

## Effect of Using Clinical Pathway on Improving Clinical Outcomes of Infants with Pneumonia

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**Abstract:** Pneumonia is the inflammation of the lung parenchyma. Pneumonia is the most common cause of death and hospital admission in children younger than 5 years. Clinical pathways are paths that health care professionals can follow which enable them to provide the best possible outcomes for the patients. Aim of study: To assess, develop, implement and evaluate effect of using CP by nurses on improving clinical outcomes of infants with pneumonia. Research Design: A quasi experimental research design was utilized. Research hypotheses: 1- infants who will expose to CP in study group will have less O<sub>2</sub> and frequency of suctioning daily less than those in control group, 2- infants who will expose to CP in study group will require daily IV fluid less than those in control group, 3- infants who will expose to CP in study group will have LOS less than those in control group. Setting: the current study was conducted in all medicine wards of one of pediatric hospital. Subjects: a convenient sample of all available nurses (34) in all medicine wards and a convenient sample of 50 infants were included after fulfilling inclusion criteria. Those infants (50) were divided equally into 2 constructed groups (study and control). Tools for Data Collection: There were four tools utilized in the current study, those tools as the following: 1-A structured interview schedule, 2-Nurses' knowledge about pneumonia sheet, 3- Clinical pathway of care of pneumonia checklist and 4- Infant's record. Results: there were statistically significant differences between study and control groups regarding frequency of o<sub>2</sub> and suctioning /day from and there was a statistically significant difference between study and control groups regarding length of hospital stay. Recommendation: clinical pathway of care of pneumonia should be applied for infants with pneumonia and provision of training program for nurses about CP of care of pneumonia.

**Key words:** Clinical Pathway • Pneumonia • Infants • Length of Hospital Stay

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### INTRODUCTION

Pneumonia is the inflammation of the lung parenchyma. In which inflammatory changes in the lungs impair effective gas exchange leading to various clinical manifestations. The World Health Organization (WHO) estimated that about 156 million new cases of pneumonia occur in under five year children each year worldwide, of which 151 million episodes (>90 percent) occur in the developing world. Less than 5 year mortality rate amongst Egyptian children is 21 per 1,000 live births and infant mortality rate is 18 per 1,000 live births [1].

Pneumonia mostly caused by infectious agents in children. These infectious agents are mainly bacteria and viruses. The signs and symptoms of pneumonia are often nonspecific and widely vary based on the patient's age and the infectious organisms involved. Cough is the most

common symptom of pneumonia in infants, along with tachypnea, retractions and hypoxemia. These may be accompanied by congestion, fever, irritability and decreased feeding [2]. Conventional diagnosis of pneumonia consists of two stages: first, determining the syndrome by history, clinical examination and chest radiology; and second, determining the etiology by microbiological, serological and molecular tests [3].

Initial priorities in managing children with pneumonia include the identification and treatment of respiratory distress, hypoxemia and hypercarbia. Children who are in severe respiratory distress should undergo tracheal intubation if they are unable to maintain oxygenation or have decreasing levels of consciousness. Increased respiratory support requirements such as increased inhaled oxygen concentration, positive pressure ventilation, or CPAP are commonly required before

recovery begins. Hospitalized patients are usually treated with an advanced generation intravenous appropriate antibiotic [4].

Clinical pathways/care pathways are structured, multidisciplinary plans of care designed to support the implementation of clinical guidelines and protocols. They are designed to support clinical management, clinical and non-clinical resource management, clinical audit and also financial management. They provide detailed guidance for each stage in the management of a patient (treatments, interventions... etc.) with a specific condition over a given time period and include progress and outcomes details. Clinical pathways aim to improve, in particular, the continuity and co-ordination of care across different disciplines and sectors [5].

Care pathways can be viewed as algorithms in as much as they offer a flow chart format of the decisions to be made and the care to be provided for a given patient or patient group for a given condition in a step-wise sequence [6]. Clinical pathways common in many health organization throughout the world, are best described as planned and systematic detailing the usual pattern of care of patients with specific disease or diagnosis. Clinical pathways are paths that health care professionals can follow which enable them to provide the best possible outcomes for the patients [7]. Clinical pathways have four main components: a timeline, the categories of care or activities and their interventions, intermediate and long term outcome criteria and the variance record. Clinical pathways differ from practice guidelines, protocols and algorithms as they are utilized by a multidisciplinary team and have a focus on the quality and co-ordination of care [6].

