

Work-Related Musculoskeletal Disorders in India: A Narrative Review on the Role and Impact of Ergonomic Interventions

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Abstract

Musculoskeletal disorders (MSDs) represent approximately 33.8% of work-related health conditions in India, significantly contributing to occupational morbidity. This narrative review explores the economic burden posed by MSDs in sectors such as healthcare, information technology, construction, and agriculture. A focused cost-benefit analysis of ergonomic interventions—including physical workplace redesign, administrative controls, and digital tools—is presented, with evidence supporting productivity gains and a return on investment (ROI) of up to 15:1. Based on empirical studies and sector-specific data, this review proposes evidence-based ergonomic strategies to guide employers, policymakers, and occupational health practitioners in mitigating MSD prevalence and optimizing workforce performance in India.

Keywords: Musculoskeletal Disorders; Ergonomic Interventions; Workplace Health; India; Occupational Safety; Cost-Benefit Analysis

Abbreviations

MSDs: Musculoskeletal Disorders.

ROI: Return on Investment.

OHS: Occupational Health and Safety.

IT: Information Technology.

SMEs: Small and Medium Enterprises.

PPE: Personal Protective Equipment.

Introduction

Musculoskeletal Disorders, or MSDs, are chronic conditions that include joint degeneration, neck pain, lower back problems, and other painful conditions. These disorders impact the productivity and mental development of different national citizens on a large scale, fundamentally enabling India to consider these ailments one of the most concerning occupational health issues. A fast pace of industrialization and a surge in India's digitization are also contributing to an increase in economic activities, thus resulting in new challenges on the ergonomic front.

As more white-collar professionals complain of posture-causing aches and pains from long hours working on a screen and sitting down, informal workers are still being made to perform physically strenuous jobs without support. However, despite the high prevalence, ergonomic interventions are still uncommon and, to a large extent, unregulated.

This review of sectoral reports, case study findings, and peer-reviewed literature has synthesized this information to understand ergonomic interventions' cost-risk/benefit dynamics.

It showcases how spending on infrastructure changes like posture monitoring AI tools, posture correcting devices, and ergonomic alterations for office furniture improve worker satisfaction while pain alleviation enhances business results. This paper also examines policy issues alongside emerging technologies and gaps for implementation in India's diverse workforce.

By aligning ergonomics with occupational health frameworks, India's workforce can adopt a proactive approach and shift from a responsive first treatment focus to a preventive, less costly system. This review aims to achieve this goal using ergonomic policy frameworks while guiding healthcare practitioners, business executives, and government officials toward sustainable evidence-based policy interventions for controlling MSDs.

Materials and Methods

This article is a narrative review synthesizes research regarding the epidemiology and prevalence of musculoskeletal disorders (MSDs) in Indian workplaces and the effectiveness of ergonomics as an intervention. It is based on sectoral studies, systematic reviews, articles published in peer-reviewed journals, and economic aspects of occupational health.

Data Sources

Specific searches on popular academic databases such as PubMed, Scopus, and Google Scholar preceded the literature selection. "India and musculoskeletal disorders," "ergonomics and the workplace," "occupational health," "ergonomic costs of musculoskeletal disorders," and "musculoskeletal disorder ROI" were some of the keywords that were searched. Only English publications from 2010 onward were included, paying attention to those which provided indicative quantitative or cost outcomes within workplace contexts relevant to India or other similar low- and middle-income countries (LMIC) settings.

Inclusion Criteria

- Empirical studies and systematic reviews focusing on MSDs within occupational settings.
- Research articles presenting economic impacts or return on investment (ROI) of ergonomic programs.
- Studies specifically involving the Indian workforce or environments with similar socio-economic conditions.

Exclusion Criteria

- Studies unrelated to occupational MSDs.
- Articles without empirical data (e.g., opinion editorials, anecdotal reports).
- Interventions focused solely on post-treatment rather than prevention.

Review Approach

The findings from eligible studies were analysed thematically across three primary dimensions:

- *Prevalence and burden* of MSDs by industry sector.
- *Cost components* include healthcare expenditure, productivity loss, and turnover.
- *Effectiveness and ROI* of ergonomic interventions across physical, administrative, and digital domains.

Where relevant, data were extracted into tables and charts to provide visual summaries of the reviewed literature. All cited studies are referenced using standardised formatting and numbered in-text to ensure clarity and traceability.

