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## I'm still standing: A longitudinal study on the effect of a default nudge

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**Objective:** This study assessed the effect of a default nudge to reduce sedentary behaviour at work over time.

**Design and main outcome measures:** A field study was conducted at a governmental organisation. In the present study, the default setting of sit–stand desks (SSDs) was changed from sitting to standing height during a two-week intervention. Stand-up working rates were calculated based on observations that were done prior to, during, two weeks after and two months after the intervention. Additionally, a pre-measure survey ( $n = 606$ ) and post-measure survey ( $n = 354$ ) were completed. Intention and social norms concerning stand-up working were compared for the 183 employees who completed both pre- and post-assessments (45.4% female,  $M_{\text{age}} = 44.21$ ).

**Results:** Stand-up working rates raised from 1.82% in the baseline to 13.13% during the intervention. After the nudge was removed the percentage was 10.01% after two weeks and 7.78% after two months. A multilevel analysis indicated a significant increase in both intention and social norms after the nudge intervention.

**Conclusions:** This study shows that a default nudge can increase stand-up working rates in offices with SSDs at least until two months after the nudge intervention.

**Keywords:** default nudge; long-term effect; sit–stand desks; workplace intervention; sedentary behaviour

Obesity rates are increasing in Western societies. As a result cardiovascular diseases and diabetes mellitus type 2 are now a leading cause of death and health care costs (Wilmot et al., 2012; WHO, 2015). Sedentary behaviour is a great contributor to tipping the scale towards the wrong end (Hamilton, Healy, Dunstan, Zderic, & Owen, 2008; Jebb & Moore, 1999). A large survey amongst the Dutch working population showed that adults between 20 and 65 years sit, approximately 9.53 h on an average workday (RIVM, 2016). This trend is also noticeable in other industrialised countries (Straker & Mathiassen, 2009). Research has suggested that achieving the daily recommended exercise of about 30 min a day does not counter the health damaging effects of a sedentary lifestyle (Ekelund et al., 2016; Owen, Healy, Matthews, & Dunstan, 2010). Reducing the time spent sitting could therefore have major health benefits. This fact has caught

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the attention of human resource departments around the world. Employers acknowledge the responsibility to provide their employees with at least the opportunity to reduce their sedentary behaviour at work. Google and Facebook are well-known examples for their investments in sit–stand desks (SSDs) (Carlton, 2011). However, research shows that after the novelty wears off SSDs are mostly used for sitting (Pronk, Katz, Lowry, & Payfer, 2012; Wilks, Mortimer, & Nylén, 2006). In this study, we examine whether a default nudge, that changes the standard setting of the SSD into standing height instead of sitting height, can decrease the time spent sitting at work.

The placement of SSDs is an attractive onetime investment for companies, since it allows employees to reduce their sitting time without having to leave their desks. Initial studies on the placement of SSDs as an intervention to decrease sedentary behaviour have reported promising results (Alkhajah et al., 2012; Chu et al., 2016; Dutta, Walton, & Pereira, 2015). However, a closer look at SSD effectiveness studies reveals that placing SSDs led only to a reduction in sitting for a brief period (Dutta et al., 2015; Pronk et al., 2012). For example, an evaluation study in four different companies that placed SSDs found that 59.8% of the employees used their SSD at standing height only once a month or less. The self-reported main reason (63%) for the non-use was that ‘they just did not bother to use the function’ (Wilks et al., 2006). It thus seems that merely providing office workers with the opportunity to work standing up is insufficient to change behaviour.

Findings from a focus group study reveal that although people actually may have intentions to sit less during working hours, they foresee all kinds of barriers when it comes to acting upon these intentions (De Cocker et al., 2015). For example, one of the most cited barriers was that they would feel uneasy about standing (e.g. that colleagues would see them as show-offs; De Cocker et al., 2015). The so-called intention–behaviour gap is a phenomenon that is frequently observed in health behaviour (Sheeran, 2002; Sheeran & Webb, 2016). People often have intentions to perform a certain health behaviour but fail to do so in the face of obstacles, in this case sitting down is easier than overcoming the perceived barriers.