Nurses play a key role in patient recovery from pneumonia as they administering antibiotics as prescribed help ensure positive patient responses. Once every shift and before administering antibiotics, check the I.V. site for patency and integrity. Monitor the child patient's response to antibiotic therapy by checking temperature, oxygen saturation, respiratory rate and adventitious breath sounds. Assisting with and encouraging child patient mobility improves respiratory function, including chest expansion and airway clearance and aids other body systems. Discomfort may adversely affect a patient's respiratory status, so assess the patient for pain and intervene, as appropriate. Throughout treatment, teach the child patient strategies for avoiding a recurrence as well as the importance of adhering to prescribed regimens and following up after discharge [8].

**Significance of Study:** Pneumonia is the most common cause of death and hospital admission in children younger than 5 years. There are an estimated 150 million episodes of childhood pneumonia per year, with 11-20 million hospital admissions and 1.575 million deaths worldwide [2]. Every year in Egypt, 42,000 children under 5 die as a result of pneumonia [9]. As this disease is common, causes death to children, requires course of management and care through a clinical pathway appeared to be a suitable method for guiding management and nursing intervention for infants with pneumonia during their hospitalization which in turn improves outcomes of pneumonia in children. But unfortunately little researches are known about efficacy of clinical pathway (CP) in pediatric health care settings has been conducted, therefore the current study hope to implement and evaluate effect of using clinical pathway by nurses on improving clinical outcomes of infants with pneumonia.

**Aim of Study:** To assess, develop, implement and evaluate effect of using CP by nurses on improving clinical outcomes of infants with pneumonia.

**Operational Definition:** Improving clinical outcomes of infants with pneumonia in the current study will be measured by:

- Decreasing daily requirements of O<sup>2</sup> and frequency of suctioning.
- Decreasing daily requirements of IV fluid requirements.
- Decreasing lengths of hospital stay (LOS).

## MATERIALS AND METHODS

**Research Design:** A quasi experimental research design was utilized to achieve aim of the study.

### Research Hypotheses:

- Infants who will expose to CP in study group will have less O<sup>2</sup> and frequency of suctioning daily less than those in control group.
- Infants who will expose to CP in study group will require daily IV fluid less than those in control group.
- Infants who will expose to CP in study group will have LOS less than those in control group.

**Setting:** The current study was conducted in all medicine wards of one of pediatric hospital, Cairo University. This hospital provides care for all children patients from all over Egypt and free.

**Subjects:**

- A convenient sample of all available nurses (34) in all medicine wards in morning and afternoon shifts.
- A convenient sample of 50 infants were included after fulfilling inclusion criteria. Those infants (50) were divided equally into 2 constructed groups (study and control). Determination of sample size was calculated according to statistical procedure known as power analysis of the sample: according to phenomenon of pneumonia and power analysis, the size of the sample which resulted was 50 infants.

**Inclusion Criteria:**

- Infants of both sexes
- Infants with pneumonia
- Infants' age between 1-12 months
- Infants have the same protocol of treatment therapy
- Infants have no other medical problems

**Tools for Data Collection:** There were four tools utilized in the current study, all of them developed by research investigators after reviewing the related literature and experts in pediatrics nursing, those tools as the following:

**A Structured Interview Schedule:** To assess socio-demographic data of both nurses and infants and it included 2 parts:

A- A socio-demographic data of nurses included data such as nurses' age, educational level, years of experiences, residence... etc.

B- A socio-demographic data of infants included data about infants' age, sex, signs and symptoms of pneumonia, management (method of oxygen therapy, frequency of suctioning).

**Nurses' Knowledge about Pneumonia Sheet:** To assess nurses' knowledge about definition, causes of pneumonia,... etc. The total questions were 10 and were in form of closed ended questions.

**\*Scoring System of Nurses' Knowledge about Pneumonia Sheet:** The total questions were 10. The answer for each question was as the following: does

not know/incorrect answer takes "0" score, incomplete answer takes "1" score and complete/correct answer takes "2" scores.

Total scores of 10 questions were 20, nurses' scores from 0-9 were considered as having unsatisfactory knowledge, scores from 10-14 were considered having average knowledge, scores from 15-17 were considered as having good knowledge and scores from 18-20 were considered as having excellent knowledge.

**Clinical Pathway of Care of Pneumonia Checklist:**

To assess nursing care given to infants by using CP of pneumonia, the total items were 10. It included the following items:

- Assessment of vital signs and weight.
- Respiratory system management (O<sub>2</sub>, suctioning, positioning,...)
- Hydration status of infant (giving oral fluid, IV fluids,...).
- Giving medications (as prescribed).
- Provide adequate nutrition (as prescribed).
- Carrying out diagnostic procedures (as prescribed).
- Level of activity.
- Care giver of infant education.
- Discharge plan.
- Improve expected outcome.

