



(RESEARCH ARTICLE)



Using the INRS QECPT method for ergonomic assessment and prevention strategies in an Algerian maternity ward

NARDJESSE BENSEKHRIA* and WISSAL BENHASSINE

Faculty of Medicine, Mustafa Benboulaïd University Batna 2, Algeria.

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Abstract

Introduction: Physical workload is a significant challenge in maternity wards, where healthcare workers face intense demands such as patient handling, prolonged postures, and repetitive efforts. This study, conducted in an Algerian maternity ward, uses the INRS (National Institute for Research and Safety) method to evaluate physical workload, identify biomechanical, organizational, and environmental risks, and propose improvement strategies.

Methods: This study followed a structured three-step approach. First, risks were identified and prioritized using ergonomic indicators to highlight critical situations. Second, a detailed evaluation of physical workload was conducted based on five dimensions: physical effort, staffing levels, temporal constraints, organizational factors, and environmental conditions. Risks were stratified into moderate and high levels to focus on key areas for intervention. Finally, preventive strategies were proposed to reduce constraints and improve working conditions for healthcare workers.

Results: Out of 31 work situations analyzed, 47.2% exhibited moderate to high-risk levels. The gynecology, high-risk pregnancy, and neonatology units concentrated critical constraints, including prolonged postures and intense physical efforts.

Conclusion: The study highlights key priorities such as improving ergonomic equipment and reorganizing workflows to reduce physical strain and preserve healthcare workers' health while ensuring quality patient care. This provides a foundation for targeted preventive strategies.

Keywords: Physical workload; Ergonomic assessment; Healthcare workers; Risk identification; Prevention strategies

1. Introduction

The increasing demands placed on healthcare professionals have underscored the critical need to evaluate and manage the physical workload within medical establishments, particularly in maternal and child healthcare facilities. Physical workload is a significant factor influencing both the well-being of healthcare workers and the quality of patient care. Despite global recognition of its importance, developing countries, including Algeria, continue to face challenges in addressing the adverse effects of high physical workloads due to limited resources and understaffing.

In Algeria, the strain on healthcare workers is particularly evident in maternal and child healthcare facilities, where the intensity of physical tasks and inadequate staffing exacerbate the workload. Existing studies have highlighted the prevalence of musculoskeletal disorders (MSDs) among healthcare providers, directly linked to their occupational tasks.

* Corresponding author: NARDJESSE BENSEKHRIA

However, a systematic evaluation of these physical demands remains underexplored, leaving a critical gap in the literature and policy framework.

1.1. Problem Statement

Maternal and child healthcare workers in Algeria face a challenging work environment characterized by insufficient staffing, repetitive physical tasks, and inadequate ergonomic support. These conditions not only compromise their health but also risk the quality of care provided to patients. Although the WISN (Workload Indicators of Staffing Needs) methodology has been employed to evaluate staffing requirements, it does not comprehensively address the biomechanical and organizational risks tied to physical workloads.

To fill this gap, this study employs the INRS methodology, a scientifically validated framework for assessing physical workload risks. By applying this approach to a maternal and child healthcare facility in Algeria, the study aims to identify critical workload determinants and propose targeted interventions to mitigate risks and improve workplace conditions.

1.2. Objectives

The main objective of this study is to evaluate the physical workload of healthcare workers in a maternal and child healthcare facility in Algeria using the INRS methodology, to identify key determinants and propose recommendations for better human resource management and working conditions.

2. Material and methods

2.1. Study Context

This study was conducted in 2023 at a maternal and child health facility located in the province of Batna, Algeria. It aimed to analyze the physical workload of healthcare workers using the validated methodology of the French **Institut National de Recherche et de Sécurité (INRS)**. The analysis focused on **31 distinct work situations**, each representing a specific professional group and service unit (e.g., midwives in the obstetric surgery unit or nurses in the neonatology department).

2.2. Study Population

A total of **236 healthcare workers** were included in the study, distributed across the 31 work situations. Each situation represents a specific combination of a professional category and a service unit.

