



ERGONOMICS IN INFORMAL WORK ENVIRONMENTS AND ITS IMPACT ON STRESS AND WELL-BEING

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<p>Article Info</p> <p>Article Received: 28 February 2026, Article Revised: 19 March 2026, Article Accepted: 09 April 2026.</p> <p>DOI: https://doi.org/10.5281/zenodo.19924883</p>	<p>ABSTRACT</p> <p>Informal work environments constitute a significant portion of global employment, particularly in developing countries such as South Africa. Despite their economic importance, these settings are often characterized by poor ergonomic conditions, which may negatively influence workers' physical health, psychological stress, and overall well-being. This article examines the relationship between ergonomics in informal work environments and worker stress and well-being. Drawing on existing literature, the paper highlights how inadequate workstation design, prolonged physical strain, and lack of occupational health regulations contribute to musculoskeletal disorders and elevated stress levels. The study further explores psychosocial dimensions, including job insecurity and environmental stressors, and their interaction with physical ergonomics. Recommendations are provided for policy development and practical ergonomic interventions tailored to informal settings.</p> <p>KEYWORDS: Ergonomics, Informal Work Environment, Occupational Health, Worker Stress, Well-being, Musculoskeletal Disorders, Workplace Design, Job Insecurity, Physical Strain, Developing Countries</p>
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INTRODUCTION

The informal sector plays a crucial role in employment generation worldwide, accounting for over 60% of global employment (International Labour Organization [ILO], 2021). This sector encompasses a wide range of activities that provide livelihoods for millions of individuals who are often excluded from formal labor protections and social security systems. In South Africa, informal work includes street vending, domestic work, small-scale agriculture, and waste picking, among others (King G Desai, 2020). These environments are typically unregulated, lacking formal occupational health and safety standards, which places informal workers at heightened risk for both physical and psychological strain.

Workers in informal settings are frequently exposed to poor ergonomic conditions, such as inadequate seating, poorly designed work tools, repetitive motions, and

prolonged working hours (Van Niekerk et al., 2018). Such conditions contribute to musculoskeletal disorders, fatigue, and long-term health problems, often exacerbated by limited access to healthcare services and minimal awareness of occupational risks (Swanepoel G Schoeman, 2016). Beyond physical health, these ergonomic challenges have psychological implications. The constant strain, uncertainty, and physical discomfort inherent in informal work can elevate stress levels, reduce job satisfaction, and negatively impact overall well-being (Chakraborty et al., 2020).

Ergonomics, defined as the science of designing work environments to fit human capabilities and limitations (Dul G Weerdmeester, 2008), is widely recognized as a strategy to enhance occupational safety, efficiency, and worker well-being. In formal sectors, ergonomic interventions have been shown to reduce injuries, improve productivity, and support mental health

outcomes (Robertson et al., 2013). However, the application of ergonomics in informal work environments remains limited due to resource constraints, lack of regulatory oversight, and insufficient knowledge of context-specific solutions (ILO, 2021).

Understanding the intersection of ergonomics, stress, and well-being in informal work settings is crucial for developing effective interventions that are both practical and culturally appropriate. This paper explores how poor ergonomic conditions in informal work environments contribute to stress and reduced well-being, highlighting the importance of tailored ergonomic strategies to improve health outcomes and overall quality of life for informal workers.

Literature Review

Overview of Ergonomics in Informal Work Contexts

The informal economy constitutes a substantial portion of global labour, particularly in low- and middle-income countries, where formal employment opportunities are limited and social protection mechanisms are often absent (International Labour Organization [ILO], 2021). Estimates suggest that informal employment accounts for more than 60% of total employment in many developing regions, underscoring the critical importance of understanding work-related risks in these settings (Chen, 2012). Informal work is inherently heterogeneous, encompassing street vending, waste picking, domestic service, small-scale agriculture, artisanal mining, and informal transport services such as motorcycle taxis or cart-pulling (Van Niekerk et al., 2018; Kiggundu, 2016). Despite their diversity, these roles share common challenges, including unregulated occupational health and safety practices, lack of formal employment protections, and limited access to structured workplace design. These systemic gaps exacerbate ergonomic hazards, affecting workers' physical and psychological well-being (Swanepoel G Schoeman, 2016).

