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MUSCULOSKELETAL DISORDERS AND WORK STRESS IN THE HEALTH STAFF AT THE SULAB DAY HOSPITAL, QUITO-2023

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Abstract

Occupational health is a primary concern in work environments characterized by high levels of stress and physical demands. In this context, musculoskeletal disorders (MSDs) emerge as a relevant aspect due to their ability to impact the quality of life and work efficiency of employees. This study aimed to analyze the relationship between MSDs and job stress among healthcare personnel at the SULAB Day Hospital in Quito, Ecuador, during the year 2023. To this end, a quantitative study with a descriptive-correlational-cross-sectional design was conducted. MSDs were assessed using two instruments: the Nordic Questionnaire to detect musculoskeletal symptoms and their functional impact, and the REBA method to evaluate ergonomic risk. Additionally, the ILO-WHO Occupational Stress Survey was used to measure stress levels. The study revealed that 50.0% of healthcare workers experienced MSDs with a medium level of risk. Furthermore, 27.4% were perceived to have a high risk. Regarding job stress, attending physicians were the most affected, with 60.5% experiencing high stress levels and 13.2% experiencing very high levels. Registered nurses also showed considerable exposure, with 75.1% experiencing high stress and 21.4% experiencing very high stress levels. The findings underscore the need to implement stress management measures and their relationship with MSDs, as a significant correlation was found with a value of $p = .024 < .05$. This level of significance is reinforced by the correlation found (Rho = .287), indicating a positive and direct relationship, suggesting that as MSDs increase, so does job stress, and bilateral.

Keywords: *Nordic Questionnaire, Occupational Stress, Healthcare personnel, REBA, Musculoskeletal Disorders.*

Introduction

Occupational health is a crucial field of study in the medical and occupational field, and among its concerns are musculoskeletal disorders (MSDs) and work stress, these conditions are particularly relevant in health personnel, due to the demanding and physically demanding nature of their daily activities. For Regalado et al. (2023), MSDs represent the second leading cause of disability at work, accounting for between 40% and 50% of the costs of occupational diseases.

MSDs are defined as a series of conditions that compromise the musculoskeletal system including muscles, tendons, ligaments, joints, cartilage and bones, these conditions can arise from various factors, such as repetitive and inappropriate movements, stress, physical overload, inadequate ergonomic postures and accidents in the workplace (Gómez et al., 2022).

According to the World Health Organization (WHO), MSDs encompass more than 150 diseases and disorders that can affect the ability to move and perform daily activities, both in work environments and in daily life (WHO, 2021). On the other hand, Aponte et al. (2022) underline the prevalence of MSDs in work environments that require repetitive movements, handling heavy loads, and maintaining prolonged postures. This disorder is particularly acute in the healthcare sector, where staff not only frequently handle equipment and patients, but also face long working hours, making them especially vulnerable to the disorder.

Research on the prevalence of MSDs in workers has revealed significant findings in a variety of contexts. A study in Peru conducted among workers at a refinery in Lima showed a prevalence of 52.9% of MSDs, with low back pain being the most common condition, often related to herniated discs. (Torres, 2023)

From an epidemiological perspective, MSDs affect approximately 1710 million people worldwide, with low back pain being the most common, with a prevalence of 568 million individuals (WHO, 2021). On the other hand, Rojas et al. (2019) highlight that muscle pain is one of the main disorders in Latin America, with prevalences of 47.8% in El Salvador and 45.9% in Nicaragua. In contrast, low back pain is less common in Panama and Guatemala, with prevalences of 12.8% and 14.8%, respectively. In Ecuador, a safety and health survey in Quito conducted by Gómez et al. (2021) revealed that 60% of respondents experienced disorders related to repetitive motions. In addition, 50% reported pain in the lower back, 40% in the neck and 26% in the upper limbs.

Another critical factor that affects healthcare professionals is work-related stress. Buitrago et al. (2021) define it as the response to excessive pressures and demands at work. In the case of healthcare workers, they regularly face situations of high emotional demand, intense workloads, critical decisions and life-or-death circumstances, which exposes them to significant levels of stress. Therefore, it is considered a risk factor that disturbs the psychological state of the individual, causing emotional, cognitive, physiological and behavioral responses to work demands that exceed the available resources.

