Effect of Evidence Based Nursing Program on Post Thoracic Surgery Patients' Health Outcomes Regarding Pulmonary Care

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Abstract

Background: Post thoracic surgery patients are often related to the high incidence of life-threatening pulmonary complications that can be avoided by a variety of pulmonary care techniques. **Aim:** Was to evaluate the effect of evidence-based nursing program on post thoracic surgery patients' health outcomes regarding pulmonary care. **Study design:** A quasi-experimental, pre-test and post-test intervention study design was implemented to achieve the aim of the current study. **Setting:** The study was conducted in chest department and cardiothoracic surgery intensive care unit at Benha University Hospital affiliated to Qalyubia Governorate, Egypt. **Subjects:** A purposive sample of sixty patients with chest diseases planned for thoracic surgeries selected from the previously mentioned settings over a period of nine months of data collection. **Tools:** Data were collected using three tools, **(I)** Patient's interview schedule questionnaire, **(II)** Pulmonary care technique observational checklist pre/post pulmonary care intervention, **(III)** Patients' health outcomes assessment. **Results:** Total knowledge level and total practice level mean scores post evidence-based nursing program implementation were higher statistically significant than preprogram. There was highly significant difference between pre and post program implementation concerning patients' health outcomes including all pulmonary function test variables, respiratory rate, heart rate, systolic blood pressure, as well as PH, PaO_2 and SO_2. **Conclusion:** Patients' knowledge and practice had been significantly improved post program implementation which reflects that early post-operative pulmonary care following thoracic surgeries was effective in reducing the risk of post-operative pulmonary complications and had a positive impact on patients' health outcomes with high statistically significance differences as ($p=<0.05$). **Recommendations:** Upgrading cardiothoracic nurses' knowledge and practice regarding to chest physiotherapy through continuous attending in-service training programs and workshops to improve the standard of nursing care given to post thoracic surgery patients.

Key words: Evidence based nursing program, Patients' health outcomes, Pulmonary care, Thoracic surgery.

Introduction:

Thoracic surgery has been the primary intervention used to diagnose and manage the congenital or acquired diseases of the chest wall, pleura, lungs, airways, mediastinum and diaphragm as mediastinal and bronchogenic carcinoma, chest trauma and lung cancer,

empyema and recurrent pneumothorax **(Jheon et al., 2020).** Open thoracotomy may be posterolateral, median, axillary or anterolateral **(Agzarian & Shargall, 2017).** Postoperative pulmonary complications negatively affect patients' quality of life and delayed recovery after surgery, prolonged

hospitalization, increased mortality and expenditure, in addition to increase incidence of lung collapse that contributes to the formation of atelectasis leading to pulmonary infections **(Haytham et al., 2016).** The type and severity of complications depend on the type of thoracic surgery that has been performed as well as on the patient's preoperative medical status **(Marseu & Slinger, 2017).**

Pulmonary care techniques include continuous positive airway pressure, incentive spirometry, pain management, postoperative exercises as shoulder range of motion exercises, trunk and thoracic mobilization, in addition to chest physiotherapy techniques as deep breathing, coughing and huffing exercises, diaphragmatic breathing, postural drainage, percussion, vibration, bronchodilators and suctioning **(Gao et al., 2015).** Many other interventions like early progressive functional activities such as sitting out of bed, walking and stair climbing are included as treatment options to address postoperative pulmonary complications and improve physical function **(Moore et al., 2017).**

Thoracic specialist nurse plays an important role in providing care to patients based on evidence and to be aware of postoperative complications for the preventive measures should take place **(Lan et al., 2014).** Evidence-based nursing (EBN) is an important approach of identifying health care needs of patients using the best research to make decisions related to care **(Khalili et al., 2015).** The initial step in managing both actual and potential health problems after thoracic surgery is making an accurate assessment of patients' health status for establishment of patients' care goals reaching with patients to best health outcomes as

assessing respiratory status, arterial blood gases, vital signs and degree of pain **(Siopi et al., 2015).**

