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Original Article

Impact of Implementing Nursing Practices Scheme on Postoperative Care Provided for Patients Undergoing Valvular Heart Replacement Surgery

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1.ABSTRACT

Background: Nursing practices scheme is an evidence based interdisciplinary process which has not previously been systemically applied to patients undergoing valvular heart replacement surgeries. Valvular heart replacement surgeries are excellent methods for treatment of patients with symptomatic valvular heart diseases who actually need surgery. The nursing role is considered as a crucial role for patients during postoperative to prevent further complications, minimize infection, adequate nursing care postoperatively is beneficial for speed and healthy recovery. **Aim**: to evaluate the impact of implementing nursing practice scheme on postoperative care provided for patients undergoing valvular heart replacement surgery. **Methods**: A quasi experimental design was utilized. Setting: The study was conducted at Cardiothoracic Surgery Department in Cardiothoracic and Vascular Surgery Center, at Mansoura University Hospital. **Subject**: A purposive sample of (70) nurses who cared for patients undergoing Valvular heart replacement surgeries. **Tools**: Two tools were used for data collection; a structured interview questionnaire, and observational performance checklist for applying nursing practices scheme for patients undergoing vulvular heart replacement surgeries. **Results**: The findings revealed that all studied nurses gained good knowledge and practices at 2nd observation compared to the 1st observation related to postoperative care provided for patients undergoing valvular heart replacement surgeries. Conclusion: The study concluded that nursing practices scheme had a positive effect on improving knowledge and performance among nurses at Cardiothoracic Surgery Department**. Recommendations**: Establishing educational and training courses for nurses in order to reach optimal standard of care for patients undergoing valvular heart replacement surgeries.

Keywords: Valvular heart replacement surgeries, Nursing Practices Scheme, Postoperative Care

2.Introduction:

Valvular heart replacement surgeries (VHRS) are major operations that require comprehensive care starting from hospital admission until patient discharge **(American Heart Association & Stanford Health Care, 2020).** Each year, about 275,000 operations (10% to 20% of all heart surgeries) are performed, and sometimes they are accompanied by extremely serious complications that increase in-hospital deaths from 3% to 7.4% **(Agarwal, 2015; Cardiol, 2016).**

Valvular heart diseases (VHDs) affect about 2.5% of people worldwide and increase with aging that is predicted to reach 16% of total population by 2050. About half of people aged 65 or older have some forms of VHDs; if left undiagnosed or untreated, they become severe and can lead to heart failure or death **(Coffey, et al, 2021; United Nations, 2019).** According to **Cardiothoracic Surgery Department, Mansoura University Hospital,** 155 VHRS from a total 360 open heart surgeries were carried out in 2021.

VHDs lead to some manifestations such as arrhythmia or irregular pulse, chest pressure or tightness, dyspnea, fatigue, lightheadedness, feet, ankle and abdominal swelling, activity intolerance, syncope, and occasionally bloody coughing particularly with mitral VHDs **(Heart and Stroke Foundation of Canada, 2019; Texas Heart Institute, 2020)**.

The goals of surgical intervention are to improve the quality of life of the clients by allowing them to retain cardiac functions. VHRS like other surgeries has some postoperative complications including atrial fibrillation that affects 30%–50% of cases **(O'Brien et al, 2019),** bleeding during or after operation, damage to blood vessels, pneumonia, stroke, heart attack, breathing problems, wound or valve infection, blood clots, reaction to anesthesia, pancreatitis and death **(Asian Society of Cardiovascular Imaging, 2017; Stanford Health Care, 2020).**

Nursing practices scheme focused on postoperative care that is provided for patients undergoing VHRS should cover these phases; immediate or post anesthetic, intermediate phase which encompasses hospitalization time, and convalescent phase. During the first two stages; maintenance of homeostasis, treatment of pain, and prevention and early detection of complications are main targets. The third stage is a transition period from discharge time to full recovery **(Antoniolli, Auda, Barancelli, & Barretta, 2017; Rosen, 2020).**

