

## Effect of Eye Care Clinical Guidelines Training on Critical Care Nurses' Competency and Eye Complications among Critically Ill Patients

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### Abstract

**Background:** Nursing care of eyes is considered a basic nursing intervention in critically ill patients. However, it is sometimes neglected due to the focus on supporting vital body functions. These patients are at great risk of eye disorders as a result of their medical conditions and treatment that can alter the eye protective mechanisms, such as the use of ventilatory support and sedation. Preventing eye problems requires improving the critical care nurses' competency through continuous pre-service education, hands-on experience, and in-service training. **Aim:** Assess the effect of eye care clinical guidelines training on critical care nurses' competency and eye complications among critically ill patients. **Methods:** Interventional research using a pre-post design was used to assess and compare nurses' scores before and after the ECCGs training. A Convenient sample of all nurses (75) who worked in the critical care unit in the Main University Hospital at Alexandria University and agreed to participate in the study was enrolled in the study. In addition, a purposive sample of 100 adult patients who had eligible criteria was included in the study. The data of the current study were collected by using three tools namely "eye care clinical competency questionnaire", "Patient's eye assessment record", and "Superficial ocular surface disorders assessment scales package". **Results:** A total of 75 nurses and 100 critically ill patients participated in the current study. The percent scores of post-implementation nurses' eye care knowledge and practice were significantly higher than their pre-implementation scores ( $p \leq 0.001$ ) respectively. However, there was no significant difference between the nurses' attitude scores ( $p = 0.147$ ). Additionally, the percent scores of eye complications were 84% in patients who received care from nurses before attending the in-service training compared to 46% of eye complications among the patients who received care from nurses after attending the in-service training with a high significant difference between both studied groups ( $p < 0.001$ ). **Conclusion:** Implementing ECCGs significantly improved eye care nurses' knowledge, and practice, which contributed to reducing the occurrence of eye complications among critically ill patients.

**Keywords:** Eye Care, Clinical Guidelines, Nurses' Competency, Patients, Eye complications

### Introduction

Critically ill patients almost have life-threatening alterations in one or more vital organs or functions. The medical team is primarily focused on the maintenance of basic vital functions, the resuscitation of life-threatening disorders, and the stabilization of the overall patient's condition. The nurses sometimes overlook the less urgent problems, such as eye complications, in particular ocular surface diseases (OSDs). Eye complications (ECs) are frequent in patients with critical illness, and they usually develop after 48 hours to one week of the patient's admission to the CCU. ECs are found in 20–42% and even up to 60% of patients (El-feky, 2020; Plaszewska-żywko et al., 2021; Selvan et al., 2020; Silva Carneiro e Silva et al., 2021).

Medical conditions and treatment of critically ill patients are among the risk factors that can compromise the natural eye protective mechanisms. Immunocompromising, disturbed level of consciousness, use of positive pressure ventilation (Mechanical Ventilation) that elevates the venous pressure and decreases the flow of the venous blood drained from the eye tissue provoking eye edema, respiratory system infections with excessive secretions and multiple suction and treatment with neuromuscular blockers and sedation are among the common risk factors of eye complications (Ahmadinejad et al., 2020; Ali et al., 2023; Hearne et al., 2018; Mahdi Shaeri et al., 2021; Silva Carneiro e Silva et al., 2021; Zakieh Momeni Mehrjardi Samaneh et al., 2021).

The provision of standardized or protocolized eye care aims to prevent ocular complications. Assessment of eyelid closure must be done at the onset of the patient's admission, immediately after stabilization of the vital body functions, and then regularly throughout the patient's stay in the CCU. There is a strong correlation between incomplete eye closure (lagophthalmos) and the development of eye complications, which can then lead to dry eye and corneal ulceration (Abd-Elftah et al., 2023; Lami & Ayed, 2023; Puspasari, 2019). Nurses' competency is a vital requirement to prevent eye complications among the critically ill population. Previous studies have shown that critical care nurses have limited knowledge and competency in eye care, and they reported that insufficient knowledge, attitudes, and skills can be considered barriers to providing eye care. Therefore, nurses must have a great deal of experience and a great deal of expertise in the careful assessment and correct diagnosis of eye problems in patients (Alghamdi et al., 2018; Elkasby et al., 2021; Jaafar et al., 2020; Kousha et al., 2018; Liem, 2019; Sayed, 2022; Selvan et al., 2020; Silva Carneiro e Silva et al., 2021). However, other novel studies have concluded that the implementation of standardized eye care protocols significantly reduced the incidence of eye complications among critically ill patients (Abd-Elftah et al., 2023; Ali et al., 2023; Elkasby et al., 2021; Hearne et al., 2018; Mobarez et al., 2022; Mohamed Tork et al., 2022; Sama et al., 2023).