Altering the environment in such a way that the intended behaviour is acted upon almost automatically is one way to overcome this intention–behaviour gap (Sheeran, 2002; Sheeran & Webb, 2016). Adapting the environment to steer people towards the healthy option, without forbidding alternative options or changing economic incentives is referred to as *nudging* (Thaler & Sunstein, 2008). The key feature of nudging is that the desired behaviour is made easier by relying on peoples’ tendency to use mental shortcuts (such as heuristics), instead of trying to overrule these automatic tendencies by appealing to peoples’ rational goals, as is the case with persuasion and education interventions. In line with this suggestion, meta-analytic evidence has shown that information-based interventions, such as sending reminders to stand up, coaching programmes and providing information on health consequences of too much sitting (e.g. Evans et al., 2012), was less effective in decreasing sedentary behaviour at work than environmental interventions (Chau et al., 2010; Chu et al., 2016; Gardner, Smith, Lorencatto, Hamer, & Biddle, 2016). Nudges, in contrast, have been shown to be promising alternatives with studies reporting medium effect sizes in various domains, such as environmentally friendly behaviour (e.g. Pichert & Katsikopoulos, 2008; ( $\Phi = .26$ )), healthy eating (e.g. Kroese, Marchiori, & de Ridder, 2016; ( $p\eta^2 = .49$ )) and saving money (e.g. Choi, Laibson, Madrian, & Metrick, 2004). Now that many companies have already invested in SSDs, it seems opportune to test whether a default

nudge can provide the last little ‘push’ into maximising the SSD potential to decrease sitting behaviour.

For this study a diagnostic approach was used to assess in what way the available arrangements affected the current unwanted sitting behaviour. It was noted that the SSDs were always at sitting height. In this study, we changed the default setting from sitting height to standing height during two weeks, hereby implementing a default nudge. Default nudges are assumed to be effective because they relieve people from the effort that is involved when they have to deal with obstacles that stand in the way of the desired behaviour, in this case deciding to sit down or stand up (Smith, Goldstein, & Johnson, 2013). Changing the default height of these SSDs can be considered as a prototypical example of a nudge; it makes use of people’s inertia, while allowing the employee to place the desk back at sitting height if so desired. Testing the effectiveness of this default nudge in terms of general time spent working standing up was the first objective of the current study.

As a second objective, we aimed to investigate the effect of the default nudge over a longer period of time. One of the most pressing issues with nudges is that very little is known about the long-term effects (Marteau, Ogilvie, Roland, Suhrke, & Kelly, 2011). In order to improve health outcomes people need to reduce their sitting time for a longer period, not just for one day (Sherstha, Ijaz, Kukkonen-Harjula, Kumar, & Nwankwo, 2015). In the current study, we will examine the impact of a default nudge over a period of eight weeks to determine whether the nudge is still effective after the nudge intervention period.

The current study took place at a large governmental organisation that had invested in SSDs three years before the start of this study, yet it was noticed that these desks were hardly used for stand-up working. We examined whether changing the default setting of the desks would engender employees to work more often in a stand-up position. Secondly, we examined if the default nudge would still have an impact after the nudge intervention period had ended.

Additionally, for exploratory purposes we included a number of psychological factors that are typically included in behaviour change interventions. Different from many traditional interventions, nudging approaches do not aim to target psychological factors like motivation or intention but rather directly affect automatic behaviour. Nonetheless, it may be interesting to explore whether psychological factors might be affected as a by-effect of the nudge, or whether certain constructs may predict how people respond to the nudge. For this purpose, we included intention, attitude, social norms and perceived behavioural control as classic concepts that are associated with behavioural change (Rhodes, Mark, & Temmel, 2012). Finally, we collected evaluations of the office workers with regard to their acceptance of the default nudge. Stand-up working rates were assessed through observations; psychological constructs and other variables of interest (e.g. demographics, see method section) were assessed through a survey in a sub-sample of employees.

## **Method**

### ***Procedure***

This study was conducted in a large governmental organisation. An important feature of this organisation is that the employees do not have allocated desks. Instead, this organisation has an open-plan flex-office in which employees can select any desk on their

floor upon arriving at work. The six office floors that were available for the study had 836 desks in total, of which 110 were (electronical) SSDs.

During the study the occupation of the SSDs was observed eight times a day in four different time periods to allow us to detect changes over time in standing behaviour. The observation periods were two weeks during the baseline measure, two weeks during the intervention, one week during the two-week follow-up and one week during the two-month follow-up. The participating floors had a different number of SSDs ranging from 4 to 36. Next to observational data of the SSDs usage, paper surveys were distributed to all present employees at the participating floors every day during one week in two survey periods. The pre-measurement was conducted two weeks before the nudge intervention, to allow for one washout week. The post-measure was conducted in the week directly after the nudge intervention. Figure 1 depicts an overview of the timeline.

