



The Open Public Health Journal

Content list available at: <https://openpublichealthjournal.com>



RESEARCH ARTICLE

Awareness among Healthcare Workers regarding Physical Hazards in Dental and Oral Hospitals of Semarang, Indonesia

Diki Bima Prasetyo^{1,*}, Muchammad Rully Sjahiril Alim², Tiwakron Prachaiboon³, Jipri Suyanto⁴, Dwi Windu Kinanti Arti^{5,6}, Eli Sahiroh^{1,6}, Nasya Adelia Putri¹, Shinta Dwi Surya Pramesti¹ and Yuliani Setyaningsih⁷

¹Department of Occupational Safety and Health, Faculty of Public Health, Universitas Muhammadiyah Semarang, Semarang, Indonesia

²Department of Management, Faculty of Economics, Universitas Muhammadiyah Semarang, Semarang, Indonesia

³Department of Public Health, Faculty of Public Health, Valaya Alongkorn Rajabhat University, Thani, Thailand

⁴Department of Public Health, Faculty of Health Sciences, Dehasen University Bengkulu, Bengkulu, Indonesia

⁵Department of Public Health Sciences, Faculty of Dentistry, Universitas Muhammadiyah Semarang, Semarang, Indonesia

⁶Dental and Oral Hospital of Universitas Muhammadiyah Semarang, Semarang, Indonesia

⁷Department of Occupational Safety and Health, Faculty of Public Health, Diponegoro University, Semarang, Indonesia

Abstract:

Background:

The hospital is a workplace that holds a potential risk of occupational diseases and work accidents for its workers. Physical factors are one of the factors that need to be properly evaluated to control these hazards.

Objective:

This study aimed to analyze the factors related to knowledge and awareness of physical hazards in the workplace.

Methods:

In this study, correlation analysis has been conducted using chi-square, and a cross-sectional design has been employed involving a sample of 200 workers from oral and dental hospitals in Semarang. This study has used several samples. The instrument used in this study has been a modification of the Victorian Trades Hall Council and Workplace Safety and Health Risk Management. The independent variables included in this study were individual characteristics, and physical hazards were taken as the dependent variable. A computer program was used for inputting, scoring, and tabulating the data, while the correlation was tested using chi-square.

Results:

The respondents in this study had a good level of knowledge of physical hazards, with 67% of knowledge accounting for the hazard of noise, 50% for the physical hazard of electricity and equipment, 51% for fire hazards, 63.5% for the physical hazard of exposure to lighting, 71.5% for the physical hazard of exposure to heat, 65% for the physical hazard of exposure to radiation, and 41.5% for the physical hazard of vibration. The years of service of the respondents accounted for a p-value of 0.045.

Conclusion:

The level of awareness of safety against physical hazards among workers in the studied hospitals has been found to be at an optimal level.

Keywords: Awareness, Hospital, Knowledge, Physical hazard, Workplace, Semarang, Indonesia.

Article History

Received: February 07, 2023

Revised: June 03, 2023

Accepted: June 26, 2023

1. INTRODUCTION

Hospitals do not involve safe work environments. Health workers in hospitals are exposed to various kinds of occupational health hazards every day that can threaten their

health and safety [1]. Worldwide, health institutions are considered to have a significant rate of occupational accidents and risks. Historically, health workers have been exposed to a variety of different occupational risks, and exposure to these risks remains high to date [2 - 4]. Occupational hazards are classified into four groups: physical, chemical, biological, and psychosocial. In addition, the National Institute of Occupational Safety and Health considers occupational hazards

* Address correspondence to the author at the Department of Occupational Safety and Health, Faculty of Public Health, Universitas Muhammadiyah Semarang, Semarang, Indonesia; Tel: (024) 76740296; Fax: (024) 76740291; E-mail: dikibimaprasetyo@unimus.ac.id

as the physical, chemical, biological, and psychological factors that occur when job requirements do not match the abilities, resources, or needs of staff [5 - 7].

Physical hazards that exist in the general work environment, especially in the hospital, include exposure to ionizing and non-ionizing radiation, noise, high temperatures, lighting, electrical hazards, and fire [8]. Occupational hazards are workplace factors that have the potential to cause injury or health problems [9]. Exposure to these hazards can cause occupational diseases, work accidents, and decreased work productivity [10].

According to the International Labor Organization (ILO), seven lives are lost due to occupational accidents and diseases in the world every 15 seconds, and as statistics show, the average cost of accidents and diseases accounts for 4% of GDP in several countries [11]. The ILO estimates that around 330 million work accidents occur annually worldwide, with around 160 million people suffering from occupational diseases, some of whom die [12].

The physical hazards that have been studied to occur in hospitals include noise levels exceeding the WHO standard of 40 dB and a peak of 45 dB [13]. Lighting influences cognitive performance and problem-solving skills, as well as interpersonal relationships at work [14]. Exposure to ionizing radiations in hospitals can reduce hemoglobin and mean corpuscular volume (MCV) to chronically low levels in the blood of exposed workers [15 - 17].

The promotion of health and safety awareness among hospital health workers has been found to reduce the risk of occupational diseases and illnesses and create a more efficient and effective hospital environment [18]. The level of risk thus depends on the knowledge of healthcare workers regarding the potential adverse health effects of ionizing radiation and the adoption of safe work practice methods by them. The gap between the onset of physical factors in dental hospitals and the lack of maximal control of the dangers of these physical factors is a reason for conducting this research. This research aimed to analyze the factors related to knowledge and awareness of physical hazards in dental hospitals.

2. METHODS

2.1. Design and Time of Research

This cross-sectional study has been carried out at the dental and oral hospitals of Semarang city. Data collection was carried out for three months, from September to November 2022.

2.2. Research Subjects

Workers at the dental and oral hospitals of Semarang City were enrolled as subjects in this research. The research sample comprised the entire population of workers (medical staff, and medical support and administration personnel), accounting for a total of 200.

2.3. Instrument

The modified form of the Victorian Trades Hall Council and Workplace Safety and Health Risk Management questionnaire has been used in this study.

2.4. Statistic Analysis

Univariate and bivariate analyses have been employed in this study. Univariate analysis was used to explain the characteristics of the variables studied. The relationship between the variables has been tested using the chi-square test with an α value of 5%. Cross-tabulation analysis has been used to analyze the relationship between the two variables.

