Ergonomic Assessment and Musculoskeletal Disorders in Nurses at a Social Security Hospital

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ABSTRACT:
The high prevalence of musculoskeletal disorders (MSDs) in nursing staff underlines the urgent need for ergonomic research to identify and reduce occupational risk factors. In this cross-sectional study conducted with 22 nurses from a social security hospital, an ergonomic assessment using the REBA and RULA methods was used to analyze the risk associated with work activities. The main objective was to determine the prevalence of MSDs in the upper extremities and their associated risk factors. Although most of the participants had a body composition within normal ranges, the results showed a prevalence of 45.9% of musculoskeletal pain in the upper extremities. Among the most important risk factors were long working hours and static work postures maintained during work. These results show the lack of implementation of adequate ergonomic practices, which accentuates the incidence of MSDs. Therefore, the adoption of ergonomic interventions, such as postural correction and workload reduction, is crucial in order to improve the quality of life of nurses, reduce occupational risks and decrease both the prevalence and impact of MSDs in this population. The implementation of these measures would not only contribute to the reduction of absenteeism, but would also improve the performance and general well-being of nursing staff.

KEYWORDS: Ergonomic assessment, musculoskeletal disorders, nurse, ergonomic risk, hospital.

Introduction:

In the healthcare sector, the activities performed by nurses often involve uncomfortable postures and repetitive movements, which can lead to musculoskeletal disorders (MSDs). Additionally, work-related musculoskeletal disorders (WMSDs) are common in the healthcare sector, particularly affecting healthcare professionals. A literature review revealed a prevalence ranging from 28% to 96%, with the lower back being frequently affected. Inexperience has been identified as a key risk factor [1]. Furthermore, MSDs manifest as chronic pain and restrictions in mobility and flexibility, which can significantly impact the ability of personnel to perform their duties.

Ergonomic risks are part of the public health issue caused by long working hours and small work environments, which in turn lead to lower work productivity. In addition, the most common areas of pain reported by nursing professionals are the neck (28.33%), shoulder (25%), wrist (13.33%), and back (25%) [2]. Moreover, musculoskeletal pain and the lack of ergonomic practices in the workplace are significant problems, highlighting the need to implement ergonomic education programs and promote the adoption of ergonomic behaviors in the healthcare sector [3]. These issues represent significant challenges to the health and well-being of nursing professionals, affecting their quality of life and patient care. Additionally, these disorders generate economic costs and reduce productivity. For this reason, the Ministry of Labor and Employment Promotion (MTPE) emphasizes the importance of mental health and ergonomics in the

workplace, as these factors contribute to more productive workers [4].

The lack of ergonomic assessments for nurses leads to an increase in muscle pain and, consequently, musculoskeletal disorders. Ergonomic assessments are divided into two groups: direct and observational methods [5]. The former involves collecting data directly from sensors attached to the worker's body. Observational methods, which are the most commonly used, involve directly observing the worker and their corresponding tasks. Among the observational methods are Rapid Upper Limb Assessment (RULA) [6] and Rapid Entire Body Assessment (REBA) [7]. Poor ergonomic assessment can result in musculoskeletal injuries for healthcare staff, underscoring the importance of identifying and addressing ergonomic risk factors in their work environment. Early detection and implementation of preventive measures are essential to minimize the risk of MSDs and ensure a safe and healthy work environment.

Recent studies indicate an increase in work-related musculoskeletal disorders (WRMD), recognized as occupational diseases in many industrialized countries. Therefore, researchers have proposed ergonomic studies focused on nurses. In [8], the authors propose the development of a mobile application to prevent the prevalence of MSDs among nursing professionals and the socioeconomic impact of these disorders. Meanwhile, in [9], personal and occupational characteristics, as well as ergonomic risks, were associated with upper limb disorders among operating room nurses, with a prevalence of 45.9%. Moreover, excessive working hours increase the risk of MSDs. Similarly, in [10] evaluated the musculoskeletal discomforts of intensive care unit (ICU) nurses to improve working conditions. In [11], a multifaceted intervention was evaluated to reduce musculoskeletal pain in nurses, achieving pain reduction in the neck, shoulders, and back. However, [12] investigated the influence of nursing activities on the prevalence of lower back pain, highlighting a lack of ergonomic education.

Ergonomic assessment studies in nursing staff often focus on assessments through perception questionnaires, as proposed by [13] or the NORDIC questionnaire in [14]. However, the most exposed extremities to MSDs and the ergonomic factors influencing them are not always identified. It is worth noting that nurses' activities are often related to improper posture or repetitive movements. The purpose of this study is to evaluate the ergonomic risk among nurses, and for this, REBA and RULA will be included. These are risk assessment methods based on systematic observation and are primarily used in the fields of engineering. This approach will yield more reliable and generalizable results and evaluations in research.

