Effect of an Educational Program on Nurses' Performance toward Caring for Ophthalmic Patients Affected by Climate Changes

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Abstract

Background: Climate changes and air pollution profoundly impact on population health at the global scale. Studies have focused on the effects of ambient air pollutants and weather temperature on eyes. **Aim:** This study aimed to evaluate the effect of an educational program on nurses' performance toward caring for ophthalmic patients affected by climate changes. **Methods:** A quasi-experimental research design was utilized to conduct the current study in the ophthalmology unit at Benha University Hospital. A convenience sample consisted of all available nurses (n=40) working mentioned setting. Two tools were used, the nurses' knowledge assessment questionnaire and the nurses' practice observational checklist toward caring for patients with eye problems affected by climate changes. **Results:** 22.5% of studied nurses had satisfactory level of total knowledge pre-program which improved to be 80 % post program and 37.5 % of them had satisfactory level of total practices of eye care procedure pre-program which to improve to 87.5 % post-program implementation. Also there was positive and significant statistical correlations between total knowledge and total practice scores of studied nurses pre and post educational program with p value =(0.003^{*} & $<0.001^{**}$, respectively), additionally, there was a significant statistical relation between nurses' knowledge as well as practice levels and personal data of the studied nurse's pre-program. **Conclusion:** Implementation of an educational program had significantly improved nurses' performance for ophthalmic patients. **Recommendation**: Continuous in-service training programs and establishing guidelines to help the ophthalmology nurses revise, acquire, and develop their knowledge and practice toward caring for patients with eye problems affected by climate changes, evaluate the effectiveness of implementing educational programs for caring of ophthalmic patients on their quality of life.

Keywords: Climate changes, educational program, Nurses' performance, ophthalmic patients.

Introduction:

Global temperature rise has already been linked to the increased prevalence of several diseases. Rising temperatures have been linked to increased cardiovascular risk and respiratory problems. As temperatures continue to rise, the risk level associated with these illnesses rise as well. Ocular diseases are not excluded from the effects of the changing climate. Through direct and indirect methods, several ophthalmologic diseases have been linked to the environmental impacts of climate change **(Ray & Ming, 2020) and (Chang et al., 2022).**

The fact that environmental factors play a role in vision loss has been known for a long time. Parts of the eye, including the eyelid, cornea, sclera and lens, are exposed to the elements every waking hours. However, the specific effects of climate change are currently compounding eye health issues related to environmental exposure **(Collins et al., 2022).** Climate change is likely to increase the

incidence of cataracts, severe allergic eye disease, glaucoma, age-related macular degeneration, trachoma infections, vitamin A deficiency, and eye injuries. It is also likely to disrupt eye health delivery through an increased frequency of extreme weather events, affecting both local operations and the supply chain **(Dzau, 2022).**

Infection can develop in the eye from irritation, such as getting a small amount of a chemical in the eye. Infection can also occur after a minor eye injury or a small scratch on the cornea. If untreated, some types of eye infections can damage the eye very quickly. Infections can be more severe in people who wear contact lenses. In addition, Herpes zoster ophthalmicus (shingles) affects the nerves of the eye and can cause symptoms, such as swelling, pain, and drainage, similar to an eye infection **(Anne & Christopher , 2022).**Signs of an eye infection may include; pain in the eye, a feeling that something is in the eye (foreign body sensation), increased sensitivity to light (photophobia), yellow, green, bloody, or watery discharge from the eye, increasing redness of the eye or eyelids, a grey or white sore on the colored part of the eye (iris), fever with no other cause, and blurred or decreased vision **(Romito & Martin., 2022).**

The primary nursing interventions for the patients with eye problems are patient assessment, patient education, medication administration and monitoring the patient's condition. Warm compresses may be applied to the affected eye for comfort. Medication is most often prescribed as ointment or drops that are placed in the affected eye. Topical medications may be prescribed for administration as often as four times daily, or they will be placed on a Keep-On-Person/Self-Administered Medication regimen. The patient should be seen for follow-up in 2-3 days to ensure that they are improving **(Roscoe, 2023).**

Significance of the study:

Global warming and the resultant dry weather have drastically increased the incidence of dry eyes, which also increases the overall risk of corneal and conjunctival infections. Chronic exposure to pollutants such as nitrogen oxide and particulate matter also predisposes to keratoconjunctival pathologies **(Miyazaki et al., 2019).** Additionally, increasing accumulation of UV radiations within our atmosphere is also a contributing risk factor to recurrent herpes zoster ophthalmicus, especially among immunosuppressed patients **(Zak-Prelich et al., 2002).**

Study was conducted by **Aziz & Tawfik, (2020)** about "Prevalence of dry eye disease among healthy Egyptian population" and estimated that; the prevalence of dry eye disease (DED) was 77.6%. There was a statistically highly significant difference in DED prevalence among all age groups ($P<0.0001$), with higher prevalence in age group of 41–50 years old, but the trend between consecutive age groups was not statistically significant ($P=0.4747$). Moreover, DED was statistically more common in females [86.9% of female participants versus 67.6% of male participants ($P<0.0001$)]. Blepharitis was found in 81% and smoking in 43.8%. Moreover, 29.7% of detected DED cases had associated dry mouth.

According to Benha statistical office, the admission rate to ophthalmology unit was about 480 patients by the end of the year 2022. **(Statistical office of Benha University hospital).** That why this research aimed to determine the nurses' needs toward caring for patients with eye problems affected by climate changes.

