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Original Article

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Consistency of Sedentary Behavior Patterns among Office Workers with Long-Term Access to Sit-Stand Workstations

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Abstract

Introduction: Sit-stand workstations are a popular intervention to reduce sedentary behavior (SB) in office settings. However, the extent and distribution of SB in office workers long-term accustomed to using sit-stand workstations as a natural part of their work environment are largely unknown. In the present study, we aimed to describe patterns of SB in office workers with long-term access to sit-stand workstations and to determine the extent to which these patterns vary between days and workers.

Methods: SB was objectively monitored using thigh-worn accelerometers for a full week in 24 office workers who had been equipped with a sit-stand workstation for at least 10 months. A comprehensive set of variables describing SB was calculated for each workday and worker, and distributions of these variables between days and workers were examined.

Results: On average, workers spent 68% work time sitting [standard deviation (SD) between workers and between days (within worker): 10.4 and 18.2%]; workers changed from sitting to standing/walking 3.2 times per hour (SDs 0.6 and 1.2 h^{-1}); with bouts of sitting being 14.9 min long (SDs 4.2 and 8.5 min). About one-third of the workers spent >75% of their workday sitting. Between-workers variability was significantly different from zero only for percent work time sitting, while between-days (within-worker) variability was substantial for all SB variables.

Conclusions: Office workers accustomed to using sit-stand workstations showed homogeneous patterns of SB when averaged across several days, except for percent work time seated. However, SB differed substantially between days for any individual worker. The finding that many workers were extensively sedentary suggests that just access to sit-stand workstations may not be a sufficient remedy against SB; additional personalized interventions reinforcing use may be needed. To this end, differences in SB between days should be acknowledged as a potentially valuable source of variation.

Keywords: computer work; day-to-day variability; individual differences; sitting time; temporal patterns; variance component analysis

Introduction

Adults, mainly in developed countries, spend a large proportion of their waking time being sedentary (Bauman *et al.*, 2011; Bennie *et al.*, 2015; Clemes *et al.*, 2016), that is in any waking behavior characterized by an energy expenditure ≤1.5 METs while in a sitting, reclining, or lying posture (Network SBR, 2012). In jobs comprising extensive computer use in an office setting, workers may be seated one half to two-thirds of their working day, which contributes to a considerable extent to the total extent of sedentary behavior (SB) during the entire day (Thorp *et al.*, 2012; Parry and Straker, 2013; Clemes *et al.*, 2016).

A growing body of evidence shows that prolonged sitting is associated with several serious health issues (Healy *et al.*, 2008; Owen *et al.*, 2010; van Uffelen *et al.*, 2010; Healy *et al.*, 2011; Proper *et al.*, 2011). An epidemiological study with >200 000 participants found prolonged sitting to be a risk factor for all-cause mortality, and responsible for 7% of premature deaths (van der Ploeg *et al.*, 2012). Sedentariness has also been shown to be associated with an increased risk of cardiovascular diseases and mortality (Thorp *et al.*, 2011; Wilmot *et al.*, 2012; Biswas *et al.*, 2015), with cancer and cancer mortality (Biswas *et al.*, 2015), and with type II diabetes (Proper *et al.*, 2011; Wilmot *et al.*, 2012; Biswas *et al.*, 2015). Some evidence suggests that these deleterious health effects of prolonged sitting can, to some extent, be alleviated by breaking up prolonged periods of sitting by short bouts of other activities of light to moderate intensity, including standing (Healy *et al.*, 2008; Dunstan *et al.*, 2012; Benatti and Ried-Larsen, 2015). Hence, SB needs to be assessed not only in terms of total sedentary time, but also using variables reflecting the temporal pattern of SB, such as the frequency of breaks in sitting, the average duration of uninterrupted periods of sitting, and the percentage of time spent in sitting bouts longer than 1 h (Alkhajah *et al.*, 2012; Toomingas *et al.*, 2012; Gorman *et al.*, 2013; Healy *et al.*, 2016; Danquah *et al.*, 2017). Previous studies have reported that individuals with a similar total sedentary time may, indeed, differ in the temporal distribution of this time (Chastin and Granat, 2010; Hallman *et al.*, 2015).