Ergonomics, defined as the science of designing tasks, equipment, and workplaces to accommodate human capabilities and limitations, traditionally focuses on industrial, office, and high-technology environments (Dul G Weerdmeester, 2008). In formal settings, ergonomics is applied systematically through workstation design, machinery adaptations, and workflow management to reduce musculoskeletal strain, enhance productivity, and improve cognitive performance (Rempel et al., 2006). In contrast, the informal sector rarely benefits from structured ergonomic interventions. Workers often rely on makeshift tools, unstable or inappropriate work surfaces, and postures that are physically demanding and repetitive, with minimal attention to safety or comfort. These conditions significantly heighten the risk of musculoskeletal disorders (MSDs), chronic pain, fatigue, and psychological stress (Punnett G Wegman, 2004; Robertson et al., 2013).

Moreover, informal work frequently entails extended working hours, unpredictable work schedules, and exposure to environmental stressors such as extreme temperatures, noise, and pollution (Kiggundu, 2016). For example, street vendors may remain standing for the majority of the day, carrying heavy loads or repeatedly handling cash and merchandise, leading to cumulative musculoskeletal strain. Waste pickers engage in lifting, bending, and sorting under unsafe and unhygienic conditions, increasing their vulnerability to both acute injuries and long-term musculoskeletal problems (Van Niekerk et al., 2018). Domestic workers, on the other hand, may be required to perform repetitive cleaning, laundry, and caregiving tasks without access to supportive tools or rest breaks, resulting in both physical exhaustion and psychological stress (ILO, 2021).

Importantly, the informal sector is characterized not only by physical hazards but also by psychosocial risks. Low income, job insecurity, and social marginalization compound the physical strain of informal work, creating a synergistic effect on workers' overall well-being (Robertson et al., 2013). Ergonomic interventions in these contexts therefore need to adopt a holistic approach, addressing both biomechanical and psychosocial dimensions. Innovative, low-cost solutions, such as portable ergonomic tools, education on safe lifting techniques, and micro-adjustments to daily workflows, have shown promise in improving worker health outcomes, yet research remains scarce and fragmented (Swanepoel G Schoeman, 2016).

The limited attention to ergonomics in informal work highlights a critical gap in occupational health research. While formal sectors have well-established frameworks for assessing and mitigating ergonomic risk, informal workers are largely excluded from these protections, making them a highly vulnerable population (Punnett G Wegman, 2004). Understanding the nature of ergonomic hazards in informal work contexts, and developing practical, context-specific interventions, is therefore essential for promoting sustainable livelihoods, reducing occupational injuries, and enhancing overall health and well-being.

Prevalence of Musculoskeletal Disorders in Informal Work

A growing body of evidence indicates that informal workers are disproportionately affected by musculoskeletal disorders (MSDs) compared to formal sector employees, primarily due to sustained exposure to ergonomic hazards and the absence of structured workplace safety measures (Alexopoulos et al., 2003; Bongers et al., 2006). MSDs encompass a broad range of conditions affecting the muscles, nerves, tendons, joints, cartilage, and spinal discs, often arising from repetitive strain, sustained awkward postures, overexertion, and inadequate tools or work surfaces (Punnett G Wegman, 2004). These conditions not only compromise physical functioning but also reduce work productivity and quality of life, perpetuating cycles of occupational

vulnerability.

Street vendors represent a high-risk group within the informal economy. They frequently stand for long periods on hard surfaces, carry heavy loads, and perform repetitive hand and arm movements while handling merchandise and cash. Prolonged static standing contributes to lower back pain, varicose veins, plantar fasciitis, and knee strain, while repetitive upper-limb activities can lead to tendinopathies and carpal tunnel syndrome (Van Niekerk et al., 2018; Aghilinejad et al., 2012). The lack of access to supportive footwear, ergonomic stalls, or scheduled rest breaks further exacerbates these risks, leading to chronic pain and functional limitations.

Waste pickers face unique ergonomic challenges. Their work often involves continuous stooping, bending, and squatting to collect, sort, and transport recyclable materials. Heavy lifting and handling of irregular, unwieldy loads contribute to chronic low back pain, degenerative joint conditions, and cumulative trauma disorders (Swanepoel G Schoeman, 2016). Additionally, exposure to uneven terrain and unsanitary environments can compound these musculoskeletal stresses, increasing the likelihood of acute injuries such as slips, falls, and contusions.

Domestic workers are another vulnerable population, performing repetitive and reach-intensive tasks such as cleaning, laundry, cooking, and caregiving. Activities that require frequent bending, lifting, and overhead reaching are strongly associated with shoulder, wrist, and spinal musculoskeletal complaints (Chen, 2012; Lund et al., 2010). The absence of mechanized equipment or ergonomic tools in domestic work, combined with long working hours and insufficient rest periods, leads to persistent musculoskeletal strain and fatigue.

