4
Five	43.1	37.6

Life Expectancy At Age 50 Years

Circulation. 2018 Jul 24;138(4):345-355.

123,000 followed 34 years (42,167 deaths): 5 low-risk lifestyle factors: never smoking, BMI 18.5 to 24.9 kg/m^2, ≥30 min/d of moderate to vigorous physical activity, moderate alcohol intake, and a high diet quality score (upper 40%).

High-Risk Lifestyle Behaviors and All-Cause Mortality (NHANES Mortality Study)



Relationship between 4 high-risk behaviors—current/former smoking, unhealthy diet, inadequate physical activity, and non-moderate alcohol consumption—and mortality in NHANES 16,958 participants.

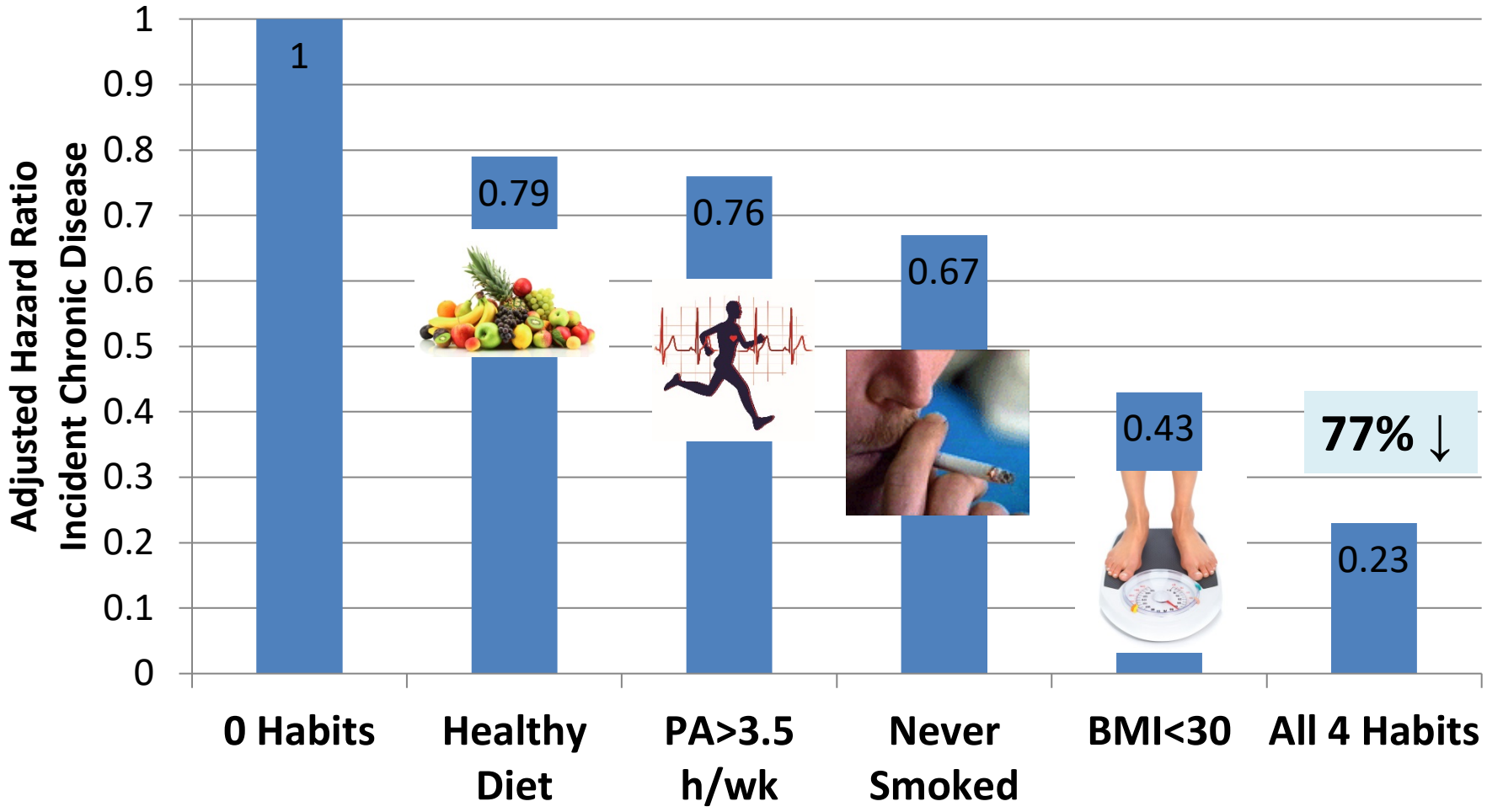
Ford et al. Am J Public Health. 2011;101:1922–1929.