### Significance of the Study

Life-sustaining measures are, for sure, a top priority to save the patients' lives and prevent life-threatening complications. Unfortunately, eye care is considered by most of the nurses as a relatively minor consideration and so it may be neglected or dismissed. Neglect of the provision of proper eye assessment and care may lead to vision loss. Most of the studies revealed that eye complications (ECs) occur in 42 to 60 percent of unconscious, sedated, or paralyzed patients. Nurses must be aware and have considerable competencies in recognizing that patients have risks of eye problems and adopt standardized

evidence-based eye care protocols or guidelines to provide high-quality eye care.

### Aims:

The aim of the current study was to:

Assess the effect of Eye Care Clinical Guidelines Training on Critical Care Nurses' Competency and Eye Complications among Critically Ill Patients. this aim was achieved by the following objectives:

1. Determine the effect of implementing eye care clinical guidelines (ECCGs) in-service training on the levels of the nurses' eye care-related knowledge, skills, and attitude.
2. Evaluate the clinical outcomes of nurses' attendance of the clinical training guidelines on the prevention or even reduction of the occurrence of eye complications among critically ill adults.

### Study Hypotheses:

- H1:** After attending the eye care clinical guidelines training, nurses exhibit a higher level of eye care-related knowledge than before.
- H2:** After attending the eye care clinical guidelines training, nurses exhibit a higher level of eye care practices than before.
- H3:** After attending the eye care clinical guidelines training, nurses exhibit a higher level of positive eye care-related attitudes than before.
- H4:** Patients who receive eye care by nurses after attending the ECCGs exhibit a lower incidence of eye complications.

### Operational Definition of Competency

Nurse competence refers to the knowledge, skills, and abilities that nurses possess to provide safe and effective eye care to critically ill patients.

### Methods

**Design:** In this design, variables of interest are measured before and after an intervention in the same participants. This design was employed to compare nurses' competency (knowledge, attitudes, and practice) scores before and after attending the eye care clinical guidelines and to evaluate the occurrence of eye complications among critically ill patients.

**Setting:** A current study was conducted in the critical care unit, namely Unit III in the Main University Hospital at Alexandria University. This unit consists of two halls with 24 beds and receives critically ill patients who require general intensive assessment and care.

**Participants and sampling:** 2 samples were recruited to conduct the study:

1. A Convenient sample of all nurses (n=75) who worked in the selected setting, and provided direct patient care were included in the study. Exclusion criteria: A nurse was excluded from the study in the following conditions: absent more than one time from the educational sessions and/or did not complete the eye care clinical competency questionnaire.
2. A purposive sample of 100 adult critically ill patients ( $\geq 18$  years) who were free from ocular surface disorders (dry eye, eye edema, conjunctival injection, and eye discharge) on the first day of the study, had incomplete eyelid closure (grade 1 or 2) and had no significant eye trauma was included in the study. Patients were divided into two equal groups. The first 50 patients received care from nurses before they attended in-service ECGs while the second 50 received care from the nurses after they attended in-service ECGs. The sample was calculated Epi-Info program according to the following parameters: a confidence coefficient of 95%, the expected frequency of 50%, a margin of error of 5%, a total population of 130 patients receiving mechanical ventilation (3months intervals), a minimum sample size of 97 patients, and the final sample size was 100 patients.

**Measurements:** Two tools were used to collect the data of the current study:

#### **Tool one: Eye Care Clinical Competency (ECCC) Questionnaire**

This tool consists of 2 parts:

**Part I:** This part was developed by the researcher to collect the demographic and clinical data of the nurses such as age, sex, work experience in the critical care unit, level of education, availability of the eye

care protocol in the unit, and attending the specialized eye care course.

