



# Physical Inactivity & Sedentary Behaviour as CVD risk factors

**Professor Marie Murphy**

Chair of Exercise & Health | Dean of Postgraduate Research

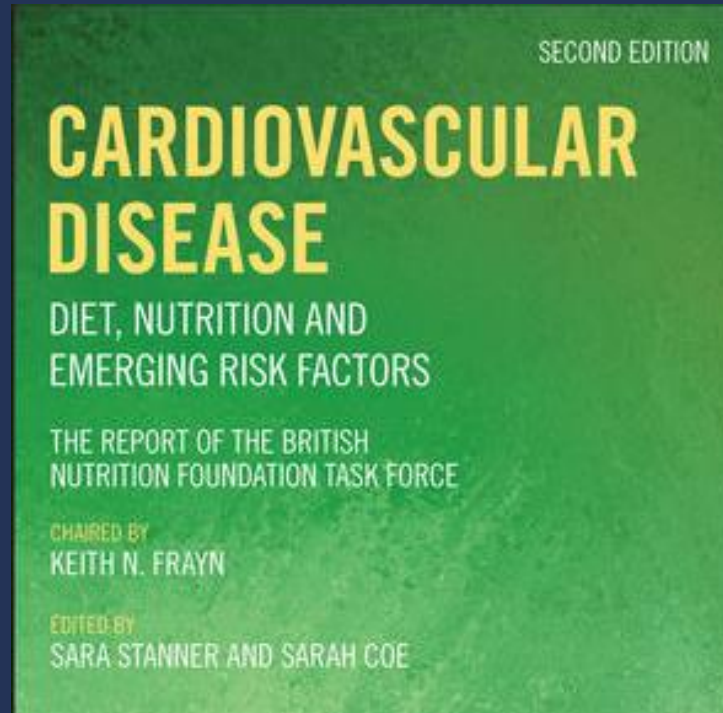


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**12 Physical Fitness and Physical Activity: Effects on Risk of Cardiovascular Disease**  
*Professor Marie Murphy, Professor Steven N. Blair, and Bridget Benelam*

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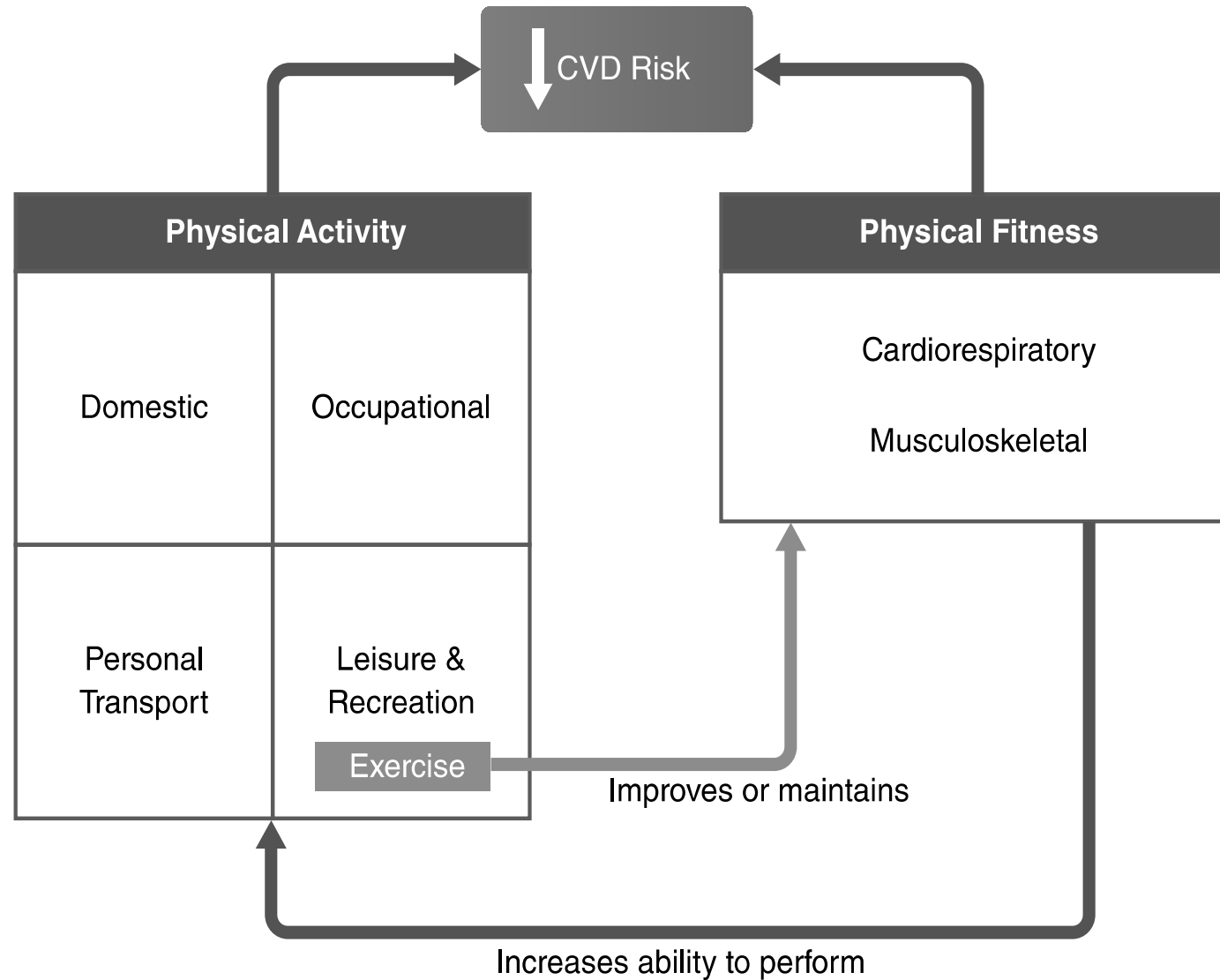


- **Physical Activity (PA), Exercise, Fitness and Sedentary Behaviour (SB)**
- **Current PA and SB guidelines**
- **Evidence update/ magnitude of risk**
- **Interventions to change behaviour**

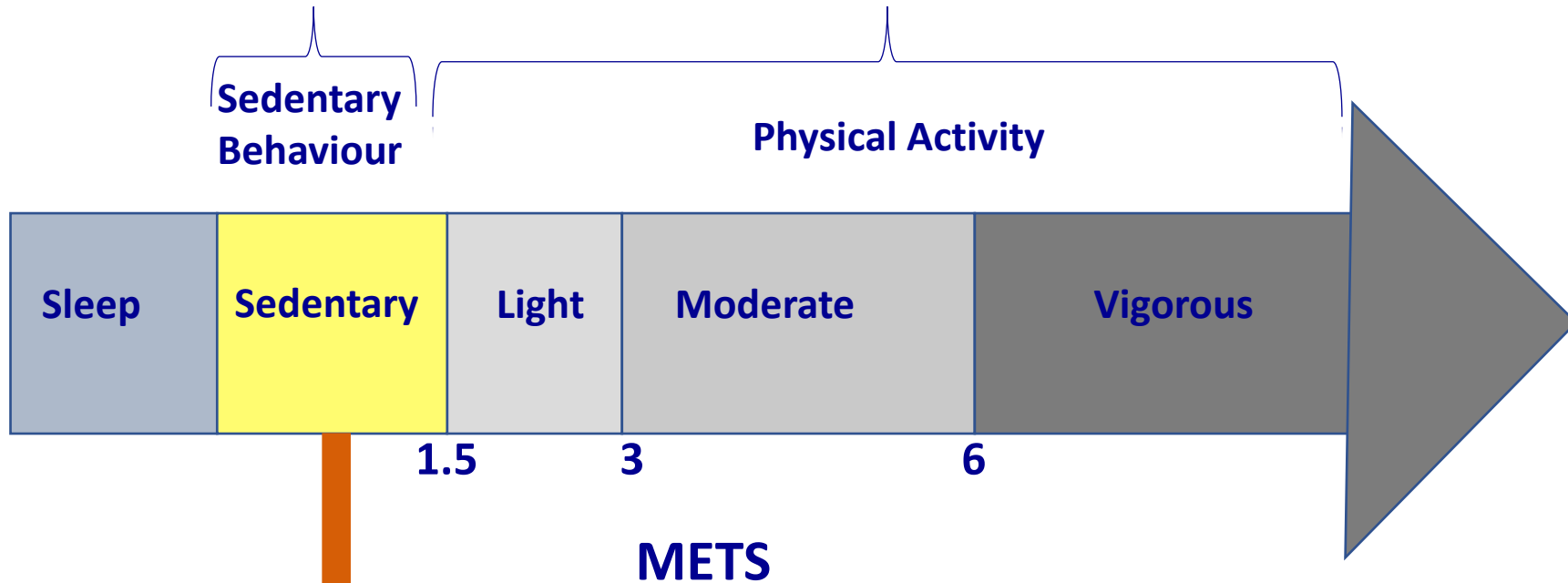
# Definitions

- **Physical Activity** is any bodily movement produced by skeletal muscles that requires energy expenditure and can be undertaken for personal transport work, recreation and leisure or to carry out domestic tasks.
- **Exercise** is planned, structured physical activity designed to improve or maintain one of the components of physical fitness
- **Physical Fitness** is a measure of the cardiovascular and musculoskeletal systems ability to cope with physical activity or exercise
- **Sedentary Behaviour** refers to any waking activity characterized by an energy expenditure  $\leq 1.5$  metabolic equivalents and a sitting or reclining posture

Personal Transport	Occupation
Domestic	Leisure & Recreation



**Fig. 12.1** Schematic showing relationship between physical activity, physical fitness, exercise, and cardiovascular disease (CVD) risk.



**Waking activity characterised by an energy expenditure  $\leq 1.5$  METs and a sitting or reclining posture**



# Exercise intensity?

	Low Intensity	Moderate Intensity	Vigorous
% VO <sub>2</sub> max	<50%	50-65%	>65%
% HR max	<55%	55-75%	>75%
METs	1.5 – 2.9	3 - 6	> 6

'at least moderate intensity'

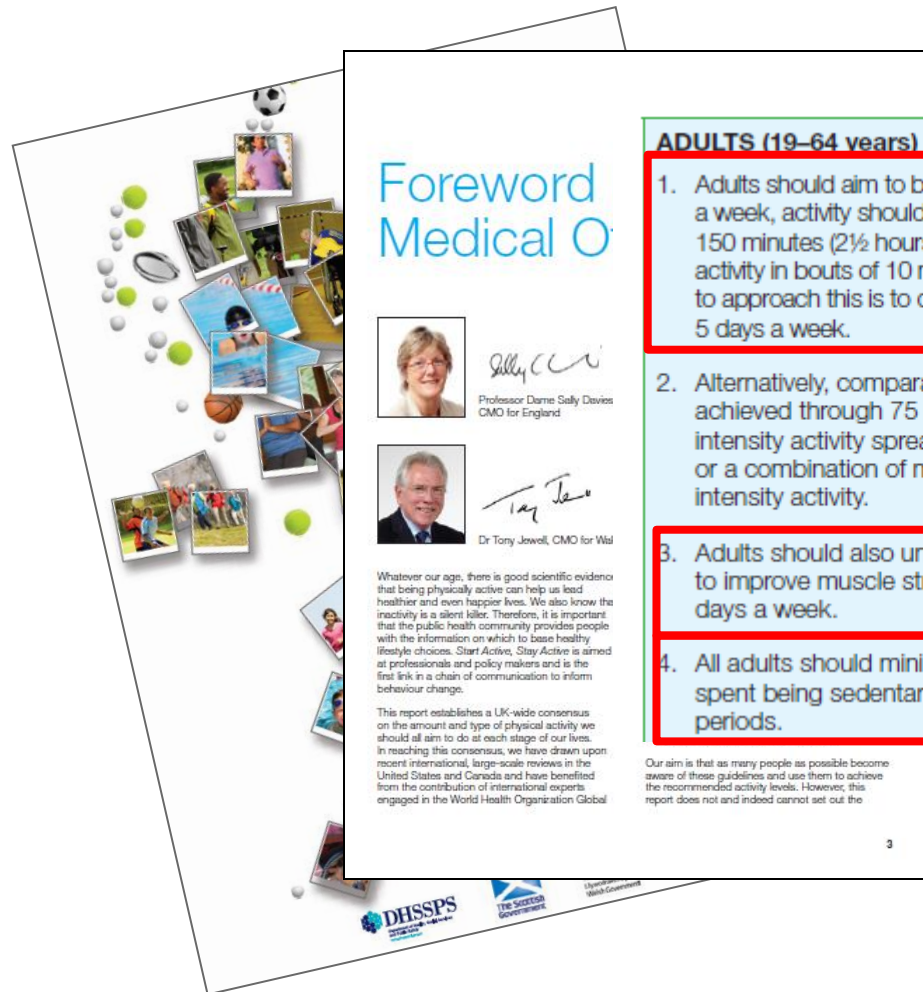
'to improve fitness'

