# Effect of Patient's Safety Educational Program on Nurses' Performance for Patients Undergoing Cardiac Catheterization

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**Abstract:** Cardiac catheterization is considered as the gold standard practice for the diagnosis and treatment of coronary artery disease. So, nursing care pre, intra and post procedure regarding patient' safety is very crucial to prevent cardiac catheterization complications .**Purpose:** is to evaluate the effect of patient's safety educational program on nurses' performance for patients undergoing cardiac catheterization. **Design:** Aquasi experimental research design was utilized. **Setting:** The study was conducted in cardiac catheterization unit, cardiac care unit at Menoufia University Hospital and Shebin El-Kom Teaching Hospital. **Sample:** A convenience sample of all available nurses 40 nurses who are working in the selected setting were selected. **Instruments:** Two instruments were used for data collection: Structural interview questionnaire and Observational checklist. **Results:** There was a highly statistical significant improvement in nurses' grand total knowledge mean score in post program implementation phase and in follow up phase (76.9± 11.5 and 75.5±13.6 respectively) than pre program phase (43.9 ±3.9). Also, there was a highly statistically significance improvement in nurses' grand total performance of cardiac catheterization procedure mean score in post program implementation phase and in follow- up phase (158.2± 2.3 and 156.2±3.0) than pre program implementation phase (93.3±13.5). **Conclusions:** patient's safety educational program was effective in improving nurses' knowledge and performance for patients undergoing cardiac catheterization. **Recommendations:** The study suggested equipping cardiac catheterization unit with simple illustrated educational guidelines covering performance and knowledge pre/post cardiac catheterization procedure.

*Key words: Cardiac catheterization, Educational program, nurses' performance and Patient's safety.*

## Introduction

Coronary heart disease is a major cause of morbidity and mortality among the worldwide population. Cardiac catheterization is considered the effective diagnosing, evaluating, and treatment method of Cardiac diseases problems. Statistics from the World Health Organization (WHO) report that over 400 000 deaths are attributed to coronary heart disease annually in the United States and Canada. In Europe, coronary heart disease causes almost 1.8 million deaths yearly and is a major contributor to morbidity (WHO, 2018). Egypt has one of the highest rates of CAD deaths in the region. CAD deaths in Egypt reached 32.4% of total deaths (World Health Organization, 2020). In El- Menoufia university hospital the statistical records report that 2000 case were undergoing cardiac

catheterization in 2021(Statistical administrative records of Menoufia University Hospital, 2021).

Cardiac catheterization (CC) is the insertion of a catheter into a vein or artery, usually from a groin or jugular access site, which is then guided into the heart. Some types of heart disease stem from abnormalities in the heart's structure. The catheter procedure had progressive improvement in noninvasive technique but it may lead to several major and minor complications such as temporary pain, nausea/vomiting, bleeding, hematoma, contrast allergy as well as major complications such as myocardial infarction, major embolic events and death (Wankhede & Biradar, 2019).

The most common and frequent of these complications is the vascular complication that arise from compression of the femoral vasculature which widely varies after sheath removal following procedure according of the compression method used to achieve femoral artery hemostasis and it include hematomas pseudo aneurysms, arteriovenous fistulae, acute arterial occlusions, cholesterol emboli, and infections that occur with an overall incidence of 1.5-9 % (Henedy & El-Sayad, 2019).

Major predictors of such complications following coronary interventional procedures include advanced age, repeat percutaneous transluminal coronary angioplasty, female gender, and peripheral vascular disease. Minor predictors include level of anticoagulation, use of thrombolytic agents, elevated creatinine levels, low platelet counts, longer periods of anticoagulation, and use of increased sheath size (Kern et al., 2021).

Patient safety in minimizing complications is increasingly recognized as essential in practice of coronary care unit. Individual have right to have safe and effective quality health care and is defined as being free from accidental harm as a result of a health care encounter removing femoral sheaths and managing related complications after procedure, such as promoting hemostasis as an essential issue are predominantly the responsibilities of nurses in many acute and critical care settings (Rajesh, 2018).

Cardiac nurses are responsible for providing patient's safety and minimizing vascular complications after cardiac catheterization procedures. They should be aware about the guidelines for providing safety for the patient. Each nurse should know the high-risk patient, safe practices for handling and maintenance of homeostasis. Moreover, nurses need to develop standard and safe protocol of care for the patients of post cardiac catheterization and percutaneous coronary intervention that protocols should be researched and be evidence based. Hence, patient outcomes can be improved if there is a greater quantity or quality of nursing care (Elgazzar & Keshk, 2018).

The goals of nursing care pre the procedure include maintaining adequate hydration and promoting patient comfort and psychological readiness for the procedure. Nursing guidelines before the procedure included assessment of the patient's physical and psychological condition, determining any conditions that may create procedural risk, make a baseline electrocardiograph (ECG) and take blood sample for laboratory tests. Patients should be given oral antiplatelet agents to reduce thrombotic complications during and after the procedure. Also nurse should give the patient intravenous fluids as prescribed and instruct him/her to shave the site of the procedure and fast after midnight the day before the procedure (Abd El-Aty et al., 2018).

