A RANDOMIZED 'JUST-IN-TIME' PROMPT TO INTERRUPT PROLONGED SITTING AT TWO INTERNATIONAL CONFERENCES HELD IN TWO COUNTRIES

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Abstract

Prolonged sitting has a detrimental effect on lipid metabolism and insulin sensitivity leading to increased risks of metabolic conditions. Attendees at conferences typically sit for long periods during oral presentations. The use of visual cues or 'just-in-time' (JIT) prompts during oral presentations can inform audiences about the deleterious effects of prolonged sitting and encourage them to avoid sitting for long periods. It remains unclear whether these 'just-in-time' prompts used in conference settings are effective in reducing prolonged sitting. The 'just-in-time' prompts were used in two separate conferences—one focused on health and the other on language. Ten oral presentation sessions were randomly assigned to the experimental group (EXPT, with the JIT prompt) and ten oral presentation sessions to the control group (CON, without the JIT prompt). In both conferences, the proportion of the attendees who stood up (i.e. did not sit) during the oral presentations in the EXPT conditions was less than 10%. The main finding was that the use of the JIT prompt to discourage prolonged sitting at the health conference where attendees were likely to be knowledgeable about the dangers of prolonged sitting was ineffective (EXPT vs CON conditions, $p>0.05$; ES=0.69) compared to conference attendees at a language conference (EXPT vs CON conditions, $p<0.05$, ES=1.14). Further research is warranted to examine the efficacies of different strategies to interrupt prolonged sitting at conferences.

Keywords: Prolonged sitting, conferences, visual prompts

Introduction

Emergent global evidence suggests that uninterrupted sedentary behaviours like sitting are independently associated with increased risks of metabolic conditions such as impaired glucose metabolism, type II diabetes (Bey & Hamilton, 2003) and obesity-associated conditions that are-serious threats to lifespan. Moreover, this association is independent of the characteristic engagement in exercise that is within prescribed health guidelines (Biswas et al., 2015). Animal studies on rodents (Bey and Hamilton, 2003) and research on humans (Bankoski et al., 2011) suggest that prolonged sitting time negatively affects lipid metabolism and insulin sensitivity. It seems that even infrequent prolonged sitting increases negative health consequences in adults (Peddie et al., 2013). Moreover, an intervention study over two weeks showed that reducing daily physical activity negatively affected insulin sensitivity (Krogh-Madsen et al., 2010).

In contrast, interrupting periods of passive sitting such as by standing and doing light exercise is associated with reduced health risks (Saunders, Green, Petticrew, Steinbach, & Roberts, 2013) and has immediate benefits such as improved sleep quality, reduced low back pain, reduced daytime sleepiness and improvement in blood pressure profile (Chia, Chen, & Suppiah, 2015). Research demonstrates that standing rather than sitting improves glycaemic regulation up to 40% (Buckley, Mellor, Morris, & Jospeh, 2013). Reducing prolonged periods of passive sitting could help reduce escalating rates of type II diabetes in the population given that many office workers spend up to 70% of the time or an average of 5.8±1.5 hours at work sitting (Chia, Chen, & Suppiah, 2015).

Conferences are venues where attendees typically sit for extended periods especially during oral presentations. While attendees would not be sitting when they move from session to session, they would be very sedentary for the rest of the time. The use of visual cues or 'just-in-time' prompts during oral presentations can inform audiences about the deleterious effects of prolonged sitting and encourage them to avoid sitting for long periods. These prompts are low-cost, potentially could have a positive health impact, and are successful in encouraging a greater use of staircases and also in getting desk-bound office workers to not sit down all the time throughout the day (Nocon, Muller-Riemenschneider, Nitzschke, & Willich, 2010; Cooley & Pedersen, 2013). Till now, information on the use of visual cues in promoting 'not sitting' during academic conference scenarios are rare, except for a single study reported by Lang, McNeii, Tremblay, and Saunders (2015).

