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RESEARCH ARTICLE

Professional Risk Mapping In the Intensive Care Unit of Hassan II Hospital in Settat, Morocco

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ABSTRACT

The healthcare sector, particularly in Intensive Care Units (ICUs), is characterized by a high level of occupational risk. This study was conducted at Hassan II Hospital in Settat, Morocco, to identify, prioritize, and address the main occupational risks faced by ICU professionals, using the Failure Mode and Effects Analysis (FMEA) method. The focus is on three primary risks: psychosocial risk, work organization, and exposure to blood and body fluids, while also covering a broader range of identified hazards. A qualitative risk assessment was conducted using FMEA to systematically identify potential failure modes and assess their impacts. Risk Priority Numbers (RPN) were calculated for each identified risk based on severity, occurrence, and detection. Data were gathered from ICU healthcare professionals through interviews, observations, and questionnaires, involving medical and nursing staff. The analysis identified 11 major occupational risks, with the top three priority risks being psychosocial stress (RPN=48), work organization challenges (RPN=36), and exposure to blood and body fluids (RPN=24). Psychosocial stressors included burnout, high stress levels, and lack of work-life balance, all significantly affecting staff performance and well-being. Work organization risks included poor communication during handovers, workload imbalance, and role confusion, contributing to increased medical errors and reduced care quality. Exposure to blood and body fluids was exacerbated by inadequate use of personal protective equipment (PPE) and improper handling of sharp objects, heightening the risk of infection transmission. The study highlights the need for an integrated risk management approach to mitigate these critical risks. Recommendations include implementing mental health support programs, standardizing work protocols, enhancing communication during handovers, and ensuring strict adherence to PPE protocols. Addressing these risks is crucial to improving both healthcare worker safety and patient care quality in the ICU.

INTRODUCTION

Occupational risks in healthcare, particularly in intensive care units (ICUs), represent a significant concern for healthcare professionals (Shimizu et al., 2010). The ICU is an inherently high-risk environment due to the nature of care provided, which is often complex, time-sensitive, and critical (Christensen & Liang, 2023). Healthcare workers in these settings are exposed to a variety of

occupational hazards, including physical, psychosocial, biological, chemical, and organizational risks (Nankongnab et al., 2021). These risks can compromise the safety and well-being of staff, leading to long-term health issues such as musculoskeletal injuries, mental health problems, and increased susceptibility to infections (Moreira et al., 2022). Furthermore, these risks directly affect the quality of patient care, as stressed or injured healthcare workers may struggle to maintain optimal performance (Zabin et al., 2023).

The complexity of ICU care arises from the need to provide continuous, often invasive monitoring, and life-sustaining treatments to patients in critical condition (Jackson & Cairns, 2021). Staff must navigate high-stakes decision-making, which can be physically and emotionally taxing (Goudarzian et al., 2024; Jassim et al., 2024). Combined with frequent exposure to infectious diseases, hazardous materials, and ergonomic stressors, ICU professionals face unique occupational challenges that require systematic risk identification and mitigation (Nelson et al., 2023; Gül,et al., 2024).

The aims of action research are:

1. **To identify and assess occupational risks**: This involves mapping the wide range of physical, psychological, organizational, and biological risks present in the ICU environment. The study leverages the input of a multidisciplinary team of ICU staff, including resuscitation doctors, general practitioners, anesthetic nurses, general nurses, and care assistants.
2. **To prioritize these risks**: Not all occupational risks carry the same level of danger or frequency of occurrence. Through the use of the Failure Mode and Effects Analysis (FMEA) methodology, risks will be ranked based on their potential severity, likelihood of occurrence, and detectability. This step ensures that resources are directed toward mitigating the most critical risks.
3. **To develop an action plan addressing the most critical risks**: The final goal is to propose a targeted action plan to reduce or eliminate the top-priority risks identified. This plan will include both preventive and corrective measures aimed at improving the safety, health, and efficiency of ICU staff, thereby enhancing overall patient care outcomes.

