Nurses, Knowledge and Practices regarding Medication Preparation and Administration Errors Occurrence at Neonatal Intensive Care Units

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Abstract

Medication errors are any preventable event that may lead to an inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer". **Aim of the study:** The aim of the study was to assessment of the nurses' knowledge and practice regarding medication preparation and administration errors in neonatal intensive care units. **Research design:** A descriptive exploratory research design was utilized. **Setting:** NICU affiliated to both: Minia University for obstetric and pediatric and Minia general hospital. **Subjects**: A convenient sample included all nurses on duty (n=60). **Research tools:** Questionnaire Sheet to gather data related to socio-demographic data of the studied nurses (age, qualification, etc.), nurses' knowledge about medication preparation and administration (concept of medication, medication preparation, medication administration errors, etc). Observational Checklist Sheet to assess nurses' practice regarding medication preparation and administration errors at neonatal intensive care units. **Results**: It was found that less than three quarters of the nurses have average knowledge regarding medication preparation and administration of medication and total practice score more than half of the nurses have average total score. There was high strong positive statistical significant correlation's between the total mean scores of nurses' knowledge and practices (r=0.89). **Conclusion**: Nurses had average knowledge and practice, toward medication preparation and administration errors in neonatal intensive care units and high significant, positive correlation was found between knowledge and practice of staff nurses towards medication preparation and administration errors. **Recommendation:** A structured educational program regarding medication preparation and administration errors must be prepared to improve knowledge and practice for nurse staff.

Keywords: Medication preparation, Medication Administration, Medication Errors, Neonates, NICU Nurses' knowledge and Nurses' practice

Introduction

Medication errors (MEs) are any preventable event that may lead to an inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer". Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labeling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use. **(Oñatibia-Astibia et al., 2021).**

Medication administration and nursing are paired like anything they never get separated in any context. They are never seen alone, where you hear about nursing, medicine or medication administration comes in every one's mind. Nurses' have been a key person in healthcare who is responsible for medication preparation, administrating and disposal. Not with adults, children, or women, but with neonate of neonatal intensive care unit (NICU), nurses are masters of all sort of work with medication. Still, after this expertise nurses are considered as personal responsible for medication errors among health care staff. Either with high dosages, administering medicine to wrong neonate, or picking up an incorrect medicine, nurses have been listed as one of culprit in literature who are related to errors of the medication**. (Soomar et al, 2019).**

Medication errors (MEs) can occur at any stage of medication process, from prescribing to handling preparing and administering. Approximately 50% of MEs result in adverse drug events (ADEs) causing significant increase in patient morbidity and mortality as well as in economic costs in health care. As ADEs caused by MEs are generally considered preventable, understanding MEs is particularly important when developing and improving preventative methods towards medication-related patient harm. **(Laatikainen et al, 2020).**

Globally, medication errors are leading causes of different injuries and avoidable harms in the health care system attributing to about 10% of the overall preventable harm for hospitalized patients**.** The neonates are particularly at greater risk for medication errors, the risk remains high, despite of interventions and changes of medical and healthcare system. Errors in medication preparation and administration can occur through failures in any of the ten rights which are right patient, right medication, right time, right dose, right route, right education/advice, right to refuse, right assessment, right evaluation/response and documentation. Health workers can make mistakes during the processes of ordering, prescribing, dispensing, preparing or administering medication. **(Tsegaye et al., 2020)**.

Medication errors cause at least one death every day and injury to approximately 1.3 million people annually in the United States of America alone. While low- and middle-income countries are estimated to have similar rates of medication-related adverse events to high-income countries, the impact is about twice as much in terms of the number of years of healthy life lost. Many countries lack good data, which should be gathered as part of the initiative. Globally, the cost associated with medication errors has been estimated at US$ 42 billion annually or almost 1% of total global health

expenditure. Errors may also be classified according to their level of severity **(WHO, 2018).**

In low and middle-income countries, the impact is about twice as much in terms of the number of years of healthy life lost having consistent reporting system and providing care based on guidelines could prevent 75% of the occurrence of harm to the hospitalized patients**.** Medication errors (MEs) are underreported in all countries, adult's hospital **(Al-Harkan et al., 2020).**