Small-scale farmers often operate in low-resource settings without mechanized support, performing repetitive manual tasks such as planting, weeding, harvesting, and carrying loads over uneven terrain. These occupational patterns contribute to high rates of low back pain, knee and hip joint strain, and upper-limb musculoskeletal disorders (Lund et al., 2010; Punnett G Wegman, 2004). Seasonal fluctuations in workload, combined with prolonged exposure to adverse environmental conditions (heat, rain, and uneven ground), intensify ergonomic risks and the overall physical burden.

Across these diverse informal occupations, studies consistently report elevated prevalence of MSDs, with workers frequently experiencing pain, functional limitations, and disability. For instance, surveys among informal workers in urban and peri-urban settings indicate that 50–70% of street vendors and waste pickers report chronic musculoskeletal discomfort, with a significant proportion reporting interference with daily

functioning and income-generating activities (Bernard, 1667; Bongers et al., 2006). These findings underscore the disproportionate physical disease burden borne by informal workers relative to their counterparts in formal employment, highlighting a pressing need for targeted ergonomic interventions and occupational health policies.

Importantly, the prevalence of MSDs in informal work is often underreported due to limited access to healthcare, informal employment arrangements, and lack of occupational health surveillance. Consequently, the true magnitude of the problem may be considerably higher than current data suggest, emphasizing the importance of research, awareness campaigns, and practical ergonomic solutions tailored to the realities of informal work environments.

Mechanisms Linking Work Tasks to Physical Strain

The physical mechanisms that connect informal work tasks to musculoskeletal strain are well-documented in occupational health and ergonomics literature. Informal workers are frequently exposed to a combination of sustained static postures, repetitive movements, and high-force exertions, which interact to produce tissue fatigue, microtrauma, and, over time, chronic injury (Punnett G Wegman, 2004; Bernard, 1667). Unlike formal employment settings, where ergonomic principles may guide task rotation, break schedules, and mechanical assistance, informal work often lacks these protective measures, leaving workers highly vulnerable to cumulative musculoskeletal damage.

Static Loading: Prolonged static postures, such as standing, crouching, or kneeling for extended periods, restrict blood flow to muscles, creating localized ischemia and metabolic fatigue. This can lead to discomfort, stiffness, and long-term degenerative changes, particularly in the lumbar spine, knees, and lower extremities (Alexopoulos et al., 2003; Rempel et al., 2006). For example, street vendors who remain on hard surfaces all day experience increased compressive forces on spinal discs, while waste pickers adopting stooped or squatting postures incur sustained joint compression in the hips and knees. Chronic static loading is further exacerbated when workers are unable to access seating, supportive footwear, or scheduled rest periods, leading to persistent musculoskeletal stress.

Repetitive Motion: Tasks involving repeated hand, wrist, arm, or trunk movements without sufficient recovery time generate microtrauma in muscles, tendons, and nerves (Robertson et al., 2013). Over time, this can result in tendonitis, tenosynovitis, nerve entrapment syndromes such as carpal tunnel syndrome, and other cumulative trauma disorders. Domestic workers, for example, frequently engage in repetitive scrubbing, lifting, and overhead reaching, while small-scale farmers perform continuous planting, harvesting, and weeding movements. The repetitive nature of these tasks,

compounded by insufficient rest, accelerates tissue inflammation, joint stiffness, and functional impairment.

Forceful Exertions: Tasks requiring high levels of physical force, such as lifting heavy loads, pushing carts, or carrying water and supplies over uneven terrain, increase the mechanical stress on muscles, ligaments, joints, and intervertebral discs. Repeated forceful exertions without mechanical assistance or ergonomic training accelerate degenerative changes in spinal discs, knees, hips, and shoulders (Bongers et al., 2006). Waste pickers and street vendors who carry heavy materials or merchandise throughout the workday exemplify populations exposed to chronic high-force loads, heightening the risk of acute injuries, disc herniation, and osteoarthritis over time.

Importantly, these mechanisms rarely operate in isolation. Informal workers often combine multiple risk factors within a single workday, prolonged standing, repeated lifting, and continuous reaching, creating a synergistic burden of physical strain (Punnett & Wegman, 2004). Environmental conditions, such as uneven ground, extreme temperatures, and lack of ergonomic tools, further exacerbate these risks (Van Niekerk et al., 2018). This cumulative exposure contributes to chronic musculoskeletal pain, functional limitations, reduced productivity, and heightened susceptibility to injury, highlighting the urgent need for context-specific ergonomic interventions tailored to informal work environments.

Beyond physical outcomes, these mechanisms also intersect with psychosocial stressors. Pain and fatigue from physical strain can increase mental stress, reduce coping capacity, and limit income-generating potential, creating a feedback loop where physical and psychological burdens amplify each other (Robertson et al., 2013). Addressing ergonomic risk in informal work, therefore, requires an integrated approach that considers both biomechanical and psychosocial determinants of health.

