MSD

Medical Science and Discovery
ISSN: 2148-6832

Comprehensive Evaluation of Occupational Accidents in a Hospital Setting: Insights from L-Type Matrix and Fine-Kinney Risk Assessment Methods

Muhammed Furkan Özden[1], Furkan Yıldız[1], Fahriye Naz Erdil[2], Sarper Yılmaz[3*]

1 Arnavutköy State Hospital, Istanbul, TR
2 Dept. of Emergency Medicine, University of Health Sciences Ümraniye Research and Training Hospital, Istanbul, TR
3 Department of Emergency Medicine, University of Health Sciences Kartal Dr. Lutfi Kirdar City Hospital, Istanbul, TR

*** Corresponding Author**: Sarper Yılmaz **E-mail:** sarperyilmaz08@gmail.com

ABSTRACT

Objective: The objective of this study was to comprehensively evaluate occupational accidents in a hospital setting using the L-Type matrix and Fine-Kinney risk assessment methods. The aim was to assess the frequency, severity, and associated risks of different types of accidents.

Methods: This single-center observational study analyzed occupational injuries that occurred to hospital employees between January 2018 and December 2022 in Arnavutköy State Hospital. Data were obtained from hospital records using a hospital information management system. Demographic characteristics, accident types, previous accident history, incapacity reports, L-Type matrix scores, and Fine-Kinney method scores were recorded. Risk scores were categorized based on predefined criteria.

Results: The study included 249 occupational accidents, with a mean age of 30.94±9.69 years. Needle stick injuries in the hand were the most common type of accident (72.7%), followed by falls and bumps (16.1%). The L-Type matrix assessment showed that 90% of accidents were mild, and none were severe. According to the Fine-Kinney method, 0.8% of accidents were in the very high-risk group. Multiple accidents were observed among 23.7% of employees, and 11.6% resulted in work disability reports.

Conclusion: Occupational accidents pose a significant risk to the safety and well-being of healthcare workers in hospitals. Needle stick injuries and falls or collisions were the most prevalent accidents. The use of risk assessment methods such as the L-Type matrix and Fine-Kinney approach allows for a comprehensive evaluation of occupational risks.

Keywords: occupational accidents, hospital employees, risk assessment, healthcare workers, safety

INTRODUCTION

The occupational health risks healthcare workers face can have far-reaching consequences on their physical and mental well-being (1). In addition to putting the lives of the individuals directly involved at risk, these risks can also disrupt patient care continuity and quality (2). Healthcare work is characterized by high levels of demands, and when combined with a fast-paced environment, the likelihood of accidents occurring increases (3). The prevalence of needle stick accidents, falls, and contact with infectious materials highlights the importance of implementing effective preventive measures. Additionally, the frequent lifting or carrying of heavy objects in hospitals, along with ergonomic challenges, further adds to the risk landscape. Healthcare organizations can implement targeted interventions and preventive strategies to mitigate occupational injuries by identifying the frequency, types, and associated risks. Preventive measures are crucial to safeguarding healthcare workers' physical and mental health, fostering a safer work environment, and optimizing patient outcomes.

Due to their inherent vulnerability in their line of work, the safety and well-being of healthcare workers in hospital settings is paramount. Because healthcare professionals are exposed to various occupational hazards, effective precautions are essential in preventing accidents and ensuring their safety.

Research Article

Received 19-05-2023

Accepted 27-05-2023

Available Online: 28-05-2023

Published 30-05-2023

Occupational risks can be identified, evaluated, and managed with tools such as the L-type matrix and Fine-Kinney method (4,5). These tools enable a systematic and standardized assessment of healthcare-specific risks, providing a comprehensive assessment. Using the L-type matrix as well as the Fine-Kinney method facilitates categorizing risk scores, enabling a clear understanding of risks' severity and priority. Organizations can then allocate resources and prioritize risk mitigation strategies accordingly. Moreover, these tools provide a framework for comparing the current risk landscape within the organization with similar healthcare settings, aiding in benchmarking and facilitating continuous improvement. Using these risk assessment tools, healthcare organizations are able to identify areas for improvement, implement targeted interventions, and improve their overall safety culture. The systematic and standardized nature of these methods ensures a more thorough evaluation of occupational risks, enabling healthcare professionals to make informed decisions and take appropriate measures to safeguard the well-being of their workforce (6). Ultimately, the adoption of these tools contributes to the prevention of occupational accidents, fostering a safer and more secure working environment for healthcare personnel.

