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Emergency Room Risk Assessment with L-Type Matrix

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ABSTRACT

The commonly used definition of "risk" in the literature is the probability of an undesirable event/occurrence taking place within a specific time frame. This requires a comprehensive risk analysis to identify these undesirable events/occurrences, calculate the severity of the associated risk, and determine whether the risk is tolerable. While risk analysis is essential for all organizations regardless of their size, the type of risk analysis to be performed, the methodology to be used, and the development of solutions to risks are determined by the type of company. Healthcare facilities require special care when it comes to risk analysis practices, as they are crucial for the health and safety of both patients and staff. Because of this, picking the right methodology, figuring out the risks, and sorting them based on how serious they are is super important for hospital management. This study, which aims to provide services within the scope of this work, conducted a risk assessment for an Emergency Room (ER) employee at the third level healthcare institution using the Risk Assessment Matrix (L-Type Matrix) approach for the purposes mentioned above.

1. Introduction

Healthcare systems in developing countries place a high priority on emergency services. Hospitals in these countries are so overcrowded that patients cannot receive adequate quality treatment. Because of this, patients are looking for different options for treatment. Emergency clinics, which are treatment centers that are easy and quick to access, are at the top of these alternatives. Along with fast healthcare, having laboratory and radiology facilities is a big reason why patients go to emergency rooms. However, this situation causes an increase in the workload of the emergency services system. Healthcare institutions in developing countries have been categorized in order to reduce this intensity. The first-level healthcare facilities are located within residential areas for easy access and are healthcare facilities where a specified number of doctors provide one-on-one care to patients based on the number of households in the area. These organizations have limited resources. The second-level healthcare institutions are available for healthcare services that cannot be provided at these institutions. Because of high patient numbers, a limited number of specialist doctors, and various resource constraints, patients are being referred to third-level healthcare facilities. The third level of healthcare facilities is healthcare facilities that provide services by more competent healthcare personnel. The emergency services provided by secondary and third level healthcare institutions are an important component

of healthcare services. For developing countries in particular, this level of importance is many times greater than for other countries. Because of this, healthcare organizations in these countries are putting in more effort to provide cost-effective emergency services. Although intensive efforts have been made, institutions are not as successful as desired. It is stated that the most important reason for this failure is the use of emergency services by patients who are not in need of urgent care. Non-emergency patients frequently visiting emergency departments not only prevent real patients from receiving care, but also reduce the quality of service due to system overload, thereby increasing costs indirectly. It is important to define the concept of risk in its broadest sense when describing the risk management process in the emergency department: The risk is an uncertain event or condition that, if it occurs, has a positive effect (and is therefore referred to as an opportunity) or a negative effect (and is referred to as a threat). Meanwhile, the science of risk management encompasses "all processes related to risk management planning, identification, analysis, response, monitoring, and control on a project. The risk analysis becomes an important tool when a job involves risk. The risk analysis is a process that helps you identify and manage potential issues that could undermine important business initiatives or projects. The first step in conducting a risk analysis is to identify the potential threats you face and then estimate the likelihood of these threats occurring. Such tools as Risk Assessment Matrices can also help identify threats. As is well known, the healthcare sector is a complex sector due to its matrix organizational structure, wide range of activities, and technology-intensive nature. The complex structure of the sector, coupled with healthcare workers' race against time and the dynamism of patients within the system, also brings with it various errors. Also, healthcare services carry a high level of risk by their very nature, even when there are no errors. The damage may cause healthcare personnel to be more exposed to infections, new diseases, or injuries during the provision of healthcare services. Since these risks can cause serious crises for a healthcare organization and can also affect its corporate reputation and sustainable success, they are of strategic importance. All processes, including high-risk areas covered by risk control in a healthcare facility, require the application of proactive methods in risk analysis and risk assessment. A top priority for these types of methods should not be the inclusion of corrective actions. Instead, necessary preventive measures should be considered, and system requirements should be determined.