**\*Scoring System for Cp of Care Pneumonia Checklist:**

The performance for each item was scored as the following: did not perform /missed takes "0" score, each item performed incomplete/incorrectly takes "1" score and each item performed complete/correct takes "2" scores. Total scores of 10 items were 20, nurses' scores from 0-14 were considered as having unsatisfactory performance of care while scores from 15-20 were considered having satisfactory performance of care.

**Infant's Record:** This used to record frequency of daily requirements of O<sub>2</sub> and suctioning, signs of dehydration and infants' hospital stay for 5 successive days.

**Procedure:** The study was conducted after obtaining an official permission from the director of the pediatric hospital after that the researchers obtained oral consents from nurses and mothers/relatives of infants who included in the study after an explanation of the aim, tools, benefits and the duration of the study to gain their cooperation. The researchers then started to interview each nurse individually to collect required socio-demographic data and this took about 10-15 minutes for each nurse.

The researchers then started to assess care provided by nurses (routine care) to infants in control group with pneumonia and follow their physical condition for 5 consecutive days for each child and recorded it in designing infant's records.

After finishing from collecting required data about nursing performance with control group, the researchers provided an educational health program to nurses about care of child with pneumonia by using clinical pathway, this program carried out upon 4 sessions within 2 weeks as following:

**The First Session:** (20-30 minutes/day) 1<sup>st</sup>. week, In which research investigators assessed nurses' knowledge about pneumonia by using nurses' knowledge assessment tool, this took about 15-20 minutes (pretest), followed by assessing nurses' performance of pneumonia by using CP guidelines checklist, this took about 10-15 minutes (pretest).

**The Second Session:** (20-30 minutes/day) 1<sup>st</sup>. week, The aim of this session was to present by researchers theoretical part of pneumonia.

**The Third Session:** (20-30 minutes/day) 1<sup>st</sup>. week, The aim of this session was to orient nurses with care of pneumonia by using CP. Teaching methods used in all sessions were lecture and discussion, researchers used handouts.

**The Fourth Session:** (20-30 minutes/day) 2<sup>nd</sup>. Week, In this session post-test assessment of nurses' knowledge about pneumonia carried out followed by reassessing nurses' care performance of pneumonia actually upon infants in study group by using CP guidelines checklist (post-test). With all nurses first, second and third sessions were carried out in the same week while fourth session had done in the second week after finishing third session by one week. Attendance of nurses was range from 3-5 in each session according to their time availability. Sessions were carried out in available class room determined by director of nursing in the hospital.

After finishing from post-test assessment researchers asked nurses to apply CP guidelines of pneumonia upon infants (study group) for 5 consecutive days, this for 5 days were determined because this is the average time for hospital stay for children if their condition become improved before discharge. There were

daily follow up for each infant in study and control groups for 5 days / week and record infant's condition in the designing infant's records.

Researchers collected socio-demographic data about infants in study and control groups from each infant's sheet which took about 5-10 minutes for each infants, researchers collected data from infants after being admitted and their condition diagnosed usually in first /or second day after admission. The study took about 6 months, started from October, 2013 to end March, 2014.

**Pilot Study:** A pilot study was conducted on 10 % of nurses and infants with pneumonia to test the clarity, visibility and content validity of the study tools and no modifications were needed. The results of pilot study were included in the study.

**Content Validity of Tools:** Content validity was done by 7 experts in the field of pediatric nursing. Construct validity was done by using constructed groups approach; the mean performance between two groups was significantly different ( $t=4.53$ ,  $p < 0.000$ ), which supports and gives evidence of construct validity.

**Reliability of Tools:** As regard reliability of tools, Cronbach's alpha between questions was .802. It obvious that the alpha value is quite high.

**Ethical Consideration:** An official permission to conduct the current study was obtained from the head and directors of selected hospital. Oral informed consents were obtained from nurses and mothers or relatives of infants with pneumonia to participate in the current study. Confidentiality of each subject was protected by allocation of the code instead of using child patient's name.

**Statistical Design:** Data was analyzed using SPSS statistical package version 20. Numerical data were expressed as mean  $\pm$ SD. Qualitative data were expressed as frequency and percentage. A comparison between qualitative variables carried out by using parametric Chi square test. Pearson correlations used for quantitative variables were carried out by using correlation. A comparison between quantitative variables was done by using non parametric t-test, a comparison between study and control groups for successive days was done by using Anova (F.test) of repeated measures and P-value  $\leq 0.05$  was considered statistically significant.

**RESULTS**

Table 1 shows that the highest percentage of nurses (79.4%) were female, their mean age were 22.68 ±5.585 years; in addition, their mean years of experiences were 6.32 ±3.022 years. The same table reveals that 31.4% of those nurses were diploma nurses.

