### Assessment of Nurses' Performance Regarding Care of Infants Suffering from Hydrocephalus

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#### Abstract

**Background:** Hydrocephalus is a common neurological disorder; it is the symptomatic accumulation of Cerebrospinal Fluid (CSF) inside the cerebral ventricles, heterogeneous in nature and complex in pathogenesis seen among infants. Nursing care provided for infants with hydrocephalus and VP shunt was challenging for effective care, functioning and complication reduction. Aim: This study was aimed to assess nurses' performance regarding care of infants suffering from hydrocephalus. Design: A descriptive design was used in this study. Setting: The study was conducted at Beni-Suif University hospital and pediatric hospital affiliated to Ain Shams University hospital. Sample: A convenient sample of 150 nurses participated from the abovementioned settings. Data collection tools: Tools used for data collection were 1): pre-designed questionnaire sheet, 2): Observational checklists. Results: The present study showed that, the Mean $\pm$  SD age of the studied nurses was (26.98 $\pm$ 4.51 year) and less than half of the studied nurses had poor knowledge level, less than half of them had average knowledge level and minority of them had good knowledge level about infants suffering from hydrocephalus. Also, more than three quarters of the studied nurses had incompetent practice level. While, less than one quarter of them had competent total practice level regarding care of infants suffering from hydrocephalus. Additionally, there was a positive correlation between total knowledge and total practice level of the studied nurses. Conclusion: the overall knowledge and practice of the studied nurses were poor which reflect the need of the studied nurses to educational program to improve their knowledge and practice regarding caring of infants with hydrocephalus. Recommendations: Development of an educational guideline based on evidence-based nursing practices to promote excellence of nursing care and provides high-quality infants care regarding infants with hydrocephalus and VP shunt.

Keywords: Hydrocephalus, Infant, Nurses' performance.							
Introduction	hydrocephalus,	which	include	non-ol			

Hydrocephalus is characterized by abnormal flow or, rarely, excessive production of Cerebrospinal Fluid (CSF), leading to the widening of the cerebral ventricles system due to the accumulation of the CSF in the brain. The choroid plexus produces most of the Cerebrospinal fluid in the ventricular system at ml/min. The cerebrospinal 0.3-0.4 fluid disturbance is a severe condition that affects brain function and may lead to death if not treated (Marcdante & Kliegman, 2019).

There are several causes such as congenital malformations as aqueduct stenosis and benign intracranial cyst. While, acquired causes as intraventricular tumor and meningitis. Infants are present with different symptoms, so its prognosis is hard to predict. There are different types of hydrocephalus, which include non-obstructive (communicating) hydrocephalus, and obstructive (non-communicating) hydrocephalus. Further, hydrocephalus can be classified as congenital, acquired, normal pressure hydrocephalus, or exvacuo hydrocephalus (**Alshehri et al., 2020**).

Hydrocephalus symptoms vary with age. Infants usually experience unusual enlargement of the head circumference because the fontanels are still not closed; other symptoms at this stage include vomiting, sleepiness, irritability, and convulsions. Diagnosis of hydrocephalus is dependent on patient history, physical examination, and neurological assessment with imaging studies like Magnetic Resonance (MRI), or other CSF monitoring techniques (**Singh et al., 2021**).

Hydrocephalic children with VP shunt are prone to many complications as shunt malfunctioning which causes failure rates up to 40-50% during the first year of insertion. Early identification and treatment of shunt malfunction is essential to prevent permanent neurological impairments or deaths. Currently, hydrocephalus management involves a surgical intervention with shunt systems, or Endoscopic Ventriculostomy (ETV). Shunting is associated with complications, such as infection, malfunction, or obstruction, in which case, a replacement may be needed (Liew et al., 2019).

The nursing practice is based on scientific principles that provide effective identification of actual and potential health problems, as well as the development of actions aimed at maintaining the life quality of the individual. Nursing should be trained, technically and scientifically, to care for the patient with hydrocephalus, which requires knowledge of neuroanatomy, neurophysiology, neurological clinical pictures, neurodiagnoses and nursing exams, intensive care and admission unit (**Krupka & Tulacz, 2021**).

