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Healing the Sedentary Workforce

Addressing Physical Pain and Mental Health

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Research conducted in partnership between Swivel, Impart Advisory and Economic Evaluation Australia

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Executive Summary

Introduction

The connection between physical pain and mental health has garnered increasing attention in both academic and clinical contexts. Work environments significantly contribute to physical injuries and mental health conditions. Physical pain can exacerbate mental health issues like depression and anxiety, while poor mental health can amplify the perception and experience of physical pain. Work-related musculoskeletal disorders (WMSDs) are a significant source of occupational injury and disability for the Australian workforce.

Impact of Physical and Mental Health in Work Environments

Australian data shows that many workers experience distress and productivity loss due to untreated conditions associated with workplace hazards. Because of the relationship between physical pain and mental health, addressing both concurrently is important to effectively treat these conditions. WMSDs may develop directly due to exposure to physical hazards or indirectly through cumulative exposure to psychosocial hazards that lead to high levels of stress, or both.

Chronic pain, lasting at least three months, is associated with mental health disorders such as depression and anxiety. Studies indicate that those suffering from chronic pain report significantly poorer mental and physical health functioning. For example, chronic pain sufferers have higher rates of mood and anxiety disorders, which are exacerbated by the pain's interference with daily activities.

Sedentary Behavior and Its Effects

Modern sedentary lifestyles, particularly among office workers, are linked to various physical health issues and mental health problems. Sedentary behavior, characterised by long periods of inactivity such as prolonged sitting, increases the risk of cardiovascular diseases, musculoskeletal pain, and metabolic conditions.

It also correlates with increased symptoms of depression and anxiety. While regular exercise is highly beneficial for workers, sedentary time must be limited and interrupted with even light-intensity physical activity. This degree of regular physical activity has been shown to reduce blood sugar levels and blood pressure among workers, as well as symptoms of stress, anxiety, and depression.

The Role of Companies in Mitigating Health Risks

Employers can play a crucial role in addressing these issues by utilising a holistic risk management approach that identifies physical and psychosocial hazards and employs preventative strategies to control the risks associated with them.

The organisation must create the working conditions that promote employees' wellbeing and prevent exposure to workplace hazards to minimise the risks to their health. Ergonomic interventions to reduce the risks of WMSDs and other conditions should involve not only adjustments to the physical environment but also consider factors such as the job design and work structure overall so workers may have the resources to meet the demands of their role.

Government Obligations

Governments worldwide are implementing regulatory frameworks to promote workplace health and safety. This includes laws mandating ergonomic standards, mental health support, and reporting requirements for workplace health practices. Compliance with these regulations is essential for creating a safe and healthy work environment.

Recommendations

Addressing the interconnected issues of physical pain, mental health, and sedentary behavior requires a comprehensive approach involving both employers and governments.

1. Employers should prioritise preventative strategies that identify and address all relevant hazards to workers to minimise the risks of developing workplace injuries and/or illnesses. Such strategies can include ergonomic improvements to workplace design, and comprehensive wellness and behavioural programs that empower workers to adopt healthy behaviours.
2. Governments should provide regulatory support and incentives for compliance.
3. Collaborative efforts can enhance workplace health, reduce long-term costs, and improve overall employee wellbeing and productivity.

By understanding and addressing the multifaceted relationships between physical pain, mental health, and sedentary behaviour, organisations can create healthier and more productive work environments that benefit both employees and employers.

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Introduction

The complex bidirectional relationship between physical pain and mental health is an area of increasing academic and clinical interest. Work environments are significant contributors to both physical injuries and mental health conditions. In turn, physical pain can cause and/or exacerbate mental health issues such as depression and anxiety (Jansen et al., 2022), and vice versa, where poor mental health can amplify the perception and experience of physical pain (Hooten, 2016; Noel et al., 2016). These issues are also aggravated by the sedentary lifestyles of many office workers, as sedentary behavior is a risk factor for multiple chronic diseases and musculoskeletal disorders (Hanna et al., 2019; Carr et al., 2016). Furthermore, physical and mental health conditions can lead to productivity loss for the organization.

According to a report by the World Health Organization and International Labour Organization (WHO/ILO, 2021), work-related musculoskeletal disorders or WMSDs account for approximately 60% of all work-related conditions in developed countries. They are also a leading cause of medical conditions and disability for the Australian workforce (Metzler et al., 2019), affecting approximately 6.9 million people from 2014 – 2015 (Oakman et al., 2019a). WMSDs, which include back pain, repetitive strain injuries, and carpal tunnel syndrome, can lead to long-term disability, lost productivity, and significant healthcare costs (Ibid, 2021).

The Global Health Estimates by the WHO indicate that musculoskeletal disorders are a leading cause of disability worldwide, contributing to a substantial burden in terms of disability-adjusted life years (Ibid, 2021). Moreover, Macdonald and Oakman (2024) note that musculoskeletal disorders are strong predictors of workforce retirement among older workers.

WMSDs present a complex challenge as multiple factors may contribute to their emergence: physical work hazards such as lifting heavy loads and repetitive motions can directly increase WMSD risk, but psychosocial and organisational factors such as high job demands, long work hours, and low organizational support also significantly contribute to their development (Demissie et al., 2024; Neupane et al., 2016). These psychosocial risk factors are also known as psychosocial hazards, which are defined by Cox et al. (2000, p.14) as "*those aspects of work design and the organisation and management of work, and their social and environmental contexts, which have the potential for causing psychological, social or physical harm*".

WMSDs may result from cumulative exposure to physical and psychosocial hazards over an extended period (Oakman et al., 2019a). A study on the pain development paths[1] of workers suffering from WMSDs by Neupane et al. (2016) found that multi-site musculoskeletal pain tended to persist for many of the participants (nearly two-thirds) after a 6-year follow-up, despite 30% of the participants being white-collar workers. High mental strain was a strong predictor for the workers' pain trajectories.

