REVISTA Ação Ergonômica

Ergonomic Action, RJ, 20(1), 2026.
ISSN 2965-7318. doi: 10.4322/rae.v20n1.e202601.en

Occupational risk of lifting, carrying and unloading loads individually in light of the criteria for classifying hazardous or unhealthy work

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Summary

The manual lifting, handling, and transport of heavy loads remain recurring practices in various work contexts, frequently associated in the scientific literature with ergonomic risks and harm to workers' health. Despite this, such activities are not recognized in Brazilian labor law as directly classifiable as unhealthy. This normative gap raises questions about the coherence between the knowledge produced in the field of ergonomics and the legal criteria currently used to characterize unhealthy activities and operations. In this context, this study analyzes the normative, doctrinal, and technical-scientific assumptions related to the classification of manual load handling within the legal-ergonomic debate on unhealthy working conditions. A hypothetical-deductive approach was adopted, with bibliographic research based on consultation of doctrinal works and legislation, aiming at the analysis of the normative content that establishes the criteria for characterizing unhealthy activities. The results indicate that, although the legal system recognizes the need to protect workers exposed to harmful agents, the manual handling of loads remains predominantly treated within the scope of preventive ergonomics, without express provision for its classification as an unhealthy agent. The analysis therefore reveals a tension between technical-scientific evidence on the impacts of intense and repetitive physical effort and the way legislation structures the recognition of unhealthy working conditions. A normative vacuum is observed , while at the same time legal, scientific and hermeneutical foundations are presented for overcoming it. In this context, the revision of NR-15, aligned with contemporary technical knowledge and constitutional commitments, proves indispensable to promote safe, healthy work environments compatible with international decent work standards.

Keywords: Unhealthy working conditions, Manual handling of loads; Ergonomics, Decent work, Occupational health.

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1. INTRODUCTION

The pursuit of harmony between health and justice depends on a complex normative framework of a multidisciplinary nature. Given this, the demand for the integration of different areas of knowledge for the proper framing of the right to unhealthy working conditions is heightened. Ergonomics is presented as an important component of this discussion, being a multidisciplinary and user-centered scientific discipline (IEA, 2020). In practice, it involves document analysis, preventive advice with a transdisciplinary approach, technical opinions, liability calculation, monitoring during inspections, advice in negotiations, labor litigation, examination of obligations and solutions employed (Rodrigues, 2022).

In light of this perspective, normative comparison proves essential for the improvement of labor rights (Andrade, 2024) and for the consolidation of safe, decent and healthy work environments, in accordance with the constitutional model of protection of health, safety and human dignity (articles 1, item III, 6, 7, item XXII, of the Federal Constitution of 1988).

Legal hermeneutics should be guided by the principles of prevention and precaution, widely recognized within the International Labour Organization (ILO) and incorporated into the Brazilian legal system through ratified conventions and the Regulatory Standards (NR) of the Ministry of Labor. Furthermore, it is suggested that the promotion of adequate working conditions be influenced by global trends in sustainable development, especially the guidelines contained in the Sustainable Development Goals of the United Nations (SDGs/UN), notably the eighth goal, which emphasizes decent work and inclusive economic growth (United Nations, 2025). A critical and systematic examination of labor legislation is an essential instrument to ensure the effectiveness of fundamental workers' rights and to foster public policies aligned with the international responsibilities assumed by Brazil.

Regulatory Standard No. 15 (NR15) recognizes eleven risk factors to which workers may be exposed as unhealthy activities: 1) noise; 2) heat; 3) vibration; 4) ionizing radiation; 5) non-ionizing radiation; 6) work under hyperbaric conditions; 7) cold; 8) humidity; 9) mineral dusts (including silica, asbestos, and manganese); 10) chemical agents (including benzene); and 11) biological agents. On the other hand, the lifting, handling, and individual, non-occasional transport of heavy loads is not included in the exhaustive list of agents harmful to health, which is why, from a strictly legal perspective, it is not characterized as a harmful factor to health capable of justifying the payment of the unhealthy work allowance. This conclusion holds true even when the activity is performed above the tolerance limits established by the Regulatory

Standards, insofar as the characterization of unhealthy working conditions requires express classification within the annexes of NR-15, as established by the consolidated jurisprudence of the Superior Labor Court - TST.

