

Are sit-stand workstations worth the investment?

What the research says about sit-stand workstations, including how to ensure you get the benefits you're paying for

Wellnomics[®] White Paper

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Introduction

Electric sit-stand workstations are all the rage currently, and they're also much more expensive than standard desks. Are they worth the additional investment? This paper takes a comprehensive look at the published evidence on sit-stand workstations to answer this question.

There is certainly clear evidence that sedentary behavior or “too much sitting” is related to multiple negative health outcomes¹, including metabolic syndrome, diabetes, cardiovascular disease, strokes and heart attacks and even cancer. With vehicle based travel and screen based entertainment in the home modern lifestyles have become increasingly sedentary. Added to this, many modern workers are in office based jobs that are also predominantly sedentary.

The general public has been hearing for years about the health risks associated with physical inactivity and as a result public health guidelines advise us to engage in at least 150 minutes of moderate-intensity activity each week to reduce these health risks.

One of the surprising results from the recent research though, is that the risks associated with sedentary behavior (sitting too much) appear to be *independent* of physical activity. In other words, even if you meet the public health guidelines for and exercise regularly, if you're spending a large proportion of your day sitting you still have an increased health risk. It's not enough to exercise regularly – we also need to spend less time sitting¹.

For workers with office based jobs this means it's no longer enough just to get regular exercise outside work. With the office likely counting for a significant proportion of the day's sitting time there is a need to intervene directly in reducing sedentary time in the workplace itself¹. It's this conclusion that has motivated the following recommendation from an international group of experts assembled by Public Health England²

*“...for those occupations which are predominantly desk based, workers should aim to initially progress towards accumulating **2 h/day of standing** and light activity (light walking) during working hours, eventually progressing to a total accumulation of **4 h/day** (prorated to part-time hours). To achieve this, seated-based work should be regularly broken up with standing-based work, the use of sit–stand desks, or the taking of short active standing breaks.”² (emphasis added)*

This recommendation has significant implications for employers. How do they ensure office staff achieve up to 4 hours per day of standing and light activity in a job that is normally assumed to be almost 100% sedentary/sitting?

This challenge has resulted in a surge of interest in sit-stand workstations, with the expectation that providing these to office staff will reduce sedentary behavior and thereby mitigate the health risks. But are sit-stand workstations the only option? How effective are they in a real office environment? And do they have any downsides?

To help employers in making decisions we need to answer some key questions:

- Exactly how sedentary is office work? How much additional activity is needed?

- What non-sit-stand interventions are there for reducing sedentary behavior in the workplace? How effective are they?
- How effective are sit-stand workstations? What do employers need to do to ensure their investment actually delivers the promised health benefits? And are there any negative effects from introducing a new 'standing work' paradigm to the workplace?

These questions are looked at in detail in the following sections with the goal of identifying evidence based recommendations for employers wanting to ensure their investment in sit-stand workstations delivers real results.

How sedentary is office work currently?

If we're to aim for 2-4 hours of standing and light activity per working day² we need to first know the increase this represents over the current situation. It might be assumed that office work is currently 100% sedentary. However, this isn't quite the case.

Looking at six different studies done in the last 3-4 years and using objective measurements of posture in the workplace (using accelerometers) the levels of sedentary behavior have been found to vary from 57%³ of working time (with the rest in light activity), 71%⁴ to 77-82%^{5,6,7,8}. Although there is some variation depending upon job type (call center workers having more sedentary time and customer service workers less sedentary time than average⁸) the most common picture is of around 80% of the time in offices being spent sitting. The conclusion below is representative:

"Office work is characterised by sustained sedentary time and contributes significantly to overall sedentary exposure of office workers." ⁷

These results suggest an 8 hour working day for office based work typically consists of up to 6.5 hours sitting, meaning 1.5 hours of non-sedentary activity per day. So to achieve the suggested long term goal of 4 hours standing and light activity per working day we need to increase non-sedentary time by approximately 2.5 hours per day – a significant amount.

What are the options for achieving this? Are sit-stand workstations the only, or best, option?

Interventions to reduce sedentary behavior in the workplace

With the existing awareness of the negative effects of physical inactivity there has already been a focus in recent years on increasing healthful activity amongst employees. A variety of interventions have been looked at including providing physical activity and active living advice, pedometers, motivational emails and hints on incidental walking.

