

# The contribution of physiotherapy in ergonomic analysis, prevention, and treatment of musculoskeletal disorders and repetitive strain injuries in healthcare

Bruna Moraes da Silva<sup>1</sup>, Claudiana dos Santos Henrique<sup>2</sup>, Letícia da Silva Cantão<sup>3</sup>, Marcelly Soares dos Santos<sup>4</sup>, Maria Eduarda de Oliveira Lopes<sup>5</sup>, Maria Izabela da Costa Paixão<sup>6</sup>, Nicololy Alves Ferraz<sup>7</sup>, Pollyana Cardoso Franco<sup>8</sup>, Raissa Oliveira Salomão<sup>9</sup>, Daniel Rodrigues Silva<sup>10</sup>

<sup>1</sup>Undergraduate student in Physiotherapy, Caratinga University Center - Nanuque, MG, Brazil [Mbraps53@gmail.com](mailto:Mbraps53@gmail.com)

<sup>2</sup>Undergraduate in Physiotherapy, Caratinga University Center - Nanuque MG, Brazil [claudianasantoshenrique@gmail.com](mailto:claudianasantoshenrique@gmail.com)

<sup>3</sup>Undergraduate in Physiotherapy, Caratinga University Center – Nanuque Campus, MG, Nanuque/MG, Brazil

[leticiascantao@hotmail.com](mailto:leticiascantao@hotmail.com)

<sup>4</sup>Undergraduate student in Physiotherapy, University Center of Caratinga - Nanuque, MG, Brazil [cellyoliveira289@gmail.com](mailto:cellyoliveira289@gmail.com)

<sup>5</sup>Undergraduate student in Physiotherapy, Caratinga University Center - Nanuque Campus, MG, Mucurici/ES-Brazil

[mariaeduardaoliveiralopes89@gmail.com](mailto:mariaeduardaoliveiralopes89@gmail.com)

<sup>6</sup>Undergraduate student in Physiotherapy, University Center of Caratinga - Nanuque, MG, Brazil [paixaoizabela897@gmail.com](mailto:paixaoizabela897@gmail.com)

<sup>7</sup>Undergraduate student in Physiotherapy, Caratinga University Center - Nanuque MG, Brazil [nicolyalvesferraz@gmail.com](mailto:nicolyalvesferraz@gmail.com)

<sup>8</sup>Undergraduate student in Physiotherapy, University Center of Caratinga – Nanuque, MG, Brazil [pollyanafranco5@gmail.com](mailto:pollyanafranco5@gmail.com)

<sup>9</sup>Undergraduate student in Physiotherapy, University Center of Caratinga - Nanuque, MG, Brazil [raissaoiveirah14@gmail.com](mailto:raissaoiveirah14@gmail.com)

<sup>10</sup>Doctor of Pharmaceutical Sciences, State University of Maringá (UEM), Maringá – Paraná, Brazil [drsfarma35@gmail.com](mailto:drsfarma35@gmail.com)

Orcid: <https://orcid.org/0009-0008-2670-4205>

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**Abstract—** The Ergonomic Work Analysis (EWA), as established by Regulatory Standard No. 17, is a crucial tool for identifying occupational risk factors and proposing interventions that promote a safer and healthier work environment. In healthcare services, continuous exposure to intense physical demands, inadequate postures, and high cognitive requirements significantly contributes to the development of Work-Related Musculoskeletal Disorders (WRMSDs) and repetitive strain injuries (RSIs). Physicaltherapy plays a strategic role in both the prevention and rehabilitation of healthcare professionals. Its scope includes the ergonomic assessment of workstations, the implementation of compensatory and educational exercise programs, and the functional rehabilitation of worker affected by occupational injuries. The integration between EWA and physiotherapeutic practice promotes not only a reduction in the incidence of RSIs and WMSDs but also improvements in quality of life, increased occupational safety, and enhanced organizational efficiency. Therefore, the systematic application of EWA, combined with physiotherapeutic interventions, constitutes a fundamental resource for promoting occupational health, especially among healthcare professionals, a group highly vulnerable to ergonomic risks.

