

## Impact of an Educational Program on Improving Nurses Knowledge and Practice concerning caring for Children with Meningitis

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### Abstract

**Background:-** Meningitis is a kind of Central nervous system infection that can be associated with high morbidity and mortality rates. Because of the high mortality rate and long-term sequels, fast and accurate diagnosis and appropriate treatment of meningitis are fundamental for a good outcome. There are several unique aspects in the clinical assessment and management of childhood meningitis that need to be considered. **So, the aim of this study** was to assess the impact of an educational program on improving nurses knowledge and practice among children with meningitis. **Design.** A quasi-experimental study design was carried out. The subjects included 30 nurses working at emergency unit in Assiut University Children Hospital. **Data collection tools** were a structured questionnaire interview sheet and an observation checklist, used in pre-post testing to measure the effect of an educational program. **Results,** The study revealed deficiency in pre-intervention knowledge and practices. Statistically significant improvements of knowledge and practices were demonstrated at the post-intervention assessment of the studied nurses. Statistically significant relations were shown between knowledge and practices among studied nurses., the program was successful in correcting the deficiency of nurses'. **The study concluded** that implementation of the program was associated with significant improvements of nurses' knowledge and practice. More experienced and aged nurses had better knowledge. **So, the researchers recommended** that the booklet program should be applied in similar settings to validate and improve nursing care in children hospitals.

**Key words:** Educational Program, Nurses, Knowledge, Practice, Children, Meningitis.

### Introduction

Meningitis is a term that refers to an inflammation of the meninges that surrounding the brain and the spinal cord. Meningitis is a possibility life-threatening condition that can rapidly progress to enduringly brain damage, neurologic problems, and until death of children (Mahmoud and Abd-ElSadik, 2013)

Meningitis requires immediate medical attention. Even with convenient treatment, morbidity and mortality can be substantial. It is essential for clinicians to recognize the signs and symptoms of meningitis and understand its management and prevention. (Swanson, 2015)

Nearly 30% of the newborn infants die from bacterial meningitis, even with treatment but the viral meningitis is rarely fatal and usually resolves without medications, Fungal meningitis can be fatal

without treatment, and the treatment is not without its own risk to the child, parasitic infections can be treated with some specific medications, such as anti-malarial drugs as well as some antibiotics. **(Rudd and Kocisko, 2014)**

The highest incidence of meningitis is between birth and 2 years, with the greatest risk immediately following birth and at 3-8 months of age. Increased exposure to infections and underlying immune system problems present at birth increase an infant's risk of meningitis **(Tunkel AR., 2016)**.

The World Health Organization beckons that each year records about half a million new cases suffering from meningitis. **(WHO, 2012)** Common cases of meningitis are infectious and result from widely range of bacterial and viral pathogens. Meningitis is a syndrome of fever, headache and meningismus with inflammation, in the subarachnoid space as evidenced by CSF pleocytosis. **(Bartt, 2012)**

Bacterial and viral meningitis are contagious, but neither is as contagious as the [common cold](#) or [flu](#). Both can be transmitted through droplets of respiratory secretions during close contact such as kissing, sneezing or coughing on someone, but cannot be spread by only breathing the air where a person with meningitis has been. Viral meningitis is typically caused by [enteroviruses](#), and is most commonly spread through fecal contamination. The risk of infection can be decreased by changing the behavior that lead to transmission. **(Kaplan, 2016)**

Nurses have a key role in all aspects of meningitis. the nurse must possess abroad knowledge for different methods of care for children with meningitis and practical skills in the application of therapies.. Nurse's management of the child with meningitis is

extensive. The isolation room is prepared in accordance with hospital procedure. The nurse carefully raises and lowers the crib sides to avoid jarring the bed. Padded side rails ensure that the child is not injury in the event of a convulsion Nursing care is to carefully monitor the child with meningitis for signs of illness progression or development of complication, to support the family, to administer medications, and to manage pain. **(Bamberger.,2010)**.

#### **Significance of the study:-**

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Meningitis is considered an endemic disease in Egypt, the total cases of meningitis registered in 2011 were for higher than those registered in 2010 (the total number of cases were 1400 and 1394 respectively) and the number of infected children who are less than fifteen years of meningitis in 2011 is equal to 800 children and this is greater than the number of the infected children in 2010, which is equal to 759. Ministry of Health study in Egypt revealed that the total number of repeated meningitis cases were 1407 in the year 2012 and 1384 cases in 2013. **(Ministry of Health (MOH) 2014)**.