Table 2 explains that there were highly statistically significant differences regarding to all items of nurse’s knowledge about pneumonia among nurses between pretest to posttest scores as (P<0.05) except nurses/ knowledge about definition of pneumonia and nursing intervention which includes: health teaching (P<0.05). The same table represents that there was a highly statistically significant difference regarding mean scores of nurses’ knowledge about pneumonia between pretest to posttest scores (t.test=14.66, P<0.05).

Table 3 represents that there were highly statistically significant differences among nurses performance regarding pneumonia before and after applying CP (P<0.05) in all items except nurses’ performance about diagnostic investigations as no a statistically significant difference was found. The same table represents that there was a highly statistically significant difference regarding mean scores of nurses’ performance about pneumonia before and after applying CP scores (t.test= 46.54, P<0.05).

Table 4 Explains socio-demographic characteristics of infants in study and control groups, table 4 indicates that the mean age infants of study group was 5.40±1.893

Table 1: Frequency and Percentage Distribution of Socio-demographic Characteristic of Nurses of Study (N=34)

Item	No.	%
-Sex:		
Male	7	20.6
Female	27	79.4
- Age:		
x ± SD	22.68±5.585	
- Years of experiences:		
x ± SD	6.32±3.022	
-Level of education:		
Nursing diploma	22	31.4
Post graduate institution of nursing	6	8.6
Bachelor of nursing	6	8.6

months and was 5.04 ±1.925 months in control group with no a statistically significant difference between both groups (t. test=.667, p=.508) and table 4 represents that the majority of infants (64% & 72% respectively), in both study and control groups were male with no a statistically significant difference between both groups (x<sup>2</sup>=.368, p=.544). Regarding to signs of pneumonia, table 4 shows that the sign with highest percentage in both study and control groups was (68% & 48% respectively), intercostal and subcostal retraction with no a statistically significant difference between both groups (x<sup>2</sup>=.071, p=.965). In relation to method of O<sup>2</sup> therapy, the same table indicates that nasal cannula was the most common method used (72% & 56% respectively), in both study and control groups with no a statistically significant difference between both groups (x<sup>2</sup>=1.461, p=.482).

Table 2: Frequency and Percentage Distribution and Mean Differences of Nurses’ Knowledge about Pneumonia in Pre and Posttest (N=34)

Item	pretest				posttest				t.test	x <sup>2</sup>	p-value
	Incorrect		correct		incorrect		correct				
	No.	%	No.	%	No.	%	No.	%			
1-Definition of pneumonia	10	29.4	24	70.6	5	14.7	29	85.3	2.138	.144	
2-Causes of pneumonia	10	29.4	24	70.6	2	5.9	32	94.1	6.476	.011*	
3-Signs and symptoms of pneumonia	15	44.1	19	55.9	2	5.9	32	94.1	13.255	.000*	
Nursing intervention includes:											
1- Taking vital signs	21	61.8	13	38.2	1	2.9	33	97	26.877	.000*	
2-administering O <sup>2</sup> and performing suctioning as prescribed	21	61.8	13	38.2	6	17.6	28	82.4	.310	.000*	
3- Assessing body weight	33	97	1	2.9	5	14.7	29	85.3	50.63	.000*	
4-Increasing fluid intake	32	94.1	2	5.9	0	0	34	100	60.444	.000*	
5- Care of positioning	21	61.8	13	38.2	6	17.6	28	82.4	.310	.000*	
6- Health teaching	10	29.4	24	70.6	8	23.5	26	76.5	.302	.582	
7-Prognosis of pneumonia	24	70.6	10	29.4	0	0	34	100	37.091	.000*	
x ± SD	9.79 ± 2.772				16.85±.989				14.66		.000*

\* p<0.05

Table 3: Frequency Distribution and Mean Differences of Nurses' Performance Regarding care of Pneumonia Before and After Applying Clinical Pathway (N=34)

Item	Before clinical pathway						After clinical pathway						test	x <sup>2</sup>	p-value
	Not done		Incomplete		Complete		Not done		Incomplete		Complete				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
-Assessment	34	100	0	0	0	0	3	8.8	3	8.8	26	76.5		56.97	.000*
-Diagnostic Investigations	0	0	0	0	34	100	0	0	0	0	34	100		0	0
-Respiratory Management	6	17.6	28	82.4	0	0	3	8.8	0	0	31	91.2		59.273	.000*
Fluid Therapy	22	64.7	12	35.3	0	0	2	5.9	0	0	32	94.1		60.667	.000*
-Medications	12	35.3	0	0	22	64.7	0	0	0	0	34	100		14.571	.000*
-Nutrition	30	88.2	4	11.8	0	0	7	20.6	0	0	27	79.4		45.29	.000*
-Activities	34	100	0	0	0	0	7	20.6	2	5.9	25	73.5		44.780	.000*
-Infant Education	34	100	0	0	0	0	0	0	6	17.6	28	82.4		68.000	.000*
-Discharge Planning	34	100	0	0	0	0	0	0	6	17.6	28	82.4		68.000	.000*
-Improved Outcomes	14	41.2	20	58.8	0	0	3	8.8	4	11.8	27	79.4		44.78	.000*
x ± SD	4.91±.933						18.00± 2.118							46.54	.000*

