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Making office workers healthier:

A public health intervention making office workers use their height-adjustable office desks more, conducted for LINAK

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Making office workers healthier:

A public health intervention making office workers use their height-adjustable office desks more, conducted for LINAK®

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Abstract

Background: Sitting down several hours a day is bad for our health. Studies have shown that providing office workers with a height-adjustable office desk can decrease hours of sitting at work. However, even though provided with a height-adjustable office desk, not all office workers use it. As the systematic mapping of human behavior through empirical research throughout the last 40 years have shown by the likes of Kahnemann, Twersky, Akerloff and Shiller, in behavioral economy, humans are not necessarily build for following through on most intensions. This has been named the action/intention gap, and it may very likely be one of the root-causes of office workers with height-adjustable office desks are not using them as much as the initially wanted to.

Objectives: LINAK A/S wanted to design and test solutions that could help office workers use their desks more. Especially office workers that didn't use or used their height-adjustable desk 20 % or less of the time (defined as light users).

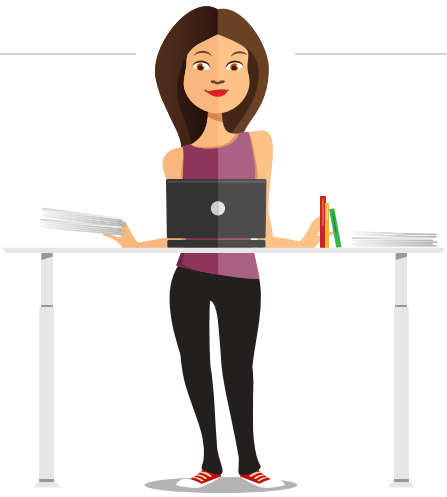
Method: Two different reminder-interventions were tested in 3 different workplaces. Data was collected through a software measuring if the desk was in a standing or sitting position, and whether the person was at their desk. Baseline as well as the intervention data was collected in periods of 2-3 weeks.

Results: For light users, we see an increase in time standing from 36.3 min/day in baseline to 78.9 min/day during the intervention. Also, equivalent to standing 7.6 % during an 8-hour workday at baseline and 16.4 % a day during the intervention period. Only looking at office workers not using their height-adjustable desk during baseline (< 2 % of the time) we found an additional effect of 12.3 min/day. No statistically significant results were found for heavy users (standing more than 20 % of the time), and no difference in effect was found of the two interventions tested.

Conclusion: LINAK A/S wanted to test reminders that would increase the odds of office workers using their height-adjustable office desks. Both interventions tested in the current pilot study showed promising effect on increasing standing time for office workers using their desk 20 % or less of the time to begin with.

Recommendations for office workers that are mainly desk based are at least 2 hours/day. (p. 6)

Reminders doubled the standing time of light users. The time increased from 36.6 min/day to 78.9 min/day.



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Contents

1.0 Background

Sedentary behavior and health

There is a broad agreement among clinicians and public health experts that sedentary behavior has negative effects on our health (van Uffelen, et al., 2010; Schmid & Leitzmann, 2014). Prospective studies have found that sedentary behavior during work hours increases the risks of both diabetes mellitus and overall mortality (van Uffelen, et al., 2010). In addition, a large meta-analysis by Schmid and Leitzmann (2014) showed an increased risk of certain types of cancer among individuals with a sedentary lifestyle (Schmid & Leitzmann, 2014). Further, several studies (van Uffelen, et al., 2010) have found associations between sedentary behavior and cardiovascular disease and obesity. In short, the human body evolved to move, and we are now discovering the potential consequences of having a daily behavior that goes against our biology.

Sedentary behaviour
"The absence of physical activity e.g. prolonged hours of sitting." (van Uffelen, et al., 2010)

Why is this a problem? Because the majority in developed countries are sitting down most of the day, while working, when watching television, when eating, when transporting ourselves, etc. We spend up to 12 hours a day sitting, many of these hours during work (van der Ploeg, Chey, Korda, Banks, & Bauman, 2012).

A study by Thorp et al. conducted in Australia among 193 employees in offices, call centers and customer service showed that office workers were sedentary 77 % of working hours (Thorp, et al., 2012). These findings are consistent with findings in other European countries (Ryan, Dali, Granat, & Grant, 2011; Toomingas, Forsman, Mathiassen, Heiden, & Nilsson, 2012). In addition, a study by McCrady et al. has shown a major difference in the average time sitting when at work and during leisure with an average of sitting down 100 minutes more during workdays (McCrady & Levine, 2009).

