Occupational Safety and Health Risk Management and Its Impact on the Physical and Psychological Health of Nurses: A Literature Review from a HIRARC Perspective

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Abstract. Nurses are frontline healthcare workers who play a vital role in the patient recovery process. However, behind this role, nurses face multidimensional and complex occupational hazards. These risks include biological, chemical, physical, ergonomic hazards, as well as psychosocial stressors that can significantly affect both physical and mental health. This study aims to evaluate the effectiveness of the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) approach in managing occupational risks among hospital nurses and its impact on their well-being. The method used is a narrative literature review of 25 national and international scientific articles published between 2013 and 2025. The results indicate that ergonomic hazards have the highest prevalence (85%), followed by psychosocial hazards (72%) and biological hazards (65%). Ergonomic hazards are associated with chronic musculoskeletal disorders, while psychosocial stress leads to emotional exhaustion, prolonged stress, and burnout. Biological hazards increase anxiety due to infection risks. The HIRARC approach has proven effective in identifying, assessing, and controlling these risks through regular training, development of standard operating procedures (SOPs), work rotation management, and strengthening a safety culture. This study concludes that the comprehensive and consistent implementation of HIRARC is crucial in creating a safe, healthy work environment that holistically supports the well-being of nursing staff.

Keywords: nurses, HIRARC, occupational safety, psychosocial, fatigue, musculoskeletal pain.

1 Introduction

The nursing profession occupies a crucial position in the healthcare system, where nurses play the role of the main implementer in direct care to patients. As a profession that requires high precision, empathy, and physical-mental resilience, nurses are required to always be on standby for a full twenty-four hours, including in the face of medical emergencies, rapid changes in patient conditions, and a significant

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administrative burden. This condition is exacerbated by the increasing workload due to the increasing number of patients without being accompanied by an adequate ratio of nurses. In this context, hospitals as health service providers are actually a work environment full of risks and pressures, which if not managed properly can cause serious consequences for the health and productivity of nurses.

Behind the strategic role played by nurses, there is a hidden reality of work that is vulnerable to various forms of work risks. Biological hazards are one of the most common types of exposure, given the intensive interactions of nurses with patients who have the potential for infection. This risk includes exposure to blood, body fluids, pathogenic microorganisms, to the possibility of contracting infectious diseases such as Hepatitis B, Hepatitis C, and HIV. Chemical hazards are also a real threat to nurses, especially those who work in emergency departments, operating rooms, or laboratories. Exposure to disinfectants, anesthetic gases, and cytotoxic drugs such as chemotherapy can interfere with the long-term functioning of the body's organs, especially the respiratory and nervous systems.

Furthermore, the ergonomic aspect of the nursing profession is also very problematic. Work positions that require nurses to stand for long periods of time, bend, rotate the body, and manually lift or move patients, are the main causes of chronic musculoskeletal disorders. Complaints of lower back, shoulder, neck, and upper and lower extremity joints are often not considered a major problem because they have been considered an integral part of a nurse's job. In fact, these disturbances can cause a decrease in quality of life, a decrease in work productivity, and even cause nurses to stop working prematurely.

On the other hand, no less serious challenges also arise from psychosocial dangers. The emotional distress stemming from the uncertainty of the patient's condition, conflicts between medical teams, verbal abuse from the patient's family, lack of appreciation for hard work, and the ever-increasing administrative workload without adequate compensation have led to an increase in the prevalence of psychological disorders among nurses. These disorders include chronic stress, mental fatigue, burnout, symptoms of anxiety disorders, and clinical depression. There is also a significant correlation between continuous night shifts and increased cases of sleep disorders, mood swings, and decreased immunity.

Occupational safety and health problems experienced by nurses become increasingly complex when hospital institutions do not have a clear and structured risk management system. In this context, the HIRARC (Hazard Identification, Risk Assessment, and Risk Control) approach is very relevant and needed. HIRARC is a systematic method used to identify various potential hazards, assess the level of risk based on its likelihood and impact, and determine appropriate control strategies to minimize or eliminate these risks.