Among office workers, the annual prevalence of neck pain is as high as 82% and is associated with lower productivity (Pereira et al., 2018). Moreover, complaints of musculoskeletal discomfort in the neck, shoulders, arms, hands, and wrists are common for computer users, likely due to repetitive motions related to the use of the mouse and keyboard, or because mouse and keyboard users tend to work with their arms inadequately supported (Greggi et al., 2024; Eliasson et al., 2023; Madeleine et al., 2013).

1 Pain development paths refer to the changes in a patient's characterisation of pain over time.

WMSDs and other work-related injuries and illnesses are also underreported, with a rate ranging from 20% – 70% in the USA (Fagan & Hodgson, 2017). Possible reasons for underreporting include poor recordkeeping, workers' reluctance to report due to the fear of reprisal in their current job or future career opportunities, policies that discourage workers from reporting, job insecurity, a lack of response from management to previous reports, or a belief that some degree of pain was a natural consequence of work (Park & Yoon, 2021; Fagan & Hodgson, 2017). Notably, organisations with poor safety climates had much higher rates of underreporting (81%) compared to those with more positive safety climates (47%) (Probst et al., 2013).

Evidence from various studies supports the notion that physical injuries sustained at work are not only a source of immediate physical discomfort but also significantly impact workers' mental wellbeing. For instance, construction workers experiencing musculoskeletal pain from work reported higher levels of depression, anxiety, and stress, which negatively affected their work ability. Furthermore, persistent pain symptoms following a disabling work-related injury are prevalent and are associated with poorer mental health outcomes and prolonged work absence (Dobson et al., 2022).

The association between pain and mental health extends beyond work-related injuries. Pain, whether acute or chronic, has been shown to significantly impair both physical and mental health functioning across various populations. For example, employees reporting pain exhibited considerably poorer functioning in both physical and mental health domains, regardless of the pain's location (Saastamoinen et al., 2006). Another study of individuals with spinal cord injuries noted that pain was linked to lower cognitive performance and higher levels of anxiety and fatigue (Carlozzi et al., 2021).

Workers with physical injuries and/or pain and mental health conditions often face productivity loss, usually measured as presenteeism (impaired performance at work) and absenteeism (time away from work) (Allen & Hubbard, 2005). A study by Elotla et al. (2021) found a statistically significant link between levels of distress and mean days of absenteeism and presenteeism, with a larger effect on presenteeism. A meta-analysis of 36 studies by De Oliviera et al. (2022) also found that the link between mental health conditions and productivity loss is positive, with depression and anxiety as the most reported conditions. Employees may continue to work despite their pain for multiple reasons, such as the social stigma of disclosing a mental health condition, or the economic pressures to keep working and to not consume sick leaves.

A survey of Australian companies found 4.5% of full-time employees experience high levels of distress in a month, associated with decreased work ability, with most receiving no treatment (Carlisle & Parker, 2014). The productivity loss can be costly: using a human capital approach, they estimated the economic cost of mental health conditions due to lost productivity as US$2.5 trillion in 2010, and the potential cost as US$6.1 trillion by 2030.

Witt et al. (2016) also found that increases in pain severity impose a cost on the economy and on healthcare systems directly and indirectly, with this burden in the European Union (EU) costing economies about 1-10% of GDP. A 2022 report by Deloitte Access Economics for Safe Work Australia estimated that had there been no work-related injuries and illnesses from 2008 – 2018, Australia's economy would have grown larger by AU$28.6 billion each year, with an additional 185,500 full time equivalent (FTE) jobs per year and translating to an annual 1.6% increase in GDP.

Many of these FTE jobs are skilled roles, which could have accelerated Australia's transition towards a knowledge-based economy, and increased wages across all occupation types (Deloitte Access Economics, 2022).

Another concern facing workers involves the effect of increasingly prevalent sedentary lifestyles on their physical and mental health. Panahi & Tremblay (2018) indicate that sedentary behavior is distinct from the lack of activity, being a distinct predictor of metabolic risk even when the need for moderate-to-vigorous intensity physical activity is met. Sedentary behavior is characterised by prolonged periods of sitting or inactivity, and is defined formally by Tremblay et al. (2017, p.9) as "*any waking behavior characterized by an energy expenditure ≤ 1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture*", with MET referring to the resting metabolic rate of the population.

Globalisation and advances in technology have led to a shift in work towards knowledge-based jobs and leisure activities that require only minimal physical activity and energy expenditure (Panahi & Tremblay, 2018). Currently, less than 20% of jobs require some moderate-intensity physical activity; however, this was nearly half of all jobs 50 years ago (Dėdelė et al, 2019). Another study by Yoon & Chung (2016) notes that sedentary jobs had risen by 83% since 1950.

The impact of prolonged sitting and lack of regular activity, commonly observed in office settings and for remote workers, has been linked to a range of physical and mental health issues (Kilpatrick et al., 2013). Sedentary behaviors are linked to an increased risk for cardiovascular diseases, musculoskeletal pain in areas such as the neck, shoulders, and lower back, reduced insulin sensitivity, and metabolic conditions (Hanna et al. 2019; Carr et al., 2016; Shearer et al., 2016).

They are also linked to poorer mental health outcomes, including increased symptoms of depression and anxiety (Hallgren et al., 2020). Physical and mental health issues also often occur together; Hanna et al. (2019) found in their study that university employees who spent significant amounts of time sitting reported higher incidences of back pain and depression.

