

## **Effect of Implementing Practice Guidelines Regarding Medication Administration Iatrogenic Events on Nurses' Performance at Neonatal Intensive Care Unit**

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### **Abstract**

**Background:** Medication errors are potentially more harmful and have a higher incidence rate in the pediatric population than adult population. Nurses frequently administer medications in inpatient healthcare settings, more errors occur in the intensive care unit. They are the last line of defense to safeguard against medication errors. **Aim of this study:** - was to determine the effect of implementing practice guidelines regarding medication administration iatrogenic events on nurses' performance at Neonatal Intensive Care Unit. **Subjects and method:** -The study was conducted at Neonatal Intensive Care Unit of El-Mabarra hospital .A quasi-experiment design was used. **Sample:** -all nurses working in the previously mention sitting were included in this study (50 nurses). **Tools:** - two tools were used to collect the required data; Structured questionnaire schedule to assess nurses' knowledge (tool I). Observational checklist to assess nurses' performance regarding medication administration (tool II). **Results** of the study revealed that, before practice guidelines the total knowledge scores of all nurses were poor while as all of them had good score immediately after and 70% after three months of implementing practice guidelines. Total practice scores of all nurses (100%) were good immediately and 50% after three months. **Conclusion:-** the practice guidelines program was effective in improving nurses' knowledge and their practice as well as reducing medication administration errors. **Recommendations:-** were suggested to establish continuous evaluation system to evaluate nurses' practice in pediatric care settings especially for

medication administration; Medication administration educational program should be included in all nursing schools and curriculum.

**Key words:** Practice Guidelines, Medication Administration, Iatrogenic Events, Nurses' Performance, Neonatal Intensive Care Unit

## Introduction

Medication administration forms a major part of the clinical nurse's role. <sup>(1)</sup> Medication administration aims to improve therapeutic outcome and quality of life while minimizing the risk of harm to the child. Medication is administered for its therapeutic effects through modification the body function to prevent, diagnose, and treat the disease. Medication can be administered by different routes; as oral, parental, topical and inhalation <sup>(2)</sup>. Hospitalized neonates, require treatment for conditions related to premature birth, and frequently exposed to invasive therapies thus, they are particularly vulnerable to iatrogenic events. The incidence of iatrogenic event was recently estimated to be 20 to 26 per 1000 child days, and many of these events were described as preventable, because 30% to 50% of such events are harmful, iatrogenic events may have a considerable impact on patient morbidity <sup>(3-7)</sup>. Among the iatrogenic reported in the various studies reviewed, medication errors were the most frequent error type <sup>(8)</sup>. Such events may be related to professional practice, health-care products, and/or procedures and systems, and includes the following: prescription; order

communications; product labeling, packaging and nomenclature; compounding; dispensing; distribution; administration; education; monitoring and use <sup>(9)</sup>.

World Health Organization, 2007 was estimated that 1 in 10 patients worldwide are affected by medical errors <sup>(10)</sup>. Published studies indicate that medication errors in the NICU are common, ranging from 13 to 91 medication errors per 100 NICU admissions <sup>(11, 12)</sup>. In addition, NICU children are more likely to experience medication errorharm than other hospital patients <sup>(4)</sup>.becausechild in an ICU receives a larger number of medications <sup>(13)</sup>. The incidence of medication errors occurring during the care of infants of 24–27 weeks' gestation age is reported as high as 57%, compared with 3% reported in the care of full-term infants NICUchild required additional system wide safeguards against medication errors and that healthcare providers must be especially vigilant when working with medications in the NICU <sup>(3)</sup>.

Medication errors have serious direct and indirect results, and are usually the consequence of breakdowns in a system of

care. Direct results include child harm as well as increased healthcare costs. Indirect results include harm to nurses in terms of professional and personal status, confidence, and practice<sup>(14)</sup>. Nurse considers the first line of defense to prevent medication errors in medication order and administration<sup>(15)</sup>. Medication administration is one of the most important duties of nurses. It requires a particular set of knowledge and attitude if implemented correctly. It can put nursing practice at risk and create preventable risk for child. Nurses hold responsibility for taking care of child and providing safety for them. Therefore, medication administration and preventing medication errors impose more obligations on them<sup>(16)</sup>.