Nursing management of infant with a ventricular shunt required adequate knowledge to provide care and maintain hand hygiene, observe for any deviations from typical behavioral and physical state while lying just on unaffected side or on back with the head raised at 15° to 30°. In addition to check the VP shunt's appropriate functioning by clamping down on the valve in a specified reservoir section (**Abdelrahman et al., 2021**).

Assessment of the skin for redness at the shunt placement on bony prominences, as well as taking note of hydration and fluid intake. Nurses caring for infants had congenital anomalies of CNS require professional nursing skills and practices, due to its specificity and complexity, in order to prevent post-operative complication and decrease mortality rate (**Amatangelo, 2020**).

#### Significance of the study:

Hydrocephalus is one of the most frequent problem seen in pediatric neurosurgical practice. As estimated by the National Institute of Neurological Disorders and Stroke that, 1 to 2 of every 1,000 was born with hydrocephalus every year. Also, it is estimated that, 750,000 infants suffer from hydrocephalus worldwide and 160,000 VP shunts are implanted each year as well (Adebayo, 2023).

The exact prevalence of hydrocephalus in Egypt it not estimated until now. Many recent studies reported that, the incidence of hydrocephalus was 6.76/1000 living births and the prevalence of congenital hydrocephalus was 0.81 per thousand among infants (**Aboel-Azm et al., 2022).** So, this studied aimed to assess nurses' performance regarding care of infants suffering from hydrocephalus.

#### Aim of the study:

This study aimed to assess nurses' performance regarding care of infants suffering from hydrocephalus.

#### **Research Question:**

1. What is the level of nurses' knowledge about hydrocephalus?

2. What is the level of nurses' practices regarding care of infants with hydrocephalus?

#### **Subjects and Methods**

The subject and methods for this study were consisted of the following four main designs as the following:

- I. Technical design
- II. Operational design
- III. Administrative design
- IV. Statistical design

#### I. Technical design:

#### A) Research design:

A descriptive design was utilized in this study.

#### **B)** Research setting

Pediatric intensive care unit affiliated to Beni-Suef University Hospital and pediatric hospital which affiliated to Ain Shams University Hospitals. Neonatal intensive care unit which affiliated to Beni-Suef University Hospital was located on 6 floor, composed of 3 rooms and contain 29 incubators and pediatric intensive care unit was located on fifth floor, composed of 2 rooms and contain and 13 beds. While pediatric hospital which affiliated to Ain Shams University Hospitals was located on Neonatal intensive care unit which affiliated to Ain Shams University Hospital at first floor; composed of 2 rooms and contain and 10 incubators. Pediatric intensive care unit located on the second floor, composed of 10 beds.

#### C) Subjects of the study:

A Convenience sample of all available nurses (150 nurse) were working in the previously mentioned settings regardless their age, years of experience and educational level, the number of nurses from neonatal intensive care unit and pediatric intensive care unit affiliated to Bani Suif University Hospital was (100 nurses). While, the number of nurses from pediatric hospital which affiliated to Ain Shams university hospitals was (50 nurses).

#### D) Tools of data collection:

The tool of data collection was interviewing self-administrated questionnaire which was divided in to two parts.

### Tool I: Pre-designed questionnaire sheet:

It was designed and written in an Arabic language by the researcher after reviewing the related literature and consists of two parts as the following:-

Part (1): Characteristics of the studied nurses which included age, gender, educational level, job, work place years of experiences and training courses.

Part (2): Nurses knowledge regarding hydrocephalus: it was adapted from (*Alshehri et al., 2020*) & (*Mahmoud & Shawq, 2021*) and aimed to assess nurses' knowledge regarding hydrocephalus. It was included the following: - Anatomy and physiology of the brain: It was included; definition, structure and function of the brain and cerebrospinal fluid (11questions).

- Knowledge about hydrocephalus in infants: It was included; definition, causes, types, symptoms, diagnosis, complications and treatment of hydrocephalus (8 questions).

