

## Developing and Validating Proposed Occupational Risk Management Standards at Critical Care Units

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**Abstract:** Risk management for health care institution is not a new socially and/or legally ordained program. A proactive risk management (RM) is an approach to identify and eliminate or minimize hazards. So risk management demand is a proactive rather than reactive strategy. Therefore, hospitals needs to develop risk management standards to provide guidelines for managing risks, protect patients, health care providers and organization's acids. A critical care unit is a high- technology environment. However, the critical care nurse needs not only to be aware of what benefits the technology holds for patients, but also what adverse effects. The aim of this study was to develop and validate risk management standards for critical care unit, El- Manial University hospital. A methodological design was carried out on a sample of seventy nurses and thirty physicians at critical care unit El- Manial University hospital; data was collected over a period three months. A risk assessment questioner tool was developed by the researcher. It consists of two parts: (1) socio-demographic data and (2) risk management standards (30 items) it covered 5 major occupational risk factors. Expert opinionnaire sheet about content validity and face validity of the proposed RM standards was undertaken. The study findings related to occupational risks hazards were occupational risks at low level in biological, psychological and physical risks(50%,48% and 47% respectively), while at moderate level in environmental and chemical risks(43% and 48% respectively). They exposed to air born and blood born in moderate level which should be managed by hospital within a week. Also, a statistical significant difference between the psychological, environmental and chemical risk was evident at  $P < 0.0564$ , also between years of experience and exposure to risk. The study suggested RM standards should be used by the critical care unit; as well these standards should be reviewed, revised and updated periodically every three years. Also, establishment of RM units within the critical care unit is recommended. In addition, applying of RM standards should be encouraged and rewarded encourage notification about risks.

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### 1. Introduction

Development of technology in health care has led to the gross of critical care facilities which helped many individuals to survive with illness. New treatment modalities and technology may affect the quality of care and positive outcome, whereas, they may reduce many challenges to the critical care nurse (de Castro, de Castro et al.,2006) Administrators of healthcare organizations expect healthcare providers to deliver best care at the most efficient manner. Catlette, (2005) pointed out that risk managers (including nurses) and regulatory agencies interpret 'the best care' as being 'the highest quality care' possible and attainment of the goal of delivering the 'best care' or 'highest quality care' is not the challenge. The same author further explained that challenge comes when the modifiers to the delivery of the best car are added for delivering the 'best care' at the most economical way using the least possible resources.

Risk management is a central part of any organization's strategic management. It is the process whereby organizations methodologically address the risk attaching to activities with the goal of achieving sustained benefit within each activity. It must be

integrated into the culture of the organization with an effective policy and a programme led by the most senior management (Erenstein, & McCaffrey 2007). In 2007, Knight defined risk management as the culture and process which are directed towards the effective management of potential opportunities and adverse effects. while El-Kashmery (2008) defined risk management as the process of identifying, quantifying and ranking risks and their associated losses, and developing cost effective management strategies to eliminate or control the risks. Development of risk management standards is required to ensure safety for patients, visitors, employee, and help hospital to manage the risk factors, face challenges and improve its services.

Critical care employees are exposed to occupational risks. The Critical care department shows a more rapid increase in recent years in both overall rate and in number of debilitating injuries that involve more extensive treatment and lost working days, as compared to minor injuries (Ramsay, 2006).

Critical care employees are exposed to different sources of occupational risk mainly blood and other potential infectious material these risks might be due

to: ineffective exposure control plan (ECP); no follow-up made available after a needle stick/sharps injury; lack of information necessary to adequately implement blood borne pathogens program; exposure to unsafe needle devices and improper handling and disposal of needles; exposure to other sharps instruments; employees are not using universal precautions; also improper labeling of potential hazards; in addition to disposal of contaminated I.V tubing into hazardous waste container; furthermore, fire hazards as well as electrical hazards (Occupational Safety & Health Administration, 2007).

Employees expose to biomedical waste as human anatomical waste, animal waste, microbiological and bio-technology waste as, waste sharps, discarded medicines and cytotoxic waste, soiled waste, liquid waste, incineration waste and chemical waste (Helena, *et al.*, 2010).

