

# Critical Care Nurses' Knowledge and Practices Regarding Medication Administration Errors at Mansoura University Hospital

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**Abstract:** Medication administration (MA) is a critical component of nursing management skills that requires critical thinking to ensure patient safety during the administration process and prevent occurrence of medication administration errors (MAEs). Medication errors (MEs) are a global problem which leads to increase mortality rates, length of hospital stay, and related costs. Critical care nurses (CCNs) should be aware of indication, action, contraindication and adverse reaction of the drug. Moreover, they should monitor the patient for any negative signs of change in his condition and develop the necessary plan of action for patient care. Aim of the study: The present study aimed to assess CCNs knowledge and practices regarding MAEs. Research Design: A descriptive study design was utilized in this study. Research questions: What is the level of knowledge that the CCNs have about MAEs? and What is the level of practice that the CCNs perform regarding MAEs?. Setting: This study was conducted in Anesthesia, Stroke, Neuro-surgical, and Cardio-thoracic Intensive Care Units (ICU) at Mansoura University Hospital (MUH), in Egypt. Sample: A purposive sample of 50 CCNs with a minimum six months of experience in ICU were included in the present study. Data Collection Tools: Two tools were used to collect data for the current study; the first tool has two parts; part one was nurses' socio-demographic characteristics that included age, gender, marital status, educational level, work shifts types, years of experience in ICU and attending training programs related to MAEs. Part two was CCNs knowledge questionnaire regarding Medication Administration Process (MAP). The second tool was observational checklist that was designed to assess CCNs practice regarding MAEs. Results: The current study finding revealed that more than three quarters of studied CCNs had satisfactory knowledge level and more than two third of the studied CCNs had unsatisfactory level of practice regarding to pre-administration phase, administration phase and post administration phase of medication. There was no significant statistical correlation existed between total knowledge scores and total practice scores of nurses. Conclusion: it can be concluded that CCNs have inadequate practices regarding MAP despite they have satisfactory level of knowledge.

**Keywords:** Medication errors, Critical care, knowledge, Practice.

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## 1. INTRODUCTION

Patient safety is a concern worldwide and is a significant challenge facing healthcare systems today (Wright et al., 2016). An important part of patient safety is the issue of MA within the acute-care setting that has long been the focus of research because it leads directly to patient morbidity and mortality (Park, Lee, & Choi, 2011). Every step in patient care

for a nursing profession is a potential opportunity for error with some degree of threat to patient safety (**Härkänen, Saano, & Vehviläinen-Julkunen, 2017**).

Medication administration process is an everyday part of nursing practice, and is much more than a simple psychomotor task (**Park et al., 2011**). Improving quality of MAP is considered number-one of all nurses' priorities and the heart of health strategy to provide error-free medication therapy (**Keers, Williams, Cooke, & Ashcroft, 2013**).

Medication errors prolong hospital stays by 2 days and increase the costs by \$2,000-\$2,500 per patient (**Vazin, Zamani, & Hatam, 2014**). In addition to weakening the patients' confidence in medical services, MEs also impose substantial costs between US\$ 6 billion and US\$ 29 billion per year (**WHO, 2014**). Medication administration errors is defined as "any dose of medication that deviates from the physicians' medication order written on the patients chart, manufacturers' preparation/ administration instructions or relevant institutional policies" (**Shawahna et al., 2016**).

The rates of nursing MEs are high in both developed and developing countries (**Lisby, Nielsen, Brock, & Mainz, 2010**). Medication errors rates in hospitals are higher in pediatric departments and ICUs than elsewhere (**Thomas & Taylor, 2014**). Although MEs can be caused by all members of health care team; nursing MEs are the most common. The reason is that nurses execute the majority of medical orders and spent up to 40% of their hospital time in the MAP (**Cheragi et al., 2013**).

Prevalent MEs include administration at inappropriate times, committing errors in prescription of medication, overprescribing, failure to follow the proper prescription, drug concentration error, and giving medication to the wrong patient due to improper identification of the patient (**Cloete, 2015**). According to **Cheragi et al. (2013)**, it's impossible to find accurate number of MEs in the third world and developing countries due to lack of reporting system and proper archiving.

Clearly, the errors of medication are a significant and growing problem in health care settings. Enhanced understanding of some associated factors, such as the hospital unit and nursing shift, on which the error occurred, might assist nursing administrators to identify common patterns and improve nursing care, ensure patient safety, and reduce hospital costs. Better organizational system then could be designed and implemented to reduce the potential MEs (**Mohamed & Gabr 2010**).

**The Aim of the Study:** The aim of this study was to assess CCNs knowledge and practices regarding MAEs in ICUs at MUH.

