Stand up to back pain(?): Reducing sitting time in work places and classrooms

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Presentation outline

- Definitions
- Association between sedentary behaviour and health
- Innovative solutions to reducing work-place sitting time
- Re-designing classroom environment to reduce sitting: current evidence
- Conclusions
- Questions, comments, discussion
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Recommendations</th>
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<tbody>
<tr>
<td>Physical activity</td>
<td>any bodily movement produced by skeletal muscles that requires energy expenditure</td>
<td>Children = 60 mins MVPA everyday</td>
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<td>Adults = 30 mins MVPA on days/wk</td>
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<tr>
<td>Exercise</td>
<td>Physical activity that is done in order to become stronger and healthier.</td>
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<tr>
<td>Physical inactivity</td>
<td>Not undertaking physical activity</td>
<td>Adults = &lt;30 minutes of MVPA/week</td>
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<td>Sedentary behaviour</td>
<td>any waking activity characterized by an energy expenditure ≤ 1.5 metabolic equivalents and a sitting or reclining posture</td>
<td>Limit time spent sedentary and break up sedentary time</td>
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Environments that promote sedentary behaviour are ubiquitous in today’s world
Variation in population levels of sedentary time in European adults according to cross-European studies: a systematic literature review within DEDIPAC

Anne Loyer1, Maitê Verlaque2, Linde Van Hecke3, Ingrid Hendriksen4, Jeroen Lakerveld1, Jostein Sarne-Johannessen5, Annemarie Koster6, Alan Donnelly7, Ulf Ekblom8, Benedicta Dafour9, Ilse Delbeke-ADDING7, Johannes Brug1, Hilde P. van der Ploeg10,11, and on behalf of the DEDIPAC consortium

- Data collected in 2002 using the IPAQ-short questionnaire in people aged 15+ as part of the Eurobarometer survey 58.2[20].
- Data collected in 2005 using the IPAQ-short questionnaire in people aged 15+ as part of the Eurobarometer survey 64.3[20].
- Data collected in 2013 using the IPAQ-short questionnaire in people aged 15+ as part of the Eurobarometer survey 80.2[20].
- Data collected in 2002-2004 using the IPAQ-short questionnaire in people aged 16-65 years as part of the International Prevalence Study. Reported median instead of mean values[21].
- Data collected in 2002-2011 using ActiGraph accelerometers in people aged 18-66 years as part of IPEN[26].
- Data collected in 2014 using the Marshall questionnaire in adults as part of SPOTLIGHT[24].
- Data collected in 2002-2003 using the IPAQ-long in people aged 18+ (66% women)[22].
N = 1587 Finnish adults
Sedentary Behaviour and all-cause mortality

Data from 17,013 Canadians, followed-up for 12 years (Katzmarzyk et al., 2009)
Sedentary Behaviour and all-cause mortality

Data from 17,013 Canadians, followed-up for 12 years (Katzmarzyk et al., 2009)
Sedentary behaviour

112% increased risk of diabetes

147% increased risk of CV event

90% increased risk of CV mortality

24% increased risk of colon cancer

32% increased risk of endometrial cancer

21% increased risk of lung cancer

Reduced muscle strength

Reduced bone density

Associated with musculoskeletal pain

Strong links with obesity

Wilmot et al., 2012: 18 studies & 794,577 participants. The greatest sedentary time compared with the lowest...

Lynch et al., 2010: Significant, positive associations between SB (highest levels vs lowest) and cancer found in 8 out of 11 studies...
Sedentary lifestyle as a risk factor for low back pain: a systematic review

Shu-Mei Chen · Mei-Fang Liu · Jill Cook · Shona Bass · Sing Kai Lo

- 15 studies, 8 deemed high quality (●)

- Only one found a significant association between LBP and sitting at work

- Conclusion: No evidence of an association between LBP and sedentary lifestyle

- BUT: None used objective measures of sitting time
201 ‘blue collar’ workers wore accelerometers & reported lower back pain intensity in the last month.

- High **total** sitting time = 3.3 time more likely to report high pain intensity
- High **leisure** sitting time = 5.3 time more likely to report high pain intensity
- High **occupational** sitting time = 3.26 time more likely to report high pain intensity

There is a need for more studies using objective measures of sitting time.
Lumbar Disc Changes Associated with Prolonged Sitting

Gregory G. Billy, MD,
Penn State Orthopaedics Penn State Hershey Bone and Joint Institute-State College Department of Orthopaedics 1850 East Park Avenue-Suite 112 University Park, Pennsylvania 16803

Figure 2.
Lumbar disc height measurements

Figure 3.
Height of L4-5 disc at beginning and end of sitting on day 1

-5 disc at beginning and end of sitting on day 2
Changes to the workplace
A typical day in the office....

