Entomology and Applied Science Letters
Volume 6, Issue 3, Page No: 15-26

Available Online at: www.easletters.com

ISSN No: 2349-2864

The Study of Risk Management Approaches for Mechanized Equipment in the Hospitals of Iran: A Case Study in the Selected Hospitals of Iran

Hesam Akbari[1], S. Nafisseh EsHagh Hosseini[2], Amir Adibzadeh[1], Hamed Akbari[1], Abdolvahed Bazmara[1*], Mohammad Hassan Naseri[3]

[1]Health Research Center, Lifestyle Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran.
[2] Department of Surgery, School of Medicine, Kamkar-Arabnia Hospital, Qom University of Medical Sciences, Qom, Iran.
[3] Atherosclerosis Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran.

ABSTRACT

Introduction: *The purpose of this study was to study risk management approaches for machinery in selected hospitals of Tabriz and Tehran. This study also examined the status of risk management among the participating groups in the study, compared them with each other and prioritized preventive measures to improve the safety of machinery. Because of the significance of incidents related to the machinery at different sections, the risk management approaches for machinery safety at industrial sections are somehow known and documented. Yet, there are a few information and knowledge about the significance of the risks related to the machinery and their management approaches at different parts of the hospital.* ***Methods****: For the study, which was a descriptive-analytic cross-sectional one, 14 hospitals of Tabriz and Tehran were visited. This study was carried out with 48 supervisors/managers of physical installation and maintenance and repairs, supervisors/managers of laundry services, supervisors/managers of food services and health and safety experts (HSE) in 2018 at 12 selected hospitals of Tabriz and Tehran. The research instrument consisted of a questionnaire, which was designed and performed by Jean-Claude Tremblay and colleagues in 2017, which was translated according to the local conditions and was used under questionnaire of the machinery risk management approaches. This questionnaire consisted of two parts of demographic information and subscales (Q1 dimension [machinery risk management], Q2 [Machinery safety], Q3 [tagout and lockout], Q4 [machinery inspection], Q5 [training]) and included 41 questions.* ***Results****: The status of the risk management approach for the machinery of the selected hospitals showed that among the four participated groups, Q4 dimension (machine inspection) had the highest mean score and the lowest mean score belonged to Q5 dimension (training). In the meantime, HSE experts had the highest risk management scores among the other three groups.* ***Conclusion****: According to the visit to hospitals and the comments of the participants in this study, it was found that no risk assessment method was carried out on the machinery. It is worth noting that during the visit, some machinery and equipment were unprotected. It was also found that inspection of machinery, instructions, and procedures for the safety of machinery, tagout and lockout and training about machinery (such as risk prevention, risk assessment, etc.) are in critical and very low status.*

Keywords: *Risk Management, Machinery, Hospital.*

HOW TO CITE THIS ARTICLE: Hesam Akbari, S. Nafisseh EsHagh Hosseini, Amir Adibzadeh, Hamed Akbari, Abdolvahed Bazmara, Mohammad Hassan Naseri; The Study of Risk Management Approaches for Mechanized Equipment in the Hospitals of Iran: A Case Study in the Selected Hospitals of Iran, Entomol Appl Sci Lett, 2019, 6 (3): 15-26.

Corresponding author: Abdolvahed Bazmara
E-mail ✉ vahed.bazmara @ yahoo.com
Received: 08/01/2019
Accepted: 27/06/2019

INTRODUCTION

Dangerous conditions associated with machinery have led to serious incidents in the industry. [1] In order to reduce these hazardous conditions, machinery should be designed or modified by integrating the risk reduction measures. Without a special risk assessment, it is difficult to choose the optimal risk reduction tools. [2] Risk assessment is a set of steps used to examine the risks associated with machinery, which can be divided into two phases, Phase 1: Risk Analysis and Phase 2: Risk Assessment. Risk analysis usually consists of three stages: Determination of the limits of the machinery, Hazard Identification, and risk estimation. The risk assessment process continues through a risk reduction process with a repetitive approach and ends with a phase when the risk is sufficiently reduced. [3]