The nurse continues to check the patient's condition in immediate postoperative nursing care. The nurse complete initial assessment and continue to follow monitoring vital signs, cardiac monitoring, providing warmth, securing connections of tubes, administering prescribed medications, hydration, assessing pain and consciousness level, laboratory and radiological studies, early mobilization, nutrition, caring of incisions, and catheters, performing exercises, using spirometer, preparing for discharge, as well as early detection and solving of complications **(Antoniolli, et al, 2017; Bojar & Johns Hopkins Medicine & University of Michigan, 2020 & Laredo, 2021)**

Preparation for discharge is a very important component of patient care. Discharge guidelines instructions should be given to patients on all aspects of care including daily living activity, exercising, sternal precautions, incision care, diet, medications, hygienic care, sexual life, returning to work, avoiding infection, identifying abnormalities, follow up schedule, and emotional support **(Deaton & Nappe; & Otto, et al, 2021; Khowaja, 2019; Weimann et al., 2017).**

An uncomplicated postoperative course results from skilled medical and nursing management; so it is important for nurses to be aware of care with VHRS patients. There is a lack of detailed, reliable formation on how to care for VHRS patients in order to effectively investigate the adequacy of the nursing care and postoperative complications rates. Also, there is a need to identify the problems associated with the care of VHRS patients to avoid, minimize or alleviate their occurrence **(Coyne, Tubaro & Wein, 2019).**

Significance of the study:

Despite the fact that nursing care provided for VHRS patients were widely used throughout the 80s and 90s and several countries worldwide adopted their use, nursing practices scheme were not used for patients' care neither in public nor private hospitals until year 2015 when they were introduced in a private hospital at Cairo namely Dar-El-Fouad. Data generated from this study can lead to improving the existing standards of practice rendered for such patients**. According to statistical records of Cardiothoracic Surgery Department, at Mansoura University Hospital,** 155 VHRS from a total 360 open heart surgeries were carried out in 2021. For these reasons, there was an urgent need to conduct this study in Cardiothoracic Surgery Department, at Mansoura University Hospital. It is also hoped that this effort will generate attention and motivation for further studies into this topic.

Aim of the study

To evaluate the impact of implementing nursing practice scheme on postoperative care provided for patients undergoing VHRS.

Research hypotheses

The nurses will gain good knowledge and practices regarding postoperative care for patients undergoing VHRS after implementation of nursing practices scheme (N.P.S).

3. Subjects and methods

Research design: Quasi-experimental study design was utilized to carry out this study.

Setting: The study was conducted at Cardiothoracic Surgery Department in Cardiothoracic and Vascular Surgery Center, at Mansoura University Hospital that is located in delta region. The department consisted of double and multiple patients' rooms with 52 beds, and an intensive care unit containing 13 beds, in addition to medical and nursing rooms, supplies' and examination offices. The total weekly admission of all cases was 12 to 19 patients with 6 to 8 of VHDs, and an average of ten to twelve cases of VHRS each month.

Subjects: A purposive sample of (70) nurses who cared for patients undergoing VHRS.

Tools of data collection

Data was collected by two tools as the following:

- **Tool I: Structured Interview questionnaire:** This tool was developed by the researcher based on reviewing related literature **(AHA, BHF, 2020; & Stanford Medicine 2021)** and opinion of experts to evaluate general characteristics of nurses involved in study. It was written in Arabic language in the form of multiple questions and true or false questions and divided into two parts

PartI: Socio-demographic characteristics: Included age, level of education, years of

experience, current job and attendance of training programs related to the topic.

Part II: Nurses' knowledge questionnaire regarding nursing practices scheme for patients undergoing vulvular heart replacement surgery: It was constructed and reviewed by utilizing the most recent relevant literatures to assess nurses' knowledge regarding nursing practices scheme and consisted of (11) true or false questions and (25) multiple choice questions (MCQ). Answers were assessed by a model answer sheet prepared by the researcher and revised by experts; scoring (1) for right answer, and (0) for "don't know", wrong, or no answer.