It is important to clarify that the analysis presented here is not intended to advocate for the monetization of occupational risks, nor does it aim to reduce the complex issue of worker health to the simple monetary compensation resulting from the hazard pay. Nor does it propose to replace preventive measures—widely recognized by scientific literature and by Labor Law itself as a structuring axis of occupational health protection—with merely compensatory mechanisms. On the contrary, this reflection raises questions about the limits and inadequacies of a normative model that, by failing to recognize certain potentially harmful exposures, may obscure risks that are actually present in the work environment. In this sense, it is reaffirmed that preventive strategies must remain the priority foundation for worker health protection, in accordance with the principles of precaution, prevention, and the dignity of the human person.

The lifting, handling, and non-occasional individual transport of loads is present in the routine of different occupations in the industrial, health, and commercial sectors (Biasi et al., 2022; Duarte et al., 2023, Lopes et al., 2023). According to Convention No. 127 of the International Labour Organization – ILO, promulgated by Decree No. 67,339 (Brazil, 1970), the activity of manual handling of loads "designates any transport in which the weight of the load is entirely supported by a single worker and includes the lifting and setting of the load," while the expression regular manual handling of loads "designates any activity devoted continuously or essentially to the manual handling of loads or which normally includes, even discontinuously, the manual handling of loads."

Unsatisfactory ergonomic conditions for handling loads can exacerbate the physical strain on workers. The *National Institute on Occupational and Safety Health* – NIOSH – a US government institution – developed an equation that allows for estimating the recommended weight limit. The need for force, trunk rotation with asymmetrical movements, horizontal and vertical distances traveled, lifting frequency, load duration, and grip quality are variables that influence the overload to which the body structures are exposed in this work activity (Waters et al., 1994). The weight limit of 23 kg, without risks to workers' health, was defined by the NIOSH method. This limit should be considered when the load is handled under ideal conditions. That is, the maximum limit depends on requirements that are rarely considered in the production process. This can also be evidenced from the perspective of NR17, since the manual transport of loads by a worker whose weight is likely to compromise their health or safety should not be required or permitted (Brazil, 2001, p. 5).

When this transport is carried out in a way that exceeds this weight limit, the literature points to harm to the worker's health, such as lower back pain, which is frequently identified among professionals in the nursing field (Cargnin et al., 2020) and the metallurgical industry. Work activities in the metallurgical industry are characterized by the presence of biomechanical factors such as handling and transporting loads, and the use of weight/force, implying physical overload (Picoloto & Silveira, 2008).

Another problem that may present an occupational link is a herniated disc. This condition has a multifactorial etiology, and among the aspects involved are: trunk flexion for prolonged periods combined with carrying or lifting weights and inadequate postures, among others (Negrelli, 2001).

Regarding biomechanical aspects, the main problem in handling loads is related to the wear and tear of the intervertebral discs (Kroemer & Grandjean, 2005). An intervertebral disc can prolapse with the combination of axial rotation with lateral flexion, axial rotation plus flexion, or lateral flexion plus flexion or extension of the trunk. This risk increases significantly when a load is added (Schmidt et al., 2007). With these movements, the viscous intradiscal fluid tends to be squeezed to the side with less pressure, and the stresses on the fibrous rings should be considered as factors in the wear and tear of the intervertebral discs (Kroemer & Grandjean, 2005).

Unfavorable biomechanical demands caused by inadequate work methods increase the intensity of risk factors and can lead to spinal injuries, increasing absenteeism and time off work due to occupational low back pain (Iguti & Hoehne , 2003; Helfenstein Junior et al., 2010) or herniated discs (Fernandes & Carvalho, 2000; Schröder & Nienhaus , 2020). Nachemson and Elfstrom (1970) developed biomechanical models to predict compressive forces in the lumbar spine. These researchers demonstrated the loads on the L3 and L4 intervertebral discs during different postures and tasks. The activity of lifting a 20 kg weight with the trunk and knees straight represented the highest measured load (3,240 Newtons - N). Conversely, when lifting the same load with bent knees, a pressure of 2,400 N was observed. Thus, there is a multidimensional relationship between occupational causes and deleterious health effects. Therefore, there is a clear causal link between activities involving the regular manual handling of loads and occupational diseases or injuries.

