

Green exercise in the workplace

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New health challenges are arising in the workplace as occupations become increasingly more sedentary, and workplace stress grows. Both impact directly on health and wellbeing. Workplace interventions that are designed to improve health and wellbeing should provide coping strategies that can directly tackle stress, as well as reducing sedentary behaviours. We explore how exposure to nature can be used as a workplace intervention to reduce stress. We show how green exercise in a workplace setting may be a potentially powerful tool to tackle physical inactivity. We also discuss future research and applications of green exercise in the workplace and identify potential barriers that need to be addressed to increase its future acceptance by both employers and employees.

Increased workplace stress and sedentary time

Much of the waking day is spent within a working environment: approximately 60 per cent of each day over a working life-span of about 40 years (British Heart Foundation, 2009). Although the workplace has been shown to have positive outcomes on physical and mental health (Waddell and Burton, 2006), much work is becoming more mentally demanding, stressful, and also more sedentary due to technological advances within the workplace (e.g. e-mail and world-wide web) allowing employees to conduct most of their work whilst sitting at their desk. Furthermore, non-active transport has become common during the commute to work. The augmentation of stress and sedentary time are negatively impacting on physical and mental health and wellbeing. In Europe, one-quarter of workers say they experience work-related stress for all or most of their working time, with an estimated 136 billion lost to sick leave and loss in productivity across Europe due to mental ill health (European Agency for Safety and Health at Work, 2014). Increased stress and sedentary time and/or lack of physical activity are workplace challenges that need to be addressed to safeguard not only the health and wellbeing of the employee but also to ensure the maximum productivity (whatever form this may be in) of the company as a whole.

Although, the effect of the indoor work environment on stress has been investigated (Rashid and Zimring, 2008), the formal use of nature and the outdoor

environment is almost non-existent. This is despite other evidence to suggest that nature can act as a buffer to stressful life events (Van den Berg *et al.*, 2010). It is well recognised that a work task that is challenging for an employee can cause a rise in arousal/stress levels. This leads to an increase in performance of the task. However, this is only up to a point of optimum arousal/stress before performance begins to decline (Figure 13.1) (Yerkes and Dodson, 1908). The relationship between how much stress/arousal leads to a peak in performance will be dependent on many factors, is individualised and can be task specific. When an employee is unable to cope with the demands of the task that are placed upon them (for whatever reason) their stress levels will be greater and performance affected. Not only does performance decline but at higher levels of stress, physiological changes occur. From an evolutionary point of view, these physiological changes to higher levels of stress were likely to be against a threat of physical danger, such as predators, and were necessary to increase the chances of survival by facilitating a fight or flight reaction. In response to a threat, heart rate, breathing and muscle tension all increase, mainly through the fast-acting sympatho-adrenal medullary (SAM) using the sympathetic autonomic nervous system to release adrenaline and noradrenaline from the adrenal glands. The slower hypothalamus-pituitary-adrenal axis (HPA axis) also plays a part but it is much slower and has longer lasting effects, and these are sustained for a period even after the threat has subsided.

In modern economies, however, the stressor is now predominantly psychological, such as a work task, but a physiological response still occurs. Although, the physiological response may increase arousal (potentially increasing performance as explained earlier), as no physical activity occurs, the physiological responses tend to be disproportionate to what is required. This is particularly relevant if the task is considered (or appraised) as a threat rather than a challenge, thus increasing the levels of stress/arousal beyond what is considered optimal for performance. Furthermore, if stressors are repeatedly placed on an employee and there is insufficient time for recovery, the augmented physiological and psychological responses accumulate over time. This more frequent, prolonged and/or severe elicitation of stress responses leads to a detrimental effect on the employee's health by increasing the wear and tear on physiological systems (McEwen and Stellar, 1993; McEwen, 1998). This occurs as with increased levels of stress the body adapts and resets itself, and thus the body operates within a new 'normal' range. This is termed allostasis. A normal response and recovery pattern to stress allows appropriate recovery to pre-stressor levels and the system becomes reset again. However, when there are repeated stressors in quick succession, an inadequate response and/or lack of habituation to a stressor, and/or failure to recover from a stressor, this leads to a continual resetting to new higher levels of 'normal' range. Thus stress, over a period of time, causes chronic exposure to fluctuating or heightened neural or neuroendocrine responses which causes physiological damage to the body (allostatic load) (McEwen and Seeman, 1999).