- Nurses' knowledge about their role regarding infants with hydrocephalus pre and post-surgical intervention: It was included; pre and post-surgical care, care of shunt and health education (7 questions).

#### Scoring system:

Total global score of 26 questions with 52 scores, were rated on three Likert scale as (incorrect= Zero, correct incompletely = 1 & correct completely= 2). These scores were summed and converted into a percent score. It was classified into 3 categories according to the following:

**1.Anatomy and physiology of the brain** (11questions with 22 scores).

Poor knowledge level if score < 60% (<13.2 scores), average knowledge level if score 60% to < 75% (13.2 to <16.5 scores), and good knowledge level if score  $\geq$ 75% ( $\geq$  16.5 scores).

# 2.Knowledge about hydrocephalus in infants (8 questions with 16 scores)

Poor knowledge level if score < 60% (<9.6 scores), average knowledge level if score 60% to < 75% (9.6 to <12 scores), and good knowledge level if score  $\geq$ 75% ( $\geq$  12 scores).

#### 3.Nurses' knowledge about their role regarding infants with hydrocephalus pre and post-surgical intervention (7 questions with 14 scores).

Poor knowledge level if score < 60% (<8.4 scores), average knowledge level if score 60% to < 75% (8.4 to <10.5 scores), and good knowledge level if score  $\geq$ 75% ( $\geq$  10.5 scores).

## 4.The total score were (26 questions with 52 scores)

Poor knowledge level if score < 60% (<31.2 scores), average knowledge level if score 60% to < 75% (31.2 to <39 scores), and good knowledge level if score  $\geq$ 75% ( $\geq$  39 scores).

#### Tool II: Observational checklists:

It was adapted from (*Hockenberry & Wilson, 2015*) and aimed to the actual nurses' practices regarding care of infants suffering of hydrocephalus pre- and post-operation. It was included the following:

Hand washing: (10 steps), Vital signs: It was included; respiration (4 steps), apical pulse (7 steps) and axillary temperature (8 steps), Measuring infants' weight: (13 steps), Measuring infants' length: (13 steps), Measuring infants' head circumference: (11 steps). Measuring infants' abdominal circumference: (11 steps), Cold compress: (12 steps), Measuring and placing the gavage tube: (9 steps), Giving formula (Gavage feeding) (15 steps), Care during convulsion: Administration (9 steps). of oral medication:(17steps), IV administration: (16 steps), Post-operative nursing care (for shunt) (12 steps), Shunt care: (13 steps).

#### Scoring system:

Total global score of 180 questions with 180 scores, were rated on two Likert scale as (not done= Zero & done = 1). These scores were summed and converted into a percent score.

#### **II.** Operational design:

The operational design includes: a preparatory phase, pilot study, and field work.

#### A) The Preparatory Phase:

It was included reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles and internet's periodicals and journals to develop tools for data collection.

#### **Tools validity:**

Face and content validity was ascertained by a panel of three experts (2 Assistant professors and 1 lecturer of pediatric nursing) from Faculty of Nursing, Ain Shams University. The expertise reviewed the tools for clarity, relevance, comprehensiveness, simplicity, and applicability; minor modifications were done and the final forms were developed.

#### Tools reliability

In the present study, reliability was tested using Cronbach's Alpha coefficients for total nurses' knowledge regarding hydrocephalus which was.758 and total nurses' practices regarding caring of hydrocephalus infants which.699.

#### **B) Pilot study (Exploratory phase):**

A pilot study was carried out on 10% (15 nurses) of sample size to test the applicability, clarity and efficiency of the tools. Depending on the results of the pilot study no modifications or refinements were done and the nurses were included in the actual study sample.

#### C) Field Work:

- The researcher explained the purpose of the study to patients included in the study.

- The actual work of this study started and completed within six months from beginning of November (2022) to the end of Abril (2023).

- Data were collected by the researcher two days per week, at morning and afternoon shifts (Monday and Wednesday) from 10:00 am to 1:00 pm & from 3:00 pm to 7:00 pm in the previous mentioned setting.