Work-related stress has established itself as a growing concern globally. A recent report by Mena (2023), reveals that 44% of the workers surveyed face stress in their work environments. According to the report by the National Autonomous University of Mexico ([UNAM], 2023), the COVID-19 pandemic has significantly exacerbated work-related stress in Latin America. In the case of Mexico, 75% of workers reported experiencing work stress. At the same time, in Ecuador, the Ministry of Public Health (MSP), in its 2021-2022 Survey of Working Conditions and Health, highlights that work-related stress indirectly contributes to the incidence of diseases in 22.5% of workers (MSP, 2021).

By observing the nature and magnitude of this problem, the present research focused on analyzing the relationship between MSDs and occupational stress in health professionals at the SULAB Day Hospital in Quito, which will allow the development and application of effective strategies that promote the health and well-being of the staff. To achieve this, specific objectives were established that include the identification of the sociodemographic and occupational characteristics of the personnel, the characterization of MSDs and the evaluation of the level of work stress and

consequently its correlation with MSDs.

The rationale for this research lies in the urgent need to protect the health and well-being of health workers, who are critical to the effective functioning of health care systems. In the context of the SULAB Day Hospital in Quito, it is important to study the relationship between MSDs and work-related stress to ensure the efficiency and quality of the health services offered. By analysing the interactions between these two factors, this study provides evidence that will inform the formulation of policies, programmes and practices aimed at improving working conditions, reducing morbidity among health workers and, consequently, increasing their job satisfaction.

Methodology

The analysis of the relationship between MSDs and work-related stress was developed under a quantitative approach with a of field, because the data were collected directly from health personnel in the aforementioned context. In addition, the scope of the objective made it necessary to develop a study (Arias Odon, 2012)of a descriptive-correlational-cross-sectional nature (Hernández Sampieri et al., 2014). This cross-cutting required collecting data at a specific time, without altering the variables of the environment, and the design was conducive both to examining the prevalence of diseases or conditions in a population, and to identifying associated factors, providing an efficient snapshot without the need for long-term follow-ups (Arévalo et al., 2020).

MSDs were approached by combining the results obtained by means of two instruments: the Nordic Questionnaire to detect musculoskeletal symptoms and their functional impact, and the REBA method to assess ergonomic risk. Additionally, the Occupational Stress Survey of the International Labor Organization (ILO) and the World Health Organization (WHO) was used to measure stress levels, essential for the systematic analysis of patterns and relationships between data. This data was collected from health personnel working at the SULAB Day Hospital, Quito, Ecuador.

In this context, the representative measure of MSDs was obtained by a linear combination of the representative numerical values of the Nordic Questionnaire and the REBA method. This integration provided a comprehensive assessment of MSDs that encompassed both the symptoms and impacts reported by workers and their exposure to ergonomic risk factors.

Representative measure from the Nordic Questionnaire

In epidemiological and occupational research, the use of the Nordic Questionnaire is considered an effective diagnostic tool that informs about the areas of the body compromised by working conditions (González, 2021). Therefore, it was useful "for the early detection of musculoskeletal symptoms" (Ibacache, 2020, p. 4).

Ibacache (2020) points out that this instrument consists of "a general questionnaire and three specific questionnaires that focus on the lower back, neck, and shoulders" (p. 4). While the particular one allows a more in-depth study on the occupational impact of these discomforts, the general one is designed for direct detection based on the respondent's perception of the presence of pain, discomfort or discomfort and its functional impact.

The Nordic Questionnaire used in this study consisted of three sections: (a) the first one in which problems were asked about the past 12 months; (b) the second where the employee was asked about the functional impact of the symptoms and to which he or she had to respond only if the employee indicated that he or she had a problem for each of the nine sections of the body, provided for in the questionnaire. In all cases, they refer to the obstacles they have had to overcome to carry out their work during the last 12 months; and (c) the third to determine if you have had these problems in the last 7 days.

The three sections just mentioned make a total of 27 items, all with "yes" or "no" answer options. Following the procedure used by Mina-Ortiz and Martínez-Padrón (2024), on this occasion, the value of "1" was assigned when the worker manifests having a problem in any part of the body: neck, shoulder, elbow, wrist, upper back, lower back, hip/legs, knees and ankles/feet; and the value of "0"

when he has no problems, which represents the absence of symptoms in that area of the body. This allowed the quantification of variables that, in their essence, are nominal in nature. It should be noted that before answering these three sections, the instrument asked each worker for a series of demographic factors and information on the number of hours they work in each week.