Stress is amplified with poor social support (from colleagues and management), perceived lack of control, and increased demands. This creates deleterious impact



Figure 13.1 The stress-performance curve (adapted from Yerkes and Dodson, 1908)

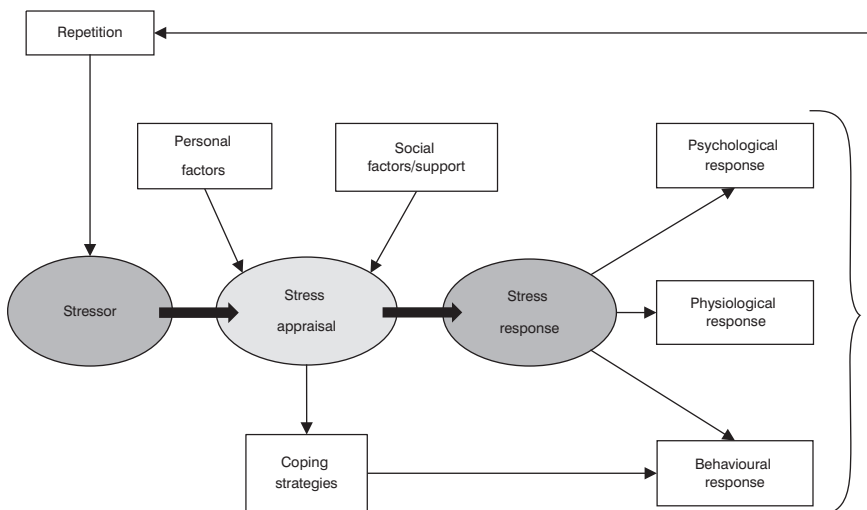


Figure 13.2 Conceptual diagram of the key elements of stress: stressor, stress appraisal and stress response and the influence of personal and social factors and coping strategies

on an employee's psychology and physiology. Stress is, therefore, considered to be an indirect risk factor of ill-health (Kompier and Marcelissen, 1990). However, the negative behavioural and physical coping mechanisms that are utilised by an individual in relation to the stress they are experiencing can influence the direct risk factors of ill-health such as physical inactivity, poor diet and hypertension. An employee who is experiencing stress is more likely to make increased errors in their work, experience a decrease in performance, resulting in an increase in sickness absence. Nevertheless, some employees may continue to be present at work despite illness or mental fatigue (presenteeism) but are likely to display poorer performance. All of these can have an overall negative impact on the whole operation including increases in staff turnover and reductions in productivity.

Positive coping strategies are required to reduce stress levels within a work environment, and to aid recovery and restoration during and between cognitively and mentally fatiguing tasks. These positive coping strategies should lead to a reduction in both psychological and physiological responses to a stressor. Figure 13.2 shows how coping strategies feed into stress appraisal and potentially alter physiological and psychological outcomes.

We know that nature can help provide restorative environments by promoting positive coping strategies, reducing physiology responses, and altering behaviour and cognitive responses. The stress reduction theory (Ulrich, 1981) suggests that as humans have a natural affiliation with nature having been exposed to natural environments for many years, we feel safe in this type of environment. This, therefore, leads to a reduction in arousal, causing relaxation and a decrease in physiological aspects of stress. Therefore, natural environments lower physiological stress. The attention-restoration theory (ART) (Kaplan and Kaplan, 1989) suggests that humans become mentally fatigued due to increased focus and directed attention. Although, directed attention is vital to undertake work tasks, over prolonged periods of time a person will become cognitively fatigued and unable to maintain their focus. Reduced levels of fatigue can be achieved by changing the focus of an employee's attention from directed attention on the task (which increases levels of fatigue and decreases cognitive function) to more indirect attention. Nature is believed to facilitate indirect attention, creating more effortless brain function, thus reducing directed attention fatigue. Both theories propose that natural environments are restorative and are likely to provide a way to reduce stress, physiological responses and attentional fatigue (which are all applicable to the workplace) and thus help to safeguard health and wellbeing in the long term.

