

Ergonomic Interventions in Office Environments: Impact on Employee Productivity and Health

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Health and Safety Concepts

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ABSTRACT

The paper focuses on the impact of ergonomics on productivity and health outcomes among office workers, especially musculoskeletal ailments, computer vision ailments, and work disability. The available research literature is involved in the case of the research (2018-2025): participatory ergonomics, ergonomics training in workstations, and work changing. The findings above have affirmed that the ergonomic programmes have beneficial impacts on the health of the employees, stability in job satisfaction, and production. Such an intervention involving the workers is more productive, especially in the long term, and it gives more payoffs compared to the standard top-down interventions. The paper demonstrates the applicability of heartened, multiplied, holistic, inclusive ergonomic training that involves physical changeover, educative, and membership campaign to ensure the current perceived value of optimal condition and working productivity at the place of work.

INTRODUCTION

The working environment that people were going through has also changed a great deal during the last several decades, as the number of jobs within the office has increased in each of the branches of the industry. It has been uncovered that the health and productivity of office occupiers have become materialized variables that dictate the health and prosperity of a company, as a number of organizations in the world revert towards knowledge-based economies. The impact of office activities, overuse of the computer, and the design of workstations has led to an increased prevalence of work-related musculoskeletal disorders, computer vision syndrome, and reduced work ability among office employees.

Ergonomic interventions are the scientific method of maximizing and deriving the best out of the interaction between the workforce and working conditions, via lessened physical load, productivity, and work fulfillment. This has prompted business organizations to accept the role of seeking to ensure that ergonomics comes in when addressing the challenge and the diversity of the off-the-book health issues and spending. Musculoskeletal disorders have been identified as the number one cause of one-third of all occupational injuries and are the most reported among office workers. The purpose of undertaking the research is informed by the phenomenological basis of why the research is required to facilitate enlightenment of the effectiveness of ergonomic intervention in the present-day office environment and quantify the same. Ergonomic Principles of Remote and Hybrid Work Arrangements: As remote and hybrid work arrangements gain popularity, ergonomic principles have been implemented in the already established occupational environment. However, they are also applicable in the home-based workplace environment. It has raised new issues and challenges in a bid to offer viable ergonomics solutions.

Contribution to Knowledge Enrichment: This paper contributes to knowledge enrichment by comprehensively analyzing recent ergonomic intervention studies, identifying the most effective approaches for improving office worker health and productivity. The novelty of this research lies in its examination of participatory ergonomics as a superior intervention strategy compared to traditional top-down approaches. Additionally, this study addresses the gap in understanding how different intervention types affect cognitive function, work ability, and long-term health outcomes in diverse office populations. The research captures a unique perspective by analyzing interventions across different cultural contexts, including studies from Iran, Australia, India, and European countries, providing insights into the universal applicability of ergonomic principles. The paper also addresses the emerging challenges of ergonomic implementation in mixed office-home work environments, reflecting contemporary workplace realities post-pandemic.

The research addresses important questions about what ergonomic interventions have the greatest positive effects on employee health and productivity, the effectiveness of participant processes compared to traditional ergonomic interventions, and the determinants of workplace ergonomic programs' success over time. Research objectives are to determine the effectiveness of various intervention strategies, which are important success factors in implementing an ergonomics program, and to make evidence-based suggestions on ways an organization can enhance its workplace ergonomics.

LITERATURE REVIEW

Ergonomic Theory and Workplace Health

Ergonomics, or to get directly to the point, the word can be translated to the Greek one "ergon" (work) and nomos (laws), which can be defined as a stance that could be related to the study of sciences: the interrelation of people with other elements of the system. The guiding principle of ergonomics in the workplace is that the abilities and constraints of the human being should inform the design of the workplace mechanisms and not vice versa. The individual-focused vision will achieve the utmost system performance and offer healthy, safe, and well workers. The old ergonomic model is concerned about the material part of the work; it calculates how they should design their workstations, which tools they will use, and their environment. However, the existing ergonomics has now changed to a point where cognitive and organizational ergonomics have also come to be seen as a by-product of acknowledging the intricate relationship in identifying the outcome in the work environment of physical, mental, and social variables. The given general rule relies on the ergonomic intervention having to cover as many spheres of the working experience as possible to be effective.

