

Assessment of Critical Care Nurses' Performance Regarding Intravenous Medication Safety

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Abstract: Medication administration is a task inherent in the scope of practice for nurses, which places nurses at significant risk for experiencing a medication error. Intravenous medication is administered directly into a patient's vein, thus initiating a rapid systemic response. **Aim:** This study aimed to assess critical care nurses' performance regarding intravenous medication safety. **Design:** A descriptive exploratory research design was utilized in the study. **Sample:** A convenient sample of 60 adult nurses from both genders who worked in the intensive care units. **Setting:** Data were collected from the Intensive Care Units at El Fayoum University Hospital. **Tools:** Two tools were used for data collection (1) Administered Questionnaire of Nurse's Knowledge. (2) Observational Checklist. **Results:** This study revealed that, 78.3% of the studied nurses had unsatisfactory level of knowledge regarding intravenous medication safety, while 86.7% had incompetent level of practice regarding intravenous medication safety. **Conclusion:** The study concluded that the majority of nurses had incompetent practice and unsatisfactory knowledge regarding intravenous medication safety, while there was statistically significant relation between total nurses' level of knowledge and total nurses' level of practice regarding intravenous medication safety. **Recommendation:** The study recommended that the importance of in-service training courses which include continuous educational and training programs for nurses about the knowledge ,clinical and administrative procedures for intravenous medication safety and establish hospital protocols and guidelines for intravenous medication safety in Arabic and English language to be readily accessible for physicians, pharmacists and nurses.

Keywords: Critical Care Nurses, Performance, Intravenous Medication Safety.

1. INTRODUCTION

Medication safety is an issue worldwide. It is estimated that more than half of all medicines over the world are prescribed, dispensed or sold inappropriately. Nearly two third of medication in intensive care unit are given by intravenous route, leading to a greater risk of errors due to miscalculation of doses and improper medication administration (Nguyen, et al., 2016).

The Intensive Care Unit brings together high-risk patients and interventions in a complex environment. Critically ill patients are prescribed twice as many medications as patients outside of the ICU. Most medications in the ICU are administered as weight-based infusions. These infusions require mathematical calculations and frequently are based on estimated weights increasing the risk of error (Abukhader, 2015).

Nurses are responsible for preparing and administering potent drugs that affects the patient's cardiovascular functions. Nurses should be competent enough in medicine administration to prevent medication errors. Each nurse should be aware of indication, action, contraindications, adverse reactions and interactions of drugs. Nurses are working at the sharp end of practice, in that they monitor patients and carry out most of the ordained therapies and nursing care (Altun, Cinar & Barin, 2016).

Significance of the study

Medication administration to patients is a part of clinical nursing practice with high risk of errors occurrence. So to help nursing staff to safeguard their practice from any errors have to make them knowledgeable then this will make them able to solve any problems that face them through their practice, decrease the errors and increase the ability to take a correct decision at a correct time (Gorski, 2018).

The issue of medication safety was highlighted by the institute of medicine (IOM). It was estimated that unintentional errors caused 44, 000 to 98, 000 deaths per year making them at least the 8th leading cause of death in US (Alsarawan, 2014)

Aim of the Study

The study aimed to assess critical care nurses' performance regarding intravenous medication safety.

Research questions:

1. What is the nurses' level of knowledge regarding intravenous medication safety?
2. What is the n nurses' level of practice regarding intravenous medication safety?

2. SUBJECTS AND METHODS

Technical design

The technical includes design, setting, subjects and tools for data collection.

- **Research design:**

A descriptive exploratory research design was utilized in this study.

- **Setting:**

The study conducted in the intensive care units at El Fayoum university hospital. It consists of 3 units; cardiac care unit, surgical intensive care unit and medical intensive care unit , the cardiac unit containing 10 beds, the surgical ICU containing 10 beds and the medical ICU containing 22 beds.

- **Subjects:**

A convenient sample of 60 adult nurses from both genders were working in the intensive care units (the Cardiac Care Unit (20), the Medical Intensive Care Unit (20) and Surgical Intensive Care Unit (20).

Tools for data collection are:

The investigator used two tools to collect the data during the study:-

Tool I. Self-Administered Questionnaire of Nurse's Knowledge: which developed by the investigator based on literature review and divided into two parts:

1. Part I: Nurses' demographic Characteristics which developed by the investigator based on literature review such as age, gender, years of experience, educational qualification, patient ratio to nurse , in which unit they belong, marital status and training courses.