METHODS

Study Design:

An action research approach (George, 2023), took place from March to June 2024 in the intensive care unit of the Hassan II hospital in Settat, Morocco, was used to identify and evaluate occupational risks in the ICU. The methodology was based on the Failure Mode, Effect, and Criticality Analysis (FMEA) model, which helps assess risks by considering their frequency, severity, and detectability. Alternatively known as failure modes, effects, and criticality analysis (FMECA), Failure modes and effects analysis, or FMEA was developed in the 1940s by the United States military as a methodical way to discover every potential point of failure in a design, a manufacturing or assembly process, a product, or a service (Bahr, 2018), following that, it was modified and codified in the industrial sector, most notably by NASA in the 1960s (*spinoff2008.pdf*, s. d.), It was widely used in other sectors of the economy, like the automobile sector (especially by Ford in the 1970s) (*Automobile History*, 2018). FMEA contributes to process reliability, patient safety, and the prevention of major hazards in the healthcare sector. It works especially well for predicting risks in intricate settings like hospital (El-Awady, 2023). This tool is still evolving and being contextualized, which makes it useful and effective, especially in the hospital sector, where it is used by the international standardization organization to improve health and safety in the workplace (Bazaluk et al., 2024; Jaddi Madarsara et al., 2019).

Each risk was rated on a scale from 1 to 4 for these factors, and a Risk Priority Number (RPN) was calculated using the formula: RPN=Severity(S)×Occurrence (O)×Detectability (D). We used a

simplified scale from 1 to 4 to calculate the Risk Priority Number (RPN) in the FMEA method, with the following factors:

Severity (S): 1 = low, 2 = moderate, 3 = high, 4 = very high.

Occurrence (O): 1 = rare, 2 = occasional, 3 = frequent, 4 = very frequent.

Detectability (D): 1 = very easy to detect, 2 = moderate, 3 = difficult, 4 = very difficult to detect.

Participants:

A working group was formed to ensure multidisciplinary perspectives and accurate risk identification. This group included: The PhD student (leading the research), the supervisor (research advisor), the head doctor of the ICU, the head nurse of the ICU, the hospital's quality officer, the chair of the nosocomial infection control committee, the chair of the council of nurses, and the head of the nursing unit. These stakeholders provided diverse perspectives on ICU operations and staff safety.

Data collection:

Data on occupational risks were gathered using a validated scanning grid, among all health professionals (resuscitation doctors, anesthetic nurses, general nurses, and care assistants) working at the ICU at Hassan II Hospital in Settat, Morocco, which allowed for systematic risk identification. Each identified risk was evaluated based on three key factors: severity, frequency, and detectability. The FMEA process was used to prioritize the risks and recommend corrective actions.

Ethical considerations:

Informed consent was obtained from participants, and confidentiality was maintained throughout the research process.

All members of the team and health professionals working in the hospital's Intensive Care Unit have expressed their willingness to take part in this project.

RESULTS

Through the application of the FMEA method and a collaborative effort from a multidisciplinary team of professionals, 11 occupational risks were identified in the ICU of Hassan II Hospital in Settat. Each risk was evaluated based on frequency (how often the risk occurs), severity (the potential impact if the risk materializes), and detectability (how easily the risk can be identified or mitigated before it causes harm). The results were used to assign a Risk Priority Number (RPN) to each identified risk, allowing us to rank them and focus on the most critical risks that need immediate attention.