To determine the representative value of the presentation of musculoskeletal symptoms, the general questionnaire comprising three sections of items was taken into account, which was scored with 1 for each item and for each of the nine areas evaluated. In the case of neck, shoulder and lower back, seven items were considered, excluding the item on temporality, for which the value of 1 was assigned for each item, which belong to the specific questionnaire of the 3 areas mentioned above. The remaining six zones that do not have a specific questionnaire are not taken into account for the assignment of scores.

To represent the weighting of the body area by position and work area according to the various activities of the employees, a score was assigned depending on the most affected area according to the job position, relevant aspects of the literature of the body areas that present greater prevalence were taken into account for the weighting.

In a section by Bouzas et al. (2019), MSDs associated with surgical practice were analyzed, identifying the most affected structures and their prevalence. It was found that 53% of cases are related to the cervical region. In addition, activities such as load handling and awkward postures increased the risk of lower back pain, with a prevalence of 51%. Wrist and hand pain affected 33% of surgeons, while 31% reported shoulder pain and 12.3% experienced arm/forearm pain and 7% lower limb pain. The nurse instrumentalist is forced to adopt forced postures for prolonged periods, which increases muscle fatigue, especially in the lower back, neck and lower limbs (Benito & Gutiérrez, 2019).

In the study by Barragán et al. (2023) in the clinical area, it is observed that the discomfort presented in the last 12 months in the medical staff was in the shoulder, which was the most susceptible to generating a TME, followed by the knee, lower back, to a lesser extent hand/wrist, neck, ankle/toes and fingers. According to Fernandez et al. (2014) in a study of MSDs in nursing assistants in the hospitalization area of a care center for the elderly, it was reported that the most affected areas are the upper and lower back with 81.63% each, followed by the neck with 79.59%, the left shoulder with 74.46% and knees with 25%.

In the outpatient setting, clinicians often adopt postures that involve leaning forward and extending their neck to access clinical screening instruments. Holding this position can cause discomfort in the neck, upper back, and symptoms of numbness in the fingers and hands. Also, resting your elbows on hard surfaces can increase pain and spread to your shoulders (Ruiz, 2019). On the other hand, nursing graduates and auxiliaries carry out activities such as complying with asepsis protocols, antisepsis, carrying out nursing care processes, it was observed that the activity they perform can cause discomfort at the level of the neck, elbow and wrists and less frequently in the shoulder, back and lower limbs. (American Association of Nurse Practitioners [AANP], 2022)

In a study by Cabanilla et al. (2020) of the ergonomic risks in nursing staff in the sterilization center area, it was reported that 29% have pain in the upper back, lower back and shoulders, 13% have pain in the arms and neck and only 4% have pain in the legs. which indicates that all these workers are exposed to muscle problems. It should be taken into account that nursing graduates perform the same functions in the area of central sterilization, so a similar weighting will be taken into account.

With the aforementioned literature, the weighting of each area of the body was carried out according to the frequency of presentation, consequently, 1 point was assigned to the least affected area, 2 points to the moderately affected area and 3 points to the most affected area as can be seen in Table 1.

Table 1 *Weighting of discomfort by area of the body in relation to the position and the work area*

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
Workspace	Neck	Shoulder	Elbow	Wrist	High back	Lower back	Hip/Legs	Knees	Ankles/feet
Resident Physician									
Operating room and postoperative	3	2	2	3	1	3	1	1	2
Hospitalization	2	3	1	2	1	3	1	3	2
Outpatient consultation	3	2	2	3	3	2	1	1	1
Attending Physician									
Operating room and postoperative	3	2	2	3	1	3	1	1	2
Hospitalization	2	3	1	2	1	3	1	3	2
Outpatient consultation	3	2	2	3	3	2	1	1	1
Bachelor of Science in Nursing									
Operating room and postoperative	3	1	1	2	1	3	2	2	3
Hospitalization	3	2	2	1	3	3	1	2	1
Outpatient consultation	3	2	3	3	1	2	1	1	2
Sterilization Center	2	3	2	2	3	3	1	1	1
Nursing Assistant									
Operating room and postoperative	3	1	1	2	1	3	2	2	3
Hospitalization	3	3	2	2	1	3	1	1	2
Outpatient consultation	1	1	2	3	1	2	3	2	3
Sterilization Center	2	3	2	2	3	3	1	1	1

