



Short article

# Biomechanical risk associated with musculoskeletal disorders in surgical instrumentators workers who work in sterilization centers

## Riesgo biomecánico asociado a trastornos musculoesqueléticos en instrumentadores quirúrgicos que laboran en centrales de esterilización

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### ABSTRACT

#### Keywords:

Biomechanical risk;  
Musculoskeletal disorder;  
Surgical instrument operator;  
Sterilization center; Risk matrix; Risk assessment.

**Introduction:** Biomechanical risks are applications of repetitive moves, forces and postures that an individual adopts when carrying out a specific activity with the probability of suffering an incident, accident or occupational disease. **Objective:** To identify the biomechanical risks associated with musculoskeletal disorders in surgical instrumentators who work in sterilization centers in 5 health institutions in Barranquilla. **Method:** A descriptive study was conducted with participation of 29 surgical instrumentators answering Kourinka's Nordic questionnaire, based on corresponding ethical principles. **Results:** 35% of those surveyed reported discomfort in the wrist, 32% discomfort in the dorsolumbar region, 21% experienced discomfort in the neck, and 14% experienced some type of discomfort or pain in the elbow or forearm. The danger and risk assessment matrix in two of the five institutions showed that the risk is very high in the processes of reception, preparation, packaging, sterilization, storage and delivery. **Conclusions:** The risks identified were: cargo handling affecting the lumbar area, forced postures in packaging and sterilization activities generating discomfort in the wrist. Diseases such as epicondylitis, foot pain, telangiectasia and carpal tunnel syndrome were evident.

### RESUMEN

#### Palabras clave:

riesgo biomecánico; trastorno músculo esquelético; instrumentador quirúrgico; central de esterilización; matriz de riesgo; valoración de riesgo.

**Introducción:** los riesgos biomecánicos son aplicaciones de movimiento repetitivos, fuerzas y posturas que adopta un individuo al realizar una actividad específica, existiendo la probabilidad de sufrir un incidente, accidente o enfermedad laboral. **Objetivo:** identificar los riesgos biomecánicos asociados a trastornos musculoesqueléticos en instrumentadores quirúrgico que laboran en centrales de esterilización en 5 instituciones de salud de Barranquilla. **Método:** se implementó un estudio descriptivo en el se invitó a participar a 29 instrumentadores que respondieron el cuestionario nórdico de Kourinka, con base en principios éticos correspondientes. **Resultados:** 35% de los encuestados manifestó molestias en la muñeca, el 32% molestias en la región dorso lumbar, el 21% experimentó molestias en el cuello, y el 14% algún tipo de molestia o dolor en el codo o antebrazo. La matriz de peligro y valoración de riesgo en dos de las cinco instituciones mostró que el riesgo es muy alto en los procesos de recepción, preparación,

empaque, esterilización, almacenaje y entrega **Conclusiones:** los riesgos identificados fueron: la manipulación de carga afectando a la zona lumbar, posturas forzadas en actividades de empaque y esterilización generando molestias en la muñeca. Se evidenció enfermedades como: epicondilitis, dolor en los pies, telangiectasia y síndrome del túnel de carpio.

## INTRODUCTION

Musculoskeletal disorders (MSD) are injuries to the bones, muscles, tendons, joints, and other tissues of the body<sup>1</sup>. According to the World Health Organization, 1.71 billion people suffer from them regardless of age, diagnosis, or occupation<sup>2</sup>. Studies in Europe indicate that the prevalence of neck MSDs is 94.1% and lumbar zone 88.2% due to the conditions of the jobs, seniority in the company, and ergonomic variables<sup>3</sup>. In Colombia, the population of health workers suffers from musculoskeletal conditions of the upper limbs. Likewise, the disabilities carried out by MSD exceeded 908 requests related to pathologies due to exposure to biomechanical risk factors<sup>4</sup>.

Exposure to biomechanical risks related to prolonged standing, load manipulation, and repetitive movements leads to the appearance of MSD<sup>5,6</sup>. The workers of the Health Service Providing Institutions (HSPV) who carry out work in the sterilization center (SC) are exposed to different occupational risks such as biological, chemical (sterilizing gases), physical (noise, lighting), psychosocial, and biomechanical; this last risk corresponds to those external elements that act on the worker during the execution of their functions within the company, that is, the lack of identification of biomechanical risks leads to cases of MSD that significantly impact the worker, employer and employee in the indicators of absenteeism from work, economic losses for the organization, and the deterioration of the worker's health and quality of life<sup>7</sup>.

Surgical instruments are professionals who work in the EC; they are exposed to a high risk of MSD due to the repetitive and demanding nature of their work. These disorders can cause pain, disability, and loss of productivity in SC processes. One of the main knowledge gaps in the field of MSD for these professionals is the need for more data on their prevalence and severity. This research seeks to provide new knowledge in safety and health by identifying biomechanical risks and musculoskeletal disorders in surgical instrument workers who work in

sterilization centers in health institutions in Barranquilla, Colombia.