Occupational Safety & Health Administration, (2007) indicated that employee expose to injury from work environment stressors during handling, transferring and repositioning of patients hospital health care workers especially nursing assistants, who do majority of lifting in many facilities may develop musculoskeletal injuries such as muscle and ligament strain and tears, joint and tendon inflammation, pinched nerves, herniated discs and others from patient handling ;and ineffective training of employees in body mechanics and proper lifting techniques.

The immediate impacts of risks on hospitals include; actions resulting in un reimbursed standby costs as activated emergency command centers, medical admissions, and canceled scheduled procedures, closed ambulatory care clinic services, transferred or discharged hospitalized patients; increased costs such as disaster-related property loss, incremental labor and overtime, incremental security, emergency supplies, pharmaceuticals, blood, emergency structure repairs; debris clean-up, emergency telecommunications, generators, purchases, and rentals, emergency morgue (Celik *et al.*, 2007).

The importance of risk management aims to accomplish three major functions: reducing the organization's risk of a malpractice suit by maintaining or improving the quality of care; reducing the probability of a claim being filed after a potentially compensable event has occurred; and preserving the institution's assets once a claim has been filed. In addition Hedges *et al.* (2008).

improving patient safety; and increase satisfaction, 3-Avoid risk.

The role of the nurse manager in managing risk is a key to overcoming hazards. However, it cannot be implemented successfully without the nurse manager being properly prepared for the position, assuming the appropriate responsibility inherent in the position, and

receiving 100% support from senior nurse executives. A basic requirement for success for nurse managers is mastering effective communication skills. These skills are critical for communicating with everyone in the healthcare system. i.e. clients and their family members, nursing staff, support staff, physicians, staff from other departments, managers and administrative personnel throughout the organization, in addition to various community healthcare staff Hiransuthikul *et al.*, (2006). Each nurse has the responsibility to identify and report unusual occurrences and potential risks to the proper authority. Nurses should also be able to recognize sentinel events and participate with nurse managers in the root-cause analysis (Yoder-Wise, 2003).

Basavanthappa (2000) defined standard as the desired quality, quantity, or level of performance that is established as a criterion against which workers performance will be measured while Kavalier and Spiegel (2003) defined standards as statements concerning proper producers and/or actions to be taken in given clinical or administrative situation. Standard contributes to the overall quality and safety of a product or services. They assure compatibility and interchangeability, reduce unnecessary variety and increase the cost- effectiveness of processes and procedure. Standards help to protect the health of human beings, animals and the general environment. (Malta standards authority, 2002).

Donabedian (1987) framework of quality which incorporates the structure, process, and outcome components of the model was used as a general guide in the present study to develop standards of occupational risk management. Structure refers to the setting in which the care is given and the resources that are available; process refers to the activities carried out by the healthcare providers; while the outcome refers to the results of the activities in which the health care providers have been involved.

#### **Aim of the Study**

The current study was carried out to: develop and validate occupational risk management standards at Critical care units.

#### **Research objectives:**

- To assess the occupational risks in Critical care units, Cairo-University Hospitals.
- To develop occupational risk management standards.
- To validate the developed standards.

#### **Significance of the Study**

Risk management in today's technologically explosion is a competitive must and a requirement for hospital accreditation. Critical care units are risky environment. They are faced with many risks such as medication errors, accidental falls, malpractice, high cost care, security problems, complications from

diagnostic or treatment procedures, patient and family dissatisfaction, medical accidents, hazardous materials and nosocomial infection. In Egypt, some hospitals reported that hospital infection rates reach to up 60% (Ahmed, 2003), and risk management standards should be available in different critical care units. Developing of these standards can provide guide line for managing the risks, protecting the patients and the health care providers as well as it will be a guide to provide safe environment for patients and employee to reduce losses, consequently improves quality of care.

## 2. Subjects and Methods

### Research Design:

Methodological design was used to achieve the objectives of the present study.

Methodological design is used to develop the validity and reliability and instrument to measure construct use as variable in research.

### Setting:

Study was conducted at 1<sup>st</sup> & 3<sup>rd</sup> Critical care Unit, El- Manial University Hospital affiliated to Cairo University Hospital.

### Sample:

All nurses working in the 1<sup>st</sup> and 3<sup>rd</sup> critical care units and agreed to participate in the study were sample of the study (70 nurses). Their level of education varied between BS.N and diploma degree; their age less than 30 to more than 40 years, years of experience 10-20 years.