Looking at the effectiveness of these a 2009 meta-analysis reviewed interventions such as fitness facilities at the workplace, supervised exercise, motivational sessions and exercise advice⁹. The authors found that

physical activity generally increased and fitness and cholesterol improved with these interventions, though analysis was difficult given the large variations in study design and interventions. Another research group¹⁰ promoted the use of stairs within a workplace. They found that this was as successful strategy to increase stair use, increase fitness, decrease weight, blood pressure and cholesterol. Websites within workplaces have also been found to increase physical activity and improve knowledge and attitudes¹¹.

These results are encouraging. However, although increasing physical activity at work is clearly beneficial the recent research¹ indicates clearly that we need to reduce sitting time as well. So do these interventions also reduce sedentary behavior?

Unfortunately the results suggest limited success on this count. One 2011 intervention study¹² implemented a 'challenge' in workplaces whereby teams used pedometers to log their steps. Supported by the provision of health information, communication and progress reports the study found sitting time decreased by 0.6 hours per day. However, this result does not appear to be typical. A 2010 systematic review of research on interventions to reduce sitting¹³ found most studies had a focus on increasing activity (with counselling, advice, email messages, pedometers and walking advice) rather than reducing sitting. And none of the studies showed significant differences in sitting times between the intervention group and control groups.

So these more traditional interventions are certainly beneficial from a health perspective, but they don't appear to be successful at reducing sedentary behavior to any significant degree. So are sit-stand workstations the answer?

The research on sit-stand workstations

Sit-stand workstations are increasingly being seen as *the* answer to reducing sedentary behavior in the workplace. But how effective actually are they? What steps are needed to maximize their benefits? And do they introduce new risks? This section looks to the research literature for answers.

Do sit-stand workstations significantly reduce sitting time?

A number of studies have looked at exactly this question, with four recent studies comparing intervention groups provided with sit-stand workstations to controls with normal desks. Pleasingly, significant reductions in sitting time were recorded in all cases, with reductions of 0.6 hours¹⁴ (4.8 minutes per work hour), 1.2 hours (73 minutes)¹⁵, 1.7 hours¹⁶, 2.1 hours (125 minutes)¹⁷ and 2.3 hours (137 minutes)¹⁸ per day.

The conclusions of the authors are clear:

"...the introduction of a sit-stand workstation can substantially reduce office workers' sitting time both at the workplace and overall throughout the week." ¹⁸

"...introducing sit-stand workstations in the office can reduce desk-based workers sitting time at work in the short term." ¹⁵

"...substantial reductions in sitting time are achievable in an office setting. Larger studies with longer timeframes are needed to assess sustainability of these changes..."¹⁷

Although these results are very promising, the caveats included above are important. These studies were generally done over short periods (typically 4 weeks) and on small groups. Many of these studies also implemented comprehensive training and support to ensure the desks were utilized correctly. For example, the programme for one study¹⁷ included a 45-minute researcher-led consultation with management representatives, a workshop for all intervention participants, regular contact to troubleshoot any difficulties and reinforce active organizational support, emails providing a "standing tip of the week". Participants also received individual verbal instructions on using the sit-stand workstation, 30-minute face-to-face consultations with a master's level health coach, followed by three telephone calls (one per week). The consultations emphasized behavior change strategies (goal-setting, self-monitoring, and use of prompts and problem solving) and included feedback on participants' baseline activity and monitor results, which were used to inform personally tailored goals regarding each of the intervention messages.

Wow! With such extensive support, and likely significant expectation pressure for the intervention participants to change their behavior, it's perhaps not surprising that effective results were obtained.

Another study illustrates this issue, comparing the differences between "Ergonomics Trained" sit-stand workstation users given a 1.5 hour interactive instruction, a sit/stand practice period, and software ergonomic reminders and "Minimally Trained" users¹⁹. Their findings reinforce the critical role of training and ongoing support in achieving results:

"Ergonomics Trained participants experienced minimal musculoskeletal and visual discomfort across the 15 days, varied their postures, with significantly higher performance compared to the Minimally Trained group who had a significantly higher number of symptoms, suggesting that training plays a critical role."¹⁹

So what happens in the real world when sit-stand workstations are introduced? It's an open question whether many organizations implementing sit-stand workstations invest in an extensive programme like those described above, particularly if providing them for all staff. The investment would be a substantial additional cost over and above the already significant cost of sit-stand workstations.

