Occupational Ergonomic Factors and Musculoskeletal Symptoms in Healthcare Personnel: A Study in Barranquilla (Colombia)

Factores ergonómicos laborales y sintomatología musculoesquelética en personal sanitario: un estudio en Barranquilla (Colombia)

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Abstract

The correlation between work exposure time, physical job demands, subjective perception of exertion, and the presence of musculoskeletal discomfort was analyzed as a strategy to generate evidence supporting preventive ergonomic interventions. A quantitative study was conducted, employing a descriptive, explanatory, and correlational research design. Data collection was carried out using a questionnaire on ergonomic risk factors and potential health effects, developed by the Trade Union Institute for Work, Environment and Health. The study sample consisted of 108 healthcare workers from the Keralty Group, engaged in the provision of medical services. A high prevalence of musculoskeletal discomfort was identified, particularly in the neck, lower and upper back, legs, and knees. These conditions were closely associated with improper working postures, manual handling of loads, and the high physical demands intrinsic to healthcare activities. A significant correlation was found between the duration of the workday and the perceived level of physical effort, suggesting that prolonged shifts without adequate rest periods increase bodily strain.

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Resumen

Se analizó la relación entre el tiempo de exposición laboral, la exigencia física del trabajo, la percepción subjetiva de exigencia y la presencia de molestias musculoesqueléticas, como una estrategia para generar evidencia que fundamente intervenciones ergonómicas preventivas. Se desarrolló una investigación con enfoque cuantitativo, basada en un diseño de tipo descriptivo, explicativo y correlacional. Para la recolección de información, se empleó como herramienta el cuestionario sobre factores de riesgo ergonómico y posibles afectaciones, elaborado por el Instituto Sindical de Trabajo, Ambiente y Salud de España. La muestra estuvo conformada por 108 trabajadores pertenecientes al Grupo Keralty dedicados a la prestación de servicios sanitarios. Se evidencia una alta prevalencia de molestias musculoesqueléticas, especialmente en las regiones del cuello, espalda lumbar y dorsal, piernas y rodillas. Estas afecciones se encuentran estrechamente relacionadas con posturas de trabajo inadecuadas, manipulación de cargas y la alta exigencia física inherente a las actividades asistenciales del sector salud. Se identificó una correlación significativa entre la duración de la jornada de trabajo y la percepción del nivel de esfuerzo físico requerido, lo cual sugiere que las jornadas prolongadas sin pausas adecuadas incrementan la carga corporal.

Palabras Clave: enfermedad laboral, ergonomía, personal sanitario, riesgo biomecánico, salud laboral.

Introduction

In healthcare work environments, the risks arising from exposure to physically demanding conditions are particularly high (Mansoor *et al.*, 2022; Sieh *et al.*, 2022). Healthcare personnel, especially those in direct care roles such as nursing, clinical assistants, and therapists, are exposed to a combination of factors that promote the development of musculoskeletal disorders (MSDs), including awkward body postures, repetitive actions, and the manual lifting or transfer of heavy objects, prolonged standing, and continuous physical exertion (Zong *et al.*, 2024, Cogollo *et al.*, 2019; da Costa & Vieira, 2010). These factors, compounded by deficient organizational conditions, generate a cumulative physical burden that deteriorates worker health, compromises performance, and increases the risk of absenteeism, staff turnover, and errors in clinical care (Portilla & Juna, 2024; Bernal *et al.*, 2015).

Ergonomics, as a scientific discipline, proposes a comprehensive intervention on working conditions, seeking the adaptation of the job to the physical conditions and cognitive capacities of the employee. In the hospital context, the application of ergonomic principles is particularly relevant, as it allows for the mitigation of physical risks, the prevention of injuries, and the promotion of the comprehensive well-being of human resources (Fikre *et al.*, 2024; Gualán & Reinoso, 2023; Kuorinka *et al.*, 1995). Despite its importance, ergonomics still lags behind in many healthcare institutions in Latin America, where a reactive and corrective culture prevails, rather than a preventi-

ve and proactive management of ergonomic risk (Vásquez *et al.*, 2025; Guzmán *et al.*, 2024; Cataño *et al.*, 2023; Quiñones *et al.*, 2022).

In Colombia, current regulations regarding Occupational Safety and Health—particularly Resolution 0312 of 2019 issued by the Ministry of Labor—define guidelines aimed at the identification, analysis, and control of biomechanical risk factors, highlighting ergonomics as an essential component within Occupational Safety and Health Management Systems (SG-SST). However, in many healthcare settings, working conditions that favor the development of musculoskeletal injuries still persist, which is particularly evident in institutions that lack control mechanisms such as active breaks, postural prevention programs, or the adaptation of clinical furniture (Ledesma *et al.*, 2018).