2. LITERATURE REVIEW

[1] has conducted risk analysis and improvement studies at a training and research hospital in Türkiye. It was determined that there are a total of 46 different risks. A risk map of the hospital has been created. Five of these risks are high, 28 are medium, and 13 are low risk. Making improvements in hospitals based on risk maps has led to significant positive results in patient and staff safety. Risk management is an important factor in improving service quality. [1], [2] conducted a study to determine whether the incorrect risk assessment tool used in the Emergency Department adequately identified patients at risk of falling. The snowball sampling method was used in the study. It was concluded that the fall risk assessment tool did not adequately screen for patients who were intoxicated, pediatric, infants, substance dependent, unconscious, or had dizziness and vertigo. The concept of risk management in hospitals originated in the 1970s in the United States, spurred by court rulings that upheld the corporate liability of hospitals for the standard of care and held medical staff accountable for its quality of care. [3] A study on physical risks found that the noise that most disturbs people in hospitals is human voices. [4] Ventilation systems are important for every building and must be designed to provide appropriate temperature and humidity. Ventilation systems in hospitals are also important. Inadequate ventilation is also among the risks in hospitals. The risk of infection is high in hospitals. Hospitals need to make sure their ventilation systems are set up to prevent infections so that patients and staff stay healthy. Special ventilation is required in operating rooms, sterilization units, laboratories, and pharmacies. [5] Employees in the healthcare sector may be exposed to biological hazards such as bacteria, viruses, fungi, or parasites transmitted from sick individuals or contaminated bodily fluids or secretions. According to a report published in the United States (US) in 1983, healthcare workers are 10 times more

likely to contract infectious diseases than other civilian workers. [7] Costa and colleagues have proposed a new system to support the management of risk indicators for a hospital in Portugal. [8], [9] has developed a risk assessment model for emergency departments in hospitals in Dublin, Ireland. Simulation was examined in terms of its suitability for risk management approaches. The study result showed that simulation is good for risk management and that simulation models can be used as risk assessment models for healthcare services. [9]

3. EMERGENCY DEPARTMENT WORKFLOW PROCESS

The emergency room, which is open 24 hours a day, is one of the busiest departments in hospitals. The emergency room, which is a hospital unit, treats patients for up to 48 hours or refers them to the appropriate clinics after providing the necessary emergency medical intervention. Healthcare facilities are divided into three levels. Third-level healthcare facilities are the highest level of healthcare facilities, so their emergency department processes are more complex. Patients arrive at emergency room in two ways: by ambulance or by their own means. There are three areas designated for green, yellow, and red patient arrivals, respectively, based on the complexity of their treatment. This green area also serves as a triage area. Triage is a way to sort patients based on how urgent their condition is. The green space is for patients with minor health issues. The yellow area is another treatment area in emergency departments. The yellow zone indicates that there is a possibility of life-threatening complications in patients undergoing treatment, and the red zone indicates moderate to long-term symptoms. The red area is for patients with high life-threatening symptoms. Patients should be admitted to these areas without delay. A trauma room is located in the emergency department but is not part of the triage. Patients who have suffered trauma due to falls, traffic accidents, etc. are treated in trauma rooms. In emergency rooms, patients are observed for a maximum of 48 hours. Following treatment, patients in emergency rooms are typically transferred to medical units for further care or discharged from the hospital. It is possible that some of the patients admitted to the red zone may be lost.

4. RISK ASSESSMENT MATRIX (L-TYPE MATRIX)

Matrix diagrams are one of the most commonly used tools for examining the relationship between two or more variables. Because Risk Assessment Matrix is simple, it is ideal for analysts who have to do risk analysis alone. But, it is not enough to use this method alone for tasks which have different processes or different flow charts and the success of the analysis depends on the analyst's experience. Especially, it has to be done in this kind of organization where the determination of dangers which are urgent and must be taken precaution as soon as possible. Firstly, the likelihood of an event and rating of the event when it occurs and evaluation are done.