Nurses working in cardiac catheterization units have a specialized role and are a highly skilled cardiovascular nurse whose primary responsibility includes providing nursing care for patients undergoing cardiac catheterization. The first step of responsibilities begins from preadmission and ends with discharge composed of, screening health, preparation of patients before procedure, assistants to surgeon during the surgical procedure and monitoring of patients after the procedure until discharge (Abo El-ata et al., 2020).

Nursing performance intra the procedure focuses on promoting the safety and comfort of the patient and working with the interventional cardiologist to ensure the successful completion of the procedure. Nurses monitor ECG and arterial pressure, noting significant changes that may accompany the administration of drugs, symptoms of ischemia or chest pain, recognize signs and symptoms of contrast sensitivity, report any changes in patient status to the physician and able to handle any situation that might arise (Morton & Fontaine, 2018).

Nursing practice post the procedure included observing vital signs, the catheter insertion site, and evaluating peripheral circulation in the affected extremity frequently (as peripheral skin color, temperature, the presence of peripheral pulses, and capillary refill, observing and managing chest pain episodes. Also maintaining adequate periods of rest with the affected extremity straight, administering required drugs, observing the patient's fluid intake and output and reporting any abnormal findings to the physician. (Abd El-Aty et al., 2018). Also giving information at discharge helps patients feel more confident in the management of their health. Patients require appropriate instructions regarding catheter insertion site management, possible complications, medication, diet, and activity instructions during the recovery period. Also teach him about recommended lifestyle modifications, chest pain management, sexual activity instructions, scheduled follow-up and action to be taken in the event of an emergency. (Kern & Kirtane, 2020).

**Significance of the Study:**

Coronary artery disease is the leading cause of morbidity and mortality in both men and women, cardiac interventions are widely accepted as a practical management option and with the increasing number of cardiac catheterizations performed However, inadequate hemostasis leads to vascular complications related to patients safety and illness, . Awareness and skillfulness regarding patient safety have an influence on risk to patient safety (Ali& Ali, 2019). By 2020, cardiovascular disease will claim 25 million deaths and coronary heart disease will surpass infectious diseases as the number one cause of death and disability in the world. In the United States, about 2 million heart patients undergo cardiac catheterization every year, and this number is increasing because this diagnosis method is valid and accurate. Coronary heart disease account for 46.2% of the overall mortality in Egypt (Aliyu, 2020). The hazard physically and emotionally occurs from cardiac catheterization procedure can disturb the patient's perception of their health. Therefore, the combination between nursing knowledge and skills pre, intra and post cardiac catheterization is important to achieve safe and correct procedure (Abo Elata et al., 2020). For this reason, this study will be conducted to evaluate the effect of patient's safety educational program on nurses' performance for patients undergoing cardiac catheterization.

## Research hypothesis

- The nurses' knowledge level regarding patient's safety undergoing cardiac catheterization will be higher on posttest than pretest.
- The nurses' performance level regarding patient's safety undergoing cardiac catheterization will be higher on posttest than pretest.

## Methods:

### Research design:

A quasi experimental research design was utilized to examine the purpose of this study (pre and posttest).

### Research setting:

The study was carried out at cardiac catheterization unit, cardiac care unit and cardiac department of Menoufia University Hospital and Shebin El-Kom Teaching Hospital.

### Sampling:

A convenience sampling technique was used to select all available nurses (40 nurses pre/post) who were working in the selected setting.

### Instruments:

### Instrument one: -Structural interview questionnaire.

It was developed by the investigator to assess socio demographic data and nurses' knowledge level. It was composed of two parts:

### Part one: Socio demographic characteristics of nurses:

It was composed of questions include data related to nurse's age, gender, marital status, qualification, years of experience and attendances of training programmers…etc.

### Part two: Nurses' knowledge assessment questionnaire:

It was developed by the investigator to assess nurses' knowledge level regarding patient's safety (pre, intra and post) cardiac catheterization. It included questions that were concerned with items related to several aspects of nursing care for patients undergoing cardiac catheterization as the following: Anatomy and physiology of the heart, coronary artery disease and cardiac catheterization. Nursing management (pre, intra and post) cardiac catheterization, vascular complications occurring post procedure and predischarge instructions for patients.

**Scoring system for the knowledge items**, zero score was provided for incorrect answer or don't know, one score provided for correct and incomplete answer and two score for correct and complete answer. Then, all marks were summed and the percentage was estimated. If the percent was $\geq 70\%$ the level of nurses' knowledge was considered satisfactory. If the percent was $< 70\%$ the level of nurses' knowledge was considered unsatisfactory.