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# 2011 Guidelines

## How much physical activity for health benefit?



***“...at least 150 minutes per week of moderate intensity activity in bouts of 10 minutes or more”***

***“...activity to improve muscular strength on at least 2 days a week”***

***“...minimise time spent sedentary for extended periods”***

# Physical activity for adults and

- + BENEFITS HEALTH
- Zz IMPROVES SLEEP
- MAINTAINS HEALTHY WEIGHT
- MANAGES STRESS
- IMPROVES QUALITY OF LIFE

## What should I do?

For a healthy heart and mind

**Be Active**

VIGOROUS MODERATE



**MINUTES PER WEEK**

**75 OR 150**

VIGOROUS INTENSITY MODERATE INTENSITY

(BREATHING FAST, HEAVY TALKING) (INCREASED BEATING, SWEATY SKIN)

**OR A COMBINATION OF BOTH**

# Physical activity for children

- BUILDS CONFIDENCE & SOCIAL SKILLS
- DEVELOPS CO-ORDINATION
- IMPROVES CONCENTRATION & LEARNING

## Be physically active

Spread activity throughout the day



## Sit less

Find ways to help all children be active for at least 60 minutes

# Physical activity for pregnant women

- Helps to control weight gain
- Helps reduce high blood pressure problems
- Helps to prevent diabetes of pregnancy
- Improves fitness
- Improves sleep
- Improves mood

**Not active?**  
Start gradually

**Already active?**  
Keep going



Do muscle strengthening activities twice a week

Every activity counts, in bouts of at least 10 minutes

No evidence of harm

Listen to your body and adapt



Don't bump the bump



# 2011 UK Physical activity guidelines are currently under review

## -updates to incorporating scientific evidence from 2010-2017



University of  
BRISTOL

School for Policy Studies

Current students Current staff Alumni

search

### UK physical activity guidelines review

- Introduction
- Process
- People
- Expert Working Groups
- National consultation
- Scientific Consensus Meeting
- Contact

## UK physical activity guidelines review



In 2018, the UK guidelines on physical activity across the life course will be reviewed and revised in line with the latest scientific evidence.

### Get involved

Apply to be an [Expert Working Group](#) member or respond to our [National Consultation](#) on the current UK CMO 2011 physical activity guidelines



Evidence Review  
(Jan-April 2018)

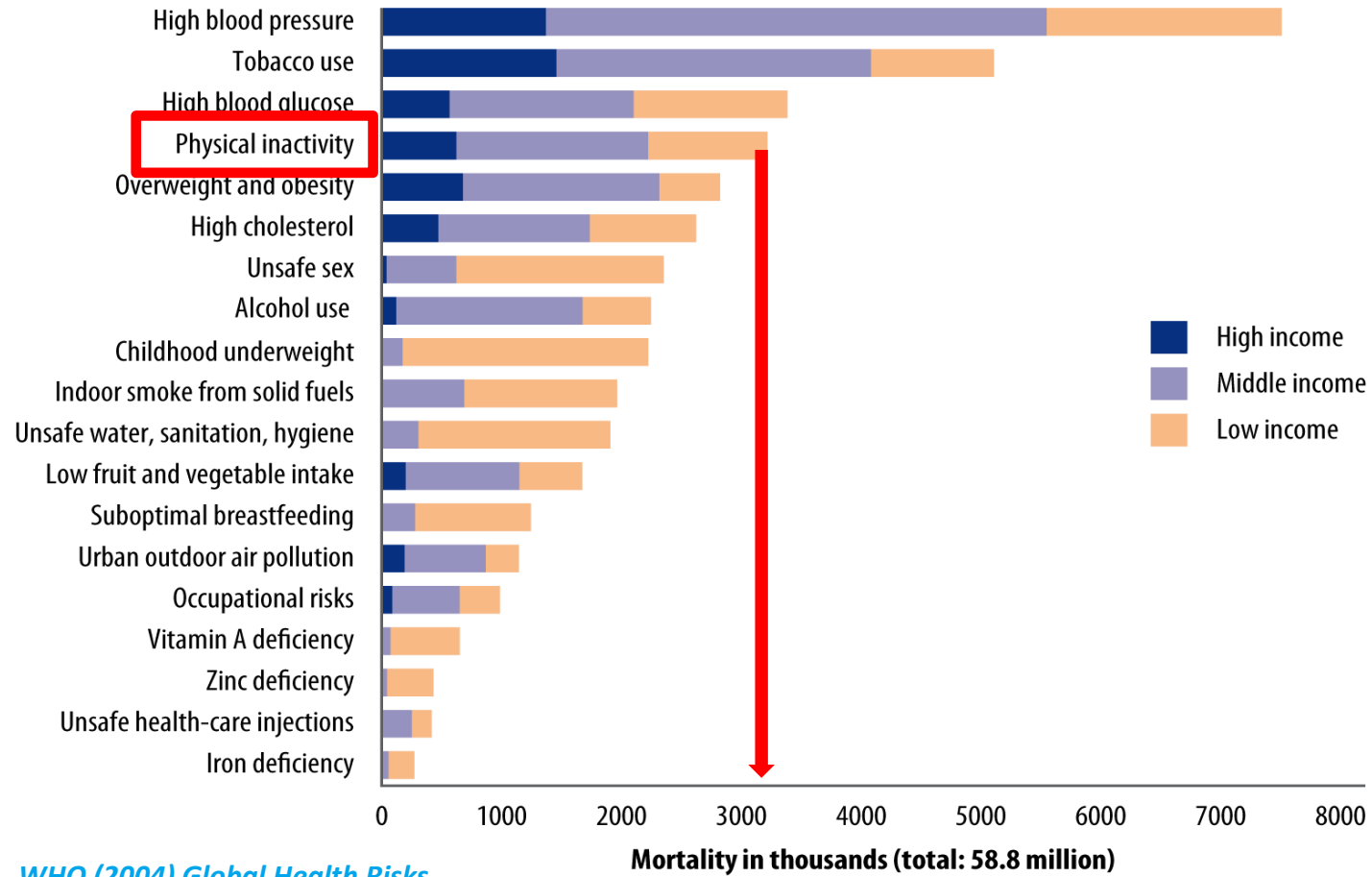
Proposed Changes  
(April-May 2018)

Consultation  
(July 2018)

2019 UK  
guidelines

- **Physical Activity (PA), Exercise, Fitness and Sedentary Behaviour (SB)**
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# World Health Organisation 2004



WHO (2004) Global Health Risks

## % of CVD Deaths and DALYs attributable to risk factors in UK



	% Deaths (mortality)		% DALYs (morbidity)	
	Male	Female	Male	Female
Diet	49.5	38.4	53.0	41.0
Low Physical Activity	10.2	9.0	11.0	9.3
Smoking	11.8	10.3	16.4	14.2
High Blood Pressure	47.5	45.9	51.3	47.0
High Cholesterol	27.6	25.7	31.9	25.9
High Fasting Glucose	15.1	12.5	15.1	12.8
High BMI	17.8	12.6	23.9	34.7

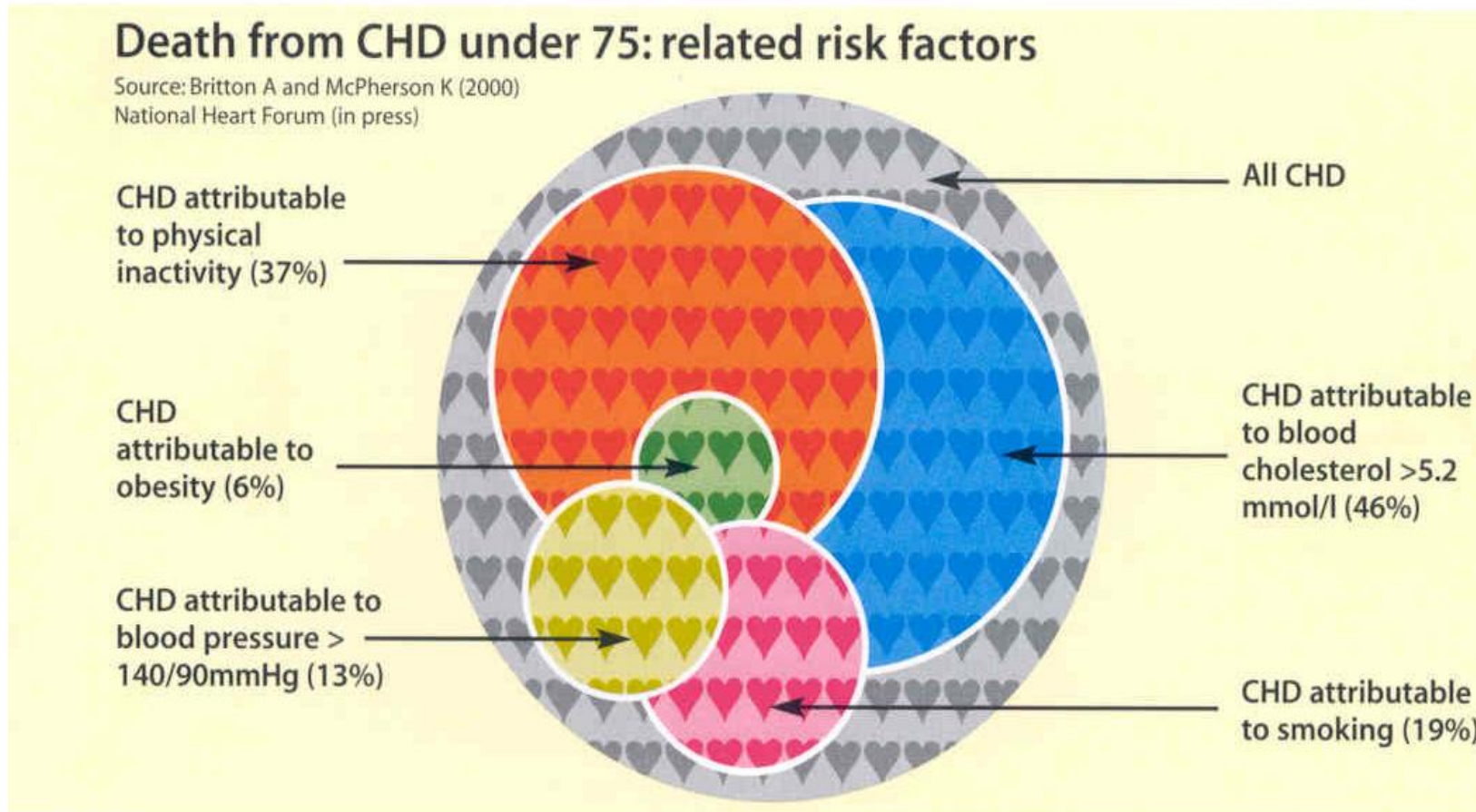
Diet

Physical Activity

- Blood Pressure
- Blood Lipids
- Weight /BMI
- Fat distribution
- Glucose control

- Endothelial function
- Inflammation

# Population attributable risk for CHD



This diagram represents an estimation of how much each risk factor contributes to death rates from CHD. The overlapping areas represent those who had more than one risk factor.