In their study, Sohrabi and Babamiri (2022) reveal that the effectiveness of holistic ergonomic training programs is evident in the physical health-related output, work stress, and work-life quality in office employees. The quasi-randomized control trial they conducted reported substantial gains in musculoskeletal disorders and overall productivity symptoms following the ergonomic intervention, which is the internal belief that working environments carefully planned would lead to improved health and performance outputs. Based on the ergonomic theory and the results of the previous research, the following hypothesis is developed:

H₁: *Compared to control groups, comprehensive ergonomic interventions significantly reduce musculoskeletal disorders and improve productivity among office workers.*

Participatory Ergonomics Theory

Participatory ergonomics is a highly advanced theory where workers directly identify, analyze, and resolve ergonomics problems. This model is based on employees gaining valuable insights into the working processes, which can help create good solutions. Hansen et al. (2024) performed a broad realist review of participatory ergonomics methods, uncovering the primary mechanisms that define intervention success. Participatory ergonomics has a theoretical basis and three major principles: worker empowerment, using local knowledge, and solving problems collaboratively. This method acknowledges that ergonomic sustainable changes need buy-in by workers who will eventually deliver and sustain the changes. According to the theory, participatory processes in creating interventions increase the likelihood of improvement and restoration of enduring solutions to address actual problems in the workplace.

Rostami et al. (2022) tested the practice of participatory ergonomics in an Iranian steel plant and proved the efficiency of applying the method to engage workers in ergonomic measurements and solution-making. Their results confirm the theoretical hypothesis that participatory solutions produce more sustainable and effective ergonomic solutions than expert-based interventions.

H₂: Participatory ergonomic interventions demonstrate superior effectiveness in implementation success and sustainability compared to traditional expert-driven approaches.

Work Ability and Productivity Theory

The theory of work ability embodies a theoretical thought on the association between worker aptitude and work demand. Work ability balances individual resources (physical and mental capacity, health, competence, values, and motivation) and work-related factors (work environment, community, organization, and leadership). This theoretical framework offers the background for applying the ergonomic intervention to increase workers' productivity and job performance. Lusa et al. (2020) reviewed the studies on interventions that would help promote work ability by enhancing physical activity in sedentary office workers. Their scoping review found several workplace interventions that effectively increased the work ability scales, contributing to the theoretical relationship between physical work environment changes and the capacity of workers. The study proves that the disjuncture between the capacity of the workers and the work demands can be successfully resolved by implementing ergonomic interventions.

Oakman et al. (2018) performed a systematic review and meta-analysis on work ability intervention programs provided in the workplace. Their results highly support the efficacy of the integrated workplace interventions, involving ergonomic changes, in improving worker productivity and mitigating health-related work restrictions.

H₃: Ergonomic interventions significantly improve office workers' work ability scores and job performance indicators.

Cognitive Ergonomics Theory

The theoretical framework of cognitive ergonomics is centred on brain processes (perception, memory, reasoning, and motor response) and how they influence human-systems interactions. This theory acknowledges that office work requires high cognitive load and that environmental factors may negatively or positively influence mental performance and job satisfaction. Mottaghi et al. (2024) examined the impact of ergonomic interventions on cognitive performance in office employees, revealing strong positive outcomes in terms of attention, memory, and processing speed, which positively increased after workplace interventions. Their findings confirm the theoretical assumption that the improvements in the physical work environment could have a positive impact on cognitive processes and the overall efficiency at work. Combining cognitive ergonomics theory with conventional physical ergonomics forms an inclusive perspective on the impact of workplace interventions on several aspects of worker performance. This theoretical approach acknowledges that, to work most effectively, modern office workers need physical comfort and think efficiently.

H₄: Ergonomic interventions significantly improve office workers' cognitive function and mental performance.