Risk score is estimated by multiplying likelihood of occurrence by severity of harm, as in

Risk Score = Likelihood of Occurrence x Severity of Harm

TABLE 1. Table of Likelihood

Rating	Likelihood	Description
1	Rare	Highly unlikely to occur. May occur in exceptional situations.
2	Unlikely	Most likely will not occur. Infrequent occurrence in past projects.

3	Possible	May occur at some time.
4	Likely	Likely to occur. Has occurred in past projects.
5	Almost Certain	Highly likely to occur. Has occurred in past projects and conditions exist for it to occur on this project.

TABLE 2. Table of Severity

Rating	Severity	Description
1	Insignificant	Minor injuries, or discomfort. No medical treatment or measurable physical effects
2	Minor	Injuries or illness requiring medical treatment. Temporary impairment.
3	Moderate	Injuries or illness requiring hospital admission.
4	Major	Injuries or illness resulting in permanent impairment.
5	Catastrophic	Fatality

TABLE 3. Risk Scores

		Severity Score				
		1	**2**	**3**	**4**	**5**
Likelihood Score	**1**	1 (Low)	2 (Low)	3 (Low)	4 (Low)	5 (Med)
	2	2 (Low)	4 (Low)	6 (Med)	8 (Med)	10 (High)
	3	3 (Low)	6 (Med)	9 (High)	12 (High)	15 (High)
	4	4 (Low)	8 (Med)	12 (High)	16 (High)	20 (Very High)
	5	5 (Low)	10 (High)	15 (High)	20 (Very High)	25 (Very High)

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TABLE 4. ER Risk Assessment Matrix