**Time spent active and sedentary**
- Sedentary – 10 hrs, 47 minutes
- Light activity – 1 hr, 15 minutes
- Moderate-vigorous activity – 38 minutes
The Stormont Study: daily sitting in 4436 office workers

Sitting at work accounted for 60% of total daily sitting time on a workday (Clemes et al. 2015)
Standing desk solutions
Systematic review: height-adjustable workstations to reduce sedentary behaviour in office-based workers

G. A. Tew\(^1\), M. C. Posso\(^1\), C. E. Arundel\(^1\) and C. M. McDaid\(^1\)

- 5 studies, 172 participants (health workers or academics)
- Quality assessment found high risk of bias (non-randomised controlled trial)
- All studies reported reductions in occupational sitting time in office workers (around 1.5 – 2 hours reduction/day)
- Insufficient evidence to make conclusions about effects on body composition, musculoskeletal symptoms and mental health
- Larger, longer term trials with more representative populations are required
Is it time for a cultural shift in the workplace?

To achieve such a change in working practice, should we be targeting the next generation of workers?

Sedentary behaviours track from childhood into adolescents and adulthood, establishing less sitting time during childhood could improve life-long health
Classroom sitting time

- Sitting is the most prevalent behaviour exhibited during waking hours in UK children, accounting for >65% of wake time.

- Australian data has shown that 63% of class time per school day is spent sedentary (Ridgers et al. 2012)

- Children sit for longer during school hours in comparison to non-school hours on school days (Ridgers et al. 2012)
Classroom sitting time

Sit-to-stand desks in primary schools have been shown to be effective in increasing energy expenditure (Benden et al. 2011, 2014) and standing and movement during the school day (Lanningham-Foster et al. 2008)

However in 2014 no study had directly measured the use of sit-to-stand desks on classroom sitting in primary school children
Stand Out in Class & Transform Us

This study aimed to examined the influence of sit-to-stand desks on classroom sitting time in primary school children, comparing two similar interventions in Bradford, UK and Melbourne, Australia.
Study methods

Bradford, West Yorkshire, UK
- 2 Y5 classes, 9-10 year old children
- School serves children in top third for overall deprivation in England

Melbourne, Victoria, Australia
- 2 Y6 classes (out of 3) 10-11 year old children
- School serves middle-to high socioeconomic status children

In both studies, one classroom was randomly allocated to the intervention and the other, the control
The interventions

Spring term (Jan – Apr 14)
- 27 children
- 3 standard desks (places for 6 children) replaced with 6 Ergotron Work-Fit-PD sit-to-stand desks
- Teacher rotated children, exposure was 1 hour/day for 9 weeks

Spring term (Sept – Nov 13)
- 26 children
- All standard desks replace with Ergotron Work-Fit-PD sit-to-stand desks for 10 weeks
- Children encouraged to stand for at least one 30 minute class per day

Both interventions: Information on benefits of reducing sitting and sitting time reduction strategies were given
Ergotron Sit-Stand desks
Study methods

Baseline measurements and 9-10 week follow-up measures were identical in each study:

- Classroom sitting, standing and stepping
- Physical activity
- Behaviour (self-reported by teachers)
- Markers of health (blood pressure, body composition, weight, height, waist circumference)
Results: Participant characteristics & baseline data

UK

- Bradford
  - 54 consented, 30 provided ActivPAL data
  - 16 boys, 14 girls
  - Age 10.0±0.3 years
  - BMI 18.3±3.2 kg/m²
  - 23% White
  - 63% South Asian
  - 13% mixed
  - Baseline classroom sitting: 200±48 minutes/day 70% of classroom wear

Melbourne

- Melbourne
  - 48 consented, 44 provided ActivPAL data
  - 19 boys, 15 girls
  - Age 11.6±0.5 years
  - BMI 19.4±3.3 kg/m²
  - 54% parents born in Australia
  - Baseline classroom sitting: 203 ± 22 minutes/day, 69% classroom wear
Results: proportion of sitting, standing and stepping, baseline to follow-up

