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The Effects of Surgical Smoke on Operating Room Nurses and the Precautions They Take for Protection from Surgical Smoke: An Example of Türkiye and Palestine

Ameliyathane Hemşirelerinde Cerrahi Dumanın Etkileri ve Cerrahi Dumandan Korunmaya Yönelik Aldıkları Önlemler: Türkiye ve Filistin Örneği

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ABSTRACT

Objective: This research was carried out to determine the effects of surgical smoke on operating room nurses and the precautions they take to protect themselves from it.

Methods: The research was carried out between June 2022 and July 2023 at Atatürk University Research Hospital and Al Şifa Hospital in Palestine Gaza Strip. The study population consisted of 169 operating room nurses working in the operating rooms of the relevant hospitals. The researchers collected the data face-to-face using a form prepared in accordance with the literature.

Results: In the study, the average age of nurses working in Turkey was 30.47±7.85, and the average age of nurses working in Palestine was 30.67±5.65. It was determined that 84.3% of the nurses working in Turkey and 68.7% of the nurses working in Palestine were women. 67.1% of the nurses working in Turkey stated that they experienced headaches, 54.3% cough, 50% watery eyes and 41.4% nausea due to surgical smoke. On the other hand, 96% of the nurses working in Palestine stated that they experienced odour in the hair, 50.5% headache, 30.3% dizziness and 21.2% airway inflammation symptoms due to surgical smoke. It has been determined that most nurses in both countries use surgical masks, gloves and gowns to protect themselves from surgical smoke.

Conclusion: In both countries, the precautions taken to prevent surgical smoke in the operating rooms were insufficient, and the nurses experienced related symptoms.

Keywords: Occupational exposure, operating room, smoke, surgical nursing

ÖZ

Amaç: Bu araştırma ameliyathane hemşirelerinde cerrahi dumanın etkileri ve cerrahi dumandan korunmaya yönelik aldıkları önlemlerin belirlenmesi amacıyla yapıldı.

Yöntemler: Araştırma, Atatürk Üniversitesi Araştırma Hastanesi ve Filistin Gazze şeridi Al Şifa Hastanesi'nde Haziran 2022-Temmuz 2023 tarihleri arasında yapıldı. Araştırmanın evrenini ilgili hastanelerin ameliyathanelerinde çalışan 169 ameliyathane hemşiresi oluşturdu. Araştırmanın verileri literatür doğrultusunda hazırlanan form ile araştırmacılar tarafından yüz yüze toplandı.

Bulgular: Araştırmada Türkiye'de çalışan hemşirelerin yaş ortalaması 30,47±7,85, Filistin'de çalışan hemşirelerin yaş ortalaması 30,67±5,65 olarak belirlendi. Türkiye'de çalışan hemşirelerin %84,3'ünün Filistin'de çalışan hemşirelerin %68,7'sinin kadın olduğu saptandı. Türkiye'de çalışan hemşirelerin cerrahi duman nedeniyle %67,1'i baş ağrısı, %54,3'ü öksürük, %50'si göz yaşarması ve %41,4'ü bulantı semptomlarını yaşadıkları belirtildi. Filistin'de çalışan hemşirelerin ise cerrahi duman nedeniyle %96'sı saçlarda koku, %50,5'i baş ağrısı, %30,3'ü baş dönmesi ve %21,2'si havayolu inflamasyonu semptomlarını yaşadıklarını ifade etti. Her iki ülkede de hemşirelerin çoğunluğunun cerrahi dumandan korunmak için cerrahi maske, eldiven ve önlük kullandığı saptandı.

Sonuç: Her iki ülkede de ameliyathanelerde cerrahi dumandan korunmaya yönelik alınan önlemlerin yetersiz olduğu ve hemşirelerin buna bağlı bazı sorunlar yaşadığı tespit edildi.

