

## Effect of Educational Program on Nurses' performance regarding Safe Medications Administration Through Nasogastric Tube among Critically Ill Children

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### ABSTRACT

**Background:** Administering oral medications to children with nasogastric tube is a challenging patient-care issue. Inappropriate prescription and preparation of oral suspensions given through nasogastric tube may result in significant harm to children. Nurses need to have knowledge concerning the characteristics of different drug dose forms, the possibility of using or not using them, and the respective correct handling technique. **Aim of the current study was** to evaluate the effect of educational program on nurses' performance regarding safe medications administration through nasogastric tube among critically ill children. **Design:** A Quasi-experimental research design was used to conduct the current study. **Setting:** This study was conducted at the pediatric intensive care units in Benha University Hospital and specialized pediatric hospital. **Subjects:** A purposive sample of 62 nurses who have been working at the previously mentioned settings. **Tools:** Two tools were utilized for data collection, a structured interviewing questionnaire sheet, and nurses practices observational checklist. **Results:** There were statistically significant differences in nurses' knowledge, and practice regarding safe medications administrating through nasogastric tube before and after program implementation. **Conclusion:** Based on the results of the present study, it can be concluded that, the educational program is highly effective method to improve the nurses' knowledge, and practice regarding safe medications administration through nasogastric tube. **Recommendations:** The study recommended to Provide continuous education and training sessions for nurses about safe medications administration through nasogastric tube to ensure enough knowledge and safe practices. Also, emphasis on the availability of printed universal guidelines about safe medications administration through nasogastric tube that illustrated simply in posters and booklets for guiding nurses' practice.

**Keywords:** Nasogastric tube, Performance, Safe medications administration, and Critically ill children

### INTRODUCTION

Children safety is a global issue affecting healthcare, it is an essential aspect of clinical nursing practice. Many nursing tasks involve a degree of risk, and medications administration carries the greatest risk. Unfortunately, children are frequently harmed or injured by medication errors. Some suffer permanent disability and for others the errors are fatal. The

primary goal of nursing care is to maximize health and wellbeing, and so optimize the quality of children's lives through safe medications administration (Wilson, 2009).

Nasogastric tube (NGT) is commonly used in hospitals for administering medications to a child who are unable to swallow safely. It does not require surgery for placement and is done through a small tube that is inserted through the nose and

runs to the stomach. To, appropriately administer medication through nasogastric tube, nurses need to have knowledge concerning the characteristics of different drug dose forms, the possibility of using or not using them, mechanism of action, absorption rate, and the respective correct handling technique ( **Mota et al., 2010**).

Administering oral medications to children with NGT is a challenging patient-care issue. Inappropriate prescription and preparation of oral suspensions given through NGT may result in significant harm to children. Most solid medicines have to be crushed or opened before being added to the feeding suspension. However, this operation is usually inappropriate for enteric-coated, sustained-release or controlled-release formulations ( **Zhu & Zhou, 2013**). In addition, many drugs have not been tested for oral absorption and bioavailability following NGT dosing and there is no available up-to-date review of drug administration via NGT ( **Podilsky et al., 2009; Clarke, 2008**).

Medications administration errors through nasogastric tube happen more often than reported or recognized. These errors are often the result of administering drugs that are incompatible with administration through a tube, and preparing or administering drugs using improper techniques, which can lead to occluded nasogastric tube, reduced effect, or toxicity. Therefore, an interdisciplinary team of nurses, pharmacists, nutritionists, and physicians should work together to develop protocols for administering drugs through nasogastric tubes. These Protocols should address using appropriate dosage forms, preparing drugs for enteral use, administering drugs separately, diluting drugs as appropriate, and flushing the nasogastric tube before, between and after drug administration ( **Thornton, 2010**).

Nurses should be at the center of the assessment and planning process for

children who require enteral tube support. This is crucial in determining how children can take their medication in the most simple and risk-free way. Meanwhile, it is vital to recognize the site of absorption of any drug given through nasogastric tube, the nurse needs to know if the distal tip of the tube is situated in the stomach because some medications are absorbed in the stomach and others in the small intestine ( **Loneragan et al., 2009**). However, most of medications given through nasogastric tube is not in liquid dosage forms and, therefore, techniques of dispersion and grinding is required. Both techniques alter the technology and pharmacokinetics of the drugs, generating the need for knowledge of their properties and the most appropriate technique for their administration ( **Williams, 2008 ; Lima & Negrini, 2009**).

#### **Significance of the Study:**

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Nurses must provide high quality, safe, evidence-based care to reduce the occurrence of medication risk ( **Boullata, 2009**). As a pediatric intensive care nursing, the researchers observed many nursing noncompliance related to safe medications administration instructions through nasogastric tube; such as drugs preparation, drugs crushing, medications mixing and flushing the tube. Unsuccessful prohibition of these noncompliance may result harmful consequences and leading to increased morbidity and mortality among children ( **Grissinger, 2013**). Moreover, few studies were performed to explore nurses' knowledge and handled the daily nursing practices regarding safe medications administration through nasogastric tube and they founded that majority of nurses had unsatisfactory level of knowledge and incompetence practice ( **Phillips & Endacott, 2011; Soares Barbosa et al., 2012 ; Abdullah et al., 2014** ). Hence, the researchers found urgent to develop educational program for nurses about safe medications administration through nasogastric tube based on the

identified needs and observation to enrich their knowledge and improving their compliance regarding safe medications administration practice.

### **Aim of the Study:**

The aim of the present study was to evaluate the effect of educational program on nurses' performance regarding safe medications administration through nasogastric tube among critically ill children through:

1- Assess nurses' knowledge and practices about safe medications administration through nasogastric tube

2- Designing and implementing educational program based on nurses' actual needs about safe medications administration through nasogastric tube

3- Evaluating the effect of educational program on nurses' knowledge, and practice about safe medications administration through nasogastric tube.

### **Research Hypothesis:**

1-There will be significant difference between pre-test and post-test knowledge score of nurses regarding safe medications administration via nasogastric tube.

2- There will be significant difference between pre-test and post-test practice score of nurses regarding safe medications administration via nasogastric tube.