Back pain is one of the main causes of permanent disability retirement, especially among retail workers. In 2007, 112,238 workdays were lost due to functional limitations resulting from this condition among professionals in the transport and cargo sector alone. When all professional activities are considered, this number reaches 12,023,830 lost days in the same

year, highlighting the magnitude of the occupational impact of back pain (Meziat & Silva, 2011).

In Brazil, in 2024 , 4,779 cases of back pain (ICD M40–M54) were registered [2]out of a total of 13,862 notifications of Work-Related Musculoskeletal Disorders (WRMDs) in the Notifiable Diseases Information System – SINAN (Ministry of Health, 2024). Back pain is also among the main causes of work absenteeism recorded by the National Institute of Social Security - INSS (Brazil, 2025). These disorders lead to absence from work and reduced work capacity, causing harm to the worker, the company, and society. From this perspective, this study aims to examine the normative, doctrinal, and technical-scientific assumptions that support the debate on the potential classification of lifting, carrying, and unloading loads individually as an unhealthy agent, contributing to the discussion on the coherence and sufficiency of current labor legislation.

2. METHOD

This research adopts a qualitative approach, with a theoretical-analytical orientation, based on the hypothetical-deductive method. This method begins with the formulation of a research problem and the construction of explanatory hypotheses, which are subsequently examined through critical confrontation between theoretical frameworks, scientific evidence, and normative devices. As systematized by Popper (2013), hypothetical-deductive reasoning constitutes a central procedure of scientific investigation, since it allows analytical propositions to be subjected to the critical scrutiny of accumulated knowledge, enabling the identification of inconsistencies, gaps, or explanatory limitations. Thus, the choice of the hypothetical-deductive method is based on the epistemological nature of the problem investigated.

This study does not focus on the direct empirical measurement of occupational exposures or the production of experimental data, as is the case in epidemiological or ergonomic field research. Instead, it seeks to critically examine the coherence between the technical and scientific knowledge produced in the specialized literature and the normative criteria used by the Brazilian legal system to characterize unhealthy activities and operations. In this context, the hypothetical-deductive method proves particularly suitable, as it allows starting from the

[2]In ICD-10, back disorders are classified under the code range: Back Disorders (ICD -10 M40–M54) . This group encompasses various clinical conditions related to the spine, including structural changes, degenerative processes, and painful conditions.

formulation of an interpretative hypothesis—in this case, the possible existence of a normative gap in the legal framework for the manual handling of heavy loads—and subjecting it to critical analysis through comparison with theoretical frameworks, scientific evidence, and normative provisions.

From this perspective, the investigation takes on a predominantly analytical and interpretative character, typical of research developed in the field of applied social sciences and law, in which the understanding of the investigated phenomenon depends on the systematic analysis of doctrinal, scientific, and legal foundations. Unlike quantitative or experimental methodological approaches, which focus on measuring variables and statistically analyzing empirical data, this research seeks to examine the logical and normative consistency of certain legal frameworks in light of available scientific knowledge.

Thus, bibliographic and documentary research was adopted as a complementary methodological strategy, since it allows for the systematic examination of scientific literature and normative sources relevant to the topic. This methodological combination allows for the identification of convergences, tensions, and possible gaps between the knowledge produced in the field of ergonomics and the legal criteria used for the recognition of unhealthy working conditions in Brazilian labor law. The methodological choice proves to be consistent with the objectives of the study, insofar as it favors a critical analysis of the interface between science, ergonomics, and the legal regulation of labor.

2.1 Methodological procedure

The methodological procedure was developed in four main stages. In the first stage, the research problem was delimited, consisting of identifying a possible dissociation between the technical-scientific knowledge produced in the field of ergonomics — especially regarding the risks associated with the manual lifting and transport of loads — and the normative criteria currently used by Brazilian labor legislation to characterize unhealthy activities and operations.