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<tr>
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<th>Intervention class</th>
<th>Control class</th>
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<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Change</td>
<td>p value</td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Change</td>
<td>p value</td>
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<tr>
<td><strong>UK Sample</strong></td>
<td>n = 16</td>
<td></td>
<td></td>
<td></td>
<td>n = 14</td>
<td></td>
<td></td>
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<tr>
<td>Sitting % WT</td>
<td>71.8 ± 10.6</td>
<td>62 ± 15.8</td>
<td>-9.8 ± 16.5</td>
<td>0.03</td>
<td>68.6 ± 20</td>
<td>65.4 ± 20.1</td>
<td>-3.2 ± 30.2</td>
<td>NS</td>
</tr>
<tr>
<td>Standing % WT</td>
<td>20.1 ± 8.7</td>
<td>23.5 ± 12.5</td>
<td>3.4 ± 14.9</td>
<td>NS</td>
<td>24 ± 20.8</td>
<td>21.9 ± 12.8</td>
<td>-2.1 ± 26.2</td>
<td>NS</td>
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<tr>
<td>Stepping % WT</td>
<td>8.2 ± 2.8</td>
<td>14.5 ± 7.9</td>
<td>6.3 ± 6.8</td>
<td>0.002</td>
<td>7.4 ± 3.6</td>
<td>12.8 ± 8.2</td>
<td>5.4 ± 9.1</td>
<td>NS</td>
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<tr>
<td><strong>Australian Sample</strong></td>
<td>n = 24</td>
<td></td>
<td></td>
<td></td>
<td>n = 20</td>
<td></td>
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<tr>
<td>Sitting % WT</td>
<td>67.9 ± 8.4</td>
<td>58.5 ± 8.4</td>
<td>-9.4 ± 10</td>
<td>&lt;0.001</td>
<td>70.8 ± 5.8</td>
<td>64.8 ± 10.8</td>
<td>-5.9 ± 11.7</td>
<td>0.04</td>
</tr>
<tr>
<td>Standing % WT</td>
<td>18.1 ± 4.5</td>
<td>26.4 ± 7.5</td>
<td>8.3 ± 7.6</td>
<td>&lt;0.001</td>
<td>15.1 ± 2.7</td>
<td>20.7 ± 5.9</td>
<td>5.6 ± 6.4</td>
<td>0.001</td>
</tr>
<tr>
<td>Stepping % WT</td>
<td>14 ± 5.2</td>
<td>15.1 ± 3</td>
<td>1.1 ± 4.9</td>
<td>NS</td>
<td>14.2 ± 3.9</td>
<td>14.5 ± 5.6</td>
<td>0.3 ± 6.2</td>
<td>NS</td>
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</table>
Study conclusions

Despite differences in desk provision, the intervention groups from both schools exhibited similar significant reductions in the proportion of class time spent sitting.

Incorporating sit-to-stand desks into classrooms appears to be an effective way of reducing classroom sitting in children from a range of socio-economic groups and cultures.

Longer term efficacy trials are needed to confirm these findings, and to determine the impact of the intervention on children’s health, cognition and academic achievement.
Standing Classrooms: Research and Lessons Learned from Around the World

Erica Hinckson1, Jo Salmon2, Mark Benden3, Stacey A. Clemen4, Bronwyn Sadholz2, Sally E. Barber5, Saeideh Aminian6, Nicola D. Ridgers2

- 13 studies of: height adjustable or stand-biased standing desks/workstations with stools, chairs, exercise balls, bean bags or mats in the classroom.

- Irrespective of approach, youth sitting time reduced by between 44 – 60 minutes/day and standing time increased 18-55 minutes/day

- Increased energy expenditure

- Improved management of students behaviour

- Impact upon academic performance, musculoskeletal pain unknown

- Most interventions to date have been just one term long

- Few large scale trial have been conducted
Academic years 15/16 & 16/17

Video clip: www.bbc.co.uk/newsround/35541032

NIHR PHR funding for a pilot randomised controlled trial with 8 schools (120 – 240 children) starting October 16

Some behaviour change technique adaptations to intervention to improve implementation

Measurements of cognitive and academic performance & musculoskeletal pain
BBC news clip
Conclusions

- There are high levels of SB in the UK, across Europe (and in other developed countries)
- SB is related to CVD, cancers and all cause-mortality
- The association between sitting and LBP is still unclear & more studies using objective methods are required
- Office workers have high levels of sitting time
- Height adjustable workstations in offices and classrooms have shown effectiveness at reducing workers and children’s sitting times, but more high quality studies are needed to ascertain health/cognitive benefits and acceptability of longer-term usage
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