### Participants

Six-hundred and six employees filled out the pre-measure survey (53.5% female,  $M_{\text{age}} = 44.61$ ,  $SD_{\text{age}} = 11.99$ ,  $M_{\text{BMI}} = 23.77$ ,  $SD_{\text{BMI}} = 3.31$ ). The pre-measure showed that the majority of the employees worked fulltime (61.9%). Three hundred and fifty-four employees filled out the post-measure survey in the week directly after the intervention (53.4% female,  $M_{\text{age}} = 44.54$ ,  $SD_{\text{age}} = 12.45$ ,  $M_{\text{BMI}} = 23.42$ ,  $SD_{\text{BMI}} = 3.00$ ). Comparative analyses were performed for the participants who had completed both the pre- and post-measure ( $n = 183$ ). The post-measure could not be matched to the pre-measure for 171 employees. This means that these 171 people were either not present in the office during the pre-measurement or did not fill out the pre-measurement for another reason. In total 767 individuals were surveyed. Informed consent was provided by the employees when filling out the survey. This study was approved by the Department of Social Sciences' Ethics Committee.

### The nudge intervention

At the start of the two intervention weeks all SSDs were placed at stand-up height by the researchers. To ensure that all employees found the SSD in stand-up height during



Figure 1. Overview of study timeline.

the day a sign was placed on top kindly asking the employees to leave the desk at standing height when they would leave the desk/office. The sign further depicted two images to give an indication of the appropriate ergonomic height to set the desk in both a sitting and standing height. The researchers placed any empty sitting height desks into standing height during their observation rounds.

### **Observations**

The observations of the SSDs were done by tally for each floor. All department heads gave consent to do the observations. Each round the researchers noted whether an SSD was empty or in use. An SSD occupation rate was calculated by dividing the number of observed 'in use' desks by the total observations times 100. When in use (indicated by personal belongings on the desk) they noted whether the employee was present or absent. When the employee was present they noted whether this person was working standing up or sitting down and their gender. A stand-up working rate was calculated by dividing the number of standing employees by the number of observed present employees at the SSDs times 100.

### **Survey**

#### *Demographics*

The participants were asked to create a personal code so pre- and post-measures could be compared while anonymity was guaranteed. Next, participants filled out the floor, name of their department, gender, age, height, weight, education level, number of days present in the office in the last 7 days and average number of working hours per week.<sup>1</sup>

#### *Intention*

Intention to engage in stand up working was measured with three items (e.g. 'I try to sit as little as possible when at work'; Prapavessis, Gaston, & DeJesus, 2015). All items were answered on a five-point Likert scale, ranging from 1 (= *Disagree*) to 5 (= *Agree*). Cronbach's alpha for the pre-measurement was .798 and for the post-measurement .782.

#### *Social norms*

Social norms were measured with five items, (e.g. 'It is expected from me that I stand during work') adapted from Prapavessis and colleagues (2015). All items were answered on a five-point Likert scale, ranging from 1 (= *Disagree*) to 5 (= *Agree*). Cronbach's alpha for the pre-measurement was .644 and for the post-measurement .699.

#### *Attitude*

Attitude was measured with four items adapted from Prapavessis and colleagues (2015), (e.g. 'What is your attitude with regard to stand-up working'). All items were answered on a five-point Likert scale, ranging from 1 (= *Negative*) to 5 (= *Positive*). Cronbach's alpha for the pre-measurement was .852 and for the post-measurement .832.

### *Perceived behavioural control*

Perceived behavioural control was measured with three items, 'If I want to, I can work more or less time in a stand-up position', 'The amount of time spent in a stand-up position is controlled by me', 'How much control do you experience about the time spend working in a stand-up position?', adapted from Prapavessis and colleagues (2015). All items were answered on a five-point Likert scale, with the first two items ranging from 1 (= *Disagree*) to 5 (= *Agree*) and the last item ranging from 1 (= *A little*) to 5 (= *A lot*). Cronbach's alpha for the pre-measurement was .776 and for the post-measurement .803.