3-There will be significant correlation between knowledge and practice scores after program implementation.

4-There will be significant relation between nurses' knowledge, and practice scores and their personal characteristics after program implementation.

### **Subjects and Method:**

#### **Research Design:**

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

#### **Settings:**

This study was conducted at the pediatric intensive care units in Benha University Hospital affiliated to University and Benha specialized pediatric hospital affiliated to ministry of health and population. The pediatric intensive care units in both hospitals are consists of two rooms with bed capacity 24 beds.

#### **Sample:**

Purposive sample of 62 nurses who are working at the previously mentioned settings were taken according to inclusion criteria that included the following:-

- Years of experience not less than one years.
- Working as a full time
- Involved in administering medication through NGT for critically ill children

#### **Tools of data collection:**

Two tools were utilized to collect data of the current study.

**Tool I: A Structured Interviewing questionnaire sheet:** It was developed by the researchers based on the scientific literature to assess nurse's knowledge regarding safe medications administration through nasogastric tube. It was translated to Arabic language and comprised two main parts which are:

**Part I:** Personal characteristics data of nurses' as age, gender , work setting, educational level, years of experience. In

addition to attendance of any previous training courses and availability of standard guidelines for medication administration through nasogastric tube in hospital.

**Part II :** Nurses knowledge about safe medications administration through nasogastric tube. It consisted of 14 true/false questions related to (It is necessary to wearing gloves or use hand disinfection before crushing tablets, it is important to have enough knowledge on the dosage forms, it is important to have enough knowledge on whether medications can be crushed or opened, sustained-release or controlled-release solid formulations can be crushed, enteric-coated solid formulations can be crushed, sublingual, irritants and chemotoxic solid drugs can be crushed, wooden, metal mortar is not suitable for crushing solid medications, multiple drugs can be mixed to prepare oral suspensions and be administered via nasogastric tube, each medication should be prepared individually and administrated separately, purified water is needed for dissolution and dilution of the crushed formulation, it is necessary to rinse the tube before and between each medication administered via NGT, it is necessary to flush the tube with at least 10-15 ml of purified water after medication administration, it is necessary to hold NGT when medication is deemed to be incompatible with feeding formula, and medications should administered slowly by gravity into the tube). In addition to four questions related to the most expected mistakes occurred during safe medication administration via nasogastric tube, its reason, suggestion to overcome these mistakes, and nurses' source of information about safe medication administration via nasogastric tube.

The scoring system consisted of giving a score of one for the correct answers and zero for the wrong answers. Total score for the questionnaire was 14

grades. A score greater or equal to 75.0% was considered satisfactory knowledge, while a score less than 75.0% was considered unsatisfactory knowledge.

**Tool II: Safe Nurses Practices observational checklist:** It was adopted from **Wolters &Kluwer (2011)** to assess nurses' practice related to safe medications administration through nasogastric tube. It consists of 27 steps and divided into three main parts as followed:

**First part :** Care provided before administration of medications through nasogastric tube. It consist of 8 steps as ( verify order and prepare equipment, perform hand washing, provide safe environment, correctly identified medications that can be not administered through NGT, Place medication near bed side, check that medication administration record and doctor's orders are consistent, Identify child, and Perform second medication checks.

**Second part :** Care provided during administration of medications through nasogastric tube. It consist of 14 steps as ( Put on gloves, raise the head of the bed 30-45degree, stop feeding pump, check the position of the tube, check that the nasogastric tube is patent by flushing with purified water, medication were crush and prepare individually, Medication were individually mixed with 10-15 ml of purified water, used a 60ml catheter tip syringe for administration of medication, flushed the NGT with 5- 20 ml purified water before administration of medication, flushed the NGT with 5- 20 ml purified water between administrations of medication, rinsed the syringe with purified water between each medication administration, flushed the NGT with 5-20 ml purified water after administration of medication, Remove gloves, and perform hand washing ).

**Third Part:** Care provided after administration of medications through nasogastric tube. It consist of 5 steps as, (stay with patient until all medications are instilled, evaluate patient's response to the medications and check for possible adverse effects, sign medication administration record and place in appropriate chart, remove gloves, and perform hand washing ).

The scoring system consisted of two points: one for done correctly and a score of zero for not done. Total score for the checklist was 27 grades. A score of less than 80.0 were considered incompetent practice, while a score greater than or equal to 80.0% were considered competent practices.

#### **Educational Program:**

The educational program was developed by the researchers based on assessment phase and after reviewing the related literature.

#### **Validity and reliability:**

Data collection tools were submitted to five experts of pediatric nursing field from the Faculty of Nursing Ain Shams, Tanta and Zagazig Universities, to test the content validity. Modifications of the tools were done according to the expert's judgment on clarity of sentences, appropriateness of content and sequence of items. The experts' agreed on the content, but recommended minor language changes that would make the information clearer and more precise. The suggested changes were made. Internal consistency reliability of all items of the tools was assessed using coefficient alpha. It was 0.87for structured interviewed questionnaires sheet, and was 0.83 for nurses' practices observation checklist.

#### **Pilot study**

The pilot study was carried out on 10% of the study subject (6nurses) over a period of one month (January, 2015). The purpose was to ascertain the feasibility of the study and the clarity and applicability of the tools. It also helped to estimate the time needed for filling out the forms. Based on the results of the pilot, modifications on tools and program contents were done and study subjects were excluded from the final study sample.

#### **Ethical Considerations:**

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The present study was conducted under the approval of the faculty of nursing ethical committee, Benha University. Then approval was obtained from the hospital manager and head of intensive care units in the previously mentioned study settings through submission of official letters issued from the dean of Benha faculty of nursing. Participants were given explanation about the purpose of the study, and they were also informed that they could withdraw from the study at any time without giving any reason. An informed signed consent was obtained from each nurse in the study. Confidentiality of participants' information was assured and the data were accessed only by the researchers involved in the study.

