Lifestyle and Workstyle: Physical Activity and Work Related Cancer Risk

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Outline

• **State of knowledge (evidence base)**
  – Sedentary behaviour (*too much sitting*) as a unique public health problem – paradigm shift
  – Evidence linking sedentary behaviour with mortality, cancer outcomes even in people who are physically active

• **Current & future research directions** towards building the evidence-base in relation to sitting
  – Settings-based interventions - work
Acknowledgements

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• Prof Jo Salmon: Deakin University

• Australian Research Council

• Victorian Health Promotion Foundation
Modern Society: Minimising Daily Muscular Activity!

Then

- Transport
- Domestic
- Work

Now
Our technologically advanced, ‘sitting orientated’ society

- **Sleep** 11pm
- **Awake** 7 am

#### Daily Schedule

- **Breakfast** 15 mins
- **Transport to work** 45 mins
- **Work on computer** 3.5 hrs
- **Lunch** 30 mins
- **Work on computer** 4 hrs
- **Transport From work** 45 mins
- **Evening meal** 30 mins
- **Watch TV** 4 hrs
- **Evening** meal 30 mins
- **Exercise – 30 min**

**Sitting Opportunities** 15.5 hrs
Sedentary Behaviours

- **Sedere** – “to sit”
- Different activities that involve sitting and low levels of energy expenditure (1.0-1.5 METS)
- Includes sitting during commuting, in the workplace, the domestic environment and during leisure time

“Sitting time” = what these sedentary behaviours primarily involve
Sitting Induces Muscular Inactivity

Too Much Sitting: The Population Health Science of Sedentary Behavior

Neville Owen\textsuperscript{1,2}, Geneviève N. Healy\textsuperscript{1,2}, Charles E. Matthews\textsuperscript{3}, and David W. Dunstan\textsuperscript{2}

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Commentary: Medical Hazards of Prolonged Sitting
Page: 101-102
i) Identifying relationships of sitting time with health outcomes

ii) measuring sitting time

iii) characterising prevalence and variations of sitting time in populations

iv) identifying the determinants of sitting time

v) developing and testing interventions to influence sitting time

vi) using the relevant evidence to inform public health guidelines and policy
Sedentary Behaviour and Health
Evidence from Prospective Studies (1996-Jan 2011)*

Every hour of TV from age 25 reduces your life expectancy by 22 minutes

Veerman et al 2011 Br J Sp Med

Mortality(all cause & CVD): +ve association

+ve association  mediated by BMI / one gender  no association

## Sitting Time and Mortality

<table>
<thead>
<tr>
<th>Study</th>
<th>N (person-yrs FU)</th>
<th>Age (years)</th>
<th>Mortality outcome</th>
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<tbody>
<tr>
<td><strong>EPIC Norfolk</strong></td>
<td>13,197 (124,902)</td>
<td>≥ 45</td>
<td><img src="image1" alt="Cancer" /> <img src="image2" alt="CVD" /> <img src="image3" alt="All cause" /></td>
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<tr>
<td>(Wijndaele et al)</td>
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<tr>
<td><strong>AusDiab</strong></td>
<td>8,800 (58,087)</td>
<td>≥ 25</td>
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<td>(Dunstan et al)</td>
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<tr>
<td><strong>Scottish HS</strong></td>
<td>4,512 (19,364)</td>
<td>≥ 35</td>
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<td>(Stamatakis et al)</td>
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<td><strong>ACLS (men)</strong></td>
<td>7,744 (21 years FU)</td>
<td>≥ 20</td>
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<td>(Warren et al)</td>
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<td><strong>JPHC</strong></td>
<td>83,034 (725,071)</td>
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<td>(Inoue et al)</td>
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<td><strong>CFS</strong></td>
<td>17,013 (204,732)</td>
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<td>(Katzmarzyk et al)</td>
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<tr>
<td><strong>CPS2</strong></td>
<td>123,216 (1,610,728)</td>
<td>≥ 50</td>
<td><img src="image1" alt="Cancer" /> <img src="image2" alt="CVD" /> <img src="image3" alt="All cause" /></td>
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<td>(Patel et al)</td>
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Amount of Time Spent in Sedentary Behaviors and All-Cause Mortality

