Effect of Educational Training Program about Chest Physiotherapy on Nurses' Performance and Clinical Outcomes for infants with Lower Respiratory Problems in Pediatric Intensive Care Unit

Heba Ibrahem Mohamed [1], Rahma Soliman Bahgat [2], Abd Elrahman Mohamed Elmashad [3], Sabah Mohamed Sharshor [4]

[1]*(Assistant lecturer of Pediatric Nursing, Faculty of Nursing / Kafr-Elsheikh University, Egypt).*
[2]*(Professor of Pediatric Nursing, Faculty of Nursing, Tanta University, Egypt)*
[3]*(Professor of Pediatrics and Neonates, Faculty of Medicine, Tanta University, Egypt)*
[4]*(Lecture of Pediatric Nursing, Faculty of Nursing, Tanta University, Egypt)*
Corresponding Author: Heba Ibrahem Mohamed

Abstract:
Background: Chest physiotherapy is the term for a group of treatments designed to improve respiratory efficiency, promote expansions of lungs and eliminate secretion from respiratory system.
Aim: was to evaluate the effect of educational training program about chest physiotherapy on nurses' performance and clinical outcomes for infants with lower respiratory problems in Pediatric Intensive Care Unit.
Settings: Pediatric Intensive Care Unit of Tanta Main University Hospital.
Subjects and method: 50 nurses working in Pediatric Intensive Care Unit and responsible for providing care for infants with lower respiratory problems and 25 infants were complained from lower respiratory problems, had normal body temperature and free from any congenital anomalies.
Tools: Three tools were used to collect data: Nurses knowledge and socio demographic data, An observation Checklist for Pediatric nurses' performance about Chest physiotherapy and Infant characteristics and clinical outcomes.
Results: The results of this study showed that improving the knowledge and practice of nurses immediate and one month after implementation of the program than pre-program. Improving clinical outcomes of the infants after application of program than pre-program application.
Conclusion: A significant improvement was observed in the total score of nurses' knowledge and practice among the studied sample in immediate post and one-month after program in comparison to that in pre-program. Improvement was observed in clinical outcomes of infants after program application.
Recommendation: In-service training program should be conducted periodically and regularly for teaching nurses working in Pediatric Intensive Care Unit the basic clinical skills.
Key words: Educational training program, chest physiotherapy, nurses' performance, lower respiratory problems, clinical outcomes.

I. Introduction

Respiratory problems are a medical term which encompasses pathological conditions affecting the organs and tissues which have important role in the process of gas exchange. They are grouped according to their symptomatology and anatomic involvement into two groups which are upper and lower respiratory tract infections. Upper respiratory tract infections include the common cold, pharyngitis and epiglottitis. Problems of the lower respiratory tract include bronchitis, bronchiolitis, asthma and pneumonia [1-3].

Lower respiratory problems were the most common cause of hospital admission being responsible for nearly one fourth of admitted cases (24.96%) where pneumonia 15.2%, bronchiolitis and bronchitis 6.2% while a cute severe asthma 3% in Egypt [4]. In 2015 there were about 291 million cases suffer from lower respiratory problems [5]

Normal breathing cycles and cough are the primary mechanisms of removing secretions from the lung in the normal lung mucociliary activity. Infants with lower respiratory problems, increased secretion viscosity and volume, dyskinesia of the cilia, and ineffective cough combine to reduce the ability to clear secretions may increase exacerbations and infections. A variety of airway clearance techniques have been developed, refined,

---

and used to assist infants in mobilizing secretions from the lower respiratory tract. Chest physiotherapy techniques were developed specifically for infants, in accordance with their physiological characteristics [6].

Chest physiotherapy (CPT) is the term for a group of treatments designed to improve respiratory efficiency, promote expansions of lungs, strengthen   respiratory muscles and eliminate secretion from respiratory system. It is including several maneuvers such as postural drainage, percussion, vibration and suctioning. Postural drainage (PD) or gravity assisted positioning is a technique in which the infant is placed in positions that allow gravity to assist with the drainage of secretions from smaller to large bronchi. In addition, percussion referred to cupping or clapping. These names describe the manual rhythmic striking of the thorax while vibration is the placement of hands along the ribs in the direction of expiratory movement of the chest. It is usually done in conjunction with other treatments to rid the airway of secretion. These other treatments include suctioning [7-9].

Nurses as main drivers of hospitals have an important role in improving quality of care which provided to infants with lower respiratory problems thus speed up recovery. Implementation of training program to nurses can be used for monitoring, evaluating and improving quality of care at the health sectors. In addition, it may allow nurses to carry out their professional roles, be acquainted with required knowledge and skills that help them to orient new staff and guide them in their practice [10, 11].

Hence, this study was conducted to evaluate the effect of the application of educational training program about chest physiotherapy on nurses' performance and clinical outcomes for infants with lower respiratory problems in pediatric intensive care unit.

Significant of the problem

Respiratory problems represent the most common diseases during childhood in both developing and developed countries. The majority of these infections are limited to upper respiratory tract, while Lower respiratory infections are the third leading cause of death worldwide with the vast majority occurring in developing countries [4,5].

II. Aim of the study

The study aimed to evaluate the effect of educational training program about chest physiotherapy on nurses' performance and evaluate clinical outcomes for infants with lower respiratory problems in Pediatric Intensive Care Unit.

III. Subjects and Method

3.1 Study design: A Quasi experimental research design was utilized to achieve the purpose of the study.

3.2 Study hypotheses: a-Pediatric nurses who received the educational training program about chest physiotherapy expected to have higher mean score of performance post the application of the educational program **b-** Infant clinical outcomes: expected to lower respiratory problems and blood gases expected to improved

3.3 Study setting: The study was conducted at Pediatric Intensive Care Unit of Tanta Main University Hospital.

3.4 Subjects:

1- Group (1): A convenient sample of (50) nurses who were responsible for provided care for infants in mooring ,evening and night shift above previously mentioned setting (Pediatric Intensive Care Unit of Tanta Main University Hospital were had 65 nurses and 15 of them in vacation) actually 50 nurses were provide care for 18 beds.

2- Group (2): Twenty- five infants were complained from lower respiratory problems had the following Criteria:

- Normal body temperature.