\* p<0.05

Table 4: Frequency and Percentage Distribution of Socio-demographic Characteristic of Infants in Study and Control Groups (N=50)

Item	Study group (N=25)		Control group (N=25)		t.test	x <sup>2</sup>	p-value
	No.	%	No.	%			
Age: x ± SD	5.40±1.893		5.04±1.925		.667		.508
-Sex: Male	16	64	18	72		.368	.544
Female	9	36	7	28			
-Signs and symptoms of pneumonia							
-Tacky pnea, tacky cardia, nasal flaring	6	24.0	9	36		.071	.965
-Intercostal and subcostal retraction	17	68.0	12	48			
-More than one answer	2	8.0	4	16			
Method of o2 therapy							
-Mask	4	16	7	28		1.461	.482
- Nasal Cannula	18	72	14	56			
-Head Box	3	10	4	16			

Table 5: Comparison between Mean Scores of Daily Frequency of Oxygen between Study and Control Groups

Item	Study group (N=25)		Control group (N=25)		t.test	p-value	F. test	p-value
	x ± SD	x ± SD	x ± SD	x ± SD				
O <sup>2</sup> 1 <sup>st</sup> day frequency	15.72±4.057		16.64±4.462		.736	.449	38.368	.000*
O <sup>2</sup> 2 <sup>nd</sup> day frequency	13.32±2.462		16.64±4.462		5.896	.002*		
O <sup>2</sup> 3 <sup>rd</sup> day frequency	11.00 ±1.708		16.00±4.359		7.456	.000*		
O <sup>2</sup> 4 <sup>th</sup> day <sup>h</sup> frequency	5.92 ±2.272		11.24±1.899		2.109	.000*		
O <sup>2</sup> 5 <sup>th</sup> frequency	2.28±1.487		9.48±.770		21.501	.000*		
Grand O <sup>2</sup> mean score	48.24±10.248		62.00±14.26		6.194	.000*		

\* p<0.05

Table 6: Comparison between Mean Scores of Daily Frequency of Suction between Study and Control Groups

Item	Study group (N=25)		Control group (N=25)		t.test	p-value	F. test	p-value
	x ± SD	x ± SD	x ± SD	x ± SD				
Suction 1st day frequency	4.56±.870		4.44± 1.003		.452	.653	7.384	.009*
Suction 2 <sup>nd</sup> day frequency	4.16 ±.898		4.08±.759		.340	.735		
Suction 3 <sup>rd</sup> day frequency	3.40 ± 1.000		4.00±.000		1.018	.049		
Suction 4 <sup>th</sup> day frequency	3.08±.702		3.72±.678		2.277	.002		
Suction 5 <sup>th</sup> day frequency	2.00±.866		3.60±.645		3.384	.000*		
Grand suction mean score	17.20± 3.202		19.76±3.455		2.717,	.009*		

\* p<0.05

Table 7 : Comparison between Mean Scores of IV Fluid Daily Amount between Study and Control Groups

Item	Study group (N=25)	Control group (N=25)	t.test	p-value	F. test	p-value
	x ± SD	x ± SD				
IV fluid amount 1st day	400.00±125.00	460.00±93.541	1.922	.061	77.089	.000*
IV fluid amount 2 <sup>nd</sup> day	360.00± 126.656	460.00± 93.541	3.17	.003*		
IV fluid amount 3 <sup>rd</sup> day	270.00 ± 69.222	420.00± 119.024	5.44	.000*		
IV fluid amount 4 <sup>th</sup> day	200.00± 102.062	380.00 ± 127.475	5.511	.000*		
IV fluid amount 5 <sup>th</sup> day	83.33± 120.386	310.00± 108.972	6.915	.000*		
Grand IV fluid mean score	1310.00 ±252.900	2030.00± 317.214	8.874	.000*		

\* p≤0.05

Table 8: Comparisons between Mean Scores of LOS between Study and Control Groups

Item	Study group (N=25)	Control group (N=25)	t.test	p-value
LOS:				
x ± SD	5.68 ±.748	8.24 ±.1.200	9.051	.000*

\* p<0.05

Table 9: Correlation between Sociodemographic background of Nurses and their Knowledge and Clinical Pathway Performance (N=34).