2 Research Methods

This study uses a narrative literature review method with a qualitative descriptive approach. The study was conducted on 25 scientific articles published in the period 2013–2025. The articles analyzed came from various national and international scientific journals that focused on occupational risk management, nurses' occupational safety, HIRARC implementation, and physical and psychological disturbances experienced by nursing personnel. Literature searches were conducted through databases such as PubMed, ScienceDirect, Emerald Insight, Garuda, and Google Scholar, with keywords including "nurse occupational hazard", "HIRARC", "musculoskeletal disorders in nurses", "workplace safety in hospital", "nurse fatigue", and "mental health of nurses".

After a selection with inclusion criteria that included the hospital nurse population, the focus of the study on occupational risks and their impact on health, as well as relevance to the implementation of HIRARC, 25 main articles were obtained that were analyzed in depth. Data from each article were extracted and compared to identify similarities in findings, differences in methodological approaches, and strategic recommendations offered.

3 Results and Discussion

The study revealed that occupational safety and health risks faced by nurses in hospital settings include multiple hazard dimensions that interact with each other and are often simultaneous. Based on an analysis of the reviewed scientific articles, it was found that ergonomic, psychosocial, and biological hazards are the three most dominant dimensions, with a high prevalence and a wide impact on the physical and psychological health of nurses.

3.1 Prevalence of Occupational Hazards

Ergonomic Hazards (85%).
Ergonomic hazards are the risk category with the highest prevalence. These hazards include unnatural posture, manual lifting of patients without assistive devices, and long standing durations during tasks. The results of a study show that musculoskeletal pain, especially in the lower back, neck, and lower legs, is most common in nurses who work more than eight hours per day and engage in repetitive physical tasks [11], [22]. This study also shows that the average nurse experiences this disorder chronically and has a direct impact on a decrease in concentration and work productivity. Untreated musculoskeletal pain is also known to increase the risk of psychological fatigue because it interferes with sleep quality and causes persistent discomfort.

Psychosocial Hazards (72%).
Psychosocial hazards stemmed from workload pressure, prolonged night shift systems, interpersonal conflicts within the team, and lack of appreciation from superiors. It was found that nurses who periodically worked night shifts experienced significant levels of mental fatigue, which was further associated with increased symptoms of anxiety and depression [11], [23]. This condition is also exacerbated by the lack of emotional support from hospital organizations and the lack of in-house mental health services. Emotional fatigue due to an unhealthy work environment leads to decreased work motivation and an increased tendency to make medical errors.

Biological Hazards (65%).
Nurses who work in intensive care rooms, emergency rooms, or isolation rooms are at high risk of exposure to blood, body fluids, as well as infectious agents such as Hepatitis B and HIV. Based on a report, at the Ibnu Sina Hospital Inpatient Installation in Pekanbaru, the incident of being punctured by a syringe is the most frequently reported case [21]. The fear of being exposed to infectious diseases not only has an impact on physical health but also causes long-term anxiety that worsens psychological conditions. This demonstrates the importance of biological hazard control through technical training, appropriate use of PPE, and the establishment of a post-incident support system [24].

Physical and Chemical Hazards (50% and 38%).
Physical risks, such as slipping, being hit by medical trolleys/equipment, or accidents due to the use of medical devices, occupy the fourth position with a prevalence of 50%. Meanwhile, chemical hazards are reported to have the lowest prevalence at 38%. However, despite its lower prevalence, chemical hazards such as exposure to disinfectants, anesthetic gases, and cytotoxic drugs can cause skin irritation, respiratory distress, as well as long-term systemic effects if not treated with adequate control procedures [25].

