

# Prevalence and Risk Factors Associated with Symptomatic Dry Eye in Nurses in Palestine During the COVID-19 Pandemic

SAGE Open Nursing  
Volume 8: 1–7  
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DOI: 10.1177/23779608221127948  
journals.sagepub.com/home/son



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## Abstract

**Introduction:** Working in closed wards at hospitals during night-time shifts and using electronic health records may raise the risk of dry eye disease in nurses.

**Objective:** The purpose of the current study was to assess the prevalence and associated factors of dry eye disease among hospital nurses in the North West Bank, Palestine.

**Methods:** A descriptive cross-sectional study. The study included 300 nurses who work at hospitals in the North West Bank, Palestine. The Ocular Surface Disease Index (OSDI) questionnaire on dry eye disease was used to estimate the prevalence of symptomatic dry eye disease.

**Results:** The percentage of dry eye disease prevalence among study participants was 62% with an OSDI score of >13 (mild to moderate and severe OSDI status). Nurses who wore contact lenses worked during the night-time, and worked in the intensive care unit were more likely to report significantly higher OSDI scores ( $p < .05$ ). Moreover, gender, smoking, and computer use were not statistically associated with dry eye disease ( $p > .05$ ).

**Conclusion:** Symptomatic dry eye disease is one of the most common ocular diseases among hospital nurses in Palestine.

## Keywords

dry eye disease, ocular surface disease index, prevalence, risk factors

Received 19 January 2022; Revised 29 August 2022; accepted 30 August 2022

## Introduction

Dry eye disease (DED) is “a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film and accompanied by ocular symptoms in which tear film instability and hyper-osmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles” (Craig et al., 2017; Tsubota et al., 2020). Predominant etiologies of DED are aqueous deficient dry eye and evaporative dry eye or a combination of the two with or without other etiological factors for DED (Craig et al., 2017).

DED can cause a variety of ocular symptoms such as pain, foreign body sensation, redness, sensitivity to light, and reflex watering as a result of corneal irritation (Javadi & Feizi, 2011). DED affects not only ocular health but also general health and well-being, quality of life, and, to a slightly lesser degree, socioeconomic burden, and is thus becoming a serious health concern worldwide, with global prevalence ranging from 20% to 50% (Stapleton et al., 2017).

The prevalence of DED was 10% in the United Arab Emirates (Aljarousha et al., 2021) and 68% in Palestine (Shanti et al., 2020). In a study conducted in China, the prevalence of dry eye symptoms (DES) among doctors and nurses was 35.84% (Long et al., 2020). Epidemiologic studies have shown that several related factors, such as age and sex, are strongly connected with the development of DED and that the condition is more prevalent in women (mostly postmenopause) and the elderly (Malet et al., 2014; Stapleton et al., 2017).

At the same time, various risk factors such as current alcohol intake, prolonged visual display terminal (VDT) usage such as computer and smartphone usage, contact lens

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wear, low humidity, and environmental pollution all contribute significantly to the increased prevalence of DES (Long et al., 2020). Sleep disruption causes increased and reduced tear production, which can all lead to the development of ocular surface disorders. As a result, sleep disruption can precipitate signs and symptoms in people with eye surface diseases (Kawashima et al., 2016). Sleep disturbance is associated with changes in the autonomic and endocrine systems, such as increased blood pressure, decreased parasympathetic tone, and increased excretion of stress hormones such as norepinephrine and cortisol (Leproult et al., 1997). Because tear production is controlled by neural and hormonal signals, a loss of sleep can have an influence on tear quantity and quality. Also, night-shift disrupts circadian rhythms, causing physiological and behavioral alterations such as changes in vital signs (blood pressure and temperature), and can lead to a variety of diseases and disrupt lifestyle routines (Åkerstedt, 1990). The circadian rhythms among night-time employees are disrupted regardless of their waking hours at night since they are exposed to light signals at work (Makateb & Torabifard, 2017). Hospital personnel are exposed to work that requires a high level of concentration and a considerable amount of VDT work in a generally dry atmosphere in wards or operating rooms. These factors may increase the risk of developing DEDs (Hyon et al., 2019).