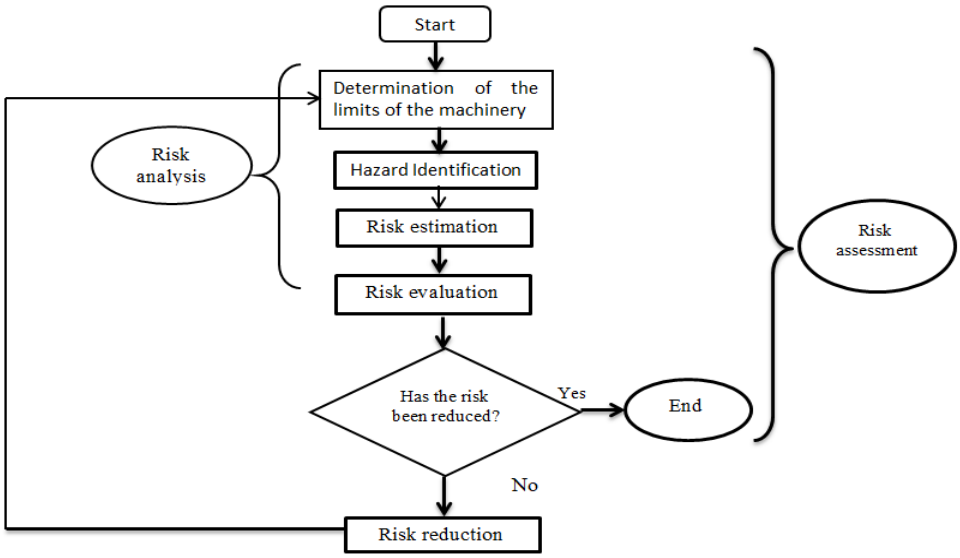

Figure 1: Risk Management Process [4]

Occupational safety and health in the hospital and care departments have been of great importance for many years. The statistics show that between 2002 and 2011, 38,241 occupational accidents and illnesses were reported in all public, surgical, and medical hospitals, which was included in 59 absenteeism days. [5] In the United States, occupational safety and health management (OSHA) shows that hospitals are among the most important hazardous sectors for workers. In 2011, there were 253,700 accidents and occupational illnesses in the hospital sector, which was equivalent to 6.8 incidents or illnesses per 100 workers. Compared to the manufacturing industry, for the same year and the same period, 4.3 illnesses and accidents per 100 workers and in construction sectors are 3.9 accidents or illnesses per 100 workers. Throughout the world, incidents created by machines are a major issue for both atonement organizations and for preventing such incidents. In the United States, about 8505 deaths were reported with machinery-related accidents from 1980 to 1989, which was equivalent to 0.8 deaths per 100 workers. [6] Machinery-related accidents are the cause of one-third of death in the United States. [7] The US Department of Labor reported 717 deaths related to machinery in 2013. [8] In Turkey, fractures and amputations account for about 69.9% of accidents and illnesses caused by agricultural machinery. [9] The events associated with machinery have different causes. The main reason is lack of protection or protective equipment (54% of cases), which lack the proper design, and not having the protection or shield removal by the operator. [10] In France, researchers estimated that 32% of machinery-related accidents are due to the lack of protective measures. [11] Other causes include the unplanned movements of automatic machinery, poor design of equipment or protective devices, etc. [12]

Machinery used in different parts of a hospital include laundry machinery (laundry, industrial dryers, etc.), food services machinery (meat grinder, dishwasher, etc.), maintenance and repair machineries (bandsaw, boilers, etc.), physical installation machineries (such as heating

systems, industrial ventilation, etc.) and health-related machinery (such as machinery related to the waste management system and cleaning). [13] In the case of occupational accidents, statistics show that a strong proportion of accidents and illnesses in the hospital sector are affected by the complexity and dislocation associated with the patient movement and control, mainly nurses and practical nurses. Statistics also show that half of the workers are in this sector. [14] Hospital accidents, especially non-medical accidents on staff, are reported to be less statistically frequent. However, OSHA has pointed out that the statistics show that 10 to 13 percent are related to workers' incidents. [15] Bedard and Metra studies showed that between 2006 and 2008, about 20.8% of the incidents in the catering services were caused by machinery, fragments of tools, many of which were caused by meat grinder. [16] In a study conducted in Brazil, it was concluded that cooking (eg, accident when using greens cleaner machinery) and lumbering (incident when using chainsaws) were conditions in which the risk and possibility of accidents were higher than normal incidents in the studied university hospitals. [17] According to OSHA, care and hospital departments have been very important in occupational safety and health in recent years, but not as much as other parts of the hospital for occupational safety and health. [13] Many writers clearly emphasize their focus on risks (including biological, ergonomic, chemical, physical, physiological, and mechanical hazards) that affect workers in medical areas. [18] Since there is an important part of non-medical workers in these sectors, they naturally should be given special importance. Therefore, this case is very significant considering the dangers of machinery and equipment. However, there is little science and knowledge about the importance of machinery hazards and their management methods within the hospital. In fact, there are a lot of areas in a hospital, where workers are at risk of machinery, for example, laundry room, kitchen, boiler room, waste management devices, etc., which considering special importance is required for the risk management of these devices. Therefore, because of paying lesser attention to occupational safety and health issues than construction and industrial, the lack of sufficient science and knowledge about the importance of machinery risks and also, conduction of a few studies in this field, this study was aimed to evaluate and identify risk management approaches for machinery safety in hospitals in Tabriz and Tehran.