Nurses play an important role in promoting neonate safety, because they are predominantly provide health care and administer medications. So, they must ensure that neonate receive the right medication, right dose, right route, right time and right evaluation for therapeutic and possible adverse events **(WHO, 2017).**

Significance of the Study

Medication errors (MEs) are 18% of the total medical errors, and are considered as one of the top ten causes of deaths in USA, there is 7000 to 9000 death each year. **(Alrabadi et al., 2021).** Medication errors (MEs) are highly common in hospital setting. In Egypt, study at NICU in Benha University Hospital found that medication errors are 10.5% in pediatric neonates. **(El-Shazly et al., 2017).**

According to the WHO (2020), cost estimates for medications errors have been estimated at "US$ 42 billion annually, not counting lost wages, productivity and health costs". The economic liability of medication errors requires professional and institutional collaboration for prevention. **(Neander, 2020).** In Egypt, study at NICU in Benha University Hospital; detected 3819 errors that affected 97% of neonates. Types of errors included 403 medication errors**,** (10.55% of total errors), 260 administration errors (6.8%) **(El-Shazly, et al, 2017).** Another study at Abu El-Rish El-Monira and Sayed Galal NICUs revealed that, 74.5% prescription errors and 69.7% administration errors were detected in the two NICUs**. (Elsayed, Abusaad, & Hashem, 2020).**

The WHO third global patient safety challenge program developed a strategy to reduce severe, avoidable medication harms by half by 2022, especially by addressing harm results from errors due to weakness in the health system and by making improvements in the medication administration practices. One of the main concepts in hospitals is the patient's safety and health **(WHO, 2020).**

The current study is under taken to explore the knowledge and practice of the nurses regarding medication preparation and administration errors in neonatal intensive care units. Results of the current study may help in evaluation of the nurse's knowledge and practice as well as providing guidance, evidences and recommendations that should be reflected in neonatal nursing education and practice. Hopefully, the results of the current study could help clinical pediatric nurses design appropriate discharge education programs for nurses of NICU regarding medication preparation and administration.

Aim of the Study

The aim of the current study was to assess nurse's knowledge and practice regarding medication preparation and administration errors occurrence at Neonatal Intensive Care Units

Research Questions

The study will answer the following questions:

1. Are the nurses having enough knowledge regarding medication preparation and administration errors at Neonatal Intensive Care Units?
2. Are the nurses having appropriate practice regarding medication preparation and administration errors at Neonatal Intensive Care Units?
3. Is there a relation between nurses, knowledge and practice regarding preparation and administration of medication at Neonatal Intensive Care Units?

Subjects and Methods

Research design:

An exploratory descriptive research design was utilized to achieve the aim of this study.

Setting:

This study was conducted at NICU affiliated to both: Minia university for obstetric & pediatric and Minia general hospitals.

Neonatal intensive care units (NICU) of Minia university for Obstetric & pediatric located in Minia city, consisted of three sectors (septic, isolation, and clean), Septic sector capacity about 12 incubators, most cases are jaundice, surgical, and there is more infectious one. Clean sector capacity about 12 incubators, most cases are RDs (respiratory distress syndrome), its less infectious one, and the isolation sector capacity is 3 incubators for most critical or infectious cases that need isolation, every sector have isolated hand washing room, average distance between every incubator , and good lightening. There is a head nurse office out of the sectors, 2 nurses rooms, doctors office, mothers room for breast feeding, place for terminal incubator care, small room for storage, and one bath room.

Neonatal intensive care units (NICU) of Minia general hospital in Minia city, it is located at third floor of hospital consist of one big sector with capacity about 22 incubators for all cases , have 3 general hand washing basin, average distance between every incubator, and good lightening. There is a head nurse office out of the sector in the entrance corridor, nurse's room, doctor's office, mother's room for breast feeding, room terminal incubator care, small room for storage, and one bath room.

Subjects:

A convenient sample was included all nurses on duty, at the previously mentioned settings (n=60); 31nurses in Minia university and 29 nurses in general hospitals).