• **Research questions:**

Q1) What is the level of knowledge that the CCNs have about MAEs?

Q2) What is the level of practice that the CCNs perform regarding MAEs?

## 2. SUBJECTS AND METHODS

### Research Design

A descriptive research design was used in the current study.

### Study Setting

This study was carried out at four ICUs at MUH, namely Anesthesia, Stroke, Neuro-surgical, and Cardio-thoracic ICU.

### Subjects:

A purposive sample of 50 CCNs regardless of their educational levels in the above mentioned settings who had at least 6 months of experience in the ICU and provided direct care for critically ill patients was recruited in the current study.

### Data Collection Tools

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

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**Tool I: Critical Care Nurses' Knowledge Questionnaire about MAEs:**

This tool was consisted of 2 main parts to assess CCNs knowledge regarding MAEs as following

**Part (1) Nurses' Socio Demographic Characteristics:** it was developed by the researcher. This part consisted of nurses' age, gender, marital status, education level, types of work shifts, years of experiences in ICU and attending training program related to MAEs.

**Part (2) Critical Care Nurses' Knowledge Questionnaire Regarding MAP:** this part was adopted from Al-Shara (2011) to assess CCNs knowledge regarding MAP. The questionnaire sheet consisted of 53 questions in form of multiple choice questions. This sheet included eight parts. The scoring system classified as follows; one grade was given for the correct answer and zero for the incorrect, missed or unknown answers. The total score was computed out of (60) =100%, and considered into two categories as follows satisfactory total score equal or more 75% ( equal or more than 45 points ), while the score less than 75% ( less than 45 points ) considered unsatisfactory.

**Tool II: Critical Care Nurses' MAEs Observational Checklist:**

This tool was constructed and developed by the researcher after review the related literature (**Emergency Care Research Institute (ECRI), 2008; WHO, 2016**) for evaluating CCNs practices about MAEs. It consisted of 3 main broad categories and it included 98 practice items. It was carried out three times apart for each nurse during MA to patients in the previous ICUs (Pre-administration, during administration, and post- administration phase of medication), then the mean of three observations was calculated. The scoring system was distributed as follows; complete done step took two grades, incomplete one took one grade and incorrect/not done was took zero grade. The total score of practice was 240 points and considered as follows: unsatisfactory practice level less than 85% (less than 204) and satisfactory practice level equal or more than 85% (equal or more than 204).

**Validity and Reliability of the Tools**

Content validity of tools was revised and ensured by a panel of five experts (one professor from Medical Surgical department, Faculty of Nursing at Mansoura University, one from Critical Care and Emergency Nursing department Faculty of Nursing at Mansoura University, two professors from Intensive Care department Faculty of Medicine at Mansoura University and one statistician professor from Faculty of Medicine at Mansoura University) who reviewed the English and Arabic tool for clarity , understanding and the applicability of the developed tools. The overall reliability of the tools was tested using Cronbach's Alpha test in SPSS (Statistical Package of Social Science) version 21 on sample of 50 subjects and found to be ( $r = 0.949$ ) for knowledge part and ( $r = 0.879$ ) for practice part.

**Pilot study**

A pilot study was done on 5 subjects to test feasibility and clarity of the tools. Based on the results of the pilot study, necessary modifications were done accordingly prior to data collection. Some items have been rephrased to be clear and understood. The subjects included in the pilot study were excluded from the whole study sample.

**Ethical Consideration**

Ethical approval was obtained from the research ethics committee of the Faculty of Nursing at Mansoura University. Permission to conduct the study was obtained from the hospital administrative authority after explaining the study aim and nature. The participation of the CCNs in this study was voluntary; each participant was informed about the nature, purpose, procedure and benefits of this study. Participants were assured that they have the right to withdraw from the study at any time without any rational.

**Data Were Collected in Two Phases****Phase I: Preparatory phase**

It was concerned with constructing, testing and piloting different data collection tools. In addition the managerial arrangements were made to conduct the current study. Once the necessary permission was obtained to do the proposed study: nurses who agreed to participate in the study were interviewed individually by the researcher to explain the nature and purpose of the study.

**Phase II: Implementation**

Data were collected from September to March 2017 during all three shifts, (morning, evening and night) and according to CCNs schedule predetermined. Once the necessary permission was obtained to do proposed study: nurses who agreed to participate in the study were interviewed individually for 10-15 minutes by the researcher to fill part I of tool I which included socio demographic characteristics, and assess knowledge of CCNs about MAEs by using part II of tool I that completed by each nurse through 20\_30 minutes time one, then the researcher checked each questionnaire items to be sure that there were no missing.