- Nurses' oral consent to participate in the study obtained and every nurse was informed that confidentiality was assured.

- The researcher explained the aim and objectives of the current study to the nurses.

- The researcher started the interview with each nurse individually used the data collection tools.

- The characteristics of nurses and their knowledge questionnaire (Appendix I) were filled by the nurse herself, then and observational check list (Appendix II) were assessed for each nurse individually and separately.

- The time consumed to fill out the full study tools ranged from 45 to 60 minutes.

- The average number of nurses interviewed were 4 nurses/day depending on the response of the participants.

#### **III. Administrative Design:**

An official permission was obtained by submission of official letters issued from the Dean of faculty of nursing, Ain Shams University to the director of Beni Suef university hospital and pediatric hospital which affiliated to Ain Shams university hospitals. The title and aim of the study were explained as well as the main data items and the expected outcomes.

#### IV. Statistical design

Data were summarized, tabulated, and presented using descriptive statistics in the form of frequency and distributions & means and standard deviations as a measure of dispersion by using appropriate statistical test. A statistical package for the social science (SPSS), version (26) was used for statistical analysis of the data, as it contains the test of significance given in standard statistical books. Qualitative data were expressed as a percentage. Chi-square (X2) test of significance was used in order to compare proportions between qualitative parameters. Probability (P-value) is the degree of significance, less than 0.05 was considered significant. The smaller the P-value obtained, the more significant is the result (\*), less than 0.001 was considered highly significant (\*\*) and the correlation coefficient was done by using the Pearson correlation test.

#### Ethical considerations

- Ethical approval was obtained from the Research Scientific Ethical committee of the Faculty of Nursing – Ain Shams University, addition oral informed consent was obtained from each study subjects prior to data collection. The researcher classified the aim of the study to nurses included in the study. Confidentiality of the gathered data and results was ensured. The study subjects have the right to withdraw from the study whenever they want.

#### Results

**Table (1)** shows that,, the Mean $\pm$  SD age of the studied nurses was (26.98 $\pm$ 4.51 year) and 38.7% of them had diploma of technical institutes of nursing. While, 62% of them were nursing technician and 62.7% of them were working in pediatric intensive care unit, 40% of them had experiences from one year to less than 3 years and 51.3% of them were attended training courses that talk about hydrocephalus for infants.

**Figure (1)** illustrates that, 48% of the studied nurses had poor knowledge level, 46.7% of them had average knowledge level and 5.3% of them had good knowledge level about infants suffering from hydrocephalus.

**Figure (2)** shows that, 77.3% of the studied nurses had incompetent practice level. While, 22.7% of them had competent total practice level regarding care of infants suffering from hydrocephalus.

**Table (2)** reveals that, there was highly statistically significant difference between the studied nurses' total knowledge and their age. While, there was no statistically significant difference between the studied nurses' total knowledge and their education qualification, job, workplace, years of experiences and attending training courses about hydrocephalus for infants.

**Table (3)** illustrates that, there was highly was highly statistically significant difference between the studied nurses' total practice and their age. While, there was no statistically significant difference between the studied nurses' total practice and their education qualification, job, workplace, years of experiences and attending training courses about hydrocephalus for infants. Table (4) reveals that, there waspositive correlation between total knowledgeand total practice level of the studied nurses.

Tuble (1). Distribution of studied narbes according to the characteristics. (n=150)						
Items	Ν	%				
Age						
Mean±SD	26.98±4.51					
Education qualification						
Diploma of technical schools of nursing	35	23.3				
Diploma of technical institutes of nursing	58	38.7				
Bachelor of Nursing Sciences	51	34.0				
Specialized diploma in nursing	6	4.0				
Job						
Nursing Technician	93	62.0				
Nursing specialist	57	38.0				
Workplace						
Neonate intensive care unit	56	37.3				
Pediatric intensive care unit	94	62.7				
Years of experience						
From one year to less than 3 years	60	40.0				
From 3 years to less than 5 years	56	37.3				
5 years or more	34	22.7				
Attended training courses about hydrocephalus for						
infants						
Yes	77	51.3				
No	73	48.7				

 Table (1): Distribution of studied nurses' according to the characteristics. (n=150)



Figure (1): Percentage of total nurses' knowledge about infants suffering from hydrocephalus (n=150).