## I. INTRODUCTION

Healthcare professionals perform daily activities that require significant physical exertion, such as changing patients' positions, moving them within units, and various forms of manual mobilization. These actions involve deep bending, trunk rotations, inclined postures, pushing or pulling heavy equipment, and handling patients with varying levels of dependence. Such demands increase musculoskeletal overload and promote the onset of pain, mainly in the lumbar spine, neck, and shoulders. This pattern was observed by Clari *et al.* (2021), who identified a high prevalence of musculoskeletal symptoms among professionals involved in hospital mobilization routines.

In addition to activities requiring great effort, many healthcare workers perform smaller, yet continuous movements, such as typing medical records, preparing materials, handling instruments, and making adjustments during procedures. These small gestures also contribute to the development of repetitive strain injuries (RSI) and work-related musculoskeletal disorders (WRMSDs). The review by Duarte *et al.* (2012) shows that both intense efforts and repetitive movements are relevant factors for musculoskeletal disorders, especially among nursing professionals, but also present in other categories depending on the type of task performed.

This situation is not limited to the hospital environment. In primary care units, professionals face combinations of prolonged posture, constant typing, and frequent movement. As demonstrated by Araújo and Souza (2021), signs of RSI/WRULD are also common at this level of care, reinforcing that physical overload is widely distributed in the health sector.

Even outside the traditional clinical setting, activities related to human care can generate similar risks. The study by Pereira Jr. *et al.* (2018), conducted with nursery professionals, identified a high prevalence of low back pain associated with repetitive bending and maintaining uncomfortable postures. Although they are not directly part of the health sector, their biomechanical demands are comparable to those of various categories within the field, contributing to the understanding of the impacts of repetitive physical overload.

Given this scenario, physiotherapy plays a fundamental role in the prevention and management of work-related injuries. The physiotherapist contributes through ergonomic assessments, task analysis, risk identification, and guidance on adjustments to the work environment and activity execution. Furthermore, they work in the rehabilitation of professionals who already present with repetitive strain injuries (RSI/WRULD), using therapeutic resources, specific exercises, muscle

rebalancing, and functional training to reduce overload and restore work capacity. The relevance of these interventions is reinforced by Santos *et al.* (2017), who highlight the importance of ergonomic actions and prevention programs in reducing musculoskeletal illnesses. Thus, physiotherapy becomes essential to promote safer environments and protect the musculoskeletal health of healthcare workers. The objective of this study is to gather, analyze, and discuss scientific publications and institutional documents that address the contribution of physiotherapy in ergonomic analysis applied to healthcare professionals.

## II. METHODOLOGY

This study was conducted through a narrative literature review, aiming to gather, analyze, and discuss scientific publications and institutional documents that address the contribution of physiotherapy to ergonomic analysis applied to healthcare professionals. The research was carried out between October and November 2025, encompassing scientific articles available in national and international databases, such as BMC Musculoskeletal Disorders, Revista Pesquisa em Fisioterapia, Research Society and Development, REASE, Cadernos ESP, and SciELO. In addition to these sources, official documents from the Ministry of Health, the Ministry of Labor and Employment, and the Brazilian Medical Association were consulted, as well as information available on institutional portals such as UNCISAL and SETRAB.

## III. ERGONOMIC RISKS AND THE RELEVANCE OF OCCUPATIONAL ERGONOMICS

Workplace settings in healthcare are characterized by the presence of multiple ergonomic risks, resulting from the combination of physical, organizational, and psychosocial demands in daily caregiving (Souza *et al.*, 2023; Oliveira Moreira, 2025). Among physiotherapists, nurses, and technicians, tasks such as patient movement and transfer, maintenance of static postures in trunk flexion and rotation, repetitive upper limb movements, and working at an accelerated pace and with a high emotional load are frequent (Augusto *et al.*, 2008; Vaz *et al.*, 2022). These factors are associated with an increased incidence of repetitive strain injuries (RSI) and work-related musculoskeletal disorders (WRMD), which are associated with pain, functional limitations, and reduced work capacity in healthcare professionals (Brazil, 2012; Brazil, 2012b).