METHODS

This descriptive-analytic study was a cross-sectional one and was carried out on four parts of the non-medical services, dealing mainly with machinery in Tabriz and Tehran hospitals in 2018. One of the moral considerations, noted at this study, was that all four participated groups who answered the questionnaire had a voluntary participating and even it was determined that if they feel that they could not cooperate for any reason, they could quit and withdraw from continuing the participation in the study. Throughout the study and while distributing the questionnaire between four groups, it was answered to the questions of participants if there was any ambiguity in the questions, so there was not any doubt and ambiguity when answering the questions. Specifications of participants, the hospitals' name, etc. were quite private and will never be divulged. The total number of hospitals in this study was 14 hospitals and the total number of participants was 48 people. The number of participants based on the occupation is shown in Table 1. The entrance criteria for this study were at least middle school degree, one-year work experience for related administrators and the associate degree for safety and health experts.

The research tool was a questionnaire designed and implemented by Jean-Claude Tremblay et al. in 2017 in Canada, which was also translated and used with the title of "Machinery Risk Management Methods Questionnaire" for collecting comments and opinions of people in the intended sectors. The questionnaire consisted of 2 parts. The first part was about demographic information about age, sex, and occupation. and the second part included 5 subscales including 41 questions from Q1 to Q5 (Q1 [machinery risk assessment] including 9 questions, Q2 [machinery protection] including 8 questions, Q3 [lockout and tagout] including 9 questions, Q4 [inspection of equipment and machinery] including 8 questions, and Q5 [training] including 7 questions) were answered based on Likert scale (strongly opposed, disagree, no comment, somewhat agree, and fully agree). [19]

Content validity and Lawsche formula were used to assess the validity of the questionnaire.

The content validity was calculated to be 0.85 among the ten experts, which indicated that it was acceptable. Cronbach's alpha method and tool were used to determine the reliability of the questionnaire. According to a study conducted in 2003, the alpha value greater than 0.9 is excellent, 0.8-0.9 is good, 0.8-0.7 is acceptable, 0.7-0.6, 6.2, 5.6 / 0 is weak, and less than 0.5 is as unacceptable. [20] The Cronbach's alpha was calculated 0.96 for the questionnaire, which indicated that the reliability of this measure is quite satisfactory. Finally, the data analysis was performed using SPSS software and the type-1 error was considered to be 0.05.

RESULTS

The present research studied the methods of risk management related to machinery safety in Tabriz and Tehran hospitals. Obviously, the most important achievement of this study was the assessment of risk management among the supervisors/managers of physical installation, maintenance and repairs, laundry services, and food services, as well as the HSE experts of the hospitals.

Table 1: The frequency of the number of participants in this study based on the occupation

job field	Frequency	Percent	Cumulative Percent
Maintenance and physical installation	14	29.2	29.2
Laundry room	10	20.8	50.0
Food service	14	29.2	79.2
HSE	10	20.8	100.0
Total	48	100.0	

Table 1 shows the participants in this study based on the frequency, consisted of 14 physical installation and maintenance and repairs managers, 10 laundry service managers, 14 catering managers, and 10 health and safety experts.

Table 2: Frequency of the number of participants in this study based on sex

Sex	Frequency	Percent	Cumulative Percent
Male	38	79.2	79.2
Female	10	20.8	100.0
Total	48	100.0	

Table 2 shows that the participated people included 38 men and 10 women.

Table 3: Frequency distribution of scores from Q1 to Q5 and the total score

	Q1	Q2	Q3	Q4	Q5	Total Score
Mean	55.03	60.02	47.39	60.41	42.93	53.31
Median	55.55	59.37	47.22	59.37	42.85	53.04
Std. Deviation	11.73	12.331	8.23	11.28	11.11	7.156
Minimum	27.78	21.88	33.33	43.75	14.29	40.85
Maximum	88.89	81.25	66.67	84.38	64.29	75.61

Table 3 shows that the highest mean is for Q4 dimension (machinery inspection) with the value of 60.41, the lowest average is for the Q5 dimension (training) with the value of 42.93, and the total score is 53.31.

Table 4: Risk Management Score Between the managers of Physical installation and Maintenance and repairs

job field		Q1	Q2	Q3	Q4	Q5	Total Score
Maintenance and physical installation	Mean	51.58	60.93	44.04	54.68	38.26	50.08
	Median	51.38	57.81	45.83	51.56	39.28	51.82
	Std. Deviation	6.51	11.86	5.64	6.45	8.45	4.35
	Minimum	41.67	43.75	36.11	46.88	21.43	41.46
	Maximum	66.67	78.13	52.78	65.63	50.00	55.49

Table 4 shows that the highest average risk management score among physical installation managers, maintenance and repairs related to dimension Q2 (machinery preservation) with the value of 60.93, the lowest mean is for Q5 dimension (training) with the value of 38.26 and the total score is 50.08.