- Free from any congenital anomalies

3.5 Tools of the study: In order to collect the necessary data for the study three tools were used:

Tool I: Socio demographic data and Nurses, knowledge:

Structured questionnaire schedule about chest physiotherapy: It was developed by the researcher after reviewing the recent related literature and consisted of two parts:

Part I: Socio-demographic data of the nurses (5) questions: such as gender, age, educational level, years of experiences and attendance course about chest physiotherapy.

Part II: Assess nurse's knowledge about chest physiotherapy (21) questions: such as meaning of chest physiotherapy, postural drainage, percussion and vibration benefits of chest physiotherapy, tools used to perform chest physiotherapy. Suction: definition, indication, types and risk factors for infants in pediatric intensive care units [12,13].

The total score of nurses' knowledge was calculated and classified as follows:
More than 70% was considered good.
70% to 60% was considered fair.
Less than 60% was considered poor.

Tool II: An observation Checklist for Pediatric nurses' performance about Chest physiotherapy
It was adopted from Wilkerson and leuver (2007) [14] and modified by the researcher to assess the actual performance of nurses who provided care for infants with lower respiratory problem in pediatric intensive care unit. The checklist consisted of 12 procedures. This was distributed as follows:
- Basic physiological measurement such as measurement of temperature, heart rate and respiratory rate
- Basic physical growth such as measurement of weight, length, head circumference, chest circumference
- Measurement of Oxygen saturation using pulse oximeter
- Chest and lung assessment
- Chest physiotherapy includes Performing postural drainage, percussion and vibration
- Oropharyngeal and nasopharyngeal suction
- Mouth care

The total score of each procedure had been calculated and classified as follows:
Satisfactory ≥ 70% of the total score.
Unsatisfactory < 70% of the total score.

Tool III: Infant characteristics and clinical outcomes include two parts.
Part 1: Infant characteristics (5 points) such as Name, age, sex, weight and diagnosis.
Part II: Infant clinical outcome such as temperature, pulse, respiration, sign and symptom of respiratory infection as(fever, cough, grunting, chest in drawing, feeding difficulties irritability, poor sleep) blood gases and oxygen saturation was obtained before and after the program application. Finding was compared against normal result.

3.6 Method:
1- **Administrative Approval:**
The study was carried out after getting an official permission from the responsible authorities and administrative staff of hospital department in the setting mentioned previously.

2- Ethical Consideration
- Nurses consent to participate in this study was obtained.
- Nurses were informed about the confidentiality of the information obtained from them and nature of the study.
- The nurses had the right to withdraw from the study at any time without any penalties.

3- Tools Development
Tools I, II, III was developed by the researcher

4- Content validity:
Tools of the study were tested for content validity by experts in the field of pediatrics and the necessary modifications were done.

5- **Tools I, II, III was test for internal consistency** using crobach's alph reliability test. This test was reliable and its coefficient value was 0.930.

6- A pilot Study:
A pilot study for 5 nurses was carried out to test clarity, feasibility and applicability of the tools, the necessary modification was done accordingly. The result of the pilot study revealed that the tool was clear and applicable. It was excluded from the study.

7- **The study was conducted through four phases,** assessment planning, implementation and evaluation phase:

Assessment Phase:
- It was carried out by the researcher for all studied nurses to assess their knowledge using **Tool (I)** The nurses' knowledge were assessed before, immediately and after one month from the program application.
- The nurse's practices were assessed before, immediately and after one month from the program application using **Tool (II)** as all nurses were observed during the different nursing procedures in all period of morning and evening shift. **Tool (III)** was used to assess clinical status of infants with lower respiratory problems to collect the base line data as pre-intervention assessment.

Planning phase:
It is based on the result of questionnaire, observational check list and reviewing the most recent related literature and the program was involved.
- Formulating program objective
- Preparation for teaching methods was chosen.

Implementation Phase:
- Select appropriate teaching methods such as interactive lecture, brain storming, group discussion and demonstration.
- Preparation of suitable audio-visual aids such as power point presentation, video, Pictures and booklet for teaching the nurses.
- Nurses were divided into ten groups each group consists of five nurses.
- Program about Chest Physiotherapy for infants with lower respiratory problems had been presented to all nurses included in the study in 7 sessions. Each group attended the following sessions.
    The first session: The aim of this session is to orient the nurses about the importance of the program. (Duration 20 minutes)
    The second session: The aim of this session is to improve nurse's performance in physiological and physical growth measurement. (Duration 30 minutes)
    The third session: The aim of this session is to increase nurse's knowledge about definition, indication, benefits and complication of chest physiotherapy as well as clarify to nurses the anatomy and physiology of respiratory system. (Duration 60 minutes)
    Fourth session: The aim of this session is to improve nurses' practices in chest physiotherapy and oxygen saturation measurement (Duration 60 minutes)
    The Fifth session: The aim of this session is to increase nurses' knowledge about definition, indication purpose, hazards and actions to be taken to prevent and/or minimize the complications of suctioning. (Duration 35 minutes)
    The sixth session: The aim of this session is to improve nurses' practices in orpharyngeal and nasopharyngeal suction. (Duration 45 minutes)
    The seven sessions: The aim of this session is to orient nurses about normal and abnormal breathing sounds. Improve nurses' practice in oral care, chest and lung assessment. (Duration 50 minutes)
- Each session started with summary of what given in the previous session and the topic of the present session. Re-demonstration by nurses carried out at the end of each session.

Evaluation Phase:
Evaluation of nurses was done before, immediate and after one month from the implementation of the program to evaluate the following:
- Nurses' knowledge using Tool I.
- Nurses' practice using tool II.
8- The infants' clinical outcome was evaluated before and immediate the implementation of the program through assessment of temperature, pulse, respiration, sign and symptom of respiratory infection as fever, cough, grunting, chest in drawing, feeding difficulties irritability, poor sleep. oxygen saturation and blood gasses.
9- Data were collected over a period of eight months; from December 2016 to August 2017.The duration of the study was take within 2 years**.**

Statistical analysis:
      The collected data was organized, tabulated and statistically analyzed using SPSS system files (SPSS package version 20). For quantitative data, the range, mean, and stander deviation were calculated. For qualitative data the number and percentage distribution were calculated. Chi-square test(X^2) was used to examine the relation between qualitative variables. For comparison between more than two means of parametric data, F value of ANOVA test was calculated, where scheffe test was performed to compare between more than

---

two mean if F value was significant for comparison between more than two means. Correlation between variables was evaluated using personal's correlation coefficient (r). Significance was adopted at p< 0.05 for interpretation of results of tests of significance .