Two tools were used for this study which were:

Tool (I): A pre designed questionnaire Sheet was done by the researcher after reviewing the relevant literature. It was written in simple Arabic language to suit level of understanding of the studied sample to collect data regarding to the following parts:

Part 1: It was concerned with the personal characteristics of the studied nurses such as age, qualification, marital status, years of experience, Place of work and attendance of training courses on how to prepare and administrate medication.

Part 2: It was related to nurse's knowledge about medication preparation and administration such as concept of medication, medication preparation, medication preparation errors, medication administration, medication administration

errors, precautions, medication routs and factors increase medication errors.

Tool (II): Observational Checklist Sheet was adopted from Agency for Healthcare Research and Quality [AHRQ] (2015) and modified by the researcher to assess nurses' practice regarding medication preparation and administration errors at neonatal intensive care units regarding to the following parts: parenteral IV medication preparation and administration checklist and oral medication preparation and administration checklist.

Scoring System:

Scoring system for knowledge: The correct answer was scored one, and that incorrect was scored zero. These scores were summed-up and converted into a percentage and classified as the following, score from < 50 referred to poor knowledge, score from 50 < 75 referred to average knowledge, score from 75 ≤ 100 referred to good knowledge.

Scoring system for practice: The right step (done) was scored one, and that wrong (not done) was scored zero. These scores were summed-up and converted into a percent score, Score from < 60 referred to poor practice, Score from 60 < 85 referred to average practice, Score from 85 ≤ 100 referred to good practice.

Validity and Reliability of the Tools

It was ascertained by five of experts in pediatric nursing specialty. their opinion was elicited regarding the format, layout, consistency, accuracy and relevancy of the tools. Reliability of the tools was done through using the appropriate statistical tests according the knowledge tool by crombach Alpha test.

Pilot Study

It was carried out on 6 nurses those represent 10% of the subject at the previously mentioned settings to test applicability of the constructed designed and adapted tools, clarity and efficiency of the included questions related to medication preparation and administration errors, and then the necessary corrections and omissions of items was performed as needed according to the results of pilot study. The pilot study was served to estimate the time needed for each subject to fill in the questions. No modifications were done in the study tools based on the pilot study. This sample was included to the total study sample. The study subjects was included the total study sample.

Study procedure

Administrative approval was obtained from the dean of faculty of nursing, Minia University to the manager of hospitals before implementation of the study. The researcher was met with hospitals manager to explain the objectives of the study that help to gain their cooperation and to allow meeting with the nurses. The researcher was introduced herself to the nurses. Then, the nurses was interviewed individually to fill the knowledge questionnaire at first, that was concerned with the characteristics of studied nurses such as age, qualification, and marital status and nurses knowledge about medication preparation and administration such as concept of medication, medication preparation, medication preparation errors and medication administration.

After that the nurses was indirectly observed during preparation and administration of medication by the researcher in Minia university hospital and the researcher teach to another college about filling the questionnaire sheet and observation of nurses during preparation and administration of medication in Minia general hospitals. The purpose of the study is simply explained to the nurses who participate in the study. The researcher was met nurses in available time to fill the knowledge tool, while observational checklist sheet was filled by the researcher.

Data collection was conducted over a six months' period extending from April 2019 till October 2019. The researcher was available three days per week; each nurse was interviewed individually, after explaining the purpose of the interview and getting agreement of the nurse to participate in the research. The researcher assured the voluntary participation and confidentiality to each subject who agreed to participate. The questionnaires were read, explained to the studied sample within average of 30 minutes.

Ethical Consideration

A written initial approval will be obtained from the Research Ethical Committee of the faculty of nursing, Minia University. Oral and written informed consent was obtained from the nurses who willing to participate in this study. Each assessment sheet questionnaire and observation checklists were coded.

Results

Table (1): Distribution of the studied nurses' according to their demographic data (no =60).