This study's primary objective is to assess occupational accidents experienced by healthcare workers in a hospital setting by using L-type matrix and Fine-Kinney methods. The purpose of these risk assessment tools is to comprehensively evaluate the frequency, severity, and associated risks of various types of accidents.

MATERIAL and METHODs

The study was designed as a single-center observational study. This study covered all occupational injuries that occurred to hospital employees between January 1, 2018, and December 31, 2022 in the Arnavutköy State Hospital, a state hospital of 2nd level. The researchers used a hospital information management system to check data obtained from hospital records. The Haseki Training and Research Hospital Ethics Committee obtained a study ethics approval prior to the study's start (no: 27-2003; date: 01.02.2023). In this study, demographic characteristics such as age, gender, occupation, type of occupational accident, whether the subject had experienced an occupational accident before, whether an incapacity report was issued as a result of the incident, the 5x5 L type matrix score and the occupational accident risk group as determined by this method, the Fine-Kinney method score, and the occupational accident risk group were noted as well.

L-type Matrix risk score is obtained by multiplying likelihood (frequency) and severity values (7). An accident occurring once a year was rated 1 (very small), once a year was rated 2 (small), several times a year was rated 3 (medium), once a month was rated 4 (high), and once a week or more often was rated 5 (very high). In the severity rating, accidents that do not cause loss of working hours and require only simple first aid are scored as 1 (very mild), accidents that do not cause loss of working days and may require outpatient treatment are scored as 2 (mild), accidents that cause loss of working days or require inpatient treatment are scored as 3 (moderate), serious injuries or injuries that cause loss of labor for 10 days or more are scored as 4 (serious), and accidents that cause death or permanent disability are scored as 5 (very serious). Mild scores were categorized as less than 8, moderate scores as between 8-15, and severe scores as more than 15 (8).

A Fine-Kinney risk index is calculated by multiplying probability, exposure, and severity (9). In this definition, probability refers to situations that could turn into occupational accidents if realized. A rating of 0.2 represents virtually meaningless situations, a rating of 0.5 represents weakly probable situations, a rating of 1 represents a situation with very low probability, a rating of 3 represents uncommon but possible situations, and a rating of 10 represents situations which should be expected. To determine the probability score, researchers evaluated the outcomes of occupational accidents in that accident group across the entire dataset. Exposure calculations were based on accidents occurring once a year or less scoring 0.5, accidents occurring several times a year scoring 1, accidents occurring once or several times a month scoring 2, accidents occurring once or several times a week scoring 3, accidents occurring once a day scoring 6, and accidents occurring more than once a day scoring 10. Using the severity calculation, cases with a mild, harmless, or insignificant result received a score of one, cases with a minor loss of labor and minor damage received a score of three, cases with a loss of labor received a score of 7, cases with disabilities or limb losses received a score of 15, death or total disability received a score of 40, and multiple deaths received a score of 100. Using the risk index obtained, an acceptable risk was defined as smaller than 20, less than 70 as definite risk, 70-200 as significant risk, 200-400 as high risk, and more than 400 as very high risk (10).

Statistics

Analyses were performed with the Statistic Package for Social Sciences (SPSS v29, Chicago, IL, USA). Compliance with normal distribution was checked by Kolmogorov-Smirnov test. For descriptive data, numbers and percentages were used for categorical variables and mean±standard deviation or median (IQR 25th - 75th) was used for continuous variables.

RESULTs

The study included 249 occupational accidents. The mean age of the occupational accident victims was 30.94±9.69 years. The study included 90 males (36.1%) and 159 females (63.9%). When the occupational accident victims were evaluated according to their occupations, 109 nurses (43.8%), 63 cleaning personnel (25.3%), 31 student interns (12.4%), 11 doctors (4.4%) and 35 people from other occupations (14.1%) were observed. When the occupational accidents were evaluated according to the type of accident, it was observed that the most common occupational accident was a needle stick in the hand (72.7%, n=181), followed by falls and bumps (16.1%, n=40), contact with blood and/or body fluids (4.4%, n=11), lifting objects in an inappropriate position (2%, n=5) and being beaten (2%, n=5). When the accidents in the last 5 years were evaluated, it was observed that 59 employees (23.7%) had experienced at least 1 occupational accident in the same institution. 29 employees (11.6%) were reported as incapacitated after an occupational accident, resulting in loss of work capacity.

http://dx.doi.org/10.36472/msd.v10i5.955

When occupational accidents were evaluated with the L-type 5x5 matrix, the median score was found to be 5 (IQR 5 - 5). When these scores were evaluated with color coding, it was observed that 224 accidents (90%) were mild (coded with green color) and 25 accidents (10%) were moderate (coded with yellow color). None of the occupational accidents were severe (color coded red).