Aim of the study

The aim of this study was to evaluate the effect of an educational program on nurses' performance toward caring for patients with eye problems affected by climate changes.

Research Hypotheses:

The hypotheses of this study were:

H1- The level of nurses' knowledge score regarding eye care for ophthalmic patients could be higher than before.

H2- The level of nurses' practice score regarding eye care for ophthalmic patients could be higher than before.

H3- There would be a significant correlation between total nurses' knowledge score and total nurses' practice score after implementing the educational program.

Subjects and methods:

Research Design:

Quasi-experimental research design was used in this study. A quasi-experimental design aims to establish a cause-and-effect relationship between an independent and dependent variable. And it is a useful tool in situations where true experiments cannot be used for ethical or practical reasons **(Maciejewski, 2020).**

Setting:

The study was carried out in ophthalmology Unit at Benha University Hospital. It is located in the second floor of Benha eye hospital affiliated to Benha University Hospital, there is a nurse station at the center of the unit, it contains three rooms and four counters; each room has two beds, each counter contains four beds. There are another four small rooms, nursing room, nursing supervisor's room, physicians' room and teaching room.

Subjects:

Convenient sample was selected and included all available nurses (40) from both sexes who were working in mention setting during the time of data collection and agreed to participate in the study.

Tools of data collection:

To achieve the purpose of the study two tools were used: -

Tool I- Nurses' knowledge assessment questionnaire:

This tool was designed by the researchers after reviewing related literature such as **Abd Elhameed et al., (2019), & Liem., (2019).** This questionnaire was presented in simple Arabic language and aimed to assess nurses' knowledge regarding eye care for ophthalmic patients. It was consisted of two parts:

Part one: Nurses' personal data, this part was composed of five questions related to age, gender, educational qualification, years of experiences and training courses.

Part two: Nurses' knowledge questionnaire, which composed of 34 multiple choice questions related to:

- Basic anatomy and physiology of eye (7 questions)
- Infection control measures (3 questions)
- Assessment of the eye (6 questions)

- Ocular problems related to climate changes (7 questions)
- Prevention and management of the ocular complications (11 questions)

Scoring system: - The score distributed as: one mark for each correct answer and zero for incorrect answer, the total score was converted into percentage and graded as the following: -

- Below 75% graded as unsatisfactory level of knowledge. (Less than 25 marks).

- From 75% and above graded as satisfactory level of knowledge. (26 marks or more).

Tool II: Observational checklist regarding eye care:

It was adapted from **Perry et al., (2021)** and modified by the researchers after reviewing related literatures to assess nurses' practice regarding eye care. It was consisted of 23 steps and divided into:

* Pre-Procedure of eye care contains (preparation) 3 steps.
* Procedure included 14 steps.
* Post procedure 6 steps.

Scoring system: The score was distributed as: one mark for each step done, and zero for not done, the total score was converted into percentage and graded as the following:

- Below 75% graded as unsatisfactory level of practice. (Less than 17 marks).

- From 75% and above graded as satisfactory level of practice. (17 marks and more).

Nurses' educational program:

It was developed by researchers based on related literature. It was given to nurses after pretest; the general objective of the educational program was to improve nurses' performance toward caring for ophthalmic patients affected by climate changes. The educational program was written in simple Arabic language and supported by pictures and illustrations to help nurses understand its content. It included two parts:

a- **The theoretical part:** Included knowledge related to anatomy and physiology of the eye, ocular problems, eye problems caused by climate changes, sings of eye infection, eye assessment, and precautions to control infections, prevention, and management of ocular complications.

b- **The practical part:** Included practical skills about eye care which included cleaning of the eye, application of eye drops or eye ointment, eye irrigation if any foreign body is present and finally covering the eye with eye patch.

Content validity

Research tools and the educational program were reviewed by a panel of five experts from Medical Surgical Nursing field at Faculty of Nursing Benha University. Jury involved three professors and two assistant professors to test the relevance, clarity of tools' content, comprehension, and necessary modification was done accordingly.

Reliability

The researchers used test – retest – methods to test the internal consistency of the tools, by administration of the same tools to the same subjects under similar conditions on two different occasions. Reliability of **knowledge questionnaire** was determined using Cronbach's alpha coefficient which was 0.996. For the second tool (**practice)**, reliability was

1.000. This only proves that this tool is an instrument with good reliability.

Ethical considerations:

- The research approval was obtained from the ethical committee of Faculty of Nursing Benha University before initiating the study work. The researchers clarified the purpose and aim of the study to nurses included in the study before data collection.
- After explaining the study's aim, official permission for data collection was obtained from the ophthalmology Unit director at Benha University Hospital.
- Verbal consent was obtained from nurses to participate in this study after explaining its aim.
- Nurses were informed about the confidentiality of the obtained information and the nature of the study. They were reassured that the obtained information was used only for the study purpose. They have the right to withdraw at any time from the research without giving any reason.

Pilot study:

A pilot study was conducted on 10% of all nurses that were included in the study from the total number of nurses (40) to test the clarity and applicability of the tools. The nurses involved in the pilot study (4 nurses) were included in the study because there were minor modifications in study tools.

Field work:

The process of data collection was performed over a period of six months during morning and afternoon shifts, started in October and December 2022 to perform pretest then the implementation of the program started from January to the end of February 2023 and posttest was performed in March and May 2023. it was carried out by the researchers through four phases:

Assessment phase:

First: - Assessment of nurses' practical skills through observational checklist (Tool II). The time needed to complete the checklist ranged between 10-15 minutes for each nurse.