	THE RISKS OF THE DOCTORS			THE RISKS OF THE OTHER EE'S STAFF			THE RISKS OF THE DATA RECORDING STAFF			THE RISKS OF THE CLEANING STAFF			THE RISKS OF THE SECURITY			CURRENT MEASURES	MEASURES TO BE TAKEN
	LIKELIHOOD	SEVERITY	RISK SCORE	LIKELIHOOD	SEVERITY	RISK SCORE	LIKELIHOOD	SEVERITY	RISK SCORE	LIKELIHOOD	SEVERITY	RISK SCORE	LIKELIHOOD	SEVERITY	RISK SCORE		
INFECTION RISK																	
The risk of infection by contact of skin with blood and body fluids	1	2	2	2	2	4	1	2	2	2	2	4	1	2	2	Personal protective equipments such as mask, goggles, gloves are available.	
The risk of infection by eye contact with blood and body fluids	1	3	3	2	3	6	1	3	3	1	3	3	1	2	2	Infection and hygiene training is held by infection control nursing. It is ensured that employees participate in the trainings.Optimal ventilation/ air-conditioning is available. Cleanings and controls are done in terms of risk level of units. Check ups and immunization program are carried out according to employees check up program by occupational physician. After injury of employees due to piercing and employees' skin contact with blood and body fluids, medical examinations are carried out by occupational physician. Isolation procedure is applied for patients who has infectious disease. Waste control, collection,separation and transportation operations are done in units according to the plan of hospital waste management.	Proper use of personal protective equipment should be provided. Incident such as sharp piercing injury, skin contact with blood and body fluids occurs insidence should be recorded regularly and analyzed and improvements should be done to prevent accidents. Monitoring of employee health should be done in accidents. The Employee Safety Committee should make an assessment every six months.
The risk of infection caused physical environment	3	2	6	5	2	10	1	2	2	5	2	10	3	2	6		
Risk injury by sharp piercing	1	4	4	5	2	10	1	4	4	2	4	8	1	2	2		
Respiratory diseases transmitted from patients	1	4	4	2	4	8	1	4	4	2	4	8	1	2	2		
HAZARDOUS WASTE ACCIDENTS																	
The risk of infection by medical waste	1	2	2	1	2	2	1	2	2	2	4	8	1	2	2		
The risk of infection by chemical / medical waste accidents	1	2	2	1	2	2	1	2	2	2	4	8	1	2	2		
NOISE RISK																	
Noise-induced diseases	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	Devices generating the noise due to failure are repaired and maintained. Defective devices are not used until they repair.	Voice volume of devices which determined on user manuals should be controlled before use, if the voice volume is above 80 dB(A) headphone should be provided.
RADIATION RISK																	
The risk of exposure to radiotion while helping patients during x-rays	1	2	2	2	2	4	0	0	0	3	2	6	1	2	2	Personnel who is reponsible for X-Ray is using personal protective equipment and dosimeter. Trainings are held for radiation safety.	The use of personal protective equipment and dosimeter should be enhanced. It is ensured that employees participate in the trainings. Incorrect and inaccurate x-rays should be avoided.
RISKS DUE TO HAZARDOUS CHEMICAL																	
Employee injuries, burns and allergic reaction due to chemical spills and splashes	1	4	4	1	4	4	1	4	4	2	3	6	1	4	4	hands the oxygen tube are enhanced. Fat, oil, or other easily combustible substances are not allowed to make contact with the valves of oxygen-containing tubes. The exit of the tube valves are kept away from contaminants such as oil and water. Oily equipment (gasket, regulator, etc.) definitely is not used. Job trainings are held for enhancing all precautions. Tubes, which are kept in clinics are tied and on special vehicles.	User manual should be on tubes and personell who use tubes should be trained once a year.
Employee injuries and burns due to misusing pressurized oxygen	1	4	4	1	4	4	1	2	2	2	4	8	1	2	2		
THE RISK OF INJURIES CONNECTED TO TRAFFIC ACCIDENTS																Entrance and exit of vehicles are controlled.	Employees are informed about occupational and safety tarinings.
The risk of traffic accidents after shifts because of sleeplessness	1	4	4	1	4	4	1	4	4	1	4	4	1	4	4	Cars which are for personnel transportation for personnels' shifts drived by experienced drivers. Cars' daily and needed maintenance is done.	Cars' daily and needed maintenance should be done.
ALLERGIC REACTION RISK																	
The risk of latex allergic reaction due to using latex gloves	1	2	2	5	3	15	1	1	1	3	2	6	1	1	1	Alternative gloves are provided when latex groves caused allergic reaction.	Personal protective equipments and proper use of them should be provided. It is ensured that employees participate in the trainings.
Skin allergic reaction due to using hand sanitizer	2	2	4	1	2	2	2	2	4	1	2	2	1	2	2	It is told about the use of protective hand cream necessity and using the cream when is needed and sufficient amount of in the hand hygiene training.	
Skin allergic reaction due to exposuring to instrument disinfectant	1	2	2	3	2	6	1	2	2	3	2	6	1	2	2	Instrument disinfection is done by trained personnel who used personal protective equipment. Instrument disinfection is available.	
The risk of allergic reaction due to cleaning materails for working environment hygiene	1	2	2	1	2	2	1	2	2	2	2	4	1	2	2	The necessary and sufficient quantity is used in. The environment ventilated during using the materials. Personal protective equipment is used.	