All physicians and assistant lecturer who agree to participate in the study were also included. A total of (30 physicians) with age ranged between: less than 30

to 35 years old, their years of experience from: 5 to 10 years

### Tools:

Data for the present study was collected using the following tools.

#### 1- Risk assessment opinionnaire:

The risk assessment opinionnaire tool was developed by the researcher based on reviewing literature and Atya (2009) to collect data about occupational risks at critical care unit at El-Manial University. It includes two parts; the first part contains socio- demographic data of study sample. Based on the literature the second part was developed to cover occupational hazards, and it's divided into five categories:

Biological hazards (4items); Psychological hazards (6items); Physical hazards (3items); Environmental and ergonomic hazards (14items); and Chemical hazards (3items)

#### Scoring system

##### Calculation of risks:

Risks were computed using the following steps:

- 1- Identification of hazards.
- 2- Identification of the exposure to the hazards frequency. A severity or impact B, Likelihood or probability C by the study sample.
- 3- Risk = frequency A × severity B × Likelihood C

#### Scale used for the risk assessment opinionnaire:

The occupational health and safety assessment series 18001 (OHSAS) facility risk assessment scale developed by Brookhaven national laboratory, (2007) was adopted by the researcher as following:

Point Value Parameter	1	2	3	4
Frequency A	≤once/year	≤once/month	≤once/week	≥ once/shift or +
Severity B	First Aid Only	Medical treatment	Lost Time	Partial Disability or death
Likelihood C	Extremely Unlikely <<1×/20yrs	Unlikely 1×/10-20yrs	Possible >1×/10-20yrs	Probable 1×/yr or more

Study sample opinionnaire based on assessment of frequency, severity, and probability of occurrence of the risk. For each individual risk, the score was based on multiplying the scores (from 1 to 4) for these three parameters. Therefore, the responses ranged from a minimum of 1 (1x1x1) to a maximum of 64 (4x4x4).

The responses were ranked into the following categories:

- 1-<8 = Negligible risks, (This means that the hospital can control these risks according to availability of solutions).
- 8-<27 = Low (Acceptable) risks, (This means that the hospital should control these risks within a month).
- 27-<64 = Moderate risks, (This means that the hospital should control these risks within a week.).
- 64 = High (Sever, substantial or intolerable) risks, (This means that the hospital should control these risks within day or immediately).

The content validity of the risk assessment opinionnaire was reviewed by a jury of five professors from medical surgical nursing department, nursing administration, medical and nursing director and three medical staff from the critical care unit. Based on the finding the researcher developed the final tool.

Reliability of the tool: Cronbach's Alpha was 0.941 to 0.943.

### Pilot Study:

After construction of the assessment sheet pilot study was carried out on 10% of the sample to test the applicability and comprehensiveness of the tool. No modifications were made so the pilot study samples were included in the total sample.

### Methodology:

An official permission was obtained from the unit director as well as from the participants. The researcher contacted the participants individually, based on the results of the assessment openionnaire, the researcher developed the proposed occupational risk management standards. These, standards were assessed by seven experts from Faculty of nursing and from the critical care unit, according the final formats for the standards were developed (annex I).

### 3.Results:

Results of the present study showed that 20 % of the medical staff were resident, while 9% have master degree in critical care, 25% of nursing staff have baccalaureate in nursing; 45% were diploma nurses.45 % of the study sample have more than 10 years of experience (means  $13.8 \pm 5.6$ )

Figure 1 showed that the highest occupational risk the study subject was exposed to it is: biological one 89% followed by Psychological 87%, environmental risk 86% respectively. 85 % of the study sample exposed to occupational risk.

Table (1) showed that the study sample exposed to biological Psychological, and physical, at low level 50% 48% 47% respectively while exposed to environmental and chemical at moderate level 43%, 48%.

Table (2) summarized the distribution of biological risks as air born, blood born (HCV, HBV). 50%, 53% and 51% respectively they were exposed to these biological risks in a moderate level. For psychological risks, stress and high workload were the highest risk exposed to as a moderate level (60 %, 68%) respectively.