The following figure shows the occupational risks identified in the intensive care unit at Hassan II Hospital in Settat, Morocco according to their Risk Priority Number (RPN):

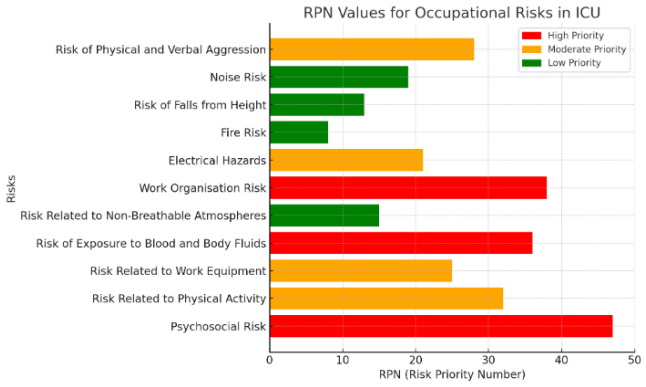

Figure 1:the occupational risks identified in the intensive care unit at Hassan II Hospital in Settat, Morocco according to their Risk Priority Number (RPN)

Psychosocial risk: Healthcare professionals in the ICU are exposed to high levels of emotional and psychological stress due to the intense nature of their work. Factors such as high patient mortality, time pressure, emotional involvement with patients, and long working hours contribute to chronic stress and burnout. The impact of this risk on mental health issues, such as anxiety, depression, and burnout, can severely affect both professional performance and personal well-being. The RPN is equal to (RPN = 4×4×3=48): High. This risk was ranked as one of the top priorities due to its frequent occurrence and the severe impact on staff well-being.

Risk related to physical activity: The ICU requires frequent physical exertion, including moving and lifting patients, which poses a risk of musculoskeletal injuries, especially for nurses and care assistants. Repetitive strain injuries (RSIs), back pain, and joint problems are common. These injuries can lead to absenteeism and long-term disability if not properly addressed. The RPN is equal to (RPN = 3×3×2=18) High. Given the frequency and physical demands of the work, this risk was identified as a major concern.

Risk related to work equipment: Medical devices, such as ventilators, monitors, and infusion pumps, are frequently used in the ICU. Improper use or malfunction of this equipment can cause harm to both patients and staff. For example, failure of ventilators can lead to respiratory distress for patients and stress for healthcare workers trying to resolve the issue. Faulty equipment can result in injuries and errors in patient care, leading to life-threatening situations.

The RPN is equal to (RPN = 3×2×2=12) Medium. While the impact of equipment failure is significant, the risk is mitigated by regular maintenance and training on equipment usage.

Risk of exposure to blood and body fluids: ICU staff are frequently exposed to blood and other bodily fluids while performing invasive procedures (e.g., catheter insertion, blood draws, wound care). This exposes them to blood-borne pathogens, such as HIV and hepatitis B or C. Exposure to infectious diseases can lead to serious health conditions, requiring immediate post-exposure interventions, and may lead to long-term consequences for healthcare workers. The RPN is equal to (RPN = 4×3×2=24) High. This risk was prioritized due to the high severity of potential infections.

Risk related to non-breathable atmospheres: Certain medical procedures, such as intubation and the administration of anesthetic gases, expose ICU staff to non-breathable or toxic atmospheres. Prolonged exposure to these environments can result in respiratory issues or poisoning. Serious respiratory conditions and toxic exposure could result in acute or long-term health problems. The RPN is equal to (RPN = 3×2×2=12) Medium. The risk is considered moderate because of the precautions generally taken, but failure in proper ventilation systems increases its severity.

Work organization risk: Poor work organization, such as understaffing, long shifts, and heavy workloads, often lead to fatigue, stress, and decreased productivity. The pressure to constantly perform critical, life-saving procedures exacerbates this risk. Prolonged overwork can lead to errors in judgment, delayed decision-making, and reduced quality of care for patients. The RPN is equal to (RPN = 3×4×3=36) High. Due to its direct impact on both patient care and staff well-being, this risk ranked among the top priorities.

Electrical hazards: The ICU relies on numerous electrically powered devices, such as heart monitors, ventilators, and infusion pumps. Faulty wiring or improper handling can lead to electric shocks or equipment malfunctions. Electric shocks can cause physical harm, while equipment malfunctions may delay critical interventions. The RPN is equal to (RPN = 3×2×2=12) Medium. Although the risk exists, regular maintenance and protocols reduce its frequency.