IV. Results

Table (1) shows that more than half of the nurses (56.0%) were age ranged from 25 to less than 30 years, their mean 27.56 ± 3.928. Regarding their education, (60.0%) of nurses graduated from technical institution of nursing. Concerning to their level of experience in intensive care unit, it was observed that more than half of nurses (52.0%) had years of experience ranged from 5 to less than 10 years. Unfortunately, all nurses (100%) didn't attend any conference or training courses related to chest physiotherapy.

Table (2) shows that more than half of infants' age (56.0%) ranged from 6 to less than 9 months. Concerning their sex, it was observed that more than half of them (52.0%) were female. As regards to their weight, it was observed that (56.0%) of infants ' weight was range from 6 to less than 8 kg. It was observed from the table that (52%, 24%, 24% respectively) of them had pneumonia, bronchitis and asthma.

Table (3) reveals that more than three quarter (78%) of nurses had poor level of total knowledge; pre-intervention. On the other hand, the majority of them (88%,96% respectively) had a good level of total knowledge; immediate post and one-month post intervention with significant improvement (p=0.000). The mean score of total knowledge of nurses improved from (19.6±7.72) pre- program to (38.72±4.52) immediate program and (40.88±2.62) one-month post program with significant improvement between before and immediate post, before and after one-month program application (P=0.000).

Table (4) represents that more than half of nurses' performance (54%) were satisfactory pre- program application regarding measuring temperature, and improved to (94%, 98% respectively) immediate and one-month post program. As regards measuring pulse, it was observed that near three quarter of nurses' performance (72%) were unsatisfactory pre-program application while, immediate program and one-month post program application, most of their performance (80%, 98% respectively) were satisfactory. Concerning measuring respiration, it was observed that more than half of nurses' performance (62%) were unsatisfactory pre-program application while immediate and one-month post program application the majority (96%, 98% respectively) of them were satisfactory.

Moreover, as regards measuring weight, it was observed that more than three quarter of nurses' performances (78%) were unsatisfactory pre-program application while immediate and one-month post program application most of their performances (90%,98% respectively) were satisfactory. Concerning measuring length more than three quarter of nurses' performances (80%) were unsatisfactory pre- program application while, immediate program and one- month post program application, their performance (86%, 96% respectively) were satisfactory. Regarding measuring head circumference more than three quarter of nurses' performances (80%) were unsatisfactory pre- program application while, immediate program it was noticed than (68%) of them obtained satisfactory score then increased to (84%) one-month post program application.

Regarding measuring chest circumference, it was observed that more than three quarter of nurses' performance (82%) were unsatisfactory pre- program application while, immediate and one- month post program application, most of their performances (94%, 98% respectively) were satisfactory. Concerning measuring oxygen saturation, it was observed that (62%, 96%, 98% respectively) of nurses' performance were satisfactory pre, immediate and one-month post program application. Regarding chest and lung assessment more than three quarter of nurses' performances (80%) were unsatisfactory pre- program application while, immediate program it was noticed than (70%) of them obtained satisfactory score then increased to (88%) one-month post program application.

Concerning, performing postural drainage, percussion and vibration, it was observed that more than three quarter of nurses' performance (78%) were unsatisfactory pre- program application while, immediate and one-month post program application their performances (84%, 96% respectively) were satisfactory. On the other hand (60%) of nurses had un satisfactory level of performance related to suctioning procedure Pre-program application while, their performance immediate and one -month post intervention (92%, 98% respectively) were satisfactory. Regarding performing oral care more than half of nurses (58%) of nurses' performances were unsatisfactory pre- program application while, immediate program it was noticed than (86%) of them obtained satisfactory score then increased to (92%) one-month post program application. There was statistically significant difference between before and immediate post, before and after one-month program application (P=0.000).

Table (5) shows a significant improvement in total score of nurses' practice of nurses' pre, immediate and one-month post intervention. The majority of nurses (84%) had unsatisfactory level of total performance; pre- intervention. On the other hand, the majority of them (96%,98% respectively) had satisfactory level of performance; immediate and one-month post intervention. The mean score of total performance of nurses improved from (101.52±37.4) pre- intervention to (173.26±16.03) immediate intervention and (184.74±11.17).

one-month post program application. There was statistically significant difference between before and immediate post, before and after one-month program application (P=0.000).

  Table (6) shows that there was a significant positive correlation between level of total knowledge of studied sample and their total practice regarding chest physiotherapy immediate post and one-month post program application (P=0.000), (r=0.85,0.70 respectively)

  Table (7) reveals that, the mean change of knowledge was highest immediate post program and one month post program than pre- program (19.12±8.04, 21.28±7.6 respectively) .On the other hand ,the mean change of score of performance was highest ;immediate program and one month post program than pre-program (71.74±32.83, 83.22±33.61 respectively). However, there was a slight decline in the mean change of knowledge and performance one- month post program than immediate program application (2.16±3.59, 11.27±11.48 respectively)

  Table (8) reveals that (60%) of infants was tachycardia before application of chest physiotherapy; while after application of chest physiotherapy (8%) of them were tachycardia. Concerning respiration (68%) of them were tachypnea before application of chest physiotherapy; compared with (12%) of them only after application of chest physiotherapy.As regards to blood gases (72%) of infant were abnormal blood gases before application of chest physiotherapy, while after application of chest physiotherapy (88%) of them were normal blood gases. Regarding oxygen saturation (56%) of infant were abnormal before application of chest physiotherapy compared with (16%) post application of chest physiotherapy.

Table (1): Percentage distribution of the studied nurses regarding their socio- demographic characteristics.

