

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

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## *Abstract*

**Background:** Thoracic surgery induces postoperative decrease in respiratory function, which can lead to the development of postoperative pulmonary complications. A variety of pulmonary care techniques are used following thoracic surgery for their prevention and treatment, even though the evidence is limited. **Aim:** The study aimed to evaluate the effect of evidence-based nursing program on post thoracic surgery patients' health outcomes regarding pulmonary care. **Design:** A quasi-experimental research design was utilized. **Setting:** The study was conducted in chest department and cardiothoracic surgery intensive care unit at Benha University Hospital affiliated to Qualubia Governorate. **Sample:** 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, (1) Patient's interview schedule questionnaire included (Personal data, medical and surgical data, knowledge assessment about chest surgery and pulmonary care), (2) Pulmonary care technique observational checklist pre/post pulmonary care intervention consisted of two parts; **Part I** chest physiotherapy techniques included (Deep breathing, diaphragmatic breathing, coughing and huffing exercises, nebulizer, positioning and mobilization), **Part II** postoperative exercises included (Shoulder range of motion (ROM) exercises, trunk and thoracic mobilization exercises). (3) Patients' health outcomes assessment included (Chest pain assessment, postoperative problems assessment, respiratory and physical parameters assessment). **Results:** Most of studied patients were educated males from 30<40 years old. More than one third of the studied patients were smokers and more than half of them were diagnosed with lung cancer. 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<sub>2</sub> and SO<sub>2</sub>. There was no significant correlation between patients' total knowledge and practice pre and post program implementation as (p=>0.05). **Conclusion:** It was concluded that the majority of patients had fair knowledge level and all patients were incompetent regarding performing pulmonary care techniques preprogram implementation while they had been improved post evidence-based nursing 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 program and workshop to improve the standard of nursing care given to post thoracic surgery patients. Further studies about pulmonary care techniques are recommended at different settings and on a large probably sample to generalize the results

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**Key words:** Evidence based nursing program, thoracic surgery, health outcomes and pulmonary care.

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## 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, diaphragm and esophagus as mediastinal and bronchogenic carcinoma, chest trauma, lung and esophageal cancer, empyema and recurrent pneumothorax (**Jheon et al., 2020**). Thoracic surgery involves the surgical procedure where an incision into the pleural cavity or chest wall and access to organs of the chest cavity by cutting through and possibly removing a portion of a rib causing division of major thoracic muscles and consistent rib retraction (**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 play an important role in the treatment of atelectasis and preventing its progression to more significant pulmonary complications following thoracic surgeries, additionally help to expand the lungs, improve lung volume, shoulder and thoracic cage mobility, clear pulmonary secretion and accelerate recovery following hospital discharge (**Marseu & Slinger, 2016**). These 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**). Others as early progressive functional activities such as sitting out of bed, walking and stair climbing (**Moore et al., 2017**).

Evidence-based nursing (EBN) is an important approach of identifying health care needs of patients using the best research and new technology to make decisions related to care (**Khalili et al., 2015**). Its goal 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**). To properly implement EBN, the nurses' knowledge and practice should be assessed and improved (**Melnyk & Fineout, 2015**).

Thoracic specialist nurse plays an important role in providing care to patients and should be aware of postoperative complications and their preventive measures (**Lan et al., 2014**). The initial step in managing both actual and potential health problems after thoracic surgery is making an accurate assessment of patient's 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**).

Postoperative thoracic nurse also assists, supports and educates thoracic surgery patients and their families to reduce stress related to surgery and postoperative pain, increase knowledge of complications management in addition to shortening the period of hospitalization. Therefore, it is important for nurses to use the most excellent accessible evidence base nursing program in making decisions concerning pulmonary care for these patients to provide high quality and effective health care for patients' outcomes (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).

The incidence of postoperative pulmonary complications following thoracic surgery is displayed in 20% of patients (Filho et al., 2021). These complications have a wide spectrum of respiratory abnormalities, associated with increase morbidity and mortality rate, hospitalization time and costs with incidence rate ranges from 1% to 23% in general surgeries (Odor et al., 2020) and from 19% to 59% in thoracic surgeries varying considerably depending on patient related and

surgical factors (Tukanova et al., 2020), mainly atelectasis, pneumonia and respiratory failure which arise in approximately 12%–40% of cases particularly within the first postoperative week with a mortality rate varying from 10% to 20% (Avila & Fenili, 2017; Jing et al., 2018). So, PPCs in patients after thoracic surgery requires considerable attention and management in hospitals (Takahashi et al., 2016).