Fire risk: The use of flammable gases like oxygen and certain anesthetic agents in the ICU presents a fire hazard, particularly when combined with electrical equipment. A fire outbreak in an ICU setting could lead to catastrophic consequences for both staff and patients. A fire in an ICU could cause severe injuries, fatalities, and damage to critical equipment. The RPN is equal to (RPN = 4×1×1=4) Low. The risk is less frequent but has severe consequences, especially in the event of poor fire control measures.

Risk of falls from height: Healthcare workers may risk falling when handling equipment on elevated platforms or when transferring patients, particularly in emergencies where fast movement is required. Falls can lead to fractures, sprains, or more severe injuries, resulting in staff absenteeism. The RPN is equal to (RPN = 3×1×2=6) Low. While the risk is present, it is less frequent in the ICU environment.

Noise risk: ICUs are often noisy due to constant alarms, ventilator beeps, and the need for communication between staff members. Prolonged exposure to high levels of noise can lead to auditory fatigue, stress, and reduced concentration. Chronic exposure to noise can affect mental health, leading to increased stress and lower work performance. The RPN is equal to (RPN = 2×3×2=12) Medium. While the risk is prevalent, it is considered less severe compared to physical and infectious risks.

Risk of physical and verbal aggression: ICU staff, particularly nurses and doctors, may face aggression from distressed patients or their families during critical moments. This can include verbal threats, physical assaults, or heightened confrontations in emotionally charged situations. Aggression can lead to emotional trauma, fear, and a hostile work environment, further exacerbating stress and reducing work efficiency. The RPN is equal to (RPN = 4×2×3=24) High. Although the impact is significant, the frequency is generally lower compared to other risks.

Risk prioritization:

The following table summarizes the three priority risks identified, along with their Risk Priority Number (RPN):

Table 1: the three priorities occupational risks identified in the intensive care unit at Hassan II Hospital in Settat

Risk	RPN=S×O×D			RPN	Appreciation
Psychosocial risk	**S**	**O**	**D**	**48**	High criticality
	4	**4**	**3**		
Work organization risk	**S**	**O**	**D**	**36**	High criticality
	3	**4**	**3**		
Risk of exposure to blood and body fluids	**S**	**O**	**D**	**24**	High criticality
	4	**3**	**2**		

After calculating the Risk Priority Number (RPN) for each risk, the top three occupational risks that require urgent intervention were identified as:

Psychosocial risk: With the highest RPN (RPN=48), psychosocial risk was deemed the most critical due to its pervasive effects on mental health, leading to burnout and decreased job satisfaction.

Work organization risk: Prolonged overwork can lead to errors in judgment, delayed decision-making, and reduced quality of care for patients.

Risk of exposure to blood and body fluids: This risk had a high RPN (RPN=24) due to the severe consequences of exposure to infectious diseases, especially in a high-risk environment like the ICU.

DISCUSSION

The findings of this study underscore the critical occupational risks faced by healthcare professionals working in the Intensive Care Unit (ICU) at Hassan II Hospital in Settat, Morocco. These risks: psychosocial risk, work organization issues, and exposure to blood and body fluids — were identified as the most significant, requiring immediate interventions to safeguard both healthcare workers and patients. The implications of these risks go beyond staff well-being, as they directly affect the quality of care and overall patient safety within the ICU. A detailed discussion of each risk highlights the necessity of adopting an integrated risk management approach that focuses on mental health, organizational efficiency, and infection control measures.

1. Psychosocial risk: Psychosocial risks were found to have the highest Risk Priority Number (RPN=48) among all the identified risks, which points to the severe psychological impact of working in an ICU environment. Healthcare workers in the ICU are subject to chronic stress due to the nature of the work, which often involves:

-High-pressure decision-making, especially in life-or-death situations.

-Long working hours that lead to fatigue and emotional exhaustion.

-Exposure to emotionally distressing events, such as patient deaths or complex medical conditions.

