

## Effect of Developing and Implementing Nursing Care Standards on outcome of Patients Undergoing Cardiac Catheterization

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**Abstract: Background:** Cardiac catheterization is an invasive procedure indicated in a wide variety of circumstances. It is used for diagnostic evaluation and therapeutic intervention in the management of patients with cardiac diseases.

**Aims of the study:** this study aimed to, assess and develop nursing care standards for cardiac patients. And evaluate the effect of implementing nursing care standards on nurse's knowledge, practice and patient out come.

**Research design:** Quasi-experimental research design was utilized.

**Setting:** cardiac catheterization unit, Assiut University Hospital

**Subjects:** Convenience sample including all nurses 24 working in cardiac catheter unit who are willing to participate in the study and 100 patients who had cardiac catheterization 50 patient pre and 50 post implementing the nursing care standards.

**Tools:** Structured interview questionnaires sheet, An observation checklist sheet and Cardiac catheterization patient's assessment sheet.

**Results:** good improvement in the mean knowledge and practice scores was found and post cardiac catheterization complications were reduced after implementation of the nursing care standards. **Conclusion:** cardiac catheterization patients are exposed to several complications, improving nurses' knowledge and practice can have favorable effect on the incidence of these complications. **Recommendations:** Nurses are need for in-service training programs and refreshing courses to improve their knowledge.

**Keywords:** Cardiac catheterization, cardiac diseases

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### I. Introduction

Coronary Artery Disease (CAD) has been remaining the first killer and the major cause of public health problems in the world, which is one of the most common causes of morbidity and mortality in different communities. Moreover, CAD is the main cause of death in the United States of America among human adults representing approximately one-third of all deaths, who are over the age of 35years (Hadaegh et al., 2015).

Cardiac catheterization is an invasive procedure indicated in a wide variety of circumstances. It is used for diagnostic evaluation and therapeutic intervention in the management of patients with cardiac diseases (Susan and Erikas, 2014).

Cardiac catheterization is done to evaluate ventricular and valvular performance and for purposes of angiography to determine the patency of the coronary arteries and measuring the pressures and oxygen saturation in the four heart chambers making possible the measurement of intra cardiac pressure, injection of radiographic contrast material dyes to visualize the heart and coronary arteries and may be performed to evaluate their structure or function (Robert, 2014 and Susan & Erikas, 2014).

Today cardiac catheterization became a routine procedure in the hospitals. More than 6 million cardiac catheterizations were performed each year in the United States (American Heart Association, 2014) According to statistical records of cardiac catheterization department at Assiut University Hospital an average of 18000 cardiac catheterization were done in the last ten years (Statistical Record of Assiut University Hospital, 2015).

Cardiac catheterization is a relatively safe procedure, the potential risk of major complications during cardiac catheterization ranges from 0.14% to 0.25% and the major complication of cardiac catheterization is vascular including bleeding, hematoma formation, thrombus, pseudoaneurysm, arteriovenous fistula and infection (Brounwald, 2014).

Nursing care for patients undergoing cardiac catheterization requires an expert nurse who understands the types of complications that can occur, as well as the assessment skills to spot them. The combination of nursing knowledge and skills during the period before and after cardiac catheterization aims to assure safe and accurate procedure, and improving physical and mental health (Smeltzer et al., 2014).

Patients' education before cardiac catheterization is very important; the nurse should explain the procedure to the patients. A visit to the catheterization laboratory is also required and patients should watch a video of the procedure. The nurse's role is not only concerned with implementation of patient teaching but also monitoring and caring for the patient post cardiac catheterization to prevent complications (Suzanne, 2016).

Nursing care standards are professional nursing activities demonstrated by the nurse through the nursing process. Standards may be defined as "a benchmark of achievement which is based on a desired level of excellence". Standards of care measure the degree of excellence in nursing care and describe a competent level of nursing care. All standards of practice provide a guide to the knowledge, skills, judgment and attitudes that are needed to practice safety (McMahon et al., 2014).

### **Significance of the Study:**

Cardiac Catheterization is a dramatic event and generally accepted as a stressful process, which is a source of stress for patient and families. Cardiac catheterization nursing care standard is a major concern to all health care team, also helps such group of patients to receive nursing standard of care which help in minimizing post cardiac catheterization complications. Therefore, the present study will attempt to establish standards of nursing care for patients undergoing cardiac catheterization. In catheterization unit at Assiut University Hospital, about 300 patients' cardiac catheterizations are scheduled for monthly (Assiut university hospital records, 2015).

### **Aim of the Study**

#### **The aims of this study were to:**

- 1- Assess nurse's knowledge and practice regarding patients undergoing cardiac catheterization.
- 2- Develop nursing care standards for cardiac catheterization patients.
- 3- Evaluate the effect of implementing the developed nursing care standards on nurse's knowledge, practice and patient out come.