Note. Weighting according to the literature reviewed. Source: Own elaboration

The expression that made it possible to determine the representative value is given by the following expression:

$$\#\boldsymbol{CNOR} = \boldsymbol{n1} \times \boldsymbol{z1} + \boldsymbol{n2} \times \boldsymbol{z2} + \boldsymbol{n3} \times \boldsymbol{z3} + \boldsymbol{n4} \times \boldsymbol{z4} + \boldsymbol{n5} \times \boldsymbol{z5} + \boldsymbol{n6} \times \boldsymbol{z6} + \boldsymbol{n7} \times \boldsymbol{z7} + \boldsymbol{n8} \times \boldsymbol{z8} + \boldsymbol{n9} \times \boldsymbol{z9}$$

Where:

BY ITS OIRIGINAL LANGUAGE SPANISH

$n1 = suma\ del\ cuestionario\ nórdico\ zona\ cuello$ $z1 = ponderación\ zona\ cuello$

$n2 = suma\ del\ cuestionario\ nórdico\ zona\ hombro$ $z2 = ponderación\ zona\ hombro$

$n3 = suma\ del\ cuestionario\ nórdico\ zona\ codo$ $z3 = ponderación\ zona\ codo$

$n4 = suma\ del\ cuestionario\ nórdico\ zona\ muñeca$ $z4 = ponderación\ zona\ muñeca$

$n5 = suma\ del\ cuestionario\ nórdico\ zona\ espalda\ alta$ $z5 = ponderación\ zona\ espalda\ alta$

$n6 = suma\ del\ cuestionario\ nórdico\ zona\ espalda\ baja$ $z6 = ponderación\ zona\ espalda\ baja$

$n7 = suma\ del\ cuestionario\ nórdico\ zona\ cadera/piernas$ $z7 = ponderación\ zona\ cadera/piernas$

$n8 = suma\ del\ cuestionario\ nórdico\ rodillas$ $z8 = ponderación\ zona\ rodillas$

$n9 = suma\ del\ cuestionario\ nórdico\ zona\ tobillos/pies$ $z9 = ponderación\ zona\ tobillos/pies$

Once the representative measure of the symptomatology and functional impact in each surveyed worker was obtained, the postures were analyzed using the REBA method. To this end, the angles in the postures of the employees were measured and the corresponding scores of the method were established. To do this, the Ergoniza software, developed by Ergonauts of the Polytechnic University of Valencia (2024), was used.

Representative measurement from the REBA Method

The use of the REBA Method materialized in the evaluation of ergonomic risks associated with various work tasks, considering factors such as posture, workload, repetitive movements, and other elements that affect the musculoskeletal health of workers (Diego et al., 2020).

The method allows for the joint analysis of the individual positions adopted. It is divided into two groups, group A evaluated trunk, neck and legs, while group B evaluated the upper limbs of the body (arm, forearm, wrist). Once the scores of the groups were obtained, the overall scores for each group were calculated. The overall scores of groups A and B consider the worker's posture. The forces exerted during its adoption to modify the score of Group A were assessed, and the type of object grip to modify the score of Group B. From these two scores, and by cross-referencing data, the C score was obtained, to which the type of muscle activity carried out in the task was added, and the final score was obtained in which the different levels of performance on the job are proposed, as can be seen in Table 2 (Diego et al., 2020).

Table 2 *Levels of action according to the final score obtained from the REBA method*

Punctuation	Level	Risk	Performance
1	0	Invaluable	No action necessary
2 to 3	1	Low	Action may be necessary
4 to 7	2	Middle	Action is needed
8 to 10	3	High	Action is needed as soon as possible
11 to 15	4	Very high	Action is needed immediately

Note. Data obtained from the Ergoniza software, developed by Ergonauts of the Polytechnic University of Valencia (2024)

Representative measure of the MST

After quantifying the representative results of each of the two instruments just mentioned, the representative value of the MSD variable was determined, which was subsequently correlated with the numerical values obtained from the Occupational Stress level variable . In this sense, the expression used to determine the measure of the MSR of each worker was as follows:

$$\#\boldsymbol{TME} = \#\boldsymbol{CNOR} + \#\boldsymbol{MREBA}$$

Where:

#TME = Representative Number of Musculoskeletal Disorder

#CNOR = Representative number of the Nordic Questionnaire

#MREBA= REBA method representative number

Once the number representing the TME was obtained, the process was carried out using the SPSS version 27 statistical software to calculate the quartiles of the TME variable with the minimum, maximum, mean and with two cut-off points, the first cut in the 25th percentile that is equal to 46 and the second cut in the 75th percentile that is equal to 59. with which three categories of SMT level were obtained, the low risk for a score less than or equal to 46, the medium risk of 47-59 and the high risk for a score greater than or equal to 60, with which the level of SMD is obtained.