The goal of evidence-based nursing is to provide patients with efficient care in a cost-effective manner to achieve the best patients' health outcomes, improve care processes, health and safety of patients after thoracic surgeries, while also decreasing the potential postoperative complications and hospital stay **(Karkada, 2015; Melnyk & Fineout, 2015).**

Therefore, postoperative thoracic nurse assists, supports and educates patients who are undergoing thoracotomy and their families to reduce stress related to surgery and postoperative pain, facilitate patients' active involvement in self-care and increase satisfaction. So, it is important that nurses use the most excellent accessible evidence base nursing program in making decisions concerning pulmonary care for postoperative patients who have undergone thoracic surgery **(Liu et al., 2018).**

Significance of the study

Thoracic surgery has increased, subsequent to an increased incidence of chest trauma and cancer. In the world more than 230 million general operations occur annually of which more than 1 million thoracic surgeries are performed **(Bustamante et al., 2017; Miskovic & Lumb, 2017).** In Egypt, approximately 49 % of chest diseased patients were in need for thoracic surgeries as a lifesaving therapy **(Besely & Abdel Mowla, 2014).** The number of patients undergoing thoracic surgeries in the cardiothoracic surgery unit at Benha University Hospital in the year (2019) was about 120 patients **(Benha University Hospital Statistical Office, 2019).**

Pulmonary complications are associated with increase morbidity and mortality rate

with incidence rate ranges from 1% to 23% in general surgeries **(Odor et al., 2020)** and from 19% to 59% in thoracic surgeries **(Tukanova et al., 2020).** Therefore, the current study was designed to evaluate the effect of evidence-based nursing program on post thoracic surgery patients' health outcomes regarding pulmonary care.

Aim of the study:

The aim of this study was to evaluate the effect of evidence-based nursing program on post thoracic surgery patients' health outcomes regarding pulmonary care.

Study hypotheses:

H1- The mean scores of patients' knowledge and practices post program will be improved significantly than pre evidence-based nursing program implementation.

H2- Patients' health outcomes will be improved significantly after implementing evidence-based nursing program regarding pulmonary care for post thoracic surgery patients.

Subjects and methods:

Study design:

A quasi-experimental pre and post intervention comparison study design was implemented to achieve the aim of the present study.

Setting:

The study was conducted in two settings; chest department and cardiothoracic surgery intensive care unit affiliated to Benha University Hospital, Qalyubia Governorate, Egypt.

Subjects:

A purposive sample consisted of sixty patients with chest diseases who underwent thoracic surgery at the cardiothoracic surgery unit at Benha University Hospital. Sample size was calculated using Epi-Info-7 program by applying the following parameters:

1. Population size =120 per 9 months
2. Population proportion = 92%
3. Accepted error = 5%
4. Confidence coefficient = 95%.

Tools of data collection:

Three tools were used to collect data to achieve the study's aim as follows:

Tool I: Interview schedule questionnaire

This tool was designed by the researcher and translated into Arabic language after reviewing recent relevant literatures and scientific references. It was adapted from **(Vanmathi, 2015; Pinheiro, Santoro & Faresin, 2016; Schwellnus, Roos & Naidoo, 2017 and Boffa et al., 2018).** It involved the following three parts:

Part I: Patients' personal data: This part concerned with the assessment of patients' personal data related to their age, sex, occupation, educational level, residence, marital status, smoking history and physical activity.

Part II: Patients' medical and surgical data: It aimed to assess past medical and surgical history, chest disease and patient complaint, drug history including respiratory and/or cardiac medications, site of surgery and length of hospital stay.

Part III: Patients' knowledge assessment (pre/post pulmonary care intervention): It aimed to assess the patients' knowledge before and after implementation of evidence - based nursing program regarding thoracic surgery It included (5) questions related to definition, purpose, types, sites and common complications of thoracic surgery as well as pulmonary care included (3) questions related

to benefits and indications, contraindications and types of pulmonary care.

Patients' knowledge scoring system:

For items related to knowledge; two scoring levels for questions were used. Each question was ranged from 0-1 scores. Whereas, each correct answer was scored (1) and each incorrect answer was scored (zero). The total score for knowledge was (8) marks and were categorized as follows:

- Good knowledge (6-8) scores.
- Fair knowledge (3-5) scores.
- Poor knowledge (0-2) scores.