### **Research hypotheses:**

To fulfill the aim of the study, the following hypotheses were formulated:

- 1-The post mean knowledge score of nurses who will be exposed to develop nursing care standards will be higher than their pre mean knowledge scores.
- 2-The post mean practice scores of nurses who will be exposed to develop nursing care standards will be higher than their pre mean practice score.
- 3-The post cardiac catheterization complications for patients cared by nurses after nursing care standards implementation will be lesser than that developed pre-implementation.
- 4-A positive relationship will exist between knowledge and practice score obtained by nurses receiving the developed nursing care standards.

## **II. Material and Methods:**

### **Research design:**

Quasi-experimental research design was utilized in this study. This design is used to explain relationship, clarify certain events happened or both. This design is also a mean of examining causal relationship; quasi-experimental design has insufficient control when compared with experimental design in at least one of three areas: (1) Manipulation of the treatment variables; (2) Manipulation of setting; or (3) Selection of subjects. In clinical nursing studies, subjects are frequently not randomly selected but are samples of convenience. Thus, nurse researchers conduct more quasi-experimental studies.

### **Study variables:**

The independent variable in this study is the developed nursing care standards while the dependent variables are: nurse's knowledge, practices, and patient outcome. The present study was portrayed under topics as the following; Technical design, operational design administrative design, and statistical design.

### **Technical design:**

#### **Setting:**

The study was conducted in the cardiac catheterization unit at Assiut University Hospital.

**Study subjects:**

A convenience sample of all available nurses (24 nurses) working in the selected setting (cardiac catheterization unit) and are willing to participate in the study and 100 patients undergoing coronary catheterization (50 patients pre and 50 patients post) application of the developed nursing care standards.

**Patients were selected according to the following criteria:**

- 1-Age range between 18 to 65 years.
- 2- Diagnosed with coronary artery disease.
- 3- Free from other diseases such as infectious disease
- 4-Both sexes (male and female).

**Study tools:**

Data pertinent to the study were collected, utilizing the following four tools:

**Tool 1- Pre/post-test structured interview questionnaire sheet for nurses:**

It was used prior to implementation of nursing care standards to measure the exact knowledge level of nurses regarding cardiac catheterization and immediately post implementation of the nursing care standards (immediate post-test). It consists of three main parts:

- Part I: includes socio- demographic characteristics of the study sample (age, marital status, qualification, years of experiences, and attendances of training programmers.
- Part II: Assess nurse's level of knowledge as regard to: a- Heart and coronary arteries disease.
- Part III: Regard to nursing care for patients undergoing before, during, after cardiac catheterization, structured interview questionnaire sheet was administered by the researcher to the nurses for answering all its components then collected.

**Scoring system:** The total score for all items was 84. Each right answer was given two degrees. Those who obtained less than 50% were considered having unsatisfactory level of knowledge. While those who obtained from 50% or more considered having satisfactory level of knowledge.

**Tool II-Observation checklist sheet:**

This tool was used pre and immediately post implementation of the nursing care standards to evaluate the effect of the developed nursing care standards on nurses' practice. It consists of three parts:

**Part (1):** Preoperative preparations.

- Preoperative nursing care are met individually for each patient.

**Part (2):** Intra operative procedures which include infection control measures such as:

- Principles of aseptic technique.
- Surgical hand washing.
- Applying a sterile glove.
- Wearing mask.
- Wearing gown.
- Nursing care during surgery.

**Part (3):** Postoperative procedures:

- Immediate postoperative nursing care for cardiac catheterization patients.
- Assessing and monitoring vital signs (temperature, pulse and blood pressure).
- Instructing patient on coughing and deep breathing exercise.
- Peripheral venous catheter insertion.
- Patient's instructions before discharge.

**Scoring system:** Each item was observed, categorized, and scored as follow: two for each step that was done correct (correctly, in time and with the required frequency) and one for each step done incorrect (incorrectly, not in time and without the required frequency) and zero for step that not done. Inapplicable means that the nurses were not able to apply the principles of the standard due to shortage in supplies and equipment, not due to shortage or negligence from the nurses. The total score for all items was 480. Those who scored less than (50%) were considered having inadequate level, above (50%) were considered having adequate level of practice.

**Tool III-Cardiac catheterization patient's assessment sheet:**

It was used to assess expected complications that might develop among patients of coronary artery diseases admitted to the cardiac catheterization unit pre and post implementation of the nursing care standards in addition to some selected biosocial characteristics for patients. It consisted of three parts:

**Part I:** includes the socio-demographic characteristics of the study sample 100 patients (e.g., age, sex, marital status, education and occupations).

