

Reducing Sitting among College Students by Promoting Standing Work Stations in Hallways: A Pilot Feasibility Study

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ABSTRACT

Purpose: Strategies to reduce sitting include the use of standing workstations, yet little research has explored their feasibility in college settings. The purpose of this study was to describe student use and perceptions of hallway standing workstations. **Methods:** Standing workstations were installed in a hallway near classrooms; email and infographic posters encourage students to use them between classes. Data on use of the stations was collected for eight weeks via a QR-directed login. Students who logged use of the stations were sent a follow-up survey on duration of station use and attitudes regarding standing stations on campus. **Results:** Logged use of the stations averaged 14.75 frequencies per week, primarily between 9:30 a.m. and 12:30 p.m. Slightly over 12% of students enrolled in nearby classes logged use of the stations at least once. Post-study survey responses indicated typical station use length was 15 to 45 minutes, and 95% of users liked the stations and desired more across campus. **Conclusion:** Creating standing workstations in hallways was an inexpensive and space-efficient strategy to change the university environment to create opportunities to reduce sitting behavior. Combined with email and visual prompts, many students chose to stand and engage in work between classes.

Keywords: sitting, standing, college students, sedentary behavior

1. INTRODUCTION

Overwhelming evidence indicates that physical activity plays an integral role in elevating both physical and mental health, and serves to prevent chronic illness and obesity (Ratey & Loehr, 2011; Warburton et al., 2006; World Health Organization, 2010). It is also well-documented that inactivity (sedentary behavior) is linked to poor health outcomes including increased central body fat, stress hormone levels, and risk for diabetes, cancer, and all-cause mortality (Biswas et al., 2015; Hahn et al., 1990). Research on sedentary behavior has often focused specifically on the amount of time spent sitting (for reviews, see Owen et al., 2010; Tremblay et al., 2010). The hazards of high amounts of sitting were first highlighted in the 1950s in a study finding that London bus drivers (who sat for a large portion of their work day) had a greater risk for heart attacks than bus conductors (whose jobs required less sitting) (Morris & Heady, 1953). Subsequent epidemiological research has provided strong evidence that sitting time is associated with increased risk for many physical and mental health problems (e.g., diabetes, cardiovascular disease, obesity, depression) as well as all-cause mortality (Hamilton et al., 2007; Katzmarzyk et al., 2009; Van Uffelen et al., 2013; Wilmot et al., 2012). More than one-half of an average person's waking hours are spent in activities associated with prolonged sitting, such as watching television and using a computer (Matthews et al., 2008). Given these findings, reducing sitting time has been identified as a health promotion goal (Clemes et al., 2020; Franklin et al., 2010; Keadle et al., 2017; Plotnikoff, & Karunamuni, 2012; Strieter et al., 2021). The most impactful interventions for changing sitting time may be those that target environments where people spend a majority of their time sitting, including work sites, K-12 schools, and universities. Among proposed environmental interventions, replacing traditional desks with standing or adjustable height workstations has been studied primarily in worksite and K-12 school settings (for reviews, see MacEwen et al., 2015; Minges et al., 2016; Sherry et al., 2016).

Studies examining the effects of introducing sit-stand workstations in *worksite settings* (see Shrestha et al., 2018, for a review) consistently show a reduction in sitting time (e.g., Alkhajah et al., 2012; Carr et al., 2016; Weatherson et al., 2020; Wilks et al., 2006). These studies have also reported health-related benefits including reduced musculoskeletal discomfort, reduced body fat, and improved mood (Danquah et al., 2017; Hedge & Ray, 2004; Pronk et al., 2012). In addition, there is evidence that office workers prefer adjustable-height workstations to traditional sitting desks (Hedge & Ray 2004) and using them leads to higher office work productivity (Garrett et al., 2016). Replacing traditional desks with standing workstations has also been studied extensively in *K-12 school settings*, most often in elementary schools (for reviews, see Minges et al., 2016; Sherry et

al., 2016). Standing stations in classrooms have been shown to reduce sitting time (e.g., Sprengeler et al., 2020; Sudholtz et al., 2016) and increase caloric expenditure (Benden et al., 2011, 2012, 2014). In addition to these movement and health-related outcomes, students and teachers have consistently reported positive attitudes about having standing workstations in classrooms (Aminian et al., 2015; Erwin et al., 2018; Hinckson et al., 2013) and some faculty perceived an improvement in student attention and engagement (Blake et al., 2012).