2. Part II: Questionnaire Of Nurse's Knowledge: it was used to assess nurse`s knowledge regarding intravenous medication safety. It was consisted of 8 subtitles. General pharmacology was 11 questions, medication orders was 4 questions, calculation and measurement was 3 questions, medication preparation was 6 questions, medication administration was 10 questions, intensive care unit and high alert medication was 10 questions , medication documentation was 3 questions and medication storage was 4 questions.

Scoring system: Self-Administered Questionnaire of Nurse's Knowledge was scored as the following: 1 for correct and zero for incorrect answer. The evaluation of the nurse's knowledge was calculated according to:

- Unsatisfactory less than 60%
- Satisfactory from 60 %:100%

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Tool II: Observational Checklist: This divided into two parts:

1. Part I: used to assess nurse's practice regarding medication rights which was adopted from Joint Commission International (JCI, 2017). It was consisted of 10 questions: right patient, right medication, right dose, right route, right time, right reason, right Education and Information, right history and assessment, right documentation and right response.

2. Part II: it used to determine the adherence of Intravenous Medication Safety practices regarding the medication safety. It was adopted from (Muzio, et al., 2016). Which consisted of 7 questions: wash hands before preparing therapy, prepare therapy in a dedicated room, use personal protective equipment during the preparation and administration of IV drugs, take vital signs before and after administration of vasoactive drugs, check the rate of infusion of solutions for IV administration, discard materials in dedicated containers after administration and perform a double check to verify the correct correspondence between prescriptions, preparation and, administration of IV drugs before administration.

Scoring system:

The observational checklists were scored according Rating scale (1 for done and zero for not done). The evaluation of the nurses' practice level was calculated according to:

- Incompetent (<70%)
- Competent (>70%)

Operational design:

It includes the preparatory phase, content validity of the developed tool, pilot study and field work.

A. The Preparatory phase:

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

Ethical consideration:

The ethical research considerations in this study included the following:

- Ethical approval was obtained from the Scientific Ethical Committee of Helwan University before starting the study.
- The investigator clarified the objective and the aim of the study to nurses included in the study.
- The investigator assured maintaining anonymity and confidentiality of subject`s data.
- Nurses were informed that they were allowed to choose to participate or not in the study and they had the right to withdraw from the study at any time without giving any reason.
- Confidentiality was maintained on all data collection forms by using codes to identify participants instead of names or any other personal identifiers.

Content validity:

Content validity was conducted to determine whether the tool covers the aim. The tools were revised by a jury of 5 experts: Associate professors and Lecturers of medical surgical nursing from faculty of nursing, Helwan University. Helwan University who reviewed the content of the tools for comprehensiveness, accuracy, clarity, relevance and applicability, minor modification were done.

Reliability:

Reliability of the tools was tested to determine the extent to which the questionnaire items are related to each other. The Cronbach's alpha model which is a model of internal consistency was used in the analysis (value throughout the implementation phases are (0.835, 0.669) respectively. Statistical equation of Cronbach's alpha reliability coefficient normally ranges between 0 and 1; higher values (more than 0.7) denote acceptable reliability.

B. Pilot study:

A Pilot study was carried out with 10% of the sample under study to test the applicability, clarity and efficiency of the tools. Nurses in the pilot study were included in the study sample.

Field Work:

- To carry out the study an approval was obtained from the hospital director and nursing director.
- A letter was issued to them from the Faculty of Nursing Helwan University, explaining the aim of the study in order to obtain permission and cooperation to conduct the study.
- Only code numbers were used and no names appeared. On the sheets the data collection was accomplished throughout the following phases:

First phase: The investigator interviewed the nurses and explained the aim of the study. They were assured that information collected would be treated confidentially and it would be used only for the purpose of research. Only codes numbers were used and no names appeared. The knowledge assessment questionnaire was distributed to all respondents' nurses and the investigator was offered clarification, whenever confusing questions raised. The average time of filling the questionnaire was 35- 45 minutes.

▪ **Second phase:** The investigator filled in the observational checklists in the morning and afternoon shifts during actual nurses' work. Nurses were observed while providing the care to the patients. Each nurse was observed three times and the mean was taken. The observational checklist was completed by the investigator in 30-35 minutes for every nursing personnel. It was done for nurses in the different intensive care units. This process took six months, from April 2019 until the end of September 2019.