3. RESULTS

Table 1 shows the distribution frequency of individual characteristics. 57.5% of the respondents were aged > 30 years, 73.5% of the respondents were women, working periods of 80% of the respondents were ≤ 5 years, the profession of most of the respondents was nursing (37.5%), 55.5% of the respondents were medical personnel in different units, the education level of most of the respondents (63.5%) was bachelor's degree, most of the respondents (51.0%) were not married, and most of them (56.5%) had a good understanding of physical hazards.

Table 2 describes the lighting conditions in the research area. The majority of workers reported their work area to be free of shadows. The majority of physicians and participants reported seeing without strain (83.3% and 82.8%, respectively); however, these percentages were relatively lower for nurses (70.7%) and technicians (68%). 76% of technicians, 89.1% of participants, 80.6% of physicians, and 77.3% of nurses reported the work area to be glare-free. Similarly, 76.6% of the participants, 72% of the nurses, 77.8% of the physicians, and 88% of the technicians reported that the lighting units were cleaned regularly. Most of the participants and physicians described emergency lighting to be functioning correctly (92% and 86.1%, respectively). The majority of physicians and participants reported lighting in the workplace to be measured regularly (83.3% and 87.5%, respectively).

Table 1. Baseline characteristics of workers in dental and oral hospitals of Semarang city.

Characteristics	Number	%
1. Age	-	-
≤ 30 years	85	42,50
> 30 years	115	57,50
Mean (\pm SD)	-	32,75 (\pm 7,89)
Median (min:max)	-	32,00 (20:67)
2. Years of service	-	-

(Table 1) contd.....

Characteristics	Number	%
≤ 5 years	91	26,50
> 5 years	109	54,50
Mean (±SD)	-	4,93 (±2,32)
Median (min:max)	-	6,00 (1:10)
3. Gender	-	-
Male	53	26,50
Female	147	73,50
4. Specialty	-	-
Physician	36	18,00
Participant	64	32,00
Nurse	75	37,50
Technician	25	12,50
5. Units	-	-
Administration	64	32,00
Medical support	25	12,50
Medical personnel	111	55,50
6. Level of education	-	-
Senior high school	5	2,50
Associate's degree	24	12,00
Bachelor's degree	127	63,50
Master's degree	36	18,00
Doctor	8	4,00
7. Marital status	-	-
Single	102	51,00
Married	98	49,00
8. Level of knowledge	-	-
Good	113	56,50
Poor	87	43,50

Table 2. Lighting hazards.

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
The work area is free of shadows								
Yes	29	80,6	57	89,1	57	76	19	76
No	5	13,9	3	4,7	9	12	1	4
Do not know	2	5,6	4	6,3	9	12	5	20
Employees see without straining								
Yes	30	83,3	53	82,8	53	70,7	17	68
No	4	11,1	9	14,1	14	18,7	3	12
Do not know	2	5,6	2	3,1	8	10,7	5	20
Glare-free work area								
Yes	29	80,6	57	89,1	58	77,3	19	76
No	2	5,6	3	4,7	8	10,7	5	20
Do not know	5	13,9	4	6,3	9	12	1	4
The lighting unit is cleaned regularly								
Yes	28	77,8	49	76,6	54	72	22	88
No	1	2,8	12	18,8	9	12	1	4
Do not know	7	19,4	3	4,7	12	16	2	8
Emergency lighting works fine								
Yes	31	86,1	54	84,4	59	78,7	23	92
No	0	0	4	6,3	4	5,3	0	0
Do not know	5	13,9	6	9,4	12	16	2	8

(Table 2) contd.....

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
Periodic measurement of lighting in the workplace								
Yes	30	83,3	56	87,5	63	84	19	76
No	5	13,9	4	6,3	4	5,3	2	8
Do not know	1	2,8	4	6,3	8	10,7	4	16

Based on the results of the study provided in Table 3, it can be inferred that the limits of permissible noise exposure in the workplace were known by 16.7% of physicians, 79.7% of the participants, 44% of nurses, and 44% of technicians, respectively. 41.7% of the physicians, 43.8% of the participants, 56.0% of the nurses, and 68% of the technicians were aware of the permissible noise limits. Copies of noise standards were available to most of the employees, accounting for 30.6% of physicians, 31.3% of the participants, 36.0% of the nurses, and 40% of the technicians. 30.6% of the physicians, 71.9% of the participants, 100% of nurses, and 100% of technicians were instructed about the noise hazards. 100% of physicians, 70.3% of participants, 100% of nurses, and 100% of technicians had knowledge regarding the signs and symptoms of hearing loss.

7.8% of participants, 26.7% of nurses, and 36% of technicians reported periodic measurements of noise at the workplace. 19.4% of physicians and 3.1% of the participants reported the availability of hearing protection devices. 10.7% of nurses reported that PPE is used to ensure an adequate level of protection for the workers. They also reported that periodic hearing checks are conducted, and that workers are aware of areas in the hospital that are at risk of excessive noise levels. 77.8% of physicians, 48.4% of participants, 65.3% of nurses, and 56% of technicians reported the availability of noise-hazard safety signs at the workplace. The performance of pre-work hearing examinations was mentioned by 36.1% of the physicians, 51.6% of the participants, 38.7% of the nurses, and 28% of technicians.

Table 3. Noise hazards.

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
Knowledge of permissible noise exposure limits in the workplace								
Yes	6	16,7	51	79,7	11	44,0	11	44,0
No	13	36,1	7	10,9	27	36,0	11	44,0
Do not know	17	47,2	6	9,4	17	22,7	3	12,0
Know the permissible noise level								
Yes	15	41,7	28	43,8	42	56,0	17	68,0
No	4	11,1	13	20,3	16	21,3	5	20,0
Do not know	17	47,2	23	35,9	17	22,7	3	12,0
Availability of copies of noise standards for all employees								
Yes	11	30,6	20	31,3	27	36,0	10	40,0
No	12	33,3	18	28,1	29	38,7	8	32,0
Do not know	13	36,1	26	40,6	19	25,3	7	28,0
Employees are instructed about noise hazards								
Yes	11	30,6	46	71,9	75	100	25	100
No	6	16,7	0	0	0	0	0	0
Do not know	19	52,8	18	28,1	0	0	0	0
Employees know the signs and symptoms of hearing loss								
Yes	36	100	45	70,3	75	100	25	100
No	0	0	7	10,9	0	0	0	0
Do not know	0	0	12	18,8	0	0	0	0
Periodic measurement of noise in the workplace								
Yes	0	0	5	7,8	20	26,7	9	36,0
No	20	55,6	5	7,8	28	37,3	7	28,0
Do not know	16	44,4	54	84,4	27	36,0	9	36,0
Availability of hearing protection equipment								
Yes	7	19,4	2	3,1	0	0	0	0
No	16	44,4	33	51,6	56	74,7	16	64
Do not know	13	36,1	29	45,3	19	25,3	9	36,0
PPE* is tested to ensure a fit and adequate level of protection								

(Table 3) contd.....