Television Viewing (hours/day)

- <1
- 1 to 2
- 3 to 4
- 5 to 6
- 7+

Hazard ratio

Reference

Sedentary behaviour research

- **Children (0-18yrs)**
- **Adult (19-64 yrs)**
- **Older adults (65+ yrs)**

No. publications

Year of publication

Thanks to Paul Gardiner – University of Queensland
Sedentary Behavior and Cancer: A Systematic Review of the Literature and Proposed Biological Mechanisms

Brigid M. Lynch

Abstract

**Background:** Sedentary behavior (prolonged sitting or reclining characterized by low energy expenditure) is associated with adverse cardiometabolic profiles and premature cardiovascular mortality. Less is known for cancer risk. The purpose of this review is to evaluate the research on sedentary behavior and cancer, to summarize possible biological pathways that may underlie these associations, and to propose an agenda for future research.

**Methods:** Articles pertaining to sedentary behavior and (a) cancer outcomes and (b) mechanisms that may underlie the associations between sedentary behavior and cancer were retrieved using Ovid and Web of Science databases.

**Results:** The literature review identified 18 articles pertaining to sedentary behavior and cancer risk, or to sedentary behavior and health outcomes in cancer survivors. Ten of these studies found statistically significant, positive associations between sedentary behavior and cancer outcomes. Sedentary behavior was associated with increased colorectal, endometrial, ovarian, and prostate cancer risk; cancer mortality in women; and weight gain in colorectal cancer survivors. The review of the literature on sedentary behavior and biological pathways supported the hypothesized role of adiposity and metabolic dysfunction as mechanisms operant in the association between sedentary behavior and cancer.

**Conclusions:** Sedentary behavior is ubiquitous in contemporary society; its role in relation to cancer risk should be a research priority. Improving conceptualization and measurement of sedentary behavior is necessary to enhance validity of future work.

**Impact:** Reducing sedentary behavior may be a viable new cancer control strategy. *Cancer Epidemiol Biomarkers Prev;* 19(11); 2691–709. ©2010 AACR.
Figure 2. Biological model of hypothesized pathways from sedentary behavior to cancer. TNF-α, tumor necrosis factor-α; IL-6, interleukin-6; CRP, C-reactive protein.
Sedentary Behaviour & Risk of Colon Cancer

Howard et al. 2008
Occupation & Colorectal Cancer

Sedentary
(computing, bookkeeper)

Light
(hairdresser, teacher)

vs.

= 2x ↑risk of distal colon cancer

>10yrs sedentary occupation compared those who never held sedentary occupation

= 2x ↑risk distal colon & 1.5x ↑risk rectal cancer

Boyle et al. 2011
‘The risk of distal colon and rectal cancer increased with increasing duration of sedentary work among both the most recreationally active and least recreationally active participants.’

Boyle et al. 2011
Device-Based Measurement of Movement and Posture

Accelerometer

The ‘market dominator’ from whose output (counts of less than 100 pm) we infer ‘sedentary’ time

Inclinometer

From whose output we can derive posture-based indices of ‘sitting’ time
How Australian Adults’ Overall Daily Behaviour Patterns Are Distributed Between Physically-Active and Sedentary Time

- Sedentary time: 9.3 hrs/day (60%)
- Light-intensity: 6.5 hrs/day (35%)
- Moderate-vigorous activities: 0.7 hrs/day (5%)

Mix of working & non-working adults aged 30-87 years

Healy et al., 2008
Time To Rethink The Physical Activity Paradigm?

Well-Known, Powerful Biological Stimulus

BUT

Low Volume

Moderate-vigorous activities

Light-intensity

Sedentary time

Newly-Emerging, Unique Biological Stimulus?

