



The need for a revolution in the office
In the *Era* of the exercising couch potato

John Buckley

Professor of Applied Exercise Science

Thanks

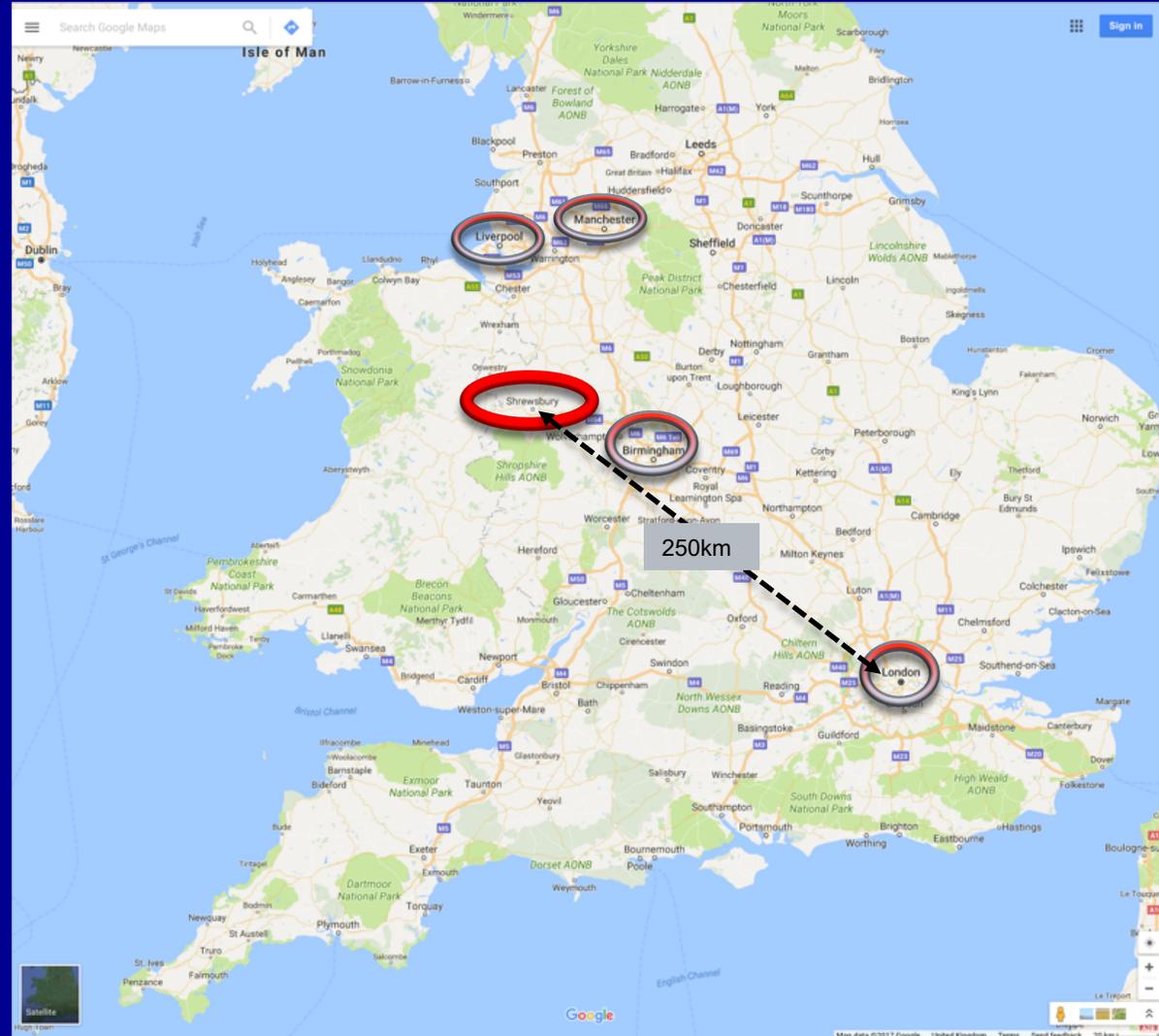
- Maggie Procopi
- Nigel Oseland

Declaration

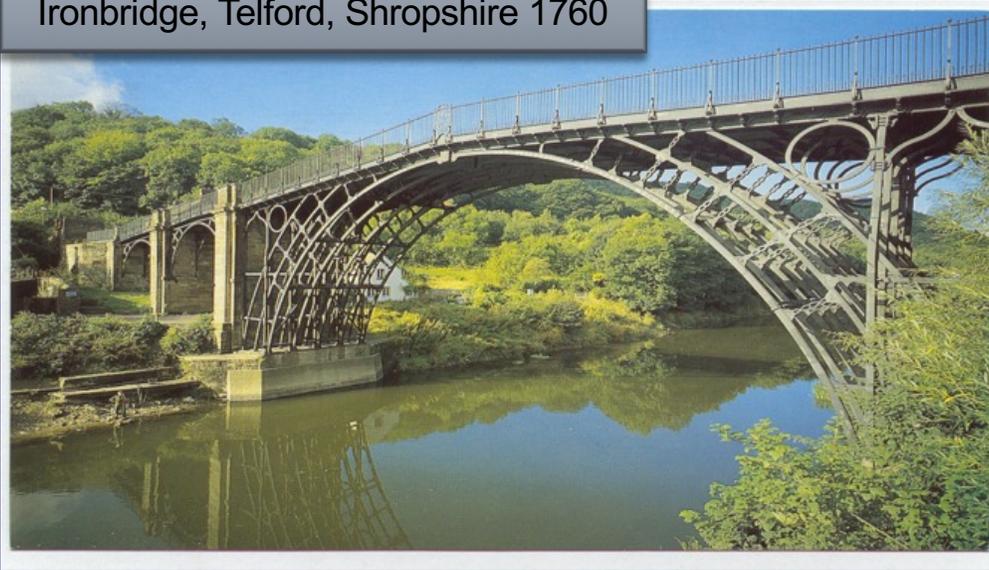
- I have no conflicts of interest, and declare presenting independent scientific evidence on reducing sedentary behaviour. My presentation does not constitute endorsement of any related product or service

Where is Shrewsbury?

Historically Centre of Universe for Sport & Physical Activity



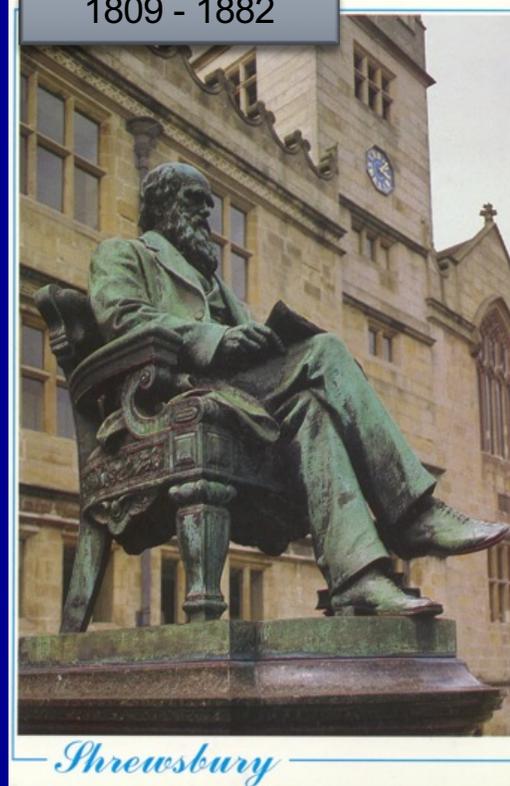
Ironbridge, Telford, Shropshire 1760



At beginning of Industrial Revolution (1760 – 1820)
average person expended 3000 Cals/day

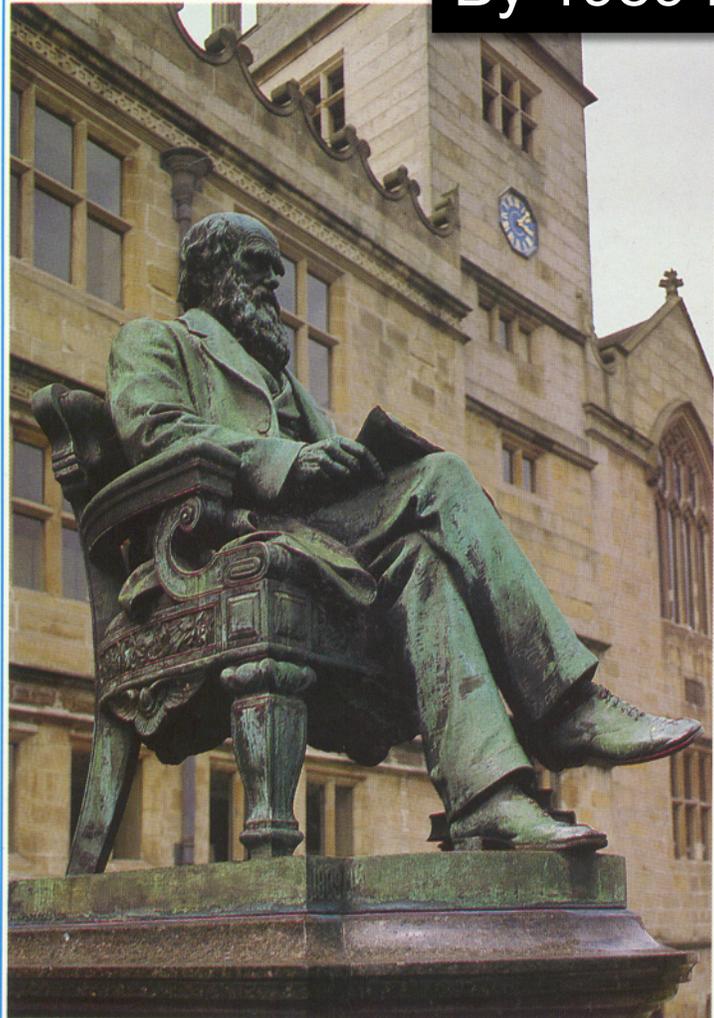
Today average person expends ~2000-2500 Cals/day
Equivalent difference of a 5 to 8 mile walk/day

1809 - 1882



Birthplace and schooling of Charles Darwin

By 1989 Darwin was proved to be right!

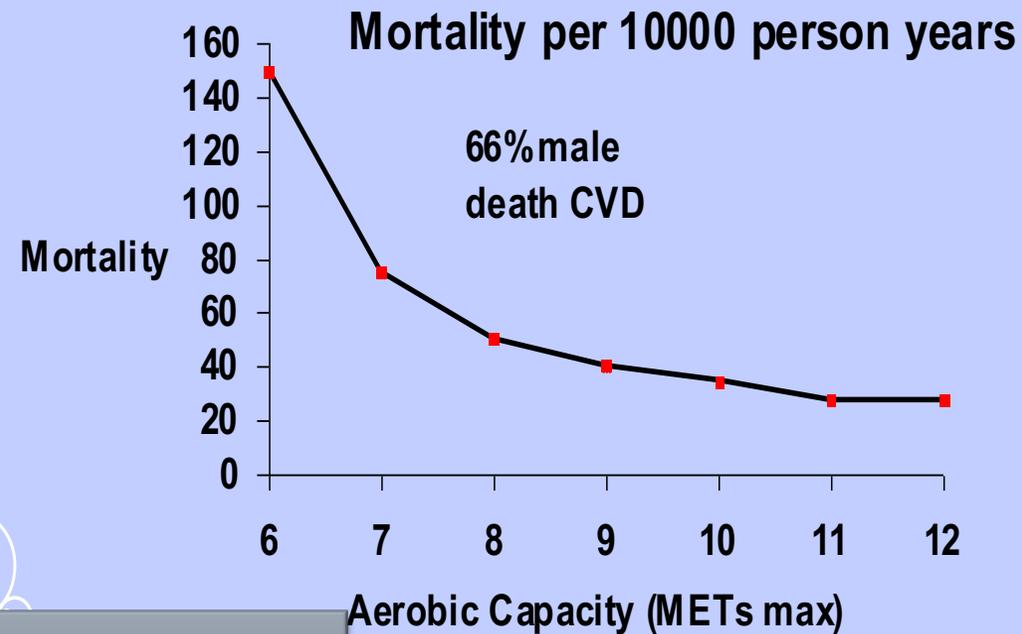


Shrewsbury

Survival of the fittest

Strong link with Very Low Aerobic Fitness

Blair et al (1989) JAMA; 262 (17): 2395-2401



1809 - 1882

To adapt to life's changing environments and become fitter one must be more active and/or exercise!

