The Effect of Educational Package on Nurses' Knowledge and Practices Regarding Patient Care Undergoing Cardiac Catheterization

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Abstract

Background: Cardiac catheterization is a medical procedure used to diagnose and treat that are certain heart conditions. **Aim:** This study aimed to evaluate the effect of educational package on nurses' knowledge and practices regarding patient care undergoing cardiac catheterization. **Research design:** Quasi-experimental research design was utilized to conduct study. **Setting:** The study was conducted at the cardiac catheterization Unit and Cardiac Care Unit at Fayoum University Hospital. **Sample:** A convenience sample of 40 cardiac nurses of both genders was included. **Data collection tools:** Tool I: Structured Interview Questionnaire: It consisted of two parts: Part A: The nurses' demographic characteristics, Part B: Cardiac Nurse's Knowledge regarding patient care. Tool II: Nurses' Observational Checklist regarding Cardiac Catheterization **Results:** There was a statistically significant improvement in the nurse's total knowledge score post the educational package program than pre education program markedly ranging from (17.5% to 75.0%). Also, the total level of nurses' practices significantly improved post the educational program than pre education program demonstrating adequate practice increased from 22.5% to 77.5%. **Conclusion:** It can be concluded that there was a significant improvement in the knowledge and practice of nurses regarding cardiac catheterization care post educational package program than preprogram. **Recommendations:** The study recommended that nurses who work in cardiac unit must be engaged in continuous education program to improve their knowledge and practice skill regarding cardiac catheterization care.

Key words: Cardiac catheterization, Educational package, Knowledge & Practice.

Introduction

Cardiac catheterization (CC) is a widely and commonly invasive standard of the diagnosis and therapeutic treatment of cardiac and coronary artery disease, it is a crucial procedure that provides valuable information about the anatomy and physiology of the heart's chambers, valves, and coronary arteries. This procedure involves evaluation of both the left and right sides of the heart, as well as the coronary arteries (**Ahmed, Hamad, and Sayed, 2023; El Mwafie, Abdelaziz and Tork, 2022; Jaber, Taha, and Metwally, 2022**).

Also is used to gather information on the adequacy of blood supply through the coronary arteries, blood pressures, blood flow throughout the heart chambers, collection of blood samples, and X-rays of the heart's ventricles or arteries **(Khaliel, Mohamed and Ghonaem, 2022; Hamid, 2022; Mahmood, Ibrahim, Hassan and Abdulghani, 2021).**

The catheter being guided into the heart under x-ray visualization. During the procedure, coronary angiography is performed, which involves injecting a colorless dye or contrast material through the catheter. This contrast material blocks the passage of x-rays, allowing clear visualization of the coronary arteries and x-ray images to be obtained and to detect specific obstructions to the coronary vasculature related to abnormalities of the heart and coronary artery **(Praseya & Handian, 2023).**

Cardiac catheterization identification of the extent and severity of CAD, to determine semilunar valve stenosis, endocardial mapping, before interventional catheterization, to assess hemodynamic and anatomy of CVS, to confirm congenital heart disease in infant and children, to take endocardial biopsy, to assess pressure and causes of angina (**Ternus et al., 2020).**

Nursing role is crucial for patients undergoing cardiac catheterization to be involved in monitoring the patient's physiological condition and managing any complications that may arise as well as maintain safety, patient advocates, providing reassurance and emotional support **(Hojjatoleslami, Borzou, Negandeh, Soultanian, and Sadeghi 2024).** The nurse responsible for caring for these patients should have a deep understanding of the possible complications and possess assessment skills that enable them to identify these complications quickly and quickly provide nursing management (**Jaber, Taha, and Metwally, 2022).**

Significance of the study

Cardiac catheterization is one of the most widely performed cardiac procedures. In the United States, more than 1,000,000 cardiac catheterization procedures are performed annually (**Bangalore, Maron, Hochman, 2021).** All invasive procedure is associated with varying complications. In Egypt, cardiac catheterization complications varies from vascular complications (2.2%), arrhythmias (1.8%), heart failure (0.8%) and myocardium infarction (2.2%), in addition to the unpleasant experience for the patient

(Bakr, Shehab, and El-Zayat, 2020). The nurses receive inadequate information and support and not enable to contribute in the provision of care for patients undergoing cardiac catheterization to the degree that they would desire. So, cardiac nurses should be aware about the guidelines for preventing safe practice, early detect, and manage these complications **(Kousar, Yaqoop, Afzal, and khan, 2022)**. Thus, the current study evaluates the of education intervention on cardiac nurses' knowledge and practice regarding cardiac catheterization care.