"We spend up to 12 hours a day sitting, many of these hours during work."
(van der Ploeg, Chey, Korda, Banks, & Bauman, 2012).

So, we are spending too much time sitting down during work, which is bad for us, but many of us engage in physical activity outside working hours. Can we avoid the adverse effects of sitting down during work by being active during leisure? As devastating as it may sound, studies suggest that high intensity physical activity doesn't make up for the adverse health effects of sedentary behavior during work hours. A review by Hamilton et al. found that sedentary behavior can lead to adverse cardiovascular and metabolic effects that are independent of whether people meet the general guidelines for physical activity (Hamilton, Healy, Dunstan, Zderic, & Owen, 2008). This claim is supported by another study where the effects of sitting time on risk of cancer persists after controlling for physical activity during leisure time (Schmid & Leitzmann, 2014).

Sedentary behavior and health

How can we address this problem?
A large number of workplace interventions have been carried out and evaluated during the last decade. Research suggests that interventions, that target modifications in the working environment on the individual-level, produces the largest reduction in workplace sitting time (Dunstan, et al., 2013). One effective way of reducing sedentary behavior at work is by providing office workers with height-adjustable office desks. Several studies have been carried out showing that installing a height-adjustable office desk can reduce the hours spent sitting down during work with thirty minutes to two hours (Shrestha, et al., 2016; Tew, Posso, Arundel, & McDaid, 2015). In addition, frequent changes in posture while working has been associated with a higher level of productivity (Karakolis & Callghan, 2014).

"We cannot change the entire environment in which people work, but we can reduce the hours of sedentary behavior."

We cannot change the entire environment in which people work, but we can reduce the hours of sedentary behavior and positively impact office workers' health during work hours by providing height-adjustable office desks. However, a challenge has been to make office workers integrate the use of their height-adjustable desks while being at work.

As one of the world's leading companies providing electrical actuator solutions for height-adjustable office desks, LINAK A/S has the opportunity of positively influencing millions of people's wellbeing and health. However, a big challenge for LINAK is that they are a sub supplier in the value chain. This means that LINAK is never in direct contact with the office worker of their height-adjustable office desks.

So how can LINAK make sure that office workers will use and keep using their height-adjustable desks, when workplaces are investing in office equipment that has the potential to improve workers health? They can't.
However, this was what LINAK wanted to investigate – how do we make office workers use their height-adjustable office desks more?

Together with /KL.7, one of the leading behavioral design agencies in Europe, LINAK set out to investigate, design, and test solutions that could help close the intention/action gap - having a height-adjustable office desks, but not using it or only using it to a small extent.

2.0 Behavioral Design

Objective
The objective of the study was to design and test interventions that could be integrated or added to LINAK's current products to increase time standing up during working hours among office workers. But even though it is both in the employers and the office workers own interest behavioral compliance tends to remain absent during a busy workday.

> **"Recommendations for office workers that are mainly desk based are at least 2 hours/day [...]"**
> (Buckley, et al., 2015)

As described in the Nobel Laurate Daniel Kahneman's book "Thinking fast and slow", the information alone ("this will do you good") rarely brings about the behavior (Kahneman, 2011). The action/intention gap plays a big part here. Office workers of course have the intention of being healthier individuals, but throughout their workday, their limited executive mental functions are used for more – seemingly – urgent matters, than cardiovascular dangers 20 years ahead (Dolan & et. al., 2010). Therefore, the prime target for design of interventions were to figure out how to help the office workers bridge the action/intention gap in a busy work day. And in a feasible effortless manner.

Recommendations for office workers that are mainly desk based are at least 2 hours/day, of standing and light activity during work hours. (Buckley, et al., 2015). Of special interest in this study were office workers that did not meet this recommendation of standing. These users are defined as 'light users' in the current study, and defined as standing 20 % or less time at their height-adjustable desk during a work day.

Approach
/KL.7's work is grounded within different disciplines concerning human behavior e.g., behavioral economics, evolutionary psychology, and social psychology. This approach is called behavioral design. In this project a behavioral analysis was conducted firstly to address the issue and identify possible barriers for non-use of height-adjustable office desks.

