Evaluating the Acceptability of Low-Cost Standing Desks in the Home Environment: An Exploratory Study

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Background: Many studies have attempted to mitigate the negative health consequences of sedentary behavior (SB) in the work environment using standing desks. However, no studies have explored the use of standing desks in the home. **Purpose**: To evaluate interest, factors influencing desk usage, and acceptability of a low-cost standing desk in the home. **Methods**: Participants (adults aged 18-65 years living in university residential areas) received a low-cost standing desk, and completed online surveys at baseline and 4 weeks to assess leisure SB. After 4 weeks, participants completed a phone interview to assess level of engagement and acceptability. A follow-up interview was conducted at 6 months. A descriptive content analysis was conducted. **Results**: A total of 71 participants were recruited, with 55 and 49 participants completing the 4-week and 6-month interview, respectively. At 4 weeks, there was a self-reported decline in weekday leisure SB ($P < .05$), but not on weekend days. Approximately 75% of interviewed participants reported using the desk every week. After 6 months, 21 participants (30%) were still using the desk. **Conclusion**: This study indicates interest in using standing desks in the home. Future research could examine the behavioral and health impact of SB interventions in this setting.

Keywords: sedentary behavior, evaluation, sitting/standing

Sedentary behavior (SB) is a risk factor for overall poor health status and health complications,[1] distinct from health risks developed from a lack of moderate to vigorous physical activity.[2] Prolonged periods of sitting have been linked to cardiometabolic risk biomarkers and premature mortality.[3,4] However, observational and experimental studies have indicated that interrupting prolonged sedentary time is associated with anti-inflammatory markers and favorable metabolic responses.[5,6] To reduce SB, it is vital to create an environment that discourages extended bouts of sitting and promotes standing or light movements.

The prevalence of SB is high in many countries.[7] It is estimated that Canadian adults spend on average 9.6 hours in SB during their waking day.[8] Common activities that contributed to this finding included driving, desk work, watching television, and engaging with electronic devices.[8] Many individuals spend increasing amounts of time in environments that restrict physical activity, human movement, muscular activity and promote SB. In particular, work environments like office settings encourage sedentary behavior. Accordingly, many interventions have aimed to reduce SB in these contexts, including the implementation of fixed standing desks, workstations adjustable to full standing height, treadmill desks, cycle ergometers, and pedal devices fitted underneath the desk that can be used while doing usual desk-based job tasks.[9] For example, a systematic review reported standing desks reduced total sitting time for office environment employees and reduced their sitting time outside of work.[10]

Receiving less attention in the research literature is SB in the home setting—an environment that allows for personal comfort creating an ideal space to engage in common sedentary activities.[11] The growth and convenience of technology (cell phones, televisions, laptops, and tablets) are also elements that elicit SB.[11] In a survey of

the Canadian population, Herman and Saunders[12] identified that 44% of adults reported >5 hours per week of leisure computer use, 31% reported >2 hours per day of television/video viewing, and 18% reported >1 hour per week video game playing occurring in their home environment—screen time that was also likely time spent sedentary. Individuals working from home have also been on the rise since the introduction of advancing technology in the 1990s, and has been increasing every year.[13] Approximately 1 in 5 university-graduate employees work at home. This suggests that the home environment is also increasingly a context for SB throughout the day.[13] Other than studies assessing television-limiting devices in the home, little intervention research has been reported on SB in the home setting.[11] While commonly studied in the work environment, to our knowledge, no studies have examined the implementation or impact of standing desks in the home environment. Therefore, the purpose of this study was to explore the level of engagement, factors influencing desk usage, and acceptability of a low-cost standing desk in the home environment.

Methods

Study Design

This exploratory study aimed to understand if there was interest in using standing desks in the home environment. The evaluation was primarily qualitative consisting of interviews. We also collected quantitative data on self-reported leisure-time sitting for descriptive purposes and for recording demographic characteristics.

Intervention

All participants received a low-cost (approximately $20 CDN), fixed-height, cardboard standing desk ($2.08 \times 1.58 \times 3.5$ ft) for their home environment. All participants were provided with 3 information sheets: (1) instructions on how to assemble the desk, (2) how to use the desk to break up sitting time, and (3) information

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about the health benefits of reducing sitting time. There was no control group in this study. The institutional research ethics board approved the study.