Socio-demographic Characteristics	(n=50)	
	No	%
Age (years)		
20<25	16	32.0
25<30	28	56.0
30<35	2	4.0
35-40	4	8.0
$\overline{X}$ ± SD	27.56 ± 3.928	
Educational level		
Secondary Nursing School	7	14.0
Technical Institution of Nursing	30	60.0
Bachelor Degree	13	26.0
Years of Experience		
<5	18	36.0
5 < 10	26	52.0
10 < 15	2	4.0
15 >20	4	8.0
$\overline{X}$ ± SD	6.98 ±4.157	
Attending any Training Program Related to chest physiotherapy		
No	50	100

Table (2): Percentage distribution of the studied infants regarding to their socio- demographic characteristics.

socio-demographic characteristics	(n=25)	
	No	%
Age (months)		
• 3 < 6	6	24
• 6 <9	14	56
• 9- 12	5	20
X ± SD	7.04±2.458	
Sex		
• Male	12	48
• Female	13	52
Weight(Kg)		
• 6<8	14	56
• 8<10	9	36
• 10-12	2	8
Diagnosis		
• Pneumonia	13	52
• Bronchiolitis	6	24
	6	24

• Asthma		
X ± SD		**7.720±1.0614**

Table (3): Distribution of the total score of nurses' knowledge pre, immediate and one month post intervention (n=50)

	Before (n=50)		Immediate (n=50)		After (n=50)		X^2 (1) *	P	X^2 (2) **	P	X^2 (3) ***	P
	No	%	No	%	No	%						
Levels of the total knowledge												
Poor	39	78	1	2	0	0	64.10	0.000*	77.56	0.000*	2.17	0.140
Fair	7	14	5	10	2	4						
Good	4	8	44	88	48	96						
Total Scores												
Range	2.0-41.0		23.0-42.0		29.0-42.0							
Mean±SD	19.6±7.72		38.72±4.52		40.88±2.62							
F value	236.94											
P value	0.000											

* Significant at P≤0.05

* Before and immediate post program.

** Before and after one month.

***Immediate and one month post program

Table (4): Distribution of Nurses Level of Performance at PICU Before, Immediate and After One Month Regarding Performance of Chest Physiotherapy for the infant with Lower Respiratory Problems

Variables	Before (n=50)		Immediate (n=50)		After(n=50)		X^2 (1) *	P	X^2 (2) **	P	X^2 (3) ***	P
	No	%	No	%	No	%						
Temperature												
• Satisfactory	27	54.00	47	94.00	49	98.00	20.79	0.000*	26.54	0.000*	1.04	0.307
• Unsatisfactory	23	46.00	3	6.00	1	2.00						
Apical Pulse												
• Satisfactory	14	28.00	40	80.00	49	98.00	27.21	0.000*	52.55	0.000*	8.27	0.004
• Unsatisfactory	36	72.00	10	20.00	1	2.00						
Respiratory Rate												
• Satisfactory	19	38.00	48	96.00	49	98.00	38.04	0.000*	41.36	0.000*	0.34	0.558
• Unsatisfactory	31	62.00	2	4.00	1	2.00						
Weight												
• Satisfactory	11	22.00	45	90.00	49	98.00	46.92	0.000*	60.17	0.000*	2.84	0.092
• Unsatisfactory	39	78.00	5	10.00	1	2.00						
Length												
• Satisfactory	10	20.00	43	86.00	48	96.00	43.72	0.000*	59.28	0.000*	3.05	0.081
• Unsatisfactory	40	80.00	7	14.00	2	4.00						
Head Circumference												
• Satisfactory	10	20.00	34	68.00	42	84.00	23.38	0.000*	41.03	0.000*	3.51	0.061
• Unsatisfactory	40	80.00	16	32.00	8	16.00						
Chest Circumference												
• Satisfactory	9	18.00	47	94.00	49	98.00	58.60	0.000*	65.68	0.000*	1.04	0.307
• Unsatisfactory	41	82.00	3	6.00	1	2.00						
Oxygen Saturation												
• Satisfactory	31	62.00	48	96.00	49	98.00	17.42	0.000*	20.25	0.000*	0.34	0.558
• Unsatisfactory	19	38.00	2	4.00	1	2.00						
Chest and Lung Assessment												
• Satisfactory	10	20.00	35	70.00	44	88.00	25.25	0.000*	46.54	0.000*	4.88	0.027
• Unsatisfactory	40	80.00	15	30.00	6	12.00						
Performing Postural drainage, Percussion and Vibration							38.58	0.000*	56.59	0.000*	4.00	0.046
• Satisfactory	11	22.00	42	84.00	48	96.00						
• Unsatisfactory	39	78.00	8	16.00	2	4.00						
Performing Suctioning (Oropharyngeal and Nasopharyngeal suction)							30.13	0.000*	39.32	0.000*	1.90	0.169
• Satisfactory	20	40.00	46	92.00	49	98.00						
• Unsatisfactory	30	60.00	4	8.00	1	2.00						

Performing Oral Care											
• Satisfactory	21	42.00	43	86.00	46	92.00	21.01	0.000*	28.27	0.000*	0.92	0.338
• Unsatisfactory	29	58.00	7	14.00	4	8.00						

* Significant at P≤0.05
* Before and immediate post program.
** Before and after one month.
***Immediate and one month post program

Table (5) Distribution of the total score of nurses' practices pre, immediate post and one- month post program regarding chest physiotherapy

* Significant at P≤0.05
* Before and immediate post program.
** Before and after one month.
***Immediate and one month post program

Table (6): Correlation between total score of nurses' knowledge and practice regarding chest physiotherapy

Levels of total practices	Before (n=50)		Immediate (n=50)		After (n=50)		X^2 (1) *	P	X^2 (2) **	P	X^2 (3) ***	P
	No	%	No	%	No	%						
Satisfactory	8	16.0	48	96.0	49	98.0	64.94	0.000*	68.58	0.000*	0.34	0.558
Unsatisfactory	42	84.0	2	4.00	1	2.0						
Total Scores												
Range	42±188		127±197		131±198							
Mean±SD	101.52±37.4		173.26±16.03		184.74±11.17							
F value	171.38											
P value	0.00											