#### **Field work:**

##### **a) Assessment phase:**

The actual field work was carried out from the beginning of February, 2015 to the end of May, 2015. A permission to conduct the study was obtained from the directors of previous mentioned setting. In the beginning, the researchers interviewed the nurses in the study settings at different working shifts ( morning and afternoon) to give them a brief idea about the study and its purpose and a written consent was obtained. Then, The first pre-test sheet was

distributed to collect nurses' personal characteristics and to assess their knowledge regarding safe medications administration through nasogastric tube using the questionnaires (Tool I). At the same time, the researchers was monitoring the nurses during their work to fill out the observational checklist (Tool II). The time required for complete the study tools ranged between 30- 45 minutes.

**b) Program Construction:**

The intervention of the training program for nurses was designed by the researchers according to the nurses' needs regarding safe medication administration via nasogastric tube. It was constructed, revised and modified from the related literature to improve the nurses' knowledge, and practice regarding safe medications administration via nasogastric tube. The contents were prepared in simple Arabic language to be easy understood by the nurses.

**c) Statement of objectives:**

The general objective of the program was to improve nurses' knowledge and practice regarding safe medications administration through nasogastric tube.

**d) Program implementation:**

The program was carried out at the study settings through 9 sessions (3sessions for theory and 6 sessions for practice) per week for four months. Nurses were divided into 12 groups, 5 nurses in each group. These session have lasted for 15 hours (3hours for theory & 12 hours for practical), started from 11 Am which was a suitable time for nurses because the time from 8 to 11Am, they were so busy with providing nursing care for children. The theoretical part of the program focused on knowledge about principle of safe medication preparation through NGT, kinds of medication that can be crushed

and administered, kind of liquid needed for dissolution and dilation of medication, appropriate tools used for crushing medication, medication rights, care of NGT, mistakes occur during medications administration via nasogastric tube, its reasons, suggestion to overcome these errors. Meanwhile, the practical parts cover the procedure of safe medication administration through NGT. The researchers started each session with a summary for the previous one. Methods of teaching were lectures, brain storming, group discussion, demonstration and re-demonstration. Proper audio-visual materials such as data show were used in order to help proper understanding of contents by nurses.

**e) Evaluation:**

After the completion of the program contents, the post-test similar to pre-test and practical demonstration were done to the nurses for measuring their improvement of knowledge, and practice regarding safe medications administration via nasogastric tube.

**Statistical design:**

All data were collected, coded, tabulated and analyzed by using SPSS (Statistical Package for the social Science Software) statistical package version 20 on IBM compatible computer. Quantitative variables were described by the Mean, Standard deviation ( $X \pm SD$ ), while qualitative variables were expressed as frequency and percentage and chi-square was used. Pearson correlation was used to measure the correlation between quantitative variables, while student t-test was used for comparing the means of two groups. One way ANOVA F-test was used for comparing the means of more than two groups of quantitative variables. A significant level value was considered when  $p\text{-value} \leq 0.05$  and a highly significant level value was considered

when p-value  $\leq 0.001$ , while p-value  $> 0.05$  indicates non-significant results.

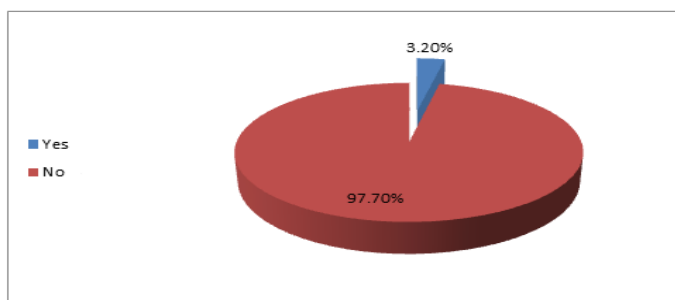
**RESULTS:**

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**Table (1): Distribution of Nurses' Personal Characteristics (N=62).**

Characteristics	Study sample n=62	
	No	%
<b>Age in years</b>		
- 20 - < 30	21	33.9
- 30 - < 40	37	59.7
- $\geq 40$	4	6.4
<b>Mean <math>\pm</math>SD: 32 <math>\pm</math> 2.7</b>		
<b>Gender:</b>		
- Male	3	4.8
- Female	59	95.2
<b>Working setting</b>		
- Benha university hospital	29	46.8
- Benha specialized pediatric hospital	33	53.2
<b>Educational level</b>		
- Diploma in nursing	49	79.0
- Technical institute of nursing	6	9.7
- Bachelor degree	7	11.3
<b>Years of experience</b>		
- <1	9	14.5
- 1 - < 10	32	51.6
- $\geq 10$	21	33.9
<b>Attendance of any previous training courses</b>		
- yes	4	6.5
- No	58	93.5

**Table (1)** shows the nurses' personal characteristics; it was observed that, the mean age of them were  $32 \pm 2.7$  years. Majority of nurses were females and more than half of them were working at Benha specialized pediatric hospital (95.2%, & 53.2%) respectively. In relation to nurses' education, 79.0% of them had diploma in nursing, while 11.3% of them had Bachelor degree in nursing and the remaining (9.7%) of nurses graduated from technical institute of nursing. Also, it was noticed that, half of nurses (51.6 %) had years of experiences ranged from 1 to less than 10 years, and 93.5% of them not attended any previous training courses regarding safe medications administration via nasogastric tube.



**Figure (1): Availability of standard guidelines about safe medications administration via nasogastric tube as reported by nurses (N=62).**

**Figure (1)** Shows the availability of standard guidelines about safe medications administration via nasogastric tube as reported by nurses. It was illustrated that 97.7% of the studied nurses reported that there is no available standard guidelines about safe medications administration via nasogastric tube.

**Table (2): Sources of Information about Safe Medications Administration via Nasogastric Tube as reported by Nurses (N=62).**

Sources of information	Study sample n=62	
	No	%
- Pediatric physician/s	9	14.5
- Hospital Pharmacist	0	0.0
- Own experiences	35	56.5
- Coworkers	18	29.0
- Scientific books, articles and magazines	0	0.0

**Table (3)** reveals to the sources of information about safe medications administration as reported by nurses. It was pointed that the nurses' main sources of information are own experiences followed by coworkers ( 56.5 % and 29.0 %) respectively. Moreover, none (0%) of the nurses used scientific books, articles and magazines as a source of information. Also, hospital Pharmacist (0%) is not a common source of information for nurses.