Lang et al. (2015) reported that in a health-informed conference audience (Global Summit on the Physical Activity of Children), the visual prompts were effective in getting a greater proportion of the audience 'not to sit' than those who were not exposed to the prompts (16.9% vs 10.5%, $p<0.05$). While these results are interesting and insightful, what is noteworthy is that the conference attendees were in the business of health or promoting health and would be more responsive to these prompts. It is not known if attendees at other conferences that are not health or exercise-associated would be just as responsive to such prompts.

The purpose of the research was to investigate the audience response to a 'just-in-time' (JIT) prompt to interrupt sitting at two conferences (one targeted at a health and exercise-informed audience and the other targeted at a language and literature-informed audience) in terms of the proportion of the attendees standing and not-sitting during oral presentations. We hypothesized that (I) a significantly greater proportion of the attendees would stand and not sit during oral presentation sessions when they were exposed to the JIT prompts compared to attendees in sessions that were not provided with the JIT prompts; and (II) a significantly greater proportion of the attendees at the health conference would be more responsive to the JIT prompts than attendees at the language conference (i.e. proportion of attendees standing at the health conference > proportion of attendees standing at the language conference).

Method

Institutional ethics approvals from the Nanyang Technological University (Singapore) and Universiti Sains Malaysia (Malaysia) were obtained, as was permission from the conference organisers to conduct the research. The language conference (International Conference on Teaching and Learning of Chinese as a Second Language, TLCSL 2015) was held on the 9-10 September 2015 in Singapore and the health conference (Movement, Health and Exercise Conference, MoHE 2015) was held on the 5-7 October 2015 in Penang, Malaysia. The MoHE 2015 attracted about 300 delegates from more than 10 countries and the TLCSL 2015 was attended by about 1000 delegates from 17 countries.

For each conference, one-hour sessions of oral presentations on the first day were the foci of the research. A coin toss was used to randomly assign 10 sessions to the experimental group (EXPT, with JIT prompt) and 10 sessions to the control group (CON, without JIT prompt). For the TLCSL 2015, oral presentations included two one-hour keynote addresses and 18 one-hour symposia, each with four 15-minute oral presentations. For the MoHE 2015, there were six one-hour keynote addresses and 14 one-hour symposia, each with four 15-minute oral presentations. Room sizes and seating varied across the conference venues but were sufficient in capacity to accommodate all the attendees. For instance, the keynote addresses were held in the ballroom or auditorium which accommodated up to 1200 people. The other presentation venues for the two conferences accommodated up to 60 people. Conversely, for the TLCSL 2015 conference, two one-hour keynote addresses and 18 one-hour symposia, each comprising four oral presentations were observed in this study.

For the EXPT condition, the JIT prompt read: "Research informs that prolonged sitting harms. Please be free not to sit at this presentation!" Cited data about how much smoking one cigarette versus one hour of sitting shortened life (Shaw, 2000; Veerman et al., 2012) was also incorporated into the slide. For the language conference, the same information was translated into Mandarin. These two slides are depicted in Figure 1.

Figure 1: Just-in-time prompt used in the EXPT condition, respectively, for the health and language conferences. No prompt was used in the CON condition

The same research team comprising the principal investigator and two research assistants were involved in both the conferences. Two student helpers stationed at the back of each venue recorded the number of attendees present at the venue and the number of attendees who stood up in the EXPT and CON conditions. Their observations were summed and then averaged for each of the sessions. Their observations did not include the presenter or the conference crew.

For both the EXPT and CON conditions, the proportion of attendees who stood up in relation to the number of attendees in the venue were computed, summed and then averaged. Independent t-tests were used to compare across the EXPT and CON conditions. Cohen's d (effect sizes) for differences between the means of groups were computed and statistical significance was accepted as $p<0.05$.

Results

Table 1 and Table 2, respectively show the collated data for the MoHE 2015 and TLCSL 2015.