In the second stage, the analytical hypothesis was formulated that the manual handling of heavy loads, although widely recognized in the scientific literature as a potential risk factor for occupational health, does not find explicit normative inclusion in the list of hazardous agents provided for in Regulatory Standard No. 15 (NR-15), which could indicate the existence of a possible normative vacuum in the legal protection system for worker health.

The third stage consisted of conducting a bibliographic and documentary survey aimed at critically examining the scientific, doctrinal, and legal foundations related to the investigated problem. The bibliographic research was conducted by consulting books, scientific articles, and specialized publications in the areas of ergonomics, occupational health, and labor law. To identify relevant productions, searches were carried out in academic databases widely used in scientific production, including open access databases related to the investigated areas (PubMed, SciELO, and Google Scholar). Combinations of the following keywords in Portuguese and English were used: "insalubridade" (unhealthiness), "monetização dos riscos laborais" (monetization of occupational risks), "levantamento manual de cargas" (manual lifting of loads), "ergonomia" (ergonomics), and "normas regulamentadoras" (regulatory standards). The selection of sources considered criteria of thematic relevance, scientific relevance, and analytical contribution to the debate about the relationship between occupational exposure, ergonomic risks, and the legal framework of working conditions.

In parallel, a documentary analysis of Brazilian labor legislation and regulatory standards related to occupational health and safety was carried out, with special attention to the normative content of Regulatory Standard No. 15 (NR-15), which establishes the criteria for characterizing unhealthy activities and operations, as well as the ergonomic provisions set forth in NR-17.

In the fourth stage, a critical and interpretative analysis of the selected material was carried out, seeking to identify convergences and divergences between the technical-scientific evidence produced by the specialized literature and the legal parameters currently used for the recognition of unhealthy working conditions in the Brazilian labor law system.

3. RESULTS/DISCUSSION

The 1988 Federal Constitution of Brazil (CF/88) establishes the legal basis for the system of health protection for working individuals. Article 1, sections III and IV, establishes the republican principles of human dignity and the social value attributed to work. These guidelines point towards a society committed to care in the workplace.

Further on, in Article 7, item XXII, the constituent legislator was explicit in highlighting, as a fundamental social right of all workers, the "reduction of risks inherent to work, through health, hygiene and safety standards". This is a programmatic provision that

signals to the sub-constitutional legislator the permanent need to improve the legal order in order to guarantee maximum safety in the workplace.

In addition to measures aimed at preventing occupational risks, the Brazilian Federal Constitution of 1988 also addresses the legal consequences that may arise from an unsafe work environment. Article 7, item XXIII, stipulates that if the employer fails to mitigate a particular harmful agent, the employee will be entitled, as the case may be, to receive additional payments for unhealthy, dangerous, or even arduous work. Furthermore, item XXVIII of the aforementioned Article 7 grants the employee injured at work access to compensation aligned with the employer's civil liability, should the employer act with intent or negligence.

Sub-constitutional legislation, in compliance with the aforementioned article 7, item XXII, of the Federal Constitution of 1988, provides numerous rules dedicated to reducing occupational risks in the workplace. Of particular note is Chapter V of Title II of Decree-Law No. 5,452, of May 1, 1943 (Consolidation of Labor Laws) (CLT), which, in articles 154 to 223-G, dictates the general rules for occupational safety and health.

Article 155, item I, and Article 200, caput, both of the CLT (Consolidation of Labor Laws), grant the Ministry of Labor and Employment (MTE) the responsibility of creating complementary regulations regarding occupational medicine and safety. Based on this legislative delegation, the MTE has, over the years, through Ordinance MTb No. 3,214, of June 8, 1978, issued the so-called Regulatory Standards (NRs). In short, they consist of a set of eminently technical and multidisciplinary regulations, whose objective is to specify, in detail, the various measures necessary to guarantee the health, hygiene, and safety of the worker.