<http://researchonline.lshtm.ac.uk/id/eprint/17972>

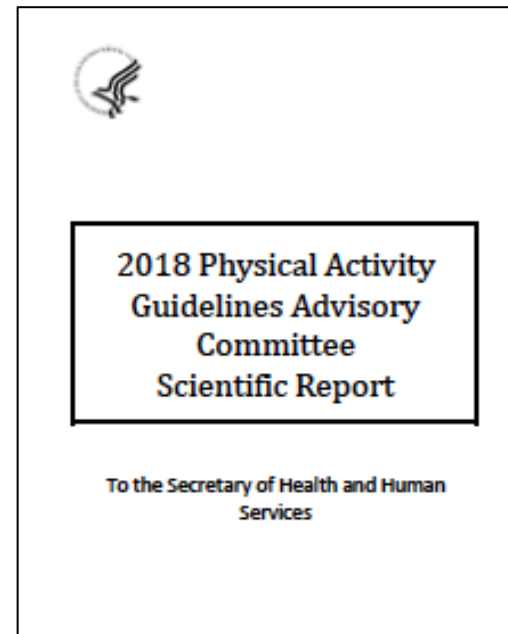
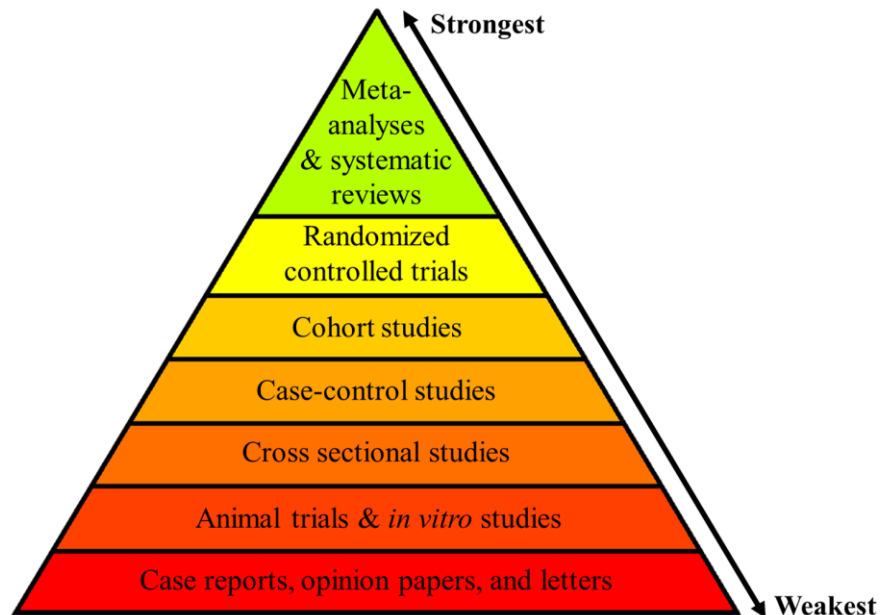
# What is the nature of the relationship and the magnitude of the effect of

- Physical inactivity (insufficient PA / little or no exercise)
- Low physical fitness
- Prolonged or uninterrupted sedentary behaviour

on cardiovascular disease risk ?



## Evidence since 2005



<https://health.gov/paguidelines/second-edition/report.aspx>



# Exercise and CVD- Epidemiological Evidence



**Jeremy N Morris CBE**  
**1910-2009**



**Ralph Paffenbarger**  
**1922-2007**



**London Transport**  
**Conductors vs Drivers**



**San Francisco**  
**Longshoremen**

# Physical Activity & Heart Attack Risk

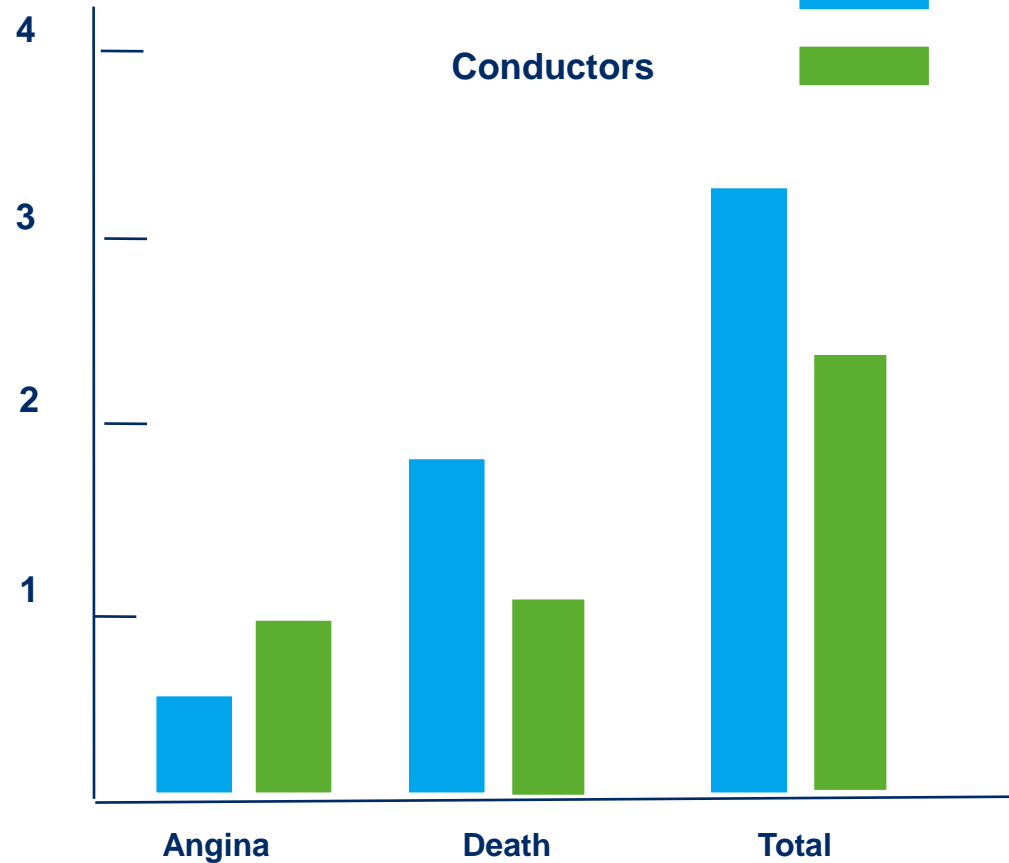


Jeremy N Morris CBE  
1910-2009



London Transport  
Conductors vs Drivers

Heart Attack  
Rate/1000



3 mos incidence

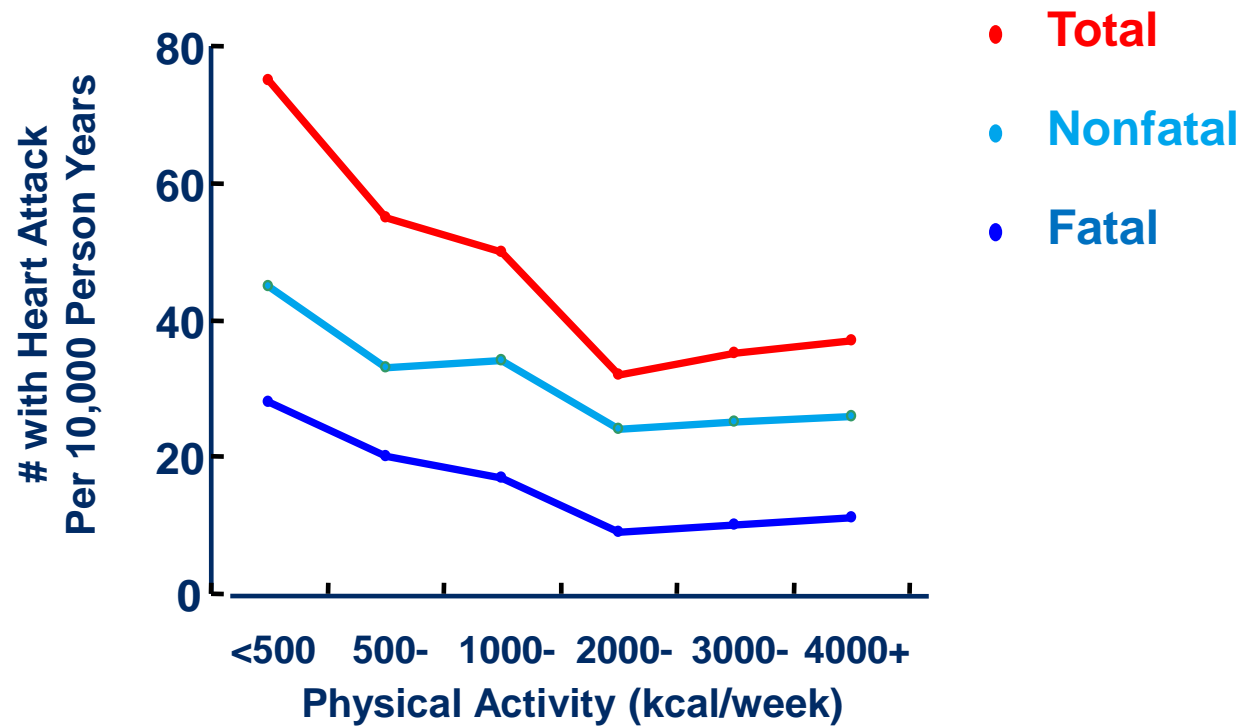
## Physical Activity & Heart Attack Risk



Ralph Paffenbarger  
1922-2007



San Francisco  
Longshoremen



Paffenbarger et al (1978) *AM J Epidemiol* 108:3: 161-175

# Physical inactivity: relative and population attributable risk

**Table 1 Relative risks (RR) and population attributable risks (PAR%) for physical inactivity in Canada, Australia, and the USA.**

Disease	Canada		Australia		USA	
	RR	PAR%	RR	PAR%	RR	PAR%
CHD	1.45	19.4	1.5	18	2.0	22
Stroke	1.60	24.3	2.0	16	na	Na
Hypertension	1.30	13.8	na	na	1.5	12
Colon Cancer	1.41	18.0	1.5	19	2.0	22
Breast Cancer	1.31	14.2	1.1	9	1.2	5
Type 2 Diabetes	1.50	21.1	1.3	13	1.5	12
Osteoporosis	1.59	24.0	1.4*	18*	2.0	18*

Being active reduces risk of

- CVD by 33%
- Stroke by 31%
- Hypertension by 32%

# Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy



I-Min Lee, Eric J Shiroma, Felipe Lobelo, Pekka Puska, Steven N Blair, Peter T Katzmarzyk, for the Lancet Physical Activity Series Working Group\*

## Summary

**Background** Strong evidence shows that physical inactivity increases the risk of many adverse health conditions, including major non-communicable diseases such as coronary heart disease, type 2 diabetes, and breast and colon cancers, and shortens life expectancy. Because much of the world's population is inactive, this link presents a major public health issue. We aimed to quantify the effect of physical inactivity on these major non-communicable diseases by estimating how much disease could be averted if inactive people were to become active and to estimate gain in life expectancy at the population level.

Published Online  
July 18, 2012

[http://dx.doi.org/10.1016/S0140-6736\(12\)61031-9](http://dx.doi.org/10.1016/S0140-6736(12)61031-9)

\*Members listed at end of paper

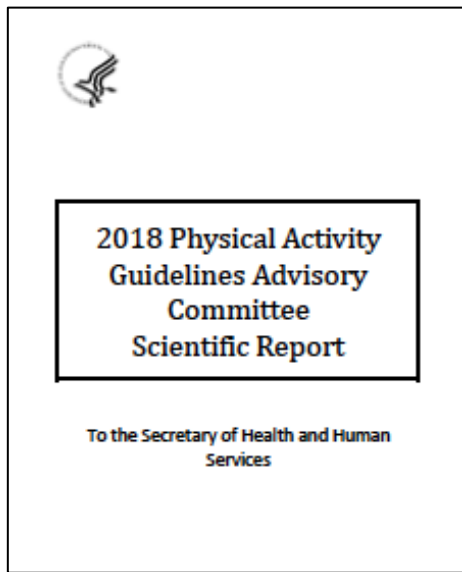
Division of Preventive  
Medicine, Brigham and



"In view of the prevalence, global reach, and health effect of physical inactivity, the issue should be appropriately described as pandemic, with far-reaching health, economic, environmental, and social consequences."