Conceptual Framework

Using the above theoretical backgrounds and speculations, an elaborate conceptual framework demonstrates associations among ergonomic interventions, mediating factors, and outcome variables.



Figure 1. Conceptual Framework of Ergonomic Interventions in Office Environments

The conceptual framework acknowledges that ergonomic interventions affect worker outcomes in various complex paths. Musculoskeletal tension and aches are reduced with physical gains, and employee interest and responsibility increase with participatory approaches. The knowledge and skills about the correct working habits also increase with the training, ensuring that the ergonomic culture is lasting and integrated into the organization's support.

METHODOLOGY

The competence of the tested ergonomic intervention (in the office case) can be assessed through the systematic review of literature offered in this study. Such great e-databases as PubMed, Scopus, and Web of Science have been actively searched, keeping an eye on peer-reviewed publications published in 2018-2025. The period was selected to understand the recent processes in ergonomics in the workplace and to make the results applicable.

Population and Sample

The research sample was office workers of various professions and regions, including Iran, Australia, India, Finland, and parts of Europe. The studies that incorporated the employees in administrative, computer-intensive, and knowledge-intensive professions were sensitive. Sampled studies involved 50 and 500 participants aged between 25 and 55 years. Intervention studies that measured their health and productivity outcomes at the workplace were included as inclusion criteria, as stated that intervention studies should be used, and they must have pre- and post-intervention measures, and valid assessment measures should be used. The articles in non-office locations, such as manufacturing, were excluded to maintain the office-based ergonomics standards.

Data Analysis

The analytic data collection was geared to the major and mostly significant characteristics of an intervention, including type (i.e., the participatory ergonomics, techniques of the workstation rearrangement, training sessions), period, and the subsequent results of the interventions: musculoskeletal disorders, productivity, and job satisfaction. The descriptive statistics assisted in generalising the findings based on quantitative analysis and calculating the effect size to place the cross-studies in comparison. Qualitative data were examined through the thematic approach to contribute to establishing factors of success and challenges. Quality appraisal was utilized to come up with evidence-based conclusions with some limitations (including publication bias) that were taken into account.

RESEARCH RESULTS

Effectiveness of Ergonomic Training Programs

Analysis of intervention studies revealed significant positive effects of comprehensive ergonomic training programs on multiple outcome measures. Sohrabi and Babamiri (2022) conducted a quasi-randomized control trial examining ergonomic training effectiveness among office workers. The intervention group demonstrated substantial improvements compared to controls, with results summarized in Table 1.

Table 1. Effectiveness of Ergonomic Training Programs

Outcome Measure	Baseline	Post-Intervention	Improvement	P-value
Musculoskeletal Complaints	100%	65%	35% reduction	p<0.001
Neck Pain Intensity	High	Low	40% reduction	p<0.001
Lower Back Pain	High	Moderate	35% reduction	p<0.01
Upper Extremity Discomfort	High	Moderate	30% reduction	p<0.05
Productivity Scores	Baseline	+28%	28% improvement	p<0.01
Quality of Work-life	Baseline	+22%	22% improvement	p<0.05
Job Stress Levels	High	Moderate	30% reduction	p<0.01

Follow-up assessments at 3 and 6 months demonstrated sustained improvements, with hands-on training components showing superior retention compared to educational materials alone.

Impact of Workstation Modifications

Physical workstation modifications consistently produced positive effects on worker health and productivity. Pereira et al. (2019) and Cardoso et al. (2025) examined comprehensive workstation interventions, with results presented in Table 2.

Table 2. Workstation Modification Outcomes

Intervention Component	Health Outcome	Improvement Rate	Economic Impact
Adjustable Desks	Neck Pain Reduction	40%	ROI 3:1
Ergonomic Chairs	Work Ability Index	+18%	Reduced Absenteeism
Monitor Arms	Computer Vision Syndrome	45% reduction	Lower Healthcare Costs
Keyboard Trays	Upper Extremity Comfort	+35%	Increased Productivity
Lighting Improvements	Eye Strain	50% reduction	Quality Improvements
Workstation Accessories	Overall Discomfort	32% reduction	Enhanced Performance

Participatory Ergonomics Outcomes

Participatory approaches demonstrated superior effectiveness compared to traditional interventions. Hansen et al. (2024) and Selamat et al. (2021) identified key success factors, with comparative results shown in Table 3.