Second: - Assessment of nurses' knowledge was done through knowledge questionnaire (Tool I) and was given to each nurse to fill it. The time required for completion of the questionnaire ranged from 20-30 minutes.

This assessment shed- light and had given more insight about the current knowledge and practice level to help detecting knowledge and practice deficits, as its results was obtained from this assessment.

Planning phase:

- The researchers put plan for carrying out the educational program after collecting data about the study setting. The educational program was developed by the researchers according to nurses' needs and deficiencies in their performance.
- Teaching materials were prepared e.g. discussion, demonstration, videos, pictures and educational booklet that helped in covering theoretical and practical information.

-The head nurse of the unit organized the attendance of nurses with the researchers according to their duties on the day. Also, helped the researchers in preparing the teaching room which used in taking the sessions.

Implementation phase:

Dissemination of the educational program through:

- The researchers gave the instructional colored booklet to nurses immediately after assessment phase.

- Total number of the studied nurses was 40 nurses; they were divided into 8 groups. Each group contained five nurses in every session. The researchers attended two days/week in the morning and afternoon shifts.
- The researchers met every group for two sessions: one session for theory and one session for practice. Each session ranged between 30-45 minutes, including periods of discussion.
- Each session started with a brief summary about what had been given through the previous session, then the objectives of the new topics, taking into consideration the use of simple language to suite the level of all nurses' education.
- Discussion, motivation and reinforcement during the intervention sessions were used to enhance learning. At the end of each session the nurses asked questions to correct any misunderstanding.

Session one: (introductory session) it included orientation and explanation of reasons and importance of designed educational program and give an explanation about eye care such as: basic anatomy and physiology of the eye, eye problems affected by climate changes, signs of eye infection, eye assessment, necessary precautions to protect the eyes from infection, and principles of eye care.

Session two: it was concerned with practical part about methods of eye care as: cleaning of the eye, applying eye drops and eye ointment, eye irrigation and covering the eye. The researcher carried revision and reinforcement according to nurses' needs.

Evaluation phase:

After implementation of the educational program, post-test was done to evaluate the effectiveness of the program through evaluation of nurses' performance using the same tools of pre-test and it was done after giving the educational program.

Comparison was done between the pre-test and post-test at the end of the research to determine the effect of the educational program on nurses' performance toward caring for ophthalmic patients affected by climate changes.

Statistical Analysis:

The collected data were tabulated and statistically analyzed using an IBM computer and the statistical package for social science (SPSS) advanced statistics, version 25 (SPSS Inc., Chicago, IL). For determining the normal distribution of quantitative variables was used to Kolmogorov-Smirnov test. Numerical data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. McNemar was used to examine the difference between qualitative variables. Chi-square tests were used to examine the relation between qualitative variables and Fisher's exact test was applied on smaller sample sizes, alternative to the chi-square test, when the frequency count is < 5 for more than 20% of cells. Spearman method was used to test correlation between numerical variables. A p-value < 0.05 was considered significant, and <0.001 was considered highly significant.

Results:

Table (1): Shows that distribution of studied nurses regarding their personal data, which clarified that 50% of the studied nurses aged from 20 - >30 years old with a mean age of (**29.70 ± 0.79)**

years, while 70% of them were married females. In addition, 40% of the studied nurses were qualified by diploma and had years of experience less than 5 years. Moreover, 50% of them received training courses about dealing with ophthalmic patients.

Table (2): Reveals that distribution of studied nurses' knowledge about eye care for ophthalmic patients affected by climate changes pre and post educational program, Where, 30% and 45% of studied nurses' had satisfactory level of knowledge about basic anatomy and physiology of eye and ocular problems related to climate change pre educational program which improved to 90% & 77.5 %, respectively of them had satisfactory level ,with a highly significant difference ($p= \leq 0.001^{**}$).

Figure (1): Illustrates that difference between total knowledge level among the studied nurses about eye care for ophthalmic patients pre and post educational program, there was 22.5% of them was satisfactory level which improved to be 80 % post program. With a highly significant statistical difference (p= <0.001**).

Table (3): Reveals that distribution of studied nurses' sub-total practices about eye care for ophthalmic patients affected by climate changes pre and post educational program, where 37.5 % of studied nurses had satisfactory level of practices before eye care procedure pre-educational program to improve to 87.5 % satisfactory level regarding practices during eye care procedure post educational program. with a highly significant difference ($p= \leq 0.001^{**}$)

Figure (2): Illustrates that difference between total knowledge level among the studied nurses about eye care for ophthalmic patients pre and post educational program, there was 30% of the studied nurses had satisfactory level of practices pre-program which improved to be 87.6% of them post program.

Table (4): Shows that relationship between nurses' personal data and their total knowledge level pre and post educational program, there was statistically significant relation between total nurses knowledge level and their personal data pre educational program regarding age, years of experience and attending previous training courses observed as ($p<0.05$), while regarding the relation post educational program it was significant with age, marital status, educational level, years of experience and attendance of previous training courses with observed p value = (<0.05).

Table (5): Shows that relationship between nurses' personal data and their total practices level pre and post educational program, there was highly statistical significant relation between total nurses practice level and their personal data pre and post educational program regarding age, marital status, educational level , years of experience and attending previous training courses with observed p value= (<0.05).

Table (6): Shows that correlation between total knowledge and practice among the studied nurses pre and post educational program implementation, there was positive and significant statistical correlations between total knowledge and total practice scores of studied nurses pre and post educational program with p value =(0.003^{*} & $<0.001^{**}$, respectively).