### Instrument two: -Observational checklist:

It was developed by the investigator after a review of literature Elgazzar & Keshk, (2018) to assess nurses' performance regarding patient's safety for patients undergoing cardiac catheterization pre and post applying educational program. It contained three parts:

### Part one: Pre cardiac catheterization procedure

It included informed consent, explanation of post catheterization care, complete family and medical

history, complete systematic assessment, allergies/adverse reaction record, ECG and complete lab tests, history for use of anticoagulants and any other medication, checking and documenting peripheral pulse.

**Part two: Intra cardiac catheterization procedure checklist:**

It included prepare equipment, follow-up of infection control measures such as (Principles of aseptic technique, surgical hand washing, applying a sterile glove, wearing mask and gown), nursing care and close monitoring ofvital signs and procedure site.

**Part three: Post cardiac catheterization procedure checklist:**

It covered the following skills: transfer of patient to bed, placing patients in a supine position, checking distal pulse, frequency of checking pulse, assessing the skin color or temperature of affected extremity, assessing vital signs from 15- 30 minutes for 2 hours initially, assessing the puncture site, frequency of assessing the puncture site, assessing the stability of pain, checking for ECG and SPO2, administering IV fluids, immobilizing the affected limb after sheath removal, checking of any abnormal symptoms, maintaining intake and output administering fluids and soft diet, administering medications, ambulation and patients instructions for self-management at home and before discharge.

**Scoring system for nurses' performance items in checklist**

Two scores were provided for correctly done performance, one score was provided for incorrectly done performance and zero score for not done performance. Then, all scores were summed and compared pre and post implementation of educational

program. If the scores < 80% the nurses' performance level was considered unsatisfactory and if the scores ≥ 80% the nurses' performance level was considered satisfactory.

**Validity of instruments:**

The instruments were tested for face and content validity by five Professors in the field of medical surgical nursing. Modifications were done to ascertain relevance and completeness.

**Reliability of instruments:**

The instruments were measured using test retest method to test internal consistency of the instruments (one, two). The period between both tests was two weeks. The reliability score was 'r' = 0.85 for instrument I, 'r' = 0.89 for instrument two. The 'r' value indicated the highly positive correlation, which showed that the instrument is reliable, feasible and practicable to conduct the main study.

**Pilot study:**

Prior to actual study, a pilot study was conducted on 10% (4 nurses) of the sample to assess the constructed instruments for feasibility, clarity and applicability and necessary modification were carried out before the main study. Participants in the pilot study were excluded from the actual study sample.

**Ethical considerations:**

Approval of the Faculty of Nursing Ethical and Research Committee, Menoufia University was obtained A written consent was obtained from all participants who met the inclusion criteria to participate in the study. Confidentiality and anonymity of nurses was assured through coding all data and all informations obtained would only be used for the purpose of th study. All participants were informed about the purpose, procedure

and benefits of the study. They were informed that participation in the study was voluntary and they can withdraw from the study at any time without penalty. Moreover, they were assured that the nature of instrumentswould not cause any physical or emotional harm to them.

**Procedure:**

- An official letter was submitted from the Dean of the Faculty of Nursing to the directors of selected settings explaining the purpose and methods of data collection.
- Data collection extended over a period of 6 months from October 2021 to march 2022 and the study was conducted throughout the following phases: Assessment &planning, implementation and evaluation phase.

**Assessment & Planning Phase:**

During this phase each nurse was interviewed individually and this interview took about 20 to 30 minutes to collect base line data using the following instruments:

- The investigator assessed nurses' demographic characteristics using part one of instrument one.
- The investigator assessed nurses' knowledge level regarding patient's safety (pre, intra and post) cardiac catheterization using part two of instrument one
- Nurses' performance level regarding patient's safety (pre, intra and post) cardiac catheterization was assessed by investigator using instrument two pre-implementation of educational program.
- Based on the baseline data gathered from all participants a colored booklet and multimedia were prepared by the investigator that included information about: (Anatomy and physiology of the heart and coronary arteries, coronary

artery disease (definition, causes, symptoms, and treatment), cardiac catheterization (what's it, function, indications, types, complications… etc, management of vascular complication ,nursing management (pre, intra and post) cardiac catheterization procedure and discharge instructions.

**Implementation phase:**

- Investigator applied educational program in 6 sessions; 3 sessions for theoretical part and 3 sessions for demonstration practical part, at morning shift. The duration of each session was about 30-40 minutes and the investigator used lecture, discussion and demonstration for illustration.
- Nurses were divided into small groups; each group contains 3-4 nurses in each session. Each nurse obtained a copy of colored booklet and CD that contained educational program regarding patient's safety (pre, intra and post) cardiac catheterization.

**Evaluation phase:**

Evaluation of all participants was carried out by the researcher using all instruments three times pre the program implementation, immediately post the program implementation and after three months. A comparison was done pre and post applying educational program to determine the effect of patient's safety educational program on nurses' performance for patients undergoing cardiac catheterization.