Several studies have demonstrated a statistically significant relationship between the duration of exposure to demanding physical activities and the onset of bodily discomfort, with a higher prevalence in anatomical areas such as the neck, lumbar region, and both upper and lower extremities (Torres, 2023; Andersen *et al.*, 2007). Furthermore, it has been verified that as the physical demands of the task increase—whether due to intensity, frequency, or duration—the risk of developing work-related musculoskeletal injuries proportionally rises (Gutiérrez *et al.*, 2025; Marin & Gonzalez, 2022; Ledesma *et al.*, 2018).

In the specific context of the present study, the importance of examining the ergonomic conditions of the human talent in the health area belonging to a private entity providing healthcare services in the city of Barranquilla, the Keralty group founded in Colombia in 1980 by a group of Spanish physicians, was recognized. This institution, like many others in the country, operates under care models that involve a high physical demand on personnel, without necessarily having implemented a systematic ergonomic approach in the management of occupational risks. Hence, the relevance of conducting a diagnosis that allows for the establishment of correlations between variables such as working hours, physical demands, perceived task demands, and bodily discomfort, from a scientific and applied perspective.

Based on the aforementioned, this research aimed to examine the relationship between the duration of exposure to work, the level of physical demand, the individual perception of effort, and the onset of musculoskeletal discomfort, in order to generate information that supports future preventive actions from an ergonomic standpoint. To this end, a quantitative methodological approach with a descriptive, explanatory, and correlational design was adopted, using the questionnaire of the Trade Union Institute for Work, Environment and Health (ISTAS), adapted to the Colombian context, as a tool.

Methodology

A quantitative approach with a descriptive, explanatory, and correlational methodological design was employed. For data collection, the questionnaire of the Trade Union Institute for Work, Environment and Health (ISTAS-CCOO, 2014) was utilized. This instrument is designed to identify ergonomic effects arising from the execution of physical tasks during the workday and addresses various dimensions, including sociodemographic and occupational data, the presence of discomfort or pain, postures adopted during work, the duration of time spent in these postures, the length of activities, manual handling of loads, and the perceived level of demand. Each item is formulated for the worker to evaluate their exposure to risk based on their daily experience.

The sample consisted of 108 healthcare workers belonging to the Keralty Group who expressed their willingness to participate voluntarily in the research, which was conducted during the first quarter of 2025. This private organization, located in the district of Barranquilla (Colombia), is dedicated to the provision of healthcare services. The composition of the sample—comprising 97 women and 11 men, for a total of 108 participants—faithfully reflects the gender distribution of personnel in the institution under study, which is characterized by a high degree of feminization in

the evaluated functional positions. This situation is due to structural factors in the labor context, where women have historically occupied the majority of positions in the analyzed care and operational areas.

Healthcare workers with more than six months of seniority in their positions were included in the study, thus ensuring their familiarity with working conditions. Conversely, employees with active medical restrictions, those performing administrative functions, personnel on probation, as well as collaborators who did not freely and informedly consent to participate, were excluded.

Results and Discussion

Table 1 presents the results related to the frequency of discomfort localized in the neck, shoulders, and/or the dorsal region of the back among the surveyed personnel. Of the 108 participants, 70 reported experiencing these discomforts sporadically, which corresponds to 64.81% of the sample. In contrast, 38 workers indicated suffering from them more regularly, representing 35.19%. These figures demonstrate a high prevalence of musculoskeletal discomfort in these anatomical regions within the evaluated group.

Table 1.
Discomfort in Neck, Shoulders, and/or Dorsal Back

		Frequency	Porcentaje	Cumulative Percentage
Valid	Sometimes	70	64.81%	64.81%
	Many times	38	35,19%	100%
	Total	108	100.0	

Table 2.
Lumbar Back Discomfort

		Frequency	Porcentaje	Cumulative Percentage
Valid	Sometimes	58	53,70	53,70
	Many times	50	46,30	100%
	Total	108	100,0	

To analyze the relationship between the evaluated variables, Pearson's correlation test was used, a statistical tool that allows for the measurement of both the strength and direction of the linear association between two continuous quantitative variables.

Table 2 shows the distribution of the frequency with which workers report discomfort in the lumbar region. Of the 108 employees surveyed, 58 indicated that they experience this type of discomfort occasionally, which represents 53.70% of the total. Meanwhile, 50 reported suffering these dis-

comforts more frequently, which is equivalent to 46.30%. These results show a significant presence of low back pain among the personnel evaluated.

Table 3 shows the frequency with which workers reported leg discomfort. Of the 108 respondents, 60 reported experiencing this type of discomfort occasionally, which corresponds to 55.55% of the population evaluated. Meanwhile, 48 indicated that such discomfort occurs more regularly, representing 44.44%. These data show a high incidence of discomfort in the lower extremities among the organization's employees.