**Part II:** this part was adapted from Ebadi et al., (2017) after reviewing related literature (Agency for Clinical Innovation, 2021; Ebadi et al., 2021; Practice et al., 2019; Sama et al., 2023; Sevgi et al., 2024). It aimed to assess the nurse's competency in providing standard eye care to hospitalized critically ill patients. It consisted of 38 items distributed along with three domains: knowledge, attitude, and practice. *The knowledge domain* consists of 18 five-point items about anatomy, physiology, contributing factors of eye disorders, eye complications, treatment, and nursing care practices. Each with one correct answer. The possible score range is 0–18. A good level of knowledge was considered if the nurses answered  $\geq 75\%$  correctly. The average level of knowledge was considered if the nurses' score of 60 - <75%, and a score of < 60% was interpreted as poor nurses' knowledge. *The attitude domain* consists of 7 items that are scored using a 5-point Likert scale ranging from Very High, High, Moderate, Low, and Very Low. -The possible score range is 0–28. Scores  $\geq 60\%$  indicate a positive attitude, while <60% indicate a negative attitude. *The practice domain* was assessed by an observational checklist consisting of 13 items (5 items for assessment and 8 items for interventions). Each nurse was observed while he/she was performing the eye care procedure. Three-point Likert scale was used to assess the level of nurses' performance: (0) = not done or done incorrectly = (1) = done, correct but incomplete, and (2) = done correct and complete. The minimal score was 0 and the maximal score was 26. A higher score means a higher level of performance. The degree of the nurses' performance was divided into two levels: competent if the sum of total practice scores was  $\geq 80\%$  and incompetent if it was < 80%. This section was tested for its content and face validity by 5 experts in the field of critical care nursing (clinical and academic) and ophthalmology, and it was pre-tested for reliability by Cronbach's alpha ( $\alpha=0.86$ ). Accordingly, the recommended amendments have been made. A higher score means a higher level of

performance. The degree of the nurses' practices was divided into two levels: competent if the sum of total practice scores was  $\geq 80\%$  and incompetent if it was  $< 80\%$ . The Cronbach's alpha for the attitude and the practice domains, as well as the Kuder-Richardson 20 for the knowledge domain, showed satisfactory internal consistency. The Cronbach's alpha for the whole questionnaire also was 0.83.

### **Tool two: Patient's Eye Assessment Record**

This tool consists of three parts.

**Part I:** This part was developed by the researcher to collect the sociodemographic and clinical profile of the patient including age, sex, Glasgow Coma Scale (GCS), Diagnosis, Positive End Expiratory Pressure (PEEP), Richmond Agitation-Sedation Scale (RASS) Central Venous Pressure, and Acute Physiology and Chronic Health Evaluation (APACHE) II. The patients' data were collected by the researcher from the patients' files.

**Part II: Grading Eyelid Closure (Lagophthalmos Scale):** This part was used to classify the degree of lagophthalmos which ranges from 0 – 2. Grade 0 indicates that the lids are completely closed. Grade 1 reflects any conjunctival exposure but no corneal exposure. Grade 2 involves any corneal exposure, even a very tiny amount. The Kappa score indicated significant reliability of the Lagophthalmos Scale (0.88).

### **Tool Three: “Superficial Ocular Surface Disorders Assessment Scales Package”**

This tool consists of three scales that assess the occurrence of eye complications:

#### **Scale I: Surgeon Periorbital Rating of Edema (SPRE)**

This scale was developed and validated by a group of surgeons to assess the levels of eye edema (Oliver et al., 2018). The scale consists of four grades to assess the severity of periorbital edema. Grade (1) indicates no coverage of the iris with eyelids. Grade (2) reveals slight coverage of the iris with swollen eyelids. Grade (3) and grade (4) interpret full coverage of the iris with swollen eyelids and full closure of the eye respectively.

#### **Scale II: Eye Dryness Schirmer**

Eye dryness The Schirmer scale is a scale for determining the degree of eye dryness based on the result of the Schirmer test which is a strip that is put in the patient's eye and then becomes wet. The centimeters of wetting of the strip determines the severity of eye dryness. The scale includes three categories. The least one ranges from 0 to 5 which assumes severe dry eye. The second category ranges from 5 – 10 of wetting of the strip which indicates moderate dryness of the eye. The highest one ranges from 10 to 15 mm, reflecting mild eye dryness. The Kappa score indicated significant reliability (0.80) for the eye dryness Schirmer scale.