Representative measure of Work Stress

The instrument used was the ILO-WHO Occupational Stress Survey. The scale is authored by the ILO-WHO (1989); it was supported by Ivancevich and Matteson. It evaluates the level of work stress, consists of 25 items organized into 7 dimensions: organizational climate, organizational structure, organizational territory, technology, influence of the leader, lack of cohesion and support of the group. Each dimension presents 7 alternatives with answers ranging from score from 1 to 7, being 1 (never), 2 (rarely), 3 (occasionally), 4 (sometimes), 5 (frequently), 6 (usually), and 7 (always). From which a number is obtained that corresponds to the level of risk in which each participant is, as can be seen in Table 3. (Sánchez, 2018)

Table 3*Work stress levels*

Punctuation	Indicator	Level	Performance
< 90	1	Low	There are no symptoms of stress
91-117	2	Middle	Alarm phase, identifying factors
118-153	3	High	Awareness phase, acting
> 154	4	Very high	Exhaustion phase, health consequences

Note. Data retrieved from the ILO-WHO. Source: Own elaboration

It is noted that each subject of the sample studied corresponds to an ordered pair, where the first is the level of the MSD and the second is the level of work stress (NEL). This census sample was made up of 62 health workers who work at the SULAB Day Hospital, Quito, Ecuador and that number of cases corresponds precisely to the population of health workers who worked in that entity at the end of 2023.

Statistical Analysis Techniques

To process all the results obtained through the application of the 3 instruments used, it was necessary to develop an Excel database, a spreadsheet of the Microsoft Corporation office suite (2024). This data, organized and adjusted to numerical values, was migrated to IBM's SPSS 27 statistical software required to perform the necessary statistical analyses (George & Malley, 2022). These included a descriptive analysis of the data based on frequency distributions and percentage referents. Likewise, a correlational analysis of Spearman's Rho was performed, a non-parametric statistical that allowed evaluating both the direction and the strength of the relationship between MSDs and occupational stress of health personnel at the SULAB Day Hospital, Quito, Ecuador.

The decision to use Spearman's Rho correlation coefficient was based on the results of a normality test performed in SPSS for each of the data series corresponding to the two correlated variables. In this case, the Kolmogorov-Smirnov goodness of fit test was used, because the sample was larger than 50 cases (Luzuriaga et al., 2023). When using this test, it was obtained that the data of the MSD level and the level of Work Stress do not follow a normal distribution, since the significance value (p) is less than .001 for each of the variables, indicating strong evidence against the hypothesis of normality.

Results and Discussion

In the field of occupational health, MSDs and work-related stress are two issues of great concern, especially among health personnel, due to the physical and emotional demands inherent in their profession. To investigate the relationship between these two critical factors, a study was carried out at the SULAB Day Hospital using three specific assessment tools.

Table 4 *Percentage of sociodemographic and employment data*

Sex		
	N	%
Female	33	53.2
Male	29	46.8
Age		
	N	%
20-25 years	9	14.5
26-35 years	19	30.6
36-45 years old	22	35.5
46-65 years old	12	19.4
Marital status		
	N	%
Married (A)	38	61.3
Single	13	21.0
Divorced	7	11.3
Common-law marriage	4	6.5
Charge		
	N	%
Resident physician	4	6.5
Bachelor of Nursing	14	22.6
Attending physician	40	64.5
Nursing Assistant	4	6.5
Work Area		
	N	%
Sterilization Center	3	4.8%
Hospitalization	12	19.4
Outpatient Consultation	9	14.5
Operating room and postoperative	38	61.3
Months you've been doing the same type of work		
	N	%
0-3 months	11	17.7
3-6 months	4	6.5
6-12 months	1	1.6
1-2 years	40	64.5
More than 2 years	6	9.7
Hours of work in the week		
	N	%
30-35 hours	13	21.0
35-40 hours	7	11.3
40-45 hours	3	4.8
45-50 hours	39	62.9

Note. Data obtained from the Nordic Questionnaire and retrieved from the SPSS data. Source: Authors, where N = Number of workers.

The results of the Nordic Questionnaire showed the descriptive analysis of the 62 collaborators, reflected in table 4, where it was evidenced that; the female sex predominated among the respondents, representing 53.2% of the total. The most frequent age group was 36 to 45 years, covering 35.5% of the sample. As for marital status, the majority are married, with 61.3%. In terms of occupation, the

most common position was that of attending physician, with 64.5%. Regarding the work area, 61.3% of the participants worked in the operating room and postoperatively. In terms of work experience, most had been working between 1 and 2 years, with 64.5%. And in weekly working hours, 45 to 50-hour days predominated, with 62.9%.