Figure (2): Percentage of total nurses' practice regarding care of infants suffering from hydrocephalus (n=150).

	N	Poor (n=72)		Average (n=70)		Good (n=8)		<b>X</b> <sup>2</sup>	P value
	.,	N	%	N	%	N	%		1 / 4140
Age	26.98±4.51	5.300	6±0.528	3				10.04 (t- test)	0.000**
Education qualification									
Diploma of technical schools of nursing	35	15	10.0	18	12.0	2	1.3		
Diploma of technical institutes of nursing	58	30	20.0	26	17.4	2	1.3	1.946	0.925
Bachelor of Nursing Sciences	51	24	16.0	23	15.3	4	2.7		
Specialized diploma in nursing	6	3	2.0	3	2.0	0	0.0		
Job									
Nursing Technician	93	45	30.0	44	29.4	4	2.65	.518	0.772
Nursing specialist Workplace	57	27	18.0	26	17.3	4	2.65		
Neonate intensive care unit	56	29	19.3	24	16.0	3	2.0	.545	0.762
Pediatric intensive care unit Years of experience	94	43	28.7	46	30.7	5	3.3		
From one year to less than 3 years	60	27	18.0	31	20.7	2	1.3	2.234	0.693
From 3 years to less than 5 years	56	26	17.3	26	17.3	4	2.7		
5 years or more	34	19	12.7	13	8.7	2	1.3		
Attended training courses	5.	.,	1217	10	017	-	110		
about hydrocephalus for									
infants									
Yes	77	37	24.7	37	24.7	3	2.0	.678	0.713
No	73	35	23.3	33	22.0	5	3.3		

Table (2): Relation between characteristics of studied nurses and their total know	ledge (	(n=150	))
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\* Statistically significant at p $\leq$ 0.05

\*\* Highly statistical significant at p≤0.01

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	N	Com (n= N	petent =34) %	Incom (n=1 N	petent 116) %	<b>X</b> <sup>2</sup>	P value
Age	26.98±4.51	144.2	7±9.68			182.52 (t-test)	0.000**
Education qualification							
Diploma of technical schools of nursing	35	3	2.0	32	21.3		
Diploma of technical institutes of nursing	58	15	10.0	43	28.7	5.360	0.147
Bachelor of Nursing Sciences	51	14	9.4	37	24.7		
Specialized diploma in nursing	6	2	1.3	4	2.6		
Job							
Nursing Technician	93	18	12.0	75	50.0	1.531	0.216
Nursing specialist	57	16	10.7	41	27.3		
Workplace							
Neonate intensive care unit	56	13	8.7	43	28.7	7.54	0.754
Pediatric intensive care unit	94	21	14.0	73	48.6		
Years of experience							
From one year to less than 3 years	60	15	10.0	45	30.0	.493	0.782
From 3 years to less than 5 years	56	11	7.3	45	30.0		
5 years or more	34	8	5.4	26	17.3		
Attended training courses about							
hydrocephalus for infants							
Yes	77	20	13.4	57	38.0	.987	0.320
No	73	14	9.3	59	39.3		

Table (3): Relation between characteristics of studied nurses and their total practice (n=150).

\* Statistically significant at p≤0.05

\*\* Highly statistical significant at p≤0.01

 Table (4): Correlation between total knowledge and total practice

	Total knowledge	
Total practice	р	.158
	r	0.05*

\* Statistically significant at p≤0.05

\*\* Highly statistical significant at p≤0.01

#### Discussion

Hydrocephalus is а condition characterized by accumulation of cerebrospinal fluid (CSF) within the brain's ventricular system, which over time can compress and injure the surrounding brain. Hydrocephalus is an important factor of morbidity and mortality in developing countries with limited diagnostic and therapeutic means. Hydrocephalus often requires surgery and lifelong treatment with multidisciplinary team. The main characteristics are the accumulation of cerebrospinal fluid (CSF) in the ventricular space with consequently ventricular dilatation. Prematurity, infection (embryofoetopathy) and intracranial structural abnormalities such as neural tube abnormalities (NTD) and aqueduct stenosis may result in hydrocephalus (Diall et al., 2022).