For physical risks such as exposure to radiation and noise, the sample was exposed in moderate level (50%) (52%) respectively.

Regarding the environmental and ergonomic risks, the study sample was exposed to the majority of its item in an equal distribution between low and moderate risks level.

While the chemical risks the study sample were exposed to it in a moderate level (pesticides, anesthesia and GIT problems (43%, 54%, 40%) respectively.

Table (3) showed a statistical significant difference between nurses and physicians regarding psychological, environmental and chemical risks.  $P < 0.0355$ ,  $0.0355$ ,  $0.0881$  respectively. While no significant difference was evident regarding biological and psychological risks.

Table (4) showed that no statistical significant differences between exposure to risks and age of the study sample, however, a statistical significant difference was evident between years of experience and exposure to risks.  $P = 0.0564$ .

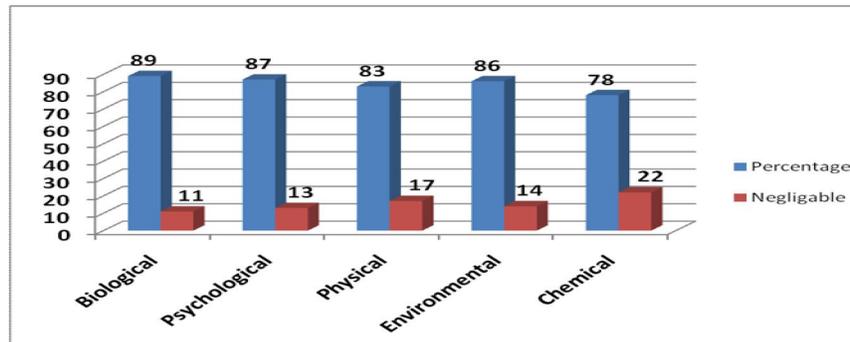


Fig. (1): Frequency Distribution of Opinion of study sample about Total Occupational Risk (N=100)

Table 1: Frequency distribution of opinions of the study sample subjects about level of total occupational risks N=100

Occupational Risks	Risk							
	Negligible		Low Level		Moderate Level		High Level	
	No	%	No	%	No	%	No	%
Biological Risks	11	11	50	50	39	39	0	0
Psychological Risks	13	13	48	48	39	39	0	0
Physical Risks	17	17	47	47	36	36	0	0
Environmental Risks	14	14	41	41	43	43	2	2
Chemical Risks	22	22	30	30	48	48	0	0

**Table 2:** Frequency distribution of opinion of the study sample about Presence occupational risks N =100

Occupational Risks	Negligible		Low Level		Moderate Level		High Level	
	No	%	No	%	No	%	No	%
<b>Biological Risks :-</b>								
Air born	6	6	44	44	50	50	0	0
Blood Born:								
HCV	7	7	40	40	53	53	0	0
HBV	7	7	42	42	51	51	0	0
HIV	16	16	50	50	34	34	0	0
GIT ( As salmonella)	13	13	55	55	32	32	0	0
Skin ( As scabies)	19	19	50	50	31	31	0	0
<b>Psychological Risks:-</b>								
Stress	8	8	32	32	60	60	0	0
High Work Load	8	8	28	28	68	68	0	0
Violence	20	20	50	50	30	30	0	0
Conflict	12	12	54	54	34	34	0	0
Job Description	15	15	50	50	25	25	0	0
Lack of cooperation	15	15	48	48	37	37	0	0
<b>Physical Risks:-</b>								
Radiation, leaser	9	9	41	41	50	50	0	0
Noise	7	7	41	41	52	52	0	0
Electrocution	35	35	40	40	25	25	0	0
<b>Environmental Risks</b>								
Fatigue	15	15	44	44	41	41	0	0
Ergonomic Problems (Lifting/Moving Patient)	13	13	40	40	47	47	0	0
Prolonged standing ( Back Pain)	10	10	47	47	38	38	4	4
Chemical waste radiological waste	8	8	52	52	40	40	0	0
Hazardous waste	14	14	46	46	40	40	0	0
Needle sticks	8	8	51	51	41	41	0	0
Mercury	12	12	41	41	42	42	5	5
Allergy from latex gloves	12	12	47	47	41	41	0	0
Allergy, headache from poor ventilation	10	10	51	51	39	39	0	0
Eye strain	14	14	38	38	48	48	0	0
Over Crowding	15	15	45	45	40	40	0	0
Insufficient emergency exit	13	13	52	52	35	35	0	0
Falling/slipping accident	12	12	46	46	42	42	0	0
Lack of job organization	11	11	46	46	43	43	0	0
<b>Chemical Risks:-</b>								
Pesticides, disinfectants	26	26	31	31	43	43	0	0
Anesthesia Gases	7	7	39	39	54	54	0	0
GIT Problems due to water treatment substances	32	32	28	28	40	40	0	0

