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Sedentary Behaviour – An Emerging and Underappreciated Occupational Hazard

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"Adverse health outcomes associated with sedentary behavior led many to conclude that sedentary behavior is a novel risk factor whose population attributable risk may even surpass that of smoking"

David A Alter. Editorial. Tracking our physical inactivity and progression to death: Is this evolutionary stagnation ? Ann Intern Med. **2017;167(7):513-514.**

Population Attributable Risk (or ***Population Attributable Fraction***)
indicates the number (or proportion) of cases that would not occur *in a population* if the factor were eliminated (e.g. how many lives would be saved if people no longer smoked?)

Presentation Outline

- Terminology - sedentary behavior (SB)
- What are the health effects of SB ?

- Will physical activity help ?
- Are there guidelines/recommendations ?
- How do we help ourselves ?

Sedentary Behaviour

SB TERMINOLOGY

- any behaviour that requires very low energy expenditure, and does not increase energy levels above normal resting levels

'Sitting time' and 'Sedentary time' are often used interchangeably

- Both refer to Sedentary Behaviour

Sedentary Behaviour

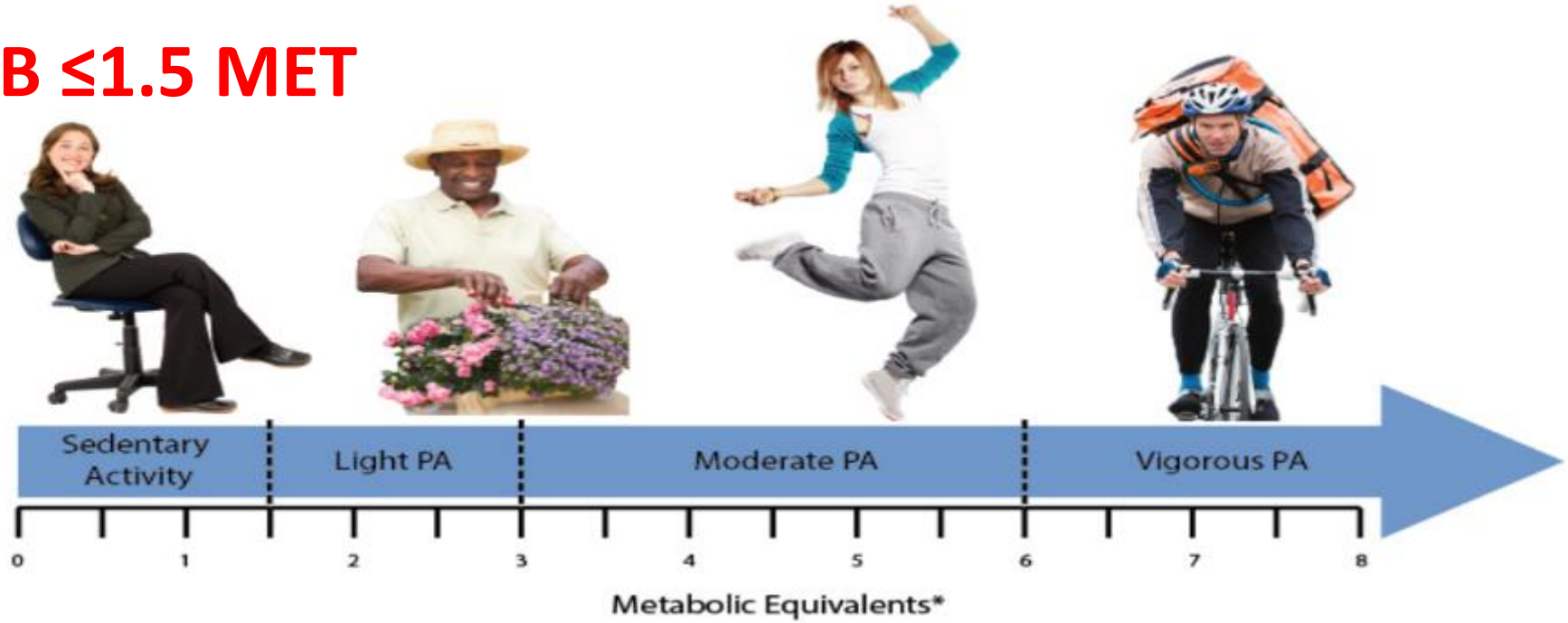
- Main posture is sitting or lying down
- Includes activities such as sleeping, sitting, watching television, desk work, writing, playing seated computer games, sitting during commuting

Metabolic Equivalent (MET)

Ratio of the work metabolic rate to the resting metabolic rate

One MET – Occurs when one is sitting quietly
Expenditure of 1 kcal/kg/hour or
Oxygen cost of 3.5 ml/kg/min