AND

Very Large Volume
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%
The ‘Breaks In Sedentary Time’ Hypothesis

• ‘Breaking-up’ sedentary time (frequent transitions from sitting to standing) has beneficial associations with health outcomes (independent of sedentary time)

Healy GN, Dunstan DW et al. Diabetes Care 2008; 31: 661-666
Sedentary Time & Breaks in Sedentary Time
NHANES 03-06

Adjusted for age, sex, race/ethnicity, moderate-vigorous intensity activity + other potential confounders

Breaks in sedentary time additionally adjusted for total sedentary time

The results suggest that simple interventions that can be implemented in the workplace and domestically to decrease passive sitting time and increase the number of breaks can also lead to substantial health improvements.

“The workplace provides an ideal opportunity to engage individuals in taking more control of their own health”.

Workplaces

“The workplace provides an ideal opportunity to engage individuals in taking more control of their own health” (Quote from submission)

Workplaces represent an arena for social leadership and peer support in tackling behaviour change, while work and employment policies and practices can enable or work against positive changes within the workforce. Furthermore, workplaces provide an ideal opportunity to reduce sedentary behaviour in the population.

Prolonged inactivity, such as sitting, is now common during working, domestic and recreational time, and typically comprises over half of waking time activity.[106, 114] Over one-quarter of Australians (26%) report sitting for eight or more hours during a typical day.[115] Recent Australian research has demonstrated the benefits of avoiding prolonged uninterrupted periods of sedentary (mainly sitting) time,[106] interspersing periods of inactivity with breaks, and substituting (at minimum) light-intensity activity for sedentary time.[106, 114] These benefits include improved weight and metabolic outcomes.

While it is important to continue to promote the significant health benefits of regular moderate to vigorous physical activity, this research indicates that extended periods of sedentary time are a sufficient cause for individual health and also underscores the importance of lower-intensity activity throughout the day (including incidental activity such as walking).

The results suggest that simple interventions that can be implemented in the workplace and domestically to decrease passive sitting time and increase the number of breaks can also lead to substantial health improvements.

“Workplaces are best placed to provide the supportive cultures often needed to sustain lifestyle change” (Quote from submission)
Focus on “normalising” standing behaviours and making them part of the work environment

Policy to reinforce regular ‘desk’ breaks
Support standing and movement during meetings & at desk

Standing to make phone calls
Walk to colleagues’ desk rather than phoning or emailing
Having standing coffee breaks

Standing/walking meetings part of normal practice
Meetings with built-in standing breaks

Standing desks
Meeting rooms with high tables
Removal of in-office rubbish bins

Standing/walking meetings part of normal practice
Meetings with built-in standing breaks
“Reducing Prolonged Workplace Sitting Time in Office Workers: A Cluster-Randomised Controlled Trial”
- The Stand Up Victoria Study

Investigators:
A/Prof. David Dunstan (Baker IDI)
Dr Genevieve Healy (Baker IDI/Uni. of Qld.)
Prof. Neville Owen (Baker IDI)
Prof. Elizabeth Eakin (Uni. of Qld)
A/Prof. Tony LaMontagne (Uni. of Melb.)
A/Prof. Marj Moodie (Deakin Uni.)
Stand Up Victoria – Brief Description

- 320 participants (50% intervention) to be recruited from one organisation in Victoria (DHS)

- **Organisational**: leadership, senior management engagement, participatory organisational and employee planning, customisation of intervention to each specific work environment

- **Individual**: education, face-to-face and telephone behavioural support

- **Environmental**: height adjustable workstations
Stand Up Victoria

Stand Up  
Sit Less  
Move More
Take Home Messages

• Create opportunities within your waking hours to limit sitting time

• Avoid prolonged sitting periods - break up sitting time on a regular basis (“Stand Up, Sit Less, Move More, More Often”)

• The above messages are in addition (and not an alternative) to engaging in regular aerobic and strength-developing physical activities
Thank You for Listening

Contact Details

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Each of us should aim to participate in an appropriate level of physical activity for our age. Each of the lifecourse chapters provides an introduction, sets out the guidelines for that age group, summarises the evidence and discusses what the guidelines mean for people. We hope that this report will be read by policy makers, healthcare professionals and others working in health improvement. The guidelines are designed to help professionals provide people with information on the type and amount of physical activity that they should undertake to benefit their health, in particular to prevent disease. The age groups covered in this report are:

- early years (under 5s)
- children and young people (5–18 years)
- adults (19–64 years)
- older adults (65+ years).