In a study similar to this research, it coincides with Valecillo et al. (2019), which focused on examining the relationship between musculoskeletal symptoms and stress in nursing staff. The study included a total of 127 collaborators, which revealed that 89.0% of the sample corresponded to the female sex, 75.0% with a mean age of 35.9± 8.01 years with a range of 25 to 61 years and average seniority of 6.7 ± 4.2 years.

Table 5 *Percentage of workers with symptoms according to position*

Body area									
Charge	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9
Resident Physician	75.0	50.0	56.1	75.0	50.0	75.0	0.0	56.1	56.1
Bachelor of Science in Nursing	75.0	71.4	71.4	71.4	71.4	57.1	71.4	57.1	64.3
Attending Physician	70.0	70.0	82.5	75.0	67.5	87.5	62.5	55.0	70.0
Nursing Assistant	56.1	75.0	75.0	75.0	100.0	75.0	50.0	100.0	50.0

Note. Data obtained from the Nordic Questionnaire and retrieved from the SPSS data. Source: Authors, where Z1=Neck; Z2=Shoulders; Z3=Elbows; Z4=Dolls; Z5=High back; Z6=Lower back; Z7=Hips and legs; Z8=Knees; Z9=Ankles and feet.

Table 5 shows the musculoskeletal symptoms according to the body area and the position of the personnel, which revealed different patterns in the manifestation of these discomforts, in general, a high presentation of discomfort is observed in areas such as the neck, shoulders, elbows, lower back and wrists in all the groups studied. An important fact was observed that in the wrist area there is similar representation, with 75.0% among resident physicians, attending physicians, nursing assistants and 71.4% among nursing graduates.

The treating physicians showed an alteration in the lower back with 87.5%, followed by elbows with 82.5% and wrists with 75%. Resident physicians present manifestations in the area of the lower back, neck and wrists with 75.0% for each area. On the other hand, nursing graduates present discomfort in the neck with 75%, shoulder, elbow, wrist with 71.4% for each area and finally nursing assistants manifested discomfort in the upper back and knee with 100.0% for each, remembering that the sample is 5 participants for this group. These results indicate the importance of considering the specific demands of each job when designing preventive interventions.

Likewise, this study coincides with the research carried out by Valecillo et al. (2019) in relation to musculoskeletal symptoms, 67.61% showed alterations in the neck area, and 56.19% in the lower back. On the other hand, Barragán et al. (2023) agree with certain findings, where they found that the dorsal region was the most affected with 24.5%, followed by the lumbar region with 17.5% and the joints of both knees with 13.5%. In the study by Zamora et al. (2020), they found that 93.1% of participants reported experiencing musculoskeletal pain to some extent, with the majority with 75.9% experiencing pain in more than one area of the body. The most common places of pain were the lumbar area with 65.1%, followed by the dorsal region with 47.2% and the neck with 37.2%, this research coincides with these manifestations were linked to uncomfortable postures, physical exertion and repetitive movements, factors that contributed to the appearance of musculoskeletal disorders of biomechanical origin.

Table 6 *Example of obtaining the representative number of the Nordic Questionnaire*

Resident Physician 32/ Operating room and postoperative	*Z1*	*Z2*	*Z3*	*Z4*	*Z5*	*Z6*	*Z7*	*Z8*	*Z9*
Nordic Quiz Score (n)	6	0	1	1	1	5	0	0	0
Body area weighting (z)	3	2	2	3	1	3	1	1	2
Multiplication (n x z)	18	0	2	3	1	15	0	0	0
PT, sum (n1xz1) + (n2xz2) +.....	32								

Note. Data obtained from the Nordic Questionnaire and retrieved from the SPSS data. Source: Authors, where Z1=Neck; Z2=Shoulders; Z3=Elbows; Z4=Dolls; Z5=High back; Z6=Lower back; Z7=Hips and legs; Z8=Knees; Z9=Ankles and feet; PT=Total score.

Table 6 shows an example of the calculation of the representative number of the Nordic Questionnaire of a study participant, a resident physician in the operating room and postoperative area, in which the final score is 32, which is obtained by adding the multiplication of the Nordic questionnaire score (n) by the weighting of the zone (z) of each of the 9 body areas.

For the evaluation of the postures, the REBA instrument was used, punctuated by the Ergoniza software, where the 62 participants were taken into account. Figure 2 shows the process for evaluating this method.