Table1: Results from the Movement, Health and Exercise Conference 2015

Session	Experiment condition (JIT prompts)			Control condition (No prompts)		
	Total participants	Participants standing	% standing	Total participants	Participants standing	% standing
1	91.6	8	8.7	94.3	11	10.6
2	105	5.5	5.2	81.1	5.5	6.8
3	65.7	5.5	8.4	60.3	3	5
4	7	0	0	23.3	0	0
5	15	2	13.3	19	1	5.3
6	13	1	7.7	42	0	0
7	17	1	5.9	11	1	9
8	57	7	12.3	14	0	0
9	49.7	5.5	11.1	19	1	5.3
10	37	1	2.7	49	2	4.1
Total	458	36.5	75.3	413	24.5	46.1
Mean±SD	45.8±34.3	3.7±2.9	7.5±4.2	41.3±29.4	2.5±3.5	4.6±3.7
CV	0.75	0.8	0.56	0.71	1.41	0.81

Table 2: Results from the International Conference on Teaching and Learning of Chinese as a Second Language 2015.

Session	Experiment condition (JIT prompts)			Control condition (No prompts)		
	Total participants	Participants standing	Standing %	Total participants	Participants standing	Standing %
1	245	9	3.6	238	0	0
2	49	5	10.2	47	4	8.5
3	35	2	5.7	46	3	6.5
4	24	2	8.3	47	1	2.1
5	31	3	9.7	33	2	6
6	49	4	8.1	36	2	5.5
7	57	3	5.2	23	0	0
8	25	2	8	65	2	3
9	32	5	15.6	39	0	0
10	46.6	7	15	31.5	0	0
Total	593.6	42	89.4	605.5	14	31.6
Mean±SD	59.4±66.2	4.2±2.3	8.9±3.9*	60.6±63.4	1.4±1.4	5.3±2.4
CV	1.11	0.55	0.44	1.05	1.00	0.45

*significantly different for EXPT (Prompt) vs. CON (No-prompt) condition at $p<0.05$.

From Table 1, the key result was that the difference in the proportion of conference attendees not sitting as a result of the JIT prompt (EXPT condition) compared to when no prompt was used (CON condition) did not attain statistical significance (7.5% vs 4.6%;

p=0.132). However, the computed effect size between the EXPT and CON conditions was moderate (0.69).

From Table 2, the main result was that there was a significant difference in the proportion of conference attendees who did not sit down in the EXPT condition compared to the CON condition (8.9% vs 5.3%; p=0.008) and, that the effect size of this difference was large (1.14).

Regardless, for both conferences, the proportions of the attendees who chose not to sit during the oral presentations in the EXPT conditions were less than 10%. This is depicted in Figure 2.

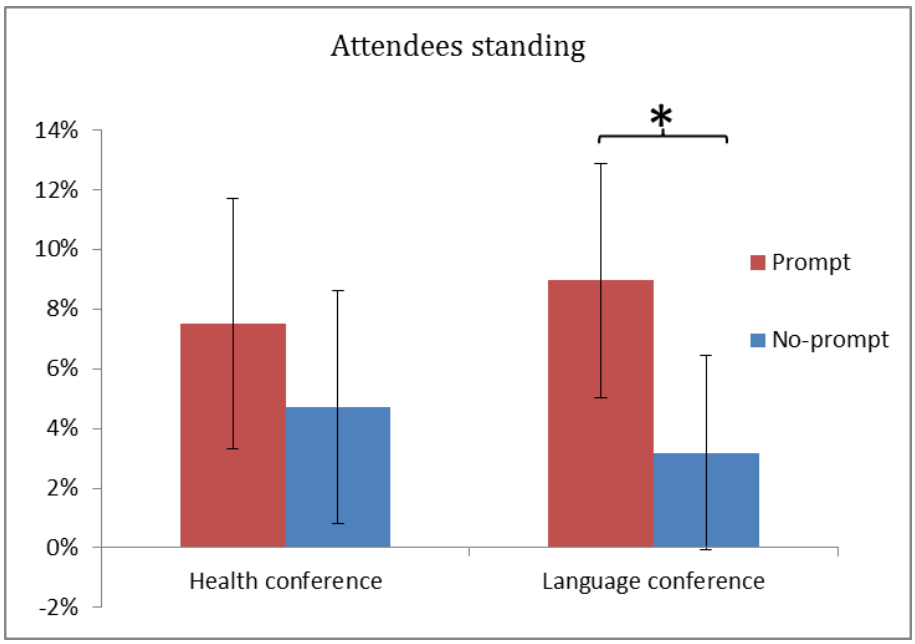

Figure 2: Proportion of conference attendees who responded to the JIT prompt in the EXPT and CON conditions for the health and language conferences. *significantly different for EXPT (Prompt) vs. CON (No-prompt) condition at p<0.05.

