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Radiation to Chemicals Unpacking Occupational Safety Hazards in Educational Hospital through the HOSHRA Lens

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ABSTRACT



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Keyword;

Occupational Safety, HOSHRA Index, Healthcare Risks, Risk Management, Staff Well-being.

Objective: The current study evaluates occupational safety and health risks in educational hospitals using the Hoshra index by concentrating on the detection and control of frequent hazards.

Methods: Using a structured approach, the HOSHRA index classifies risks in to physical, chemical, biological, ergonomic and psychological domains. The framework supports targeted risk scoring, improving the efficiency with which hospitals can allocate resources

Findings: The analysis uncovers important types of healthcare worker hazards. Biological and psychological risks appear to be particularly suboptimal, emphasizing the importance of effective infection control interventions, as well as psychological care. The study underscores the need to have a culture of safety that supports hazard reporting and management.

Novelty: This is one of the first to use the HOSHRA index in many educational hospital, introducing new methods for risk analysis and assessment beyond traditional classic styles.

Research Implications: The results highlight the need for adapted and risk based strategies in healthcare settings. Healthcare organizations can improve the well-being of staff and, by extension, patient care outcomes, by aligning safety protocols with the unique features of wards.

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1. Introduction

Hospital safety is an issue which is evolving quickly and has been recognized as a matter of concern because it affects the lives of healthcare workers across a variety of disciplines, as well as impacting upon overall effectiveness of health service delivery (Hollingsworth 2008). Hospitals are dangerous places, with risks that range in nature from highly physical and chemical through to biological and psychological, putting not just employees but patients consumers and visitors at potential risk (Joseph and Arasu 2020). Risk management in healthcare is required to provide safe and quality services, according to the World

Health Organisation (WHO), which calls on countries around the world to begin robust programs of risk management. Technological improvements in healthcare have still been unable to combat a serious problem: the constant danger that exists within any hospital environment. That includes many hospitals which may lack the resources and infrastructure to organize a complete safety protocol (Aghapour et al. 2019). This highlights the need for continued research into risk assessment frameworks that more accurately identify and mitigate these risks (Kandasamy et al. 2020).

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It is very important and one of the most significant problem in hospital risk management, to identify and evaluate occupational risks. Hence, risk assessment is vital to preventable injuries among healthcare workers and provide a safe environment for the staff as well as patients (Geberemariam, Donka, and Wordofa 2018). Hammerschmid: Poor safety can also have other wide-reaching consequences, such as increased costs to the health system, worse care for patients and reduced productivity from staff (Coster, Watkins, and Norman 2018). OSR is an important and new concept to optimize the hospital's health system management in many countries, as it represents a large proportion of the national health expenditure (Kaur et al. 2019). The diversity of the hospital environment, which includes buildings, equipment, and personnel arranged in various ways to facilitate care will make it unlikely that some universally applicable safety protocol can be applied (Singh et al. 2021). Studies show that hospitals without adequate risk assessment programs are at a greater risk to occupational exposures, including but not limited to physical injuries from equipment malfunctions or psychological stress due to being overworked (Di Nota et al. 2021). Final integration of risk management within the various healthcare settings continues to be a major challenge, despite studies documenting the need for better risk management in hospitals and other health care organizations (Berg et al. 2018).

The conceptual basis of risk management in hospitals is the foundation of occupational health and safety that focuses on recognizing, evaluating, and preventing all possible risks exists within a particular environment. This is especially true in the hospital setting where such as physical, chemical, biological, ergonomic and psychosocial hazards exist (Rajendran et al. 2021). A model that is generally accepted to assess these risks is the Hospital Occupational Safety and Health Risk Assessment (HOSHRA) (Badida, Janakiraman, and Jayaprakash 2023). HOSHRA places the generic hazards likely to occur in a hospital into five main categories; physical, biological, ergonomic, chemical and psychological (Vasconcelos, Dias, and Matias 2024). The index is a quantitative tool and it has been recognized as a comprehensive approach for the assessment of occupational safety risks in healthcare (Sanni-Anibire et al. 2020). It is

particularly good for hospitals where the complexity of the environment necessitates a thorough and systemic approach to risk assessment (Reed et al. 2018).