The so called Septigon Model (Koester, 2007) was used to structure the analysis. Using the model consists of exploring a problem in seven different dimensions all influencing the behavior in different ways. The seven dimensions are: 1) Individual, 2) Group, 3) Organization, 4) Society and Culture, 5) Process, 6) Physical space, and 7) Technology.

2.1 Interventions

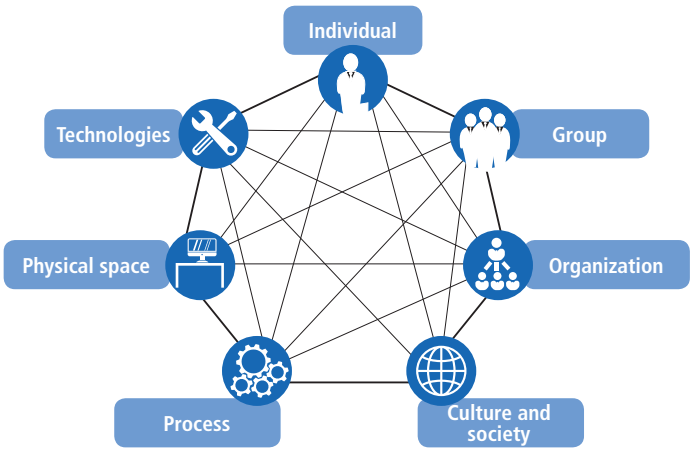


Figure 1. Septigon Model

One of the main findings from this analysis was that there are very few triggers in the working environment reminding office workers to stand up while working.

> **"[...] there are very few triggers in the working environment reminding office workers to stand up while working."**

This finding was apparent in all seven dimensions of the Septigon Model. As an example, on the individual level you might not get any bodily cues, that it is time to stand up, or you might not interpret them as such. For example, when feeling tired or without energy, it is from an evolutionary perspective not logical for you or your body to want to stand up and use more energy. When feeling tired you would want to save energy and sit down. However, feeling tired and without energy is often a sign that you need to stand up.

Another finding from the behavioral analysis was that much of the guidance already given office workers was "perfect" or expert guidance. But if office workers are not using their desks at all, standing up for 2 hours/day might be a bit too demanding. Research within habit-formation has shown that to turn a given behavior into a habit, the initial behavior needs to be fairly simple (Fogg, 2017). As Fogg also states, some habit loops might have an internal trigger, but a habit rarely starts with internal triggers. Therefore, the need for building external triggers was the focus of the intervention design. Drawing from patterns of design from external cognition (Donald, 1993). Two different strategies were tested as described below.

In order to address this problem, /KL.7 developed a number of strategies to increase the users' awareness, aiming at affecting the behavior of office workers that could be implemented as part of LINAK's current actuator solutions. Thereby making it possible for LINAK to influence the behavior of office workers without being in direct contact with them.

2.1 Interventions

Two different awareness strategies were chosen:

- E-mail reminders
- Tactile and auditory reminders

The content of the e-mail reminders was based on different behavioral approaches with focus on (the numbers indicate how many e-mails with that particular topic the intervention groups received):

- Effectiveness during the day (1),
- Energy when you are off work (2),
- Social messages involving colleagues (1),
- Long-term health benefits (1),
- Short-term health benefits (1),
- Habit formation (3),
- Loss aversion (1),
- And a welcome (1) and goodbye e-mail (1)

The e-mail was designed so the subject-line itself promoted the desired action, and the main text provided further information and motivation regarding how and why to stand up while working. The e-mails were kept short and in a personalized style.
E-mails were sent to the intervention group's inboxes during working hours. One e-mail with new content was send each day. Distribution time varied to make the content and action of the e-mail fit the time for the action, tying the e-mail reminder closer to the moment of the desired action. For example, participants received an e-mail with a recommendation to raise their desk before going to lunch at 11 a.m. so the desk was raised when coming back after lunch.

For the tactile and auditory intervention, reminders were placed at the desk for the office workers to feel and hear them. The office workers received a reminder once every hour. The only information office workers had prior to the intervention was that their desks would remind them of standing up every hour, from the morning where interventions were implemented.

2.2 Intervention sites and period

Three intervention sites in Denmark were recruited for the study. The recruitment criterion was that they already had LINAK actuator solutions installed.

Workplace 1 had 27 participants, workplace 2 had 21 participants and workplace 3 had 17 participants. Workplace 1 and 2 received e-mail reminders as intervention and workplace 3 received tactile and auditory reminders as intervention.