**Part II:** Assess the patient physically and psychologically.

**Part III:** Assess the patient's post-operative/ post catheter complications.

**Tool IV: The nursing care standards booklet:**

The nursing care standards was developed by the researcher based on nurses and patients' needs assessment, literature review, researcher experience and opinions of the medical and nursing expertise. The teaching booklet was revised and modified based on the expertise comments; it was written in Arabic using simple language with illustrations and it was concerning knowledge about:

- Brief illustration of the anatomy and physiology of the heart and coronary arteries.
- Information about coronary artery disease (definition, risk factors, and management).
- Information about cardiac catheterization (definition, types, indications, complications... etc.).
- Information about medical therapy before and after cardiac catheterization, life style modifications, the importance of follow up and when it is necessary to seek medical help and immediately go to the hospital.

**Basic nursing competencies for patients undergoing cardiac catheterization. This tool covered 9 major broad competencies which were further subdivided into sub competencies:**

- 1-Ensure that pre-operative care is met individually for each patient.
- 2-Ensure that infection control is properly followed in the operating catheterization lab.
- 3-Ensure sufficient nursing care for every patient during catheterization.
- 4-Ensure that postoperative criteria are met for each patient.
- 5-Ensure that continuous monitoring and recording are followed after cardiac catheterization.
- 6-Ensure patient is properly educated before discharge.
- 7-Ensure that safety for each patient during transportation from operating room to intensive care unit.
- 8-Ensure that all staff (health team) follows ethics and patient rights in the catheterization unit.
- 9-Ensure that nurses are following professionalism.

**Operational design:**

**Pilot study:**

A pilot study was implemented on 10% of the total study subjects to test the tools. Analyses of the pilot study revealed that minimal modifications are required. These modifications were done and the subjects were not excluded in the actual study.

**Methods:**

A structured interview was utilized to fill out the questionnaire sheet (tool I). Observation technique was utilized to fill out the check list for practice of nurses (tool II), cardiac catheterization assessment sheet (tool III), as well as nursing care standards booklet (tool IV).

**Protection of human rights:**

An official permission to conduct the study was obtained by the researcher from the head of the cardiac catheterization unit at Assiut university hospital. Nurses and patient were formed of the purpose and nature of the study. The investigator emphasized that the participation is voluntary and confidentiality and anonymity of the subjects will be assured through coding all of data.

**Procedure:**

The study was carried out on 3 phases:

**Phase 1:** (Preparatory phase):

A review of current and past, local and international related literature in the various aspects of the problems using books, articles, periodicals, and magazines was done. The proposed study setting was assessed for the number of nurses and patients. This phase ended by a pilot study.

**Content validity:**

It was established by panel of 5 expertises who reviewed the instruments for clarity, relevance, comprehensiveness, understanding, applicability and easiness, minor modifications were required.

**Phase 2:** (Planning phase):

Based on findings of the exploratory phase, the nursing care standard was developed, after extensive literature review considering nurses needs and their levels of understanding.

**Phase 3: (Implementation phase):**

Data were collected from the cardiac catheterization unit at Assiut University Hospital during one year. The purpose of the study was explained to the nurses prior to answering the questions. The study was carried out at morning, and afternoon shifts.

At initial interview the researcher introduced herself to initiate line of communication, explain the nature and purpose of the developed nursing care standards and fill out the structured interview sheet (tool I) to assess nurse's knowledge pre-implementation of the nursing care standards and the researcher filled out the observation checklist sheet (tool II) to assess nurse's practice pre-implementation of nursing care standards.

Also, the researcher scheduled with them the teaching sessions for both theory and practice and the nurses were divided into small groups, each group contains 1-2 nurses. Teaching has been implemented for nurses in terms of sessions and teaching on the spot during their official working hours, there were a total of 10 sessions. Number of nurses in each session 1-2 nurses, the duration of each session was 30-45 minutes, including 10 minutes for discussion and feedback. Each session usually started by a summary of what has been taught during the previous sessions and the objectives of the new topics. Feedback and reinforcement of the developed nursing care standards was performed according to nurses needs to ensure their understanding.

Also, the researcher explained the nature and purpose of the developed nursing care standards to the selected patients who are willing to participate in the study and filled out the patient assessment sheet (tool III). Each nurse obtained a copy of the developed nursing care standards booklet that included all the training contents.

**Phase 4: (Evaluation phase):**

The effect of the developed nursing care standards on patient's outcome was reached through comparing level of nurse's knowledge and practice pre and post implementing the nursing care standards has been evaluated by the researcher through filling the study tool (I, II).

**Administrative design:**

Permission to carry out the study was obtained from the responsible hospital authorities of the catheterization unit at Assiut University Hospital, after explaining the aim of the study and the developed nursing care standards to obtain their cooperation.

**Statistical analysis:**

Data entry and data analysis were done using SPSS version 19 (Statistical Package for Social Science). Data were presented as number, percentage, mean, standard deviation. Chi-square test was used to compare between qualitative variables. An independent sample t-test was used to compare quantitative variables between two groups and ANOVA test was done for more than two groups. Paired samples t-test was used to compare quantitative variables between pre-test and post-test. Pearson correlation was done to measure correlation between quantitative variables. P-value considered statistically significant when  $P < 0.05$ .