Studies have noted, however, the importance of regular physical activity in mitigating these issues. In their survey of university office employees, Puig-Ribera et al. (2015) found that higher volumes of physical activity were positively related to mental wellbeing; as levels of activity rose, the percentage of lost work performance was also sharply reduced. Chu et al. (2014) also noted in their review of 17 randomised controlled trials (RCTs) that physical activity programs with personalised supervision not only improved physical health, but also mental health outcomes. In brief, the multifaceted relationships among work-related injuries, sedentary behaviour, mental health, and physical pain emphasise the need for integrated approaches in managing these issues.

Additionally, the wellbeing of workers should be studied in the context of their working environment, organisational structure and dynamics, and their role within the organisation (Turner & Lingard, 2020). For example, the prevalence of presenteeism may be influenced by socioeconomic constraints and work expectations faced by the employees to keep working despite pain and discomfort. The workplace may also stigmatise the pursuit of medical help, especially for mental health conditions, contributing to a feeling of disempowerment over their condition (Ibid, 2020).

Organisations and employers should therefore help to create the working conditions conducive to their employees' wellbeing, thereby helping them to manage job strain (De Oliviera et al., 2022).

The Constitution of the World Health Organization (WHO) defines health as a "*state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*" (WHO, 1946, p.1). Therefore, an organisation's approach to employee health and wellbeing should be proactive and target not only the prevention of adverse health outcomes but to create and design a healthy workplace environment and organisational structure where all workers' health and safety are protected and promoted (Burton, 2010).

This investment in employee health is not only for productivity's sake, but also to contribute to the overall interests and mission of the organisation; a healthy work environment that promotes job satisfaction and provides adequate time and resources can help the employee perform meaningful work that aids the business and the quality of the goods and services it provides (McLellan, 2017). Thus, addressing these issues properly is crucial for improving overall health outcomes, promoting worker morale, and enhancing work participation and productivity.

Physical Pain and Mental Health

A substantial body of literature highlights the relationship between physical pain and mental health, with each being a risk factor for the other (Hooten, 2016; Noel et al., 2016). A 17-country population survey by Gureje et al. (2008) was conducted in multiple continents and across cultures (*N = 85088*) and found that self-reported pain issues were linked with mood and anxiety disorders (including PTSD, panic disorder, and generalised anxiety disorder).

The disorder prevalence was also linearly associated with pain; the highest rates were among those with multi-site pain problems. Vadivelu et al. (2017) found that about 30-45% of chronic pain patients in their study experienced symptoms of depression. This was supported by neuroimaging studies which indicated that those with depression had less ability to regulate pain.

A study by Noel et al. (2016) (*N = 14790*) found that individuals with chronic pain in adolescence reported significantly higher rates of anxiety and depressive disorders, and after controlling for factors such as age, sex, or sleep levels, chronic pain sufferers were associated with a 33% higher likelihood of having anxiety and a 38% higher likelihood of having depressive disorders. Conversely, individuals with mood disorders have an increased risk of developing cardiovascular conditions and diabetes, and depression sufferers have almost double the risk of dying compared to the general population (Doherty & Gaughran, 2014).

Hooten (2016) also found in their study that while chronic pain sufferers have high rates of depression (exceeding 50%), participants without chronic pain but exhibited depressive symptoms were also more likely to develop neck or lower back pain upon follow-up. Neuroimaging indicates that both anxiety and depression are linked to chronic pain and overlapping areas in the brain are activated by both conditions (Ibid, 2016).

The psychological effects of pain are influenced by the nature and context of the pain. For instance, the evidence tends to point to chronic pain as a significant source of mental health issues. Chronic pain is differentiated from acute pain by an occurrence of at least 3 months, according to the International Association for the Study of Pain (Marques et al., 2023). Chronic pain sufferers often suffer from depression and anxiety, which are also comorbid with substance use and PTSD (Leyde et al., 2024; Gureje, 2007).

This chronic pain may have also been caused by work injuries, as is the case in Dobson et al. (2022), where they find persistent pain symptoms following a disabling work-related injury are prevalent and associated with mental health conditions and prolonged work absence. Multiple authors propose that a key factor that links chronic pain to poorer mental health outcomes is the extent to which pain interferes with the patient's daily function, and thus their perceived control over their condition (Leyde et al., 2024; Cheshire et al., 2021; Turner & Lingard, 2020; Wiedemann et al., 2017; Gureje, 2007).

Some studies have proposed psychological models and neurobiological mechanisms to explain how physical pain and mental health conditions interact. The fear-avoidance model of pain suggests that individuals who suffer trauma from acute pain may trigger a state of hypervigilance and avoidance behaviors due to their fear of pain. This fear leads to a feedback loop of negative thoughts that promote avoidance, which further amplifies their pain (Hooten, 2016; Liedl & Knaevelsrud, 2008).

Liedl and Knaevelsrud (2008) also note the role of the hypothalamic-pituitary-adrenal (HPA) axis and its link to stress hormone production, the lower levels of serotonin in chronic pain sufferers, and how stress evokes inflammation in specific brain regions linked to anxiety and depression. Marques et al. (2023) also indicate that depression may be related to pain via inflammation, via its link to increased levels of inflammatory markers such as interleukin-6 (IL-6) and interleukin-11 (IL-11). Interestingly, they find that reducing the severity of depressive symptoms may also reduce the pain, so they propose a multimodal approach to reduce the patient's reliance on opioids. This evidence suggests that addressing both physical and mental health concurrently is crucial for effective treatment and rehabilitation.

Work-related Musculoskeletal Disorders

Work-related musculoskeletal disorders are a common source of occupational injury and disability in many countries, and a major cause of sickness absence and decreased productivity for workers (Oakman et al., 2019b; Macdonald & Oakman, 2022; Metzler et al., 2019; Neupane et al., 2016; Macdonald & Evans, 2006). Musculoskeletal disorders comprise a range of conditions that affect muscles, tendons, ligaments, joints, peripheral nerves, and related tissues (Oakman et al., 2019a).