Physical Activity

	Coronary heart disease	Type 2 diabetes	Breast cancer*	Colon cancer	All-cause mortality
Prevalence of inactivity in population (%)†	35.2% (22.3–40.5)	35.2% (22.3–40.5)	38.8% (23.3–44.3)	35.2% (22.3–40.5)	35.2% (22.3–40.5)
Prevalence of inactivity in people eventually developing the outcome (%)†	42.2% (23.0–56.2)	43.2% (23.6–57.6)	40.7% (22.5–56.7)	42.9% (23.4–57.1)	42.9% (23.4–57.1)
RR, unadjusted‡	1.33 (1.18–1.49)	1.63 (1.27–2.11)	1.34 (1.25–1.43)	1.38 (1.31–1.45)	1.47 (1.38–1.57)
RR, adjusted‡	1.16 (1.04–1.30)	1.20 (1.10–1.33)	1.33 (1.26–1.42)	1.32 (1.23–1.39)	1.28 (1.21–1.36)
PAF with unadjusted RR (%)§	10.4% (7.2–13.4)	18.1% (10.8–22.8)	11.6% (6.8–15.5)	11.8% (6.8–15.1)	14.2% (8.3–18.0)
PAF with adjusted RR (%)§	5.8% (3.2–7.8)	7.2% (3.9–9.6)	10.1% (5.6–14.1)	10.4% (5.7–13.8)	9.4% (5.1–12.5)



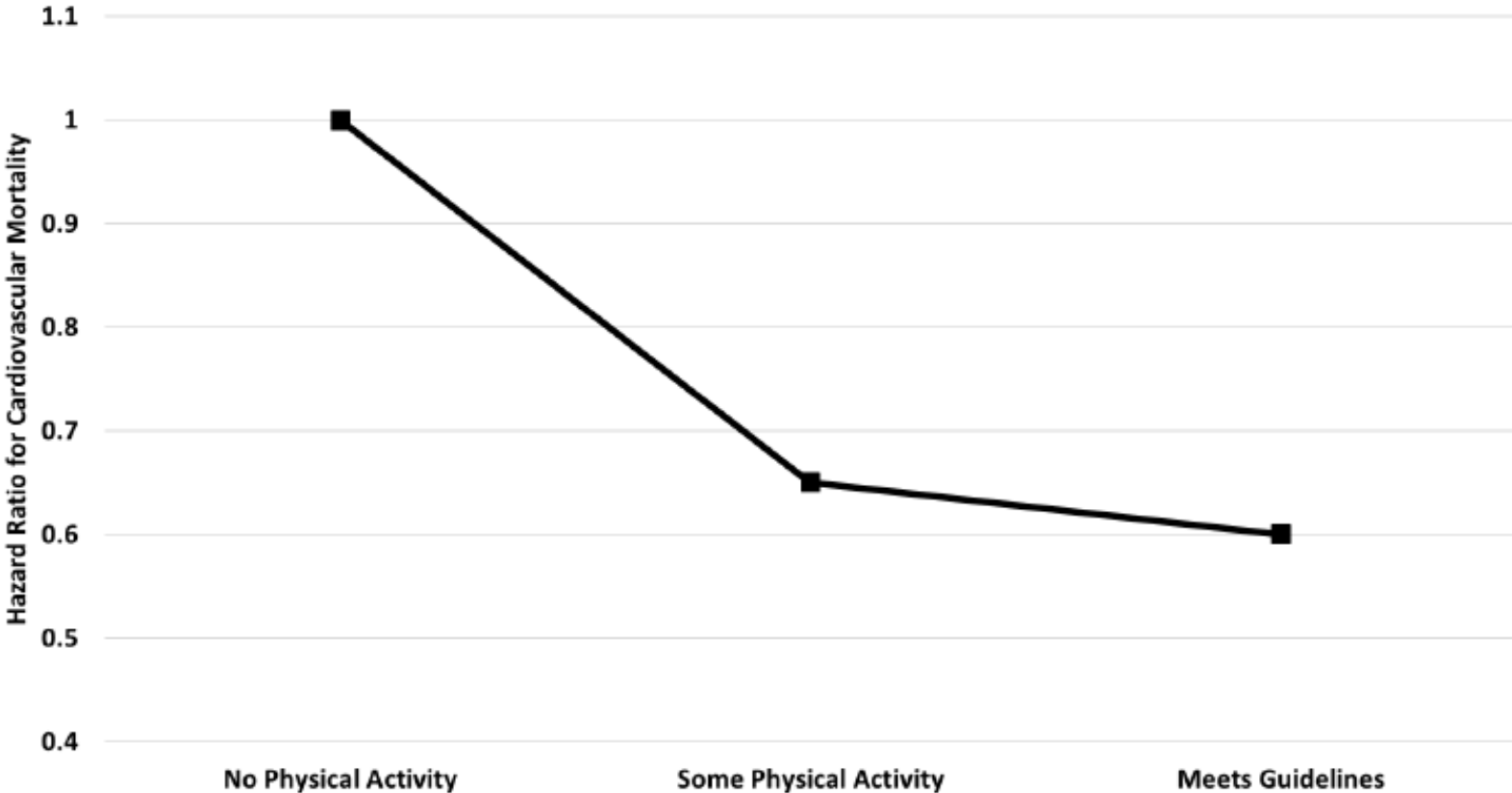
# What is the relationship between physical activity and cardiovascular disease incidence?

1 systematic review 9 meta-analysis (each 12-43 studies)  
CHD (n=6) , stroke (n=5) heart failure (n=3)

- Any amount of PA has greater benefit than none
- Meeting current guidelines will result in about 75 percent of the maximal benefit
- More physical activity results in greater benefit, although the incremental benefit is less;
- No evidence risk of PA 3-5 times the current guidelines.
- Insufficient evidence is available to determine whether these relationships vary by age, sex, race, ethnicity, socioeconomic status, or weight status

# Health benefits accrue even for those with pre-existing conditions

Figure C-2. Risk of Cardiovascular Mortality Among People with Type 2 Diabetes by Dose of Physical Activity

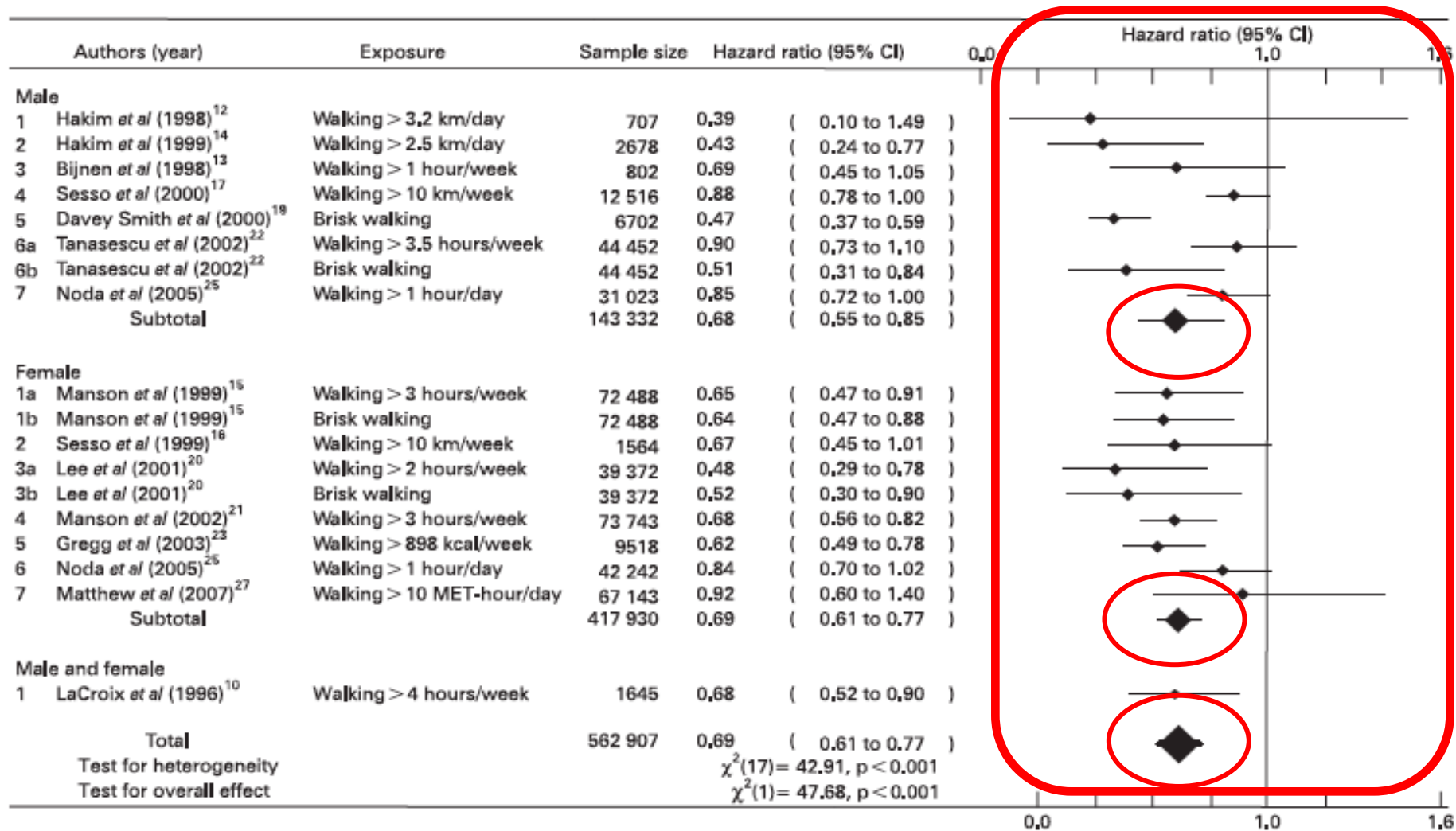


Source: Adapted from data found in Sadarangani et al., 2014.<sup>28</sup>

Department of Health and Human Services (2018)  
Physical Activity Guidelines Advisory Committee Scientific Report  
<https://health.gov/paguidelines/second-edition/report.aspx>



# Walking and CVD risk

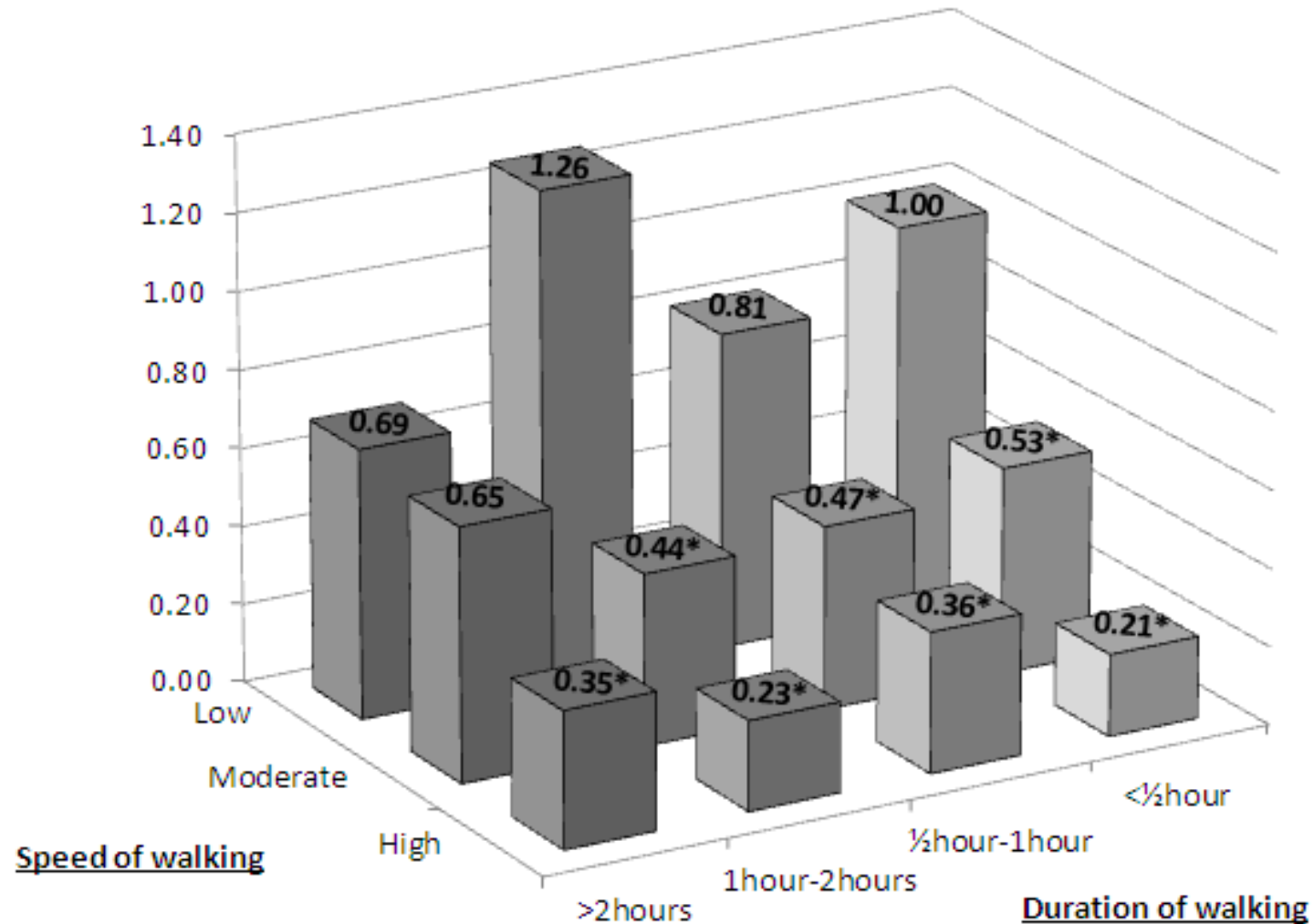


**Figure 1** The association between walking and cardiovascular risk in men and women. The referent group refers to the lowest walking (volume/intensity) group and hazard ratios of less than 1.0 suggest benefits of walking. MET, metabolic equivalent.