Results were organized in categories as follow:

- **Good knowledge** (25-36 point) > 66,7%
- **Fair knowledge** (13-24 point) > 33,3 to ≤ 66,7%
- **Poor knowledge** (0-12 point) ≤ 33,3%

Tool II: Observational performance checklist for applying nursing practices scheme for patients undergoing vulvular heart replacement surgery: It was developed by the researcher based on recent related literature review **(Bojar, Michigan Medicine, 2020; Cardiac & Thoracic Surgery Associates, 2021)** to assess nurses actions in relation to nursing practices scheme. It included all items of care provided for patients undergoing VHRS and carried by nurses from admission till discharge at pre and postoperative phases in relation to the following three main parts: routine admission nursing care, preoperative nursing care, and postoperative nursing practices.

This part consisted of four categories including immediate postoperative nursing care, routine postoperative nursing care, observation and reporting of postoperative complications, and postoperative teaching, instructions and preparation for discharge. Scoring system for nursing practices provided for patients undergoing VHRS was "2" for "Done correct and complete", "1" for "Done correct and incomplete", and "0" for "Done incorrect or Not done".

Each item in this tool was calculated and scored on three points rating scores, and total scores for nurses practices provided for patients undergoing VHRS as follow:

- **Adequate level of practice** > 66,7%
- **Average level of practice** > 33,3 to ≤ 66,7%
- **Inadequate level of practice** ≤ 33,3%

Data was collected in ten months starting from December 2020 to October 2021.

Content validity:

Data collection tools were tested for content validity by seven experts in medical-surgical nursing, cardiothoracic surgery and biostatics affiliated to Mansoura university to assess the relevance and clearance of each item. Following experts' opinions, some items were removed while others were added, and paraphrasing was done for some questions to be clearer. The content validity index per items ranged from 0.7 to 1.0 for both relevance and clarity and accordingly needed modifications were done.

Pilot study:

A pilot study was conducted on seven nurses (10% of total sample size) who provided direct care for VHRS patients to assess clearance, relevance, and applicability of both tools. After completing the pilot study, some questions were removed as all nurses answered them correctly at 1st observation, some items were removed from the observational checklist while other items were added based on nurses' needs assessment. The nurses involved in pilot study were excluded from the main study sample.

Field work:

After completing pilot study on the appropriate number of participants, and doing necessary modifications, the main study was conducted afterward. It began with introducing myself to participants and oriented them about study's aim and sessions. The studied nurses were interviewed for the first time to complete tool I "Structured Interview Questionnaire" to assess their knowledge regarding nursing practices scheme. They were asked to complete part II from the same tool again after attending N.P.S sessions.

Each nurse was observed individually in morning and evening shifts over three to four times or until completing all care provided for patients undergoing VHRS. After observing nurses for the first time without informing them that they were being observed, a N.P.S. proposal regarding care provided for patients undergoing VHRS was illustrated to the studied nurses according to their availability (four to six nurses in each session) and previous organization with head nurses. Studied nurses were observed again during providing care for patients without informing them to assess the effectiveness of N.P.S on their performance.

The scheme required three to four sessions to be fulfilled, and each session extended for 30 to 50 minutes, with an average of 120 to 180 minutes for total timing. The first session included an overview about heart anatomy, functions and

places of valves, cardiac circulation, definition of VHDs, causes, risk factors, signs and symptoms, diagnosis, options of treatment, definition VHRS. The second session consisted of preoperative care and health education, and the third one contained postoperative care, preparation for discharge and follow up as well as quick conclusion of all items of the scheme. participants were allowed to ask and verbalize their concerns regarding the scheme and its contents.