Symptoms include pain, discomfort, loss of sensation, loss of strength or flexibility, or the loss of ability to perform certain movements (Ibid, 2019a). As long-term exposure to WMSD-related hazards increases the risk of developing these conditions, with as much as 26% – 37% of lower back pain due to workplace exposure, older workers are particularly vulnerable (Macdonald & Oakman, 2024). The prevalence of WMSDs along with the significant cost they impose on individual workers and society underscore the importance of minimising WMSD risk in the workplace.

While WMSDs are more commonly perceived as associated with physical hazards, empirical evidence points to psychosocial and organisational factors having a significant effect on WMSD development. Moreover, physical and psychosocial factors can have a synergistic effect, further increasing WMSD risk (Macdonald & Oakman, 2022). For example, a study by Widanarko et al. (2015) found that workers with high exposure to both physical and psychosocial hazards had the highest odds ratios for neck and shoulder pain, having nearly 5 times the odds of experiencing pain in this region than the control. Lapointe et al. (2009) also reported an interaction effect between job strain and poor posture among office workers, leading to musculoskeletal symptoms.

WMSD symptoms may develop due to multiple factors. Aside from the direct risk posed by exposure to physical hazards, psychosocial and organisational factors may increase WMSD risk indirectly via two pathways. First, job demands such as time pressure, long hours, and high workloads may cause workers to engage in long periods of a work-related activity that increases their WMSD risk, such as prolonged sitting, maintaining a poor posture, or doing repetitive actions (Macdonald & Oakman, 2022; Macdonald & Evans, 2006). Secondly, the worker may have a stress response to these hazards which lead to physiological effects that increase WMSD risk or have other adverse health effects (Ibid, 2022).

Roquelaure (2018) describes four such effects that arise from the stress response: arousal of the central nervous system that increases muscle tone and stiffness and musculoskeletal load in the muscles and tendons, the release of catecholamines like adrenaline which reduce muscle and tendon circulation thereby promoting muscle fatigue, the release of corticoids that promote fluid retention and tunnel syndromes (e.g. carpal tunnel syndrome), and the activation of inflammatory cytokines. These bodily reactions increase muscle tension which can thus increase WMSD risk.

Sedentary Behaviour, Physical Pain, and Mental Health

Sedentary behaviour has become increasingly prevalent in modern work environments, particularly among office workers. This behaviour has been linked to various physical health issues, including musculoskeletal disorders, cardiovascular disorders, metabolic disorders, and mental health problems such as depression and anxiety (Tronco et al., 2021; Hanna et al., 2019; Carr et al., 2016; Kilpatrick et al., 2013). In Australia, working adults spend about 6.2 – 9.6 hours a day engaging in sedentary behaviours (Kar & Hedge, 2020).

Unsurprisingly, Sakakibara et al. (2023) note that white-collar workers are more sedentary than blue collar workers (62.3% versus 40.4%), and when controlling for demographic and work-related variables among white collar workers, higher sedentary behaviour was associated with poorer mental health. Other research points to the link between sedentary behaviour and adverse mental health outcomes. A systematic review of sedentary behaviour and mental health among adolescents found strong evidence linking leisure screen time with a higher risk of depressive symptoms (Hoare et al., 2016). Additionally, sedentary behaviour in both leisure and occupational contexts have been linked to poor mental health outcomes among adults, increasing symptoms of depression and anxiety (Hallgren et al., 2020).

Sedentary workers also experience a range of physical health issues. Specifically, they may experience WMSD symptoms in office workstations as they tend to maintain a static position in front of a computer for a long period of time and engage in repetitive movements when using a mouse and keyboard. These repetitive behaviors have a cumulative effect on the body, eventually leading to WMSDs. Crucially, it is the prolonged period of sitting, standing, or lying down that is itself harmful, and may be due to the inactivity of skeletal muscle (Koh, 2018) and blood vessel constriction within as few as 30 – 60 minutes of sitting (Duran et al., 2023). Thus, sedentary workers tend to complain of pain in their joints, shoulders, back (upper and lower), neck, wrists, and arms (Bigošová et al, 2019; Lee & Cho, 2015). A sedentary lifestyle also contributes to muscle stiffness, a narrower range of motion, impeded blood flow, and reduced muscle mass and vascularisation (Lurati, 2017).

The health benefits of regular physical activity notwithstanding, regular exercise alone is not enough to offset the effects of sedentary behavior, and prolonged periods of sitting should be avoided or reduced as much as possible (Koh, 2018). Sedentary workers should still engage in regular physical activity due to its positive effects for physical and psychological health (Panahi & Tremblay, 2018; Lurati, 2017; Puig-Ribera et al., 2015; Biddle & Asare, 2011) but should also limit sedentary time with even light-intensity physical activity (Falck et al., 2016).

An RCT by Duran et al. (2023) found that a 5-minute break for every 30 minutes of sedentary time reduced blood sugar levels and blood pressure among a sample of middle- and older-age adults compared to the control group. Substituting sedentary time with moderate-to-vigorous physical activity can significantly reduce the odds of experiencing mental stress among office workers (Onodera et al., 2019), but even light-intensity physical activity is associated with fewer self-reported symptoms of stress, depression, anxiety and burnout (Jonsdottir et al., 2010).

The Role of Companies in Addressing Physical Pain, Mental Health, and Sedentary Behaviour

The literature highlights the interplay among physical pain, WMSDs, sedentary behaviour, and mental health. Addressing these issues in the workplace requires a holistic approach that not only identifies physical and psychosocial hazards and their sources but also controls and prevents the risks associated with them (Macdonald & Oakman, 2022). Workplace risk management should prioritise actions that eliminate or reduce the severity of a hazard, in line with the hierarchy of control[2] (Safe Work Australia, 2022; Oakman et al., 2019a).