Investigations of standing work stations in the university setting are sparse. College students spend large portions of their days sitting (Peterson et al., 2017; Rouse & Biddle, 2010), and survey and qualitative interview-based studies (Benzo et al., 2016; Cowgill et al., 2021) indicate that university students support the idea of introducing standing work stations. In two studies (Green et al., 2020; Jerome et al., 2017), standing workstations were placed in classrooms and student volunteers alternated sitting/standing during the semester. Jerome et al. (2017), using video recordings of class meetings, reported significant decreases in time spent sitting and increases in standing time when standing desks were used. Surveys of participants in the Green et al. (2020) indicated 75.0% perceived positive effects of standing on alertness, 69.3% on attention and focus during class, and 47.8% on class participation.

Thus, research on standing desks in the college setting has shown that, when students stand at workstations in a classroom, their sitting time is reduced and they report positive attitudes about the experience. However, one question that has not been addressed is whether students will take advantage of standing workstations in their environment. The feasibility and acceptability of strategies to reduce daily sitting time have been identified as important questions for the study of sedentary behavior (Healy et al., 2008; Owen et al., 2010). In addition, the limited study of standing workstations has focused on using them in the classroom. Yet, it may be possible to promote reduced sitting by creating standing workstations in other university areas where students commonly sit. Mnich et al. (2019) explored this idea by adding standing work stations in *study areas* of one university. Observational data was collected (the number of students sitting vs. standing) for a baseline period then a second interval after posters and table signs were added which promoted the standing choice. The results indicated that 5.6% of students chose to stand during the first part of the study, with standing increasing to 10.9% after the signage intervention. The purpose of this study was to continue this line of inquiry by examining the feasibility, use and perceptions of standing workstations in university *hallways*, locations where college students often spend time between classes.

2. METHODS

2.1 Context and Description of the Standing Work Stations

The study was conducted at a mid-sized public regional university in the southeastern United States. Prior to the initiation of the project, the researchers engaged in pilot work by placing three portable standing workstations in a hallway near classrooms. Signs were posted on the wall at each station that provided a brief rationale for using the standing desk instead of sitting. The researchers intermittently monitored student use of the stations and had conversations with students using them. One student recommendation was that hallway standing stations be located near electrical outlets to charge laptops computers and cell phones.

Over the summer, two fixed standing work stations were installed in a hallway near four classrooms. Both stations were platforms 10 feet long and 16 inches wide. One was 39 inches from the floor; the other 45 inches. Both standing work stations provided spaces for three students to work that included an electrical outlet with USB charging input (see Figure 1). The standing work stations were constructed and electrical work completed by the university's physical plant staff; the entire job cost the department \$540. At each station, an infographic highlighting the benefits of standing was placed on the wall (Agency Central, n.d.; see Figure 2). It also included a QR code that could be used to log use of the station.