Tool II: Pulmonary care technique observational checklist (pre/post pulmonary care intervention): It was adopted from **(Kumar, 2010; Linayao, 2017; Ahmad, 2018 and Rodrigues et al., 2020)** to assess patients' practice regarding pulmonary care techniques including; chest physiotherapy techniques as (breathing exercises (7 steps), diaphragmatic breathing exercises (4 steps), coughing and huffing exercises (7 steps), nebulizer (8 steps), positioning and mobilization (19 steps), as well as postoperative exercises as (shoulder range of motion (ROM) exercises (6 steps), trunk and thoracic mobilization exercises (3 steps).

Patients' practice scoring system:

Each step in the checklist was scored from 0 to 2. Two scores were given for each step that done completely and correctly, one score for the step that done incompletely and zero for the step that not done. The total score for patients' practice observational checklist was **(108)** marks for (54 steps), total practice scores were calculated then converted into percent and categorized as follows:

- ≥85% was considered as competent level of practice (91.8 scores or more).

- <85% was considered as incompetent level of practice (Less than 91.8 scores).

Tool III: Patients' health outcomes assessment (postoperative): It included three parts as the following:

Part I: Chest pain assessment (pre/post pulmonary care intervention): It included the following two items:

1- The Numeric Pain Rating Scale: This tool was adopted from **(Firdous, et al., 2017)** to evaluate the effectiveness of pulmonary care on post thoracic surgery patients' pain intensity. It is an instrument which reflects the intensity of patients' pain, consisting of a 10 cm straight line, with 11-point ranges from '0' representing (no pain) to '10' representing (worst pain imaginable).

Scoring system for numeric pain rating scale:

The values on the pain scale correspond to the pain levels as follows:

- 0 was considered "no pain",
- 1-3 was considered "mild pain",
- 4-6 was considered "moderate pain"
- 7-10 was considered "severe pain".

2- Checklist of nonverbal pain indicators (CNPI): This tool was adopted from **(Pollack, 2016)** to evaluate the patient's behavior that indicates pain during rest and activity post pulmonary care. It included 6 items: vocal complains (nonverbal) as "moans, gasps, cries", facial grimaces as "narrowed eyes, clenched teeth, tightened lips", bracing as "clutching or holding onto furniture, equipment, or affected area during movement", rubbing as "massaging affected area", restlessness as "constant or intermittent shifting of position, intermittent or constant hand motions, inability to keep still" and vocal complaints (verbal) as "ouch, stop, that's enough".

Scoring system for checklist of nonverbal pain indicators:

Each item scored from 0 to 3; (0) means behavior not observed, (1) means behavior observed during rest, (2) means behavior observed during activity and (3) means behavior observed during rest and activity.

Part II: Postoperative problems assessment (pre/post pulmonary care intervention): This tool was adapted from **(Wang et al., 2017).** It included pulmonary complications as (dry cough, bloody cough "hemoptysis", difficult breathing, chest pain, sputum or secretions in the air way, cyanosis, abnormal breathing sounds as wheezing and crackles).

Part III: Respiratory and physical parameters assessment (clinical database) (pre/post pulmonary care intervention): It was adapted from **(Weber & Kelley, 2013; Moslam, Badawy & Asidac, 2015).** It aimed to assess pulmonary function test (PFT) as forced vital capacity (FVC), peak expiratory flow (PEF), forced expiratory volume /1 sec (FEV1), as well as arterial blood gases (ABGs) and vital signs assessment (respiratory rate, body temperature, heart rate and blood pressure).

Pulmonary care program booklet: The booklet was designed by the researcher under the guidance of the supervisors after reviewing the latest literature related to the study. It written in simple Arabic language with different illustrated colored pictures that included all theoretical and practical content to improve learning ability of the patients, increase their knowledge level and practices regarding pulmonary care to enhance post-operative patients' health outcomes. It divided into two parts; The first part included brief description of thoracic surgery (definition, aim, types, sites and complications), as well as of pulmonary care (its benefits, indications, contraindications and types). The second part was concerned with patients' practices related to chest physiotherapy techniques as (breathing exercises, diaphragmatic breathing exercises, coughing and huffing exercises, nebulizer, positioning & mobilization), as well as postoperative exercises as (shoulder ROM exercises, trunk and thoracic mobilization exercises).