Access to Healthcare and Injury Progression

An additional and critical factor exacerbating negative health outcomes among informal workers is limited and often inequitable access to occupational health services. In contrast to workers in the formal sector, informal workers typically operate outside regulated labour systems and are therefore excluded from structured workplace health programmes, employer-funded medical aid schemes, and routine occupational health surveillance (International Labour Organization [ILO], 2021). This exclusion results in a lack of preventative care, delayed diagnosis, and minimal access to rehabilitation services, all of which contribute to the worsening of otherwise manageable ergonomic conditions.

In many cases, informal workers rely on overburdened public healthcare systems, which may not prioritise occupational health concerns or provide specialised

ergonomic assessments. Financial constraints, long waiting times, and geographic barriers further discourage timely healthcare-seeking behaviour. As a result, injuries that could have been treated effectively at an early stage are often neglected until they become severe. The absence of periodic health screenings also means that early warning signs, such as mild discomfort, fatigue, or reduced range of motion, are frequently overlooked.

The progression of untreated injuries follows a predictable but concerning trajectory. Minor musculoskeletal injuries, when not managed appropriately, tend to evolve into chronic conditions that significantly impair function and quality of life. For instance, undiagnosed sprains or soft tissue injuries may develop into persistent pain syndromes, characterised by inflammation, reduced mobility, and long-term discomfort. Similarly, repetitive strain injuries (RSIs), which are common in tasks involving continuous manual labour, may initially present as mild soreness but can progress into debilitating conditions such as tendonitis or carpal tunnel syndrome if left untreated. Over time, these conditions can lead to permanent functional limitations, restricting the worker's ability to perform essential tasks.

This progression is further compounded by the nature of informal work, which often does not allow for rest or recovery. Because income is typically earned on a daily basis, workers may continue working despite injury, thereby aggravating their condition. The lack of social protection mechanisms, such as paid sick leave or disability benefits, reinforces this cycle of continued exposure to harmful working conditions.

Beyond the direct physical consequences, the economic and social implications of injury progression are substantial. As workers experience declining physical capacity, their productivity decreases, leading to reduced income and increased financial instability. In severe cases, individuals may be forced to exit the workforce entirely, eliminating their primary source of livelihood. This loss of income often extends beyond the individual, affecting household welfare and increasing dependency on family members or community support systems.

Indirect costs also include increased out-of-pocket healthcare expenses, which can be catastrophic for low-income households. Furthermore, chronic pain and disability are frequently associated with psychological distress, including anxiety and depression, thereby compounding the overall burden of disease (Chen, 2012; Swanepoel & Schoeman, 2016). The cumulative effect of these factors highlights a cycle of vulnerability in which poor access to healthcare leads to injury progression, which in turn deepens socioeconomic disadvantage.

Addressing these challenges requires a multifaceted approach, including the integration of informal workers into national health systems, the development of community-based occupational health programmes, and

the promotion of early intervention strategies. Without such measures, the health and economic burdens associated with untreated ergonomic injuries will continue to disproportionately affect this already vulnerable population.

Psychological Stress and Ergonomic Factors

The Job Demand–Control Model in Informal Settings

The Job Demand–Control (JDC) model, developed by Karasek (1976), provides a foundational framework for understanding how work environments contribute to psychological stress. The model posits that job strain emerges when individuals are exposed to high job demands while simultaneously having low levels of control or decision-making authority over their work. Although the model was originally conceptualised within formal employment settings, its applicability to informal work is particularly significant, given the structural vulnerabilities that characterise this sector.

Informal workers frequently operate under conditions that intensify both physical and psychological demands. These demands include prolonged working hours, repetitive manual tasks, constant customer interaction, and the need to sustain productivity without adequate rest. Unlike formal workers, they rarely benefit from regulated work schedules, enforced breaks, or occupational health protections. Consequently, recovery periods are often insufficient, leading to cumulative fatigue and heightened stress levels over time.

Equally important is the dimension of low decision latitude. Informal workers often have limited autonomy over key aspects of their work, despite the perception that self-employment implies independence. In reality, factors such as fluctuating market conditions, customer demands, competition, and municipal regulations constrain their ability to control workload, pricing, or working hours. For instance, a street vendor may feel compelled to work long hours in physically demanding conditions to secure sufficient income, even when experiencing pain or exhaustion. This perceived lack of control exacerbates psychological strain, as workers are unable to modify their environment or pace of work to mitigate stressors.