2.3. Data Collection

The necessary data were collected through the following sources:

- **Direct Observations:** A systematic field analysis of healthcare workers' activities conducted by a team of ergonomists.
- **Semi-structured Interviews:** Discussions with healthcare workers to gather their perceptions of work-related constraints.
- **Documentary Analysis:** Examination of activity logs and job descriptions to assess assigned tasks and their characteristics.

2.4. INRS Methodology

The evaluation followed the first three steps of the INRS method for analyzing physical workload:

Identification of Risks Related to Physical Workload: Identification of high-risk situations using a checklist with four key questions.

Prioritization of Work Situations: A standardized grid was used to classify work situations based on five indicators:

- Physical efforts,
- Workspace Design
- Time-related characteristics,
- Work environment,
- Work organization.

Risks were rated on a four-level ordinal scale (from negligible to unacceptable).

Search for Preventive Measures: Development of tailored recommendations to mitigate the identified constraints, prioritizing collective and organizational interventions.

3. Results

This study aims to analyze the physical workload in a maternal and infant health facility in Algeria, identifying key occupational risks faced by healthcare workers and proposing targeted prevention strategies. The INRS method, based on a systematic approach, was used to identify, prioritize, and assess the risks associated with physical workload.

3.1. Risk Identification

The first step of the INRS method, involving a series of four key questions, was implemented to assess the risks associated with physical workload in a maternal and child healthcare facility in Algeria. This phase, conducted in close collaboration with the facility's occupational physician and human resources department, enabled the mapping of the primary risk factors, their locations, and the related activities.

The first phase involved a series of four key questions to map the main risks (table 1):

Table 1 Distribution of Primary Risks and Organizational Challenges Across Units and Professional Groups

Unit/Service	Professional Group	Primary Risk (Q1)	Manual Handling Risk (Q2)	Imposed Cadence (Q3)	Organizational Difficulties (Q4)
Pre-Labor and Delivery Ward	Midwife	High absenteeism rate due to MSDs (26.5% of returns)	Frequent handling, prolonged awkward postures	Rhythm dictated by unpredictable emergencies	Frequent malfunctions of monitoring devices
Neonatology	Pediatric Nurse	Musculoskeletal pain from repetitive care tasks	Intensive handling of newborns	Tasks paced by feedings every 3 hours	Organization disrupted by emergencies
Gynecology	Nurse (ISP)	Pathologies associated with physical efforts	Repeated patient mobilizations, lifting heavy loads	High-pressure work due to tight workflow	Stress related to managing complex care situations
Operating Room	Nurse (ISP)	Issues related to irregular schedules	Prolonged patient positioning	Frequent unforeseen events due to emergency interventions	Lack of adequate equipment
Gyneco-Obstetric Emergencies	Midwife	Time pressure and emotional burden	Handling of non-cooperative patients	Simultaneous management of multiple emergencies	Noisy and stressful environment

3.2. Prioritization of Work Situations

The second step of the INRS method, focused on prioritizing high-risk work situations, allowed for a comprehensive analysis of 31 distinct work scenarios. By utilizing a multi-criteria assessment grid encompassing biomechanical, organizational, and environmental indicators, this process revealed notable disparities in risk levels among the various units and services within the facility. (Table 2)

Table 2 Ranking of Work Situations by Number of Critical Factors Identified

Rank	Unit/Service	Professional Category	Number of Critical Factors Identified	Comments
1	Gynecology	Nurse (ISP)	14	High biomechanical risks (patient mobilization, awkward postures).
2	High-Risk Pregnancy	Nurse (ISP)	13	Significant time pressure and organizational challenges, complex care requirements.
3	High-Risk Pregnancy	Midwife	12	Unpredictable emergencies and high emotional burden.
4	Neonatology	Nurse (ISP)	10	Frequent handling, night shifts, stress from emergency management.
5	Neonatology	Pediatric Nurse	10	Critical care for newborns, prolonged awkward postures.
6	Delivery Room	Midwife	9	Significant physical effort, prolonged postures, frequent emergencies.
7	Gynecological-Obstetric Emergencies	Midwife	9	Simultaneous management of multiple emergencies, stressful and noisy environment.
8	Operating Room	Surgical Nurse (ISP)	8	Extended patient handling and positioning, complex organization.
9	Postpartum Unit	Nurse (ISP)	8	Risks associated with patient mobilization and emotional burden.