Results and Discussion

Sector-Wise Prevalence of MSDs

Musculoskeletal disorders (MSDs) are quite prevalent in India, particularly in areas of work with sustained postures, repetitive actions, and physical strain. Studies show that prevalence figures for MSDs in high-risk sectors are markedly higher than global averages, evidencing a combination of ergonomic underdesign and high task intensity workload. An Indian meta-analysis in 2025 on occupationally active workers from diverse sectors reported prevalence figures for MSDs above 60%, with lower back, neck, and upper limb regions most commonly affected [10].

These statistics underscore the need for industry-specific and cross-sector ergonomic strategies tailored to task design and workplace constraints.

<i>Occupational Sector</i>	<i>MSD Prevalence (%)</i>	<i>Source Ref. No.</i>
Construction	77%-81%	[1]
Agriculture	76%	[3]
Healthcare	75%	[7]
Information Technology (IT)	65%-74%	[13]
Mining	78%-81%	[1]
Domestic Work	32%	[15]
Railway Porters (Sahayaks)	65%	[9]

Table 1: Prevalence of MSDs by Sector in India.

Economic Burden of Work-Related MSDs in India

Musculoskeletal disorders (MSDs) pose a significant threat to employee health and impose substantial financial burdens on employers and the broader Indian economy. Direct costs include medical consultations, physiotherapy, medications, diagnostic imaging, and treatment expenses. Indirect costs encompass absenteeism, workforce turnover, reduced productivity, legal claims, and insurance payouts.

Direct costs include diagnostics and treatment, while indirect costs cover absenteeism, attrition, and productivity loss. MSDs reduce India's Gross National Product (GNP) by 1.3% to 2.4% annually [6].

Key financial impacts include:

- MSD-related absenteeism accounts for nearly 20% of all lost workdays in manufacturing and construction industries [12].
- Worker compensation claims related to ergonomic injuries are steadily rising in the formal sector, especially among employees engaged in repetitive mechanical tasks [7].
- Recruitment and retraining costs following disability-related resignations are substantial, particularly in small and medium-sized enterprises (SMEs). Depending on the sector and skill level, these costs can range from 20% to 40% of the employee's annual salary.
- Long-term effects include early retirement, increased disability claims, and reduced workforce participation, especially among women in caregiving and manual labor roles, which widens occupational health disparities.
- Limited insurance coverage in the informal sector results in high out-of-pocket expenses, pushing many affected households below the poverty line [4].

Countries like Japan and Germany have successfully reduced indirect economic losses through proactive ergonomic laws, universal physiotherapy access, and mandatory employer safety audits. India can benefit from adopting similar strategies by integrating ergonomics into national labor and health policies.

Impact and ROI of Ergonomic Interventions

A range of physical, administrative, and digital ergonomic interventions has demonstrated measurable improvements in health outcomes and workforce productivity. These interventions reduce physical strain and foster a culture of safety, engagement, and long-term cost savings.

Intervention Type	Absenteeism Reduction (%)	Productivity Gain (%)	Estimated ROI Range	Source Ref. No.
Ergonomic Chair & Desk Setup	Up to 48%	Up to 32%	3:1 - 15:1	[13]
Task Rotation and Breaks	20-30%	10-15%	2:1 - 4:1	[10]
Digital Posture Monitoring	15-20%	8-12%	1.5:1 - 3:1	[12]
Workstation Redesign (Manufacturing)	30%	30%	3:1 - 5:1	[2]
Ergonomic Training Programs	15-25%	10-20%	2:1 - 4:1	[8]

Table 2: ROI Summary of Common Ergonomic Interventions.

Return on investment (ROI) analysis indicates that comprehensive ergonomic programs can yield returns between 3:1 and 15:1, depending on the intervention's scale and employees' baseline health status. Research from global case studies suggests that every ₹1 lakh invested in proactive ergonomic programmes can yield ₹3-₹15 lakhs in reduced medical costs, downtime, and recruitment losses over 12-18 months.

Sector-Specific Implementation

The ergonomic interventions must be tailored to the specific risk factors, tasks, and environments of different industries in India. Given the workforce's diversity, contextualising solutions is key to improving effectiveness and adoption.