In addition, social support, another critical buffer against stress, is often minimal or inconsistent in informal settings. Unlike formal workplaces, which may provide collegial networks, supervisory guidance, or employee assistance programmes, informal workers typically operate in isolation or within loosely organised groups. The absence of structured support systems limits opportunities for emotional coping, knowledge sharing, and collective problem-solving.

The convergence of high demands, low control, and limited social support creates a “high-strain” work environment, which has been strongly associated with adverse psychological outcomes. These include

emotional exhaustion, irritability, reduced coping capacity, and increased vulnerability to burnout. Expanding on this framework, Siegrist (1996) highlights that when high effort is not matched by adequate rewards, financial, social, or psychological stress is further intensified. Similarly, research by Bongers et al. (2006) demonstrates that such psychosocial stressors are closely linked to musculoskeletal disorders, reinforcing the interconnected nature of physical and mental health in occupational contexts.

Environmental Stressors and Mental Health

Ergonomic challenges in informal work are rarely experienced in isolation; they are often compounded by adverse environmental conditions that significantly amplify psychological stress. Informal workers, particularly those operating in outdoor or unregulated environments, are routinely exposed to a range of physical stressors that directly and indirectly affect mental well-being.

Extreme temperatures, for example, place considerable strain on the body’s physiological systems. Prolonged exposure to heat can lead to dehydration, fatigue, and heat-related illnesses, while cold environments may cause discomfort and reduced dexterity (Akerman et al., 2016a, 2016b; Leyk, 2016). These physical stressors diminish cognitive performance, impair decision-making, and increase irritability (Evans & English, 2002; Paas & van Merriënboer, 2020). Similarly, constant exposure to environmental noise, common in busy markets or roadside settings, can lead to sensory overload, reduced concentration, and heightened stress responses (Arregi et al., 2024; Hahad et al., 2016).

Air pollution and poor sanitation further contribute to both physical and psychological burdens. Inhalation of pollutants can cause respiratory issues and general discomfort, while unsanitary working conditions may evoke feelings of disgust, stigma, and social marginalisation (World Health Organization, 2021). Crowded or unsafe environments, including areas with high crime rates or limited infrastructure, introduce an additional layer of psychological strain, as workers must remain constantly vigilant to protect themselves and their goods (International Labour Organization, 2016).

These environmental stressors interact synergistically with ergonomic risks to intensify overall strain. According to Lund et al. (2010), individuals exposed to chronic environmental adversity are more likely to experience mental health challenges such as anxiety, depression, and emotional exhaustion. In informal work settings, this is reflected in increased mental fatigue, reduced attention span, frustration, and emotional dysregulation.

Empirical evidence further illustrates these dynamics. Studies have shown that street traders exposed to prolonged sunlight and high noise levels report higher

incidences of mood disturbances, sleep disruption, and elevated perceived stress (Bongers et al., 2006). Sleep disruption, in particular, has cascading effects on mental health, impairing emotional regulation and cognitive functioning. Similarly, waste pickers working in hazardous and unsanitary environments frequently report feelings of distress, anxiety, and diminished life satisfaction, as highlighted by Chen (2012). These findings underscore the importance of considering environmental context when assessing the psychological impact of ergonomic conditions.

Bidirectional Links Between Physical and Psychological Outcomes

A critical aspect of understanding the impact of ergonomic factors on informal workers is recognising the bidirectional relationship between physical health and psychological well-being. Rather than operating independently, these domains are deeply interconnected, with each influencing and reinforcing the other in complex ways (Engel, 1677; Turk G Ronald Melzack, 2011).

Chronic physical discomfort, particularly musculoskeletal pain, imposes a significant cognitive and emotional burden. Persistent pain demands constant attention, reduces concentration, and limits the individual's ability to engage effectively in daily tasks. Over time, this can lead to heightened stress, frustration, and feelings of helplessness (Turk G Okifuji, 2002). The ongoing strain associated with managing pain is also linked to the development of anxiety and depressive symptoms, as individuals may become concerned about their ability to work, earn income, or maintain their quality of life.

Sleep disturbances are another common consequence of chronic pain. Discomfort may interfere with the ability to fall or stay asleep, resulting in inadequate rest and further exacerbating fatigue and emotional instability (Dubessy G Arnulf, 2023). Reduced sleep quality, in turn, impairs cognitive functioning, decision-making, and emotional resilience, creating a cycle of declining mental and physical health.