Aim of the study

This study aimed to evaluate the effect of educational package on nurses, knowledge and practice regarding patient care undergoing cardiac catheterization.

Research Hypothesis

- **H1:** Nurses who receive the educational package will exhibit improved knowledge mean scores post implementation than pre implementation.
- **H2:** Nurses who receive the educational package will exhibit improved practice mean scores post implementation than pre implementation.

Subjects and Method

Research design

Quasi experimental research design was utilized to conduct study.

Setting

This study was conducted at the Cardiac Catheterization Unit and Cardiac Care Unit at Fayoum University Hospital.

Sample

The sample consisted of 40 nurses working in Cardiac Catheterization Unit and Cardiac Care Unit at Fayoum University Hospital. They recruited based on the following criteria: both genders, above 20 years of age, who having at least six months of experience dealing with Cardiology Units and agree to participate in the study. Those who took previous course about cardiac catheterization will be excluded.

Tools of data collection:

Data was collected by using the two following tools:

Tool I: Structured Interview Questionnaire: It was developed by researchers based on review of the recent relevant literature. It consisted of two parts:

Part A: The nurses' demographic characteristics:

This part was used to collect data about cardiac nurses as age, gender, educational status, marital status, clinical area, year of experience, attending training courses etc.

Part B: Cardiac nurse's knowledge regarding patient care:

This part aimed to assess nurses' knowledge regarding patient care for cardiac catheterization it was adopted from by the researcher (**Rajesh, 2018; Kousar et al., 2022)** and adapted by the researcher, composed of 54 items such as cardiac physiology, disease, ECG interpretation, indications, cardiac catheterization activity care , cardiac medication ,follow up and complication .

Scoring system

Each correct answer was assigned score one and zero for "incorrect". The scores of items summed up. The total nurses' knowledge score of each subject was calculated, converted into percentage and interpreted as follows:

- **<50%:** Inadequate knowledge
- **50-75%:** Moderately adequate knowledge
- **≥ 75%:** Adequate knowledge

Tool II: Nurses' Observational Checklist: This tool was adopted from (**Williams, and Wilkins, 2011 Rajesh, 2018**). This tool used to assess nursing practice regarding patient care before, during and after cardiac catheterization. It consists of 20 items. The gathered data was assess using 3 points Likert scale ranging from 0 to 2 where (0) means not applicable, (1) means not done, and (2) means done correctly.

Scoring system

The score of each item was used 3 points Likert scale ranging from 0 to 2. The total score of observation of checklist was collected and distributed as follows:

- < 50 % Inadequate practice
- 50 - 75%: Moderately adequate practice
- ≥75%: Adequate practice

Validity and Reliability

Content validity done by a jury of five experts in the field of Medical Surgical Nursing to review the tools for clarity, relevance, comprehensiveness, accuracy, understandable and applicability. Minor modifications were done. Cronbach's Alpha was used to measure the internal consistency of the tools used in this study. The nurses, Knowledge was (0. 871) and practice checklist was (0.862).

Pilot study

A pilot study was conducted on 10% of studied sample to test the applicability, clarity and the efficiency of the study tool. As to estimate the time needed to answer it. The modifications were done for the used tool into the studied group.

Field work

- An approval was obtained from a scientific ethical committee of Fayoum University.
- An approval was obtained from the director of El-Fayoum University Hospital.
- An oral informed consent was obtained from each participant prior to data collection after an explanation of the aim of the study.
- Data collection was started and completed within four months beginning of September (2024) until the end of December (2024).
- Purpose of the study was simply explained to the nurses who agreed to participate in the study prior to any data collection.
- Each participant was given a questionnaire about nurses' data, years of experience, education level.
- Data collection and teaching session was done 3days /week by the researcher from 9 am to 4 pm for collecting data from nurses in morning and afternoon shift.
- Regarding nurses' practice, the observational checklist was used prior, during and after cardiac cath. It had taken 10 to 15 minutes for

every nurse, the researcher observed the nurses self-administrated questionnaire to ensure the maximal realistic observations of the nurses' performance and minimize bias possibility.