Children suffering from meningitis require special care from nurses to ensure maximum performance. so, during the researchers' work at Emergency Unit in the Assiut University Children Hospital, it was observed that nurses were lacking the necessary basic knowledge and practices related to caring of children with meningitis. So, this study was designed in a trial to improve nurses' knowledge and practices concerning the care offered to children with meningitis.

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

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To assess the impact of an educational program on improving nurses knowledge and practice concerning caring for children with meningitis through;(a) assess the level of nurse's knowledge and

practice concerning the caring of children with meningitis. (b) developing an educational program based on the pre assessment of the nurses knowledge and practice (c) assessing the impact of the educational program on the nurses knowledge and practices about care given to the child with meningitis.

**Hypothesis:** Implementing an educational program will affect positively on nurses' knowledge and practices regarding nursing care of children with meningitis.

## **Subjects and Method**

### **1-Research design**

A quasi-experimental research design was utilized in the present study.

### **2-Setting**

The study was conducted in the Emergency at Assuit University children Hospital.

### **3- Sample**

A convenient sample of the nurses working at Emergency Unit in Assuit University Children Hospital. Total number was 30 nurses they were divided into (3) baccalaureate and (27) practical of nursing.

### **4- Tools of data collection:-**

Two tools were utilized to collect data pertinent to the study:-

**Tool I: A structured questionnaire interview sheet** for nurses. It consists of two parts.

**1-Personal and socio-demographic characteristics:** as age, qualification, job position, duration of nursing total and current job experience, and previous attendance of training courses.

**2- Assessment of knowledge:** This part was developed by the researchers to assess nurses' knowledge about meningitis and evaluate the gaining of knowledge after the program. This part includes 28 questions about definitions of meningitis, types, incidence, causes, complications, management and prevention of meningitis. It was used as a tool for data collection in both pre and post-test of the educational program.

**Scoring system:** each complete answer 2 grades; incomplete(1) while wrong (0). Total grades of knowledge equal 115 marks. The total knowledge score was classified as:

\* Poor: < 60%.

\* Satisfactory: > 60%

**Tool II: Observation Checklist:** it was adopted from **Vicky and Cindy (2011)** and evaluate nurses' practices given to child with meningitis. It includes the following practices:-

- Vital signs (55 items)
- Blood sample (8 items)
- lumbar puncture (6 items)
- Intravenous fluid (10 items)
- Resuscitation. (21 items)

It was used as a tool for monitoring the nurses' practices in both pre and post-test of the educational program.

Scoring system: The items observed to be done correctly were scored "1" and the items not done were scored "0". The practice was considered adequate if the percent score was 60% or more and inadequate if less than 60%.

**Tool III:** The educational program handout. An educational program was developed by the researchers based on the knowledge and practices needs in a form of printed (Arabic booklet). It was also

supplemented with information based on review of relevant literature (nursing textbook, journals, internet resources, etc.) about care provided to children in with meningitis. Then the program was reviewed by a panel of experts before its implementation.

**General objective of the program:-**  
Was to improve nurses' knowledge and practices about care offered to the child with meningitis.

**Specific objective of the program:-**

The program's specific objectives were that the nurse who attended the program should be able to:

Define and list causes, types, sign and symptoms of each type, complications and nursing care of meningitis

Efficiently provide the nursing procedures offered for children with meningitis in emergency unit(vital sign, blood sample, lumber puncture, resuscitation and intravenous fluid).

**The program included 2 parts:**

**Theoretical part:** it included two lectures, one session for each. The first lecture included definition of meningitis, types of meningitis, dangers type, causes and incidence. The second lecture included sign and symptoms of meningitis, complications of each one, treatment and prevention.

**Practical part:** This part covered the nursing procedures offered for children with meningitis such as vital signs, intravenous fluid, blood sample, lumber puncture and resuscitation. One session of each procedure and each group has 1-2 nurses. The time required for the program implementation was 7 months with approximately 280 hours divided in 80 hours theoretical and 200 hours practical.

**Program evaluation**

Evaluation of the program's success was based on the improvement of the nurses' knowledge and practices. This evaluation was done before the program, then immediately after the end of the program and was repeated after three months using the same tools in each time.

