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Sedentary Behaviour: Definitions and Distinctions for Cancer-Prevention Research



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Breakfast 15 mins



Work on computer 3.5 hrs



Lunch 30 mins







Transport From work 45 mins

> Evening meal 30 mins





Watch TV 4 hrs

Exercise – 30 min



Sleep **11pm**

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work 45 mins

Transport to

Sedentary behaviour





Ainsworth BE, et al. Med Sci Sport Exer. 2000;32:S498–S516

Sitting induces muscular inactivity



Hamilton, M.T., Hamilton, D.G. and Zderic, T.W. (2007). Role of low energy expenditure and sitting in obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease. *Diabetes, 56*, 2655-2667



Sedentary behaviour and health: a traffic-light system for the status of the science



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Australian Diabetes, Obesity & Lifestyle Study *



AusDiab1, AusDiab2 (AusDiab3, 2011-12)

population-based observational and cohort study 1999/2000 (n=11,247) and 2004/2005 (n=9,303)

aim to estimate national prevalence of diabetes and its precursors in Australian adults \geq 25 years

* www.bakeridi.edu.au/ausdiab



AusDiab1 - TV time: summary of cross-sectional findings

TV time in AusDiab1 associated with:

- Abnormal glucose metabolism¹
- Metabolic syndrome ²
- Elevated 2-h plasma glucose ^{3, 4} and other glycaemic measures ³
- Associations independent of leisure-time physical activity
- Associations generally stronger for women than for men



AusDiab2: overall sitting time and biomarkers





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Device-based measurement of movement and posture

Accelerometer





Inclinometer



The 'market dominator' from whose output (counts of less than 100 pm) we infer 'sedentary' time From whose output we can derive posture-based indices of 'sitting' time



You can be 'active', but mostly sit

The 'Active' Couch Potato



Mean mod-to-vigorous time = 31 mins/day % Waking hours spent in Sedentary = 71%



How adults' overall daily movement patterns are distributed over physically-active and sedentary time



Healy, G.N., Wijndaele, K., Dunstan, D.W., Shaw, J.E., Salmon, J, Zimmet, P.Z. and Owen, N. (2008). Objectively-measured sedentary time, physical activity and metabolic risk: the AusDiab study. *Diabetes Care, 31,* 369-71



The 'breaks in sedentary time' hypothesis

Breaking-up sedentary time (with frequent transitions from sitting to standing) has beneficial associations biomarkers (independent of total sedentary time)



Healy, G.N., Dunstan, D.W., Salmon, J., Cerin, E., Shaw, J.E., Zimmet, P.Z., and Owen, N. (2008). Breaks in sedentary time: Beneficial associations with metabolic risk. *Diabetes Care, 31,* 661-666.



Sedentary time & breaks in sedentary time: NHANES 2003-2006



Adjusted for age, sex, race/ethnicity, moderate-vigorous intensity activity + other potential confounders Breaks in sedentary time additionally adjusted for total sedentary time

Healy G.N., Matthews, C.E., Dunstan, D.W., Winkler, E.A.H., Owen, N. (2011). Sedentary time and cardiometabolic biomarkers in US adults: NHANES 2003-06. *European Heart Journal, 32,* 590-597





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The range of variation in adults' sedentary time



Quartiles of sedentary time

Quartiles of sedentary time. Based on 1 week of accelerometer data in 1712 adults, these stacked column graphs show the allocation of waking hours spent sedentary, in light activity, and in exercise, from the lower to the upper quartile of overall sedentary time; data from the National Health and Nutrition Examination Survey.

Owen, N., Sparling P.B., Healy G.N., Dunstan D.W. and Matthews C.E. (2010). Emerging evidence on a new health risk. *Mayo Clinic Proceedings*, *85*, 1138-1141.





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Ecological Models for Health Behaviours

Multiple dimensions of influence on behaviour

Behaviour-specific models are needed

Environments can directly influence behaviour

Behavior settings – 'restrict the range of behaviors, by promoting and sometimes demanding certain actions and by discouraging or prohibiting others...'