#### **Scale III: Conjunctival Injection**

The conjunctival injection assessment scale consists of four grades ranging from 0 - 3 that classify the grade of the conjunctival injection. Grade 0 refers to the fact that there is no redness of the eye and grade 1 indicates some redness. whether grade 2 means extensive redness of the eye and grade 3 reflects overall conjunctival redness. The Kappa score indicated significant reliability (0.89) for the Conjunctival Injection scale.

### **Ethical Considerations**

This study has been approved by the Ethical Research Committee at the Faculty of Nursing (IRB 00013620). Informed consent was obtained from the nurses. Voluntary participation and withdrawal from the study at any time without any rationale, or penalty were assured. The participants' anonymity and confidentiality of the information were assured. No patient harm was expected, and the patient's beneficence was assured.

### **Data Collection**

#### **Phase I: Pre-Implementation of Eye Care Guidelines Training Sessions**

- Before data collection, the domains of knowledge and attitudes were translated into Arabic to suit the nurses' mother tongue. Two bilingual experts in English and their mother tongue Arabic translated the English version into Arabic. The two versions were submitted to the third bilingual expert to compare them for concept similarity and equivalence (Khalaila, 2013).

- A meeting between the researcher and the administrative authorities (medical and nursing) of the selected setting was conducted to reach an agreement about the application of the study.
  - Nurses were distributed to three groups (25 per each). One nurse from each group was nominated as a team leader to facilitate communication with the team. Each team leader was contacted to determine a suitable off-the-duty time to attend a meeting with the researcher. The hospital's conference hall was booked and prepared with catering services by the researcher to conduct the first interview with the groups. The first interview aimed to explain the aims and the plan of the study, sign the informed consent, and complete tool one (sociodemographic and clinical data, knowledge, and attitude domains). This interview lasted 60 – 90 minutes.
  - To assess the nurse's eye care clinical practice, and to assess the occurrence of eye complications, the following two actions were done:
    - o 50 eligible patients were recruited on the first day of their admission to the unit. These patients were assessed daily for seven consecutive days by the researcher during the morning shift (eye care was done once in the morning shift with the patient's bath).
    - o Each nurse's eye performance was blindly observed by the researcher (the presence of the researcher in the unit was natural because the researcher supervised the clinical training of the undergraduate nursing students).
  - In this phase, data were collected from March to July (4 months).
- educational sessions (off duty time), education content package, and catering service.
  - The validity of the educational content was approved by a panel of nursing educators and ophthalmologists. Suggested modifications were followed accordingly.
  - The ophthalmologist and infection control specialists were invited to participate in the educational sessions.
  - The in-service training was held for three weeks. Each nurse attended three days (two sessions/day) of in-service training (6 sessions: 2 theoretical sessions and 4 hands-on eye assessment and care sessions) per week. The hands-on eye assessment and care were demonstrated by the researcher on a real patient in front of each nurse individually. Each nurse was allowed to demonstrate once in front of the researcher.
  - Each theoretical lecture duration lasted from 45 to 60 minutes, and each practical session ranged from 10 to 15 minutes.
  - The researcher started each theoretical and training session with a summary of what was presented in the previous session and the objectives of the new session.
  - Teaching methods that were used include lectures using PowerPoint presentations, flip charts, demonstration, and re-demonstration. Additionally, the use of teaching aids such as videos.
  - After finishing the three weeks of training sessions, one week later, all nurses were invited to attend the closing session and asked to complete the same ECCGs questionnaire.
  - The nurses' eye care practices using the same checklist were blindly assessed by the researcher (post-ECCG, eye care was performed 3 times per day compared to one time pre-ECCG).
  - For seven consecutive days, an assessment of each patient was carried out by the researcher (sometimes in the presence of the ophthalmologist) using a portable slit lamp to evaluate the occurrence of ocular surface disorders (dry eye, periorbital edema, conjunctival injection, and eye discharges) using tool three. This action was done to assess

### **Phase II: Eye Care Guidelines Training Sessions**

- Before the second phase of the study, all necessary arrangements had been made to provide educational classes such as a booking of the conference room, nurses' schedules were received from the head nurse to know the most convenient time for the nurses to attend the

and or evaluate the effect of eye care provided by nurses.