When the occupational accident was evaluated with Fine-Kinney score, the median score was 70 (IQR 70 - 70). When the scores were evaluated according to risk status; 44 accidents (17.7%) were in the acceptable risk group, 9 accidents (3.6%) were in the definite risk group, 193 accidents (77.5%) were in the significant risk group, 1 accident (0.4%) was in the high-risk group and 2 accidents (0.8%) were in the very high-risk group.

DISCUSSION

This study provides valuable insight into the characteristics of occupational accidents among hospital workers. Based on the study's results, occupational accidents pose a significant risk to the safety and well-being of healthcare workers, and among the 249 accidents monitored, one resulted in death. Effective measures must be taken to prevent and minimize such accidents. There was a 30.94±9.69 average age among the employees who had occupational accidents, illustrating that accidents can affect people of all ages. Sengel et al. reported that the mean age in their study was 39.3 years, higher than our study's mean age (11). Taking into account the specific risk factors that may arise at different levels of professional development, safety precautions and training programs should target employees of all ages.

Table 1. Characteristics of occupational accidents

		n=249	%
Age		30.94	9.69
Sex	Male	90	36.1
	Female	159	63.9
Occupation	Nurse	109	43.8
	Physician	11	4.4
	Cleaning Personnel	63	25.3
	Intern	31	12.4
	Other	35	14.1
Type of Accident	Assault	5	2
	Fall/Collision	40	16.1
	Needle Prick	181	72.7
	Electric shock	1	0.4
	Foreign Body in Eye	3	1.2
	Contact with blood and/or body fluids	11	4.4
	Contact with chemicals	1	0.4
	Narcotic drug injection	1	0.4
	Lifting in an inappropriate position	5	2
	Burn	1	0.4
Recurrence		59	23.7
Loss of working days		29	11.6

Table 2. Analysis of occupational accidents according to 5x5 matrix and Fine-Kinney method

Variable		n or median	IQR or %
5x5 matris score		5	(5 - 5)
5x5 matris category	Mild (green)	224	90
	Moderate (yellow)	25	10
	Severe (red zone)	0	0
Fine-Kinney risk index		70	(70 - 70)
Fine-Kinney category	Acceptable	44	17.7
	Definite	9	3.6
	Significant	193	77.5
	High	1	0.4
	Very High	2	0.8

According to the distribution of occupational accidents among different professions, the hospital environment poses distinct risks for each profession. In particular, nurses suffer the most accidents due to their direct involvement in patient care and continuous exposure to a multitude of hazards. According to the literature, previous descriptive studies have reached similar conclusions (12). Occupational accidents also occur frequently among cleaning personnel. This outcome underscores the crucial significance of formulating meticulous occupational safety plans that specifically cater to this group, with the primary objective of mitigating contact risks associated with hazardous chemicals, exposed syringes, and sharp implements such as scalpels. Furthermore, the prevalence of physicians and interns in occupational accidents accentuates the pressing need to develop comprehensive security protocols and comprehensive training programs that effectively address the risks stemming from their unique work responsibilities and environmental conditions.

Based on the study data, needlestick injuries are the most common type of accident encountered, accounting for the majority of accidents. This finding aligns with previous literature, highlighting the ongoing risk posed by this type of accident for healthcare workers (13). The potential consequences of infection transmission underscore the importance of vigilant tracking of needlestick injuries, emphasizing the necessity for enhanced device manufacturing and infection control protocols that prioritize safety. Falling and colliding are other types of accidents frequently observed in the hospital setting, emphasizing the need for ergonomic measures and the use of safety equipment.

One alarming discovery in the study findings is the observation of a significant occurrence of multiple occupational accidents among patients throughout their work duration. A literature review found this rate was 35.6% in Lee's study (14). This finding highlights the crucial need for robust and ongoing safety programs to reduce the risks of recurring accidents among hospital staff. Furthermore, it is noteworthy that 11.6% of these accidents resulted in work disability reports spanning one or more days. This outcome sheds light on the implications of these accidents on the affected individuals' health, work productivity, and the overall healthcare system. Thus, it further emphasizes the necessity of addressing and mitigating the ramifications of such accidents.