Findings From the European Prospective Investigation Into Cancer and Nutrition–Potsdam Study

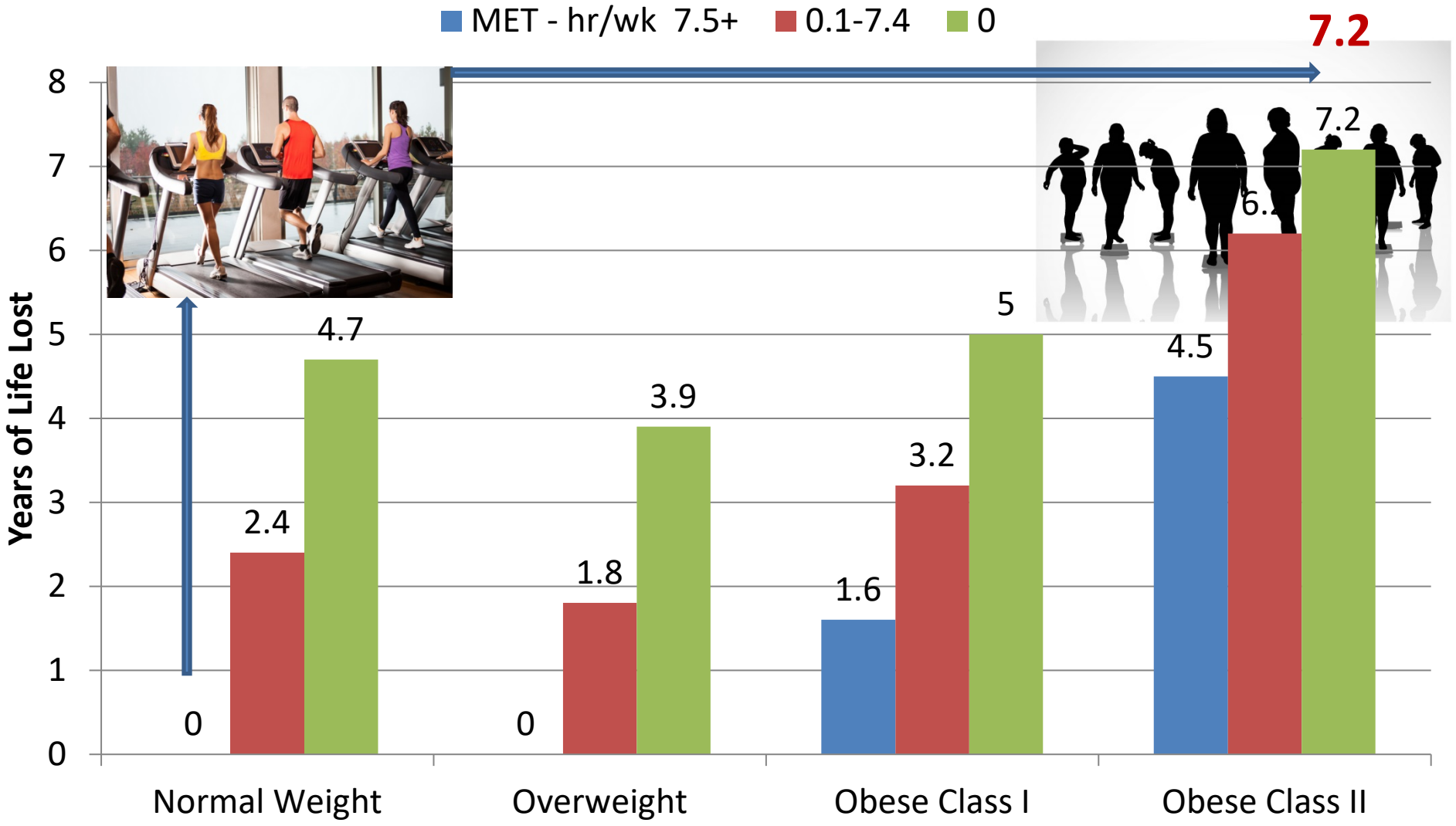
Ford et al. Arch Intern Med. 2009 Aug 10;169(15):1355-62.