Anahtar Kelimeler: Ameliyathane, cerrahi hemşireliği, duman, mesleki maruziyet

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INTRODUCTION

Many surgical procedures utilize surgical instruments such as electrocautery and lasers for hemostasis, excision, and dissection, and the high heat generated during the use of such instruments causes the burning of proteins and other organic substances, leading to thermal necrosis of surrounding tissue cells. Surgical smoke, a combination of water vapor, gases, and particles, forms as a result of the breakdown and evaporation of fat and protein in tissues[1] and consists of 95% water vapor, while 5% consists of combustion products and cellular debris. The 5% of surgical smoke contains chemicals, blood and tissue particles, viruses, and bacteria. For this reason, surgical smoke poses a potential health risk to operating room personnel.[2]

The Occupational Safety and Health Administration (OSHA) of the U.S.A. states that an estimated 500.000 healthcare employees, including surgeons, nurses, anesthesiologists, and other healthcare staff, are exposed to surgical smoke each year.[3-5] Surgeons working 20-40 cm away from the point of surgical smoke generation are exposed to the highest smoke concentrations. However, because surgeons operate only a few times a week, their exposure to surgical smoke is generally much less than that of other healthcare staff. Unlike surgeons, nurses, other operating room staff, and anesthesiologists, who work 8-10 hours a day, are constantly exposed to the hazards of surgical smoke.[6] Small but continuous exposure to surgical smoke raises concerns because of the potential for long-term cumulative effects.[7]

In the literature, many symptoms associated with exposure to surgical smoke have been identified to date.[6-10] Following exposure to surgical smoke, eye irritation, watering eyes, headache, nausea, dizziness, acute or chronic inflammation, respiratory changes, asthma, chronic bronchitis, drowsiness, nasopharyngeal lesions, throat irritation, weakness, fatigue, cardiovascular dysfunction, and anxiety have been observed in operating room employees.[3,4,6,9,11-13] However, exposure to surgical smoke might also have mutagenic and carcinogenic effects.[6] Long-term exposure to surgical smoke causes cancer in laboratory animals and has been associated with a higher incidence of cancer in humans.[6,8]

The American Association of Operating Room Nurses (AORN) and the National Institute for Occupational Safety and Health (NIOSH) recommend that surgical smoke be evacuated using smoke evacuators to protect healthcare staff and patients from surgical smoke hazards. To this end, they established guidelines and standards to ensure a healthy work setting, which recommend the use of appropriate equipment and procedures to prevent smoke exposure and the minimization of smoke exposure with capture devices.[14] Many guidelines recommend the use of smoke evacuation systems and high-filtration masks for surgical smoke, providing training to raise healthcare staff's awareness of the dangers of surgical smoke, and ensuring that healthcare employees have a positive perception of the quality and ease of implementation of smoke evacuation recommendations. It is stated that the measures taken must be implemented and made legal.[7] However, a literature review showed that the protective measures taken to protect against surgical smoke are inadequately implemented.[9,10,15] In a study conducted by Asdornwised[9] in Thailand, all operating room nurses (100%) reported using central smoke extraction systems, 63.7% using portable smoke extraction units, and 43.5% using in-line filtered wall aspirators at a low level or none at all. In a study by Usta et al.[10] 90.5% of the nurses reported that the operating rooms they worked in had a general ventilation system, 89.5% did not have a smoke extraction device, and of the nurses working in operating rooms with a device, only 45.5% reported using the device, 40% reported that there were no filters on surgical smoke-producing equipment, and 32.4% reported that they did not know if there were any. In a study by Aydın et al.[15], it was reported that 77.6% of operating room employees used surgical masks, 55.2% used aspiration catheters, 28.4% used gowns, and 26.9% used surgical goggles to protect themselves from surgical smoke. No studies were detected in the literature on the effects of surgical smoke on healthcare employees in Palestine and the precautions taken to address surgical smoke.

AIM

This study aimed to determine and compare the effects of surgical smoke on operating room nurses in Türkiye and Palestine and the precautions taken to address surgical smoke.

Research questions

- Are the symptoms occurring because of surgical smoke similar among operating room nurses working in hospitals where the study was conducted in Türkiye and Palestine?
- Are the precautions taken against surgical smoke by operating room nurses working in the hospitals where the study was conducted in Türkiye and Palestine similar?

METHODS

Study design

Descriptive and cross-sectional research design was used in the present study.

Setting and participants

The study was conducted in the operating room of Atatürk University Research Hospital and the operating room of Al Şifa Hospital in Palestine Gaza Strip between June 2022 and July 2023. The population consisted of the nurses working in the operating rooms of Atatürk University Research Hospital and Al Şifa Hospital in Palestine Gaza Strip. The study did not employ a sampling method but attempted to reach the entire population. Two nurses from the operating room at Atatürk University Research Hospital were excluded from the study because they were on leave between the specified dates, and the study was completed with a total of 70 nurses. At Al Şifa Hospital in Palestine Gaza Strip, 31 nurses did not wish to participate in the study, and the study was completed with a total of 99 nurses. The study sample consisted of 169 nurses who worked in operating rooms between September and November 2022 and volunteered to participate in the study, reaching 83.66% of the population.