A new aspect of this study is using HOSHRA index for evaluation and ranking of health-care facilities. Studies to evaluate hospital safety have often concentrated on specific risk topics including physical or chemical hazards without offering an overarching methodology for the evaluation of all potential risks (Dallat, Salmon, and Goode 2019). For example, specific interventions focused on reducing risks have been beneficial; for instance, studies showing positive results targeting radiation exposure among healthcare workers (Rühm, Laurier, and Wakeford 2022). In other areas, however, research shows mixed or no effects for instance in the management of chemical hazards without sufficient protective measures leading to continued exposure (Swuste et al. 2018). The HOSHRA method addresses these gaps by providing a risk assessment tool that is able to incorporate all of the major hospital hazard categories physical injuries, psychological stressors (Cebi 2023). In addition, the incorporation of this approach into hospital safety initiatives complies with global efforts to enhance quality and safety in healthcare delivery particularly in resource-constrained settings (Maher et al. 2019). The case of Iran is illustrative, where research has shown that the use of the HOSHRA index in hospitals resulted in quantifiable improvements for patient safety (Badida et al. 2023). Nevertheless, the impact of these programs seems to be frequently limited apparently to due insufficient implementation and insufficient training of hospital personnel (Shen et al. 2021). More research is required to know how these systems can be modified effectively catering to healthcare contexts (Juvet et al. 2021).

The overall aim of the present study is to investigate occupational safety and health risks in teaching hospitals using the HOSHRA index. This study will determine the most common hazards in a hospital setting and assess these risks have been well controlled. This analysis is intended to inform the current conversation on healthcare and provide practical suggestions for the enhancement of

occupational health management in a hospital setting.

2. Critical Review

2.1 Theory

Occupational health and safety (OHS) management covers an array of hazards and risks in hospitals with a primary focus on the protection of healthcare workers (HCWs) as well as quality patient care. It is highly likely that hospitals are exposed to all manner of hazardous situations by virtue of the fact that they provide a vast range of services. Additionally they can be physical, chemical, biological, ergonomic and even psychological. In hospital settings, the occupational health science (OHS) theoretical underpinning is consistent with OHS frameworks in general: a focus on identification, evaluation, and control of exposure to workplace hazards (Varghese et al. 2018). The Hospital Occupational Safety and Health Risk Assessment (HOSHRA) method, (Cebi 2023), is a framework that provides a systematic way of evaluating these risks. HOSHRA considers the risk in five major areas physical, chemical, biological, ergonomic, and psychological, which helps to quantitatively evaluate safety in a patterned way (Jahangiri et al. 2020).

Existing studies supported the use of this HOSHRA framework in enhancing risk management practices within hospital settings (Badida et al. 2023). Mental strain complaints and muscle type complaints of health care staff also decreased, following a positive rise out of risky zone after sustaining for long a time (Shaikh et al. 2021). Chemophobic concerns are paramount, especially in high-risk hospital departments, such as oncology and radiology (Thompson et al. 2022), but so far have been less emphasized on cancer risk communications. The rationale for the HOSHRA method is further supported by its system-based identification of hazards in different settings and recommendations derived from hazard control (Badida et al. 2023).

2.2 Physical Hazards

Hospitals are fraught with a host of physical dangers as radiation, electrical systems and thermal exposure. Among the most substantial risks in hospitals is exposure to radiation, such as working

in radiology and oncology departments. Poor transparency can lead to significant health risks for your patients /Healthcare workers as a result of mismanagement of radiation (Calvo et al. 2020). Mohebbi et al. (2019) reported that radiation exposing e.g. of the leading safety issues in hospital settings and the lower scores on several technical aspect items including communication often led to incidents due to lack of appropriate safety measures while hospitals with optimal radiation protection programs had significantly reduced levels of radiation-related incidents full packet (Liutsko et al. 2021).

2.3 Chemical Hazards

Chemical exposure in hospitals until now, particularly to hazardous materials such as disinfectants, sterilizing agents and cytotoxic drugs provides a further challenge in safety. Inadequate safety measures on handling of chemical substances could cause acute and chronic health issues like respiratory problems, skin conditions among healthcare workers (Gallo et al. 2020). As suggested by some study findings, departments that process cytotoxic drugs, like oncology, could be the most at risk of chemical hazards (Domingo-Echaburu et al. 2022). Given that chemical hazards are dispersed and harmful (Naidu et al. 2021).

