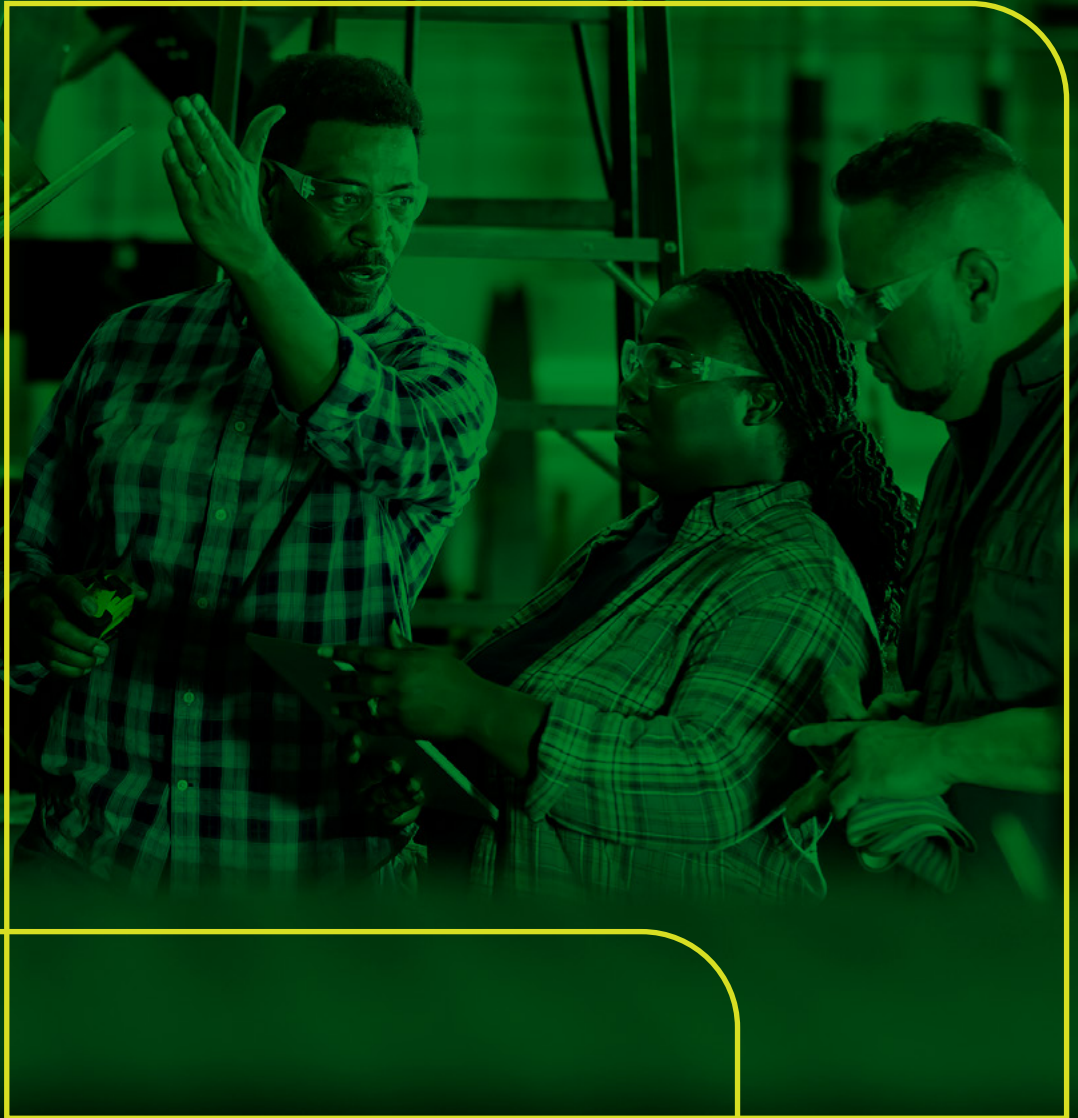




MSD Solutions Lab

an **nsc** program



The Intersection of DEI and MSDs

Ensuring Equitable Outcomes

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Executive Summary

The goal of this report is to create an understanding of why diversity, equity and inclusion (DEI) should be a foundational element of musculoskeletal disorder (MSD) prevention, describe how organizational characteristics can perpetuate disproportionate risk between workers and provide equitable solutions organizations can implement to lessen disproportionality in risk. While personal factors may be relevant, it is important to distinguish that these are not themselves risk factors – MSD risk factors are due to the workplace not accommodating or providing for all people. This paper will cover personal factors such as age, gender, race/ethnicity and cultural background, but does not focus on other personal factors such as religion, geographic location or sexual orientation, as more research that directly links these factors and MSDs is still needed.

Organizations should take several steps to ensure all employees are equitably safe from MSDs in their workplace. A first step to accommodating proper ergonomic solutions for all employees is understanding that people are unique, workplaces are diverse and certain aspects of work can lead to inequities experienced by some groups of workers.

In addition to this, it is important to foster inclusion. In an inclusive workplace, employees are empowered and encouraged to speak up about concerns. Creating a strong safety culture, developing a psychologically safe workplace, and acknowledging and accounting for psychosocial risks are important factors in making sure the workplace is safe and inclusive.

Once these aspects are understood, employers would be best served by identifying and advancing equitable solutions that improve jobs with the greatest MSD risk. When doing so, it is essential to seek and include feedback on job tasks and risk factors from a diverse group of employees to source solutions suitable for all. Potential equitable solutions are provided at the conclusion of this report, using the Hierarchy of Controls as a framework.

While the solutions provided are relatively specific as they relate to the Hierarchy of Controls, there are some overall takeaways. Employers need to be mindful of the risks in their workplace and a way to achieve this is to involve frontline workers in the design and implementation of safety solutions. Simple changes to workspaces to make them more accessible to a greater range of workers can also improve musculoskeletal safety not only for at-risk workers but for all workers.

This report is intended to be a starting point for organizations to use to work towards building a safer workplace for all employees. An equitable workplace recognizes and celebrates the differences in its workforce and prioritizes the inclusion of all when implementing ergonomic programs and MSD prevention solutions. In summary, employers should implement solutions to keep all employees safe and free from ergonomic hazards, regardless of individual characteristics, and to enhance productivity and workflow.



Introduction

At a fundamental level, the facets of diversity, equity and inclusion (DEI) and ergonomics share very similar goals. Ergonomics is a human-centered practice, modifying work environments and job tasks to meet the needs of the workforce and empower healthier, safer and more efficient work. In other words, the goal of ergonomics is to fit the work to the worker, and this really means all workers, of all demographic characteristics. Yet, when ergonomic hazards are unmitigated in the workplace, MSDs are likely to occur.