Table 4 presents the results on the frequency with which workers reported knee discomfort. Of the 108 employees surveyed, 59 reported experiencing this type of discomfort on an occasional basis, which corresponds to 54.62% of the total. For their part, 49 reported feeling this discomfort more frequently, representing 45.31%. These values show a high presence of knee joint disorders in the study group.

As for the cumulative percentage, this reflects the progressive sum of the values reported: those who reported discomfort "sometimes" represent a cumulative 54.62%, while the category "many times" completes 100%, which indicates that both groups include all the participants evaluated.

Table 5 summarizes the distribution of body postures adopted by employees during their workday, classified into five categories: "Sitting," "Standing with limited movement," "Walking," "Movement with changes in level (stairs, ramps, steps, etc.)," and "Squatting or kneeling postures." Of the 108 participants, 25 indicated performing their duties in a seated position, equivalent to 23.14% of the sample. For their part, 20 indicated remaining standing with little mobility, representing 18.51%.

Furthermore, 22 workers reported that their work involves continuous walking, which represents 20.37%, and an equal proportion indicated performing movements including ascents or descents on different levels, with the same percentage

Table 3.
Leg Discomfort

		Frequency	Porcentaje	Cumulative Percentage
Valid	Sometimes	60	55,55	55,55
	Many times	48	44,44	100%
	Total	108	100,0	

Table 4.
Knee Discomfort

		Frequency	Porcentaje	Cumulative Percentage
Valid	Sometimes	59	54,62	54,62
	Many times	49	45,37	100%
	Total	108	100,0	

Table 5.
Working postures

		Frequency	Percentage	Cumulative Percentage
Valid	Sitting (chair, stool, vehi-cle, lumbar support, etc.)	25	23,14	23,14
	Standing with little or no walking	20	18,51	41,65
	Walking	22	20,37	62,02
	Walking while ascending or descending different levels (steps, stairs, ramp, etc.)	22	20,37	82,39
	Kneeling/squatting	19	17,59	100%
	Lying on back or side	0	0	
	Total	108	100%	

(20.37%). Finally, 19 collaborators stated that they perform their activities in squatting or kneeling postures, which corresponds to 17.59% of the total evaluated. These data allow for the identification of postural variability in the functions performed, a key aspect for ergonomic analysis.

Table 6 presents information regarding the positions adopted by workers in relation to head and neck movements during their tasks. The responses were classified into four categories: "Forward tilting of the neck or head," "Backward tilting," "Lateral tilting (to one side or both)," and "Turning of the neck or head." Of the 108 employees surveyed, 35 reported tilting their head or neck forward, representing 32.40% of the total.

On the other hand, 24 workers indicated performing backward tilting, which corresponds to 22.22%, while 22 reported lateral tilting, either to one side or both, equivalent to 20.37%. Finally, 27 workers stated that they turn their neck or head during the performance of their duties, representing 25%. These findings allow for the identification of relevant postural patterns for the ergonomic analysis of the workstation

Table 7 presents the results related to the postures adopted by workers regarding the movement of the back and trunk during their work activities. The responses were classified into four types: "Forward tilting of the trunk or back," "Backward tilting," "Lateral tilting (to one side or both)," and "Turning of the trunk or back." Of the 108 workers surveyed, 26 indicated that they usually tilt forward, which represents 24.07% of the total.

Meanwhile, 29 collaborators reported adopting a backward tilt during their workday, corresponding to 26.86%. An equal number to the first, that is, 26 employees, indicated tilting their back or trunk to one side or both, also equivalent to 24.07%. Finally, 27 workers reported performing turns of the trunk or back, which represents 25%. These data reflect the diversity of postural movements that could be linked to ergonomic risks in the work environment.

Table 8 contains information regarding the postures adopted by workers in relation to the use of shoulders, wrists, and feet during the execution of their tasks. The responses were grouped into three categories: "Hands above the head or elbows above shoulder level," "Flexion of one or both

Table 6.
Head postures

		Frequency	Percentage	Cumulative Percentage
Valid	Tilt neck/head forward	35	32,40	32,40
	Tilt neck/head back	24	22,22	54,62
	Tilt neck/head to one side or both	22	20.37	75
	Tilt neck/head	27	25	100%
	Total	108	100%	

Table 7.
Back trunk posture

		Frequency	Percentage	Cumulative Percentage
Valid	Tilt back/trunk forward	26	24,07	24,07
	Tilt back/trunk backward	29	26,86	51,56
	Tilt back/trunk to one side or both	26	24,07	75,63
	Rotate back/trunk	27	25	100%
	Total	108	100%	

Table 8.
Posture of shoulders and wrists

		Frequency	Percentage	Cumulative Percentage
Valid	Hands above the head or elbows above the shoulders	37	34,26	34,26
	One or both wrists bent upward or downward, sideways or turned (forearm twist)	37	34,26	68,52
	Exerting pressure with one foot	34	31,48	100%
	Total	108	100%	

wrists in different directions or forearm rotation," and "Application of pressure with one foot."

