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Review Article

Applications of ergonomics in the inclusion of people with disabilities in the workplace: scoping review protocol

Aplicações da ergonomia na inclusão de pessoas com deficiência no trabalho: protocolo de revisão de escopo

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Abstract

Introduction: The inclusion of people with disabilities in the workforce is a global concern, and despite advances in the understanding of disability and the rights of this population, exclusion and low employability still prevail. The inclusion of this population in the workforce requires considering environmental factors in the interaction with the diversity of functionality experiences and human needs. Ergonomics help transform the workplace and ensure accommodations for the well-being of workers, safety, and productivity, promoting greater inclusion. **Objective:** This article presents the scope review protocol to map evidence on the adoption of ergonomics for the inclusion of people with disabilities in the workforce, answering the question, "How does the literature highlight the results of ergonomics in the inclusion of people with disabilities in the workforce?" **Method:** The review protocol followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) adapted for Scoping Reviews. Search strategies were developed with the support of a specialized librarian for databases such as PubMed, Scopus, Web of Science, and Embase. The Rayyan® software will be used for screening titles and abstracts, and Mendeley® for full-text analysis. **Inclusion and exclusion criteria:** The following were included: a) peer-reviewed articles; b) qualitative, quantitative, or mixed studies; c) articles available in full text; d) studies on applied ergonomics and inclusion of people with

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disabilities, including psychosocial disabilities. Literature reviews, letters, expert opinions, and editorials were excluded.

Keywords: Ergonomics; Diversity, Equity, Inclusion; Work.

Resumo

Introdução: A inclusão de pessoas com deficiência no trabalho é uma preocupação global e, apesar de avanços no entendimento da deficiência e nos direitos dessa população, ainda se verifica um cenário de exclusão e baixa empregabilidade. A inclusão dessa população no trabalho requer considerar os fatores ambientais na interação com a diversidade de experiências de funcionalidade e necessidades humanas. A ergonomia contribui para transformar o trabalho e assegurar as acomodações para o bem-estar dos trabalhadores, a segurança e a produtividade, promovendo maior inclusão. **Objetivo:** Este artigo apresenta o protocolo de revisão de escopo para mapear evidências sobre a adoção da ergonomia para a inclusão de pessoas com deficiência no trabalho, respondendo à questão "como a literatura aponta os resultados da ergonomia na inclusão das pessoas com deficiência no trabalho?". **Método:** O protocolo de revisão seguiu os itens de Relato Preferenciais para Revisões Sistemáticas e Meta-Análises adaptadas para Revisões de Escopo. Foram elaboradas estratégias de busca com apoio de uma bibliotecária especializada para bases como *PubMed*, *Scopus*, *Web of Science* e *Embase*. O *software Rayyan*® será usado para a triagem de títulos e resumos; e o *Mendeley*®, para análise dos textos completos. **Critérios de inclusão e exclusão:** Incluíram-se: a) artigos revisados por pares; b) estudos qualitativos, quantitativos ou mistos; c) artigos disponíveis em texto completo; d) estudos sobre a ergonomia aplicada e inclusão de pessoas com deficiência, considerando deficiências psicossociais. Excluíram-se revisões de literatura, cartas, opiniões de especialistas e editoriais.

Palavras-chave: Ergonomia; Diversidade, Equidade, Inclusão; Trabalho.

Introduction

People with disabilities (PwD) are recognized as subjects of rights and can find meaning, belonging, and a sense of dignity through work (Blattner, 2021), which plays a central role in adult life and in the social and economic development of the population (Vujica Herzog & Harih, 2020; Silva & Oliver, 2022). However, the inclusion of PwD in the labor market is a global concern due to the experiences of exclusion, unemployment, vulnerability, and poverty still faced by this population in all regions of the world (United Nations, 2019).

Despite several advances, including the establishment of Article 27 of the International Convention on the Rights of Persons with Disabilities (CRPD), which reaffirms the right of PwD to work on an equal basis with others (Brasil, 2009), and the need to prioritize this group, these individuals continue to face substantial barriers to participating in work and employment (United Nations Development Programme, 2015; Ananian et al., 2024), as recognized, for example, in the United Nations' Sustainable Development Agenda. Evidence from different countries shows that anti-

discrimination policies and workforce development strategies have been insufficient in changing the situation regarding PwD participation (Saleh & Bruyère, 2018).

