Novel intervention strategies for reducing sedentary behavior in the workplace

Society of Behavioral Medicine Annual Meeting 2016

Emily Mailey, Kansas State University
Matthew Buman, Arizona State University
Lucas Carr, University of Iowa
Abby King (discussant), Stanford University
Overview of Symposium

• Brief introduction to sedentary behavior

• Emily Mailey: Effects of two intervention approaches for reducing sitting time at work on sedentary behavior and health: The Up4Health trial

• Matt Buman: Long-term effects of sit-stand workstations on workplace sedentary time and cardiometabolic health: A natural experiment

• Lucas Carr: Lessons Learned from a Series of Experiments Testing Active Sitting Devices to Interrupt Sedentary Time

• Discussion led by Abby King
Is Sitting The New Smoking?

A study released by the American College of Occupational and Environmental Medicine suggests that, because you’re human, you lose 11% to 14% of your productivity-potential every day. You check the news. You chitchat with a colleague in the next cubicle. You daydream about dinner, who is going to be on Jimmy Kimmel tonight, or your upcoming weekend road-trip. We’re all human. We’re not machines. And there’s not much we do to change it.

Here’s something you can change. Research also suggests that for every health risk you possess, you lose an additional percentage of your productivity-potential (small health risks obviously impact productivity less than serious health concerns). Some studies suggest that the average person has between 10 to 12 health risks every single
Inactivity 'kills more than obesity'

By James Gallagher
Health editor, BBC News website

A lack of exercise could be killing twice as many people as obesity in Europe, a 12-year study of more than 300,000 people suggests.

University of Cambridge researchers said about 676,000 deaths each year were down to inactivity, compared with 337,000 from carrying too much weight.

They concluded that getting everyone to do at least 20 minutes of brisk walking a day would have substantial benefits.
Even for the active, a long sit shortens life and erodes health

New research links sitting for long hours with elevated risk of cancer, cardiovascular disease, type 2 diabetes and early death.

(Lawrence K. Ho / Los Angeles Times)
What is sedentary behavior?

• Any waking activity characterized by an energy expenditure <1.5 metabolic equivalents and a sitting or reclining posture

Sedentary Behavior Research Network, 2012
Why sedentary behavior?

- A significant public health concern
  - Sedentary behavior is associated with increased risk of obesity, diabetes, cardiovascular disease, some cancers, and mortality
  - Independent of participation in MVPA
How does sitting affect health?

- During prolonged sitting:
  - Large muscle groups are at rest and don’t need to use glucose → Glucose tolerance and insulin sensitivity decrease
  - The enzyme that breaks down fat in the blood is deactivated → Triglycerides and LDL increase

- When accumulated over months and years, risk of chronic disease and mortality increases

Saunders et al., 2012
Sitting in the workplace

- Over 80% of adults now have sedentary occupations
- On average, spend 70-80% of working hours sitting
Occupational energy expenditure is declining

Church et al., PloS One, 2011
What can we do about it?

• Breaking up sedentary time may counteract negative metabolic effects of prolonged sitting
  • Postprandial glucose and insulin levels reduced following brief activity breaks

Healy et al., *Diabetes Care*, 2008
Intervention considerations

- Sedentary behavior is highly dependent on contextual/environmental factors
- Intervention approaches:
  - Take away opportunities to sit or provide easy alternatives
  - Use prompts/cues to action
  - Influence social norms
  - Engineer inefficiency
Interventions targeting sedentary behavior at work

- Chau et al. (2010)
  - No published studies that identified reducing sitting as a primary aim

- Neuhaus et al. (2014)
  - Review of 14 studies
  - Activity-permissive workstations
  - Average reduction in workplace sedentary time: 90 minutes per 8-hour workday
Interventions targeting sedentary behavior at work

• Prince et al. (2014)
  • Review of interventions that included sedentary behavior (SB) as an outcome
  • 63 studies reviewed, 6 focused on SB exclusively
    • SB interventions: -91 minutes SB/day
    • Lifestyle interventions (PA+SB): -35 minutes SB/day

• Martin et al. (2015)
  • RCTs only
  • 51 studies reviewed, 3 focused on SB exclusively
    • SB interventions: -42 minutes SB/day
    • Lifestyle interventions (PA+SB): -22 minutes SB/day

• Need for more interventions specifically targeting sedentary behavior
Interventions targeting sedentary behavior at work

- Shrestha et al. (2016)
  - Cochrane review evaluated RCTs, cluster-RCTs, and quasi-randomized controlled trials of workplace interventions to reduce sitting at work
  - 20 studies
  - Sit-stand desks decreased work sitting 30-120 min/day
  - Conflicting evidence for active workstations
  - Walking breaks did not reduce sitting
  - Limited evidence for counseling and computer prompting software programs