**Limitation of the study:**

- 1- It was difficult to recruit all nurses together at the same time to attend the teaching sessions.
- 2- Implementation of the developed nursing care standards by the researcher took long periods of time, the researcher spent more time waiting while nurses attend the teaching sessions during the workload activities.
- 3- Implementation of the developed nursing care standards by the researcher carried out during the nurses' working hours.
- 4- Hospital policy prevents health insurance for a period of time and high mortality rate of patients in this period. Therefore, the researcher took a long period of time to collect data from patients.

### III. Results:

**Table (1):** Frequency distribution of socio-demographic characteristics of the studied nurses (n=24).

Characteristics	Frequency (n= 24)	
	N.	%
<b>Age: (years)</b>		
• < 20	7	29.2
• 20 – 30	7	29.2
• > 30	10	41.7
Mean ± SD	30.29 ± 7.02	
<b>Sex:</b>		
• Male	3	12.5
• Female	21	87.5
<b>Marital status:</b>		
• Single	8	33.3
• Married	16	66.7
<b>Level of education:</b>		
• Nursing diploma	15	62.5
• Technical institute of nursing	5	20.8
• Baccalaureate degree of nursing	4	16.7
<b>Years of experience:</b>		
• < 3	6	25.0
• 3 - < 5	5	20.8
• 5 - < 10	10	41.7
• ≥ 10	3	12.5
Mean ± SD	7.18 ± 4.25	
<b>Previously Attended training courses related to cardiac catheterization and heart diseases:</b>		
• Yes	3	12.5
• No	21	87.5

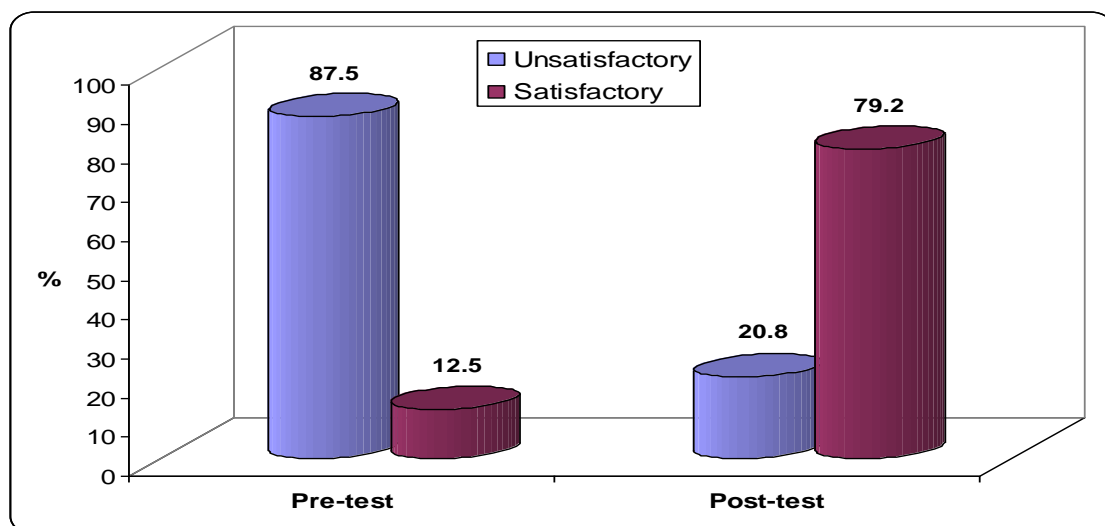
This table shows that; the highest percent of nurses (41.7%) their age was more than 30years and have diploma degree; (62.5%), (66.7%) of them were married, their years of experience ranged from 5 to 10years (41.7%) with mean of (7.18±4.25) years. The majority of nurses (87.5%) had no in-service training courses related to cardiac catheterization and heart disease.

**Table (2):** Total mean knowledge scores obtained by nurses pre and post implementing nursing care standards for patients undergoing cardiac catheterization (n=24).

Knowledge items	Maximum score	Pre-test	Post-test	P-value
<b>Knowledge about anatomy of heart and coronary artery disease, cardiac catheterization</b>	32			0.0001***
Mean ± SD		13.00 ± 2.70	30.79 ± 1.56	
Range		7.0 - 19.0	26.0 - 32.0	
<b>Knowledge about nursing care of patients before undergoing cardiac catheterization:</b>	8			0.0001***
Mean ± SD		3.08 ± 1.89	7.83 ± 0.48	
Range		0.0 - 6.0	6.0 - 8.0	
<b>Knowledge about nursing care of patients during cardiac catheterization:</b>	18			0.0001***
Mean ± SD		7.88 ± 0.90	17.29 ± 1.00	
Range		6.0 - 10.0	14.0 - 18.0	
<b>Knowledge about nursing care of patients after cardiac catheterization:</b>	26			0.0001***
Mean ± SD		9.88 ± 1.23	25.17 ± 1.31	
Range		7.0 - 12.0	21.0 - 26.0	
<b>Total score of knowledge:</b>	84			0.0001***
Mean ± SD		33.83 ± 4.65	81.08 ± 3.40	
Range		23.0 - 46.0	69.0 - 84.0	

\*\*\*: Highly significant

This table shows that there was a highly statistically significant difference between knowledge scores of nurses' pre & post implementing nursing care standards.