**Statistical Analysis**

Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 22. Graphics were done using Excel program.
Two types of statistics were done:

- Descriptive statistics: They were expressed as mean and standard deviation (X+SD) for quantitative data or number and percentage (No & %) for qualitative data.
- Analytical statistics: Student test was used to analyze quantitative data for comparison between two means .ANOVA (F) test was used to analyze quantitative data for comparison between more than two means. Chi-square ($\chi^2$) test was used to analyze qualitative data .Fisher Exact test was used to analyze qualitative data however, if an expected value of any cell in the table was less than 5, if the table was 4 cells. Likelihood Ratio (LR) tests was used to analyze qualitative data (if the table was more than 4 cells).Level of significance was set as P value <0.05 for all significant tests.

**Results:**

**Table(1):** illustrates that approximately 50% of the studied nurses aged between 25 to <35 years. The majority (82.5%) of them were females, married (65%) while 65% of them had a technical nursing Institute and only 10% had bachelor education. More than half (55%) of studied nurses had 5< 10 years of experience in the cardiac catheterization unit and 85% of them received training course.

**Table(2):** demonstrates that the majority of studied nurses (87.5%) had satisfactory knowledge level regarding all knowledge aspects with grand total knowledge in post program implementation phase compared to 85% in the follow up phase while 97.5% of them had unsatisfactory knowledge preprogram implementation (p<0.0001).

**Figure. 1:** shows that there was highly statistically significance improvement in nurses' grand total knowledge mean score in (post and follow up) program

implementation phase than in preprogram implementation phase.

**Figure 2:** show that 97.5% of studied nurses had unsatisfactory performance level regarding nursing intervention (pre, intra and post) cardiac catheterization procedure and only 2.5% of them had satisfactory performance level in preprogram implementation phase. While 95% of studied nurses had satisfactory performance level and 5% of them had unsatisfactory performance level in post program implementation phase. Also, 90% of studied nurses had satisfactory performance level and 10% of them had unsatisfactory performance level in follow up program implementation phase.

**Table (3):** shows that there was highly statistically significance improvement in nurses' grand total performance about cardiac catheterization procedure mean score in post program implementation phase with mean± SD (158.8± 2.3) and in follow up phase with mean± SD (156.2±3.0) while total performance mean score in preprogram implementation phase with mean± SD (93.9±13.5).

**Table(4):** revealed the relation between the nurses' socio-demographic characteristics and their mean score of post intervention knowledge about cardiac catheterization. A higher mean total knowledge score post intervention was significantly related to an age of 25 – <35 year or 35 - <45 years (77.7 ± 3.9, and 77.7± 3.03 respectively), a higher level of education (Bachelor with 81.9± 2.3), and a 5 -10 years of experience (78.5 ± 3.5) (P<0.01, < 0.001, and <0.001 respectively). By contrast, none of gender, marital status, and receiving a training courses had a significant impact on increasing mean total post intervention knowledge (P>0.05 for each).

**Table(5):** highlighted the relation between the nurses' socio-demographic characteristics and their mean score of post intervention performance about cardiac catheterization. A higher mean total performance score post intervention was significantly related to an age of 25 – <35 Y or 45 - ≥ 55 Y (159.2 ±2.7, and 162.0 ± 1.8 respectively), and a higher level of education (Bachelor with 160.3± 2.5), (P<0.02, and <0.001 respectively). By contrast, none of experience, gender, marital status, and receiving a training course had a significant impact on increasing mean total post intervention performance (P>0.05 for each).

**Figure (3):** show that there was positive significant correlation between grand total knowledge and grand total performance level of nurses regarding patient's safety for patients undergoing cardiac catheterization (p<0.001).

## Table (1): Distribution of studied nurses according to their Sociodemographic characteristics (N = 40)

| Socio demographic characteristics | Frequency | |
|---|---|---|
| | N0. | % |
| **Age (Years):** | | |
|   < 25years | 6 | 15 |
|   25 – <35 years | 20 | 50 |
|   35 – < 45 years | 8 | 20 |
|   45 – 55 years | 6 | 15 |
| **Gender:** | | |
|   Male | 7 | 17.5 |
|   Female | 33 | 82.5 |
| **Educational Level** | | |
|   Diploma of secondary school | 10 | 25 |
|   Technical Institute | 26 | 65 |
|   Bachelor | 4 | 10 |
| **Marital status:** | | |
|   Married | 26 | 65 |
|   Unmarried | 11 | 27.5 |
|   Widow | 3 | 7.5 |
| **Experience**: | | |
|   < 5 years | 10 | 25 |
|   5- <10 years | 22 | 55 |
|   > 10 years | 8 | 20 |
| **Received any training course:** | | |
|   Yes | 34 | 85 |
|   No | 6 | 15 |
| **Total** | 40 | 100 |