Since a substantial proportion of daily sitting occurs during work, particularly among office workers, the last decade has shown a rapidly growing interest in interventions to reduce prolonged sitting in office environments. The introduction of sit-stand workstations has been particularly well studied, compared with other initiatives. In the short term, sit-stand workstations may reduce total sedentary time by up to 100 min per day, without adverse effects on performance (Neuhaus *et al.*, 2014a; Commissaris *et al.*, 2016; Shrestha *et al.*, 2018). A recent study even showed that a multicomponent intervention including a sit-stand workstation was cost-effective over the lifetime of the cohort, in that the investment lead to considerable improvements in several variables related to health and well-being (Gao and Li, 2018). Introduction of sit-stand workstations may not only have an immediate effect on total sedentary time, but also on the temporal pattern of SB, as illustrated by an increase in the frequency of shifts between sitting and standing/moving among office workers studied by Alkhajah *et al.* (2012). Barbieri *et al.* (2017) showed that this effect may be even larger if the sit-stand workstation is equipped with a semi-automated system supporting position changes. However, a majority of studies on sit-stand workstation interventions have follow-up periods of <3 months, and evidence suggests that effects can diminish over time. As an example, the sedentary time had decreased by 99 min per day compared with preintervention at a 3-month follow-up after the introduction of sit-stand workstations in a population of office workers studied by Healy *et al.* (2016), but this effect had declined to 45 min per day after 1 year. A study among call-center workers in Sweden, some of which had prolonged access to sit-stand workstations, reported that differences in sitting between workers with and without sit-stand workstations corresponded to only ~5% of total work time, and that the frequency of shifts between sitting and nonsitting did not differ significantly between the two groups (Straker *et al.*, 2013). The authors suggested that the effects of sit-stand workstations on SB deteriorated when the workers did not view the workstations as a novelty anymore. Thus, SB patterns may differ between the novel and accustomed users, but studies of the latter are rare (Toomingas *et al.*, 2012; Carr *et al.*, 2016; Hallman *et al.*, 2018).

Most intervention studies on the effects of sit-stand workstations have reported findings in terms of average values of sedentary behavior variables across workers and days, and rarely discuss dispersion within and between workers. In largely ignoring this variability in SB, studies have missed what may be important information regarding the effects of sit-stand workstations on SB. While a few studies have addressed between-days (within-worker) variability of total time in sitting for the purpose of guiding proper exposure assessment strategies (Aadland and Ylvisåker, 2015; Pedersen *et al.*, 2016), Barbieri *et al.* (2017) were, to the best of our knowledge, first to report variability between days and between workers in variables describing temporal patterns of SB among users of sit-stand workstations. Moreover, they discussed the relevance of such variables in a context of ergonomics implications. They found that between-worker variability was small for most SB variables, and often not significantly different from zero. This indicates that workers were homogeneous with respect to their average sit-stand workstation usage across several days. However, a clear and significant variability in usage patterns was found between individual days, most likely as a result of work tasks differing between days (Barbieri *et al.*, 2017). This illustrates that an examination of the distribution between and within workers of variables describing SB may reveal important information concerning the expected effectiveness of sit-stand workstations in reducing and breaking up sitting. Barbieri *et al.* (2017) investigated novel users of sit-stand workstations in the context of an intervention, and corresponding evidence on office workers accustomed to having sit-stand workstations as a natural part of their working environment is not available in the literature.

Thus, in the present study on office workers who had been equipped with a sit-standworkstation for at least 10 months, we aimed to determine, (i) the average extent and temporal pattern of SB in the group, (ii) the extent to which SB differed between days within workers, and, (iii) the extent to which SB differed between workers, including whether some workers showed an SB suggesting limited use of their sit-stand workstation.