Occupational hazards are a threat to all workers. However, Krieger et al. (2008) proposed the “inverse hazard law” implying that more occupational and social hazards are found in sociodemographic groups with the least societal power. In other words, work is a social determinant of health. Given that health hazards vary inversely with the resources of a population, this characterizes the magnitude of the predicament faced by such populations. A critical, often overlooked point of the “inverse hazard law” is that investigating the health consequences in socio-economically disadvantaged populations cannot be achieved by focusing solely on these groups.

Instead, to fully understand health consequences in these populations, a broader understanding of the societal context and underlying systems is necessary. Krieger et al. (2008) demonstrated connections between the social context and systems (e.g., racial discrimination, sexual harassment, workplace abuse), occupational hazards (e.g., dust, fumes, chemical, noise, ergonomic strain) and poor health within understudied, low-income, working-class populations. Krieger (2010) further emphasized the connection between societal determinants of health and occupational health inequities when viewed through an ecosocial theory perspective.

The fundamental idea of this theory is that who is employed (or not), the nature of their work, the exposures they face, their treatment, job stability, benefits, pay and the actions taken to address these issues are all contingent on societal context. These issues intersect with people’s socioeconomic status, race/ethnicity, nationality, immigration status, age, gender, sexuality and more. To this effect, current work in recognizing the importance of considering DEI factors in relation to MSD risk and prevention touches on many issues pertaining to health disparities of diverse working populations.

MSDs at a Glance

MSDs are the largest category of workplace injury resulting from risk factors including forceful exertions, awkward or static postures, and repetitive movements. MSDs are injuries or disorders of the muscles, nerves, tendons, joints, cartilage and spinal discs. Specifically, work-related MSDs are conditions in which the work environment or performance of work contributes significantly to the condition, the condition is made worse by the work performed or the condition persists longer due to work-related factors. Affecting nearly one-quarter of the global population, MSDs impact business efficiency and workers’ ability to live their fullest lives.

MSDs are also the leading cause of worker disability, involuntary retirement and limitations to gainful employment. In addition to the impact these injuries have on employee wellbeing, they cost businesses in the private sector nearly \$17 billion a year.

While DEI certainly intersects with all workplace safety issues, it is appropriate to give attention to the intersection of DEI and MSDs given the employee and employer repercussions of workplace MSDs. Employers must understand how they can ensure everyone in their workforce can avoid these injuries.



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For the workplace to be safe and equitable for all employees regardless of race, color, religion, sex (including pregnancy, sexual orientation or gender identity), national origin, age, disability or genetic information (including family medical history), it is important to understand the facets of DEI, why they are important and how to address concerns in the interest of workplace safety equity, ergonomics and the prevention of musculoskeletal disorders (MSDs).



DEI within the workplace, and especially regarding safety, has received increased emphasis and attention in recent years. While efforts have been made to increase workplace safety through regulations, innovative technologies, hazard assessments and other efforts, some workers remain at substantial and disproportionate risk for injuries in the workplace.

According to data compiled by the Bureau of Labor Statistics (BLS) and the U.S. Census Bureau, 16% of all private-sector workers in the United States were employed in high-risk occupations (Baron et al., 2013). However, many demographic groups have significantly higher representation in high-risk occupations, with 21% of males, 24% of Hispanics, 21% of non-Hispanic Black, 20% of American Indians/Alaska Natives, 22% of foreign-born workers and 26% of workers with no more than a high school education being employed in high-risk occupations. This is in comparison to 13% of White workers and 9% of workers with higher than a high school level of education seen in these same high-risk occupations.

DEI at a Glance (Morukian, 2022; Shore & Chung, 2022)

Diversity encompasses all human characteristics that make us who we are, such as race, ethnicity, gender/sex, socioeconomic status, national origin, disability status, language or religion.

Equity aims to promote fairness by creating a level playing field for all and making sure everyone has an equal chance to succeed by recognizing some groups of individuals may have unearned advantages.

Inclusion is the practice of creating an environment where everyone is equally valued, respected for their individuality, and their need for belongingness and uniqueness is satisfied.

Research shows workers of color face more work-related injuries and illnesses, but most workers' compensation systems do not gather data on race and ethnicity (Buchanan et al., 2010; Seabury et al., 2017; Smith et al., 2023; Strong & Zimmerman, 2005). Based on Washington state's workers' compensation claims between 2013–2017, Black workers consistently had the highest claim rates across all industry and occupational sectors. Similarly, Hispanic claimants surpassed White and Asian/Pacific Islander claimants in most industry and occupational sectors. Nearly half of the accepted claims were attributed to bodily reaction/overexertion injuries during this reporting period. Collectively, these data demonstrate the disproportionate rate of non-fatal injuries, inclusive of MSDs, between groups in a variety of industry sectors.

Focusing on DEI in organizations not only increases fairness and acceptance, but it can also have positive impacts on productivity, improved innovation and creativity, personal growth, retention of valuable talent and strengthened communication with a broad range of clients, customers and professional contacts (Dike, 2013). Accommodating diversity also helps employers and companies as it opens them up to a larger potential workforce that is as diverse as the company's client base.

The Influence of Systemic Factors

This paper is intended to identify workplace factors that can lead to inequitable MSD outcomes among a diverse workforce and provide solutions for mitigation. However, it is worth noting that many of the factors leading to disparate health outcomes in the United States are due to more than organizational factors. These underlying causes undoubtedly contribute to differences in worker safety but are out of the scope of the present work. If you would like to learn more about some of these factors, see these sources on [systemic racism](#), [gender bias](#), [ageism](#), [ableism](#) and the [poverty cycle](#).

More recently, Richard et al. (2021) reported that racial diversity in upper and lower management has positive impacts on workplace productivity. The highest organizational productivity was observed when there was more racial diversity in lower and upper management. However, the lowest productivity was observed when there was more racial diversity in lower management but less racial diversity in upper management. This implies organizations that are diverse in their lower management should strive to also be diverse in upper management.

Further, providing employees with a sense of control in the organization creates a culture that values and promotes equity (Al-Zawahreh & Al-Mahi, 2012). Perceptions of workplace equity tend to increase levels of employee performance (Banks et al., 2012), increase job satisfaction (Khalifa & Truong, 2010) and decrease an employee's intention to leave their employer (Mahajan & Benson, 2013). Other potential benefits include increased recognition of the value and skill of employees and increased power and reputation of the company externally (Chicha, 2006). When all employees are included in their workplace and their unique voices are heard, there is reduced absenteeism, improved innovation and creativity, more business growth and increased commitment, confidence and morale in the workforce (O'Donovan, 2018).