Of the 108 participants, 37 reported keeping their hands raised above their head or their elbows above shoulder level, representing 34.26% of the total. An equivalent number indicated performing flexion or rotation movements with their wrists, also equivalent to 34.26%. For their part, 34 workers indicated applying pressure with one foot during their workday, which corresponds to 31.48%. These results allow for the identification of biomechani-

cally demanding postures that could be associated with musculoskeletal risks.

Table 9 presents a cross-tabulation examining the relationship between the gender of the employees and the weight ranges they most frequently handle in the performance of their work tasks. The data were organized into four categories: "Between 3 and 5 kg," "Between 5 and 15 kg," "Between 15 and 25 kg," and "Not applicable." Regarding male workers, it was recorded that 2 of them report handling loads between 3 and 5 kg, another 2 indicated managing weights between 5 and 15 kg, and 2 reported moving weights between 15 and 25 kg. Additionally, 5 workers stated that their duties do not involve the handling of loads. With respect to female workers, 20 affirmed moving weights between 3 and 5 kg, while an equal number indicated handling weights within the range of 5 to 15 kg.

Furthermore, 16 women reported working with weights ranging between 15 and 25 kg, and 41 stated having no contact with loads during their duties; which comprises a total of 11 men included in the study and 97 women, for a total of 108 respondents. The percentage analysis reflects a higher female participation in all weight categories. For example, women represent 90.91% in the group that handles between 3 and 5 kg, and in the 5 to 15 kg category they also outnumber men, with a proportion of 20 to 2. In the 15 to 25 kg range, female workers constitute 88.89% of the total in that category. Finally, in the "Not applicable" option, a considerable difference was evident, with 41 women compared to only 5 men.

Table 10 presents a cross-tabulation analyzing the relationship between the usual duration of the workday and the workers' perception of the level of physical demand associated with their duties. The physical demand was classified into five levels: "Very low," "Low," "Moderate," "High," and "Very high." In the group of employees whose workday does not exceed 4 hours daily, none reported perceiving the physical load as "Very low" or "Low,"

Table 9.
Cross-tabulation between sex and manipulation weights. Count

		LOS PESOS QUE CON MAYOR FRECUENCIA MANIPULAS SON DE:				
		Entre 3 y 5kg	Entre 5 y 15kg	Entre 15 y 25kg	No Aplica	Total
SEXO	Masculino	2	2	2	5	11
	Femenino	20	20	16	41	97
TOTAL		22	22	18	46	108

Table 10.
Cross-tabulation of working hours and demands. Count

		EXIGENCIA FÍSICA DEL TRABAJO					
		Muy bajas	Bajas	Moderadas	Altas	Muy altas	Total
Habitualmente, ¿cuántas horas al día trabajas en este puesto?	4 horas o menos	0	0	2	0	0	2
	Más de 4 horas	13	12	43	25	13	106
TOTAL		13	12	45	25	13	108

while 2 reported a "Moderate" level, and none were in the "High" or "Very high" categories. This category encompasses a total of 2 workers.

In contrast, among employees with workdays exceeding 4 hours, 13 affirmed perceiving a "Very low" demand, 12 indicated a "Low" perception, 43 rated it as "Moderate," 25 as "High," and 13 as "Very high," representing a total of 106 individuals. When comparing both categories of working hours, it is notable that the majority of workers, regardless of the duration of the workday, rate the physical demand as "Moderate." However, employees with longer workdays tend to report higher levels of physical demand, suggesting a possible relationship between the duration of daily work and the perceived intensity of the required physical effort.

Table 11 presents the distribution of workers' perceptions regarding the level of physical demand involved in their work activities, classified into five categories: "Very low," "Low," "Moderate," "High," and "Very high." According to the results, 12% of the participants (13 employees) consider that their work involves a very low physical demand, while 13% (14 employees) perceive it as low.

The largest proportion corresponds to those who classify the demand as moderate, representing 39.9% of the total (43 workers). In the "High" category, there are 25 employees, which is equivalent to 23.1%, and finally, the remaining 12% (13 employees) report that the physical demand in their duties is very high. These data reveal a general trend towards the perception of moderate demand, although with a significant presence of high and very high levels among the respondents.