Item	Nurses' knowledge	Nurses' performance
Age	R=.216 P=.220	R=.393 P=.215
Years of experiences	R=.105 P=.553	R=.033 P=.852
Level of education	R=.053 P=.767	R=.581 P=.000*

\* p≤0.05

Table 10: Correlation between Age of Infants and Daily Requirements of O<sup>2</sup>, Suctioning and LOS (N=50).

Item	Infants' Age
Daily Requirements of O <sup>2</sup>	R=.204, P=.155
Daily Requirements of Suctioning	R=.265, P=.352
Daily Requirements of LOS	R=.153, P=.465

\* p≤0.05

Table 5 shows that there was no a statistically significant difference between study and control groups regarding frequency of o<sup>2</sup>/day in first day (p□0.05), but there were statistically significant differences between study and control groups regarding frequency of o<sup>2</sup>/day from second till fifth day (F.test = 38.368, p□0.05).

Table 6 reveals that there was no a statistically significant difference between study and control groups regarding frequency of suction /day in first and second day (p□0.05), but there were statistically significant differences between study and control groups regarding frequency of suction /day from third till fifth day (F.test= 7.384, p□0.05). Table 5 and 6 prove first hypothesis of the study.

Table 7 represents that there was no a statistically significant difference between study and control groups regarding IV fluid requirements /day in first day (p□0.05), but there were statistically significant differences between study and control groups regarding daily

requirements of IV fluid /day from second till fifth day (F.test= 77.089, p□0.05). Table 7 proves second hypothesis of the study.

Concerning to table 8 which represents that mean duration of hospital's stay of infants and it was 5.68±.748 days for study group while was 8.24±.1.200 days for control group and there was a statistically significant difference between study and control groups regarding mean duration of hospital's stay (t.test=9.051, p□0.05). Table 8 proves third hypothesis of the study.

It is obvious from table 9 that there were no statistical significant correlations between nurses' knowledge and nurses' ages, years of experiences and level of education (r=.393, r=.355, r=.379, p □ 0.05 respectively). Regarding to correlations between nurses' performance by following CP and nurses' age, years of experiences there were no statistical significant correlations between them (p □ 0.05). But there was correlation between nurses' performance by using clinical pathway and nurses' level of education (r=.581, p □ 0.05 respectively).

Table 10 represents that there were no statistical significant correlations between age of infants and daily requirements of o<sup>2</sup>, suctioning and LOS (r=.204, r=.265, r=.153, p □ 0.05, respectively).

## DISCUSSION

Pneumonia is defined as an inflammation of lung tissue due to an infectious agent. Pneumonia causes substantial morbidity in children worldwide and is a leading cause of death in children in the developing world. The incidence of pneumonia is the highest in children under 5 years of age and in recent years the incidence of complicated and severe pneumonia seems to be increasing [10].

Clinical pathways have been developed in health care as multidisciplinary care plans that outline the sequence and timing of actions necessary for achieving expected patient outcomes and organizational goals regarding quality, costs, patient satisfaction and efficiency. The concept of CP refers to specific guidelines

for care that describe patient treatment goals and define a sequence and timing of intervention for meeting those goals efficiently [11].

It was observed from the results of the current study that highest percentage of nurses were female, their mean age was  $22.68 \pm 5.585$  years, in addition, their mean years of experiences was  $6.32 \pm 3.022$  years. The highest percentages of those nurses were diploma nurses. These results match with results found by Meherali *et al.* [12] as they found that the majority of studied nurses were female, having diplomas in nursing and majority of the nurses completed their diploma recently.

From researcher points of view this may be related to nursing job in Egypt still associated with female beside that male nurses prefer to travel abroad or working in private hospitals and leave governmental hospitals for female nurses specially at morning and afternoon shifts because of its low salary and this was the time selected by research investigators to collect required data. Regarding to highest percentage of nurses were diploma nurses, this may be associated with the number of nurses graduated from diploma schools of nursing in Egypt is higher than bachelor graduated nurses and in addition, the study sample was collected from medicine wards and it is well known that diploma nurses work in those wards and bachelor nurses work in intensive care units which need qualified nurses.

The results of the current study explained that there was a highly statistically significant difference regarding mean scores of nurses' knowledge about pneumonia between pretest and posttest scores. From researcher points' of view this may due to lack of training courses and staff development in hospitals for nurses, in addition nurses themselves are not interested to enhance, develop or at least refresh their knowledge whether newly or old graduated nurses and they assured that they are employees in governmental hospitals and their salaries are assured.