Various learning methods were used in sessions such as interactive lectures, discussions, brainstorming, demonstration and re-demonstration, as well as different materials like colored printed booklet and Laptop for PowerPoint presentation, videos. The duration needed to complete the implementation process (data collection) including pre and post tests and observations was about ten months starting in December 2020 to October 2021.

4. Results:

Table (1) Shows percentage distribution of the studied nurses according to their socio-demographic characteristics. The results revealed that more than half of studied nurses were females(59.3%), aged from twenty five to less than thirty years old (53.7%). Half of them (50.0%) had technical nursing education, and more than half (51.9%) had less than two years of experience in the field. The majority of studied nurses (87%) didn't attend training sessions about nursing practices provided for patients undergoing VHRS.

Table (2) Shows studied nurses knowledge score and test of significance in relation to overall knowledge pre and post implementation of nursing practices scheme. It was indicated that nearly all of studied nurses (92.59%) gained good knowledge score post implementation nursing practices scheme (N.P.S) compared with (68.5%) of them had fair knowledge scores pre implementation of nursing practices scheme (N.P.S). The results revealed that there was a significant differences (P value <0.001*) in nurse's knowledge level post implementing nursing practices scheme.

Table (3) Shows studied nurses practices score percentage and test of significance in relation to assessment of providing postoperative nursing care for patients undergoing valvular heart replacement surgery during 1st and 2nd observation. The results revealed that nearly all of the studied nurses scored good practices at both observations regarding immediate and routine postoperative care. More than two thirds of studied nurses (74.1% & 72.7%) gained good practices at 2nd observation compared to (27.78% & 3.7%) respectively at 1st observation regarding observation and reporting of post-operative complications and postoperative instructions and teaching for discharge respectively.

Tables (4) Shows studied nurses practices score percentage and test of significance in relation to assessment of providing pre-discharge postoperative teaching and nursing guideline implementation for patients undergoing valvular heart replacement surgery at 1st and 2nd observation. It can be noticed that in relation to diet, more than one third of studied nurses (46.29%) gained good practices at 2nd observation compared to (9.3%) at 1st observation. As regards to hygienic instructions, more than one third of studied nurses (41.1%) gained good practices at 2nd observation compared to (3.7%) at 1st in observation. Moreover, the majority of studied nurses (85.2%) gained good practices regarding medication instructions at 2nd observation compared to less than half (44.4%) at 1st Observation. As regards to daily living activities and sternal precautions, (63.0% & 75.9%) respectively gained good practices at 2nd observation compared with (29.6%) at 1st Observation. The results revealed a statistical significant difference between 1st and 2nd observation in relation to teaching the patient to observe and report abnormalities as well as follow up.

Table (5) Shows ranking of studied nurses postoperative practices that provided for patients undergoing valvular heart replacement surgery at 1st and 2nd observations. The results indicated that maximum scores of nurses practices for immediate postoperative care during 1st and 2nd observations with Mean ± SD equal to (88.21 ± 2.85 & 95.07 ± 2.16) respectively. This followed by health education regarding follow up and sternal precautions with Mean ± SD equal to (79.88 ± 11.03 & 77.25 ± 13.39) at 2nd observations compared to (46.42 ± 12.35 & 61.11 ± 17.75) at 1st observations. The results also indicated that maximum scores of nurses practices for diet and hygienic care during 1st and 2nd observations with Mean ± SD equal to (73.28 ± 16.82& 67.39 ± 13.63) respectively at 2nd observations compared to (53.79 ± 16.07& 45.44 ± 15.46) at 1st observations. It also noticed that as regards to medications and daily activities with Mean ± SD equal to (66.23 ± 12.39 & 63.89 ± 21.41) at 2nd observations compared to (54.43 ± 20.31 & 47.57 ± 25.80) at 1st observations. The results revealed that statistical significant difference (P value <0.001*) between 1st

and 2nd observations in relation ranking of studied nurses practices that provided for patients undergoing valvular heart replacement surgery.