Data Collection Tool

A survey form, which was developed by the researchers in line with literature data,[9,10,16] was used to collect the data. The survey included questions regarding the sociodemographic characteristics of operating room nurses, problems encountered in operating room workers exposed to surgical smoke, and precautions taken to protect against surgical smoke.

Data Collection

Data collection began with the online survey, but because of insufficient feedback, verbal permission was obtained from hospital administrations, and the researchers administered the survey using face-to-face interviews. Each survey took approximately 15 minutes to complete.

Statistical Analysis

The Statistical Package for the Social Sciences (IBM SPSS Corp., Armonk, NY, USA) 21.0 was used for data coding and analysis. The data were analyzed using skewness and kurtosis coefficients for normal distribution. Descriptive statistics such as Student's T-Test, Fisher's Exact Test, Pearson's Chi-Square Test, and numbers, percentages, mean, and standard deviation values were used in data analysis, and P <.05 was considered statistically significant for all tests.

Ethical Consideration

The approval for the study was received from the Atatürk University Faculty of Medicine Clinical Research Ethics Committee (Date: 02.06.2022, Number: 2022/65). Official permission was obtained from the institutions where the study would be conducted. All individuals who were included in the study were informed about the purpose and method of the study, and that they could withdraw from the study at any time (Respect for Autonomy), and their consent was obtained. It was stated that individual information would be protected by the researcher, and the identity of the information obtained, and the respondent would be kept confidential (Confidentiality and Protection of Confidentiality). General attention was paid to the implementation of the ethical principles of "Anonymity and Security" and "Non-maleficence/Beneficence."

RESULTS

Descriptive data of the nurses are given in Table 1.

Table 1. Nurses' Socio-Demographic Characteristics

	Türkiye (n=70)		Palestine (n=99)		t	*P*
Age (Mean ± SD)	30.47±7.85		30.67±5.65		0.191	.849
	n	**%**	**n**	**%**	**Chi-Square**	***P***
Gender						
Female	59	84.3	68	68.7	5.343	**.029**
Male	11	15.7	31	31.3		
Marital status						
Married	34	48.6	59	59.6	2.014	.162
Single	36	51.4	40	40.4		
Educational status						
High School	15	21.4	0	0.0		
Associate Degree	15	21.4	10	10.1	49.996	**<.001**
Bachelor's Degree	28	40.0	87	87.9		
Total duration of experience						
< 5 years	24	34.3	46	46.5		
5-10 years	19	27.1	40	40.4	20.551	**<.001**
10-15 years	17	24.3	13	13.1		
> 20 years	10	14.3	0	0.0		
Duration of experience in the operating room						
< 5 years	31	44.3	85	85.9		
5-10 years	23	32.9	12	12.1	36.012	**<.001**
10-15 years	10	14.3	2	2.0		
> 20 years	6	8.6	0	0.0		
Chronic disease						
Yes	5	7.1	1	1.0	4.504	.083
No	65	92.9	98	99.0		
Smoking status						
Yes	27	38.6	19	19.2	7.774	**.008**
No	43	61.4	80	80.8		
Receiving training on surgical smoke protection						
Yes	17	24.3	26	26.3	0.084	.858
No	53	75.7	73	73.7		

t: Student t test

Operating room nurses working in hospitals where the study was conducted in Türkiye and Palestine were found to be similar in terms of age, marital status, and chronic disease characteristics (*P*>.05). However, gender, education, length of service, length of service in the operating room, smoking status, and surgical smoke protection training were found to vary between countries (*P* < .05). Among operating room nurses working in Türkiye, 84.3% were female, 40% had a bachelor's degree, 34.3% had less than 5 years of experience as a nurse, 44.3% had less than 5 years of experience in the operating room, and 61.4% were nonsmokers. Among operating room nurses working in Palestine, 68.7% were female, 87.9% had a bachelor's degree, 46.5% had been working as a nurse for less than 5 years, 85.9% had worked in the operating room for less than 5 years, and 80.8% were non-smokers (Table 1).

