Cross-sectional Examination of Long-term Access to Sit–Stand Desks in a Professional Office Setting

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Introduction: Prolonged sedentary behavior is an independent risk factor for many negative health outcomes. Although many employers have begun introducing sit–stand desks as means of reducing employee's occupational sitting time, few studies have examined the impact of prolonged access to such desks on sitting/standing time or cardiometabolic outcomes. The present study compared occupational sedentary/physical activity behaviors and cardiometabolic biomarkers among employees with long-term access to traditional sitting and sit–stand desks.

Methods: This study used a naturalistic, cross-sectional study design. Occupational sedentary and physical activity behaviors and cardiometabolic health outcomes were collected in a controlled laboratory between February and June 2014. Data were analyzed in September 2014. Adults working in full-time sedentary desk jobs who reported having either a sit–stand desk (n=31) or standard sitting desk (n=38) for a minimum of 6 months were recruited.

Results: Employees with sit–stand desks sat less (p=0.02) and stood more at work (p=0.01) compared with employees with sitting desks. Significant inverse correlations were observed between several occupational physical activity outcomes (walking time, steps at work) and cardiometabolic risk factors (systolic blood pressure, weight, lean mass, BMI) over the entire sample.

Conclusions: Employees with long-term access to sit–stand desks sat less and stood more compared with employees with sitting desks. These findings hold public health significance, as sit–stand desks represent a potentially sustainable approach for reducing sedentary behavior among the large, growing number of sedentary workers at increased risk for sedentariness-related pathologies.
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Introduction

Sedentary jobs have risen 83% since 1960 and now account for 43% of all U.S. jobs.[1] Office workers sit more than 80% of the workday,[2] placing them at increased risk for many related pathologies.[3] Conversely, interrupting prolonged periods of sedentary time with light-intensity physical activity may result in improved cardiometabolic health benefits.[4,5] Although recent evidence suggests light-intensity physical activity may improve health, few data are available regarding the health benefits of increased standing.

Recent evidence suggests introducing sit–stand desks may reduce sitting time over a short duration (≤3 months).[6–9] It is unknown, however, whether long-term access to sit–stand desks reduces sitting time or improves cardiometabolic risk factors. The present study compared sedentary/physical activity behaviors and cardiometabolic risk factors among employees provided access to sit–stand desks or sitting desks for >6 months. The authors hypothesized employees with access to sit–stand desks would sit less, stand more, and have healthier cardiometabolic profiles than employees with sitting desks.

Methods

Subjects and Design

All data were collected between February and June 2014. Data were analyzed in September 2014. The authors recruited 69 adults working full-time at a large Midwest company (~1,000 employees) that began replacing sitting desks with fully adjustable,

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electronic lift, sit–stand desks (Knoll, Dividend Horizon, East Greenville, PA) in 2009. At the time of data collection, a total of 200 employees (20%) had been provided access to sit–stand desks at random, minimizing self-selection. Employees provided access to sitting or sit–stand desks for a minimum of 6 months were recruited. Part-time employees, those working in non–desk dependent jobs, and new hires (<6 months) were excluded. Employees were recruited through e-mails and advertisements posted on the company website. Participants completed an eligibility screener prior to enrollment. Research protocols were IRB approved and voluntary written informed consent was obtained.

Measures

Occupational sedentary/physical activity behaviors (sitting, standing, walking, sit–stand transitions) were measured objectively by an inclinometer/accelerometer (*activ*PAL3 VT, PAL Technologies, Glasgow, UK) demonstrated to be accurate and valid for measuring different postures (i.e., sitting, standing,[10] walking).[11] Participants wore the monitor for 5 continuous workdays (minimum of 18 hours/day) during all non-bathing hours including sleep. Participants recorded sleep, work, and non-wear time. Age, sex, and work characteristics (weekly working hours, desk type, and duration of desk use) were collected via questionnaire.

All cardiometabolic health outcomes were collected in a controlled laboratory setting. Blood pressure was measured with a stethoscope and sphygmomanometer. Heart rate was measured through tactile arterial palpation. Height was measured to the nearest 0.5 cm using a professional grade height rod (Seca 769, Hanover, MD). Weight, fat mass, lean mass, and body composition were measured using a reliable[12] and valid[12,13] multifrequency bioelectrical impedance analyzer (InBody 720, BioSpace Inc., Cerritos, CA). Waist circumference was measured in duplicate with a Gulick measuring tape.[14] Estimated cardiorespiratory fitness was assessed via the Astrand–Rhyming submaximal cycle ergometer test.[15]

Statistical Analysis

The authors estimated a sample size of 65 necessary to detect, with 80% power, at $\alpha \leq 0.05$, a −5.3% between-group difference in percentage work sitting time based on a similar study.[16] Group differences for demographics, sedentary/physical activity behaviors, and cardiometabolic risk factors were compared by independent samples *t*-test (presented as mean and SD) or nonparametric (Mann–Whitney test) analyses (presented as median and interquartile range), depending on data distribution. Post hoc analyses explored main effects of sex and sex–desk interactions via a univariate general linear model test. Bivariate and partial correlation tests examined correlations between sedentary/physical activity outcomes and cardiometabolic risk factors across the entire sample. Statistical analyses were performed in SPSS, version 20.

Results

A total of 69 middle-aged, mostly female employees participated (31 sit–stand desks, 38 sitting desks, Table 1). Participants wore the monitors 4.8 of 5.0 (96%) days with no between-group differences observed ($p=0.90$). Sitting desk employees reported having access to their desks longer than employees with sit–stand desks ($p<0.01$).

Table 1. Combined and Between-Group Comparisons According to Desk Type (Mean±SD)

	All (N=69)	Sit desks (*n*=38)	Sit–stand desks (*n*=31)	*p*-value
Age (years)	44.1±10.7	43.6±10.6	43.4±13.5	0.56
% female	74	71	82	0.64
Average work time (hours/week)	39.5±7.9	39.1±9.9	39.9±4.3	0.78
Average duration with current desk type (years)	4.6±5.4	6.4±6.2	1.8±0.8	**<0.01**
Weight (lbs)	194.5±47.7	192.4±47.1	197.1±48.9	0.69
BMI (kg/m^2)	30.5±6.6	30.1±6.8	31.0±6.4	0.55
Lean mass (lbs)	119.0±25.1	119.7±25.4	118.0±25.1	0.78
Fat mass (lbs)	74.7±31.4	72.9±33.1	76.9±29.6	0.60
Percent body fat (%)	37.8±9.1	36.7±9.9	39.2±7.9	0.26
Waist circumference (cm)	99.0±16.4	97.8±14.9	100.6±18.1	0.49
Resting heart rate (bpm)	75±9	74±10	76±7	0.23
Systolic blood pressure (mmHg)	122±10	124±7	120±12	0.10
Diastolic blood pressure (mmHg)	75±9	77±8	73±10	0.08
Estimated peak V02 (ml/kg/min)	30.8±8.1	30.7±8.1	30.8±8.2	0.96

Note: Boldface indicates statistical significance ($p<0.05$).
bpm, beats per minute; cm, centimeter; kg, kilogram; lbs, pounds; m, meter; min, minute; ml, milliliter; mmHg, millimeters of mercury.