VI. *Some Account of a Disorder of the Breast.* By WILLIAM HEBERDEN, M. D. F. R. S.

Read at the COLLEGE, JULY 21, 1768.

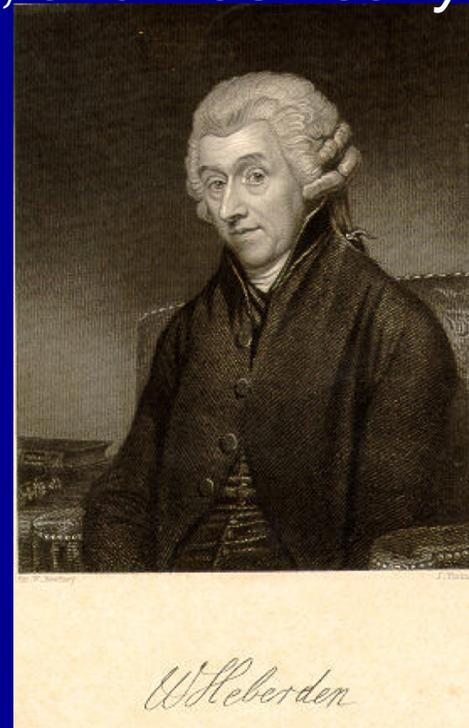
THERE is a disorder of the breast, marked with strong and peculiar symptoms, considerable for the kind of danger belonging to it, and not extremely rare, of which I do not recollect any mention among medical authors. The feat of it, and sense of strangling and anxiety with which it is attended, may make it not improperly be called Angina pectoris.

THOSE, who are afflicted with it, are seized, while they are walking, and more particularly when they walk soon after eating, with a painful and most disagreeable sensation in the breast, which seems as if it would

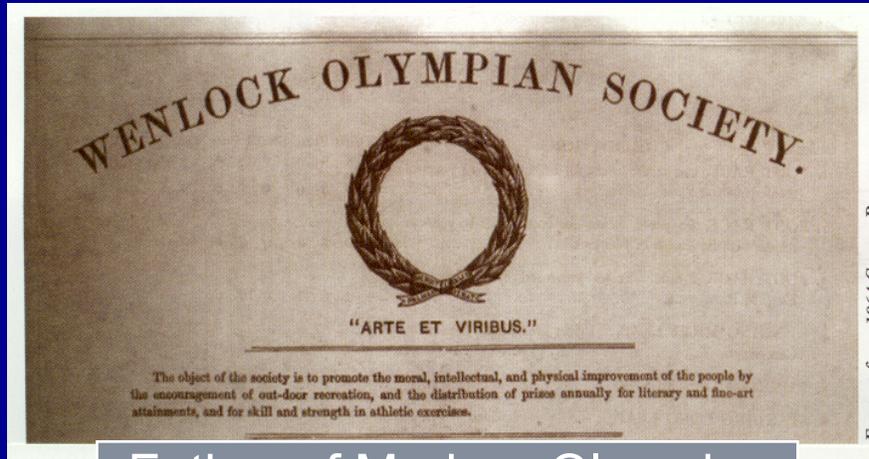
1772

**30 min/day exercise
a first cure of Angina?**

“I knew of one who set himself the task of sawing wood for half an hour every day, and was nearly cured”



Exercise Medicine in Shropshire in 1890s



Father of Modern Olympics



Dr. W.P. Brookes

“ If the Olympic Games that modern Greece has not yet been able to revive still survives today it is due not to a Greek, but to Dr. W.P. Brookes.. my oldest friend!”

Baron Pierre de Coubertin

Letter to Parliament, 4th June, 1890

The school attendance is usually 3 hours in the morning and 2 ¹/₂ hours in the afternoon. This would leave time to devote *half an hour a day to bodily training...*

2015
Centre for Active Living
MSc Exercise Medicine



A new industrial disease has hit the western world with force



1982

- Sedentary behaviour!
 - *Is simply being on your feet more avoiding too much sitting enough of to counteract some of the effects of modern industrial disease?*

Outline of my talk

- The increasing global office-bound workforce
- The activity spectrum from sedentary behaviour to MVPA
- Population trends and potential ills of sedentary behaviour as an independent health risk factor
- Evidence-base and interventions, recommendations to combat sedentary behaviour in office workers

Standing-desk workers 'less tired, more engaged'

11 October 2018



New research suggests that standing desks, which allow employees to alter their position during the day, may boost performance at work.

A number of NHS staff were given new desks and set goals for standing time.

After a year, researchers found sitting time was reduced by more than an hour a day compared with their colleagues.

Employees who reduced time sitting, by using desks that also allowed them to work while on their feet, also said they were less tired and more engaged.

- **Could offices change from sitting to standing?**



OPEN ACCESS

Effectiveness of the Stand More AT (SMArT) Work intervention: cluster randomised controlled trial

Charlotte L Edwardson,^{1,2} Tom Yates,^{1,2} Stuart J H Biddle,³ Melanie J Davies,^{1,2,4} David W Dunstan,^{6,7,8,9,10,11} Dale W Esliger,^{2,12} Laura J Gray,¹³ Benjamin Jackson,¹² Sophie E O'Connell,⁴ Ghazala Waheed,¹ Fehmidah Munir¹²

For numbered affiliations see end of article.

Correspondence to: C L Edwardson ce95@le.ac.uk

Additional material is published online only. To view please visit the journal online.

Cite this as: *BMJ* 2018;363:k3870 <http://dx.doi.org/10.1136/bmj.k3870>

Accepted: 08 August 2018

ABSTRACT

OBJECTIVES

To evaluate the impact of a multicomponent intervention (Stand More AT (SMArT) Work) designed to reduce sitting time on short (three months), medium (six months), and longer term (12 months) changes in occupational, daily, and prolonged sitting, standing, and physical activity, and physical, psychological, and work related health.

DESIGN

Cluster two arm randomised controlled trial.

SETTING

National Health Service trust, England.

PARTICIPANTS

37 office clusters (146 participants) of desk based workers: 19 clusters (77 participants) were randomised to the intervention and 18 (69 participants) to control.

INTERVENTIONS

The intervention group received a height adjustable workstation, a brief seminar with supporting leaflet, workstation instructions with sitting and standing targets, feedback on sitting and physical activity at three time points, posters, action planning and goal setting booklet, self monitoring and prompt tool, and coaching sessions (month 1 and every three months thereafter). The control group continued with usual practice.

MAIN OUTCOME MEASURES

The primary outcome was occupational sitting time (high worn accelerometer). Secondary outcomes were objectively measured daily sitting, prolonged sitting (≥ 30 minutes), and standing time, physical activity, musculoskeletal problems, self reported work

related health (job performance, job satisfaction, work engagement, occupational fatigue, sickness presenteeism, and sickness absenteeism), cognitive function, and self reported psychological measures (mood and affective states, quality of life) assessed at 3, 6, and 12 months. Data were analysed using generalised estimating equation models, accounting for clustering.

RESULTS

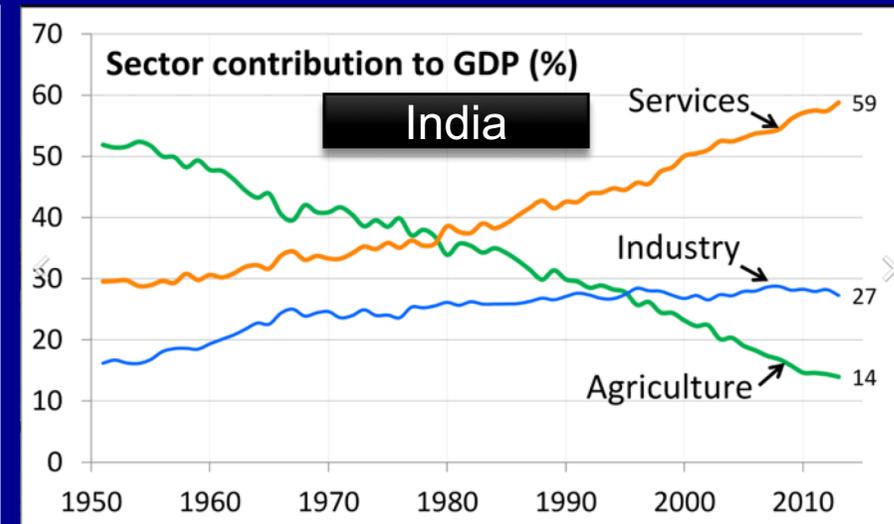
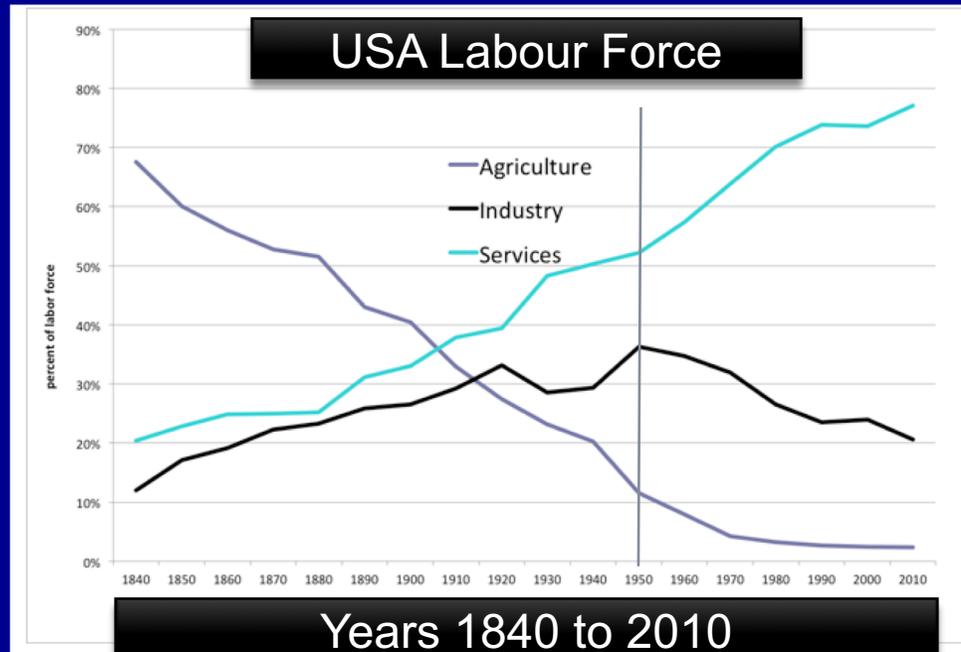
A significant difference between groups (in favour of the intervention group) was found in occupational sitting time at 12 months (-83.28 min/workday, 95% confidence interval -116.57 to -49.98 , $P=0.001$). Differences between groups (in favour of the intervention group compared with control) were observed for occupational sitting time at three months (-50.62 min/workday, -78.71 to -22.54 , $P<0.001$) and six months (-64.40 min/workday, -97.31 to -31.50 , $P<0.001$) and daily sitting time at six months (-59.32 min/day, -88.40 to -30.25 , $P<0.001$) and 12 months (-82.39 min/day, -114.54 to -50.26 , $P=0.001$). Group differences (in favour of the intervention group compared with control) were found for prolonged sitting time, standing time, job performance, work engagement, occupational fatigue, sickness presenteeism, daily anxiety, and quality of life. No differences were seen for sickness absenteeism.