- Developed program based on Nurses' need, relevant recent literature. The researcher implemented education program using power point, photo, and hardout about cardiac catheterization patient care.
- The nurses were divided into six group and each group consist of six to eight nurses according to work schedule. One session per day through 3 days per week, one session for theoretical and two session for practice, the duration of each session range from 45-60 minutes to provide nurses time to nurses of sufficient knowledge, discuss and answer questions.
- The researcher evaluated the participants using the questionnaire sheet and observation checklist pre implementing the program and post ending the program.

Ethical considerations

Ethical approval will be obtained from Fayoum University Supreme Committee for Scientific Research Ethics and will be assured that confidentiality and privacy were considered. Each patient has the right to withdraw from the study at any time. Ethics, valves, culture and beliefs were respected.

Statistical design

The collected data were organized, tabulated and statistical analyzed using the statistical package for social science (SPSS). The statistical analysis was done using percentage range, chi square (X^2), T- test, and ANOVA.

- $P > 0.05$ Non significant
- $P \leq 0.05$ significant
- $P < 0.001$ High significant

Results

Table (1): Frequency distribution of demographic characteristics of studied nurses. It presents the majority of nurses (65.0%) were aged between 21–25 years, with a mean age of 25.08 ± 2.45 years. Female nurses represented 55.0% of the sample, and more than half were married (57.5%). Most participants held a Technical Institute Qualification (82.5%) and had 1–<5 years of general nursing experience (80.0%), with a mean of 3.90 ± 1.80 years. Similarly, 87.5% had 1–<5 years of experience specifically in cardiac catheterization, averaging 3.56 ± 1.49 years. Notably, only 27.5% of nurses had previously attended a heart catheterization training course.

Table (2): Knowledge levels pre & post educational program among studied sample. It shows that all knowledge domains, the proportion of nurses with adequate knowledge increased significantly following the educational intervention. In cardiac physiology, adequacy rose from 15.0% to 72.5%, and in cardiac pathology from 12.5% to 75.0%. In ECG interpretation, it increased from 20.0% to 80.0%, and in cardiac

catheterization definition and indication from 17.5% to 82.5%. Likewise, in intervention care, adequacy improved from 7.5% to 80.0%; in catheterization care from 15.0% to 80.0%; and in cardiac medication from 12.5% to 75.0%. Follow-up care showed an increase from 10.0% to 70.0%, knowledge of complications from 7.5% to 67.5%, and patient education and activity from 15.0% to 77.5%. All changes were statistically significant ($P < 0.001$)

Table (3): Comparison of total nurses' knowledge levels pre and post the educational package program among studied nurses. It points that significant improvement in the overall knowledge levels of nurses after the educational intervention. The proportion of nurses with adequate knowledge increased markedly from 17.5% to 75.0%, while those with inadequate knowledge decreased from 55.0% to 7.5%. The total knowledge score range shifted from 12–29 pre-intervention to 33–48 post-intervention. The mean score also increased significantly from 16.5 ± 2.67 to 45.9 ± 4.70.

Table (4): Comparison of total nurses' practice levels pre and post the educational package program among studied nurses. It shows the total level of nurses' practice significantly improved after the educational package program. The percentage of nurses demonstrating adequate practice increased from 17.5% to 80%, while those with inadequate practice decreased from 60% to 5%. The total practice score range shifted from 9–20 pre-educational program to 23–36 post program, with a significant rise in the mean score from 12.59 ± 2.56 to 31.67 ± 4.35. These improvements were statistically significant ($P < 0.001$).

Figure (1): Shows that there was a clear and statistically significant improvement in nurses' practice levels following the program. The percentage of nurses demonstrating adequate practice increased markedly from 22.5% to 77.5%, while inadequate practice declined from 47.5% to 7.5%. The moderate level also decreased from 30.0% to 15.0%.