The distribution of symptoms experienced by nurses after exposure to surgical smoke is given in Table 2. It was found that 82.9% of nurses working in Türkiye and 97% of nurses working in Palestine reported experiencing at least one symptom related to surgical smoke, and the difference between the groups was statistically significant (*P* < .05). When examining the symptoms experienced by nurses because of surgical smoke, operating room nurses working in Türkiye reported the most common complaints of headache (67.1%), cough (54.3%), watery eyes (50.0%), hair odor (45.7%), nausea (41.4%), and burning throat (40.0%). Operating room nurses working in Palestine reported the most common complaints of hair odor (96.0%), headache (50.5%), dizziness (30.3%), airway inflammation (21.2%), fatigue (20.2%), and cough (19.2%) because of surgical smoke.

It was determined that the prevalence rates of some symptoms experiences of nurses due to surgical smoke in Türkiye and Palestine differed at a statistically significant level: headache (Türkiye 67.1%; Palestine 50.5%), burning throat (Türkiye 40.0%; Palestine 12.1%), nausea (Türkiye 41.4%; Palestine 9.1%), cough (Türkiye 54.3%; Palestine 19.2%), watery eyes (Türkiye 50.0%; Palestine 1.0%), odor in hair (Türkiye 45.7%; Palestine 96.0%), sneezing (Türkiye 30.0%; Palestine 11.1%),eye irritation (Türkiye 27.1%; Palestine 3.0%), anxiety (Türkiye 15.7%; Palestine 4.0%), myalgia (Türkiye 10.0%; Palestine 1.0%), difficulty

Table 2. Symptoms Experienced by Nurses Due to Surgical Smoke Exposure

	Türkiye (n=70)				Palestine (n=99)					
	Evet		Hayır		Evet		Hayır			
Symptoms*	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**Chi- Square**	***P***
Headache	47	67.1	23	32.9	50	50.5	49	49.5	4.642	**.040**
Burning throat	28	40.0	42	60.0	12	12.1	87	87.9	17.614	**<.001**
Nausea	29	41.4	40	57.1	9	9.1	90	90.9	26.536	**<.001**
Cough	38	54.3	32	45.7	19	19.2	80	80.8	22.549	**<.001**
Watery eyes	35	50.0	35	50.0	1	1.0	98	99.0	58.760	**<.001**
Hair odor	32	45.7	38	54.3	95	96.0	4	4.0	55.423	**<.001**
Sneezing	21	30.0	49	70.0	11	11.1	88	88.9	9.532	**<.001**
Fatigue	19	27.1	51	72.9	20	20.2	79	79.8	1.113	.355
Eye irritation	19	27.1	51	72.9	3	3.0	96	97.0	21.060	**<.001**
Anxiety	11	15.7	59	84.3	4	4.0	95	96.0	6.909	**.012**
Myalgia	7	10.0	69	90.0	1	1.0	98	99.0	7.349	**<.001**
Dizziness	14	20.0	56	80.0	30	30.3	69	69.7	2.260	.156
Difficulty breathing	18	25.7	52	74.3	12	12.1	87	87.9	5.189	**.026**
Rhinitis	11	15.7	59	84.3	8	8.1	91	91.9	2.395	.142
Feeling of fainting	14	20.0	56	80.0	6	6.1	93	93.9	7.636	**<.001**
Airway inflammation	8	11.4	62	88.6	21	21.2	78	78.8	2.761	.103
Conjunctivitis	3	4.3	67	95.7	4	4.0	95	96.0	0.006	1.00
Vomiting	3	4.3	67	95.7	3	3.0	96	97.0	0.189	.693
Drowsiness	16	22.9	54	77.1	2	2.0	97	98.0	18.780	**<.001**
Dermatitis	4	5.7	66	94.3	6	6.1	93	93.9	0.009	.925
Hypoxia	3	4.3	67	95.7	4	4.0	95	96.0	0.006	.937
Cardiovascular disorders/Arrhythmias	3	4.3	67	95.7	0	0.0	99	100.0	4.320	.069
Abdominal pain	7	10.0	63	90.0	12	12.1	87	87.9	0.185	.806
Asthma	8	11.4	62	88.6	0	0.0	99	100.0	11.867	**<.001**
Irritability	17	24.3	53	75.7	4	4.0	95	96.0	15.454	**<.001**
Weakness	17	24.3	53	75.7	14	14.1	85	85.9	2.817	.109

*More than one answer was given.

breathing (Türkiye 25.7%; Palestine 12.1%), feeling of fainting (Türkiye 20.0%; Palestine 6.1%), drowsiness (Türkiye 22.9%; Palestine 2.0%), asthma (Türkiye 11.4%; Palestine 0%) and irritability (Türkiye 24.3%; Palestine 4.0%) (*P*<.05) (Table 2).