Table (6) Shows relation between overall studied nurses knowledge score and nurses practices. The results revealed that statistical significant relation between overall studied nurses knowledge score and practices post implementation (r=0.535*) (p <0.001*). In relation to nurses knowledge, routine postoperative care, it was noticed statistical significant relation (r = 0.609*) (p <0.001*) post implementation compared to (r=0.164)(p=0.235) pre implementation. The results also showed that in relation to nurses knowledge, postoperative instructions and preparation for discharge (r= 0.293*) post implementation, compared to (r=0.015) pre implementation (p <0.001*).

Table (7) Shows relation between overall studied nurses knowledge and socio-demographic data. The results showed that there was a statistically positive relation between overall studied nurses knowledge and receiving training regarding care provided for patients undergoing valvular heart replacement surgery (F:0.555, P:0.599) pre implementation while (F:2.064*, P:0.044*) respectively post implementation. The results revealed that statistical relation between studied nurses knowledge score and sex (F:0.962, p: 0.340) & (F:0.330, p:0.743) respectively in pre and post implementing phases. It can be noticed that statistical relation between nurses knowledge and education (F: 0.431, P:0.732) & (F: 3.544*, P:0.021*) respectively pre and post implementation. The results also indicated that the statistical relation between studied nurses knowledge score and years of experience in field (F:0.431, P:0.732) & (F: 3.544*, P:0.021*) respectively pre and post implementation phases.

Table (8) Shows relation between overall studied nurses practices and socio-demographic data. The results showed that It was noticed that there was a statistically positive relation between studied nurses practices and socio-demographic data in relation to ages at 2nd observation (F: 3.363*, P: 0.042*) compared to no statistical relation at 1st observation (F: 2.244, P: 0.116). The results indicated that in relation to studied nurses practices and socio-demographic data regarding level of education, there was statistically positive relation (F: 5.294*, P: 0.003*) and (F:6.050*, P: 0.001*) respectively at 1st and 2nd observation. In relation to studied nurses practices and socio-demographic data regarding years of experience in the field, it was noticed that there was statistical positive relation at 2nd observation (F: 3.395*, P: 0.025*) compared to no statistical relation (F: 1.368, p: 0.263) at 1st observation.

nurses (46.29%) gained good practices at 2nd observation compared to (9.3%) at 1st observation. As regards to hygienic instructions, more than one third of studied nurses (41.1%) gained good practices at 2nd observation compared to (3.7%) at 1st in observation. Moreover, the majority of studied nurses (85.2%) gained good practices regarding medication instructions at 2nd observation compared to less than half (44.4%) at 1st Observation. As regards to daily living activities and sternal precautions, (63.0% & 75.9%) respectively gained good practices at 2nd observation compared with (29.6%) at 1st Observation. The results revealed a statistical significant difference between 1st and 2nd observation in relation to teaching the patient to observe and report abnormalities as well as follow up.

Table(1):Percentage distribution of the studied nurses according to their socio-demographic characteristics (N = 54)

Socio-demographic data	No.	%
Age of participants		
< 25	21	38.9
25 < 30	29	53.7
≥ 30	4	7.4
Min. – Max.	21.0 - 32.0	
Mean ± SD.	25.17 ± 2.68	
Median	25.0	
Sex of participants		
Female	32	59.3
Male	22	40.7
Level of education		
Diploma	4	7.4
Technical nursing	27	50.0
Bachelor degree	17	31.5

Postgraduate	6	11.1
Years of experience in field		
< 2	28	51.9
2 < 5	14	25.9
5 < 10	10	18.5
≥ 10	2	3.7
Training received regarding VHRS care		
Yes	7	13.0
No	47	87.0

SD: **Standard deviation**

Table (2): Studied nurses knowledge score and test of significance in relation to overall knowledge pre and post implementation of nursing practices scheme (N = 54)