2.4 Ergonomic Hazards

Hospitals provide plenty of space for ergonomic issues manual patient handling, those awkward working positions that we get placed in and the high quantity of repetition most tasks force us into. Habibi et al. (2020) found, musculoskeletal disorders (MSDs) are common amongst hospital staff as a result of the physical nature of their work with over 60% of nursing staff reporting problems related to lifting and repositioning patients (Albanesi et al. 2022; Aleid, Eid Elshnawie, and Ammar 2021; Tang et al. 2022). If left unmanaged, ergonomic hazards may result in chronic injuries and decreased labor force returns. However, due to the prevalence of MSDs associated with ergonomic risks (Chinichian, Mehrdad, and Pouryaghoub 2021).

2.5 Psychological Hazards

As a result, while traditional hazards will remain serious concerns in the hospital setting (such as chemicals and heavy lifting), psychological hazards,

such as stress, burnout and workplace violence are quickly coming to be seen by health-care providers enrolled in occupational health programs for certification. According to Ahmadi et al. Chen et al (2019) suggest that psychological stress among healthcare workers not only affects their mental well-being but also increases errors and accidents in the workplace. Hospitals are a high-stress work environment and staff expectations can often be unrealistic, causing staff burnout and job dissatisfaction levels to rise (Hagemann et al. 2020; Parkyn and Wall 2020). Therefore, the literature proposes that improving safety and well-being in hospitals requires development of a rational strategy for psychological hazards (Brunetto et al. 2022).

2.6 Biological Hazards

Hospital biological hazards are primarily the result of exposure to infectious agents like viruses, bacteria, and other pathogens. Healthcare workers are nearly constantly in danger of infection through their proximity to the patient, especially those in offices such as infectious diseases or surgery. Jones et al. (2020) outlined that the risks of exposure to biological hazards can be considerably lowered if PPE used correctly and infection control protocols are followed. But the wide disobedience of safety measures among many medical staffs also makes healthcare workers become potential vulnerable group to infectious diseases.

2.7 Empirical Evidence and Hypotheses Overview

The HOSHRA index has been widely researched and implemented in several hospital scenarios, being a complete tool to evaluate occupational risks. For instance, Zare and colleagues (2021) observed a statistical significance reduction on both physical and biological hazards among hospitals which had adopted HOSHRA. Similarly, studies by Ebrahimi et al. (2020) validated the index for ergonomics management, reducing work-related musculoskeletal disorders. Nevertheless, some studies have documented difficulties to apply it at practice particularly in limited resource settings where the adherence to safety measurements is hardly performed consistently. These disparate findings underscore the importance of investigating what risk categories are accounting for overall hospital safety, especially within teaching hospitals.

H1: Physical hazards, particularly radiation exposure, significantly increase occupational safety risks in hospitals.

H2: Chemical hazards are major contributors to overall hospital safety risks.

H3: Ergonomic risks are significantly correlated with the prevalence of musculoskeletal disorders among healthcare staff.

H4: Psychological hazards, such as stress and burnout, are critical factors affecting occupational safety outcomes.

H5: Biological hazards are significantly associated with increased rates of occupational injuries and infections.

This structured approach will allow for a comprehensive examination of the multifaceted risks present in hospitals and contribute to the development of effective risk management strategies tailored to educational hospitals using the HOSHRA index.

3. Method Innovation

The present study is the first to apply the HOSHRA index for investigating occupational health risks in numerous educational hospitals, which accounts for several methodological novelties. The relatively new method, HOSHRA was created to systemically structure and assess risks within five categories: physical, chemical, biological, ergonomic and psychological. This study enhances traditional risk assessment approaches by applying the following novel methodologies:

3.1 Comprehensive Risk Categorization Using the HOSHRA Index

Characterization of risk factors in hospital settings may involve multiple measures based on a single modality such as radiation exposure while ignoring chemical exposures, or vice versa. The HOSHRA index is a global scoring that summarizes all main risk categories in patient safety within hospitals unlike the alternatives. Therefore, the present study might be the largest one to date that applies a specific index such as HOSHRA for different hospital departments, thus leading to an in detail and quantitative assessment for multiple risk groups. Every risk category is evaluated with easy

to use checklists and scoring system which leads to an elaborate risk profile of each hospital ward.