The main contribution of this study is to provide a list of extremities exposed to MSDs and the ergonomic factors influencing them. The rest of the article is organized as follows: Section 2 describes the state of the art, Section 3 outlines the methodology, the results are presented in Section 4, the discussion is in Section 5, and finally, the conclusions are in Section 6.

2) <u>Methods and Methodology</u>:

Many articles address various aspects related to ergonomics and health in the field of nursing. In [15], the authors evaluated the effect of an educational program on ergonomics for preventing musculoskeletal disorders (MSDs) among operating room nursing staff, where they achieved a significant reduction in the prevalence and risk of MSDs following the intervention. On the other hand, in [16], a prototype of smart pajamas designed to prevent pressure injuries was evaluated, highlighting the need for improvements in its handling, physical effort, opening and closing system, and size adjustment. Similarly, in [17], the authors explored healthcare professionals' perceptions of interprofessional teamwork in the emergency department, emphasizing the importance of effective communication and professional experience. Likewise, in [18], a digital tool (ICE) was developed for outbreak management in hospitals, which could reduce nurses' workload and thereby mitigate MSDs. Moreover, [19] presented a framework for evaluating and developing ergonomic interfaces for telenursing robots, aiming to reduce the physical and cognitive workload of nurses.

Additionally, in [20], the ergonomic risk of manual patient handling and its relationship to low back pain in nurses was studied, finding a high prevalence of both. On the other hand, in [21], the prevalence and risk factors of MSDs in nurses were evaluated, finding a high prevalence and associations with factors such as working in the same position for extended periods and a lack of injury prevention training. However, in [22], the authors designed a trial to evaluate the effectiveness of a multifaceted intervention for the prevention and management of musculoskeletal pain in nurses, combining participatory ergonomics, case management, and health promotion. Finally, in [23], the use of barcode scanning for medication by nursing staff was employed, highlighting the importance of behavioral and motivational factors, which resulted in a reduction in MSDs.

In [24], they reduced nurses' workload and improved patient comfort, particularly in intensive care units.

Also, in [25], the authors determined the work activities associated with low back pain in nurses, revealing a prevalence of 76.7% and its association with improper postures, physical effort, and working while in pain. Additionally, in [26], a chair was used to assist in patient transfers to avoid ergonomic postures. Similarly, in [27], high ergonomic risk activities in ICUs and emergency rooms were evaluated, emphasizing the need to implement ergonomic improvements and prevention programs. Likewise, in [28], the relationship between MSDs and job performance among nursing staff was studied, finding that increased workload raises the risk of these disorders, which negatively impacts job performance.

Many articles address aspects related to ergonomics in the healthcare sector, such as back pain in rehabilitation nurses [29], neck, back, hand pain, and musculoskeletal discomfort [30], where musculoskeletal discomfort and hand pain were identified [31]. Working in the same position for long hours and a lack of training generate MSDs in nurses [21]. Additionally, the positive effects of ergonomic programs in reducing ergonomic risk are evaluated, as suggested by [32], [33] and [34], who mention the effectiveness of implementing an ergonomic training program for nurses. The presented articles highlight the importance of ergonomics in nursing tasks, where they address risk assessments using different tools to improve health but do not quantify the ergonomic risk of the activities performed by nurses in their work environment, with the aim of improving the health and well-being of healthcare professionals.

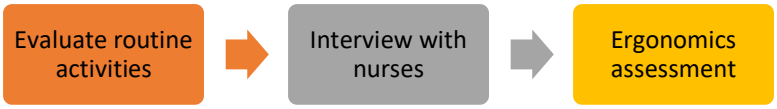

Figure 1. Ergonomics assessment process.

The study was conducted in a social security hospital, where only nurses participated. The different work activities they perform were evaluated, followed by an ergonomic assessment for all the activities carried out in the hospital. The study considered a sample of 22 nurses, of which only 3 were adults, and all participants were women. Prior to the assessment, they were interviewed with basic questions regarding the duration of the activity, age, and any pain experienced in recent months. They were also verbally informed about the purpose of the ergonomic evaluation. Figure 1 details the stages of the ergonomic assessment.

2.1 Ergonomic Evaluation Methods:

The REBA method allows for a comprehensive evaluation of postural load throughout the body, considering the interaction between different anatomical areas and key factors in the nursing environment, such as the applied force, repetitive movements, and postures adopted during patient mobilization and the performance of nursing tasks [7].