- In this phase, data were collected from August to October (2 months).

### Data Analysis

Using the SPSS Version 21, the study data were coded, tabulated, and analyzed. Data analysis was performed using SPSS 16. Descriptive statistics used included absolute and relative frequency and mean (M) and standard deviation (SD). The inferential statistics used included an independent t-test, paired t-test, and chi-square with a 95% confidence interval. In addition, A p-value of < 0.05 was considered a statistically significant difference, a highly statistically significant difference was considered at a p-value  $\leq 0.001$ , and no statistically significant difference was considered at a p-value > 0.05.

### Results

**Table 1** shows the demographic and clinical data of nurses who participated in the study. It can be noted that the mean age of the studied nurses was  $29.95 \pm 4.93$  years and about two-thirds (70.7%) of them were females. Regarding years of experience, nurses who had experience of more than 6 months and less than 5 years were represented equally with nurses who had more than 10 years (29.3%). While the percentage of nurses who had years of experience between 6 and 10 years was 41.4%. About academic qualifications (60%) of them had a diploma degree (40%) had a bachelor's degree. Additionally, more than half of the sample (73.3%) reported no eye protocol is available at the unit, however, (26.7%) was not known. Moreover, more than three-quarters of the nurses (84%) had no attendance history of any previous eye care-related in-service education.

**Table 2** reveals a comparison of the nurses' Knowledge, attitudes, and practice percent scores before and after attending ECCGs. It was observed that about two-thirds (65.3%) of nurses had poor knowledge before the implementation of ECCGs compared to (5.4%) after the implementation of ECCGs. The difference between pre and post-ECCG nurses' knowledge was statistically significant ( $P < 0.05$ ). Regarding the percent score of the nurses'

attitudes before and after attending ECCG, it was noted that the majority of the sample had positive attitudes toward eye care (88%) before the implementation of ECCG compared to (94.7%) after the implementation of ECCGs. The difference between pre and post-ECCG nurses' attitudes was not statistically significant ( $P > 0.05$ ). Additionally, the vast majority of the nurses had competent eye care performance post-implementation of ECCGs (84.0%) compared to (18.7%) pre-implementation of ECCG. The difference between the pre and post-ECCG was highly statistically significant at ( $P < 0.001$ ).

**Table 3** displays the demographic and clinical data of the patients who participated in the study. Regarding the demographic data of the two studied groups (pre-ECCGs and post-ECCGs), no statistically significant differences were discovered. About the clinical data, it was seen that the majority of patients in the pre and post-groups were attached to mechanical ventilation (80% and 78% respectively) with synchronized Intermittent Mandatory Ventilation (SIMV) mode and 62% of the patients in the pre-group compared with 48% for the post group were on sedation without neuromuscular blockers. Regarding APACHI II, the mean score was higher in the post-group ( $28.54 \pm 4.95$ ) than the pre-group ( $27.22 \pm 4.85$ ) with no statistically significant difference between the two studied groups. Regarding GCS, the mean score was  $4.61 \pm 1.35$  in the pre-group compared with  $4.35 \pm 1.22$  in the post-group. Concerning RASS, the mean score was  $-4.53 \pm 0.40$  in the pre-group, compared with  $-4.63 \pm 0.38$  in the post-group.

**Table 4** illustrates the percent distribution of the pre and post-groups according to the degree of lagophthalmos. Among the Pre ECCG patients, slightly higher than two-thirds (42%) of them had grade (1) compared to nearly one-third (58%) had grade (2). Additionally, in the post-ECCG patients, nearly one-third (30%) had grade (1) compared to two-thirds (70%) had grade (2) with no significant difference between both groups ( $P = 0.221$ ).

**Table 5** shows a comparison of the percentage scores of eye complications among the two studied groups throughout the study. It

can be noted that the highest percentage of EC was for eye discharge (80% of patients in the control group and 42% of patients in the study group). While the lowest percentage was for conjunctival injection (58% of patients in the control group and 36% of patients in the study group). Additionally, the incidence of all eye

complications was 84% of patients in the control group and 46% of the patients in the study group with a high significant difference ( $p < 0.001$ ) between both studied groups.