These conditions contribute to burnout, which manifests as a combination of physical, mental, and emotional exhaustion, ultimately impairing the workers' ability to perform their duties effectively. Burnout in healthcare settings has been linked to higher rates of medical errors, poor patient outcomes, and increased absenteeism among staff. The impact of psychosocial stress also extends to higher staff turnover, as healthcare workers may leave their jobs to escape these high-stress environments. In the same, a systematic review by Papazian et al. (2023) found that ICU nurses and doctors are particularly susceptible to burnout due to long hours, exposure to patient deaths, and high-intensity decision-making (Papazian et al., 2023). This mirrors your findings that ICU environments foster high stress, leading to burnout and reduced quality of care (Cole & Siddiqui, 2022).

Another study by Salas-Bergués et al. (2024) reported similar results, the healthcare workers in ICUs experiencing burnout, resulting in emotional exhaustion and reduced professional efficacy (Salas-Bergüés et al., 2024). The focus on work-life balance initiatives and counseling support in your recommendations is consistent with the interventions suggested in the literature.

Key recommendations to address psychosocial risks:

-Mental health support programs such as regular counseling and debriefing sessions can provide emotional outlets for healthcare workers (Van Patten & Bartone, 2019).

-Work-life balance initiatives, such as flexible work schedules and mandatory rest periods, can help mitigate fatigue and prevent emotional burnout (Zarowsky & Rashid, 2022).

-Team-building activities and peer support systems should be introduced to promote a culture of mutual support, helping staff to manage stress collectively (Mikolajczak-Degrauwe et al., 2023).

2. Work organization risk: The work organization risk ranked second in terms of priority, reflecting the critical importance of effective communication and structured task delegation in high-pressure environments like the ICU. This risk arises due to several factors:

-Poor communication during patient handovers can lead to incomplete or incorrect transmission of patient information, which increases the risk of medical errors.

-Inefficient task distribution among healthcare workers, particularly during peak hours, can lead to task overload for certain staff members, while others may experience underutilization.

-Role ambiguity often contributes to confusion, leading to duplicated efforts or delays in patient care, further increasing the risk of preventable errors.

In the ICU, clear and accurate communication is paramount to ensure the continuity and safety of patient care. Miscommunication during shift changes or handovers is a well-known risk factor for medical errors, especially in critical care settings where patient conditions can change rapidly.

In the same, a study conducted by Janagamia et al. (2020) identified communication failures during handovers as the leading cause of medical errors in ICUs (Janagama et al., 2020). A study conducted by Na Zhang et al. during the COVID-19 pandemic among nurses highlights the importance of clear role delineation and balanced workload distribution, suggesting that task overload can result in poor patient outcomes (Zhang et al., 2022).

Some actions recommended in the literature relating to the risk associated with work organization can be summarised as follows:

-Implement standardized handover protocols that ensure comprehensive, clear, and consistent communication between staff at shift changes (Nasiri et al., 2021).

-Role clarification to ensure all staff members know their specific responsibilities and avoid duplication of tasks (Courtright & Kerlin, 2014; Sprung et al., 2010).

-Balanced workload distribution to prevent overload and ensure that all staff members contribute equally to patient care (Kovacs & Lagarde, 2022). These interventions will help create a more organized and structured working environment, reducing the likelihood of errors and improving the overall efficiency of care in the ICU.

3. Risk of exposure to blood and body fluids: Given the high-exposure environment of the ICU, the risk of exposure to blood and body fluids is a major concern, ranking third in priority. Healthcare workers are routinely exposed to infectious agents via:

-Needlestick injuries and improper handling of sharp instruments.

-Inadequate use of Personal Protective Equipment (PPE), leading to potential contact with contaminated fluids.

-Improper PPE disposal and handling, which increases the risk of secondary exposure to blood-borne pathogens.