Practice about chest physiotherapy	Level of total score of nurses' knowledges											
	Immediate post						One month after program					
	Poor (n=1)		Fair (n =5)		Good (n =44)		χ^2 p value	Poor (n = 0)		Fair (n = 2)		Good (n =48)	p value	χ^2
	N	%	N	%	N	%		N	%	N	%	N	%	
Satisfactory	0	0.00	4	8.00	44	88.00	29.17 0.000	0	0.00	1	2.00	48	96.00	3.75 0.153
Unsatisfactory	1	2.00	1	2.00	0	0.00		0	0.00	1	2.00	0	0.00	
R	0.58							0.70					
P	0.000*							0.000*					

* Significant at P≤0.05
* Before and immediate post program.
** Before and after one month.
***Immediate and one month post program

Table (7): Mean change of scores of knowledge and practice about chest physiotherapy among nurses immediate and one- month post program than pre-program application

Change of knowledge and practice scores		Knowledge scores (n=50)	Practice scores (n = 50)
Change of scores immediate post than pre- program application	Range	0-37	7-128
	Mean ± SD	19.12±8.04	71.74±32.83
Change of scores after one month than pre- program application	Range	1-38	10-139
	Mean ± SD	21.28±7.6	83.22±33.61

Change of scores after one month than immediate post program	Range	0- 14	0-52
	Mean ± SD	2.16±3.59	11.27±11.48

* Significant at P≤0.05

Table (8): Percentage distribution of infant related to their clinical outcome pre –program ,immediate and one month post application of program n=(25)

	Before (n=25)		Immediate(n=25)		X^2	P value
	No	%	No	%		
Pulse						
• Normal	10	40	23	92	15.062	0.000*
• Tachycardia	15	60	2	8		
Respiration						
• Normal	8	32	22	88	16.333	0.000*
• Tachypnea	17	68	3	12		
Blood gases						
• Normal	18	72	22	88	2.000	0.157
• Abnormal	7	28	3	12		
Oxygen saturation						
• Normal	11	44	21	84	8.681	0.003*
• Abnormal	14	56	4	16		

* Significant at P≤0.05

V. Discussion

Lower respiratory tract infections (LRTI) are generally more severe and are responsible for the large majority of complications especially in young children. The complications of lower respiratory tract are severe pneumonia, obstructive bronchitis, severe bronchiolitis, Asthma. It has generally more severe course and are a major cause of morbidity and mortality in children. [1-3] Chest physiotherapy is the term for a group of treatments designed to improve respiratory efficiency, promote expansion of lungs, strengthen respiratory muscle, eliminate secretions from the respiratory system and help the infant to breathe more freely and to get more oxygen into the body. The various methods of chest physiotherapy include postural drainage, chest percussion, and chest vibration, turning exercise and coughing exercise. All these usually done in conjunction with other treatments such as suctioning and administration of expectorant drugs. [8,9]

Regarding socio-demographic data of the studied nurses, the results of the current study showed that, more than half of the nurses' age was between 25 to less than 30 years Table (1). This result may be attributed to the distribution of older age to be ahead nurse not involved in patient care. This result in agreement with by Ahmed (2014) [15] who found that less than two thirds of the nurses' age was between 20-<30 years. Regarding to their educational level near two third of them graduated from technical institution of nursing Table (1). This may be due to the fact that technical institution of nursing provides the community with large number of technical nurses graduates after only two years from studying than other agencies such as faculties of nursing. This finding was in consistent with Ahmed (2014) [15] who stated that, half of nurses had technical institution of nursing. Concerning to level of experience of nurses in intensive care unit, it was observed that more than half of nurses have years of experience ranged from 5 to less than 10 years, this agreement with the finding of Kunswa (2010) [16]   who mentioned that the majority of studied nurses had years of experience ranged from 5-10 years. Also, Dawoud (2013) [17] found that the majority of nurses have years of experience ranged from 5 to less than 10 years.

It was observed from the current study that lower respiratory problems such as pneumonia and asthma were common in age group range from 1- 6 months **(Table 2).** This result was in a agreement with **Mohamed (2008)** [18] who state that the majority of his sample were children less than 1 year and diagnosed with pneumonia. In Egypt, this may be due to lack of immunity of these children due to poverty and lack of nutritional diet, lack of hygienic care provided by the mothers, lack of health care services available to children and lack of appropriate care provided by the mothers to their children. The result of the present study reveals that most of infants were from rural areas **(Table 2)** from the researcher point of view this may be due almost hospital referral of acute cases to PICU for better facilities and equipment.

As regards nurses' total level of knowledge, the current study revealed that more than three quarter of nurses had poor level of total knowledge; pre- intervention Table (3). This study may be attributed to there was no source for acquiring knowledge from doctors, head nurses, attending training courses and even no guidelines or any protocol of nursing intervention. On the other hand, the majority of them had a good level of total

knowledge; immediate post and one-month post intervention Table (3). This result is in agreement with Ramya and Neethu (2013) [19] who found that extreme statistically significant difference is found between the total knowledge score of pre and post- test revealing effectiveness of the training program. Another study carried out by Kheder (2016) [20] about assessment of nurses' knowledge and practice regarding chest physiotherapy reported that the nurses were not aware of knowledge about chest physiotherapy in general.

On assessing nurse's practice, regarding the physiological measurement, the current study clarified that, more than half of nurses had satisfactory level of performance related to measuring temperature. From the researcher point of view this may be attributed to the importance of vital signs and cannot be ignored as it is a basic nursing activity in the child assessment which should precede nursing care planning and implementation. This finding was agreed with Unkuri, Suhonen, Katajisto (2014) [21] in their study about assessment of nursing skills related to patients' vital signs, found that satisfactory level of performance related to measuring temperature, so it is a basic procedure in the assessment.

In the present study, the results revealed that near three quarter of nurses demonstrate unsatisfactory level of performance regard measuring pulse and respiration pre- program application (Table 3). From the researcher point of view this may be contributed to the use of electronic equipment to monitor and record patients' where it's provide faster assessment and save time than manual method. In contrary to the present findings Unkuri, Suhonen, Katajisto (2014) [21] who stated that nursing skills related to respiration and heart rate were very good level. Whereas, immediate post and one-month post program application most of them demonstrate satisfactory score. This may be attributed to sufficient basic information given to nurses that reflects the importance of essential manual nursing skills where manual observations, such as palpating the pulse, are important because they allow the nurse more time to interact with the infant and, thereby, develop a therapeutic relationship. Boyd (2013) [22] who supported this view, reinforcing that all children should have a manual set of essential observations recorded.