This study employed two distinct risk assessment methods: the 5x5 L-type matrix and the Fine-Kinney approach. These two risk assessment methodologies emerge as valuable tools in determining the severity and potential of potential risks associated with observed occupational accidents (15,16). According to the 5x5 matrix, the majority of accidents fall into the mild category, indicating the effectiveness of implemented safety measures. However, the presence of accidents in the moderate risk category also highlights the need for the continuity of preventive strategies and ongoing evaluation. On the other hand, the risk analysis conducted using the Fine-Kinney method examines accidents in greater detail across multiple categories. According to this assessment, a significant portion of accidents is assessed in the high-risk category. The distinctiveness of this method, compared to the L-type matrix evaluation, lies in its consideration of the potential risk arising from the difference in the occurrence of accidents, as well as the dimensions of the damage that may arise in the event of an accident, taking into account the concept of "probability" rather than just frequency. The higher number of accidents in the higher-risk group in this evaluation demonstrates the potential hazardous outcomes that accidents within the hospital setting may entail.

Moreover, the unique characteristics of the pandemic period in which this study was conducted should be taken into consideration. Considering that certain environmental factors even affect measurement methods for certain parameters, understanding the extent to which the comprehensive personal protective equipment used by healthcare workers during this period may have contributed to their dexterity and protection against occupational accidents would be beneficial (17,18). The decrease in tactile sensitivity can be considered to be associated with a slowdown in manual dexterity, which in turn is linked to the risks of occupational accidents (19). Additionally, it is plausible to consider that the cognitive impairments and reduced concentration caused by the Covid-19 infection could also have an impact on the number of occupational accidents (20). Especially in cases where there were atypical presentations, such as skin manifestations, instead of the typical respiratory symptoms, workers may have continued to work without knowing that they were infected with Covid-19, thus becoming more vulnerable to the side effects caused by the infection and potentially leading to occupational accidents (21). Therefore, any changes and precautions taken to protect occupational safety and health should be approached by considering both the physical limitations that may arise from the use of personal protective equipment and the potential risks associated with cognitive function impairments caused by infections like Covid-19.

In conclusion, this study provides valuable insights into the frequency and characteristic features of accidents that occur within hospital settings. Based on these findings, it can be said that comprehensive safety measures, tailored training programs, and ongoing risk assessment processes are necessary to minimize and prevent such accidents. By identifying occupational groups, types of accidents, and associated risks, this study contributes to acquiring the necessary knowledge for implementing strategies that protect the safety and health of hospital workers. The implementation of these strategies to establish a safer working environment for employees will play a crucial role in enhancing healthcare quality.

Limitations

This study is subject to several limitations, which are crucial to consider for a balanced evaluation of the findings. Firstly, the study design is both single-center and observational, which may limit the generalizability of the results. The specific characteristics of Arnavutköy State Hospital and its workforce may differ from other hospitals, potentially leading to variations in the frequency and types of occupational accidents across different institutions. Secondly, this study's L-type matrix and Fine-Kinney methods used for risk assessment have inherent limitations. The inclusion of subjective parameters such as probability and severity in both methods highlights the potential for bias in these evaluations. It is essential to be aware of these limitations to interpret the results appropriately and avoid overgeneralization. Further research incorporating multiple centers and employing more

objective measures for risk assessment would be valuable in enhancing the understanding of occupational accidents in diverse healthcare settings.

CONCLUSION

This study highlights the presence of various occupational accident risks within the hospital setting, particularly emphasizing needlestick injuries and falls or collisions. It underscores the significance of addressing these accidents. Risk assessment methods such as the L-type matrix and Fine-Kinney offer valuable insights by evaluating the severity and potential harm associated with accidents, shedding light on important information pertaining to these incidents.

Acknowledgments: None

Conflict of interest: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author Contributions: Concept Design- **MFÖ, FY, FNE, SY;** Data Collection or Processing- Analysis or Interpretation, Literature Search, Writing **SY**

Ethical approval: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and/or with the Helsinki Declaration of 1964 and later versions.