SB ≤1.5 MET



Light Intensity Activities	METs
Sleeping	0.9
Sitting - Watching television, commuting	1.0
Writing, desk work, typing	1.5
Walking (2.7 km/hr) level ground, slow stroll	2.3
Walking (4 km/hr)	2.9
Moderate Intensity Activities	**METs**
Walking 4.8 km/hr	3.3
Calisthenics, home exercise	3.5
Walking 5.5 km/hr	3.6
Cycling < 16 km/hr (leisure)	4.0
Cycling stationary (light effort)	5.5
Vigorous Intensity Activities	**METs**
Vigorous cycling	8.0
Calisthenics (pushups, situps, pullups, jumping jacks), heavy vigorous effort	8.0
Jogging in place, running	8.0
Rope jumping	10.0

Physical Inactivity

- Performing insufficient amounts of physical activity (PA) i.e. not meeting specified PA guidelines

Physical Activity (PA)

- light-intensity (<3 METs)
- moderate-intensity (3–6 METs)
- vigorous-intensity (>6 MET)

Moderate-Vigorous Physical Activity (MVPA)

Physically Active vs Sedentary Behaviour (Accelerometer data from 2 subjects)

Subject A – PHYSICALLY INACTIVE, No SB

- did not meet recommended levels of PA
- engaged in low-intensity PA for 75% of day, with 25% of daily activity as SB
- 26.3 METS

Subject B – PHYSICALLY ACTIVE, SB

- met recommended levels of PA
- spent 70% of the day in SB
- 23.6 METs

Pate RR, O'Neill JR, Lobelo F. The evolving definition of "sedentary". Exerc Sport Sci Rev 2008;36:173-8)

News › Obituaries

Professor Jerry Morris: Scientist who first demonstrated the link between exercise and health (1910-2009)

Tuesday 1 December 2009 00:00 GMT

11

"Men in physically active jobs [conductors] have a lower incidence of coronary heart-disease in middle age men than have men in physically inactive jobs [drivers]".

Morris, J.N., Heady, J.A., Raffle, P.A.B., Roberts, C.G., and Parks, J.W., (1953).
Coronary heart disease and physical activity of work. *Lancet* 265, 1111-1120.

Meta-analyses performed on SB and outcomes for :

- **cardiovascular disease and diabetes (14 studies)**
- **cancer (14 studies)**
- **all cause mortality (13 studies)**

Prospective cohort designs used in all but 3 studies

Sedentary times quantified using self-report in all but 1 study

Biswas et al. Sedentary time and its association with risk for disease incidence, mortality and hospitatlization in adults. A Systematic review and meta-analysis. Ann Intern Med. 2015;162:123-132. doi:10.7326/M14-1651

Sedentary time associated with risk of :

Cardiovascular disease
(HR 1.14, 95% CI 1.0 - 1.73)

Cancer (HR 1.13, 95% CI = 1.05 - 1.21)

Type 2 diabetes
(HR 1.91, 95% CI = 1.64 to 2.22)

Mortality from cardiovascular disease
(HR 1.18, 95% CI = 1.11 to 1.26)

Mortality from cancer (HR 1.17, 95% CI = 1.11 to 1.24)

Mortality from all causes (HR 1.24, 95% CI = 1.09 to 1.41)

Biswas et al. Ann Intern Med. 2015;162:123-132. doi:10.7326/M14-1651

Among studies assessing mortality and incidence, significant associations specifically found with :

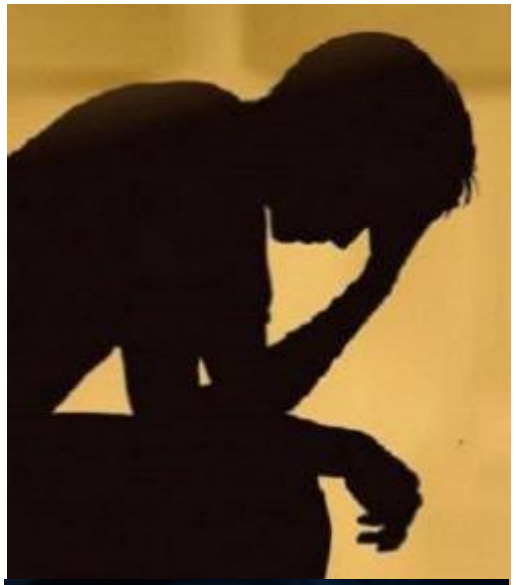
* **Breast cancer**
* **Colon cancer**
* **Colorectal cancer**
* **Endometrial cancer**
* **Epithelial ovarian cancer**

Biswas et al.
Ann Intern Med.
2015;162:123-132.
doi:10.7326/M14-1651

Hamer M, Coombs, N, Stamatakis E. Associations between objectively assessed and self reported sedentary time with mental health in adults: an analysis of data from the Health Survey for England. BMJ Open 2014; 4(3) e004580.