## METHOD

### Kind of investigation

This is a descriptive study.

### Participants

All surgical instrument workers who work in the SC of five HSPV of Barranquilla participated. As inclusion criteria, workers linked to the company, hired to perform functions in the SC, and those who wished to participate voluntarily by signing the informed consent were considered. Participants with musculoskeletal disorders of congenital or acquired origin, workers on maternity leave, on vacation, and participants who did not wholly complete the instrument were excluded.

### Instruments

The Kourinka Nordic Questionnaire was used to screen and detect signs and symptoms in workers. According to González, this questionnaire has validity tests and Cronbach's alpha reliability of 0.86 for the complete scale, which indicates consistency and coherence in measuring the construct<sup>8</sup>. Likewise, it has been used in different parts of Colombia, showing stable and reliable results.

### Statistical analysis

The information was processed by preparing a data consolidation matrix in Microsoft Excel®, which would later be analyzed with univariate descriptive statistics.

### Statement on ethical aspects

This research considered the ethical aspects issued in Resolution 008430 of 1993, which establishes the scientific, technical, and administrative standards for health research<sup>9</sup>, and the Declaration of Helsinki of the World Medical Association, which is a proposed

ethical principle for medical research involving human subjects, including research on identifiable human material and information<sup>10</sup> and the Singapore Declaration on Scientific Research Integrity. Likewise, it had the evaluation of the scientific committee and the endorsement of the ethics and bioethics committee of the Universidad Libre section of Barranquilla, Colombia.

**Table 1.** Sociodemographic characterization.

Variables	Frequency	%
<b>Sex</b>		
Women	29	100
<b>Age</b>		
20-29	1	3.5
30-39	14	48.3
40-49	8	27.6
50-59	4	13.8
60 or more years	2	6.9
<b>Work Locations</b>		
Headquarters 1	4	13.8
Headquarters 2	7	24.1
Headquarters 3	8	27.6
Headquarters 4	4	13.8
Headquarters 5	6	20.7
<b>Time worked</b>		
One year and three months	25	86.2
Nine months	1	3.5
11 months	1	3.5
Five months	1	3.5
Three months	1	3.5

## RESULTS

A total of 29 female surgical instruments (women) participated in this study; 48.3% were between 30 and 39 years old, followed by 27.6% between 40 and 49 years old. Regarding the locations where the instrumenters work, location 3 represents 27.6%, followed by location 2 with 24.1%. 86.2% have been employed for one year and three months (Table 1).

Twenty-one percent of the participants experienced neck discomfort; of this percentage, only 3.6% needed to change jobs. 17.9% have reported discomfort during the last 12 months, attributed to poor posture, repetitive movements, and load handling.

Almost 11% of the study population experiences shoulder discomfort, and none have been forced to change jobs. However, 10.7% have experienced discomfort in the last 12 months, attributed to physical exertion and carrying loads. 32.1% of the subjects have manifested some discomfort in the dorsolumbar area, 28.6% presented these discomforts during the last 12 months, and 10.7% manifested it during the last seven days. These discomforts are attributed to poor posture, repetitive movements, load handling, standing position, and temperature changes.

Fourteen percent had experienced discomfort in the elbow or forearm without needing to change jobs. 17.9% of the participants have reported discomfort during the last 12 months, and only 3.6% have received some treatment during the last 12 months. 35.7% of the instrument workers have had discomfort in their wrist or hand, and 32.1% of them had this during the last 12 months. These discomforts are attributed to handling the autoclave, lifting loads, and temperature changes.

Regarding the hip and lower limbs, the participants reported discomfort in the hip (3.6%), knee (3.6%), foot (3.6%), and leg (10.7%). None of the participants had to change jobs due to these discomforts, except 3.6% due to foot discomfort. It is striking that the ankle was not reported to have any discomfort within the regions. 7.1% had knee discomfort in the last 12 months, and 10.7% had leg discomfort. 3.6% have received treatment for their knees in the last 12 months. These discomforts are attributed to poor posture and prolonged standing.

The results obtained regarding receipt of treatment for discomfort in the last 12 months, the intensity of pain, and the onset of symptoms (Table 2).