Table (1): Distribution of studied nurses regarding their personal data (n=40).

Nurses' personal data	(n = 40)	
	No.	%
Age / years		
20 - <30	**20**	**50.0**
30 - < 40	12	30.0
≥ 40	8	20.0
Mean ± SD	**29.70 ± 0.79**	
Sex		
Male	12	30.0
Female	**28**	**70.0**
Marital status		
Single	8	20.0
Married	**28**	**70.0**
Divorced	4	10.0
Educational level		
Nursing Diploma	**16**	**40.0**
Technical institute of Nursing	12	30.0
Bachelor degree of Nursing	12	30.0
Years of Experience		
< 5	**20**	**50.0**
5-< 10	16	40.0
≥ 10	4	10.0
Mean ± SD	**4.60 ± 0.67**	
Attending previous training courses related ophthalmic care		
Yes	**20**	**50.0**
No	20	50.0
Number of attended courses (n=20)		
One course	**8**	**40.0**
Two courses	4	20.0
Three courses	4	20.0
More than three courses	4	20.0
Mean ± SD	**2.20 ± 1.19**	

Table (2): Difference between total knowledge level among the studied nurses about eye care for ophthalmic patients pre and post educational program (n=40)

Nurses' knowledge about eye care for ophthalmic patients	Knowledge level	Knowledge (pre educational program) (n= 40)		Knowledge (post educational program) (n= 40)		X^2 test P value
		(No.)	%	(No.)	%	
Basic anatomy and physiology of eye	Satisfactory ≥ 75%	12	30.0	32	80.0	18.050 <0.001**
	Unsatisfactory < 75%	28	70.0	8	20.0	
Infection control measures	Satisfactory ≥ 75%	23	57.5	36	90.0	11.077 0.001**
	Unsatisfactory < 75%	17	42.5	4	10.0	
Ocular assessment	Satisfactory ≥ 75%	13	32.5	34	85.0	19.048 <0.001**
	Unsatisfactory < 75%	27	67.5	6	15.0	
Ocular problems related to climate changes	Satisfactory ≥ 75%	18	45.0	31	77.5	11.077 0.001**
	Unsatisfactory < 75%	22	55.0	9	22.5	
Prevention and management of the ocular complications	Satisfactory ≥ 75%	12	30.0	33	82.5	19.048 <0.001**
	Unsatisfactory < 75%	28	70.0	7	17.5	

(X^2) Mc Nemar's chi square test (**) Highly statistically significant at ≤0.001

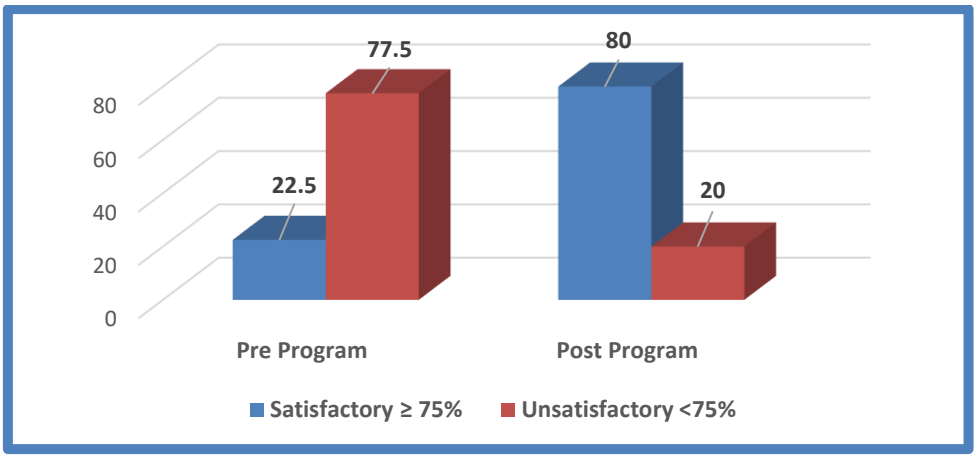

Figure (1): Difference between total knowledge level among the studied nurses about eye care for ophthalmic patients pre and post educational program (n=40)

Table (3): Difference between total practice level among the studied nurses (before, during and after eye care procedure) during pre and post educational program (n=40)

Nurses' practices regarding eye care	Practice level	Practice (pre educational program) (n= 40)		Practice (post educational program) (n= 40)		X^2 test P value
		(No.)	%	(No.)	%	
Practices before eye care procedure	Satisfactory ≥ 75%	15	37.5	29	72.5	12.071 0.001**
	Unsatisfactory < 75%	25	62.5	11	27.5	
Practices during eye care procedure	Satisfactory ≥ 75%	19	47.5	35	87.5	14.062 <0.001**
	Unsatisfactory < 75%	21	52.5	5	12.5	
Practices after eye care procedure	Satisfactory ≥ 75%	17	42.5	32	80.0	13.067 <0.001**
	Unsatisfactory < 75%	23	57.5	8	20.0	