CONCLUSIONS

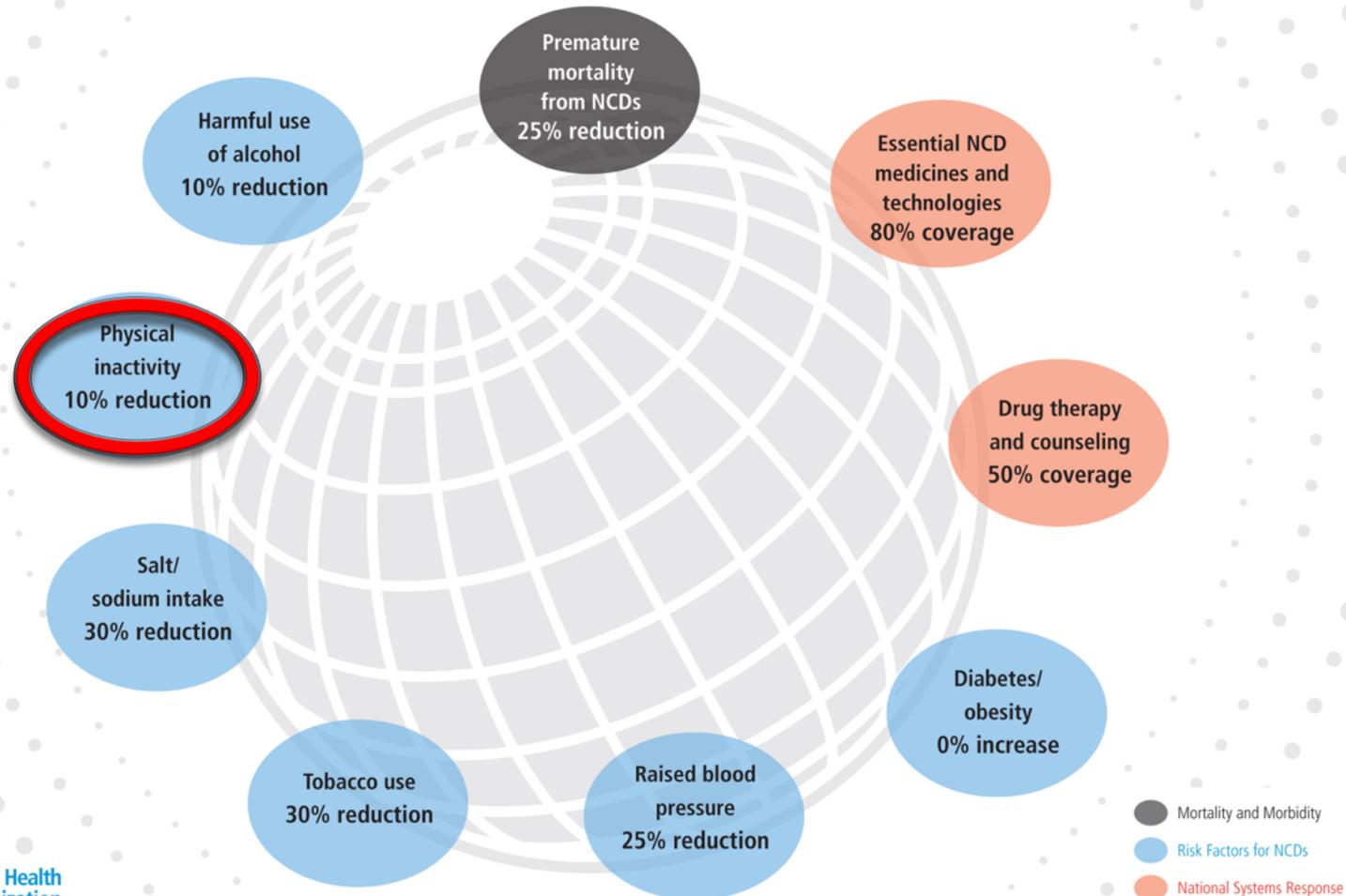
SMArT Work successfully reduced sitting time over the short, medium, and longer term, and positive changes were observed in work related and psychological health.

TRIAL REGISTRATION

Current Controlled Trials ISRCTN10967042.



Set of 9 voluntary global NCD targets for 2025





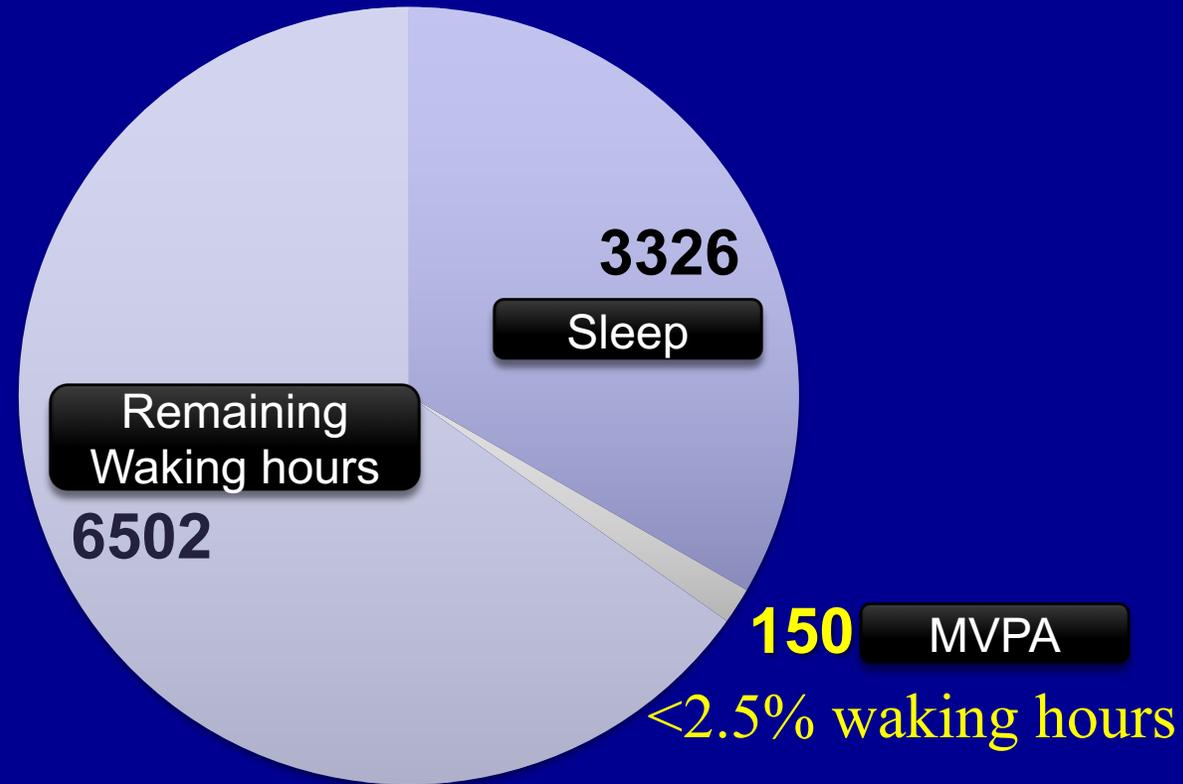
Media centre Publications Countries Programmes Governance About WHO

Global Strategy on Diet, Physical Activity and Health

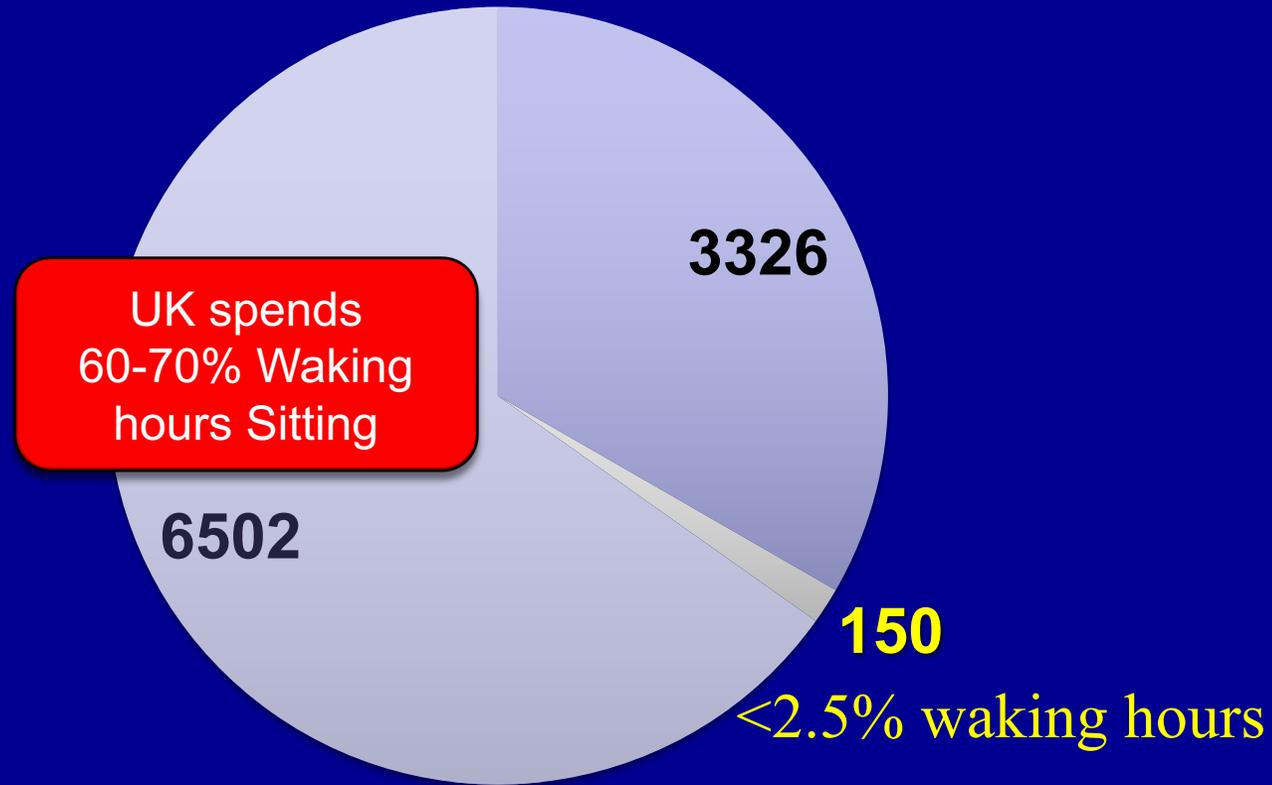
Leisure time PA
Sport & Exercise
Transport
Occupation
Domestic

Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity

**Of your 10,000 minutes per week,
150 mins represents 2.5% of waking hours**

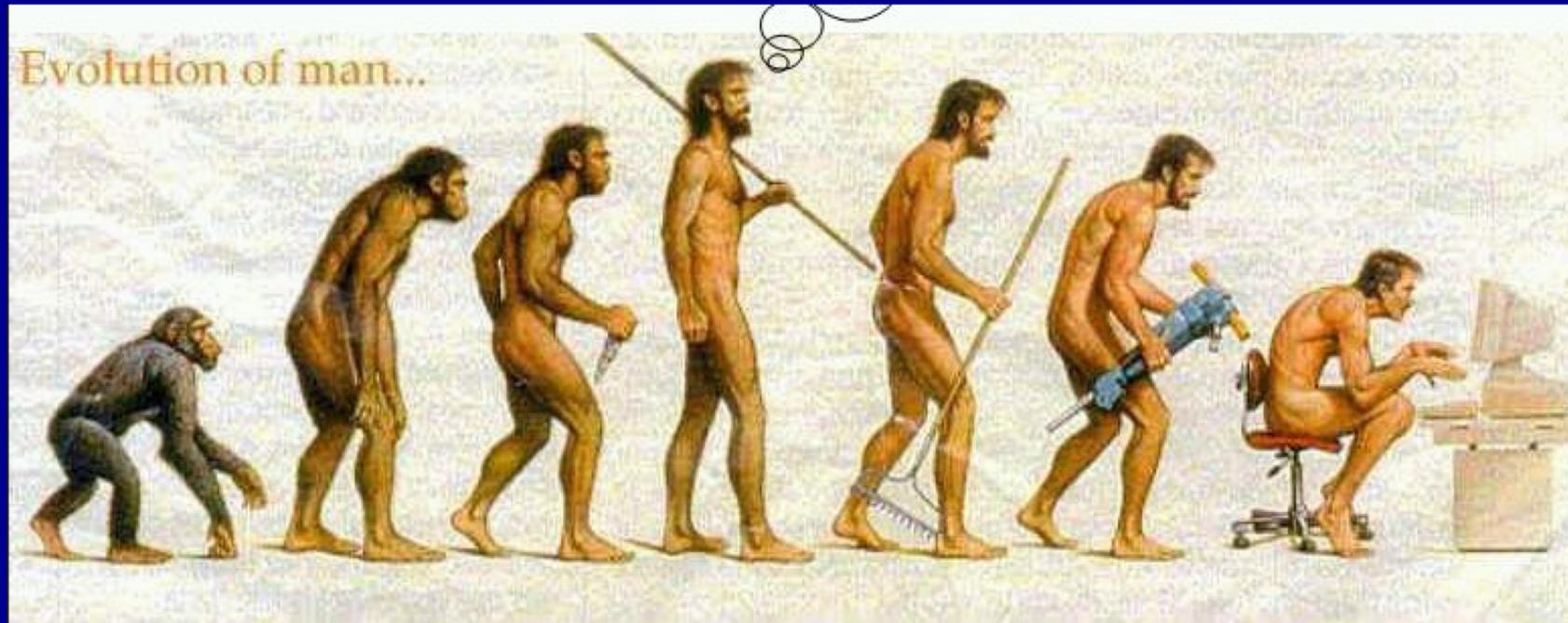


Of your 10,000 minutes per week 60-70% waking hours spent sitting



Buckley et al. *Br J Sports Med* 2015;0:1-6.