**Table 2: Knowledge of Nurses about Cardiac Catheterization on Pre,Post and Follow-up Tests**

| Knowledge aspects about cardiac catheterization and grand total knowledge | Pre tests | | Post tests | | Follow up tests | | $X^2$ | P |
|---|---|---|---|---|---|---|---|---|
| | N0 | % | N0 | % | N0 | % | | |
| **Anatomy and Physiology of Heart** | | | | | | | | |
| Unsatisfactory Knowledge | 35 | 87.5 | 2 | 5 | 3 | 7.5 | 68.9 | <0.0001 |
| Satisfactory knowledge | 5 | 12.5 | 38 | 95 | 37 | 92.5 | | |
| **Cardiac catheterization** | | | | | | | | |
| Unsatisfactory Knowledge | 10 | 25 | 3 | 7.5 | 3 | 7.5 | 8.5 | <0.001 |
| Satisfactory knowledge | 30 | 75 | 37 | 92.5 | 37 | 92.5 | | |
| **Nursing management for cardiac catheterization complication** | | | | | | | | |
| Unsatisfactory Knowledge | 39 | 97.5 | 5 | 12.5 | 6 | 15 | 73.6 | <0.0001 |
| Satisfactory knowledge | 1 | 2.5 | 35 | 87.5 | 34 | 85 | | |
| **Pre-discharge instructions for the patients** | | | | | | | | |
| Unsatisfactory Knowledge | 40 | 100 | 5 | 12.5 | 6 | 15 | 77.6 | <0.0001 |
| Satisfactory knowledge | 0 | 0 | 35 | 87.5 | 34 | 85 | | |
| **Grand total knowledge** | | | | | | | | |
| Unsatisfactory Knowledge | 39 | 97.5 | 5 | 12.5 | 6 | 15 | 73.6 | <0.0001 |
| Satisfactory knowledge | 1 | 2.5 | 35 | 87.5 | 34 | 85 | | |

**Figure (1): Mean of the level of Nurses'Knowledge Pre, Post and Follow up tests**
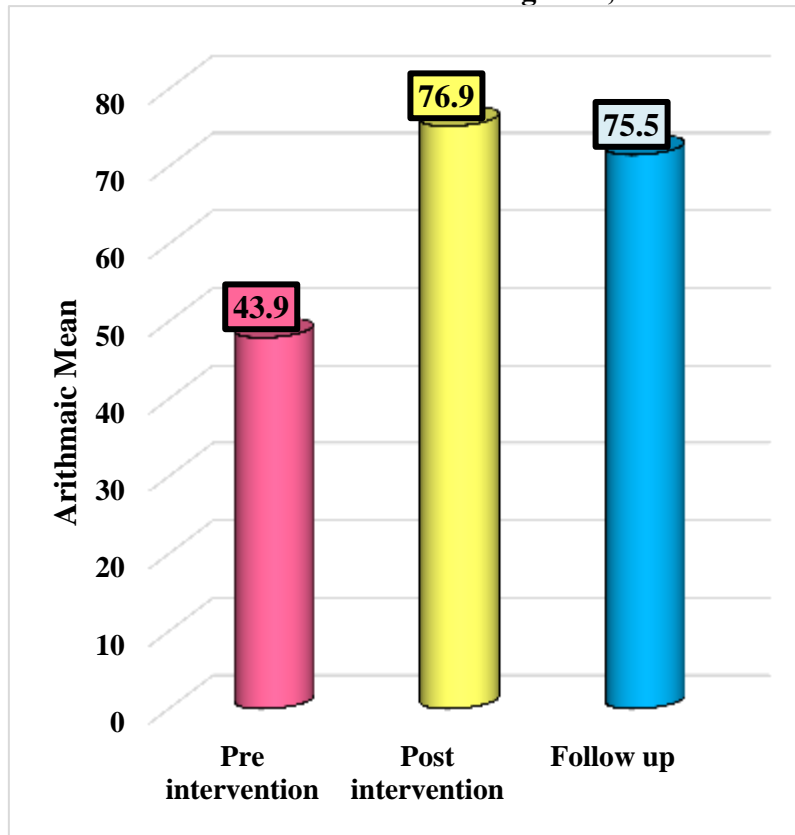
**Figure (2): Distribution of Nurses According to Their Performances Related to Patient's Safety Cardiac Catheterizations Care**
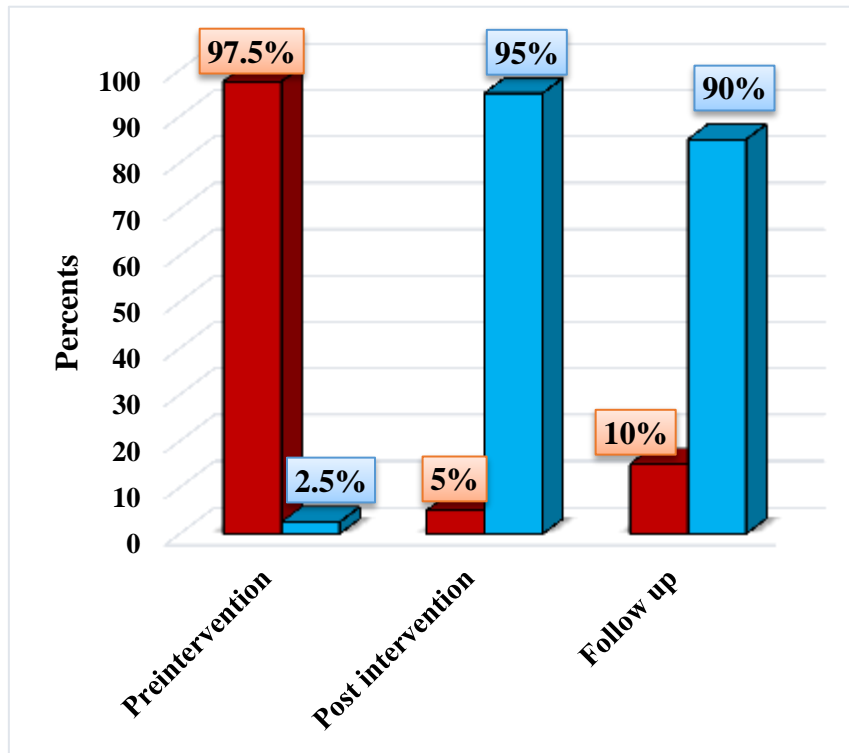