Weight is an important factor in hospital clinical decision-making and can significantly impact clinical interventions related to medication dosing. Actual body weight can significantly change throughout the hospital stay. Therefore, an accurate weight is an essential piece of information for medical treatment and determining additional interventions [23]. The finding of the present study revealed that near three quarter of nurses obtained unsatisfactory score regarding weight measurement pre-program application Table (3). This may be attributed to the lack of adequate equipment and lack of continuous education in the unit. While immediate post and one-month post program application most of them demonstrated satisfactory level in measuring weight Table (3). From the researcher point of view the present findings may be related to provision of nurses with adequate equipment required for measuring weight, increase their awareness about the importance of weighing infants and obtain weights routinely and good supervision of head nurse. In agreement with the present study Bloomfield, Steel. MacLeenan, Noble (2016) [24] who reported that educational program increase the awareness of nursing staff for obtaining daily weight and it was effective in improving post program score of nurses.

Measuring length, head circumference and chest circumference have a little value but can be used to decide that the infant within the normal range of growth and development. Regards to measuring length, head circumference and chest circumference the results of the present study revealed that more than three quarter of nurses had unsatisfactory level of performance pre- program application Table (3). This attributed to the nurse believes that measuring height, head circumference and chest circumference indicated only for special case and performed in growth clinics not performed as routine care for all infants. This study in harmony with study carried out by Sharshour (2012) [25] who stated that the majority of studied nurses demonstrated incomplete level of performance in taking general measurement before program. Also, in the same line with the present study Mohamed (2017) [26] who found that the majority of nurses did not take the length, the head and chest circumference. Whereas, immediate post and one-month post program application it was noticed than the majority of them obtained satisfactory score.

The finding of the present study revealed that the majority of nurses demonstrate satisfactory level of performance, immediate post and one-month post program Table (3). This may be attributed to the awareness of nurses about the importance of monitoring oxygen saturation and because of the fact that these personnel use the pulse oximeter on a more regular basis. Contrary to the present findings Alshehri (2010) [27] who found that a marked deficiency in the use of the pulse oximeter for children.

Chest and lung assessment is an important component of health assessment and is a valuable tool in managing infant with respiratory problems. The present studies revealed that more three quarter of nurses' performances were unsatisfactory pre- program application Table (3). This may be attributed to many nurses still regard these skills within the domain of the medical officer and not a 'legitimate nursing activity'. This finding was consistent with June (2012) [28] who cited that chest auscultation has not become part of the ritual of nurses' daily work as compared to the physiological measurement. Listening to lung sounds and accurately assessing the pattern and work of breathing are often absent from nurses' routine practice. On the other hand, Warner (2008) [29] who stated that chest and lung assessment becoming increasingly important as the scope of

nursing roles and the very nature of clinical practice changes and added that the introduction of more technology does not reduce the need for nurses to use assessment skills, but rather increases it.

Regarding immediate post and one-month post program application most of nurse's performance was satisfactory. This may be attributed to increasing the nurses' awareness about the importance of chest and lung assessment for the infant and identifying their responsibilities. This result in harmony with Elewa1 and Elkattan (2017) [30] who found that statistically significant differences between pre/post educational program regarding to nurses' practice namely physical assessment include measuring vital signs, respiratory assessment and they cited that the results may be due to the positive effect of the educational program, which improved nurses' practice. They added that the incompetence in nurses' level of practice pre- implementation of the educational program may be due to lack of supervision, neglection from nurses, shortage of qualified staff, as well as shortage of an orientation program for the nurses.

Concerning, performing postural drainage, percussion and vibration, the finding of the present study showed that more than three quarter of nurses' performance were unsatisfactory before application of program. This may be attributed to lack of training program to nurses, where all nurse not attain any programs related to this topic while, immediate post program and one-month post program application the majority of them obtain satisfactory level of performances. Disagreement with the present finding Newstead (2017) [31] in his study to investigate the knowledge, clinical practice and attitudes of nursing professionals regarding chest physiotherapy techniques he found that most respondents have a high level of knowledge and understanding of chest physiotherapy techniques, and were confident in their ability to safely and effectively apply selected chest physiotherapy techniques in the clinical setting.

The current study showed that more than half of nurses obtained unsatisfactory performance regarding suctioning procedure before program application **Table (3)**. Finding of the present study was congruent with a study by Ansari (2012) [32] who determine the difference between knowledge and performance of the nurses in following standards of suctioning; they concluded that nurses had a poor performance in suctioning, despite their acceptable knowledge. While the majority of nurse's immediate post and one-month post program application demonstrated satisfactory level of performance regarding suction **Table (3).**

From the researcher point of view increase their awareness of the danger of accumulation of secretions in infant's airway, good training, supervision and continues evaluation could be the reason behind good level of performance after program application. Finding of the present study not congruent with Jansson (2013) [33] who found that practices during and post program was significantly lower than the required quality of care. Also, Sharshor M (2102) who found that than half of nurses were competent in performing suctioning before standard application increased to include all of them immediately and after three months application of standers [34].

Regarding nurses' level of performance related to oral care the present study showed that more than half of nurses' performances were unsatisfactory pre- program application. This may be attributed to at PICU infants are usually critical so many of nurses pay attention to important cars as suction monitor vital signs and respiratory status than mouth care also. In harmony with this finding El-Aziz (2014) [35] **and** Ibrahim , Sadek , Basuiny **(2013)** [36] **who found that** the majority of studied nurses were inadequate in performing oral care before the program and this result improved after education above half of nurses'.

While, immediate post program application it was noticed than the majority of them obtained satisfactory score. This may be attributed to increasing the nurses' awareness about the importance of mouth care for infants. This present result was congruent with **Prendergast (2012)** [37] **who** stated that the frequency of oral care documentation post education improved with an increase in every 2-4 hours compliance with the oral care protocol with the improvement in the quality of oral care provided by the nursing staff. **In the same** Shah and Mathur **(2016)** fount that the frequency of oral care increased once education had been introduced, which them improved patient oral health [38].