In Palestinian governmental hospitals, the night-shift work hours are 10 h from 9 p.m. to 7 a.m., so the nurse will be awake for 10 h. On the other hand, when electronic health records became computerized, nurses began to spend more time on computers. Additionally, extended use of mobile phones, working in close wards at hospitals such as intensive care units, night-time working hours, and the use of electronic health records by nurses may increase the risk of DED. However, to the best of our knowledge, there has been no report on DED among nurses in Palestine. Therefore, the purpose of this study was to evaluate the prevalence and associated factors of DED among nurses in the North West Bank.

## Method

### Design

A cross-sectional study was conducted on nurses who worked in the hospitals in the North West Bank districts (Jenin, Tubas, Talkarm, Qalqeliah, Nablus, and Salfet). The study was conducted from March to October 2021.

### Research Questions

1. What is the level of dry eye among nurses?
2. Are there differences between Ocular Surface Disease Index (OSDI) mean scores and demographic characteristics?

### Sample

According to the nursing department in the Palestinian Ministry of Health, the total number of nurses who work in governmental hospitals in the north region is approximately 900 nurses. The sample size was calculated using Raosoft program with a confidence level of 95%, a margin of error of 5%, and a response rate of 50%. A total sample of 270 participants was needed to conduct this study. An additional 30 participants were added to overcome participants' who had incomplete questionnaires and dropped out. So the final sample was 300 participants.

### Study Instrument

A self-administered instrument composed of two parts

1. Demographic data and work conditions: developed by the researcher and it includes age, gender, education level, experience, working department, work shift, computer use, contact lenses use, and smoking.
2. OSDI questionnaire: The OSDI is a valid and reliable instrument for measuring DED (Schiffman et al., 2000). The OSDI is assessed on a scale of 0 to 100, with higher scores representing greater DED. Scores  $\geq 13$  indicate symptomatic dry eye, in which 13 to 22, 23 to 32, and 33 to 100 indicate mild, moderate, and severe presence of DES, respectively (Miller et al., 2010). The OSDI is graded on a scale of 0 to 4, where 0 indicates none of the time; 1, some of the time; 2, half of the time; 3, most of the time; and 4, all of the time. To calculate the OSDI score, total points were multiplied by 25 and then divided by the total number of responses (Dougherty et al., 2011).

The OSDI questionnaire is a reliable method that can be used to examine DES (Javadi & Feizi, 2011).

### Data Collection

After obtaining permission to conduct the study from Arab American University and the Palestinian Ministry of Health, the researcher visited the hospitals and met the head of nurses and department head nurses. He explained to them the objectives of the study and asked them to prepare a list of names of nurses and the scheduled duty to meet them. Then, the researcher explained the objectives of the study to the nurses. The nurse who agreed to participate assigned the informed consent and then completed the questionnaire. The participants completed the paper-format questionnaires in the English version. The study was conducted in the middle of the COVID-19 pandemic. The participants used masks for their control when they completed the questionnaires.

### Ethical Consideration

Ethical approval was obtained from Arab American University and the Palestinian Ministry of Health. A consent form was

provided for every participant prior to the study. Voluntary participation was explained. No names were mentioned or any personal information about the participant. All data was kept confidential and was used for study purposes only. There was no harm consequences due to participation refusal, such as care quality or privileges. A clear explanation was given to each participant about the study objectives and tool, and enough time was given for questions.

## Results

### Sample Characteristics

A total of 300 participants completed the study. The findings revealed that the mean age of nurses was  $34.6 \pm SD = 8.3$  years (range 23–55 years) and 174 (58.0%) were males. Also, the majority of participants 230 (76.7%) had a bachelor's degree, and 109 (63.7%) of them were smokers, as seen in Table 1.