In this context, it is important to emphasize that the problem of regular manual handling of loads is specifically addressed by NR No. 17, which deals with the issue of ergonomics in the workplace. Item 17.5 - "Lifting, carrying and unloading of loads individually" - reveals that the weight of the load being transported acts as a harmful agent in the work environment, an ergonomic risk likely to cause occupational diseases.

Similar to what occurs with other harmful agents that result in the receipt of an additional payment for unhealthy working conditions, the employer, in order to neutralize risks, must adopt preventive measures in non-occasional manual handling of loads. This is stipulated in item 17.5.4 of NR No. 17:

> 17.5.4 In the non-occasional manual handling and transport of loads, one or more of the following preventive measures must be adopted:
> a) implement facilitating technical means;
> b) Adjust the weight and size of the load (dimensions and shape) so that they do not cause an increase in physical effort that could compromise the safety and health of the worker;
> c) limit the duration, frequency and number of movements to be performed by workers;

> d) reduce the distances to be traveled with loads, when applicable; and
> e) Alternate with other activities or sufficient breaks, between periods not exceeding two hours.

These technical precepts highlight the characterization of the weight of the transported load as a notorious harmful agent. That is, a permanent risk factor in the workplace that demands, in addition to the aforementioned preventive measures, the necessary financial compensation for the employee subjected to this circumstance detrimental to health.

According to Delgado (2024, p. 882), additional payments consist of "supplementary compensatory payments due to the employee as a result of performing work under specifically more onerous circumstances". In the labor law context, the Consolidation of Labor Laws (CLT) establishes the normative parameters that guide the characterization of unhealthy activities. Article 189 states that activities or operations that, "by their nature, conditions, or methods of work, expose employees to agents harmful to health, above the tolerance limits established based on the nature and intensity of the agent and the time of exposure to its effects", will be considered unhealthy. Complementarily, Article 190 assigns to the Ministry of Labor the competence to "approve the list of unhealthy activities and operations and adopt rules on the criteria for characterizing unhealthiness, the tolerance limits for aggressive agents, means of protection, and the maximum time of employee exposure to these agents".

These provisions, considered together, outline the normative framework that underpins the recognition and regulation of unhealthy working conditions in the Brazilian legal system, establishing both the technical prerequisites for harmfulness and the administrative competence for its technical definition.

The weight supported by the regular transport of loads translates into a harmful and unhealthy agent in the workplace, with the potential to cause occupational diseases or injuries. One of the causes related to these diseases is ergonomic factors, such as task invariability, the temporal organization of the activity, static load, force, repetitiveness, the size of the workstation, the duration of the load, and organizational, cognitive, and psychosocial demands (Ministry of Social Security, 2003). However, it is important to emphasize that Regulatory Standard No. 15, when regulating activities and operations considered unhealthy, does not classify the harmful agent in question as part of its classifiable categories of unhealthiness.

Preventive measures outlined in item 17.5.4 are not always sufficient to mitigate potential harm to the worker's physical integrity; therefore, given this serious circumstance, the need for additional compensation corresponding to the payment of the hazard pay becomes evident.

From this perspective, in order to receive this benefit, it is necessary for the Ministry of Labor to recognize the harmful agent related to the weight supported by the regular manual transport of loads as unhealthy. This is what the jurisprudence of the Superior Labor Court establishes, as embodied in item I of Precedent No. 448, which states that, in addition to the finding of unhealthiness in an expert report, it is necessary "the classification of the unhealthy activity in the official list prepared by the Ministry of Labor".

It is important to emphasize that additional compensation cannot take precedence over protecting the worker's health. It is clear that the adoption of preventive measures should be prioritized, as it offers more effective results and contributes to guaranteeing fundamental rights such as the preservation of health, physical integrity, and human dignity.

This critique of the legislation does not represent a defense of the monetization of risks or a renunciation of preventive measures. It is indisputable that priority should be given to implementing actions aimed at reducing the risk of harm to workers' health in the face of the apparent economic advantage arising from the perception of the hazard pay (Stürmer & Salles Tellechea, 2024). The argument related to classifying weight lifting as a hazardous activity is based on the search for greater coherence and alignment in current legislation. The recognition of risks and the incorporation of preventive measures more explicitly into legislation can strengthen worker protection and contribute to mitigating the monetization of occupational risks—a mechanism that, although provided for by law, does not ensure full coverage for all harmful agents present in workplace exposures.