NSC DEI Definitions and Commitment Statement

DEI has gained increased attention recently, but these are more than just buzzwords. While included earlier are cited definitions of diversity, equity and inclusion, NSC takes these definitions a step further by adding an element of justice to these definitions. Importantly, NSC reinforces that equity implies fairness and justice as a root cause. Additionally, NSC supports that inclusion should entail the intentional pursuit of creating equitable systems that provide all individuals equitable access to resources and in which individuals have a voice and representation. Related, NSC is committed to using an equity lens for all work and adheres to the below commitment statement:

At NSC, we demonstrate our commitment to diversity, equity and inclusion through our culture and our values. Our culture embraces all people regardless of ancestry, color, national origin, race, gender identity, sex, sexual orientation, age, religion, physical or mental disability, or veteran status. We boldly empower our team to model respect and dignity. We find impactful opportunities for growth and development. We create a safe environment that includes mental, physical, psychological and emotional protections. To be NSC is to deliver our mission by working together – our employees, members and stakeholders – in such a way that everyone feels a sense of belonging.

We believe that you can't be safe if you don't feel safe. Feeling safe requires a commitment to equitable policy implementation and promoting diversity in the safety profession. We must cultivate our own diverse, inclusive and equitable work environment to deliver on our mission to save lives, from the workplace to anyplace.



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Understanding Work Systems

A first step to implementing ergonomic solutions for all employees is understanding diversity within a workforce and knowing how certain aspects of work can lead to inequities experienced by some groups of workers. Ergonomics, when properly executed in an organization, has the potential to ensure all workers can perform their jobs safely and with maximum efficiency. The following sections discuss how work may be organized or completed and how this could disproportionately affect certain groups of workers. Work organization (e.g., working hours, type and pace of work), workplaces and equipment should be designed with diversity in mind.

Work Organization

Work organization characteristics such as work scheduling and non-standard work arrangements can negatively impact employees' musculoskeletal health and safety (Caruso, 2014; Howard, 2017; Marucci-Wellman, 2018). Additionally, the type of work being completed (e.g., physically demanding work or sedentary work) can impact worker health and safety, including MSDs (Afanuh & Johnson, 2017; Ahn et al., 2019; Andersen et al., 2016; Genin, et al., 2018; Hiesinger & Tophoven, 2019). These characteristics of work may be more likely to lead to disproportionately negative outcomes for certain workers (Marucci-Wellman, 2018). Learning how these aspects of work can affect the prevalence of MSDs is imperative for employers to modify work to better suit diverse workforces or eliminate such work organization risks altogether.



Working Hours

Existing literature shows work aspects such as shift work, long hours and part-time employee status can impact the prevalence of MSDs among workers (International Labour Organization [ILO], 2013). For example, a study conducted among nurses revealed night workers had a significantly higher prevalence of MSD symptoms in their lower back and ankle compared to day workers (Attarchi et al., 2014). Additionally, longer working hours are associated with an increased prevalence of MSDs. One study found that working 12 or more hours a day, more than 40 hours per week, and working on two or more weekends per month were all associated with MSDs in nurses (Lipscomb et al., 2002). Working more than 52 hours a week has also been found to be associated with a higher prevalence of upper and lower limb pain (Lee et al., 2018).

Men tend to work on average longer hours compared to women, which may lead them to disproportionately experience more MSDs (ILO, 2013). However, women participate more in part-time work, which has been found to result in an increased risk of experiencing an MSD in comparison to full-time employment (Gignac et al., 2018; ILO, 2013; Lipscomb et al., 2002). Part-time work tends to lack the health benefits typically associated with full-time employment, which may complicate, prolong, or inhibit MSD treatment and recovery leading to increased acuity or exacerbated conditions. Therefore, men and women may have varying likelihoods of suffering from an MSD depending on the type of shifts they work or their employment status.

The type of shift being completed may also disproportionately impact older workers and workers of color. One study found that for all workers, occupational injury risk, including the risk of MSDs, significantly increased on night shifts when compared to morning shifts due to increased levels of fatigue (33% increase), while the risk was also slightly elevated on afternoon or evening shifts (Fisher et al., 2017). However, workers 20 years of age or younger experienced less risk on the afternoon or evening shift compared to workers over the age of 20. A possible explanation for this is that adolescents tend to sleep longer and later into the day, which could make them less fatigued for their afternoon or evening shifts.

Ferguson et al. (2023) found that non-White workers were more likely to be employed in jobs that required working a mixture of day and night shifts. Such a demanding work schedule can increase the risk of negative safety outcomes, such as MSDs, due to less time for adequate sleep and recovery from work, longer exposure to hazards and demands at work, and less time to attend to non-work responsibilities (Caruso & Waters, 2008). Employers should be aware of how worker shifts may differentially impact them and develop solutions to prevent such disproportionate MSD risk.

Type and Pace of Work

Other workplace factors highly associated with MSD risk and prevalence are the type of job and the pace at which work is done (Gallagher & Herberger, 2013; Lin et al., 2010). Mehlum and colleagues (2008) found employees in a lower occupational class experienced a higher prevalence of MSD pain. For those employed in jobs paying lower wages, 62% of women and 66% of men reported lower back pain over the last month, while those in higher-paying roles experienced MSD pain at rates of 43% and 35%, respectively.



This study also found the prevalence of musculoskeletal pain is partially due to the type of work being completed – those with a higher prevalence of pain typically performed manual labor, while those with less pain did more sedentary work. Manual labor jobs are also more likely to result in musculoskeletal injuries in comparison to jobs not requiring manual labor (Bernard & Putz-Anderson, 1997), and many of the experiences of manual workers can cause stress and lead to increases in MSDs (Ahn et al., 2019). Finally, workload, time demands, effort and physical demands have been shown to have a significant, positive relationship with MSDs (Habibi et al., 2015).

Some research has shown women tend to suffer more MSD-related pain in the upper back and upper limbs while men tend to suffer more from lower back pain (ILO, 2013; Institute for Work & Health, 2016). However, it is unclear whether this is due to biological differences in musculoskeletal structure or differences in tasks between industries where there is traditionally a higher representation of either males or females, which can have varying levels of MSD risk. For example, the health care, social assistance and educational services industries typically employ more women and consistently appear within the top 10 most MSD-afflicted industries (Injury Facts, 2020). Work in these industries often involves tasks that contribute to a higher risk of MSDs such as repetitive movements, awkward positions and static postures (Healthy Workplaces, 2021; Isusi et al., 2020).