Also, the findings revealed that 98 (32.7%) have more than 15 years of experience and 144 (48.0%) reported that they are working in medical and surgical wards. More than half of the participants 158 (52.7%) reported that they were using a computer for more than 4 h daily, and 178 (59.3%) were working rotation shifts. According to the analysis, 48 (16.0%) of the participants wear contact lenses, as shown in Table 2.

### Research Question Results

The analysis revealed that 186 (62.0%) of the nurses had DED. The level of severity of DED indicated that 51 (17.0%) were mild; 44 (14.7%) were moderate, and 91 (30.3%) were severe, as seen in Table 3.

**Table 1.** Demographic Characteristics of the Participants (N = 300).

Characteristics	M (SD)	n (%)
Age	34.6 (8.3) Range: 23–55 years	
	Less than 35 years old	166 (55.3)
	More than 35 years old	134 (44.7)
Gender	Male	174 (58.0)
	Female	126 (42.0)
Educational level	Diploma	34 (11.3)
	Bachelor	230 (76.7)
	Master and above	36 (12.0)
Smoking	Yes	109 (36.3)
	No	191 (63.7)

M = mean; SD = standard deviation.

The results of the analysis of variance (ANOVA) indicated that nurses' age, educational level, and contact lenses had statistically significant differences in their scores of DED ( $p < .05$ ), as seen in Table 4. The results of ANOVA indicated that the nurse's experience, work department, and working-time shift had statistically significant differences in scores of DED ( $p < .05$ ), as seen in Table 4.

## Discussion

The prevalence of dry eyes reported by our study (62%) was similar to that found in the population of the Eastern Province of Saudi Arabia (65.4%; Alkabbani et al., 2021) and the Jordanian population (59%; Bakkar et al., 2016). Similarly, previous studies conducted on health professionals showed that the prevalence of DED among residents of surgical specialties and paramedical workers was 56% and 42.7%, respectively (Castellanos-González et al., 2016; Hyon et al., 2019). A study that was conducted on general population in Palestine showed that the prevalence of DED was high (68%; Shanti et al., 2020).

However, this result is high compared with other countries. Long et al. (2020) reported that the prevalence of DED among nurses in China was 35.84%. The high prevalence might be attributed to several factors mainly related to the number of hours of working at night shift, and hospitals status (air condition, temperature, and humidity). The various DED diagnostic methods that may depend on questionnaires or objective clinical tests, and selection of the study population made comparisons among population-based studies estimating DED prevalence more complex.

Also, the association between age and DED was also observed in this study. Aging is a significant risk factor for

**Table 2.** Work-Related Characteristics of the Participants (N = 300).

Characteristics	n (%)	
	Less than 5 years	88 (29.3)
	5–10 years	82 (27.3)
	11–15 years	32 (10.7)
	More than 15 years	98 (32.7)
Work department	Emergency room	42 (14.0)
	Intensive care unit	61 (20.3)
	Operation room	32 (10.7)
	Medical and surgical wards	144 (48.0)
	Maternity	21 (7.0)
Computer use/daily	Less than 2 h	19 (6.3)
	2–4 h	123 (41.0)
	More than 4 h	158 (52.7)
Working shift	Straight morning	81 (27.0)
	Evening & night	41 (13.7)
	Rotation	178 (59.3)
Contact lenses	Yes	48 (16.0)
	No	252 (84.0)

dry eye. Large epidemiological studies from the Women's Health Study and Physician's Health noted that DED prevalence increases in women and men every five years after the age of 50 (Paulsen et al., 2014; Schein et al., 1997). Therefore, a better understanding specifically of age-related DED and therapies tailored to this specific population are much needed. Aging is often accompanied by comorbidities such as cardiovascular diseases, type 2 diabetes, depression, glaucoma, and other ocular diseases. Some of these comorbidities themselves or the medications that are used to manage them may have a deleterious secondary effect on the ocular surface. An example is diabetes mellitus which affects retina, lacrimal gland, and corneal nerves and is frequently associated with DED (Achtsidis et al., 2014).