23,153 German participants, aged 35 to 65 years, followed 8 yrs.

HEALTH HABITS: never smoked, BMI<30, >3.5 h/wk activity, plant-based diet.

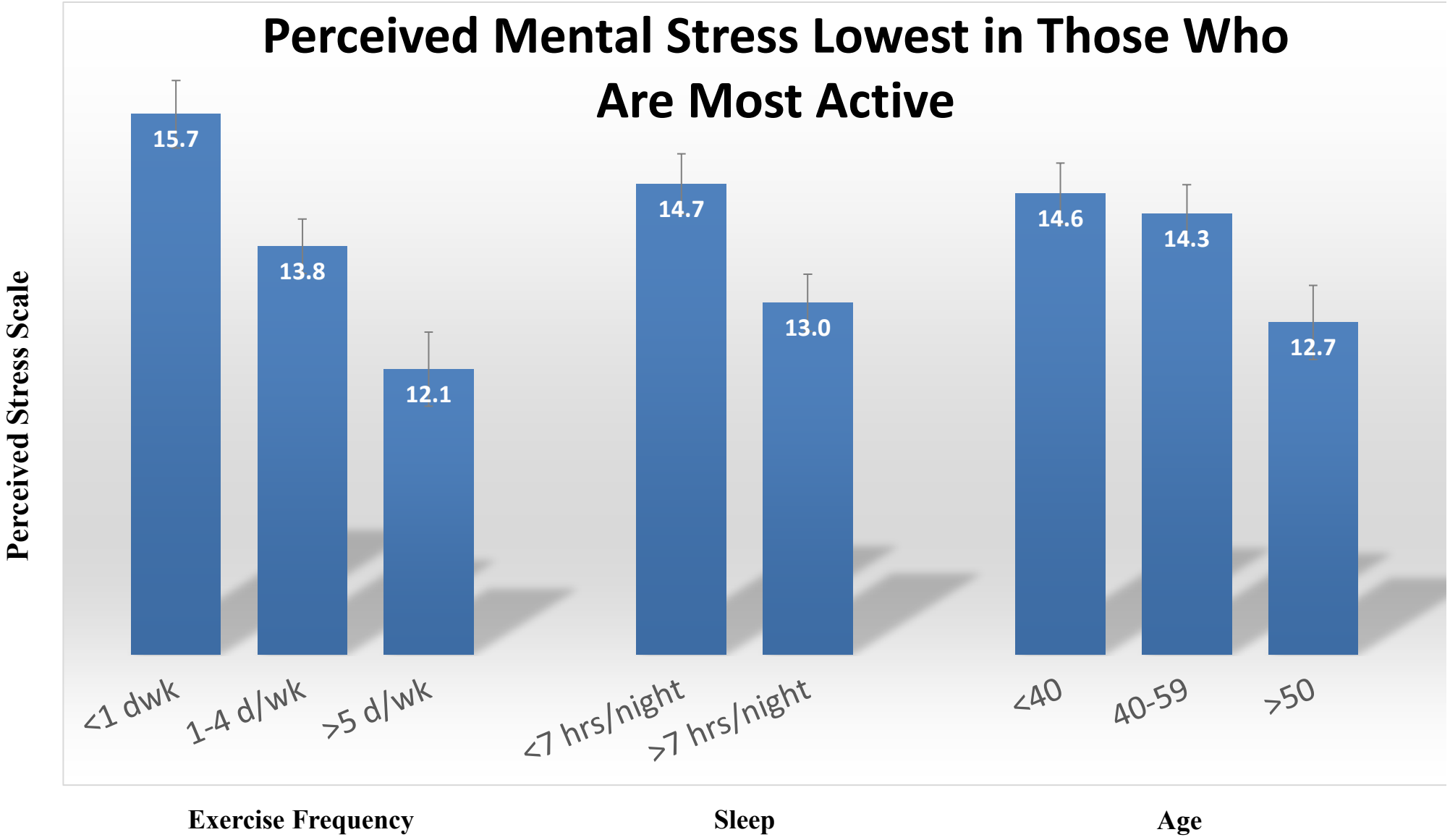


Gain 7.2 years of life by being active (>150 min/wk) and normal weight



Moore et al. PLoS Med 2012;9(11):e1001335. Association of leisure time physical activity with mortality during follow-up in pooled data from six prospective cohort studies in the National Cancer Institute Cohort Consortium, comprising **654,827 individuals, 21–90 y of age**. Adjusted survival, 40+ years of age. 7.5 MET-hr/wk is equivalent to brisk walking (3 METS) 2.5 h per week on average.