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
Yes	0	0	0	0	13	17,3	4	16,0
No	16	44,4	36	56,3	37	49,3	12	48,0
Do not know	20	55,6	28	43,8	25	33,3	9	36,0
Regular hearing checks								
Yes	0	0	0	0	8	10,7	0	0
No	22	61,1	50	78,1	30	40,0	12	48,0
Do not know	14	38,9	14	21,9	37	49,3	13	52,0
Workers are aware of areas in the hospital that are at risk of excessive noise levels								
Yes	36	100	64	100	63	84,0	21	84,0
No	0	0	0	0	6	8,0	2	8,0
Do not know	0	0	0	0	6	8,0	2	8,0
Is there a noise hazard safety sign?								
Yes	28	77,8	31	48,4	49	65,3	14	56,0
No	1	2,8	8	12,5	15	20,0	7	28,0
Do not know	7	19,4	25	39,1	11	14,7	4	16,0
There is a pre-employment hearing check								
Yes	13	36,1	33	51,6	29	38,7	7	28,0
No	9	25,0	11	17,2	24	32,0	8	32,0
Do not know	14	38,9	20	31,3	22	29,3	10	40,0

Table 4. Electric installations and equipment.

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
Electrical installation is carried out by a licensed electrician								
Yes	13	36,1	33	51,6	29	38,7	7	28,0
No	9	25,0	11	17,2	24	32,0	8	32,0
Do not know	14	38,9	20	31,3	22	29,3	10	40,0
Officers are notified of the dangers of electricity								
Yes	31	86,1	34	53,1	71	94,7	21	84,0
No	5	13,9	30	46,9	4	5,3	4	16,0
Power cords, plugs, and sockets are in good condition and not overloaded								
Yes	10	27,8	31	48,4	20	26,7	10	40,0
No	5	13,9	8	12,5	5	6,7	2	8,0
Do not know	21	58,3	25	39,1	50	66,7	13	52,0
Electrical equipment is checked regularly								
Yes	33	91,7	62	96,9	65	86,7	24	96,0
No	1	2,8	0	0	5	6,7	0	0
Do not know	2	5,6	2	3,1	5	6,7	1	4,0

36.1% of the physicians, 51.6% of the participants, 38.7% of the nurses, and 28% of the technicians reported most of the electrical installations to be carried out by licensed electricians. 86.1% of the physicians, 53.1% of the participants, 94.7% of the nurses, and 84% of the technicians reported that electrical equipment is checked regularly. Electrical cables, plugs, sockets, and conditions have been reported as good and not overloaded by 27.8% of the physicians, 31% of the participants, 26.7% of the nurses, and 40% of technicians. The dangers of electricity have been explained to 91.7% of the physicians, 96.9% of the participants, and 86.7% of the nurses Table 4.

According to Table 5, 66.7% of physicians, 71.9% of participants, 61.3% of nurses, and 60% of technicians have attended emergency procedure training. Most of them knew about fire extinguishers that are inspected regularly. As many as 72.2% of physicians, 82.8% of participants, 82.7% of nurses, and 88.0% of technicians stated the emergency exit to be safe and with no obstacles. Most of them stated that the flammable materials are stored properly (i.e., 68.8% of the participants and 68.0% of the technicians). Briefings on emergency evacuation have been reported to be given by the staff in the statements of 66.7% of physicians, 73.4% of participants, 61.3% of nurses, and 60.0% of technicians. Most

of the staff already knew about the things that can cause fire, as evidenced by statements from 72.2% of the physicians, 71.9% of the participants, 77.3% of the nurses, and 64.0% of technicians.

Table 6 shows the heat hazard exposure assessment where the majority of technicians (100%), nurses (90.7%), participants (92.2%), and physicians (88.9%) confirmed that the temperature in their workplace was suitable. Also, 93.8% of the participants, 93.3% of the nurses, 88% of the technicians, and 100% of the physicians reported the ventilation in their workplaces to be good. 73.4% of the participants, 84% of the

nurses, 76% of technicians, and 80.6% of physicians reported having air conditioning in their workplace as well as the monitoring of temperature and humidity. More than half of the respondents, including 75% of the physicians, 92% of the technicians, 82.8% of the participants, and 81.3% of the nurses, were aware of early signs of heat-related illnesses. Workplace uniforms were reported to be comfortable by 89.1% of the participants, 81.3% of the nurses, 77.8% of the physicians, and 84% of the technicians. Performance of pre-employment checks was confirmed by 59.4% of the participants, 64% of the technicians, 65.3% of the nurses, and 58.3% of the physicians.

Table 5. Fire hazards.

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
Staff attending emergency procedures training								
Yes	24	66,7	46	71,9	46	61,3	15	60,0
No	12	33,3	29	38,7	29	38,7	10	40,0
Fire extinguishers are available and inspected regularly								
Yes	26	72,2	53	82,8	62	82,7	22	88,0
No	0	0	2	3,1	1	1,3	0	0
Do not know	10	27,8	9	14,1	12	16,0	3	12,0
Emergency exits kept away from obstacles								
Yes	26	72,2	47	73,4	46	61,3	18	72,0
No	4	11,1	2	3,1	16	21,3	5	20,0
Do not know	6	16,7	15	23,4	13	17,3	2	8,0
Flammable materials are kept in proper storage								
Yes	24	66,7	44	68,8	48	64,0	17	68,0
No	0	0	0	0	4	5,3	1	4,0
Do not know	12	33,3	20	31,3	23	30,7	7	28,0
Staff briefed on emergency evacuation								
Yes	24	66,7	47	73,4	46	61,3	15	60,0
No	12	33,3	17	26,6	29	38,7	10	40,0
Staff are aware of things that can cause a fire								
Yes	26	72,2	46	71,9	58	77,3	16	64,0
No	10	27,8	18	28,1	17	22,7	9	36,0

Table 6. Heat exposure hazards.