(X^2) Mc Nemar's chi square test (**) Highly statistically significant at ≤0.001

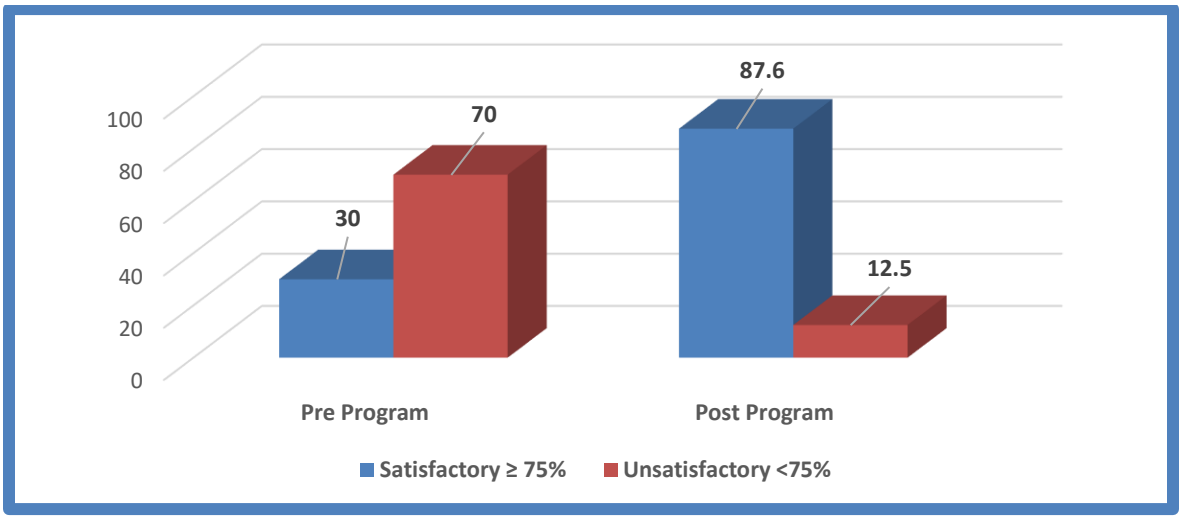

Figure (2): Difference between total practice level among the studied nurses about eye care for ophthalmic patients pre and post educational program (n=40)

Table (4) Relationship between nurses' personal data and their total knowledge level pre and post educational program (n=40)

Nurses' Personal data	Variables	Total knowledge level Pre program		X^2 Test P value	Total knowledge level Post program		X^2 Test P value
		Satisfactory (n=9)	Un Satisfactory (n=31)		Satisfactory (n=32)	Un Satisfactory (n=8)	
		No. (%)	No. (%)		No. (%)	No. (%)	
Age	20 - <30	9(100.0)	11(35.5)	11.613 0.003*	20(62.4)	0(0.0)	11.875 0.003*
	30 - < 40	0(0.0)	12(38.7)		6(18.8)	6(75.0)	
	≥ 40	0(0.0)	8(25.8)		6(18.8)	2(25.0)	
Sex	Male	3(33.3)	9(29.0)	0.061 FEp 1.000 n.s	12(37.5)	0(0.0)	4.286 FEp 0.079 n.s
	Female	6(66.7)	22(71.0)		20(62.5)	8(100.0)	
Marital status	Single	0(0.0)	8(25.8)	4.977 0.083 n.s	4(12.5)	4(50.0)	9.643 0.008*
	Married	9(100.0)	19(61.3)		26(81.3)	2(25.0)	
	Divorced	0(0.0)	4(12.9)		2(6.2)	2(25.0)	
Educational level	Nursing Diploma	6(66.7)	10(32.3)	5.591 0.061 n.s	16(50.0)	0(0.0)	10.833 0.004*
	Technical institute of Nursing	3(33.3)	9(29.0)		10(31.2)	2(25.0)	
	Bachelor degree of Nursing	0(0.0)	12(38.7)		6(18.8)	6(75.0)	
Years of experience	< 5	9(100.0)	11(35.5)	11.613 0.003*	20(62.5)	0(0.0)	10.312 0.006*
	5-< 10	0(0.0)	16(51.6)		10(31.3)	6(75.0)	
	≥ 10	0(0.0)	4(12.9)		2(6.2)	2(25.0)	
Attending previous training courses related ophthalmic care	Yes	9(100.0)	11(35.5)	11.613 FEp 0.001**	20(62.5)	0(0.0)	10.000 FEp 0.003*
	No	0(0.0)	20(64.5)		12(37.5)	8(100.0)	

(FEp) p value for Fisher exact for chi square (n.s) Not Statistically Significant at >0.05

(*) Statistically Significant at ≤0.05 (**) Highly statistically significant at ≤0.001

Table (5) Relationship between nurses' personal data and their total practice level pre and post educational program (n=40)

Nurses' Personal data	variables	Total practice level Pre program		X^2 Test P value	Total practice level Post program		X^2 Test P value
		Satisfactory (n=12)	Un Satisfactory (n=28)		Satisfactory (n=35)	Un Satisfactory (n=5)	
		No. (%)	No. (%)		No. (%)	No. (%)	
Age	20 - <30	12(100.0)	8(28.6)	17.143 <0.001**	20(57.1)	0(0.0)	5.714 0.057 n.s
	30 - < 40	0(0.0)	12(42.8)		9(25.7)	3(60.0)	
	≥ 40	0(0.0)	8(28.6)		6(17.2)	2(40.0)	
Sex	Male	6(50.0)	6(21.4)	3.265 FEp 0.130 n.s	12(34.3)	0(0.0)	2.449 FEp 0.298 n.s
	Female	6(50.0)	22(78.6)		23(65.7)	5(100.0)	
Marital status	Single	0(0.0)	8(28.6)	7.347 0.025*	6(17.2)	2(40.0)	8.327 0.016*
	Married	12(100.0)	16(57.1)		27(77.1)	1(20.0)	
	Divorced	0(0.0)	4(14.3)		2(5.7)	2(40.0)	
Educational level	Nursing Diploma	9(75.0)	7(25.0)	10.536 0.005*	16(45.7)	0(0.0)	7.238 0.027*
	Technical institute of Nursing	3(25.0)	9(32.1)		11(31.4)	1(20.0)	
	Bachelor degree of Nursing	0(0.0)	12(42.9)		8(22.9)	4(80.0)	
Years of experience	< 5	12(100.0)	8(28.6)	17.143 <0.001**	20(57.1)	0(0.0)	8.571 0.014*
	5-< 10	0(0.0)	16(57.1)		13(37.2)	3(60.0)	
	≥ 10	0(0.0)	4(14.3)		2(5.7)	2(40.0)	
Attending previous training courses related ophthalmic care	Yes	12(100.0)	8(28.6)	17.143 FEp <0.001**	20(57.1)	0(0.0)	5.714 FEp 0.047*
	No	0(0.0)	20(71.4)		15(42.9)	5(100.0)	