Perceived Mental Stress Lowest in Those Who Are Most Active

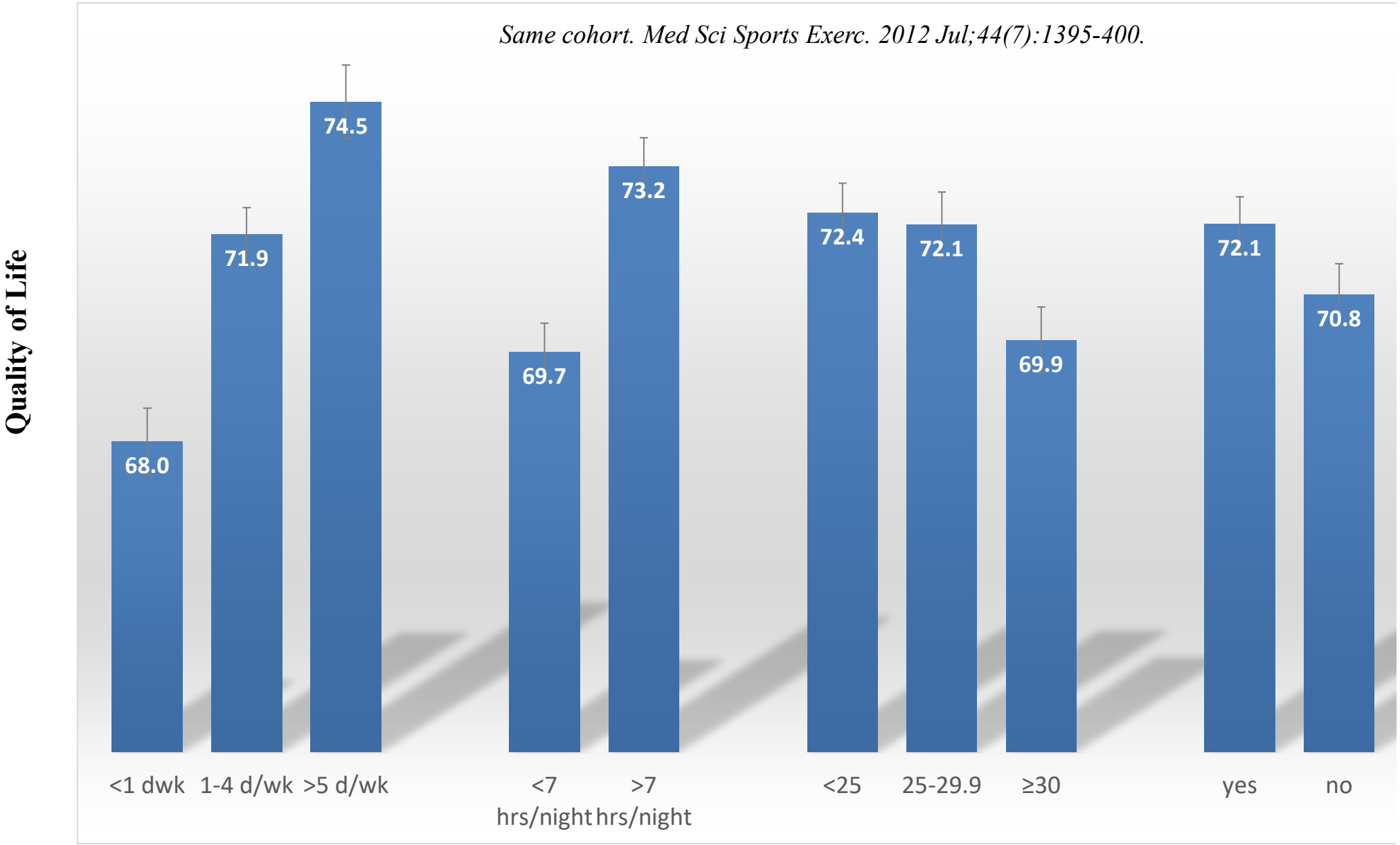


Knab, Nieman, et al. Med Sci Sports Exerc. 2012 Jul;44(7):1395-400.

N=998 study participants (60.4% women and 39.6% men, 18–85 yr, BMI = 16.7–52.7) (P for trend <0.001) (GLM analysis).