Sallis, J. F. Owen, N. and Fisher, E.B. (2008). Ecological models of health behavior. In K. Glanz, B. K. Rimer and K. Viswanath. (Eds.). *Health Behavior and Health Education: Theory, Research, and Practice.* (pp. 465 – 482). Fourth Edition, San Francisco, Jossey-Bass.



Thinking about multiple influences on physicallyactive and sedentary time



Ecological Model of Four Domains of Sedentary Behavior



TV time and neighbourhood walkability



Unstandardised regression coefficients (and 95% confidence intervals); differences in TV viewing time (min/day) compared to the reference category (low walkability)

Sugiyama, T., Salmon, J., Dunstan, D., Bauman, A. and Owen, N. (2007). Associations of neighborhood walkability with TV viewing time among Australian adults. *American Journal of Preventive Medicine*, 33, 444–449.



Sedentary time and neighborhood walkability; an emerging scientific puzzle

Australia (Adelaide): TV time significantly lower among women in high-walkable neighbourhoods

USA (Baltimore and Seattle): Overall sedentary time (accelerometer assessed), TV time and time sitting in cars significantly <u>lower</u> for men and women <u>high-walkable</u> neighbourhoods

Belgium (Ghent): Overall sedentary time (accelerometer assessed) significantly <u>higher</u> for men and women <u>high-</u><u>walkable</u> neighbourhoods

Sugiyama, et al .(2007). Associations of neighborhood walkability with TV viewing time among Australian adults. *American Journal of Preventive Medicine*, 33, 444–449; **Kozo et al.** (under review); **Van Dyck, et al**. (2010). Neighborhood walkability and sedentary time in Belgian adults. *American Journal of Preventive Medicine*, 39, 25-32.





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National Health and Medical Research Council

Australian Government

Project Grant: 2009-2011

Understanding the <u>acute</u> metabolic effects of prolonged sitting in adults

The IDLE Breaks study







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SITTING INCREASES RISK F DEATH UP TO 40%

Sitting 6+ hours per day makes you up to 40% likelier to die within 15 years than someone who sits less than 3. Even if you exercise. Hr/Day

Average Physical Activity (Waking Hours):

Sedentary

Low-Intensity Physical Activity (Walking, Standing)

Medium-Vigorous Physical Activity (Running, Sports)

> Studies show that only reducing sitting time helps. It's clear that sitting is killing us: but how?

0.7

93

Hr/Day







Sitting less for adults

The arrival of the 'electronic age' has fundamentally changed how much time we spend sitting (also called being 'sedentary') at home, during travel and at work. This change has been directly linked to an increase in health problems, such as poor nutrition, obesity and insulin resistance, which can lead to diabetes. These health problems also increase your risk of developing ocronary heart disease.

There are many ways in which adults can sit for long periods throughout the day. A typical day might include sitting:

- to eat breakfast
- to drive to work
- at your desk at work
- to drive home
- to eat dinner
- · during the evening to do things such as watch television, use a computer and socialise.

It's very easy to sit too much – adults spend more than half of their waking hours sitting.^{1–3} Therefore, to reduce your risk of health problems, it's important to be aware of how much you sit and try to move more throughout the day.

Why is sitting less better for your health?

Adults who sit less throughout the day have a lower risk of early death – particularly from cardiovascular disease (CVD).^{4,5}

Most research so far has been on how watching television affects health, because watching television is the most common leisure activity among adults. Adults who watch less than two hours of television a day are less likely to have type 2 diabetes or be obese, and have a lower risk of developing CVD.⁵ The reverse is also true – the more time an adult spends watching television, the higher their risk of health problems.

Adults who do regular planned exercise, such as going to the gym or running, can still sit for long periods of time every day. Figure 1 (see page two) shows how easy it is for an adult to spend a large amount of time sitting during a typical working day. In this example, the adult gets 60 minutes of physical activity that day through a brisk walk in the morning and strength training in the evening. However, they also spend 15 hours (over 90% of total waking hours) sitting.