**Table (3): Distribution of Mistakes related to Medications Administration via nasogastric tube as reported by nurses (N= 62)**

Items	No	%
<b>the most expected Mistakes occur during administration of medication through NGT</b>		
- Improper technique	30	48.4
- Drug-drug interaction	0	0.0
- Drug- food interaction	14	22.6
- Blockage in the nasogastric tube	18	29.0
- Child aspiration if tube displacement	0	0.0
<b>reasons of why these mistakes occur</b>		
- Poor nurse-physician communication	44	71.0
- High work loads	8	12.9
- Nursing incompetency	2	3.2
- Distraction and interruption	6	9.7
- Failing to follow the five rights	2	3.2
<b>suggestions to overcome these mistakes?</b>		
- Follow the standard guidelines	32	51.6
- continuous training and evaluation	30	48.4
- Motivation	0	0.0
- Improve hospital performance	0	0.0

**Table (3)** shows distribution of mistakes related to medications administration via nasogastric tube as reported by nurses. It was revealed that, the common mistakes occur during administration of medications through nasogastric tube were improper technique, tube blockage and drug-food interaction (48.4%, 29.0%, & 22.6%) respectively. Also, this table illustrated that the majority 71.0% of nurses reported these mistakes due to poor nurse- physician communication and 51.6 & 48.4% of them suggested following standard guidelines and continuous training as way to overcome these mistakes respectively.

**Table (4): Distribution of the Nurses' Knowledge regarding Safe Medications Administration via NGT Pre/Post Program Implementation (N=62).**

Items of Knowledge	Pretest (n=62)				Posttest (n=62)				$\chi^2$	P value
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory			
	No	%	No	%	No	%	No	%		
1. It is necessary to wearing gloves or use hand disinfection before crushing tablets	7	11.3	55	88.7	61	98.4	1	1.6	33.41	0.001**
2. It is important to have enough knowledge on the dosage forms	1	1.6	61	98.4	50	80.6	12	19.4	38.19	0.001**
3. It is important to have enough knowledge on whether medications can be crushed or opened	3	4.8	59	95.2	54	87.1	8	12.9	40.11	0.001**
4. Sustained- release or controlled-release solid formulations can be crushed	0	0.0	62	100.0	58	93.5	4	6.5	36.08	0.001**
5. Enteric-coated solid formulations can be crushed	0	0.0	62	100.0	59	95.2	3	4.8	32.74	0.001**
6. Sublingual, irritants and chemotoxic solid drugs can be crushed	0	0.0	62	100.0	59	95.2	3	4.8	31.73	0.001**
7. Wooden, metal mortar is not suitable for crushing solid medications	2	3.2	60	96.8	61	98.4	1	1.6	30.24	0.001**
8. Multiple drugs can be mixed to prepare oral suspensions and be administered via nasogastric tube	7	11.3	55	88.7	60	96.8	2	3.2	31.55	0.001**
9. Each medication should be prepared individually and administrated separately	4	6.4	58	93.6	60	96.8	2	3.2	28.95	0.001**
10. Purified water is needed for dissolution and dilution of the crushed formulation	7	11.3	55	88.7	62	100.0	0	0.0	42.16	0.001**
11. It is necessary to rinse the tube before and between each medication administered via NGT	8	12.9	54	87.1	59	95.2	3	4.8	29.98	0.001*
12. It is necessary to rinse the tube with at least 15 ml of purified water after medication administration	0	0.0	62	100.0	60	96.8	2	3.2	30.75	0.001**
13. It is necessary to hold NGT when medication is deemed to be incompatible with feeding formula	3	4.8	59	95.2	55	88.7	7	11.3	29.05	0.001**
14. Medications should administered slowly by gravity into the tube.	2	3.2	60	96.8	58	93.6	4	6.4	43.85	0.001**

**Table (4)** shows nurses' knowledge regarding safe medications administration via nasogastric tube pre/post program implementation. It was found that, there was a highly statistically significant difference ( $p < 0.001$ ) before and after the program where majority of nurses (100%, 98.4%, 98.4%, 96.8%, 96.8% & 96.8%) respectively had satisfactory knowledge after the program implementation related to Purified water is needed for dissolution and dilution of the crushed formulation, It is necessary to wearing gloves or use hand disinfection before crushing tablets, wooden, metal mortar is not suitable for crushing solid medications, multiple medications can be mixed, each medication should be prepared individually & administrated separately and it is necessary to rinse the tube with at least 15 ml of purified water after medication administration.

**Table (5): Distribution of nurses' practice regarding safe medications administration via NGT pre and post program implementation (N= 62)**