Official reports and literature reviews indicate that repetitive strain injuries (RSI) are among the main causes of sick leave and disability retirement in the healthcare sector, with repercussions at the individual, institutional, and social

security levels (Brazil, 2012; Oliveira Moreira, 2025). Studies with physiotherapists and other workers in the field demonstrate a high prevalence of complaints in the lumbar and cervical spine, shoulders, wrists, and hands, frequently related to manual handling of loads, inadequate furniture, and lack of scheduled breaks (Vaz et al., 2022; França et al., 2022).

The structured integration of ergonomics and physiotherapy into occupational health programs becomes fundamental for the prevention of injuries and the promotion of quality of life at work (Souza et al., 2023; Cândido, 2025). Ergonomics, from an occupational health perspective, aims to adapt work to the characteristics of the human being, encompassing biomechanical, cognitive, and psychosocial dimensions to promote comfort, safety, and efficiency (Augusto et al., 2008).

In Brazil, this concept finds normative support in Regulatory Standard No. 17 (NR-17), which “establishes the guidelines and requirements that allow the adaptation of working conditions to the psychophysiological characteristics of workers” (Brazil, 2022, p. 1). NR-17 covers aspects such as furniture, equipment, lifting and transporting loads, work organization, and environmental conditions, linking to the management of occupational risks foreseen in labor legislation (Brazil, 2022; Brazil, 2024).

#### IV. ERGONOMIC ANALYSIS OF WORK AND THE ROLE OF THE PHYSIOTHERAPIST

Among its main requirements, NR-17 mandates the performance of a Workplace Ergonomic Analysis (WEA) or Preliminary Ergonomic Assessment (PEA) when working conditions may compromise the health and performance of workers (Brazil, 2022). This process must consider both prescribed and actual work, identifying discrepancies that generate physical and cognitive overload, as well as opportunities for intervention (Ferreira; Shimano; Fonseca, 2009). In healthcare services, this implies evaluating beds, surgical tables, stretchers, wheelchairs, transfer devices, material flows, and schedules, with the aim of adapting tasks and workstations to the biopsychological and psychophysiological capacities of professionals (Brazil, 2022; Setrab, 2025).

The physiotherapist possesses specific training in biomechanics, kinesiology, and exercise physiology, enabling them to analyze in detail the physical loads imposed by work and their repercussions on the musculoskeletal system (Ferreira; Shimano; Fonseca, 2009; Souza et al., 2023). In Ergonomic Analysis of Work (AET), this professional observes and records postures, ranges of motion, frequency of repetitive movements, force requirements, exposure times, and compensation strategies,

articulating this information with reported complaints and absenteeism data (Ferreira; Shimano; Fonseca, 2009; Vaz et al., 2022). Based on this diagnosis, the physiotherapist contributes to identifying critical points in the work process and proposing corrective and preventive measures aligned with the guidelines of NR-17 and available scientific evidence (Brazil, 2022; França et al., 2022).

Literature highlights that the inclusion of physiotherapists in interdisciplinary occupational health and safety teams facilitates the integration of legal requirements, technical recommendations, and operational realities (França et al., 2022; Ferreira; Shimano; Fonseca, 2009). Working alongside safety engineers, occupational physicians, nurses, and hospital managers, these professionals participate in defining priorities, developing ergonomic action plans, and monitoring results (Souza et al., 2023; Ferreira; Shimano; Fonseca, 2009). Therefore, the role of physiotherapy in ergonomic analysis goes beyond risk identification, contributing to the development of feasible and sustainable solutions in the healthcare environment (Augusto et al., 2008; Brasil, 2022).

One of the main areas of focus for physiotherapy in ergonomics is the prevention of repetitive strain injuries (RSI) through educational programs and systematic training (Souza et al., 2023; França et al., 2022). These programs include theoretical and practical guidance on spinal biomechanics, lever principles and center of gravity, as well as demonstrations of safe patient movement and transfer techniques using assistive devices, reducing the load on the spine (State University of Health Sciences of Alagoas, 2025; Brazil, 2012b). By promoting the perception of early signs of fatigue and pain, the physiotherapist encourages the adoption of self-care strategies and the search for ergonomic adjustments in the workplace (Souza et al., 2023; Brazil, 2012b).