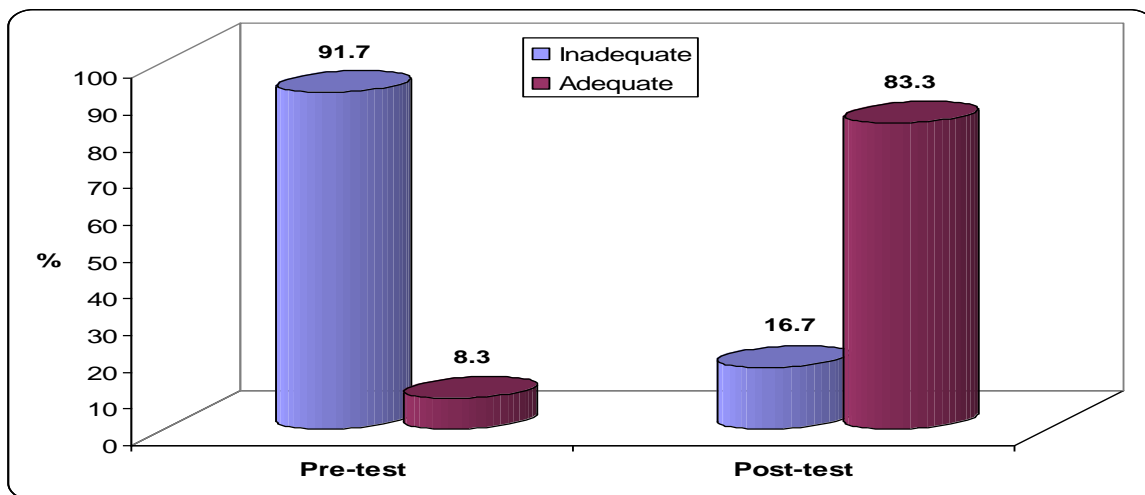
**Figure (1):** Comparison between the studied nurses regarding knowledge level pre and post implementing nursing care standards for patients undergoing cardiac catheterization.

**Table (4):** Total mean practice scores obtained by nurses pre and post implementing nursing care standards for patients undergoing cardiac catheterization (n=24).

Nurses practice	Maximum score	Pre test	Post test	P-value
<b>Efficient pre-operative care:</b>				
Mean ± SD	38	7.13 ± 2.01	35.75 ± 1.45	0.0001***
Range		4.0 - 11.0	32.0 - 38.0	
<b>Peripheral venous catheter:</b>				
Mean ± SD	44	9.63 ± 2.24	43.58 ± 0.58	0.0001***
Range		3.0 - 13.0	42.0 - 44.0	
<b>Coughing:</b>				
Mean ± SD	26	3.92 ± 1.38	25.21 ± 1.10	0.0001***
Range		1.0 - 7.0	23.0 - 26.0	
<b>Ensure continuous monitoring:</b>				
Mean ± SD	102	34.21 ± 6.31	100.79 ± 1.22	0.0001***
Range		17.0 - 45.0	98.0 - 102.0	
<b>Infection control measures:</b>				
Mean ± SD	112	31.46 ± 7.42	110.88 ± 1.15	0.0001***
Range		11.0 - 46.0	108.0 - 112.0	
<b>Efficient nursing care during surgery:</b>				
Mean ± SD	32	11.42 ± 4.28	31.88 ± 0.45	0.0001***
Range		1.0 - 21.0	30.0 - 32.0	
<b>Post-operative criteria:</b>				
Mean ± SD	36	3.21 ± 1.56	34.88 ± 0.85	0.0001***
Range		1.0 - 6.0	33.0 - 36.0	
<b>Educating patients before discharge:</b>				
Mean ± SD	72	5.21 ± 4.96	71.63 ± 0.88	0.0001***
Range		0.0 - 18.0	68.0 - 72.0	
<b>Ensure the nurses are follow professionalism:</b>				
Mean ± SD	18	4.77 ± 1.26	13.80 ± 3.43	0.0001***
Range		0.0 - 7.0	6.0 - 17.0	
<b>Total score of performance:</b>				
Mean ± SD	480	111.97 ± 17.89	466.27 ± 5.42	0.0001***
Range		56.0 - 158.0	442.0 - 476.0	

\*\*\*Highly significant

This table illustrates that there was a highly statistically significant difference regarding all items of nursing practice pre & post implementing the nursing care standards for patients' cardiac catheterization.