Administrative design:

An official permission was obtained from at El Fayoum University Hospital Medical Director to the Nursing Director. A letter was issued to them from the faculty of nursing; Helwan University explains the aim of the study to obtain the permission for data collection. The nurses included in the study were informed about the aim of the study, an oral permission was obtained from them and confidentiality was assured.

Statistical design:

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 25, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, which describe a categorical set of data by frequency, percentage or proportion of each category, comparison between two groups and more was done using Chi-square test (χ^2). Correlation between variables was evaluated using Pearson's correlation coefficient (r). Significance was adopted at $P < 0.05$ for interpretation of results of tests of significance (Dawson & Trapp, 2001).

3. RESULTS

Table (1): Frequency and Percentage Distribution of Demographic Characteristics of the Studied Nurses, (n=60).

Item	No	%
Age (years)		
- 20 - < 30	59	98.3
- ≥ 30 - < 40	1	1.7
Mean \pm SD	24.8500 \pm 2.80330	
Range	14	
Gender		
- Male	23	38.3
- Female	37	61.7
Qualification:		
- Nursing diploma	2	3.3

- Technical institute	49	81.7
- Bachelor	9	15
Marital status		
- Married	19	31.7
- Single	41	68.3
Years of experience		
- 1: < 5 years	59	98.3
- ≥5: 10 years	1	1.7
Working setting		
- CCU	20	33.3
- MICU	20	33.3
- SICU	20	33.3
Patient ratio nurses		
- One patient	1	1.7
- Two patients	57	95
- Three patients	2	3.3
Mean ± SD	2.0167 ± 0.22487	
Range	2	
Training course		
- No	60	100

Table (1) represents that (98.3 %) of the studied subject was at age group 20-< 30 years with mean 24.8500 ± 2.80330 , most of them were females (61.7%), and singles (68.3%) and (81.7%) with technical institute degree. The studied subject was equally distributed among the three targeted units (33.3%). 98.3 % of the studied nurses had years of experience equal to 1- <5 years. No one gave history of taking a training course about medication safety. The main patient to nurse ratio was 2:1 as reported by (95%) of the nurses with mean 2.0167 ± 0.22487 .

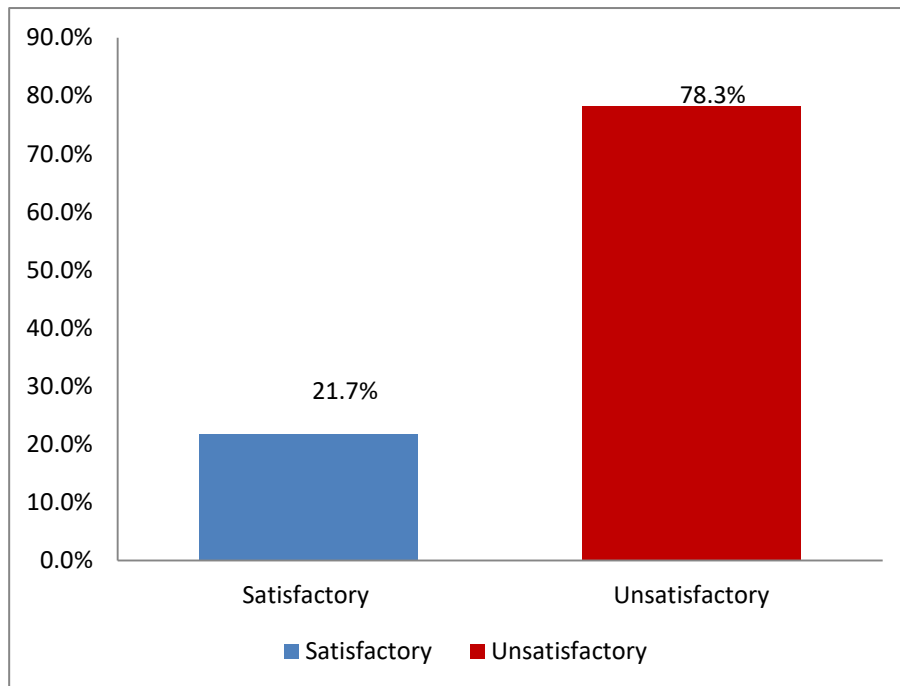


Figure (1): Percentage Distribution of Total level of knowledge for the Studied Nurses (n=60)

Figure (1) shows that, (21.7%) of the studied nurses had satisfactory knowledge regarding medication safety, while (78.3%) of them had unsatisfactory knowledge regarding medication safety.