#### V. PREVENTIVE INTERVENTIONS, REHABILITATION, AND INSTITUTIONAL CHALLENGES

Workplace gymnastics and active breaks, coordinated by physiotherapists, are widely described as strategies capable of reducing musculoskeletal complaints and improving flexibility and work readiness (Pereira et al., 2018; França et al., 2022). Workplace kinesiotherapy protocols include segmental and global stretching, strengthening of postural muscles, joint mobilizations, and respiratory exercises, adjusted to the specific demands of each sector (Fiosale, 2018; Mendes et al., 2010). When associated with the readjustment of furniture, stretcher height, organization of material flows, and revision of schedules, these interventions tend to have a more

consistent impact on reducing symptoms and absences due to RSI/WRULD (Brazil, 2012a; Brazil, 2022; Vaz *et al.* , 2022).

In cases where RSI/WRULDs are already established, physiotherapy plays a central role in treatment and functional rehabilitation, with individualized therapeutic plans according to the phase and severity of the condition (Brazil, 2012b; Mendes *et al.* , 2010). Protocols frequently include specific kinesiotherapy for stretching and muscle strengthening, manual therapy techniques, joint mobilizations, coordination exercises, and global postural re-education, aiming to relieve pain and restore functional capacity (Mendes *et al.* , 2010; Brazilian Medical Association, 2013). Studies with workers affected by RSI/WRULDs show that structured rehabilitation programs, individual or in groups, can significantly improve functionality and quality of life, favoring a return to work (Silva *et al.* , 2006; Mendes *et al.* , 2010).

More recent approaches reinforce the importance of integrating physical, organizational, and psychosocial aspects in the management of RSI/WRULDs, recognizing the multifactorial nature of these disorders (Brazil, 2012a; Augusto *et al.* , 2008). From this perspective, the physiotherapist guides specific ergonomic adjustments to the affected professional's workstation, negotiates task adaptations with management, and participates in defining criteria for gradual return and work readaptation, in accordance with NR-17 (Brazil, 2022; França *et al.* , 2022). The articulation between therapeutic plan, ergonomic analysis, and institutional occupational health policies increases the likelihood of lasting results, with less recurrence of symptoms (Souza *et al.* , 2023; Oliveira Moreira, 2025).

Institutional experiences and intervention studies indicate that ergonomics programs with the active participation of physiotherapists result in a reduction in musculoskeletal complaints, a decrease in absences due to repetitive strain injuries (RSI/WRULD), and an improvement in quality of life at work indicators (Souza *et al.* , 2023; França *et al.* , 2022). These effects impact patient safety, as professionals with less pain and better functional capacity tend to perform procedures with greater precision and a lower risk of errors (Brazil, 2012a; Oliveira Moreira, 2025). Furthermore, the reduction in absences and costs associated with rehabilitation and staff replacement represents a significant organizational gain, reinforcing the strategic role of occupational health (Brazil, 2012b; Vaz *et al.* , 2022).

However, challenges persist in consolidating continuous ergonomic programs in healthcare services, such as low institutional prioritization, limited resources,

and difficulty in sustaining preventive actions in high-demand healthcare settings (Oliveira Moreira, 2025). The literature emphasizes the need to strengthen a preventive culture, with formal policies promoting worker health, structured inclusion of physiotherapy in multidisciplinary teams, and monitoring of risk and illness indicators (Brazil, 2022). In this context, the contribution of physiotherapy in ergonomic analysis, prevention, and treatment of RSI/WRULDs is essential for healthcare professionals to perform their activities safely, with dignity, and sustainably throughout their careers (Souza *et al.* , 2023; França *et al.* , 2022).

## VI. SCIENTIFIC EVIDENCE ON THE CONTRIBUTION OF PHYSIOTHERAPY IN THE PREVENTION OF MUSCULOSKELETAL DISORDERS

Scientific literature consistently demonstrates that physiotherapy plays a central role in preventing musculoskeletal disorders when integrated with ergonomic actions in the workplace. Studies show that interventions conducted by physiotherapists, such as participatory ergonomic programs, biomechanical adaptations, and postural guidance, significantly reduce the incidence of WRMDs and RSI in workers exposed to high physical loads and repetitive demands (Pereira; Lemos, 2021; Silva *et al.* , 2022; Fernandes *et al.* , 2023). The nature of the activities performed by these workers, characterized by repetitive movements, maintaining inadequate postures, continuous use of physical force, and high care demands, strongly favors the development of musculoskeletal overload. In this scenario, the role of the physiotherapist becomes indispensable, given their technical ability to assess, identify and intervene directly on these risks (Pereira; Lemos, 2021).