Crucially, this strategy proactively targets risk at the source, rather than rehabilitating workers who already exhibit signs of adverse health outcomes.

2 If eliminating the hazard cannot be done, the following risk control actions should proceed down the hierarchy of control: reduce the risk through substitution or isolation, reduce the risk via physical or mechanical changes to work systems, use administrative actions to reduce harm levels, or use personal protective equipment (PPE) to limit exposure (**WorkSafe Victoria, 2022**). These actions should be followed as far as is 'reasonably practicable', or what can be reasonably done considering factors such as the likelihood of risk, the information and avenues available to the person concerned to minimize the risk, and the cost of doing so (**Safe Work Australia, n.d.**).

As many hazards are associated with the work structure, working conditions, or management decisions, the risk management for physical pain and mental health conditions should be integrated into the company's broader management strategy (Macdonald & Oakman, 2024).

The first step in managing workplace risks is to identify all hazards (Oakman & Chan, 2015). As workers are in the best position to identify the issues related to their role, workers should be consulted and involved in developing and implementing the pertinent changes[3] (Burgess-Limerick, 2018). Their input is valuable because stress responses are influenced by the worker's perception of the hazard. Macdonald & Oakman (2024) recommend that workers be given surveys such as the Copenhagen Psychosocial Questionnaire to rate their hazard exposures, identify all risk sources, and design interventions in line with the risk control hierarchy. To maximise impact, organisations should prioritise risk control actions that target hazards with the greatest impact on risk (Wells, 2009). Finally, the effectiveness of these actions should also be evaluated (Macdonald & Oakman, 2022).

A key element in the success of workplace risk management is the active participation and support of senior management. However, senior management often lack awareness on risk assessment procedures and the health effects of psychosocial hazards (Macdonald & Oakman, 2024). While the effects of psychosocial hazards on WMSD risk are variable, they are comparable to the effects of biomechanical hazards (Macdonald & Oakman, 2022).

Building awareness on these issues is therefore crucial for managers to understand why changes may be necessary to reduce risks, and to provide resources for the required changes (Oakman et al., 2019). Eliasson et al. (2023) recommend the designation of a risk management team for the organisation, which includes a manager, a workers' representative, and an ergonomist, to develop, implement, and evaluate action proposals.

Creating Ergonomic Workspaces

Ergonomics studies the interaction between the worker and the environment, and the strategies undertaken to maintain health and safety. Ergonomic interventions involve not only actions conducted by the workers themselves, but also actions by the employer that can accommodate the worker's needs (Shearer et al., 2016). These interventions are not limited to the physical environment; they also involve the organisational domain (office work structure, policies, and dynamics) and the cognitive domain (involving mental processes such as mental workload, stress, and decision-making) (Christy & Duraisamy, 2020).

Thus, effectively managing workplace risks associated with physical pain, sedentary behaviours, and mental health conditions should consider not only the physical environment and how tasks are designed, but also the job design and work structure overall. Designing healthy work environments involves considering organisational decisions such as organisational strategies, structure, and workload management, workplace factors and environmental design factors such as performance targets and hiring policies, and physical factors such as workstation equipment and technology (Macdonald & Oakman, 2022).

3 Studies conducted on manufacturing firms that implemented this approach found improvements in productivity, performance, and information flow. However, this strategy is most effective if the organization has high trust and rapport among its members (**Ibid, 2018**).

Companies can provide crucial workplace resources that help the worker to cope with the demands of their role, or to design the work to eliminate or minimise hazard exposure. This includes, but is not limited to, how their workstations can be improved and how their schedules and tasks can be modified. For sedentary workers, integrating regular physical activity into daily routines and creating supportive work environments that minimise prolonged sitting and promote mental wellbeing can help improve overall health outcomes and enhance productivity.

For example, ergonomic adjustments such as adjustable chairs, standing desks, and proper computer monitor placement can significantly reduce the risk of WMSDs and associated pain. As WMSDs tend to be caused or aggravated by factors such as poor workplace design (Koppiahraj et al., 2020), these changes can help alleviate physical discomfort and improve employee productivity and satisfaction (Hanna et al., 2019). Various studies have examined the effectiveness of ergonomics interventions and have generally found improvements in physical and mental health and productivity.

Kar & Hedge (2020) tested whether a sit-stand-walk intervention could reduce WMSDs, physical and mental fatigue, and increase physical activity without harming productivity for computer-based work. They found significantly reduced WMSD symptoms for the sit-stand-walk intervention compared to sitting or standing alone. In a cluster-randomised trial, Pereira et al. (2018) compared the productivity outcomes of ergonomics and neck-specific exercise training (EET) to an ergonomics and health promotion info (EHP) treatment arm for a population of office workers. The EET treatment arm demonstrated productivity benefits with lower productivity loss, lower presenteeism, and lower absenteeism at the 12-month mark.

Over a 6-month RCT, Shariat et al. (2018) found that exercise and ergonomic changes to the environment reduced neck pain, shoulder pain, and lower back pain in desk job holders. They recommend from their results that managers implement at least 1 intervention that includes stretching, core exercises, and chair adjustment.

An RCT by Falk et al. (2022) that tested 4 intervention arms (height-adjustable desk provision, an online sedentary behaviour modification program, the desk and the program, and the control) for a sample of 95 sedentary employees working from home found that the desk-and-program arm exhibited large improvements in mood, moderate improvements in fatigue, interference with activities, work performance, satisfaction and productivity when compared to the control.