**Figure (2):** Comparison between the studied nurses regarding practice level pre and post implementation of the nursing care standards for patients undergoing cardiac catheterization.

**Table (5):** Relation between nurse’s knowledge and their practice scores post implementing nursing care standards for patients undergoing cardiac catheterization.

Knowledge score	Practice score				P-value
	Inadequate (n= 4)		Adequate (n= 20)		
	N.	%	N.	%	
• Unsatisfactory	3	75.0	2	10.0	0.018**
• Satisfactory	1	25.0	18	90.0	

\*\*High significant

This table shows that; there was a high statistical significant difference between nurse’s knowledge and their practice scores post implementation of the nursing care standards ( $p < 0.018$ ).

**Table (6):** Frequency distribution of the studied patients according to socio-demographic characteristics (100)

Characteristics	No. (n= 100)	%
<b>Age: (years)</b>		
< 40	34	34.0
40 – 50	42	42.0
> 50	24	24.0
Mean ± SD (Range)	42.54 ± 10.82 (18.0 – 66.0)	
<b>Sex:</b>		
Male	71	71.0
Female	29	29.0
<b>Marital status:</b>		
Single	9	9.0
Married	91	91.0
<b>Level of education:</b>		
High education	42	42.0
Secondary	31	31.0
Basic education	13	13.0
Read and write	7	7.0
Illiterate	7	7.0
<b>Occupation:</b>		
Mental work	54	54.0
Manual work	31	31.0
No work	15	15.0

This table shows that; the highest percent of the studied patients (42%) their age ranged from 40-50 years with mean of (42.54 ± 10.82), more than half of them were male; the majority of them (91%) were married, (42%) were highly educated and more than half of them were mental workers (54%).



**Table (7):** Frequency distribution of the studied patients as regard physical assessment. (n=100).

Items	Frequency (n= 100)	
	N.	%
<b>-Presenting symptoms:</b>		
• Chest discomfort	46	46.0
• Shortness of breath	6	6.0
• Palpitations (irregular heartbeats)	3	3.0
• Weakness or dizziness	18	18.0
• Nausea	4	4.0
• Sweating	24	24.0
<b>-Risk factors:</b>		
• Hypertension	15	15.0
• Smoking	44	44.0
• Diabetes Mellitus	15	15.0
<b>-Medical and surgical history:</b>		
• Heart failure	0	0.0
• Coronary artery disease	60	60.0
• Myocardial infarction	35	35.0
• Valvular Heart disease	2	2.0
<b>-Previous surgical intervention:</b>		
• Coronary artery bypass grafting	3	3.0
<b>-Body mass index categories:</b>		
• Normal	13	13.0
• Overweight	69	69.0
• Obese	18	18.0
<b>-Nutritional status</b>	Mean ± SD	Range
* Weight (Kg)	78.62 ± 10.08	55.0 – 100.0
* Height (Cm)	168.18 ± 6.62	160.0 – 185.0
* BMI (Kg/cm <sup>2</sup> )	21.5 ± 35.2	27.74 ± 2.61

**This table illustrates that; regarding to presenting symptoms:**

Nearly half of patients (46%) were having chest discomfort. Regarding to risk factors (44%) were smokers. Regarding to medical and surgical history (60%) was having coronary artery disease. Regarding body mass index (69%) of patients were overweight.

**Table (8):** Frequency distribution of the studied sample according to postoperative complications pre and post implementing nursing care standards.

Variables	Pre (n= 50)		Post (n= 50)		P-value
	N.	%	N.	%	
<b>1- Local complications:</b>					
*Allergic reaction at insertion site from the dye	4	8.0	0	0.0	0.117
*Bleeding	14	28.0	10	20.0	0.349
*Hematoma	14	28.0	12	24.0	0.648
<b>2-Systemic complications:</b>					
<b>a-Circulatory complications:</b>					
*Bleeding at the catheter insertion site	6	12.0	0	0.0	0.027**
*Hematoma / AV aneurysm	10	20.0	0	0.0	0.0001***
*Arm hematoma	7	14.0	1	2.0	0.059*
*Chest pain or discomfort/ readmitted to CCU	7	14.0	5	10.0	0.538
*Perforation	1	2.0	0	0.0	0.315
<b>b-Urinary complications:</b>					
*Urinary retention	21	42.0	9	18.0	0.009**
<b>c-Gastrointestinal complications:</b>					
*Nausea and/or vomiting	37	74.0	26	52.0	0.023**
<b>d-Allergic reaction to the dye:</b>					
*Itching	5	10.0	1	2.0	0.204
*Flushing	2	4.0	2	4.0	1.000
*Allergy	7	14.0	2	4.0	0.160
*Chest pain	22	44.0	11	22.0	0.019**
<b>3-Late complications:</b>					
*Fever and/or chills	1	2.0	0	0.0	0.315
*Increased pain, redness, swelling, bleeding or other drainage from the insertion site	11	22.0	0	0.0	0.0001***
*Coolness, numbness and/or tingling, or other changes in the	1	2.0	0	0.0	0.315

affected extremity					
*Chest pain/ pressure, profuse sweating, dizziness, and/ or fainting	8	16.0	3	6.0	0.110
*Radial artery occlusion	10	20.0	3	6.0	0.037**