Conclusion: Quality of evidence low due to poorly designed studies, small sample sizes, short duration

Shrestha et al., Cochrane Database Syst Rev, 2016
Stand up!
Effects of two intervention approaches for reducing sitting time at work on sedentary behavior and health: The Up4Health trial

Emily L. Mailey, Sara Rosenkranz, Kelsey Casey & Aaron Swank

Kansas State University
The Up4Health Study

• Workplace is an ideal setting for implementing interventions to reduce sitting time

• No currently established guidelines for *how* one should go about incorporating activity throughout the workday

• Purpose: Compare two intervention approaches to breaking up sitting time at work
  - Short, frequent breaks (1-2 minutes every half hour)
  - Longer, planned breaks (two 15-minute breaks)

• Examined intervention effects on sedentary behavior and health outcomes
Study Design

Inclusion Criteria:
- Female (premenopausal)
- Working >35 hr/wk
- Spend >80% of workday sitting
- <60 min/wk of MVPA
- Not pregnant or actively dieting

Randomization
- Short Breaks (n=24)
- Long Breaks (n=25)

Baseline
- Accelerometer
- Questionnaires
- Health Outcomes

8-Week Intervention

Health Outcomes Assessed:
- Cholesterol
- Triglycerides
- Fasting blood glucose
- Blood pressure

Post-intervention
- Accelerometer
- Questionnaires
- Health Outcomes
My goal: To take a 1-minute activity break once every 30 minutes throughout each workday for the next 8 weeks.

Strategies I will use to help me accomplish this goal:

1.

2.

3.

Challenges I am likely to anticipate and strategies for overcoming the challenges:

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Strategies</th>
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<tbody>
<tr>
<td>1.</td>
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<td>3.</td>
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Dear [Name],

Today marks the start of Week 3 of the Up4Health program. We received your Week 1 logs last week – thank you for sending them! So far we have discussed the physical and mental benefits of incorporating movement during the workday, and now we’d like to offer a few ideas for how you can add physical activity to your day. Of course, the strategies you use should be individualized and structured around your typical day. We would encourage you to think of ways you can make tasks you already do regularly more physically active. Here are a few ideas:

1. Take the long way to the bathroom/water fountain
2. Walk to a co-worker’s desk instead of communicating via e-mail
3. Stand up while talking on the phone
4. Keep exercise equipment (e.g., stability ball, dumbbells) in your office
5. Take the stairs instead of using the elevator
6. When you need to refocus, try standing up and taking a quick walk around the office
7. Encourage walking and standing meetings with colleagues when possible
8. Use a stack of books to convert part of your desk to a standing desk
9. Leave your lunch in the car, or walk to a local restaurant for lunch
10. Send print jobs to a remote printer

If you have found some creative ways to increase movement throughout your workday, please share them with us! They may benefit other participants who hadn’t thought of them.

We will be sending you a packet containing your accelerometer and food diary this week – please be on the lookout for it to arrive before the end of the week. We would like you to start wearing the accelerometer next Monday, 4/21/2014 and continue for 7 days (through Sunday, 4/27/2014). We will include an addressed envelope for you to send the accelerometer and food diary back to us once you are done with them. If you have any questions, don’t hesitate to contact us.

Up4Health Team
Up4Health: Tools for Prompting your Activity Breaks

For your mobile phone:

Don’t Forget-Auto Reminders by A3Logics (Android and Apple)
- This application enables users to add reminders for scheduled events, meetings, appointments and more. The reminder alerts are customizable and can be received as text messages or via phone call. The alarm sound is customizable so you may choose from a variety of sounds or set to vibrate for a silent alarm.

Alarm Clock 4 Free by Alarm Clock Company (Apple)
- If you want something simple, this alarm clock app allows you to set unlimited alarms, and all functions are fully adjustable.

Alarmed – Reminders + Timers (Apple)
- This app provides pop-up reminder alerts at your specified frequency. Includes a “nag me” feature for auto-repeating of reminders if you're prone to ignoring them the first time.

Life Reminders by Cameleo-Tech (Android)
- Life Reminders allows you to easily create a reminder for your daily tasks and activity breaks. Simply set the time(s) you need a task reminder and, when the time comes, Life Reminders notifies you when it’s time to move.