Cleaning and housekeeping are also majority female fields with high MSDs, which could be the result of working under time pressure and at high speeds, increasing their chance of injury and MSD (Healthy Workplaces, 2021). Specifically, Buchanan et al. (2010) reported increased injury risk factors for female, Hispanic housekeepers in comparison to all workers in the service industry sector. While these industries may experience a high number of MSDs, other fields such as mining or construction – which employ a higher number of men and experience a high number of MSDs but are more “visibly dangerous” – have been the focus of occupational safety and health laws and regulations (ILO, 2013). *However, this has historically caused hazards in less “visibly dangerous” industries where women are overrepresented to be under-recognized or understudied, even when the risks and dangers are still prevalent.*

More labor-intensive work with high demands and fast paces can also be difficult for older workers (Holmstrom & Engholm, 2003). Among older workers, Hiesinger & Tophoven (2019) reported that sustained, elevated levels of physical and psychosocial work demands harm physical health, including MSDs, as well as mental health. Based on older workers’ responses to the American Working Conditions Survey, Morrissey (2023) reported that older workers ages 50-70 experience difficult working conditions that could lead to MSDs, with 50% engaged in physically-demanding occupations, 54% exposed to unhealthy or hazardous work conditions, 46% in high-pressure jobs and 54% in challenging work schedules. These older workers also experience psychosocial risks, with 46% experiencing limited autonomy and 14% experiencing adverse social interactions. While workers in their prime age (35-49) were also likely to experience difficult working conditions, such conditions combined with increased risks faced by older workers due to their aging bodies put older workers at greater risk for serious injuries than prime-age workers (Morrissey, 2023).

These workplace demands are especially important as research has shown aging workers may have a harder time recovering from an injury, thus making the injury more severe and causing more time away from work. According to the BLS, the median duration of absence from work due to a workplace injury increases consistently with age, from 5 days among those younger than 25 years old to 12 days for those aged 55 and older (Rogers & Wiatrowski, 2005). Additionally, aging workers are more likely to sustain fewer, but more serious injuries, such as fractures, compared to younger workers. Younger workers are more likely to experience more frequent, but less serious injuries, such as sprains and strains (Silverstein, 2008).

Using data from the National Health Interview Survey, Kachan et al. (2012) reported that for workers aged 55 and older, industry type emerged as the primary factor associated with non-fatal injury risk, including MSDs. Industries such as agriculture, forestry, fisheries and construction consistently exhibited higher risk levels across all age groups, while younger workers in manufacturing and older workers in transportation, communication and other public utilities faced elevated injury risks, inclusive of MSDs. These findings emphasize the importance of tailored safety measures that account for industry and job tasks’ differential impact on certain workers to mitigate workplace injury risks effectively.



Trends regarding type and pace of work and race/ethnicity are also found in the literature. Latino immigrants and Black male workers are more likely to be employed in dangerous jobs and industries (Seabury et al., 2017). These high-risk industries lead to higher rates of injury and illness, including MSDs. This finding may be due to disparities in diverse economic opportunities that lead to more hazardous jobs for workers of color which inherently increase the risk of workplace injury (O'Brien et al., 2020). Research shows almost half of all Black workers are employed in the health care, retail, or accommodations and food service industries, and are underrepresented in high-growth, high-wage, low-safety risk industries, such as information technology, professional services and financial services (Stewart et al., 2021).

Individuals who move countries to better their living or working conditions, whether permanently (immigrants) or temporarily (migrants) may be at increased risk of MSDs. For example, migrant workers are also more likely to experience work-related injuries and illnesses, including MSDs, in comparison to non-migrant workers, though this relationship may fluctuate based on other variables such as industry or gender (Hargreaves et al., 2019). Akay and Ahmadi (2022) showed that immigrant workers often face greater exposure to physical hazards and work under poor psychosocial working conditions compared to non-immigrant workers. Their findings are like that of Sterud et al. (2018) who reported that immigrant workers in Europe and Canada experience poorer working conditions and occupational health than native workers. Further, Snipes et al. (2017) found that farm owners forced their migrant workers to work despite injuries and denied access to medical care or treatment, while native workers more commonly had time off approved and received better health care. Given these findings on the impact of type and pace of work on MSDs, employers should provide safety measures, such as more rest breaks or flexibility in scheduling, to keep workers safe.



Workplace and Equipment Design

Other job aspects that may not account for diversity and may inadvertently lead to MSDs are workspace design or workstation layouts, the design of equipment, and the design and assignment of personal protective equipment (PPE). According to ISO standard 26800:2011, workspaces and workstations should be designed to accommodate about 90% of the population (ranging from a female in the fifth percentile to a male in the ninety-fifth percentile), and while this does accommodate nearly all industrial workers, this may leave some employees without proper workspaces and equipment (Salvendy, 2012). However, it is often not financially feasible for most companies to go beyond this range of accommodation.

Workplace Design

Notably, [a lack of diverse equipment or workspaces](#) has the potential to impact employees who have existing physical limitations and workers who fall outside of the targeted 90% of the population. An employee who uses a wheelchair or someone smaller than a fifth percentile female may have difficulty accessing the full range of their workstation depending on its design, especially if it lacks adjustability. In addition to accessing individual workstations, such employees may have [difficulty reaching common items](#), causing a need for repetitive reaching and placing the worker at increased risk for MSDs (BostonTec, 2022). Considerations such as adjustable workstations and furniture, [relocation of commonly used materials and tools](#), and other forms of accommodations in alignment with the ADA 2010 Standards for Accessible Design can mitigate MSD risks.

Similarly, the Job Accommodation Network states it is essential to account for individuals who may have limitations related to mobility, vision, hearing or cognitive abilities in the design of computer workstations. A lack of accommodations in workspaces could put those with disabilities at a disproportionate risk of developing an MSD.

Ergonomically designed work environments also can ensure workplaces are age-friendly (NIOSH, 2023). BMW took a proactive approach by staffing a production line with workers reflecting the anticipated age distribution in 2017, which included more older workers (Loch et al., 2010). The older workforce achieved a 7% productivity increase within three months, reducing absenteeism and defects. This was achieved through various small, cost-effective changes such as increasing the emphasis on managing health care, enhancing workers' skills and the workplace environment, and instituting part-time policies and change management processes to enhance workplace ergonomics. Therefore, with ergonomics in the working environment properly addressed, older workers can work with increased efficiency and lessened risk of MSDs.

PPE and Equipment Design

In addition to workstation and work environment design, diversity in PPE selection is inadequate and may pose an additional risk to workers. PPE has traditionally been designed to fit the average White male, and as a result, females in the workforce are often not provided with properly fitting gear (ILO, 2013). On average, women tend to have shorter heads, broader faces, shorter legs, longer trunks, smaller feet and smaller hands compared to men (Marth, 2022). Failing to account for these differences in body proportions can lead to PPE that is ill-fitting, uncomfortable, cumbersome, oversized, potentially hazardous and overall less effective at keeping workers safe (Marth, 2022). Ill-fitting PPE can pose ergonomic and MSD hazards through impaired vision, restricted movement and an increased risk of tripping, falling or straining (Tranter, 2021).