Table 5: Risk Management Score between Laundry Services managers

job field		Q1	Q2	Q3	Q4	Q5	Total Score
Laundry room	Mean	51.11	59.37	43.05	62.81	41.78	51.64
	Median	50.00	59.37	40.27	64.06	42.85	53.04
	Std. Deviation	10.57	12.75	8.90	13.29	13.88	6.71
	Minimum	30.56	31.25	33.33	43.75	14.29	40.85
	Maximum	69.44	78.13	55.56	81.25	60.71	61.59

Table 5 shows the highest average risk management scores among the laundry services managers related to the Q4 dimension (machinery inspection) with the value of 62.81, the lowest average is for the Q5 dimension (training) with the value of 41.78, and the total score is 51.64.

Table 6: Risk Management Score between Food Services managers

job field		Q1	Q2	Q3	Q4	Q5	Total Score
Food service	Mean	51.98	57.14	47.42	57.58	42.09	51.39
	Median	58.33	57.81	47.22	56.25	41.07	51.82
	Std. Deviation	12.00	12.46	7.09	8.55	9.09	4.82
	Minimum	27.78	21.88	36.11	46.88	25.00	41.46
	Maximum	66.67	78.13	58.33	71.88	57.14	58.54

Table 6 shows that the highest average risk score between food services managers related to the Q4 dimension (machinery inspection) with the value of 57.58, the lowest mean is for the Q5 dimension (training) with the value of 42.09, and the total score is 51.39.

Table 7: Risk Management Score between Safety and Health Managers

job field		Q1	Q2	Q3	Q4	Q5	Total Score
HSE	Mean	68.05	63.43	56.38	70.00	51.78	62.19
	Median	68.05	59.37	56.94	73.43	53.57	60.67
	Std. Deviation	9.99	13.26	5.24	12.25	10.27	6.98
	Minimum	55.56	46.88	50.00	46.88	35.71	55.49
	Maximum	88.89	81.25	66.67	84.38	64.29	75.61

Table 7 shows that the highest average risk score between health and safety managers related to Q4 dimension (machinery inspection) with the value of 70.00, the lowest mean is for the Q5 dimension (training) with the value of 51.78, and the total score is 62.19.

According to Tables 3 to 7, it can be concluded that the highest average risk management score is for health and safety managers with a score of 62.19 and the lowest average score is for physical installation and maintenance and repairs managers with a value of 50.08. It can also be concluded that the highest mean score is for Q4 dimension and the lowest average score is for Q5 dimension.

Table 8: Comparison of the Risk Management score between jobs for Q1 Dimension using TUKEY Test

job field	job field	Mean Dif.	Std. Error	Sig.	Confidence %95 Interval	
					Lower Bound	Upper Bound
Maintenance and	Laundry room	0.47	4.10	0.999	-10.49	11.44

physical installation	Food service	-0.39	3.74	1.000	-10.40	9.61
	HSE	-16.46*	4.10	0.001	-27.43	-5.50
Laundry room	Maintenance and physical installation	-0.47	4.10	0.999	-11.44	10.49
	Food service	-0.87	4.10	0.997	-11.83	10.09
	HSE	-16.94*	4.43	0.002	-28.78	-5.09
Food service	Maintenance and physical installation	0.39	3.74	1.000	-9.61	10.40
	Laundry room	0.87	4.10	0.997	-10.09	11.83
	HSE	-16.07*	4.10	0.002	-27.03	-5.10
HSE	Maintenance and physical installation	16.46*	4.10	0.001	5.50	27.43
	Laundry room	16.94*	4.43	0.002	5.09	28.78
	Food service	16.07*	4.10	0.002	5.10	27.03

Table 9: Comparison of Risk Management scores for Q3 Dimension Using TUKEY Test

job field	**job field**	**Mean Dif.**	**Std. Error**	**Sig.**	**Confidence %95 Interval**	
					Lower Bound	**Upper Bound**
Maintenance and physical installation	Laundry room	0.99	2.81	0.985	-6.51	8.50
	Food service	-3.37	2.56	0.559	-10.22	3.48
	HSE	-12.34*	2.81	0.000	-19.85	-4.83
Laundry room	Maintenance and physical installation	-0.992	2.81	0.985	-8.50	6.51
	Food service	-4.36	2.81	0.416	-11.87	3.14
	HSE	-13.33*	3.03	0.000	-21.44	-5.22
Food service	Maintenance and physical installation	3.37	2.56	0.559	-3.48	10.22
	Laundry room	4.36	2.81	0.416	-3.14	11.87
	HSE	-8.96*	2.81	0.014	-16.47	-1.45
HSE	Maintenance and physical installation	12.34*	2.81	0.000	4.83	19.85
	Laundry room	13.33*	3.03	0.000	5.22	21.44
	Food service	8.96*	2.81	0.014	1.45	16.47