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
The temperature at your workplace is appropriate								
Yes	32	88,9	59	92,2	68	90,7	25	100
No	4	11,1	5	7,8	7	9,3	0	0
Ventilation at your workplace is good								
Yes	36	100	60	93,8	70	93,3	22	88
No	0	0	4	6,3	5	6,7	3	12
There is a workplace air conditioner								
Yes	36	100	64	100	75	100	25	100
No	0	0	0	0	0	0	0	0
Temperature and humidity are monitored								
Yes	29	80,6	47	73,4	63	84	19	76
No	7	19,4	17	26,6	12	16	6	24

(Table 6) contd....

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
Recognize the early signs of heat-related illnesses								
Yes	27	75	53	82,8	61	81,3	23	92
No	9	25	11	17,2	14	18,7	2	8
Comfortable uniform for your workplace								
Yes	28	77,8	57	89,1	61	81,3	21	84
No	8	22,2	7	10,9	14	18,7	4	16
There is a pre-employment check to exclude unfit								
Yes	21	58,3	38	59,4	49	65,3	16	64
No	15	41,7	26	40,6	26	34,7	9	36

Table 7 reveals the knowledge and perceptions of health participants regarding the dangers of radiation. With respect to the radiation warning signs, all reported the posting of these signs. Physicians, nurses, technicians, and participants (80.6%, 78.7%, 84%, and 89.1%, respectively) stated the laboratory to be secured from unauthorized access. Technicians, nurses, physicians, and participants who used personal protective equipment (PPE) when dealing with radioactive substances accounted for 80%, 88%, 77.8%, and 90.6%, respectively. Physicians, participants, nurses, and technicians (*i.e.*, 94.4%, 73.4%, 88%, and 92%, respectively) were informed about the

dangers of ionizing radiation. Radiation safety training before starting work was reported by physicians, participants, nurses, and technicians, accounting for 83.3% 85.9%, 84%, and 88%, respectively. The monitoring of radiation levels in the workplace was reported by 88.9% of the physicians, 86.7% of the nurses, 96% of the technicians, and 87.5% of the participants, respectively. Disposal of radioactive materials was reported to be carried out by authorized service providers in the responses of 6% of the technicians, 94.4% of the physicians, 95.2% of the participants, and 94.7% of the nurses, respectively.

Table 7. Radiation exposure hazards.

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
Radiation warning sign posted								
Yes	36	100	64	100	75	100	25	100
No	0	0	0	0	0	0	0	0
Do not know	0	0	0	0	0	0	0	0
Laboratory access from unauthorized access								
Yes	0	0	0	0	0	0	0	0
No	29	80,6	57	89,1	59	78,7	21	84
Do not know	7	19,4	7	10,9	7	10,9	4	16
PPE to use when dealing with radioactive substances								
Yes	28	77,8	58	90,6	66	88	20	80
No	1	2,8	1	1,6	2	2,7	2	8
Do not know	7	19,4	5	7,8	7	9,3	3	12
Workers are informed about the dangers of ionizing radiation								
Yes	34	94,4	47	73,4	66	88	23	92
No	1	2,8	2	3,1	1	1,3	0	0
Do not know	1	2,8	15	23	8	10,7	2	8
Staff are given radiation safety training before starting work								
Yes	30	83,3	55	85,9	63	84	22	88
No	1	2,8	0	0	3	4	0	0
Do not know	5	13,9	9	14,1	9	12	3	12
Staff are provided with refresher radiation safety training								
Yes	27	75	55	85,9	49	65,3	20	80
No	4	11,1	5	7,8	9	12	2	8
Do not know	5	13,9	4	6,3	17	22,7	3	12
Workers of childbearing age are given special training								
Yes	25	69,4	48	75	50	66,7	17	68
No	2	5,6	2	3,1	5	6,7	2	8

(Table 7) contd....

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	n	%
Do not know	9	25	14	21,9	20	26,7	6	24
There are ionizing radiation standards posted in certain locations for easy viewing by workers								
Yes	31	86,1	49	76,6	52	69,3	19	76
No	2	5,6	2	3,1	10	13,3	2	8
Do not know	3	8,3	13	20,3	13	17,3	4	16
There is regular environmental monitoring for radiation levels in the workplace								
Yes	32	88,9	56	87,5	65	86,7	24	96
No	0	0	1	1,6	3	4	0	0
Do not know	4	11,1	7	10,9	7	9,3	1	4
Disposal of radioactive material is carried out only by authorized providers								
Yes	34	94,4	61	95,2	71	94,7	24	96
No	0	0	0	0	0	0	0	0
Do not know	2	5,6	3	4,7	4	5,3	1	4
There is a pre-employment check								
Yes	27	75	44	68,8	50	66,7	21	84
No	1	2,8	1	1,6	2	2,7	1	4
Do not know	8	22,2	19	29,7	23	30,7	3	12
Periodic health checks are carried out for staff exposed to radiation								
Yes	27	75	45	70,3	58	77,3	18	72
No	3	8,3	1	1,6	2	2,7	0	0
Do not know	6	16,7	18	28,1	15	28,1	7	28

Based on the findings presented in Table 8, the permitted vibration exposure threshold values in the workplace were known by 61.1% of the physicians, 25.0% of the participants, 73.3% of the nurses, and 60.0% of the technicians, respectively. Most of the workforce has reported being given instructions or information regarding the dangers of vibration in the workplace. 44.4% of the physicians more often exposed to vibrations from medical devices were found to know about the signs and symptoms of vibration hazards. 38.9% of the physicians, 32.8% of the participants, 52.0% of the nurses, and

28.0% of the technicians stated regarding the unavailability of vibration personal protective equipment. They also reported that there is no test to ensure the suitability of vibration personal protective equipment. Most of the workforce admitted that they do not know if there are periodic inspections regarding vibration (*i.e.*, 77.8% of physicians and 73.3 nurses, respectively). As many as 80.6% of physicians, 50.0% of the participants, 94.7% of the nurses, and 84.0% of the technicians have realized that the equipment in the hospital has the risk of causing excessive vibration.

Table 8. Vibration hazards.

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
	n	%	n	%	n	%	-	%
Knowledge of permissible vibration exposure limits in the workplace								
Yes	22	61,1	16	25,0	55	73,3	15	60,0
No	5	13,9	26	40,6	8	10,7	4	16,0
Has received training on the dangers of vibration								
Yes	13	36,1	15	23,4	40	53,3	7	28,0
No	8	22,2	7	10,9	11	14,7	4	16,0
Do not know	15	41,7	42	65,6	24	32,0	14	56,0
Recognize the signs and symptoms of interference due to vibration hazard								
Yes	16	44,4	17	26,6	48	64,0	11	44,0
No	10	27,8	20	31,3	11	14,7	8	32,0
Do not know	10	27,8	27	42,2	16	21,3	6	24,0
Periodic vibration measurements in the workplace								
Yes	6	16,7	10	15,6	14	18,7	3	12,0
No	21	58,3	24	37,5	45	60,0	12	48,0
Do not know	9	25,0	30	46,9	16	21,3	10	40,0

(Table 8) contd.....