Critical care nurses' practices were evaluated through using tool II which include the observational checklist to assess CCNs practices about MA. It has been observed by the researcher three times apart during MA to patients in the previous ICUs, and then the mean of three observations was calculated. The observational checklist for MA was completed by the researcher in 30\_35 minutes for every nursing personal.

**Data Analysis**

All statistical analyses were performed using the SPSS version 21. Qualitative data were described using numbers and percentage. However, quantitative data were described using median, mean and standard deviation. The comparisons were determined using Student's t-test for variables with continuous data while Chi-square test was used for comparison of variables with categorical data. The correlations were tested using the correlation coefficient test. Statistical significance was set at  $p < 0.05$ .

**3. RESULTS**

**Table 1** represents characteristics of the studied sample, the age of the studied samples ranged between 25 and 35 years with a mean age of  $(25.34 \pm 2.047)$ . The majority of CCNs were female (86.0%). Regarding marital status more than three quarters of CCNs were married (74.0%). Concerning the level of education, more than half of CCNs were bachelor degree (54%) and more than three quarter of them (80%) have experience years ranged between 5 and 10 years with mean years of experience of  $(4.05 \pm 4.51)$ . Finally all of them (100%) didn't attend training programs regarding MA.

**Table 2** shows percentage distribution of total satisfaction score level of CCNs knowledge regarding MAP as indicated from this table, that nearly to total of studied nurses have a satisfactory level of knowledge regarding high alert medication (98.0%), the majority of them have satisfactory level regarding storage of medication and MEs ( 84.0% and 82.0% respectively). As regards medication documentation and medication order more than three quarters of the studied nurses have got a satisfactory level of knowledge (78.0% and 74.0% respectively). On the other hand the majority of the studied nurses have an unsatisfactory level of knowledge regarding medication calculation (88.0%) and nearly half of them have an unsatisfactory level of knowledge regarding medication preparation.

**Table 3** shows that more than two-thirds of the studied CCNs had an unsatisfactory level of practice regarding the pre-administration phase of medication, administration phase of medication and post-administration phase of medication (64.0%, 68.0% and 70.0%) respectively. On the other hand, more than one-third of the studied CCNs have a satisfactory level of practice regarding the pre-administration phase (36%).

**Table 4** reveals that there is no significant statistical correlation existed between total knowledge scores and total practice scores of nurses.

**Table 1: Socio-demographic characteristics of the studied sample (n=50)**

Variable	No.=50	%
<b>Age</b>		
< 25	16	32.0
25 to 35	24	48.0
>35	10	20.0
	Mean $\pm$ SD	$25.34 \pm 2.047$
<b>Gender</b>		
Male	7	14.0
Female	43	86.0

<b>Marital Status</b>		
Single	11	22.0
Married	37	74.0
Divorced	2	4.0
<b>Level of education</b>		
Diploma	12	24.0
Institutes of nursing	11	22.0
Bachelors	27	54.0
<b>Years of working experience in ICU</b>		
<5	4	8.0
5 to 10	40	80.0
>10	6	12.0
Mean ±SD 4.05 ±4.51		
<b>Attending training programs/ workshops/scientific conferences regarding medication administration</b>		
No	50	100.0
yes	0	0.0

**Table 2: Frequency and percentage distribution of total satisfaction score level of CCNs knowledge regarding MAP (n=50)**

Items	Satisfactory		Unsatisfactory	
	Number	percentage	Number	percentage
'Medication error	41	82.0	9	<b>18.0</b>
Medication order	37	74.0	13	<b>26.0</b>
Medication calculation	6	12.0	44	<b>88.0</b>
Medication preparation	29	58.0	21	<b>42.0</b>
Medication administration	35	70.0	15	<b>30.0</b>
High alert medication	49	98.0	1	<b>2.0</b>
Documentation	39	78.0	11	<b>22.0</b>
Storage	42	84.0	8	<b>16.0</b>
Total knowledge of the studied sample	37	74.0	13	<b>26.0</b>

**Table3: Frequency and percentage distribution of total satisfaction score level of CCNs practices regarding MAP (n=50)**

Item	Satisfactory		Unsatisfactory	
	No.	%	No.	%
Pre-administration	18	36.0%	32	<b>64.0%</b>
During administration	16	32.0%	34	<b>68.0%</b>
Post administration	15	30.0%	35	<b>70.0%</b>

**Table 4: Correlation between total knowledge and practice**

Variable	Total Knowledge score				χ <sup>2</sup>	P
	Satisfactory		Unsatisfactory			
	No	%	No	%		
Total practice score						
Satisfactory	2	5.4%	1	7.7%	0.089	0.765
Unsatisfactory	35	94.6%	12	92.3%		