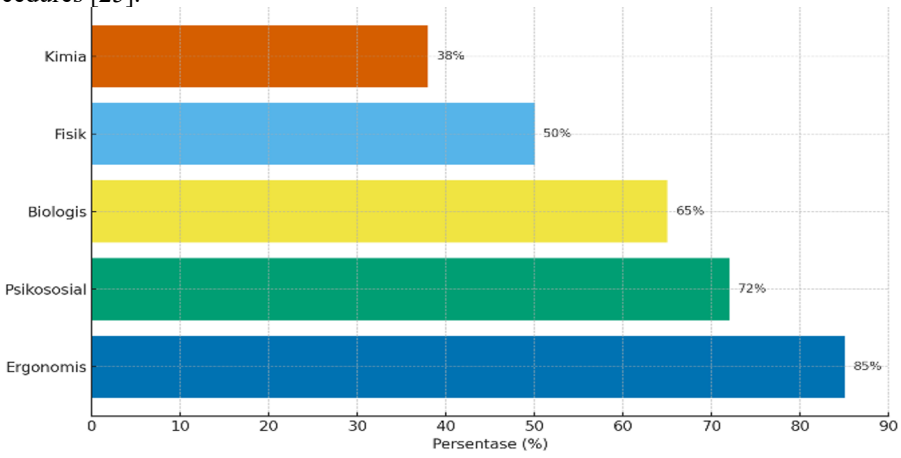


Fig. 1. Prevalence of occupational safety and health hazards in nurses.

Table 1. Summary of The Prevalence of Types of Occupational Hazards of Nurses

Hazard Type	Prevalence	Major Complaints / Impacts
Ergonomic	85%	Chronic lower back, neck, and shoulder pain; decreased focus.
Psychosocial	72%	Burnout, mental fatigue, depression, medical errors.
Biological	65%	Needle punctures, infection anxiety, blood/fluid exposure.
Physical	50%	Slipping, equipment accidents, absenteeism.
Chemical	38%	Respiratory irritation, skin reactions, systemic disorders.

3.2 Implementation of the HIRARC Approach

One of the important highlights in the literature results is the effectiveness of the HIRARC approach in managing work risks systematically. By thoroughly identifying hazards, hospitals can develop risk maps and develop evidence-based risk control systems. The control strategies found include the preparation of SOPs, training on the use of PPE, resetting work rotations, and periodic reporting of work incidents [10].

The HIRARC approach assists hospitals in formulating risk control strategies in stages. Some of the strategies that are the focus of this approach include:

Regular training to improve staff's understanding of the types of hazards that exist in the workplace and how to identify and control them.

The preparation of SOPs (Standard Operating Procedures) as a standard guide in the implementation of tasks, so as to minimize procedural errors and exposure to dangers.

Well-designed work rotations aim to reduce physical and mental fatigue due to prolonged night shifts and high workloads.

Strengthening safety culture, which is the establishment of a work environment that supports transparency, fearless incident reporting, and continuous system improvement.

However, in practice, the implementation of HIRARC faces several challenges. One of the main obstacles is the blame culture that is still strong in some hospital institutions. This culture makes nurses reluctant to report incidents that occur for fear of being punished or judged negatively. As a result, risk data is incomplete and efforts to improve the system are limited. In addition, the lack of technical and safety training, lack of management support (provision of PPE, allocation of time for training), and the absence of a good incident reporting system also hinder the effectiveness of HIRARC in the field.

4 CONCLUSION

Based on the results of the analysis of the 25 articles reviewed in this systematic review, it can be concluded that the occupational safety and health risks faced by nurses in the hospital environment are multidimensional and often occur simultaneously.

Ergonomic, psychosocial, and biological hazards are the three dominant types of risks that have a significant impact on the physical and mental well-being of nurses. Ergonomic hazards occupy the highest prevalence, at 85%, and are closely related to unergonomic working postures as well as strenuous and repetitive physical activity, leading to chronic musculoskeletal disorders. Psychosocial dangers, with a prevalence of 72%, arise due to work pressure, night shift systems, and lack of emotional support, which leads to mental exhaustion, prolonged stress, and even depression. Biological hazards, such as exposure to blood and body fluids, recorded a prevalence of 65% and in addition to threatening physical health, also increased long-term anxiety.

The Hazard Identification, Risk Assessment, and Risk Control (HIRARC) approach has proven to be effective in managing various occupational risks systematically, especially in ergonomic and psychosocial aspects. However, the success of the implementation of HIRARC is largely determined by the commitment of the hospital management, the quality of the training provided, and the courage of the institution in building an open, supportive, and system-oriented work culture, rather than focusing on individual punishment.

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