REFERENCES

1. Rai R, El-Zaemey S, Dorji N, Rai BD, Fritschi L. Exposure to Occupational Hazards among Health Care Workers in Low- and Middle-Income Countries: A Scoping Review. Int J Environ Res Public Health. 2021 Mar 5;18(5):2603.
2. Poghosyan L, Nannini A, Finkelstein SR, Mason E, Shaffer JA. Development and psychometric testing of the Nurse Practitioner Primary Care Organizational Climate Questionnaire. Nurs Res. 2013;62(5):325–34.
3. Lazarino MSA, Lazarino JPSA, da Silva JM. Health workers' health in face of disasters: what the experience in Brumadinho, Brazil, taught us. European Journal of Public Health. 2020 Sep 1;30(Supplement_5):ckaa166.1388.
4. Murzin MA, Tepina MS, Gorlenko NV. Occupational Risk Assessment for Workers of Aluminum Production Using the Example of RUSAL Bratsk OJSC. IOP Conf Ser: Mater Sci Eng. 2021 Mar;1079(6):062080.
5. Karahan V, Aydoğmuş E. Risk Analysis and Risk Assessment in Laboratory Studies. EJOSAT. 2023 Mar 30;(49):55–60.
6. Ankaraligil T, Özdemir A. RISKS ANALYSIS IN CATERING INDUSTRY. IJHSRP. 2019 Dec 13;4(3):184–99.
7. Gay S, Pope B, Badrick T, Whiley M. Review of current incidents and risk calculations used in the Royal College of Australasian Pathologists Key Incident Management and Monitoring Systems - a system that could be used by all Australasian medical laboratories, and easily adapted to worldwide use. Biochem Med (Zagreb). 2022 Feb 15;32(1):010702.
8. Jensen RC, Bird RL, Nichols BW. Risk Assessment Matrices for Workplace Hazards: Design for Usability. Int J Environ Res Public Health. 2022 Feb 27;19(5):2763.
9. Yılmaz F, Ozcan MS. A Risk Analysis and Ranking Application for Lifting Vehicles Used in Construction Sites with Integrated AHP and Fine-Kinney Approach. Adv Sci Technol Res J. 2019 Sep 1;13(3):152–61.
10. Dogan B, Oturakci M, Dagsuyu C. Action selection in risk assessment with fuzzy Fine–Kinney-based AHP-TOPSIS approach: a case study in gas plant. Environ Sci Pollut Res Int. 2022;29(44):66222–34.
11. Erturk Sengel B, Tukenmez Tigen E, Bilgin H, Dogru A, Korten V. Occupation-Related Injuries Among Healthcare Workers: Incidence, Risk Groups, and the Effect of Training. Cureus. 2021 Apr 6;13(4):e14318.
12. Strid EN, Wåhlin C, Ros A, Kvarnström S. Health care workers' experiences of workplace incidents that posed a risk of patient and worker injury: a critical incident technique analysis. BMC Health Serv Res. 2021 May 27;21:511.
13. Datar UV, Kamat M, Khairnar M, Wadgave U, Desai KM. Needlestick and sharps' injury in healthcare students: Prevalence, knowledge, attitude and practice. J Family Med Prim Care. 2022 Oct;11(10):6327–33.
14. Lee SJ, You D, Gillen M, Blanc PD. Psychosocial work factors in new or recurrent injuries among hospital workers: a prospective study. Int Arch Occup Environ Health. 2015 Nov;88(8):1141–8.
15. Gul M, Yucesan M, Ak MF. Control measure prioritization in Fine − Kinney-based risk assessment: a Bayesian BWM-Fuzzy VIKOR combined approach in an oil station. Environ Sci Pollut Res. 2022 Aug 1;29(39):59385–402.
16. Vatanpour S, Hrudey SE, Dinu I. Can Public Health Risk Assessment Using Risk Matrices Be Misleading? Int J Environ Res Public Health. 2015 Aug;12(8):9575–88.
17. Tatliparmak AC, Yilmaz S. Agreement of Oscillometric and Auscultatory blood pressure measurement methods: An ambulance noise simulation study. The American Journal of Emergency Medicine. 2023 May 1;67:120–5.
18. Ünal Ö. During COVID-19, which is more effective in work accident prevention behavior of healthcare professionals: Safety awareness or fatalism perception? Work. 2020;67(4):783–90.
19. Cheung SS. Responses of the hands and feet to cold exposure. Temperature. 2015 Mar 31;2(1):105–20.
20. Del-Aguila-Arcentales S, Alvarez-Risco A, Villalobos-Alvarez D, Carhuapoma-Yance M, Yáñez J. COVID-19, Mental Health and Its Relationship with Workplace Accidents. IJMHP. 2022;24(4):503–9.
21. Tatliparmak A, Serdar ZA, Kartal SP, Çelik G, Hacinecipoğlu F, Temel ŞY, et al. Cutaneous Findings of COVID-19 Infection Related with Length of Hospital Stay: A Prospective, Multicenter Study. Turkiye Klinikleri J Dermatol. 2022;32(1):56–61.