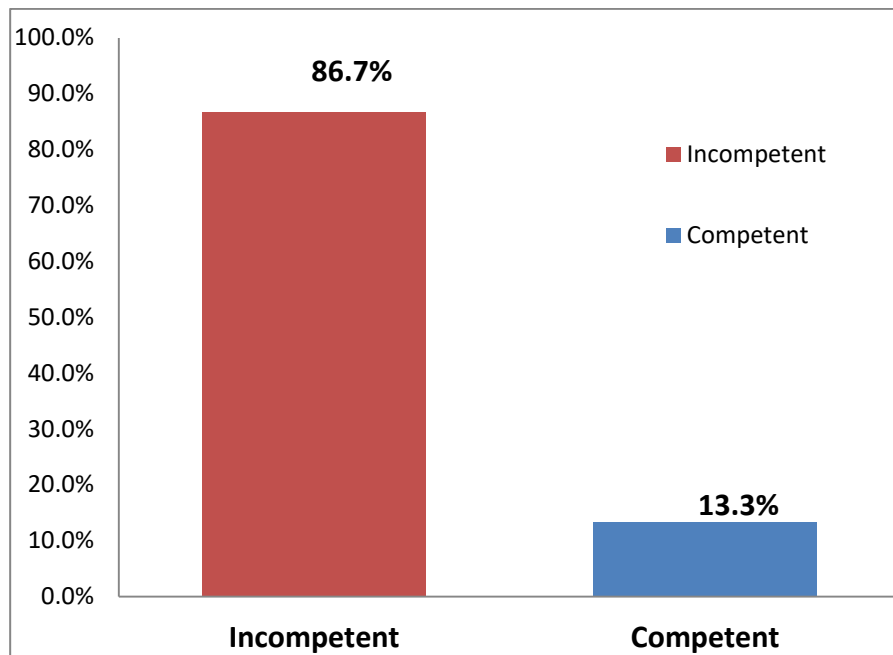


Figure (2): Percentage Distribution of Total level of practice for the Studied Nurses (n=60)

Figure (2) shows that (86.7 %) of the studied nurses had incompetent practice regarding medication safety, while (13.3 %) of them had competent practice regarding medication safety.

Table (2): Relations between Total Knowledge score of the Studied Sample and their Demographic data

Demographic data	Total knowledge score of the studied sample (n= 60)			
	Un satisfactory		Satisfactory	
	No.	%	No.	%
Age(years)				
- 20 - < 30	46	97.9	13	100
- ≥30 - < 40	1	2.1	0	0
χ^2	0.281			
P value	0.596			
Gender:				
- Male	21	44.7	2	15.4
- Female	26	55.3	11	84.6
χ^2	3.697			
P value	0.055			
Qualification:				
- Nursing diploma	1	2.1	1	7.7
- Technical institute	39	83	10	76.9
- Bachelor	7	14.9	2	15.4
χ^2	0.993			
P value	0.609			
Marital status				
- Married	9	19.1	10	76.9
- Single	38	80.9	3	23.1
χ^2	15.708			
P value	0.000 *			
Experience				
- 1: < 5 years	46	97.9	13	100
- ≥5: 10 years	1	2.1	0	0
χ^2	0.281			

P value	0.596			
Working setting				
- CCU	7	14.9	13	100
- MICU	20	42.5	0	0
- SICU	20	42.5	0	0
χ^2 P value	33.191 0.000 *			
Patient ratio nurses				
- One patient	1	2.1	0	0
- Two patients	45	95.8	12	92.3
- Three patients	1	2.1	1	7.7
χ^2 P value	1.235 0.539			
•No training course	47	100	13	100
χ^2 P value	- -			

*Significant (P<0.05)

Table (2) shows that there was no statistically significant relation between total nurses' knowledge and their demographic characteristics except for marital status and working settings.

Table (3): Correlation between Total Knowledge Scores and Total Practice Scores of the Studied Sample regarding medication safety (n=60).

Variables	Total knowledge scores	
	R	P
> Total practice Scores	0.492	0.000 *

*Significant (P<0.05)

r= Pearson Correlation Coefficient

Table (3) shows that there was statistically significant relation between total nurses' knowledge and their practice.