Research is emerging and accelerating on avoiding sitting time with “*at least*” light physical activity (including standing) during the other 97.5% of waking hours



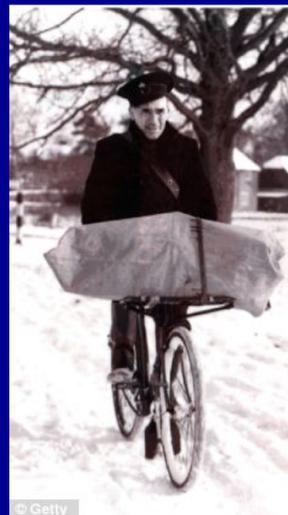
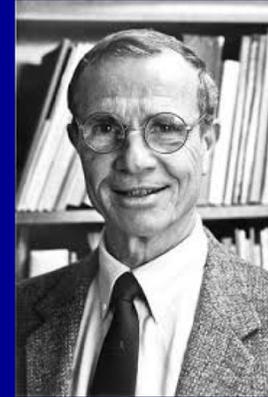
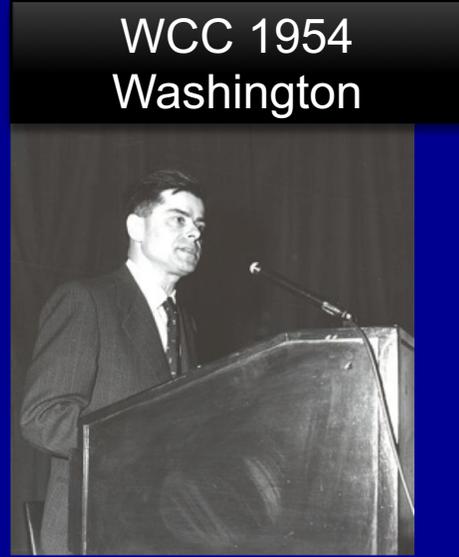
Light activity at work



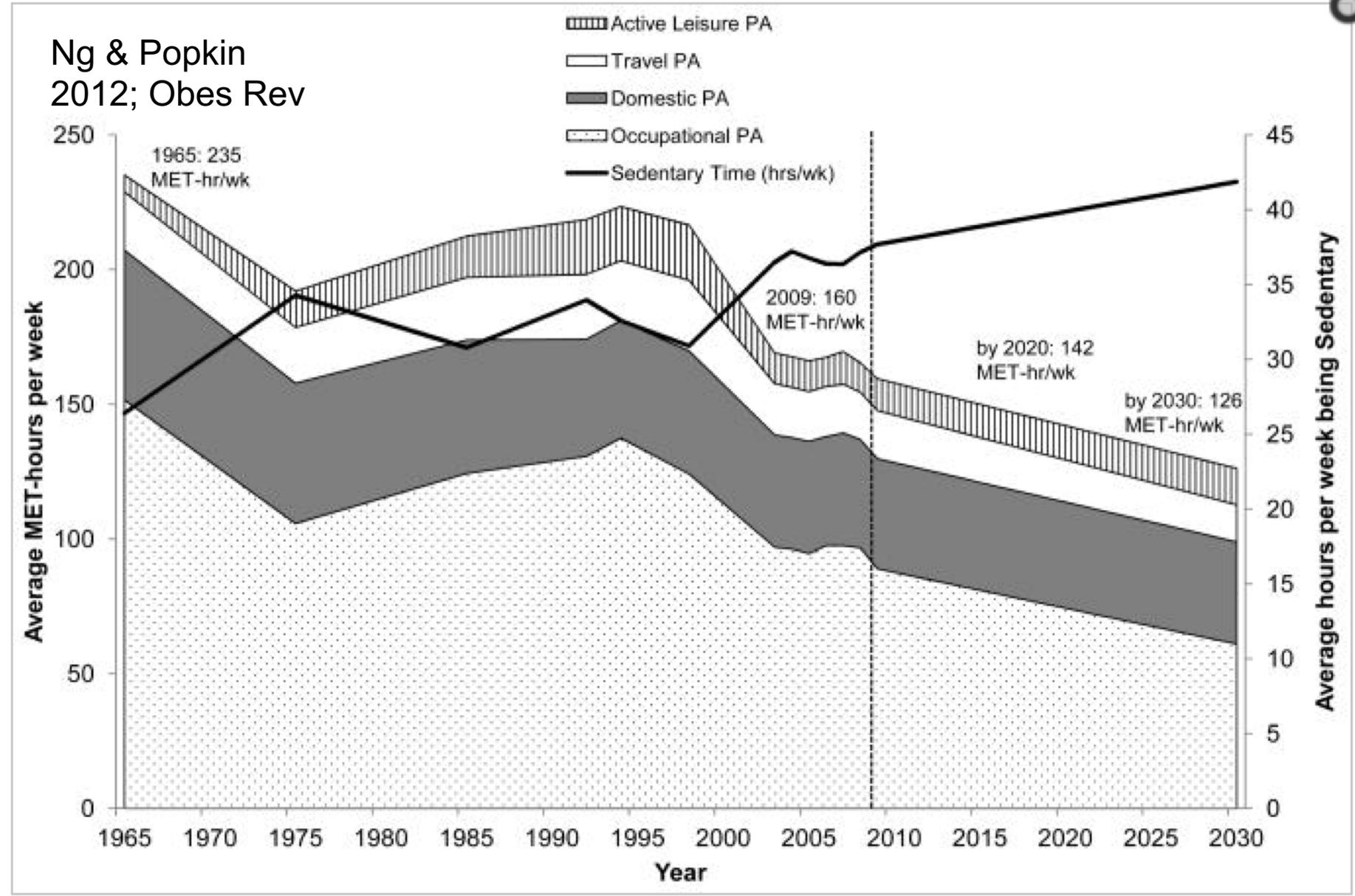
Standing-up to work and learn is nothing new, so how 'bout you!

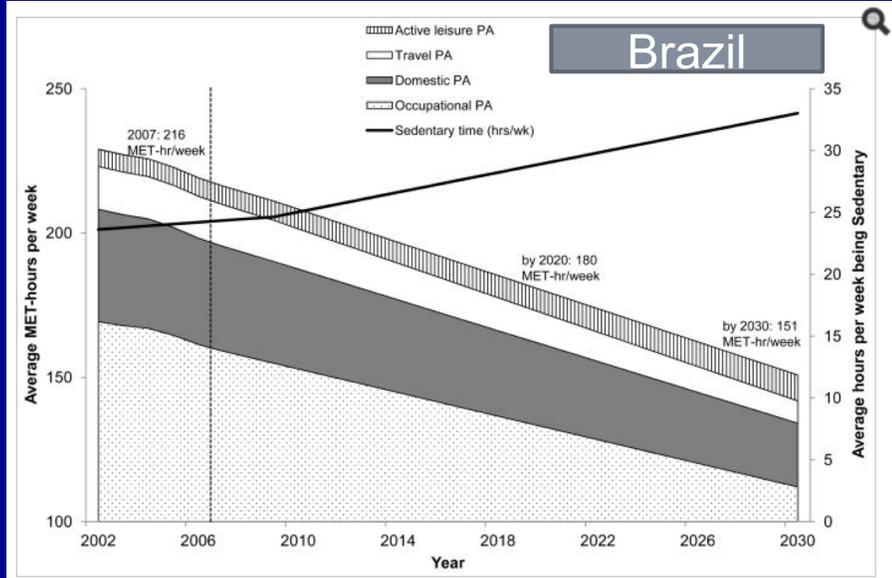


Occupational activity at the “heart” of physical activity for health evidence

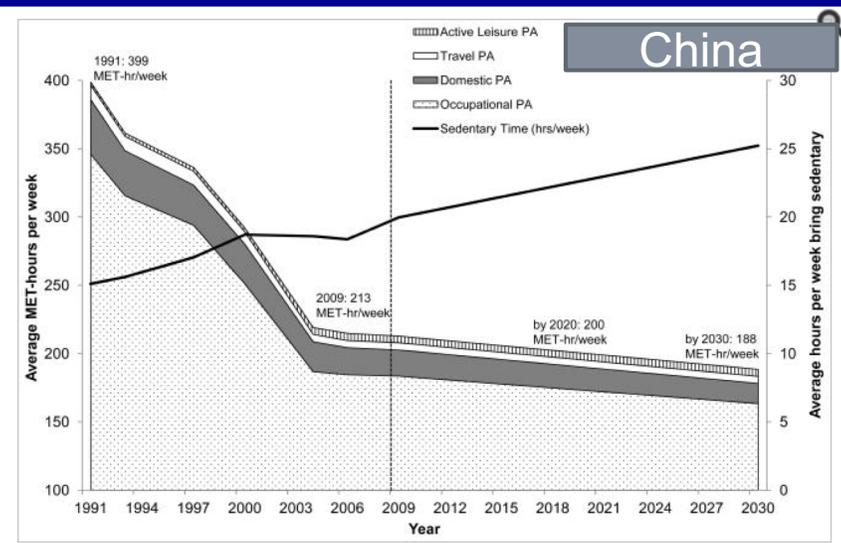
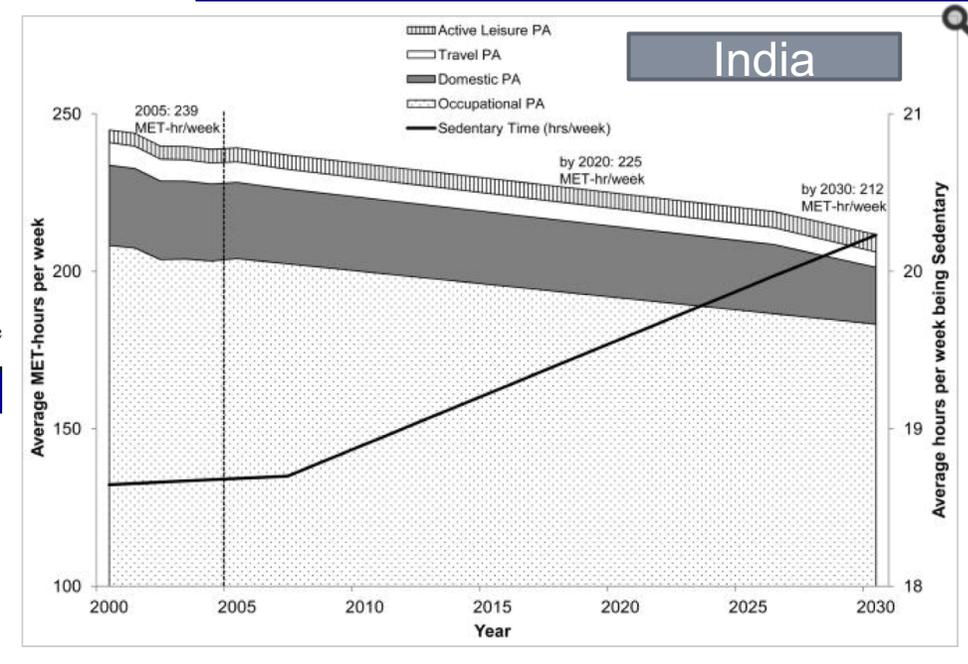