-Infection control in ICUs is critical, not only for the safety of healthcare workers but also for protecting patients from nosocomial infections (hospital-acquired infections). In the same, a study conducted by Mohamud et al. at the Mogadishu Somalia Turkey Recep Tayyib Erdogan Training and Research Hospital highlights that sharp injuries account for the majority of occupational infections among healthcare workers (Mohamud et al., 2023). In their review, they suggest that regular PPE audits and sharps-handling protocols, which are also emphasized in your studies, are essential to reduce exposure. Similarly, WHO (2019) identified the importance of ongoing training in PPE use and regular audits, reinforcing the need for a comprehensive infection control strategy in ICUs. However,

WHO's study further underscores the need for stronger policy enforcement, such as penalizing non-compliance with PPE protocols (*WHO,2020*, s. d.).

Some actions recommended in the literature relating to the risk of exposure to blood and body fluids can be summarised as follows:

-PPE compliance audits and ongoing training on proper PPE use, especially during procedures involving potential exposure to blood and body fluids (Lin et al., 2020).

-Ensuring that there is consistent access to PPE supplies, so healthcare workers are always adequately protected (Martin et al., 2022; Slocum et al., 2023).

-Establishing clear sharp-handling protocols to minimize the risk of injuries from needles or other sharp objects (Cheetham et al., 2021).

-Regular safety audits to ensure that PPE protocols are followed and that there are no breaches in infection control measures (Avo et al., 2020).

These steps will minimize healthcare workers' exposure to hazardous materials, creating a safer working environment and reducing the likelihood of infection transmission in the ICU.

The need for an integrated risk management approach in the ICU at the Hassan II Hospital:

The study highlights the interconnected nature of these risks and the need for a holistic approach to risk management. Addressing only one risk in isolation would not be sufficient to significantly improve the working conditions in the ICU.

Inadequate infection control measures, such as inconsistent PPE use, not only increase the risk of exposure but also contribute to higher stress levels, further compounding the psychosocial risks.

By implementing an integrated action plan that addresses all three priority risks: psychosocial stress, work organization, and exposure to blood and body fluids, healthcare managers can create a safer, more supportive environment for ICU staff. This, in turn, will lead to improved patient outcomes, as healthcare workers who are physically, emotionally, and mentally well are better equipped to deliver high-quality care.

Action plan:

To implement our action plan for the three priority risks, we used approved and validated planning tools. In our case, we used the Gantt chart as a planning tool.

The working group has determined a set of actions for each priority risk, which will be planned using the Gantt chart.

The following figures represent all the elements sought within the framework of the FMEA method, which is used for prioritized risk management.

Priority risk	*Potential failure mode*	*Effects of failure*	*Possible cause*	*Detection methods*	*Recommended actions*
Psychosocial Risk RPN= 48					
Burnout	Staff experiencing mental and physical exhaustion	Decreased performance, errors, and absenteeism	Excessive workload, lack of support	Regular staff surveys, performance audits	- Introduce flexible work schedules and mandatory rest breaks. - Offer mental health counseling and debriefing sessions.
High-stress levels	staff showing signs of stress-related illnesses (anxiety, depression)	Lower morale decreased patient care quality	Long working hours, high emotional demand	Counseling program feedback, health assessments	- Provide stress management workshops. - Implement resilience training and support programs. - Foster team-building exercises.
Lack of work-life balance	Staff having difficulty managing personal and professional responsibilities	Increased turnover, absenteeism	Rigid work schedules, lack of rest periods	Absenteeism reports, staff feedback	- Introduce rotation schedules that allow for rest. - Promote flexible work hours where possible.

Figure 2: recommended actions based on psychosocial risk as 1st priority risk

The figure presents a Failure Mode and Effects Analysis (FMEA) for psychosocial risks in the ICU, specifically focusing on burnout, high-stress levels, and lack of work-life balance. Each row systematically breaks down these risks into failure modes, their effects, causes, detection methods, and recommended actions.