Items	Pre test (n=62)				Post test (n=62)				x <sup>2</sup>	P value
	Competent		Incompetent		Competent		Incompetent			
	No	%	No	%	No	%	No	%		
<b>Care provided pre administration phase.</b>										
1. Verify order and prepare equipments	7	11.3	55	88.7	62	100.0	0	0.0	22.36	0.00**
2. Perform hand hygiene	3	4.8	59	95.2	58	93.6	4	6.4		
3. Provide safe environment	1	1.6	61	98.4	58	93.6	4	6.4		
4. Nurse correctly identified medications that can be not administered through NGT	2	3.2	60	96.0	55	88.7	7	11.3		
5. Place medication near bed side	6	9.7	56	90.3	60	96.8	2	3.2		
6. check that medication administration record and doctor's orders are consistent	3	4.8	59	95.2	62	100.0	0	0.0		
7. Identify child	2	3.2	60	96.8	62	100.0	0	0.0		
8. Perform second medication checks	1	1.6	61	98.4	59	95.2	3	4.8		
<b>Care provided during administration phase</b>										
1. Put on gloves	3	4.8	59	95.2	55	88.7	7	11.3	64.34	0.00**
2. Raise head of the bed 30-45 degree	1	1.6	61	98.4	58	93.6	4	6.4		
3. Stop feeding pump	4	6.4	58	93.6	60	96.8	2	3.2		
4. Check the position of the tube	2	3.2	60	96.8	57	91.9	5	8.1		
5. Check tube patent by flushing the tube with purified water	2	3.2	60	96.8	57	91.9	5	8.1		
6. Medication was crushed and prepare individually	2	3.2	60	96.8	61	98.4	1	1.6		
7. Medication were individually mixed with 10-15 ml of purified water	3	4.8	59	95.2	57	91.9	5	8.1		
8. Nurse used a 60ml catheter tip syringe for administration of medication	1	1.6	61	98.4	54	87.1	8	12.9		
9. Nurse flushed the NGT with 5-20 ml purified water before administration of medication according the child size	0	0.0	62	100.0	52	83.9	10	16.1		
10. Nurse flushed the NGT with 5-20 ml purified water between administrations of medication	0	0.0	62	100.0	55	88.7	7	11.3		
11. Nurse rinsed the syringe with purified water between each medication administration	0	0.0	62	100.0	54	87.1	8	12.9		
12. Nurse flushed the NGT with 5-20 ml purified water after administration of medication	2	3.2	60	96.8	55	88.7	7	11.3		
13. Remove gloves	3	4.8	59	95.2	54	87.1	8	12.9		
14. perform hand washing	3	4.8	59	95.2	58	93.6	4	6.4		
<b>Care provided after administration Phase</b>										
1. Stay with child until all medications are instilled	10	16.1	52	83.9	56	90.3	6	9.7	18.52	0.00**
2. Evaluate child's response to the medications and check for possible adverse effects	7	11.3	55	88.7	55	88.7	7	11.3		
3. Sign medication administration record and place in appropriate	6	9.7	56	90.3	57	91.9	5	8.1		
4. Remove gloves	2	3.2	60	96.8	60	96.8	2	3.2		
5. perform hand washing	3	4.8	59	95.2	56	90.3	6	9.7		

**Effect of Educational Program on Nurses' Performance Regarding Safe Medications Administration Through Nasogastric Tube among Critically Ill Children**

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**Table (5)** shows nurses' practice regarding safe medications administration via nasogastric tube pre/post program implementation. It was found that, there was a highly statistically significant difference ( $p < 0.00$ ) before and after the program where the majority of nurses had competent practice after the program implementation related to all steps of care provided (pre, during & after) medications administration phases.

**Table (6): Total Knowledge and Practice Scores of Nurses Regarding Safe Medications Administration via NGT Pre/Post program Implementation (N=62).**

Items		Pre test (n=62)		Posttest (n=62)		$\chi^2$	P- value
		No	%	No	%		
<b>Knowledge</b>	<b>Satisfactory</b>	3	4.8	62	100.0	68.38	0.001**
	<b>Unsatisfactory</b>	59	95.2	0	0.0		
<b>Practice</b>	<b>Competent</b>	4	6.4	60	96.8	84.45	0.001**
	<b>Incompetent</b>	58	93.6	2	3.2		

**Table (6)** shows the total knowledge and practice scores of nurses regarding safe medications administration via NGT pre/post program implementation. It was cleared that, before implementation of the program, the majority (95.2% & 93.6%) of nurses have unsatisfactory knowledge and incompetent practice respectively compared to after implementation of the program, where, the majority of nurses (100.0 % & 96.8 % ) have satisfactory knowledge and competent practice respectively.

**Table (7): Relation between Nurses' knowledge and Practices Scores about safe medications administration via NGT and their Personal Characteristics after Program Implementation (N= 62)**

Characteristics	Knowledge		Test of significance		Practice	Test of significance	
	n = 62	Mean±SD	F/t test	P- value	Mean±SD	F/t test	P- value
<b>Age in years</b>							
20 - < 30	21	62.61±6.35	F= 4.82	0.001**	90.74±2.34	F = 0.852	0.001**
30 - < 40	37	58.85±7.08			88.81±3.28		
≥ 40	4	49.09± 4.66			83.22± 1.86		
<b>Gender:</b>							
Male	3	48.82±6.58	t =3.62	0.119	98.55+9.28	t =0.806	0.752
Female	59	40.18± 4.16			89.32+ 3.62		
<b>Educational level</b>							
Diploma	49	48.31±2.38	F =4.02	0.001**	96.14±4.32	F =0.738	0.001**
Technical	6	42.45±1.98			93.61±3.88		
Bachelor	7	49.36± 2.64			98.62± 2.82		
<b>Years of experience</b>							
<1year	9	38.36±4.32	F =2.96	0.001**	80.70±3.39	F =0.842	0.001**
1- < 10 years	32	39.44±1.48			92.48±3.46		
≥ 10 years	21	40.39± 2.33			93.12± 2.88		

**Table (7)** shows the relation between nurses' knowledge and practices scores about safe medications administration via NGT and their personal characteristics after program implementation. It was observed that there were highly statistically significant relation between total nurses' knowledge and practice scores with all their personal characteristics except the gender of nurses where p- value = (0.119 , 0.752) respectively. As well as satisfactory knowledge and competent practice was found among: age group 20 to less than 30 years old, Bachelor level of education and had years of experience 10 years or more.

**Table (8): Correlation between Nurses' knowledge and Practices Scores after Program Implementation (N= 62)**

Items	r	P-value
Knowledge	0.868	0.000**
Practice		

**Table (8)** shows correlation between nurses' knowledge and practices scores in relation to safe medications administration via NGT, it was revealed that there were a highly statistically significant positive correlation between nurses' knowledge and practices scores after program implementation ( $r=0.868$ ,  $p<0.000$ ).

### Discussion:

Medications safety is always having great concern in health care. When children are unable to feed orally, nasogastric tube is recommended. The placement of nasogastric tube in the gastrointestinal tract opens the possibility of drugs delivered through it (**Luft et al., 2008; Bankhead et al., 2009**). Giving oral medication through nasogastric tube is not uncommon and is a well-known area that prone to error happening. Inappropriate technique not only threaten the safety and efficacy of therapy, but may also cause obstruction of the probe, resulting in child discomfort, and longer time spent by nursing staff with tube handling (**Boullata, 2009 ; Gonzaga, 2012**).