Variable	Physician (n=36)		Participant (n=64)		Nurse (n=75)		Technician (n=25)	
Vibration protection devices are available								
Yes	2	5,6	16	25,0	1	1,3	2	8,0
No	14	38,9	21	32,8	39	52,0	7	28,0
Do not know	20	55,6	27	42,2	35	46,7	16	64,0
PPE* is tested to ensure a fit and adequate level of protection								
Yes	3	8,3	5	7,8	10	13,3	0	0
No	12	33,3	17	26,6	27	36,0	7	28,0
Do not know	21	58,3	42	65,6	38	50,7	18	72,0
Periodic vibration checks are carried out								
Yes	6	16,7	9	14,1	12	16,0	3	12,0
No	2	5,6	0	0	8	10,7	0	0
Do not know	28	77,8	55	85,9	55	73,3	22	88,0
Workers are aware of tools in hospitals that are at risk of excessive vibration								
Yes	29	80,6	32	50,0	71	94,7	21	84,0
No	6	16,7	27	42,2	4	5,3	4	16,0
Do not know	1	2,8	5	7,8	0	0	0	0

Table 9. Physical hazard knowledge level and distribution frequency of each physical factor question.

Physical Hazard	Knowledge Level				Mean (±SD)	Median (min:max)
	Good		Poor			
	f	%	f	%		
Noise ^a	134	67	66	33	4.92 (±1.28)	5.00 (1 : 7)
Electrical equipment ^b	100	50	100	50	24.7 (±0.89)	2.50 (1 : 4)
Fire ^c	102	51	98	49	4.21 (±1.84)	5.00 (0 : 6)
Lighting ^d	127	63,5	73	36,5	4.83 (±1.26)	5.00 (1 : 6)
Heat exposure ^e	143	71,5	57	28,5	5.93 (±0.94)	6.00 (3 : 7)
Radiation ^f	130	65	70	35	9.89 (±1.35)	10.00 (5 : 12)
Vibration ^g	83	41,5	117	58,5	2.65 (±1.81)	2.00 (0 : 7)

Note: The number of questions on each physical factor is a = 12, b = 4, c = 6, d = 6, e = 7, f = 12, g = 8.

Based on the results presented in Table 9, most of the respondents (67%) had a good level of knowledge regarding noise hazards, 50% of the respondents had a good knowledge of electricity and equipment, 51% had a good knowledge of the fire, 63.5% had a good knowledge of lighting, 71.5% had a good knowledge of heat exposure, 65% had good knowledge of radiation, and 41.5% of the respondents had a good knowledge of vibration.

In this study, the chi-square test has been used to test the hypothesis regarding the correlation of age, gender, profession, unit, education level, marital status, and years of service with physical hazards in the workplace. As Table 10 indicates, there has been no correlation found between age and physical hazards (p-value = 0.885) with a value of OR = 0.922 (95% CI: 0.523 – 1.624); however, age is a risk factor that has been found to affect the knowledge of participants regarding physical factors in hospitals. There was no correlation observed

between gender and physical hazards (p-value = 0.338) with a value of OR = 1.382 (95% CI: 0.726 – 2.629); thus, gender cannot be considered a risk factor that can affect participants' knowledge regarding physical factors in dental hospitals. Also, there was no correlation found between profession and physical hazards (p-value = 0.291), between units and physical hazards (p-value = 0.622), and between education level and physical hazards (p-value 0.755). There has also been no correlation observed between marital status and physical hazards (p-value 0.776) with a value of OR = 1.118 (95% CI: 0.639 – 1.956); thus, marital status cannot be considered a risk factor affecting participants' knowledge regarding physical factors in dental hospitals. However, there has been a correlation observed between years of service (0.045) and physical danger with an OR = 1.843 (95% CI: 1.046 – 3.246); this indicates that the length of service is not a risk factor that can affect the knowledge of workers regarding physical factors in dental hospitals.

Table 10. Bivariate analysis of the correlation between individual characteristics and physical hazards.

Variable	Category	Physical hazard category						OR (95% CI)	p
		Good		Poor		Total			
		n	%	n	%	n	%		
Age	> 30 years	64	55,7	51	44,3	115	100	0.922 (95% CI: 0.523-1.624)	0,885
	≤ 30 years	49	57,6	36	42,2	85	100		
Gender	Male	33	62,3	20	37,7	53	100	1.382 (95% CI: 0.726-2.629)	0,338
	Female	80	54,4	67	45,6	14	100		
Specialty	Physician	17	47,2	19	52,8	36	100	-	0,291
	Participant	33	51,6	31	48,4	64	100		
	Nurse	48	64,0	27	36,0	75	100		
	Technician	15	60,0	10	40,0	25	100		
Units	Administration	33	51,6	31	48,4	64	100	-	0,622
	Medical support	15	60,0	10	40,0	25	100		
	Medical personnel	65	58,6	46	41,4	111	100		
Level of education	Doctor	5	62,5	3	37,5	8	100	-	0,755
	Master's degree	18	50,0	18	50,0	36	100		
	Bachelor's degree	72	56,7	55	43,3	127	100		
	Associate's degree	14	58,3	10	41,7	24	100		
	Senior high school	4	80,0	1	20,0	5	100		
Marital status	Single	59	57,8	43	42,2	102	100	1.118 (95% CI: 0.639-1.956)	0,776
	Married	54	55,1	44	44,9	98	100		
Years of service	>5 years	69	63,3	40	36,7	109	100	1.843 (95% CI: 1.046-3.246)	0,045
	≤ 5 years	44	48,4	47	51,6	91	100		

4. DISCUSSION

4.1. Physical Hazards

It is important that all workers have the knowledge and awareness of safety in the work environment. One of the hazards that must be considered by workers is the physical hazards [19]. Many kinds of physical hazards exist in the work environment, which occur upon exposure to lighting, noise, electricity, fire, heat, radiation, and vibration [20, 21]. Good lighting is crucial for performing the required tasks efficiently in the dental office without hazards or accidents. Poor lighting can affect both the body and the mind, leading to symptoms, such as eye strain, headache, fatigue, stress, and anxiety [22].