Ng & Popkin
2012; Obes Rev



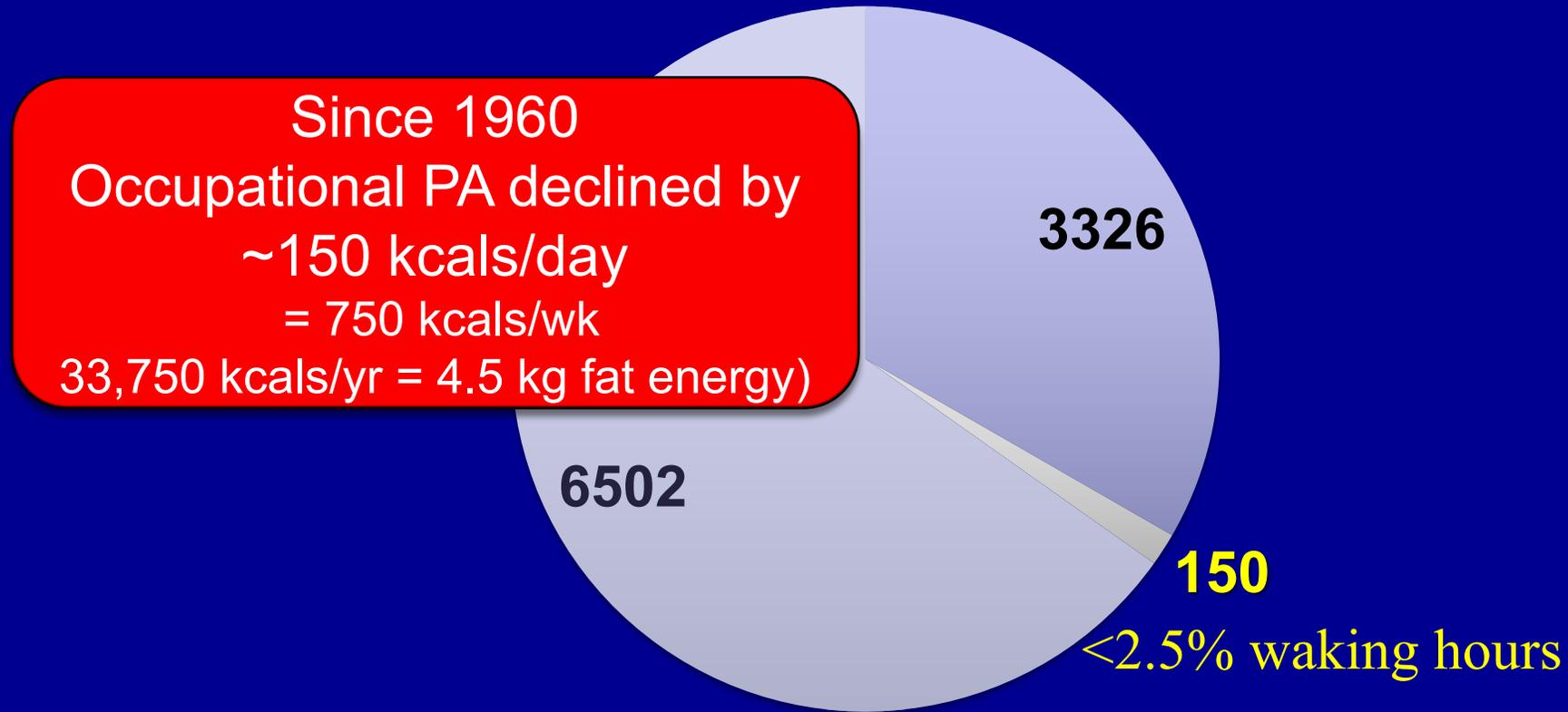


Brazilian Adults MET-hours Per Week of All Physical Activity, and Hours/Week of Time in Sedentary Behavior: Measured for 2002–2007, Forecasted for 2009–2030



Chinese Adults MET-hours Per Week of All Physical Activity, and Hours/Week of Time in Sedentary Behavior: Measured for 1991–2009, Forecasted for 2010–2030

Changes in occupational PA in developed countries



Standing vs sitting and all-cause mortality, 13 year follow-up Canada Fitness Survey

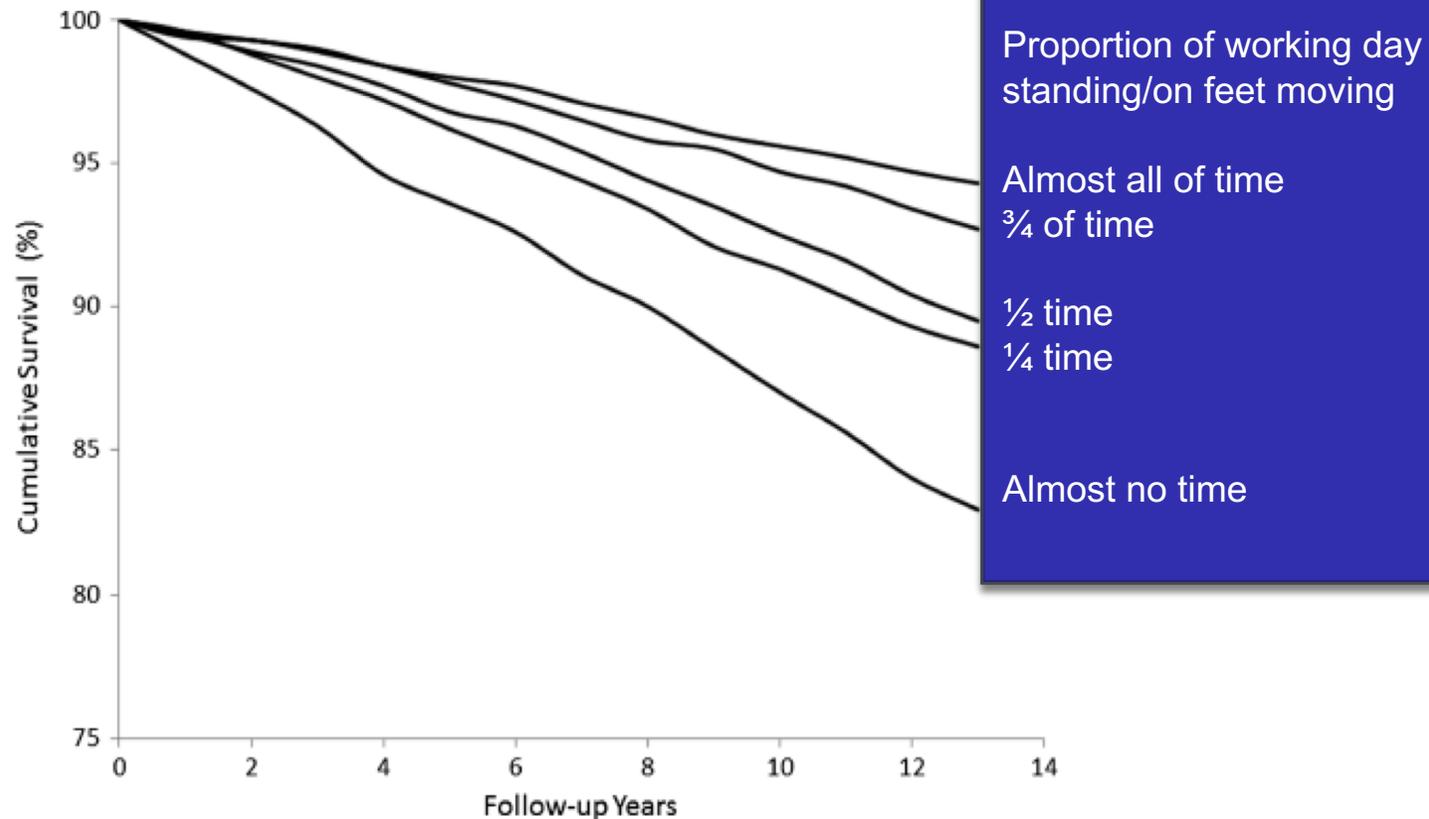


FIGURE 1—Kaplan–Meier survival curve for all-cause mortality across categories of daily standing time in 16,586 men and women 18–90 yr of age, in the Canada Fitness Survey, 1981–1993. Log-rank $\chi^2 = 175.9$, $df = 4$, $P < 0.0001$. The sample sizes across the categories were 2543 (15.3%), 6227 (37.5%), 3943 (23.8%), 2259 (13.6%), and 1609 (9.7%), for the categories of standing almost none of the time, one fourth of the time, half of the time, three fourths of the time, and almost all of the time, respectively.

Surely I don't have to worry about sitting too much because I do more than the recommended 150 mins per week!



Does 150 mins/wk
MVPA cover the ills of
prolonged daily sitting?

*What does your
activity-sedentary
risk profile look like?*



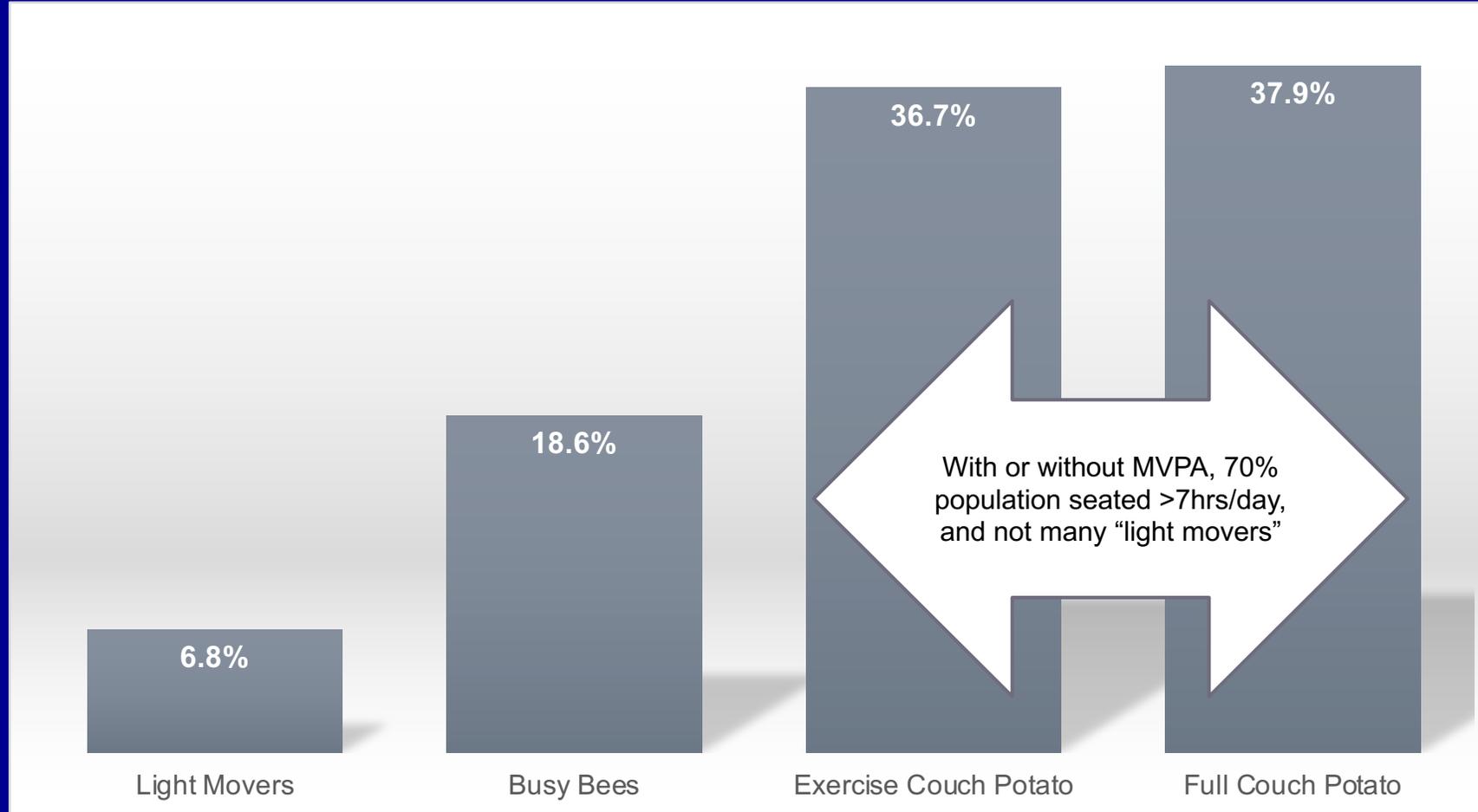
What is your activity category?