**Data collection:**

-An official letter was obtained from the Dean of the Faculty of Nursing to the Heads of the Emergency units, as well as the Head of Nursing Services Administration Department, soliciting the necessary approvals to conduct the research. The aim and methodology of the study was explained to administrators, and as well as potential participants.

-An Arabic translation of all study tools was done and preparation of the program lectures in form of Arabic module.

**Pilot study**

Before starting the collection of data, a pilot study was carried out on a group of 3 nurses in order to evaluate the questions validity and warding to modify the sheet and also to know the approximate mate time required for each intervention. The pilot study is the most important steps in the entire research process for discovering problems.

The observation checklist was applied by the researcher to make sure that all items included were applicable. The necessary modifications were done and the final form was reached.

**Validity**

The validity of the study tool will be assessed to check the relevance, coverage, and clarity of the questions by a jury panel

of professors from five expert pediatric field and its result was 96%.

### **Reliability**

Reliability will be estimated by Alpa Cronbachs test for study and its result was R=0. 68

### **Ethical consideration:**

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The oral consent was taken from all nurses participate in the study. The purpose and nature of the study was explained by the researcher through direct personal communication prior starting to their participation in the study. This data was confidential between nurses and the researchers and used for the purpose of the research only.

### **Field of the work**

- The field work was carried out through a period of 7 months starting from March to October, with approximately 280 hours divided in 80 hours theoretical and 200 hours practical, nurses were divided into 20 small groups each group has 1-2 nurses (Increased number of admission to the unit with decrease number of nurses so, nurses were divided into small subgroups that could attend the program).

- The program was implemented for nurses in the form of scheduled sessions as well as on the spot teaching during their official working hours. There was a total of 7 sessions. These were repeated to each subgroup of 1-2 nurses. The duration of each session was variable and ranged between 60 and 90 minutes, each subgroup was given the freedom to choose their optimal time for receiving the program. Each participant obtained a copy of the program booklet that included all the training material. Each session usually started by a summary of what has been taught during the preceding sessions and

the objectives of the new one. Reinforcement techniques, such as giving praise and/or recognition to the interested nurses, were used for motivation during program implementation.

- The actual work started by meeting the nurses throughout the morning shift, the researchers first introduced themselves to nurses and gave them a complete back ground about the study and its aim, then the pre-test format, pre- designed by the researchers in Arabic Language, was distributed in order to collect the required data. The researcher was available for more clarification whenever needed. Then, the content of the program was designed based on actual educational need assessment of the studied nurses according to the result of the pre- test. Consequently, the subject content has been sequenced through theoretical sessions and practical sessions that contained a practical performance to the targeted intervention, from the researchers and are demonstration from the studied sample

-Methods of teaching were through a modified lecture, demonstration and re-demonstration and group discussion. Suitable teaching aids were pre pared and used especially for the program.

### **Data analysis:**

The collected data were revised, coded and fed to a fox pro program data base. Data was then transferred to SPSS version 16 program for statistical analysis which included frequency, percentages, cross tabulation, mean, standard deviation and chi square test. Whenever the expected values in one or more of the cells in a 2x2 tables was less than 5, Fisher exact test was used instead. In larger than 2x2 cross-tables, no test could be applied whenever the expected value in 10% or more of the cells was less than 5. Statistical significance was considered at p-value <0.05.

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**Results:-**

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**Table (1):** Socio-demographic characteristics of the studied nurses

<b>Item</b>	<b>No. (n=30)</b>	<b>%</b>
<b>Age:</b>		
< 24 y	8	26.7
24 –	14	46.7
29 -	5	16.7
≥ 34 y	3	10.0
Mean ± SD	27.19±8.77	
<b>Years of experience:</b>		
< 5 years	5	16.7
5 – 10 years	14	46.7
> 10 years	11	36.7
Mean ± SD	11.24±4.90	
<b>Years of experience in current place:</b>		
< 5 years	9	30.0
5 – 10 years	12	40.0
> 10 years	9	30.0
Mean ± SD	9.88±3.74	
<b>Attending training courses:</b>		
Yes	18	60.0
No	12	40.0