Items	no= 60	%
Age of nurses':		
• Less than 20 years	1	1.7
• From 21 to 30 years	46	76.6
• From 31 to 40 years	12	20.0
• more than 40 years	1	1.7
Mean ± SD	27.0 ± 4.73	
Marital status:		
• Single	25	41.7
• Married	34	56.6
• Divorced	1	1.7
	5.52 ± 5.50	
Place of work:		
• Neonatal unit in Minia university	31	51.7
• Neonatal unit Minia general hospitals	29	48.3

Table (1) shows that two thirds of nurses' age 76.6% ranged from 21 to 30 years with a mean 27.0 ± 4.73 years old. Regarding to the nurses' marital status it was shown that more than half of them 56.6 were married. Regarding the place of work, it was noticed that 51.7 % of nurses' who were working at neonatal unit in Minia university.

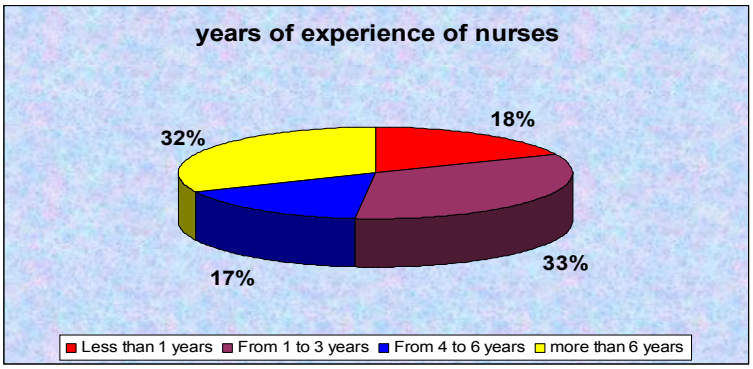

Fig.1. Percent distribution of nurses according to years of experience

Fig.1 illustrates that 33.3% of nurses who having work experience ranged from 1 to 3 years.

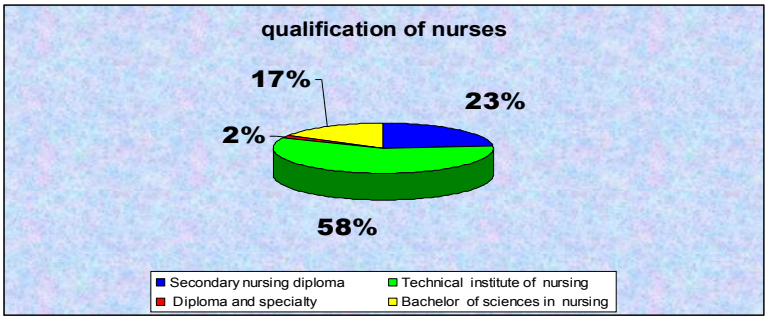

Fig.2. Percent distribution of nurses according to qualification of nurses'

Fig.2 shows that more than half of nurses having technical institute of nursing 58.3%.

Table (2) Nurses' knowledge concerning the medication preparation and administration errors in neonatal intensive care units (n= 60).

Items	Nurses n= 60						X2 P. value
	Poor		Average		good		
	N	%	N	%	N	%	
Medication	12	20.0	42	70.0	6	10.0	3.22(0.05)
Medication preparation and administration	5	8.3	52	86.7	3	5.0	3.46(0.05)
Cofactors for errors during the preparation and administration of medication	7	11.7	40	66.7	13	21.6	4.28(0.05)
Total scores of nurses knowledge	7	11.7	44	73.3	9	15.0	2.55(0.05)

*= Significant

Table (2) shows the nurses' knowledge concerning the medication preparation and administration errors at neonatal intensive care units. The significant difference was illustrated in all medication and cofactors for errors during the preparation, administration of medication and total scores of nurses' knowledge items (p. 0.05, 0.05, 0.05, and 0.05) respectively.

Table (3): Nurses' practices concerning the medication preparation and administration errors in neonatal intensive care units (n= 60).

Items	Nurses n= 60						X2 P. value
	Poor		Average		good		
	N	%	N	%	N	%	
I.V of medication preparation and administration	2	3.3	37	61.7	21	35	**8.42(0.05)**
Oral medication prepare and administration	4	6.7	28	46.6	28	46.7	15.3(0.12)
Total scores of nurses practices	1	1.7	31	51.7	28	46.7	12.4(0.19)
Total scores of nurses knowledge and practices	2	3.4	41	69.5	16	27.2	**14.2(0.05)**

*= Significant

Table (3) shows nurses' practices regarding medication preparation and administration errors at neonatal intensive care units. The significant difference was illustrated in I.V of medication preparation, administration and total scores of nurse's knowledge and practices items (p. 0.05, 0.05) respectively.