### EARLY YEARS (under 5s)
1. Physical activity should be encouraged from birth, particularly through floor-based play and water-based activities in safe environments.
2. Children of pre-school age who are capable of walking unaided should be physically active daily for at least 180 minutes (3 hours), spread throughout the day.
3. All under 5s should minimise the amount of time spent being sedentary (sitting or standing) for extended periods (except time spent sleeping).

### CHILDREN AND YOUNG PEOPLE (5–18 years)
1. All children and young people should engage in moderate to vigorous intensity physical activity for at least 60 minutes and up to several hours every day.
2. Vigorous intensity activities, including those that strengthen muscle and bone, should be incorporated at least three days a week.
3. All children and young people should minimise the amount of time spent being sedentary (sitting) for extended periods.

### ADULTS (19–64 years)
1. Adults should aim to be active daily. Over a week, activity should add up to at least 150 minutes (2½ hours) of moderate intensity activity in bouts of 10 minutes or more – one way to approach this is to do 30 minutes on at least 5 days a week.
2. Alternatively, comparable benefits can be achieved through 75 minutes of vigorous intensity activity spread across the week or a combination of moderate and vigorous intensity activity.
3. Adults should also undertake physical activity to improve muscle strength on at least two days a week.
4. All adults should minimise the amount of time spent being sedentary (sitting) for extended periods.

### OLDER ADULTS (65+ years)
1. Older adults who participate in any amount of physical activity gain some health benefits, including maintenance of good physical and cognitive function. Some physical activity is better than none, and more physical activity provides greater health benefits.
2. Older adults should aim to be active daily. Over a week, activity should add up to at least 150 minutes (2½ hours) of moderate intensity activity in bouts of 10 minutes or more – one way to approach this is to do 30 minutes on at least 5 days a week.
3. For those who are already regularly active at moderate intensity, comparable benefits can be achieved through 75 minutes of vigorous intensity activity spread across the week or a combination of moderate and vigorous activity.
4. Older adults should also undertake physical activity to improve muscle strength on at least two days a week.
5. Older adults at risk of falls should incorporate physical activity to improve balance and co-ordination on at least two days a week.
6. All older adults should minimise the amount of time spent being sedentary (sitting) for extended periods.
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 are linked to heart disease. These health problems also increase your risk of developing coronary 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 time than half of their waking hours sitting. Therefore, if you reduce the risk of health problems, it is 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). 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. 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 sit for long periods of time every day. Figure 1 (see page 2) 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 60% 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.

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, 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 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 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)

- 7 am: Watch TV (1 hour)
- 8:30 am: Travel by car to school (10 minutes)
- Morning spent in classroom (2.5 hours)
- Physical activity during recess and lunch (40 minutes)
- Play computer games or watch TV (1 hour)
- Lunch and homework (30 minutes)
- Participation in organized sport (50 minutes)
- Travel by car to school (15 minutes)

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.

Sitting less, move more
Spare Slides
Sedentary Behavior and Health: Measurement Research Opportunities

- 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

- Re-analyses of prospective epidemiological data sets, treating sitting time and its relevant variations as distinct exposure variables
Sedentary Behavior and Health: Research Opportunities with Biomarkers and Biological 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?

- Dose-response evidence to support sedentary behavior guidelines

- Identifying potential pathways through gene-expression studies; genetic variations that may underlie predispositions to sit, and/or greater risk susceptibility

- Neurophysiology of preferences for sitting; environmental saturation with cues, social modeling and anticipatory reinforcement
Sedentary Behavior and Health: Intervention-Research Opportunities

- Feasibility of reducing and/or breaking up prolonged sitting, for different groups (younger, older, those with established diseases) 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 Behavior and Health: Environment and Policy Research Opportunities

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

- Relationships of sedentary time, breaks and prolonged bouts with environmental attributes

- Evidence on behavioural, adiposity and biomarker changes from ‘natural experiments’ (height-adjustable workstations; community infrastructure initiatives; home-environment changes)

- 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)