Hegewisch and Mefferd (2021) examined PPE fit in the construction industry and found that women, non-binary and transgender workers encounter difficulties obtaining properly fitting PPE. Their survey data found only 19% of respondents consistently received appropriately sized gloves and safety gear while on the job. Furthermore, the importance of considering hand size in hand tool and glove design in relation to MSD prevention is evident. Multiple studies have shown the importance of properly fitting gloves concerning hand-arm vibration syndrome (Bovenzi

et al., 2016; Hewitt et al. 2016; Johanning et al. 2020). PPE may also not be equitably available to all workers, as exemplified by inadequate access to PPE for non-White health care workers (Nguyen et al., 2020).

Fram et al. (2021) examined the ease of use of one-size-fits-all orthopedic tools and surgical instruments and the injury rates of male and female orthopedic surgeons. Female orthopedic surgeons experienced more musculoskeletal symptoms related to surgical instruments, possessed negative attitudes towards these instruments and identified a significant number of common instruments as challenging or uncomfortable to use when compared to their male colleagues. Similarly, Hislop et al. (2023) revealed that female surgeons, especially novices, took longer to complete standardized surgical tasks and experienced double the frequency of musculoskeletal pain compared to male colleagues. Female surgeons and those needing smaller gloves also consistently reported difficulties and needing modified grip techniques with standard tools. These tool design studies further emphasize the importance of considering the diverse needs of the user in ergonomics and MSD prevention.



However, efforts have been made to ensure adequate PPE fit throughout industries, as seen in the proposed rule to clarify PPE standards in the construction industry (U.S. Department of Labor, 2023). The proposal states that PPE must fit each employee properly to protect them from occupational hazards such as MSDs. This is an important step to ensure employees of all sizes and proportions are protected in all industries. Effectively designing and evaluating equipment and PPE as a function of worker characteristics is a must for MSD prevention.



Fostering Inclusive Organizational Practices

Beyond accounting for diversity in the workplace to mitigate MSDs, it is important to also foster inclusion. In an inclusive workplace, employees are empowered to speak up about concerns, inclusive of safety and MSD concerns. Creating a strong safety culture, developing a psychologically safe workplace, and acknowledging and accounting for psychosocial risks are important factors in making sure your workplace is inclusive and safe from MSD risks. Achieving DEI is incomplete until employees feel a sense of belonging, where their contributions are valued, and they perceive themselves as belonging and essential (Verllinden, 2023).

Safety Culture

Cultivating a safe and healthy work environment is dependent on an organization's safety culture, which should be rooted in DEI principles. Safety culture refers to an organization's shared perceptions, beliefs, values and attitudes that combine to create a commitment to safety and an effort to minimize harm (Weaver et al., 2013). The National Health Service of England (2022) states that a positive safety culture is collaboratively crafted, created and nurtured so workers are safe. Positive safety cultures also foster continuous learning and improvement of safety risks, supportive and psychologically safe teamwork, and an environment where employees are empowered to speak up.

To this effect, The Joint Commission (2012) emphasizes that workplaces are safer when a positive safety culture is present, as workers are more likely to adhere to standard safety precautions when they feel their organization has a positive safety culture. Understanding how organizational culture can hinder or facilitate safety practices is also essential (Flynn, 2014). Organizations need to recognize that adhering to "the way we do things here" may unintentionally exclude workers from diverse backgrounds. To avoid the exclusion of workers and to promote a strong safety culture, organizations should focus on inclusion, open communication, trust and the engagement of all employees (Rattan, 2023). Therefore, employers should consider how their workplace policies and procedures, accessibility of information, workers' cultural backgrounds, and psychologically safe teams and work environments might impact their overall safety culture, subsequent MSD risks and injuries, as well as organizational flexibility and efficiency.



Policies and Procedures

Organizations can strengthen their safety culture with policies and procedures that promote healthy, balanced lifestyles for workers. Workplaces that do not offer benefits such as paid sick leave and disability relief may enable an unsafe culture in which employees feel insecure about their employment and unsafe taking necessary time off when they've suffered a workplace injury, such as an MSD. Luong and colleagues (2012) found that for workplaces with paid sick leave and long-term disability benefits, workers experienced significantly fewer MSD symptoms of the knee compared to similar workers from workplaces with fewer benefits and policies. Policies and benefits also need to be clearly understood by all employees, as just the existence of proper policies and procedures is not enough to combat MSDs. Workers may enter a workplace unfamiliar to them, with a lack of knowledge of different materials, procedures and regulatory structures (Flynn, 2014). This lack of familiarity and understanding of how to operate within the system can lead to unsafe situations even when policies and procedures are in place.

Additionally, McCollister and colleagues (2010) found that Hispanic workers in the U.S. reported limited access to health care due to a lack of health insurance coverage. Their analysis of 1997-2007 data from the National Health Interview Survey highlighted a 7% decrease in coverage among U.S. workers, with the steepest declines observed among Hispanic workers, particularly in the construction industry (25% decrease). More recently, despite coverage gains from the Affordable Care Act, coverage disparities persist. Specifically in 2022, the Hispanic uninsured rate grew from 2.5 to 2.7 times higher than the rate for White people from 2010 to 2022, while Black people remained 1.5 times more likely to be uninsured than White people (Hill et al., 2024). Such a lack of health insurance coverage may make proper treatment of MSDs difficult and can slow a worker's recovery time and the return-to-work process. Clear and accessible policies and procedures are vital to ensuring organizations are equitably protecting all workers from safety risks.

Further, MSD risk assessments may not properly account for additional risks faced by those who are physically disabled. Risk assessments are procedures within a workplace used to provide an objective measure of risks that may lead to MSDs or other injuries. However, many standard observational risk assessments such as the Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment (REBA) and the Ovako Working Posture Analysis System (OWAS) are not designed to account for workers who may have a physical disability (Herzog et al., 2019). As such, it is essential to work with a certified professional ergonomist or occupational therapist, dependent upon workers' disability status, to ensure their knowledge is applied to the workplace or station redesign to address risks and make work tasks less burdensome for the employee.

Accessibility

Language barriers can also affect inclusion in the workplace and impact MSD outcomes. These barriers between non-English speaking workers and their supervisors and colleagues pose a common challenge for companies, especially in areas lacking bilingual support (Flynn, 2014). Managers often rely on the best English speaker among non-native-speaking employees to translate, risking miscommunication. Also, hiring bilingual individuals as safety professionals or supervisors solely based on language skills does not guarantee effective communication or leadership.

Workplaces with multilingual workers need to provide MSD safety education, training materials, posters and other signage in languages that reflect their workforce to ensure all workers are aware of safety procedures and protocols (Adebajo et al., 2018; Samanta et al., 2013). Jeraj and Butt (2020) explored language barriers and their relationship with MSDs and other difficulties experienced by diverse workforces. They found technical language and a lack of information made it difficult for some workers to access health care resources. Their findings also revealed additional inconsistencies in the quality of care and lack of control over treatment options, which suggests the presence of additional underlying factors contributing to inequities. Employers need to be aware of and correct such translation inequities that may impact workers and aim to educate workers on health care and treatment options related to MSDs and other injuries.