Managers were informed about the project, but office workers were only told that the workplace had been selected to participate in a small public health research project.

3.0 Method

The main objective of this study conducted by LINAK and /KL.7 is to increase minutes standing among office workers that were not using their height-adjustable office desk or used it less than the recommended time.

Office workers are split into light and heavy users defined as:

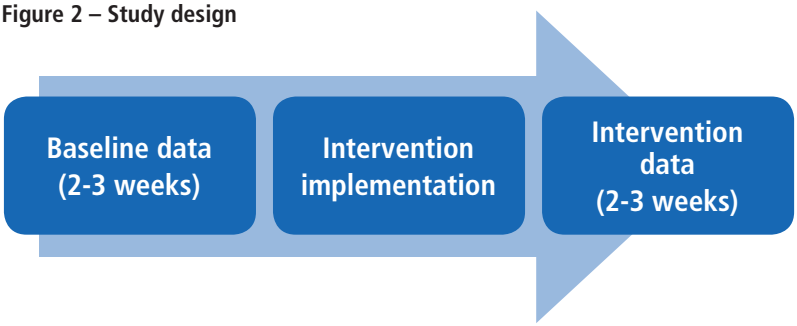
Light users:
Stand up **20 %** or less of the total time registered

Heavy users:
Stand up more than **20 %** of the total time registered

3.1 Study design

The study examines whether office workers use their height-adjustable office desks more, equally or less during the intervention period compared to a baseline period (Figure 2).

Figure 2 – Study design



3.2 Data collection

Behavioral data
Software and additional hardware to monitor behavior was installed during November and December 2016 at the three intervention sites. The software was linked to the office worker's computer through a USB2LIN06 cable, monitoring whether the worker was at his or her desk, as well as the height of the desk at a given time. A new value was registered each time the desk was adjusted or the status changed from active to idle, or idle to active.

Baseline data was collected in December 2016, 2-3 weeks before the interventions were implemented. The office workers were told as little as possible about the intervention to avoid changing their behavior as a result of being monitored (c.f. The Hawthorne effect).

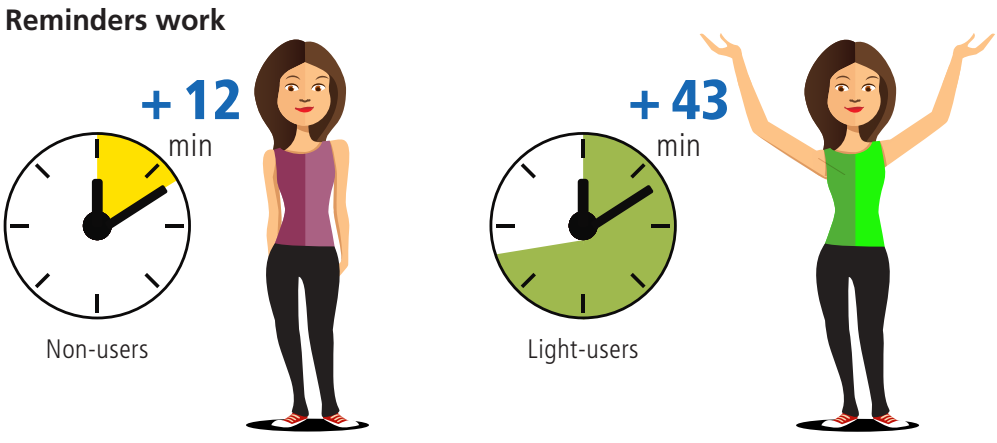
The intervention period lasted for 3 weeks for workplace 1 and 3, and 10 days for workplace 2. The intervention data was collected during January 2017.

The Hawthorne effect:
"This effect is generally defined as the problem in field experiments that X's' knowledge that they are in an experiment modifies their behavior from what it would have been without the knowledge."
(Adair, 1984)

Qualitative data
In addition to quantitative behavioral data, qualitative data was collected. A consultant from /KL.7 observed the use of the height-adjustable office desks both during the baseline period and after the intervention period for a period of 3-4 hours for each visit. After the intervention period, interviews were also conducted with 16 users to get a qualitative evaluation of the interventions. It was important to conduct the interviews after the intervention period, so the interviewer's questions did not influence the outcome of the interventions.