Content validity and reliability:

The content validity of the tools was done by three experts; two in the field of medical surgical nursing from the faculty of nursing, Benha University and medical consultant in the field of chest diseases from faculty of medicine, Benha University. The experts reviewed the tools to check the relevancy, simplicity, clarity, comprehensiveness, and applicability of the questions. The consensus among experts regarding the questionnaire was 98 % and the observational checklist was 99 % for most items. As for the reliability, the tools were confirmed for consistency by Cronbach's alpha coefficient. The reliability score of patients' knowledge questionnaire about thoracic surgery and pulmonary care **tool I (part III)** was r coefficient (r= 0.703) and was (r= 0.927) for patients' practice regarding pulmonary care techniques **tool II** for which denotes the high internal consistency of the used tools.

Ethical considerations:

- The study approval was obtained from the ethical committee of nursing Faculty before initiating the study work.

- The researcher clarified the purpose and aim of the study to patients included in the study before data collection.

- Oral consent was obtained from the patients to participate in the study.

- The researcher was assured maintaining anonymity and confidentiality of data.

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- The patients were informed that they allowed to choose their participation in the study and they have the right to withdraw from the study at any time.

Pilot study:

A pilot study was conducted on 10% of the study subjects (6 patients) in order to test the clarity and applicability of the study tools and the program, also to estimate the time required for each tool to be filled by the researcher as well as to identify any possible obstacles that may hinder data collection. Based on the results of the pilot study the necessary modifications were done for more applicable tools to collect data. The patients selected for the pilot study were excluded from the study subjects. The pilot study was done two weeks before starting the study.

Fieldwork:

- Data collection of the current study was carried out through nine months, from the beginning of January, 2021 at the end of September, 2021. The researcher attended the setting four days per week during afternoon shifts.

- Each interview took a time of about 30-45 minutes. The precautions practice measures due to the spread of the Corona virus, infection control were taken as maintaining physical distance, wearing facemask, gloves and using alcohol aseptic solution for both the researcher and the patients included in the study. The study was conducted through four phases:

1- Assessment phase: It was carried out for all studied patients by the researcher to collect data regarding their personal data, lifestyle, medical and surgical history, then the studied patients were assessed for their knowledge

and the practice regarding pulmonary care techniques preoperatively and pre evidence-based nursing program implementation using **(tool I &II).** Also, on the second post-operative day the researcher assessed the studied patients' health outcomes including chest pain assessment, postoperative pulmonary problems and physical parameters as (PFT, ABGs & vital signs) **(tool III)** as a base line assessment.

2- Planning phase: Once the initial assessment finished, an evidence-based nursing program was designed based on individual patients' teaching needs. The researcher set up teaching plan covering general and specific objectives.

3-Implementation phase: The program implementation had been carried out in chest department two days per week preoperatively and was conducted in 4 sessions. Each session lasted about 30-45 minutes/ day for average number of one to two patients/session considering time table for operation. **1st session:** Explanation about the definition, purpose, types, sites and common complications of thoracic surgery as well as benefits, indications, contraindications and types of pulmonary care techniques. **2nd session:** Include applying chest physiotherapy techniques as (breathing exercises, diaphragmatic breathing exercises, coughing and huffing exercises). **3rd session:** Completion of the chest physiotherapy techniques including nebulizer, positioning & mobilization exercises). **4th session:** Include applying postoperative exercises as (shoulder ROM exercises, trunk and thoracic mobilization exercises).

4- Evaluation phase:

Evaluation of the effect of evidence-based nursing program on patients' knowledge,

practice and health outcomes was done by comparing the results pre and post the implementation of the program by using the same data collection tools of the preprogram implementation through the following phases:

Phase 1: Immediately post-test was performed after implementing the evidence-based nursing program preoperatively to evaluate the effectiveness of the program on patients' knowledge and practices (utilizing tool I "part III" & tool II) in order to compare the change in the studied patients' knowledge and practices.