Priority risk	*Potential failure mode*	*Effects of failure*	*Possible cause*	*Detection methods*	*Recommended actions*
Work organization risk RPN= 36					
Poor communication in handovers	Incomplete or unclear information during shift changes	Patient safety risks, medical errors	Lack of standardized handover protocols	Handover audits, patient safety incident reports	- Implement standardized handover protocols. - Regular training on communication and documentation during shift changes.
Work overload	Staff unable to manage high workload	Increased errors, stress, and decreased care quality	Insufficient staffing, poor workload distribution	Staff performance reviews, workload assessment	- Reallocate staff based on workload needs. - Hire additional staff or use temporary staffing solutions to reduce overload.
Role confusion	Unclear roles and responsibilities among staff	Task duplication, delays in care delivery	Lack of clear role definitions	Team meetings, error, and delay reports	- Establish clear job roles and responsibilities. - Provide cross-functional training to clarify roles and prevent task duplication.

Figure 3: actions recommended according to the risk linked to work organization as the 2nd priority risk

The figure presents a Failure Mode and Effects Analysis (FMEA) for work organization risks in the ICU, focusing on poor communication during handovers, work overload, and role confusion. This table highlights key elements contributing to organizational inefficiencies that may impact patient care quality and staff well-being.

Priority risk	*Potential failure mode*	*Effects of failure*	*Possible cause*	*Detection methods*	*Recommended actions*
Risk of exposure to blood and body fluids RPN= 24					
Inadequate PPE use	Staff not wearing appropriate protective equipment	Increased risk of infection (e.g., bloodborne pathogens)	Insufficient PPE supply, lack of training	PPE audits, infection control reports	- Conduct regular PPE compliance audits. - Provide continuous training on the use of PPE, and ensure the availability of PPE.
Improper handling of sharps	Unsafe handling of needles or sharp objects	Needlestick injuries, exposure to bloodborne pathogens	Lack of safety protocols, inadequate training	Incident reports, safety audits	- Implement strict protocols for sharp handling. - Provide training on safe disposal and handling of sharp objects. - Monitor compliance regularly.
Contaminated PPE	Staff reusing contaminated PPE	Infection transmission	Lack of PPE supply or improper disposal methods	Safety audits, staff feedback	- Establish clear disposal policies for used PPE. - Regularly check PPE stocks and ensure consistent supply.

Figure 4: actions recommended according to the risk of exposure to blood and body fluids as the 3rd priority risk

The figure provides a Failure Mode and Effects Analysis (FMEA) for the risk of exposure to blood and body fluids in the ICU, highlighting inadequate PPE use, improper handling of sharps, and contaminated PPE. This table outlines potential failure modes that increase the risk of infection transmission among healthcare staff, emphasizing the need for proper infection control protocols.

Action plan using the Gantt chart (Atlassian, s. d.)**:**

The following figures show the action plan drawn up to correct the failure modes related to each priority risk, using the Gantt chart.

Table 2: Action plan for work organization risk

Priority risk	Action Item	Recommended Actions	Responsible Person(s)	Needs (Resources & Requirements)	Oct 2024	Nov 2024	Dec 2024	Jan 2025	Feb 2025	Mar 2025	Apr 2025	May 2025	Jun 2025
Work organization risk RPN=36	Standardize handover protocols	Develop and enforce standard handover protocols to ensure clear communication.	ICU Supervisor, Quality Officer	Templates for standardized handovers, staff training sessions	●	●	●	●	●				
	Role clarification and workload distribution	Create clear role definitions and distribute workload evenly to prevent overload.	ICU Supervisor, Department Manager	Staff role review, management oversight, workload balancing system		●	●	●	●				
	Continuous monitoring of work processes	Conduct regular reviews and audits of workflow efficiency to avoid duplication of tasks.	Quality Officer, ICU Supervisor	Audit tools, external consultants for efficiency evaluation					●	●	●	●	