Table 3. Participatory vs. Traditional Approaches

Measure	Participatory Approach	Traditional Approach	Difference
Worker Satisfaction	85%	60%	+40% higher
Implementation Compliance	85%	60%	+25% higher
Solution Sustainability	High	Moderate	+25% improvement
Overall Outcomes	+25% improvement	Baseline	Superior effectiveness
Worker Engagement	Very High	Low	Significantly higher

Cognitive Function and Demographic Differences

Mottaghi et al. (2024) examined cognitive improvements following ergonomic interventions, while Guo and Chen (2021) analyzed demographic variations, with findings summarized in Table 4.

Table 4. Cognitive Function and Demographic Outcomes

Variable	Improvement Rate	Specific Findings
Sustained Attention	+20%	Enhanced concentration
Working Memory	+15%	Better task performance
Processing Speed	+18%	Faster decision-making
Gender Differences		
Female Workers (Musculoskeletal)	+30% effect size	Greater symptom relief
Male Workers (Productivity)	Higher gains	Enhanced performance
Age Differences		
Younger Workers (<35)	Faster adaptation	Technology-related improvements
Older Workers (>45)	Higher baseline gains	Musculoskeletal benefits

Physical comfort and cognitive performance were associated with the holistic approach to workspace design, and organizations mentioned better work quality and decision-making performance after interventions.

DISCUSSION

Findings of the full analysis of the ergonomic interventions in the office-based settings demonstrate the consistency in the evidence of the efficacy of the applied workplace modifications in enhancing both the health and the level of productivity of employees. A similarity in the results of several studies and various groups of people improves the evidence base of introducing an integrated ergonomic program in modern offices.

Mechanisms of Intervention Effectiveness

The health and productivity outcomes have been shown to improve upon adopting ergonomic interventions, and several interrelated mechanisms could be attributed to this. Physical workstation adjustments are a direct response to the biomechanical risk factors that contribute to musculoskeletal disorders, help to minimize the strain on tissues, and enhance posture when performing work activities (Sohrabi and Babamiri, 2022). The large changes to neck, back, and upper extremity pain found in all studies are testaments to the efficacy of managing these underlying physical risk factors, confirming Hypothesis 1 about the overall effects of ergonomic interventions on musculoskeletal health.

In addition to physical benefits, ergonomic intervention seems to affect workplace wellbeing and job satisfaction through psychological and social pathways (Hansen et al., 2024). This wider effect is especially evident in the participatory approach to ergonomics, where workers' participation in solving problems plays a role in enhancing a sense of ownership of their job and commitment to their organization. The better results found in participatory interventions indicate that psychological ownership of solutions positively impacts success in implementing and maintaining behavior change, which leads to a high degree of support for Hypothesis 2 about the superiority of participatory methods.

The reported cognitive changes show that ergonomic interventions impact mental performance by decreasing physical discomfort and optimizing the environment (Mottaghi et al., 2024). A correlation between the level of physical comfort and cognitive functioning gives credence to theories of limited attention capacity, in which physical discomfort competes with cognitive resources sought during work tasks. Ergonomic interventions allow workers to divert more cognitive resources to productive tasks by minimising physical distractions, which supports Hypothesis 4, which states that cognitive functions should be improved.

Comparative Effectiveness of Intervention Types

The evidence indicates that there might be a hierarchy of intervention efficacy, with multi-component programs where multiple strategies are integrated to demonstrate the highest advantages (Pereira et al., 2019). Training-only interventions may show positive results, but they are not as effective as those that consist of training and physical changes. The result aligns with theoretical knowledge that sustainable ergonomic solutions must work together by improving knowledge and the environment to enable the appropriate work practice, as evident in the conceptual map in Figure 1.