Table (5): Relation between nurses' total knowledge scores and demographic characteristics pre and post the educational program. It shows that there was a statistically significant relation between age and nurses' total knowledge scores before and after the educational program. Younger nurses aged 21–25 years showed a significant improvement from 18.33 ± 5.10 to 37.29 ± 3.74 at ($P < 0.001$), and although nurse aged 26–30 years also improved, nurses with a B.Sc. qualification had significantly higher knowledge scores than nurses from institutes both pre and post the educational program ($P < 0.05$). Similarly, nurses with more experience in general nursing and cardiac catheterization showed significantly higher knowledge gains (P values ranged from 0.002 to 0.003).

Table (6): Relation between nurses' total practice scores and their socio-demographic characteristics pre and post the educational intervention. It shows that a significant relationship

was observed between nurses' total practice scores and several socio-demographic characteristics. Nurses aged 21–25 years showed a marked improvement from 13.63 ± 3.50 pre-intervention to 28.75 ± 3.50 post-intervention ($P < 0.001$), with significantly lower scores than those aged 26–30 years, who achieved higher post-intervention scores (32.38 ± 2.75). Also, significant differences were also noted based on level of education, where Bachelor nurses outperformed institute graduates both pre (P = 0.006) and post (P = 0.002) the intervention. Likewise, nurses with more years of experience in general nursing and cardiac catheterization demonstrated significantly better practice scores in both phases (P values from 0.002 to 0.030). Nurses who had previously attended a heart catheter course had significantly higher total practice scores than those who had not, both pre ($P = 0.019$) and post the educational program ($P = 0.003$). In contrast, gender and marital status were not significantly associated with practice scores at any stage ($P > 0.05$).

Table (7): Correlation between nurses' total knowledge and practice scores pre and post the educational program among studied nurses. It represents that there was a strong statistically significant positive correlation between nurses' total knowledge and total practice scores. pre the educational program, the correlation coefficient was r = 0.851, at (P < 0.001). There was statistical correlation between total knowledge score and total practice cr = (0.641, p < 0.001).

Table (1): Frequency distribution of sociodemographic characteristics of studied nurses (n=40)

Variables	N	%
Age		
21-25	**26**	**65.0**
26-30	**14**	**35.0**
Mean ±SD	**25.08 ± 2.45**	
Gender		
Male	**18**	**45.0**
Female	**22**	**55.0**
Marital status		
Single	**17**	**42.5**
Married	**23**	**57.5**
Level of education		
Technical of nursing institute	**33**	**82.5**
Bachelor nursing nurse	**7**	**17.5**

Years of experience in nursing		
1to <5 years	**32**	**80.0**
5to <10 years	**8**	**20.0**
Mean ±SD	**3.90 ± 1.80**	
Years of experience in cardiac catheterization		
1- <5 years	**35**	**87.5**
5- <10 years	**5**	**12.5**
Mean ±SD	**3.56 ± 1.49**	
Training course about cardiac catheterization		
Yes	**11**	**27.5**
No	**29**	**72.5**

Table (2): Knowledge levels pre & post educational program among studied sample (n=40)

Items of knowledge	Pre						Post						Chi-square	
	Adequate		Moderately		Inadequate		Adequate		Moderately		Inadequate			
	N	%	N	%	N	%	N	%	N	%	N	%	X^2	P-value
Cardiac physiology	6	15.0	16	40.0	18	45.0	29	72.5	8	20.0	3	7.5	28.495	<0.001*
Cardiac pathology	5	12.5	13	32.5	22	55.0	30	75.0	6	15.0	4	10.0	32.898	<0.001*
ECG Interpretation	8	20.0	9	22.5	23	57.5	32	80.0	5	12.5	3	7.5	30.927	<0.001*
Cardiac Catheterization Definition and indication	7	17.5	17	42.5	16	40.0	33	82.5	7	17.5	0	0.0	37.067	<0.001*
Cardiac Catheterization intervention	3	7.5	15	37.5	22	55.0	32	80.0	6	15.0	2	5.0	44.552	<0.001*
Cardiac Catheterization care	6	15.0	16	40.0	18	45.0	32	80.0	7	17.5	1	2.5	36.522	<0.001*
Cardiac Medication	5	12.5	11	27.5	24	60.0	30	75.0	8	20.0	2	5.0	36.946	<0.001*
Follow up for cardiac catheterization patient	4	10.0	12	30.0	24	60.0	28	70.0	9	22.5	3	7.5	34.762	<0.001*
Complication of Cardiac Catheterization	3	7.5	10	25.0	27	67.5	27	67.5	11	27.5	2	5.0	40.799	<0.001*
Education and Activities after Cardiac Catheterization	6	15.0	11	27.5	23	57.5	31	77.5	6	15.0	3	7.5	33.747	<0.001*