Nurse must aware about of the child's developmental age and the most effective methods for approaching each age group when administering medication. It is a challenge for health care provider especially pediatric nurse to ensure that children in hospital continued taking their regularly prescribed medicines when they entered the hospital till discharge. Also nurse has an important role in administration of medication and observation for any adverse reaction<sup>(17)</sup>.

**Aim of this study:** - was to determine the effect of implementing practice guidelines regarding medication administration iatrogenic

events on nurses' performance at Neonatal Intensive Care Unit.

**Research hypothesis**

Nurses' performance regarding medication administration iatrogenic events in neonatal intensive care unit expected to be improved after implementing practice guidelines

**Materials and Method**

**Research design**

Quasi-experimental research design was used in this study.

**Setting**

The study was conducted at Neonatal Intensive Care Unit of El- Mabarra hospital which affiliated to the Health Insurance at Tanta City.

**Subject**

All nurses working in the previously mentioned setting (50).were included in the study.

**Tools of data collection:-**

Two tools were used to collect the necessary data.

**Tool I:-** Structured questionnaire schedule. It was designed and developed by the researcher and includes two parts:

**Part one:** - Socio demographic data of the nurses (age – educational level –year of experience –marital status –attendance any conference related to medication administration).

**Part two:** -nurses knowledge about medication administration and its errors in pediatric care

setting, and factors contributing to medication errors. It includes definition, dose, types, forms and methods of medication administration, pharmacodynamics, pharmacokinetic, sources of medication, factors affecting medication absorption, right storage of medication methods of calculation of medication dose, rules of infection control and documentation of medication administration

Total scores of nurses' knowledge were calculated and classified as follow:

More than 70% were considered good 60-70 % were considered fair.

Less than 60% were considered poor.

**Tool II:-** Medication administration iatrogenic events nursing observation checklists. It was developed by (Wong s' 2003) <sup>(16)</sup> and modified by the researcher to assess nurses' performance regarding medication administration .It includes the following procedures: administration of oral medication (48) scores, administration of medication through gastric tube (20) scores, administering parenteral medication: intramuscular (44) scores, intradermal (20) scores and intravenous injection (48) scores. Administration of topical medication: eye and ear drops (38) scores. Rectal suppository (36) scores and administration of inhalation medication (nebulizer) (34) scores.

The sum grades of practice were (288).

Scoring system for nurses' practice included:

The total grades of nurses' knowledge were (48).

Scoring system for nurses' knowledge includes:

Correct and complete answer was scored (2)

Correct and incomplete answer was scored (1)

Incorrect or no answer was scored (0)

Done correctly was scored (2)

Done incorrectly was scored (1)

Not done was scored (0)

Total scores of nurses' practice were calculated and classified as follow:

More than 70% were considered good.

60-70 % were considered fair.

Less than 60% were considered poor.

**Method**

An official permission to conduct the study was obtained from responsible authorities.

**Ethical and legal consideration:**

An informed consent for participation in the study was obtained.

Nature of the study was not caused any harm and/or pain for the entire sample.

Confidentiality and privacy was taken into consideration regarding data collection.

Two tools were used in this study Tool (I) to assess nurses' socio demographic data and their knowledge regarding medication administration. Tool (II) to assess nurses' performance in medication administration.

The tools of the study were introduced to ten nurses' expert in the field of pediatric nursing to test its validity. Modification was done accordingly.

Pilot study was carried out on 10% of study sample to test tool reliability the necessary modification was carried and not excluded from the study.

The nurses were divided into ten groups (each was composed of 5 nurses).

The educational program session was implemented (9 sessions) in front of all nurses included in the study.

The first session:

It was emphasizing on the explanation of the purpose of program, iatrogenic events of medication administration definition, common medication errors that occur in NICU, sources of errors, error reduction strategies for the neonatal and nursing care plane to prevent iatrogenic events of medication administration.

The second session:

It was focused on the concept of drug, factors affecting medication administration and methods of medication administration, factors affecting medication absorption, right storage of medication, correct order of medication administration, methods of calculation of medication dose.