Phase 2: Evaluation was done at 2nd, 4th, 6th and 8th postoperative day to evaluate the effectiveness of evidence-based nursing program on the patients' practice (tool II) and health outcomes (tool III).

Statistical analysis:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0 (Armonk, NY: IBM Corp). Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level.

Results:

Table (1): Shows that 65% & 60% of the studied patients were educated males respectively, 70% of them their age was 30<40 years old with Mean±SD was 34.10 ± 5.40 and had hard manual work (40%), whereas 80% were married. Also, they were living in rural areas 55% of the studied patients.

Figure (1): Shows that 86.7% of the studied patients had a fair level of knowledge pre-evidence-based nursing program implementation, while all of them 100% had a good level of knowledge immediate post-program implementation.

Table (2): Shows that the highest mean percent score preprogram implementation was 61.33 ± 14.20 concerning patients' knowledge about thoracic surgery. But the lowest mean percent score was 33.33 ± 26.04 regarding the patients' knowledge about pulmonary care. On the other hand, the mean percent of total score was increased immediate post program implementation to 95.33 ± 9.29 & 93.33 ± 14.78 for the same items respectively with a high statistically significant differences in relation to total mean score pre and immediate post implementation of evidence-based nursing program (p= <0.001*).

Figure (2): Shows that all of studied patients 100% had incompetent practices regarding pulmonary care techniques at preprogram implementation, but improved to be competent as observed in 98.3%, 75% & 85% of them at immediate, 4th and 6th postoperative day post evidence-based nursing program implementation respectively, while return to decline at 8th postoperative day post evidence-based nursing program implementation to 73.3%. The adequate level of reported practice score regarding pulmonary care techniques among patients was improved from 0% pre to 73.3% on 8th day post evidence-based nursing program implementation.

Table (3): Shows that there was no statistically significant relation between patients' total knowledge and practice with health outcomes pre and post evidence-based nursing program implementation as (p=>0.05).

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Table (1):   Frequency distribution of the studied patients regarding their personal data (n = 60)

Personal data	No.	%
Sex:		
• Male	36	60.0
• Female	24	40.0
Age/year:		
• 20 - < 30	12	20.0
• 30 - < 40	42	70.0
• 40 - < 50	6	10.0
Min - Max range 22 – 49 Mean ± SD = 34.10 ± 5.40		
Educational level:		
• Uneducated	21	35.0
• Educated	39	65.0
Marital status:		
• Single	9	15.0
• Married	48	80.0
• Divorced	3	5.0
Residence:		
• Rural	33	55.0
• Urban	27	45.0
Occupation:		
• Manual work	24	40.0
• Written work	15	25.0
• No work	21	35.0
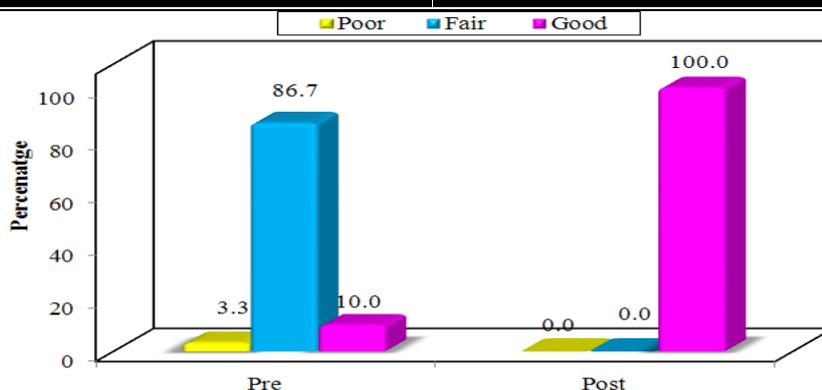
Figure (1):   Level of patients' total knowledge related to thoracic surgery and pulmonary care pre and immediate post evidence-based nursing program implementation (n = 60)

Table (2): Mean score, standard deviation and significant difference of the studied patients' knowledge pre and post evidence-based nursing program implementation (n = 60)