Participants

Recruitment occurred in November 2017. Study information was included in e-mails to 13,000+ campus members (staff, faculty, and students) living on campus neighborhood residential areas via weekly e-blasts. Recruitment flyers were displayed in residential buildings, and research assistants recruited at 3 community centers on campus to showcase the standing desk. Any campus resident who contacted the research team was screened for eligibility and invited to participate in the study, and scheduled a time to pick up the standing desk. Participants were eligible if they lived on campus (excluding students living in dormitory residences), were between 18 and 65 years old, and had the capability to stand. Individuals were excluded if they self-reported conditions which restricted them from standing, already used a standing desk in their home, or were unable to read or understand English. Written informed consent was obtained from each participant prior to data collection.

Data Collection

Data were collected at baseline, 4 weeks (postintervention), and 6 months (follow-up).

Quantitative Survey Instrument.   At baseline, participants were asked to complete a series of online questions regarding their sociodemographic characteristics (gender, age, ethnicity, occupation, income, marital status, household composition, and height/weight), leisure-time physical activity and sitting behavior, and occupational sitting and physical activity behavior via FluidSurveys. Physical activity behavior was assessed using the International Physical Activity Questionnaire-Short Form.[14] Leisure-time sitting behavior was measured with the Sedentary Behavior Questionnaire.[15] Modifications were made to the Sedentary Behavior Questionnaire to fit the scope of the study by allowing the response options to be open-ended answers (ie, hours and minutes) and modifying each question to state if the activity was done while "sitting at home." One response answer was further modified to include leisure computer use: "Playing computer or video games or using the computer or laptop for leisure." The Occupational Sitting and Physical Activity Questionnaire was used to assess sitting and standing behavior in the workplace.[16] After baseline assessment, participants were provided with the standing desk and additional intervention components.

Qualitative Interviews.   After 4 weeks, participants participated in a one-on-one semistructured phone interview lasting 20 minutes. The interview consisted of questions relating to the level of engagement and usage, factors (barriers/facilitators) influencing desk usage, and acceptability (impact, likes/dislikes, and future use) of the desk. Participants also repeated the International Physical Activity Questionnaire-Short Form, modified Sedentary Behavior Questionnaire, and Occupational Sitting and Physical Activity Questionnaire over the phone. The interviews were audio recorded. At 6-month follow-up, participants were contacted for a final one-on-one semistructured phone interview that took approximately 5 minutes. The interview assessed current desk usage.

Analysis

Participant demographic characteristics were analyzed descriptively in SPSS (version 24; IBM, NY). A paired samples *t* test was conducted to test for differences in leisure sedentary behavior on weekdays and weekend days at baseline compared with 4-week follow-up. Interviews were audio recorded, and responses to questions were tabulated in Excel (Excel Version 16 Microsoft, WA). A descriptive content analysis[17] was conducted to summarize topics derived from the interview questions (predefined themes of interest). Given the novelty of the research focus no a priori hypotheses were speculated.

Results

Sampling and Participants

A total of 71 participants were recruited for this study. Table 1 provides participant characteristics at baseline and those who completed the 4-week interview (n = 55). The majority of the participants were female, of Asian descent, well educated, and were full-time employees or students. Although participants were seemingly healthy, with a mean body mass index in the normal/healthy range, and the majority reporting ≥150 minutes of moderate to vigorous physical activity per week, they were also highly sedentary. Participants reported spending on average more than 7.5 hours sitting while at work, and more than 8.5 hours sitting during their leisure time on both weekdays and weekend days. There were no significant differences in any of the baseline characteristics for those who completed the 4-week interview compared with those who did not (all *P*s > .05). There was a significant difference in leisure-time spent sitting (in minutes per day) on weekdays at baseline (mean = 539.57, SD = 342.08) compared with 4-week follow-up (mean = 399.98, SD = 251.46); $t_{53} = 3.25$, $P = .002$. There was no difference on weekend days ($P > .05$).

Qualitative Data: 4-Week Follow-Up

Usage.   Approximately 75% of individuals who were interviewed reported using the desk every week, with most using it 1 to 2 days per week. Usage varied with individuals using the desk for 5 to 10 minutes per day to 2 hours per day (both continuously and broken up). Common places for the desk included the bedroom, home office, and living room. The most common task for using the desk was work- or leisure-related laptop/computer tasks. The remaining 25% reported either that they never used the desk, used it once, for a few days, or only for 1 to 2 weeks.

