The Research File

Summary from the Canadian Fitness and Lifestyle Research Institute and ParticipACTION

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Stand up - it may save your life: Examining the effects of prolonged sitting on morbidity and mortality

The industrial revolution may be largely credited for the changes we see in the physical, economical and social environments we now live in.[1] These changes, such as the development of new technologies (whereby communication and transportation has improved) have resulted in reduced demands for physical activity.[1,2] These reductions in the demands for being physically active have been linked to increases in adverse health outcomes among a substantial proportion of the population both in Canada and around the world. To date, much of the focus of public health initiatives has been to raise awareness of the benefits of regular moderate-to-vigorous physical activity with the hope that this may subsequently increase activity levels; however, there is growing interest in identifying the effects of sedentary behaviours on health outcomes.[1,2] More specifically, whether extended periods of time spent in sedentary pursuits pose a health risk independent of one's level of physical activity. This research bulletin summarizes recent findings on the health risks associated with prolonged sitting.

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Sedentary behaviour & health

Sedentary behaviour may encompass a range of activities that usually involve sitting; for example, commuting by an automobile, watching TV, playing video games, or working at a desk.[1,2] These activities typically require very little energy expenditure (1.0 to 1.5 METs).[1,2] According to Owen et al., an important distinction should be made between being sedentary (as described above) and not being moderately-to-vigorously active.[1] Traditionally, 3 or more METs has served as the cut-off point for characterizing moderate-to-vigorous activity. Those who reported no such activity or who did not meet the minimum activity guidelines were often described as being 'sedentary'.[1] This may underestimate the potential health benefits of participation in light intensity activities (1.9 to 2.9 METs).[1]

Table 1 summarizes the findings from a review conducted by Owen and colleagues of studies, involving both self-report data on TV-time and objective measures of sedentary behaviour.[1] For more comprehensive information on the studies please refer to the reference list in the review article.

Author(s)/year	Type of measurement	Sample	Outcome of interest	Result
Dunstan et al., 1999/2000 (AusDiab study)	- Self-reported TV time	- N=11,000 - Adults from Australian states and Northern Territories	- Biomarkers of cardio-metabolic risk	- Positive association between TV viewing time and abnormal glucose metabolism and metabolic syndrome.[1] - Strong dose-response association between TV time and 2h plasma glucose and fasting glucose in women.[1]
Healy et al., 2008 (AusDiab study)	- Self-reported TV time	- Healthy, physically active adults	- Metabolic risk	- Dose-response relationship observed between TV-time and waist circumference, systolic blood pressure, 2h plasma glucose, fasting plasma glucose, triglycerides and HDL-cholesterol.[2]
Thorp et al., 2004/2005 (AusDiab study)	- Self-report TV and sitting time	- Men and women	- Cardio-metabolic biomarkers	- Stronger relationship between TV time and metabolic health for women. - No significant difference in relationships of sitting time with metabolic health between men and women.
Ekelund et al., 2009 (ProActive trial)	- Accelerometer-determined sedentary time	- N=258 - Adults from UK, aged 30-50 years with family history of Type 2 Diabetes	- Metabolic biomarkers	- Detrimental relationship between sedentary time and insulin (in cross-sectional analysis. Borderline significant in prospective analysis).
Balkau et al., 2008 (RISC study)	- Accelerometer-determined sedentary time	- N=801 - Adults from Europe aged 30-60 years	- Metabolic biomarkers	- Detrimental relationship between sedentary time and insulin.
Healy et al., 2007 & 2008 (AusDiab studies)	- Accelerometer-determined sedentary time	- N=169 - Adults aged 30-87 years, general population	- Metabolic biomarkers	- Detrimental relationship between sedentary time and waist circumference, triglycerides and 2-h plasma glucose.[3] - Negative correlation between sedentary time and light intensity activity. - Breaks in sedentary time shown to have beneficial association with metabolic biomarkers.

Dunstan et al., 2009 (AusDiab study)	- Self-reported TV time	- Adults	- Mortality	- High levels of TV time associated with increased mortality from all causes and cardiovascular disease.
Katzmarzyk et al., 2009 (Canada Fitness Survey)	- Self-report overall sitting time	- N=17,013 Canadians aged 18-90 years	- Mortality from all causes, cardiovascular disease	- Dose-response relationship between sitting time and mortality from all causes and cardiovascular disease.[4] - Relationship was stronger for obese individuals with higher rates of sitting time.

[1] Relationships remained significant after adjusting for physical activity intensity and waist circumference
[2] Relationship true for women only
[3] Relationships remained significant after adjusting for time spent in moderate-to-vigorous activity
[4] Relationships remained significant after adjusting for age, alcohol consumption, PAR-Q, smoking status and physical activity level

Sitting time: An international comparison

Until recently, population surveillance of sedentary behaviour has been lacking.[3] Moreover, studies that do exist often use different instruments for capturing data, making it difficult to compare results between populations with any consistency.[3] A recent study by Bauman and colleagues aimed to quantify sitting time using the International Physical Activity Questionnaire. Their study involved almost 50,000 adults (aged 18-65 years) from 20 countries worldwide.[3] The results from the study showed that the median sitting time was 300 minutes/day (5 hours/day). According to investigators; Portugal, Brazil and Columbia had the lowest reported amount of sitting (median≤180 min/day), whereas the highest amount of reported sitting was found among those living in Taiwan, Norway, Hong Kong, Saudi Arabia and Japan (medians≥360 min/day).[3] Furthermore, higher rates of sitting were noted among younger adults compared to older and those with post-secondary level of education (compared to those with high school or less).[3] Table 2 provides a brief description of how Canadian adults compare internationally with respect to sitting time.[3]

Table 2: How do Canadians fare?

• Median sitting time= 300 min/day	• 46% reported sitting for 4 hours or less (1st and 2nd quintiles)
• Post-secondary graduates had higher median sitting times	• 54% reported sitting for 4 hours or more (3rd, 4th and 5th quintiles)

What have we learned?

- It is possible to achieve recommended levels of physical activity but still spend a significant proportion of one's waking hours sedentary.
- Engaging in prolonged sedentary activities (such as TV-viewing) is associated with increased cardiovascular and metabolic risk.
- Prolonged sitting is also associated with an increased risk of mortality from all causes and from cardiovascular disease.
- The relationship between certain sedentary behaviours and adverse health outcomes appear to be stronger for certain subgroups of the population (e.g., women and obese individuals)
- Participation in light-intensity physical activity and breaking up time spent in sedentary activities may improve metabolic risk

More info…

1. Owen, N., Healy, GN., Matthews, CE., Dunstan, DW. Too Much Sitting: The Population-Health Science of Sedentary Behaviour. *Exerc Sport Rev*. 2010;38(3):105-13.

2. Katzmarzyk, PT., Church, TS., Craig, CL., Bouchard, C. Sitting Time and Mortality from All Causes, Cardiovascular Disease and Cancer. *Med Sci Sports Exerc*. 2009;41(5):998-1005.

3. Bauman et al. The Descriptive Epidemiology of Sitting: A 20-Country Comparison Using the International Physical Activity Questionnaire (IPAQ). *Am J Prev Med*. 2011;41(2):228-35.

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