**Table 3:** Comparison of opinions about occupational risks between nurses and physicians N = 100

Occupational Risks	Group				X <sup>2</sup> Test	P- Value
	Physicians		Nurses			
	No	%	No	%		
<b>Biological Risks</b>						
Negligible	4	4	7	7	0.667	0.887
Low	18	18	32	32		
Moderate	8	8%	31	31		
High	0	0	0	0		
<b>Psychological Risks</b>						
Negligible	4		9	9	0.667	0.0355
Low	19		29	29		
Moderate	7		32	32		
High	0	0	0	0		
<b>Physical Risks</b>						
Negligible	6	6	11	11	2.000	0.572
Low	15	15	32	32		
Moderate	9	9	27	27		
High	0	0	0	0		
<b>Environmental Risks</b>						
Negligible	5	5	7	7	0.667	0.0355
Low	19	19	24	24		
Moderate	6	6	37	37		
High	0	0	2	2		
<b>Chemical Risks</b>						
Negligible	7	7	15	15	0.667	0.0881
Low	17	17	13	13		
Moderate	6	6	42	42		
High	0	0	0	0		

**Table 4:** relation between opinions about presence of occupational risks and subjects age, experience N=100.

	Occupational Risks				X <sup>2</sup> Test	P- Value
	Negligence		Risk			
	No	%	No	%		
<b>Age (Years):</b>						
< 30	3	3	10	10	0.333	0.5611
30-	3	3	20	20		
40+	9	9	55	55		
<b>Experience (Years):</b>						
<10	2	2	15	15	0.333	0.0564
10-	3	3	17	17		
20+	10	10	53	53		

#### 4. Discussion

Occupational risk management seeks to educate hospital health team how to deal with inevitable adverse patient care occurrences, and to reduce the risk of liability. Risk management develops a system to identify clinical areas of risk, establishing means to monitor patient care, including evaluation care as indicated and taking action to improve this care (Tabish, 2001 in Rofaief, 2003).

The present study findings revealed that majority of the study sample exposed to occupational risks, while minority of the sample consider risk as negligible, their exposure to risks ranged between 73 % to 89% depending upon the type of the occupational risks, either biological, Psychological or physical risk.

Generally a slide difference has been noticed between the low and moderate exposure to risks. On the other hand, the study findings revealed that blood-borne infection (HCV-HBV), air-borne infection have the highest percentage of biological risks that the studied sample at Critical Care Unit El-Manial University hospitals were exposed to them at moderate level. These findings could be due to lack awareness of universal precautions, lack of personal protective equipment, following ineffective rules and regulations and improper supervision. This result is supported by findings of researchers Ilhan Ital. (2006) who described that hospitals are dangerous places to work in where health care workers are exposed to many hazards. Occupational Health Centre (2006) stated that the myriad of occupational hazards to which hospital workers may be exposed include biological hazards. Health care workers, particularly those in hospital settings, are regularly exposed to biological or infectious agents as hepatitis B (HBV), hepatitis C and airborne droplet. Yale-new haven hospital & Yale school of medicine (2007) found that occupational exposure to, and the transmission of hepatitis B (HBV) and hepatitis C (HCV) are of the utmost importance from a risk management standpoint because of the need to protect health care workers, patients and visitors from these viruses. In this regards, Lastly Kriner (2008) clarified that an estimated 600,000 to a million healthcare workers including nurses, laboratory

staff, doctors and housekeepers are stuck each year by contaminated needles that could expose them to potentially life-threatening diseases such as hepatitis B or C.