Study Population - Community

11 658 (self-report analysis) and
1 947 (objective data) men & women



Objective (actigraph)sedentary time assoc. with risk of psychological distress (GHQ12)

(OR=1.74, 95% CI 1.07 to 2.83)

Self-reported total sitting time

(OR=1.34, 95% CI 1.15 to 1.56)

Self-reported MVPA , and Objective (actigraph) light-intensity activity assoc. with lower risk of psychological distress

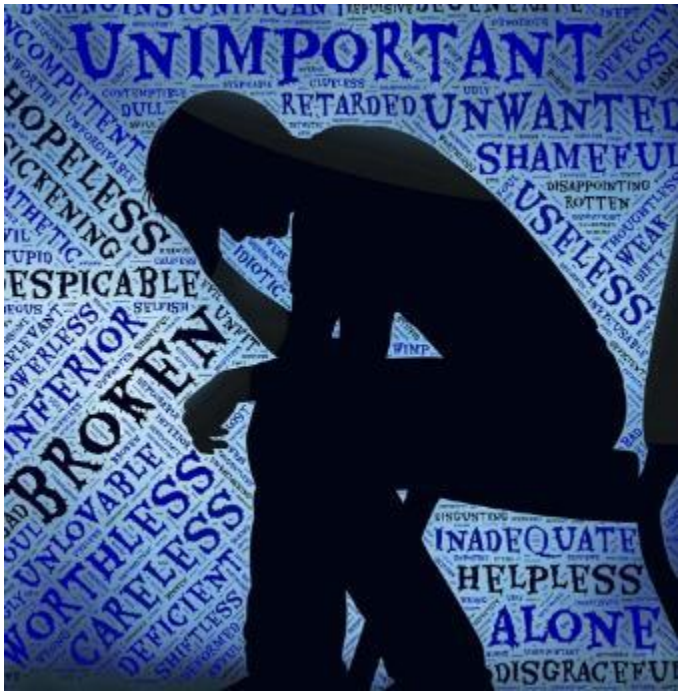
Zhai L, Zhang Y, Zhang D. Sedentary behaviour and the risk of depression: a meta-analysis. *Br J Sports Med* 2015;49:705-709.

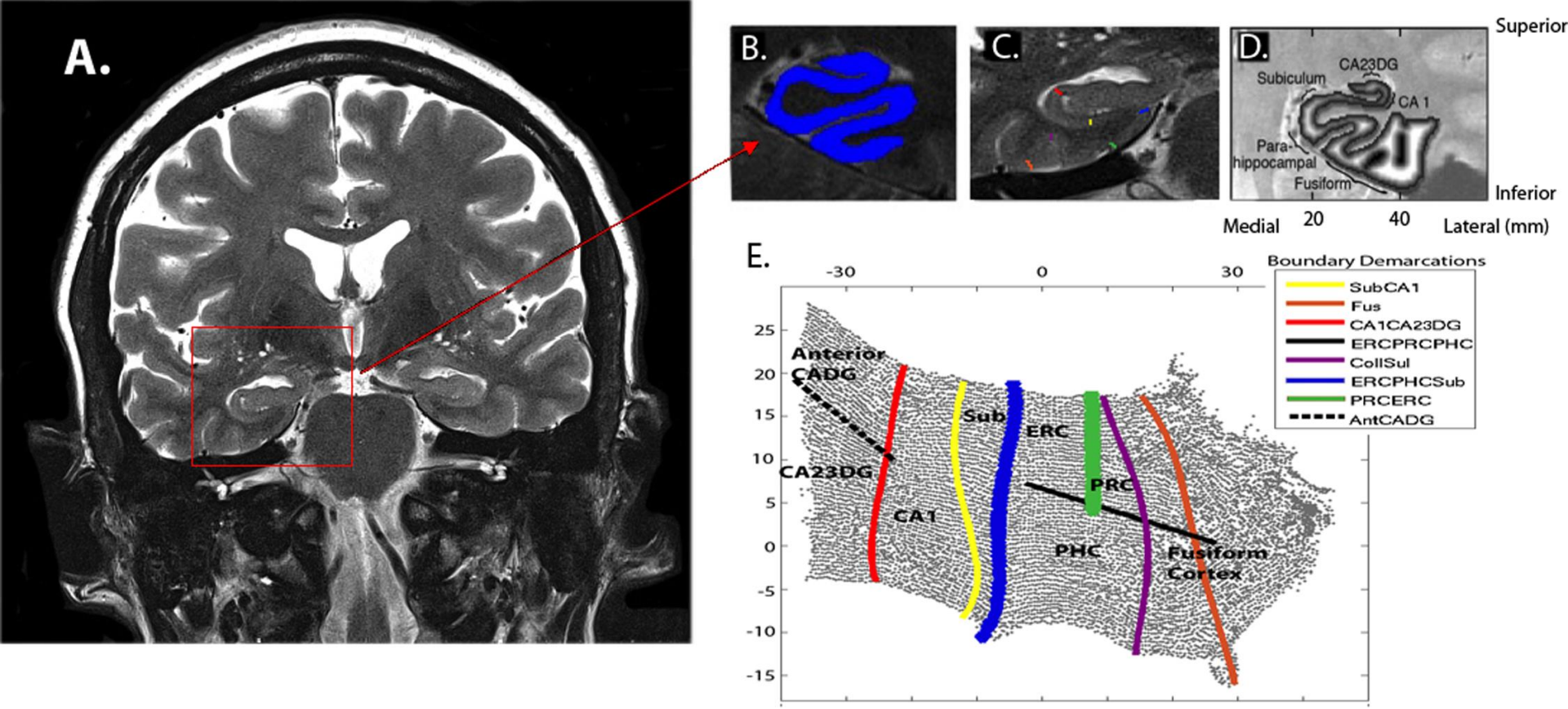
13 cross-sectional studies with 110,152 participants