*Hamer M and Chida Y (2008) Walking and primary prevention: a meta-analysis of prospective cohort studies British Journal of Sports Medicine 42: 238-243*



Figure 3. Hazard ratios for HF by categories defined by self-assessed speed and duration of walking.



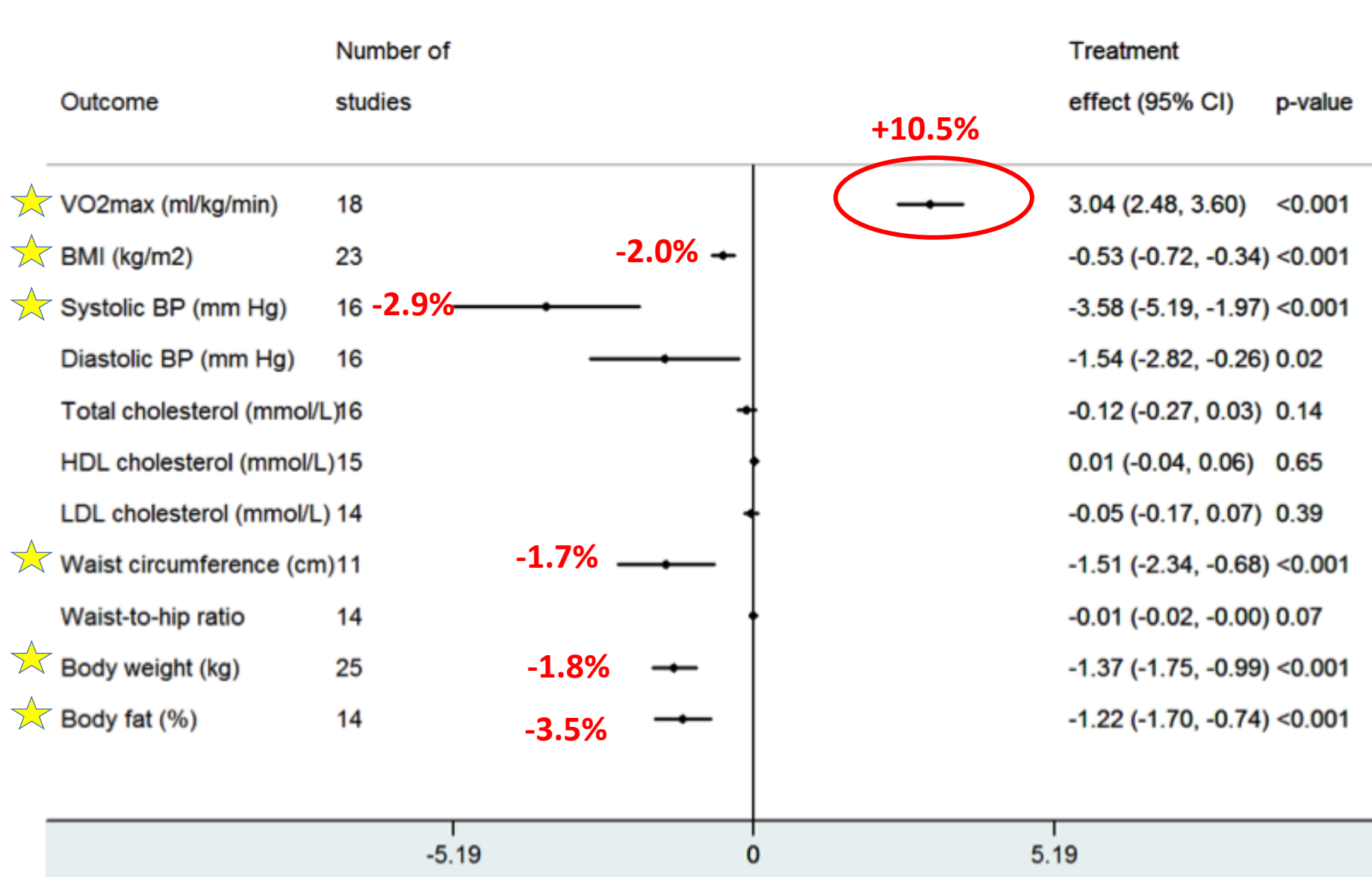
Saevereid HA, Schnohr P, Prescott E (2014) Speed and Duration of Walking and Other Leisure Time Physical Activity and the Risk of Heart Failure: A Prospective Cohort Study from the Copenhagen City Heart Study. PLoS ONE 9(3): e89909. doi:10.1371/journal.pone.0089909  
<http://journals.plos.org/plosone/article?id=info:doi/10.1371/journal.pone.0089909>

# The effect of walking on cardiovascular risk:

## An updated systematic review and meta-analysis of randomised control trials

- 32 RCT conducted 1971-2012,
- Inactive participants > 18 yrs, walking intervention > 4 wks
- CVD risk factors pre- and post-intervention (or  $\Delta$ ) reported
- 1508 participants (30-83y); 16 F only, 3 M only, 14 both
  
- Intervention
  - Length: mean 18.7 weeks (range: 8–52 weeks)
  - Duration: 20–60 min at 2–7 days per week
  - Intensity: light (3), moderate (19), vigorous (3), “self-paced” (3), “brisk” (4)

# Weighted Mean Treatment Effects



Murtagh et al (2015) The effect of walking on risk factors for cardiovascular disease: An updated systematic review and meta-analysis of randomized control trials Preventive Medicine 72 (2015) 34–43

# Effects of frequency, intensity, duration and volume of walking interventions on CVD risk factors: a systematic review and meta-regression analysis of randomised controlled trials among inactive healthy adults

Pekka Oja,<sup>1</sup> Paul Kelly,<sup>2</sup> Elaine M Murtagh,<sup>3</sup> Marie H Murphy,<sup>4</sup> Charlie Foster,<sup>5</sup> Sylvia Titze<sup>6</sup>

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bjsports-2017-098558>).

<sup>1</sup>UKK Institute, Tampere, Finland  
<sup>2</sup>Physical Activity for Health Research Centre, Institute of

## ABSTRACT

**Objective** Walking interventions in healthy populations show clinically relevant improvements for many cardiovascular disease (CVD) risk factors. We aimed to assess the changes in CVD risk factors and the dose–response relationship between frequency, intensity, duration and volume of walking and cardiovascular risk factors based on randomised controlled trials (RCTs)

disease (CHD), type 2 diabetes, and breast and colon cancers, and increase life expectancy.<sup>2</sup> One key approach to increase population levels of physical activity is to promote safe, accessible and environmentally friendly activity options including improved infrastructure for walking and cycling for transport and recreation... Walking is the ideal physical ac

## What are the findings?

- Walking interventions have clinically significant effect on cardiovascular disease risk factors including body mass, body mass index, body fat, systolic and diastolic blood pressure, fasting glucose and an increase in VO<sub>2</sub> max.
- Even modest amounts of walking appear to provide health benefit.
- There is insufficient evidence on the exact volume and pace of walking required for benefit.

# Self-rated walking pace and all-cause, cardiovascular disease and cancer mortality: individual participant pooled analysis of 50 225 walkers from 11 population British cohorts

Emmanuel Stamatakis,<sup>1,2</sup> Paul Kelly,<sup>3</sup> Tessa Strain,<sup>3,4</sup> Elaine M Murtagh,<sup>5</sup> Ding Ding,<sup>1,2</sup> Marie H Murphy<sup>6</sup>

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bjsports-2017-098677>)

<sup>1</sup>Epidemiology Unit, Charles Perkins Centre, University of Sydney, Sydney, New South Wales, Australia

<sup>2</sup>Prevention Research Collaboration, Faculty of Medicine and Health, School of Public Health, University of Sydney, Sydney, New South Wales, Australia

## ABSTRACT

**Background/objectives** Walking pace is associated with risk of premature mortality. However, whether this relationship is independent of total volume of physical activity and highest physical activity intensity remains unclear. We examined the associations between walking pace and cause-specific mortality, investigating the potential modifying effect of factors such as total physical activity volume, highest physical activity intensity, age, sex and body mass index (BMI).

**Methods** Prospective pooled analysis of 11 population-based baseline surveys in England and Scotland between 1994 and 2008 that were linked with mortality

with an 11% reduction in risk for ACM compared with no walking.<sup>5</sup>

Considering specific health endpoints, cardiovascular disease (CVD) and cancer are the two most common avoidable causes of mortality in the UK.<sup>6</sup> Hamer and Chida conducted a meta-analysis of 13 cohort studies and found a 31% reduction in risk of CVD mortality in the highest walking categories compared with the lowest walking volume/intensity category.<sup>2</sup> A recent large analysis of over 250 000 adults in the UK found walking to work was associated with a 36% reduction in risk of CVD mortality compared with non-active commuting.<sup>7</sup> The results

## CONCLUSIONS

Walking is known to benefit health. Assuming causal relationships, these analyses suggest that increasing walking pace could be linked with lower risk for all-cause and CVD mortality. Walking pace should be emphasised in public health messages, especially in circumstances when increase in walking volume or frequency is less feasible.

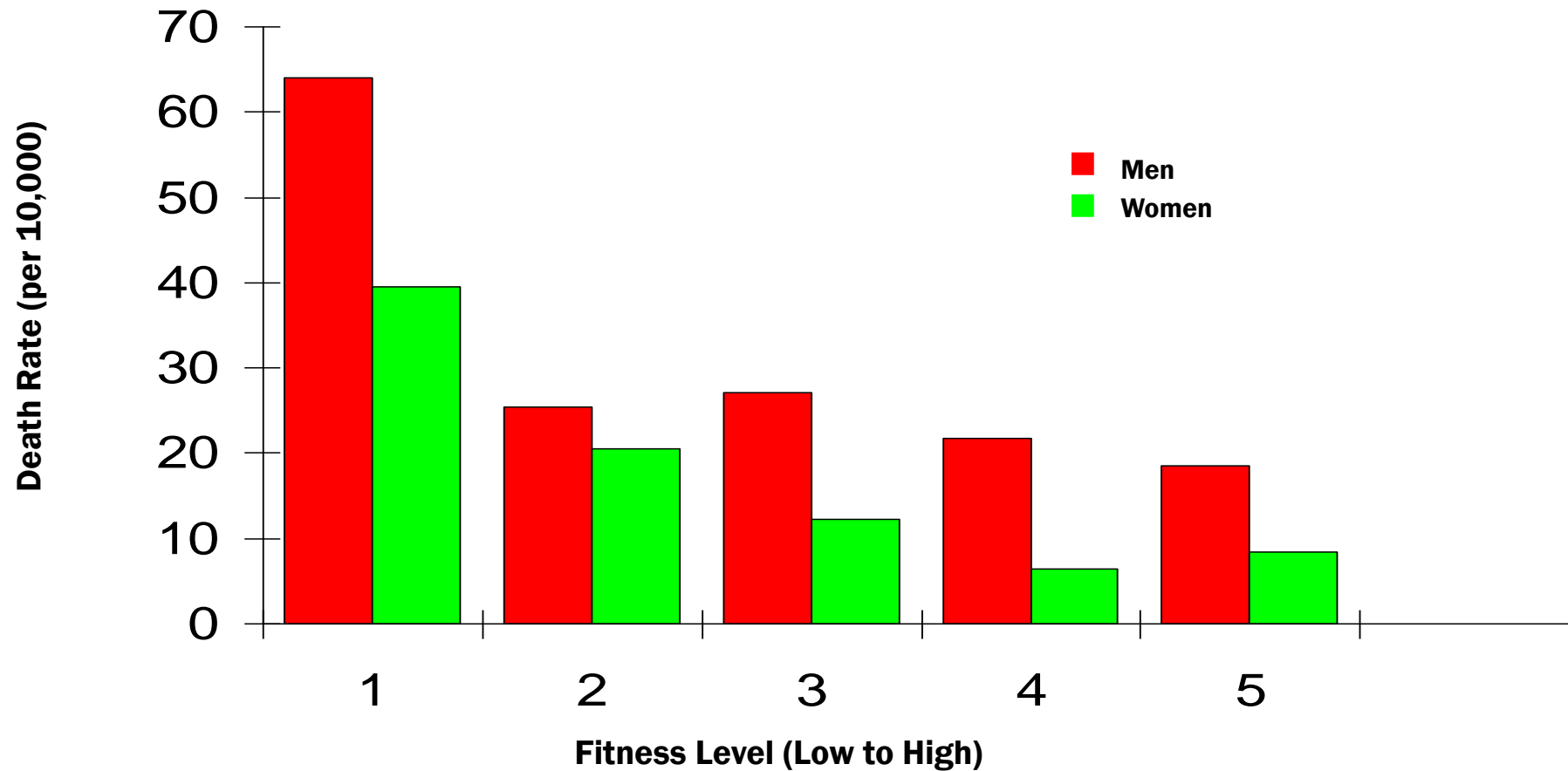
# Physical Fitness

**Cardiorespiratory**- the ability of the cardiovascular and respiratory systems to supply oxygen to skeletal muscles for use during physical activity

**Musculoskeletal** – the ability of muscles to produce force (muscle strength) and to repeat or sustain a contraction (muscle endurance)

# Cardiorespiratory Fitness & Mortality

All-Cause Death Rates by CRF Categories – 3,120 Women and 10,224 Men followed for 8 years



Blair, S. N., Kohl, H. W., Paffenbarger, R. S., Clark, D. G., Cooper, K. H., & Gibbons, L. W. (1989). Physical fitness and all-cause mortality: a prospective study of healthy men and women. *JAMA*, 262(17), 2395-2401.