Several authors demonstrate that ergonomic analysis performed by physiotherapists, based on biomechanical and functional principles, is effective in identifying environmental, organizational, and behavioral inadequacies that contribute to work-related illnesses. The literature reinforces that on-site evaluation allows for a comprehensive understanding of the demands of the task and the interaction between the worker, the environment, and the equipment (Ribeiro; Torres, 2022; Cunha *et al.* , 2023; Freitas *et al.* , 2023).

Simple ergonomic interventions, such as adjustments to furniture, reorganization of workflow, adaptation of patient transfer methods, and implementation of active breaks, have a concrete impact on reducing the risks associated with repetitive strain injuries (RSI/WRULD), as demonstrated in national and

international studies. When applied continuously, these measures promote safer and more functionally adequate environments (Martins; Vasconcelos, 2024).

Beyond the ergonomic analysis itself, the literature indicates that the physiotherapist's preventive role has a strong educational component. Training programs, postural guidance, instruction in safe mobilization techniques, and stimulation of body awareness promote the adoption of protective behaviors and reduce the incidence of musculoskeletal injuries. This educational approach contributes to strengthening the culture of prevention within healthcare institutions. (Santos; Almeida; Prior, 2021).

## VII. INTEGRATED APPROACHES TO REDUCING REPETITIVE STRAIN INJURIES/WORK-RELATED MUSCULOSKELETAL DISORDERS AND PROMOTING OCCUPATIONAL HEALTH

Ergonomics should not be understood merely as a corrective tool, applied after injuries have occurred, but as a fundamental science for... Worker health. When integrated with health surveillance actions, periodic inspections of work environments, and educational practices, ergonomics strengthens the construction of safe environments and promotes sustainable organizational changes, becoming the main preventive response against the advancement of repetitive strain injuries (RSI/WRULDs). In addition to reducing biomechanical overload and the risk of recurrence, its application contributes to improving quality of life, preserving functional capacity, and reducing work absences (Bellucci). *et al.*, 2024).

Treatment of these conditions requires a multidisciplinary approach, combining organizational changes, psychological support, and clinical interventions such as physiotherapy and workplace kinesitherapy. The goal is to alleviate symptoms, prevent the condition from worsening, and promote functional recovery, preserving both the physical health and emotional well-being of the worker (Brazil, 2020; Brazil, 2023). Workplace-contextualized rehabilitation, in turn, is essential to prevent relapses and readapt the professional to the real demands of their role.

The work environment also plays a fundamental role. According to Moraes and Mont'Alvão (2010), inadequate ergonomics and a precarious work environment, without regular breaks for rest and stretching, aggravate the risk of injuries. This indicates the need for a preventive approach involving the ergonomic adaptation of the workplace.

Thus, the body of evidence analyzed demonstrates that the integration of ergonomic analysis, preventive

measures, and therapeutic interventions constitutes a comprehensive, effective, and sustainable approach to reducing repetitive strain injuries (RSI), promoting health, and improving the quality of working life. The systematic presence of physiotherapists in occupational health teams is therefore revealed to be a fundamental strategy for building safer, healthier, and more humanized work environments.

## VIII. FINAL CONSIDERATION

An analysis of the role of physiotherapy in ergonomics shows that the work of this professional is essential for the prevention, management, and rehabilitation of repetitive strain injuries (RSI) in the healthcare workplace. The combination of qualified ergonomic assessment, educational interventions, organizational adjustments, and therapeutic follow-up strengthens an integrated approach capable of reducing musculoskeletal problems, improving the quality of working life, and promoting safer and more humanized environments. Although challenges persist, such as the lack of institutional recognition and the need for greater inclusion of ergonomic physiotherapists in healthcare services, the results presented demonstrate that the integration of prevention, ergonomics, and rehabilitation is an effective and sustainable way to protect workers' health and optimize organizational efficiency.

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