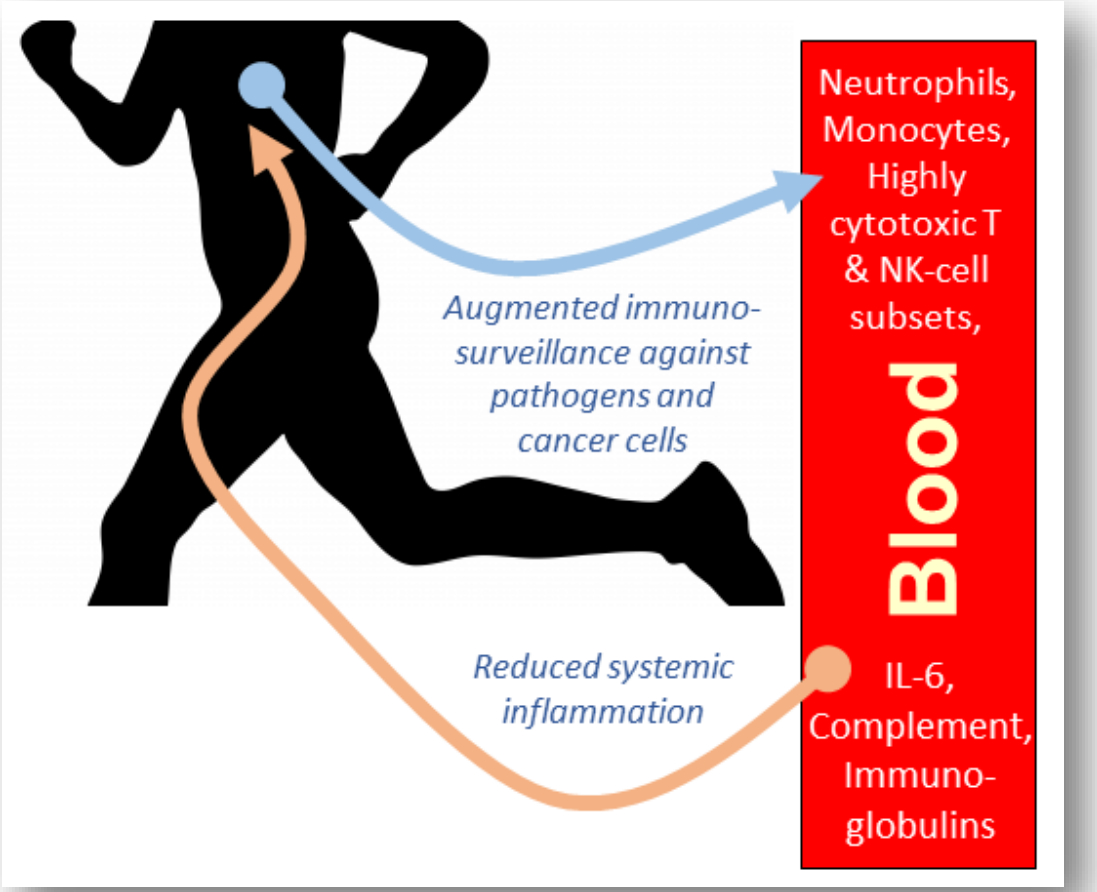
Quality of Life Highest in Most Active

Same cohort. Med Sci Sports Exerc. 2012 Jul;44(7):1395-400.

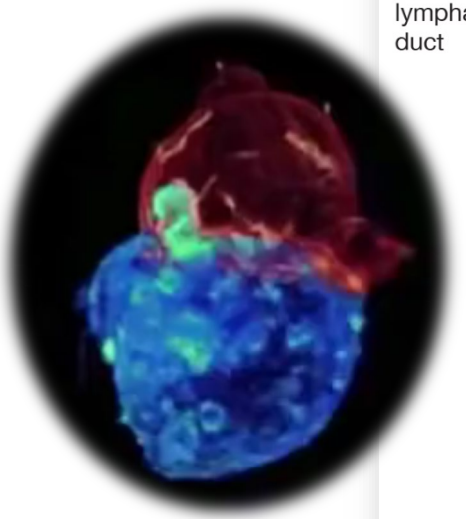


Moderate physical activity and enhanced viral and immune defense

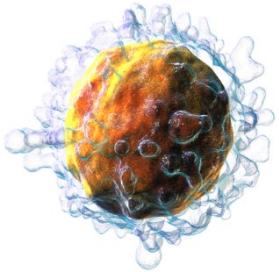
- Regular aerobic exercise similar to 30-60 minutes of near-daily brisk walking **improves overall surveillance against pathogens** by stimulating the ongoing exchange of important types of white blood cells between the circulation and tissues.