**Table (1):** Demographic and clinical data of nurses who participated in the study

Variable	(n= 75)	
	Frequency	Percent
Age		
≥ 18 – 25	34	45.3
26 – 35	25	33.3
36 ≥ 45	16	21.4
M ± SD	29.95±4.93	
Sex		
Female	53	70.7
Male	22	29.3
Years of Experience		
> 6 months - ≤ 5 years	22	29.3
6 years – 10 years	31	41.4
> 10 years	22	29.3
Level of Education		
Diploma	45	60
Bachelor	30	40
Is there an eye care protocol in the unit?		
Yes	0	0
No	55	73.3
I do not know	20	26.7
Did you attend any eye care educational activity?		
Yes	12	16
No	63	84

**Table (2):** Comparison of Percent Scores of the Nurse's Knowledge, Attitudes, and Practice Before and After the Implementation of ECCG

Level of Knowledge	Pre (75)		Post (75)		$\chi^2$	P -value	95% CI for P -value	
	No	%	No	%			LL	UL
Good (≥ 75%)	9	12	52	69.3	68.630	0.000**	0.000	0.000
Average (60% - < 75%)	17	22.7	19	25.3				
Poor (< 60%)	49	65.3	4	5.4				
Level of Attitudes	Pre (75)		Post (75)		$\chi^2$	P -value		
	No	%	No	%				
Positive ≥ 60%	66	88	71	94.7	2.1065	0.147	0.083	0.245
Poor ≤ 60%	9	12	4	5.3				
Level of Performance	Pre (75)		Post (75)		$\chi^2$	P -value		
	No	%	No	%				
Competent Practice (≥ 85)	14	18.7	63	84	49.759	0.000**	0.00	0.00
Incompetent Practice (< 85)	61	81.3	12	16				

\*\*A highly statistically significant at P value  $P < 0.001$ .

CI: Confidence interval

LL: Lower limit

UL: Upper Limit

**Table (3):** Demographic, Clinical Data of the Patients Included in the Study Pre and Post ECCG

Variables	Pre (n = 50)		Post (n = 50)		Test of sig.	p	95% CI for P -value	
	No.	%	No.	%			LL	UL
<b>Age in years</b>								
Mean ± SD	57.82±16.57		61.12±17.65		t = 0.964	0.337	0.242	0.613
<b>Sex</b>	No.	%	No.	%				
Male	29	58.0%	26	52.0%	$\chi^2 = 0.364$	0.546	0.133	0.688
Female	21	42.0%	24	48.0%				
<b>Glasgow Coma Scale (GCS)</b>								
Mean ± SD	4.61± 1.35		4.35± 1.22		t =1.026	0.307	0.122	0.645
<b>Sedation</b>	No.	%	No.	%				
Patients with sedation only	31	62.0%	24	48.0%	$\chi^2 = 1.980$	0.159	0.060	0.228
Patient with sedation and neuromuscular blockers	19	38.0%	26	52.0%				
<b>Richmond Agitation-Sedation Scale (RASS)</b>								
Mean ± SD	27.22± 4.85		28.54±4.95		t =1.346	0.181	0.282	0.655
<b>Acute Physiology and Chronic Health Evaluation (APACHE II) Score</b>								
Mean ± SD	27.22± 4.85		28.54±4.95		t =1.346	0.181	0.282	0.655
<b>Central Venous Pressure (CVP)</b>								
Mean ± SD	13.13±4.86		14.77±6.59		t =1.419	0.159	0.134	0.453
<b>Received Mechanical Ventilation (MV)</b>								
SIMV	40	80.0%	39	78.0%	$\chi^2 = 3.898$	$^{MC}P = 0.273$	0.243	0.462
AC	2	4.0%	0	0.0%				
CMV	1	2.0%	3	6.0%				
PCAC	7	14.0%	8	16.0%				
<b>Positive End Expiratory Pressure (PEEP)</b>								
Mean ± SD	5.19±0.38		5.36± 0.76		t = 1.475	0.145	0.077	0.563
<b>Peak Pressure</b>								
Mean ± SD	66.14±11.08		67.63±6.86		t = 0.807	0.422	0.176	0.859