(FEp) p value for Fisher exact for chi square (n.s) Not Statistically Significant at >0.05 (*) Statistically Significant at ≤0.05 **(**)** Highly statistically significant at ≤0.001

Table (6): Correlation between total knowledge and practice among the studied nurses pre and post educational program implementation (n=40)

r-\ p values / Variable	Periods	Total knowledge	
		r	p
Total practice	Pre program	0.457	0.003*
	Post program	0.898	< 0.001**

(*) Statistically Significant at ≤0.05 (**) Highly statistically significant at ≤0.001

Discussion:

Climate change is one of the most important challenges currently facing the world. The adverse impacts of climate change can be catastrophic and a potential threat to the humanity existence. Therefore, it is essential for everyone, especially those in the scientific community to have a full appreciation of the issue as well as the potential solutions to the problem so that they can initiate the necessary changes to the economies, resource utilization, behavior, and general approach to nature **(Yang et al., 2018).**

This study aimed to evaluate the effect of an educational program on nurses' performance toward caring for patients with eye problems affected by climate changes. To fulfilled this, aim the finding discussed through the following parts: (1) personal data for studied nurses (2) nurses' knowledge regarding eye care for ophthalmic patients affected by climate changes. (3) nurses' practices related to eye care procedure for ophthalmic patients affected by climate changes pre and post educational program, (4) relation and Correlation between total nurses' knowledge and their practice pre and post implementation of educational program.

The present study revealed distribution of studied nurses regarding their personal data, which clarified that half of the studied nurses aged from 20 - >30 years old with a mean age of (29.70 ± 0.79) years, while nearly three quarters of them were married females. This might be due to age bracket is associated with heightened professional activity in all fields and this also reflect the general nursing situation in Egypt where male nurses are still having a very little rate.

Additionally, less than half of the studied nurses had diploma qualification and half of them had years of experience less than 5 years. From the researchers' point of view this finding may be due to that, most nurses prefer to graduate from technical institutes as they employ quickly and had better work chances at this young age. Also, number of nurses graduated from institutes and diploma is higher than bachelor's degree in Egypt. Moreover, half of them received training courses about dealing with ophthalmic patients.

These findings agreed with **Sayed, (2022)**, who conducted study about "The Effect of an Educational Program Designed for Nursing Eye Care on Critical Care Nurses' Performance" and found that, more than three quarters of nurses aged from 20-<30 years old and most of them were female. While, regarding the experience; nearly half of them had from 3-<5 years and more than half of them had Bachelor degree and had training courses for eye care. But this finding is inconsistent with **Jaafar, et al., (2020),** who conducted study about "Nurses' Knowledge based on Evidence Based Practice toward Eye Care for Intensive Care Units Patients" and revealed that, the studied sample was highly educated and had bachelor's degree in nursing.

Concerning distribution of studied nurses' knowledge about eye care for ophthalmic patients affected by climate changes pre and post educational program, there was a highly significant difference ($p= \leq 0.001$**). As, one third of studied nurses had satisfactory level of knowledge about basic anatomy and physiology of eye as well as prevention and management of the ocular complications pre-educational program which improved to majority of them had satisfactory level post educational program. From the researchers' point of view, this might be due to the providing of the educational program which included different sessions about eye care and ocular disorders.

The current findings were in agreement with **El-Shafaey and Basal, (2018)** who studied "Effect of Implementing Teaching Program on Knowledge and Practice of nurses and clinical outcomes of patients post cataract surgery" and revealed that, all of the studied nurses had a good level of knowledge score immediately post- implementation of teaching program. Also, the current finding was agreed with **Abdullah et al, (2019),** who studied "Effect of Nursing Intervention on Nurses' Knowledge and Practice Regarding Cataract Surgery" and revealed that there was a highly statistically significant improvement in mean scores total nurses' knowledge concerning caring of patients undergoing cataract surgery post- intervention after follow up when compared with pre-intervention. There was highly statistically significant difference regarding nurses' knowledge related to eye anatomy, cataract disease, nursing role and pre discharge instructions of cataract surgery pre intervention, post- intervention and follow up with P value <0.001.

