South American Publishing

SAP Primary Care. 2026; 2:100
doi: 10.62486/pc2026100

REVIEW

Perception of ergonomic risks in surgical instrument nursing: narrative review

Percepción de riesgos ergonómicos en enfermería instrumentista: revisión narrativa

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Cite as
Ferrín Zambrano ED, Chávez Ponce JA, Santos Zambrano TB. Perception of ergonomic risks in surgical instrument nursing: narrative review. SAP Primary Care. 2026; 2:100. https://doi.org/10.62486/pc2026100

Publication History
Submitted: 03-09-2025
Revised: 07-11-2025
Accepted: 08-02-2026
Published: 09-02-2026

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ABSTRACT

Introduction: surgical instrument nursing staff work in highly demanding environments with exposure to multiple ergonomic risk factors that can affect their health and professional performance.
Method: a review was conducted by searching scientific databases including PubMed, Scopus, and regional sources, selecting studies published between 2019-2024 on ergonomic risks, risk perception, and prevention strategies in surgical nursing personnel.
Results: surgical instrument nurses face significant ergonomic risks including prolonged standing positions, repetitive movements, forced postures, and inadequate equipment handling. Individual factors such as age, work experience, and workload significantly influence risk perception. Evidence-based prevention strategies include organizational interventions, technical adaptations, educational programs, and individual ergonomic practices.
Conclusions: risk perception in surgical instrument nursing staff is multifactorial and requires comprehensive intervention approaches combining organizational changes, workplace design improvements, continuous training, and promotion of individual preventive practices to ensure occupational health and patient safety.

Keywords: Surgical Instrument Nursing; Occupational Health; Ergonomics.

RESUMEN

Introducción: el personal de enfermería instrumentista labora en entornos altamente demandantes, con exposición a múltiples factores de riesgo ergonómicos que pueden afectar su salud y su desempeño profesional.
Método: se realizó una revisión mediante búsqueda en bases de datos científicas incluyendo PubMed, Scopus y fuentes regionales, seleccionando estudios publicados entre 2019-2024 sobre riesgos ergonómicos, percepción del riesgo y estrategias de prevención en personal de enfermería quirúrgica.
Resultados: el personal de enfermería instrumentista enfrenta riesgos ergonómicos significativos incluyendo posiciones de bipedestación prolongada, movimientos repetitivos, posturas forzadas y manipulación inadecuada de equipos. Los factores individuales como edad, experiencia laboral y carga de trabajo influyen significativamente en la percepción del riesgo. Las estrategias de prevención basadas en evidencia incluyen intervenciones organizacionales, adaptaciones técnicas, programas educativos y prácticas ergonómicas individuales.
Conclusiones: la percepción de riesgos en enfermería instrumentista es multifactorial y requiere enfoques integrales de intervención que combinen cambios organizacionales, mejoras en el diseño del entorno laboral, capacitación continua y promoción de prácticas preventivas individuales para garantizar la salud ocupacional y la seguridad del paciente.

Palabras clave: Enfermería Instrumentista; Salud Ocupacional; Ergonomía.

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INTRODUCTION

The operating room is among the most demanding areas in the healthcare system, where surgical technicians perform critical tasks that involve maintaining static and forced postures for long periods of time, handling specialized instruments, and performing repetitive movements under adverse ergonomic conditions. During long working hours, these demands create an environment conducive to the development of musculoskeletal disorders and other ergonomically related conditions.[1,2]

Ergonomics seeks to adapt working conditions to people's abilities; this is particularly important in the operating room, where physical and cognitive demands are constant. Posture-related problems are key determinants of the genesis of occupational pathologies among healthcare personnel, particularly among nursing staff.[3,4]

Various studies have shown that these professionals face multiple ergonomic risk factors, such as poor posture, prolonged standing, repetitive actions, moving loads, and the use of equipment that does not fit their bodies.[5] All these circumstances affect not only their physical health but also their work performance, quality of life, and potentially the safety of the patients in their care.[6]

It is essential to understand how these risks are perceived from the point of view of healthcare personnel, as this will determine whether preventive measures and safe behaviors are implemented. However, previous research shows a considerable discrepancy between the objective risks of the surgical environment and the perceptions that professionals have of them.[7,8]

