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# Ergonomics, musculoskeletal disorders, treatment and return to work: a conceptual framework for intervention programs

Ergonomía, Trastornos Musculoesqueléticos, Tratamiento y Retorno al Trabajo – Marco Conceptual para programas de intervención

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## Abstract

Musculoskeletal disorders are one of the most recurrent diseases among manual workers worldwide. The objective of this study was to analyze primary results of a systematic review on ergonomics, musculoskeletal disorders, treatment, and return to work in blue-collar workers to form a new conceptual framework applicable to intervention programs in this area. This study was based on the available scientific evidence we identified. Descriptive data and their trending topics areas were used to form the conceptual framework. The trend shows that working conditions can be represented as a three-axis scheme with a multidimensional conceptual framework considering ergonomic risks, the treatment of affected workers and the determinants related to working conditions. These results may help future research in the field of ergonomics as well as emerging topics focused on intervention programs.

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**Keywords:** Ergonomics; Literature Review; MSD; Conceptual Framework.

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## Resumen

Los trastornos musculoesqueléticos son una de las enfermedades más recurrentes entre los trabajadores que realizan operaciones manuales a nivel mundial. El objetivo de este estudio fue analizar los resultados primarios de una revisión sistemática sobre ergonomía, trastornos musculoesqueléticos, tratamiento y retorno al trabajo en trabajadores operativos para formar un nuevo marco conceptual aplicable a los programas de intervención en esta área. Este estudio se basó en la evidencia científica disponible identificada. Se utilizaron datos descriptivos y sus áreas de temas de tendencia para formar el marco conceptual. La tendencia muestra que las condiciones de trabajo pueden representarse como un esquema de tres ejes con un marco conceptual multidimensional que considera los riesgos ergonómicos, el tratamiento de los trabajadores afectados y los determinantes relacionados con las condiciones de trabajo. Estos resultados podrían ayudar a futuras investigaciones en el campo de la ergonomía, así como a temas emergentes centrados en programas de intervención.

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**Palabras clave:** Ergonomía; Revisión de literatura; TME; Marco conceptual.

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# Introduction

Musculoskeletal disorders (MSD) are one of the most common health conditions in working populations<sup>(1)</sup> and one of the most recurrent diseases in manual workers worldwide<sup>(2)</sup> owing to their high correlation with sickness absence<sup>(3)</sup> and disability retirement<sup>(4)</sup>. This situation provides a high opportunity to conduct deep studies centered on Human Factors/Ergonomics (HFE)<sup>(5)</sup> and has motivated the study of working conditions with exposure to physical stress to become a focus of research in recent years.

Several studies such as those carried out by Hembecker<sup>(6)</sup> and Andersen<sup>(7)</sup> recognize the operational workers population (blue-collar workers) as the one with the highest risk of generating MSDs due to their work activities and associated sick leave.

Bibliometric researches, such as those carried out by Martínez-Aries<sup>(8)</sup>, determine the growth and importance of the term ergonomics in the last 15 years, even within administration and innovation. In this regard, Literary Review & Science Mapping studies have become a good way to domain scientific knowledge, reflected through an aggregated collection of intellectual contributions<sup>(9)</sup>.

A recently published systematic review by Hacay et al. on ergonomics, MSD, treatment and return to work focused on the methodological description of studies selected and preliminary results of the co-word network<sup>(10)</sup>. In this further analysis of the published literature, we aimed to form a new conceptual framework applicable to intervention programs for MSD.

# Methodology

The present study used primary information from the aforementioned systematic review<sup>(10)</sup>, considering the co-word network made by 185 selected papers to identify trending topics in the last 12 years (2010–2021) regarding ergonomic fields (ergonomics, MSD, treatment, rehabilitation, return to work) in manufacturing jobs focused on blue-collar manufacturing workers in manual activities considering all countries, ages, and research methodologies. Only open access published papers written in English were considered, retrieved from Scopus, Web of Science, and PubMed

Multidimensional schemas can be useful for representing large databases, as mentioned by Feyer<sup>(11)</sup>. This was developed in more detail by Huo<sup>(12)</sup>, who proposed using operational database queries to generate measures, dimensions and hierarchies in the same schema.

In this line, a database of the 237 terms identified in the articles selected from the review and the co-word network<sup>(10)</sup> was used to determine by consensus among the researchers (AHC, FB, MSA, and AGG), a multidimensional scheme based on the communities of the bibliometric network that identifies the three main areas of study on which the different investigations have focused, considering the cause, i.e. the effect of risk exposure and its determinants. Thus, one axis focuses on the

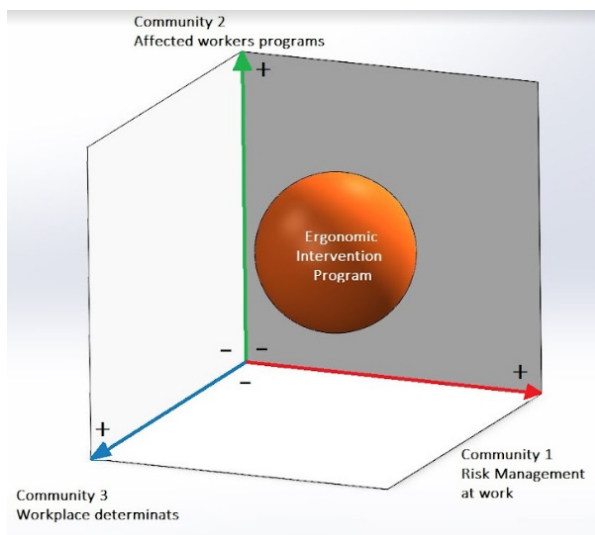
management of risk exposure, another on the management of the affected worker, and the third on the determinants of the job.