Table 10: Comparison of Risk Management score for Q4 Dimension Using TUKEY Test

job field	**job field**	**Mean Dif.**	**Std. Error**	**Sig.**	**Confidence %95 Interval**	
					Lower Bound	**Upper Bound**
Maintenance and physical installation	Laundry room	-8.12	4.15	0.221	-19.22	2.97
	Food service	-2.90	3.79	0.870	-13.03	7.23
	HSE	-15.31*	4.15	0.003	-26.41	-4.21
Laundry room	Maintenance and physical installation	8.12	4.15	0.221	-2.97	19.22
	Food service	5.22	4.15	0.595	-5.87	16.32
	HSE	-7.18	4.49	0.389	-19.17	4.80
Food service	Maintenance and physical installation	2.90	3.79	0.870	-7.23	13.03
	Laundry room	-5.22	4.15	0.595	-16.32	5.87
	HSE	-12.41*	4.15	0.023	-23.51	-1.31
HSE	Maintenance and physical installation	15.31*	4.15722	0.003	4.21	26.41
	Laundry room	7.18*	4.49	0.389	-4.80	19.17
	Food service	12.41*	4.15	0.023	1.31	23.51

Table 11: Comparison of risk management scores between jobs for Q5 dimension using TUKEY test

job field	job field	Mean Dif.	Std. Error	Sig.	Confidence %95 Interval	
					Lower Bound	Upper Bound
Maintenance and physical installation	Laundry room	-3.52	4.27	0.843	-14.93	7.89
	Food service	-3.82	3.90	0.761	-14.24	6.59
	HSE	-13.52*	4.27	0.015	-24.93	-2.10
Laundry room	Maintenance and physical installation	3.52	4.27	0.843	-7.89	14.93
	Food service	-0.30	4.27	1.000	-11.72	11.10
	HSE	-10.00	4.61	0.149	-22.32	2.32
Food service	Maintenance and physical installation	3.82	3.90	0.761	-6.59	14.24
	Laundry room	0.30	4.27	1.000	-11.10	11.72
	HSE	-9.69	4.27	0.121	-21.10	1.72
HSE	Maintenance and physical installation	13.52*	4.27	0.015	2.10	24.93
	Laundry room	10.00	4.61	0.149	-2.32	22.32
	Food service	9.69	4.27	0.121	-1.72	21.10

Table 12: Comparison of Risk Management score between Jobs for the Total Score Using TUKEY Test

job field	job field	Mean Dif.	Std. Error	Sig.	Confidence %95 Interval	
					Lower Bound	Upper Bound
Maintenance and physical installation	Laundry room	-1.55	2.32	0.908	-7.77	4.66
	Food service	-1.30	2.12	0.927	-6.98	4.37
	HSE	-12.10*	2.32	0.000	-18.32	-5.88
Laundry room	Maintenance and physical installation	1.55	2.32	0.908	-4.66	7.77
	Food service	0.252	2.32	1.000	-5.96	6.47
	HSE	-10.54*	2.51	0.001	-17.26	-3.83
Food service	Maintenance and physical installation	1.30	2.12	.927	-4.37	6.98
	Laundry room	-.25	2.32	1.000	-6.47	5.96
	HSE	-10.80*	2.32	0.000	-17.02	-4.58
HSE	Maintenance and physical installation	12.10*	2.32	0.000	5.88	18.32
	Laundry room	10.54*	2.51	0.001	3.83	17.26
	Food service	10.80*	2.32	0.000	4.58	17.02

In Tables 8 to 12, the ANOVA test was used to compare the risk-management score between jobs and TUKEY test was used for two-way analysis. The results showed that:

There is a significant difference between Tables 8, 9 and 12 for Q1 and Q3 dimensions and the total score between different occupational levels and the results show that there is a significant difference between HSE managers and other occupations and vice versa (PV <0.05).

In Table 10, for Q4 dimension, there is a significant difference between the managers of the physical installation and maintenance and repairs and the HSE managers, food services managers with HSE managers and HSE managers at other levels of occupation.

In Table 11, for Q5 dimension, there was a significant difference between the managers of the physical installation and the maintenance and repairs with the HSE managers and vice versa.

Table 13: Risk Management Score for Sex Comparison with 5 Dimensions and Total Score Using the T-Test

Di.	Sex	N	Mean	Std. Deviation	Std. Error Mean
Q1	male	38	53.50	11.95	1.93
	female	10	60.83	9.20	2.91
Q2	male	38	58.96	12.11	1.96
	female	10	64.06	12.94	4.09
Q3	male	38	46.19	8.52	1.38
	female	10	51.94	5.07	1.60
Q4	male	38	59.37	11.11	1.80
	female	10	64.37	11.61	3.67
Q5	male	38	42.19	11.56	1.87
	female	10	45.71	9.19	2.90
Q total	male	38	52.18	6.96	1.12
	female	10	57.62	6.49	2.05

According to Table 13 in which T-test was used to obtain the Risk Management Score, there was a significant difference in Q3 and Q total, between the score of males and females, which was lower in males than females, and this difference was statistically significant.