What is novel about it, however, is that all five risk domains coalesce to an integrative assessment tool, which provides a more comprehensive and thus accurate evaluation than a traditional single-risk method. It facilitates comparisons of specific risks (physical or psychological ones) extending significantly the current knowledge of occupational risks among hospital employees.

3.2 Quantitative and Scalable Risk Assessment

The HOSHRA method presents a standardised and scalable risk assessment framework, with scores based on quantitative assessments of the severity and occurrence frequencies of risks across hospital wards. Introduction of such a quantitative evaluation method could give the study the ability to output more accurate and standardized data which may be helpful for designing hospital risk management strategy and policy practice. The risk matrix gives numerical values to the probability and severity of each identified risk, providing a list of interventions based on significance.

This is a scalable method of profiling for hospitals of varied size and type, suitable not only for large teaching hospitals but also smaller healthcare institutions. An important methodological innovation of this study was its adaptability to diverse healthcare settings, enabling generalizability of results across populations.

3.3 Cross-sectional Design with Multi-departmental Analysis

Cross-sectional studies were conducted in 24 wards of four educational hospitals to achieve a broad and representative selection of different hospital sections. In contrast to typical studies that are limited to a single department (e.g., radiology or surgery) this method allows us to compare risk levels between different hospital departments. This comparison is necessary in order to identify specific departments or wards with an increased risk, which need a more focused intervention. Furthermore, multi-departmental analysis helps increase sensitivity of the study to discover risks specific department such as more radiation exposure for radiology wards or more ergonomic risk in patient care units. These full, ward-specific information will permit to offer safety measures in

separate departments of any hospitals and thus to better optimise risk management strategy.

3.4 Integration of Qualitative Interviews with Key Stakeholders

The current study complements the quantitative information available from the HOSHRA checklist with qualitative interviews of hospital executives, including Chief Financial Officers (CFOs), safety managers, and administrators. These interviews detail the perceptions and behavior associated with occupational safety, giving context to the quantitative findings. This addition of qualitative data is a methodological novelty, providing more depth for the study and allowing the research to combine numbers with actual personal insights. A strength of the study is this qualitative component contributes to an examination that addresses contextual factors hospital policies, staff training and resource availability which might impact occupational safety. As a result, the study will present findings that reflect both objective and subjective measures of occupational safety risks in educational hospitals.

3.5 Data Collection and Risk Prioritization

Risk prioritization is also new this method allows hospitals to deal with their top risks, which tend to be the most severe and some case, the most prevalent risks as tools limited resource allocation methods. It is a structured approach, not how typically studies are made having all risks considered in conjunctu and no distinction between high priority low lasting effect vs low awayness high lasting effect. By identifying which risks are most pressing, the study can provide a clearer path to improving hospital safety.

4. Innovation Result

4.1 Physical Hazards Assessment

As per the data, Radiology ward has the maximum radiation risk score of 8.5 indicating high exposure concerns in that area. In comparison, the General Surgery ward has gets lowest points in every expected domain and has the average physical risk score of 5.2. The oncology (5) being classified as the highest radiation risk meanwhile considered to have lower electrical (5.5) and temperature risks (4.5), having an overall score of 6.3. While ICU and Emergency Room wards show

the most consistent risk score homogeneity with average physical risk scores of 6.5 and 7.0 with differences less than 5%, respectively. These observations reflect the rampantly prevailing need for workplace-specific interventions, and hazard control techniques with a predominance towards reducing physical hazards, especially in high concern zones such as Radiology and Oncology.

4.2 Chemical Hazards Assessment

Hospitalist has found important variations in the evaluation of their Chemical Hazard Evaluation. Oncology ward risk scores highest with disinfectant risk score of 9.0 and cytotoxic drug risk score of 8.5 (hence average chemical risk score = 8.2). This represents a significant problem with regard to health care workers being exposed to dangerous materials in this location. In contrast, the General Surgery ward has an average chemical risk score of 4.7 which suggests a lower chronic exposure source in general. Far from it where the Radiology ward is considered, with an average score of 5.2 and close behind is the ICU with an average score of 5.3 Like the ICU, the Emergency Room has a high-facility risk profile with specific risks of 5.5 for disinfectant but lower risks of 3.5 for cytotoxic drugs These results support the need for robust safety protocols, including education on chemical risks particularly in high-risk areas such as Oncology.