Furthermore, this study showed a highly significant positive correlation between level of total knowledge of studied sample about chest physiotherapy and their total practice immediate and one-month post program with (P=0.000), Where all of studied sample who had a good knowledge had also satisfactory level of performance. From the researcher point of view, this is true since knowledge is the prerequisite to practice and practice facilitate retention of knowledge. This implies that educating nurses about chest physiotherapy will help them to develop satisfactory level of practice. This result was disagreement with Leodoro (2012) [39] who found that, there was no statistical significance relation between nurses' practice and knowledge.

Analysis of the results of this study illustrated that there was an improvement in the mean score of knowledge and practice immediate post intervention than pre-intervention. Also, there was an improvement in the mean score of knowledge and practice one month's post- intervention than pre-intervention. However, there was a decline in the mean scores of knowledge and practice one month than immediate post intervention. These findings underscore the importance of the periodic and continuous education programs to maintain knowledge and practice toward chest physiotherapy.

Clinical outcomes are broadly agreed, measurable changes in health or quality of life that results from provided care. Constant review of clinical outcomes establishes standards against which to continuously improve all aspects of practice. Measuring change in infant's condition using clinical outcome measures (such as assessment of respiratory rate, chest sounds, heart rate and oxygen saturation) is one way to monitor the clinical impact of the effectiveness of the educational program. The present study revealed that there is improvement in heart rate and respiratory rate after application of chest physiotherapy. This finding in agreement with **Valenza** (2013) [40] who found that significant improvement of all examined lung function parameters, significant improvement of the radiology in general and reduced length of stay.

The result of the present study revealed improvement in infants' blood gasses and oxygen saturation after applying chest physiotherapy Table (8). This could be explained in the fact that respiratory physiotherapy removes secretions from airways, prevent or treat pulmonary collapses (atelectasis), thereby optimizing gaseous exchange, increased oxygenation and reducing respiratory effort. In the same line with the present finding **Hough (2008)** [41] that CPT used in infants has been reported to be associated with improved oxygenation and secretion clearance and improvement in chest sound. In addition, this was in congruent with what stated by **Slonim (2008)** [42] who found that effective chest physical therapy mobilizes tracheobronchial secretions in his sample of children which resulted in clearance and improvement in chest sound. Koulouras (2016) [43] who added that prone position is effective improve survival in patients with Rspiratory distress syndrome. Kole and Metgud (2014) [44] who found that treatment techniques CPT are safe and effective for improving oxygenation in neonates with respiratory problems and can be used in clinical settings.

On the other hand, **Thomas (2010)** [45] who stated that chest physiotherapy is the most irritating routine intensive care procedure to children. An increase in oxygen consumption often occurs when children receives chest physiotherapy accompanied by an elevation in heart rate, blood pressure, and intracranial pressure. CP leads to short-term decreases in oxygen, Changes in these vital signs and other variables may be even more pronounced in pediatric patients because the lung of a child is characterized by a higher closing capacity and the chest walls are characterized by a much higher compliance, thus predisposing the child to the development of atelectasis secondary to percussion and vibration.

VI. Conclusion & Recommendations

Conclusion

Based on the finding of the present study; it can be concluded that: The educational training program was effective where, knowledge and practice of studied sample regarding chest physiotherapy in infant with lower respiratory problem were improved. A significant improvement was observed in the mean score and level of knowledge and practice among the studied sample in immediate post and one-month post program in comparison to that in pre-program.

Recommendations:

1. In-service training program should be conducted periodically and regularly for teaching nurses working in Pediatric Intensive Care Unit the basic clinical skill.
2. The hospital should provide education program to help nurses to increase their knowledge about nursing procedures especially chest physiotherapy.
3. Nurse educators must ensure that nursing staff are confident and competent to monitor and record infants' vital signs, both manually and electronically.

References

[1]. Ionescu C. The Human Respiratory System. The Human Respiratory System. London: Springer Co., 2013; 13-22.
[2]. Lumb A. Nunn's Applied Respiratory Physiology. London: Elsevier Health Sciences Co., 2016; 3-10.
[3]. Nandini S, Goutam S. Lung sound classification using cepstral-based statistical features". J Computers in Biology and Medicine. 2016; 75 (1):118–129
[4]. Boloursaz M, Lotfian F, Aghahosseini F. Epidemiology of lower respiratory tract infections in children. J Compr Ped .2013;4(2): 93–8
[5]. GBD Collaborators. Global, regional and national levels of age-specific mortality and 240 causes of death, 1990-2015: A systematic analysis for the Global Burden of Disease Study 2013. Lancet 2015; 385(1):1990–2015
[6]. Perrotta C, Ortiz Z, Roque´ F. Chest physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old. The Cochrane Library. 2016.
[7]. Lee A, Button B, Tannenbaum E. Airway-Clearance Techniques in Children and Adolescents with Chronic Suppurative Lung Disease and Bronchiectasis. J Front Pediatr .2017; 5(2): 11-5.
[8]. Hazari A, Kalyana C, Gupta R, Deokule P, Amaravadi SK. Effect of postural drainage positions on vital parameters in asymptomatic healthy individuals. J of Physiotherapy. 2017;4(1):44-8.
[9]. Gajdos V, Katsahian S, Beydon N, Abadie V, Pontual L, Larrar S. Effectiveness of chest physiotherapy in infants hospitalized with acute bronchiolitis: Amulti center, randomized, controlled trial. PLoS Medicine J. 2010;7(1):1–12.
[10]. Al-Hchaim M, Hamza R, Effectiveness of educational program on nurse's knowledge about management of patients with heart failure. International J of Scientific and Research. 2016; 9 (6): 416.

[11]. Amirzade N, Baghaei R, Feizi A, KHorsandi F. Evaluating the application of safe suction criteria by nurses working in intensive care unit in Urmia. 2013;11(2):10

[12]. Jacinto C, Gastaldi A, Aguiar D., Maida K, Souza and H. Physical therapy for airway clearance improves cardiac autonomic modulation in children with acute bronchiolitis. Braz J Phys Ther. 2013; 17(6): 533–540.

[13]. Preeti S. Chest physiotherapy for infants. International Journal of Physiotherapy and Research, Int J Physiother . 2014; 5 (2): 699-05.