11 longitudinal studies with 83,014 participants

RR for depression (highest vs non/occasional SB)
- 1.25 (95% CI 1.16 to 1.35)

- Cross-sectional studies - 1.31 (95% CI 1.16 to 1.48)
- Longitudinal studies 1.14 (95% CI 1.06 to 1.21)





Atrophy of the medial temporal lobe (MTL)

- **occurs with aging, resulting in impaired episodic memory**

In 35 non-demented adults, Age adjusted Total MTL thickness correlated inversely with self reported hours of sitting/day ($r = -0.37$, $p = 0.03$)

Siddarth P, Burggren AC, Eyre HA, Small GW, Merrill DA (2018) Sedentary behavior associated with reduced medial temporal lobe thickness in middle-aged and older adults. PLOS ONE 13(4): e0195549. https://doi.org/10.1371/journal.pone.0195549

USA Prospective cohort study, 2017

7,985 black and white adults aged ≥45 yrs

Sedentary time measured using a hip-mounted accelerometer

Median follow up - 4.0 years, 340 participants died,

Strong dose–response relationship between daily SB volume & all-cause mortality

(even after adjustment for many baseline factors, including MVPA)

Diaz KM, Howard VJ, Hutto B *et al*. Patterns of sedentary behavior and mortality in U.S. middle-aged and older adults: a national cohort study. *Ann Intern Med* 2017;167:465–475.

Greater Total Sedentary Time and Mortality

Risk of mortality with ↑ sedentary time

HR 1.22 [95% CI, 0.74, 2.02]

HR 1.61 [0.99, 2.63]

HR 2.63 [1.60, 4.30]

P for trend< 0.001

Diaz et al,
Ann Intern Med 2017
doi:10.7326/M17-0212

Longer Sedentary Bout Duration

Risk of mortality with ↑ sedentary bout

HR 1.03 [0.67,1.60]

HR 1.22 [0.80, 1.85]

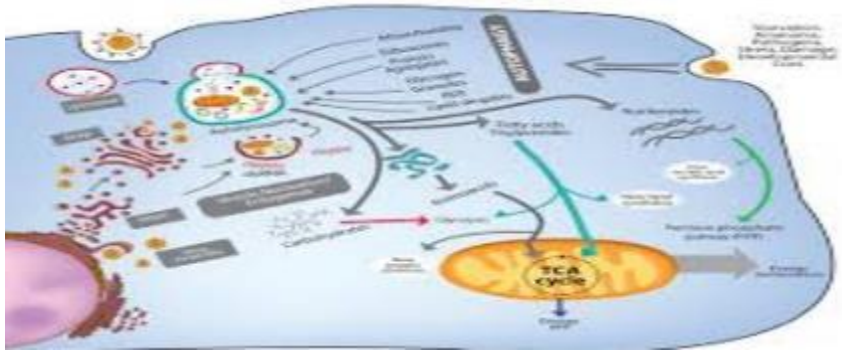
HR 1.96 [1.31, 2.93]

P for trend<0.001

Participants with high sedentary time [≥12.5h/d] and high bout duration [≥10min/bout]) had greatest risk for death

SB and Adverse Health Outcomes Mechanisms remain unclear and complex

Hypotheses focused on cardiometabolic pathways



Ranged from :

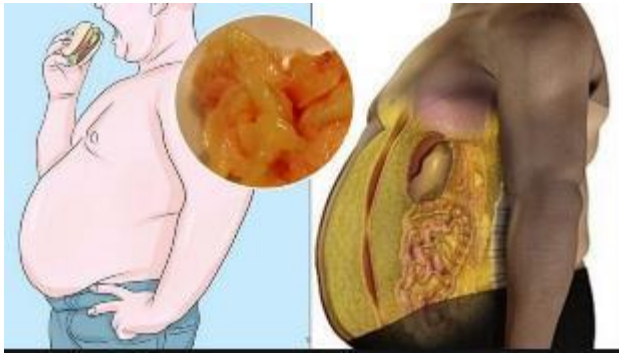
Alterations in genetic expression of energy metabolism