Therefore, nurses' knowledge and practices to perform medications administration correctly and safely needed to be assessed as well as, it is critical for taking action to improve the quality of drugs administration to children with nasogastric tube. However, few studies describe implementation of program with that goal. So, this study is designed to assess the effect of educational program on nurses' performance regarding safe medications administration through nasogastric tube among critically ill children.

As regards characteristics of the studied nurses, the current study results revealed that the highest percentage of them were female that might due to the study of nursing at Egypt was exclusive for females only till few years ago, thus the profession of nursing in Egypt was mostly feminine. Majority of them having diploma nursing degree and had years of experiences ranged from one to less than ten years. This finding was supported by **Shahin, (2012)** who assess the impact of a designed instructional program about enteral nutrition on the nurses' knowledge and practices at the critical care department and found that the highest percentage of them were females and having diploma in nursing.

Nonetheless, most of the studied nurses' reported that, there is no available guideline for safe medications administration through nasogastric tube. This indicates lack of standardization for performance of effective children procedure. On the contrary, **Persenius et al., (2008)** who conducted a study concerning assessment and documentations of patients nutritional status and they found that, the majority of nurses in three Sweden hospital indicated that there had written guidelines regarding enteral nutrition. In line with this perspective, **the national guidelines clearing house, (2009)** stressed on the availability of guidelines for safe practice in drug administration via

nasogastric tube to reduce the risk of occurrence of errors. **Mota et al., (2010)** who evaluate of nurses' knowledge concerning medication administration via nasogastric and enteral tube and they emphasizes the necessarily to standardize guideline and protocols in the acute and community care settings.

Regarding to nurses' source of information about safe medications administration via nasogastric tube, the result of the current study revealed that nurses rely primarily on their own experience and coworkers for information and administering medications via nasogastric tube which has resulted in a variety of improper technique and a lack of consistency. This could be due to limited hospital information resources, and nurses don't value knowledge about medications administration because they assume that it is mostly the doctors' responsibility. These results supported by **Thronton, (2010)** who provides up-to-date information about medication safety and found that most nurses depend on their personal experience and co-workers as a sources of their information about medications administration which has resulted in a variety of medication errors.

In relation to the common medications mistakes occur via nasogastric tube as reported by nurses. The present study showed that, nurses mentioned improper technique, tube blockage, and drug-nutrient interaction were the common medications mistakes occur via nasogastric tube. Interestingly, more than half of them suggested that fellow the standard guidelines as a way to reduce these mistakes. These results agreed with the result of **Best & Wilson (2011)** who conducted a study to assess administration of medicines via an enteral feeding tube and they found that the common medication errors occur via nasogastric tube were drug-drug interaction and drug-feed interaction. Similarly, these results

were consistent with **Abdullah et al., (2014)** who revealed that the majority of nurses reported tube blockage and aspiration as a common medications mistakes occur via nasogastric tube.

Findings of the current study revealed that the majority of nurses perceived poor nurse-physician communication as the common reason of medications administration mistakes via nasogastric tube. This may be due to physicians don't spend enough time discussing care options with nurse. These results are in congruence with **Dumo, (2012)** who study the factors affecting medication errors among staff nurses and reported that poor nurse/physician relationship may cause medication administrative errors. In line with this perspective **Kin-Wai, (2014)** who stated that deficiency of formal and adequate communication between health care professions might have contributed to medication errors.

On assessing nurses' knowledge about safe medications administration through nasogastric tube, the findings of the current study reflected that, the total scores of nurses' knowledge before program implementation was unsatisfactory. This may be due to lack of training program in this field, unavailability of safe guidelines for medications administration via nasogastric tube, absent of multidisciplinary team cooperation, and lack of nurse incentives and desire to improve their knowledge especially whom working in intensive care units for several years. These findings go in line with **Abdullah et al., (2014)** who assess the nurses' knowledge and practice about administration of medication via nasogastric tube among critically ill patients and found that all nurses had unsatisfactory level of knowledge.

However, after implementation of the program, there was a significant improvement in the total scores of nurses



who achieve satisfactory level of knowledge. This finding is matched with the hypothesis number one. The improvement scores indicated that, the program was a successful method to increase nurses' knowledge about safe medication administration via nasogastric tube. These findings are consistent with findings of **Lee & Lin, (2013)** who develop an e-learning program for medical and nursing experts to improve pediatric medication safety and they found that there was a significant gain of nurses knowledge after program implementation.

One important aspect to consider is that, most nurses after program implementation were correctly known that wooden, metal mortar are not suitable tool for crushing solid medications because the possibility of occurrence of potential drug interaction. This may be due to the educational program was effective method that help in increase their knowledge which in turn contribute in reducing noncompliance to the recommended practices. This is proved with the statement from **Mota et al., (2010)** who stated that, usage of wood, metal or plastic mortar not suitable because there is a potential interaction between the prescribed dosage form with the mortar material as well as, potential drug interactions as consequence of not washing the mortar between the crushing of multiple drugs. This result came in same line with **Decloedt and Maartens, (2009)** who insist using of porcelain or glass mortar instead of use of wood or metal mortar to avoid drug interaction.

Another important aspect to consider is that, majority of nurses after program implementation correctly reported that, almost all enteric-coated, sublingual, irritants, and chemotoxic solid formulations should not be crushed and administered through nasogastric tube to avoid dangerous adverse effects as well as increase the risk of toxicity. These results

are congruence with **Zhu et al., ( 2012)** who conducted a study concerning the appropriateness of administration of nasogastric medication and preliminary intervention and they mentioned that enteric-coated and sublingual medication should not be crushed or opened and administered through nasogastric tube to avoid compromising their physicochemical, biopharmaceutical, and pharmacological properties.

On investigating nurses' practices about safe medications administration through nasogastric tube, the finding of the present study showed that, the majority of nurses had incompetent practices in all steps of safe medications administration procedure before program implementation. These findings explained by only a few nurses have been trained on safe medications administration via nasogastric tube; nurses do not feel competent enough to deliver safe medication to the children. As well as nurses in pediatric intensive care units at Benha University hospital and specialized pediatric hospital had no written protocols or resources of information to improve their practices. These findings are in agreement with a study carried out by **Phillips & Endacott, (2011)** who assess the nurses' practices regarding medications administration via enteral tubes and they found that nurses had incompetent practices. In the same line, **Soares Barbosa et al., (2012)** who evaluate oral drug administration by enteral tube in adults at tertiary teaching hospital and they found that nurses had inaccurate practices regarding medications administration through enteral tube.