Construction and Agriculture

These sectors require low-cost, durable interventions that withstand physically intensive work and outdoor conditions. Common modifications include ergonomically designed tools for harvesting and masonry, posture-supportive load carriers, and fundamental scaffold redesign. In rural pilot educational programs, implementing safe lifting and bending technique campaigns and task rotation has contributed to relieving strain-related discomfort.

Healthcare

Hospital nursing and support personnel suffer musculoskeletal stress due to prolonged static work, standing, and repetitive lifting. This burden can be lessened with devices like mobile carts, adjustable-height beds, and patient hoists. Some institutions have introduced regular ergonomics training sessions covering safe patient handling, workstation setup for administrative roles, and early symptom identification, especially in high-traffic wards [7].

Information Technology and Finance

Ergonomic issues in these sectors stem from prolonged sitting, screen exposure, and inadequate workstation design. Interventions typically include height-adjustable chairs, monitor risers, and external keyboards to support neutral wrist positioning. Many firms

have also begun offering digital posture-assessment tools and guided break reminders, especially for remote employees. While outcomes have not yet been widely studied in India, international data suggests such approaches contribute to musculoskeletal relief and improved employee engagementment [14].

Warehousing and Delivery

Manual handling and repetitive reaching are common in logistics and e-commerce hubs. Optimising shelf height, introducing padded flooring, and limiting overhead stacking can reduce physical exertion. Some facilities have also trialed basic ergonomic awareness training for pickers and packers. While data is limited, companies are increasingly exploring ergonomic layouts to support worker safety and performance.

Public Sector and Education

Teachers, clerks, and administrative staff in schools and government offices often work with outdated furniture or poor posture support. Replacing rigid chairs with ergonomic alternatives and scheduling alternating standing-sitting time have been informally reported to improve comfort. Wellness programs in a few state institutions have begun to include ergonomic guidance in routine health briefings.

Barriers to Implementation

Even as the evidence base for ergonomics grows, Indian businesses face multiple barriers to implementation that limit both reach and long-term effectiveness.

Lack of financial incentives for SMEs

India's industrial and service sectors are primarily served by small and medium-sized enterprises (SME), which function on limited profit margins. For these businesses, increasing expenditure on ergonomic redesigns, new equipment, or adjustable chairs is often regarded as optional rather than preventive and strategic investment. This economic burden is worsened by the absence of subsidised government schemes or incentive programs that support ergonomic workplace upgrades.

Weak enforcement of OHS regulations

India has defined occupational safety and health (OSH) policies, but their implementation and enforcement are weak and fragmented. Most legislations rely on the Factories Act or subordinate sectoral safety codes, neither of which contains specific ergonomic provisions or mandates risk assessments. Moreover, there is no means of enforcing such measures in the informal economy, yet more than 90% of the Indian workforce is in unregulated or semi-regulated spaces [6]. This leads to a situation where both employers and workers lack formal accountability structures for adopting ergonomic practices.

Limited access to ergonomic consultants

In India, especially in the lower-tier cities, many businesses lack the proper infrastructure to implement even the most basic ergonomic shifts. Overcrowded workspaces with shared resources and outdated equipment make applying elementary ergonomic practices difficult. Specific industries like textile processing, metalwork, and transport still have limited automation, aggravating the human ergonomic load.

Minimal awareness in informal sectors

Employers and employees lack a basic understanding of ergonomics, which becomes a hindrance. Many workers in blue-collar jobs and those in the gig economy tend to experience discomfort and fatigue, which is part of the job. The assumption is that ergonomics applies solely to multinational firms and corporate professionals sitting at desks. Furthermore, some employers fear that integrating

ergonomic changes will introduce non-quantifiable costs and disrupt workflow with little to no positive impact in the short term.

Lack of Trained Ergonomic Professionals

Not having enough trained professionals in ergonomics and occupational health hinders intervention design and implementation. These revolve around working in rural or industrial contexts, which makes these ergonomics consultants invaluable. Although physiotherapists have the qualifications to assist, they are often excluded from the planning and auditing of a workplace due to budget constraints.

Fragmented Data and Feedback Mechanisms

In many Indian businesses, especially in manufacturing and logistics, there is no standard process for collecting injury data, conducting workstation evaluations, or assessing intervention outcomes. This lack of monitoring mechanisms makes it difficult to justify ergonomic investments or fine-tune programs based on real-world feedback.