Table (4): Mean scores of nurses' knowledge and practice about medication preparation and administration errors according to their qualifications (n= 60).

Mean scores of nurses' knov practice	Secondary nursing n= 14	Technical in nursing n= 35	Diploma and special	Bachelor of s nursing n= 10	F. test	P. value
	(X`± SD)					
Medication errors	1.9 ± 0.6	1.8 ± 0.4	1.0 ± 0	2.1 ± 0.5	1.48	0.02*
Medication preparation and ac errors	1.9 ± 0.2	1.9 ± 0.4	2.0± 0	2.0± 0.0	0.07	0.97
Cofactors for errors during the pre administration of medication	2.0 ± 0.6	2.1± 0.5	1.0 ± 0	2.3 ± 0.4	1.85	0.01*
Total scores of nurses knowledge	2.0 ± 0.6	2.0 ± 0.4	1.0 ± 0	2.2 ± 0.4	1.36	0.01*
I.V of medication prepar administration	2.4 ± 0.5	2.5 ± 0.6	2.0 ± 0	2.4 ± 0.5	0.36	0.05*
Oral medication prepare and admini	2.6 ± 0.4	2.4 ± 0.6	3.0± 0	2.0± 0.4	2.65	0.05*
Total scores of nurses practices	2.5 ± 0.5	2.5± 0.5	2.0 ± 0	2.1 ± 0.3	2.20	0.02*
Total scores of nurses knowledge ar	2.2 ± 0.4	2.2 ± 0.5	3.0 ± 0	2.3 ± 0.5	0.94	0.02*

***= Significant**

Table (4); shows the mean scores of nurses' knowledge and practice about the medication preparation and administration errors according to their qualifications**.** The significant difference was illustrated in, medication, cofactors for errors during the preparation and administration of medication, and total scores of nurses' knowledge (P. 0.02, 0.01, 0.01); respectively. While significant difference were not shown regarding the medication preparation and administration errors. The significant difference were found concerning, I.V of medication preparation and administration, oral medication prepare and administration, total scores of nurses practices, and total scores of nurses knowledge and practices (P. 0.05, 0.05, 0.02 and 0.02); respectively.

Table (5): Mean scores of nurses' practice about medication preparation and administration errors according to their years of experience (n= 60).

Mean scores of nurses' knowledge and practice	Less than 1 year n= 11	From 1 to 3 years n= 20	4 years and more n= 10	More than 6 years n= 19	F. test	P. value
	(X`± SD)					
Medication errors	1.5±0.5	2.0±0.4	1.9±0.5	2.0±0.5	2.11	0.02*
Medication preparation and administration errors	1.9±0.3	2.0±0	2.1±0.5	1.8±0.4	0.82	0.04*
cofactors for errors during the preparation and administration of medication	2.0±0.5	2.0±0.6	1.9±0.3	2.2±0.6	0.96	0.04*
Total scores of nurses knowledge	2.0±0.3	2.0±0.5	1.9±0.5	2.1±0.5	0.40	0.03*
I.V of medication preparation and administration	2.6±0.5	2.2±0.6	2.6±0.5	2.5±0.5	1.60	0.02*
Oral medication prepare and administration	2.5±0.5	2.3±0.7	2.3±0.4	2.4±0.6	0.33	0.04*
Total scores of nurses practices	2.5±0.5	2.4±0.5	2.4±0.5	2.4±0.5	0.20	0.04*
Total scores of nurses knowledge and practices	2.3±0.5	2.5±0.5	2.0±0.4	2.2±0.4	1.17	0.03*

***= Significant**

Table (5) shows the mean scores of nurses' knowledge and practice about the medication preparation and administration errors according to their years of experience. The significant difference was illustrated in all items, medication, cofactors for errors during the preparation and administration of medication, and total scores of nurses' knowledge (p. 0.02, 0.04, 0.04, and 0.03); respectively. The significant difference was found concerning, I.V of medication preparation and administration, oral medication prepare and administration, total scores of nurses practices, and total scores of nurses knowledge and practices (P. 0.02, 0.04, 0.04 and 0.03); respectively

Table (6): Correlation between nurses' knowledge and practices regarding preparation and administration of medication at neonatal intensive care units.