#### 4. DISCUSSION

Medication errors can have serious and costly consequences, such as increased patient lengths of stay, additional medical interventions, serious harm, or even death (Restelli, Taylor, Cochrane & Noble, 2017). In the current study, the majority of the studied nurses were females. This finding could be interpreted in the light of the fact that the majority of nurses in Egypt are females and their number are still greater than male in the nursing field until ten years ago. Moreover, most of the studied sample carrying Bachelor nursing degree and married. In relation to age and years of experience, nearly half of the nurses their age ranged between 25- 35 years and having more than 5 years of working experiences in the ICU. This finding agreed with Abusaad and Etawy (2015), who assessed MAEs at Children's University Hospital and revealed that the majority of nursing staff were females, and more than half of them aged between 25-35 years old, more than three quarters of them were married, more than half of them carrying bachelor degree, and most of them had from 5 to 10 years of working experiences in ICU .

As regard to attending training programs, workshops or scientific conferences and years of experience regarding MA, the result of this study showed that, all of the CCNs under the study didn't attend training programs, workshops or scientific conferences regarding MA. This may be due to lack of in-service training program in spite of the training courses for nurses about MA safety that are very important to improve their performance. This is consistent with Sulosaari et al. (2015), who reported and confirmed that training and education were identified as major drivers for the safe, competent and punctual administration of medication and it was crucial for nurses to undertake the necessary training to keep the level of their knowledge and technical skills of MA up to date.

Concerning the total level of CCNs knowledge about all aspects of MAP. The result of this study revealed that most of CCNs had satisfactory level regarding MAP in ICU. This may be due to having bachelor degree in nursing.

Based on the result of the current study, it was found that, the majority of the studied CCNs had a satisfactory knowledge regarding High alert medication, storage, MEs and medication documentation and had unsatisfactory knowledge regarding medication calculation. One possible factor that may explain this finding that course of mathematics and metric system safety weren't incorporated in nursing curriculum and weren't practiced by nurses in clinical practice. This point of view is supported by A study conducted by Lu et al. (2013), who assessed nurses' knowledge of high alert medications before and after educational program and showed that the intervention group scored higher post-test scores than pre-test.

On the same line , the result of this study is consistent with Sherriff, Burston, and Wallis (2012), who reported that statistical data and research studies show that many nurses are insufficient skilled in medication calculations. Also Wheeler et al. (2012) reported that nurses' mathematical competency in medication administration was unsatisfactory and improving this can be achieved by a practical educational program.

On the other hand, this study was contradicted with Sallam (2016) who conducted a study entitled" nurses' performance regarding administration of high alert medication" which showed that 62.5% of nurses had unsatisfactory level of knowledge. .

Concerning the total level of CCNs practice regarding MAEs in ICU, The result of this study revealed that most of CCNs had unsatisfactory level of practice regarding the pre – administration phase of medication, administration phase of medication and post administration of medication. Several factors that may have relevance to this finding are lack of orientation program prior to work in ICU , increased number of patients , inadequate staffing , nurses' work load, inadequate communication between nurses and physicians, and absence of updating courses regarding MA. Unavailability of nursing guidelines books, lack of in-service training courses and lack of job description, all of these contributed to unsatisfactory practice of CCNs regarding MA in ICU. This is consistent with Rothschild et al. (2005), who stated that performance level failure were judged as skill-based slips and lapses knowledge-based mistake, rule-based mistake, or unable to be determined.

Furthermore, these results were consistent with Sneck et al.(2015), who demonstrated lack of nurses' medication practical skills emphasized by a study done by Hanafi (2012), entitled" Knowledge, attitudes and practice of nurse regarding adverse drug reaction reporting which showed that, practice of nurses aren't satisfying.

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Clearly, CCNs must understand that the mistakes are signs of safety problems exist, not that a nurse is doing a bad job. The mistake should be viewed as an opportunity to learn why the error occurred and how to prevent similar errors that others may make in the future.

### 5. CONCLUSION

Based on the findings of the current study, it can be concluded that most of the studied CCNs have an unsatisfactory practice level regarding MAP which has statistically significant negative effect on exposing critically ill patients to MEs and consequent complications.

### 6. RECOMMENDATION

Based on the results of the current study, the following recommendations for a safer MAP are suggested:

- a) Assessment of MEs should be done periodically.
- b) Periodic training of nurses and nurse managers on aims, benefits, and processes of MEs reporting through lectures, projects, simulation methods, practice and other didactic measures in special medication errors' fields (e.g. medication calculation skills, distractions/interruptions).
- c) A designed in-service training program about MA either in the computer for easy use or in a written policy for the unit must be offered.

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