Engagement with nature in the workplace

Research exploring the use of nature in the workplace to improve wellbeing has focused on altering the indoor environment, such as the use of plants within the workplace, views of nature through a window, or the use of images (pictures or screens) showing different natural views.

Integrating nature into the workplace by introducing potted plants can modify mood (Shibata and Suzuki, 2004) and stress levels (Bringslimark *et al.*, 2009) but sometimes the use of plants is not feasible. Views of natural environments from windows have been demonstrated to reduce stress including job stress (Leather *et al.*, 1998), increase job satisfaction and result in fewer reported ailments (Kaplan, 1993). Windows may provide a wealth of opportunities for very brief views of the natural world (Kaplan, 2001). Indeed students who had more natural views out of their windows reported enhanced directed attention during a battery of cognitively demanding tasks (Tennessen and Cimprich, 1995). Interestingly, the type of nature that can be viewed from the window appears to play a role in job satisfaction, with trees resulting in the highest level of satisfaction and mowed areas the least (Kaplan 2007). However, it appears that no more than a few trees, some landscaping, or some signs of vegetation can all make a difference for restoration. Having buildings present does not seem to impact unfavourably (Kaplan, 1993).

Using images and screens may be a useful alternative as images depicting natural scenes can aid physiological recovery from stress (Brown *et al.*, 2013). Although a surrogate of nature, posters and screens are generally less preferred than real nature (Verderber 1986), but the use of screens would be of particular benefit in enclosed office spaces without windows or without access to a direct view of nature. This alternative could be considered when technology is already present in the work space or when maintenance of plants is not viable. Furthermore, generally the images presented can be of a higher quality in terms of their nature content than real landscapes from windows and may provide enhanced reduction in stress and restoration.

Modifying the indoor space by introducing images, plants and views only focuses on the immediate employee surroundings. However, encouraging employees to engage with nature on a larger scale can be achieved at set points during the day, such as lunchtime. This brings additional benefits including allowing the employee to be more physically active and spend time away from their work area. However, there has been little rigorous research regarding the benefits of engaging with natural spaces in work time.

Given that nature exposure improves recovery from stress (Ulrich, 1984; Ulrich *et al.*, 1991) and mental fatigue (Berman *et al.*, 2008; Berman *et al.*, 2012); the positive benefits of nature exposure during breaks in the working day is a logical option to explore. However, the use of the outdoors surrounding a workplace has been largely overlooked and yet the green environment has a huge potential for enhancing health and wellbeing. Taking breaks away from the work station to visit natural spaces provides an opportunity to recover from stress and mentally demanding tasks and alter attention to indirect attention. Physically moving from a work environment will enhance the “being away” component of ART, which is particularly important for employees in an office where the work environment is a continuous reminder of the pressure of work commitments.

As only five minutes of interaction with nature has been shown to improve mood and self-esteem (Barton and Pretty, 2010), it suggests the breaks only need

to be short to be of some benefit. Furthermore, a short view of nature prior to a stressor in the afternoon, may help improve recovery of the nervous system (Brown *et al.*, 2013). In this study participants viewed a screen with images of nature or built environments for ten minutes prior to undertaking a stressor (which included remembering and reciting numbers whilst being assessed by an investigator). Interestingly, the response to the stressor itself did not change irrespective of the images viewed prior to the stressor. However, the recovery period showed significant differences in the activity of the parasympathetic nervous system, which suggests enhanced recovery of the autonomic nervous system after viewing nature images in comparison to built images. This implies that in a workplace viewing nature at lunchtime might be beneficial to stressful tasks completed in the afternoon. It might also improve recovery between stressors to prevent allostatic load/stress building up over time, facilitating the wellbeing of the employee. More research needs to be conducted to explore this concept further, especially within workplace settings, but it may be that short breaks throughout the day, where the employee is exposed to nature, may be beneficial not only to the employee but the employer may see some gains through enhanced performance and productivity.