Table (3): Comparison of total nurses' knowledge levels pre and post the educational intervention among studied nurses (n=40)

Total knowledge	Pre		Post		Tests	
	N	%	N	%	t/X^2	P-value
Adequate	**7**	**17.5**	**30**	**75.0**	**29.626**	**<0.001***
Moderately	**11**	**27.5**	**7**	**17.5**		
Inadequate	**22**	**55.0**	**3**	**7.5**		
Range	**12-29**		**33-48**		**34.399**	**<0.001***
Mean ± SD	**16.5±2.67**		**45.9±4.70**			

Table (4): Comparison of total nurses' practice levels pre and post the educational intervention among studied nurses (n=40)

Total practice	Pre		Post		Tests	
	N	%	N	%	t/X^2	P-value
Adequate	**7**	**17.5**	**31**	**80**	**25.736**	**<0.001***
Moderately	**9**	**22.5**	**6**	**15.0**		
Inadequate	**24**	**60**	**2**	**5**		
Range	**9-20**		**23-36**		**23.908**	**<0.001***
Mean ± SD	**12.59±2.56**		**31.67±4.35**			

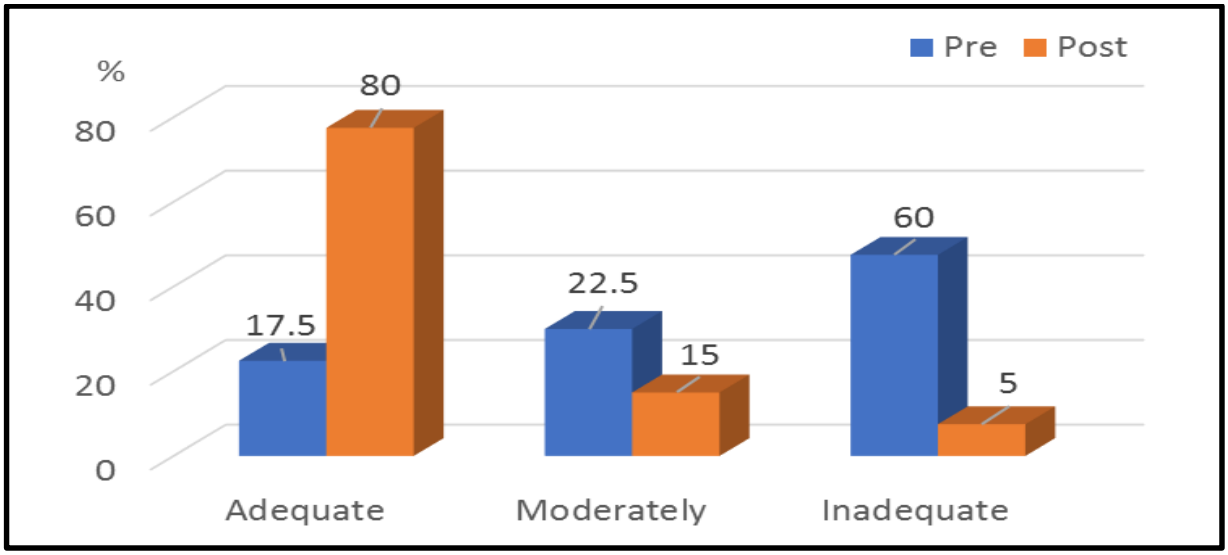

Figure (1): Distribution of nurses' total practice levels before and after the educational intervention.