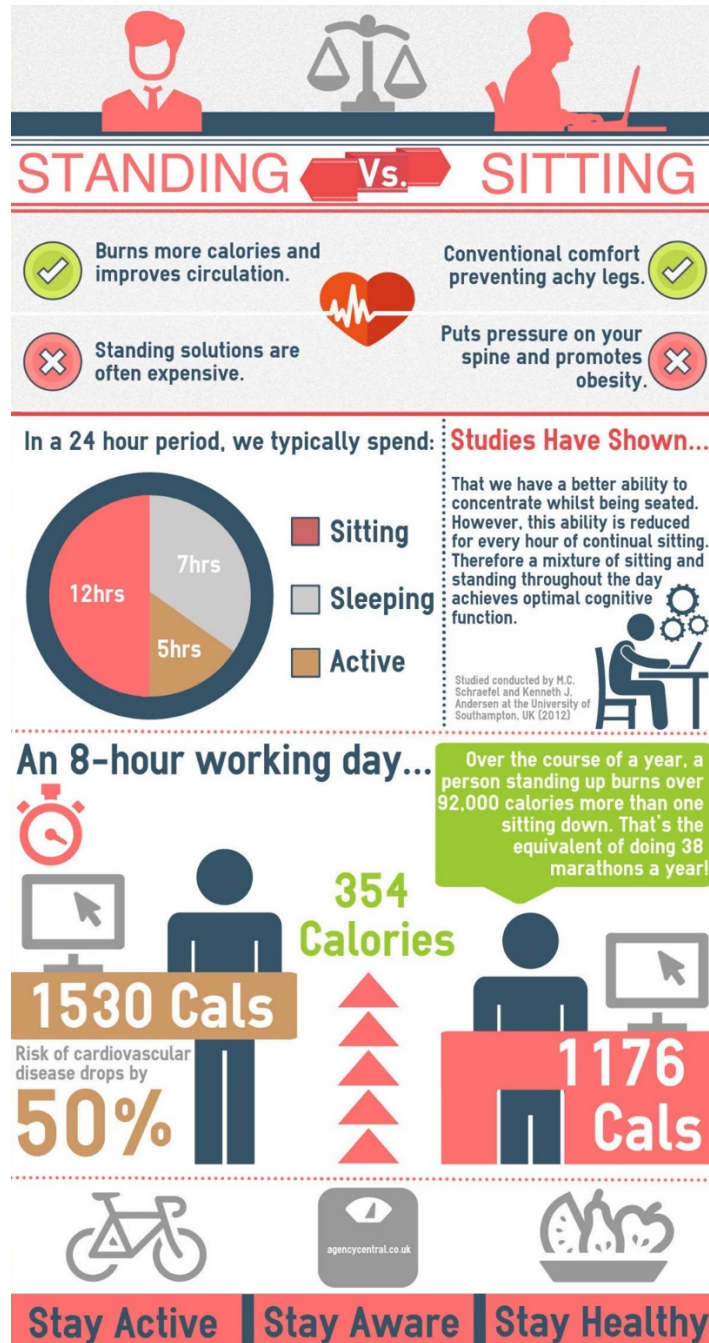
Figure 1

Photograph of Hallway Standing Work Station



Figure 2

Sign Promoting Using Standing Work Station



2.2 Data Collection and Analysis

During the fall 2022 semester, 26 courses were taught in the four classrooms in the hallway where the standing work stations were located. At

the start of the semester and again two weeks later, students enrolled in these classes and those pursuing degrees in the department housed in the building were sent email messages. Emails informed students about the new standing work stations in the hallway, encouraged them to use the stations between classes or when in the building, and requested students use the provided QR code to log in when using a station. The QR code linked to a brief Google Survey that indicated students were voluntarily providing research data on use of the standing work stations. Data collected was the student's ID number and the day and time of the login. Logged use of the work stations was collected for eight weeks.

A second source of data was gathered from a survey of students who had logged work station use. Eight weeks after the start of the semester, students who had logged use of the standing work stations were sent an email inviting their completion of a brief online survey. The survey gathered demographic information (age, sex, and academic classification), and included two items inquiring about the frequency and duration of their use of the workstations. The first question asked, "How often do you use the standing hallway work stations?" Response options were (a) Less than once a week, (b) once a week, (c) twice a week, and (d) three or more times a week. The second question was "When you use a standing hallway work station, how long do you typically use it?" Participants chose from the options: (a) less than 15 minutes, (b) 15 to 30 minutes, (c) 30-45 minutes, and (d) 45 minutes or longer. Additionally, participants responded to three items using a 5-point Likert scale (Strongly Disagree to Strongly Agree): (1) "I like the standing work stations in the hallway," (2) "I like the idea of using a stand-up station to decrease the amount of time I spend sitting during the day," and (3) "I wish there were more standing work stations in hallways of other buildings on campus."

3. RESULTS

3.1 Use of Standing Work Stations

Over the eight weeks, there were 118 recorded logins at the work stations, an average of 14.75 per week. Use of the stations were logged throughout the day, with peak use between 9:30 am and 12:30 pm. Of the total 118 logins, 20.3% (n=24) were before 9:30 a.m., 33.1% (n=39) were between 9:30 and 10:59 a.m., 25.4% (n=30) from 11:00 a.m. to 12:29 p.m., 13.6% (n=16) from 12:30-1:59 p.m., and 7.6% (n=9) after 2:00 p.m.

Examination of ID numbers provided during logins indicated 51 students had logged using the stations. Most of these students (86.3%, n=44) were enrolled in at least one class taught in classrooms near the standing work stations; 28 were enrolled in one class and 16 were enrolled

in 2 or more classes taught in these nearby classrooms. By comparing login ID numbers and class rosters, it was determined that these 44 students represented 12.1% of the 363 students enrolled in classes taught in the classrooms in the designated hallway.