In Latin America, particularly in Ecuador, there is little research on this topic, which represents a challenge for occupational health.[9]

Given that the field of ergonomics in surgical nursing is heterogeneous, with studies using different methodologies, contexts, and approaches, a narrative review is the most appropriate design for synthesizing this scattered evidence, allowing for critical and integrative interpretation and offering a comprehensive view of the state of knowledge. Therefore, the objective of this study was to explore how surgical nurses perceive ergonomic risks in the surgical environment, analyze the factors that modulate this perception, and evaluate the available preventive strategies to guide more effective occupational health interventions.

METHOD

A narrative analysis of the scientific literature on the subjective assessment of ergonomic risks among operating room surgical technicians was conducted. The literature review was carried out between January and March 2025 using the following scientific information platforms: PubMed/MEDLINE, SCOPUS, SciELO, and regional Latin American repositories. Searches were performed using MeSH and DeCS terms: "ergonomics" [MeSH], "occupational risks" [MeSH], "perioperative nursing" [MeSH], and "musculoskeletal diseases" [MeSH]; in Spanish, "ergonomía" [DeCS], "riesgos laborales" [DeCS], and "enfermería quirúrgica" [DeCS]. These were combined using Boolean operators: ("ergonomics" OR "ergonomics risk") AND ("perioperative nursing" OR "surgical nursing" OR "scrub nurse") AND ("risk perception" OR "musculoskeletal disorders" OR "occupational health").

Inclusion criteria

Scientific publications from the period 2019–2025; Research on adverse ergonomic factors among nursing staff, particularly in surgical contexts; Studies on the subjective assessment of occupational risks among healthcare professionals; Works on preventive measures for musculoskeletal disorders; Documents in Spanish, English, or Portuguese.

Exclusion criteria

Publications without full-text availability; research not directly related to ergonomics or nursing; documents with significant methodological deficiencies; and duplicate records.

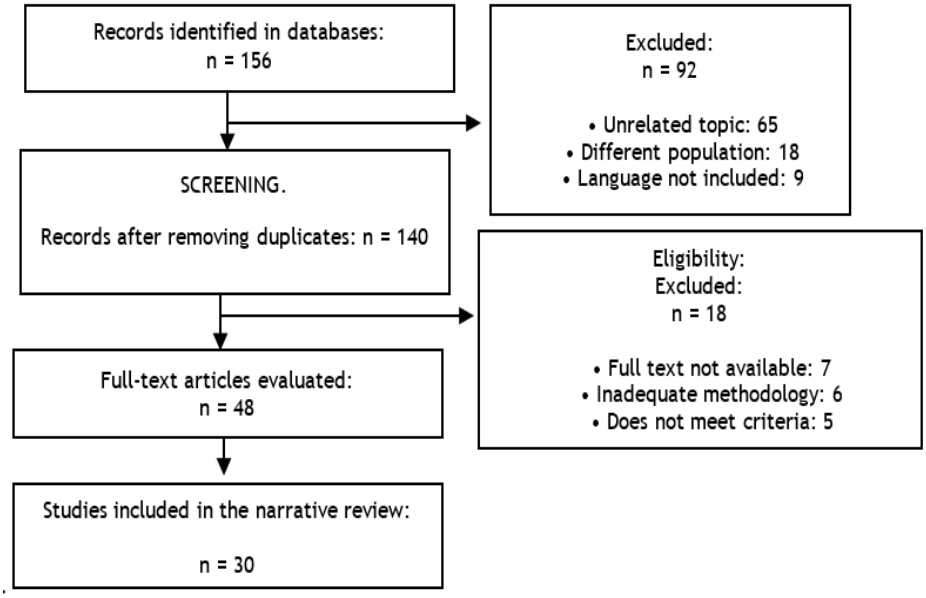


Figure 1. Article preselection and selection process

Selection and analysis

Initially, 156 potentially relevant documents were identified. Two independent reviewers evaluated the titles and abstracts in parallel; discrepancies were resolved by consensus and, when necessary, by the decision of a third reviewer. After removing duplicates and applying the selection criteria, 48 articles were preselected for full-text analysis. The reasons for exclusion at this stage included an irrelevant population (nurses outside the surgical context), the absence of data on risk perception, and insufficient methodological quality. Finally, publications that met all the established criteria were included. The studies included 18 quantitative, 7 qualitative, and 5 mixed-design investigations, conducted mainly in Ecuador, Spain, Brazil, Turkey, Nigeria, and the United States, with sample sizes ranging from 24 to 312 participants.