Worker Backgrounds

While effective communication is crucial, focusing solely on language can overshadow other significant cultural differences. Workplaces should consider the cultural background of their workers and how this may impact feelings of inclusion, MSD prevalence and overall health outcomes. Cultural backgrounds can influence people's perceptions of their illness, the likelihood of raising concerns over pain or seeking treatment, and their approaches to healing (Peacock & Patel, 2008). In turn, this can complicate MSD and other health outcomes.

Cultural factors affecting workplace safety and the risk of MSDs include workers' views on work, relationships with co-workers and employers, perceptions of workplace dangers relative to other risks, adaptation to workplace hazards and comparisons with other worker groups (Flynn, 2014). For example, immigration policies and political debates have intensified the vulnerability of immigrants and their families in the United States and may lead to their involvement in more dangerous work (Gomberg-Muñoz, 2010). In their study on Latino immigrant workers, Gomberg-Muñoz (2010) found that workers' "willingness to work" and cultivate social identities as "hard workers" may increase their likelihood of accepting dangerous working conditions and increase injury risk, including the risk of MSDs.

Moreover, Garcia and de Castro (2017) studied Filipino fish processing workers and found their cultural values of "hiya" and "pakikisama," which concern the tendency to avoid evoking shame and the need to get along with others, respectively, may prevent them from expressing dissatisfaction, reporting occupational injuries or addressing challenges with supervisors. This potentially leads to repeated, more severe occupational injuries and internalized discontent.

Additionally, some workers rely on alternative therapies which may discourage them from seeking professional medical advice or following prescribed treatments. More research is needed to better understand the underlying relationship between culture, health and illness before we can fully address racial and ethnic inequities in health and safety (Samanta et al., 2013). Employers also need to understand how the diversity of their workers may impact their feelings of inclusion or perceptions of workplace safety as a means to better understand MSD prevention.

Psychological Safety

Another key component of an inclusive work environment is psychological safety. Common definitions of psychological safety describe perceptions of feeling safe to speak up when hazards or other challenges arise without fear of negative consequences in workgroup settings (Edmonson, 1999; Kahn, 1990). Employers need to create environments and [cultures](#) that allow all employees to feel safe speaking up and being their true selves at work. While DEI efforts in the workplace have historically focused on the diversity component by supporting workers of color, there is currently a shift to concentrating more on [inclusion](#), in which the focus becomes creating an organization where all workers feel psychologically safe and welcomed (Janssens & Zanoni, 2008; Nair & Vohra, 2015). This shift towards psychological safety and genuine inclusion can also facilitate health promotion at work. For example, Thissen et al. (2023) reported that employee wellbeing at work is significantly influenced by a sense of belonging to the organization or team, with managers showing appreciation for their employees and involving them in decision-making.

Shore and Chung (2022) explored the relationship between workplace inclusion and employees of color and found that inclusive environments encourage people to voice their opinions, while exclusive environments cultivate cultures of silence that suppress employee voices. Voice suppression can prove particularly harmful to employees of color, as they may already perceive their voices and opinions as less valued than the majority group. As a result of this disparity, Black and Hispanic workers report the most unease about reporting unsafe work conditions when compared to other racial and ethnic groups (Mabud et al., 2021). Therefore, Black and Hispanic workers may be more uneasy reporting conditions with MSD risk. Low-wage workers and workers of color are also commonly more fearful of reporting an occupational injury, inclusive of MSDs, due to potential job loss and subsequent economic instability, intimidation from employers and co-workers to not report workplace injuries, or stigma around getting injured and feeling pain (The Committee on Education and Labor, 2008; Topete et al., 2018).

Women may also feel more comfortable than men reporting work-related MSDs. In a sample of working individuals 50 years of age or older with arthritis, women reported more severe symptoms and limitations than men (Gignac et al., 2018). Another study looking at MSDs in veterans found women were more likely to report moderate to severe pain while men were more likely to report no pain (Higgins et al., 2017). A longitudinal study from Norway looking at just over 64,000 individuals found 22% of women in their sample had filed for disability at the five-year follow-up compared to 18% of men (Gjesdal et al., 2011). While the studies mentioned do not explicitly identify why gender differences in reporting are occurring, several possible explanations exist. The type of work being performed, a lack of accommodations for women, or stereotypical gender norms around admitting pain and seeking help may amplify differences in speaking up and MSD reporting.

Psychosocial Hazards

Rick and Briner (2000) suggest a hazard is anything that could potentially cause harm. Furthermore, the Canadian Centre for Occupational Safety and Health (2024) describes a hazard as “any source of potential damage, harm or adverse health effects on something or someone.” The keywords in these two definitions are “cause” and “source,” indicating that a hazard is the origin or root of the harm experienced. According to Nemmers (2018) and Martinelli (2019), there are six hazards: biological, chemical, ergonomic, physical, safety and psychosocial. Though no definition exists in an OSHA standard, psychosocial hazards are discussed in several other countries, generally as a component of their occupational health and safety management regulations.

Psychosocial hazards are psychosocial factors that are perceived or experienced as unfavorable and can cause damage. Damage from a psychosocial hazard occurs in the mind of the individual exposed, which in turn influences their behavior. The resulting action could expose the individual to harm and cause similar or different harm to others (Daniels, 2022). Psychosocial hazards are causal to other psychiatric, psychological and physical illnesses and injuries (Tagoe & Amponsah-Tawiah, 2019). The severity, duration and frequency of exposure to psychosocial hazards can negatively affect psychological safety and increase the potential for psychosocial risk factors.



Psychosocial Risk Factors

In addition to safety culture and psychological safety, several psychosocial risk factors can play a role in workplace inclusion and the prevalence of MSDs. According to the National Institute for Occupational Safety and Health (NIOSH), psychosocial risk factors are factors in the work environment that can cause stress, strain or interpersonal problems for the worker. Common psychosocial risk factors are job stress, job dissatisfaction, time pressure and poor organizational, supervisor or coworker support.

Related to MSDs, research shows a lack of job control is associated with higher levels of stress, which can lead to a higher risk of developing an MSD (ILO, 2013; Landsbergis et al., 2018). Occupational stress has direct associations with MSDs, in that people with higher occupational stress are more likely to experience work-related MSDs (Hämmig, 2020; Li et al., 2021). Related, Ng and team (2019) found psychosocial stressors at work, such as role conflict, led to MSDs of the wrist/hand, shoulders and lower back. Habibi and team (2015) also reported workload frustration has a significant relationship with MSDs. Lastly, using the Quality of Work Life Survey, Yang et al. (2023) reported significant associations between back pain and several psychosocial factors, including job strain, work-life imbalance, harassment and discrimination based on race/ethnic origin, gender or age.