[14]. Wilkinson M, Leuven V. Procedure Checklists for Fundamentals of Nursing 2007. F. A. Davis Co., P113

[15]. Ahmed R. Quality of nursing care provided for neonates with tracheoesophageal fistula. J of Education and Practice. 2014 ;5(3):190-7.

[16]. Kunswa A. Needs, Problems and Nursing Care of Newborn Infants, Pediatric Department, Doctorate Thesis, Faculty of Nursing, Ain Shams University, Egypt, 2010; 118- 124.

[17]. Dawoud B. Evidence based nursing guideline for infants care with pneumonia. Pediatric Department, Master Thesis, Faculty of Nursing, Tanta University, Egypt, 2013:42

[18]. Mohamed A. Hospitalization for respiratory disease among infants and young children at Cairo University teaching hospitals, 2008 .Thesis submitted for partial fulfillment of master degree of pediatrics, faculty of Medicine, Cairo University, Egypt.

[19]. Ramya K, Neethu J. Effectiveness of self-instructional module on nursing management of patients with chest tube drainage for staff nurses working in a selected hospital of Odisha. International J of Nursing Education.2013; 5(2):155-159.

[20]. Kheder M. Assessment of Nurses Knowledge & Practice Regarding Chest Physiotherapy in Elmek Nimer University Hospital. master degree in medical surgical nursing. shendi university, faculty of post graduate studies and scientific research 2016:28-30.

[21]. Unkuri S, Suhonen R, Katajisto J. Self-assessed level of graduating nursing students'nursing skills. J of Nursing Education and Practice. 2014; 12 (4):60.

[22]. Boyd C Student Survival Skills: Clinical Skills for Nurses. London: Wiley Blackwell, Oxford Co., 2013;305

[23]. Pan S, Zhu L, Meng C, Xia P. Weight-based dosing in medication use: what should we know? Patient Prefer Adherence. 2016; 10 (1): 549–560

[24]. Bloomfield R, Steel E. MacLeenan G, Noble D. Accuracy of weight and height estimation in an intensive care unit: Implications for clinical practice and research. Critical Care Medicine. 2016; 34(8), 2153-2157.

[25]. Sharshour S. Establishing basic standards of nursing care protocol at neonatal intensive care unit. Pediatric Department, Doctorate Thesis, Faculty of Nursing, Tanta University, Egypt, 2012; 81.

[26]. Mohammed M. Assessment of the nurses' performance in providing care to patients undergoing nasogastric tube. International J of Caring Sciences . 2017 ;(10) 2: 915-20.

[27]. Alshehri M. Pulse Oximetry: Are Health Personnel Aware of Its Clinical Applications and Limitations?. Annals of Saudi Medicine, 2010; 20(1): 75-77

[28]. June S. The analysis of activities not performed by the nursing team regarding the diagnosis of ineffective breathing pattern in the elderly. Ann Thorac Med. J 2012; 46 (3): 34.

[29]. Warner J, Burge D, Glasper E. Nursing physical assessment skills: implications for UK practice. British J of Nursing. 2008;16(7):965-970.

[30]. Elewa1 A, Elkattan B . Effect of an educational program on improving quality of nursing care of patients with thalassemia major as regards blood transfusion. American J of Nursing Research. 2017; 5 (1) : 13-21.

[31]. Newstead C, Seaton J, Johnston C , Atherine L. Australian critical care nursing professionals' attitudes towards the use of traditional "chest physiotherapy" techniques. Hong Kong Physiotherapy J. 2017;36: 33-48.

[32]. Ansari A, Masoudi N, Adib-Hajbagheri M, Afazel M. The gap between knowledge and practice in standard endo-tracheal suctioning of ICU nurses, ShahidBeheshti Hospital. J of Critical Care Nursing. 2012;5(2):71–76

[33]. Jansson M, Ala-Kokko T, lipalosaari P. Evaluation of endotracheal-suctioning practices of critical-care nurses. J of Nursing Education and Practice. 2013; 7(3): 43-56.

[34]. Mudd S, Sloand E. Lower Respiratory Disorders. Pediatric Nurse Practitioner Certification. 6 th ed . United Status: Gones and Bartlett Co.,2017; 138-9.

[35]. Abd El-Aziz M . Effect of educational program on nurses, knowledge and skills about oral care for traumatized patients. Al-Azhar Assiut Medical J. 2014; 12 (1):25-39

[36]. Ibrahim N., Sadek Y, Basuiny N. Effectiveness of application of an educational module about prevention of ventilator associated pneumonia on pediatric nurses` knowledge and performance. Pediatric Department, Doctoral Thesis, Faculty of Nursing, Alexandria University, Egypt, 2013:99-110

[37]. Prendergast V, Jakobsson U, Renvert S, Hallberg R. Effects of a standard versus comprehensive oral care protocol among intubated neuroscience icu patients: results of a randomized controlled trial. J of Neuroscience Nursing. 2012; 44(3):134 – 146.

[38]. Shah N , Mathur P. Effectiveness of an educational video in improving oral health knowledge in a hospital setting. Indian J Dent. 2016; 7(2): 70–75

[39]. Leodoro J. Nurses' knowledge and practice of pre-postoperativecare, Master thesis, Faculty of Nursing, Samar State University. 2012:70 .

[40]. Valenza M, Demet G, Sanchez I. Effectiveness of a respiratory physiotherapy program on pleural effusion: A randomized controlled trial. European Respiratory J. 2013; 42(1): 33-38.

[41]. Hough J. chest physiotherapy in the preterm infant: an evidence based practice review. Annual Conference Proceedings J Paediatr Child Health. 2008; 44 (1): 10.

[42]. Slonim A. Do not use chest physiotherapy (CPT) in bronchiolitis, it is not helpful: excerpt from avoiding common pediatric errors. Williams & Wilkins Co., 2008.

[43]. Koulouras V, Efficacy of prone position in acute respiratory distress syndrome patients: A pathophysiology-based review .World J Crit Care Med. 2016 ;4; 5(2): 121–136.

[44]. Kole J ,Metgud D. Effect of lung squeeze technique and reflex rolling on oxygenation in preterm neonates with respiratory problems: A randomized controlled trial .Indian J of health science . 2014; 7(1): 15-21

[45]. Thomas K,. Chest physiotherapy in mechanically ventilated children: A review Crit Care Med. 2010;28 (5):1648-51.