The employment rate among PwD remains disproportionately low compared to the non-disabled population. Globally, it is estimated that around 1.3 billion people have some form of disability, about 15% of the world's population. Of these, 80% are of working age, but only 36% are employed, while the employment rate for the non-disabled population is 60% (United Nations, 2019). In Brazil, this population comprises 18.6 million people, approximately 9% of the population over the age of two. The situation regarding labor market participation in the country reflects the global context. Data from 2022 shows that 29.2% of PwD were employed, while the employment rate for the non-disabled population was 66.4% (Instituto Brasileiro de Geografia e Estatística, 2023). Furthermore, there is lower participation of this population in the formal labor market (Dutra et al., 2020), lower wages, and greater barriers faced by women with disabilities and by PwD with more severe impairments (Ananian et al., 2024).

Contemporary understandings of disability recognize it as a universal, interactive, and context-dependent human experience, meaning it is not solely determined by health conditions or body structures and functions (Cieza et al., 2018; Organização Mundial da Saúde, 2008; Farias & Buchalla, 2005; Fernandes et al., 2023). From this perspective, the CRPD (Brasil, 2009) defines PwD as those with physical, intellectual, or sensory impairments, which, when interacting with various barriers, may prevent full and effective participation in society with others.

Thus, disability is not inherent to the individual but encompasses environmental factors, including the physical surrounds and its characteristics, other people in various relationships and roles, attitudes and values, services and social systems, policies, rules, and laws (Buchalla, 2003; Farias & Buchalla, 2005). The inclusion of this population in various life contexts requires considering whether each context is suitable to respond to the diversity of functionality and human needs.

In this perspective, ergonomics, a discipline focused on understanding how humans interact with various components of a system by applying theories, principles, data, and methods to create solutions that enhance both people's well-being and the system's efficiency as a whole, plays a crucial role in adapting the work environment to the individual (International Ergonomics Association, 2024), facilitating greater inclusion and retention of PwD in the workforce.

Workplace accommodations are essential to ensure that PwD can perform their duties effectively and safely. Ergonomic interventions, which involve designing and changing workstations, tools, and processes to match the worker's capabilities, are key to reducing barriers in the workplace for these individuals. These adaptations not only increase productivity but also promote the overall well-being of workers.

The guarantee of reasonable accommodations at work by employers is established both in Article 37 of the CRPD (Brasil, 2009) and in Article 27 of the Brazilian Law on the Inclusion of Persons with Disabilities (Brasil, 2015), and aims to promote participation and retention in the workforce, as well as greater awareness of disability in this context. However, workers with disabilities still face challenges in disclosing their disability and requesting workplace accommodations. Young workers with disabilities are unsure about when to show their needs and the process to do so, as well as fearing

stigma and discrimination, noticing a lack of employer support, and their employer's lack of knowledge about disability and accommodations (Lindsay et al., 2019).

Decision support systems have been developed to assist in understanding the worker with a disability and their support needs related to more suitable activities and work environments for their capabilities (Vujica Herzog & Harih, 2020). The employer's commitment to providing accommodations at work — which can include flexible hours, workplace modifications, breaks, professional support, equipment, accessible practices, and other strategies based on the needs of PwD — is positively associated with job retention (Jansen et al., 2021; Kersten et al., 2023), or faster return to work after absence, and negatively associated with long-term disabilities (Jansen et al., 2021).

Literature reviews have addressed the inclusion of PwD with analyses that highlight the persistent challenges and barriers to accessing and keeping employment. These barriers are numerous and multifaceted, encompassing physical, attitudinal, and systemic factors that hinder the full participation of this population in the workforce (Jansen et al., 2021; Kersten et al., 2023; Paz-Maldonado & Silva-Peña, 2020). However, no synthesis studies have been identified that bring together the contributions or limitations of ergonomics in including this population in the workforce. Therefore, a review was designed to map this topic and answer the following question: how does literature address the results of ergonomics in the inclusion of people with disabilities in the workforce?

This article aims to detail the protocol of the review, with the purpose of clarifying the procedures and criteria that will guide the literature mapping and subsequent analyses.