Nevertheless, after program implementation there was a highly statistical significant improvement with the number of nurses who achieve competent scores. These findings match with the hypothesis number two. This may be due to the program makes refreshment in nurse' knowledge, which in turn led to

improvement in their practice. These results in accordance with **Kenney & Goodman, (2010)** who conducted a study to evaluate care of patient with enteral tube and they pointed out that there was a significant improvement of all nurses' practices after program implementation.

In this regard **Batrof & Mansour, (2012)** mentioned that continuing education for nurses are required to maintain competence in practice in an effective manner. In the same line, **Gonzaga et al., (2012)** who conducted study to assess an integrated qualification program about drugs administration through feeding tubes and they founded that comprehensive training program are necessary and effective in improving medications administration skills.

Apparently, the present study findings proved that there was positive correlation between nurses' knowledge and practices scores after program implementation. This explains that nurses' practices directly influenced by their knowledge and knowledge is essential to achieve best practices. These findings match with the hypothesis number three. Supported to these findings **Shahin, (2012)** who found strong positive correlation between nurses' knowledge and practices scores and stated that the knowledge is important for safe nursing practices.

Our results of the present study revealed that there were highly statistically significant relation between nurses' age with knowledge, and practices scores after program implementation. This relation may be due to the fact that the young nurses are new graduated, cooperative, and more receptive with higher education and memory abilities than those with old one. These findings match with the hypothesis number four. These results are inconsistent with **Abdullah et al., (2014)** who found that there were no significant correlation

between the age of participant and their knowledge and practices scores.

Regarding gender of the participants, the present study revealed that there was no statistically significant relation between gender of nurses with knowledge and practices scores after program implementation. This may be due to that there are many others factors affect knowledge and practice of nurses such as receiving training program, availability of written guidelines and resources. These results were congruent with the study of **Al-kalaldeh, (2011)** who conducted a study to assess enteral nutrition in the critically ill patients and found that there was no significant correlation between male and female nurses with their knowledge and practices scores regarding enteral nutrition.

As regarding to relation between knowledge, practices scores and nurses' level of education, the present study finding revealed that there were a highly statistically significant relation between nurses' level of education with knowledge, and practice scores after program implementation. These findings are in agreement with **Hamed, (2009)** who conducted a study to assess nurses performance during cardio-pulmonary resuscitation in intensive care unit and cardiac care unit at Benha University hospital and reported that Bachelor degree nurses knowledge and practices scores were significantly better than diploma nurses because of their basic knowledge and practice received during academic years, which is different than that received by diploma nurses.

The current study showed that there was a highly statistically significant relation between the nurses' years of experience and practices scores after program implementation. These findings are supported by **(Daniel et al., 2013)** who reported that the more nurses years of

experience and working in intensive care units, the higher efficiency of clinical practices. As years of experience were positively correlated to nurses' knowledge and performance. In the same line **Ali et al., (2014)** who conducted a study to assess the effectiveness of nursing care standard regarding the infection control precaution of leukemic children and they found positive statistically correlation between the nurses years of experience and practices scores.

It was evident from the present study that there was a highly significant relation between nurses' years of experience with knowledge scores after program implementation. These findings are consistent with **Ragab et al., (2013)** who carried out a study about effect of designed training program on nurses' performance regarding care of patient with blood borne viral hepatitis and clarified that years of nurses' experience were positively statistically correlated with total knowledge scores through immediate post, three, and nine months post implementing of the training program.

### **Conclusion:**

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Based on the results of the present study, it can be concluded that, the educational program is highly effective method to improve nurses' knowledge, and practice regarding safe medications administration through nasogastric tube. However, there was statistically significant positive correlation between nurses' knowledge, and practices scores after program implementation. As well as, there were highly statistically significant relation between nurses' knowledge and practices scores with their age, years of experience and level of education post program implementation.

### **Recommendations:**

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In the light of the findings of the current research, the following recommendations are suggested:

1. Provide continuous education and training sessions for nurses about safe medications administration through nasogastric tube to ensure enough knowledge and safe practices.
2. Emphasis on the availability of printed universal guidelines about safe medications administration through nasogastric tube that illustrated simply in posters and booklets for guiding nurses practice.
3. Collaborative interaction with nurses, physician, and pharmacist will assure safe administration of medications via nasogastric tube.
4. Further study can be replicated on other Hospitals using a large sample size to generalize the findings.

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### **References:**

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- Abdullah, M., Mohammed, W., and Ismail, M. (2014): Nurses' Knowledge and Practices about Administration of Medications via Nasogastric Tube among Critically Ill Patients, *Journal of Education and Practice*, 5(1): 147-159.
- Ali, A., Bahgat, S., Zaki, A., and El-Shanshory, R. (2014): Effectiveness of