Themes within the observation guide included:
1) Physical environment
2) Daily work routines
3) Behavioral patterns
4) Current interventions already within the workplace
5) Identification of possible factors that may lead to biases

Themes within the interview guide:
1) Experience with the intervention
2) Use of the intervention
3) Improvements of the intervention



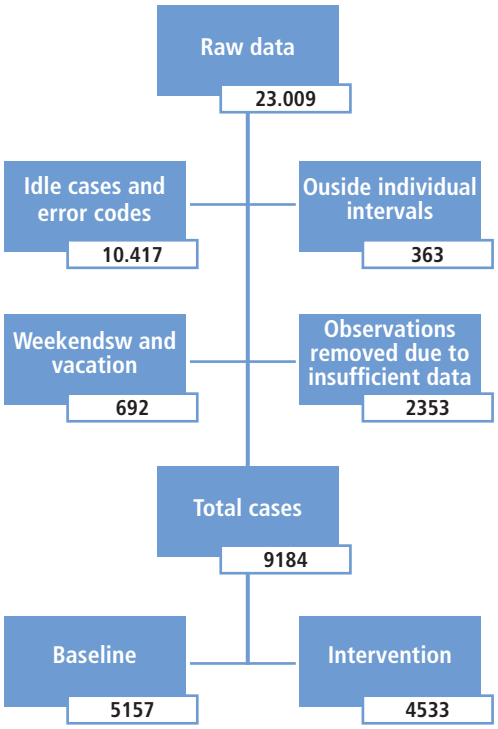
Reminders increased the participants' standing time. The standing time of non-users increased by 12 min. Light-users doubled their standing time by adding 43 min per day to their base time, going from 36 min to 79 min of standing per day.

3.3 Data management

Before data was analyzed, it was cleaned in regard to removing all observations registered as either: 1) idle, 2) error codes, 3) values not in individual intervals*, 4) data in weekends and holidays, and 5) Insufficient data due to: individuals with no data before and/or after the intervention period; individuals with less than 20 hours registered in total or less than nine hours in either baseline or intervention; single observations > 8 hours (Figure 3).

*Individual intervals for sitting and standing were calculated for each individual finding the two normal distributions of the data for each individual.

Figure 3 – data management



3.4 Statistical analyses

The effect of the two interventions was analyzed by:

- **Total time** standing in relative terms (i.e. percent of the total time spent by the desk sitting down/standing up) during an 8-hour workday

- **Total time** standing in absolute terms (minutes sitting down/standing up) during an 8-hour workday

The distribution of the measurements was calculated either in relative terms (i.e. percent of the total time spent by the desk sitting down/standing up) or in absolute terms (minutes sitting down/standing up). To ensure comparability, all measurements in absolute terms were calculated so that they reflect the number of minutes on a standardized work day of 8 hours.
By using the means from these distributions, we can observe how the participants develop – individually as well as in different groupings – from the baseline to the intervention period. Since the number of observations differ significantly from individual to individual, all means are weighted as to ensure that all individuals' observations count equally.

When comparing the weighted means, we account for the statistical uncertainty by consistently including the 95 pct.-confidence intervals (CI). Only then can we plausibly conclude whether there is a significant change in the measurements over time or not. This is also the reason why we visualize the data in the Appendix A with box plots, as they – as opposed to bar charts or pie charts – show a true image of the entire data distribution.

In the linear regression model the method of block-recursive modeling is used. By doing so, we can observe how the introduction of additional variables (e.g. intervention type) affect the overall relationship between baseline/intervention and time standing up/sitting down, while at the same time controlling for all other variables.

All analyses and visualizations are conducted in the open-source program R.

3.5 Qualitative insights that might affects behavior

Prior to the implementation of the interventions, a consultant from /KL.7 observed the behavior among workers at the 3 intervention sites to identify possible challenges for implementing the interventions.

In this regard, several insights were noted:

1. Some users already stood up most of the time

2. Many users already had LINAK® reminder software installed – which could influence the effect of the interventions to be tested

4.0 Results

The final dataset consists of 9184 valid observations and 4536 valid hours of sitting and standing, distributed across 54 individuals. Observations, hours and number of individuals are shown in the table below for heavy and light users as well as the two different interventions (table 1).

4.1 Overall results

LINAK wanted to investigate whether two different types of reminders could help office workers stand up more at their height-adjustable office desks. Of special interest was to affect the behavior among office workers that stood up working 20 % or less of the time at their desk (light users).