Conversely, psychological stress plays a significant role in shaping the perception and experience of physical pain. High levels of stress can increase muscle tension, amplify inflammatory responses, and lower pain thresholds, making individuals more sensitive to discomfort (Evans G English, 2002; Liu G Boyatzis, 2021). Stress also affects coping mechanisms, reducing the individual's ability to manage pain effectively or seek appropriate care. This interaction creates a self-reinforcing loop in which stress exacerbates pain, and pain intensifies stress (Turk G Edwards, 2011).

Research by Punnett and Wegman (2004) and Bongers et al. (2006) highlights this reciprocal relationship, demonstrating that psychosocial stressors not only

contribute to the onset of musculoskeletal disorders but also influence their severity and progression. In informal work settings, where both ergonomic risks and psychological stressors are pervasive, this bidirectionality becomes particularly pronounced.

The implication of this interconnectedness is that ergonomic inadequacies cannot be addressed in isolation from broader psychosocial factors. Interventions aimed at improving physical working conditions must also consider mental health support, stress management, and social support mechanisms. A holistic approach that integrates both physical and psychological dimensions is essential for effectively addressing the complex health challenges faced by informal workers.

Well-Being in Informal Work Settings

Defining Well-Being

Well-being is a multidimensional construct that extends beyond the absence of disease to include overall physical health, psychological functioning, social connectedness, and subjective life satisfaction, as defined by the World Health Organization (2020). It reflects an individual's ability to function effectively, maintain meaningful relationships, and experience a sense of purpose and stability in daily life.

In informal work settings, however, these dimensions of well-being are frequently compromised due to the structural and environmental challenges inherent in this sector (International Labour Organization, 2016; World Health Organization, 2021). Physically, workers are often exposed to hazardous conditions, repetitive strain, and prolonged postures, resulting in ongoing discomfort and reduced functional capacity (Andrasfay et al., 2021). Psychologically, the cumulative burden of work-related stressors, including financial uncertainty, high workloads, and limited control, contributes to emotional exhaustion, anxiety, and diminished coping ability (Alzoubi et al., 2024; Leiter G Maslach, 2017; Romani G Ashkar, 2014).

Social well-being is also affected. Informal workers often experience marginalisation and lack formal recognition of their contributions to the economy (International Labour Organization, 2016).

This can lead to social stigma, reduced self-worth, and limited access to supportive networks. For example, occupations such as waste picking are frequently associated with negative societal perceptions, which may erode dignity and self-esteem.

Economic insecurity further undermines well-being by creating a persistent state of uncertainty. Irregular income, lack of job security, and absence of social protection mechanisms contribute to chronic worry about meeting basic needs such as food, housing, and healthcare. These overlapping challenges illustrate that well-being in informal work contexts is not determined

by a single factor but is the outcome of interacting physical, psychological, social, and economic pressures (International Labour Organization, 2016; World Health Organization, 2022).

Physical Discomfort and Quality of Life

Chronic musculoskeletal disorders (MSDs) represent one of the most significant threats to well-being among informal workers (World Health Organization, 2021; International Labour Organization, 2016). While their impact on work productivity is well documented, their broader implications for quality of life are equally profound. Persistent pain and discomfort interfere with fundamental aspects of daily living, including mobility, sleep, and the ability to perform routine activities (Dueñas et al., 2016a).

For many informal workers, physical pain extends beyond the workplace into the home environment (World Health Organization, 2021). Tasks such as cooking, childcare, or commuting may become increasingly difficult, leading to a loss of independence and increased reliance on others. Sleep disturbances are particularly common, as pain can disrupt rest and prevent physical recovery. This lack of restorative sleep contributes to fatigue, irritability, and decreased cognitive functioning, further diminishing overall well-being (Hyndych et al., 2025).

The psychological consequences of chronic pain are also substantial. Individuals experiencing ongoing discomfort often report feelings of frustration, helplessness, and reduced life satisfaction. Over time, this may contribute to the development of mental health conditions such as anxiety and depression (Turk G Akiko Okifuji, 2002; World Health Organization, 2022). Research by Bongers et al. (2006) highlights the strong association between musculoskeletal pain and psychosocial distress, emphasising the need for integrated approaches to worker health.

Empirical studies reinforce these findings. For instance, research by Alexopoulos et al. (2003), demonstrates that workers with chronic pain are significantly more likely to report poor general health and reduced work performance. Similarly, Swanepoel and Schoeman (2016), found that persistent pain among informal workers is associated with decreased participation in community and social activities, further isolating individuals and reducing overall life satisfaction.

Socioeconomic Factors Amplifying Stress

The well-being of informal workers cannot be fully understood without considering the broader socioeconomic context in which they operate. Informal employment is typically characterised by job insecurity, low and unstable wages, absence of labour protections, and limited access to social safety nets (Naicker et al., 2021). These conditions create a baseline level of chronic stress that interacts with and amplifies ergonomic and

environmental risks.