The distribution of nurses' knowledge and opinions regarding the use of smoke evacuation devices in the operating rooms where they work is given in Table 3. When nurses were asked about the existence of a protocol in the operating room for protection from surgical smoke, 58.6% of nurses working in Türkiye stated that there was no protocol, while 38.4% of nurses working in Palestine stated that there was a protocol, and the difference between the groups was found to be statistically significant (*P*<.05) (Table 3).

Table 3. Nurses' Knowledge and Opinions Regarding Surgical Smoke Evacuation Devices

	Türkiye (n=70)		Palestine (n=99)		Chi-Square	*P*
	n	%	n	%		
Is there a protocol for protection from surgical smoke?						
Yes	10	14.3	38	38.4		
No	41	58.6	29	29.3	17.235	**<.001**
I don't know	19	27.1	32	32.3		
Are the precautions taken in the operating room sufficient to protect from surgical smoke?						
Yes	6	8.7	14	14.1	1.150	.339
No	64	91.3	85	85.9		
Are there filters on surgical smoke-producing instruments?						
Yes	6	8.6	15	15.2		
No	45	64.3	54	54.5	2.234	.327
I don't know	19	27.1	30	30.3		
Is a central smoke evacuation system used for surgical smoke protection?						
Yes	15	21.4	69	69.7		
No	33	47.1	19	19.2	38.302	**<.001**
I don't know	22	31.4	11	11.1		
Is a portable evacuation system used for surgical smoke protection?						
Yes	20	28.6	12	12.1		
No	28	40.0	67	67.7	13.528	**.001**
I don't know	22	31.4	20	20.2		
Is a liquid aspirator used for protection from surgical smoke?						
Yes	9	12.9	3	3.0		
No	38	54.2	71	71.7	10.108	**.018**
I don't know	23	32.9	25	25.3		

The majority of nurses working in both countries said that the precautions taken in the operating room were not sufficient to protect against surgical smoke, and the difference between the groups was not significant (*P*>.05) (Table 3).

While 47.1% of nurses working in Türkiye stated that the central evacuation system was not used, 69.7% of nurses working in Palestine stated that the central evacuation system was used, and the difference between the groups was statistically significant (*P* <.05) (Table 3).

A total of 40% of nurses working in Türkiye and 67.7% working in Palestine stated that they did not use portable evacuation systems, and the difference between the groups was found to be statistically significant (*P*<.05) (Table 3).

Also, 54.2% of nurses working in Türkiye and 71.7% of nurses working in Palestine stated that liquid aspirators were not used, and the difference between the groups was found to be statistically significant (*P*<.05) (Table 3).

Table 4. Personal equipment used by nurses to protect themselves from surgical smoke

	Türkiye (n=70)		Palestine (n=99)		Chi-Square	*P*
	n	%	n	%		
Surgical mask						
Yes	65	92.9	99	100.0	7.287	**.011**
No	5	7.1	0	0.0		
High-filtration masks						
Yes	5	7.1	0	0.0	1.423	**.011**
No	65	92.9	99	100.0		
Gloves						
Yes	57	81.4	99	100.0	19.918	**<.001**
No	13	18.6	0	0.0		
Surgical gown						
Yes	56	80.0	98	99.0	18.283	**<.001**
No	14	20.0	1	1.0		
Surgical goggles						
Yes	34	48.6	0	0.0	60.196	**<.001**
No	36	51.4	99	100.0		

The distribution of personal protective equipment employed by nurses for protection from surgical smoke is given in Table 4. It was found that the distribution of personal protective equipment used by nurses for protection from surgical smoke differed statistically and significantly between countries (*P*<.05). For protection from surgical smoke, 92.9% of nurses working in Türkiye and 100% of nurses working in Palestine stated that they used surgical masks; 92.9% of nurses working in Türkiye and 100% of nurses working in Palestine stated that they did not use high-filtration masks; 81.4% of nurses working in Türkiye and 100% of nurses working in Palestine stated

that they used gloves; 80% of nurses working in Türkiye and 99% of nurses working in Palestine stated that they used surgical gowns; 51.4% of nurses working in Türkiye and 100% of nurses working in Palestine stated that they did not use surgical surgical goggles.