Factors Influencing Desk Use.   Overall, participants reported numerous barriers and facilitators influencing desk usage (see Table 2). Characteristics of the desk that limited use included incorrect height, instability, lack of surface area, whereas some individuals made modifications to the desk to make it more user-friendly. Physiological responses reported by individuals when using the desk included negative consequences (eg, pain and discomfort) and positive benefits (eg, improvements in posture). Some individuals reported not having enough space in their home for the desk or that the desk was not suitable for the tasks they wanted to use it for. On the other hand, some individuals reported that placing the desk in a good location acted as a reminder to use the desk and provided them with the ability to change positions/location. The most suitable task for this desk was laptop work.

Acceptability of Desks.   Participants generally liked that the desk was affordable, easy to set up and move around, and having the option to stand and change positions. The dislikes related to the nature of the low-cost model in that they were nonadjustable for height and not aesthetically pleasing in the home environment.

Table 1 Participant Characteristics at Baseline and 4-Week Follow-Up

Characteristic	Baseline (N = 71)	4 wk (n = 55)
Gender		
Women	37 (52.1%)	31 (56.4%)
Men	33 (46.5%)	23 (41.8%)
Choose not to answer	1 (1.4%)	1 (1.8%)
Age, mean (SD), y	38.30 (12.35)	37.24 (12.51)
Ethnicity		
White	21 (29.6%)	15 (27.3%)
Asian	28 (39.4%)	22 (40.0%)
Other/mixed	20 (28.2%)	16 (29.1%)
Choose not to answer	1 (1.4%)	1 (1.8%)
Missing	1 (1.4%)	1 (1.8%)
Highest level of education		
High school	8 (11.3%)	5 (9.1%)
University certificate, diploma, or degree	28 (39.4%)	22 (40%)
Postgraduate degree	34 (47.9%)	26 (47.3%)
Choose not to answer	1 (1.4%)	1 (1.8%)
Missing	1 (1.4%)	1 (1.8%)
Occupation type		
Working full-time	28 (39.4%)	22 (40.0%)
Working part-time	8 (11.2%)	5 (9.1%)
Working from home full-time	3 (4.2%)	2 (3.6%)
Working from home part-time	3 (4.2%)	3 (5.5%)
Student full-time	20 (28.2%)	16 (29.1%)
Student part-time	1 (1.4%)	–
Retired	3 (4.2%)	2 (3.6%)
Other	5 (7.0%)	4 (7.3%)
Annual household income		
≤$25,000	8 (11.3%)	5 (9.1%)
$25,000–$50,000	17 (23.9%)	13 (23.6%)
$50,000–$75,000	11 (15.5%)	8 (14.5%)
$75,000–$100,000	6 (8.5%)	4 (7.3%)
≥$100,000	16 (22.5%)	13 (23.7%)
Not sure	2 (2.8%)	2 (3.6%)
Prefer not to disclose	11 (15.5%)	9 (16.4)
Body mass index, kg/m^2		
Underweight (<18.5)	1 (1.5%)	1 (1.8%)
Normal range (18.5–24.9)	42 (59.2%)	33 (60.0%)
Overweight (25.0–29.9)	16 (22.5%)	10 (18.2%)
Obese (≥30.0)	8 (11.2%)	6 (10.9%)
Missing	4 (5.6%)	5 (9.1%)
Do you have a standing desk at work?		
Yes	7 (9.9%)	5 (9.1%)
Occupational sitting, mean (SD), min/d	464.66 (279.22)	449.86 (298.29)
Meeting PA guidelines		
Yes	45 (63.4%)	27 (49.1%)
No	25 (35.2%)	28 (50.9%)
Missing	1 (1.4%)	–
Leisure SB, mean (SD), min/d		
Weekday	513.82 (333.10)	398.25 (249.45)
Weekend	520.85 (314.18)	452.91 (222.91)

Abbreviations: PA, physical activity; SB, sedentary behavior. Note: Values are presented as mean (SD) or number (percentage).