Discussion

The main finding of the study was that the use of the JIT prompt to discourage prolonged sitting at the health conference where attendees were more likely to be knowledgeable about the dangers of prolonged sitting was ineffective (EXPT vs CON conditions, p>0.05; ES=0.69) compared to conference attendees at a language conference (EXPT vs CON conditions, p<0.05, ES=1.14). This finding is somewhat surprising as there appears to be a knowledge-behaviour gap (i.e. being informed of the dangers of prolonged sitting, yet choosing to remain seated) for the attendees at the health conference. An earlier research study of a similar nature, albeit the conference site was in Canada, Lang et al. (2015) reported that 10.5% of an health-informed audience in the control situation (no prompt)

chose to stand compared to 17% in the experimental condition when the audience was presented with the prompt with information about the dangers of prolonged sitting. However, Lang and colleagues (2015) reported that even in the intervention group, only 1 of 5 participants chose to stand. They deduced that even within an informed audience who are aware of the detrimental effects on health from prolonged sitting, a higher proportion of the audience chose to remain seated. Their finding is consistent with the current observation. In the present study, though differences between the EXPT and CON conditions for the health conference did not achieve statistical significance (probably because of the large coefficient of variation, see Table (1)), the effect size for the mean difference between the two conditions was moderate.

Therefore, unlike the cited results of Lang et al. (2015), the use of JIT prompt in the current study was ineffective in altering the immediate behaviour of the attendees in the health conference. It is noteworthy that unlike the point-of-decision prompt used in the study of Lang et al. (2015), which stated that prolonged sitting was associated with increased health risks, the JIT prompt used in the present study also provided information about the 'shortened' lifespan attributed to smoking (see Figure 1). It is indeterminate if the additional information affected the present results. However, this warrants further research.

It appears that different reactions are expected from healthy participants, with or without a history of exercise or physical activity engagement, in response to interventions to break up sedentary time at work. For instance, Cooley and Pedersen (2013) reported that desk-bound workers with no prior engagement in exercise or physical activity were more compliant and responsive to interventions to increase non-purposeful movement to break up prolonged sitting than participants with an active history of exercise or physical activity.

In contrast to the results obtained for the health conference (MoHe 2015), the language conference (TCSL 2015) elicited a significant difference in the responsiveness in terms of the proportion of attendees who chose not to sit in response to the prompt in the EXPT versus CON conditions (see Table 2-and Figure 2). The large effect size for this difference in the means also attested that the audience in the EXPT and CON conditions responded in a meaningful manner.

Even though no statistics were used to analyse the difference in response of the attendees in the EXPT across the two conferences in the present research (owing to differences in the sample size, country and context), it appeared that the attendees in the language conference were more responsive to the JIT prompt than attendees in the health conference. The reason as to why a health-informed audience (MoHE 2015)–was less responsive compared to a plausibly less health-informed audience (TCSL 2015) is not readily apparent and alludes to a need for further research. However, the knowledge-behaviour gap shown in the health-informed audience is indicative that behaviour change is complex and context-based. Therefore, simple approaches used to ameliorate prolonged standing may not work for all contexts.

The present research has several strengths and weaknesses. A key strength was that the research was based upon a randomized design, employed two independent counters, and

also included a health-informed conference audience and one that is not, for comparison. A weakness of the study was that individual participant behaviours was not studied—i.e. the research did not differentiate if the participants who chose to stand at each session were the same or different individuals. It is unknown if peer influence or the lack of it had any impact on the attendees' choice to stand or not in both the EXPT and CON conditions at the two conferences. Another weakness of the study was that it is unknown if the audiences at the two different conferences were at similar levels of readiness for any sort of behaviour change and this could account for the results reported in the present research.