The extracted data were systematized into the following thematic areas: Ergonomics in the healthcare context; Classification of ergonomic risks; Subjective risk assessment; Preventive and coping strategies.

RESULTS

The 30 studies included 18 quantitative studies (60 %), 7 qualitative studies (23 %), and 5 mixed-method studies (17 %). They were conducted mainly in Ecuador, Spain, Brazil, Turkey, Nigeria, and the United States, with sample sizes ranging from 24 to 312 participants. Most focused on operating room nursing staff (scrub nurses and circulating nurses), although some also included nurses from peripheral units. The findings are presented below and organized into thematic areas.

Ergonomics in the surgical setting

This discipline seeks to contribute to the well-being and performance of healthcare personnel through the implementation of principles and methods. Failure to do so can increase the risk of musculoskeletal injuries because of exposure and improper handling of equipment and users and can lead to work-related stress.[10]

In surgical contexts, the human factor is mixed with technical demands. Nursing staff face significant challenges related to surgical skills and user care, taking responsibility for instrumentation and perioperative care, where injuries that may occur directly affect their ability to work and, therefore, their quality of life.[11,12]

Types of ergonomic risks in surgical nursing

Postural and biomechanical risks

The International Labor Organization recognizes poor lighting, inadequate temperature, incorrect postures, and repetitive movements as critical factors. All of these factors are linked to physical, mental, and environmental stress, including standing for more than 12 hours.[13]

Ergonomic risks are related mainly to weight handling and body mechanics when a patient is being cared for. The most common factors are age, muscle problems, forced postures, prolonged exertion, repetitive movements, and the ability to handle heavy loads.[14]

Physical and environmental risk factors

Ergonomic risks fall within the scope of inappropriate physical overload that leads to occupational disability. Poor posture causes injuries to muscles, tendons, and joints, resulting in lower back pain from handling loads, performing forced movements, and moving patients.

Perception of ergonomic risk

Risk perception drives in-depth analysis of theoretical models that identify, assess, and respond to dangerous situations. Healthcare personnel manage risks in their daily work, which influences how they think and act, especially operating room nurses, where ergonomic risk is present.[16]

The health belief model provides surgical nurses with a conceptual framework for assessing ergonomic risks and encourages them to take preventive measures in their daily work.[17]

Factors influencing the perception of occupational risk

Various personal and environmental factors influence how nursing staff perceive ergonomic risk, notably their length of service and the preventive measures they apply in their daily work.[18]

Demographic factors such as age, sex, and physical condition increase risk perception. With increasing age, the degree of postural risk increases. Demands and workload impact ergonomic risks, with a tendency to prioritize procedural efficiency over ergonomic safety, temporarily decreasing risk perception.

Prevention and coping strategies

Organizational interventions

Organizational strategies include planned rotation between different surgical roles to prevent continuous postural overload and reduce prolonged exposure to static postures and repetitive movements.[21] The implementation of scheduled breaks during lengthy procedures facilitates muscle recovery and postural change.[22]

Technical and design adaptations

Technical interventions include the implementation of height-adjustable instrument tables that allow the working height to be adapted to the height of the instrument nurse.[23] The design of instruments with anatomical handles and balanced weights reduces strain on the hands and wrists during manipulation.[24]

Training strategies

Specific training programs on the principles of ergonomics applied to the surgical context improve awareness of risks and preventive techniques.[25] Training on the fundamental principles of biomechanics applied to surgical tasks improves the understanding of injury mechanisms and preventive strategies.[26]

Individual practices

Specific stretching routines before, during, and after procedures reduce muscle tension and prevent contractures.[27] Methods for maintaining body alignment and neutral positions during procedures reduce joint and muscle overload.[28]

Monitoring and evaluation

Systematic assessment of ergonomic risks in the surgical environment allows new risks to be identified and the effectiveness of interventions to be evaluated.[29] Periodic assessment of risk perception among staff allows changes in risk awareness to be monitored.[30]

Main categories of interventions for the prevention of ergonomic risks among surgical nursing staff

Two main categories of interventions for the prevention of ergonomic risks among surgical nursing staff were identified: organizational strategies and technical and design interventions.