Method

The scoping review was chosen as the most proper method for this research due to its ability to map and synthesize the set of available evidence on a topic, providing a comprehensive and detailed view of the field (Colquhoun et al., 2014). This method is especially useful for identifying gaps in knowledge and exploring key concepts, as envisioned in the objective of this study (Arksey & O'Malley, 2005). Furthermore, the scoping review offers the necessary flexibility to examine how research has been conducted, contributing both to a better understanding of the current panorama of scientific production and to the development of future systematic reviews.

The planning of this review uses the Preferred Reporting Items for Systematic Reviews and Meta-Analyses adapted for Scoping Reviews (PRISMA-ScR) which converge with the guidelines of the Joanna Brigs Institute (JBI) manual for evidence synthesis (Tricco et al., 2018, Aromataris, et al., 2024).

Review question

The review question was constructed using the acronym "Population, Concept, Context" which was configured as follows: how does the literature show the results of ergonomics in the inclusion of people with disabilities at work?

Secondary research questions were designed to deepen knowledge about specific aspects related to the research topic: (1) What approaches and methods are reported in

relation to ergonomics, and what are the gaps? (2) What are the target populations of the study in relation to the type of disability? (3) How are other social determinants (gender, race/color, ethnicity, etc.) addressed in studies? (4) Which countries (high-income or low-income) are included in the studies? (5) Which work sectors (industry, services, agriculture) and types of employment (formal, informal) are reported?

Eligibility criteria

To select the studies included in this article, the following inclusion criteria will be adopted: a) articles published in peer-reviewed journals resulting from research with primary data sources; b) studies that use qualitative, quantitative or mixed designs; c) articles available in full text, whether open access or retrieved through access to the institutions where the participating researchers are affiliated, without temporal restrictions. Literature reviews, letters, expert opinions and editorials will not be included.

Population

Research that has PwD as participants, regardless of age or gender, will be included in this study. The definition of disability adopted will be that of the CRPD, which covers individuals with long-term impairments of a physical, intellectual, sensory and psychosocial nature, as in the case of people with Autism Spectrum Disorder or severe mental disorders.

Concept

Considering that ergonomics encompasses physical, environmental, cognitive, organizational, and socio-technical factors in the assessment and design of work situations, with the aim of adapting them to both the limits of the human body and production demands, studies that explore the application of ergonomic principles for the inclusion of PwD at work. These studies can address architectural adaptations, furniture, tools and work processes, in addition to the design and evaluation of tasks, products, environments and systems.

Context

The context addressed in this study refers to work, considering both formal and informal work, in sectors such as industry, commerce and services. In addition, this review will also encompass income generation strategies, such as self-employment and community initiatives, including cooperatives and solidarity economy enterprises. Studies involving voluntary, unpaid work or any work situation that does not promote the autonomy of PWD will not be considered.

Sources of information

The search strategy will involve conducting a systematic search for peer-reviewed literature descriptors in the electronic databases *PubMed, Scopus, Web of Science,* and

Embase. The choice and selection of databases to be explored came from the need to expand systematic scanning. The choice of the *PubMed and Embase* databases was due to their international scope in health literature, while *Scopus* and *Web of Science* offer a broader and multidisciplinary approach, managing to reach the Americas, Europe, and a part of Asia.

Search strategy

Specific search strategies were developed for each of the databases explored in this research, with the help of an information system professional, as detailed in Table 1. Furthermore, when reviewing the references of the included articles, an approach will be used. *"bottom-up"* to find documents relevant to this scoping review that may not have been captured by database searches. Table 1 presents the specific search strategies applied in each database for this review.

Table 1. Search strategies and databases to be used in the scoping review.