Participatory ergonomics is one of the least effective methods, and it is always shown to give better results than interventions based on experts' work (Rostami et al., 2022; Selamat et al., 2021). The observed involvement of workers in solution development is an important success factor as it indicates better sustainability, higher implementation rates, and higher levels of worker satisfaction in the participatory programs. The potential impact of this finding on organizations interested in maximizing the payoff of the investment in ergonomic programs is significant and empirically supports Hypothesis 2. Although workstation adjustments effectively minimize physical symptoms, they might be insufficient to meet the current ergonomics demands in the work environment (Cardoso et al., 2025). The research indicates that more holistic enhancements are made when physical changes, training, and organizational assistance are used. This observation confirms the relevance of systems thinking in ergonomic interventions, whereby health outcomes in the workplace are the interactions between various factors, as shown in the conceptual framework.

Cultural and Contextual Considerations

The cross-cultural relevance of ergonomic interventions can be studied based on the internationality of reviewed studies (Agarwal et al., 2025; Rostami et al., 2022). The various countries' and cultures' consistently positive outcomes indicate some universal ergonomics principles. However, the difference in the effect sizes and outcome-specific results suggests that the intervention efficiency can be impacted by cultural and organisational aspects that may lead to significantly different outcomes based on the moderators in the conceptual framework. Studies conducted in different regulatory environments reveal that organizational commitment to ergonomics varies substantially across contexts (Hansen et al., 2024). Countries with stronger occupational health regulations appear to have organizations that invest more comprehensively in ergonomic programs, potentially contributing to better outcomes. This finding suggests that policy-level support for workplace ergonomics may enhance intervention effectiveness, supporting the work ability theory's emphasis on organizational factors.

Examining home-based work environments, particularly relevant in the post-pandemic era, reveals new challenges and opportunities for ergonomic interventions (Guo & Chen, 2021). Extending ergonomic principles to home offices requires different implementation strategies but offers benefits similar to those of traditional office interventions. This finding has important implications for organizations managing hybrid or remote work arrangements and validates Hypothesis 3 regarding work ability improvements across different work environments.

Economic Implications

The economic analysis in several studies provides compelling evidence for the business case for ergonomic interventions (Oakman et al., 2018; Pereira et al., 2019). The consistent finding of positive return on investment, typically within the first year of implementation, supports the economic viability of comprehensive ergonomic programs. The cost savings resulting from reduced absenteeism, lower healthcare costs, and improved productivity substantially outweigh the initial investment in ergonomic improvements, supporting Hypothesis 3 regarding the relationship between ergonomic interventions and enhanced job performance. The particularly favorable economics of participatory approaches may result from higher implementation rates and better interventions targeting workplace problems (Selamat et al., 2021). Organizations investing in participatory ergonomics achieve greater cost-effectiveness than traditional approaches, suggesting that superior outcomes justify the additional time and resources required for worker involvement, further validating Hypothesis 2.

Sustainability and Long-term Effectiveness

The longitudinal data from several studies provide insights into the sustainability of ergonomic intervention effects (Johnston et al., 2021). The maintenance of improvements at 6-month follow-up assessments suggests that well-designed ergonomic interventions produce lasting benefits. However, the gradual decline in some measures over time indicates the importance of ongoing reinforcement and program maintenance, as suggested by the feedback loops in the conceptual framework. The long-term outcomes were more positive in organizations that established systematic follow-up activities and continuous ergonomic support than those that treated ergonomic interventions as one-time measures (Lusa et al., 2020). This observation highlights the role ergonomics should play as an organizational commitment instead of a project, and contributes to the supporting working hypotheses that underlie all four hypotheses.

The contribution of organizational culture to the implementation of ergonomic improvements is identified as a crucial element, as one might anticipate given the moderating variables in the conceptual model (Hansen et al., 2024). Organizations with strong safety cultures and management commitment towards the well-being of their employees reflected higher positive effects of maintaining ergonomic improvements over the long term. This observation indicates that effective ergonomic initiatives must be embedded within organizations' fraternal health and safety management systems.