The conceptual model is based on the fact that the application of intervention programs must simultaneously consider the relationship between these three aspects within their scope outside the characteristics of the workplace.

## Results

The analysis of the identified studies on ergonomics, MSDs, treatment and return to work found shows a limited scope considering the lack of research that integrates everything from exposure to risk factors, to treatment and rehabilitation of affected workers.

Regarding all the trending topics analyzed in the systematic review, a broad and complex model was created in which the conceptual framework was not one-sided. The trend shows that working conditions can be represented as a three-axis scheme. Also, that intervention measures must be implemented according to the preventive management of ergonomic risks (Community 1, axis 1), treatment and returning to work management for affected workers (Community 2, axis 2), and work guidelines for physical and mental risk factors as determinants of exposure (Community 3, axis 3) (Figure 1).



**Figure 1:** Ergonomic Intervention Framework.

This framework shows a multidimensional analysis considering the different dimensions that these communities comprise, the relationship between the dimensions of each axle, which will determine the shape, size, and scope of the ergonomic intervention program. According to this, the ergonomic programs must consider intervention programs related to risks due to working conditions, treatment and

rehabilitation of affected workers, and the determinants that occur transversally from the work environment or lifestyle.

The size and form of the ergonomic intervention program (+/- axis level) will depend on the level of risk, effect, or condition that the job represents. Thus, a company with low levels of ergonomic risk, affected workers will determine a simple and low impact program, while a high exposure to ergonomic risk factors, several people exposed and affected, will determine a broader and more complex intervention program. Such framework focuses on the need of covering the full scope of the problem including risk prevention, treatment and return-to-work of affected workers.

## Discussion

Through the analysis of the studies selected in this long-standing research, we can see that this is a current, relevant, and growing topic.

This new analysis of collected scientific evidence mainly from high income countries and in recent years of intervention programs to improve ergonomic working conditions, treatment and return to work for blue-collar workers with MSD raises visibility of the elements that should include an ergonomic management program, and guide future lines of research<sup>(10)</sup>. According to the World Health Organization (WHO), the growing interest in research topics is present in the interaction of different branches of science, considering MSD as one of the main health issues worldwide<sup>(13)</sup>.

Most of the studies focused on exposure and its association with MSD in general in working populations (blue collar workers) considering one or more pain sites, mainly low back pain, cervical and dorsal, and upper extremities. These trends confirm the multifactorial etiology of ergonomic risks in the workplace making this area of research necessary, current and growing. The iteration of changes and ways of working, as well as modern technological tools, which could mark a gap among less industrialized countries in these areas to cover the needs before exposure to these risks.

Multimorbidity, including different sites involved in MSDs, such as hands, arms, back, hips, neck and shoulders; as well as the different factors that are shown in rehabilitation and return to work studies, indicate the multidimensional nature of this problem<sup>(14)</sup>. In addition, other mental, physical, and environmental factors have an influence on MSD, which entails complementing current ergonomic procedures with other factors in successful interventions.

Among the preventive measures of affected employees, the study of these working conditions focuses on management programs that promote both occupational health and intervention in the workplace, and including the physical and mental conditions with the worker as well<sup>(15)</sup>. Along this line, the conceptual framework would consider future applications of comprehensive intervention programs in the

prevention of MSDs at work considering multi-component parts, risk assessment, job intervention, exposed workers, and long-term jobs.

This schematic interpretation carried out in the different communities of the model, showed that the trend of application in ergonomic programs is not isolated but must start from a comprehensive analysis of the worker, the activity, and the working condition, stressing the need of multidisciplinary knowledge to ensure the well-being of exposed and affected workers.

On the other hand, some limitations are determined by the few previous studies that comprehensively outline this line of research as well as the lack of application studies of these models. Owing to these limitations, we consider this model an open door for future research that deepens the elements of each dimension and applies them to intervention schemes. This conceptual framework might help future research in the field of ergonomics as well as emerging topics focused on improvement management programs that could be implemented in the workplace.

In summary, the trend of research carried out in recent years suggests the need of new studies that can deepen the intervention measures within the scope of exposure to ergonomic risks, the treatment and rehabilitation of affected workers, and the different determinants that are related to the generation of MSD. Our research calls to the question if the role of ergonomists is sufficient for current job needs. Alternatively, this is an indicator that the general role of these professionals is to seek new opportunities for modernization through technology worldwide and better coordination with other involved disciplines.

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