Also, the present study results revealed that stress as well as high workload have the highest percentage of psychological risks in which the studied sample at Critical Care Unit El-Manial University hospitals were exposed to it at moderate level. That could be due to shortage of staff, un- clarified job description or doing unexpected work, and job dissatisfaction. Many researchers supported this result: Kavalier & Spiegel (2003); and El-Kashmery, (2008) indicated that hazards found in hospitals include psychological hazards as stress, shift work, overtime, inadequate staffing and heavy workload in addition occupational Health Centre (2006) mentioned that many factors in the hospital environment can affect the psychological and social well-being of workers and can have an adverse impact on workers e.g. improper decision-making, latitude, role ambiguity, poor management ability, inadequate resources, and shift work. Also, rotating shifts and night work can have a negative impact on general well-being and performance because of the constant disruption of an individual's biological clock. Shift work can also negatively affect workers' social roles. It can contribute to digestion problems, heart disease, and sleep problems.

Physical risks as radiation/laser, noise induced hearing loss are risks in which the studied sample are exposed to (at moderate level) were shown in the current study. This could be due to lack of awareness of universal precautions, lack of personal protective equipment, and also because of the nature of the critical care equipment. These results are in agreement of Kavalier & Spiegel (2003) who stated physical hazards such as radiation, radioactive materials, lasers and noise, in addition internal disaster may be caused by radiation affected staff working in critical care units (Ahmed, 2003). Moreover, long term exposure to high levels of noise (more than 80decibels) can cause permanent hearing loss (Occupational Health Centre, 2006). El-Kashmery (2008); & Sosa, (2008); added that workplace hazards include physical hazards as

radiation and noise hazards affected health care staff. The present study results further indicated that fatigue, prolonged standing (back pain, varicose veins) and hazardous waste have the highest percentage of environmental and ergonomic risks in which employees are exposed to this could be due to high work load, shortage of staff, ineffective supervision, lack of housekeeping measures, lack of universal precautions. Childs, (2007) mentioned that incidents in all health care organizations include musculo- skeletal disorders, contact with hazardous substance and high on the agenda for all health care professionals are manual handling incidents. The author added that every year several thousand of nurses and other health professionals leave the health service due to back injury. Kriner (2008) pointed out that back injuries and other repetitive stress and muscle disorders are among the most common injuries affecting hospital workers. The main hazard in hospitals and nursing homes comes from patient handling, lack of equipment, lack of adequate staffing and a variety of health risks to hospital workers.

Regarding chemical risks, the present study revealed that anesthetic gases, pesticides /disinfectants and GIT problems due to water treatment substances are among the risks in which the employees are exposed to it. This could be due to lack of universal precautions, disregard health and safety rules, these results are in agreement with corresponded with Sharma, (2002.; and Kavalier & Spiegel (2003); and El-Kashmery (2008) who stated that hazards found in hospitals include chemical hazards as disinfectants; waste anesthetic gases have a tremendous effect on health care team.

As can be seen from study findings no statistical significant difference between nurses and physician was evident. This could be due to nurses were dealing with patients during the whole shift not intermittent as physicians, also nurses shortage was another factor which lead to increase work load for nurses where create conflict between nurses, and sometimes violence towards each other and toward patient.

Also, there were statistical significant differences between nurses and physicians sample regarding environmental and chemical risks. This might be due to nurses sample were exposed to environmental factors as needle sticks, allergy from latex and falling more than physicians and also they exposed to pesticides and anesthesia gases, also because nurses exposed to patient all over the shift with the liability they suffer more from the previously mentioned causes in addition to insufficient protective devices and sometimes in a appropriate infection control techniques and lack of supervision.

As regards the difference between years of experience and occupational risk a statistical

significance was evident. This could be due to nurses and physicians having several years of experience , as well as they are less frequently contacted with patients than the experienced sample, that's why their exposure to risks become less frequent either because they were working as charge nurses or head nurse or senior residence or assistant medical lecturer.

### Conclusion

The current study concluded that nurses and physician working in such hazardous areas i.e. critical care units have more exposure to different hazards. Therefore, establishment of a RM committee in critical care units is recommended. RM standards should be used and followed in Critical Care. RM standards should be disseminated by the units' administration to all health care workers in the units; RM standards should be reviewed, revised and updated periodically every three years as appropriate and as necessary to reflect ongoing improvements.

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