Overall knowledge	Pre		Post		Test of Sig.	p
	No.	%	No.	%		
Poor knowledge	2	3.7	0	0.0	MH= 96.5*	<0.001*
Fair knowledge	37	68.5	4	7.41		
Good knowledge	15	27.8	50	92.59		
Total score						
Min. – Max.	14.0 - 97.0		73.0 – 106.0		t= 11.945*	<0.001*
Mean ± SD.	66.13 ± 14.86		95.74 ± 8.26			
Median	68.0		98.0			
% score						
Min. – Max.	12.61 – 87.39		65.77 – 95.50			
Mean ± SD.	59.58 ± 13.38		86.25 ±7.44			
Median	61.26		88.29			

SD: Standard deviation **MH: Marginal Homogeneity Test** **t: Paired t-test**

p: p value for comparing between the studied groups *: Statistically significant at p ≤ 0.05

Table (6): Relation between overall studied nurses knowledge score and nurses practices (N = 54)

Nurses practices	Knowledge score			
	Pre		Post	
	r	p	r	p
C1: Immediate post-operative nursing care	0.050	0.720	0.112	0.420
C2.Routine post-operative care	0.164	0.235	**0.609***	**<0.001***
Post-operative care for tubes and drainage system.	0.088	0.525	**0.601***	**<0.001***
C3 three: Observation and reporting of post-operative complications	0.155	0.264	0.111	0.422
C4 four: Postoperative instructions , and teaching for discharge	0.015	0.912	**0.293***	**0.032***
Postoperative nursing care	0.142	0.307	**0.535***	**<0.001***

r: Pearson coefficient *: Statistically significant at $p \leq 0.05$

Table (7): Relation between overall studied nurses knowledge and socio-demographic data (N = 54)

Socio-demographic data	Overall knowledge (% score)	
	Pre	Post
	Mean ± SD.	Mean ± SD.
Age of participants		
< 25	60.32 ± 9.20	82.85 ± 9.55
25- < 30	59.61 ± 15.36	87.73 ± 4.59
≥ 30	55.41 ± 19.27	93.47 ± 0.45
F(p)	**0.220(0.803)**	**5.444*(0.007*)**
Sex of participants		
Female	60.08 ± 14.41	85.45 ± 7.31
Male	58.85 ± 12.03	87.43 ± 7.62
t(p)	0.330(0.743)	0.962(0.340)
Level of education		
Diploma	50.90 ± 20.71	80.41 ± 16.90
Technical institute	62.83 ± 8.24	84.45 ± 6.98
Faculty	57.90 ± 16.57	88.71 ± 2.57
Postgraduate	56.08 ± 16.34	90.65 ± 5.90
F(p)	**1.382(0.259)**	**3.179*(0.032*)**
Years of experience in field		
< 2	58.62 ± 11.69	83.63 ± 8.45
2 - 5	60.10 ± 10.27	87.20 ± 5.67
5 - 10	59.46 ± 21.54	91.53 ± 2.22
> 10	69.82 ± 4.46	90.09 ± 7.43
F(p)	**0.431(0.732)**	**3.544*(0.021*)**
Training received regarding VHRS care		
Yes	54.44 ± 27.89	91.51 ± 3.03
No	60.34 ± 10.02	85.47 ± 7.59
t(p)	**0.555(0.599)**	**2.064*(0.044*)**

t: Student t-test **F: F for ANOVA test** *: Statistically significant at $p \leq 0.05$

Tables (8): Relation between overall studied nurses practices and socio-demographic data (N = 54)

Socio-demographic data	Overall practice(% score)		
	1st Observation	2nd Observation	Average
	Mean ± SD.	Mean ± SD.	Mean ± SD.
Age of participants			
< 25	71.0 ± 3.36	80.98 ± 8.23	76.65 ± 5.52
25- < 30	71.64 ± 3.0	84.19 ± 3.32	78.73 ± 2.65
≥ 30	74.55 ± 0.90	87.95 ± 2.83	81.85 ± 2.20
F(p)	**2.244 (0.116)**	**3.363*(0.042*)**	**3.479*(0.038*)**
Level of education			
Diploma	68.54 ± 4.93	74.18 ± 10.97	72.25 ± 7.99
Technical institute	71.17 ± 2.97	82.66 ± 5.86	77.68 ± 3.91
Faculty	71.49 ± 2.44	84.27 ± 2.95	78.66 ± 2.26
Postgraduate	74.83 ± 1.28	87.65 ± 1.89	81.74 ± 1.58
F(p)	**5.294*(0.003*)**	**6.050*(0.001*)**	**6.201*(0.001*)**