\*A statistically significant P value P &lt;0.005

CI: Confidence interval

LL: Lower limit

UL: Upper Limit

**Table (4):** Distribution of the Control and Study Groups According to the Degree of Lagophthalmos

Degree of lagophthalmos	Pre (n = 50)		Post (n = 50)		$\chi^2$	p
	No.	%	No.	%		
- Conjunctival exposure (grade 1) on admission	21	42.0%	15	30.0%	1.563	0.221
- Corneal exposure (grade 2) on admission	29	58.0%	35	70.0%		

 $\chi^2$ : Chi-square test**Table (5):** Percent scores of eye complications among the two studied groups (pre-and post) throughout the study.

Eye complications	Pre ECCG (n=50)		After ECCG (n=50)	
	N	%	N	%
- Eye Dryness	38	76	19	38
- Periorbital Edema	30	60	19	38
- Conjunctival Injection	29	58	18	36
- Eye Discharge	40	80	21	42
- Overall Eye Complications	42	84	23	46



## Discussion

### Pre-implementation Phase of ECCG

The present study investigated the effect of ECCGs training on eye care clinical competence among critical care nurses. Findings revealed that nearly half of the study sample was aged 18 – 25 years with a mean age of  $29.95 \pm 4.93$ . Additionally, the majority of the nurses were females, with a diploma degree. Moreover, the majority of the nurses reported that there was no standardized eye care protocol to be followed in the unit, while the other nurses did not know if there was an available eye care protocol or not. Also, the majority of nurses had not attended any specialized eye care training or instructions. This result is consistent with Liem (2019) who found that 92.2% of studied nurses had no previous eye care training and all participants acknowledged that they did not have an EC protocol to follow (Liem, 2019).

As regards the percent scores of pre-implementation ECCG nurses' competency including knowledge, practice, and attitudes, the current study demonstrated that, concerning eye care-related knowledge, less than one-fifth of the nurses had good knowledge, less than one-third were average and nearly half of the nurses had poor knowledge. In addition, a vast majority of the nurses had incompetent eye care practices. Poor nurses' eye care-related knowledge and incompetent nurses' practice could be attributed to, as it was mentioned by the majority of the nurses, no protocolized eye care in the unit was available in the unit and the majority of the nurses did not attend in-service training or instructions about eye care. Moreover, based on the researcher's observations (the researcher spent about 6 hours/ day, 6 days/week, and 8 months/year in the unit supervising the clinical training of the undergraduate nursing students), technical nurses who graduated from the institute of nursing were not adequately exposed to educational opportunities that allowing them to successfully achieve the required critical care competencies. After graduation, they were assigned to work as registered nurses in the different hospital units including the critical care units. With the high pressure and workload in these units, there was no time or chance to allow the nurse to attend any in-service training related to the CCU-required competencies and the result was poor quality and unsafe patient care.

Additionally, poor nurses' knowledge leads to a feeling of insecurity and pushes them to pay particular attention to care for other complex and sophisticated conditions so that eye care is taken for granted as a relatively minor concern.

The poor nurses' eye care-related knowledge found in the current study is congruent with the results of other studies aimed at assessing the nurses' eye care knowledge. They described the level of nurses' knowledge using different adjectives such as poor, bad, and unsatisfactory. (Alghamdi et al., 2018; Ebadi et al., 2021; Jaafar et al., 2020; Lami & Ayed, 2023; Mohamed & El-dakhakhny, 2019; Sayed, 2022). Contrary to the result of the current study, Vyas (2018) and Khalil (2019) in their studies found that the nurses had good, high, and sufficient eye care-related knowledge. Additionally, incompetent eye care nurses' practice is consistent with Vyas (2018) and Khalil (2019) who reported that nurses showed no appropriate practice pattern, and they recommended conducting a training program to improve nurses' EC practice (Khalil, 2019; Sonal Vyas, Ashish Mahobia, 2018). In the same line, Lami, and Ayed (2023) found that nurses had inadequate practice of eye care. Besides, Sayed (2022) reported that only around ten percent of the nurses attained a satisfactory level of eye care practice. Mohamed and El-dakhakhny, (2019) revealed that the total practice level of all studied nurses was unsatisfactory. Contrary to this result, Ebadi (2021) mentioned that intensive care nurses' eye care practice was good.