This table revealed that; there was a highly statistical significant difference between pre and post implementing of nursing care standards regarding circulatory, urinary, gastrointestinal, allergic reaction to the dye and incidence of late complications.

#### IV. Discussion:

The study results indicated, that the majority of nurses their age was more than 30 years, were female and having a nursing diploma was the highest proportion, nearly half of them, their experience ranged from 5 to 10 years and the majority of them have no in service training courses related to cardiac catheterization.

The previous result is contradicted with **Norush et al., (2014)**; who stated that health care provision of, requires in-service training programmers for nurses. Also **David, (2006)**; stated that continuing professional development by education and training after the point of qualification and or registration help nurses in improvement of patient care and enables professional nurse practitioners to provide quality nursing care and service delivery to their patients.

As regard nurse’s knowledge, the current study showed that, pre implementing nursing care standards there was unsatisfactory level of nurse’s knowledge about anatomy of the heart, coronary arteries and standards of care patients for undergoing cardiac catheterization, which reflects the lack in their scientific preparation. Post implementation of the nursing care standards there was an improvement in the nurses’ level of knowledge regarding the care offered to cardiac catheterization patients. The findings indicated that there was good improvement in the mean knowledge scores after implementing nursing care standards.

So, we can conclude from the data collected and analysis in the present study that all studied nurses weren’t properly prepared prior to their working and /or dealing with cardiac catheterization patients and they got their experience while being there, working and managing the patients in the real life emergency situations.

Post implementing nursing care standards, level of nurses’ knowledge regarding cardiac catheterization was significantly improved. This improvement might be related to the fact that all nurses were in young age and this age might have good readiness for learning new things. Furthermore, this was in accordance with **Evens, (2006)**; who discovered that knowledge could be obtained through basic and continuing education, training, personal experience, and in-service training.

Also the present study showed highly significant relation between nurse’s level of knowledge and practice post implementing nursing care standards. This finding indicated that skills can be easily improved, especially if linked with their scientific base of knowledge. This result was supported by **Youssef, (2007)**; in congruence with the current study findings conducted a study at the reconstructive microsurgical and traumatology care units in Assiut University Hospital. Entitled “Microvascular free tissue transfer surgeries, impact of a designed teaching protocol on nurse’s knowledge, practice and patient’s outcome” which revealed an improvement in nurse’s practice after the attendance of continuing nursing education sessions. Research findings indicated that continued nursing education programs increase both knowledge practice and can also improve attitudes.

The present study showed significant difference between total nurses’ knowledge score with their years of experience in relation to pre and post implementing nursing care standards and attendance of training program about care of patient undergoing cardiac catheterization. Attending training program about care of patient undergoing cardiac catheterization help nurses to gain more knowledge about how to provide safe care and prevent or reduce postoperative complications that may occur.

As well, **National Institute for Clinical Excellence, (2012)**; stated that nurses with many years of experience may require minimum of additional instruction before they are ready to take a patient assignment, nurses working in one clinical specialty may need moderate amount of instructions to acquire through training program.

The current study revealed a great improvement in the level of nurse’s practice post implementing nursing care standards in all items. This has been concluded by the presence of significant differences between results of pre and post implementation of the nursing care standards. This finding indicated that skills can be easily improved especially if linked with their relevant scientific base of knowledge.

In this respect, **Sherwood, (1996)**; reported an improvement in nurses’ practice after the attendance of continuing nursing education sessions. Research findings indicated that continued nursing education programs increase both knowledge and performance and can also improve attitudes. As well, **Abd-Alla, (2000)**; documented that the in service training program has a beneficial effect on improving nurses’ knowledge and skills. They also recommended the organization of educational programs according to the need of nurses with continuous evaluation.

The present study showed that age was relation with all items of nursing care through the study period except immediately post implementing nursing care standards. However, nurse's experience was found to be relation with total practice scores through all the study periods. This means that young nurses might have good readiness for learning and practicing new things as well as their awareness about the continuing education is higher than those who were old age. This result agrees with that of **Ghanem, (1997)**; who reported a statistically significant correlation between nurse's performance scores and their duration of experience.