**Table 3.** Severity Level of Dry Symptoms Among the Participants ( $N = 300$ ).

Severity level	$n$ (%)
Normal	114 (38.0)
Mild	51 (17.0)
Moderate	44 (14.7)
Severe	91 (30.3)

These results are concordant with many previous studies. Castellanos-González et al. (2016) indicated that surgical residents with DED had a significant association with age. Also, Tuladhar et al. (2019) showed that DED was significantly associated with age among medical students. Similarly, a study conducted by Shanti et al. (2020) in Palestine showed that DED is more prevalent in subjects older than 45 years.

According to gender and DED among nurses, the results of the current study showed no association between gender and DED. These results were supported by Sherry et al. (2020). However, Shanti et al. (2020) reported an association between DED diagnoses and the female gender where females had a 1.5 times higher risk of developing DED compared to males. Also, Tuladhar et al. (2019) indicated that DED prevalence is more common among male students than female students. While Castellanos-González et al. (2016) reported a higher prevalence of DED in the female group. Further, Hyon et al. (2019) showed that female sex was associated with DED. These findings may be explained by the consumption of contraception hormones or infertility in the middle-aged female group and the effect of these hormones on the female's lacrimal gland, goblet cell function, meibomian glands, and ocular surface sensitivity which

**Table 4.** The Differences Between Mean of Dry Eye Symptoms and Demographic Nursing and Nurses Work-Related Characteristics ( $N = 186$ ).

Variable		$N$	$M$ (SD)	$F$	$P$ -value
Age	Less than 35 years	64	25.50 (10.80)	39.14	.001*
	More than 35 years	122	44.21 (22.59)		
Gender	Male	102	36.22 (19.31)	1.212	.272
	Female	84	39.67 (23.44)		
Educational level	Diploma	27	50.96 (24.53)	6.528	.002*
	Bachelor	128	35.90 (20.76)		
	Master and above	31	34.03 (16.20)		
Smoking	Yes	74	38.31 (22.78)	.078	.781
	No	112	37.42 (20.34)		
Contact lenses	Yes	35	44.91 (25.19)	5.0	.027*
	No	151	36.12 (20.01)		
Experience	Less than 5 years	21	22.10 (10.97)	26.1	.001*
	5–10 years	46	28.24 (11.08)		
	11–15 years	23	24.70 (13.56)		
	More than 15 years	96	48.91 (22.16)		
Department	Emergency room	22	46.23 (27.70)	3.7	.006*
	Intensive care unit	46	30.83 (16.94)		
	Operation room	13	29.80 (19.40)		
	Medical and surgical wards	94	38.90 (19.91)		
	Maternity	11	49.73 (26.59)		
Working shift	Straight morning	75	51.01 (22.29)	35.6	.001*
	Evening & night	30	34.80 (16.99)		
	Rotation	81	26.62 (13.78)		
Computer use	Less than 2 h	4	36.75 (27.81)	.391	.677
	2–4 h	57	35.74 (22.49)		
	More than 4 h	125	38.74 (20.63)		

Note:  $M$  = mean;  $SD$  = standard deviation;  $F$  = one-way analysis of variance (ANOVA), \* $p < .05$ .

may contribute to DED (Vehof et al., 2014). In the older-aged female group, lower levels of estrogens and androgen may cause inadequate lacrimal gland secretion that is associated with aqueous deficient DED (Sharma & Hindman, 2014).