If an adult meets the Australian Government's physical activity recommendations of 30 minutes or more moderate-intensity physical activity on most, if not all, days of the week, they are classified as 'physically active'. However, adults may increase their health benefits if they also sit less during the day. In fact, new evidence suggests that, no matter what your total sitting time is, regular interruptions from sitting (even as little as standing up) may help to reduce your risk factors for developing coronary heart disease and diabetes.²⁷

Sit less, move more



Sitting less for children

The arrival of the 'electronic age' has fundamentally changed how much time we spend sitting (also called being 'sedentary') at home and in other places, such as at school and work. This change has been directly linked to an increase in health problems, such as poor nutrition, obesity and insulin resistance, which can lead to diabetes. These health problems increase your risk of developing coronary heart disease.

There are many opportunities for children and young people to sit for long periods of time. Even children and young people who play sport after school and meet the *Physical Activity Recommendations for Children and Adolescents*¹ can still spend large amounts of the day sitting. See Figure 1 below for an example of what may be a typical child's day.

Figure 1. Example of a child's sitting time during one day (total sitting time 7.5 hours)



Because it's so easy for children and young people to sit too much, it's important for parents/ carers, teachers and child care workers to encourage them to sit less and move more.

Why is sitting less better for children and young people?

Sitting less helps to reduce the risk of children and young people developing health and other problems in later life.

Watching television, using a computer and playing electronic games, which usually involve sitting for long periods of time, are a big part of children's and young people's leisure time. Therefore, children and young people who spend less time doing these things have better health than those who spend too much time doing these things.

Sit less, move more



http://www.heartfoundation.org.au/Healthy_Living/Physical_Activity/Pages/default.aspx

Healthy livi

SPECIAL COMMUNICATIONS

AMERICAN COLLEGE of SPORTS MEDICINE

POSITION STAND .

Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults: Guidance for Prescribing Exercise

This pronouncement was written for the American College of Sports Medicine by Carol Ewing Garber, Ph.D., FACSM, (Chair); Bryan Blissmer, Ph.D.; Michael R. Deschenes, Ph.D., FACSM; Barry A. Franklin, Ph.D., FACSM; Michael J. Lamonte, Ph.D., FACSM; I-Min D., Sc.D., FACSM; David C. Nieman, Ph.D., FACSM; and . Swain, Ph.D., FACSM.

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ACSM Position Stand: Guidance for Prescribing Exercise (2011) – Sedentary Behaviour

- Sitting = television watching, computer use, and sitting in a car or at a desk.
- 2. Spending long periods of sitting =
 - CHD mortality, depression, increased waist circumference, elevated blood pressure, worsened chronic disease biomarkers such as blood glucose, insulin, and lipoproteins
- 3. Sitting is detrimental even among in <u>individuals who meet</u> <u>current physical activity recommendations</u>
- 4. *"health and fitness professionals should be <u>concerned</u> <u>about the amount of time</u> clients spend in activities such as <u>television watching and sitting at a desk</u>"*





Re-analyses of prospective epidemiological data sets, treating sitting time as distinct exposure variable?

Valid and reliable self-report AND device-based measures for epidemiological, genetic and behavioral studies

Characterizing sedentary behavior variables: total time; breaks; prolonged bouts; sedentary/light balance; sedentary/moderate balance; time-of-day variations



Sedentary behavior/microcirculation relationships (e.g., kidneys; retina) as potential markers of inflammation

What amounts and intensities of moderate and/or vigorous activity might be protective, in the presence of prolonged sitting time?

Identifying potential pathways through gene-expression studies.

Genetic variations that may underlie predispositions to sit, and/or greater risk susceptibility



Feasibility of reducing and/or breaking up prolonged sitting, for different groups (younger, older, cancer-type survivors) in different settings (workplace, domestic, transit)?

If intervention trials find significant changes in sitting time indices, are there improvements in relevant biomarkers?

Mortality outcomes require considerable patience and are solid and categorical: but, device-based data with biomarker and gene-expression changes allow *acute and medium-term intervention impacts on pathways* to be examined



Sedentary time indices in built-environment/physical activity studies (*IPEN 11-country study; the 'Belgian paradox'*)

Evidence on behavioural, adiposity and biomarker changes from 'natural experiments' (*height-adjustable workstations; community infrastructure initiatives*)

Strong behavioral criteria to guide environmental, organizational and policy initiatives on 'too much sitting' (dose-response data from device-based measurement, with biomarker and mortality outcomes)



THANK YOU FOR YOUR INTEREST