3.3. Risk Assessment by Dimension

The analysis of 31 work situations, categorized into five key dimensions—**physical efforts**, **workspace design (dimensioning)**, **time constraints**, **environmental conditions**, and **organizational factors**—offered a nuanced understanding of the risks associated with the physical workload. In this refined approach, **combined risk** was recalculated by considering two moderate risks as equivalent to one critical risk, reflecting the compounded burden of moderate risks. This adjustment provides a more realistic prioritization of risks requiring intervention. The revised table below summarizes the recalculated percentages for each dimension (table 3):

Table 3 Distribution of Risk Levels Across Key Dimensions of Physical Workload

Dimension	Percentage of Critical Risks (%)	Percentage of Moderate Risks (%)	Percentage of Combined Risks (Critical + Moderate) (%)
Physical Efforts	17.1	35.7	34,9
Workspace Design	8.2	42.8	29,6
Time Constraints	4.0	20.4	14,2
Environmental Conditions	22.9	42.8	44,3
Organizational Factors	14.3	28.5	28,5

3.4. Exploration of Prevention Strategies

The analysis of combined risks revealed that environmental conditions posed the highest combined risk (44.3%), followed by physical efforts (34.9%), organizational factors (28.5%), and workspace design (29.6%). These findings emphasized the need to prioritize preventive actions by addressing both moderate and critical risks comprehensively.

Prevention strategies were tailored to each dimension, following a hierarchical approach that focused on the elimination of risks at the source, the implementation of collective measures, and, where necessary, the use of individual protective measures. The following table outlines the specific prevention strategies designed for each dimension of risk. (table 4)

Table 4 Preventive Strategies Categorized by Risk Dimensions

Dimension	Risk Elimination	Collective Prevention	Individual Prevention
Physical Efforts	Motorized equipment for patient transfers.	Ergonomic workstations, task rotations.	Training in safe handling techniques.
Workspace Design (Dimensioning)	Redesign of crowded and poorly adapted spaces.	Dedicated logistics circuits, adjustable work surfaces.	Awareness on ergonomic use of workspaces.
Time Constraints	Reducing unnecessary movements.	Patient triage, scheduled breaks.	Stress management workshops.
Environmental Conditions	Improved ventilation, acoustic solutions.	Soundproofed rest areas, traffic management protocols.	Stress management training and personal protective equipment (PPE).
Organizational Factors	Process redesign to limit repetitive movements.	Floating teams, workforce planning.	Part-time work arrangements, peer support groups.

3.5. Strategic Recommendations

Building on the analysis and tailored prevention approaches, the following strategic recommendations are proposed to address the identified risks effectively and ensure sustainable improvements in working conditions:

3.5.1. Immediate Actions:

Organizational adjustments such as scheduled breaks and task rotations to alleviate immediate workload pressures.

Mitigation of environmental constraints through enhancements in ventilation and lighting systems to improve the overall working environment.

3.5.2. Medium- and Long-Term Projects:

Acquisition of ergonomic equipment to reduce physical strain and enhance efficiency across critical tasks.

Workforce reinforcement through targeted recruitment and strategic staff redeployment to balance workload distribution and address understaffing in high-risk units.

4. Discussion

The evaluation of physical workload using the five indicators of the INRS method provided a comprehensive understanding of the risk factors associated with physical strain in the study population and their levels of criticality. The findings revealed moderate to high levels of biomechanical constraints, consistent with prior research in healthcare settings (1). This preliminary phase of identifying and prioritizing work situations with excessive physical strain enabled a targeted approach to prevention and intervention efforts. The multidisciplinary collaboration with occupational health services and human resources ensured methodological rigor and a thorough risk analysis.