In relation to characteristics of the studied nurses, the current study revealed that, the Mean±SD age of the studied nurses was (26.98±4.51 year). This study was in agreement with Ahmed et al., (2021) who conducted a study entitled "Nurse's Skills Regarding Care of Preterm Infants in Neonatal Intensive Care Unit Selected in Jazan, KSA" and reported that the mean±SD of the studied nurses' age was 26.3±5.97 years. Also, this finding was on the same line with Khedr et al., (2021) who carried out a entitled "Assessment of nurses' study competency level regarding the care of infants with congenital anomalies of central nervous system" and mentioned that the mean±SD of the studied nurses' age was  $27.8 \pm 0.37$  years.

The present study represented that, more than one third of the studied nurses had diploma of technical institutes of nursing. This result was supported by **Mahmoud & Shawq**, (2021) in their study entitled "Assessment of nurse's knowledge about care of children treated with Ventricular Peritoneal Shunt" and mentioned that less than half of the studied nurses had nursing institute. Contrariwise, this study was disagreed with **Mahmoud & Shawq**, (2022) in their recent study titl ed "Application of program for nurse's management about care of children treated with ventricular peritoneal shunt" and stated that more than half of the studied nurses had technical institute of nursing.

The present study reported that, less than two thirds of the studied nurses were nursing technician and working in pediatric intensive care unit, in the researcher point of view, this could be related to their educational level. This finding was similar to Elbilgahy & Mohammed, (2019) who conducted a study entitled "Improving the quality of nursing care provided for children undergoing ventriculoperitoneal shunt" and found that more than half of the studied nurses were technician and more than three quarters of them were working in pediatric intensive care unit.

Contrariwise, this study was dissimilar to **Alomar et al.**, (2023) in their recent study titled "The impact of nursing education on emergency bedside external ventricular drain insertion for children with acute hydrocephalus" and represented that less than one quarter of the studied nurses were working in pediatric intensive care units.

The present study found that, more than one third of the studied nurses had experiences from one year to less than 3 years; this might be related to their age. This result was in agreement with Vieira et al., (2022) in their recent study titled "External drains: ventricular Development and evaluation of a nursing clinical practice guideline" and revealed that more than one quarter of the studied nurses had experiences in pediatric units from one year to 3 years. Contrariwise, this finding was in disagreement with Manzo et al., (2019) who carried out a study entitled "Repercussion of an educational intervention on the knowledge of the nursing team regarding the use of external ventricular drains in pediatrics" and mentioned that more than half of the studied nurses had less than 3 years experiences.

The current study reported that, more than half of the studied nurses were attended training courses about hydrocephalus for infants; this may be related to that all nurses working with hydrocephalus infants in studied hospitals must be attend training courses about hydrocephalus for infants. This study on the same line with Souza et al., (2020) who conducted a study entitled "Retaining knowledge of external ventricular drain by nursing professionals" and stated that more than three fifth of the studied nurses had more than two training courses. Contrariwise, this result was disagreed with Krupka & Tulacz, (2021) who carried out a study entitled "Problems of nursing care of prematurely born children with haemorrhagic hydrocephalus" and mentioned that slightly more than half of the studied nurses didn't attended training courses regarding hydrocephalus.

Concerning total nurses' knowledge about infants suffering from hydrocephalus, the current study represented that, less than half of the studied nurses had poor knowledge level, less than half of them had average knowledge level and minority of them had good knowledge level about infants suffering from hydrocephalus.