Table 12 presents the results obtained from the correlation analysis between the duration of the workday and the personnel's perception of physical demand. The Pearson correlation coefficient yielded a value of 0.2519, indicating a weak positive association, suggesting that as working hours increase, the perception of physical exertion tends to increase slightly.

Tabla 12.
Correlation between work time factor and physical demand

		EXIGENCIA FÍSICA DEL TRABAJO
Tiempo de trabajo	Correlación de Pearson Sig. Bilateral	0,2519 0,0085
	N	108

Regarding the two-tailed significance level, a value of 0.0085 was obtained, demonstrating that the identified relationship is statistically significant. These findings allow us to conclude that, although the time dedicated to the workday influences the perception of physical demand, it is not the only factor involved. Variables such as the nature of the tasks, the conditions under which they are perfor-

Table 11.
Physical demands of the job

		FRECUENCIA	PORCENTAJE	PORCENTAJE ACUMULADO
Valido	Muy bajas	13	12%	12%
	Bajas	14	13%	25%
	Moderadas	43	39,9%	64,9
	Altas	25	23,1	88%
	Muy altas	13	12%	100%
	Total	108	100%	

med, and the inclusion of active breaks could influence this perception and should be considered in subsequent studies. Furthermore, the significant nature of this correlation can guide decisions related to work organization and the adoption of ergonomic measures that reduce the impact of physical exertion during extended workdays.

Table 13 presents the results of the correlation analysis between the perceived level of physical demand at work and the presence of bodily discomfort in the surveyed workers. The Pearson correlation coefficient obtained was 0.99, which indicates a nearly perfect positive relationship between both variables; that is, the greater the physical demand, the higher the frequency or intensity of bodily discomfort reported by employees.

Table 13.
Correlation between work demands and body discomfort.

		EXIGENCIA FÍSICA DEL TRABAJO
Exigencia física del trabajo	Correlación de Person	0,99
	Sig. Bilateral	2.03×10^{-8}
	N	108

Regarding the two-tailed significance value, this was 2.03×10^{-8} (0.0000000203), which demonstrates a very high level of statistical significance. This result practically rules out the possibility that the observed relationship is due to chance, as it is far below the conventional significance thresholds (0.05 and 0.01). Consequently, it can be strongly affirmed that there is a direct and significant association between the physical workload of work and the occurrence of musculoskeletal discomfort, which reinforces the need to implement preventive measures from the perspective of occupational ergonomics.

A high prevalence of musculoskeletal discomfort is reflected in the healthcare personnel surveyed in the city of Barranquilla, particularly in areas such as the neck, back (dorsal and lumbar), legs, and knees. This trend is consistent with various studies that document that healthcare workers are among those most affected by musculoskeletal disorders (MSDs) due to the physical and postural demands of their work (Paredes & Vázquez, 2018; Sánchez, 2018).

In this study, 64.81% of workers reported discomfort in the neck, shoulders, and/or dorsal back "sometimes," and 35.19% indicated experiencing it "often." Similarly, 53.70% reported occasional discomfort in the lower back, and 46.30% reported it frequently. Discomfort in the legs and knees showed similar patterns: approximately 55% occasional and 45% frequent. Similar results were found by Cortés *et al.* (2024), who reported a 78% prevalence of lumbar discomfort in nurses. Likewise, Ardila & Díaz (2020) reported 71% of dorsal pain in hospital personnel, while Albar & Sivianes (2016) identified only 45% of discomfort in the neck and shoulders, possibly due to better ergonomic conditions.

The analysis of adopted work postures revealed a significant combination of demanding positions: 20.37% walking, 20.37% walking on uneven surfaces, 18.51% standing without moving, and 17.59% working in squatting or kneeling positions. These conditions are closely related to musculoskeletal injuries, as demonstrated by Cataño *et al.* (2023) and Andersen *et al.* (2007), who link prolonged standing, bending, and body twisting with a higher risk of MSDs. Furthermore, a high frequency of neck наклоны (32.40% forward and 25% turned), along with trunk twists (25%) and elevated arm postures (34.26%), was evident.

The relationship between gender and physical load was also notable. 89.8% of the surveyed personnel were female, and this group assumed the greatest burden of weight handling. This reinforces the findings of Messing *et al.* (2003), who explain that women in the healthcare sector are more exposed to repetitive tasks, load handling, and awkward postures due to occupational segregation and a lack of adapted ergonomic measures.

Regarding the perception of physical demand at work, 39.9% of workers considered it "moderate,"

23.1% "high," and 12% "very high," figures comparable to studies conducted by Suarez (2021), who linked high physical load with a higher rate of absenteeism in public hospitals.