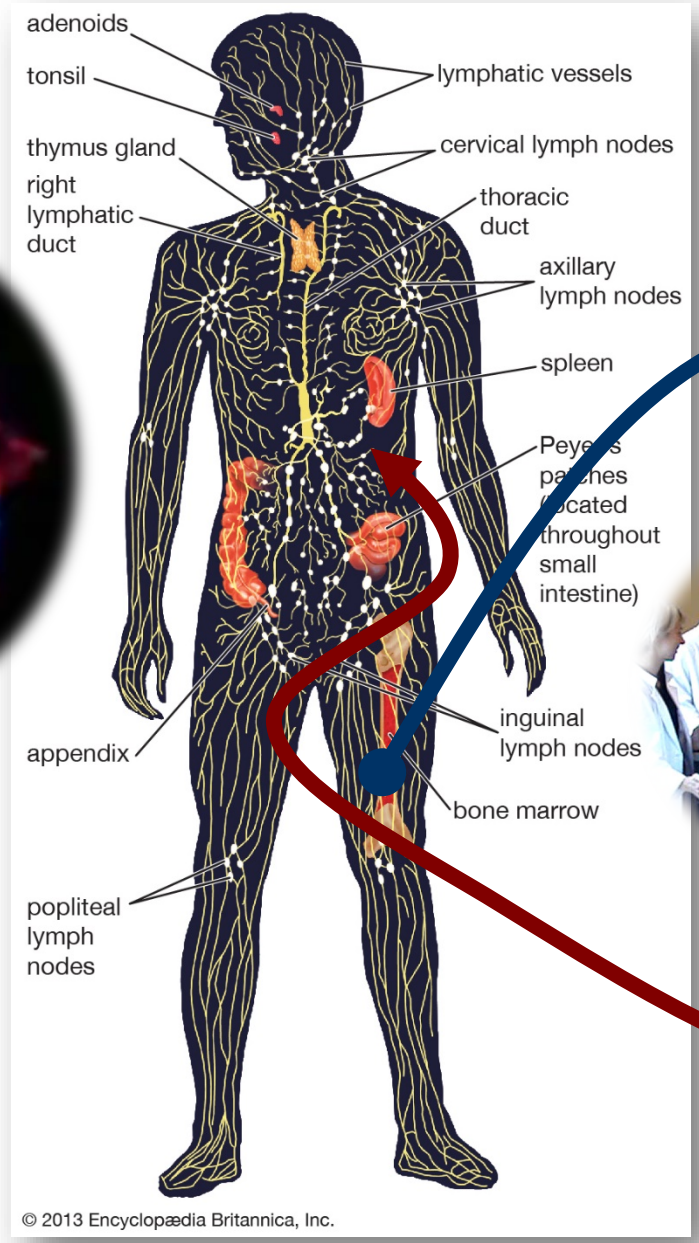


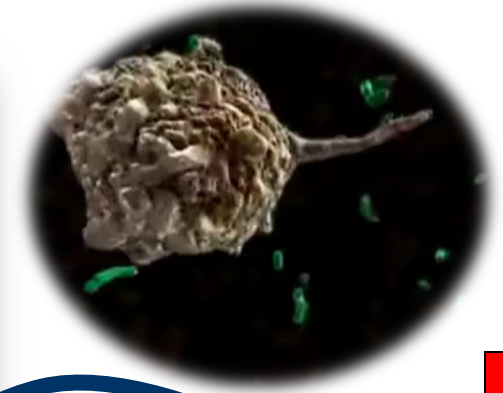
Nieman & Wentz.
J Sport Health Sci. 2019;8(3):201-217.