This result was disagreed with *Alomar et al.*, (2023) who reported that slightly more than half of the studied nurses had satisfactory knowledge level regarding hydrocephalus. Also, this finding was in disagreement with *Alshehri et al.*, (2020) who mentioned that less than two thirds of the studied subjects had good knowledge regarding hydrocephalus.

**Regarding total nurses' practice regarding care of infants suffering from hydrocephalus,** the present study reported that, more than three quarters of the studied nurses had incompetent practice level. While, less than one quarter of them had competent total practice level regarding care of infants suffering from hydrocephalus, in the researcher point of view, this might be related to that more than one third of them had from one year to less than 3 years and less than half of them didn't attended any training courses regarding hydrocephalus. This study on the same line with *Ikwuegbuenyi et al.*, (2023) who stated that less than three quarter of the studied nurses had inadequate practice regarding hydrocephalus caring pre implementing evidence based practices. Contrariwise, this result was disagreed with *Baewy & Aziz*, (2020) who revealed that more than two thirds of the studied nurses had incompetent practice level regarding caring of infants with hydrocephalus

Concerning relation between characteristics of studied nurses and their total knowledge, the current study revealed that, there was highly statistically significant difference between the studied nurses' total knowledge and their age. While, there was no statistically significant difference between the studied nurses' total knowledge and their education qualification, job, workplace, years of experiences and attending training courses about hydrocephalus for infants.

This study was similar to *Alshehri et al.*, (2020) who stated that there was no statistically significant difference between total knowledge of the studied nurses and their gender, educational level, residence, work unit, experience years and training courses about hydrocephalus. Contrariwise, this result was dissimilar to *Mahmoud & Shawq*, (2021) who mentioned that there was no statistically significant difference between the studied nurses' knowledge level and their age

**Regarding relation between characteristics of studied nurses and their total practice,** the present study represented that, there was highly was highly statistically significant difference between the studied nurses' total practice and their age. While, there was no statistically significant difference between the studied nurses' total practice and their education qualification, current job, workplace, years of experiences and attending training courses about hydrocephalus for infants.

This finding was in agreement with *Ikwuegbuenyi et al.*, (2023) who found that there was a statistically significant difference between the studied nurses practice level and their age. Also, this result was on the same line with *Ahmed et al.*, (2021) who stated that there was no statistically significant difference between the studied nurses' practice and their

unit in work. Contrariwise, this study was in disagreement with *Ebrahim et al., (2019)* who reported that there was a statistically significant difference between total practice level of the studied nurses and their educational level, experiences years and training courses.

**Concerning correlation between total knowledge and total practice,** the present study reported that, there was positive correlation between total knowledge and total practice level of the studied nurses; this could be related to that level of knowledge effect positively or negatively on practice and vice versa.

This result was similar to *Alomar et al.*, (2023) who mentioned that there was positive correlation between nurses' knowledge and practice. Contrariwise, this finding was dissimilar to *Mahmoud & Shawq*, (2022) who represented that there was negative correlation between total knowledge and total practice.

#### Conclusion

**Based on findings of the present study**, **it can be concluded that**: The present study showed that, less than half of the studied nurses had poor knowledge level, less than half of them had average knowledge level and minority of them had good knowledge level about infants suffering from hydrocephalus. Also, more than three quarters of the studied nurses had incompetent practice level. While, less than one quarter of them had competent total practice level regarding care of infants suffering from hydrocephalus.

#### Recommendations

# Based on the findings of the present study, the following can be recommended:

• Establish continuous training courses to improve nurses' knowledge and practices regarding caring of children with hydrocephalus.

• Developing a simplified illustrated and comprehensive booklet for improving nursing knowledge and practice regarding caring of ventriculoperitoneal (VP) shunt.

• Development of an educational guideline based on evidence-based nursing practices to promote excellence of nursing care and provides high-quality infants care regarding infants with hydrocephalus and VP shunt.

• Replication of the same study on larger probability sample at different geographical locations for data generalizability.

• Future studies should target diverse populations in order to test whether similar factors are similarly important for nurses regarding caring of infants with hydrocephalus.

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