The third session

About medication administration policies and roles as five right and instruction before preparing the medication, forms of calculation

Preparation of suitable media for teaching as lecture, data show, group discussion, doll for demonstration, book notes. Observe nurses for actual practices in NICU was done by the researcher using observational checklists tool II. The researcher was observed the nurse in different nursing procedure during different shifts.

of infusion and the infection control during medication administration.

The fourth session:

About documentation of medication administration, complication of medication administering.

The fifth session:

Concentrate on route practice of oral medication administration.

The sixth session:

about intramuscular injection route practice.

The seventh session:

It was focus on intradermal and subcutaneous injection route practice.

The eighth session:

It was about intravenous injection route practice and methods of medication calculation.

The ninth session:

Emphasized on medication administration by inhalation, topical and rectal route practices.

The time required for each session ranged from 30 to 45 minutes. The theoretical part was given through the first 10 to 15 minutes while the demonstration was carried out in remaining minutes by the researcher.

Re demonstration was done by nurses at the end of each session. The teaching sessions were carried out in conference place of hospital and NICU.

Evaluation phase: evaluation was done before immediately and after three months of the guideline program implementing for nurse' knowledge and practice using Tool I and II.

Data were collected over a period of six months from June to December 2016.

### **Results:**

Table (1): shows percentage distribution of the studied nurse related to Socio-demographic characteristics. It was clear that , 52.0 % of the studied nurses from 20 < 25 years and 48 %.0 from 25 < 35 years old. The study showed that, 30 % of nurses had diploma degree ,while as nurses who had completed university nursing education and technical institute of nursing were 20.0% and 50% respectively. Regarding their year of experience 40.0% of the nurses had less than 5 years of experience, and 32.0 % from 5 to 10 years. 28.0% of them had more than 10 years. It was observed that, all nurses not attend any previously training program about medication administration.

Table (2) and figure (1): show Percentage distribution of the Effect of the Guidelines Program on Nurses' Total Score of Knowledge before practice guideline the total scores of nurses' knowledge were poor. Whereas, immediately after practice guidelines the total

score for all nurses (100%) were good and 70% after three months.

Table (3) and figure (2): show percentage distribution of the Effect of the Guidelines Program on total Score of nurses' practice found that the total practice score of all nurses' (100%) were poor before implementing practice guidelines. While as immediately after guidelines all nurses' practice (100%) were good and 50.0% after three months with statistical significant difference.

Table (4): shows Nurses' opinions about different factors of medication errors. It was found that, nurses' opinions about factors related to children are the majority of them(92.0 %, 88.0 %, ) stated that the health condition of the child and their age respectively were affect the occurrence of medication errors. Nurses' opinions about factors related to doctor it was noticed that, the majority of them(96.0%, 84.0%) mentioned that the medication orders and experience were affect the occurrence of medication errors respectively .Factors related to the nurses. It was observed that, the majority of them(94.0%, 92.0%, 90.0%) stated that nurses' experience, shortage of nurses, work load were affect the occurrence of medication errors respectively. Regarding to factors related to medication 72.0% 52.0% and 50.0% of the study sample explained that medication sensitivity, expired date affect the occurrence

of medication errors respectively. Regarding to nurses' opinions about factor related to hospital it was found that, 94.0%, 90.0% and 88.0% of nurses stated that alternative of medication, no policies and rules and no work shop about medication.

Table (5): illustrates common types of medication errors as reported by nurses before implementing practice guidelines. It was noticed that, 58.0 % and 52.0 % of study sample were stated that the prescription and preparation errors were the common types of medication errors occurrence respectively. Moreover, the majority of nurses (94.0 %) were cleared that the administration error was more common types of medication errors. Regarding to mistakes that occur when administrating not described medication by the doctor it was found that, 30.0 %, 60.0 % of nurses were mentioned that delayed calling doctor and no documentation of medication were the errors occur when administrating not described medication respectively. Furthermore, the majority of them (90.0%) were stated that no talking about error was more error occurs when administrating not described medication.

Table (6) presents committed errors reported by nurses regarding medication administration before and after three months of implementing practice guidelines. It was found that, most of nurses showed improvement after three months of practice guidelines in the history of

committed errors which decreased from 40.0% before to only 2.0 % after three months of practice guidelines. There were statistical significant difference.