Patients' knowledge	Pre (pre-operative and pre–program)	Immediate post program	Z	p
A- Regarding to thoracic surgery:				
Total Score:	(0–5)			
• Mean ± SD	3.07 ± 0.71	4.77 ± 0.46		
• Mean % score	61.33 ± 14.20	95.33 ± 9.29	6.745*	<0.001*
B- Regarding to pulmonary care:				
Total Score	(0–3)			
• Mean ± SD	1.0 ± 0.78	2.80 ± 0.44		
• Mean % score	33.33 ± 26.04	93.33 ± 14.78	6.606*	<0.001*
Total knowledge:				
Total Score	(0–8)			
• Mean ± SD	4.07 ± 1.02	7.57 ± 0 .65		
• Mean % score	50.83 ± 12.79	94.58 ± 8.09	6.799*	<0.001*
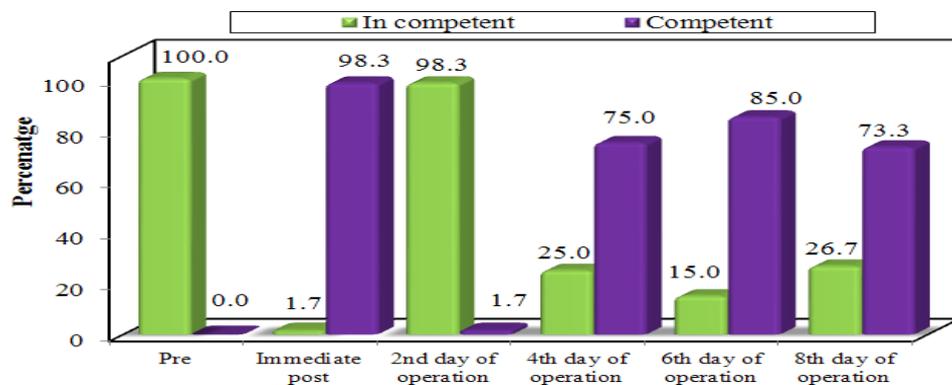
Figure (2): Level of the studied patients' practice regarding pulmonary care techniques observational checklist pre and post evidence-based nursing program implementation (n = 60)

Table (3): Relation between patients' total knowledge and practice with health outcomes pre and post evidence-based nursing program implementation (n = 60)

Patients' health outcomes	Total knowledge				Total practice		
	Pre			Post	Pre	Post	
	Poor (n = 2)	Fair (n = 52)	Good (n = 6)	Good (n = 60)	In competent (n = 60)	In competent (n = 13)	Competent (n = 47)
	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.
The numeric pain rating scale	6.00 ± 0.0	7.65 ± 1.03	7.83 ± 1.17	5.32 ± 1.44	7.62± 1.06	5.31 ± 1.47	5.49 ± 1.42
Test of sig.	**H=4.828 (0.088)**			–	–	**U=274.50 (0.575)**	
Checklist of nonverbal pain indicators	9.50 ± 3.54	9.56 ± 2.20	8.50 ± 2.51	8.72 ± 1.43	9.45±2.24	45.01±5.68	46.06±6.93
Test of sig.	**F= 0.590 (0.558)**			–	–	**t=0.499 (0.620)**	
Pulmonary function test	2.50 ± 2.12	2.85±1.06	3.17±0.98	0.77±0.83	2.87 ± 1.07	0.97 ± 0.46	0.84 ± 0.52
Test of sig.	**H=0.505 (0.777)**			–	–	**U=258.50 (0.390)**	
Arterial blood gases (ABGs)	1.50±0.71	2.17±1.26	2.00±1.79	0.60±1.22	2.13±1.29	0.36 ± 0.63	0.67 ± 0.77
Test of sig.	**H= 0.713 (0.700)**			–	–	**U=227.50 (0.135)**	
Vital signs	1.00±0.0	2.33±0.90	2.50±0.55	1.45±0.85	2.30±0.89	1.49 ± 0.55	1.40 ± 0.49
Test of sig.	**H= 4.636 (0.098)**			–	–	**U=275.0 (0.573)**	

Discussion:

Regarding to patients' personal data, the present study revealed that more than half of the studied patients were males. This finding is supported with **Moon et al., (2019)** who conducted a research about "Intramuscular stimulation as a novel alternative method of pain management after thoracic surgery" that the majority of patients were male. While disagree with a study **Struck et al., (2019)** about "Thoracotomy for emergency repair of iatrogenic tracheal rupture: Single center analysis of perioperative management and outcomes" and reported that the most patients were female.