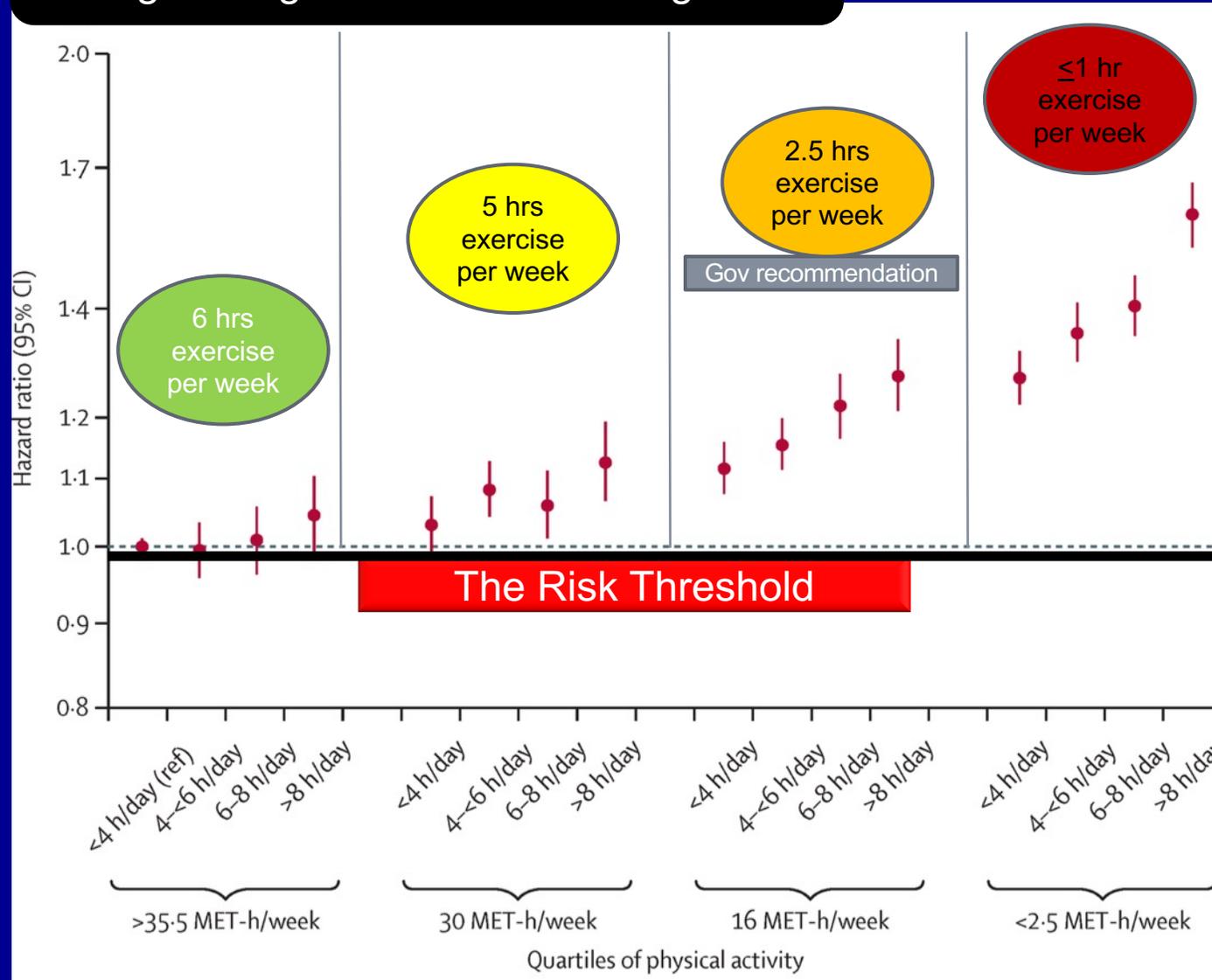
Exclusive Categories of PA and Sedentariness

- Couch potatoes – low PA, high sedentary
- Light movers – low PA, low sedentary
- Exercise couch potato- high PA, high sed'y
- Busy bees - high PA, low sedentary time

% Population (n = 2200)
For each exclusive *Physical Activity* group



How much mod-vig exercise required to guard against too much sitting?



RISK CALCULATOR

*Influence of sedentary time on risk of mortality in those who exercise
 (N > 1 million)*

| Daily Sitting Time | Exercise > 6 hrs per week | Exercise 5 – 6 hrs per week | Exercise 2.5 hrs per week <i>W.H.O. recommended</i> | Exercise ≤ 1 hr per week |
|--------------------|---------------------------|-----------------------------|--|--------------------------|
| < 4 hrs | | | | |
| 4 – 6 hrs | | | | |
| 6 – 8 hrs | | | | |
| >8 hrs | | | | |

Influence of sedentary time on increasing risk of mortality in those who exercise (N > 1 million)

| Daily Sitting Time | Exercise > 6 hrs per week | Exercise 5 – 6 hrs per week | Exercise 2.5 hrs per week <i>W.H.O. recommended</i> | Exercise ≤ 1 hr per week |
|--------------------|---------------------------|-----------------------------|--|--------------------------|
| < 4 hrs | No added risk | | | |
| 4 – 6 hrs | No added risk | | | |
| 6 – 8 hrs | Little bit of risk | | | |
| >8 hrs | 5% | | | |

Influence of sedentary time on increasing risk of mortality in those who exercise (N > 1 million)

| Daily Sitting Time | Exercise > 6 hrs per week | Exercise 5 – 6 hrs per week | Exercise 2.5 hrs per week <i>W.H.O. recommended</i> | Exercise ≤ 1 hr per week |
|--------------------|---------------------------|-----------------------------|--|--------------------------|
| < 4 hrs | No added risk | 4% | | |
| 4 – 6 hrs | No added risk | 7% | | |
| 6 – 8 hrs | Little bit of risk | 5% | | |
| >8 hrs | 5% | 10% | | |

Influence of sedentary time on increasing risk of mortality in those who exercise (N > 1 million)

| Daily Sitting Time | Exercise > 6 hrs per week | Exercise 5 – 6 hrs per week | Exercise 2.5 hrs per week <i>W.H.O. recommended</i> | Exercise ≤ 1 hr per week |
|--------------------|---------------------------|-----------------------------|--|--------------------------|
| < 4 hrs | No added risk | 4% | 10% | |
| 4 – 6 hrs | No added risk | 7% | 15% | |
| 6 – 8 hrs | Little bit of risk | 5% | 18% | |
| >8 hrs | 5% | 10% | 22% | |

Influence of sedentary time on increasing risk of mortality in those who exercise (N > 1 million)

| Daily Sitting Time | Exercise > 6 hrs per week | Exercise 5 – 6 hrs per week | Exercise 2.5 hrs per week <i>W.H.O. recommended</i> | Exercise ≤ 1 hr per week |
|--------------------|---------------------------|-----------------------------|--|--------------------------|
| < 4 hrs | No added risk | 4% | 10% | 22% |
| 4 – 6 hrs | No added risk | 7% | 15% | 30% |
| 6 – 8 hrs | Little bit of risk | 5% | 18% | 35% |
| >8 hrs | 5% | 10% | 22% | 50% |

Exercising couch potatoes similar effects to....



Let's move on to...
Health assessments and interventions
for reducing (breaking up) sedentary
time in office workers

Examples of activation...

- Stimulated nudges to take “stand-up” breaks
- Nudges to take light activity breaks
- Standing meetings
- Sit-stand desk workstations
- Exercise-work stations (cycles, treadmills)

Studies on assessments and interventions for interrupting sedentary time in office work

- Physical
 - Cardio-metabolic benefits
 - Musculoskeletal benefits/drawbacks
 - Perceived or actual fatigue/alertness
- Psycho-social/organisational performance
 - Psychological cognitive performance
 - Individual well-being
 - Group social well-being

Growing incidence of laptop and tablet posture!



Cardio-metabolic effects; 10+ studies

- Dunstan et al, Diabetes Care. 2012;35(5):976-83.
- Peddie et al, Am J Clin Nutr. 2013;98(2):358-66.
- Stephens et al. Metabolism. 2011;60(7):941-9.
- Newsom et al., Diabetes Care. 2013;36(9):2516-22.
- Thorp et al., Med Sci Sports Exerc. 2014;46(11):2053-61.
- Buckley et al. Occup Environ Med. 2014;71(2):109-11.
- Bailey et al, J Sci Med Sport. 2015;18(3):294-8.
- Graves et al, BMC Public Health. 2015 Nov 19;15:1145.
- Henson et al, Diabetes Care. 2016;39(1):130-8
- Healy et al., Med Sci Sports Exerc. 2016 May 17

Vascular endothelial function

- Acute (over 1 day) response benefits
- Chronic improvements in blood flow dilatation in arteries



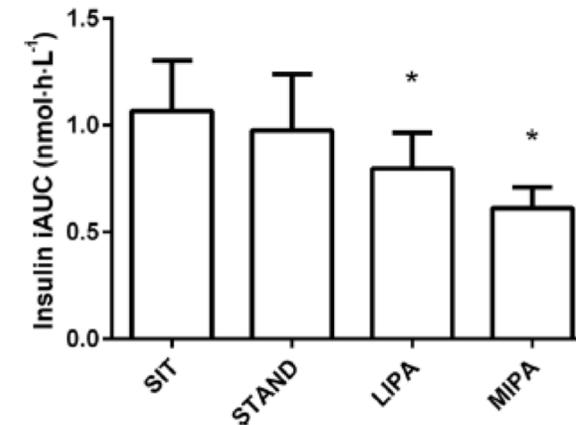
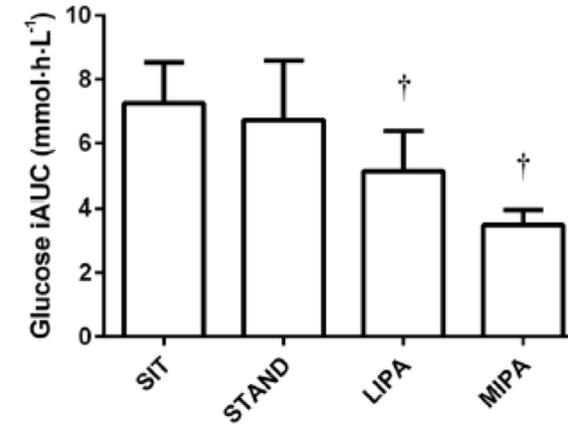
BRIEF COMMUNICATION

Does the type of activity “break” from prolonged sitting differentially impact on postprandial blood glucose reductions? An exploratory analysis

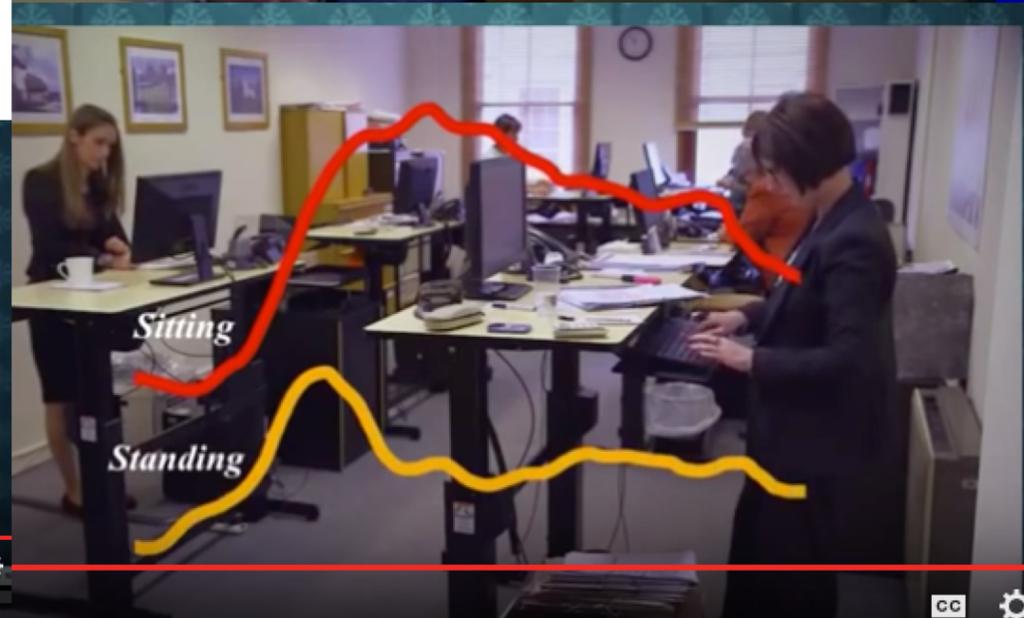
Robyn N. Larsen, Paddy C. Dempsey, Francis Dillon, Megan Grace, Bronwyn A. Kingwell, Neville Owen, and David W. Dunstan

Appl. Physiol. Nutr. Metab. 00: 1–4 (0000) dx.doi.org/10.1139/apnm-2016-0642

Published at www.nrcresearchpress.com/apnm on 24 March 2017.