**Table (2): Nurse's knowledge about meningitis throughout intervention program phases .**

Items	Pre		Post		Follow-up		P-value
	No.	%	No	%	No.	%	
<b>. 1.Knowledge about Meningitis</b>							
Meningitis is:	0	0.0	30	100.0	18	60.0	0.000*
Among children, meningitis is considered:	0	0.0	30	100.0	21	70.0	0.000*
The most important types of meningitis:	0	0.0	30	100.0	15	50.0	0.000*
Meningitis is caused by many factors such as:	0	0.0	30	100.0	13	43.3	0.000*
Children at risk of meningitis are:	0	0.0	21	70.0	6	20.0	0.000*
The most dangerous type of meningitis:	2	6.7	30	100.0	11	36.7	0.000*
Meningitis occurs more frequently among children at age:	0	0.0	15	50.0	0	0.0	0.000*
Incidence of meningitis increases in	0	0.0	29	96.7	6	20.0	0.000*
Bacterial meningitis among age under 2 months is caused by:	0	0.0	27	90.0	4	13.3	0.000*
Bacterial meningitis among age mont-18 year is caused by:	0	0.0	21	70.0	0	0.0	0.000*
Viral meningitis, the most common among children is caused by:	0	0.0	17	56.7	1	3.3	0.000*
The parasitic meningitis among children is caused by:	0	0.0	2	6.7	0	0.0	0.004*
The fungal meningitis among children is caused by:	0	0.0	22	73.3	0	0.0	0.000*
The most important signs & symptoms among infants are:	0	0.0	2	6.7	0	0.0	0.088
Associated signs & symptoms with meningitis among children above 1 year are	0	0.0	14	46.7	0	0.0	0.000*
The most important complications of meningitis are:	0	0.0	21	70.0	1	3.3	0.000*
It can prevent some types of meningitis by using protective procedures through caring the	0	0.0	30	100.0	6	20.0	0.000*
It can prevent some types of meningitis by using the following immunizations:	0	0.0	20	66.7	3	10.0	0.000*
The most important antibiotics that are used as chemical prevention and can administer for individual who contact directly to affected child are:	0	0.0	13	43.3	1	3.3	0.000*
<b>2.Knowledge about Medical Diagnosis of meningitis</b>							
The most important signs & symptoms that help in diagnosing meningitis are:	0	0.0	11	36.7	0	0.0	0.000*
The most important physical examinations that help in diagnosing meningitis are:	0	0.0	21	70.0	1	3.3	0.000*
The most important laboratory tests that help in diagnosing meningitis are:	0	0.0	29	96.7	7	23.3	0.000*

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**Table (2): Con**

Items	Pre		Post		Follow-up		P-value
	No.	%	No.	%	No.	%	
<b>. 3. Knowledge about medical treatment of meningitis</b>							
The type of treatment is depends on:	0	0.0	17	56.7	4	13.3	0.000*
Medical treatment has major role in decreasing death rate and complications of the disease through:	0	0.0	23	76.7	0	0.0	0.000*
<b>. 4. Knowledge about caring of Children with meningitis</b>							
Monitoring of vital signs regularly which are:	0	0.0	19	63.3	0	0.0	0.000*
Monitoring the signs &symptoms of intracranial pressure which are:	0	0.0	19	63.3	0	0.0	0.000*
The most important things to be checked and documented are:	0	0.0	16	53.3	0	0.0	0.000*
The most important preventive methods through contact with children	0	0.0	7	23.3	0	0.0	0.000*
Providing full comfort for children with meningitis through:	0	0.0	10	33.3	0	0.0	0.000*
Supporting family of children with meningitis through:	0	0.0	22	73.3	17	56.7	0.000*

**P- value < 0.05**

**Table (3): Comparison between mean score of studies nurses' performance of meningitis care throughout intervention program phases**