Organizational Strategies

The organizational strategies identified focus on modifications to work processes and human talent management. Job rotation effectively reduced prolonged exposure to static postures and repetitive movements through planned rotation between different surgical roles. Scheduling breaks during prolonged procedures allow for muscle recovery and postural change, preventing accumulated fatigue.

Limiting surgical days by restricting continuous hours in procedures significantly reduces the risk of fatigue injuries. Staffing with appropriate personnel facilitates load sharing and reduces individual effort. Finally, ergonomics committees, as multidisciplinary teams, allow for early identification of risks and the development of specific solutions for each surgical context.

Table 1. Organizational strategies

Strategy	Description	Benefits	Reference
Job rotation	Planned rotation between different surgical roles to avoid continuous postural overload	Reduces prolonged exposure to static postures and repetitive movements	Letvak S, et al. AORN J. 2023;117(3):225-32
Scheduling breaks	Implementation of scheduled breaks during prolonged procedures	Allows for muscle recovery and postural change	Apple B, Letvak S. AORN J. 2021;114(1):67-74
Limiting surgical days	Restriction of the number of continuous hours in surgical procedures	Prevents accumulated fatigue and reduces the risk of injury	Bernal D, et al. Int J Nurs Stud. 2021;52(2):635-48
Adequacy of staffing	Adequate staffing levels for complex procedures	Allows for sharing of workloads and reduces individual effort	Kim SS, et al. Int Arch Occup Environ Health. 2022;87(3):323-30
Ergonomics committees	Creation of multidisciplinary teams for risk assessment and implementation of improvements	Facilitates early identification of risks and development of specific solutions	Dennerlein JT, et al. Occup Environ Med. 2020;74(5):336-43

Technical and Design Interventions

Technical interventions focus on modifications to the physical environment and equipment. Height-adjustable surgical tables allow the work area to be adapted to the individual height of the surgeon. Antifatigue mats significantly reduce pressure on the lower limbs during prolonged standing.

Adjustable lighting using directional systems reduces visual strain and eliminates awkward postures to improve visibility. Ergonomic instruments with anatomical handles and balanced weights reduce strain on hands and wrists. Mechanical lifting systems reduce effort when heavy loads are handled. Specially designed surgical stools allow alternating between sitting and standing positions during prolonged procedures.

These results demonstrate that combining organizational strategies and technical interventions constitutes a comprehensive approach to preventing musculoskeletal disorders in surgical nursing and improving working conditions and staff safety.

Table 2. Technical and design interventions

Strategy	Description	Benefits	Reference
Adjustable surgical tables	Implementation of height-adjustable instrument tables	Allows the working height to be adapted to the height of the instrument nurse	Rashedi E. Ergonomic Assessment of a New Back Table for Perioperative Nurses [dissertation]. 2018
Anti-fatigue mats	Installation of surfaces that reduce pressure on the lower extremities	Reduces fatigue from prolonged standing	Ataseven Tuğran S, Savci A. Turk J Health Sci Life. 2023;6(2):41-7
Adjustable lighting	Directional and adaptable lighting systems	Reduces visual strain and awkward postures to improve visibility	Xavier RS, et al. BioMed Res Int. 2022;2022:1023728
Ergonomic instruments	Instrument design with anatomical handles and balanced weight	Reduces strain on hands and wrists during handling	Carneiro P, et al. Int J Ind Ergon. 2021;61(1):22-28
Lifting systems	Implementation of mechanical devices for moving heavy equipment	Reduces effort during load handling	Lee SJ, et al. Int J Nurs Stud. 2019;47(12):1569-75
Surgical stools	Use of specially designed seats for prolonged procedures	Allows switching between sitting and standing positions	Yasobant S, Rajkumar P. Indian J Occup Environ Med. 2020;18(2):75-81

CONCLUSIONS

Surgical nurses face significant ergonomic risks from prolonged standing, poor posture, repetitive movements, and equipment handling, all of which affect their musculoskeletal health and work performance.