In another RCT, 740 office workers from 14 organisations were either assigned to an individualised workstation ergonomic intervention and given neck-specific exercise training, or participation in a health promotion program (Johnston et al., 2021). The first group had a significantly greater reduction in neck pain intensity at 12 weeks compared to the second group. However, this was not maintained at 12 months, and they recommend continuing exercise for long term benefits.

In another experiment, ergonomics training reduced 38% of musculoskeletal discomfort in the neck and left shoulder of the participants after 6 months, and the intensity and interference of pain in the right wrist was reduced by 39% (Sohrabi & Babamiri, 2021). The ergonomics training comprised a 6-hour training course that introduced the principles (i.e., identifying office-related WMSDs, how to control WMSDs by altering the environment, corrective tips for the workstation and equipment, and isometric neck exercises).

These results are also supported by a meta-analysis by Waongenngarm et al. (2018) that notes taking breaks as effective in reducing discomfort and lower back pain, especially active breaks with posture change. The active breaks promote blood circulation in the lower back, increase flow of synovial fluid to lubricate intervertebral discs, and help with spinal curvature. Notably, they found that the active breaks did not seem to adversely affect work performance, promoting concentration and alertness instead. This last point is worth noting, as ergonomic interventions may face challenges in implementation.

An RCT by Rasmussen et al. (2020) discovered that a major issue for their study was participation, with only 62% of the participants present in the last workshop. Similarly, Carr et al. (2016) reported that health programs that encourage employees to be more active outside of working hours often fail due to poor attendance and are unable to instill long-term behavioural change. Another potential barrier and employer concern with interventions involves their opportunity cost regarding the employee's productivity, specifically whether recommendations that involve physical activity or taking breaks may interrupt their work (Rosenkranz et al., 2020).

Some studies have found, however, that even light-intensity physical activity can offer significant benefits without affecting their work. For example, Carr et al. (2016) found that slow pedaling on a seated elliptical workstation for only 50 minutes at 59 rpm increased the workers' total activity from baseline by 11.5% (and 107 additional kilocalories burned per day) with no adverse effects on work.

Other studies (Rosenkranz et al., 2020; Panahi & Tremblay, 2018; Lurati, 2017) recommend the use of active microbreaks, or short breaks that involve some form of light physical activity such as standing, stretching, or walking, throughout the day. Taking two active microbreaks per hour (even for 3-5 minutes each) throughout the workday can reduce WMSD symptoms, stress, and fatigue without interrupting their workflow (Rosenkranz et al., 2020; Lurati, 2017). Hamer et al. (2014) also recommend scheduling meetings that require participants to stand or walk and providing easily accessible staircases instead of elevators as practical measures to reduce sedentary time.

Mental health support is another key area where companies can make a significant impact. Training managers to recognise signs of mental distress and providing them with the tools to support their teams effectively can foster a healthier work environment and workplace culture that destigmatises mental health issues (Hallgren et al., 2020). Employee wellbeing can also be improved via flexible work arrangements and schedules, so they can balance their work with personal responsibilities, thereby reducing stress and burnout.

Allowing remote work can also enable employees to create a comfortable and ergonomic home office setup (Muniswamy et al., 2021). Additionally, companies can implement comprehensive wellness programs that include regular physical activity sessions, access to fitness facilities, mental health workshops, and stress management training (Jiménez Díaz-Benito et al., 2022). In cases where risks cannot be eliminated, workers can be provided support and strategies to help them cope with stressors and to develop resilience.

Finally, fostering a supportive and inclusive workplace culture is crucial for addressing the interconnected issues of physical pain, mental health, and sedentary behaviour. Companies should prioritise open communication, provide regular feedback, and recognize employee achievements.

Increasing Government Obligations for Employers

Encouraging teamwork and collaboration can help build a sense of community and support among employees, which is beneficial for both mental and physical health. By implementing ergonomic solutions, promoting wellness programs, encouraging regular movement, providing mental health support, offering flexible work arrangements, and fostering a supportive culture, companies can significantly enhance the wellbeing and productivity of their employees.

Governments worldwide are increasingly recognising the importance of workplace health and safety, leading to the implementation of stringent regulatory frameworks, and the introduction of legislation aimed at protecting and promoting mental wellbeing. One example is the EU's Working Time Directive; according to Directive 2003/88/EC (2003), firms operating within the EU need to adhere to provisions that cover maximum weekly working hours, rest periods, leave entitlements, and considerations for night-time work or shift work. Another example involves occupational safety and health (OSH) regulations that require employers to assess and mitigate risks related to MSDs, which are prevalent in sedentary occupations (Hanna et al., 2019). Such regulations mandate employers to ensure a safe and healthy work environment, addressing both physical and mental health risks.

Moreover, employers are now legally required to implement measures that prevent workplace stress and provide support for employees suffering from mental health issues. To illustrate, laws may mandate the provision of employee assistance programs (EAPs) and training for managers to recognise and address mental health concerns (Hallgren et al., 2020). Compliance with these legislative measures and standards is crucial for creating a supportive work environment that fosters mental health and enhances overall employee wellbeing. This is supported by findings from the WHO which indicate that every US$1 invested in improving treatment for common illnesses experienced at work like depression and anxiety has a return of US$4 in health and ability to work (Cohen et al., 2020).

In Australia, workplace mental health is governed by separate Commonwealth, state, and territory legislation, and regulated within each jurisdiction. These authorities aim to assess compliance with human rights standards and to address mental health through a risk management approach (Hosseini et al., 2023; Cohen et al, 2020). Psychosocial risk management for the EU is discussed by Framework Directive 89/391/EEC on Safety and Health of Workers at Work, which obliges employers to address all types of risk with a focus on prevention and to establish health and safety procedures, although psychosocial hazards are not mentioned explicitly (Leka et al., 2015).