"Light users standing time increased from 36,3 min/day in the baseline to 78,9 min/day during the intervention."

In this regard, we see very positive results for these users. Light users standing time increased from 36,3 min/day in the baseline to 78,9 min/day during the intervention. More than doubling their minutes of standing (table 2). In relative terms, this result corresponds to standing 7,6 % during an eight-hour workday in the baseline, and 16,4 % a day during the intervention period (table 2). These results are statistically significant when controlling for other variables (table 3 – user).

We also investigated whether office workers not using their height-adjustable office desk at all, prior to the intervention (less than 2 % of the time), had had any additional benefits of the interventions. We saw that this group had an additional significant effect on their standing time of 12,3 min/day (table 3 – non-user). This result means that, on top of the positive effect already identifies among light users, the non-users experienced an even greater improvement in their standing behavior. In short, the interventions worked better, the less the office workers stood up in the baseline period.

"We saw that this group [non-users] had an additional significant effect on their standing time of 12,3 min/day."

4.1 Overall results

Both interventions increased standing behavior in light users with no statistically significantly difference between interventions (table 3 – intervention). We also looked at the effect for heavy users, where no statistically significant results were found when controlling for other variables (table 3 – intercept).

For readers interested in distribution of the data, boxplots can be found in appendix A.

4.2 Qualitative evaluation

Both interventions were positively assessed by office workers. The e-mail reminders were referred to as easy to read, fun and motivating, informative, and tying a concrete behavior to a concrete action. Among the less positive remarks, office workers thought it was too few reminders and they didn't like that there was no specific pattern in terms of when they received the e-mail (e.g., same time a day, or connected to the use of their desk).

Regarding, remarks for the tactile reminders, reminding users to stand up every hour, were also positive overall. Here, the reminders could be linked to the LINAK Desk Control reminders, so reminders were timely, not telling you to stand up, when you had just stood up for e.g., 20 minutes.

Table 1 – counts

	BASELINE			INTERVENTION			TOTAL		
	n(obs.)	n(hours)	n(individ.)	n(obs.)	n(hours)	n(individ.)	n(obs.)	n(hours)	n(individ.)
Total	5157	2201	54	4533	2335	54	9184	4536	54
Light users	1870	456	25	1673	862	25	2939	1318	25
Heavy users	3287	1745	29	2860	1473	29	6245	3218	29
Light users: E-mail intervention	1005	266	16	489	252	16	953	518	16
Light users: Tactile intervention	865	190	9	1184	610	9	1986	800	9
Heavy users: E-mail intervention	2772	1637	25	2067	1065	25	4937	2702	25
Heavy users: Tactile intervention	515	108	4	793	408	4	1308	516	4

Table 2 – effect sizes

	BASELINE				INTERVENTION		TOTAL	
	Sitting (min/day)	**Standing (min/day)**	**Standing (pct.)**	**Individuals (n)**	**Sitting (min/day)**	**Standing (min/day)**	**Standing (pct.)**	**Individuals (n)**
Total	**346.4** (CI:312.4-380.3)	**133.7** (CI:99.5-167.8)	**27.8** (CI: 20.4-35)	54	**346.4** (CI:310.1-382.6)	**133.6** (CI:97.3-169.9)	**27.8** (CI: 20.3-35.4)	54
Light users	**443.7** (CI:431.5-455.9)	**36.3** (CI:24.1-48.5)	**7.6** (CI: 5-10.1)	25	**401.1** (CI:357-445)	**78.9** (CI:35-122.8)	**16.4** (CI: 8.3-25.6)	25
Heavy users	**262.4** (CI:219-305.9)	**217.6** (CI:174.1-261)	**45.3** (CI: 36.3-54.4)	29	**299.2** (CI:247-351.3)	**180.8** (CI:128.7-232.9)	**37.7** (CI: 26.8-48.5)	29
Light users: E-mail intervention	**442.6** (CI: 425.9-459)	**37.4** (CI: 20.7-54)	**7.8** (CI: 4.3-11.3)	16	**394.5** (CI: 332.8-425.2)	**85.5** (CI: 43.9-93.4)	**17.8** (CI: 9.3-30)	16
Light users: Tactile intervention	**445.7** (CI: 424.5-467)	**34.3** (CI: 13-55.5)	**7.1** (CI: 2.7-11.6)	9	**412.9** (CI: 341.7-439.3)	**67** (CI: 35.2-81.9)	**14** (CI: 8.9-28.3)	9
Heavy users: E-mail intervention	**259** (CI: 210.6-307.6)	**221** (CI: 172.6-269)	**46** (CI: 36-56.1)	25	**289.7** (CI: 232.3-324.1)	**190.6** (CI: 133.2-251)	**39.6** (CI: 27.7-51.5)	25
Heavy users: Tactile intervention	**284** (CI: 229.6-325.2)	**196** (CI: 154.3-236)	**40.8** (CI: 32.2-53)	4	**358.5** (CI: 301-389.3)	**121.5** (CI: 102-150.9)	**25.3** (CI: 15.6-46.9)	4