Years of experience in field			
< 2	71.11 ± 2.82	80.96 ± 6.92	76.69 ± 4.64
2 - 5	71.85 ± 3.50	84.86 ± 4.15	79.14 ± 3.45
5 - 10	71.86 ± 3.48	86.18 ± 2.74	80.03 ± 2.39
> 10	75.56 ± 0.43	88.49 ± 0.97	82.30 ± 0.85
F(p)	**1.368 (0.263)**	**3.395*(0.025*)**	**3.032*(0.038*)**

F: **F for ANOVA test** *: Statistically significant at $p \leq 0.05$

5. Discussion:

Valvular heart replacement surgeries (VHRS) have been the golden slandered for the past 40 years of treatment for VHDs. They require comprehensive care that begins from hospital admission to discharge and follow up plan. Management of underlying conditions, and medical treatment are keys for optimal long-term success of cardiac surgeries **(Sousa-Uva, et al, 2018).** Proper medical care can help effectively in good prognosis, preventing further complications as well as accelerating return to daily living activities **(AHA & WHO, 2020).**

The nurse has a crucial role for management of patients undergoing VHRS to prevent complications, return to activity of daily living, reduce pain, and improve quality of care for early discharge **(Camelo, Leal, Santos A., Santos F., & Silva, 2016).** Therefore, there is an urgent need to develop a scheme based on recent knowledge and practices to help nurse in this mission. This study provided an opportunity for nurses to be evaluated in the practices related to nursing care provided for patients undergoing VHRS and determine practice differences that could be improved through education and training.

Regarding socio-demographic characteristics, the results showed that more than half of studied nurses were females, aged less than thirty years old. The results of the present study agreed with **Abd-ElMouhsen, Ahmed, Ghanem &** Thabet**, (2019)** who reported that the majority of studied nurses were females. On the other hand, **Abboud, Muhabes & Yasir, (2020**) disagreed with the present study by reporting that more than half of participants were males. This might be attributed to the late involvement of males in education of nursing.

As regards to level of education, the present study revealed that half of studied nurses had technical nursing education. This result came in accordance with **Elbashier, Jeesh, &Khalid, (2021**), who reported that the large percent of studied nurses had technical nursing education. On the other hand, the results of **Kheiri, Pezeshkian,** Shadbad**, & Talas, (2018),** disagreed with the present study by reporting that the majority of studied nurses graduated from college. This might be attributed to the financial and social burdens of studying in college.

In relation to experience, the present study indicated that more than half of studied nurses had less than two years of experience at Cardiothoracic surgery Department. This was agreed by **Elateif, (2017),** who reported that more than two thirds of participants had the same period experience regarding care provided for open heart surgery patients**.** On the other hand, **Abboud, et al, (2020) & Jarelnape, (2021)** disagreed with the present study by reporting that more than half of participants had less than five years of experience. This may be attributed to the recent re-establishing and reopening of Cardiothoracic Department in my locality and recruiting new nurses.

Attending training programs, the present findings showed that the majority of studied nurses didn't enroll in any training programs. This study was agreed by **Abd-Elaziz, Mohammed, Sabaq, & Sharkawi, (2021),** who reported that the majority of participants didn't enroll in any training program. Another study done by **Al-Fatlawi (2016)** and **Abdulrdha, (2018)** disagreed with the present study, who reported that the majority of participants relatively attended training programs. This might be attributed to lack of motivators to enroll in training programs.