DISCUSSION

The study aimed to identify health problems regarding surgical smoke exposure among operating room nurses working in hospitals in Türkiye and Palestine, where the study was conducted, and to compare the measures taken to protect against the effects of this smoke. The study results showed that the vast majority of nurses in both countries experienced at least one symptom as a result of surgical smoke exposure. Their knowledge of the use of surgical smoke evacuators in their workplaces was inadequate, and they often used surgical masks, gloves, and surgical gowns for protection.

In-service training is crucial for protecting healthcare professionals from surgical smoke and raising their awareness of this issue.[17] However, 75.7% of nurses working in Türkiye and 73.7% of nurses working in Palestine reported that they had not received any training on surgical smoke protection. Similarly, the literature reports that in-service training on surgical smoke is inadequate.[12,16-18] In this context, it may be recommended to organize in-service training activities at regular intervals to both update individual knowledge and ensure institutional awareness.

Based on the results of the present study, 82.9% of nurses working in Türkiye and 97% of nurses working in Palestine reported experiencing at least one symptom related to surgical smoke. The frequency of symptoms varied across countries. In Türkiye, the most frequently reported symptoms were headache (67.1%), cough (54.3%), watery eyes (50%), hair odor (45.7%), nausea (41.4%), burning throat (40%), and sneezing (30%). In Palestine, the most common symptoms related to surgical smoke were hair odor (96%), headache (50.5%), dizziness (30.3%), airway inflammation (21.2%), and fatigue (20.2%). In a previous study by Okgün Alcan et al.[16], the most common symptoms experienced by nurses related to surgical smoke were reported to be headache, nausea, cough, burning throat, watery eyes, and hair odor. Another study reported that nurses most frequently experienced burning in the throat, asthma/respiratory distress, headache, hair odor/loss, irritability, and watery eyes because of surgical smoke.[17] Similar studies in the literature also reported that symptoms such as headache, watery eyes, dizziness, burning in the throat, cough, nausea, and respiratory problems were frequently faced because of surgical smoke exposure.[9,10,15] The difference in the frequency of symptoms between the two countries may be because of individual nurses' differences in working hours, the physical conditions of the operating rooms in which they worked, and differences in the institutions' occupational safety practices.

The American Association of Operating Room Nurses (AORN) recommends the development and implementation of protocols for surgical smoke protection.[19] However, the study found that such protocols were not in the hospitals where the study was conducted. In Türkiye, 14.3% of nurses reported that their institution had a protocol, while 27.1% reported that they were unaware of the protocol. In Palestine, these rates were 38.4% and 32.3%, respectively. The results of the present study also show that nurses in Türkiye are more aware of the existence of surgical smoke protection protocols in their institutions. Similar results were reported in the literature.[10,15]

Although one method employed to remove surgical smoke from the environment is centralized smoke extraction systems[20,21], these systems were not available in the hospitals where the study was conducted. In the study, 21.4% of nurses working in Türkiye and 69.7% of those working in Palestine reported using centralized smoke extraction systems. The difference was statistically significant, and it was concluded that while the knowledge level of nurses in Türkiye was better, the knowledge level in both countries was generally inadequate. In this context, continuing professional training programs must be established to increase the knowledge of nurses and other operating room staff about the risks of surgical smoke and the use of extraction systems. Supporting educational content with up-to-date scientific data, providing hands-on training, and conducting internal audits will contribute to increased knowledge. In similar studies, the percentages of nurses who reported using centralized systems were reported to be 11.4%, 25.6%, and 45.8%.[10,17,22]

Another method employed to remove surgical smoke is the portable surgical smoke extraction systems. During the data collection, the hospitals where the study was conducted did not have such systems. The results of the present study showed that 28.6% of nurses working in Türkiye and 12.1% of those working in Palestine reported using portable systems for surgical smoke extraction, and this difference was statistically significant, which suggests that nurses in Palestine are more aware of this issue. However, the literature reports that the use of portable systems is quite low.[10,22]

The use of liquid aspirators is not recommended for surgical smoke removal.[16,17,22] However, liquid aspirators were used to reduce the effects of surgical smoke in both healthcare facilities where the study was conducted. The results indicated that 54.2% of nurses working in Türkiye and 71.7% of those working in Palestine stated that liquid aspirators were not used to remove surgical smoke. Based on these results, it can be said that nurses working in Türkiye are more aware of the use of liquid aspirators in reducing the effects of surgical smoke. However, the literature indicates higher rates of liquid aspirator use for surgical smoke removal.[16,22]