An added benefit of taking a break in a natural space for the employee is that they feel they take back some control of the structure of their day. By the employee managing the structure of the day this may help alleviate work-related stress that usually results from the employee not feeling in control. Furthermore, taking the decision to move away from the workplace during a break will, in itself help and be a motivator for being outside and interacting, passively or actively, with nature. In a recent study from Denmark (Lottrup *et al.*, 2012), 37 per cent of workers spent at least one day outside during the working week. The main use of the outdoor environment was to have lunch followed by conversations with colleagues. The majority though, felt that they were not encouraged to go outside (range 77–89 per cent), but with encouragement, mainly by colleagues, increased the likelihood of going outside. Very few (less than 12 per cent) felt that they were encouraged to go outside by their manager.

In a UK-wide survey we conducted in 2011 (n=2079), only 10.5 per cent of workers visited their local green space at work once a week or more, despite 55 per cent rating the quality of local green space around work to be fair or greater than fair. Those that did visit on a regular basis had significantly improved work mood and work engagement. However, there seems to be a gender difference with 6 per cent more men engaging with green spaces than women. It also appears that the relationship between greenspace access and stress differs between genders. Reduced workplace stress is associated with increased access for males, but no significant relationship was found for females (Lottrup *et al.*, 2013). Generally the reasons cited for not going outside during a break is that the employee was too busy (Hitchings, 2010), but interestingly seeing others in the space persuaded them to visit more often. This suggests that promoting the outdoors to a few and getting them to encourage others may help foster a culture shift and alter social

norms, thus resulting in workplace behaviour change. Therefore, employers should facilitate regular breaks and provide opportunities for finding and using natural spaces, which are accessible in the time frame. Furthermore, by helping a range of individuals (maybe heads of groups) to engage in the outdoors, more employees are likely to take part. Overall, this would be beneficial for the business and would safeguard and potentially increase the health and wellbeing of employees.

The positive outcomes of a break in a natural space are further enhanced as the employee becomes active by leaving their desk; thus breaking up their sedentary time. Furthermore, if breaks within nature involved some form of physical activity such as walking, employees would also be more likely to meet physical activity recommendations, which in turn would lead to further improvements in health and wellbeing.

Physical activity interventions in the workplace

The combination of high levels of stress, longer hours at work, the increasing technological advances whilst at work and the use of inactive transport to commute to work is meaning that there are fewer opportunities to undertake incidental physical activity. Physical activity is a well-known contributor to improved physical and mental health (Bouchard et al., 2006). Some 20 per cent of men and 27 per cent of women aged 18 and over are not meeting World Health Organisation physical activity guidelines of 150 minutes per week of moderate physical activity (WHO, 2010). However, in affluent countries, this figure is elevated further, with 26 per cent of men and 35 per cent of women not undertaking enough physical activity. Furthermore, the higher levels of stress that are reported exacerbate the reduction in physical activity, due to individuals feeling that there is lack of time to undertake physical activity or even take breaks away from their work station (Trost et al., 2002). The periods of time of prolonged inactivity are, therefore, also increasing, which has its own independent negative health outcomes (Hamilton et al., 2008).

All of this together indicates that both pre-emptive and pro-active steps are required to ensure physical activity guidelines are met. The workplace is an ideal setting for this as there is a large target audience. If the cycle of inactivity can be broken and breaks incorporated within a working day then this should reduce stress, diminish prolonged periods of inactivity and increase physical activity. The National Institute of Clinical Excellence recommendations (NICE, 2009) suggest counselling and fitness programmes are the most effective in increasing physical activity levels. This can be achieved through active commutes, active breaks, using the stairs and walking to meetings.