There was statistical significant improvement for the types of errors committed by nurses whereas before practice guideline it was 40.0% compared to only 2.0% after three months. (where p-values <0.001)

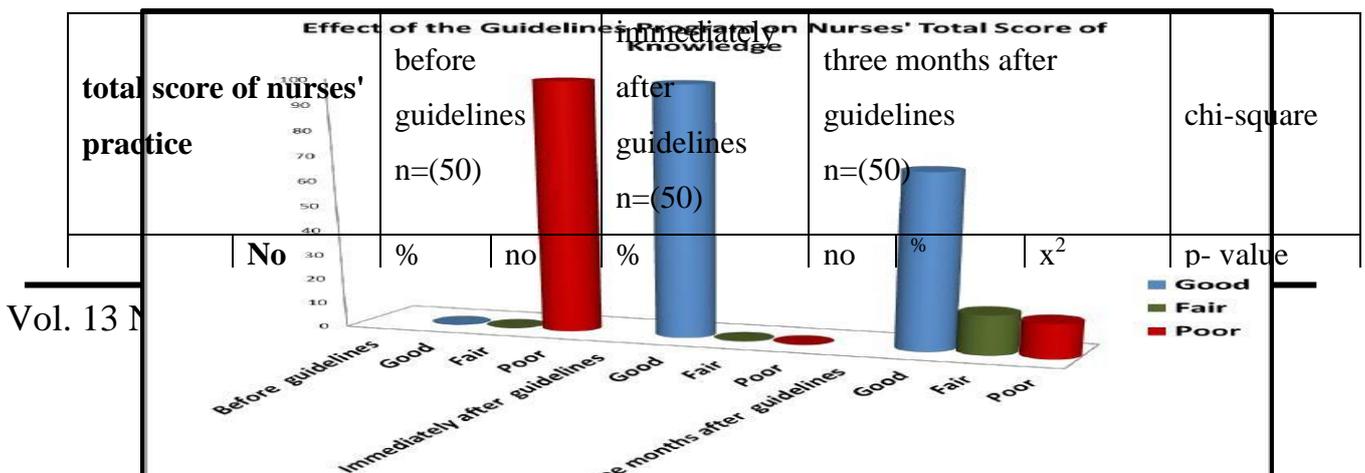
Regarding to causes of committed errors, it was found that, there was improvement after three months of implementing practice guidelines in the causes of committed errors decreased from 96.0% before to only 2.0% after three months of implementing practice guideline. (where p-values <0.001).

As regards nursing intervention after committed errors it was observed that general improvement among study sample after practice guidelines 74.0% before compared to only 4.0 % after three months. Regarding documentation of medication errors (incident report). Before guidelines program no incident report while as after three months of guidelines all medication errors occurred were reported. There were statistical significant difference (where p-values <0.001)

