

Infographic: Physical activity, sitting time and mortality

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Physical inactivity, defined as not meeting the current public health guidelines for physical activity, is a major risk factor for non-communicable diseases and premature mortality. Recent estimates suggest that about 9% of all deaths annually, which corresponds to more than 5 million deaths globally, can be attributed to physical inactivity.¹

Sitting time constitutes the majority of awake time in the adult population. Sedentary behaviours have been proposed to be associated with many chronic conditions independent of physical activity,² and many national health and scientific authorities have introduced guidelines on sitting.^{3,4}

In one of the papers published as part of *The Lancet* 2016 series of physical activity,⁵ we sought to examine how much physical activity is needed to attenuate or even eliminate the detrimental association of daily sitting time and TV viewing time with mortality.

We conducted a systematic review to identify prospective, observational cohort studies that have individual-level exposure data on physical activity, sitting time (and/or TV viewing time), and outcome data on all-cause, or cardiovascular disease or cancer mortality.

We identified 13 studies that provided data on physical activity, sitting time and all-cause mortality, and asked these studies to reanalyse their data in a harmonised manner according to a predefined protocol. We defined sitting time into four categories (0–4 hours/day, 4–6 hours/day, 6–8 hours/day, >8 hours/day). Physical activity was assessed by self-report including leisure time physical activity and walking. All studies recalculated their estimates of physical activity into metabolic equivalent of task-hours per week and thereafter categorised physical activity into four equally large groups (quartiles). The joint associations, combining the four groups of sitting time with quartiles of physical activity (in total 16 groups) with all-cause mortality, were estimated by Cox

regression in all 13 studies and thereafter meta-analysed. The combination of the top quartile of physical activity and lowest category of sitting (<4 hours/day) was used as the reference group.

We included 1 005 791 participants who were followed up for 2–18 years, during which 84 609 (8.4%) died. A clear dose-response association was observed, with an almost curvilinear increased risk for all-cause mortality with increased sitting time in combination with lower levels of physical activity. Those who were categorised as ‘inactive’ (<5 min of moderate-to-vigorous-intensity physical activity

(MVPA)/day) and sat for 8 or more hours every day had a 59% increased risk of mortality compared with the referent group. This risk is similar to that of smoking and obesity previously reported in the literature.^{6,7}

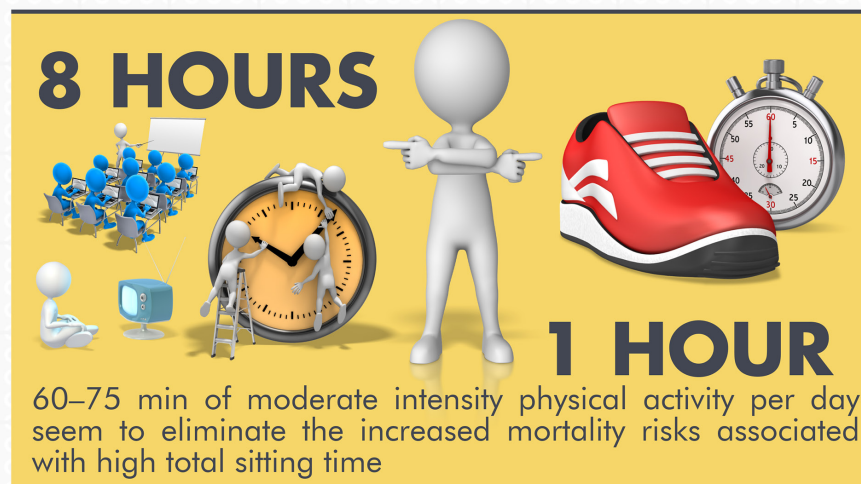
There was no increased risk of mortality by increasing sitting time in the most active group of participants, who were active for about 60–75 min of MVPA every day even if they sat for more than 8 hours per day. This amount of MVPA may be considered high but were reported by a quarter of the participants and is congruent with the level of physical activity showing maximum mortality benefit in a recent large meta-analysis.⁸

These findings indicate that increased sitting time is associated with increased all-cause mortality. However, the magnitude of increased risk with increased sitting time is substantially attenuated

One Hour of Physical Activity Eliminates the Detrimental Effects of 8 Hours of Inactivity

Reference : by Ulf Ekelund et al. The Lancet 2016

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The conclusions of this meta-analysis were drawn from data collected on more than 1 million men and women



Sitting for more than 8 h/day and with no additional physical activity is similar to that of smoking and obesity in terms of mortality risk



If long periods of sitting time each day are unavoidable (eg, for work or transport), it is important also to be physically active

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or even eliminated in physically active people. Indeed, those belonging to the most active one-quarter of the population and thus active for at least 1 hour per day of MVPA seem to have no increased risk of mortality, even if they sit for more than 8 hours per day.

The results summarised in the infographic provide further evidence on the benefits of physical activity, particularly in societies where increasing numbers of people have to sit for long hours for work or transport.

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REFERENCES

- 1 Lee IM, Shiroma EJ, Lobelo F, *et al*. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 2012;380:219–29.
- 2 Biswas A, Oh PI, Faulkner GE, *et al*. Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: a systematic review and meta-analysis. *Ann Intern Med* 2015;162:123–32.
- 3 Department of Health. *Australia's Physical Activity and Sedentary Behaviour Guidelines for Adults (18–64 years)*. Canberra, Australia: Australian Government, Department of Health, 2014.
- 4 Young DR, Hivert MF, Alhassan S, *et al*. Sedentary Behavior and Cardiovascular Morbidity and Mortality: A Science Advisory From the American Heart Association. *Circulation* 2016;134:e262–79.
- 5 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;388:1302–10.
- 6 Schumacher M, Rücker G, Schwarzer G. Meta-analysis and the Surgeon General's report on smoking and health. *N Eng J Med* 2014;370:186–8.
- 7 Whitlock G, Lewington S, Sherliker P, *et al*. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. *Lancet* 2009;373:1083–96.
- 8 Arem H, Moore SC, Patel A, *et al*. Leisure time physical activity and mortality: a detailed pooled analysis of the dose-response relationship. *JAMA Intern Med* 2015;175:959–67.