Being physically inactive is a direct risk factor for cardiovascular disease with individuals not engaging in regular physical activity having a 20–30 per cent greater risk for cardiovascular disease (WHO, 2010), thus being physically inactive is a key physical health issue. Walking is a simple activity that promotes sustainable changes in physical activity and helps to reach moderate activity

guidelines (Welk et al., 2000). This suggests that walking interventions should be promoted within the workplace (NICE, 2009). Workplace interventions that include walking increase overall physical activity, but it is unclear whether this actually decreases overall sedentary behaviour. Some studies show a decrease in sedentary time whereas others also identified that sitting time is unaffected by workplace physical activity interventions (Chau *et al.*, 2010)2010. However, increasing activity during suitable periods of the day, such as lunchtime, provides opportunities to break up long periods of sedentary time. This may have cardiovascular benefits, even without reducing total time spent being sedentary. This is of particular importance to ensure the health and wellbeing of employees.

A more active workforce reduces absenteeism, reduces health care costs and increases productivity, all of which are likely to aid employers (Proper *et al.*, 2002). Existing research on workplace physical activity interventions have primarily focused on increasing physical activity itself and dietary outcomes, although some have explored other factors. A meta-analysis of physical activity interventions in the workplace showed that participation can have positive effects on fitness and anthropometric measurements as well as work attendance and job stress (Conn *et al.*, 2009). It is important that physical activity interventions in a workplace should not only enhance physical health but also ensure benefits to psychosocial health, to further benefit the employee and the employer. However, only a handful of studies have investigated physical activity interventions and their impact on psychosocial factors (Brown et al., 2011).

The break at lunchtime is a time when employees could engage in moderate physical activity, thus interrupting the long periods of sedentary time. Further, it provides an opportunity to decrease stress levels and restore physical and mental fatigue. However, the lunch break is often a time when employees continue to remain at their workstations due to work demands or peer pressure. Thus a detrimental cycle of increased stress and sedentary behaviour dominates. Physical activity in a natural environment (green exercise) at lunchtime may be of particular benefit for workplace health and could help improve physical and also psychosocial health.

Green exercise interventions in the workplace

NICE guidelines suggest encouraging active breaks to increase physical activity but this guideline should be extended to include active walking breaks within a natural environment. Whilst generic physical activity interventions have been investigated, the use of green exercise interventions at work has received very limited attention. The combination of positive nature breaks and physical activity may offer the opportunity to utilise the physical benefits of exercise combined with the restorative and stress reducing effects of nature, and potentially increase social interactions, thus enhancing psychosocial aspects.

However, only 15 per cent of participants reported using the outdoor environment for physical activity (Lottrup *et al.*, 2012). The quality and accessibility of local green space is important but it may be that individuals

require more facilitation to undertake green exercise. The use of green exercise as an intervention in a workplace should require little investment beyond the provision of a walking route and the encouragement for individuals to use it. From anecdotal experience this can be achieved through the development of walking groups that spontaneously arrange and carry out walks during the working day. Alternatively *walk champions* from inside the company can be initiators of walks.

A study that we conducted entitled *Walks4work* (Brown *et al.*, 2012; 2014) demonstrated that a workplace intervention of walking in nature (which included parkland, trees and more natural areas) improved mental wellbeing, reduced negative mood and reduced perceived stress levels in contrast to walking in a built environment (composed of paved footpaths adjacent to roads, housing estates, and industrial areas). The *Walks4work* intervention consisted of an eight-week phase where participants (33 per group) were assigned to one of the two walking groups and were asked to complete two lunchtime walks every week. Both walking groups followed a set circular walking route approximately 2 km in length, designed to provide a walk of approximately 20 minutes in duration. Each participant was free to choose which two weekdays they walked in order to promote adherence and were able to walk individually or with others in either direction around the prescribed route. Around 42 per cent in each group achieved the target of two lunchtime walks per week and the majority achieved one for the full eight weeks. By the end of the eight weeks there was a 10 per cent increase in participants who walked over 5000 steps and a 12 per cent decrease in participants who were walking fewer than 2500 steps. Even the small increase in number of steps is likely to contribute to enhancing health due to the positive relationship between physical activity and health (Tudor-Locke, 2010).