As for age, the results of the present study revealed that nearly three quarters of the studied patients were recorded within age group of thirty to less than forty years old with mean age of 34.10 ± 5.40 years. This finding is in agreement with **Zahran et al., (2020)** they conducted a study about "Evaluation of the predictive value of thorax trauma severity score (TTSS) in thoracic-

traumatized patients" they reported that young patients (< 40 years) were frequently exposed to severe thoracic injury and undergoing thoracotomy. But this is in contrast with a study was done by **Segalini et al., (2019)** entitled "Outcomes and indications for emergency thoracotomy after adoption of a more liberal policy in a western European level 1 trauma center: 8- year experience" and reported that most of patients were aged between 25-53 years.

Regarding the educational level, the current study showed that nearly two thirds of the studied patients were educated. This finding demonstrates that chest diseases or problems are spread among different classes of people in the community. Similarly, **Molassiotis et al., (2015)** reported in their study about "The effect of resistance inspiratory muscle training in the management of breathlessness in patients with thoracic malignancies" that the majority of studied patients had secondary education. On the other hand, it is in disagreement with **Mohamed et al., (2018)** who studied "The impact of chest physiotherapy technique (CPT) on respiration, pain and quality of life post thoracic wall fixation surgery among flail chest patients (FC)" reported that less than half of the studied patients were illiterate.

Concerning marital status, the result revealed that the majority of the studied patients were married. This finding is in line with a study supported by **Shady, Abo Seada & Mostafa (2020)** about "Effectiveness of acupressure in the reduction of pain and anxiety among patients with open thoracotomy" they reported that the highest percentage of the studied patients were married. Conversely, in a study carried out by **Almeida et al., (2017)** which entitled "Respiratory status of adult patients in the postoperative period of thoracic or upper abdominal surgeries" they found that close to half of participants were not married or lived in a paired relationship.

In relation to residence, the present study findings revealed that more than half of the studied patients lived in rural areas and this may explain different aspects of the sample. This finding is consistent with a study done by **Hopkins et al., (2015)** entitled "Post thoracotomy pain syndrome following surgery for lung cancer: symptoms and impact on quality of life" they mentioned that the majority of the studied groups were from rural areas. While disagrees with **Bakalis et al., (2018)** who studied "Nursing assessment of post-operative pain in patients undergoing general (thoracic) surgery" and stated that the majority of participants resided urban areas.

As regard to occupation, the results of the current study revealed that less than half of the studied patients had manual work. This result is in agreement with the study of **Eleter et al., (2016)** which entitled "Effect of inspiratory muscle training on clinical outcomes of patients undergoing cardiothoracic surgeries" reported that less than half of the studied groups were manual workers. This finding is contradicted with **Molassiotis et al., (2015)** who found that the majority of the studied patients were retired. It may be due to different educational level of the studied patients in the current study and the geographical place of Benha University Hospital which near to patients from rural areas.

Regarding level of patients' total knowledge about thoracic surgery and pulmonary care, the results illustrated that the vast majority of the studied patients had fair level of total knowledge pre evidence-based nursing program implementation, while all of them had good level immediately post program implementation. This finding is in

accordance with **Oswald et al., (2018)** who reported in a study about "Patients want more information after surgery: A prospective audit of satisfaction with perioperative information in lung cancer surgery" that the patients who received more information about the disease, surgery and care that help them get well after surgery were in satisfactory level of knowledge.

Concerning mean score of the studied patients' knowledge regarding thoracic surgery and pulmonary care, the finding of the present study revealed that there were high statistically significant differences in relation to total mean score regarding the total patients' knowledge about thoracic surgery and pulmonary care pre and immediate post evidence-based nursing program implementation. This result is supported by the findings of a study conducted by **Shady, Mostafa & Abdalla (2020)** which entitled "The impact of pre and postoperative education on recovery period following cardiothoracic surgery" they asserted that there were high statistically significant differences regarding the mean score of the studied patients' knowledge between pre and post education.