Workday duration also proved to be a relevant factor. 98.15% of respondents work more than 4 hours daily, and within this group, the highest levels of physical demand were reported. A low but statistically significant positive correlation was identified between working hours and physical demand ($r = 0.2519$, $p = 0.0085$), similar to that found by Morales *et al.* (2024) and Seguel & Valenzuela (2014), who associated prolonged workdays with a greater perception of physical fatigue and biomechanical risk.

The most significant result of the present study is the nearly perfect correlation between the physical demand of work and the occurrence of bodily discomfort ($r = 0.99$, $p < 0.0000001$). This finding is higher than that documented in most reviewed research, such as that of Torres & Rodríguez (2021), who found a moderate correlation ($r = 0.56$), and that of Orozco *et al.* (2025), who identified a relevant but not as extreme association. The high correlation observed in this study can be explained by the sum of multiple risk factors present in the evaluated work environment, such as the lack of active breaks, the absence of ergonomic supports, and a high rotation of demanding tasks.

These results reinforce the necessity of strengthening occupational health and ergonomics programs in hospital institutions, in accordance with the provisions of Resolution 0312 of 2019 of the Colombian Ministry of Labor and ISO standard 11226:2000, which establish the minimum standards to guarantee adequate physical conditions at work.

Conclusion

The findings of this study demonstrate a high prevalence of musculoskeletal discomfort among healthcare personnel in the municipality of Barranquilla, concentrated mainly in the regions of the neck, lumbar and dorsal back, legs, and knees. These conditions are directly related to critical ergonomic factors, such as inadequate postures, manual handling of loads, and the high physical demands inherent in the caregiving tasks of the healthcare sector.

The significant correlation identified between work exposure time and the perception of physical demand suggests that prolonged workdays, without adequate breaks or task variability, considerably increase physical overload. Furthermore, a highly close relationship was evidenced between physical demand and the presence of musculoskeletal discomfort, which confirms that these variables interact decisively in the occurrence of occupational injuries.

These results offer solid empirical evidence to support the urgency of designing and implementing preventive ergonomic interventions aimed at mitigating biomechanical risks in healthcare settings. Such interventions should include, among other actions: the systematic evaluation of ergonomic factors, task redesign, job rotation, the inclusion of active breaks, and continuous staff training in postural hygiene.

Consequently, it is concluded that ergonomic management cannot be limited to corrective or reactive measures but must be adopted as a preventive, comprehensive, and sustained strategy, aligned with the principles of the Occupational Safety and Health Management System (SG-SST), as stipulated in current national and international regulations. This approach will not only reduce the incidence of musculoskeletal disorders but also improve well-being, productivity, and service quality in the healthcare sector.

However, this study presents some limitations that should be considered for future research. Among these, the geographical restriction of the sample, concentrated in a specific institutional context, limits the generalization of the findings. Furthermore, the cross-sectional design prevents the establishment of causal relationships between ergonomic conditions and the health effects on personnel. Finally, psychophysical or psychoso-

cial variables that could significantly influence the perception of ergonomic risk were not incorporated. It is recommended that future research address these aspects through longitudinal designs and multidisciplinary approaches that allow for a broader and deeper understanding of the studied phenomenon.

Author contributions

Melani Sharon Rodríguez Rodríguez: methodology, analysis, project development, initial writing, final writing

Pedro Luis Babilonia Tejedor: methodology, analysis, project development, initial writing, final writing

Jhon Felipe Pirela Atencio: methodology, analysis, project development, initial writing, final writing

Carlos Alberto Severiche Sierra: conceptualization, methodology, analysis, project development, initial writing, final writing

Referencias

Albar, M. J., & Sivianes-Fernández, M. (2016). Percepción de la identidad profesional de la enfermería en el alumnado del grado. *Enfermería Clínica, 26*(3), 194-198. https://www.sciencedirect.com/science/article/abs/pii/S1130862115001722

Andersen, J. H., Haahr, J. P., & Frost, P. (2007). Risk factors for more severe regional musculoskeletal symptoms: A two-year prospective study of a general working population. *Arthritis & Rheumatism, 56*(4), 1355-1364. https://doi.org/10.1002/art.22513

Ardila, C., & Díaz Gómez, B. A. (2020). Síntomas musculoesqueléticos en operadores logísticos de una empresa de envíos de Santander, Colombia. *Investigaciones Andina, 22*(40), 245-254. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0124-81462020000100245&lng=es&tlng=es

Álvarez, D. E., Araque Geney, E. A., & Jiménez Lyons, K. A. (2022). Sistema de gestión de la seguridad y salud en el trabajo, mipymes de Sincelejo, Colombia. *Tendencias, 23*(2), 178-201. http://www.scielo.org.co/scielo.php?pid=S0124-86932022000200178&script=sci_arttext