### **Subjects and method**

#### **Aim of the study:**

**The present study was conducted to fulfill the following aim:**

Evaluate the effect of evidence-based nursing program on post thoracic surgery patients' health outcomes regarding pulmonary care.

#### **Study hypotheses:**

**To achieve this aim, the following study hypotheses were formulated:**

H1- The mean scores of patients' knowledge and practices post implementing pulmonary care will be higher than their score pre implementation of evidence-based nursing program.

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

H3- The mean scores of assessment for post thoracic surgery patients post pulmonary care intervention will be higher than their scores before.

- **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.

- **Sample:**

A purposive sample consisting of sixty patients with chest diseases who underwent thoracic surgery at the cardiothoracic surgery unit at Benha University Hospital over a period of nine months from the beginning of January, 2021 to the end of September, 2021, according to the following criteria:

Conscious adult patients aged from 20 to 60 years old, from both sexes, with different educational levels, able to communicate effectively and agreed to participate in the study. Patients diagnosed with psychosis or currently undergoing antipsychotic treatment were excluded from the study, in addition to unconscious and ventilated patients.

- **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; Schwelnus, 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, type, 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.

The questionnaire tool contained (8) questions about thoracic surgery and pulmonary care. All knowledge items were multiple-choice questions. The patients were asked to reply to these questions with only one correct response for each question pre and post program implementation.

**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. The overall knowledge scores were categorized as follows:

- Good level of knowledge (6-8) marks.
- Fair level of knowledge (3-5) marks.
- Poor level of knowledge (0-2) marks.

**Tool II: Pulmonary care technique observational checklist (pre/post pulmonary care intervention):** These checklists were 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).

**Scoring system:**

Each step in the checklist was scored from 0 to 2. Two grades were given for each step that done completely and correctly, one grade 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:

- $\geq 85\%$  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 will be 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), ... etc., arterial blood gases (ABGs) and vital signs assessment (respiratory rate, body temperature, heart rate and blood pressure).

- **Content validity:**

The face and content validity of the tools were checked through a jury consisting of three experts; two in the field of medical surgical nursing, one professor and one assistant professor from the faculty of nursing, Benha University and one 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.

- **Reliability:**

All tools of the study were tested statistically for its reliability, and it was evaluated using test-retest method by the Cronbach's alpha test which is used to measure the internal

consistency. The reliability score of patients' knowledge questionnaire about thoracic surgery and pulmonary care **tool I (part III)** was r coefficient ( $r= 0.703$ ) and ( $r= 0.927$ ) for patients' practice regarding pulmonary care techniques **tool II** for which denotes the high internal consistency of the used tools.

- **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 in 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 to have more applicable tools for data collection. Patients selected for the pilot study were excluded from the study subjects. The pilot study was done two weeks before starting the study from half to the end of December 2020.

- **Field work:**

- Data collection of the current study was carried out through nine months, from the beginning of January, 2021 to the end of September, 2021. The researcher attended the setting four days (Saturday, Monday, Tuesday and Thursday) per week during afternoon shifts.

- Each patient was interviewed five times; preoperative in chest department (pretest to have baseline assessment about patients' level of knowledge and practice and post immediate test), 2<sup>nd</sup>, 4<sup>th</sup> postoperative day in cardiothoracic surgery ICU unit, 6<sup>th</sup> and 8<sup>th</sup> postoperative day in chest department at Benha University Hospital (post-test).

- Each interview took a time of about 30-45 minutes. The precautionary practices measure due to the spread of the Corona virus, infection control was 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 three phases:**

#### **Assessment phase:**

It was carried out for all studied patients by the researcher to collect baseline data regarding their personal data, lifestyle, medical and surgical history, knowledge and practice regarding pulmonary care techniques preoperatively using **(tool I &II)**. Also, in the second post-operative day the researcher assessed patients' health outcomes including chest pain assessment, postoperative pulmonary problems, respiratory and physical parameters as (PFT, ABGs & vital signs) **(tool III)** as a base line assessment. Filling in the previously mentioned tools was done by the researcher before implementation of the program for each patient individually within an average time of 20 to 30 minutes. All information collected through data collection tools were interpreted for identifying individualized teaching needs. The researcher set up teaching plan covering all objectives. These objectives were categorized into general and specific objectives. The program resources and facilities were allocated (printed material and location of session that best serve the learner). The researcher determined the timetable of sessions, teaching methods, media used and learner's activities. After data collection, the appointment for starting program sessions was detected and scheduled with the patient for the following days.