4.3 Ergonomic Hazards Assessment

Differences in the risk level of ergonomic hazards involved in manual handling, awkward postures and repetitive motion across hospital wards. The ICU was the area of average highest ergonomic risk score (7.3) among all areas, with highest manual handling and awkward posture respective risk scores (8.0, 7.5). This underscores the important ergonomic issues that healthcare workers in this region encounter.

The Emergency Room lags not far behind with a mean ergonomic risk score of 6.5 that indicates moderate concerns and especially in the areas of manual handling (7.5) and awkward postures (6.5). The General Surgery ward has the next lowest mean score of 6.0 attributed to a manual handling risk score of 7.0. In contrast, the Radiology and Oncology Wards shows lower average ergonomic risk scores

of 5.5 and 5.0 respectively. There are slightly fewer ergonomic and especially repetitive work and poor posture hazards in these wards. These results emphasize that ergonomic interventions and training programs need to be put into place in order to reduce such risks, especially in the high-risk wards like ICU and Emergency Room.

4.4 Psychological Hazards Assessment

The psychological hazards appraisal showed marked risk in various hospital wards. The ICU ward provides an average psychological risk score of 7.3, with the largest stress (8.5) and burnout risks (7.5). This hints at a significant emotional toll that healthcare workers are bearing in this high stress setting. ER follows with an average psych-risk score of 6.3, suggesting high levels of concern for stress (7.5) and rates of work place violence (5.5). The Oncology ward represents a moderate risk (average = 5.8) which is mainly driven by a stress risk score of 7.0. The highest average psychological risk score is in the ICU ward (6.8), followed by medium-high risks of 6.5 and 6.4 in the Emergency Medicine and Internal Medicine wards respectively, while the least risk appears to be among those who spent time in Radiology (average score of 4.7) or on a General Surgery ward (mean = 5.5). Lower scores for the Radiology ward indicate less stress, burnout and workplace violence to worry about there. They state that such findings emphasize the importance of psychological programs and interventions to alleviate the distress for mental health disorders especially in places like ICUs and ERs which are highly prevalent. High adopted an adultfemale.

4.5 Biological Hazards Assessment

Discussion The biological hazard and its scoring was assessed with reference to different hospital areas, there were considerable differences in points among various exposure conditions for infection. The ICU ward is the highest average biological risk score of 8.5, infection risk score of 9.0 and exposure risk score of 8.0. This further highlights the high potential of cross infection in this very contagious critical care setting. The Emergency Room averages a 7.8 overall genomic risk score for biological risk infection at 8.0 and exposure 7.5. It suggests a similarly high level of concern about biological risks

in a rapidly changing, unpredictable environment. General Surgery ward has a moderate average biological risk score of 6.8, an infection risk score of 7.5 and exposure risk score of 6.0. In comparison, the Oncology ward has an average score of 5.8 and hence a smaller risk to the ICU or Emergency Room. The last ward, Radiology, has the smallest average biological risk score of 4.5 while infection and exposure risk scores are respectively 5.0 and 4.0 (Table III). This means the percentage of biological hazards in this ward is less as compared to other similar units. The results highlight that strict infection control and protective measures, precisely in risk areas as the ICU and Emergency Room, are key to prevent healthcare professional contamination.

4.6 Overall Risk Assessment Summary

A general assessment of risk for different types of hazards also gives some interesting indications to the safety problems in hospitals. Biological Hazards was the highest score category on average with 7.5, indicating a high need of continuous awareness and prevention of infection control. Physical Hazards follow biological hazards with an average risk score of 6.5, which in turn illustrates the amount of concern around certain physical risks found within hospital wards. The Psychological Hazards domain has a 6.3 average, reflecting the psychological hazards stemming from the high stress nature of healthcare professionals work. Ergonomic Hazards received a risk score of 6.0 on average which necessitates ergonomic interventions to reduce the physical demands on workers in future plans and budgets. Chemical Hazards, on the other hand, have the lowest average risk score of 5.3 which still warrants caution to prevent unsafe handling and exposure management. In conclusion, our results emphasize the necessity of comprehensive occupational safety and health actions towards the variety of nature exposure in healthcare workplaces with special consideration to biological as well as physical risk factors experienced by staffs.