DISCUSSION

This study evaluated the risk management methods between non-medical personnel in hospitals of Tabriz and Tehran. This study supports the study of Jeen-Claude Tremblay et al. (2017) entitled "Machinery Safety in Hospitals", which showed that the risks associated with machinery are quite serious and the machinery protection is often incomplete. [21]

None of the installations visited had risk assessment execution procedures, lockout and tagout plans, or specific documentation on the safety rules and regulations of the device risks, and the workers and managers agreed that these methods are perfectly suitable and applicable in the hospital section. They also came to the conclusion that the hospital sector is fully aware of the best way to manage machinery risk, but its implementation level is lower than what is seen in industrial sectors. [15] In this study, according to visits from the hospitals, it was observed that in most and almost all hospitals there was no guidance, instruction, a procedure for assessing machinery risk, specific guidelines for the safety of machinery, and also no documentation regarding the implementation of risk assessment and machinery conservation. The documents provided by HSE experts included machinery safety checklist, occupational health and safety training course, and fire-fighting course.

According to Tables 4 to 7, for Q1 dimension, the majority of participants agreed that the risk assessment approach, done in any way, is a crucial approach to risk prevention, definition of corrective action, and improving safety. They believed that staffs did not sufficiently participate in conducting the risk assessments and, on the other hand, did not carry out the risk assessment at their installations. For Q2 dimension, most respondents believed that when detecting the device hazards, (it was important to note that, given that there was no documentation for hazard identification, the hazards were reported verbally), quick protection measures will be done and when a change or a replacement is made on machinery, the worker is notified very quickly. Moreover, most respondents agreed that machinery in the hospital was completely safe. On the other hand, they believed that information about the protection of machinery and machinery safety rules was not enough and most of the information given to them was verbal. For the Q3 dimension, most of the participants believed that the tagout and lockout system in their installation was not a well-known method and was not used sufficiently. Instructions for operating tagout and lockout methods are not provided to the workers, while they mostly agree that their safety of installation will considerably increase by installing the tagout and lockout. For the Q4 dimension, most partici-

pants believed that machinery inspection was a useful preventive measure in the hospital and significantly increased occupational safety at their installations, as well as it is a technical inspection that could be carried out in different parts of the hospital. On the other hand, they believed that the inspection of machinery was not regularly carried out in accordance with the program predetermined by the relevant managers. For Q5 dimension, most respondents believed that occupational safety and health training was carried out in all parts of the hospital, but most of them believed that workers did not receive adequate training about their device safety, risk prevention, machinery and equipment, adequate training with respect to the tagout and lockout executive procedures, and training on device risk assessment. Among the ethical considerations highlighted in this study was that all four groups of respondents volunteered to participate in the study and even it was stipulated that they could withdraw whenever they feel they could not cooperate for any reason and disregard from continuing the study. During the study and during the distribution of questionnaires among all four groups, all respondents' questions were fully justified in the case of ambiguity in questions, so that there would be no doubt or ambiguity in answering the questions. The profile of the patients and the name of the hospital will be completely confidential and will not be disclosed, and it is stipulated that the results and proposed measures of the study will be made available to the relevant hospitals.

CONCLUSION

The results showed that in each of the four groups of participants, Q4 dimension had the highest mean score and the lowest mean score was for Q5 dimension. In the meantime, HSE experts had the highest risk management scores among the other three groups. Considering that incidents occurring in different parts of the hospital are much higher than those associated with the risk of machinery, the present study showed that there are risks associated with machinery that causes a risk. Regarding the visit to the hospitals and the comments of the participants in this study, it was found that there was no risk assessment method for the machinery. Due to the fact that there are some unshielded machinery and equipment, this also cannot be a consequence of risk assessment. It was also found that inspection of machinery, instructions and procedures for the machinery safety and advertising agencies, and lockout and machinery training (such as risk prevention, risk assessment, etc.) were in very critical and low status. According to the results of this study, it is suggested that the procedure of hospitals' approach should change from senior management to the staff in order to reduce the risks associated with machinery. In addition, this study confirmed that the underlying causes of a low-risk management score among participants could be due to inadequate science and information on machinery and equipment, lack of training on machinery safety for workers, inadequate and irregular monitoring and inspection of managers, lack of methods and instructions for the safety of machinery and tagout and lockout, lack of safety rules and standards in the hospital, poor design of equipment or protective measures, etc. Therefore, the present study suggests that: 1. hospitals perform a risk assessment in the first phase to identify the hazards of machinery and determine corrective actions, 2. develop an annual operational plan (such as machinery conservation program, tagout and lockout program, training courses related to the safety of machinery for workers, the identification of regular and periodical inspections of machinery, formulation of instructions, and procedures and machinery standards for workers) and it should be available to them. 3. hospital managers can engage workers to identify risks through the HSE experts at hospitals, consult them when assessing risks, and ensuring that corrective action is taken. In the fourth phase, all actions must be documented. For future studies, in addition, the risk assessment should systematically be implemented to clarify a more complete picture of the dangerous situation associated with machinery. It is suggested that according to the high risks such as working people inside or around boilers and electrical hazards for staff of maintenance and repairs, cutting due to contact with sharp surfaces, burns from hot surfaces, falling on the sliding surface etc., burning for staff in the food services and musculoskeletal disorders for laundries, technical-engineered and managerial measures such as local and general ventilation, etc. and the use of PPE to increase the safety and health of employees should be considered. In