There is a discrepancy between the actual ergonomic risks in the operating room and how professionals perceive them. Variables such as age, experience, workload, and organizational culture modulate this perception and the response to these risks.

Effective prevention requires a comprehensive approach that includes organizational measures (staff rotation, breaks, and adequate staffing), technical adjustments (ergonomic furniture and equipment), ongoing training (biomechanics, simulations, and participatory assessment), and individual practices (stretching, correct positioning, and self-monitoring).

The success of these strategies depends on institutional commitment and a safety culture that prioritizes occupational health. Investing in ergonomics not only protects staff but also improves the quality of care and surgical efficiency.

The effectiveness of comprehensive interventions adapted to the surgical context should be investigated, and how improving risk perception can generate sustainable preventive changes among surgical nursing staff should be explored.

FUNDING

The authors did not receive funding for the development of this research.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

AUTHOR CONTRIBUTION

Conceptualization: Eilen Dayana Ferrín Zambrano, José Alfredo Chávez Ponce, Thainah Bruna Santos Zambrano.
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BIBLIOGRAPHIC REFERENCES

1. Puicon Mejia MJ, Vega Ramírez AS. Riesgos ergonómicos en el profesional de enfermería: revisión narrativa. CIETNA. 2022;9(1):50-9.

2. Fierro Vasco SG, Guano Gutiérrez DA, Ocampo Bermeo JD, Pacheco Toro SI. Riesgos ergonómicos en personal de enfermería: una revisión práctica. Cienc Digit. 2022;6(1):225-37.

3. Marin-Vargas BJ, Gonzalez-Argote J. Riesgos ergonómicos y sus efectos sobre la salud en el personal de Enfermería. Multimed. 2022;26(1):e2549.

4. Marin-Vargas BJ, Gonzalez-Argote J. Condiciones de trabajo, los riesgos ergonómicos y sus efectos sobre la salud en el personal de enfermería. Salud Cienc Tecnol. 2021;1(4):37-52.

5. Pesántez Calle MF, Rogel Echeverría JB, Romero Vélez LC, Guaraca Pino AC, Quezada Arias CM, Parra Sinchi JC, et al.

Riesgos ergonómicos en el personal de enfermería del Hospital San Vicente de Paúl, Ecuador. UNIR. 2022.

6. Acevedo Ore TJ, Aguilar Matos C, Cori Huayta. Relación entre riesgo ergonómico y alteraciones musculoesqueléticas en profesionales de Enfermería de un hospital de Jauja 2021. Universidad Peruana Los Andes; 2022.

7. Elizalde Ordoñez H, Sánchez Marca IA, Medina León BD, Montalván Celi NJ. Riesgos ergonómicos del personal de Enfermería en Ecuador. Rev Latinoam Hig. 2024;2(2):155-79.

8. Brito MBA, Silva Plbc. Riscos Ocupacionais Do Profissional De Enfermagem Em Instituições Hospitalares: Estratégias Para Prevenção. Recifij-anteriores. 2021;1(4):27-46.

9. Xavier RS, Vigário PDS, Faria ACD, Dusek PM, Lopes AJ. The Perception of Nursing Professionals Working in a Central Sterile Supplies Department regarding Health Conditions, Workload, Ergonomic Risks, and Functional Readaptation. Adv Prev Med. 2022;2022:1023728.

10. Asenjo Fátima, Martínez Maria, Berbel Antonio, Gascón José, et al. Ergonomía en el sanitario: artículo monográfico. Revista Sanitaria de Investigación. 2024;5(8):319.

11. Sevilla AM, Yopla AM, et al. Ergonomic risks and musculoskeletal disorders in surgeons. Salud Cienc Tecnol Serie Conf. 2024;3:701.