To meet these safety obligations, organisations may follow the guidelines provided by standards such as the PAS 1010 and ISO 45003, which directly address the management of psychosocial risks in organizational settings (The British Standards Institution [BSI], 2011; International Organization for Standardization [ISO], 2021). Both standards recommend a preventative approach for risk management, emphasize the continuous monitoring and evaluation of these processes, and can be integrated into organisations' existing OSH systems (Leka et al., 2011).

To ensure transparency and accountability, governments are also increasingly requiring employers to report on their health and safety practices. This includes documenting incidents of work-related injuries, measures taken to address mental health issues, and efforts to reduce sedentary behaviour. For example, Seppälä et al. (2018) examined several Finnish policy papers that address occupational health and recommendations for promoting physical activity and reducing sedentary behaviour. Some of the pertinent policies or behaviour change techniques (BCTs) recommended include personal health plans for employees, training and monitoring on health choices and behavior, and restructuring the physical and social environment to minimise sedentary behaviour.

Regular reporting helps monitor compliance with regulations and provides valuable data for continuous improvement of workplace health policies. Non-compliance can result in penalties, further emphasising the importance of adhering to government-mandated health and safety standards (Turner & Lingard, 2020). To address the health risks associated with prolonged sedentary behaviour, governments are setting ergonomic standards for workplace design.

These standards provide guidelines for the proper arrangement of workstations, including the use of adjustable chairs, standing desks, and appropriate monitor heights. Compliance with these ergonomic standards is essential for preventing WMSDs and promoting a healthy and productive workforce (Hamer et al., 2014).

Governments are also encouraging employers to adopt health promotion programmes through incentives and subsidies. These programmes often include initiatives such as regular physical activity sessions, wellness workshops, and health screenings. By providing financial incentives, governments aim to reduce the burden of work-related health issues on public health systems and enhance the overall health of the workforce. For example, tax credits or grants may be offered to companies that implement comprehensive wellness programs (Jiménez Díaz-Benito et al., 2022). Another valuable aspect of the strategy is the use of public awareness campaigns to educate both employers and employees about the importance of workplace health and safety.

These campaigns aim to highlight the risks associated with sedentary behaviour and poor mental health, and to promote best practices for creating a healthy work environment. By raising awareness, governments hope to foster a culture of health and safety that extends beyond regulatory compliance to become an integral part of organisational values.

Lastly, the promotion of flexible work policies, remote work options, and other accommodations can help employees balance their work and personal lives. These policies would be particularly beneficial for reducing stress and preventing burnout, which are significant contributors to poor mental health and physical pain in the workplace (Muniswamy et al., 2021).

In summary, increasing government obligations for employers to address physical pain, mental health conditions, and sedentary behaviour reflect a growing recognition of the critical role that workplace health plays in overall public health. Through a combination of regulatory frameworks, incentives, reporting requirements, and public awareness campaigns, governments are encouraging employers to create safer, healthier, and more supportive work environments. These efforts are essential for improving employee wellbeing, enhancing productivity, and reducing the long-term costs associated with work-related health issues.

Conclusion

Research has consistently demonstrated a bidirectional relationship between the physical pain and mental health of workers, where physical pain can cause or worsen mental health issues, and poor mental health can amplify the experience of physical pain. Work environments are sources of physical and psychosocial hazards that potentially cause harm to workers in the form of adverse health outcomes such as WMSDs, which lead to productivity losses for the company in the form of absenteeism and presenteeism.

Additionally, the sedentary lifestyles of many office workers have been linked to many physical and mental health issues, such as WMSDs, cardiovascular diseases, metabolic conditions, and increased symptoms of depression and anxiety. The relationships evidenced between physical pain, sedentary behaviour, and mental health therefore underscore the importance of a comprehensive and integrated approach to workplace health and risk management that considers factors such as the work environment, organisational structure, and job design.

Employers should address these issues with a risk management approach, by identifying all relevant physical and psychosocial hazards and their sources and preventing or controlling the risks in accordance with the risk control hierarchy. Effective risk management not only considers the physical environment and physical interventions, but also how work is structured and designed overall to minimise psychosocial hazard exposure. Such policies can include ergonomic adjustments to employee workspaces, the promotion of movement strategies like active microbreaks and regular light physical activity to minimise sedentary behavior, the access to comprehensive wellness programs, and the encouragement of a healthy, supportive workplace culture that considers the mental health outcomes of employees.

Employers should ensure that their ergonomics programs help in designing work environments to provide adequate resources and support for workers, educate workers on the various hazards and on ways to improve their health outcomes, and empower the workers to adopt preventive behaviors. By fostering an environment that addresses both physical and mental health needs, companies can improve overall employee satisfaction and performance.

Governments are increasingly recognising the importance of workplace health and safety, implementing stringent regulatory frameworks that require employers to ensure safe and healthy work environments. Mental health legislation, ergonomic standards, and incentives for health promotion programs are key elements of these frameworks. Governments are also promoting flexible work policies and public awareness campaigns to educate employers and employees about the risks associated with sedentary behaviour and poor mental health. Regular reporting and accountability measures help monitor compliance and drive continuous improvement in workplace health policies.

Addressing the challenges of physical pain, mental health, and sedentary behaviour requires an integrated approach that involves both employers and governments. Employers must prioritise workplace risk management and ergonomic improvements, while governments provide the necessary regulatory support and incentives. Collaboration between the private and public sectors is crucial for creating a holistic strategy that enhances workplace health. By working together, employers and governments can create safer, healthier, and more supportive work environments that promote employee wellbeing and productivity. These efforts are essential for reducing the long-term costs associated with work-related health issues and improving the overall quality of life for employees.