Current regulations present gaps that place workers in a kind of "legal limbo," preventing the full recognition of their rights. An emblematic example is the insufficient regulation of hazard pay for motorcyclists. This is a category continuously exposed to occupational risks, but whose regulatory protection remains incomplete or inadequately defined (Pereira, 2022). Another example refers to the outdated nature of NR-15 regarding the recognition and classification of chemical agents (Formigoni, 2015; Fleck, 2017) , especially when compared to internationally consolidated benchmarks, such as those periodically revised by the American Governmental Conference of Industrial Hygienists (ACGIH). While the ACGIH maintains an updated repertoire of approximately 740 categorized chemical agents, NR-15 only includes 147 agents with established tolerance limits, highlighting a significant regulatory gap (Barbosa, 2023).

The omissions identified between the Regulatory Standards and the Consolidation of Labor Laws highlight the need for critical reflections and technically qualified debates to guide their continuous improvement, since these instruments constitute a constantly evolving social

construct, and not an immutable normative system (Andrade, 2024). From this perspective, it becomes essential to develop studies that thoroughly analyze the effects arising from the application of the Regulatory Standards, in order to broaden the understanding of the challenges inherent in their effective implementation. Such investigations can contribute to identifying weaknesses, guiding regulatory adjustments, and supporting public policies more suited to protecting worker health and safety (Clock & Batiz, 2016).

Italian regulations can serve as an example for updating Brazilian legislation, as there is a predominance of a preventative policy, with greater control, specificity, and... with constant updates (Ferraz & Villatore, 2018). The inadequacy of updating the parameters of Brazilian legislation becomes evident when compared to the regulations in force in Portugal and Spain, for example (Peixe et al., 2009).

This difference becomes particularly evident when analyzing the legally established limits for manual lifting of loads. In Brazil, the Consolidation of Labor Laws (CLT) sets maximum limits of 60 kg for men and 25 kg for women. In Portugal, a load exceeding 30 kg in occasional operations and exceeding 20 kg in frequent operations is considered excessive (Portugal, 1993). In Spain, the reference value is 25 kg under ideal conditions, according to the *Guía Técnica para la Evaluation and Prevention of them Risks related to the Manual Load Handling* (Instituto Nacional de Seguridad y Salud en (el Trabajo, 2024). In several European countries, these parameters are guided by the guidelines of the *European Agency for Safety and Health at Work* (2019), which favor more restrictive limits, aligned with contemporary ergonomic and biomedical evidence.

The discrepancy between the limits adopted in Brazil and those in force in some European countries highlights the absence, in the Brazilian labor law system, of an updated and effectively protective regulatory framework. This regulatory gap reduces the capacity of the legal system to prevent harm to health and to ensure adequate working conditions for individuals exposed to manual lifting of loads.

The exposure limits established by the *American Conference of The American Conference of Governmental Industrial Hygienists* (ACGIH) could provide a relevant reference for updating national parameters applicable to workers. The ACGIH has systematically and continuously monitored the advancement of the best scientific evidence related to occupational health, periodically updating its exposure limit values based on high-quality toxicological, epidemiological, and hygienist studies (American Conference) . of Governmental Industrial Hygienists , 2024).

4. CONCLUSIONS

This critical essay analyzed the normative, doctrinal, and technical-scientific foundations that comprise the debate regarding the recognition of lifting, carrying, and unloading loads individually as hazardous activities. The results of the analysis show that, although Brazilian labor law was conceived under a protective logic, it remains insufficient and internally inconsistent with regard to protection against ergonomic risks with proven harmfulness. This insufficiency stems from normative gaps that compromise the protection of the biomechanical integrity of workers, especially those subjected to strenuous tasks that demand high physical effort, without such conditions receiving due legal recognition.