Wilks et al²⁰ surveyed staff at four companies using that had introduced sit-stand workstations and found that 60% used the sit-stand function only once per month or less, with only 20% used it at least once per day. The authors of the study concluded:

"Utilisation of the sit-stand function was less than what could be expected to relieve static musculoskeletal loading during VDU work.... Users were, in general, positive to the worktables, but showed poor compliance in using them. User and purchaser satisfaction with regard to improving individual health ergonomics was questionable in respect of the low level of usage."²⁰

In other words, even though staff were happy with the desks the utilization was so low that any health benefits from introducing sit-stand workstations were unlikely to be realized.

Overall, however, it seems clear that sit-stand workstations can significantly reduce sedentary time. But effective training and ongoing support do appear critical to achieving this effectiveness.

Can sit-stand workstations improve employee health?

The ultimate goal of using a sit-stand workstation is to mitigate the negative health effects of sedentary behavior. To this end the research shows some positive results.

Multiple studies have shown improvements in musculoskeletal discomfort with sit-stand workstations^{21,22,25} and a 2014 literature review²³ covering seven studies found six of the seven showed reductions in discomfort, with the conclusion:

*"sit-stand workstations are likely effective in reducing perceived discomfort"*²³

Additional benefits measured in the research include less foot swelling when standing for 15 minutes in the hour²⁴, increased overall sense of well-being and energy, reduced appetite and dietary intake¹⁴ decreased fatigue²⁵ and increased energy expenditure²⁶.

After introducing standing work blood glucose levels have also been found to reduce by 11%²⁷ (with the introduction of an alternating 30 minute sit-stand protocol) and 43%²⁶ (after a 3 hours standing period). With increased blood glucose levels being one of the proposed mechanisms behind the negative health effects of sedentary behaviour¹ the measurement of reduced blood glucose after introducing standing is a positive sign that the underlying causes of the long term negative health outcomes of sedentary behavior – such as metabolic syndrome, diabetes, stroke and heart attack – are being addressed.

There is not yet sufficient evidence to say that use of sit-stand workstations can reduce the incidence of these negative health outcomes. However, early results show clear benefits, and these may eventually lead to long term improvements in health outcomes also.

Are there any downsides to using sit-stand workstations?

Sitting is bad for you, but unfortunately so is prolonged standing. One concern with sit-stand workstations is users could replace prolonged sitting with prolonged standing, which has its own health risks.

Musculoskeletal discomfort

Spinal height has been found to be reduced more when working in a standing position compared to sitting²⁸. While this is not necessarily linked to back pain or discomfort other studies have found that back pain is reported with prolonged standing at work^{29,30}, although this issue is worst when the standing is done at work without the freedom to sit³¹, which should not be the case for office workers using a sit-stand workstation.

Lower limb and foot discomfort is also reported with prolonged standing at work more than when sitting³⁰,³² with this issue appearing to be vascular in origin (related to circulation)^{33,34}.

Progression of carotid atherosclerosis

A significant association between the amount of standing at work and the progression of carotid artery wall thickening has been found³⁵. This study also found that men with carotid artery narrowing or ischemic heart disease were especially vulnerable to the adverse effects associated with standing at work.

Chronic venous disease

Chronic venous disease is a common disorder that affects the veins of the legs[†]. If the valves within the veins do not work properly, blood can pool in the legs increasing the pressure in the veins. Symptoms of chronic venous disease include varicose veins, leg swelling and leg pain. Standing or sitting for too long without walking can decrease blood flow out of the legs and result in increased pressure on the veins. A 2007 study that examined multiple risk factors for the development of chronic venous disease in office workers found that while prolonged sitting and standing are both risk factors, standing was a greater risk than sitting³⁶. Other studies have also found varicose veins associated with prolonged standing at work^{37, 38}. Furthermore, a large, prospective Danish study in 2005³⁹ found that workers standing or walking at least 75% of their working time were significantly more likely to be hospitalized for varicose veins than other employees. The authors concluded,

"This prospective study confirms that prolonged standing at work constitutes an excess risk of hospital treatment due to varicose veins and accounts for more than one fifth of all cases of working age" p.847³⁹

They go on to recommend that standing and walking at work should be limited and alternate with other positions such as sitting.