Future Trends

India's approach to workplace ergonomics is gradually evolving beyond basic compliance toward more proactive, tech-enabled solutions. Several emerging trends point to a future where ergonomics is integrated into organisational culture and public health policy.

AI-based Monitoring: Real-time posture tracking

In real time, computer vision and AI tools are being piloted to analyse posture, repetitive movements, and workstation alignment. These systems can identify risk patterns and offer immediate feedback, helping prevent injuries before they escalate. As costs decline, their use will likely expand beyond large IT firms to mid-sized offices and remote setups.

Wearables: Strain and fatigue sensors

Wearable sensors and fitness trackers are now being used to track physical strain, sedentary time, and movement quality. In some logistics and retail settings, they help flag fatigue and prevent overload. For desk-based workers, wearable posture trainers and mobile reminders are being introduced to reinforce healthy habits.

Remote Assessments: Virtual consultations for hybrid work setups

With remote and hybrid work becoming standard, organisations increasingly offer virtual workstation assessments and digital physiotherapy guidance. This ensures employees in non-office environments receive tailored advice on posture, screen height, and break routines.

AR/VR Training: Immersive simulations for task-specific ergonomics

In safety training, augmented and virtual reality platforms are being explored to simulate lifting techniques and safe postures. These are gaining traction in vocational institutes and select healthcare and industrial training programs.

Policy Reform: Integration of ergonomic standards in OSHWC updates

While India's current regulations lack detailed ergonomic mandates, proposed updates under the Occupational Safety, Health and Working Conditions Code (OSHWC) may offer room for inclusion. Mandatory ergonomic audits, if implemented, could significantly improve compliance in formal sectors.

As these trends mature, they present a strong case for integrating digital ergonomics, remote monitoring, and personalised training into India's workplace wellness framework. For organisations like BJM Health, this shift offers an opportunity to lead the charge in

scalable, tech-enabled MSK care.

Patient-Centric Benefits of Ergonomic Interventions

While ergonomic interventions are often assessed for their organizational impact, the *direct benefits to patients suffering from MSDs* are equally crucial. Effective ergonomic solutions can lead to:

- *Early Symptom Relief*: For employees experiencing chronic back, neck, or joint pain, ergonomics-based modifications help reduce discomfort, allowing them to continue working without progressing toward disability.
- *Reduced Dependency on Medication*: Workplace-based preventive ergonomics reduce the need for long-term analgesics or anti-inflammatory drugs, thereby decreasing the risks of gastrointestinal, renal, and cardiovascular side effects.
- *Improved Quality of Life*: For workers dealing with repetitive strain injuries or posture-related pain, targeted ergonomic strategies (like customized chairs, breaks, or load-limiting tools) enhance day-to-day functional capacity and mental wellbeing.
- *Decreased Recurrence*: Incorporating ergonomic awareness and tools into rehabilitation protocols helps reduce recurrence and promotes *sustainable recovery* in patients undergoing physiotherapy for work-related MSDs.
- *Empowerment Through Education*: Ergonomic education as part of patient counseling empowers workers to take responsibility for their posture, movement, and habits both at the workplace and at home.

Integrating ergonomic assessment and modification into *physiotherapy care plans* also leads to more comprehensive, long-lasting recovery for patients with musculoskeletal conditions—especially when initiated early.

Conclusion / Final Considerations

In terms of the MSDs, there has been very little change in the last decade. These disorders are some of the foremost occupational health problems in India, for emerging economies, and prevalence rates go above 70% in many high-incidence areas such as construction, agriculture, healthcare, and even IT. Along with increasing absenteeism and decreasing productivity, these disorders also result in significant direct out-of-pocket healthcare expenses and organizational inefficiencies due to underutilized resources, leading to a considerable economic burden.

MSDs represent a critical but solvable workplace health challenge in India. Evidence shows that ergonomic interventions, even at basic levels, can significantly enhance employee health, reduce costs, and improve productivity. To ensure sustainable adoption, a multi-pronged approach combining digital innovation, sector-specific customization, and regulatory commitment is necessary.

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Conflict of Interest

The authors declare no conflict of interest. All views and interpretations presented in this review are solely those of the authors, do not represent those of the authors, and do not represent the positions of any affiliated institutions.

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