### *Additional questions post-measure survey*

In the post-measurement, we assessed self-reported standing behaviour by asking the employees 'How often in the last two weeks did you spend part of the day working in a stand-up position?'. The answers were coded in 1 (= did work standing) and 0 (= did not work standing). Next, we asked them how often they stood during meetings. The default nudge was then explained to participants, after which they were asked to *evaluate* the nudge: 'Do you think it is acceptable to be unconsciously influenced in this way?'. They could answer 1 (= *yes*), 2 (= *no*) and 3 (= *no opinion*). Consecutively, they were probed for the reason behind their answer. Finally, the participants were thanked for their participation.

### *Data analysis plan*

For the observational measures descriptive data are presented. The current study design did not allow for statistical analyses of trends over time due to the dependent nature of the (group-level) observations. To assess a change in intentions, attitude, social norms and perceived behavioural control a multilevel analysis was performed to accommodate for the nested data with three levels: floor, individuals and time. Since different floors had different number of SSDs, the exposure to the nudge varied depending on the floor the participant is from. The analyses were carried out using lme4 package in R (Bates, Mächler, Bolker, & Walker, 2015; Sherstha et al., 2015). Separate paired t-tests were performed with intention, attitude, social norm and perceived behavioural control as dependent variables and time point (pre-measure vs. post-measure) as independent variable, while controlling for floor and individual differences. All dependent variables were standardised. To explore whether the evaluations of the default nudge were dependent on participants' intentions to work standing up a multinomial regression with evaluation as dependent variable, post-measure intention as independent variable and floor as control variable was performed.

## **Results**

### *Descriptives from pre-measure*

The full pre-intervention sample ( $n = 606$ ) was used to get an apprehension of the employees' baseline intentions, attitudes, social norms and perceived behavioural control. Before the nudge intervention the employees in this organisation had on average low intentions to engage in stand up working ( $M = 1.93$ ,  $SD = .91$ ). The attitude

towards stand-up working was on average neutral ( $M = 2.91$ ,  $SD = .95$ ). The social norm was not in favour of stand up working ( $M = 1.49$ ,  $SD = .48$ ). Before the nudge intervention the employees experienced considerable control over their working position, sitting or standing ( $M = 3.36$ ,  $SD = 1.06$ ).

### Observations

#### *SSD occupation rate*

An occupation rate was calculated to assess whether the nudge intervention influenced the selection of the SSDs over normal desks as a workplace. The SSD occupation rate during the baseline measure was 74.16%. During the nudge intervention it was 75.25%. Two weeks after the intervention it was 74.31% and two months after the intervention the occupation rate was 71.71%. There is no indication to assume that the popularity of the SSDs changed, either positively or negatively, because of the nudge intervention.

#### *Stand-up rate SSD*

The first objective was to see if people would work more often standing up when the SSDs were placed at standing height by default. During the baseline measurement 1.82% of the employees were working standing up. During the nudge intervention this percentage rose to 13.13%. Our second objective was to examine the effect of the default nudge over time. Two weeks after the intervention period (i.e. when the SSDs were no longer placed at standing height by default) the stand-up rate was still 10.10%. Two months after the nudge intervention the stand-up rate was 7.82%, which is still considerably higher than the percentage at baseline. Figure 2 gives an overview of the stand-up rates. The observations indicate that the default nudge increased the stand up working rate and that there appears to be a lasting, although decaying, effect after the nudge had been removed.

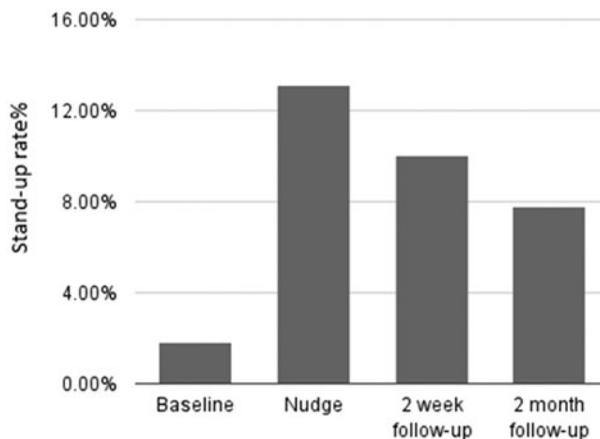


Figure 2. Stand-up rates over time.