Result of the current study in congruence with what reported by Soh *et al.* [13] as they found that there are gaps in nurses' knowledge regarding nosocomial pneumonia and its prevention. With increasing awareness and knowledge, nurses can intervene to reduce nosocomial pneumonia infection rates. There is a need for nurses to have greater exposure to nosocomial pneumonia prevention education, guidelines and research.

Regarding to improved nurses knowledge after program intervention, the result of the current study in agreement with what reported by Mahmoud and Abd-ElSadiq [14] in their study that there was a statistically significant difference between total mean score of nurses' knowledge regarding meningitis pre and post CP guidelines implementation. The result of the current study matches with a study had done by Meherali *et al.* [12] as they reported that the educational intervention significantly improved the knowledge level of the nurses regarding evidence based guidelines for ventilator associated pneumonia (VAP) prevention as nurses scored higher in post-test than pretest.

The current study revealed that there are highly statistically significant differences among nurses performance regarding care of pneumonia before and after applying CP guidelines.

The result of the current study in compatible with what reported by Mahmoud and Abd-ElSadiq [14] in their study that the mean score of nurses' performance regarding to invasive procedure pre and post CP guidelines implementation had a highly significant difference, in addition Refai [15] had found in her study that there was an improvement in nurses' practice scores in post nursing CP higher than in pre nursing CP implementation.

These results supported by Carusone [16] who found that nurses strongly supported the idea of the CP and believed that providing pneumonia care in the nursing home was better for the residents. As a result of using the CP, nurses felt that pneumonia was being identified, diagnosed and treated earlier. In addition to the benefits to resident care, the nurses felt that their skills and knowledge also improved. Nurses generally supported the implementation of the pathway although some concern was expressed about the additional responsibility and resources that would entail.

From researcher points of view unsatisfactory nurses' performance care of pneumonia may due to most of the nurses in pediatric hospitals are not qualified to work with children and their distribution to hospitals based upon ministry of health besides lack of training courses and staff development in hospitals for nurses but when training program became available their knowledge and performance improved.

It was observed from the results of the current study that the mean age of infants with pneumonia of study group was  $5.40 \pm 1.893$  months and  $5.04 \pm 1.925$  months in

control group with no a statistically significant difference between both groups. This result was in agreement with what found by Hussein [17] in her study that the mean age of study group was  $4.93 \pm 2.99$  months and  $5.13 \pm 2.92$  months for control group with no statistically significant differences between study and control groups regarding age.

In Egypt, this may be due to lack of immunity of those 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. This lay a heavy burden on health care services in Egypt in terms of utilization of hospitals and health centers.

The result of current study revealed that the majority of infants in both study and control groups were male with no a statistically significant difference between both groups. This result was in congruence with what found by Hussein [17] in her study that the majority of her study sample was males' infants with no statistically significant differences between study and control groups regarding sex.

In Egypt, this does not mean pneumonia is common in males than females' infants but may be due to over caring and value of male infants which many of Egyptian's women and families give to male infants while for females infants, families commonly search another way of treatment such as traditional medicine or going to nearest pharmacy for treatment.

The results of current study revealed that there are statistically significant differences between study and control groups regarding frequency of  $\dot{v}$ /day from second till fifth day and the same picture was observed regarding to grand mean scores of frequency of  $\dot{v}$ /day.

The results of the current study are in congruent with what was found by Rhew *et al.* [18] who reported in their study that their findings in the CP group are including improving respiratory signs and/or symptoms and decreasing  $\dot{v}$  daily requirements, the ability to take oral medications and decreasing I.V. fluid faster than non-CP group and these were common criteria for early switch and early signs for patients discharge from hospital and reduce level of consciousness (LOS).

This result in agreement with Cheney [19] who found in her study that there was a statistical significant difference between control group and pathway group regarding to supplemental oxygen, as control group require more oxygen frequency than pathway group.

In addition this result matches with result of study by LU Min-jun [20] who found in his study that after the implementation of the CP for pneumonia, the cure rate was improved and there had statistical significance before and after the implementation of CP on children with bronchial pneumonia (not severe) regarding to daily requirements of oxygen. Also Farquhar [21] added that the use of a CP for community-acquired pneumonia reduces hospital resource consumption (antibiotic use,  $\dot{v}$  requirements and IV fluid therapy and leads to clinical outcomes comparable to those achieved through conventional management.

It was observed from the results of the current study that there are statistically significant differences between study and control groups regarding frequency of suction /day from third till fifth day and the same result was observed regarding to grand mean scores of frequency of suction /day.