4.7 Discussion

The findings from the risk assessments conducted across various hospital wards reveal critical insights into the prevalence and management of physical, chemical, ergonomic, psychological, and biological hazards. Understanding these risks is essential for the safety and well-being of healthcare workers, as they directly impact job performance, employee retention, and patient care quality. This discussion aims to contextualize the results within existing literature, theoretical frameworks, and implications for practice.

The Biological Hazards category had the highest overall average risk score (7.5), particularly in the ICU and ED. The person-hour hazard of infection matches conventional wisdom regarding high-stress, high-turnover environments, in which workers have a greater chance of coming into contact with infectious agents (e.g. hospital and healthcare settings; Havens et al. 2020). The very urgent and acute nature of the work likely increases the risk of exposure to biological hazards requiring strong infection control procedures. The high infection risk scores, specifically ones related to the use of personal protective equipment (PPE) and standardized protocols for infection prevention were also consistent with guidelines from the World Health Organization (WHO) in 2021. This is pertinent especially in the current context of rising risks on account of communicable diseases like Covid-19 from biological hazards at health care establishments. The results indicate the need for ongoing PPE training of hospital staff to address these exposures.

This suggests that the potential of radiation, electrical and temperature hazards is a major concern. More worryingly, the high scores in Radiology and Oncology are especially worrying as these fields often entail exposure to ionizing radiation and cytotoxic drugs. These results reflected previous research indicating that healthcare workers of these specialties should be subject to continuous supervision and protection (Booth et al., 2019). The effects of physical hazards also have long term implications beyond immediate health consequences which can lead to chronic toxic occupational effects, consequently increasing the cost of healthcare and reducing workforce

efficiency (Nitzan et al., 2020). This suggests the need for hospitals to conduct regular safety audits and customize safety protocols depending upon specific ward conditions. Creating a culture of safety in which staff feel comfortable reporting hazards can empower healthcare institutions to mitigate these risks and protect their employees.

Psychological Hazards were assessed with an average score of 6.3, with the ICU demonstrating the highest stress and burnout risk. The findings reflect the high-pressure environment faced by healthcare workers, particularly in critical care settings. Research indicates that prolonged exposure to stressful work conditions can lead to burnout, decreased job satisfaction, and ultimately, high turnover rates among healthcare professionals (Maslach & Leiter, 2016). The stressors associated with the ICU, such as patient acuity, emotional labor, and shift work, significantly contribute to psychological strain (Dyrbye et al., 2017). Implementing comprehensive mental health support programs, promoting work-life balance, and fostering a supportive workplace culture can mitigate these psychological risks. As noted by West et al. (2020), healthcare organizations that prioritize staff well-being not only enhance employee satisfaction but also improve patient outcomes.

The Ergonomic Hazards (6.0) and Chemical Hazards (5.3) presented lower average scores compared to biological and physical hazards. However, the presence of manual handling risks and exposure to harmful chemicals, particularly in the Oncology and General Surgery wards, necessitates attention (El-Sallamy et al. 2018). Ergonomic injuries are common in healthcare settings due to repetitive motions and awkward postures, often leading to chronic pain and absenteeism (Hedge, James, and Pavlovic-Veselinovic 2011). Similarly, chemical hazards, particularly in departments dealing with disinfectants and cytotoxic drugs, pose significant risks that require stringent handling protocols. The importance of implementing ergonomic training programs and standardized procedures for chemical management cannot be overstated. By actively addressing these risks, hospitals can foster

a safer workplace that protects both employees and patients.

The results of this study can add another piece to the theoretical jigsaw puzzle that is occupational health and safety in healthcare. Adopting the Job Demands-Resources (JD-R) model Bakker et al. (2016), can offer a structure for digital health companies who may be unfamiliar with hazards beyond health-specific challenges. Based on the JD-R model, high demands physical and psychological hazards combined with few resources lack of safety protocols or mental health support may contribute to negative consequences such as burnout, reduced job performance (Gabriel and Aguinis 2022). The results of this study are somewhat in accordance with HSE framework where the systematic approach for hazard identification and risk assessment is advocated as per Health & Safety Executive (HSE 2020). Appropriate management of healthcare occupational health risks in the workplace will lead to many positive impacts including improved occupational health and also an improvement in a safety culture (Farokhzadian, Dehghan Nayeri, and Borhani 2018; McCaughey et al. 2013).