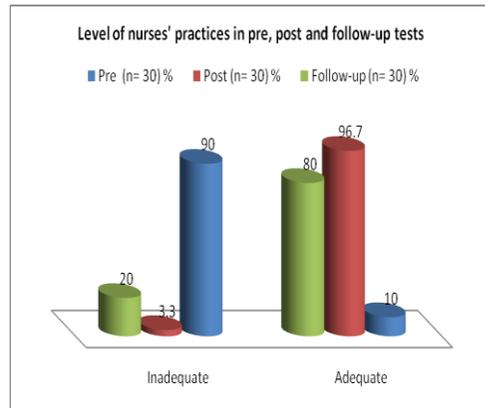
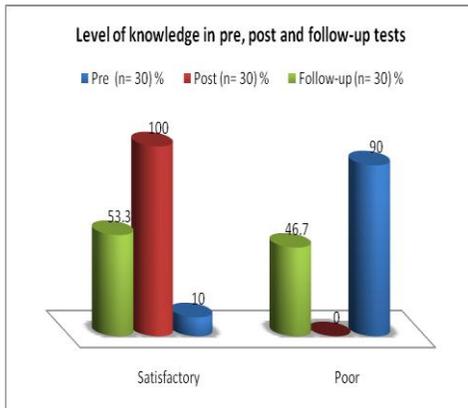
	Score	Pre	Post	Follow-up	P-value
		Mean ± SD	Mean ± SD	Mean ± SD	
<b>Vital signs</b>	156	24.67 ± 19.19	134.37±16.82	97.20 ± 23.61	0.00*
<b>Intravenous fluid</b>	8	1.97 ± 2.20	7.60 ± 1.54	6.80 ± 1.65	0.00*
<b>Lumber puncture</b>	42	14.80 ± 7.50	35.03 ± 7.05	28.37 ± 7.34	0.00*
<b>Blood sample</b>	26	1.47 ± 3.41	19.10 ± 1.90	17.20 ± 3.49	0.00*
<b>Resuscitation</b>	22	2.60 ± 3.11	20.57 ± 1.85	15.33 ± 4.16	0.00*

**P- value < 5**

**Table (4): Correlation between total nurses' knowledge and practices among pre, post and follow-up**

Group	Knowledge Mean ± SD	Practices Mean ± SD
Pre	10.43 ± 2.65	45.50 ± 26.69
Post	96.87 ± 12.10	216.67 ± 23.20
Follow-up	58.90 ± 13.58	164.90 ± 35.10
P-value	0.000*	0.000*

P- value < 5



**Figure. (1): Level of nurses' knowledge and practices throughout program phases.**

**Table (1)** shows the socio-demographic characteristics of the studied nurses. It was found that less than half of the nurses (46.7%) their age ranged from 24-28 years with mean age (27.19±8.77). The majority of the studied nurses (70%) had years of experience ranged from 5-10 with mean duration of 9.88 and 60% of them had educational program courses related to emergency need.

Nurses' complete knowledge about meningitis was illustrated in **table (2)** It was found that no one of nurses had complete answers before program implementation about meningitis (Meningitis is, Among children meningitis is considered, The most important types of meningitis, Meningitis is caused by many factors such as, Children at risk of meningitis

are and the most dangerous type of meningitis) this percentage increased to 100% at post I and slightly decreased to (60%, 70%, 50%, 43.4%, 20.0% & 36.7%) respectively at post II.

Concerning the nurses' complete knowledge about common types of meningitis it was found that no one of the nurses knew the sign and symptoms and treatment before the program implementation. On the other hand all nurses at the posted mentioned that sign and symptoms and treatment, with statistically difference significant (p <0.000\*).

Moreover, when the nurses were asked about the Supporting family of children with meningitis, it was found that none of nurses had complete answers before program implementation, while 73.3% of nurses mention them

completely at post I and 57.6% at post II(follow up).

**Table (3)** Presents a comparison between mean score of nurses' performance of meningitis care throughout intervention program phases (pre, post and follow-up). It indicates increases in the practice scores in all practice areas at the post-program phase. However, this increase reached statistical significance for nurses' basic practice about vital sign, lumbur puncture, intravenous fluid, blood sample and resuscitation ( $p < 0.00^*$ ). However, the practice scores have demonstrated some declines after three months at follow up testing. Nevertheless, the scores were still higher than the pre-program baseline scores.

**Table (4)** indicates statistically significant improvement were revealed in total knowledge and practice score were much higher in the post program implementation (I) (96.8 and 216.67, respectively) compared to preprogram (10.43 and 45.58, respectively). That is showing statistically significant relation between knowledge and practice ( $p < 0.000$ ).

**Figure (1):**displays the level of nurses' knowledge and practices throughout program phases. It points to a sharp statistically significant rise of the percentage of satisfactory knowledge and adequate practice from a pre-program level (10 %) to 90 % and 96.7%, respectively) at post-test level ( $p < 0.001$ ). Although the percentage of total knowledge and practices has declined in the follow-up phase, it was still statistically significantly higher than the pre-program level,  $p < 0.001$ .