Figure 1 *Posture evaluation in a surgeon at the SULAB Day Hospital*

Note. Photo taken of a surgeon at the SULAB Day Hospital performing umbilical hernia surgery. Angle measurement data taken from the REBA report of the Ergonauts Software. https://www.ergonautas.upv.es/ergoniza/app/index.html

Table 7 *Percentage of ergonomic risk of the REBA method*

Ergonomic risk	N	%
Middle	20	32.3
High	32	51.7
Very high	10	16.0
Total	62	100.0

Note. Data retrieved from Ergonauts software and SPSS data. Source: Authors' elaboration, where N = number of workers.

After obtaining the scores using the Ergoniza software, the data were analyzed using the SPSS software, found in Table 7. The results revealed that the ergonomic risk of the participants was distributed as follows: 16.0% rated it as very high, 51.7% as high and 32.3% considered it medium. These figures reflect an important presentation of the elevated risk among participants.

The above results are consistent with the report of Bouzas et al. (2019) who identified that in surgical practice, cases that present discomfort in the cervical region are the cause of contractures due to forced

postures of the neck, as a result of work in the operating room. In addition, activities such as load handling and awkward postures increased the risk of lower back pain. Ruiz (2019) suggested specific guidelines to improve ergonomics in the workplaces of medical personnel, which could contribute positively to the prevention of musculoskeletal disorders

To obtain a comprehensive understanding of MSDs, the scores obtained from the Nordic questionnaire, which assesses the symptoms related to these disorders, were added together with the REBA method. The combination of these tools allowed an approximation of the presence and severity of MSDs, considering both the symptoms reported by the individuals and the relevant postural factors in their work environment.

Table 8 *Percentage of TME level by position*

MSD Level	Low Risk		Medium Risk		High Risk	
Charge	N	%	N	%	N	%
Resident Physician	3	60.0	2	40.0	0	0.0
Bachelor of Nursing	4	28.6	6	42.9	4	28.6
Attending Physician	3	7.9	22	57.9	13	34.2
Nursing Assistant	4	80.0	1	20.0	0	0.0
Total	14	22.6	31	50.0	17	27.4

Note. Data obtained from Nordic questionnaire and retrieved from SPSS data. Source: Authors' elaboration, where N = number of workers.

Table 8 shows the distribution of the risk of musculoskeletal disorders among a sample of 62 participants. It is evident that the majority of participants, approximately 50.0%, are classified in the medium risk category. This indicates a moderate concern in terms of musculoskeletal risk. Meanwhile, 27.4% of the participants are in the high-risk category, suggesting that a proportion of the sample is exposed to risk factors that are potentially harmful to musculoskeletal health. However, it is encouraging to note that a percentage of 22.6% are in the low-risk category, indicating that there are some participants who are less exposed to risk factors or who have effective prevention measures in their workplace.

In the continuation of this study, the results of the level of stress perceived by the 62 participants in relation to MSDs were evidenced.

Table 9 *Percentage of stress level by job title*

Stress level	Low Risk		Medium Risk		High Risk		Very high risk		Total	
Charge	N	%	N	%	N	%	N	%	N	%
Resident Physician	0	0.0	0	0.0	4	80.0	1	20.0	5	100.0
Bachelor of Nursing	0	0.0	1	7.1	10	75.1	3	21.4	15	100.0
Attending Physician	0	0.0	10	26.3	23	60.5	5	13.2	38	100.0
Nursing Assistant	1	20.0	0	0.0	3	60.0	1	20.0	5	100.0
Total	1	1.6	11	17.8	40	64.5	10	16.1	62	100.0

Note. Data obtained from the occupational stress questionnaire and retrieved from the SPSS data. Source: Authors' elaboration, where N = number of workers.

Table 9 shows that those most affected by work-related stress are treating physicians, representing 60.5% of cases in the "high" category and 13.2% in the "very high" category. Nursing graduates also have a high exposure, with 75.1% in the "high" category and 21.4% in the "very high" category. In contrast, cases of work stress are reported among resident physicians and nursing assistants in the "very high" category with 20%, remembering that in both groups there are 5 collaborators within the

study. These results suggest that treating physicians and nursing graduates are the groups most affected by high and very high levels of work-related stress.
Regarding the results of the present research, which show the presence of high levels of stress, especially among resident physicians, treating physicians and nursing assistants. This is consistent with research by Mena (2023) that found high levels of stress among health personnel, although rates may vary slightly between studies. Likewise, in the study by Montoya and González (2022), it was reported that with a high level of stress, there is a lower quality of life in physical health.