3.2 Survey Results

Of the 51 students who were sent the end-of-study survey, 48 responded (31 female, 17 male, 81% at the junior/senior level). Self-reported frequency and typical duration of use of the standing work stations are shown in Figures 3 and 4. Slightly over 80% of respondents reported using the stations once a week or less; with 16% twice a week or more. Self-reported duration of use was highest for 15 minutes or less (37.5%, n=18) and 30-45 minutes (35.4%, n=17).

Perceptions of the hallway standing work stations were overwhelmingly positive (see Table 1). Over 95% of participants liked the stations and wished there were more in hallways across campus, and 77.1% had a positive attitude about using these types of stations to decrease sitting time.

Figure 3

Frequency of Standing Workstation Use as Reported by Users

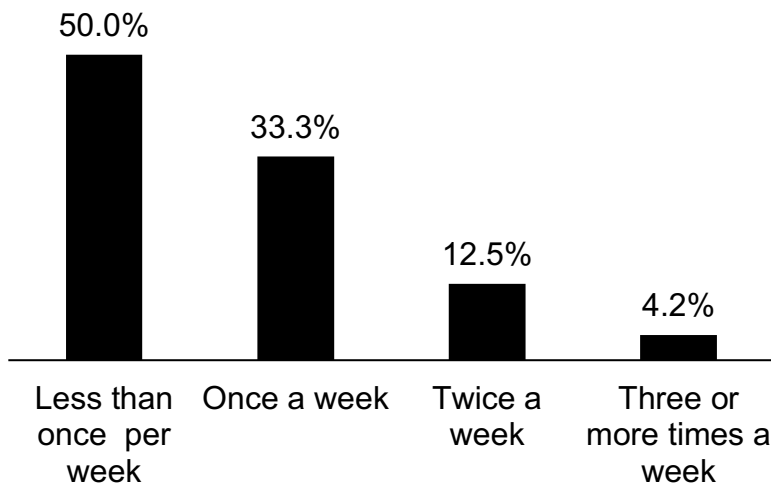


Figure 4

Duration of Standing Workstation Use as Reported by Users

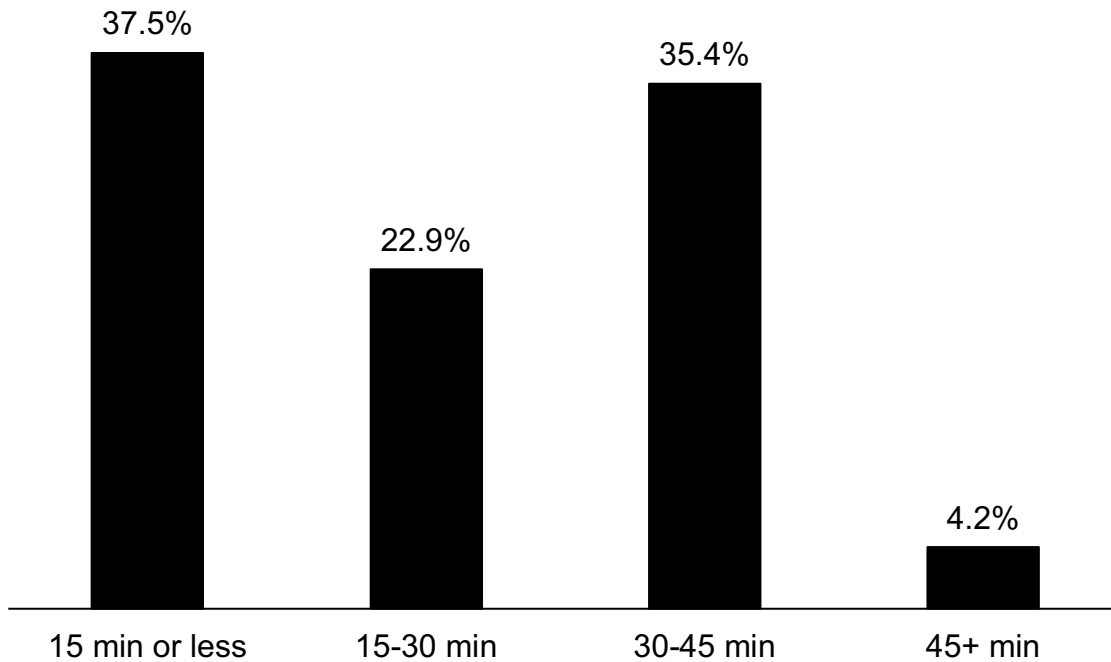


Table 1

Survey Responses Regarding Perceptions of Standing Work Stations in Hallways

Item	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)
I like the standing work stations in the hallway	0 (0.0%)	0 (0.0%)	2 (4.2%)	5 (10.4%)	41 (85.4%)
I like the idea of using a stand-up station to decrease the amount of time I spend sitting during the day	0 (0.0%)	2 (4.2%)	9 (18.8%)	2 (4.2%)	35 (72.9%)
I wish there were more standing work stations in hallways of other buildings on campus	0 (0.0%)	0 (0.0%)	2 (4.2%)	8 (16.7%)	38 (79.2%)