Methods

Study design and study population

We conducted an observational field study of 24 office workers (21 female and 3 male) recruited from among the office staff of the regional county health care administration in Sweden. All workers at the administration office had default access to an electrically adjustable sit-stand workstation; these workstations were implemented throughout at the administration 6 years before the study. Workers did not receive any specific coaching sessions on the health risks associated with extensive sitting, nor on how to use their sit-stand workstation, since the stations were regarded as a natural, standard part of the work environment. Inclusion criteria were that workers had been employed at the office for at least the preceding 10 months (indicating that they would be accustomed to their sit-stand workstation), had computer-intensive work tasks, and had no self-reported illnesses preventing standing work at the time of the study. Participation in the study was voluntary, and the participants signed an informed consent before inclusion. The study was approved by the Regional Ethical Review Board in Uppsala, Sweden (Dnr. 2013/444), and conducted in accordance with the Helsinki Declaration. Data were collected between February and April 2014.

Data collection

To identify SB patterns, workers were equipped with a tri-axial accelerometer on the front of the right thigh (Actigraph GT3X+ activity monitor, Actigraph LLC, Pensacola, FL, USA). The accelerometer was attached to the skin surface by a member of the research team, using adhesive tape, with the x-axis pointing downwards, y-axis horizontally to the left, and z-axis horizontally forward, as described in Skotte *et al.* (2014). Data were collected continuously at 30 Hz for 7 days as the workers performed their regular work and leisure activities. ActiLife software (Actigraph LLC) was used for initializing the monitors, downloading the data, and for checking wear-times. The software was used to detect nonwear times, and these data were removed from further analysis. All further analyses was performed using custom algorithms in Matlab® (MathWorks, Inc., USA), and only included workers with at least 6 h of valid data from each of at least two workdays.

Data processing

The accelerometer data were filtered using a fourth-order low-pass Butterworth filter with a cutoff frequency of 5 Hz, and then divided in windows of 2 s with 50% overlap. For each window, mean acceleration and standard deviation (SD) of acceleration were computed along each of the three axes. On the basis of this data, a dichotomous timeline of SB and non-SB was obtained using a slightly modified version of the classification algorithm in Skotte *et al.*, 2014). The algorithms proposed by Skotte *et al.* (2014) have been shown to provide reliable and valid classifications of sitting and nonsitting physical activities (including standing and walking) in free-living settings (Stemland *et al.*, 2015), and they have been used successfully in several studies addressing SB and non-SB during work (Gupta *et al.*, 2018; Hallman *et al.*, 2018). In the present study, sitting (SB in the context of the present article) was identified to occur in periods during which the SD of acceleration in the vertical direction (SD_x) was less than 0.98 m s^{-2} (1/10 of the gravitational acceleration), *and* the inclination angle relative to the line of gravity was larger than 45°. All other periods were thus classified as nonsedentary behavior (non-SB).

Since we did not have access to exact start and end times of the workday, we used the period between 9 AM and 3 PM on each weekday as 'working hours', as we were certain that the workers were present at their job during these 6 h. Days when the worker reported to be sick or on vacation were not analyzed. We only included workdays in the analyses, since we aimed specifically to document natural patterns of SB when at work for office workers having access to a sit-stand workstation.

Data analysis

For each day and worker, the occurrence and temporal pattern of SB during working hours were assessed using a selection of the variables proposed by Toomingas *et al.* (2012) (Table 1).

The variances between workers and between days (within worker) in each variable were then estimated using a nested random effects model (Searle, 1992):

$$y_{\text{worker,day}} = \mu + \alpha_{\text{worker}} + \varepsilon_{\text{day(worker)}} \qquad (1)$$

where $y_{\text{worker,day}}$ is the value of the variable for a particular worker on a particular day, μ is the mean-of-means of the group, that is the mean across workers of their individual means across days, α_{worker} is the individual worker effect and $\varepsilon_{\text{day(worker)}}$ is the residual effect corresponding to day within workers. The expected mean squares of a one-way analysis of variance (ANOVA) were resolved using MATLAB to obtain the between-workers (S^2_{Bw}) and between-days within-worker (S^2_{BD}) variance components, that is the variance of α_{worker} and $\varepsilon_{\text{day(worker)}}$ in equation (1), along with their 95% confidence intervals (CIs). Variance components were expressed in terms of the corresponding SDs for the ease of interpretation.