Various types of work activities in dental hospitals generate noise, such as grinding, trimming, denture-polishing units, and compressed air. Noise levels, however, vary based on the working time and the number of patients visiting at that time of the day. The Occupational Safety and Health Administration recommends a threshold value (NAV) of 85 dBA for working 8 hours daily [23]. Ensuring safety and raising awareness regarding the drawbacks of noise exposure among individuals are crucial. Electrical hazards also pose a significant risk of death and injury to individuals; therefore, attention to safety is an essential first step in any environmental setting [24].

The use of medical gases, flammable materials, and electrical and electronic equipment involves the risk of causing a fire and it can threaten the safety of patients and workers [25]. In a previous study, a group of health workers (surgeons, physician assistants, nurse anesthetists, and anesthesiologists) who participated in fire simulation training had higher

knowledge of fire hazards, compared to a group of healthcare workers who did not receive or attend training on fire hazards [26]. In this study, 66.7% of the physicians, 71.9% of the participants, 61.3% of the nurses, and 60% of the technicians had attended fire emergency response simulation training. Previous research explains that a good knowledge of fire prevention and control is essential for every hospital staff so that these events can be managed wisely [27]. This is in line with the theory stating that employers should provide training to workers who can be exposed to electrical hazards [18, 28].

X-rays are ionizing radiations used extensively in medical and dental practice. Radiation has emerged as a major occupational hazard and is associated with a high amount of damage. It is important to carry out radiation monitoring in the dental physics department to create a better working environment and to reduce the effects of radiation on occupational health [29]. In this study, 65% of the workforce had good knowledge of radiation exposure. A study reported most Sudanese radiographers, working in Khartoum, to have good awareness of radiation hazards (98%), radiation safety (96%), standard radiation safety (90%), and the importance of radiation safety (100%) [30]. The vibrations generated from the radiation tools can transfer to a human's body [31]. Exposure to these vibrations of the dental clinician may lead to a possible risk of him/her developing various vibration-induced symptoms, such as vascular, neurological, muscle, and skeletal symptoms or disorders [32]. A research conducted on 374 dental physicists in Sweden stated that they had signs on their thumbs, fingers, and hands, decreased hand strength, tremors, and pain in their elbows, hands, fingers, and neck. In this study, 44.4% of the physicians knew and were aware of the signs and

symptoms of disturbances occurring due to vibration hazards. However, in this study, most of the workforce admitted that they do not know if there is a regular inspection of vibration (*i.e.*, 77.8% of physicians and 73.3% of nurses, respectively).

4.2. Correlation between Age and Physical Hazards

In this study, those aged less than 30 years (57.6%) had good knowledge of physical hazards compared to those aged more than 30 years. There has been no correlation observed between age and understanding of physical hazards. This may be due to the smaller proportion of those aged less than 30 years. This is the same as the research that has stated no correlation between age and the level of acceptance of health and safety training. Most of the respondents with a high level of training acceptance were less than 25 years of age [33].

In our study, it was discovered that individuals aged below 30 years exhibited a commendable level of knowledge (57.6%), outperforming those aged above 30 years. However, no correlation has been found between age and the understanding of physical hazards. This lack of correlation can potentially be attributed to the smaller proportion of individuals aged below 30 years. These findings align with the previous research that suggests no correlation between age and the acceptance level of health and safety training. Interestingly, a majority of respondents who displayed a high level of training acceptance were below 25 years of age [33]. Furthermore, previous research has reported that the higher the age of health workers, the higher their level of awareness related to fire safety [34].

4.3. Correlation between Gender and Physical Hazards

The assessment of the relationship between gender and an understanding of physical hazards in the workplace has unveiled intriguing insights. With regards to knowledge and perceptions of these hazards, males have been found to have a stronger grasp, with 62.3% demonstrating good understanding, while females have shown a slightly lower percentage at 54.4%. However, it is worth noting that the majority of both men and women possessed suitable knowledge and perceptions regarding physical hazards, as revealed by the questionnaire results.

In line with the previous studies, high rates of acceptance for health and safety training have been observed, with 68.1% of women and 66.3% of men showing a positive inclination towards training [33]. A survey conducted among nurses and midwives to assess occupational health hazards found that a significant portion of both males and females (57.6%) acknowledged the potential risks associated with needle sticks, blood exposure, and skin incisions [35]. Furthermore, a study focusing on nurses' awareness of environmental health hazards, including physical factors, highlighted gender differences in risk factors [36].

Additionally, concerning radiation hazards, it is interesting to note that while weak evidence was found regarding gender differences in awareness, women tended to rate all aspects of radiation hazards higher on average, indicating a higher level of concern and awareness among women in this context [37].

These findings shed light on the complex relationship between gender and knowledge of physical hazards, emphasizing the importance of considering gender-specific factors in occupational health and safety initiatives.

4.4. Correlation between Profession and Physical Hazards

The statistical tests revealed intriguing insights into the knowledge of physical hazards among different healthcare professionals. Among the participants, nurses, and technicians, more than half of them possessed good knowledge regarding physical hazards, with percentages of 51.6%, 64%, and 60%, respectively. Surprisingly, physicians, despite their expertise, displayed a slightly lower percentage at 47.2%. These findings suggest that knowledge of physical hazards is not solely determined by one's profession.

Interestingly, this study did not find any significant correlation between profession and knowledge of physical hazards. However, in another study, a statistically significant correlation was identified between categories of health workers and their understanding of occupational hazards and safety practices [18, 38]. This highlights the importance of considering different professional groups when addressing occupational hazards and promoting safety practices.

These findings underscore the need for comprehensive training and education programs that target all healthcare professionals, regardless of their specific roles. By enhancing knowledge and awareness of physical hazards, healthcare workers can contribute to creating a safer working environment for themselves and their colleagues.

4.5. Correlation between Units and Physical Hazards

There was no correlation found between work units and physical hazard knowledge in this study. However, the results of more than half of the respondents concerning their expertise in the administration, medical support, and medical staff (51.6%, 60%, and 58.6%, respectively) were good. Different from other studies, nutrition service health workers reported the highest exposure to loud noises (86.0%) and heat (82.4%), while surgical and anesthetic health workers reported the highest exposure to glare (65.4%). Inadequate lighting (69.2%), radiation (80.4%), and vibration (42.3%) were also reported. 60.1% of health workers in inpatient departments reported being exposed to radiation and 21.9% in outpatient departments. Exposure to physical hazards differed significantly among the five departments, including noise, inadequate lighting, heat, cold, radiation, and vibration [39].