**Table 2.** MSD distribution by body region, time, and risk factors attribute discomfort.

Body region	Frequency	Have you had any discomfort?	Have you needed to change jobs?	Have you had any discomfort in the last 12 months?	Have you received treatment for these complaints in the last 12 months?	Have you had any discomfort in the last 12 months?	mean pain intensity (SD)	For how long?			To what do you attribute these discomforts?
								< 2 months	2-3 months	> 3 months	
Neck	%	6 21.4	1 3.6	5 17.9	2 7.1	2 7.1	2.2 (1.3)	5	1		Poor posture, repetitive movements, load handling
Shoulder	%	3 10.7	0	3 10.7	1 3.6	2 7.1	4 (1)	1	1	1	Physical effort, load transportation
Dorsal or lumbar	%	9 32.1	0	8 28.6	0	3 10.7	3 (1.2)	3	4	1	Poor posture, repetitive movements, load handling, standing, and temperature changes.
Elbow or forearm	%	4 14.3	0	5 17.9	1 3.6	2 7.1	2.5 (0.6)	2	1	1	Critical care exposure, lifting load, temperature changes
Wrist or hand	%	10 35.7	0	9 32.1	1 3.6	4 14.3	2 (0.9)	5	2	3	Critical care exposure, lifting, temperature changes, repetitive movements
Knee	%	1 3.6	0	2 7.1	1 3.6	0	0 (0)	1			
Foot	%	1 3.6	1 3.6	0	0	0	3 (0)	1			Bad posture
Ankle	%	0	0	0	0	0	0 (0)				
Leg	%	3 10.7	0	3 10.7	0	2 7.1	3.3 (2.1)	1			Standing time
Hip	%	1 3.6	0	0	0	0	0 (0)				

## DISCUSSION

The behavior of the sociodemographic variables shows that the concentration of professionals studied is in the intermediate age group, which allows us to identify that it is a significantly young population but that at the same time presents symptoms or discomforts attributable to risk factors, biomechanics-specific to professional practice that, in the future, could affect their state of health and work functionality.

The findings of this research are compared and discussed with national and international studies in the nursing population due to the scarcity of specific studies on surgical instrumentation. The above indicates that, as this is one of the first studies in Colombia that generates evidence regarding the phenomenon of biomechanical risks in surgical instruments, it constitutes a strength that serves as a

background and valuable input for future research within health institutions. Additionally, according to Girón *et al*<sup>11</sup>, the current study expands the possibility of generating theoretical evidence that serves as a reference to delve deeper into the work context of the surgical instrument, their health and their work safety for a better positioning and growth of the profession.

The discomfort associated with MSD identified in the neck, although not in the same proportion, is consistent with what Rosario *et al*<sup>12</sup> reported, who express that female workers are exposed to presenting discomfort in the neck throughout the entire workday in the neck area by 71.7%. On the other hand, discomfort in the dorsolumbar area confirms what Girón *et al*<sup>11</sup> found, which affirms that occupational low back pain is included as an occupational disease in the profession of Surgical Instruments. The results of the studies by Quispe *et*

*al*<sup>13</sup>, Velasco<sup>14</sup>, Rodríguez *et al*<sup>15</sup>, Vilela *et al*<sup>16</sup>, and Van *et al*<sup>17</sup> estimated that this type of discomfort was generally associated with biomechanical risk factors, such as repetitive movements, manual manipulation of loads and prolonged postures.

In that order of ideas, possible injuries attributed to biomechanical risk factors such as epicondylitis, pain and swelling in the feet, telangiectasias, pain in the lower back, stiffness in the neck and shoulder, as well as possible injuries to the hands, arms, back muscles found in this study, are consistent with what was found in the research by Quispe *et al*<sup>13</sup>. However, it is necessary to mention that occupational risk factors are susceptible to intervention and modification by companies through strategies such as active or healthy breaks, training, epidemiological surveillance systems, preventive work accident days, and occupational illness.

This study has some limitations related to the scope of the design, the sample size, and, therefore, the generalization of results. However, the approach and identification of this thematic area, specifically in surgical instrumentation, contributes to the design of Occupational Health and Safety Management Systems in the HSPV, which would help mitigate work accidents and occupational diseases.

## CONCLUSIONS

Surgical Instrumentalists who work in CE present TME attributed to physical biomechanical risks such as prolonged standing posture, effort due to load manipulation, and repetitive movements. Exposure to biomechanical risks also contributes to discomfort in the upper and lower limbs, neck, and back (lumbar), causing MSDs such as low back pain, telangiectasias, pain in the lower back, stiffness in the neck and shoulder, and possible injuries to the hands, arms, muscles of the back, and spine.

Due to the topic's importance in the framework of safety and health at work, it is recommended that future studies establish more considerable and more significant sample sizes to generalize results to the population. Likewise, in-depth analyses based on inferential statistics can precisely obtain those causal factors that could influence the phenomenon's presence.

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## STATEMENT ON CONFLICTS OF INTEREST

The authors declare no conflict of interest.

## CONTRIBUTION OF THE AUTHORS

**The first author** participated in constructing each element of this research, precisely the problem and results, and the construction and approval of the final manuscript.

**The second author** participated in constructing each element of this research, including the problem, theoretical aspects, analysis of the results, and construction and approval of the final manuscript.

**The third author** participated in constructing each element of the research, specifically in the methodological construction of the research and the construction and approval of the final manuscript.

**The fourth author** participated in the construction of each element of the research, specifically in the construction of the problem and discussion and the construction and approval of the final manuscript.

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