One of the most significant challenges is the lack of access to affordable healthcare and health insurance. Without financial protection, workers may delay or avoid seeking medical care, even when experiencing significant pain or injury (Irvine G Rose, 2024). This not only worsens health outcomes but also increases long-term costs, both financially and in terms of reduced functional capacity (Aust et al., 2024; Dueñas et al., 2016b; Irvine G Rose, 2024; Naicker et al., 2021).

The absence of paid sick leave further compounds this issue. Informal workers are often forced to continue working despite illness or injury, as taking time off directly results in loss of income. This creates a cycle in which health is sacrificed for immediate economic survival, ultimately leading to more severe and chronic conditions.

Economic instability also contributes to heightened psychological stress. Unpredictable income streams make it difficult to plan for the future, manage expenses, or cope with unexpected financial shocks. According to Chen (2012), such economic precarity is a defining feature of informal work and a key driver of vulnerability. Constant financial pressure increases anxiety levels, reduces resilience, and heightens sensitivity to physical discomfort and workplace stressors.

These socioeconomic factors do not operate in isolation but interact dynamically with ergonomic hazards. For example, a worker experiencing physical pain may be unable to reduce workload due to financial necessity, thereby exacerbating the injury. Similarly, stress related to economic insecurity may intensify the perception of pain and reduce the ability to cope effectively. As a result, well-being in informal work settings must be conceptualised as the product of both immediate occupational risks and broader structural inequalities.

Ergonomic Interventions: Evidence and Gaps

Formal Workplace Evidence

A substantial body of research from formal workplace settings demonstrates the effectiveness of ergonomic interventions in reducing musculoskeletal disorders and improving worker well-being (Punnett and Wegman, 2004). These interventions typically involve a combination of physical modifications, organisational changes, and worker education.

Ergonomic redesign of workstations is one of the most widely studied approaches. Adjustable chairs, desks, and tools allow workers to maintain neutral postures, thereby reducing strain on muscles and joints. For example, height-adjustable workstations can minimise bending or overreaching, which are common risk factors for back and shoulder injuries.

Tool redesign is another critical intervention. By modifying tools to reduce the amount of force required or to improve grip and handling, workers can perform tasks more efficiently and with less physical strain. Similarly, introducing task variation, where workers alternate between different activities, helps to prevent repetitive strain injuries by distributing physical strain across different muscle groups.

Training and education programmes further enhance the effectiveness of these interventions by increasing awareness of proper body mechanics, posture, and injury prevention strategies (Aghilinejad et al., 2012; Punnett and Wegman, 2004). Participatory ergonomics, where workers are actively involved in identifying risks and developing solutions, has also shown significant success in improving outcomes (Haines et al., 2002; Rivilis et al., 2008).

Research by Robertson et al. (2013) indicates that such interventions can lead to measurable reductions in injury rates, improved comfort, and increased productivity. Importantly, these benefits extend beyond physical health to include improved job satisfaction and reduced absenteeism.

Translating Interventions to Informal Work

Despite the strong evidence base from formal workplaces, the application of ergonomic interventions in informal work settings remains limited and underdeveloped. This gap is largely due to structural and contextual challenges unique to the informal sector.

One major barrier is financial constraint. Informal workers often lack the resources to invest in ergonomic equipment or workspace modifications. Even low-cost interventions may be perceived as unaffordable when income is inconsistent or barely sufficient to meet daily needs. The absence of regulatory frameworks and enforcement mechanisms further limits the adoption of ergonomic practices. Unlike formal workplaces, informal settings are not subject to occupational health and safety standards, and there are no labour inspectors to ensure compliance. This lack of oversight reduces incentives for implementing preventive measures.

Additionally, the nature of informal work environments, often mobile, temporary, or unstructured, poses practical challenges. Street vendors, for example, may operate in different locations each day, making it difficult to establish stable ergonomic setups. Similarly, waste pickers and day labourers work in unpredictable conditions that limit the feasibility of standardised interventions.

However, emerging research suggests that context-sensitive, low-cost solutions can still be highly effective. Simple innovations, such as portable seating for street vendors, can significantly reduce fatigue and lower back strain. Modified carts for waste collection can minimise

heavy lifting and improve efficiency. Basic training on posture, lifting techniques, and self-care strategies can empower workers to reduce risk using available resources (Punnett G Wegman, 2004; ILO, 2021).

Participatory approaches are particularly promising in this context. By involving workers directly in the identification of risks and the development of solutions, interventions can be tailored to specific needs and constraints. Research by Chakraborty et al. (2020) highlights that such approaches not only improve the relevance and feasibility of interventions but also enhance worker engagement and ownership.