**Table (1): Percentage distribution of the studied nurses related to socio-demographic characteristics (n=50)**

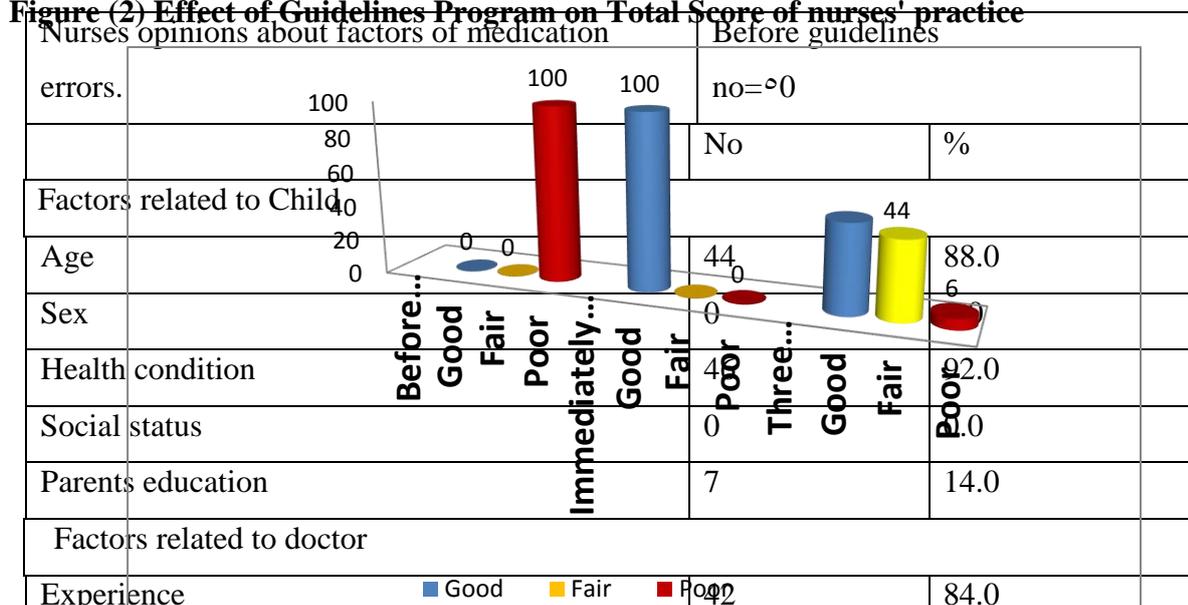
Socio-demographic characteristics of nurses.	No	%
Age in years:		
20 < 25	26	52.0
25- 35	24	48.0
Mean ± SD	28.08±12.8	
Educational level:		
Bachelor degree	10	20.0
technical Institute of nursing	25	50.0
Diploma degree	15	30.0
Marital status:		
Married	46	92.0
Single	4	8.0
Attendance any conference or work shop related to medication administration:		
Yes	0.0	0.0
No	50.0	100.0
Years of experience :		
< 5	20	40.0
5-10	16	32.0
> 10	14	28.0
Total	50	100.0

**Figure (1): Effect of the Guidelines Program on Total Score of Nurses' Knowledge, Practice Immediately After the Program, Knowledge, Practice Three Months After the Guidelines.**



**Table (5): Percentage Distribution of the studied nurse related to Common Types of Medication Errors**

**Figure (2) Effect of Guidelines Program on Total Score of nurses' practice**



**Table (4) Percentage distribution of the nurses' opinions about different factors of medication errors before and after guidelines.**

Common medication errors reported by nurses	Before guidelines	%
Experience	44	94.0
Work load	45	90.0
Shortage in nurses number	46	92.0
Psychological condition	35	70.0
Social condition	30	60.0
Dispensing error	26	52.0
Lack of knowledge about medication	26	52.0
Administration error	47	94.0
Monitoring errors	32	64.0

Table (6): Percentage Distribution of the Nurses' Committed Errors which reported by Nurses regarding Medication Administration before and after three months of implementing practice guidelines

Committed Errors Reported by Nurses	Before guidelines n=50)		Three months after guidelines n=50)		Chi-square	
	no	%	no	%	X <sup>2</sup>	P-value
Reported	20	40.0	1	2.0		
Not reported	30	60.0	49	98.0		
Total	50	100.0	50	100.0	78.0	0.004*
Type of medication error:						
Errors in preparation	5	10.0	1	2.00		
Errors in administration	15	30.0	0	0.00		
Total	20	40.0	1	2.0	82.35	0.001*
Causes of medication errors:						
Not clear drug prescription.	10	20.0	1	2.00		52
Shortage of nurses' staff.	15	34.0	0	00.0		

## DISCUSSION

Pediatric medication errors are different from adults because doses are individually based on child weight, age and body surface area.<sup>(18)</sup> Medication errors are potentially more harmful and higher incidence rate in pediatric patient and contribute to child morbidity and mortality<sup>(19, 20)</sup>. Nurses play a major role in reducing medication errors. They are the last line of defense to safeguard against medication errors<sup>(21)</sup>. Nursing education focus on prepare nurses for the future, as health care is dynamic. They need for both strong theoretical background and an equal amount of hands-on clinical experience. This is only possible when the nurses are knowledgeable and well informed<sup>(22)</sup>.