Reduction in insulin sensitivity

↑ Triglycerides, ↑ LDL cholesterol

Reduction in net calorie expenditure

↑ visceral and abdominal adiposity



Booth FW, Laye MJ, Lees SJ, Rector RS, Thyfault JP. Reduced physical activity and risk of chronic disease: the biology behind the consequences. Eur J Appl Physiol. 2008;102:381-90. [PMID: 17987311]

Emerging Hypothesis

Physiologic mechanisms underlying the health benefits of PA may be distinct from adverse health consequences of SB

Young DR, Hivert MF, Alhassan S, Camhi SM, Ferguson JF, Katzmarzyk PT, et al; Endorsed by The Obesity Society. Sedentary behavior and cardiovascular morbidity and mortality: a science advisory from the American Heart Association. Circulation. 2016;134: e262-79.

High mortality associated with prolonged and uninterrupted sedentary bouts :

- reaffirms potential importance of skeletal muscle inactivity on cardiometabolic pathway mechanisms

Xbox addict, 20, killed by blood clot after 12-hour gaming sessions

By Rebecca Twomey UPDATED: 10:26 BST, 6 January 2016

Share 14 View comments

A mourning father has sent out a plea to other parents to protect their children from the dangers of playing computer games.

Blood clot victim, Chris Staniforth, 20, died after spending up to 12 hours at a time playing on his Xbox.

The gaming enthusiast suffered a blockage to his lungs when he developed deep vein thrombosis – commonly associated with passengers on long haul flights where they are relatively immobile for hours on end.

CNN

Man dies in Taiwan after 3-day online gaming binge

By Katie Hunt, CNN and Naomi Ng, for CNN

JUDO FOR CHILDREN

Hamilton MT, Etienne J, McClure WC, Pavey BS, Holloway AK. Role of local contractile activity and muscle fiber type on LPL regulation during exercise. Am J Physiol. 1998;275:E1016-22. [PMID: 9843744] 7. Barnett

Physical Activity Helps …. A bit

High activity level attenuates, but does not eliminate increased risk associated with high TV-viewing time

Ekelund U, Steene-Johannessen J, Brown WJ *et al*. 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. *Lancet* 2016;388:1302–1310.

31% of the world's population do not meet minimum recommendations for physical activity

In 2007, 5·3 – 5·7 million deaths worldwide from NCDs could have theoretically been prevented if people who were inactive had instead been sufficiently active

Kohl HW et al. The pandemic of physical inactivity: global action for Public Health. Lancet 2012; 380: 294-305

Canadian Physical Activity Guidelines (18-64 years)

To achieve health benefits, adults aged 18-64 years should accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week, in bouts of 10 minutes or more.

It is also beneficial to add muscle and bone strengthening activities using major muscle groups, at least 2 days per week.

More daily physical activity provides greater health benefits.

Canadian Sedentary Behaviour Guidelines

The Canadian Sedentary Behaviour Guidelines for Children (aged 5-11 years) and Youth (aged 12-17 years) represent the first systematic evidence-based sedentary behaviour guidelines in the world. Their development followed a rigorous and transparent scientific process using a systematic review of the best available evidence, similar to the process used to develop the new Canadian Physical Activity Guidelines.

The Canadian Sedentary Behaviour Guidelines are intended to address the 23 hours of the day that children and youth may not be engaged in physical activity.

These guidelines are presented alongside the new Canadian Physical Activity Guidelines for Children and Youth and are designed to help children and youth live healthy, active lives. They are meant to help encourage Canadians to limit the time they spend watching TV, playing video and computer games, and other sedentary behaviours.