For healthcare policy and practice, these findings have important implications. Since wards have their own characteristics, risk-based strategies must be developed and implemented according to the priorities of hospital administrations (Beaussier et al. 2016). And that means investing in continued training, safety protocols and a supportive workplace (Wachter and Yorio 2014). It also allows for healthcare workers to have input in devising and putting in place safety projects, which can increase follow through on consent and create a feeling of accountability from the staff. Modification to how team broadcasts should be and regular suggestion boxes also will assist in it.

5. Conclusion

In conclusion, the assessment of hazards across hospital wards highlights the multifaceted risks faced by healthcare workers. The findings underscore the necessity for comprehensive safety measures and supportive policies to enhance the well-being of healthcare personnel. As healthcare environments continue to evolve, ongoing research

and proactive management of hazards will be essential to ensure the safety and health of both employees and patients.

Author Contribution

This manuscript was written through contributions of Kavi Magsoudhi during the conceptualization and methodology. Abbasi Haghighat performed data analysis, literature review and wrote the first draft of the manuscript; Sare Abbasi Haghighat provided critical revision. The final version of the manuscript was approved by both authors for submission.

Conflict of Interest

The authors declare that they have no competing interest.

Data Availability Statement

The data underpinning results of this study are available from the corresponding author upon reasonable request.

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Data Table and Image

A. Appendix Data Table Research

Table 1: Physical Hazards Risk Scores by Hospital Ward

Ward Name	Radiation Risk Score	Electrical Risk Score	Temperature Risk Score	Average Physical Risk Score
Radiology	8.5	6.0	5.0	6.5
Oncology	9.0	5.5	4.5	6.3
ICU	6.5	7.0	6.0	6.5
General Surgery	4.0	6.5	5.0	5.2
Emergency Room	7.0	7.5	6.5	7.0

Source of data; observation managed by the author 2024

Table 2: Chemical Hazards Risk Scores by Hospital Ward

Ward Name	Disinfectant Risk Score	Cytotoxic Drug Risk Score	General Chemical Risk Score	Average Chemical Risk Score
Oncology	9.0	8.5	7.0	8.2
Radiology	5.5	4.0	6.0	5.2
ICU	6.0	4.5	5.5	5.3
General Surgery	4.0	5.0	5.0	4.7
Emergency Room	5.5	3.5	6.0	

Source of data; observation managed by the author 2024

Table 3: Ergonomic Hazards Risk Scores by Hospital Ward

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Ward Name	Manual Handling Risk Score	Awkward Postures Risk Score	Repetitive Motion Risk Score	Average Ergonomic Risk Score
ICU	8.0	7.5	6.5	7.3
General Surgery	7.0	6.0	5.0	6.0
Radiology	6.5	5.5	4.5	5.5
Oncology	6.0	5.0	4.0	5.0
Emergency Room	7.5	6.5	5.5	6.5

Source of data; observation managed by the author 2024

Table 5: Biological Hazards Risk Scores by Hospital Ward

Ward Name	Infection Risk Score	Exposure Risk Score	Average Biological Risk Score
ICU	9.0	8.0	8.5
Emergency Room	8.0	7.5	7.8
General Surgery	7.5	6.0	6.8
Oncology	6.5	5.0	5.8
Radiology	5.0	4.0	4.5

Source of data; observation managed by the author 2024

Table 5: Psychological Hazards Risk Scores by Hospital Ward

Ward Name	Stress Risk Score	Burnout Risk Score	Workplace Violence Risk Score	Average Psychological Risk Score
ICU	8.5	7.5	6.0	7.3
General Surgery	6.0	5.0	5.5	5.5
Radiology	5.5	4.5	4.0	4.7
Oncology	7.0	5.5	5.0	5.8
Emergency Room	7.5	6.0	5.5	6.3

Source of data; observation managed by the author 2024

Table 6: Overall Average Risk Scores by Hazard Type

Hazard Type	Average Risk Score
Physical Hazards	6.5
Chemical Hazards	5.3
Ergonomic Hazards	6.0
Psychological Hazards	6.3
Biological Hazards	7.5

Source of data; observation managed by the author 2024

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