BBC
TWO



1 / 59:04



א.ט.כ. / עב



Blood glucose responses to ½ day of standing desks in office workers

Buckley et al., *Occup Environ Med.* 2014 Feb;71(2):109-11

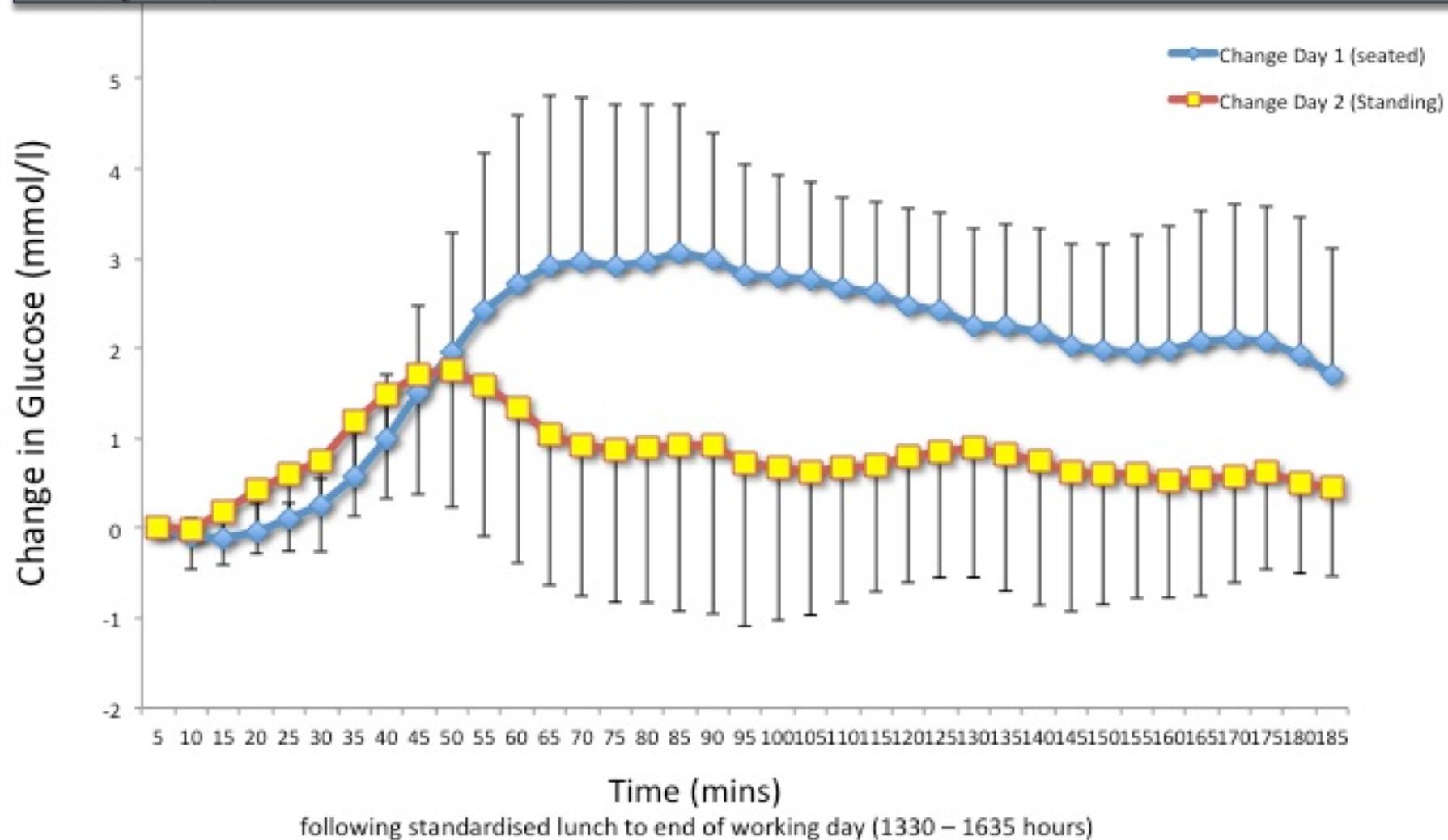
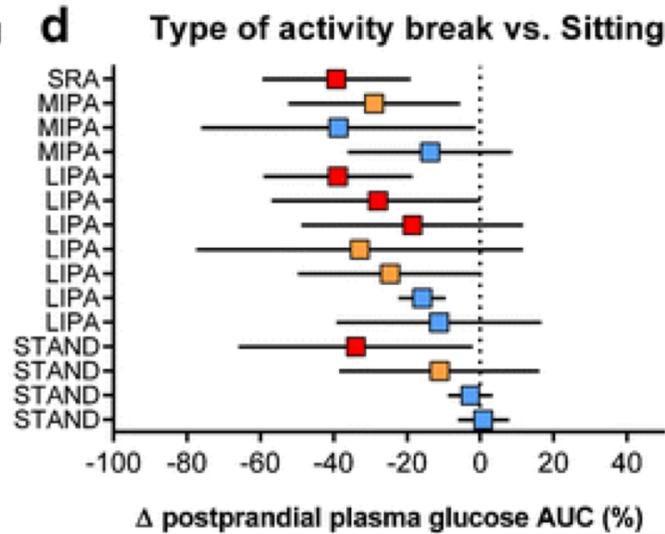
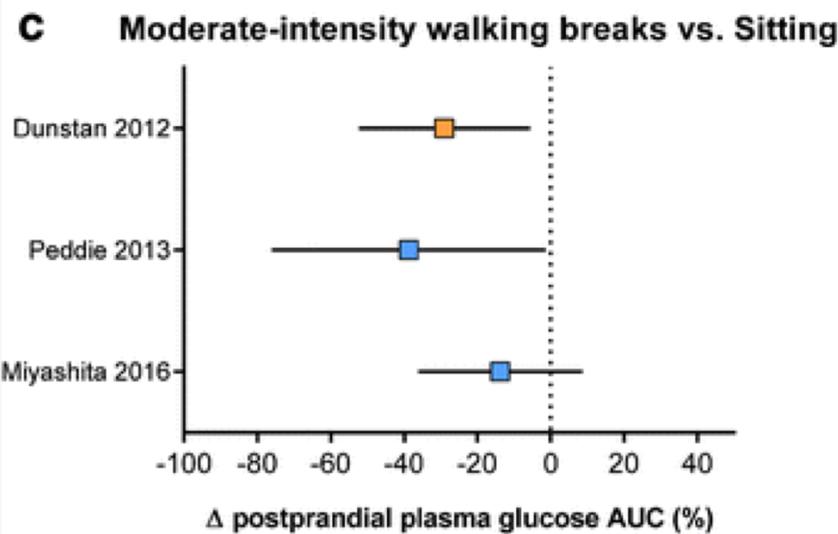
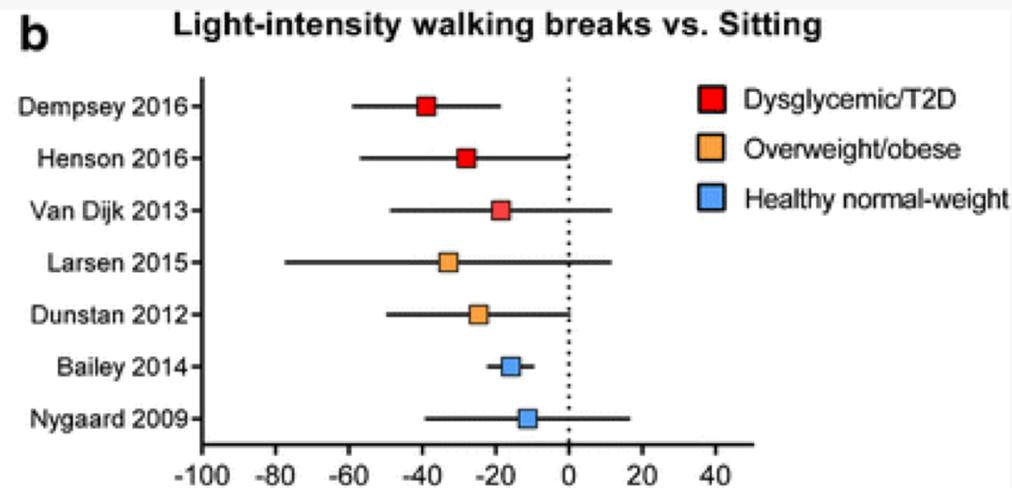
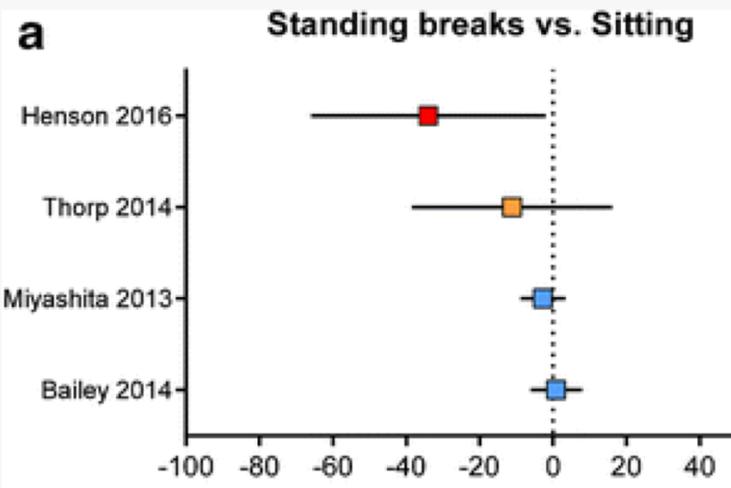


Fig 1. Change in blood glucose, following a standard buffet lunch, whilst working predominantly for 185 mins in a seated or standing position (n=9)



Effects on blood glucose and insulin

- Standing breaks and certainly light walking breaks at work have as much effect on keeping blood glucose down as does doing moderate intensity exercise