4. DISCUSSION

Intravenous (IV) medication is administered directly into a patient's vein, thus initiating a rapid systemic response. It is a complex process usually requiring the preparation in the clinical areas before administration to the patient (Johnson, Vaughans & Hicks, 2018).

The result considering gender of the studied nurses, the present study showed that more than half of them were female. From the investigator's point of view, this might be due to there are a large number of female nurses than males in nursing profession. This result was consistent with Shahin (2019), which about "Improving intravenous medication administration and reducing medication errors among critical care nurses at Jordan University Hospital "reported that more than half of the nurses were female.

As regards to age of the studied nurses, the present study showed that, mean age in the majority of the studied nurses were aged between 20 to < 30 years old. This result was inconsistent with Alsarawan (2014), which about "Medication Errors: Nurse's perception of Main Types and Leading Factors, and Reporting Attitudes in North West Bank Governmental Hospitals" found that, majority of the studied nurses were age 39 years old.

In relation to marital status, the study result showed that, two third of the studied nurses were single. From the investigator's point of view, this might be due to the majority of the studied nurses were aged between 20-30 years old. This finding is inconsistent with Ebrahem & Elnagar (2016), which about" Impact of Nursing Intervention Regarding Medications Errors on the Level of Psychiatric Nurses' Practice" reported that the majority of the nurses were married.

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Concerning total nurses' knowledge regarding intravenous medication safety, this study finding revealed that, majority of nurses had unsatisfactory level of knowledge. From the investigator's point of view, this might be due to lack of in-service training courses. This result was in accordance with **Johari, et al. (2013)** which about " Medication Errors among Nurses in Government Hospital" reported that more than half of the nurses had unsatisfactory level of knowledge.

Concerning total nurses' practice regarding intravenous medication safety in ICUs, this study finding revealed that, most of nurses had incompetent practice regarding to intravenous medication safety. From the investigator's point of view, this might be due to lack of nurses' knowledge which reflects on their performance, lack of orientation program prior to work in ICU. Adding to shortage of the nurses staff especially bachelor nursing leading to work overload in these units. Moreover, unavailability nursing guideline books, lack of in-service training courses and lack of job description, all these contributed to incompetent practice level of nurses regarding intravenous medication safety in ICUs. This is consistent with **Abo El-Ata, et al. (2019)**, entitled "Nurses' Performance Regarding Administration of Inotropic Medications for Critically Ill Patients"" which revealed that most of nurses had unsatisfactory level of practice.

The finding of the present study revealed that there was statistically significant relation between nurses' knowledge and their working setting. This might be due to the fact that, the natural of work between each units. This result is inconsistent with **Ltheeth & Ahmed (2017)**, which about " Effectiveness of an Educational Program on Nurses' Knowledge Concerning Medication Error at Teaching Hospital in AL-Nasiriyah City " reported that there was no statistical significant association between nurses' work place and their knowledge

Concerning the relationship between nurses' practice and nurses' knowledge, the current study illuminated that there was a highly positive correlation between nurses' practice and nurses' knowledge. Also, this result was in some degree of agreement with **Hassan & Ahmed (2012)**, a study entitled "Patient Safety: Assessing Nurses' Compliance" showed that, there were statistical significant correlation between Level of education and total scores of nurses' safety practices regarding the administration of high alert medications.

5. CONCLUSIONS

On the light of the current study results, the following can be concluded:

More than two thirds of the studied nurses had unsatisfactory knowledge regarding intravenous medication safety, while the majority of them had incompetent practice regarding intravenous medication. Moreover, there was statistically significant relation between total nurses' knowledge and total nurses' practice regarding intravenous medication safety. As well as there was no statistically significant relation between total nurses' knowledge and their demographic characteristics except for marital status and 'working setting. Also there was no statistically significant relation between total nurses' practice and their demographic characteristics.

6. RECOMMENDATIONS

Based upon results of the current study, the following recommendations were suggested:

- Provide importance of in-service training courses which include continuous educational and training programs for nurses about the knowledge, clinical and administrative procedures for intravenous medication safety.
- Establish hospital protocols and guidelines for intravenous medication safety procedure in Arabic and English to be readily accessible for physicians, pharmacists and nurses.
- Establish an electronic medication system to every unit for delivering basic knowledge on medications.

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