#### **Implementation phase: (The program implementation): It included the following steps:**

1. The program implementation had been carried out in chest department preoperatively.
2. The program implementation was conducted in 4 sessions. Each session lasted about 30-45 minutes/ day for 2 days per week (2 sessions/ day) for average number of one to two patients/session considering time table for operation, including periods of discussion according to the patients' progress and feedback. Motivation, problem solving and reinforcement techniques were used to enhance active participation of the patient in the educational sessions.
3. Different teaching and learning methods were used during the sessions which included; discussion, demonstration and re-demonstration, instructional media include mobile videos and printed handout with pictures, which was presented in clear and concise form to learn patients about pulmonary care techniques.
4. The program colored booklet was given to each patient under the study in order to help for reviewing and support teaching.
5. At the beginning of the first session, patients were oriented regarding the program contents, its purpose and its impact on his condition and outcomes. Patients were informed about the time of the next session at the end of the sitting.
6. Each session was started by a summary about what has been discussed in the previous session and the objectives of the new session, using simple Arabic language, also the session ended by a summary of its contents and feedback from the

patients was obtained to ensure that he/she got the maximum benefit.

- **1<sup>st</sup> session:** (introductory session) explanation of reasons and importance of the program and give an 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.
- **2<sup>nd</sup> session:** Include applying chest physiotherapy techniques as (breathing exercises, diaphragmatic breathing exercises, coughing and huffing exercises).
- **3<sup>rd</sup> session:** Completion of the chest physiotherapy techniques including nebulizer, positioning & mobilization exercises).
- **4<sup>th</sup> session:** Include applying postoperative exercises as (shoulder ROM exercises, trunk and thoracic mobilization exercises).

7. The researcher carried revision, reinforcement and answered questions according to patients' needs.

8. At the end of these sessions, I received notes from the patients and thanked them for their cooperation with me. I asked them about their opinion on the program and their benefits from the subject, then distributed the questionnaire to do another test. The researcher informed the patients that they will be evaluated by the researcher at 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup> and 8<sup>th</sup> postoperative day.

#### **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 pretest through the following phases:

**Phase 1:** Immediately post-test was performed after implementing the evidence-based nursing program preoperatively (following the teaching session) 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 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup> and 8<sup>th</sup> postoperative day to evaluate the effectiveness of evidence-based nursing program on the patients' practice (tool II) and health outcomes (tool III).

#### **Statistical design:**

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.

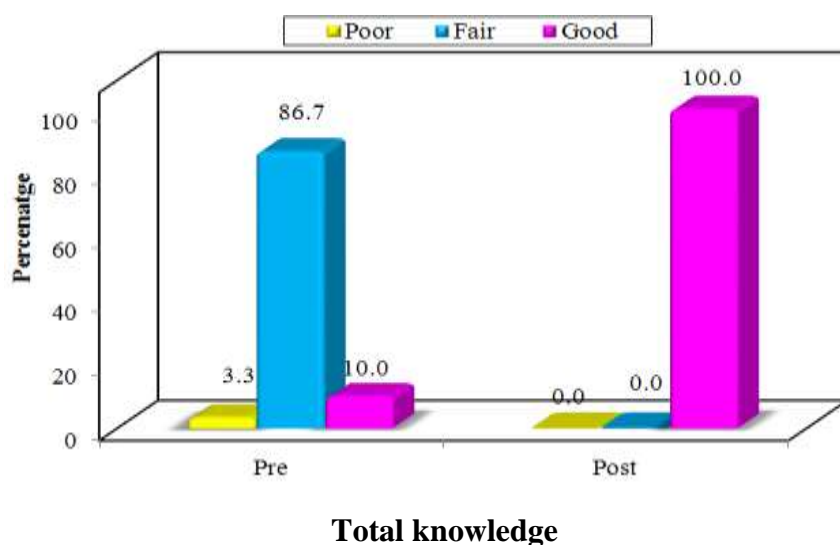


## Results

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

Personal data	No.	%
<b>Sex:</b>		
• Male	36	60.0
• Female	24	40.0
<b>Age/year:</b>		
• 20 - < 30	12	20.0
• 30 - < 40	42	70.0
• 40 - < 50	6	10.0
<b>Mean ± SD = 34.10 ± 5.40</b>		
<b>Educational level:</b>		
• Uneducated	21	35.0
• Educated	39	65.0
<b>Marital status:</b>		
• Single	9	15.0
• Married	48	80.0
• Divorced	3	5.0
<b>Residence:</b>		
• Rural	33	55.0
• Urban	27	45.0
<b>Occupation:</b>		
• Manual work	24	40.0
• Written work	15	25.0
• No work	21	35.0