addition, all machinery should be visited periodically in terms of earth connection system (earth) to eliminate electrocution hazards from the staff. Among the limitations of this study, it is likely that some of the participants were not interested in answering the questions because of fatigue and answered at random and by chance. On the other hand, there were some hospitals, which were not willing to cooperate in implementing this study at their hospitals.

Appendix: Machinery Risk Management Practices Questionnaire

Item	Row	Statements of Machinery Risk Management	strongly agree	agree	No comment	disagree	strongly disagree
Q1 (RISK ASSESSMENT)	1	**machinery risk assessment includes a useful preventive approach in the hospital section**					
	2	**Risk assessment of machinery within our facility is a well-known method.**					
	3	**Risk assessment of machinery in our facility is sufficiently used.**					
	4	**Risk assessment is a meaningful method to determine and identify the corrective actions to be implemented on the machinery**					
	5	**Risk assessment of machinery significantly improves safety in our facility**					
	6	**The statistic analysis including accidents and incidents is a useful indicator to help prioritize risk assessment.**					
	7	**The participation of workers is solicited as much as required to identify the near-miss and hazards.**					
	8	**The workers have the opportunity to give their comments and opinions until finding solutions**					
	9	**The participation of workers is appropriate and adequate when it comes to performing risk assessments.**					
Item	Row	Statements of Machinery Risk Management	strongly agree	agree	No comment	disagree	strongly disagree
Q2 (safeguarding of machinery)	1	**The rules and safety standards of machinery are relatively well-known in our facility.**					
	2	**The machinery safeguarding is sufficiently prioritized in our hospital.**					
	3	**equipment and safety rules related to machines are clearly defined in our facility**					
	4	**Information about the machinery safeguarding is sufficiently communicated in our facility.**					
	5	**In general, the machines used in our facility are safe.**					
	6	**When hazards of the machine are detected, safeguarding measures are rapidly taken in our facility.**					
	7	**When a change or modification is created on a machine or a piece of equipment, the workers involved are rapidly informed.**					
	8	**The subcontractors (external workers) are fully well-informed about the safety rules of the machine.**					
Item	Row	Statements of Machinery Risk Management	strongly agree	agree	No comment	disagree	strongly disagree
Q3(tagout/lockout procedures)	1	**Machine tagout/lockout include in a useful prevention approach in the hospital section**					
	2	**Tagout/lockout can easily be carried out in the hospital sector**					
	3	**Tagout/lockout of machinery is a well-known method in our facility**					
	4	**Tagout/lockout of machinery is sufficiently used in our facility**					

	5	**Tagout/lockout in our facility is easily applicable to the machines**					
	6	**New workers will receive quickly instructions about tagout/lockout procedures**					
	7	**Tagout/lockout allowed to significantly better safety of machine in our facility**					
	8	**Tagout/lockout mainly related to the workers of maintenance**					
	9	**Tagout/lockout procedures are respected by the sub-contractors (external workers)**					
Item	Row	Statements of Machinery Risk Management	strongly agree	agree	No comment	disagree	strongly disagree
Q4(inspection of machinery)	1	**The machinery inspection is a useful prevention approach in the hospital section.**					
	2	**The machinery inspection is a method that can be easily performed in the hospital section.**					
	3	**Machinery inspection is a well-known method in our facility.**					
	4	**The machinery inspection is a method sufficiently performed in our facility.**					
	5	**Managers/supervisors regularly participate in the process of inspection in their respective service.**					
	6	**The machinery inspection allowed to significantly better occupational safety in our facility**					
	7	**The worker opinion is regularly requested during the inspection of a workstation.**					
	8	**During inspections in our facility, the workers' involvement is well sufficient valued.**					
Item	Row	Statements of Machinery Risk Management	strongly agree	agree	No comment	disagree	strongly disagree
Q5(machine safety training)		**Preventive occupational safety and health (OHS) training are given in the hospital section.**					
		Training of OHS is sufficiently provided in our facility.					
		Training of workers about the risk prevention of machine is adequate in our facility.					
		The concerned workers receive adequate training regarding the machinery and equipment they need to operate.					
		The workers in each device receive sufficient training related to machine safety.					
		The concerned workers receive sufficient training with respect to tagout/ lockout procedures.					
		A sufficient number of persons has been trained about the risk assessment methods of the machine in our facility.					