When examining the personal protective equipment used by nurses to protect themselves from surgical smoke, it is possible to argue that the majority of nurses working in both countries use surgical masks, gloves, and surgical gowns to protect themselves from surgical smoke. A study by Aydın et al.[15] reported that 77.6% of operating room employees used surgical masks, 28.4% wore gowns, and 26.9% wore surgical goggles to protect themselves from surgical smoke. In their study, Aktaş and Aksu[22] reported that 89% of nurses used surgical masks, 75.6% gloves, 72% surgical gowns, and 51.2% surgical goggles. In the study by Usta et al.[10], it was found that 85.7% of nurses used surgical masks, 71.4% gowns, 68.6% gloves, and 49.5% surgical goggles, while the rate of using high-filtration masks was 25.7%. Guidelines prepared for protection from surgical smoke state that surgical masks are not sufficient for smoke filtration and that high-filtration masks must be used.[8,9,17,23] However, in this study, only 7.1% of nurses in Türkiye stated that they used high-filtration masks for protection from surgical smoke, while nurses working in Palestine stated that they did not use these masks. Similarly, in the study by Okgün Alcan et al.[16], it was reported that only 4.2% of nurses used filtration masks. In another study, the rate of nurses using high-filtration masks for protection from surgical smoke was 9.8%.[17] Both this study and the literature indicate that the rate of use of high-filtration masks for protection from surgical smoke is very low. The literature has reported some problems with the use of these masks. High-filtration masks are uncomfortable for long-term use and can cause respiratory distress.[23,24] Also, prolonged use of these masks has been reported to cause external pressure on the facial skin and superficial nerves, and to cause headaches because of cerebral hemodynamic changes resulting from carbon dioxide (CO_2) retention.[24] Also, the cost of these masks is considerably higher than surgical masks.[23] For these reasons, we believe that nurses working in Türkiye, in particular, do not prefer using high-filtration masks, and the high cost and difficulty in procuring these masks may be the reason why they are not used at all for surgical smoke prevention in Palestine.

In the present study, one of the biggest differences between the two countries regarding the use of personal protective equipment to protect against surgical smoke was the use of surgical goggles. While all nurses working in Palestine reported not using surgical goggles to protect against surgical smoke, nearly half of the nurses working in Türkiye reported using surgical goggles. The literature reports that nurses use surgical goggles to protect themselves from surgical smoke.[10,15,22] The primary reason for the difference in surgical goggles use between the two countries in this study might be the lower economic conditions in Palestine compared to Türkiye, more limited access to healthcare supplies, and differences in occupational health and safety policies within institutions.

Limitations of the Study

The present study was limited only to nurses working in the operating room unit of Atatürk University Research Hospital and Al Şifa Hospital in Palestine Gaza Strip**.**

Surgical smoke is a significant condition that negatively affects the health of operating room employees. The present study found that the vast majority of operating room nurses working in hospitals in both Türkiye and Palestine experienced at least one symptom because of surgical smoke, and that the prevalence of symptoms varied between countries. Their knowledge and opinions regarding the use of surgical smoke evacuators in their clinics were inadequate, and the personal protective equipment used for protection against surgical smoke was inadequate. For this reason, it is recommended that in-service training be provided and repeated at regular intervals to increase nurses' awareness of surgical smoke and the use of personal protective equipment. It is recommended that written protocols for protection against surgical smoke be established in hospitals. It is recommended that healthcare institutions provide surgical smoke prevention devices. It is also recommended that comprehensive studies with larger sample sizes and encompassing different countries evaluate the effects of surgical smoke on all healthcare professionals working in operating rooms and local policies to reduce the risks posed by surgical smoke must be developed based on recommendations from organizations such as the World Health Organization (WHO), the National Institute for Occupational Safety and Health (NIOSH), the Centers for Disease Control and Prevention (CDC), and the Association of Operating Room Nurses (AORN).

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Bilgilendirilmiş Onam: Katılımcılardan onam alınmıştır.
Hakem Değerlendirmesi: Dış bağımsız.
Yazar Katkıları: Fikir- AA, DG; Tasarım- AA, DG; Denetleme- AA, DG; Kaynaklar- AA, DG; Veri Toplanması ve/veya İşlemesi- AA, DG; Analiz ve/ veya Yorum- AA, DG; Literatür Taraması- AA, DG; Yazıyı Yazan- AA, DG; Eleştirel İnceleme- DG
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