Database	Search strategy
PubMed	((“ergonomical”[All Fields] OR “ergonomically”[All Fields] OR “ergonomics”[MeSH Terms] OR “ergonomics”[All Fields] OR “ergonomic”[All Fields] OR (“ergonomical”[All Fields] OR “ergonomically”[All Fields] OR “ergonomics”[MeSH Terms] OR “ergonomics”[All Fields] OR “ergonomic”[All Fields]) OR “Human Engineering”[All Fields] OR “Human Factors Engineering”[All Fields] OR (“ergonomics”[MeSH Terms] OR “ergonomics”[All Fields] OR (“human’[All Fields] AND “factors”[All Fields] AND “engineerings”[All Fields])) OR “Man-Machine Systems”[All Fields] OR (“Man-Machine Systems”[MeSH Terms] OR (“man machine”[All Fields] AND “systems”[All Fields]) OR “Man-Machine Systems”[All Fields] OR(“systems”[All Fields] AND “man”[All Fields] AND “machine”[All Fields]))) AND (“diversity equity inclusion”[All Fields] OR (“diverse”[All Fields] OR “diversely”[All Fields] OR “diversities”[All Fields] OR “diversity”[All Fields]) OR (“equities”[All Fields] OR “equity”[All Fields]) OR (“inclusion bodies”[MeSH Terms] OR (“inclusion”[All Fields] AND “bodies”[All Fields]) OR “inclusion bodies”[All Fields] OR “inclusions”[All Fields] OR “inclusion”[All Fields] OR “inclusive”[All Fields] OR “inclusively”[All Fields] OR “inclusiveness”[All Fields] OR “inclusivity”[All Fields]) OR (“access”[All Fields] OR “accessed”[All Fields] OR “accesses”[All Fields] OR “accessibilities”[All Fields] OR “accessibility”[All Fields] OR “accessible”[All Fields] OR “accessing”[All Fields])) AND (“employee s”[All Fields] OR “occupational groups”[MeSH Terms] OR (“occupational”[All Fields] AND “groups”[All Fields]) OR “occupational groups”[All Fields] OR “employee”[All Fields] OR “employees”[All Fields] OR (“employees”[All Fields] OR “occupational groups”[MeSH Terms] OR (“occupational”[All Fields] AND “groups”[All Fields]) OR “occupational groups”[All Fields] OR “employee”[All Fields] OR “employees”[All Fields]) OR (“occupational groups”[MeSH Terms] OR (“occupational”[All Fields] AND “groups”[All Fields]) OR “occupational groups”[All Fields] OR “worker”[All Fields] OR “worker s"[All Fields] OR "worker s"[All Fields]) OR ("occupational groups"[MeSH Terms] OR (“occupational”[All Fields] AND “groups”[All Fields]) OR “occupational groups”[All Fields] OR “worker”[All Fields] OR “workers”[All Fields] OR “worker s”[All Fields]) OR “Job”[All Fields] OR (“work”[MeSH Terms] OR “work”[All Fields]))) AND (adaptiveclinicaltrial[Filter] OR autobiography[Filter] OR biography[Filter] OR casereports[Filter] OR classicalarticle[Filter] OR clinicalstudy[Filter] OR clinicaltrial[Filter] OR clinicaltrialprotocol[Filter] OR clinicaltrialphasei[Filter] OR clinicaltrialphaseii[Filter] OR clinicaltrialphaseiii[Filter] OR clinicaltrialphaseiv[Filter] OR collectedwork[Filter] OR comparativestudy[Filter] OR controlledclinicaltrial[Filter] OR correctedandrepublishedarticle[Filter] OR equivalencetrial[Filter] OR evaluationstudy[Filter] OR guideline[Filter] OR legislation[Filter] OR multicenterstudy[Filter] OR observationalstudy[Filter] OR practiceguideline[Filter] OR pragmaticclinicaltrial[Filter] OR preprint[Filter] OR randomizedcontrolledtrial[Filter] OR technicalreport[Filter] OR twinstudy[Filter] OR validationstudy[Filter])
Scopus	(TITLE-ABS-KEY (ergonomics OR ergonomic OR “human engineering” OR “human factors engineering” OR “human factors engineerings” OR "man-machine systems" OR “systems man-machine”) AND TITLE-ABS-KEY (“diversity, equity, inclusion” OR diversity OR equity OR inclusion OR accessibility) AND TITLE-ABS-KEY (employee OR employees OR worker OR workers OR job OR work)) AND (LIMIT-TO (DOCTYPE , “ar”))
Web of Science	Ergonomics OR Ergonomic OR “Human Engineering” OR “Human Factors Engineering” OR “Human Factors Engineerings” OR “Man-Machine Systems” OR “Systems Man-Machine” (All Fields) and “Diversity, Equity, Inclusion” OR Diversity OR Equity OR Inclusion OR Accessibility (All Fields) and Employee OR Employees OR Worker OR Workers OR Job OR Work (All Fields) and Article or Early Access (Document Types)
Embase	(ergonomics OR ergonomic OR ‘human engineering’ OR ‘human factors engineering’ OR ‘human factors engineerings’ OR ‘man-machine systems’ OR ‘systems man-machine’) AND (‘diversity, equity, inclusion’ OR diversity OR equity OR inclusion OR accessibility) AND (employee OR employees OR worker OR workers OR job OR work) AND (‘article’/it OR ‘article in press’/it OR ‘preprint’/it)