- nursing care standard regarding the infection control precaution of leukemic children. *Tanta scientific journal*, 7(2):82-97.
- Al-Kalaldehy, M. (2011): Enteral nutrition in the critically ill: A mixed methods study of adherence to evidence based protocols, nursing responsibility and teamwork. Access to Electronic Thesis of Sheffield University, 1-287.
- Bankhead, R., Boullata, J., Brantley, S., Corkins, M., Guenter, P.(2009): Enteral nutrition practice recommendations. *JPEN J Parenter Enteral Nutrition*, 33: 122-167
- Batrof, M., and Mansour, K. (2012): Management principles for health professionals, (5<sup>th</sup> ed). Lippincott Company: Philadelphia, p.141.
- Best, C., & Wilson, N. (2011): Advice on safe administration of medications via enteral feeding tubes. *British Journal of Community Nursing*, 6-10.
- Boullata, JI. (2009): Drug administration through an enteral feeding tube-the rational behind the guidelines. *American Journal Nursing*, 109(10): 34-42.
- Clarke, S. (2008): Drug administration via nasogastric tube. *Pediatric Nursing*, (20):32.
- Daniel, B., Nagaraju, B., Padmavathi. V., Bolouri, A., Zothanmawia, C., and Sahar, H. (2013): A study to assess the effectiveness of structured teaching programme on care of patient with central venous access device among staff nurses in selected oncology hospital of Bangalore, *International Journal of Medicine and Medical Science Research*, 1(1): 001-012. Available online at <http://academeresearchjournals.org/journal/ijmmsr>.
- Decloedt, E., & Maartens, G.(2009): Pitfalls of administering drugs via nasogastric tubes. *SAMJ: South African Medical Journal*, 99 (3):148-149.
- Dumo, AM.(2012): Factors Affecting Medication Errors among Staff Nurses: Basis in the Formulation of Medication Information Guide. *IAMURE International J. of Health Education*, 1 : 1-62.
- Gonzaga, M., Moreira, M., Wick, J., Ribeiro, A.(2012): Drug administration through feeding tubes; an integrated qualification program. *Nutricion Hospitalaria*, 27: 1309-1313.
- Gonzales, J. (2011): Safe medications administration. doctor thesis, nursing Graduate College, University of Iowa, Iowa city.
- Grissinger, M.(2013): Preventing errors when drugs are given via enteral feeding tube. *Pediatrics journal*, 38(10): 575-576.
- Hamed, M. (2009): Nurses performance during cardio-pulmonary resuscitation in Intensive Care Unit and Cardiac Care Unit at benha University hospital, Master thesis, Faculty of Nursing, Benha University.
- Kenny, D., & Goodman, P. (2010): Care of the patient with enteral tube feeding: an evidence-based practice protocol. *Nursing Research*, 59 (1): 22-31.
- Kin-Wai, K. (2014): A systematic review of factors improving medication safety of oral medication via enteral feeding tube in institution, Master thesis of public health, University of Hong Kong.

**Effect of Educational Program on Nurses' Performance Regarding Safe Medications Administration Through Nasogastric Tube among Critically Ill Children**

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- Lee, T., & Lin, F. (2013): The effectiveness of an e-learning program on pediatric medication safety for undergraduate students: A pretest–post-test intervention study. *Nurse Education Today*, 33, 378-383.
- Lima, G., Negrini, M. (2009): Assistência farmacêutica na administração de medicamentos via sonda: escolha da forma farmacêutica adequada. *Einstein São Paulo*, 7: 9-17.
- Lonergan, M., Broderick, J., Coughlan, T., Collins, D., & O'Neill, D. (2009): Prescribing and enteral tubes in the general hospital. *Journal of American Geriatric Society*, 57(4), 736–737
- Luft, C., Vieira, M., Beghetto, G., Polanczyk, A., Mello, D. (2008): Suprimento de micronutrientes, adequação energética e progressão da dieta enteral em adultos hospitalizados. *Rev. Nutr.*, 21: 513-523.
- Mota, L., Barbosa, V., Studart, M., Melo, M., Lima, E., & Mariano, A. (2010): Evaluation of intensivists' knowledge concerning medication administration through nasogastric and enteral tubes. *Rev. Latino-Am Enfermagem*, 18(5), 888–894.
- Persenius, M., Hall-Loard, M., Baath, C., & Larsson, B. (2008): Assessment and Documentation of Patients Nutritional Status: Perception of Registered Nurses and Their Chief Nurses. *Journal of Clinical Nursing*, 17: 2125-2136.
- Phillips, M., & Endacott, R. (2011): Medication administration via enteral tubes: a survey of nurses' practices. *Journal of Advanced Nursing*, 67(12), 2586-2592.
- Podilsky, G., Berger-Gryllaki, M., Testa, B., Buclin, T., Roulet, M., Pannatier, A. (2009): The bio-availability of bromazepam, omeprazole and paracetamol given by nasogastric feeding tube. *European Journal Clinical Pharmacology*, 65:435–442.
- Ragab, I., Mohammed, A., Osman, M., and Mekkawy, M. (2013): Effect of designed training program on nurses' performance regarding care of patient with blood born viral hepatitis at Assuit University Hospital, *Journal of American Science*, 9(11): 359-370.
- Shahin, M., Mohammed, W., & Sayed, M. (2012): Nurses' Knowledge and Practices regarding Enteral Nutrition at the Critical Care Department of Al-Manial University Hospital in Egypt: Impact of a Designed Instructional Program. *Journal of American Science*, 8 (11), 397-405.
- Soares Barbosa, P., de Paula, L., Soares Barbosa, D., & da Cunha, F. (2012): Oral drug administration by enteral tube in adults at a tertiary teaching hospital. *The European e-Journal of Clinical Nutrition and Metabolism*, 7: 241-244.
- The National Guideline Clearing House. (2009): ASPEN(American Society for Parenteral and Enteral Nutrition) enteral nutrition practice recommendations: medication administration. Agency for healthcare research and quality. Available from <http://guidelings.gov/content.aspx?f=rss&id=14718>.
- Thornton, P. (2010): Medication safety, *journal of pharmacy practice and research*, 40(2): 144-147.
- Williams, T. (2008): Medication administration through enteral feeding tubes. *Am. Journal Health System Pharmacology*, 65: 2347-2357.
- Wilson V. (2009): Introduction to nursing, midwifery and person-centered care. In:

- Dempsey, J., French, J., Hillege, S., Wilson, V. (1<sup>st</sup>ed). *Fundamentals of Nursing & Midwifery: a person-centered approach to care*. Lippincott company: Philadelphia. pp.1234-45.
- Wolters, & Kluwer. (2011): *Skill Checklists for Taylor's Clinical Nursing Skills: A Nursing Process Approach, Health*. (3<sup>rd</sup> ed). Lippincott Williams & Wilkins Company: London. p.1321.
- Zhu, L., Xu, L., Jin, J., Wang, H., Zhou, Q. (2012): Appropriateness of administration of nasogastric medication and preliminary intervention. *Therapeutic and clinical risk management*, 8: 393-401.
- Zhu, L., & Zhou, Q. (2013): Therapeutic concerns when oral medications are administered nasogastrically. *Journal of Clinical Pharmacy and Therapeutics*, 11:11-14.