Table (5): Relation between nurses' total knowledge scores and demographic data pre and post the educational practice program (n=40)

Items	Total knowledge							
	Pre		T-test		Post		T-test	
	Mean	SD	t	P-value	Mean	SD	T	P-value
Age								
21-25	18.33	5.10	3.033	0.004*	37.29	3.74	4.854	<0.001*
26-30	23.69	6.00			43.44	4.19		
Gender								
Male	21.44	5.80	0.920	0.363	40.39	5.60	0.737	0.466
Female	19.68	6.21			39.23	4.37		
Marital status								
Single	20.57	6.03	0.109	0.914	39.30	5.07	0.660	0.513
Married	20.35	6.18			40.35	4.82		
Professional qualification								
Institute	19.24	5.88	3.110	0.004*	38.55	4.54	3.928	<0.001*
B.Sc.	26.29	1.80			45.43	1.51		
Years of experience in nursing								
1- <5	19.31	5.65	2.621	0.013*	38.59	4.46	3.329	0.002*
5- <10	25.13	5.41			44.38	4.07		
Years of experience in cardiac catheterization								
1- <5	19.54	5.85	2.813	0.008*	38.91	4.66	3.144	0.003*
5- <10	27.00	1.22			45.60	1.82		
Participated in a heart catheter course								
Yes	24.09	5.99	2.492	0.017*	43.73	4.63	3.590	<0.001*
No	19.10	5.52			38.24	4.20		

Table (6): Relation between nurses' total practice scores and their demographic data pre and post the educational package program (n=40)

Items	Total practice							
	Pre		T-test		Post		T-test	
	Mean	SD	t	P-value	Mean	SD	t	P-value
Age								
21-25	13.63	3.50	2.890	0.006*	28.75	3.50	3.478	<0.001*
26-30	16.88	3.46			32.38	2.75		
Gender								
Male	15.61	3.62	1.034	0.308	30.00	3.68	0.309	0.759
Female	14.36	3.93			30.36	3.72		
Marital status								
Single	14.83	3.89	0.189	0.851	29.91	3.49	0.572	0.571
Married	15.06	3.78			30.59	3.95		

Professional qualification								
Institute	**14.18**	**3.71**	**2.938**	**0.006***	**29.42**	**3.54**	**3.247**	**0.002***
B.Sc.	**18.43**	**1.72**			**33.86**	**1.07**		
Years of experience in nursing								
1- <5	**14.28**	**3.62**	**2.253**	**0.030***	**29.34**	**3.57**	**3.317**	**0.002***
5- <10	**17.50**	**3.59**			**33.63**	**1.19**		
Years of experience in cardiac catheterization								
1- <5	**14.34**	**3.69**	**2.776**	**0.008***	**29.63**	**3.55**	**2.839**	**0.007***
5- <10	**19.00**	**1.00**			**34.20**	**0.84**		
Participated in a heart catheter course								
Yes	**17.18**	**3.66**	**2.459**	**0.019***	**32.91**	**2.17**	**3.208**	**0.003***
No	**14.07**	**3.54**			**29.17**	**3.61**		

Table (7): Correlation between nurses' total knowledge and practice scores pre and post the educational intervention among studied nurse (n=40)

Total practice	Total knowledge	
	R	P-value
Pre	**0.851**	**<0.001***
Post	**0.641**	**<0.001***

Discussion

Cardiac illnesses are the most vital cause of morbidity and mortality worldwide. Cardiac catheterization remains the most definitive procedure for diagnosis and evaluation of coronary artery disease and considered the gold standard for the diagnosis and treatment of cardiac diseases **(Mangla et al., 2017).**

Patients undergoing Cardiac catheterization require assistance from a wide variety of health professional. Nurse plays a vital role in helping cardiologists and providing care to patients undergoing cardiac catheterization procedures **(Abo El-ata, Shehab, and El Zayat, 2020).** So, the purpose of the current study was to evaluate the effect of educational package on nurses' knowledge and practices regarding patient care undergoing cardiac catheterization.