Ultimately, addressing ergonomic challenges in informal work requires innovative, flexible, and inclusive strategies that account for the realities of this sector. Bridging the gap between formal evidence and informal practice is essential for improving both health outcomes and overall well-being among informal workers.

Summary and Synthesis

The reviewed literature provides a comprehensive and integrated understanding of how ergonomic conditions shape health and well-being within informal work settings. Across multiple studies and theoretical perspectives, a consistent pattern emerges: informal workers are disproportionately exposed to hazardous physical conditions, and these exposures are closely linked to a high prevalence of musculoskeletal disorders (MSDs). Repetitive movements, prolonged static postures, manual handling of heavy loads, and inadequate tools or workspaces create a cumulative physical burden that significantly increases the risk of injury. Unlike in formal employment, where preventive measures and early interventions are more readily available, these risks in informal settings often remain unaddressed, allowing minor injuries to progress into chronic and disabling conditions.

However, the literature also demonstrates that the impact of poor ergonomics extends far beyond physical health. Ergonomic deficiencies are deeply intertwined with environmental and socioeconomic stressors, creating a layered and compounding effect on psychological well-being. Informal workers frequently operate in physically demanding and unpredictable environments, characterised by extreme weather, noise, pollution, and safety concerns, while simultaneously facing economic insecurity and limited access to social protection. These overlapping stressors intensify mental strain, contributing to emotional exhaustion, anxiety, reduced coping capacity, and overall psychological distress. Importantly, the interaction between physical discomfort and psychological stress is not unidirectional; rather, it is reciprocal and self-reinforcing. Chronic pain increases emotional burden and cognitive fatigue, while psychological stress heightens pain perception and reduces resilience, thereby perpetuating a cycle of declining health.

A key synthesis emerging from the literature is that well-being in informal work cannot be understood through a single lens. Instead, it is the outcome of dynamic interactions between physical, psychological, social, and economic determinants. Physical health challenges, such as MSDs, directly impair functional capacity and quality of life. Psychological stressors, including job strain and environmental pressures, undermine emotional well-being and mental health. Social factors, such as marginalisation and lack of recognition, erode self-esteem and limit access to supportive networks. At the same time, economic precarity, characterised by unstable income, lack of employment benefits, and vulnerability to financial shocks, creates a constant state of uncertainty that intensifies both physical and psychological strain. These dimensions are mutually reinforcing, meaning that challenges in one area often increase vulnerability in others.

The literature further highlights that, despite the severity of these challenges, there is a substantial evidence base from formal workplace settings demonstrating the effectiveness of ergonomic interventions. Strategies such as workstation redesign, tool modification, task rotation, and worker training have been shown to significantly reduce injury rates, improve comfort, and enhance productivity. Importantly, participatory approaches, where workers are actively involved in identifying risks and developing solutions, have proven particularly effective in ensuring that interventions are contextually relevant and sustainable.

Nevertheless, a critical gap exists in translating these established interventions into informal work contexts. The informal sector presents unique challenges, including limited financial resources, absence of regulatory frameworks, and highly variable or mobile work environments. These constraints require a shift away from standardised, resource-intensive solutions toward more flexible, low-cost, and context-sensitive approaches. Emerging evidence suggests that such adaptations are not only feasible but can yield meaningful improvements in worker health and well-being. Simple innovations, combined with education and participatory engagement, have the potential to mitigate ergonomic risks even in resource-constrained settings.

Collectively, these findings underscore the urgent need for a paradigm shift in how informal work is conceptualised and addressed within research and policy. Historically, ergonomic principles have been largely confined to formal employment sectors, leaving a significant portion of the global workforce underserved. The literature strongly advocates for an interdisciplinary approach that integrates insights from occupational health, public health, ergonomics, economics, and social policy. Such an approach is essential for developing holistic interventions that address the full spectrum of factors influencing well-being in informal work.

Furthermore, there is a clear need for policy innovation that recognises informal workers as an integral part of the economy and extends protections and resources accordingly. This includes integrating ergonomic considerations into urban planning, public health initiatives, and labour policies, as well as promoting community-based and worker-driven solutions. Embedding ergonomic principles into the design and organisation of informal work systems, rather than treating them as optional add-ons, represents a critical step toward reducing health inequities and improving quality of life for this vulnerable population.

In summary, the literature converges on a central insight: improving well-being in informal work requires more than isolated interventions; it demands systemic, inclusive, and contextually grounded strategies that simultaneously address physical risks, psychological stressors, and socioeconomic vulnerabilities.

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