**Table 3: Mean of Nurses'Practice Levels in the Care of Patients Undergoing Cardiac Catheterization on Pre, Post and Follow-up Tests**

| Total practice score | | Mean | ± SD | Minimum | Maximum | P value |
|---|---|---|---|---|---|---|
| Total practice pre catheterization procedure (27 items) | pre | 33.1 | 4.9 | 23.0 | 43.0 | F =208.2 P<0.0001 |
| | post | 51.3 | 1.2 | 19.0 | 54.0 | |
| | follow up | 50.1 | 1.5 | 15.0 | 54.0 | |
| Total practice during catheterization procedure (24 items) | pre | 28.3 | 3.8 | 19.0 | 33.0 | F =403.5 P<0.0001 |
| | post | 45.9 | 0.8 | 27.0 | 48.0 | |
| | follow up | 45.5 | 1.1 | 20.0 | 48.0 | |
| Total practice after catheterization procedure (32 items) | pre | 32.6 | 1.4 | 15.0 | 45.0 | F =494.5 P<0.0001 |
| | post | 61.5 | 1.07 | 34.0 | 64.0 | |
| | follow up | 60.6 | 1.3 | 27.0 | 64.0 | |
| Grand Total practice about cardiac catheterization procedure (83 items) | pre | 93.9 | 13.5 | 66.0 | 110.0 | F =686.1 P<0.0001 |
| | post | 158.8 | 2.3 | 113.0 | 166.0 | |
| | follow up | 156.2 | 3.0 | 98.0 | 166.0 | |

F = Analysis of variance test

**Table 4: Mean Score of Nurses' Knowledge according to Their Demographic Characteristics on Posttest**

| Socio-demographic characteristics | Total knowledge | N | Mean score post total knowledge about cardiac catheterization | | |
|---|---|---|---|---|---|
| | | | Mean ± SD | F | P-value |
| **Age (years)** | < 25 years | 6 | 73.8 ± 4.8 | 5.8 | <0.01** |
| | 25 – <35 Y | 20 | 77.7 ± 3.9 | | |
| | 35 - <45 Y | 8 | 77.0 ± 3.03 | | |
| | 45 - 55 years | 6 | 72.5 ± 3.3 | | |
| **Education** | Diploma | 10 | 75.9 ± 3.2 | 10.6 | <0.001 ** |
| | Technical Institute | 26 | 78.5 ± 2.6 | | |
| | Bachelor | 4 | 81.9 ± 2.3 | | |
| **Experience** | < 5 years | 10 | 76.4± 2.5 | 11.2 | <0.001 ** |
| | 5 – 10 Y | 22 | 78.5 ± 3.5 | | |
| | > 10 years | 8 | 75.7± 4.4 | | |
| **Gender** | Male | 7 | 78.1 ± 3.2 | t=0.8 | 0.42 NS |
| | Female | 33 | 76.3 ± 2.1 | | |
| **Marital status** | Married | 26 | 73.2 ± 2.2 | 0.05 | 0.9 NS |
| | Unmarried | 11 | 73.0 ± 2.2 | | |
| | Widow | 3 | 78.0 ± 3.5 | | |
| **Received training course** | Yes | 34 | 76.4 ± 2.0 | t=1.2 | 0.2 NS |
| | No | 6 | 72.3 ±1 .8 | | |