Regarding total patients' practice of pulmonary care techniques, the current study illustrated that all of studied patients had incompetent practices regarding pulmonary care techniques pre evidence-based nursing program implementation, but improved to be high competent level post implementation. This result is in agreement with **Elatar (2021)** who studied "Effect of inspiratory muscle training program on health outcomes among patients with thoracic surgery" mentioned that the majority of patients had unsatisfactory practice level regarding inspiratory muscle training pre implementation of a training

program but changed to satisfactory level post implementation.

Regarding relation between patients' total knowledge and practice with health outcomes pre and post evidence-based nursing program implementation, results showed that there was no statistically significant relation between patients' total knowledge and practice with health outcomes pre and post evidence-based nursing program implementation. The current results disagree with **Ni et al., (2017)** who conducted a study about "Exercise training for patients pre- and post-surgically treated for non–small cell lung cancer: a systematic review and meta-analysis" and **Liao et al., (2021)** whose study entitled "The feasibility and efficiency of remote spirometry system on the pulmonary function for multiple ribs fracture patients" they asserted that there was significant relation between patients' practice and health outcomes regarding pulmonary function and pain score post intervention.

Conclusion:

The majority of the studied patients had fair knowledge and all of them were incompetent regarding performing pulmonary care techniques pre evidence-based nursing program implementation while patients' knowledge and practice had been significantly improved post program implementation which reflects that early post-operative pulmonary care following thoracic surgeries was effective in reducing the risk of post-operative pulmonary complications and had a positive impact on patients' health outcomes with high statistically significance differences as (p=<0.05).

Recommendations:

1- All pulmonary care approaches should be planned and applied as individual programs tailored to thoracic surgery patients

preoperatively following a comprehensive evaluation.

2- Upgrading cardiothoracic nurses' knowledge and practice regarding to pulmonary care intervention through continuous attending in-service and training programs and workshops.

3- Further studies about pulmonary care techniques performed by nurses on thoracic surgery patients are recommended at different settings in Egypt and on a large probably sample to generalize the results.

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تأثير برنامج تمريضي قائم على الأدلة على المخرجات الصحية للمرضى بعد جراحة الصدر فيما يتعلق بالرعاية الرئوية

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يرتبط مرضى جراحة الصدر غالبًا بزيادة معدل حدوث المضاعفات الرئوية التي تهدد الحياة والتي يمكن تجنبها من خلال مجموعة متنوعة من تقنيات واجراءات الرعاية الرئوية. لذلك هدفت الدراسة الي تقييم تأثير البرنامج التمريضي القائم على الأدلة على المخرجات الصحية للمرضى بعد جراحة الصدر فيما يتعلق بالرعاية الرئوية. تم استخدام تصميم شبه تجريبي لدراسة مقارنة الاختبار القبلي بالبعدي لتحقيق هدف الدراسة. وقد أجريت الدراسة في قسم الصدر ووحدة جراحة القلب والصدر بمستشفى بنها الجامعي، محافظة القليوبية، مصر. تم تطبيق الدراسة على 60 مريضاً ومريضه خضعوا لعملية جراحية بالصدر في وحدة جراحة القلب والصدر بمستشفى بنها الجامعي خلال 9 أشهر من جمع البيانات. حيث كشفت النتائج على زيادة ذو دلالة إحصائية عالية في متوسط إجمالي مستوى معلومات وممارسة المرضى بعد تطبيق البرنامج التمريضي القائم على الأدلة مقارنة بقبل تطبيق البرنامج، كذلك هناك فرق كبير ذو دلاله إحصائية قبل وبعد تطبيق البرنامج فيما يتعلق بالمخرجات الصحية للمرضى. كما أوصت الدراسة برفع مستوى معلومات وممارسة فريق التمريض في وحدة القلب والصدر فيما يتعلق بتطبيق الرعاية الرئوية من خلال حضور برامج تدريبية ورش عمل باستمرار لتحسين مستوى الرعاية التمريضية المقدمة للمرضى بعد جراحة الصدر.