This nested random effects model assumes that both $\alpha_{\text{worker}}$and $\varepsilon_{\text{day(worker)}}$ are randomly distributed, that is that SB does not differ systematically between days. A standard repeated measures ANOVA for the effect of the order of measurement day(s) showed that this assumption of randomness was justified for all SB variables.

Results

On average, participants were 52 (SD = 12) years of age and had a body mass index of 26.0 (SD = 4.2) kg m^{-2}. Sixteen of the 24 participants had been working at the administration office 14 years or more; with a maximum of 42 years. Six participants had been employed for

Table 1. SB and non-SB behavior variables, averaged over all workers and days, with between-workers (S_{BW}) and between-days (S_{BD}) variance components, expressed in terms of SDs with 95% CI

Variable (unit)[a]	Mean	S_{BW} [95% CI]	S_{BD} [95% CI]
Percentage of total work time spent in SB (%) [LEV1]	68.2	10.4 [3.0–17.3]	18.2 [15.8–21.4]
Frequency of changes from sitting (SB) to standing/walking (non-SB) (not vice versa) (h^{-1}) [FREQ1][b]	3.2	0.6 [0.0–1.0]	1.2 [1.0–1.4]
Mean duration of uninterrupted periods in SB (min) [FREQ2]	14.9	4.2 [0.0–7.3]	8.5 [7.4–10.0]
Mean duration of uninterrupted periods in non-SB (min) [FREQ3]	6.8	2.4 [0.0–4.2]	4.9 [4.3–5.8]
Percentage of total work time spent in uninterrupted SB periods longer than 1 h (%) [FREQ4]	17.4	4.9 [0.0–11.4]	17.7 [15.4–20.8]
Percentage of total work time in uninterrupted non-SB periods longer than 1 h (%) [FREQ5]	4.4	2.9 [0.0–6.6]	10.0 [8.7–11.8]

[a]In square bracket: name of the corresponding variable in Toomingas *et al.* (2012).
[b]Toomingas *et al.* (2012) counted changes in posture from sitting to standing *and* vice versa, while we counted only changes from SB to non-SB.

2–4 years, one for 1.5 years and one for 10 months. The participants worked as HR consultants (*n* = 10), project leaders (*n* = 6), unit managers (*n* = 3), or had another job description (*n* = 5). Valid data for 6 h in each of five working days were obtained from 18 workers. Three workers provided four valid working days, one worker three and two workers 2 days. The reasons for invalid data included workers having been on leave or work-related travel or worked from home for some of the days, which meant that they did not use their sit-stand station for work on those days. There were no days lost due to noncompliance with wearing the accelerometer or technical malfunctions of the accelerometer system.

The workers spent on average 68.2% (SD = 20.9%) of their work time sitting (median = 73.3%), with a range between individual workdays from 0.8% of work time to 93.1% of work time (Table 1, Fig. 1). One-third of the workers were, on average, sitting >75% of the time and 20 out of the 24 workers had at least 1 day during which their total time in SB was >75% of the workday. The cumulative distribution among the workers of the percentage of total work time in SB illustrates this considerable dispersion between workers and days (Fig. 1). The corresponding variance components (expressed as SDs of SB time) were 10% between workers and 18% between days (Table 1). For both SDs, the 95% CI did not include zero, suggesting a genuine dispersion between days and between workers.

Workers changed from sitting to standing/walking on average 3.2 times per hour, with periods of SB and non-SB being, on average, 14.9 and 6.8 min long, respectively (Table 1). Figures 2 to 4 illustrate that behavior differed substantially between days, as also indicated by significant between-days SDs (Table 1). While the figures may suggest some dispersion between workers, the CIs include zero, indicating that there was no significant difference between workers for these variables.