[NS]P>.05

[**]P<.01

**Table (5): Relation between the nurses' socio-demographic characteristics and their mean score post intervention performance about cardiac catheterization (N= 40)**

| Socio-demographic characteristics | Total performance procedure | N | Mean score post grand total performance about cardiac catheterization procedure | | |
|---|---|---|---|---|---|
| | | | Mean ± SD | F | P-value |
| **Age (years)** | < 25 years | 6 | 149.3 ± 1.7 | 4.5 | <0.02* |
| | 25 – <35 Y | 20 | 159.2 ± 2.7 | | |
| | 35 - <45 Y | 8 | 156.5 ± 6.1 | | |
| | 45 - 55 years | 6 | 162.0 ± 1.8 | | |
| **Education** | Diploma | 10 | 155.4 ± 3.1 | 15.2 | <0.001** |
| | Technical Institute | 26 | 155.6 ± 3.2 | | |
| | Bachelor | 4 | 160.3 ± 2.5 | | |
| **Experience** | < 5 years | 10 | 150.4 ± 3.8 | 1.06 | 0.37 NS |
| | 5 – 10 Y | 22 | 157.0 ± 4.1 | | |
| | > 10 years | 8 | 158. ± 4.7 | | |
| **Gender** | Male | 7 | 160.0 ± 4.3 | t=1.6 | 0.15 NS |
| | female | 33 | 157.5 ± 4.0 | | |
| **Marital status** | Married | 26 | 159.9 ± 3.8 | 0.18 | 0.82 NS |
| | Unmarried | 11 | 140.6 ± 4.9 | | |
| | Widow | 3 | 160.3 ± 4.7 | | |
| **Received training course** | Yes | 34 | 158.4 ± 2.5 | t=1.4 | 0.15 NS |
| | No | 6 | 150.8 ± 5.7 | | |

[NS]P>.05                    *P<.05

[**]P<.01

**Figure (3): Correlation and regression line between Levels of Nurses'knowledge and performance among post test.**
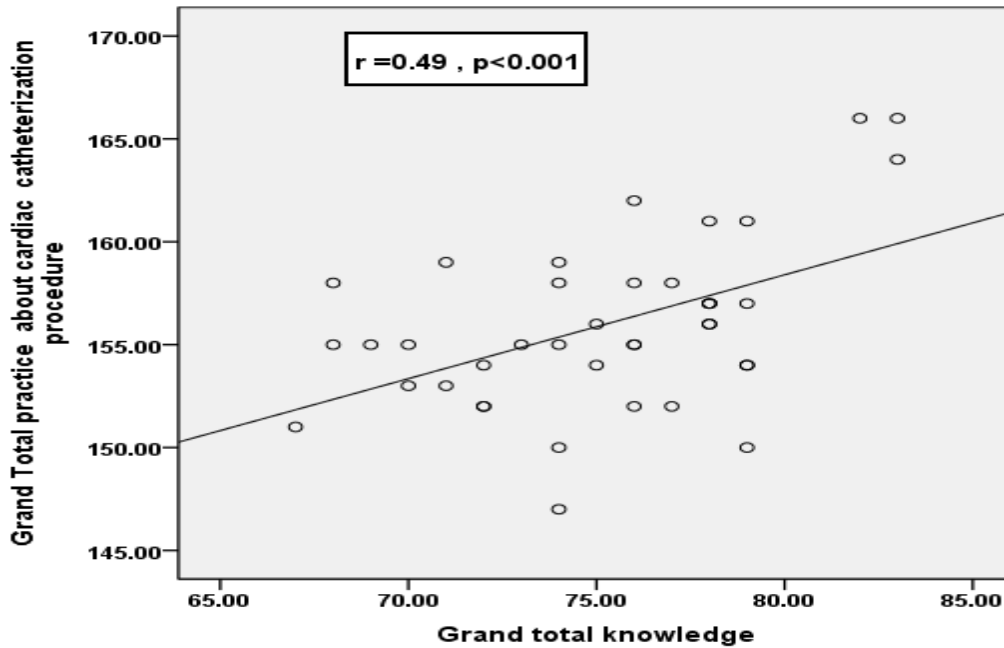


## Discussion

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. Patient safety in minimizing complications is increasingly recognized as essential in practice of coronary care unit. (Fekry&Abd Elwahab, 2020). So the purpose of the current study was to examine the effect of patient's safety educational program on nurses' performance for patients undergoing cardiac catheterization.

The results of the present study supported hypotheses & showed an improvement in nurses' knowledge and performance level regarding to patient's safety post implementation educational program.

The study reported that the majority of studied nurses had satisfactory level of knowledge regarding aspects of patient's safety in cardiac catheterization and total knowledge in post and follow up phases while most of them had unsatisfactory knowledge

level on preprogram implementation. This finding was consistent with ElGazzar & Keshk, (2018) who found that the majority of nurses had a highly satisfactory level of knowledge about patient safety on cardiac catheterization post implementation the learning guideline. Although their level of knowledge was not good on pretest. In the same line, Khaliel et al., (2020) revealed that more than half of studied nurses had unsatisfactory level of total knowledge regarding patient's safety measures on pretest but on post test the percentage of nurses who had high knowledge increased. From researcher's view this result indicated that patient's safety educational program was effective in improving nurses' knowledge level.