4. DISCUSSION

In response to evidence of the negative health implications of sitting for extended periods of time, the use of standing (or adjustable height) workstations has been proposed as a means to reduce sitting time. Research on the feasibility and effects of standing work stations in educational settings has primarily been conducted in early grades of K-12 schools (for reviews, see Minges et al., 2016; Sherry et al., 2016); very little study has been conducted in the college setting. Previous survey-based studies (e.g., Benzo et al., 2016; Laine et al., 2017) indicate that college students realize they sit most of the day, acknowledge the need to decrease sitting behavior, and would be interested in more opportunities to stand on campus. While few studies have examined student responses to standing in the college classroom, early findings indicate that when college students try standing desks, they have positive experiences. In their study of 22 college students, Chrisman et al. (2020) found that 64% who tried standing desks reported they would stand in class given the opportunity to improve their health and be more alert/attentive in class. Similarly, in their study of 48 college students who alternated sitting and standing in class, Green et al. (2020) found that 91% of students were interested in standing opportunities on campus, and most felt their ability to concentrate and level of alertness in class was higher when standing than sitting. While these early studies are positive, it has yet to be determined whether college students will stand if changes in school environment are made that provide them opportunities to do so. Surveys of students suggest barriers to using standing stations exist (Laine et al., 2017); college students may find it socially unacceptable to stand in class (Cowgill et al., 2021) or are just not interested in doing so due to fatigue or other reasons (Chrisman et al., 2020; Green et al., 2020).

This study sought to extend existing research in the college setting by creating standing work stations in an academic hallway, marketing the stations and benefits of reducing sitting, then collecting data on station use and student perceptions. Results indicated that hallway work station use was logged by 51 students over the eight weeks of data collection. Logins averaged 14.75 times per week. Consistent with the schedule of classes in this hallway, use was highest during the morning, and most users were juniors and seniors. Stations were used by 12.1% of students enrolled in classes in the hallway where stations were located, as well as by students who did not have classes in the building. Most participants indicated using the stations no more than once a week, and for durations longer than 15 minutes, although frequency and length of use varied considerably. Among students who used the work stations, over 95% liked using them and expressed interest in having more in other buildings on campus. While these results should be positively interpreted, it was also evident that many

students enrolled in classes near the standing work stations chose not to use them, and this is consistent with previous research indicating that not all students are interested in standing more on campus (Chrisman et al., 2020; Cowgill et al., 2021; Green et al., 2020; Mnich et al., 2019).

There are two recognized limitations of this study. First, classes scheduled in classrooms near the standing work stations were primarily those taken by students majoring in kinesiology, health sciences, health and physical education, sport management, and athletic training. This student population, who are pursuing degrees related to health, physical activity, and sport, may be more open to health-promoting environmental changes (such as reducing sitting) than students pursuing other majors. Future research on the use of this type of intervention in the college setting should examine locating standing work stations in buildings housing a variety of degrees and courses. Second, students were encouraged to use a provided QR code to register their use of the stations, and data on use frequency were derived from these logins. Given the public setting of the stations, more accurate monitoring (e.g., using a video camera, or posting a researcher to record station use) was not undertaken. The voluntary self-report use of the work stations likely under-reflected actual use. Future studies may pursue more accurate measuring strategies.

In summary, we created opportunities for college students to reduce sitting behavior between classes by installing relatively inexpensive standing workstations in hallways that included electrical charging stations, and promoted their use via email and wall posters. Stations were used 14-15 times a week during data collection and these stations continue to exist and are used on a regular basis.

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6.1 Disclosure of Funding Sources

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6.2 Conflict of Interest

The authors declare no conflicts of interest.

6.3 Contribution of Authors

EH: study pilot work and design, IRB approval, data collection and analysis, manuscript preparation.

HR: study design, data collection, manuscript preparation

RG: study pilot work and design, manuscript editing

CB: study pilot work and design, manuscript editing

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