The average percentage of time in uninterrupted periods of SB longer than 1 h was 17.4%, with a between-days SD significantly different from zero, while the between-workers variability did not differ significantly from zero (Table 1). Whereas 21 of the 24

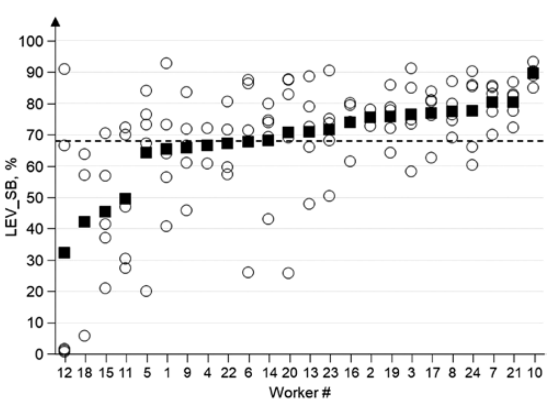

Figure 1. Individual data on the percentage of total work time spent in SB (LEV_SB). For each worker (*n* = 24), separate days are illustrated by open circles and the mean across days by filled squares. Workers are arranged in increasing order of mean exposure and identified by their unique ID number. The dashed line marks the overall group mean.

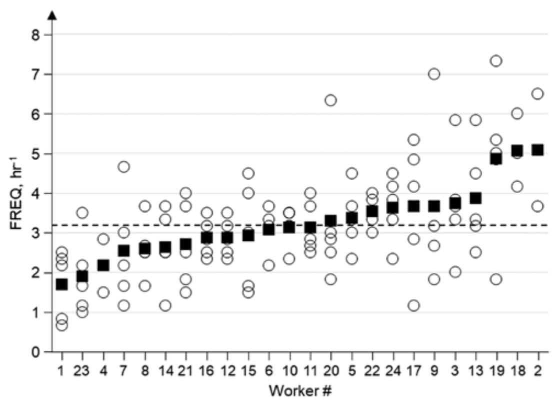

Figure 2. Individual data on the frequency of transitions from SB to non-SB per hour (FREQ). For each worker (*n* = 24), separate days are illustrated by open circles and the mean across days by filled squares. Workers are arranged in increasing order of mean exposure and identified by their unique ID number. The dashed line marks the overall group mean.

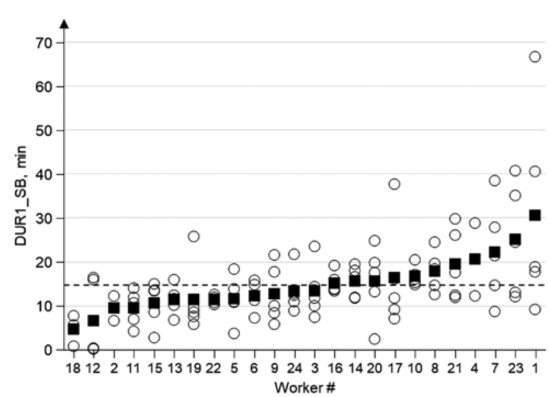

Figure 3. Individual data on the mean duration of uninterrupted SB periods, in minutes (DUR1_SB). For each worker (*n* = 24), separate days are illustrated by open circles and the mean across days by filled squares. Workers are arranged in increasing order of mean exposure and identified by their unique ID number. The dashed line marks the overall group mean.

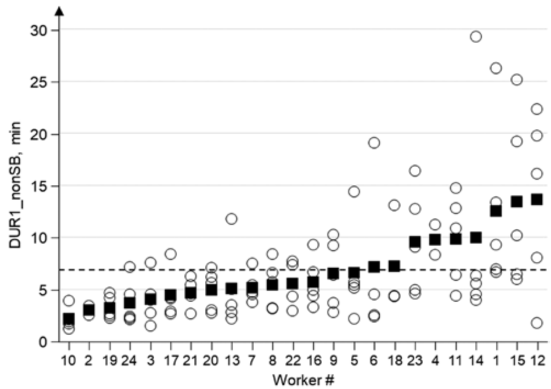

Figure 4. Individual data on the mean duration of uninterrupted non-SB periods, in minutes (DUR1_non-SB). For each worker (*n* = 24), separate days are illustrated by open circles and the mean across days by filled squares. Workers are arranged in increasing order of mean exposure and identified by their unique ID number. The dashed line marks the overall group mean.

workers had at least 1 day without any uninterrupted SB period longer than 1 h, six workers had days with >50% of work time spent in SB periods that long (Supplementary Fig. S1, available at *Annals of Work Exposures and Health* online). The average percentage of time in uninterrupted periods of non-SB longer than 1 h was smaller than the corresponding value for SB periods, that is 4.4%, with a between-days SD of 10.0% (Table 1). Supplementary Figure S2 (available at *Annals of Work Exposures and Health* online) shows that 11 out of the 24 workers did not have any period at all of non-SB longer than 1 h.