**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): Level of patients' total knowledge related to thoracic surgery and pulmonary care at pre and immediate post evidence-based nursing program implementation (n = 60)**

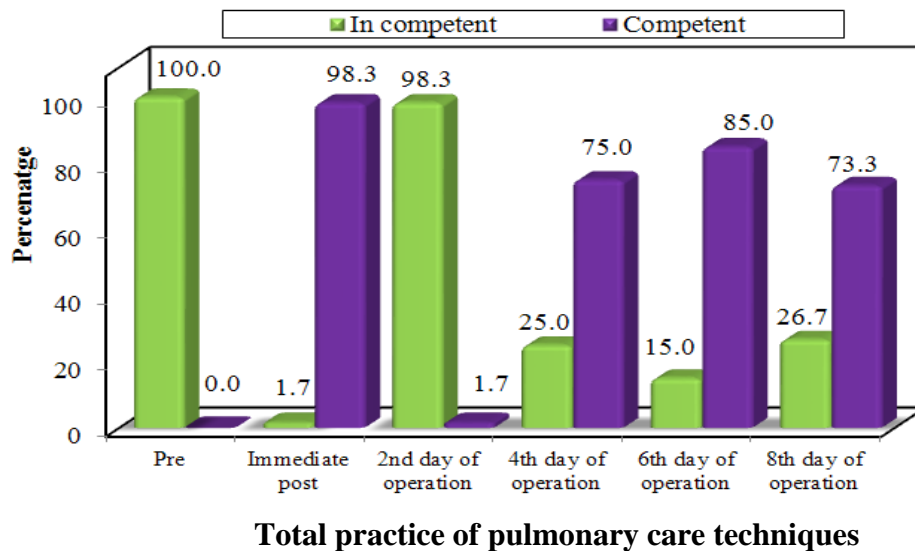
This figure illustrates that 86.7% of the studied patients had a fair level of knowledge pre-evidence-based nursing program implementation, while all of them 100% had a good level of knowledge immediate post-program implementation.

**Table (2): 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 program	post	Z	p
<b>A- Regarding to thoracic surgery:</b>					
<b>Total Score:</b>	<b>(0-5)</b>				
• Mean ± SD	3.07 ± 0.71	4.77 ± 0.46		6.745*	<0.001*
• Mean % score	61.33 ± 14.20	95.33 ± 9.29			
<b>B- Regarding to pulmonary care:</b>					
<b>Total Score</b>	<b>(0-3)</b>				
• Mean ± SD	1.0 ± 0.78	2.80 ± 0.44		6.606*	<0.001*
• Mean % score	33.33 ± 26.04	93.33 ± 14.78			
<b>Total knowledge:</b>					
<b>Total Score</b>	<b>(0-8)</b>				
• Mean ± SD	4.07 ± 1.02	7.57 ± 0.65		6.799*	<0.001*
• Mean % score	50.83 ± 12.79	94.58 ± 8.09			

SD: Standard deviation  
 Z: Wilcoxon signed ranks test  
 p: p value for comparing between pre and post  
 \*: Statistically significant at  $p \leq 0.05$

Table (2) shows that the highest mean percent score preprogram implementation was  $61.33 \pm 14.20$  concerning patients' knowledge about thoracic surgery. But the lowest mean percent score was  $33.33 \pm 26.04$  regarding the patients' knowledge about pulmonary care. On the other hand, the mean percent of total score was increased immediate post program implementation to  $95.33 \pm 9.29$  &  $93.33 \pm 14.78$  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): Level of the studied patients' practice regarding pulmonary care techniques observational checklist pre and post evidence-based nursing program implementation (n = 60)**

**Figure (2)** illustrates 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, 4<sup>th</sup> and 6<sup>th</sup> postoperative day post evidence-based nursing program implementation respectively, while return to decline at 8<sup>th</sup> 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 8<sup>th</sup> day post evidence-based nursing program implementation.

**Table (3): Correlation between patients' total knowledge and total practice pre and post evidence-based nursing program implementation (n = 60)**

Total practice	Total knowledge	
	rs	p
Pre (pre-operative and pre-program)	0.090	0.496
Post program		
- Immediate post (pre-operative)	0.144	0.272
- 2 <sup>nd</sup> day of operation	0.032	0.810
- 4 <sup>th</sup> day of operation	0.061	0.641
- 6 <sup>th</sup> day of operation	0.196	0.133
- 8 <sup>th</sup> day of operation	0.165	0.208

r<sub>s</sub>: Spearman coefficient

\*: Statistically significant at p ≤ 0.05

**Table (3)** shows that there was no significant correlation between patients' total knowledge and total practice pre as well as post program implementation as (p=>0.05).