Results of the current study revealed that the majority of studied nurses had significant improvement in the level of knowledge mean score in post program implementation phase and in the follow-up phase than preprogram implementation phase. These results were in the same line with Rajesh,

(2018) who indicated that the pretest mean score of knowledge was 17.57 and the posttest mean score was 32.23, the mean of improvement was found to be statistically highly significant at $p<0.001$ level. These findings were supported by Shini et al., (2018) who reported that the mean score of knowledge after educational protocol was higher than mean score before implementation of educational program about the management of patients with coronary angioplasty.

The current study showed that the majority of studied nurses had unsatisfactory performance level regarding nursing intervention (pre, intra and post) cardiac catheterization procedure preprogram implementation. While most of them had satisfactory performance level in the post, follow-up phases and there was a highly statistically significant improvement in nurses' performance level post program implementation. These findings were in the line with the results obtained by ElGazzar & Keshk, (2018) who conducted a study about creating learning guidelines for nurses caring for patient's safety before, during or after cardiac catheterization in post than pre implementation educational protocol in all domains of care. Also, this result was supported by Ali & Ali, (2019) who found that there was a statistically significant difference between nurse's practice during, pre and post program implementation, indicating that all of them had inadequate level of practice preprogram & more than half of them had adequate level during post program implementation.

On the other hand, these findings contradicted with Abo El-ata et al., (2020) who reported that more than half of studied nurses had satisfactory practices regarding care of patients undergoing cardiac catheterization before and after the procedure. In addition, more than three quarters of them also had satisfactory practice regarding practice during cardiac catheterization. From the researcher point of view, the enhancement of nurses' performance after program might be due to the effect of implemented program. Nurses' young age, repetition, imitation and experience could enhance learning.

The current study showed that there was highly statistically significant improvement in nurses' performance about cardiac catheterization procedure mean score in post and follow up phase post program implementation than preprogram implementation phase. This result was supported by Rajesh, (2018) who found that the pretest mean score of practice was 8.07 and the posttest mean score was 15.77. Also in the same line with khaliel et al., (2020) who revealed that more than two thirds of the studied nurses had incomplete level of practice scores related to patient's safety measures in cardiac catheterization unit. From the researcher' s point of view this improvement in mean performance score was related to the readiness of nursing staff to improve their practice and accept any recent guidelines regarding their performance,

The current study revealed that knowledge score was high post intervention was significantly among the age of 25 – <35 Y or 35 - <45 Y due to the higher level of education. These findings supported by Hasballah et al., (2019) who found that the association between nurse's knowledge and some socio- demographic characteristics of the sample for 40 nurses is significant relationship among age groups, and level of education with nurse's knowledge. This result showed that qualification has great effect on the nurses' knowledge. This was inconsistent with Feroze, et al, (2017), Hassan, (2017),

Younus, (2018) whofound no statistical significant differences between knowledge score of nurses having different level of education, and years of experience in nursing profession.

Also, the highest performance score was among nurses age of 25 – <35 Y or 45 - ≥ 55 Y and a higher level of education. This was supported by Henedy & El-Sayad , (2019) who revealed that there were statistical significant differences among nurses' educational levels regarding knowledge and practice as baccalaureate nurses had higher knowledge and practice scores than diploma and technical institute nurses. Also, these results agreed with El-Solan &Badawy, (2017) who showed that there was a highly statistically significant relation between nurse's knowledge, practice and their socio demographic data such as level of education.

In this study there was positive correlation between total nurses' knowledge and total performance scores which means that if nurses' knowledge is adequate the nurses' performance will be improve. These findings are supported by Jabr et al., (2022) who revealed that there was a statistical significant positive correlation between knowledge score and practice score. Additionally, this result was in the same line with khaliel et al., (2020) who revealed that there was a positive correlation between total nurse's knowledge and total practice scores,It also agreed with Ali & Ali, (2019) who showed that there was positive and significant correlation between nurse's knowledge and practice post program implementation.

## Conclusions:

There was highly statistically significant improvement in nurses' knowledge and performance level immediate post patient's safety educational program implementation and in follow up phase 3 months post program implementation compared to preprogram implementation. So, patient's safety educational program is effective in improving nurses' knowledge and performance for patients undergoing cardiac catheterization.

## Recommendation:

Based on the findings of this study, the following recommendations are derived and suggested:
▪ Cardiac catheterization units should be equiped with simple illustrated guidelines protocol covering cardiac catheterization procedure performance and knowledge pre/post cardiac catheterization.
▪ Continuous training courses should be implemented for cardiac nurses to update their knowledge and performance regarding to patient's safety.

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