Discussion

In the present observational field study, we found that office workers who were accustomed to sit-stand workstations as a natural part of their work environment spent on average 68.2% (median = 73.3%) of their working time sitting, and that about one-third of the workers spent >75% of the time in SB. The workers changed, on average, 3.2 times per hour from sitting to standing/walking, with bouts of sitting being on average 14.9 min long. Between-days (within-worker) variances were significantly different from zero for all investigated variables, suggesting a genuine difference in SB between days for the individual worker. Between-workers variance only differed significantly from zero for the percentage of total work time spent in SB, indicating that the studied workers were homogeneous with respect to their average temporal pattern of SB across an extended period of time.

The percentage of total work time in SB in the present population is slightly lower than that reported in three other studies of SB in workers with long-term access (at least 1 year) to sit-stand workstations, reporting averages of 71% work time in SB (Danquah *et al.*, 2017), and medians of 78% of work time and 79% of work time (Toomingas *et al.*, 2012; Carr *et al.*, 2016). Our result corresponds closer to the 66% reported for the control office in Hallman *et al.* (2018). The lower values in the present study may be due to the workers being less bound to their workstation than the ‘employees who sat most of their workday’ investigated by Danquah *et al.* (2017), the ‘adults working in full-time sedentary deskwork’ in the study by Carr *et al.* (2016), and the call center workers with very computer-intensive tasks studied by Toomingas *et al.* (2012). Both Carr *et al.* (2016) and Toomingas *et al.* (2012) showed that workers with long-term access to sit-stand workstations sat less and stood more than workers only having access to a sit desk, with differences in the order of 5–14% time. Thus, we assume that access to a sit-stand workstation had some effect on SB even in the present population, compared with the hypothetical situation of these workers not having a sit-stand workstation.

The frequency of transitions from sitting (SB) to standing/walking (non-SB) in the present study, that is 3.2 per hour, were on the lower end of frequencies reported elsewhere, namely 3–6 transitions per hour (Alkhajah *et al.*, 2012; Gorman *et al.*, 2013; Carr *et al.*, 2016; Danquah *et al.*, 2017). However, in the present study sitting bouts were relatively short, being on average about 15 min, as compared with baseline average values of about 30 min in an intervention study on the introduction of sit-stand workstations (Healy *et al.*, 2016). This may confirm that workers in the present population were less bound to their workstation than those participating in some previous studies of sit-stand workstations, but also that there would be a potential in the present population, and in particular for some workers, for further reducing SB time and increasing the number of transitions from SB to non-SB (cf. Fig. 1).

All of the cited studies addressing SB among office workers with access to sit-stand workstations report SB variables as an average across one or more days, and do not address the extent of variability between days. The between-days variability in SB may, however, be important information, describing variation in SB on a larger time scale (days) than that reflected by more common variables, such as the within-day frequency of shifts between SB and non-SB. In the present population, workers behaved rather homogeneously in terms of their average SB patterns, except for the total percent of work time in SB, while we observed considerable differences in SB patterns across days for the individual worker. This is consistent with results reported by Barbieri *et al.* (2017), investigating the extent to which users of regular and semi-automated sit-stand workstations differed in terms of SB during a short follow-up period of 3 months after the introduction of the workstations. They also reported the between-days variability of several SB variables to be significantly different from zero in both groups, and larger than the between-workers variability. A larger variability between days than between subjects has also been reported, while expressed in terms of an intra-class correlation, in studies of university staff and students in Norway (Aadland and Ylvisåker, 2015), and workers at offices in Denmark and Greenland (Pedersen *et al.*, 2016). Thus, office workers appear to be rather homogeneous in their average SB patterns across days, while individual days may differ considerably; irrespective of whether sit-stand workstations were introduced recently (Barbieri *et al.*, 2017) or have been a natural part of the work environment for a considerable period of time (present study).