	Practices	
	Correlation Coefficient (r)	P. value
Knowledge	0.89	0.001*

*= Significant

Table (6) shows the correlation regarding the total scores of nurses' knowledge and practices. It is evident that the highest strong positive statistical significant correlation's was found between the total scores of knowledge and practice of nurses 'knowledge and practices (r=0.89).

Discussion

Regarding to Socio-demographic characteristics of participating nurses, it was found that, less than three quarters of the nurses' age (76.6%) ranged from 21 to 30 years with a means (27.0 ± 4.73) years. This is supported by **Ramya, (2016)** study entitled assessment of knowledge, attitude and practice towards prevention of medication error in children among staff nurses working at selected settings in Chennai, who found that majority (86%) of the staff nurses belonged to 20-30 years and majority (96%) of the staff nurses were female. this result also agrees with the study done by **Ragheb & Metwally, (2016)** in Egypt entitled the effect of

training program on reduction of nurse's medication errors that show the high percentage (74%) of the sample was less than 30 years.

Although this contradicts with the findings of **Enyew etal.,** (**2020**), entitled magnitude and associated factors of medication administration error among nurses working in Amhara region referral hospitals, northwest Ethiopia, found that more than half (56.3%) of the respondents were males and nearly half (50.6%) of them were married.

The results of the current study also revealed that, total knowledge score regarding medication preparation and administration of medication were more than two thirds of the nurses (**73.3%)** having average knowledge **(**P. 0.05). This finding was supported with **Ramya**, (**2016),** who showed that the overall means ± SD of knowledge score was 77.2%, more than half (53%) of the staff nurses had moderately adequate knowledge and 47% of the staff nurses had adequate knowledge towards prevention of medication error in children.

These results disagree with study of **(Gracia Gracia, Serrano & Garrido, 2019)**, entitled assessment of medication errors and drug knowledge gaps among critical-care nurses, indicated that nurses have a low level of knowledge of the drugs they use the most and with which a greater number of medication errors are committed in the ICU, also was contradicted with (**Abd Elmageed et al, 2020**), whom revealed that less than two thirds of nurses have poor total knowledge score regarding medication preparation and administration.

The current study showed that the total practice score of nurses regarding medication preparation and administration errors around more than half (51.7%) of the nurses have average total score. This finding was contradicted with **Ramya, (2016),** who showed that more than two thirds (69%) of the staff nurses had good practice and31% of the staff nurses had moderate practice towards prevention of medication error in children, also contradicted with the results of the study conducted by **(Abd Elmageed et al, 2020),** whom found that more than three quarters of the nurses have poor practice score regarding drug preparation and administration**.**

The results of the current study, revealed that, highest strong positive statistical significant correlation's was found between the total scores of knowledge and practices of nurses' knowledge and practices (r=0.89), These results agree with the study by **(Abassy, & AL-Mosawi, 2021).,** showed that there was a strong correlation between knowledge and practice (r= 0.58). Therefore from the above discussion, we can infer that there is a significant correlation between knowledge and practice of staff nurses one can influence the other.

Conclusion

This study concluded that:

Nurses had average knowledge and practice, toward medication preparation and administration errors in neonatal intensive care units. This study proved a significant, positive correlation between knowledge and practice of staff nurses towards medication preparation and administration errors.

Recommendation

Based upon findings of the present study, the following suggestions are recommended:

- Prepare a structured educational program regarding medication preparation and administration errors to improve knowledge and practice for nurse staff.
- Evidence-based medication preparation and administration guidelines should be integrated in pharmacology courses curriculum for nursing students.
- Simple handouts as booklets and brochures about medication preparation and administration for essential instruction and medication errors should be developed and distributed at all nursing care settings.

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