Smoking predisposes people to dry eyes by decreasing the tear film breakup time (Thomas et al., 2012). However, no association between smoking and dry eyes was found in this study. This result is supported by Shanti et al. (2020), who found no association between smoking habits and DED. Also, it was supported by Castellanos-González et al. (2016), who found no association between DED and smoking among residents. However, Sherry et al. (2020) reported an association between DED and smoking. This discrepancy can be explained by the study sample in the current study, which is limited to healthcare professionals who are less likely to smoke because of their health education. Our participants spent most of their time indoors and therefore had a low exposure to smoking, which might explain the absence of an association between smoking and dry eyes in the current study.

The results of the current study showed an association between contact lenses and DED. These results were supported by a large epidemiologic study including office workers in Japan which revealed that contact lens wearers showed a 2.38 times higher risk of having a diagnosis of DED than noncontact lens wearers (Uchino et al., 2008). Also, Alkabbani et al. (2021) found an association between contact lens usage and the OSDI score among the Arab population in Dubai. However, the results of the study contradicted Alshamrani et al. (2017) who did not find an association between contact lenses and DED among the Saudi Arabian population. Also, another study indicated no correlation between daily lens wear duration and DED (Lubis & Gultom, 2018).

Surprisingly, the study also found an association between the working department and DED. This result was supported by Castellanos-González et al. (2016) who found a 56% higher prevalence of DED among surgical residents and suggested that working inside the operating room, in which the ventilation environment is closed and precise procedures with great concentration are performed, might increase the risk of DED. Also, Hyon et al. (2019) indicated that hospital workers might have an increased risk of DED.

The environmental characteristics of hospitals, such as low indoor humidity, reduced indoor airflow, and exposure to volatile organics, might make individuals more prone to developing DED (López-Miguel et al., 2014; Lu et al., 2018).

The long-term effects of night-time working may be more highlighted after several years and might show more effects later in life because DED is an inflammatory process that over time damages the lacrimal glands and, in the long run, changes the quality and quantity of tear film and results in ocular surface disease (Makateb & Torabifard, 2017).

The results of the current study revealed an association between shift work and DED. This result was supported by

Makateb and Torabifard (2017), who reported that all DEDs were aggravated significantly after the night shift. Conjunctival redness increased after the night shift. Also, the results were supported by Ahn et al. (2021), who concluded that there was an association between shift work and DED in a group of younger subjects. The use of computers decreases the number of eye blinks, leading to incomplete blinking, evaporation of tears, and subsequently DED (Portello et al., 2013).

The results of the current study revealed that there was no association between computer use and DED. This result is inconsistent with Akkaya et al. (2018), who found that long-term computer usage may cause an evaporative-type DED. Also, Hyon et al. (2019) indicated that long-term computer use was possibly associated with an increased risk of DED. In addition, Bayhan et al. (2014) reported that OSDI scores were significantly higher in the group using computers for a long time. Gajta et al. (2015) concluded that VDT use for more than 8 h daily has been identified as a significant risk factor for dry eyes. All people who spend a significant amount of time on computers are advised to use artificial tears to reduce the symptoms of dry eye syndrome and avoid serious complications.

### *Strengths and Limitations*

It seems to be the first study in Palestine to evaluate the prevalence and associated factors of DED among nurses in the North West Bank. One limitation of the study was the self-reported questionnaire. The study was also based on respondent recall of events from the past week, which predisposes the results to recall bias. The study did not specify wearing masks (Aksoy & Simsek, 2021) and time of use since various studies have shown a relationship between the use of masks and the development of DED (Baris et al., 2021; Nair et al., 2022).

### *Implications for Practice*

Recommendations include improving the infrastructure of hospital environments and rotating the nurse between closed and open departments. Further research is required to better understand other potential risk factors associated with DED, including the impact of drug use, systemic diseases, and anxiety.

### **Conclusion**

The study confirmed that DED is highly prevalent among nurses in the North West Bank hospitals (62%). The study confirmed that there is an association between DED and both demographic characteristics of the nurses and work conditions such as age, smoking, contact lenses, work department, and work-time shift, while there is no association with gender.

## Acknowledgments

The authors would like to express their thanks to the nurses who participated in the study


## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article

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