In addition to MSD rates, psychosocial factors can also impact the MSD recovery process. Lu et al. (2014) found workers who faced physical workplace violence, low job autonomy and high job strain were more likely to experience work-related injury absence compared to their counterparts. Similarly, workers experiencing physically demanding roles tend to have higher rates of short- and long-term absenteeism due to MSDs while those with more flexibility in their role have lower absenteeism due to MSDs (Canjuga et al., 2010). Psychosocial factors can also influence the duration of disability, recovery after a work-related injury and return to work after an injury. Moreover, low job satisfaction at work and low social support, either from supervisors or co-workers, can influence sickness absence due to low back pain (Hoogendoorn et al. 2002) and can hinder recovery after a work-related injury (Thumula & Negrusa, 2022).

Due to workplace and societal factors, such as pay inequity or a lack of representation in higher levels of an organization, female workers are more frequently exposed to psychosocial risks, such as workplace violence or harassment, compared to male workers (Healthy Workplaces, 2021). In a NIOSH-led study, Fekedulegn et al. (2019) found that workplace discrimination varied, with the highest prevalence at 25% among Black women and the lowest at 11% among White men. Black workers reported a 60% higher rate of discrimination than White workers, while women reported a 53% higher prevalence of discrimination than men. This study emphasizes the need for focused interventions to reduce workplace discrimination among at-risk segments of the U.S. labor market. While mistreatment or discrimination alone do not lead to higher rates of MSDs, they contribute to emotional turmoil, burnout, depression and anxiety (ILO, 2013; Healthy Workplaces, 2021; Isusi et al., 2020), which are associated with a higher probability of developing an MSD (Healthy Workplaces, 2021).

Psychosocial risks are also more pervasive in jobs and industries commonly employing workers of color, and therefore such employees are at a higher risk of experiencing psychosocial risk factors (Mutambudzi, 2017). In the construction industry, psychosocial risks such as harassment and discrimination can harm workplace safety, inclusive of MSD risk, productivity and skilled workforce retention (Respectful Workplace Review Committee, 2020; Kelly & Benitez, 2022). These issues disproportionately affect women and Black, Indigenous and other people of color in the industry. Further, Black workers are commonly employed in the health care, retail, or accommodations and food service industries, which tend to see higher levels of occupational stress and can in turn lead to disproportionately more MSDs for those employed in these industries (Stewart et al., 2021).

Given that both psychosocial stressors and employee demographics vary by industry, it is important to be aware of disproportionality in the experience of psychosocial risk factors (BLS, 1999). Taken together, psychosocial MSD risks remain prevalent within all industries and impact employees differently depending on many factors. Employers should work to mitigate psychosocial risks in their workplaces while understanding the disproportionate impact such risks may have on their workforce.

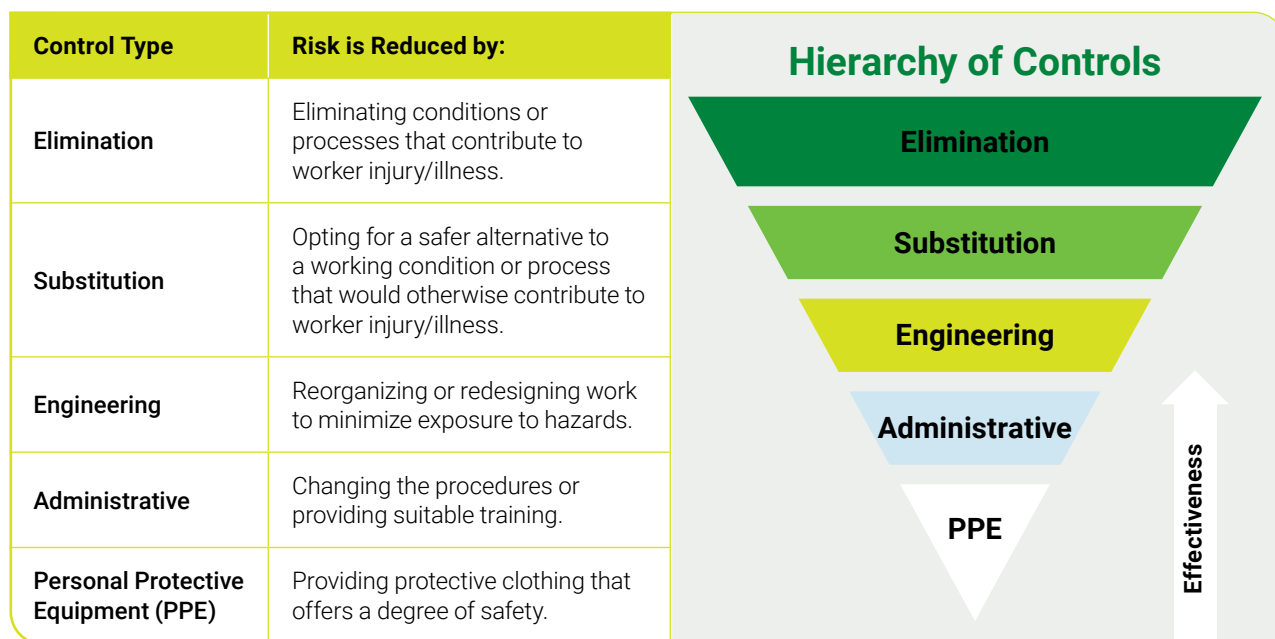
Implementing Equitable MSD Solutions

Understanding the impact of workplace factors, such as work organization, availability of proper equipment, safety culture, psychological safety and psychosocial risk factors, is only part of cultivating a safe and equitable work environment for all workers. Another important step to creating a safe and equitable working environment is ensuring leadership and employees are actively involved in MSD prevention.

Regarding leadership involvement, senior leaders are encouraged to champion DEI practices by fostering a positive safety culture and promoting inclusivity through open dialogues and social connections within teams. Leaders should also cultivate situational and cultural awareness to foster inclusiveness. Lastly, it is vital for leaders to develop positive relations with workers (e.g., transformational leadership), provide workplace support (e.g., peer support and organizational support) and consider the importance of work design (e.g., characteristics such as job autonomy, interdependence and role clarity) to build psychological safety (Frazier et al., 2017).

Employee involvement and feedback are also imperative to implementing MSD solutions that are equitable and inclusive. Specifically, organizations need to create an environment that is conducive to providing feedback on the design of workspaces for continuous improvement, possibly through user surveys or focus groups to understand the unique ergonomic challenges of employees from various backgrounds. Employees should also be empowered to actively engage in ergonomics and safety discussions, offer suggestions and voice their concerns. Another tactic to enhance solutions development is establishing employee working groups that consist of diverse employees and include those employees in risk assessments and subsequent analyses to provide different perspectives and lead to more comprehensive hazard identification and better safety solutions. Finally, consider the role DEI factors might play when investigating workplace incidents to understand whether biases or systemic issues contributed to the incident and address them accordingly.