# Cardiorespiratory Fitness & CVD Risk

24 studies

84 323 participants and 4485 cases

Pooled RRs CHD/CVD per 1-MET higher level of CRF  
= 0.85 (95% CI, 0.82-0.88),

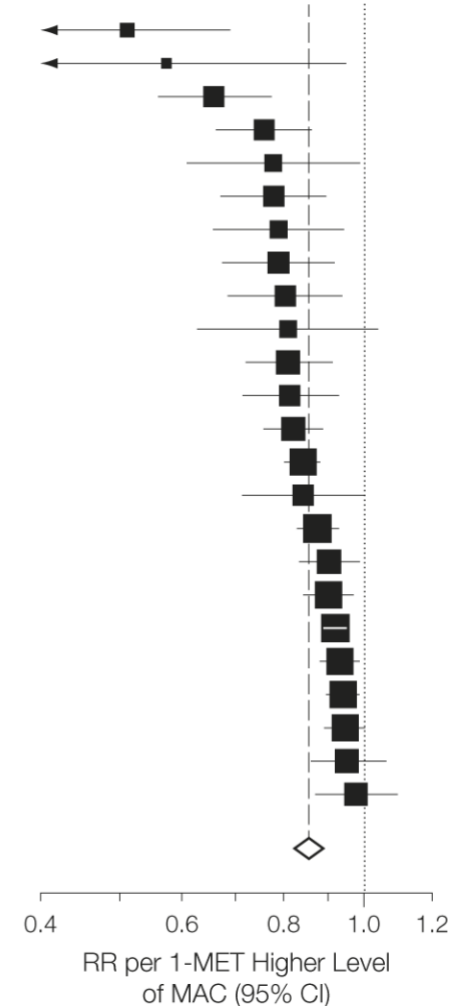
Each 1-MET higher level of mean aerobic capacity  
was associated with 15% decrease in CVD risk

This is comparable to

- 7 cm decrease waist circumference,
- 5 mmHg reduction in BP
- 1 mmol/L reduction in triglyceride or fasting glucose,
- 0.2-mmol/L increase in HDL cholesterol

Study	Events	RR	95% CI
CHD/CVD			
Allen et al, <sup>31</sup> 1980 [women]	1.32	0.51	(0.38-0.68)
Sobolski et al, <sup>52</sup> 1987	0.49	0.57	(0.35-0.94)
Allen et al, <sup>31</sup> 1980 [men]	3.12	0.65	(0.56-0.76)
Bruce et al, <sup>34</sup> 1980	3.66	0.75	(0.65-0.85)
Peters et al, <sup>48</sup> 1983	1.70	0.77	(0.60-0.98)
Arraiz et al, <sup>32</sup> 1992	3.37	0.77	(0.66-0.89)
Miller et al, <sup>6</sup> 2005	2.54	0.78	(0.65-0.94)
Gulati et al, <sup>39</sup> 2005	3.11	0.78	(0.67-0.91)
Rywik et al, <sup>49</sup> 2002	2.98	0.79	(0.68-0.93)
Cumming et al, <sup>35</sup> 1975	1.58	0.80	(0.62-1.03)
Jouven et al, <sup>43</sup> 2005	4.22	0.80	(0.71-0.90)
Sawada and Muto, <sup>51</sup> 1999	3.77	0.81	(0.71-0.92)
Gyntelberg et al, <sup>41</sup> 1980	5.36	0.81	(0.75-0.88)
Mora et al, <sup>46</sup> 2003	6.59	0.83	(0.79-0.87)
Stevens et al, <sup>21</sup> 2002 [women]	2.83	0.83	(0.70-0.99)
Laukkanen et al, <sup>8</sup> 2007	6.28	0.87	(0.82-0.92)
Erriksen et al, <sup>37</sup> 2004	5.32	0.90	(0.83-0.98)
Stevens et al, <sup>22</sup> 2004	5.89	0.90	(0.84-0.96)
Sui et al, <sup>7</sup> 2007 [men]	7.18	0.91	(0.89-0.94)
Stevens et al, <sup>21</sup> 2002 [men]	6.48	0.93	(0.88-0.98)
Slattery and Jacobs, <sup>5</sup> 1988	6.86	0.94	(0.90-0.97)
Balady et al, <sup>33</sup> 2004 [men]	6.43	0.94	(0.89-0.99)
Sui et al, <sup>7</sup> 2007 [women]	4.67	0.94	(0.85-1.05)
Balady et al, <sup>33</sup> 2004 [women]	4.27	0.97	(0.87-1.09)
Overall	100.00	0.85	(0.82-0.88)

Test for heterogeneity:  $I^2 = 74.7\%$ ;  $P < .001$





Published in final edited form as:

Med Sci Sports Exerc. 2001 May ; 33(5): 754–761.

## Physical fitness and activity as separate heart disease risk factors: a meta-analysis

Paul T. Williams

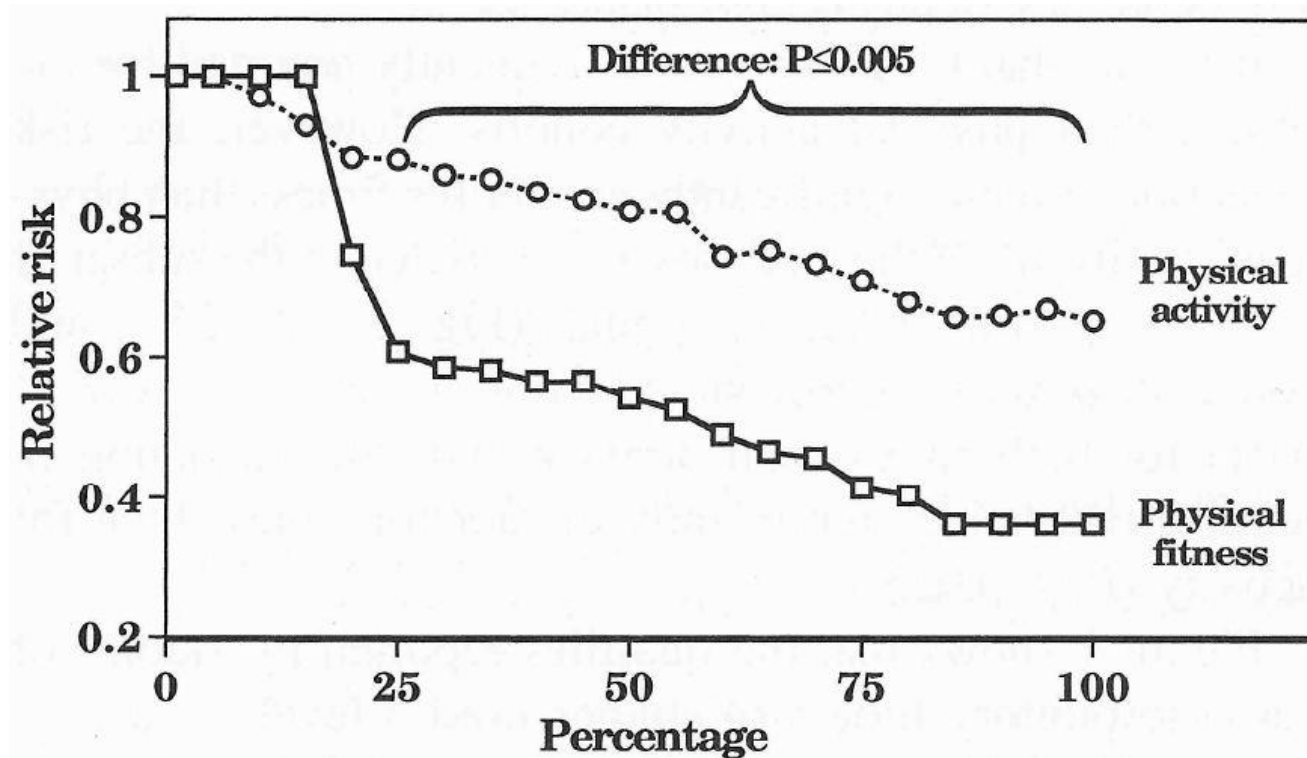
Life Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720

### 38 Cohorts reporting

- total physical activity (30) or
- physical fitness (8)

### Relative risks ranked from

- least fit/active to most fit/active across 20 categories



# What about strength training?

Strain et al. *BMC Public Health* (2016) 16:1108  
DOI 10.1186/s12889-016-3774-6


BMC Public Health

RESEARCH ARTICLE

Open Access

## The forgotten guidelines: cross-sectional analysis of participation in muscle strengthening and balance & co-ordination activities by adults and older adults in Scotland



Tessa Strain , Claire Fitzsimons, Paul Kelly and Nanette Mutrie

Strain, T., Fitzsimons, C., Kelly, P., & Mutrie, N. (2016). The forgotten guidelines: cross-sectional analysis of participation in muscle strengthening and balance & co-ordination activities by adults and older adults in Scotland. *BMC public health*, 16(1), 1108.

# What about strength training?

EPIDEMIOLOGY

## Strength Training and the Risk of Type 2 Diabetes and Cardiovascular Disease

ERIC J. SHIROMA<sup>1,2,3</sup>, NANCY R. COOK<sup>2,3</sup>, JOANN E. MANSON<sup>2,3</sup>, MV MOORTHY<sup>3</sup>, JULIE E. BURING<sup>2,3</sup>, ERIC B. RIMM<sup>3,4</sup>, and I-MIN LEE<sup>2,3</sup>