Bernal, D., Campos-Serna, J., Tobias, A., Vargas-Prada, S., Benavides, F. G., & Serra, C. (2015). Work-related psychosocial risk factors and musculoskeletal disorders in hospital nurses and nursing aides: A systematic review and meta-analysis. *International Journal of Nursing Studies, 52*(2), 635-648. https://doi.org/10.1016/j.ijnurstu.2014.11.003

Cataño, A., Viadero-Rosario, L., Borré-Ortiz, Y., & Molina-Romero, J. (2023). Riesgo biomecánico y trastornos musculoesqueléticos en instrumentadores quirúrgicos que laboran en centrales de esterilización. *Duazary, 20*(4), 283-289. https://doi.org/10.21676/2389783X.5152

Cogollo, Z., De Los Reyes Blanco, Y., Espinosa Fortich, J., Herrera Martínez, M., López Restrepo, L., Ojeda Otero, C., & Severiche Sierra, C. (2019). Prevalencia de molestias músculo-esqueléticas en odontólogos de odontoclínicas universitarias de Cartagena de Indias (Colombia). *Revista Cubana de Salud y Trabajo, 20*(1), 30-37. https://revsaludtrabajo.sld.cu/index.php/revsyt/article/view/95/123

Cortés, J., Vélez Álvarez, C., & Mejía Castaño, L. (2024). Factores asociados al agotamiento laboral en personal sanitario durante la pandemia SARS-CoV-2. Colombia. *Revista Cubana de Salud y Trabajo, 25*(3). e757 https://revsaludtrabajo.sld.cu/index.php/revsyt/article/view/757

Da Costa, B. R., & Vieira, E. R. (2010). Risk factors for work-related musculoskeletal disorders: A systematic review of recent longitudinal studies. *American Journal of Industrial Medicine, 53*(3), 285–323. https://doi.org/10.1002/ajim.20750

Fikre, D., Hawulte Ayele, B., Sime, A., Tebeje, F., & Weldegebreal, F. (2024). Prevalence of work-related musculoskeletal disorder and ergonomic risk practice among medical laboratory professionals at health facilities of eastern Ethiopia. *Frontiers in Public Health, 12*, 1443217. https://doi.org/10.3389/fpubh.2024.1443217

Gualán, C., & Reinoso, M. (2023). Trastornos músculo-esqueléticos en el personal de enfermería de un hospital en Cuenca, Ecuador. *Revista Religación, 8*(37), 2301094. https://doi.org/10.46652/rgn.v8i37.1094

Gutiérrez, M. T., Morales Chávez, E., Castillo Villanueva, V., & Vásquez Vásquez, G. (2025). Factores de riesgo ergonómico en trabajadores de fábricas de muebles en el estado de Chihuahua, México. *Ingeniería y Desarrollo, 43*(1), 104-121. https://doi.org/10.14482/inde.43.01.049.612

Guzmán, A. C., Romero-Gazabón, D. S., & Severiche-Sierra, C. A. (2024). Síntomas osteomusculares en trabajadores del transporte de servicio especial del Grupo Empresarial Alianza T S. A. *Sociedad & Tecnología, 7*(1), 18-34. https://doi.org/10.51247/st.v7i1.403

Hsieh, P. L., Lee, Y. C., Yang, S. Y., Lin, Y. L., & Huang, Y. R. (2022). Association between work content and musculoskeletal disorders among home caregivers: A cross-sectional study. *Industrial Health, 60*(6), 514-524. https://doi.org/10.2486/indhealth.2021-0160

Instituto Sindical de Trabajo, Ambiente y Salud (ISTAS), & Comisiones Obreras (CCOO). (2014). *Cuestionario sobre factores de riesgo ergonómico y posibles afectaciones.* https://ergopar.istas.net/ficheros/documentos/v2/T7.Estandar_Cuestionario%20de%20factores%20riesgo%20ergon%C3%B3micos%20y%20da%C3%B1os.pdf

International Organization for Standardization. (2000). *ISO 11226 – Ergonomics – Evaluation of Static Working Postures*. Geneva, Switzerland: ISO.