Table 2 – linear regression model

	Effect on Minutes Standing			Effect on Minutes Standing		
	B	*CI*	*p*	*B*	*CI*	*p*
(Intercept)	-36.79	-87.60 – 14.03	.152	-33.32	-86.40 – 19.75	.213
User (Light User)	79.40	4.71 – 154.08	.038	92.58	9.59 – 175.57	.030
Intervention (Tactile)				-25.10	-116.64 – 66.43	.584
Non-User (Yes)				12.34	30.01 – 3.84	.040
Observations		54			54	
R^2 / adj. R^2		.080 / .063			.092 / .037	

5.0 Discussion

The current study was a pilot study examining whether two different reminders would increase minutes standing up during work hours at three different workplaces. We saw an increase in standing behavior among light users - standing at their desk 20% or less at baseline. Both interventions were effectively increasing minutes standing up for light users. Especially for office workers not using their height-adjustable office desk prior to the intervention.

Like this study, several other studies have found that conducting interventions to make office workers use their height-adjustable desks more, is effective. Many of these studies have had multi-component interventions with both interventions on an organizational and individual level (Neuhaus, Healy, Dunstan, Owen, & Eakin, 2014; Healy, et al., 2013; Danquah, et al., 2016). A large cluster of randomized interventions with 19 offices and 317 workers, conducted in Denmark, showed positive results in standing time after the intervention (Danquah, et al., 2016).

5.1 Strengths and limitations

Data collection method
Data was collected through a software measuring each time an office worker adjusted his or her desk, and each time the office worker's computer was not in use or away from the workstation.

There are several strengths using this data collection method. First, behavioral data is more accurate than self-reported data, since users are seldom completely aware of their own behavior. Second, an accelerometer wouldn't have been appropriate for this study, since we are only interested in whether people stand more or not. Not if people move more. Third, there is a chance that having to register your behavior daily (self-report) or wearing an accelerometer will remind the office worker being in an intervention (cf. the Hawthorne effect). This itself can affect behavior in a positive direction leaving researches with biased results. Therefore, it is also a strength that users were not reminded daily of being measured. Only when the software and hardware were installed prior to the baseline data collection.

The software is intelligent and will mark the user as "idle" if the computer is not in use, leaving out the possibility of a person leaving their computer for hours while their desk will be registered as e.g., standing up. However, if a person is sitting or standing at their desk with their computer switched off or in sleeping mode, this will not be registered or registered as "idle". To adjust possible bias due to the method of collecting data, a number of steps were taken during data cleaning and statistical analyses as mentioned in the method paragraph.

5.2 Study design

The study was designed to use individuals as their own control. It could have strengthened the study design if each of the three intervention sites had been complemented by matched control groups at the same workplace or similar workplaces. Even though this was not possible in the current pilot project, the study design is still considered valid and an effect was found across all three workplaces among light users.

"How long does it take to form a new habit? For some people, a few weeks is enough, for other people, several months are needed depending on which behavior is in focus." (Clear, 2014)

When conducting a study like this, there are several potential contextual biases if the intervention groups are too aware of being studied. A possible risk is to increase the effect size. We aimed at reducing these biases through several actions. First, we used a method of collecting data, where users were not aware of being measured daily. Second, prior to the baseline period, users were told they participated in an intervention regarding their health. Any effect of being part of the intervention itself will therefore be evident in the baseline data that would lead to smaller overall effect sizes. This means that the results found in the current study will unlikely be due to the contextual factors of how the interventions were conducted, but only the interventions themselves.