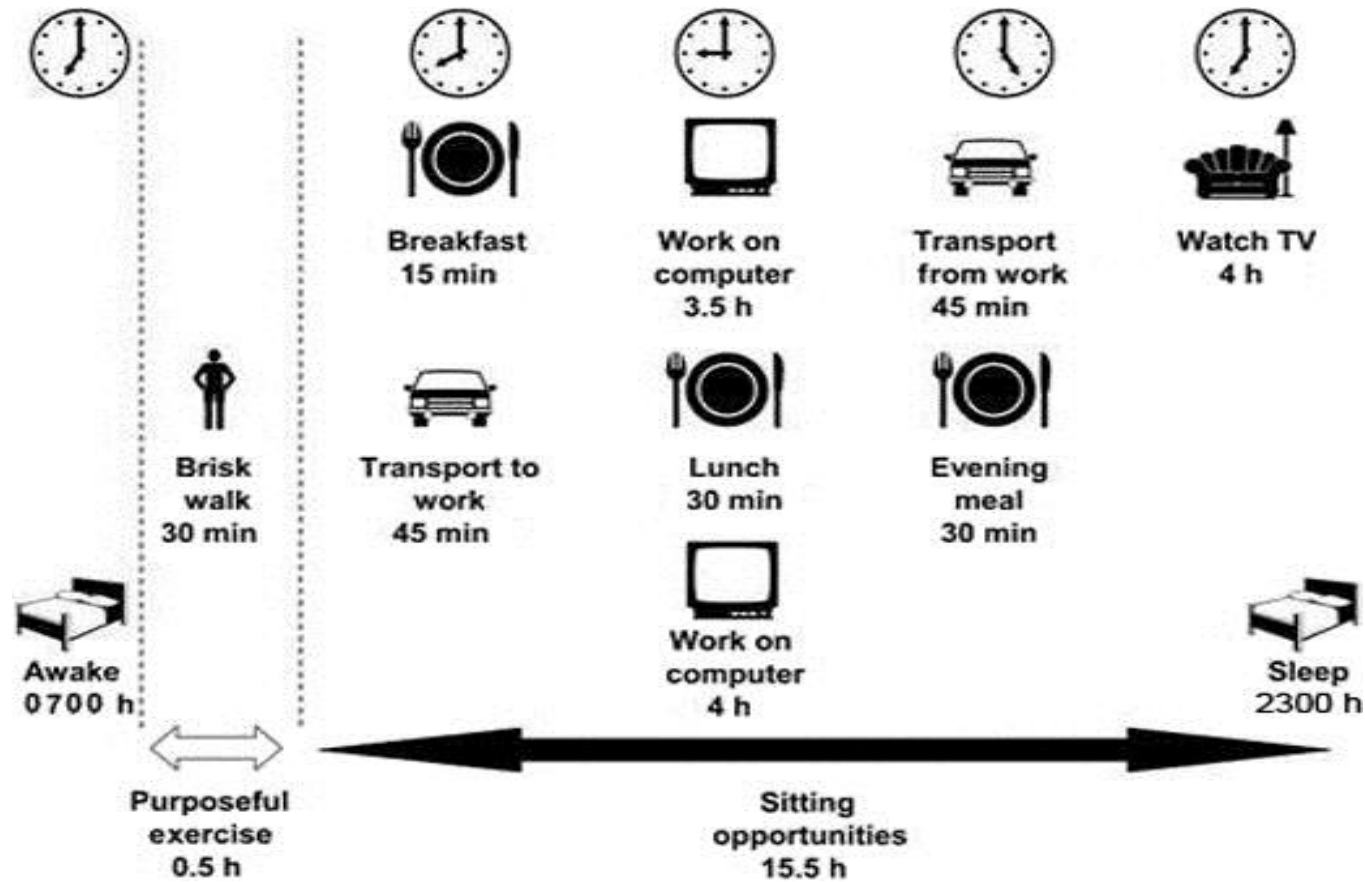
<sup>1</sup>Laboratory of Epidemiology and Population Science, Intramural Research Program of the National Institutes of Health, National Institute on Aging, Bethesda, MD; <sup>2</sup>Division of Preventive Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA; <sup>3</sup>Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, MA; and <sup>4</sup>Department of Nutrition, Harvard School of Public Health, Boston, MA

## Women's Health Study

- 35,754 women
- 10 year follow-up
- 1742 cases of CVD

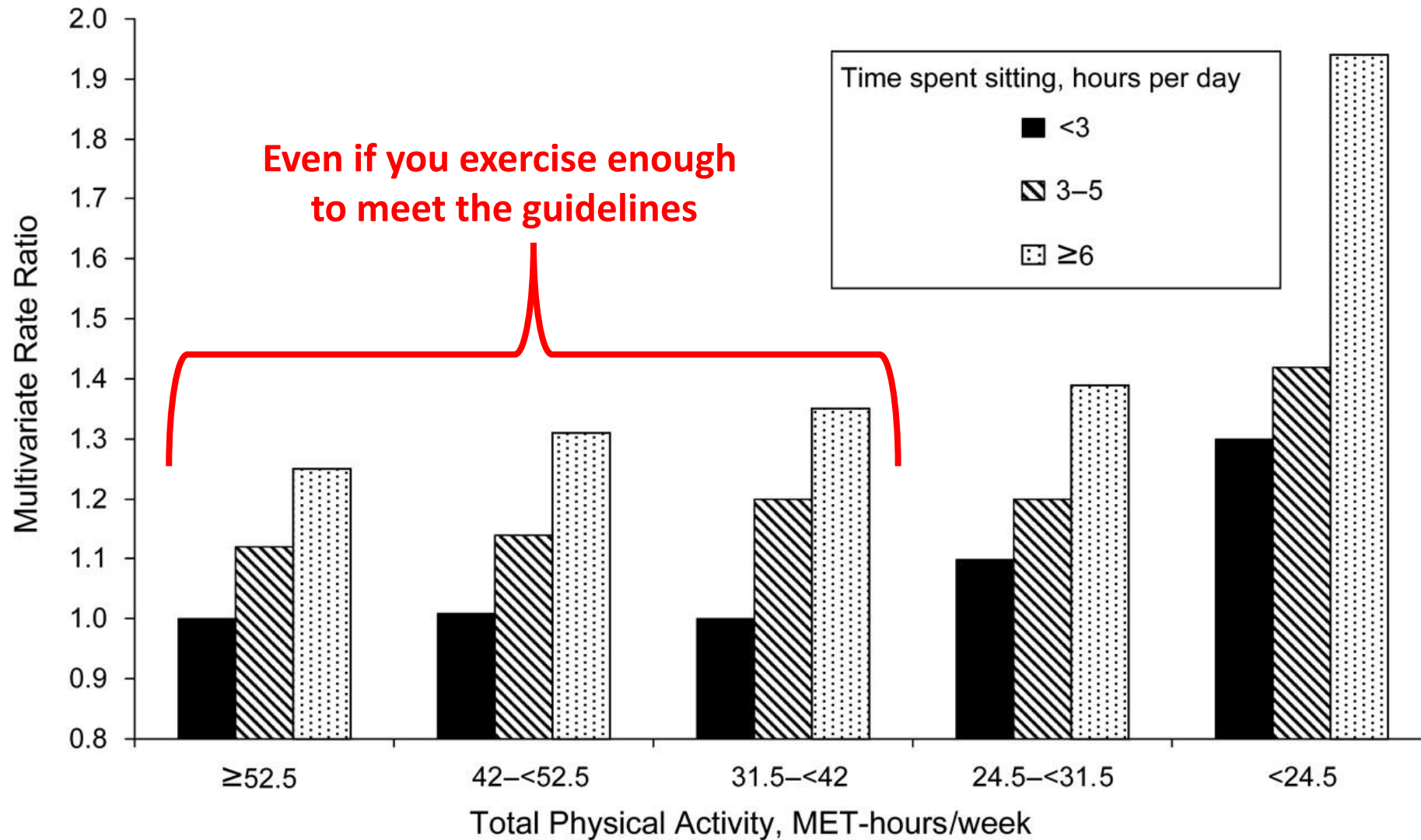
Women who did strength training had 17% reduced risk of CVD  
(hazard ratio = 0.83, 95% confidence interval = 0.72, 0.96)

# Sedentary Behaviour



# Sitting Time and All-Cause Mortality

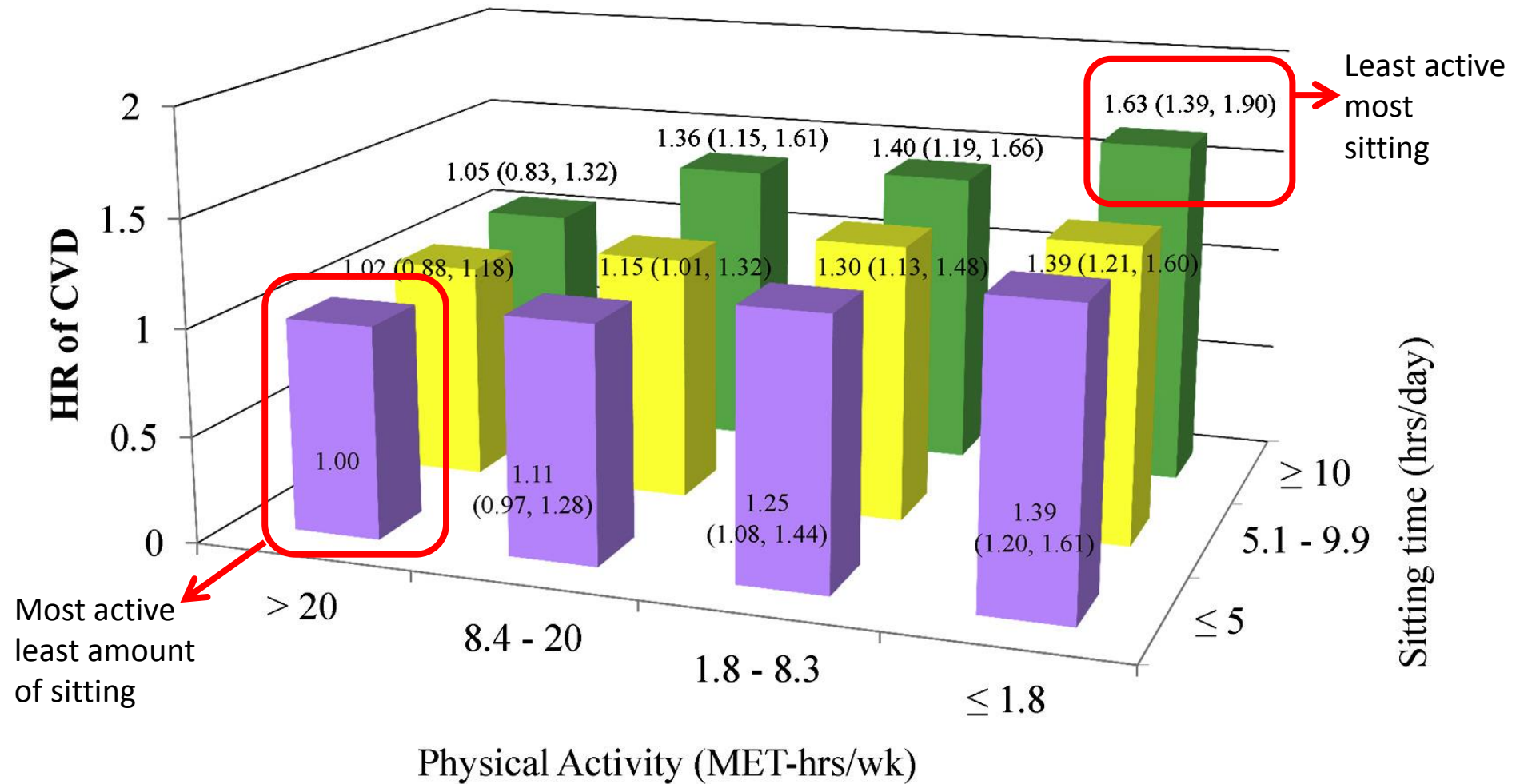
n= 53,440 men 97,776 women followed 14 years



Patel A V et al. (2010) Leisure time spent sitting in relation to total mortality in a prospective cohort of US adults. *Am. J. Epidemiol.* 2010;172:419-429

# Sitting Time, Physical Activity and CVD in Women

Womens Health Study n=71,018 women aged 50-79 followed 12-17 years





# Sedentary Behaviour and CVD morbidity and mortality

Diabetologia (2012) 55:2895–2905  
DOI 10.1007/s00125-012-2677-z

META-ANALYSIS

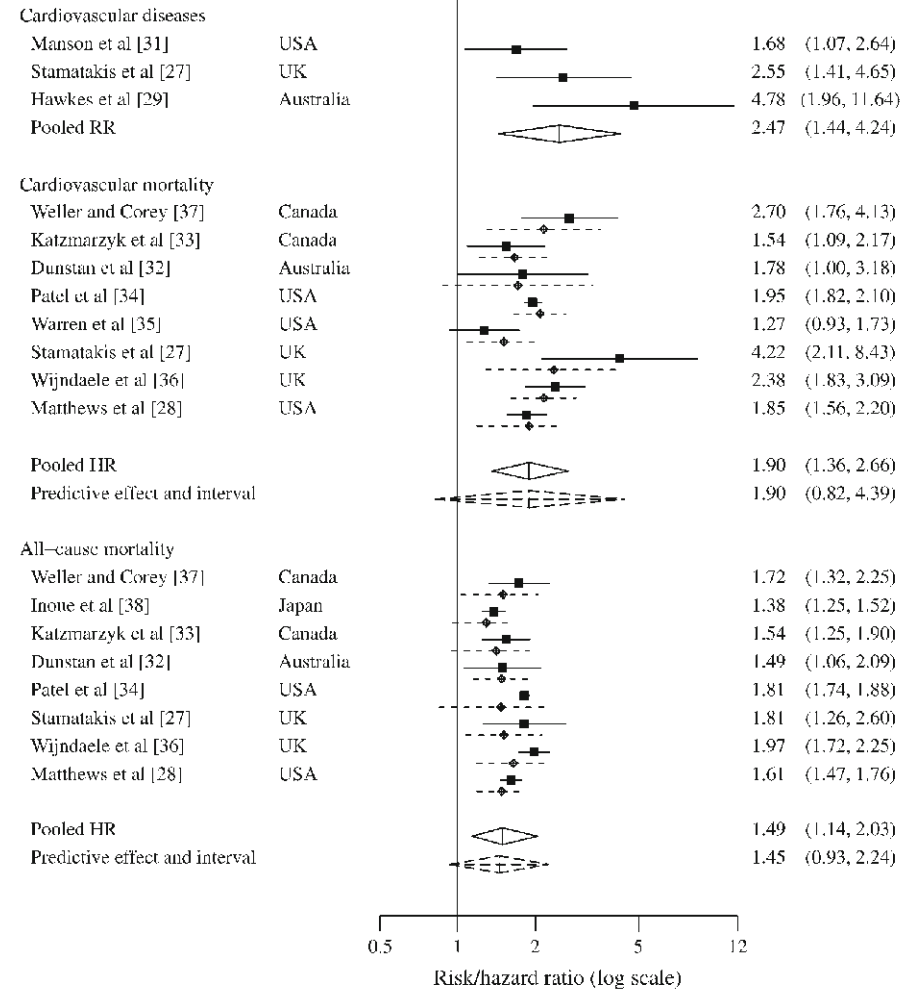
## Sedentary time in adults and the association with diabetes, cardiovascular disease and death: systematic review and meta-analysis