Table 3: Action plan for psychosocial risk

Priority risk	Action Item	Recommended Actions	Responsible Person(s)	Needs (Resources & Requirements)	Oct 2024	Nov 2024	Dec 2024	Jan 2025	Feb 2025	Mar 2025	Apr 2025	May 2025	Jun 2025
Psychosocial Risk RPN=48	Mental health support programs (counseling, debriefing)	Establish regular debriefing sessions; provide counseling services.	Head of HR, ICU Supervisor	Hiring of mental health professionals, dedicated spaces for sessions	●	●	●						
	Flexible work schedules	Implement flexible scheduling to reduce stress and burnout.	Head of HR, Department Manager	Shift planning software, policy adjustment, approval from management		●	●	●					
	Staff feedback and monitoring	Introduce regular mental health surveys and stress monitoring for staff.	HR Team, ICU Supervisor	Survey tools, software for anonymous data collection and analysis				●	●	●			

Table 4: Action plan for risk of exposure to blood and body fluids

Priority risk	Action Item	Recommended Actions	Responsible Person(s)	Needs (Resources & Requirements)	Oct 2024	Nov 2024	Dec 2024	Jan 2025	Feb 2025	Mar 2025	Apr 2025	May 2025	Jun 2025
Risk of exposure to blood and body fluids RPN=24	PPE compliance audits and staff training	Train staff on proper PPE usage; conduct compliance audits regularly.	Infection Control Committee, ICU Supervisor	PPE inventory, training materials, audit checklists	●	●							
	Improve PPE access and safety checks	Ensure availability of PPE at all times; perform regular safety checks of equipment.	Quality Officer, Head of Supply Chain	PPE supply contracts, safety audit templates, inventory management software		●	●	●					
	Continuous safety audits and PPE protocol updates	Regularly update PPE protocols based on audits; provide feedback and corrective actions.	Infection Control Committee, Quality Officer	Review committee, updated PPE protocols, staff briefings					●	●	●		●

The action plan will be evaluated for possible adjustments and corrections. This evaluation will be the subject of the next stage of our action research.

The involvement of the ICU's healthcare professionals:

Implementing the proposed risk mitigation strategies, including mental health programs, ergonomic training, and improved infection control protocols, is crucial for improving healthcare worker safety and reducing the likelihood of errors that compromise patient care. Regular updates to risk assessments are also recommended to keep pace with changes in the ICU environment.

Limitations:

The study was conducted in a single hospital, which may limit the generalizability of the findings. Future research should include multiple ICUs to understand and compare occupational risks in other units and hospitals.

CONCLUSION

The research conducted within the Intensive Care Unit (ICU) at Hassan II Hospital in Settat, Morocco, provided a comprehensive analysis of the occupational risks faced by healthcare professionals. Through the systematic application of the Failure Mode and Effects Analysis (FMEA) method, the study successfully prioritized the most critical risks and designed targeted interventions aimed at mitigating these hazards.

FMEA, a proactive risk assessment tool, allowed the research team to evaluate potential failure points in the workflow and identify areas where improvements could be made to enhance the safety and well-being of the ICU staff. This approach not only addressed immediate occupational risks, such as exposure to infectious agents, ergonomic stress, and the psychological toll of working in a high-pressure environment but also focused on developing sustainable solutions that could be integrated into the hospital's operational procedures.

The action plan that emerged from the study includes practical and scalable measures. These interventions, ranging from improving protective equipment protocols and enhancing staff training to introducing new safety measures in the ICU environment, are designed to reduce the incidence of work-related injuries and enhance overall patient care quality.

Close monitoring of the action plan's implementation is a critical component of the strategy. Regular audits and feedback loops will be established to ensure that the measures are effectively reducing risks as intended. If successful, these interventions have the potential to be adapted and expanded to other units within Hassan II Hospital, ultimately creating a safer working environment for the entire healthcare workforce.

This research not only contributes valuable insights to the management of occupational risks in healthcare settings but also sets a precedent for other hospitals to adopt similar methodologies for continuous improvement in staff safety and patient outcomes.

Following the evaluation of this action plan for our hospital's intensive care unit, the next stage will be devoted to all the hospital's medical departments, to achieve a comprehensive, integrated approach to occupational risk management.

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