REBA

Degree	REBA score	Risk level	Prevention
0	1	Negligible	Not necessary
1	2-3	Low	It may be necessary
2	4-7	Middle	Necessary
3	8-10	High	Necessary soon
4	11-15	Very high	Needed immediately

Note: Hignett and McAtamney (2000)

In Table 1 shows the score that ranges from 1 to 15 depending on the movement of the limb during work; As this value increases, the ergonomic risk increases, requiring preventive measures.

On the other hand, the RULA method evaluates postural risk in healthcare workers by analyzing posture, force, and repetitive movements, helping to identify potential ergonomic risks in daily clinical activities [6]. It analyzes the working postures of the wrist, forearm, arm, neck, trunk, and legs. This method divides the body into two groups, and the postures are evaluated according to their range of motion. Another method, OWAS (Ovako Working Posture Analyzing System), focuses on identifying and classifying specific work postures and their associated risks, allowing for the immediate implementation of corrective interventions in the workplace in [35].

Table 2. RULA

Score	RULA result
1-2	It is an acceptable result if it is not repeated for a long time.

3-4	The work done should be analyzed better, some changes can be made
5-6	It is necessary to review the work done as soon as possible and make changes in the short term.
7	There is an urgent need to review and change the work done

Note: McAtamney & Corlett, (1993)

In Table 2 shows the values of the work postures and risk factors, with a final score that ranges between 1 and 7, and the result for each score is also shown.

The present study calculates the REBA and RULA scores for five hospital workstations. These workstations provide emergency services, medical care, intervention procedures, and basic services. Fifteen activities performed most frequently by nurses were identified. To calculate the REBA and RULA scores, photographs were taken of the working postures of the nurses, involving a total of 22 nurses. Figure 2 shows the photographs of the activities performed by the nurses in the various hospital workstations.

3] Results: Present the findings of the research paper in this section.

Of the 22 nurses who participated in the study, 100% were women, with a mean age of 35 years, an average height of 155 cm, and an average weight of 57 kg. A total of 45.9% of the nurses reported pain in the neck, back, shoulders, and hands.

Figure 2. Most Frequent Activities

The ergonomic assessment identified activities that require preventive measures, as these could lead to musculoskeletal disorders (MSDs), which in turn could result in workplace absenteeism. Of the activities evaluated, three were classified as high-level, eight as medium-level, and the rest as low-level in terms of REBA evaluation. Using the RULA method, three activities required intervention, seven required an evaluation of preventive measures, and five did not require intervention.

In Figure 3, it can be seen that Activity 1 has a score of 10, while Activities 2 and 4 have a score of 11. According to REBA Table 1, these activities require prompt attention. In the case of Activities 3, 5, and 6, they present a medium risk, so preventive measures need to be evaluated.