Behavior is measured over several weeks since a change in behavior (standing vs. sitting) changes from day to day as a result of different work tasks, meetings, and so forth. Is 2-3 weeks then enough to make sure it is an effect of the intervention is not just random? Yes, it is. A Danish study found that the number of days needed to obtain a reliable measure for sitting time was 4.7 days for work when using an accelerometer *(Pedersen, Danquah, Petersen, & Tolstrup, 2016)*. Is 2-3 weeks enough to conclude that the behavior will last after the intervention period? Here we should consider the research in habit-formation. How long does it take to form a new habit? For some people, a few weeks is enough, for other people, several months are needed depending on which behavior is in focus *(Clear, 2014)*. In this study, we wanted to affect a very simple and easy to do action – standing up, with a very simple trigger. A Danish study of Danquah et al. found an effect on time standing up also after 3 months. However, further research would be needed to conclude whether and how long the effects of these interventions will last.

5.3 Generalizing the results

Can the results be generalized to other kinds of workplaces? Yes, this is very likely, since other similar studies at other workplaces have found an effect of their interventions (Neuhaus, Healy, Dunstan, Owen, & Eakin, 2014; Healy, et al., 2013; Danquah, et al., 2016). In addition, an effect among light users were found at all three workplaces where there was a variability in work culture, knowledge prior to the intervention, work assignments, and so forth.

Can the results also be generalized to other countries and cultures? When conducting the behavioral analysis prior to designing the interventions, it was of great importance to LINAK A/S that the interventions chosen could be used across markets. Therefore, interventions rooted in behavioral mechanisms, that are universal for most people across cultures, were chosen. Even though it has not yet been tested, and therefore no definite conclusions can be made, when working with universal behavioral mechanisms, it is likely that the intervention would also affect office workers in countries and cultures different from the Danish.

6.0 Conclusion

In this study, conducted by /KL.7 for LINAK A/S, we found that the two interventions reminding people to stand up were effective to do so in office workers, not using their desk or using their desk for 20 % or less of the time prior to the interventions.

At baseline office workers stood 36.3 min/day while this increased to 78.9 min/day during the intervention period.
In the longer run this might effectively improve the health of office workers already having a height-adjustable office desk.

Supplementary analysis
Supplementary analysis can be seen in appendix A.

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Appendix A – Supplementary analysis

Boxplot – effect minutes pr. day

Figure 1 – Whole group

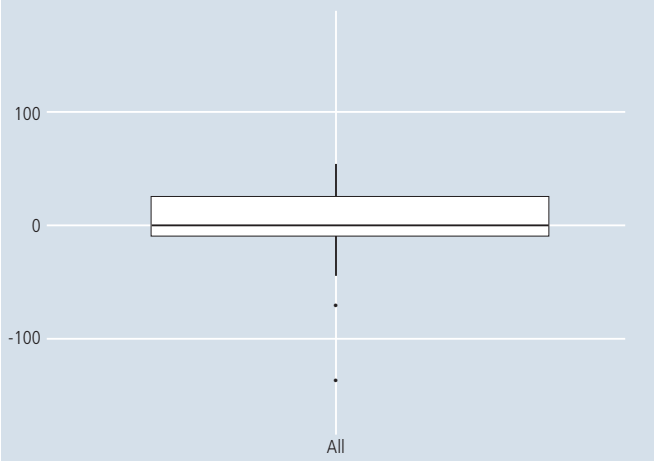

Figure 2 – Light and heavy users

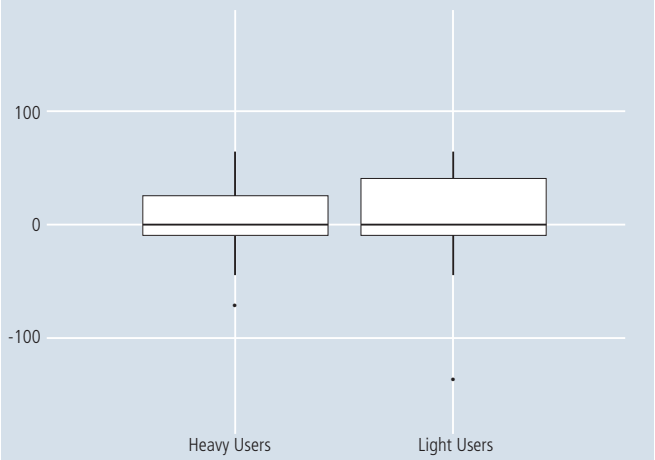

Figure 3 – Heavy and light users split on intervention