The result of the present study was found that, all nurses' knowledge scores were poor about medication administration before implementing practice guidelines. This may be attributed to the lack of in-service training programs and absence of related literature about medication which help nurses to get the required knowledge whenever they need. Furthermore, there was no motivation for the nurses to improve their practice. The lack of information may be as a result of stress on nurses and impact on their quality of care provided to children. This justification goes with **Harmina and Mustafa** (2000)<sup>(23)</sup> who studied the effect of in-service education program on nurses' knowledge and

application on the nursing process at Jordan university hospital and mentioned that, the importance of in-service education as cornerstone of total quality management, and continuous improvement was impossible without it. It was effective in changing the nurses' knowledge and practice.

It was noticed that, immediately after implementing practice guidelines, all nurses were good in their knowledge about medication administration. This improvement might be related to the fact that, the majority of nurses were young, as their age between 20 to 25 years and liable to learn and acquired knowledge through the practice guidelines program. Nurses need specific information about what constitutes medication errors to fill the gap between the nurses' perceived knowledge and their actual knowledge. This can be applied by educational programs designed to promote the recognition of these errors.

This finding is highly supported with **Armitage and Knapman** (2010)<sup>(24)</sup> who studied the effect of intervention program on nurses' knowledge about medication in Mexico University, and mentioned that, more than half of the nurses showed improvement post nursing intervention program. Another study done by **Koren**. (2010)<sup>(25)</sup>, who studied the trend of medication errors in hospitalized children and mentioned that, nurses'

knowledge regarding medication errors were improved after nursing intervention program. The present study revealed that all nurses not receiving previous training program regarding medication administration. This could be explained that, the highly expressed need of this group of nurses to learn more about the technique of correct medication administration and its errors. The current study revealed that, all nurses had poor practice regarding medication administration. This is may be due to the fact that, the majority of nurses were young; that nurses new to hospital system were more likely to make medication errors, probably due to a different or new environment. Stress of work load, lack of knowledge, supplies, hospital policy and rules, lack of regular and update in-service training program under highly experienced supervision regarding medication administration. Present finding is highly supported by **Rizk (2004)**<sup>(26)</sup>, who studied about assessment the actual nursing care for children under intravenous infusion therapy in pediatric unit at Shbeen El-kom University and mentions that, inadequate nurses' practice may be related to the fact that, nurses were not supplied with enough information and training about medication administration. On the contrary, immediately and after three month of practice guidelines all of nurses' practices were good. The enhancement in nurses' practice may be related to the

organize and effective program sessions, regular and frequent demonstration of competence medication administration to ensure high levels of retention of psychomotor skills. The finding was congruent with **toomy et al.**(2003)<sup>(27)</sup>, they cited that, nursing practice improved after receiving the educational program and they attributed that, this change to increased nurses' knowledge .The interpretation also was in the same line with **Gammon and Gould (2005)**<sup>(28)</sup>, who showed that, specific intervention strategies such as education are influential in improving knowledge and compliance. Regarding nurses' practice of medication administration. The study figured out that, there was significant improvement after practice guidelines application. The finding of this study is accordance with **Selbest (2009)**<sup>(29)</sup>, who studied the medication errors in pediatric emergency department. And mention that, the program of drug administration was affected positively the majority of the nurses' practice in the study sample. In addition **Mekinenet all, (2010)**<sup>(30)</sup>,illustrated that overall level of nurses'practice were significantly improved after program implementation. The relation between socio demographic characteristic of nurses and their knowledge and practice about medication administration and its errors before, immediate and after three months of implementing practice guidelines. Finding of

the study revealed that, no statistically significance relation between nurses' knowledge and practice and their socio demographic characteristic. This would seem to indicate that, any nurse was potentially at risk for making a medication error. Thus, all nurses in an organization need continuous in-service training program to avoid such errors about medication administration. This finding was supported by **Abdel Aziz. (2004)**<sup>(31)</sup>, who mentioned that, continuous production of new medication and substitute, lack of in service training program to follow up the new knowledge about medication lead to no significance relation between nurses' knowledge and their socio demographic characteristic. Also **Mahday. (2003)**<sup>(32)</sup> who studied the nurses' role in managing the patient in Ain shams university hospital. And found that, there is no significant relation between nurses' knowledge and their socio demographic characteristic, namely, experience, qualification and attending any training conference. The results of present study also revealed that, there was statistically significance correlation between nurses' practice and their knowledge immediate and after three month of implementing practice guidelines program. This may attributed to the improvement in nurses' knowledge and practices after implementing practice guidelines program. Knowledge and practice were improved parallel; this reflects the