The fall in blood pressure following the eight weeks of walking was significantly greater in the natural setting than in the built group. This needs to be treated with caution, however, as the blood pressure in the built group was much lower at the start of the intervention. The blood pressure for the nature walking group only fell so that they had similar values to the built group at the end of the intervention. Any walk, whatever the environment, is useful for reducing blood pressure, especially if it slightly elevated prior to the start of a walking programme.

Other physiological measures taken (e.g. heart rate and autonomic control during rest, stressor, and recovery from a stressor) and evening cortisol measures, are indicative of levels of overall stress (Hellhammer *et al.*, 2009). These were not different between the two groups. It may be the measures we took were not sensitive enough, or the stimulus of two walks (or less than that in some cases) was not enough to evoke these physiological responses. Other research exploring vascular markers (although not within the workplace) (Thompson *et al.*, 2013) suggests that an eight-week green exercise intervention may be sufficient to evoke local vascular re-modelling changes. Thompson *et al.* (2013) analysed blood samples and identified changes in components utilised in building the extracellular matrix of the vascular walls following the intervention. It may

indicate that local vascular changes are occurring, which matches the blood pressure changes that we saw in participants in the *Walks4work* study.

Our walks were self-led and had no facilitator input, although this represents a low-cost approach, it is likely this led to reduced adherence for some of the participants during the study period. On questioning participants at the completion of the study about walk leaders, participants overwhelmingly did not wish to have a walk leader from outside the company but to have a fellow employee promote the walks. Interestingly, those who had formed their own walk groups were still walking regularly when we visited the company two years later, showing a long-term behaviour change. Walk champions from within the company to assist in promoting the walks are essential for future interventions.

Although our *Walks4work* study found psychological changes including a reduction in perceived stress, future research into the effect of repeated exposure to green exercise is required in order to understand the potential role of lunchtime workplace green exercise interventions on modifying physical and mental health, particularly among highly stressed or hypertensive individuals. Detailed and rigorous studies are needed to explore the benefits and limitations. Additionally, it is essential that evaluation of any intervention is undertaken to use any findings as evidence for workplaces and for passing on good practice to other companies. Therefore, this should be supported by measures of fidelity by including adherence, exposure, quality of delivery and participant responsiveness/engagement.

For green exercise interventions to be successful there are potential barriers to overcome including perception of risks (such as safety) and the perception that there is a lack of time to undertake a walk. This may be facilitated by clear walking routes with an indication of the length of time of the walk. Walking with partners, groups and walk leaders (as mentioned above) may help alleviate some of these perceptions of risk and further engage more individuals and have the added benefit of social support that is so important for reducing stress. Additionally, an initial driver to engage a whole range of different individuals from different backgrounds would also be useful in altering social norms to elicit a behaviour change and change in culture within the company. Perhaps, most importantly, is to engage managers throughout the process and involve them in the promotion of green exercise. In our *Walks4work* study we found that where immediate line-managers were engaged in the intervention, participants were much more likely to complete the suggested walks. The economic analysis of the cost-effectiveness of green exercise interventions within workplaces needs to be undertaken, alongside providing clear evidence and guidance to help employers make calculated decisions about using green exercise initiatives within their own workplace.

Conclusions

The outdoor space close to a workplace can be a valuable asset to enhance employer and employee health and wellbeing. Many cultural, behavioural and planning factors, though, are required to facilitate its use. Green exercise helps

increase levels of physical activity and provides a respite from stressful situations during a working day. Green exercise or viewing nature may be a useful positive coping mechanism to alter stress appraisal and elicit a positive behaviour change and reduce negative physiological and psychological changes. We conclude that green exercise at or near the workplace should be attractive to employees and employers alike as they offer a physical and mental wellbeing boost during the working day with very little investment. Unfortunately, many people are not engaging with green spaces around their workplace, mainly because of a perceived lack of time. A shift of culture and attitude within whole workplaces is required to facilitate the use of green exercise. If workplaces do engage with green exercise, we expect the employer will find a reduction in stress and fewer sick days with concurrent improvements in job performance and overall productivity.