Concerning overall knowledge of studied nurses, the present results showed that the majority of studied nurses gained good knowledge post implementing N.P.S. compared to more than two third scored fair knowledge pre implementation. These results were agreed by **Hamza & Kreem, (2019)** who reported remarkable development in nurse's knowledge after conducting an educational program about pre and postoperative nursing management. On the other hand, another study done by **Soliman, (2020)** disagreed with the present study by reporting that the majority of participants scored satisfactory levels of knowledge in initial assessments resulting from continuous training and evaluating of nursing staff. This might be attributed to the positive effect of nursing practices scheme on improving knowledge among nurses as well as cooperation of the participants.

Regarding postoperative care, the results of the present study indicated that nurses scored good practices at both observations. These results came in the same line with **Bakr, El-Zayat & Shehab, (2020)** who reported that no changes in postoperative performance after attending training about nurses care for patients undergoing cardiac catheterization. Contrary, **Leal, Mancia & Reisdorfer, (2021)** reported poor nursing practices and resources needed to provide ideal care post heart surgery. This might be attributed to applying all nursing practices under direct supervision of medical staff.

Concerning postoperative health education, the present results indicated that nurses gained good practices at 2nd observation compared to 1st observation in relation to giving proper health education following VHRS. The study done by **Horii, et al, (2021)** agreed with the present results, they reported that nurses' competencies related to technical knowledge and skills including health education might increase through traditional clinical training programs as well as self-reported competency assessments.

In relation to preparation of patients for discharge, results of the present study showed that the majority of studied nurses had good practices at 2nd observations compared to fair levels at 1st observations. This result was agreed by **Abdulrdha & Mansour, (2018) and Abdelhady, Faltas, & Shaker (2020)** who revealed that nurses initially had poor practices regarding all aspects of patients discharge planning in surgical cardiac wards. On the other hand, **Bakr, et al, (2020) and Jarelnape, (2021)** disagreed with the present study by indicating that the majority of participants had satisfactory levels of performance regarding discharge plan.

Regarding relation between knowledge and practices, current findings indicated that there were statistical significant relations ($p < 0.001$) between nurses' knowledge and practice regarding care provided for patients undergoing VHRS indicating that skills can be improved if linked with relevant scientific bases of knowledge. Agreeing with the present study **Abdelatif ,AbdElhafiez, Hegazy, & Nada, (2021)** who reported a significant association between nurses total knowledge and total practices scores in their study which framed to develop nursing performance guidelines based on their needs assessment. on the other hand, **Eldakhakhny, Ghatas, & Mohamed, (2020)** disagreeing with present study by reporting no statistical relation between practice and knowledge among studied nurses.

Concerning correlation among studied nurses socio-demographic characteristics and knowledge, the current results showed that there were statistically significant relations between socio-demographic characteristics and knowledge score. A study done by **Abdulmalek el al, (2018)** agreed with the present study by reporting a statistical significant relation between nurses' knowledge and skills. This might be attributed to increased knowledge of old nurses and conducting extensive training programs for young nurses.

As regards to ranking of studied nurses' postoperative practices, the present findings indicated that there were ranking changes regarding postoperative instructions and preparation for discharge between 1st and 2nd observations. A study conducted by **Ahmed & Sallem (2018),** agreed with the results of the present study, who reported that there was statistically difference in ranking in relation to items of nursing care between pre and post implementation phases.

6. Conclusion

From the findings of the present study it can be concluded that nursing practices scheme had a positive effect on improving knowledge and performance among nurses at Cardiothoracic Surgery Department.

7. Recommendations:

- Nurses working in Cardiothoracic Surgery Department should update their knowledge through practicing and educational programs, workshops, lectures about N.P.S. for patients undergoing VHRS .
- Development of manual guidelines for nurses about caring for patients undergoing VHRS.
- Develop a program about patient discharge to ensure safe life after hospitalization and establish teaching plan unit for patients undergoing VHRS

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