Testing out theories



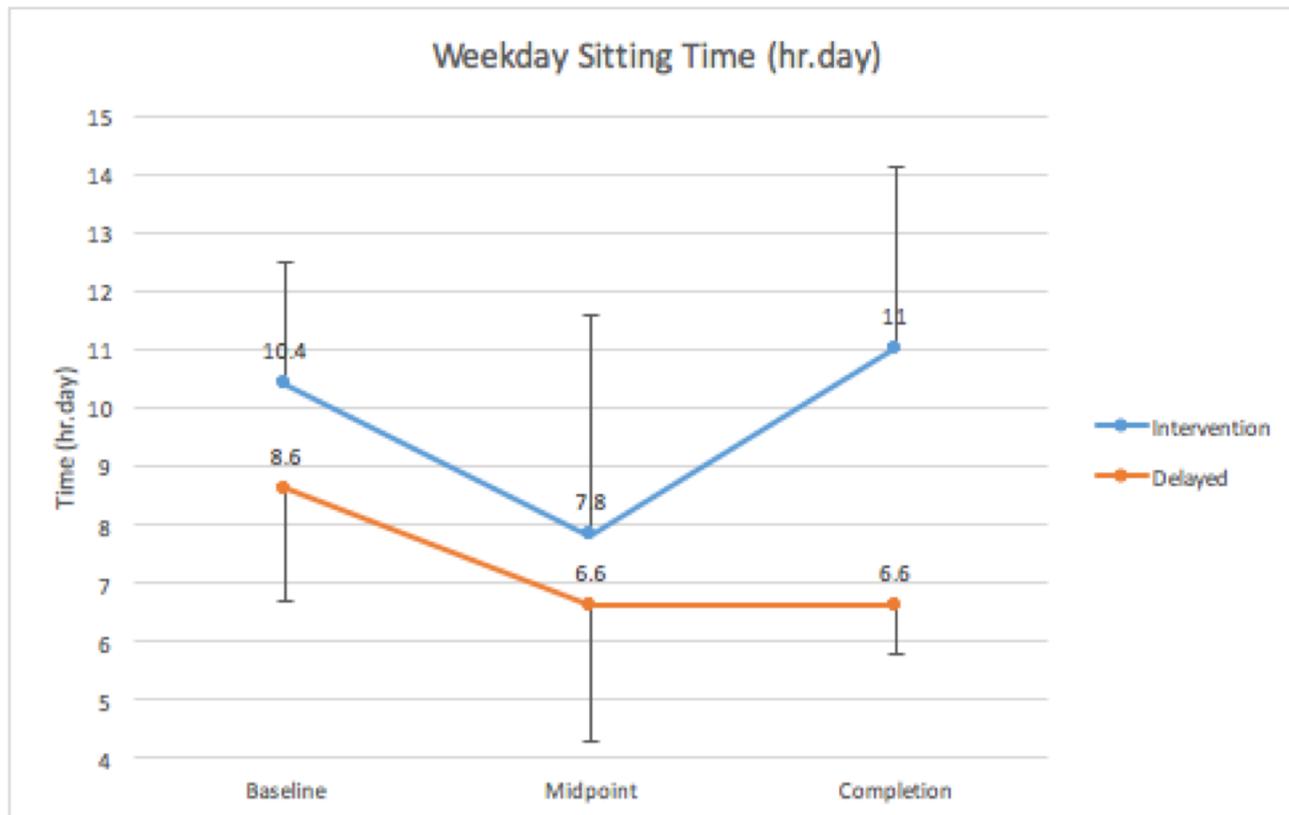


Figure 1: Weekday Sitting Time

Parker, Morris & Buckley unpublished
Univ Chester/Shrewsbury

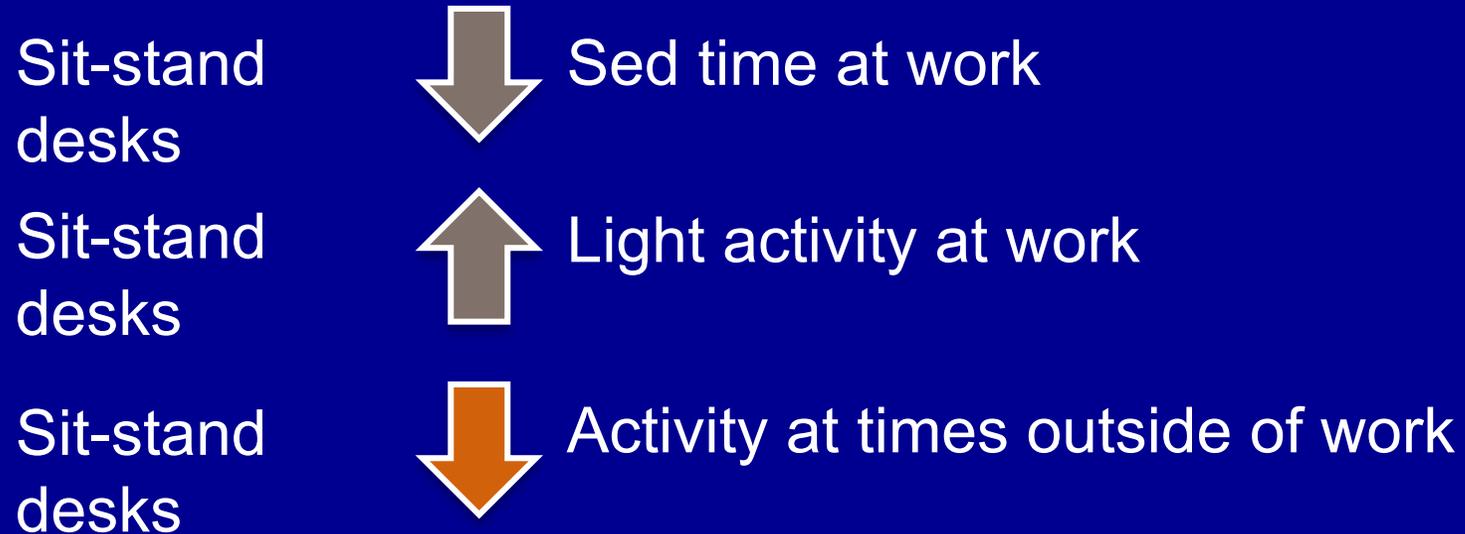


Some behaviour pitfalls!

Mansoubi et al.,

Apr 2016 Med Sci Sport Exerc

Does standing work lead to less activity outside work?



[Cochrane Database Syst Rev.](#) 2015 Jan 26;1:CD010912. doi: 10.1002/14651858.CD010912.pub2.

Workplace interventions for reducing sitting at work.

[Shrestha N¹](#), [Ijaz S](#), [Kukkonen-Harjula KT](#), [Kumar S](#), [Nwankwo CP](#).

AUTHORS' CONCLUSIONS: At present there is very low quality evidence that sit-stand desks can reduce sitting time at work, but the effects of policy changes and information and counselling are inconsistent. There is a need for high quality cluster-randomised trials to assess the effects of different types of interventions on objectively measured sitting time. There are many ongoing trials that might change these conclusions in the near future.

STUDY PROTOCOL

Open Access

The ReSiT study (reducing sitting time): rationale and protocol for an exploratory pilot study of an intervention to reduce sitting time among office workers



Benjamin Gardner^{1*} , Stephen Dewitt¹, Lee Smith², John P. Buckley³, Stuart J. H. Biddle⁴ and Louise Mansfield⁵

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For and against: sit-stand desks

Bridget Leathley 13 May 2016

Display Screen Equipment (DSE) [f](#) [t](#) [in](#) [e](#) [+](#) [g](#)

Is standing at our desks really good for our health? Bridget Leathley investigates whether it is worth investing in stand-sit desks.



SMARt Work trial

Assessing the effectiveness of a programme designed to reduce sitting time at work

Randomised controlled trial



The SMARt Work intervention reduced occupational and daily sitting time in the short, medium and longer term in desk-based workers.



146 Desk-based staff who spend the majority of their work day seated
 80% female Mean age: 41.2 years NHS employees

Randomisation

77 **Intervention**
 Used the Stand More AT (SMARt) Work programme
 Feedback (anthropometric data and blood test results)

69 **Control**
 Standard work routine

Primary outcome
 Sitting time at 12 months (minutes per workday)

Meaningful difference
 60 minute difference

| | Intervention | Control | Difference between arms 95% CI |
|---------------------------|--------------|-----------|--------------------------------|
| Occupational sitting time | -72.0 mins | +9.2 mins | -81.2 mins [-116.6, -50.0] |
| Daily sitting time | -63.0 mins | +8.0 mins | -71.0 mins [-114.5, -50.3] |

Practical guidance for current best evidence

Consensus statement

The sedentary office: an expert statement on the growing case for change towards better health and productivity

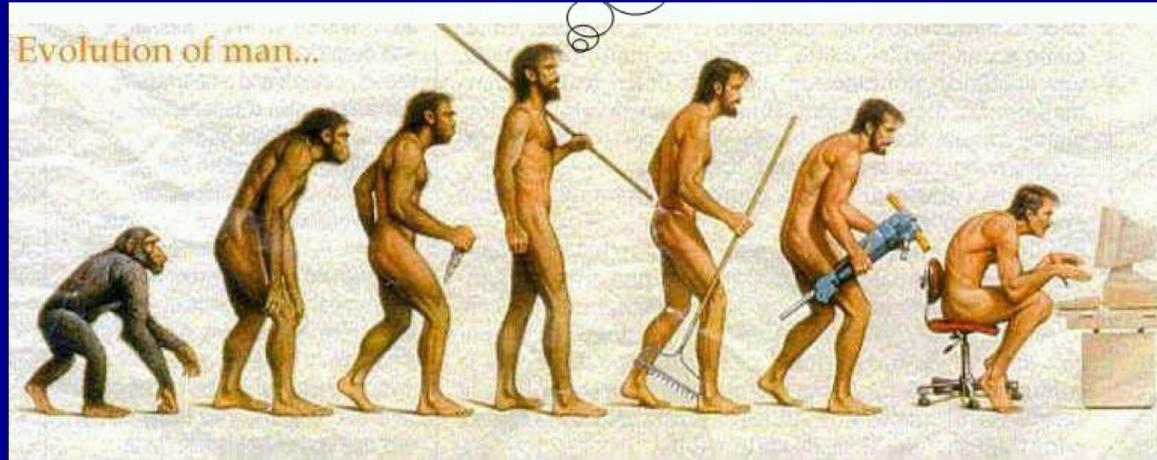
John P Buckley,¹ Alan Hedge,² Thomas Yates,^{3,4} Robert J Copeland,⁵
Michael Loosemore,⁶ Mark Hamer,⁶ Gavin Bradley,⁷ David W Dunstan⁸

Br J Sports Med 2015;0:1–6.

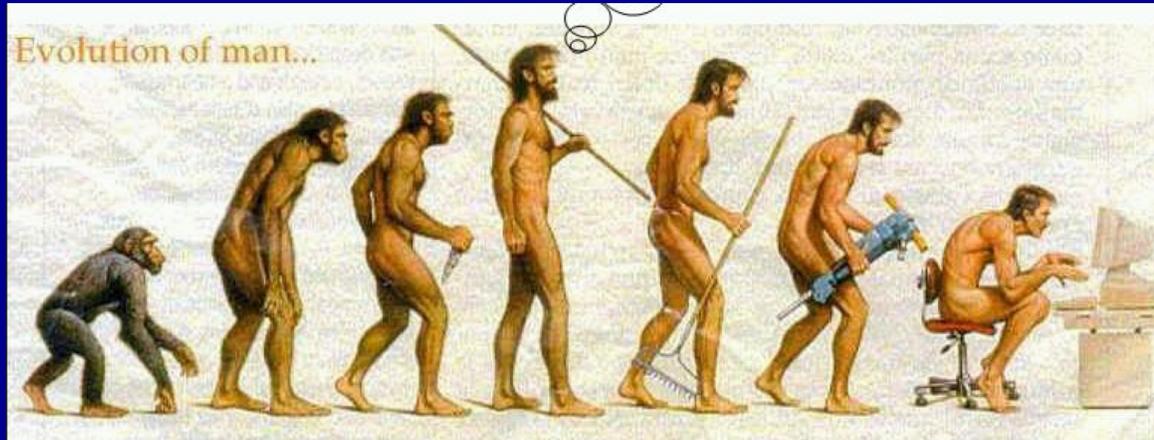
Aim:

For desk-based office workers to accumulate a minimum 2 hours of being on feet per day; ideally a total of 4 hours

Summary – evolution and physical activity behaviour change



Gearing up for behaviour change



R

1

2

3

4





*Writing and travel
broaden your ass if not
your mind and I like to
write standing up*

Hemingway, 1950