12. Segovia Lohse HA. La ergonomía: una necesidad imperiosa para los cirujanos. Cir parag. 2023;47(3):08-10.

13. Puicon Mejia MJ, Vega Ramírez AS. Riesgos ergonómicos en el profesional de enfermería: revisión narrativa. cietna. 2022;9(1):224-6.

14. Pinta Cacoango AE, Albán Sabando EA, Durazno Nacipucha JD, Davis Bone AD. Trastornos musculoesqueléticos asociados a factores de riesgo ergonómicos del profesional de enfermería en la movilización de pacientes. Revista Científica Arbitrada Multidisciplinaria PENTACIENCIAS. 2024;6(4):311-28.

15. Defranc Balanzategui PO, Arellano Valdiviezo AI. Consideraciones sobre ergonomía física y cognitiva en el ámbito laboral. Más Vita Rev Cienc Salud. 2024;6(3):106-18.

16. Chicaiza-Izurieta EW, Martínez D. Uso de la mecánica corporal para disminuir lesiones en los estudiantes de enfermería. RCS. 2025;8(15):2-26.

17. Valverde LG, Fierro LG, Muñoz Aucapiña MJ, Soledispa Reyes SJ. Conocimiento y actitud de los estudiantes de enfermería sobre la salud ocupacional: un estudio transversal. Ibero-American Journal of Health Science Research. 2024;4(2):244-51.

18. Yousefi Seyf N, Safari Variani A, Varmazyar S. Investigation of the relationship between demographic factors and ergonomic risks assessed by the HEMPA method with musculoskeletal disorders among nurses. Theor Issues Ergon Sci. 2023;24(4):368-85.

19. Ataseven Tuğran S, Savci A. Work-Related Ergonomıc Rısks and Musculoskeletal Problems in Operating Room Nurses. Turk J Health Sci Life. 2023;6(2):41-7.

20. Xavier RS, Vigário PS, Faria ÁCD, Dusek PM, Lopes AJ. The perception of nursing professionals working in a central sterile supplies department regarding health conditions, workload, ergonomic risks, and functional capacity. BioMed Res Int. 2022;2022:1023728.

21. Letvak S, Apple B, Jenkins M. Factors Affecting Perioperative Nurse Adherence to Ergonomic Safety Measures. AORN J. 2023;117(3):225-32.

22. Apple B, Letvak S. Ergonomic challenges in the perioperative setting. AORN J. 2021;114(1):67-74.

23. Rashedi E. Ergonomic Assessment of a New Back Table for Perioperative Nurses [dissertation]. 2018.

24. Carneiro P, Braga AC, Barroso M. Work-related musculoskeletal disorders in home care nurses: Study of the main risk factors. Int J Ind Ergon. 2017;61:22-8.

25. Obaseki C, Erhabor NI. Ergonomic Standard Compliance of Nurses in Tertiary Hospitals in Edo State, Nigeria. NIU J Soc

Sci. 2023;9(4):199-205. doi: 10.58709/niujss.v9i4.1778

26. Darragh AR, Huddleston W, King P. Work-related musculoskeletal injuries and disorders among occupational and physical therapists. Am J Occup Ther. 2009;63(3):351-62.

27. Chen HM, Wang HH, Chen CH, Hu HM. Effectiveness of a stretching exercise program on low back pain and exercise self-efficacy among nurses in Taiwan: a randomized clinical trial. Pain Manag Nurs. 2014;15(1):283-91.

28. Yousefi Seyf N, Safari Variani A, Varmazyar S. Investigation of the relationship between demographic factors and ergonomic risks assessed by the HEMPA method with musculoskeletal disorders among nurses. Theor Issues Ergon Sci. 2024;25(3):268-86.

29. Bos E, Krol B, van der Star L, Groothoff J. Risk factors and musculoskeletal complaints in non-specialized nurses, IC nurses, operation room nurses, and X-ray technologists. Int Arch Occup Environ Health. 2007;80(3):198-206.

30. Apple B, Letvak S. Ergonomic Challenges in the Perioperative Setting. AORN J. 2021;113(4).