In summary, given prolonged standing has its own risks it's important that prolonged sitting is not simply substituted for long periods standing instead. The benefits of a sit-stand workstation lie in the ability to adjust work positions from sitting to standing and back again regularly.

Do sit-stand workstations affect productivity?

A 2014 review paper looking at this question reviewed eight studies on sit-stand workstations that included productivity measures²³. Three of the studies reported an increase in productivity during sit-stand work, four reported no effect on productivity, and one reported mixed productivity results. The review therefore concluded that based upon the evidence to date:

"...sit-stand workstations do not cause a decrease in productivity."²³

What environmental aspects affect the use of sit-stand workstations?

The research indicates a number of practical, organizational and personal reasons can affect utilization of the sit-stand workstations in the workplace. One is the design of the sit-stand workstation¹⁶ such as the surface that can be raised being too small, or problems with the adjustability mechanism (for example, not tall enough or unbalanced). Generally desks where the entire work surface is height adjustable is preferred as are electric mechanisms compared to manually operated ones. Another is the perceived productivity in different positions^{16, 40} with some preferring to sit or stand to do specific tasks, for example, sitting to read and standing to type or vice versa.

Use of sit-stand workstations is also influenced by the culture of the work groups with use increasing as more co-workers also stood to work and it became the 'norm'^{16, 40}. In one study²⁰ the most common reason for not using the sit-stand workstation was that people simply 'did not bother' to use it. This may

[†] <http://www.uptodate.com/contents/chronic-venous-disease-beyond-the-basics>

be to do with lack of understanding of the benefits of varying positions or how to use the desks, or it may be that people simply did not remember to adjust the desk regularly. Those who received instructions were more frequent users than those who had not received instructions¹⁹ and provision of information may improve commitment and uptake¹⁶.

Also, as mentioned in an earlier section, training in use of sit-stand workstations, practice in moving to standing and working for periods of time, and email reminders, have all been shown to improve musculoskeletal and visual discomfort, posture variation and performance compared to those who received no coaching, no reminders and no mandatory standing practice¹⁹. One study⁴⁶ demonstrated that using prompting software, which reminded participants to take a break from sitting appeared on-screen for one minute every 30 minutes, resulted in less frequent and less prolonged periods of sitting compared to those who received education only.

Overall the provision of sit-stand workstations is well received by workers^{30,16,40}. Even where utilization has been poor²⁰ 78% of participants still considered that the sit-stand workstations had improved their working environment.

Implications for use of sit-stand workstations in the workplace

The research shows sit stand workstations as potentially one of the best solutions for achieving significant reductions in sedentary behavior in the office and improving related health measures without negatively affecting productivity.

However, it appears that that without a significant investment in organizational and individual change management and ongoing support the long term utilization of sit-stand workstations may be considerably lower than that needed to obtain useful health benefits. Although there are ways to maximize user acceptance of and satisfaction with sit-stand workstations, user acceptance does not appear to be the main barrier. The issue is perhaps more one of user motivation and achieving sustainable behavior change.

Staff and management may like having sit-stand workstations, but unless steps are taken to ensure they are properly utilized the investment in sit-stand desks could be wasted from a health perspective.

More research is needed looking at the long term utilization of sit-stand workstations in the workplace and identifying reliable and cost-effective methods for maximizing and maintaining the benefits sit-stand workstations can offer with regard to reducing sedentary/sitting time and introducing regular postural change.

Recommendations for sit-stand workstations

Based upon the research findings to date summarized in this paper the following recommendations can be made for sit-stand workstations and their introduction and use within the workplace.

Consider the design of the sit-stand workstation carefully

The latest European standard recommends sit/stand workstations support an adjustability range between 26 inches (650mm) and 49 inches (1250mm)⁴¹.