This result matches with what was found by Hauck [22] and Garin *et al.* [23] who found that patients who placed on pneumonia CP care were much more likely than non-pathway patients to have favorable outcomes of care in form of decreasing daily requirements of suctioning and IV fluid therapy. This results in congruence with Frei *et al.* [24] as their study demonstrates that CP antibiotics are associated with reduced total hospital cost in form of decreasing daily requirements of  $\dot{v}$  therapy, suctioning and IV fluid therapy in patients who received pathway antibiotics than patients who did not receive pathway antibiotics.

From researcher points of view this may due to compliance of nurses for giving  $\dot{v}$ /day and performing frequency of suctioning/day as prescribed in infant's sheet and their follow up to infants reflects improvement in infant's chest condition and vice versa when neglected and just tell mother/relative to give  $\dot{v}$ /day and performing suctioning to children.

The results of current study revealed that there are statistically significant differences between study and control groups regarding IV fluid requirement/day from second till fifth day and the same picture was noticed regarding to grand mean scores of signs/day.

This result was in congruence with result of study by Cheney [19] as she found that infants in control group need fluid supplementation greater than infants nursed in pathway group. This result in compatibility with what was reported by Marrie *et al.* [25] who found that data showed that a CP for community acquired pneumonia can reduce the use of hospital resources in form of I.V fluids

and  $o^2$  daily requirements without compromising the wellbeing of patients. Also Wachter [26] reported that CP patients were showed improvement or resolution of symptoms, were able to maintain oral intake and were hemodynamically stable and require no more I V fluids also had to be stable faster than non- CP patients. From researcher points' of view this may due to compliance of nurses for giving IV fluid/day as prescribed in infant's sheet and their follow up to infant reflects improvement in infant's hydration condition and vice versa when neglected.

Concerning to mean duration of LOS was  $5.68 \pm .748$  days for study group and  $8.24 \pm 1.200$  days for control group and there was a statistically significant difference between study and control groups regarding mean LOS. This results in congruence with what was reported by Mahmoud and Abd-ElSadiq [14], Rafai [15] and Loeb *et al.* [27] who found that treating residents of nursing homes with pneumonia with a CP result in reducing hospitalizations.

In addition Frei *et al.* [24] supported result of present study as they found in their study that a decrease in LOS and total hospital costs in patients treated with pathway antibiotics. Also Carusone *et al.* [16] found that the implementation of a CP for treating pneumonia in nursing homes are desired by nurses who found that it results in better care and fewer LOS of residents. Also Garin *et al.* [23] added that A CP is improving the quality and efficiency of care delivery and that the use of clinical pathways improves certain specific outcomes such as decreasing LOS or avoid many complications.

Wachter [26] reported that CP involving early mobilization and an early switch from intravenous to oral antibiotics results in reduced LOS patients with community-acquired pneumonia and the median LOS was significantly shorter for patients randomized to the clinical pathway, compared with those randomized to standard care. Kelly *et al.* [28] reported in their study that LOS was significantly lower in the CP group compared with the control group and concluded that implementation of inpatient CP led to a decrease in length of stay and a reduction in total cost while improving quality of care for hospitalized asthmatic children.

From researcher points' of view this may due to compliance of nurses for giving  $o^2$  /day, performing required number of suctioning /day and IV fluid /day as prescribed in infant's sheet and follow up to infants results in general improvement in outcomes of infants' condition and early discharge from hospital and LOS and vice versa.

The results of present study showed that there were no statistical significant correlation between nurses' knowledge and nurses' ages, years of experiences and level of education. Regarding to correlations between nurses' performance and nurses' age, years of experiences there were no statistical significant correlations between them, but there was a correlation between nurses' performance and nurses' level of education. From researcher points of view this may related to CP is an easy way can be taught and performed by at any age and years of experiences of nurses.

The results of present study represented that there were no statistical significant correlations between age of infants and daily requirements of  $o^2$ , frequency of suctioning and LOS. From researcher points of view this may because CP are guidelines when followed accurately and correctly by nurses will result in better results regardless age such as daily requirements of  $o^2$ , frequency of suctioning and LOS.

## CONCLUSION

The current study concluded that CP of care of pneumonia is effective in improving outcomes of infants with pneumonia. This is manifested by decreasing frequency of oxygen, suctioning requirement/day, IV fluid requirement/day and finally decreasing LOS of study group and these proved the hypotheses of the current study.

**Recommendations:** Based on the results of the current study, the following recommendations were reached:

- Clinical pathway of care of pneumonia should be applied for infants with pneumonia.
- Provision of training program for nurses about CP of care of pneumonia.
- Replication of such study on a larger and different age group of infants and nurses to be able generalize the results of current study.

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