Table 2   Barriers and Facilitators to Using the Standing Desk

Barriers	Facilitators
Desk characteristics (n = 37)	Modifications to desk (n = 12)
• Unstable	• Increase/decrease height
• Incorrect height	• Postural aids (shoes and cushioned floor mat)
• Limited surface area	• Increase surface area
• Cardboard material	
Physiological consequences (n = 18)	Physiological benefits (n = 5)
• Physical pain (soreness, tightness, and strains)	• Pain reduction
• Discomfort	• Improves posture
Home environment (n = 16)	Home environment (n = 5)
• Lack of space	• Good location
	• Change in scenery
Task (n = 12)	Task (n = 18)
• Unsuitable for task (ie, multiple computer monitors)	• Suitability to task (ie, laptop work)
	Cues and prompts (n = 7)
	• Desk as a visual reminder

Note: n is the number of participants who reported factors related to the category.

Even so, 43 of 55 (78%) participants reported that they would continue using the standing desk, and 32 (58%) participants would recommend the desk to family and/or friends.

Qualitative Data: 6-Month Maintenance

Interviews were completed with 49 participants at 6 months. Of these, 21 participants were still using the standing desk (42.9%). Of the participants who were no longer using the desk (n = 28), common reasons given for discontinuing use included desk characteristics (not height adjustable, unstable; n = 6), experiencing lack of motivation or negative outcomes (tiredness, discomfort; n = 5), and low exposure (not at home; n = 7). Half of these individuals still had the desk (stored away), and the other half removed the desk from their house (recycled or took to work).

Discussion

This study presents research that describes participants' level of engagement, factors influencing their desk usage, and acceptability of a low-cost standing desk in their home environment. Most individuals reported using the desk 1 to 2 days a week anywhere from 5 minutes per day to 2 hours per day. Factors influencing desk usage were desk characteristics, modifications made to the desk, physiological benefits and consequences, the home environment, suitability for the task, and cues and prompts. Participants in this study reported that as a novel component of the home environment, the desk itself acted as a visual reminder to stand and use the desk. Regarding acceptability, participants liked that the desk was affordable, easy to set up and move around, and they liked having the option to change positions. At the end of 4 weeks, most participants were still using the desk, yet only half of these participants were still using the desk after 6 months. There was also a self-reported 140-minute decline in leisure-time SB over the initial 4-week period but just during the work week. This reduction is slightly greater than what has been found in standing desk interventions at work (eg, 33–137 min/8-h workday[10]); however, we must be cautious in this comparison as we did not use an objective measure of SB.

The most common barrier was the inability to adjust the height of the standing desk, which many participants reported being the reason they stopped using the desk. This was due to the low cost and nonadjustable nature of the desk. However, 2 studies in Australia[18,19] using costlier, adjustable sit-stand workstations in the office have also identified barriers related to the design of the workstation (unstable work platform, height adjustability restrictions for taller users or certain office setups, and reduced desk space). In our study, some participants made modifications to the desk either by increasing their own height by standing on stools, books, or heighted platforms, or by increasing the height of their desk by placing the desk on heightened objects. Surface area was also increased in some cases by adding additional cardboard materials to the outer edging of the surface, and participants used postural aids such as wearing shoes or standing on a cushioned surface. Another concern related to the design of the desk in this study was that it was aesthetically unpleasing. Participants were concerned that the desk did not match their home interior, and some participants painted the cardboard or placed a table cloth over the desk to make it more visibly pleasing. In comparison, office workers were not concerned with the appearance of the desk in their workplace.[18] Finally, a unique barrier to the home environment is the lack of space for the desk, with many participants expressing how they would like the desk to be portable, easier to move around, and to store away. Future implementation should use standing desk models that take into consideration some of these design aspects, including the aesthetics, material, and portability of the standing desk that make it more suitable for the home environment.

We conducted a modest recruitment campaign over a 1-month period demonstrating interest in trying a standing desk at home. We recruited a diverse sample of individuals within the study including by gender, income, employment status, and ethnic background. Notably, the majority of the sample self-reported meeting physical activity guidelines, and it is possible that invitations to participate in SB interventions are more salient for active individuals. The sample was well educated and residing within a large university campus, so findings may not generalize to other home settings. All measures were self-reported and subject to social desirability and recall limitations.

This is the first study to explore acceptability of standing desks in the home environment. There was interest in using standing

desks in the home, and the desks used were largely considered acceptable in both the short and long term. The (micro) home environment remains a potentially important context for SB intervention on both theoretical and pragmatic grounds.[11] Future research could explore the feasibility of interventions aimed at reducing sedentary behavior in this setting using objective measures of SB and appropriate control conditions. Examining whether reductions in SB during leisure hours or during the day for those who work at home have meaningful physical or psychosocial benefits requires elucidation.

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