Kuorinka, I., Forcier, L., Hagberg, M., Silverstein, B., Wells, R., Smith, M. J., ... & Pérusse, M. (1995). *Work-related musculoskeletal disorders (WMSDs): A reference book for prevention*. https://library.wur.nl/WebQuery/titel/939759

Ledesma, C., Crespo, H. G., & Castro, A. M. A. (2018). Ausentismo y desempeño laboral en profesionales de enfermería de áreas críticas. *Revista Cuidarte, 9*(1), 1973-1987. https://doi.org/10.15649/cuidarte.v9i1.426

Mansoor, S. N., Al Arabia, D. H., & Rathore, F. A. (2022). Ergonomics and musculoskeletal disorders among health care professionals: Prevention is better than cure. *JPMA. The Journal of the Pakistan Medical Association, 72*(6), 1243-1245. https://doi.org/10.47391/JPMA.22-76

Marin, B. J., & Gonzalez-Argote, J. (2022). Riesgos ergonómicos y sus efectos sobre la salud en el personal de enfermería. *Revista Información Científica, 101*(1). e3724 http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1028-99332022000100011

Messing, K., Punnett, L., Bond, M., Alexanderson, K., Pyle, J., Zahm, S., Wegman, D., Stock, S. R., & de Grosbois, S. (2003). Be the fairest of them all: Challenges and recommendations for the treatment of gender in occupational health research. *American Journal of Industrial Medicine, 43*, 618-629. https://doi.org/10.1002/ajim.10225

Ministerio de Trabajo. (2019). Resolución 0312 de 2019: Por la cual se definen los estándares mínimos del Sistema de Gestión de la Seguridad y Salud en el Trabajo (SG-SST). República de Colombia.

Morales, C. M., Reinoso Avecillas, M. B., & Narváez Zurita, C. I. (2024). Factores asociados a la fatiga laboral y su influencia en los trastornos del sueño. *Revista Universidad y Sociedad, 16*(3), 108-120. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2218-36202024000300108

Orozco, Z. L., Borja Mora, L. K., & López Telenchana, L. S. (2025). Correlación entre tiempo, exigencia física, exigencia de trabajo y molestias corporales de la ergonomía en la prevención de lesiones laborales. *Revista InveCom, 5*(1), e501097. https://doi.org/10.5281/zenodo.12676250

Paredes, M. L., & Vázquez Ubago, M. (2018). Estudio descriptivo sobre las condiciones de trabajo y los trastornos musculo esqueléticos en el personal de enfermería de la Unidad de Cuidados Intensivos Pediátricos y Neonatales. *Medicina y Seguridad del Trabajo, 64*(251), 161-199. http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S0465-546X2018000200161

Portilla, Y. E., & Juna Juca, C. F. (2024). Factores asociados a trastornos musculoesqueléticos en profesionales de enfermería que laboran en servicios críticos. Una revisión sistemática. *Aquichan, 24*(4), e2442. https://doi.org/10.5294/aqui.2024.24.4.2

Quiñones, D., Vodniza Patiño, A. S., Matabanchoy Tulcan, S. M., Matabanchoy Salazar, J. M., & Lopez Barreto, L. M. (2022). Fatiga laboral en contextos hospitalarios en Latinoamérica: Revisión sistemática. *Revista Colombiana de Salud Ocupacional, 12*(2), e-7905. https://doi.org/10.18041/2322-634X/rcso.2.2022.7905

Sánchez, A. (2018). Prevalencia de desórdenes músculo esqueléticos en trabajadores de una empresa de comercio de productos farmacéuticos. *Revista Ciencias de la Salud, 16*(2), 203-218. https://doi.org/10.12804/revistas.urosario.edu.co/revsalud/a.6766

Seguel, F., & Valenzuela, S. (2014). Relación entre la fatiga laboral y el síndrome burnout en personal de enfermería de centros hospitalarios. *Enfermería Universitaria, 11*(4), 119-127. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1665-70632014000400002

Suarez, C. A. (2021). Enfermedad profesional y ausentismo laboral en los trabajadores de un hospital de Lima-Perú. *Revista de la Facultad de Medicina Humana, 21*(2), 364-371. https://doi.org/10.25176/rfmh.v21i2.3657

Torres, S. (2023). Riesgo ergonómico y trastornos musculoesqueléticos en trabajadores de industria alimentaria en el Callao en el 2021. *Horizonte Médico, 23*(3), e2207. https://doi.org/10.24265/horizmed.2022.v23n3.04

Torres, Y., & Rodríguez, Y. (2021). Surgimiento y evolución de la ergonomía como disciplina: Reflexiones sobre la escuela de los factores humanos y la escuela de la ergonomía de la actividad. *Revista Facultad Nacional de Salud Pública, 39*(2), 1-9. https://doi.org/10.17533/udea.rfnsp.e342868

Vásquez, M. V., Arana Blas, R. D., & Tercero Rivera, T. (2025). Riesgos laborales en personal de salud: Una revisión bibliográfica. *Revista Científica Estelí, 13*(52), 30-51. https://doi.org/10.5377/esteli.v13i52.19980

Zong, H., Yi, W., Antwi-Afari, M. F., & Yu, Y. (2024). Fatigue in construction workers: A systematic review of causes, evaluation methods, and interventions. *Safety Science, 176*, 106529. https://www.sciencedirect.com/science/article/pii/S092575352400119X