Australian Government
Comcare

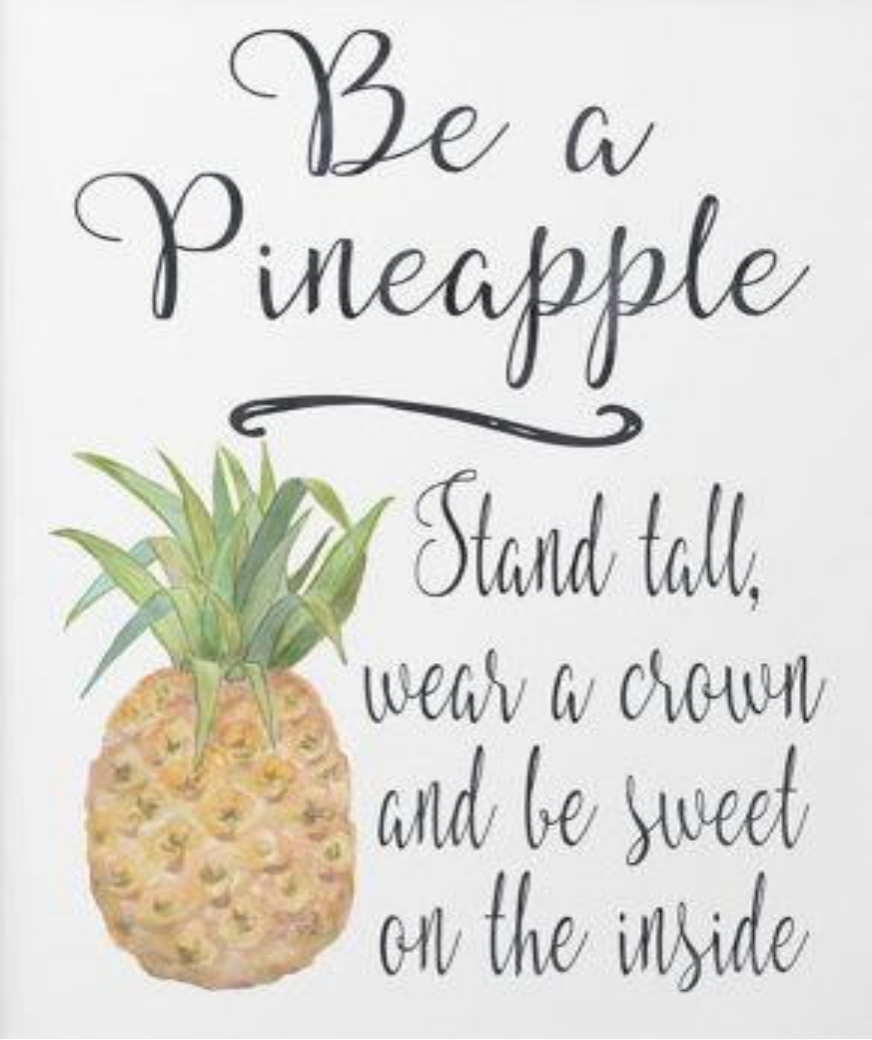
THE FACTS ABOUT SEDENTARY PRACTICES

The research is clear – long periods of sitting have serious health consequences :

- **On average, office workers sit for 76% of the day**
- **Prolonged sitting ↑ risk for MSD, cancer, CVD & death**
- **It is a risk factor, even if you exercise regularly**
- **Even short, regular breaks from sitting are beneficial for workers' health**

How do we help ourselves ?

Activities Targeting Sedentary Behavior at Work



People

- Walk around to colleagues in close proximity, rather than relying on e-mail for communication

- Have lunch away from desks
- Posters to prompt employees to stand up at regular intervals

Policy

- Mini physical activity breaks during work hours e.g. desk breaks, standing when on telephone, stretching, short walks
- Encourage standing or walking meetings; include “stretch break” in meeting agendas

Place

* Office layout that encourage breaks in sitting time e.g. printer not close to the desk

* Encourage stop and stretch breaks on long commutes

*Software that encourage breaks in sitting time

*Sit-stand adjustable workstations

AHY Chu, SHX Ng, CS Tan, AM Win, D Koh, F Müller-Riemenschneider.

A systematic review and meta-analysis of workplace intervention strategies to reduce sedentary time in white-collar workers. Obesity Reviews 2016 May;17(5):467-81.

Cochrane Library

Trusted evidence.
Informed decisions.
Better health.

Published 20 June 2018

Cochrane Database of Systematic Reviews

Workplace interventions for reducing sitting at work

Cochrane Systematic Review - **Intervention** | Version published: 20 June 2018 see what's new

New search Conclusions changed Am score 136 View article information

Nipun Shrestha | Katriina T Kukkonen-Harjula | Jos H Verbeek | Sharea Ijaz | Veerle Hermans | Zeljko Pedisic

34 studies, 3,397 employees

Low to very low quality evidence for most interventions

Low-quality evidence:

- **sit-stand desks may ↓ sitting at work in 1st year**
- **Effects likely to reduce with time**

Insufficient evidence about effects for other interventions (limitations in study protocols & sample sizes)