E. G. Wilmot · C. L. Edwardson · F. A. Achana ·  
M. J. Davies · T. Gorely · L. J. Gray · K. Khunti ·  
T. Yates · S. J. H. Biddle

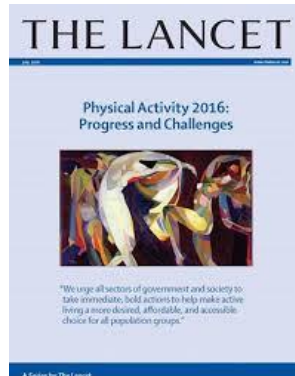
18 studies (16 prospective, 2 cross-sectional)

High levels of SB associated with

- 147% increase in the risk of cardiovascular disease (RR 2.47; 95% CI 1.44, 4.24)
- 90% increase in the risk of cardiovascular mortality (HR 1.90; 95% CI 1.36, 2.66)



# Can the health effects of sedentary behaviour be cancelled by being very active?



## Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women

Ulf Ekelund, Jostein Steene-Johannessen, Wendy J Brown, Morten Wang Fagerland, Neville Owen, Kenneth E Powell, Adrian Bauman, I-Min Lee, for the Lancet Physical Activity Series 2 Executive Committee\* and the Lancet Sedentary Behaviour Working Group\*

### Summary

Lancet 2016; 388: 1302–10

Published Online

July 27, 2016

[http://dx.doi.org/10.1016/](http://dx.doi.org/10.1016/S0140-6736(16)30370-1)

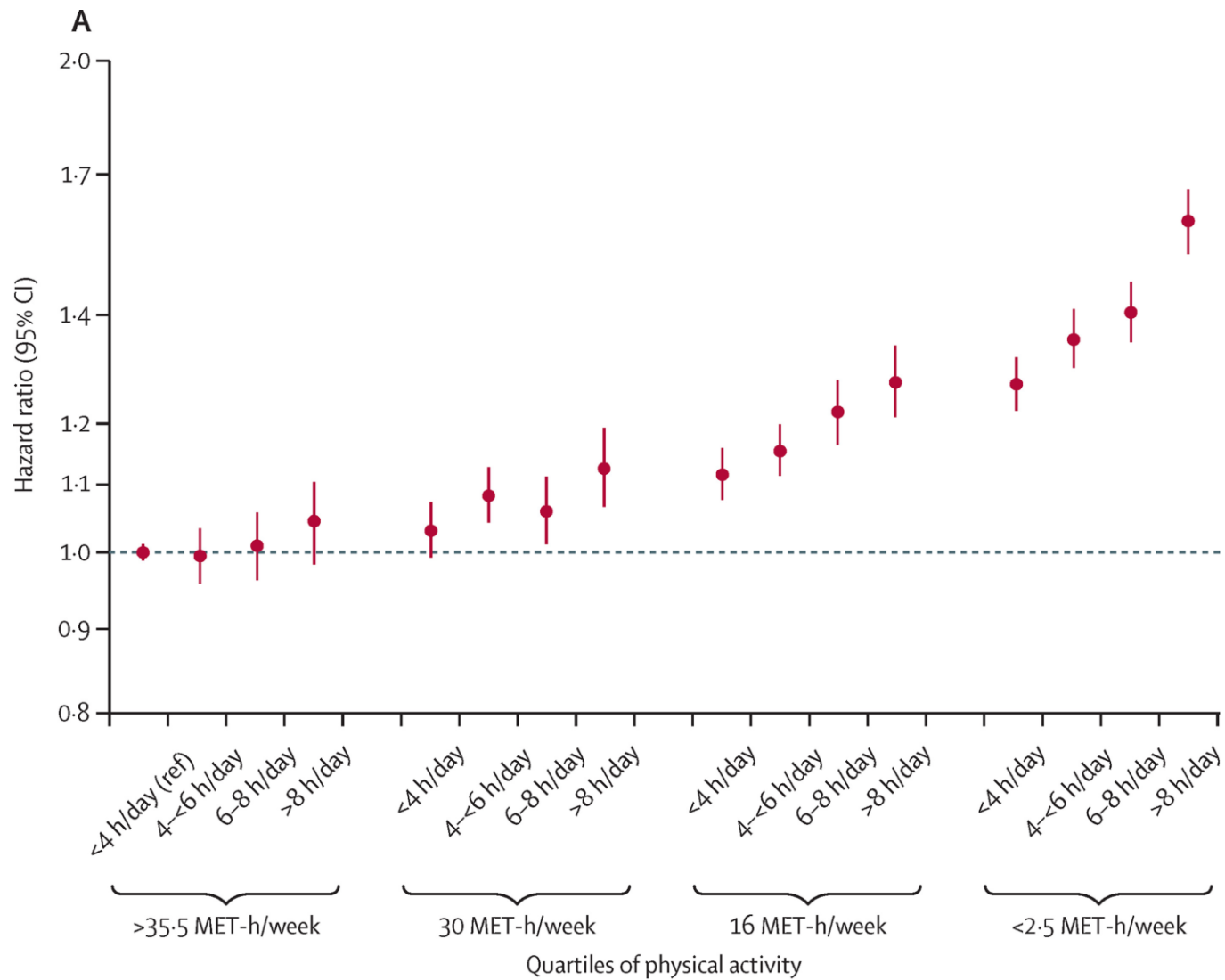
[S0140-6736\(16\)30370-1](http://dx.doi.org/10.1016/S0140-6736(16)30370-1)

**Background** High amounts of sedentary behaviour have been associated with increased risks of several chronic conditions and mortality. However, it is unclear whether physical activity attenuates or even eliminates the detrimental effects of prolonged sitting. We examined the associations of sedentary behaviour and physical activity with all-cause mortality.

## Review of 16 studies

- >1m participants followed between 2 and 18 years
- Self reported sitting, TV viewing and physical activity
- All cause mortality



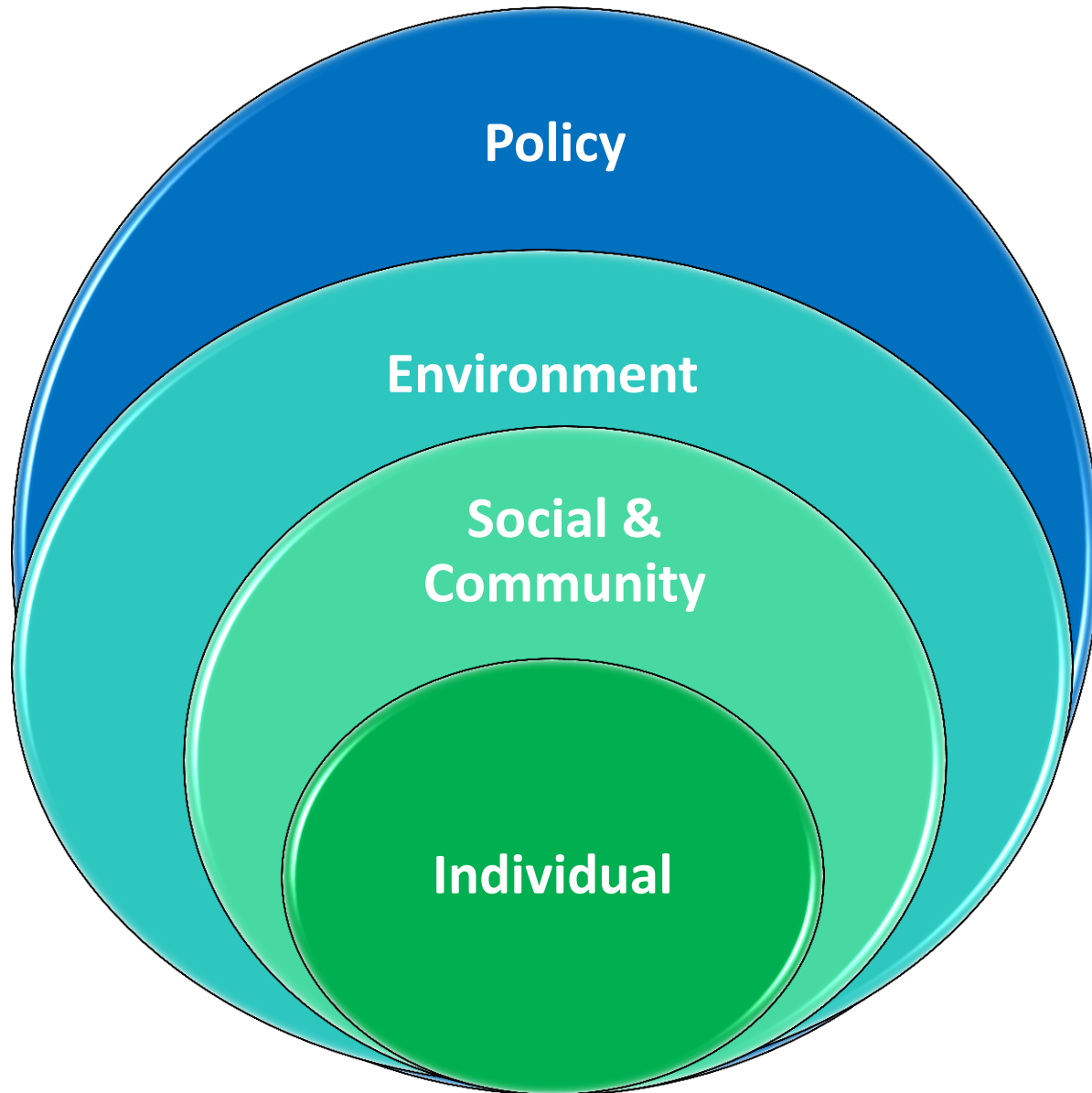


**High levels of moderate intensity physical activity (i.e., about 60–75 min per day) may eliminate the increased risk of death associated with high sitting time.**

**(only a very small proportion of the population do this amount of PA)**

- **Physical Activity (PA), Exercise, Fitness and Sedentary Behaviour (SB)**
- **Current PA and SB guidelines**
- **Evidence update/ magnitude of risk**
- **Interventions to change behaviour**

# Changing PA and SB what works (moderate to strong evidence)?



- Community design
- Access to facilities

- Point of decision prompts
- Built environment for active transport

- Multicomponent
- Community-wide delivery
- Worksite intervention (SB)

- Behaviour Change Techniques
- Family / School support
- Peer-led

# Take home messages



- Physical activity (meeting current UK guidelines) reduces risk of CVD by 15-35% depending on baseline PA, gender and disease endpoint
- Physical fitness, is associated with a reduced risk of CVD by similar magnitude to PA. Strong independent association for cardiorespiratory fitness, emerging evidence for association with musculoskeletal fitness.
- For both Physical Activity and Physical Fitness the greatest population benefit is derived from moving from low to moderate levels of activity and fitness
- Prolonged and/or uninterrupted sedentary behaviour increases CVD risk even in those meeting current PA guidelines. Only very high levels of physical activity attenuate this increase in risk
- PA and SB are complex behaviours. Changing these behaviours is likely to require interventions at the individual, community, environmental and policy level



# Physical Inactivity & Sedentary Behaviour as CVD risk factors

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