As regard instructions before discharge for patients who underwent cardiac catheterization, the present study revealed that, before implementing of the standard nurses did not have any background or information about, postoperative nursing care and discharge instructions. Post implementation there were significant improvement in nurses' level of knowledge and practice about postoperative care and discharge instructions.

As well, **Zilling and lithner, (2013)**; illustrated that patients must be prepared for discharge by providing them with physical support before leaving hospital to increase their awareness through explanation of simple instructions about their life style changes. According to **Pudner, (2015)**; prior to patient's discharge, they will need advice as to how their wound should be managed at home. The patient will need to be given information for fluid, activity, wound care, healing and well educated before discharge about warning signs and symptoms.

The study patients' characteristics revealed that regarding age ranged between 30-65 years old in pre and post implementation of the nursing care standards group. In the same line, **Anderson et al. (2015)**; mentioned that the number of cardiac catheterization is more common in patient aged 40-65 years.

As regards gender, in the current study, more than half of the patients were male. This result comes in agreement with **Susan and Erikas (2014)**; who mentioned that, sixty seven percent of the studied patients were male.

However, this result disagrees with **Rosemary et al. (2015)**; who mentioned that the majority of participated patients with cardiac catheterization were female. Furthermore, the findings of the present study showed that, the prevalence of cardiac catheterization was greater in males than females. This result agrees with **Morton et al., (2013)**; who found that men have a greater rate of cardiac catheterization than women.

As regard to their occupation most of patients were employee. This study finding was supported by **Emran and weatherly, (2004)**; who reported that physical activity and loading, as lifting heavy objects can cause exertional angina.

In the same context, results showed that, the majority of subjects had chest pain and sweating these results were in line with **Chernecky and Berge, (2014)**; who reported that, all patients with cardiac disease complained from chest pain.

Concerning preoperative risk factors, the study showed that nearly half of patients were smokers. This result comes in agreement with, **Kern, (2015)**; who mentioned that, the majority of sample in study and control groups were smokers and smoking is considered one of the risk factors for sternal surgical site infection. However, this result disagrees with **Azer, (2011)**; who stated that more than two thirds of the study and control groups were non-smokers.

Regarding to body mass index study findings indicate that more than half of patients were overweight. This result agrees with **Karimi et al., (2009)**; who reported that patients were overweight with a body mass index more than or equal 12.0kg/m<sup>2</sup>. This result agrees with **Diab, (2012)**; who reported that, more than one-third of patients had desirable weight and more than one- fourth were obese. As well, this result agrees with **Azer, (2011)**; who reported that two thirds in the study and more than one third in the control group were having standard level of weight.

As regard cardiac catheterization complications in the present study, it was found that the incidence of cardiac catheterization surgery complications post implementing of the nursing care standards was lesser than pre implementation. The most common complications which occurred pre implementation of the nursing care standards were bleeding, hematoma, urinary retention, chest pain, redness, radial artery occlusion, nausea and vomiting.

This result agrees with **Olsen et al., (2012)**; who reported that one of the major complications after cardiac catheterization were bleeding, hematoma, urinary retention, chest pain increased pain, swelling, flushing, allergy, redness, radial artery occlusion, nausea and vomiting.

The results of the present study showed that implementing postoperative care standards help in improving patients' conditions and in reducing postoperative complications in the studied patients after application of the standard postoperative care.

Finally, it can be concluded that, developing and implementing nursing care standards for patients undergoing cardiac catheterization achieved its objectives by improving nurse's knowledge and practice. The catheterization unit nurses must constantly seek better ways to improve their care provided to the patient through implementing the developed standards of practice to ensure quality of care in a way in which they can improve their profession and they should also update these standards frequently.

## V. Conclusion & Recommendations

Nurses' knowledge and practice regarding nursing care standards for patients undergoing cardiac catheterization in catheterization unit at Assiut University Hospital were inadequate, and implementation of the nursing care standards for patients with cardiac catheterization showed a significant improvement in nurses' knowledge and practice, application of nursing care standards when dealing with cardiac catheterization patients showed a significant improvement in patient's knowledge & a lesser incidence of complications.

Based on the results of the present study, the following is recommended:

### For nurses:

- 1- Nurses should be encouraged to attend specific meetings as workshops and seminars held for coronary artery disease and cardiac catheterization to be acquainted with the most recent advances and skills in the field.
- 2- Clinical meeting should be planned periodically in order to present to all nurse's new advances in this field.
- 3- Periodic monitoring of nurse's knowledge and practice to evaluate the level of nurses working in cardiac catheterization unit.
- 4- Nurses should be aware of the preoperative identification of patients at high risk for developing complication after catheterization.

### For patients:

- 1- Patients should be provided with sufficient information on cardiac catheterization and health improvement before discharge from the hospital.

### For further and research:

- 1- Replication of this research on a larger probability sample acquired from different geographical areas in Egypt for generalization.

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