In addition to ensuring a positive culture is in place and that all workers are involved, MSD risks can be reduced by adopting work practices and solutions that remove or reduce identified risks. Mitigation techniques are typically assessed according to their position on the Hierarchy of Controls. In decreasing order of quality, they are:



The section below outlines potential solutions to address inequities in the workplace, organized by the [Hierarchy of Controls](#). While this is not an exhaustive list, we encourage safety professionals to apply the information and examples provided in this paper to their unique environments. Employers should focus on identifying and advancing equitable solutions to improve jobs with the greatest MSD risk. When doing so, it is essential to seek and include feedback on job tasks and risk factors from a diverse group of employees to source solutions helpful for all. While the solutions presented are especially beneficial to prevent MSDs, many of these solutions can be applied to prevent other workplace injuries.

Elimination

- Be mindful of jobs that demand high exertions, awkward or sustained postures, or a fast pace and eliminate them when able

Substitution

- Use workplace design adaptable to those with different sizes, abilities and needs (e.g., desks with adjustable heights that can be adapted to accommodate wheelchair users, commonly used items stored between shoulder and hip height) – when possible, strive for universal designs to accommodate varied sizes and shapes
- Provide ergonomic accommodations, including reasonable accommodations for employees with known medical conditions or disabilities – this may include adjustable workstations, supportive seating, ergonomic tools and assistive devices to minimize the risk of strain or injury

Engineering

- Include employees from all levels of the organization in the design and evaluation of engineering controls
- Provide assistive devices that are adjustable and can adapt to worker needs to minimize the forces, reaches and repetitive motions in the job – these may include devices such as (but not limited to): lifts, hoists, cobots, carts, counterbalances, turntables and conveyors
- Consider different needs and issues for employees with sensory conditions – for example, account for employees with hearing differences with visual warnings and training in addition to auditory ones
- Ensure technology tools and interfaces are designed with accessibility features to accommodate employees with various abilities (Downey et al., 2023)
- Install ramps, handrails, elevators or other accessibility assistance to enable easy access to different areas of the workplace
- Understand the requirements of equipment and determine if workers with medical conditions will be affected – for example, some automated equipment and robots have magnets installed which can interfere with medical implants or devices
- Incorporate designs respecting different cultural norms and practices – for example, install guards around equipment that can get otherwise caught on culturally sensitive clothing that cannot be substituted (e.g., workers who wear hijab/abaya clothing)
- Understand the requirements and accommodation requests that fall under the [American Disabilities Act \(ADA\)](#) to ensure workers are protected

Administrative

Policies and Procedures

- Promote diverse representation in ergonomics and safety leadership, committees and training materials – when employees see leaders and colleagues who reflect their identities, they may feel more comfortable engaging in safety discussions and reporting hazards
- Analyze current ergonomics, safety and health policies and revise them where necessary – the goal of revisions should be to ensure these policies cover and are accessible and applicable to the full diversity of workers in your workplace
- Routinely check in with employees on which policies or training may need revision and make timely changes
- Translate policies and trainings to ensure understanding across all cultures, backgrounds and perspectives relevant to your workplace – additionally, have bilingual staff or translators available to answer any questions or concerns relating to workplace policies or training
- Consider including images or pictures to convey important safety information across language barriers and for those with verbal or auditory disabilities
- Develop, communicate and review policies and procedures that address discrimination, harassment or bias in the workplace
- Ensure safe manual materials handling guidelines for employees of all sexes and builds (e.g., evaluate jobs that require heavy lifting or lowering, use safe limits derived from the NIOSH Lifting Equation or Liberty Mutual Manual Materials Handling Equations or similar resources)
- Ease working pace requirements to reduce stress, [fatigue](#) and the risk of serious injury
- Allow frequent rest breaks to alleviate MSD symptoms – more frequent, shorter breaks provide more recovery than longer, less frequent breaks

- Ensure pay equity for all those who are performing the same or equivalent job
- Consider “job sharing” or part-time work for employees at higher risk (e.g., older workers) as needed to account for differences in endurance and strength
- Make sure the workplace is accessible to all employees, including those with mobility challenges or disabilities
- Develop and facilitate reasonable accommodation guidelines for workers returning to work or to meet their medical needs (ILO, 2016)
- Determine if hiring or promotion practices are, purposefully or not, systematically treating employees differently or assigning them different work based on their demographic characteristics

Reporting

- Ensure the systems for reporting pain and other MSD signs and symptoms are accessible and communicated to all employees, including temporary and part-time workers
- Provide a system for workers to report MSD risks and hazards anonymously
- Encourage employees to report risks or incidences and be prepared to act on reports

Training

- Develop safety training programs that consider employees’ diverse learning styles, abilities and preferences – this can involve using formats, such as visual, auditory or hands-on learning, to ensure everyone comprehends safety protocols
- Create a mental health training program for managers, focusing on prompt, supportive communication and practical assistance for their workers – this could potentially result in a substantial decrease in work-related sick leave (Milligan-Saville et al., 2017)

Access to Health Care and Sick Leave

- Provide access to health care, resources to access affordable health care and paid sick leave for all workers
- Include access or resources to mental health care to mediate the effects of psychosocial risk factors and promote psychological safety
- Consider workplace health benefits to address MSD pain or symptoms, such as on-site fitness centers, massage or physical therapy

Personal Protective Equipment

- Routinely check in with employees on if and which PPE needs are being appropriately met, including those with different body types, abilities and cultural preferences
- Use PPE vendors with diverse offerings/sizes that fit your workforce
- Offer on-site PPE vendor sourcing/fitting events (during all shifts) so all employees have the chance to try on options and provide feedback to vendors
- Source technology that fits your workplace and your workforce – for example, consider modular exoskeletons instead of one-size-fits-most models

Conclusion

Diversity, equity and inclusion are vital to consider in the prevention of workplace MSDs. Work environments vary widely in their organization of work, availability of proper equipment and workplace designs, safety culture, psychological safety and psychosocial risk factors. Additionally, workers are diverse in their characteristics, and such workplace factors may disproportionately affect workers' risk of experiencing an MSD, as well as affecting workplace productivity.

Proper ergonomic interventions should account for diverse workforces and workplaces and can lead to inclusive, safe and open environments. Equitable solutions, such as those offered throughout this report, can be implemented to improve the workplace for all employees. Employers should consider the unique needs of their diverse workforces to create inclusive environments with equitable MSD prevention solutions to keep all employees safe and free from ergonomic hazards, regardless of individual characteristics. An equitable workplace recognizes and celebrates the differences in its workforce, prioritizes the inclusion of all when implementing ergonomic programs and MSD prevention solutions, and strengthens the company and its bottom line.

Authors

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