4.6. Correlation between Education Level and Physical Hazards

The test results showed no relationship between the level of education and workers' knowledge of physical hazards. Knowledge of physical hazards among unmarried people (57.8%) was greater than that of married people (55.1%). The results of previous studies have shown the awareness of physical hazards, *i.e.*, ionizing radiation and radiation protection, to be improved through the level of education, training, and experience; those with excellent knowledge of radiology and medical physics demonstrated higher average scores on radiation protection knowledge [37].

4.7. Correlation between Marital Status and Physical Hazards

The test results showed no relationship between marital status and knowledge. Knowledge of physical hazards among unmarried people (57.8%) was greater than that of married people (55.1%). However, when the correlation has been examined between marital status and an understanding of occupational hazards and safety practices, the results have been obtained to be significant [38].

4.8. The Correlation between Service Period and Physical Hazards

The results have indicated a relationship between the length of service and knowledge related to the physical hazards in the hospital environment. This is in line with a previous research that has shown the length of service and profession to affect the knowledge levels ($P < 0.05$) [40]. Data have also shown most workers working > 5 years to have good knowledge (63.3%). The exposure to psychological risk factors in nurses who have worked in the same hospital for 1-5 years was higher than those who have worked in the same hospital for a longer time [26, 31].

CONCLUSION

The awareness of safety measures for physical hazards among workers in the studied hospitals was optimal. Periodic monitoring has been carried out regularly, and security measures have primarily been in place. Although workers were not fully aware of the safety margins from physical hazards, they had a comparatively good knowledge of them. The efforts made by the hospital have been reported to be good by the respondents; however, they need to be maintained and even further enhanced so as not to pose a high risk due to exposure to physical hazards while working.

LIST OF ABBREVIATIONS

ILO	=	International Labor Organization
MCV	=	Mean Corpuscular Volume
PPE	=	Personal Protective Equipment

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical clearance has been obtained from the Health Research Ethics Commission of the Faculty of Nursing and Health, University of Muhammadiyah Semarang, with number 0149/KEPK/VII/2022.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee, and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants of this study.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

All data and materials have been incorporated and provided in the manuscript.

FUNDING

The author would like to thank the Research and Community Services Board (LPPM) Universitas Muhammadiyah Semarang for funding of the research and for assisting during the article's writing.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

- [1] Topf M. Hospital noise pollution: An environmental stress model to guide research and clinical interventions. *J Adv Nurs* 2000; 31(3): 520-8. [<http://dx.doi.org/10.1046/j.1365-2648.2000.01307.x>] [PMID: 10718870]
- [2] Kunaviktikul W, Wichaikhum O, Nantsupawat A, *et al.* Nurses' extended work hours: Patient, nurse and organizational outcomes. *Int Nurs Rev* 2015; 62(3): 386-93.
- [3] Ndeijo R, Musinguzi G, Yu X, *et al.* Occupational health hazards among healthcare workers in Kampala, Uganda. *J Environ Public Health* 2015; 2015: 1-9. [<http://dx.doi.org/10.1155/2015/913741>] [PMID: 25802531]
- [4] Smith P, Fritschi L, Reid A, Mustard C. The relationship between shift work and body mass index among Canadian nurses. *Appl Nurs Res* 2013; 26(1): 24-31. [<http://dx.doi.org/10.1016/j.apnr.2012.10.001>] [PMID: 23158849]
- [5] Berhane K, Kumie A, And J. Health effects of environmental exposures, occupational hazards and climate change in ethiopia: Synthesis of situational analysis, needs assessment and the way forward. *Ethiop J Health Dev* 2016; 30(1 Spec Iss): 50-6. [PMID: 28867920]
- [6] Tung CY, Chang CC, Ming JL, Chao KP. Occupational hazards education for nursing staff through web-based learning. *Int J Environ Res Public Health* 2014; 11(12): 13035-46. [<http://dx.doi.org/10.3390/ijerph111213035>] [PMID: 25514154]
- [7] Yasin J, Fisseha R, Mekonnen F, Yirdaw K. Occupational exposure to blood and body fluids and associated factors among health care workers at the University of Gondar Hospital, Northwest Ethiopia. *Environ Health Prev Med* 2019; 24(1): 18. [<http://dx.doi.org/10.1186/s12199-019-0769-9>] [PMID: 30611201]
- [8] Ashton I. *Monitoring For Health Hazards At Work*. 3rd ed. Blackwell Science 2000.
- [9] Hasselhorn H-M, Toomingas A. *Occupational Health For Healthcare Workers: A Practical Guide*. Amsterdam: Elsevier Sci Bv 2001; pp. 1-113.
- [10] Farzaneh AK. Condition of observing the principles of radiation protection in radiology centers in sistana and baluchestan province of Iran. *Int J Curr Res Rev* 2013; 5: 82-5.
- [11] Aghakhani AVC, Baghaei R. Prevalence and factors of occupational accidents in nurses of educational and treatment centers of urmia university of medical sciences, Urmia. In: *J Urmia Nurs Midwifery Fac*. 2017; p. 1394.
- [12] Nekooi MM, Amiresmaili MR, Mirshahi F, *et al.* The rate of occupational hazards and its effective factors. *Health Develop J* 2013; 2(3): 235-49.
- [13] Ryan KM, Gagnon M, Hanna T, *et al.* Noise pollution: Do we need a solution? An analysis of noise in a cardiac care unit. *Prehosp Disaster*