The high prevalence of musculoskeletal disorders (MSDs) among midwives and nurses underscores the urgency of addressing this significant issue. MSDs accounted for 26.5% of return-to-work visits, with lumbar pain and sciatica representing 21.5% of cases. These findings align with prior studies emphasizing the risks posed by patient handling, awkward postures, and repetitive movements (2, 3). Marion Bossenauer's ergonomic analysis of midwives' tasks during deliveries similarly highlighted the risks of MSDs, particularly in the back, shoulders, and knees, resulting from bent, twisted postures and pulling efforts (4). Furthermore, Benhassine's study, which applied the OWAS (Ovako Working Posture Analysis System) method to 106 positions, identified six requiring urgent intervention, including delivery room midwives and neonatal caregivers, corroborating the need for targeted ergonomic solutions (1).

The study also highlighted potential cardiovascular risks linked to the physical and emotional demands of obstetric work, including chronic stress, prolonged standing, and repetitive lifting. These findings echo those of other studies connecting irregular work shifts in healthcare professionals to increased fatigue, sleep disturbances, and cardiovascular risks (5, 6).

The adverse impact of workplace design was another significant finding. Inadequate room dimensions, clutter, and the lack of adjustable equipment were key contributors to postural discomfort and MSD risk, as noted in Lahoucine's 2022 study on delivery room ergonomics (3). Such spatial constraints exacerbate the physical strain on healthcare workers, emphasizing the importance of optimizing work environments.

Organizational factors emerged as critical risks, with unpredictable activity variations and irregular work schedules significantly impacting midwives and nurses across various services. These conditions amplify fatigue and stress, affecting both staff well-being and care quality. The findings align with studies linking irregular shifts to heightened fatigue, sleep disorders, and cardiovascular risks (7, 8). Addressing these organizational challenges is crucial for improving work conditions and outcomes.

Environmental constraints, including heat, noise, biological risks, and unpleasant odors, also contributed to workplace strain. Similar findings were reported in Lahoucine's study and by Pereira Ferraz et al. (2017), who highlighted how unpleasant odors and environmental discomfort increased the physical and mental workload of healthcare providers (3, 9). Their research emphasized the need for appropriate equipment, such as air filtration devices and specific deodorizers, to mitigate these factors and reduce improvisation by staff at the expense of their comfort.

These challenging working conditions not only directly impact physical strain but also exacerbate the effects of organizational and temporal risks. A holistic, systemic approach is therefore essential to create a safe and healthy work environment conducive to healthcare workers' well-being and the quality of care provided. By integrating ergonomic solutions, organizational reforms, and environmental improvements, this study underscores the importance of comprehensive strategies to mitigate workload-related risks effectively.

5. Conclusion

This study, employing the INRS method, offered a comprehensive assessment of the physical workload risk factors among healthcare professionals in a maternal and child health facility in Algeria. The findings highlighted significant biomechanical, organizational, and environmental constraints contributing to musculoskeletal disorders (MSDs) and other work-related health issues. High-risk areas, including gynecology, high-risk pregnancy, obstetric units, and neonatology, were identified as priorities for targeted interventions.

The results underscore the urgent need for tailored prevention strategies, including ergonomic interventions, organizational improvements, and workforce reinforcement. Addressing physical workload requires a holistic approach that integrates risk elimination at the source, collective prevention measures, and individual support. Moreover, the critical role of environmental improvements, such as optimizing ventilation, reducing noise, and reorganizing workspaces, was emphasized.

The discussion of these results, framed within the context of existing literature, confirmed the alignment of findings with global observations of healthcare professionals' workload challenges. These include the impact of repetitive motions, prolonged postures, and the psychological stress of unpredictable and demanding work environments.

This study contributes to the growing body of evidence supporting the importance of systemic and multidisciplinary approaches to workplace risk management in healthcare. By implementing these evidence-based recommendations, healthcare institutions can improve the well-being of their staff, enhance job satisfaction, and ultimately promote higher-quality patient care.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there are no conflicts of interest to disclose regarding the publication of this manuscript.

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