### ***Survey data changes from baseline to follow up***

One hundred and eighty-three office workers (45.4% female) completed both the pre- and post-measures. The mean age was 44.21 (SD = 12.53) with a mean body mass index of 23.45 (SD = 2.88). Fifty-two (29.4%) of these participants indicated that they worked standing up during the default nudge intervention period. Intention for stand-up working increased significantly from the pre-measure ( $M = 1.93$ ,  $SD = .97$ ) to the post-measure ( $M = 2.09$ ,  $SD = .98$ ,  $t(176) = 2.95$ , 95% CI [.05, .26]). Also social norms increased significantly from the pre-measure ( $M = 1.45$ ,  $SD = .46$ ) to the post-measure ( $M = 1.59$ ,  $SD = .54$ ,  $t(176) = 4.34$ , CI [.17, .44]). Attitude towards stand-up working did not change ( $p > .335$ ) nor did ratings for perceived behavioural control ( $p > .140$ ).

### ***Acceptance of the default nudge intervention***

The full post-measure sample ( $n = 351$ ) was used to apprehend what the employees thought of the default nudge intervention. About 31.6% of the employees indicated in the post-measurement to have worked standing up in the past two weeks. 56.5% of the employees indicated to find it acceptable to be unconsciously influenced by the default nudge. One employee who answered 'yes' on the acceptability question wrote 'I think it is a good idea, I usually just sit down without thinking about it'. 11.0% found it not acceptable, one employee wrote: 'I think it is mostly annoying, I don't want to work standing up'. Finally, 25.4% indicated that they had no opinion about being nudged. One person who indicated to have no opinion wrote: 'I don't know how long to stand for'. The post-intervention survey thus indicates that the majority of the employees approved of the default nudge. A multinomial regression with non-acceptance as a reference group showed that intention to work standing up significantly predicts whether the employee would find the nudge acceptable,  $b = 1.09$ ,  $Wald \chi^2(1) = 15.79$ ,  $p < .001$ . The odds ratio tells us that as intention is one point higher the change in the odds of finding the nudge acceptable, compared to finding it not acceptable, is 2.97. Intention to work standing up also significantly predicted whether the employee would say to have no opinion about the nudge, compared to non-acceptance,  $b = .68$ ,  $Wald \chi^2(1) = 5.49$ ,  $p = .019$ . The odds ratio tells us that as intention is one point higher the change in the odds of having no opinion about the nudge, compared to finding it not acceptable, is 1.97. In short, employees who have a higher intention to work in a standing position are more likely to accept the nudge. Likewise employees who have a lower intention are more likely to not accept the nudge.

## **Discussion**

The first objective of the current study was to investigate the effectiveness of a default nudge in encouraging stand-up working. Specifically, we implemented the default nudge by placing adjustable SSDs at standing height instead of sitting height. We observed that the default nudge increased the use of the SSDs for stand-up working. As a second objective, we examined whether this particular nudge would still have an impact after two months. Our results indicated that while the stand-up working rate slightly decreased, it was still approximately four times higher compared to baseline observations. These results suggest that the default nudge may have long-term effects. Finally, we assessed classic psychological variables typically associated with behavioural change

for exploratory purposes. Results showed that employees' intentions to work standing up were considerably low before the start of the default nudge intervention. The survey results indicated that the intention to work standing up actually (though slightly) increased after the nudge intervention. Moreover, employees also perceived the social norm to work standing up more favourable after the implementation of the default nudge. Although nudging interventions in general do not aim to directly target psychological variables as such, the currently observed by-effects of the nudge on these variables may have interesting implications with regard to the underlying mechanisms of the achieved behavioural change, particular in terms of its sustainability over time. Together, the findings of the current study demonstrate the effectiveness and potential long-term effects of the default nudge, yielding both theoretical and practical contributions.

### ***Contributions***

The current study is one of the first to look at the impact of a default nudge on behaviour after the intervention period. This is particularly interesting considering that most known successes of default nudges are concerned with choices that are made once, for example, with regard to organ donation and selecting a pension plan (Johnson & Goldstein, 2003; Loewenstein, Bryce, Hagmann, & Rajpal, 2015). While nudges in general are praised as the ultimate tool to help people perform healthier behaviour there is paucity in empirical papers that study their long-term effects (Marteau et al., 2011). Nudges are in essence easy and cheap to implement, but if the nudge only works for a short period renewing the nudges to ensure the desired behaviour can actually break the bank. The results from this study showed promising effects also after the intervention period, thereby contributing to the rapidly emerging literature on nudging as a strategy for behaviour change.