Results from 231 workers

Open bench workers

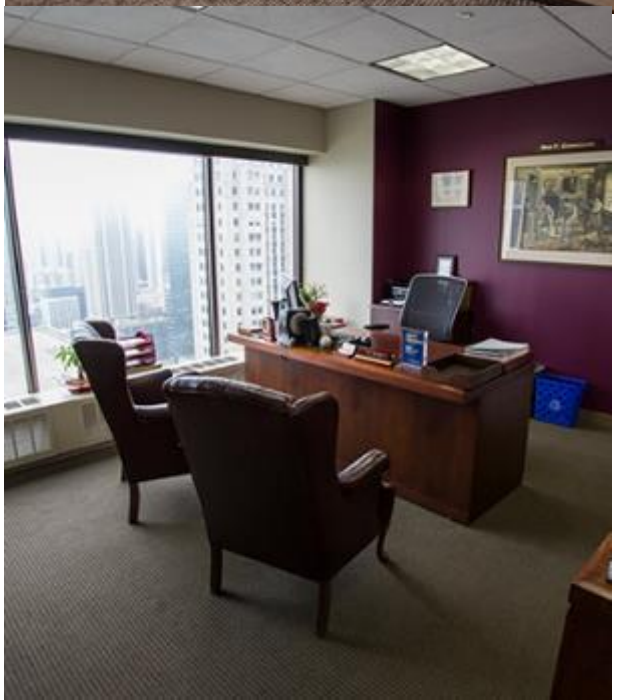
- **20% more active vs. those in cubicles**
- **32% more active vs. private offices**

Open bench workers

- **9.1% lower perceived stress at the office than those in cubicles**

Higher PA at office related to lower Physiological Stress outside the office (14.2% higher)

Lindberg CM, Srinivasan K, Gilligan B, et al. Occup Environ Med Epub ahead of print: [please include Day Month Year]. doi:10.1136/ oemed-2018-105077



Take Home Messages

SB - a recently recognized lifestyle risk factor linked to:

- **Type 2 diabetes (HR 1.91)**
- **Cardiovascular disease (CVD) (HR 1.14)**
- **Cancer (HR 1.13)**

- **Mortality from CVD (HR 1.18);**
- **Mortality from Cancer (HR 1.17)**
- **Mortality from ALL causes (HR 1.24)**

Others: Impacts on physical capacity, mental health, quality of life, cognition

Take Home Messages

5·3–5·7 million deaths globally from NCDs could be prevented if people who were inactive had instead been sufficiently active

Being Active helps but is not enough

Avoid SB - especially prolonged bouts

Guidelines: 150 mins MVPA per week

(for adults) Breaks after 30 mins of SB


3x/h


SITTING IS
THE NEW
SMOKING.

THANK YOU !

david.koh@ubd.edu.bn

Occupational Medicine 2018;**68:**350–351

Occupational Medicine 2018;68:350–351
doi:10.1093/occmed/kqy059

EDITORIAL

Sedentary behaviour at work—an underappreciated occupational hazard?

The link between a physically inactive job and heart disease was first recognized in the early 1950s, when Jeremy Morris and colleagues published their seminal paper [1], which indicated that 'Men in physically active jobs [conductors] have a lower incidence of coronary heart-disease in middle age men than have men in physically inactive jobs [drivers]'. They also noted that the disease was not as severe as in physically active workers—'tending to present first in them as angina pectoris and other relatively benign forms, and to have a smaller early case-fatality and a lower early mortality-rate'.

Since then, attention has been focused on physical activity as well as for sedentary behaviour at work, both of which are presently believed to be independent risk factors for ill-health and mortality. In 2012, an editor-

large-scale epidemiological studies [4], sedentary behaviour was linked to excess risk for cardiovascular disease (CVD) incidence (hazard ratio [HR] 1.143, 95% confidence interval [CI] 1.002–1.729), cancer incidence (HR 1.130, 95% CI 1.053–1.213) and type 2 diabetes incidence (HR 1.910, 95% CI 1.642–2.222). There was also associated higher mortality noted from CVD (HR 1.179, 95% CI 1.106–1.257), cancer (HR 1.173, 95% CI 1.108–1.242) and all causes (HR 1.240, 95% CI 1.090–1.410). A more recent prospective study using objectively measured physical activity levels showed that both the total sedentary time and longer sedentary bout duration had a dose-dependent association with higher risk for all-cause mortality [5]. It has also been suggested that sedentary behaviour may be related to adverse


Problems
Stress
No Time
Job
Family
Work
Debts
Health
Worry
Business
Problems
Job
Debts
Accounts

Healthy retired French population

1,011 65 year old subjects

PA (MET-h/week) and SB (h/d) assessed by :

- Population Physical Activity Questionnaire

- modified Global Physical Activity Questionnaire

ORs (with 95% CIs) for cardiovascular & cerebrovascular events

associated with PA at work and compared to SB at work :

- light (<3 METs), moderate (3–5.9 METs), vigorous (≥6 METs)

Hupin D, Raffin J, Barth N, Berger M, Garet M, Stampone K, Celle S, Pichot V, Bongue B, Barthelemy J-C and Roche F (2019) Even a Previous Light-Active Physical Activity at Work Still Reduces Late Myocardial Infarction and Stroke in Retired Adults Aged>65 Years by 32%: The PROOF Cohort Study. Front. Public Health 7:51. doi: 10.3389/fpubh.2019.00051