Electric desk height adjustment is preferable to manual adjustment. The lower effort required and greater ease of use means users of electric sit-stand workstations are more likely to adjust the desk often[†].

Preferably, the whole desk surface should be raised and lowered so different tasks are not impeded by the change in working position. In addition, all cables should be able to move easily when the work surface is adjusted.

Ensure the floor surface and shoes are appropriate

A carpeted or other softer surface has found to be better than a harder surface (concrete or lino) in terms of perceived comfort^{42,43}, lower leg swelling⁴⁴ and fatigue³⁷.

Wearing comfortable flat-soled or non-heeled shoes when standing is also important and has been found to decrease the prevalence of varicose veins³⁷.

Don't replace prolonged sitting with prolonged standing

The risks of prolonged standing are well established and it's important that in the move to decrease prolonged sitting these risks are not overlooked. Sit-stand workstations should be used to provide a way for workers to vary their position not to simply stand to work⁴⁵. Additionally, workers should be given time to adapt to the change to a standing working style – with a gradual transition to increased standing time over time^{2, 17}.

Provide information, training and reminders

Users should be provided with up-to-date information about the risks of prolonged sitting and standing and the benefits of varying working positions throughout the day. Training should be provided so that the operation of the sit-stand workstation are well understood and optimal working heights in both standing and sitting positions are clear for each user. Training should include advice on footwear, standing surface and guidelines for optimal times to be spent sitting or standing (see further below).

Software reminders can enhance the uptake and use of the sit-stand workstations and increase posture variation^{19,46}.

Limit sitting and standing times and encourage regular postural change

The guidelines in the literature for the optimal intervals between sitting and standing vary. However, current recommendations, based largely on expert consensus and emanating from musculoskeletal medicine, are that postural change should occur at least every 20 to 30 minutes⁴⁷. Positive health effects have been found with standing for 15 minutes an hour²⁴. In addition, it's been found that musculoskeletal discomfort from standing for 45 minutes was not mitigated by 15 minutes sitting⁴⁸, suggesting 45 minutes is too long a period to stand. Recent expert consensus recommendations are to aim for 2 hours per day of non-sitting time, eventually progressing to 4 hours in an 8 hour working day². With the average office worker only achieving about 1.5 hours currently, this suggests we need to aim for an additional 0.5 to 2.5 hours of standing. To achieve this between 10% and 40% of the current sitting time needs to be converted to standing time.

Given these numbers its recommended that standing should be for at least 10 minutes per hour but less than 45 minutes before a transition to sitting, with at least two transitions between sitting and standing per hour. Over time standing should be increased to at least 20-25 minutes per hour.

Overall this implies at least two postural changes per hour, or 16 postural changes in an 8 hour work day. Considering the relatively high frequency of the postural changes this represents, together with the need to substantially increase standing time but also not stand too long, it's likely that users may find it challenging

to maintain the an ideal sit-stand protocol consistently over time. The use of reminders of some sort may therefore be key to ensuring satisfactory compliance and maximize utilization of sit-stand workstations.

Conclusions

The research appears to strongly support sit-stand workstations as a suitable workplace intervention for achieving the significant reductions in sedentary behavior that experts are asking for. Full size electronically adjustable sit-stand workstations are recommended.

Positives to sit-stand workstations include:

- High user acceptance
- No reduction in productivity
- Reduced discomfort and higher energy
- Reduced blood glucose levels

Negatives include:

- High cost of purchase
- Potential negative health outcomes from standing too long
- The need for significant training and ongoing support to achieve good utilization

Achieving optimal health benefits from sit-stand workstations means getting users to:

- Change posture at least two times per hour
- Replace up to 50% of their existing sitting time with standing
- Spend no more than 45 minutes standing in one period

The biggest challenge for employers considering sit-stand workstations is the significant behavior change required for users to realize the health benefits and avoid potential negatives. Just providing sit-stand workstations to staff is, by itself, unlikely to be effective. The research suggests that a significant additional investment is required in training and support to ensure workstations are properly utilized, and ensuring this is sustained, with this being key to achieving a good return-on-investment.

Better ways are needed to achieve sustainable and effective use of sit-stand workstations without relying on a large and ongoing investment in training, coaching and support to get users to use their sit-stand workstations.

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