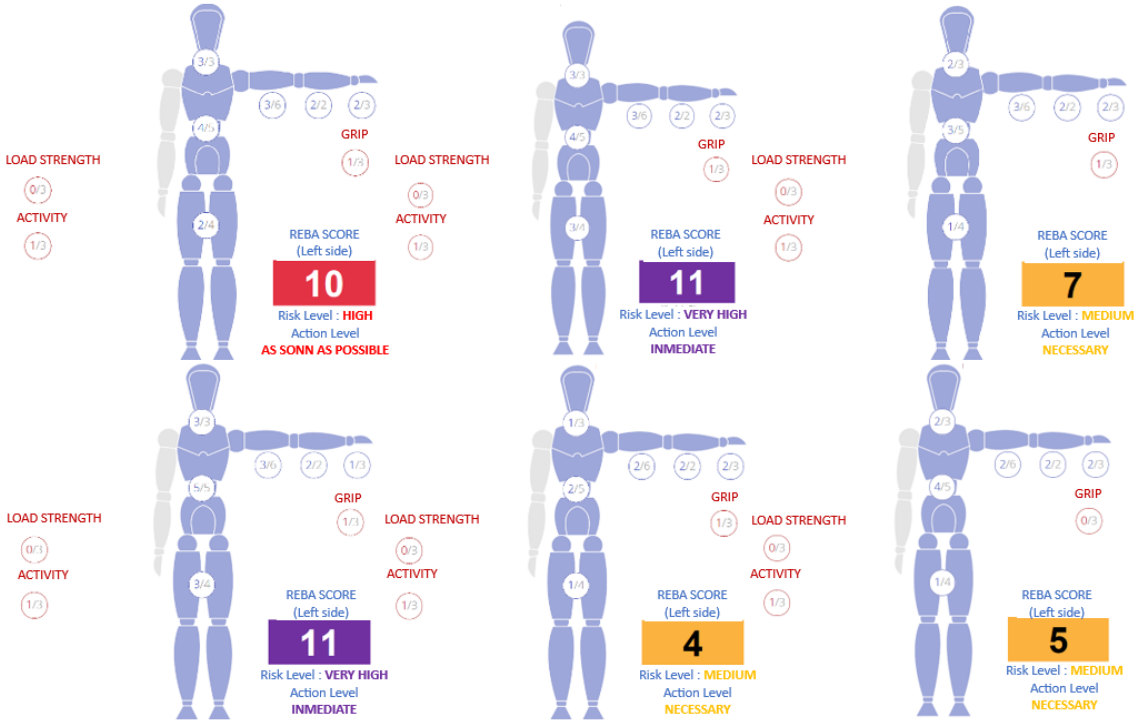

Figure 3. Ergonomic Evaluation of Activities Performed by Healthcare Staff

In Figure 4, it can be observed that only Activities 8 and 12 received scores of 5 and 4, indicating a medium risk according to REBA Table 1. In contrast, Activities 7, 9, 10, and 11 were classified as low.

Figure 4. Ergonomic Evaluation of Activities Performed by Healthcare Staff

Figure 5 shows the results of the evaluation of Activities 13, 14, and 15, which present medium risk according to the REBA score and table, and therefore require preventive measures.

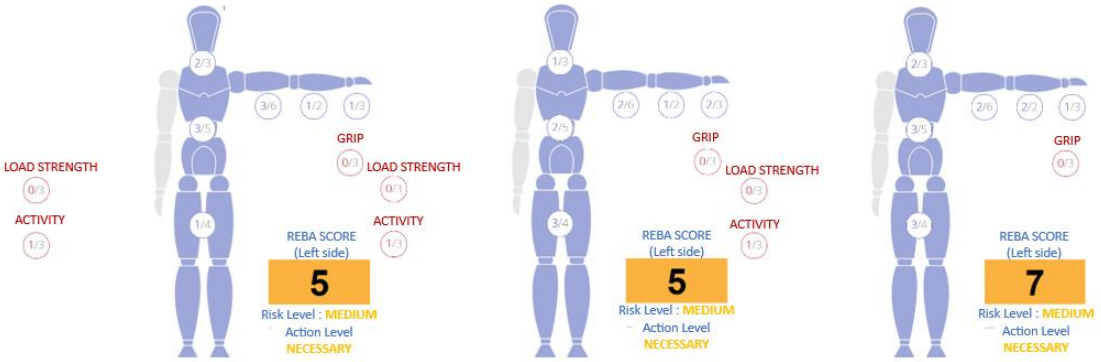

Figure 5. Ergonomic Evaluation of Activities Performed by Healthcare Staff

In Figure 6, the evaluation of Activities 1, 2, and 3 using the RULA method is displayed. According to the RULA table, Activities 1 and 2 require prompt intervention.

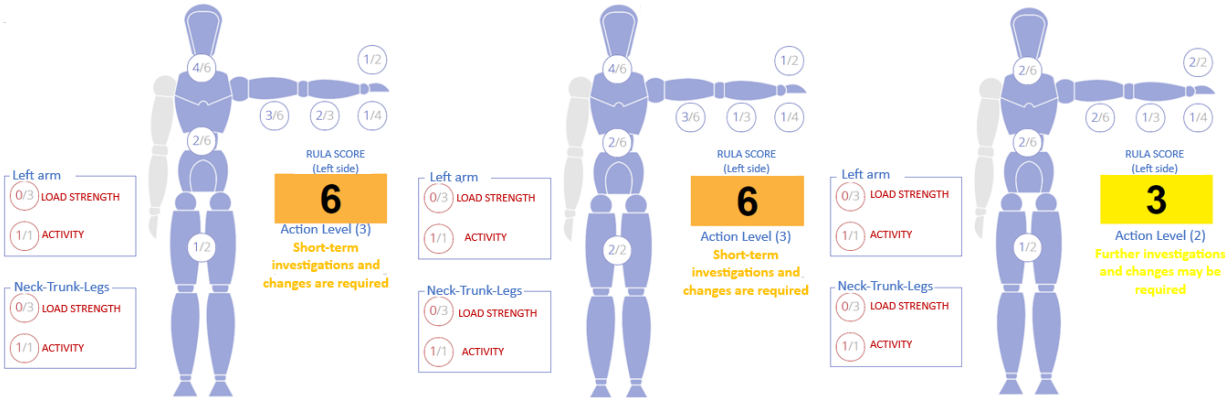

Figure 6. Ergonomic Evaluation of Activities Performed by Healthcare Staff

Next, Figure 7 shows the evaluations of Activities 4, 6, and 9 using the RULA method, where it can be noted that both Activities 4 and 6 require prompt attention, while Activity 4 requires an evaluation of preventive measures.