On a practical level, this study demonstrates how companies that invested in SSDs can make easy adjustments to use the full SSD potential by applying a default nudge. Thereby, it is relevant to note that a majority of employees were positive about the nudge intervention. This aligns with prior research indicating that people are generally appreciative of nudges that help them perform health behaviours (Kroese et al., 2016; Junghans, Cheung, & De Ridder, 2015). Only a minority of 11% indicated to disapprove of the nudge intervention, which is low when placing this percentage in the context of nudge approval in general: a recent paper by Reisch and Sunstein (2016) indicated that 42% of their polled Europeans disapproved of the presented default nudges. Moreover, it is relevant to note that the employees who indicated to disapprove of the nudge intervention, also had lower intentions to work standing up, whereas people with higher intentions were more likely to approve of the nudge. This aligns with an important general premise of nudging interventions, which is that they should help people achieve their personal goals (i.e. enact their intentions) but not influence people against their will. Future studies could take a closer look at the interaction between pre-existing behavioural intentions and nudge effectiveness and approval.

### ***Limitations and future research***

Appreciating the promising conclusions of the current research, some limitations should be acknowledged. As a consequence of conducting an unobtrusive field study, we did

not employ advanced activity measures such as accelerometers to assess employees' sitting and standing behaviour during the day. While such advanced measures have obvious advantages, an unintended by-effect of their application would be that participants are consciously aware of being in a study assessing behaviour, and that included participants may be particularly motivated to reduce their sedentary behaviour, as they would need to sign up for the study. Hence, to get an indication of naturally occurring behaviour, and to be able to include the total pool of employees, we chose to employ group-level observations. Another limitation of this field study is that it was not possible to have a control condition. However, the results were unlikely to be caused by other external influences since the organisation was informed that no other HR interventions should take place for the duration of the study. Also, the pre-measure was unlikely to have carry-over effects influencing the current results, since there was a week between the pre-measure survey and the intervention period with observations. Thus, we feel confident that the obtained results were indeed caused by the intervention.

Finally, the group-level observations could not be paired with the individual survey data. Therefore, it was not possible to investigate how the psychological variables were associated with behaviour on the level of individual employees, other than self-reported standing behaviour in the post-measurement. The self-reported results showed that approximately 30% of the surveyed employees used an SSD for stand-up working. This percentage is higher than the stand-up rate because the employees did not stand the whole day. Also in the comments the employees wrote that they did not know how long to stand for. Future studies could investigate whether providing guideline regarding recommended standing duration would affect the effectiveness of the default nudge.

Another suggestion for future research would be to further investigate the underlying mechanisms scaffolding long-term effects of nudges. In this particular study, people were exposed to a default nudge every day during an intervention period of eight working days. Daily exposure to a default nudge might lead to habit formation. Habits can be formed by repeatedly performing a behaviour in the same environment (Lally, van Jaarsveld, Potts, & Wardle, 2010), and there is an indication that habits play an important role in sedentary behaviour (Conroy, Maher, Elavsky, Hyde, & Doerksen, 2013). In the case of stand-up working, people might need a nudge to engage in stand-up working initially, but after being repeatedly being nudged into stand-up working a new healthy habit might be built. Also the supporting role of improved social norms, as a by-effect effect of the nudge could be contributing to the long-term effect (Huh, Vosgerau, & Morewedge, 2014). Future studies should look into habit formation as a potential explanation for long-term effects.

## Conclusions

Altogether, this study demonstrated that a very subtle change that can be easily implemented can increase stand-up working rates in offices that have SSDs. Based on the current findings, a recommendation for managers is to place more sit-stand desks and put them by default in a standing position. By sitting less a small step in the right direction has been taken to reduce further increasing obesity rates and its severe consequences.

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No potential conflict of interest was reported by the authors.

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### Note

1. An adapted version of the Workforce Sitting Questionnaire (Chau, van der Ploeg, Dunn, Kurko, & Bauman, 2011) was administered, however, due to applying very broad answer categories (e.g. 0–3 h, 4–7 h) this questionnaire did not yield meaningful information (e.g. 74.3% of the employees indicated to sit between 4 and 7 h a day) and will not be discussed further.

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