Concerning the necessary precautions to control infection, the present study showed that, more than half of the studied nurses had satisfactory level of knowledge about control infection measures pre-program implementation, while post program implementation, the majority of studied nurses had satisfactory level of knowledge regarding necessary precautions of control infection. This finding was consistent with **Liu et al., (2021),** in their study entitled "Protection procedures and preventions against the spread of coronavirus disease 2019 in healthcare settings for nursing personnel" they stated that educating nurses on procedures for infection control, and implementing protective measures to prevent nosocomial infections are critical to prevent further outbreaks. Also, this finding is consistent with **Fashafsheh et al. (2013),** who found that the most common precaution taken

by the Palestinian nurses were taking swab for culture in case of any sign of infection.

Regarding the eye assessment, the present study showed that, less than one third of the studied nurses had satisfactory level of knowledge regarding eye assessment pre-program implementation. While, post program implementation most of studied nurses had satisfactory level of knowledge regarding eye assessment. This finding is consistent with **Milutinovic et al., (2017),** in their study entitled "Eye care in mechanically ventilated critically ill adults-nursing practice analysis" who found that, the minority of studied nurses had knowledge and experience in performing eye assessment.

Meanwhile this finding disagreed with **Alghamdi et al., (2018),** in their study entitled "Assessment of intensive care nurse knowledge and perception of eye care practice for unconscious and mechanically ventilated patients in intensive care units in Saudi Arabia" who stated that, most of the studied nurses had knowledge and practice regarding assessment of the eye.

Regarding the nurses' knowledge about ocular problems related to climate changes, the results of the current study revealed that, less than half of the studied nurses had satisfactory level of knowledge pre-program implementation. Which changed into more than two third post program implementation. This may be due to lack of training courses about climate changes and its effect on eye problems which improved by the educational program. This result comes in agreement with **Streich, (2014),** who studied "Nursing faculty's knowledge on health impacts due to climate change" and reported that, the faculty students were aware of the larger idea of health impacts due to climate change, however, many do not know about the specific health impacts related to climate change.

Concerning prevention and management of eye complications, the findings of the present study illustrated that, less than one third of the studied nurses had satisfactory level of knowledge preprogram implementation. While, post program implementation, more than three quarters of studied nurses had satisfactory level of knowledge regarding prevention and management of eye complications. From the researchers' point of view this result may be due to lack of training courses about prevention and management of eye complications while the availability of program hand out improved nurses' knowledge about prevention and management of eye complications during patient care.

This finding is consistent with **Abid et al., (2018)** in their study entitled " Effect of Implementing Nursing Guideline on Nurses' Performance Regarding Patients Undergoing Cataract or Glaucoma Surgery" who stated that before guidelines implementation the most of studied nurses had a low level of knowledge regarding nursing care pre and post eye surgery and they didn't follow aseptic technique measures when changing eye dressing.

Regarding the total knowledge level among the studied nurses about eye care for ophthalmic patients pre and post program implementation, the present study demonstrated that, there was an improvement after implementing the program as evidence there was less than one third of them had satisfactory

level pre -program implementation which improved to be majority post program implementation. With a highly significant statistical difference, which **this finding supported the first hypothesis.**

Correspondingly, the current study agreed with **Sayed, (2022)** who illustrated that, more than two thirds of nurses had unsatisfactory level of knowledge regarding eye care pre-program implementation. While post-program; more than three quarters of the studied nurses had satisfactory level of knowledge regarding eye care. In addition, this is in agreement with **Cho et al., (2017)** who studied "Development and validation of an eye care educational program for intensive care unit nurses in Korea" and reported that the levels of eye care-related knowledge, awareness and practice were enhanced following the implementation of the educational program.

Concerning of studied nurses' total practice about eye care for ophthalmic patients affected by climate changes pre and post educational program, there was a highly significant difference. As, more than half of studied nurses had unsatisfactory level of practices before pre-educational program to reach satisfactory level regarding practices during eye care procedure among most nurses post educational program. **This supports that second research hypothesis**. This could be due to implementation of practical sessions and demonstration of eye care procedures to prevent ocular complications.

This finding agree with **Abid (2018)** whose studied" Effect of Implementing Nursing Guideline on Nurses' Performance regarding Patients Undergoing Cataract or Glaucoma Surgery" who revealed that, after training nurses on eye conditions, there was an improved knowledge and practice change.

The current study illustrated that there was a highly significant statistical difference (p= <0.001**) among the studied nurses between total practice level pre and post educational program. Meanwhile these results disagreed with **El Shafaey and Basal, (2018)** who also demonstrated a major deficiency in nurses' performance of postoperative care for cataract patients before implementation of the guidelines. It was a striking finding that none of them could adequately perform the application of eye ointment, eye dressing using infection control, and non-pharmacologic pain relief.

Concerning relationship between nurses' personal data and their total knowledge level pre and post educational program, the current study showed that there was highly statistical significant relation between total nurses knowledge level and their personal data pre educational program regarding age, years of experience and attending previous training courses observed as ($p<0.05$). From the researcher point of view these results may be due to that nurses who attended previous training courses about eye care had more knowledge than nurses who didn't attend previous training courses and nurses who had high educational qualification and more experience had more knowledge than others who had lower levels of education and lower years of experience at pre and post program implementation.