- Med 2016; 31(4): 432-5.
[http://dx.doi.org/10.1017/S1049023X16000388] [PMID: 27211892]
- [14] Ogunlade OB, Ogunfowokan AA. Clinical nurses' satisfaction with night shift in selected hospitals in ile-. *Int J Caring Sci* 2014; 7(1): 129-39.
- [15] Abdellah RF, Attia SA, Fouad AM, Abdel-Halim AW. Assessment of physicians' knowledge, attitude and practices of radiation safety at Suez Canal University Hospital, Egypt. *Open J Radiol* 2015; 5(4): 250-8.
[http://dx.doi.org/10.4236/ojrad.2015.54034]
- [16] Heydarheydari S, Haghparast A, Eivazi MT. A novel biological dosimetry method for monitoring occupational radiation exposure in diagnostic and therapeutic Wards: From radiation dosimetry to biological effects. *J Biomed Phys Eng* 2016; 6(1): 21-6.
[PMID: 27026951]
- [17] Shafiee M, Hoseinnezhad E, Vafapour H, Borzoueisileh S, Ghorbani M, Rashidfar R. Hematological findings in medical professionals involved at intraoperative fluoroscopy. *Glob J Health Sci* 2016; 8(12): 232.
[http://dx.doi.org/10.5539/gjhs.v8n12p232]
- [18] Tziaferi SG, Sourtzi P, Kalokairinou A, Sgourou E, Koumoulas E, Velonakis E. Risk assessment of physical hazards in greek hospitals combining staff's perception, experts' evaluation and objective measurements. *Saf Health Work* 2011; 2(3): 260-72.
[http://dx.doi.org/10.5491/SHAW.2011.2.3.260] [PMID: 22953210]
- [19] Gardiner K. *Pocket Consultant: Occupational Health*. Wiley-Blackwell 2022; p. 480.
[http://dx.doi.org/10.1002/9781119887638]
- [20] Roveshti M M, Raei M, And F. Assessment and characterization of physical hazards in workplace: A case study in a military dental hospital. *Paramed Sci Military Health* 2022; 17(1): 21-30.
- [21] Qu Y, Zhang W, Ryan I, *et al*. Ambient extreme heat exposure in summer and transitional months and emergency department visits and hospital admissions due to pregnancy complications. *Sci Total Environ* 2021; 777: 146134.
[http://dx.doi.org/10.1016/j.scitotenv.2021.146134] [PMID: 33689898]
- [22] Kumar UK, Murgod S, Ropak B, *et al*. Health hazards in prosthodontic practice - A Review. *Indian J Dental Adv* 2018; 10(1): 30-4.
[http://dx.doi.org/10.5866/2018.10.10030]
- [23] Murphy WJ, Franks JR. Revisiting the niosh criteria for a recommended standard: Occupational noise exposure. *J Acoust Soc Am* 2002; 111(5): 2397.
[http://dx.doi.org/10.1121/1.4778162]
- [24] Salvaraji L, Jeffrey M S, Awang Lukman K, Saupin S, And R. Electrical safety in a hospital setting: A narrative review. *Ann Med Surg* 2022; 78: 103781.
[http://dx.doi.org/10.1016/j.amsu.2022.103781]
- [25] Hey LA, Turner TC. Using standardized or checklists and creating extended time-out checklists. *AORN J* 2016; 104(3): 248-53.
[http://dx.doi.org/10.1016/j.aorn.2016.07.007] [PMID: 27568538]
- [26] Kishiki T, Su B, Johnson B, *et al*. Simulation training results in improvement of the management of operating room fires—A single-blinded randomized controlled trial. *Am J Surg* 2019; 218(2): 237-42.
[http://dx.doi.org/10.1016/j.amjsurg.2019.02.035] [PMID: 30885454]
- [27] Safavi HA, Mahjobipor H, Mohammadzadeh M. Education and treatment guideline for evaluation of applying basic standards of anesthesia care in surgery. *IJME* 2011; 10(4): 357-63.
- [28] Abdel-Wahed A, Ghandour AA, Elsaiedy WH, Aa G. Risk assessment of physical health hazards in al-azhar university hospital in new damietta, Egypt. *Egypt J Hosp Med* 2013; 53: 1019-35.
[http://dx.doi.org/10.12816/0001665]
- [29] Relat R. Knowledge, attitude and practice of radiation protection protocols amongst students of a Dental College. *Dentistry* 2019; 9(1)
[http://dx.doi.org/10.4172/2161-1122.1000530]
- [30] Mohamed A, Elamin T. Radiation safety awareness and practice in sudanese medical facilities: A descriptive. *Int J Sci Res* 2015; 4(5): 2190-5.
- [31] Rytönen E, Sorainen E, Leino-Arjas P, Solovieva S. Hand-arm vibration exposure of dentists. *Int Arch Occup Environ Health* 2006; 79(6): 521-7.
[http://dx.doi.org/10.1007/s00420-005-0079-y] [PMID: 16421714]
- [32] Szymanska J. Dentist's hand symptoms and high-frequency vibration. *Ann Agric Environ Med* 2001; 8(1): 7-10.
[PMID: 11426919]
- [33] Adebowale OO, Afolabi MO, Adesokan HK, *et al*. Determinants of work-related risks among veterinary clinical students in South West Nigeria. *Vet Med Int* 2020; 2020: 1-10.
[http://dx.doi.org/10.1155/2020/2780378] [PMID: 32802304]
- [34] Cho OH, Lee D, Hwang KH. Patient safety awareness, knowledge and attitude about fire risk assessment during time-out among perioperative nurses in Korea. *Nurs Open* 2022; 9(2): 1353-61.
[http://dx.doi.org/10.1002/nop.21180] [PMID: 35092180]
- [35] Amare TG, Tesfaye TT, Girmay B, Gebreagziabher TT. Exposure to occupational health hazards among nursing and midwifery students during clinical practice. *Risk Manag Healthc Policy* 2021; 14: 2211-20.
[http://dx.doi.org/10.2147/RMHP.S280555] [PMID: 34093047]
- [36] Azizoğlu F, Köse A, Gül H. Self-reported environmental health risks of nurses working in hospital surgical units. *Int Nurs Rev* 2019; 66(1): 87-93.
[http://dx.doi.org/10.1111/inr.12467] [PMID: 29926902]
- [37] Salih S, Zeidan ZA, Alzalabani A, Albadrani MSS, And M. Awareness and knowledge towards ionizing radiation hazard among medical students, interns and residents In Al-Madinah Al-Munawarah, KSA. *Life Sci J* 2014; 11(3): 6-10.
- [38] Aluko OO, Adebayo AE, Adebisi TF, Ewegbemi MK, Abidoye AT, Popoola BF. Knowledge, attitudes and perceptions of occupational hazards and safety practices in Nigerian healthcare workers. *BMC Res Notes* 2016; 9(1): 71.
[http://dx.doi.org/10.1186/s13104-016-1880-2] [PMID: 26852406]
- [39] Nankongnab N, Kongtip P, Tipayamongkhogul M, *et al*. Occupational hazards, health conditions and personal protective equipment used among healthcare workers in hospitals, Thailand. *Hum Ecol Risk Assess* 2021; 27(3): 804-24.
[http://dx.doi.org/10.1080/10807039.2020.1768824] [PMID: 34539172]
- [40] Jalali MG, Baloochestani A, Maghami M, *et al*. Prevention and control of operating room fires: Knowledge of staff employed by selected hospitals of isfahan university of medical sciences. *Asian J Nurs Edu Res* 2016; 6(3): 342.