15 yr follow-up completed for 688 (68%) subjects

89 deaths (all-cause mortality)

91 fatal & non-fatal cardiovascular & cerebrovascular events

Active work (light, moderate, vigorous)

cf sedentary work associated with reduced

risk of cardiovascular (myocardial infarction)

and cerebrovascular events (stroke)

(OR = 0.79, 95% CI: 0.32–0.91, *p* < 0.02)

Light intensity work (OR = 0.68, 95% CI: 0.31–0.87, *p* < 0.02)

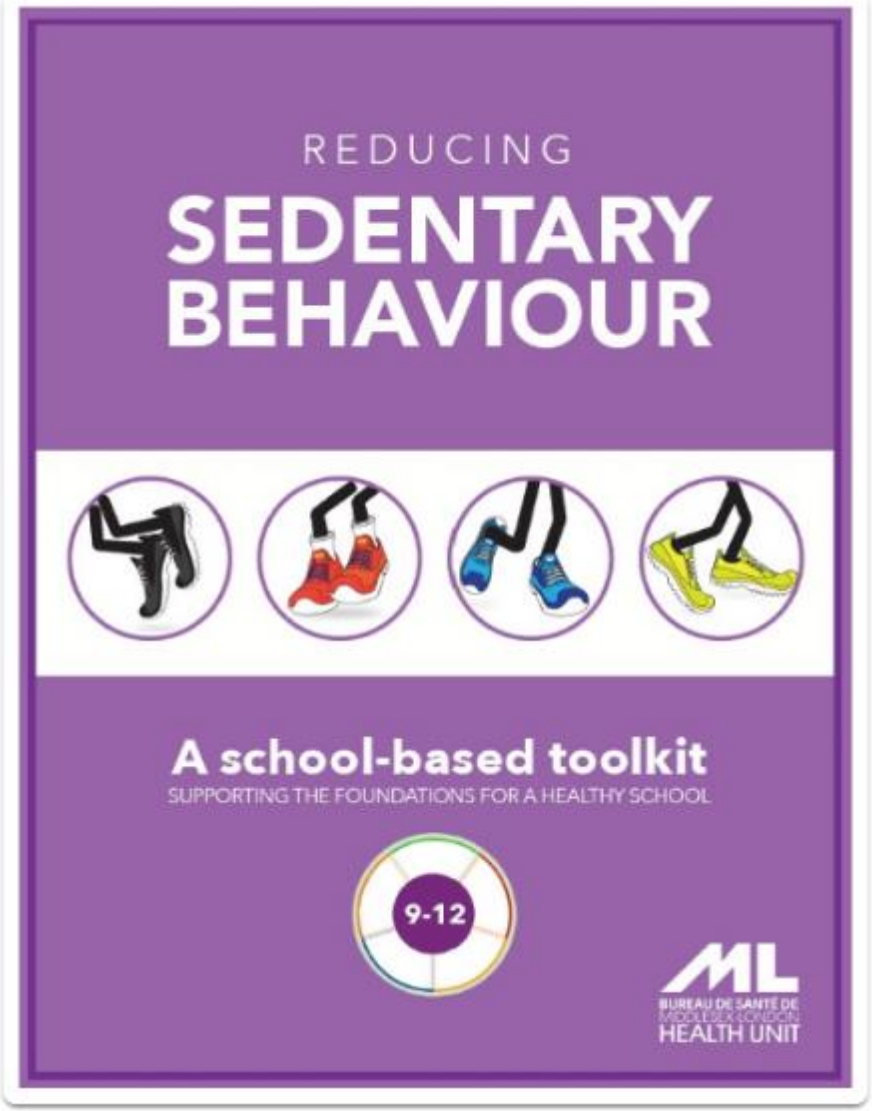
Hupin D, Raffin J, Barth N, Berger M, Garet M, Stampone K, Celle S, Pichot V, Bongue B, Barthelemy J-C and Roche F (2019) Even a Previous Light-Active Physical Activity at Work Still Reduces Late Myocardial Infarction and Stroke in Retired Adults Aged>65 Years by 32%: The PROOF Cohort Study. Front. Public Health 2019; 7:51. doi: 10.3389/fpubh.2019.00051

Some Websites

Canada
https://klandskillsca.files.wordpress.com/2016/03/canadian-physical-activity-guidelines.pdf
https://www.canada.ca/en/public-health/services/health-promotion/healthy-living/physical-activity/24-hour-movement-guidelines-children-youth.html

Australia
http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines
https://www.playaustralia.org.au/Physical-Activity-and-Sedentary-Behaviour-Guidelines
https://www.comcare.gov.au/Forms_and_Publications/publications/services/fact_sheets/fact_sheets/the_business_case_for_reducing_sedentary_work_practices

UK
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213745/dh_128225.pdf



https://www.healthunit.com/school-toolkit-9-12-sedentary-behaviour