Cytotoxic T cells

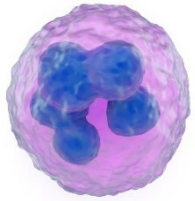




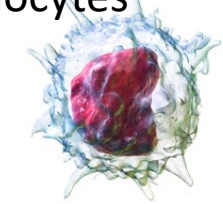


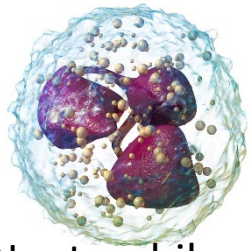
Blood

Lung Macrophages

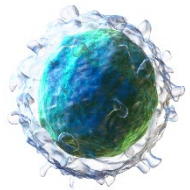


Monocytes

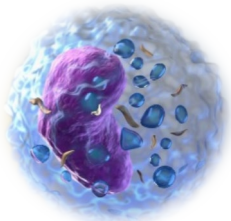




Neutrophils



Immature B cells



Natural killer cells

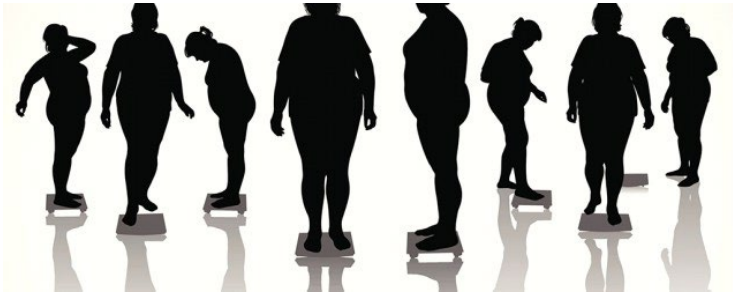
Exercise stimulates the ongoing exchange of leukocytes between the circulation and tissues, especially those with high effector and cytotoxic functions. Brain Behav Immun. 2011;25(4):658-66; Physiol Behav. 2018 Oct 1;194:260-267.

% DIFFERENCE IN INFECTIOUS DISEASE INCIDENCE AND MORTALITY RATES BETWEEN PHYSICALLY ACTIVE AND INACTIVE ADULTS

(Reduced incidence rates for influenza, the common cold, and severe cases of COVID-19, with diminished mortality rates for pneumonia and other viral and bacterial infections. Nieman, RMD Open, in press).

PLoS One 2016;11: e0148448
Prev Med 2019;123:65–70
Br J Sports Med. 2011 Sep;45(12):987-92
Brain Behav Immun. 2020 Jul;87:184-187

Battle of the Bulge



Two Weapons

Exercise

National Weight Control Registry of >10,000 successful weight losers (lost and maintained +30 pounds for 1 year and more)

1. ***High Activity:*** *>75% exercise, expend >1,000 kcal/wk*
2. ***Limited TV:*** *63% watch <10 h/wk*
3. ***Low-calorie, low-fat diet*** *(<30% calories from fat)*
4. ***Consistent diet:*** *regular diet schedule, without splurging on weekends, holidays, special occasions*
5. ***Breakfast:*** *78% report eating breakfast daily*
6. ***High diet restraint:*** *high control over eating without giving in to emotional, life-change events and availability of desserts, etc. Avoid sugar-sweetened beverages.*
7. ***Self-monitoring:*** *more than half weigh themselves weekly and track daily food intake ("caloric awareness")*

Am J Prev Med. 2014 Jan;46(1):17-23; J Nurse Practitioners 2016;12:286-287.

Your Lifestyle Rx Your Lifestyle

PERSONAL INFORMATION:

Name _____ Age ____ Height _____ Weight _____

Activity (hours/wk) _____ Fruit/vege servings/day _____

Your Motivation _____

LIFESTYLE RECOMMENDATIONS:

- ❑ Avoid tobacco use
- ❑ Maintain BMI under 25 kg/m^2; Your target weight is: _____ lb.
- ❑ Total 2.5-5 h/week exercise (aerobic and muscle fitness); reduce sitting time
- ❑ Follow a plant and whole food-based diet:
  - ❑ Eat ≥4.5 cups of fruits and vegetables each day (emphasize wide variety of both)
  - ❑ Select whole grains, nuts, seeds, legumes (beans, soy products)
  - ❑ Limit intake of high-fat meats and dairy products; substitute fish and poultry
  - ❑ Limit intake: sugar beverages, salt, saturated & hydrogenated fat, refined grains
  - ❑ Don't eat more than you burn up every day *(develop "caloric awareness")*
- ❑ Keep alcohol intake moderate (≤1 drink/d F; ≤ 2 drinks/d M)
- ❑ Sleep 7-8 h per night (regular schedule)
- ❑ Keep stress under control (reduce stressors)

Nieman DC. North Carolina Research Campus

NOTES

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