Regarding demographic characteristics, current study showed that two third of nurses' age were between twenty to thirty years, the majority of them were female, more than half of them were married. These findings disagree with **Atia & Abdelwahid, (2023)** who founds that less than half of nurses' age were between thirty to less than forty years, the majority of them were female, half of them were married. **El said et al., (2023)** stated that nurses mean age 34.90 ± 7.26; the highest percentage were married and female. This outcome aligns with a previous study conducted by **Bayan (2018)،** who revealed that cardiac nurses' participants were falling within the age range of 26-30 years and Bayan's

work reinforces the notion that many cardiac catheterization units have a significant number of younger nurses, likely due to recent graduates entering the field.

In relation to educational level, that the most of the nurses' study are graduated from Institute qualification This finding in line with study by Sayed **and colleagues (2020)** who found that less than two thirds were technical institute of nursing Also, the resent results align with study by **El Sayed et al., (2022)** who stated that less than half of the studied nurses had technical institute of nursing. **Bangalore, Patel, and Sharma (2023)** who supported the previous study. These results are contradicted with results of **Fekry and Abd Elwahab (2020)** who revealed that the three quarters of their studied samples had diploma of secondary school.

As regards years of cardiac experiences, the current study showed that most participants had from one to less than 5 years of experience. This finding is in line with study by **El Sayed et al., (2022)** who stated that three quarters of nurses had experience from 1 to more than 3 years of experience.

Regarding the nurse's knowledge, the present study shows that over half of nurses' knowledge were inadequate pre-educational package program compared with three quarters of nurses were adequate post program. This might be related to the majority of nurses had a technical institute of nursing. In addition, another cause for a lack of knowledge is that most of nurses were not receiving any previous training about cardiac catheterization care for updating information regarding cardiac care.

This finding of the present study consistent with the study of **Yaqoob et al., (2019)** who shows that the majority of the nurses, 54.3%, had adequate, 40% nurses had inadequate, knowledge scores after intervention program. Similarity, study by **Aysha & Ahmed, (2019)** who found a statistically significant difference between pre and post educational training regarding cardiac catheterization, nurses' level of knowledge. In the same line with **Kousar et al., (2022)** who showed that there was an improvement in the nurses knowledge scores 97.5% ($p \leq 0.00$), related to pre and post than pre angiography care after interventional lecture session. This explained by educational program was effective in improving nurses' knowledge level regarding cardiac catheterization care.

Regarding nurses' practice, the current study revealed that two third of the studied nurses had an inadequate practice level (pre-test), while majority of nurses had adequate level of practice immediately after the educational program for cardiac catheterization care. The results also, showed that there was a highly statistically significant difference between the total nurses' practice level pre and post receiving educational program CC. The findings of the current study are supported by **Sania et al., (2022)** who showed that significant difference between nurses' practice after the implementation of the educational training shows (66.7%) inadequate practice before

the intervention, while (83.3%) of them had an adequate level of practice after the intervention; it is also found to be a significant p-value ≤0.001.

Barton, Bruce & Schreiber, (2018) in the same line with the current study findings, their study revealed that an improvement in nurses' practice after the attendance at continuing nursing education sessions.

In this study there was a positive correlation between total nurses' knowledge and total performance scores which means that if nurses' knowledge is adequate the nurses' performance will be improved. These findings are supported by **Jabr, Taha, & Metwally, (2022)** who revealed that there was a statistically significant positive correlation between knowledge score and practice score. In addition, this result was in the same line with **Khaliel, Mohamed, and Ghonaem (2022)** who revealed that there was a positive correlation between total nurse's knowledge and total practice score. It also agreed with **Ali & Ali, (2019**) who showed that there was positive statistically significant correlation between total nurse's knowledge and total practice score post program implementation compared to preprogram implementation.

Conclusion

It can be concluded that:

- More than half of study sample were female, two thirds of studied nurses ages were (21-25) Years.
- There was a significant improvement in the knowledge and practice of nurses about cardiac catheterization after implementation of educational package program.
- There was improved in knowledge and practice of cardiac nurses regarding cardiac catheterization after education program.

Recommendations

- It is recommended to encourage continuous educational program for all nurses working in the cardiac catheterization.
- Future research about patient satisfaction and improvement in nurses' performance from the patient perspective.

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