These findings agreed with **Tork et al., (2022)** who studied "Effect of Designed Eye Care Protocol on Nurses' Knowledge and Practices Regarding Prevention of Ocular Surface Disorders among Sedated and Intubated Children at Pediatric Intensive Care Unit" and stated that, there were a statistical significant relation between nurses' total knowledge scores and their ages, academic qualifications and years of experiences pre and post designed eye care protocol. While, these results disagreed with **Alghamdi et al., (2018)** who stated that there were no statistical significant relation between nurses' total knowledge scores and perception regarding their age, years of experience and educational levels. Also, the results disagreed with, **Jaafar, et al., (2020),** who revealed that, there was no significant difference between nurses' educational level and their level of knowledge regarding eye care for ICU patients**.**

Regarding relationship between nurses' personal data and their total practice level pre and post educational program, the current study showed that, there was highly statistical significant relation between total nurses practice level and their personal data pre and post educational program regarding marital status, educational level , years of experience and attending previous training courses with observed p value= (<0.05). From the researchers' point of view these results may be due to the fact that nursing education, training courses and years of experience could improve level of practical skills among the studied nurses, while sex and age has no significant statistical relation with practical scores may be related to the fact that the majority of the studied nurses were females and nurses in old age were occupied with work stress, hours of work and occupational hazards.

These finding agreed with **Gad, et al., (2023)**, who studied "Effect of Intervention Guidelines on Nurses' Performance Regarding Patient's Outcome Post Glaucoma Surgery" and stated that, there was statistically significant relation between satisfactory nurses' practice and their qualifications. Also, this finding was parallel to **Elkasby et al., (2021)**, who studied "Effect of Eye Care Learning Package for Mechanically Ventilated Patients on Critical Care Nurses' Performance" and found that, there was a positive statistical significant relation between nurses' knowledge, and practices with years of experience. However, this finding contradicts with **Vyas, et al., (2018),** who studied "Knowledge and practice patterns of Intensive Care Unit nurses towards eye care in Chhattisgarh state" and found that, no relationship between work experience with knowledge and practice about eye care.

Regarding correlation between total knowledge and practice among the studied nurses pre and post educational program implementation. The study revealed that there was positive and significant statistical correlations between total knowledge and total practice scores of studied nurses pre and post educational intervention with p value =(0.003* & <0.001**, respectively) and **this supports the third research hypothesis**. From the researchers' point of view this result may be due to that knowledge is a significant positive predictor of the practice and knowledge acquired by the studied nurses helped them to perform practical skills

after understanding the scientific knowledge background.

This finding agreed with **Sayed, (2022)** whose results showed that there were statistically significance positive correlation between total nurses' knowledge and total practice score. Also, this finding was consistent with **Ebadi et al., (2021)** who studied "Evaluating intensive care nurses' clinical competence in eye care; a cross-sectional descriptive study" and showed that knowledge had significant positive correlations with practice. On the other hand, these findings were disagreed with **Khalil et al., (2019)** who conducted a study entitled "Critical care nurses' knowledge and practices concerning eye care of patients at two teaching university hospitals" and reported that no significant correlation between total knowledge score of the studied nurses about eye care and their performance.

Conclusion:

Implementation of an educational program had significantly improved nurses' performance for ophthalmic patients. In addition, there was a significant statistical relation between nurses' knowledge as well as practice levels and personal data of the studied nurses pre-educational program. In addition, there was a significant statistical positive correlation between nurses' total knowledge and total practice scores post educational program.

Recommendations:

1- Conducting periodical in-services educational programs for nursing staff in ophthalmology unit to achieve the optimal level of performance regarding care of ophthalmic patients.
2- Nursing educators should establish and distribute a manual procedure book to all nurses working in ophthalmology unit including standard techniques that must be applied and followed.
3- Replication of the study on a large probability sample from different geographic distribution for generalization of the results.
4- Further research is recommended to evaluate the effectiveness of implementing educational programs for caring of ophthalmic patients on their quality of life.
5- Conducting training courses regarding eye care based on standard care for nurses within continuous education to increase their knowledge, which can lead to patient safety and enhance quality of care.

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تأثير برنامج تعليمي على أداء الممرضات نحو رعاية مرضى العيون المتضررين من التغيرات المناخية

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تؤثر التغيرات المناخية وتلوث الهواء بشكل عميق على صحة السكان على مستوى عالمي. اثبتت الدراسات على آثار الملوثات الجوية المحيطة ودرجة الحرارة على العينين. لذا هدفت هذه الدراسة إلى تقييم تأثير برنامج تعليمي على أداء الممرضات نحو رعاية مرضى العيون المتضررين من التغيرات المناخية وقد أجريت هذه الدراسة في وحدة العيون في مستشفى بنها الجامعى. وتم اختيار جميع الممرضات المتاحة وعددهم40 ممرضه اللاتى يعملن في وحدة الرمد لتحقيق الهدف من البحث. وأظهرت نتائج هذه الدراسة أن 22.5٪ من الممرضات كان لديهم مستوى مرضيى من مجموع المعومات قبل البرنامج والذى تطور الى نسبة 80٪ بعد البرنامج وكذلك و 37.5٪ منهم لديها مستوى مرض من الممارسات قبل البرنامج الذي تحسن إلى 87.5٪ بعد تنفيذالبرنامج. أيضا كان هناك علاقه ذات دلاله إحصائية بين مجموع المعلومات و الممارسة لدى الممرضات قبل وبعد البرنامج بنسبه = (0.003*& <0.001**، على التوالي). وقد أوصت نتائج الدراسة بتطبيق برامج تدريبية مستمرة للممرضات في المؤسسات الصحيه وإنشاء تطبيق مبادئ توجيهية لمساعدة ممرضات العيون على تحسين الرعايه المقدمه للمرضى الذين يعانون من مشاكل العين المتضررة من التغيرات المناخية. وتقييم فعالية تنفيذ البرامج التعليمية لرعاية المرضى العيون على نوعية حياتهم.