Checklist Reminder Alarm Clock by Zekab Apps & Games (Android)
- This application reminds you of everything you need to do during the day. The simple app enables users to create a reminder and alert in seconds and sets and alarm to remind you of scheduled task, meetings, appointments or activity. This app features louder tones and notification sounds.
Intervention

### Up4Health Daily Activity Log (Week 1, Monday)

<table>
<thead>
<tr>
<th>Today's date:</th>
<th>Time arrived:</th>
<th>Time left work:</th>
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<table>
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<tr>
<th>Planned 15 minute break time</th>
<th>Completed (✓)</th>
<th>Actual Time</th>
<th>Duration (minutes)</th>
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<td>1</td>
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<td>2</td>
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<table>
<thead>
<tr>
<th>Notes</th>
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<tbody>
<tr>
<td>1</td>
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<td>2</td>
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</table>

### Additional Breaks in Sitting (at least 1 minute)

<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>Notes</th>
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Sedentary behavior measure

- Actigraph GT3X accelerometer
- Worn on hip for 7 consecutive days at baseline and week 8
- Sedentary behavior: <100 counts per minute
- Working hours: 8 a.m. – 5 p.m.
- Examined total minutes of sedentary time and bouts >10 min
### Participant characteristics (N=49)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)/Freq (%)</th>
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<tbody>
<tr>
<td>Age</td>
<td>38.71 (8.19)</td>
</tr>
<tr>
<td>Hours worked per week</td>
<td>41.52 (3.36)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>41 (83.7%)</td>
</tr>
<tr>
<td>Other race</td>
<td>8 (16.3%)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>High school graduate</td>
<td>7 (14.3%)</td>
</tr>
<tr>
<td>College graduate</td>
<td>42 (85.7%)</td>
</tr>
<tr>
<td>Annual household income</td>
<td></td>
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<tr>
<td>&lt;$60,000</td>
<td>20 (40.8%)</td>
</tr>
<tr>
<td>&gt;$60,000</td>
<td>23 (46.9%)</td>
</tr>
<tr>
<td>Not disclosed</td>
<td>6 (12.3%)</td>
</tr>
</tbody>
</table>
Results: Adherence

• Of 49 randomized participants, 38 completed the study
  • 87.5% retention in short break group
  • 68.0% retention in long break group

• Adherence: % of working days participant followed recommended protocol
  • Short break group (>12 activity breaks per 8-hour workday): 69.2%
  • Long break group (at least 2 activity breaks totaling ≥25 minutes): 60.8%
Results: Sedentary Behavior

Accelerometer Data

Sedentary Minutes per Workday

-35.6 min; $d=-0.75$

Activity Log Data

Minutes of Standing per Workday

- Short Breaks: 80.3
- Long Breaks: 46.3
## Results: Health Outcomes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>Baseline $M(SD)$</th>
<th>Post-intervention $M(SD)$</th>
<th>Cohen’s $d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol</td>
<td>Short</td>
<td>170.7 (29.4)</td>
<td>160.7 (30.8)</td>
<td>-0.33</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>196.2 (27.0)</td>
<td>191.4 (27.4)</td>
<td>-0.18</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>Short</td>
<td>136.2 (52.6)</td>
<td>115.4 (56.2)</td>
<td>-0.38</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>145.3 (69.6)</td>
<td>143.3 (76.1)</td>
<td>-0.03</td>
</tr>
<tr>
<td>Glucose</td>
<td>Short</td>
<td>98.8 (15.2)</td>
<td>94.6 (13.8)</td>
<td>-0.29</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>102.2 (37.8)</td>
<td>102.4 (39.8)</td>
<td>0.004</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>Short</td>
<td>113.1 (11.8)</td>
<td>110.3 (11.8)</td>
<td>-0.23</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>113.4 (14.6)</td>
<td>112.1 (17.5)</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Overall, small to moderate improvements in short break group only.
Discussion

• To our knowledge, this was the first intervention to manipulate frequency of activity breaks and examine effects on health outcomes in a real-world context
• Outcomes unanimously favored the short break group compared to the long break group
• Taking short, frequent breaks from sitting is a feasible and effective approach for reducing sedentary time
• Modest improvements in some health outcomes after 8 weeks
Discussion

- Public health messages need to address sedentary behavior
  - Separate from MVPA
- “Low hanging fruit” for inactive individuals
- Short, frequent breaks are easy to incorporate into workday
  - Point-of-choice prompts every 30 minutes
Discussion

• Moderately high adherence rates
  • Value of self-monitoring
• Impetus was on individuals for behavior change
• Difficult to make/sustain changes without institutional support
• Future studies should include organizational and environmental changes to modify social/physical environment
Limitations

• No true control group
• Homogenous sample (female, educated, inactive)
• Accelerometers not an optimal measure of sedentary behavior
Conclusions

• Results support previous research that has highlighted the importance of frequent breaks from sitting
• Potential for small changes in sedentary behavior to impact health outcomes in inactive individuals
• Individuals can reduce sedentary behavior without substantial environmental support
Acknowledgments

• Sara Rosenkranz
• Aaron Swank
• Kelsey Casey
• PAN-CRC students and staff
• Funding: KSU Small Research Grant
Stand up!