Conclusion

The present research demonstrated the effectiveness in the use of JIT prompts to reduce sitting behaviours of attendees for a language conference, but not for a health one. Although it appears that only a small proportion of the attendees responded positively to the prompt, the effect sizes for the differences between the EXPT and CON conditions ranged from moderate to large. Given that JIT prompts are simple to design and administer, are of low cost and effort, and can reach large audiences, its use can be extended to training workshops and even university lectures. They are also an easy way to pass on health messages which could spur people to make a positive behaviour change, there and then. However, as it may not be effective all the time, researchers should be mindful of the differences in culture, country and context~~,~~ where the JIT prompt is used. Perhaps future research should examine the factors and contexts at conferences that make the use of JIT prompts efficacious.

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References

Bankoski, A., Harris, T. B., McClain, J. J., Brychta, R. J., Caserotti, P., Chen, K. Y., Berrigan, D., Troriano, R. P., & Koster, A. (2011). Sedentary activity associated with metabolic syndrome independent of physical activity. *Diabetes Care, 34,* 497-503.

Bey, L. & Hamilton, M. T. (2003). Suppression of skeletal muscle lipoprotein lipase activity during physical inactivity: a molecular reason to maintain daily low-intensity activity. *Journal of Physiology, 55,* 673-682.

Biswas, A., Oh, P. I., Faulkner, G. E., Bajaj, R. R., Silver, M. A., Mitchell, M. S., & Alter, D. A. (2015). Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: a systematic review and meta-analysis. *Annals of Internal Medicine, 162,* 123-132.

Buckley, J. P, Mellor, D. D., Morris, M., & Jospeh, F. (2013). Standing-based office work shows encouraging signs of attenuating post-prandial glycaemic excursion. *Occupational Enviroment Medicine*. Retrieved from http://oem.bmj.com/content/early/2013/12/02/oemed-2013-101823.

Chia, M., Chen, B., & Suppiah, H. (2015). Office sitting made less sedentary – a future-forward approach to reducing physical inactivity at work. *Montenegrin Journal of Sports Science and Medicine, 2*, 5–10.

Cooley, D. & Pedersen, S. (2013). A pilot study of increasing nonpurposeful movement breaks at work as a means of reducing prolonged sitting. *Journal of Environment and Public Health*. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23690798.

Krogh-Madsen, R., Thyfault, J. P., Broholm, C., Mortensen, O. H., Olsen, R. H., Mounier, R., Plomgaard, P., Hall, G. V., Booth, F. W., & Pedersen, B. K. (2010). A 2-wk reduction of ambulatory activity attenuates peripheral insulin sensitivity. *Journal of Applied Physiology*, *108,* 1034-1040.

Lang, J. J., McNeii, J., Tremblay, M. S., & Saunders, T. S. (2015). Sit less, stand more: A randomized point-of-decision prompt intervention to reduce sedentary time. *Preventive Medicine, 73,* 67-69.

Nocon, M., Muller-Riemenschneider, F., Nitzschke, K., & Willich, S. N. (2010). Increasing physical activity with point-of-choice prompts-a systematic review. *Scandinavian Journal of Public Health, 38,* 633-638.

Peddie, M. C., Bone, J. L., Rehrer, N. J., Skeaff, C. M., Gray, A. R., & Perry, T. L. (2013). Breaking prolonged sitting reduces postprandial glycemia in healthy, normal-weight adults: a randomized crossover trial. *American Journal of Clinical Nutrition.* Retrieved from http://dx.doi.org/10.3945/ajcn.112.051763.

Saunders, L. E., Green, J. M., Petticrew, M. P., Steinbach, R., & Roberts, H. (2013). What are the health benefits of active travel? A systematic review of trials and cohort studies. *Plos One.* Retrieved from http://dx.doi.org/10.1371/journal.pone.0069912 .

Shaw, M., Mitchell, R., & Dorling, D. (2000). Time for a smoke? One cigarette reduces your life by 11 minutes. *British Journal of Medicine*. Retreived from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1117323.

Veerman, J., Healy, L., Genevieve, N., Cobiac, L. J., Vos, T., Winkler, E. A. H., Owen, N., & Dunstan, D.W. (2012). Television viewing time and reduced life expectancy: a life table analysis. *British Journal of Sports Medicine*, *46*, 927-930.