Relational analysis

To establish the correlation between the level of MSDs and the level of work stress, Spearman's Rho statistic was used, which is a non-parametric measure of the relationship between two variables, and is used for data that do not follow a normal distribution, as is the case of this study. Spearman's Rho correlation coefficient varies between -1 and 1. A value of 1 indicates a positive perfect correlation, -1 indicates a negative perfect correlation, and 0 indicates no correlation (Anderson et al., 1999).

Table 10 *Data to determine Spearman's correlation*

	TME Level				Work stress level				
Score	Low (1)	Middle (2)	High (3)	Total	Low (1)	Middle (2)	High (3)	Very high (4)	Total
Charge	N	N	N	N	N	N	N	N	N
Resident Physician	2	3	0	5	0	0	4	1	5
Bachelor of Nursing	4	6	4	14	0	1	10	3	14
Attending Physician	5	22	11	38	0	10	23	5	38
Nursing Assistant	4	1	0	5	1	0	3	1	5
Total	15	32	15	62	1	11	40	10	62

Note. Data retrieved from the SPSS data. Source: Authors' elaboration, where N = number of workers.

Table 10 shows the data of the 62 study participants, ordered pairs of MSD level and work stress level that were correlated.

Table 11 *Spearman's Rho correlation between MSDs and Work Stress*

Spearman's Rho	Work stress level		
	Rho	p	N
TME Level	.287*	.024	62

Note. Data retrieved from the SPSS data. Source: Authors. Where Rho = Spearman's correlation coefficient, *= The correlation is significant at the level .01 (bilateral), p = significance, N = number of workers.

Regarding the relationship between the MSD level and the level of work stress, Table 11 indicates a significant correlation, with a p-value less than .05 (.024). In addition, the degree of significance reinforces a positive correlation (Rho= .287), which denotes a positive and low relationship, indicating that as MSDs increase, so does work stress.
It can be seen that what was found in this study coincides with the research of Valecillo et al. (2019) and Carbajal (2022) who found a significant correlation between musculoskeletal symptoms and occupational stress in nursing staff and in health personnel in charge of patient care, respectively, which coincides with other reports and suggests the design of individual and organizational strategies in order to reduce and prevent these occupational risk factors.
On the other hand, the research carried out by Montoya and González (2022), explored the

relationship between musculoskeletal conditions, stress and their impact on quality of life. 55 individuals participated in this descriptive study. The findings revealed an inversely proportional correlation between musculoskeletal alterations and two fundamental aspects of quality of life: physical health (correlation of -.385) and environment (correlation of -.304). The research carried out by Arias and Chala (2021) focused on examining the relationship between musculoskeletal disorders and stress in teachers in the health area, in which a relationship between the two variables was not found, because they were not exposed to psychological stress.

Conclusions

Based on the results obtained in this study, several important findings stand out. A high occurrence of musculoskeletal symptoms was observed among the different occupational positions, in general a high manifestation of discomfort is observed in areas such as the neck, shoulders, elbows, lower back and wrists. In terms of affected areas, the lower back is observed to be especially problematic for treating physicians and resident physicians, while neck problems predominantly affect nursing graduates and resident physicians. In addition, there is evidence of a high manifestation of problems in the upper back and knees in nursing assistants. These results indicate the importance of considering the specific demands of each job when designing preventive interventions.

Another important point is the level of MSDs, in which 50.0% of the participants were classified as medium risk level and 27.4% with a high risk of developing MSDs. This phenomenon is especially relevant in the healthcare work context, where exposure to prolonged postures and repetitive movements can contribute to the onset of musculoskeletal disorders. This finding highlights the need to implement effective prevention measures to reduce ergonomic workload and promote appropriate ergonomic practices in the healthcare work environment.

In addition, in terms of occupational stress, treating physicians emerge as the most affected group, with a significant 60.5% experiencing high levels of stress and a notable 13.2% reporting very high levels. Nursing graduates also show considerable exposure, with 75.1% and 21.4% in the high and very high stress categories respectively. These findings underscore the importance of implementing stress management and support measures, especially among these most vulnerable professional groups.

Finally, a significant positive and direct correlation between MSDs and work stress was evidenced, suggesting a relationship between these two factors. This finding underscores the importance of addressing both ergonomic and psychosocial risks in the workplace to promote the health and well-being of health care workers.

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