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About the Authors

Byron Kwong

Byron Kwong is a respected professional in health, safety, and wellbeing. He is the most recent member of the team joining *Impart* in June 2024, but he brings with him a comprehensive background in occupational therapy and ergonomics. Byron has consistently demonstrated his expertise in the development and maintenance of health and safety systems, earning him recognition in his field.

Byron's career is marked by significant achievements, including leading roles in establishing health and safety frameworks at *EnergyAustralia* and his instrumental involvement in the development of *Swivel*'s ergonomic assessment platform. His work has not only improved operational health and safety standards but has also introduced innovative digital solutions to address ergonomic risks in the workplace.

His professional accolades, such as the *Employee of the Year* and the *Managing Director's Safety Merit Award*, underscore his commitment to excellence in workplace health and safety management. Byron's educational qualifications, including a Bachelor's degree in Ergonomics Safety and Health and in Occupational Therapy from La Trobe University, further cement his authority in the field.

Byron's strategic leadership and deep industry knowledge continue to drive the advancement of health and safety practices, positioning the organization as a leader in workplace wellbeing solutions. His approach is characterised by a methodical and evidence-based methodology, ensuring that health and safety protocols not only comply with current standards but also anticipate future workplace needs.

Mary Catherine Mercado

Mary Catherine A. Mercado is a seasoned research analyst and writer with a strong background in econometrics, statistical analysis, and economic research. With expertise in both life sciences and economics, she is well-versed in using econometric tools and methods for data analysis and modelling.

Her recent work as a Lead Researcher with Impart Advisory focuses on projects in wellbeing and digital innovation. In addition, she has contributed to numerous projects as an economic analyst with EEA, where her work spans various topics at the intersection of policy, sustainability, and technology.

She holds an MS in Economics from De La Salle University-Manila, where she developed robust skills in econometrics and macroeconomic analysis.

Her academic work includes a master's thesis exploring the impact of political freedom on economic growth, using sophisticated statistical methods to assess regional and resource-related variables.

Her previous experience also includes roles in science education, notably with the Bonifacio Art Foundation, where she led educational programmes and collaborated on international science exhibitions. These roles have demonstrated her ability to communicate complex information to a wide audience and manage large-scale projects with diverse stakeholders.

About the Authors

Dr. Michael D'Rosario

Michael D'Rosario serves as a Principal at *Impart*, where his expertise in evidence-based policy, AI/data science, and econometrics is integral to the organisation's strategic initiatives. His professional journey encompasses significant roles in policy analysis, research, and education, underscoring his deep-rooted knowledge and experience in these domains.

In his role at *Impart*, Michael's focus on econometric analysis and model design plays a crucial role in advancing the company's research and policy evaluation efforts. His work is characterised by a methodical approach to data and policy analysis, contributing to the development of informed and actionable strategies for the organisation and its clients.

Michael's distinguished career has seen him lead research and educational programs at renowned institutions, where he has been responsible for the development of courses in Artificial Intelligence, ModelOps, and Algorithm design, among others. This experience has honed his skills in both theoretical and applied aspects of his field, making him a valuable asset to Impart.

With a strong academic background, including a PhD in Econometrics, and multiple graduate degrees, Michael's credentials are a testament to his expertise and commitment to his field of work. His scholarly and professional achievements reflect a career dedicated to the advancement of economic and policy research.

Michael has consulted to a number of business and NFPs. His business advisory work has involved consulting to Linfox, Ron Finemore Transport, Lincraft, Becton, and ERG, amongst others. His NFP work, an area of genuine passion, has involved consulting work with BCCM, Per Capita, Deaf Connect, NDS, AMBA, Twins Trust, the University of Oxford and the Australian Hygiene Poverty Project.

Michael has lectured and chaired courses at the University of Melbourne, CQUniversity, and the University of Adelaide. At *Impart*, Michael's contributions are pivotal to the organisation's research and policy initiatives. He leads the economic modelling program and *Economic Evaluation Australia*, a dedicated evaluation team. His analytical skills and comprehensive understanding of economic and data science principles guide *Impart*'s approach to research, ensuring that projects are both innovative and grounded in solid empirical analysis. Michael's presence at *Impart* significantly enhances the company's capacity to deliver research and policy insights that are both relevant and impactful.

IMPART

About Impart Advisory

Impart is a purpose-driven management consulting group that specializes in delivering comprehensive, high-impact solutions through its distinct divisions: Economics, Research Services, AI Strategy, and Data Science. Each division is dedicated to offering strategic insights and innovative approaches tailored to meet the unique needs of their clients, with a focus on driving sustainable business outcomes. Impart's multifaceted approach allows them to provide expert guidance across sectors, integrating economic analysis with cutting-edge technologies such as artificial intelligence and data-driven solutions to solve complex challenges.

At the heart of Impart's commitment to rigorous analysis and effective decision-making is Economic Evaluation Australia (EEA), the group's specialized evaluation practice. EEA is dedicated to conducting thorough evaluations of programmes and policies, using sophisticated econometric and analytical methods. EEA's work is pivotal in helping organisations understand the social, economic, and environmental impacts of their initiatives, providing clients with robust evaluations that support evidence-based decision-making and policy development.

About Swivel Research

Swivel Research, a division of Swivel, is dedicated to research focused on ergonomics and wellbeing, particularly for sedentary workers. Swivel is an innovative solution provider in digital ergonomics, offering state-of-the-art comfort and health solutions to leading Australian businesses.

Swivel's research arm is committed to enhancing workplace environments by focusing on the physical and mental health of employees, ensuring that ergonomic solutions are backed by rigorous scientific research. By leveraging digital technology, Swivel helps businesses improve the productivity and wellbeing of their workforce through optimised, data-informed ergonomic practices.