## Discussion

**Regarding to patients' personal data,** the present study revealed that most of studied patients were males. This finding is supported with **Li et al., (2017)** who performed a study about "Body surface area: a novel predictor for conversion to thoracotomy in patients undergoing video-assisted thoracoscopic lung cancer lobectomy" and **Moon et al., (2019)** who conducted a research about "Intramuscular stimulation as a novel alternative method of pain management after thoracic surgery" they stated that the majority of patients were male. While disagree with **Struck et al., (2019)** who studied "Thoracotomy for emergency repair of iatrogenic tracheal rupture: single center analysis of perioperative management and outcomes" reported that most patients were female. From the researcher point of view, this could be explained in light of the known fact that risk factors of chest disease such as smoking and exposure to cancer causing agents in the workplace are more prevalent in men than women.

**As for age,** the results of the present study revealed that most of the studied patients were recorded within age group of 30<40 years old. This finding is to some extent 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" and **Beshay et al., (2020)** who performed a study about "Analysis of risk factors in thoracic trauma patients with a comparison of a modern trauma center: a monocenter study" they found that young patients (< 40 years) were frequently exposed to severe thoracic injury and undergoing thoracotomy.

But this is in contrast with the result of a study done by **Segalini et al., (2019)** which 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" they mentioned that most of patients were aged between 25-53 years. This finding also inconsistent with **Wojtys et al., (2019)** they carried out a research about "Assessment of postoperative pain management and comparison of effectiveness of pain relief treatment involving paravertebral block and thoracic epidural analgesia in patients undergoing posterolateral thoracotomy" their results showed that the age of most of the studied patients was recorded between 51 and 70 years. From the researcher point of view this attributed to several factors such as, criteria of selection of sample and increase probability of chest trauma or injury occurs usually in the in middle age.

**Regarding the education level,** the current study illustrated that most 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)** who conducted a research about "The effect of resistance inspiratory muscle training in the management of breathlessness in patients with thoracic malignancies" found that majority of the studied patients had secondary education. On the other hand, this result disagrees 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 similar to that of **Shady, Abo Seada & Mostafa (2020)** who performed a study 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. A possible explanation is that most of patients' age ranged between 30-40 years old.

**In relation to residence**, the present study findings revealed that more than half of the studied patients were living 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)** which entitled "Post thoracotomy pain syndrome following surgery for lung cancer: symptoms and impact on quality of life" they mentioned that 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" they stated that the majority of participants resided urban areas.

**As regard to occupation**, the current result revealed that more than one third of the studied patients were manual workers. This result is to some extent 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 by **Molassiotis et al., (2015)** who conducted a research about "The effect of resistance inspiratory muscles training in the management of breathlessness in patients with thoracic malignancies" found that majority of the studied patients were retired. From the researcher point of view this may be due to different educational level of the studied patients in the current study.

**Regarding level of patients' total knowledge about thoracic surgery and pulmonary care**, the results illustrated that most of the studied patients had fair level of total knowledge at pre, while all of them had good level at immediately post evidence-based nursing program implementation. This finding is in accordance with **Vanmathi (2015)** who carried out "A study to evaluate the effectiveness of video assisted teaching program on knowledge regarding post-operative exercise among patients undergoing cardiothoracic surgery in Kovia medical center hospital at Erode" they found that patients had poor knowledge at pretest but in posttest they had adequate knowledge and their total knowledge score was improved from pre to posttest. The results were similar also to findings of **Oswald et al., (2018)** who studied "Patients want more information after surgery: A prospective audit of satisfaction with perioperative information in lung cancer surgery" stated that patients who received more information about the disease, surgery and care that help them get well after surgery were satisfactory.

**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 implementation of evidence-based nursing program. 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 at pre evidence-based nursing program implementation, but improved to be competent post its 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.

### **Conclusion**

Based on the findings of the current study, it was concluded that:

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 they had been 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:**

Based on the current study result, the following recommendations can be suggested:

- 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 chest physiotherapy through continuous attending in-service and in job training program and workshop periodically and regularly to improve the standard of nursing care given to post thoracic surgery patients.
- 3- Further studies about pulmonary care techniques performed by nurses on thoracic surgery patients are recommended at different settings and on a large probably sample to generalize the results.

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