A promising finding in the current study is positive nurses' attitudes toward the importance of eye care. The discrepancy between the nurses' knowledge, practice, and attitudes could be explained by the fact that the bias of a self-report questionnaire. This type of questionnaire allows the nurses to subjectively select their responses that may be either overestimated or underestimated. Another reason behind the positive nurses' attitudes may be nurses' worries about their annual evaluation. Positive attitudes present in the current study are in line with Alghamdi et al., (2018). They found that nurses had a good attitude regarding eye procedures, especially in patients attached to mechanical ventilation.

Furthermore, Ebadi (2021) mentioned that intensive care nurses' eye care attitude was good. Contrary to the current finding, Sayed (2022) found that the majority of the studied nurses had discouraging attitudes toward the importance of eye care because nurses did not consider eye care a lifesaving procedure.

### Post-implementation phase of ECCG

The implementation of ECCG has significantly improved nurses' knowledge, practice, and attitudes. This is demonstrated by the significant difference between the percentage of nurses' knowledge and practice scores. After attending ECCG, the nurses who had a good level of knowledge before attending the ECCG were statistically improved (12% versus 69.3%). Similarly, there was a statistically significant improvement in the percent score of the levels of nurses' practice post-ECCG (14.6% versus 84%). However, the improvement in the mean score of nurses' attitudes was not statistically significant (88% versus 94.7%). Another evidence that supports the fact of improvement in nurses' competencies is the reduction in the incidence of eye complications among the studied patients. As proved by the current study, the overall incidence of eye complications was reduced significantly from 84% to 46%.

The improvement in the nurses' competencies and reduced eye complications are consistent with several studies. Cho et al., 2017 highlighted that, following the implementation of an education program, there had been a significant increase in nurses' knowledge, awareness, and self-reported practice. Furthermore, Tork et al., 2022 found that nurses' knowledge and practice had significantly improved following the implementation of designed eye health protocols. Along the same lines, Liem (2019) found a significant increase in nurses' knowledge scores about eye care after they attended educational intervention. Another study was developed by Elkasby et al., (2021). They found statistically significant improvement in the performance of critical care nurses following the implementation of the package of training compared to the before training (Cho et al., 2016; Elkasby et al., 2021; Liem, 2019; Mohamed Tork et al.,

2022). Moreover, Ali et al., (2023) reported that the use of evidence-based eye care intervention has reduced ocular complications in patients attached to a mechanically ventilated machine. Also, Momeni Mehrjardi et al., (2021) reported that there was an improvement in the total score of clinical competence (knowledge, practice, and attitudes). In addition, Kousha et al., (2018) have demonstrated that the implementation of this protocol significantly decreases eye complications in clinical practice and is easy to implement.

Furthermore, Mobarez et al., (2022) have shown a reduction in keratitis, conjunctivitis, dried eye, and corneal ulceration when patients are treated with an Eye Care Protocol. Pourghaffari Lahiji et al., (2021) reported that it has been demonstrated that the implementation of a protocol for eye care significantly reduced ocular complications. Similarly, Sama et al., (2023) concluded that applying a protocolized eyecare bundle has significantly reduced the incidence of exposure keratopathy among vulnerable critically ill patients such as sedated mechanically ventilated patients (Azam Pourghaffari Lahiji, Mohsen Gohari, 2021; Mobarez et al., 2022; Sama et al., 2023).

### Conclusion:

The implementation of ECCGs has been shown to significantly improve the eye care nurse's competence and significantly reduce superficial eye complications in critically ill patients.

### Recommendations

- Consider the ECCGs training program as one of the topics of continuing in-service education for nurses. To maintain the effectiveness of training programs, they should be repeated based on the latest changes in the ECCGs.
- An electronic and printed copy of the ECCGs should be available on the desk inside the CCU.
- The ECCG should be taught to undergraduate and postgraduate nursing students.
- Nursing managers should also pay attention to the content of the ECCGs to improve the quality of monitoring the quality of EC nursing

services to pave the way for the implementation of the contents of the ECCGs.

- It is also recommended to improve the quality of nursing care and evidence-based practice in other areas based on approved clinical guidelines.
- Replication of the study in different critical care settings on larger probability samples to help in the generalizability of findings.

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