The finding of extensive SB for some workers in the present study, resembling SB in office workers without access to sit-stand workstations, indicates that not all workers equipped with a sit-stand workstation will use it regularly, as reported even in previous studies of user preferences (Wallmann-Sperlich *et al.*, 2017). Merely providing workers with a sit-stand workstation will not guarantee long-term use; not even if workers have an awareness of ergonomics matters (Straker *et al.*, 2013); thus, it may be necessary to re-iterate initiatives promoting effective use of sit-stand workstations at regular intervals in populations with long-term access to these workstations. Supporting this notion, Neuhaus *et al.* (2014b) showed that merely introducing a sit-stand workstation was less effective in reducing SB (by 33 min in an 8-h workday) than introducing it as part of a multicomponent intervention (reduction by 47 min) (Neuhaus *et al.*, 2014a). Robertson *et al.* (2013) also emphasized the crucial importance of training workers in the use of sit-stand workstations as part of an implementation, and Edwardson *et al.* (2018) showed that repeated coaching sessions and feedback on health and behavior as part of a multicomponent intervention including introduction of sit-stand workstations could maintain or even augment reductions in sitting time across a 1-year period. In workers having had access to a sit-stand workstation for over a year, an intervention including software prompts and real-time feedback to change desk positions proved to be effective in increasing the frequency of use of the standing option, and led to a 76% reduction in the number of workers who never used the standing option (Sharma *et al.*, 2018). The above-mentioned studies all suggest that the decay effects proposed by Straker *et al.* (2013) may be counteracted by appropriate initiatives, which may even inspire workers who were previously nonusers. The present result of one-third of the workers spending >75% of their work time sitting in spite of having access to a sit-stand workstation does, indeed, advocate for additional personalized behavioral interventions targeting those individuals identified to be particular at risk of not benefiting from their sit-stand workstation (Gilson *et al.*, 2007; Wallmann-Sperlich *et al.*, 2017). Had the dispersion in SB between workers been less, in combination with an unfavorable group mean, additional interventions targeting the entire population could have been justified; such as organizational interventions or changes in the physical work environment promoting activity (Gorman *et al.*, 2013; Bellicha *et al.*, 2015). Thus, we emphasize that a closer examination of the structure of exposure distributions among workers will give a better basis for interventions than just examining overall group exposures. In doing so, individuals exhibiting deviating or less favorable SB patterns can be identified even though the group may not, on average, be at risk.

The present study has a major strength in addressing SB in workers who were fully accustomed to sit-stand workstations as a natural part of their work environment; studies of equally experienced users are rare. Another strength is the access to detailed information on SB, based on direct measurements, and using a number of variables describing different properties and temporal patterns of SB and non-SB. Furthermore, the reported results on variabilities in SB between workers and between days (within worker), obtained using variance component analysis, offer a deeper insight in the structure and properties of SB in the population than in most previous studies. A limitation of the study is the pragmatic decision to use a time window from 9 AM to 3 PM to represent the workday. However, considering that this time window is 6 h long, we do not expect any substantial bias compared with results representing the exact total workday. A final limitation is that we have studied a rather small population in an office setting with specific characteristics in terms of work tasks and work environment. SB can differ substantially between office populations and even between office workers working at the same office with different duties, and thus different work tasks (Ryan *et al.*, 2011). In future studies, we encourage a deeper analysis of the extent and determinants of variability between and within workers in SB and non-SB patterns, including the influence of specific work tasks and personal characteristics of the worker. This may help in identifying effective interventions at the individual and group levels to reduce and break up SB in office work.

In conclusion, in the present observational field study, we found that office workers who have had access to a sit-stand workstation for at least 10 months spent, on average, 68% of their time sitting, changed three times per hour from sitting to standing/walking, and had bouts of SB about 15 min long on average. Between-days (within-workers) variability in SB were substantially larger than between-workers variability, suggesting a rather consistent pattern of SB across workers, while days within individual workers showed clear differences in SB. In the process of developing sustainable interventions at the organizational or individual level to reduce SB in a specific office setting, determining the extent of SB variability between and within workers should be the first step.

Supplementary Data

Supplementary data are available at *Annals of Work Exposures and Health* online.

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