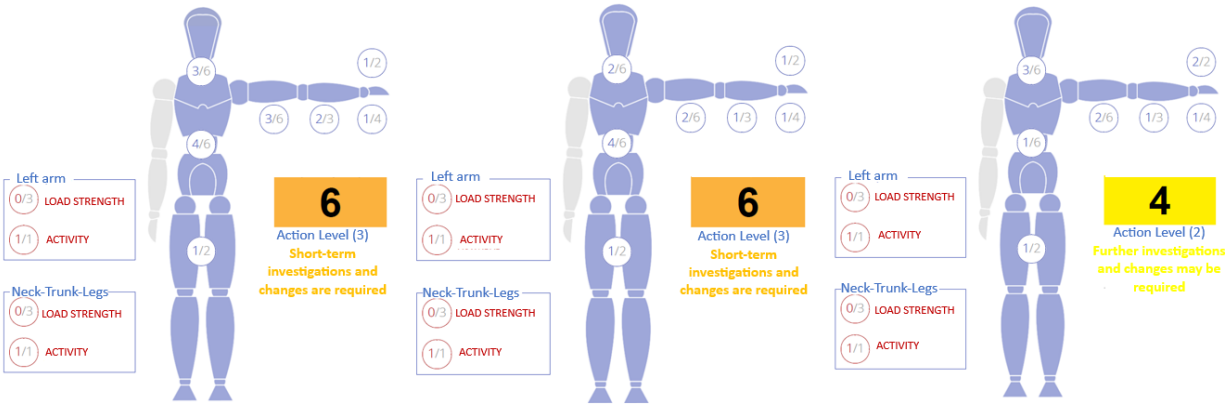

Figure 7. Ergonomic Evaluation of Activities Performed by Healthcare Staff

4] Discussion

The healthcare field is multidisciplinary and constantly evolving; however, ergonomic assessment has become essential. There is clear evidence of wear and tear that results in MSDs, which healthcare professionals themselves are often unaware of or do not take interest in. This highlights the importance of evaluating and measuring the risk they are exposed to.

Considering each of the aspects evaluated, we can indicate that three activities were classified as high-level risk, eight as medium-level, and the rest as low-level. These findings align with [21], reflecting the existence of postural alterations that lead to preventable ergonomic risks. However, the quantitative assessment through REBA and RULA instruments allows for the identification of 15 frequently performed activities, such as peripheral IV-line insertions and wound and trauma care

conducted by nursing professionals, results supported by the studies of [7] and [6], yielding a significant score for interpretation.

The repetitive movements identified flexion, extension, and wrist rotation, fine and gross pinching, adduction, and spinal extension correlate with the tasks performed, contributing to a constant ergonomic risk. This risk can be prevented according to the studies by [27] and [18], thereby avoiding absenteeism due to the pain associated with these MSDs, which have medium- and long-term effects. Additionally, promoting a healthy lifestyle becomes essential.

5] Conclusion

In light of all the above, it is evident that failing to address the demonstrated and quantified risk, as assessed by the REBA and RULA methods, will lead to two disadvantageous scenarios: diminished work performance and compromised health and well-being of the worker. Healthcare institutions must ensure a safe environment, and thus the responsibility falls on both parties. Therefore, it is essential to. Promote programs and strategies to improve workplace ergonomics, achieving acceptance within the community by recognizing the risks faced by each worker in their specific tasks. This can be accomplished through training sessions and/or dynamic presentations.

Improve the infrastructure and/or equipment that are routinely used, which currently challenge the primary goal of protecting the professional's ergonomics. This will allow management to reevaluate supplier contracts with a focus on renewal. By applying proper ergonomics, the time required for each task could be reduced, promoting safer practices that ensure the integrity of both the patient and the healthcare professional.

Enable the occupational health department, responsible for this area, to make decisions based on evaluations and/or tests that allow for a more in-depth diagnosis. This would also encourage periodic evaluations of workers' well-being. Identify the service and/or worker with a high or medium risk score so that they can be further evaluated (clinical assessment) by the appropriate specialty.

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7] Conflict of interest: The authors declare that there is no conflict of interest.

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