Various scientific evidence from the fields of ergonomics, occupational health, and occupational medicine indicates that handling loads, repetitive strain, and biomechanical overload constitute significant risk factors for the development of musculoskeletal disorders, such as back pain, work absences, and functional disabilities. The disconnect between this body of evidence and the current regulatory framework—which does not classify such risks as hazardous agents—reveals a mismatch that violates the constitutional principles of prevention, human dignity, and the reduction of risks inherent to work.

Thus, it is observed that the lack of regulation weakens not only the legal protection of occupational health, but also the internal coherence of the social protection system. This scenario demands the formulation of legislative and interpretative solutions capable of promoting greater alignment with scientific evidence and international guidelines for worker protection. From this perspective, it becomes essential that the Ministry of Labor and Employment use the regulatory delegation provided for in the Consolidation of Labor Laws to include, in Regulatory Standard No. 15, the ergonomic risks related to the handling of loads.

The criticism presented should not be confused with advocating for the monetization of occupational risks. Nor does it intend to replace preventive measures—considered fundamental by scientific literature and labor law—with the simple granting of an additional payment for unhealthy working conditions. Preventive measures remain the central axis of occupational health protection, in observance of the principles of precaution, prevention, and human dignity. Mere economic compensation cannot be interpreted as a legitimate substitute for effective protection, under penalty of perpetuating conditions harmful to the worker and creating a false perception of benefit.

The analysis developed emphasizes the need for normative coherence and scientific rationality. The objective is not to transform the hazard pay into a mechanism of institutional

tolerance for risk, but to ensure that the legislation reflects the current state of technical and legal knowledge, promoting the effectiveness of labor protection.

Another relevant point concerns the need to expand studies on the implementation and effects of Regulatory Standards. Systematic and rigorous research is essential to identify barriers to the application of standards, reveal protective gaps, and guide the improvement of the regulatory framework. These studies can also support more consistent public policies and strengthen state action in addressing occupational risks.

Regulatory analysis stands out as a strategic dimension of the work of ergonomists and healthcare professionals. By integrating technical aspects with legal and regulatory interpretation, these professionals contribute to identifying regulatory shortcomings and improving the guarantees provided for in labor legislation. This work strengthens the constitutional commitment to human dignity, prevention, and reduction of occupational risks.

Furthermore, critical studies of this type provide relevant input to the Permanent Tripartite Commission (CTPP) for the review process of Regulatory Standards. The articulation between technical-scientific evidence and qualified legal analysis assists in formulating parameters that are more consistent with labor reality and in the continuous updating of standards, as required by the principle of prevention.

Within the scope of this study, it was demonstrated that the main legal obstacle to extending the hazard pay supplement to ergonomic risks lies in the restrictive nature of NR-15 (Brazilian Regulatory Standard 15), which only covers physical, chemical, and biological agents, completely excluding biomechanical overload factors. This delimitation, typical of a traditional conception of hazardous work, does not keep pace with the advancement of scientific knowledge, which identifies ergonomic risks as a relevant cause of illness and socioeconomic impact. This mismatch between science and regulation compromises the effectiveness of labor protection by:

- to limit the scope of oversight, due to the strictness of the regulations;
- to restrict judicial interpretation, which remains tied to the literal meaning of the rule;
- To distance the Brazilian legal system from international guidelines, such as ILO Conventions No. 155 and 187;
- To undermine the constitutional principle of reducing the risks inherent in work.

Therefore, it is argued that revising NR-15 is necessary to harmonize the regulatory framework with scientific evidence, strengthen prevention, and overcome the protective deficit currently imposed on workers exposed to cargo handling.

The proposed reflection identifies and describes the existing regulatory vacuum, while offering legal, scientific, and hermeneutical foundations for overcoming it. The revision of NR-15, aligned with contemporary technical knowledge and constitutional commitments, is an indispensable measure to promote safe, healthy work environments compatible with international standards of decent work.

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ACKNOWLEDGMENTS

Not applicable.

FINANCING

Not applicable.

CONFLICT OF INTEREST

There are no conflicts of interest.

Received: May 2, 2025

Revised: November 17, 2025

Approved: April 14, 2026

Executive Editor: Italo Rodeghiero Neto