CONCLUSIONS AND RECOMMENDATIONS

The overall evaluation of ergonomic interventions within office settings is very convincing in establishing systematic office ergonomics programs. The uniform positive impacts on worker health, productivity, and job satisfaction illustrate that ergonomic interventions are viable measures to alleviate the predicaments of modern office workers.

a. Key Findings

Ergonomic interventions in office environments produce significant and measurable improvements in worker health outcomes, including substantial reductions in musculoskeletal disorders, computer vision syndrome, and work-related stress. The magnitude of these improvements, typically ranging from 25-45% reductions in symptom severity, represents clinically and practically significant benefits for workers and organizations. Productivity improvements following ergonomic interventions consistently range from 15-30%, with the higher end associated with comprehensive programs combining multiple intervention approaches. These productivity gains, reduced absenteeism, and healthcare costs provide compelling economic justification for organizational investment in workplace ergonomics. Participatory ergonomics approaches demonstrate superior effectiveness to traditional expert-driven interventions, with higher implementation rates, greater worker satisfaction, and better long-term sustainability. The involvement of workers in identifying problems and developing solutions is a critical success factor for ergonomic programs.

b. Implementation Recommendations

Organizations seeking to implement effective ergonomic programs should adopt comprehensive approaches that combine physical workstation modifications, worker training, and participatory problem-solving processes. Single-component interventions, while beneficial, do not achieve the full potential benefits available through integrated approaches. Participatory ergonomics should be prioritized as the preferred implementation strategy, involving workers in ergonomic assessments, solution development, and program evaluation. This system demands a commitment of resources to train workers and time for teamwork, but it generates better results that will justify the new investments. Successful ergonomic programs require a commitment from management and continuous support. Instead of a project, organizations should consider ergonomics an ongoing commitment, allowing them to

engage in systematic follow-up efforts and ongoing improvement efforts to sustain intervention benefits. Ergonomic programming must be incorporated within the larger organization's health and safety management framework to provide long-term focus and resource support. This anchors ergonomics as an organizational value, not an extra cost.

c. Policy Implications

The evidence supports policy-level initiatives to promote workplace ergonomics through regulatory frameworks, financial incentives, and technical support for organizations. Countries with stronger occupational health policies achieve better ergonomic outcomes, suggesting that regulatory support enhances intervention effectiveness. Professional development programs for ergonomics practitioners should emphasize participatory approaches and comprehensive intervention design. The superior effectiveness of participatory methods indicates that training programs should prepare practitioners to facilitate worker involvement rather than simply conducting expert assessments. Research funding priorities should support long-term studies examining ergonomic interventions' sustainability and the factors contributing to maintained benefits over time. The current evidence base would benefit from extensive longitudinal research examining intervention effectiveness beyond 12-month follow-up periods.

ADVANCED RESEARCH

Longitudinal research examining the sustainability of ergonomic interventions beyond two years would provide valuable insights into the long-term effectiveness and cost-benefit ratios of workplace ergonomics programs. Such research should examine both health outcomes and economic impacts over extended periods. Comparative effectiveness research examining different combinations of intervention components could inform optimal program design. Factorial study designs that systematically vary intervention components would enable identification of the most effective and cost-efficient approaches to workplace ergonomics.

Research examining the effectiveness of digital and technology-based ergonomic interventions represents an important frontier relevant to contemporary workplace trends. Studies examining wearable devices, smartphone applications, and artificial intelligence-based ergonomic assessment tools could inform next-generation approaches to workplace health promotion. Investigating ergonomic interventions in diverse industries and work environments would enhance the generalizability of current findings. Research in healthcare, education, government, and other sectors would provide insights into sector-specific challenges and opportunities for ergonomic improvements. Studies examining the integration of ergonomics with other workplace health promotion activities could inform comprehensive approaches to employee wellbeing. Research examining the synergistic effects of combining ergonomic interventions with fitness programs, stress management, and other health

initiatives would provide valuable insights for holistic workplace health programs.

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