## **Discussion**

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Meningitis is a term used to describe an inflammation of the

membranes that surround the brain or the spinal cord. Meningitis especially bacterial meningitis, is a potentially life-threatening condition that can rapidly progress to permanent brain damage neurologic problems and even death of children **Marcdante and Kliegman (2015)**.

The first dimension that has been explored in the present study by pediatric nurses was the assessment of nurses' knowledge about different subjects related to meningitis. This assessment was done in order to evaluate the basic knowledge that pediatric nurses utilize during their care for children with meningitis and to identify areas of knowledge defects that need to be managed accordingly.

The results of the current study revealed that about half of nurses age were ranging from 24-28 years and less than half of them had 5-10 years experiences. Regarding training courses, it was noticed that the majority of the studied sample did not attend any training courses. Because of the increase number of patients in Emergency unit. In this line with **Shehata, (2011)** who reported that the majority of nurses had not attend any training courses about communicable disease especially meningitis.

According to the present study findings, before the training program, nurses had poor knowledge about meningitis, this was indicated by their low scores. This poor baseline knowledge was noticed among nurses' might be attributed to that, after graduation, nurses abandon reading and neglect updating their professional knowledge. Another possible reason might be the absence of any resources or programs for continued nursing education. This is in the line with, **Hussien, (2013)** who found that participants had poor knowledge before

training program. Also, the same finding was reached by **Japheth et al., (2012)** was found that nurses had poor scored in knowledge about Meningitis. This finding is in the line with **Paudyal et al., (2008)** who found that nurses had poor scored in knowledge about meningitis and they referred their finding due to lack of appropriate courses in the curricula of schools and institutions. The above results agree with the study done by **Al-Wily (2015)** who showed that high significant relationship concerning the nurses responses for knowledge between the pre and post program.

In my opinion old age nurses' and not attend any training courses had poor knowledge due to lack of appropriate courses in the curricula of schools and institutions

The second dimension that has been explored in the present study in order to evaluate the state of nursing care offered to children with meningitis by the studied nurses as observed through a checklist during their work. The primary intervention for meningitis include obtaining vital sign, I.V fluid, lumbar puncture, blood sampling and assessing airway breathing ( resuscitation) (**Hockenberry and Wilson., 2015**)

According to the present study findings, before the training program, nurses had poor knowledge about care of children with meningitis, this was indicated by their low scores, and revealed that the minority of nurses knew clinical manifestation of meningitis in both infants and older children. In agreement with this, findings of the study done by **Mohammed and Hassan (2015)** which showed that none of nurses knew the functional changes before the program implementation except only a few number knew meningitis.

After the program, the immediate post-test, and follow-up test (after three months), have shown statistically significant improvements for total knowledge in relation to care with children with meningitis. Although the follow-up scores have shown some declines they were still higher, compared to pre-program levels. The observed significant improvement in the studied nurses' knowledge when exposed to an educational experience indicates that these nurses could readily benefit from it. This might be due to the fact that information was simple, in addition to the use of suitable media for clarification, and the guidance offered during application of the program that enhanced the process of learning. Thus, the improvement points to the effectiveness of the training program, which was successful in nurses' acquisition of knowledge. The present study findings are in agreement with **Hussien(2013)**. Those authors have assessed the base knowledge of nurses in different specialties prior to the application of remedial educational programs. They all reported very poor nurses' knowledge levels before the exposure to designated educational programs, which significantly and immediately improved after the application of the programs, and declined at the follow-up.

The decline in the percentages of nurses with satisfactory knowledge in the follow-up phase is a normal and expected finding. This is known as retained of knowledge gained with time. Hence, the follow-up knowledge scores were mostly less than those recorded at the post-test stage. However, they still remained higher, compared to pre-program levels. A similar observation was demonstrated by **Ali (2010)** who noticed a direct relationship between memory attrition and length of time that elapsed after exposure to certain educational events.

Cardiopulmonary resuscitation (CPR) is indicated in any situation in which breathing, heartbeat, or both are absent. Nurses are generally the first responders to a cardiac arrest and initiate basic life support while waiting for the advanced cardiac life support team to arrive. When a child presents with meningitis, begin with an assessment of the airway, breathing and circulation (Beevi, A., 2009). According to our result the majority of the studied nurses had inadequate performance related to resuscitation. The same results were found in a randomized controlled study in pediatric resuscitation carried out by Hussien (2013) which was found poor pre training nurses scores in resuscitation skills.