REFERENCES

1. Etherton JR, Myers ML. Machine safety research at NIOSH and the future directions. International Journal of Industrial Ergonomics. 1990 Sep 1;6(2):163-74.
2. Lyon BK, Hollcroft B. Risk assessments: Top 10 pitfalls & tips for improvement. Professional Safety. 2012 Dec 1;57(12):28-34.
3. Harper C, Virk G. Towards the development of international safety standards for human robot interaction. International Journal of Social Robotics. 2010 Sep 1;2(3):229-34.
4. Aneziris ON, Papazoglou IA, Konstandinidou M, Baksteen H, Mud M, Damen M, Bellamy LJ, Oh J. Quantification of occupational risk owing to contact with

moving parts of machines. Safety science. 2013 Jan 1;51(1):382-96.
5. Gravel S, Vergara D, Katherine Lippel K, Dubé J, Ducharme JF, Legendre G. Santé et sécurité des travailleurs qui cumulent des précarités: la lutte aux inégalités de santé attribuables au travail. 2016.
6. Pratt SG, Kisner SM, Helmkamp JC. Machinery-related occupational fatalities in the United States, 1980 to 1989. Journal of occupational and environmental medicine. 1996 Jan 1;38(1):70-6.
7. Etherton J, Main B, Cloutier D, Christensen W. Reducing risk on machinery: a field evaluation pilot study of risk assessment. Risk Analysis: An International Journal. 2008 Jun;28(3):711-21.
8. Smits AJ, Giannakopoulos GF, Zuidema WP. In response: Disability after nondisplaced and minimally displaced radial head fractures [Injury 45 (2014) 2110–2119]. Injury. 2015 Dec 1;46(12):2522.
9. Akdur O, Ozkan S, Durukan P, Avsarogullari L, Koyuncu M, Ikizceli I. Machine-related farm injuries in Turkey. Annals of agricultural and environmental medicine. 2010;17(1):59-63.
10. Backström T, Döös M. Problems with machine safeguards in automated installations. International Journal of Industrial Ergonomics. 2000 Jul 1;25(6):573-85.
11. Dei Svaldi D, Charpentier P. Une étude des accidents en automatisme à partir de la base de données EPICEA. Hygiène et sécurité du travail-Cahiers de notes documentaires. 2004(196):3.
12. Luken K, Paridon H, Windemuth D. ND 2261-Bypassing and Defeating Protective Devices of Machines: a Multidimensional Problem. Cahiers de Notes documentaires. 2006(205):55.
13. Tweedy JT. Healthcare hazard control and safety management. CRC Press; 2014 Mar 12. .
14. Cordero CA, Sanz JL, Wiña PL. Measurement of machinery safety level in the European market: A real case based on market surveillance data. Safety science. 2009 Dec 1;47(10):1351-8.
15. Neuss MN, Polovich M, McNiff K, Esper P, Gilmore TR, LeFebvre KB, Schulmeister L, Jacobson JO. 2013 updated American Society of Clinical Oncology/Oncology Nursing Society chemotherapy administration safety standards including standards for the safe administration and management of oral chemotherapy. Journal of Oncology Practice. 2013 Mar;9(2S):5s-13s.
16. Ziam S, Lakhal S, Laroche E, Alderson M, Gagné C. Application des pratiques préventives par les infirmières et infirmiers: la perspective innovante de la capacité d'absorption. 2017.
17. Sêcco IA, Robazzi ML, Shimizu DS, Rúbio MM. Typical occupational accidents with employees of a university hospital in the south of Brazil: epidemiology and prevention. Revista latino-americana de enfermagem. 2008 Oct;16(5):824-31.
18. Gorman T, Dropkin J, Kamen J, Nimbalkar S, Zuckerman N, Lowe T, Szeinuk J, Milek D, Piligian G, Freund A. Controlling health hazards to hospital workers: A reference guide. NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy. 2014 Feb;23(1_suppl):1-69.
19. Tremblay JC, Gauthier F. Safety of machinery in hospitals: An exploratory study in the province of Quebec, Canada. Safety science. 2018 Mar 1;103:207-17.
20. Cronbach LJ, Shavelson RJ. My current thoughts on coefficient alpha and successor procedures. Educational and psychological measurement. 2004 Jun;64(3):391-418.
21. Tremblay MS, Aubert S, Barnes JD, Saunders TJ, Carson V, Latimer-Cheung AE, Chastin SFM, Altenburg TM, Chinapaw MJ. Sedentary Behavior Research Network (SBRN)-Terminology Consensus Project process and outcome. The International Journal of Behavioral Nutrition and Physical Activity. 2017;14(1):75. doi: 10.1186/s12966-017-0525-8