Mechanism(s) used to manage records and data throughout the review

During the titles and abstracts screening phase, we will use the *Rayyan*® application, which will automatically exclude duplicate texts, in addition to eliminating files with similarities above 95%. For analysis of full texts and subsequent data extraction, the *Mendeley*® reference manager will be used. These tools will be used to ensure efficient records management and facilitate data organization, reducing review time. Each step will be conducted to ensure the integrity and quality of the data, with reconciliation measures implemented to resolve discrepancies between reviewers who will work "blindly" and anonymously.

Process that will be used to select studies at each stage of the review

To select studies, two authors will independently review the titles and abstracts of the articles, deciding which studies should be evaluated in full. All potentially relevant articles will be obtained and reviewed in full. Any disagreement between reviewers will be resolved with the help of a third reviewer. The study selection process will be presented later using the PRISMA flowchart. During each round of title and abstract screening, the Rayyan app will be kept in blinded mode to ensure that the screening is carried out independently. Inter-rater agreement will not be statistically tested.

Planning the data extraction process

Data extraction and management will be conducted by two authors using an Excel-based extraction form to identify and analyze the following information:

- Bibliometric information (author, year of publication, magazine, affiliation of authors).
- Ergonomic interventions aimed at improving inclusion in the workplace for PwD.
- Results related to the inclusion of PwD in the workplace, considering different groups, functions and contexts.
- Contextual variables: work situations, countries of intervention (high, medium or low income) and types of disability.
- Study designs.
- Social determinants: how gender, race and other factors are addressed in studies.
- Geographic coverage.
- Job sectors and types of employment (e.g. industries, service sectors, formal vs. informal employment).

Data extraction steps

To prepare for data extraction, it is essential to adopt a structured process that guarantees consistency and accuracy in information collection. The following steps are designed to ensure that data extraction is carried out meticulously and systematically, ranging from training researchers to verifying the reliability of the extracted data.

Training stage

Process: Prior to extraction, all three researchers will participate in training sessions to ensure consistency and understanding of the data extraction protocol.

Responsible: Training sessions will be led by senior researchers or methodologists.

Reliability check step

Process: After training, a reliability check will be carried out, where a subset of articles will be independently extracted by all three researchers.

Responsible: The extraction will be done by the researchers to establish reliability between them.

Final data extraction step

Process: After reliability check, data extraction for the entire dataset will be performed following the agreed protocol.

Responsible: The extraction will be conducted by the three researchers using the Excel-based form.

Strategy for data synthesis

To answer the research questions, a detailed synthesis will be applied based on the principles of thematic analysis proposed by (Thomas & Harden, 2008). Initially, line-by-line coding will be carried out, where each line of the primary texts will be systematically coded to capture its meaning and content. Next, the development of descriptive themes will be conducted, organizing the initial codes into themes that will emerge from the inductive analysis of the data. In the analytical theme generation stage, study findings will be integrated, and additional interpretations will be formulated, going beyond the specific content of the studies. Finally, in the final refinement and synthesis, the analytical themes will be adjusted until they comprehensively cover all the initial descriptive themes. If parts of the plan cannot be executed as anticipated, an iterative approach will be taken to review and adjust the coding and synthesis methods, ensuring the coherence and integrity of the results.

Final Considerations

The scoping review presented aims to guide the mapping of evidence on ergonomics interventions in the inclusion of PwD at work. This protocol is expected to provide a basis to guide a robust scoping review that makes available data on practices and research that support the inclusion of this group in the work.

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Authors' Contributions

Carolina Maria do Carmo Alonso and Talita Naiara Rossi da Silva coordinated the team of researchers and carried out the final review of the article. Barbara Iansã de Lima Barroso, Lilian de Fatima Zanoni Nogueira, Priscila Blasquez da Costa Leite and Maria Luísa Corrêa Muniz participated in the design of this protocol and contributed to the writing of the manuscript. All authors approved the final version of the text.

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