importance of integration between theory and practice providing an optimum learning and facilitates the acquisition of the clinical skills of nursing. This is highly supported with **Koren (2010)**<sup>(25)</sup>, who studied the trends of nurses regarding medication administration errors in pediatric hospital in Toronto. And mention that, there was significant relation between nurses' errors in practice before intervention program and poor knowledge which is improved after nursing intervention program. The improvement of nurses' knowledge and practice may be related to the highly expressed need of this group of nurses to learn more about medication administration and its errors. The finding of the present study showed that, regarding nurses' opinion about the factors affecting occurrence of medication errors. The health condition of the children is one of the most common factors of child's related errors. Physicians' writing was difficult to read or illegible which was the physician related factors. Whereas, nurses' experience, shortage of nurses number, work load and lack of knowledge about medication were the most common nurses' factors related errors. This result was accordance with a study done by **Balas M, Scott L and Rogers A. (2004)**<sup>(33)</sup>, And identified that, 33% of medication errors were due to late administration, with nurses expressing that high patient acuity and heavy workloads altered their ability to pass medications in an

efficient fashion. Another study done by **Mayo A &Duncan D. (2004)**<sup>(34)</sup>, and found that the orders written by physicians were illegible and not clear. The current study indicated that, there was no significant relationship between number of errors and years of experience. The majority of nurses identified more than one factor contributed to medication errors the rate of potentially harmful medication errors may be three times higher in pediatric patients than adult patients. Medication errors may occur at any step in the process from ordering to transcription, dispensation and administration. The current study revealed that, the most common errors of medication were administration error .This may be attributed to nurse failing to check the child's name band with the medication administration record. Errors occur when the medication labels/packaging are poor quality or damaged. Also, medication errors occur when there was confusion between two drugs with similar names, when nurses are distracted by other patients, coworkers or events on the unit .In addition errors occur when nurses were tired and exhausted and manpower shortage, nursing workload, staffing and increasing workloads were the factors influencing accuracy of medication administration.

This finding accordance with a study done by **Fahimi et al, (2008)**<sup>(35)</sup>, who found that, the

error rates were higher in the administration process compared to the preparation process in intravenous medications. The current results revealed that, more than one type of error occurred per patient. Prescribing errors are the most frequently detected error after administration errors, this may be related to doctor's writing on the prescription chart that was difficult to read or illegible, or when the physician prescribes the wrong dose.

As regards indicators of the program effectiveness, an evaluation of the practice guidelines program was carried out before and after three months only. To give nurses the opportunity to implementing program guidelines and to determine the efficiency and effectiveness of the practice guidelines program regarding medication administration and it' errors. The present study revealed that, most of nurses in the study sample showed improvement in the history of committed errors and its' types. Also, the study clarified that majority of the nurses reported that, shortage of nursing staff were the most causes of their errors, this finding was highly supported by **AbdAlaziz.(2004)** (31), and **Pfeifer.(2011)** (36), they mention that, nurses' staff shortage leads to multiple role for nurses, which increase errors regarding medication administration . Regarding to the appropriate intervention for the committed

mention errors of nurses in the study sample revealed significance improvement in their intervention about medication errors after three months of practice guidelines compare with before implementing guidelines.

## **Conclusion**

Nurses' knowledge and practice were improved regarding medication administration immediately and after three months of implementing practice guidelines.

## **Recommendations**

Based upon the finding of the current study the following recommendations were suggested:

Establish continuous evaluation system to evaluate nurses' practice in pediatric care settings especially for medication administration

Educational program should be included in all nursing schools and curriculum,

Encourage nurses to updating their knowledge and practice about medication administration,

Further researches should be conducted about medication administration to assess nurses' knowledge and practice regarding medication administration and its' errors in pediatric care setting.

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