The risk of drug allergy due to the risk of exposure to splashes	1	4	4	3	4	12	0	0	0	1	4	4	1	4	4	Appropriate personal protective equipment is used.	
ERGONOMIC RISKS																	
Employee injuries due to falling or rolling of unfixed goods or materials on the wall or floor	1	3	3	2	3	6	1	3	3	2	3	6	1	3	3	Occupational health and safety (ergonomics danger and risks) training are held. Unused patient transport trolley, stretcher are parked in designated areas. Heavy materials which may harm employees when fall from high place are not kept in top of shelves, are kept in bottom of shelves. Warning sign is put on slippery slopes. Transportation of patients are done by more than one employees based on patients.	Occupational health and safety (ergonomics danger and risks) training should be ensured. Heavy materials (properties, cabinets) which may harm employees when fall from high place should be fixed. Unused patient transport trolley, stretcher should be parked as the brakes locked in designated areas.
The risk of injury due to falling or bumping which are connected to the irregular placement of the objects in the working environment	1	2	2	1	2	2	1	2	2	2	3	6	1	2	2		
Diseases of nov skeletal system due to standing for a long time	1	2	2	3	2	6	0	0	0	3	2	6	3	2	6		
Diseases of cardio-vascular due to standing for a long time	1	2	2	3	2	6	0	0	0	3	2	6	3	2	6		
Body injuries during transportation of patients	1	2	2	5	3	15	0	0	0	3	2	6	1	2	2		
Body injuries during withdrawalling or moving of materials or goods in the unit	0	0	0	1	2	2	0	0	0	3	2	6	0	0	0		
Wrist disorders related to use the computer for a long time	1	1	1	1	2	2	2	2	4	0	0	0	1	1	1		
The risk of injury, sprains and bumps are connected to impact, slip, stumble, fall and incarceration due to wet/slippery floor	1	3	3	2	3	6	1	3	3	3	3	9	1	3	3		
COMMUNICATION																	
Communication problems experienced with patients and their relatives																	
The risk of anger and stress	1	2	2	2	2	4	2	2	4	1	2	2	2	2	4	Communication, stress management, anger management trainings and enhancing their professional knowledge and skills trainings are held for employees. A security guard is available during 24 hours. Hospital general using areas are monitored by security cameras White code call and violence notification is made when it is necessary.	Communication, stress management, anger management trainings should be held for employees. Psychological support should be provided when it is necessary. All units of hospitals should be protected 24 hour securities. Hospital general using areas should be monitored by security cameras. When it is necessary white code call should be responded immediately. Improvement works should be done.
The risk of claim or litigation	2	3	6	2	3	6	1	2	2	1	2	2	1	3	3		
THE RISK OF VIOLENCE																	
Physical violence (attack, blow)	5	4	20	5	4	20	1	3	3	1	3	3	1	4	4		
Verbal assault (insult, threat, slander)	5	4	20	5	4	20	2	2	4	1	2	2	2	4	8		
Sexual abuse (verbal, physical)	1	4	4	1	4	4	1	4	4	1	4	4	1	4	4		
THE RISK OF INJURIES CONNECTED TO ELECTRICAL SHOCK																Occupational health and safety training are held.	The maintenance and calibration of electrical equipment should be done regularly. It is ensured that employees participate in the trainings.
Electical shock due to the electrical leakage of devices	1	3	3	1	3	3	1	3	3	2	3	6	1	3	3	Ground control is done periodically. Leakage current protection insurance is available on electrical panels.	Missing or defective leakage current relays should be replaced
Burns that occured during the use of defibrillators	1	3	3	1	3	3	0	0	0	0	0	0	0	0	0	Defibrillators are used only by licensed personnel.	The proper use of defibrillators, user manual should be secured on a visible place.

5. CONCLUSION

Healthcare is a service sector that involves a high degree of risk. In hospitals, which are the most important component of the healthcare system serving hundreds of people every day, risk management is extremely important. Risk management is a comprehensive system that identifies risks through analysis, eliminates existing risks, and implements the necessary measures to prevent risks before they arise. Due to the fact that emergency rooms are open 24 hours, ER employees may face with various risk factors. Such as are an infection, radiation, etc. These factors need to be identified correctly, and then current measures and measures to be taken should be defined clearly. If measures are implemented correctly, risks can be eliminated. Under the scope of the study, risk analysis of employees of ER of a training and research hospital in Türkiye by Risk Assessment Matrix. Firstly, risks which ER's employee can be faced with possibly, then likelihood and severities of risks were defined. The risk score was determined in the light of this information. Risk Assessment Matrix was created. There have been few studies conducted on emergency department risk assessment in the literature. The study is one of the application examples of a risk analysis in ER. Other risk analysis methodologies can be applied for ER in future research. In addition, Risk Assessment Matrix can be applied to other units in the hospital as well.

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