However, at the follow-up (after three months), there was a slight decline. Nevertheless, the percentages of adequate performance remained higher than those at the pre-program phase, and the differences were still statistically significant. Again, this decline is quite expected because of the attrition of acquired skills over time. In agreement with this finding, study done in Ireland by Jissir and Hassan (2015.) on nurses' acquisition and retention of CPR knowledge and skills in Ireland. The findings showed an acquisition in nurses' knowledge and psychomotor performance following implementation of the program and deterioration in both knowledge and skills was found ten weeks following training.

Cherry, (2014) emphasized that nurses must obtain vital signs in meningitis children as a specific intervention. Hyperthermia, hypothermia, tachycardia, bradycardia, hypertension and hypotension can occur in child with meningitis. In this regard the present study revealed that, the majority of nurses had adequate performance related to axillary temperature measurements.

Furthermore, the majority of nurses did not verify the apical pulse, respiration and blood pressure measurements correctly. This result can be attributed as the nurses in this setting at Assuit university children hospital consider apical pulse, respiration and blood pressure responsibility of the physician. This result agree with when he assessed the nurses performance of physical examination, who was found that most of studied nurses not finding the apical focus from the point of maximum impulse and some health care services do not check children's blood pressure.

**The present study showed that** majority of the studied nurses didn't clean the site of injection with alcohol. This could be attributed to lack of antiseptic solutions. Furthermore, The present study findings related to the principles of infection control and performance of universal precautions (hand washing and wearing gloves) were poor among studied nurses. This might be attributed to lack of nurses' knowledge about infection control precautions and may be due to the increasing number of children and the shortage of trained nurses. This finding are in accordance with a study conducted in Maternal and Child Health Centers by Mohammed and Hassan (2015) who found nurses' performance regarding infection control precautions such as hand washing, wearing gloves and patient care equipment were poor.

At the past intervention phase, the nurses performance showed statically significant improvements as compared to pre-intervention phase. In this respect, many studies in Assuit Hussien, (2013) demonstrated that nurses' practice related to vital sign, lumbar puncture, resuscitation and blood sampling had statistically significant improvements at the post-test, compared with pre-test.

Regarding integrating knowledge into practice, the present study has demonstrated statistically significant relation between knowledge and practice. with higher mean score of nurses performance. The finding is quite expected and is congruence with **Tuvadimbwa,,(2015)** who reported a linear positive correlation between knowledge and practice scores of studied nurses. Furthermore, **Ali.,(2010)** demonstrated better practice among nurses were good knowledge.

Finally, the program has achieved its objectives by improving the knowledge of nurses. Moreover, improvement in nursing practices was noticed throughout the program phases.

### **Conclusions:**

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***Based on the results of the present study,*** it was concluded that pediatric nurses in Assiut University children Hospital were lacking the necessary basic knowledge and practices related to care given to children with meningitis. An educational program was developed based on needs assessment regarding meningitis. Implementation of the program was associated with significant improvements of nurses' knowledge and practices. This was remarkable at the immediate post-test, and slightly declined at three-month follow-up test. Program attendance was the only independent predictor of nurses' knowledge and practices scores. Therefore, the program was successful in correcting the deficiency in nurses' knowledge and performance regardless to their personal and job characteristics.

### **Recommendations:**

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***In the light of the study findings, the following recommendations are suggested.***

- The developed program should be applied and repeated again every 2-3 months in the same study setting, and adopted in other similar settings with required modifications.
- Pediatric nurses should update their knowledge and performance through continued nursing education, training, and frequently attending seminars and conferences based on their needs assessment.
- Continuous evaluation for nurses caring of children with meningitis is crucial, as they may lose knowledge and skills in the course of time.
- Further research is needed to assess the impact of application of educational programs on the quality of nurses' services provided, and patient outcome.
- Providing educational guidelines, posters, pamphlets and manuals about meningitis should be available at each nursing station in wards and encourage nurses to get use of them.
- Encourage the nurses to participate in training courses and congresses held by specialists in meningitis to update their knowledge.
- The educational program can be designed and constructed for nurses through the program; an emphasis can be directed and oriented in management of children with meningitis should include continuous training to all nursing staff who works in pediatric units.

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