

Assessment of The Nurse Interns' Medication Administration Safety Performance

Asmaa S. Ahmed¹, Harisa M. A. Elshimy², Samah F. Fakhry³

¹Department of Nursing Administration, Faculty of Nursing, Ain Shams University, Egypt.
e-mail: dr.asmaa.ahmed@nursing.asu.edu.eg

²Department of Nursing, Administration, Faculty of Nursing, Ain Shams University, Egypt.
e-mail: harisa_elshimy@yahoo.com

³Department of Nursing, Administration, Faculty of Nursing, Ain Shams University, Egypt.
e-mail: dr.samah.faisal@nursing.asu.edu.eg

Received June 5, 2020, accepted September 10, 2020.

doi: 10.47104/ebnrojs3.v2i4.171

ABSTRACT

Contents: Medication administration is an integral part of delivering quality nursing care. The nurse intern should follow the specific guidelines to enhance their medication administration safety.

Aim: The study aims to assess the nurse intern's medication administration safety performance.

Methods: The study was conducted at Ain Shams University Hospitals using the descriptive design on 90 nurse interns by using three tools, namely, medication administration knowledge questionnaire, the observational checklist for nurse interns' safety performance, and Medication Administration safety Attitude Rating Scale.

Results: Findings of the study revealed that the minority of nurse interns (4.3%) had satisfactory total knowledge, 39% had adequate total practice, and around two-thirds of them (62.6%) had a positive attitude.

Conclusion: It is concluding that the nurse interns had unsatisfactory knowledge of the medication administration safety, and their related practices are mostly inadequate, although the attitude tends to be high. The study recommended that nurse internship programs emphasize medication administration safety knowledge and practice, focusing on identified gaps and deficiencies. Further research is proposed to assess the effect of training strategies on the nurse intern's medication administration safety.

Keywords: Medication administration, nurse interns, safety performance

1. Introduction

The reality that medical treatment can harm patients is one that the healthcare community has had to discuss over recent years. In particular, adverse events associated with medication appear among the chief causes of this harm while patients reside in hospitals and are known to be responsible for a large proportion of hospital admissions (Kongkaew *et al.*, 2013). Every nurse administers an average of 10 medications for every hospital patient every day (McLeod *et al.*, 2014).

Preventable adverse drug events (ADEs) occurring during the medication use process in hospitals are associated with an additional length of stay and healthcare costs (National Coordinating Council for Medication Reporting and Prevention {NCCMERP}, 2015). Prescribing and drug administration appear to be associated with the most significant number of medication errors (MEs), whether harm is caused or not (Keers *et al.*, 2013; McLeod *et al.*, 2014). Patient safety is a crucial aspect in the care of the patients and one of the dimensions to determine the quality of care (Sorra *et al.*, 2016). Medication errors have been identified as one of the most common types of errors affecting patient safety, ranging from 42 to 59% of all medical errors (Getnet and Biftu, 2017).

The Medication Administration Process (MAP) is, predominantly, a nursing responsibility that has been estimated to consume approximately 40% of nursing practice time (Huynh *et al.*, 2016). The MAP has become increasingly complex due to escalating patient acuity, numerous generic and trade medication names, expanded medication delivery routes, increased use of new and diverse medication safety technologies, and an increased number of medication orders. The lack of standardization of the MAP is also a key contributing factor in medication administration complexity (Pirinen *et al.*, 2015)

To reduce Adverse Drug Effects (ADEs), health care leaders and organizations have updated safety principles and practices, i.e., how errors are examined, understood, and addressed (Jeffs *et al.*, 2015; Keiffer *et al.*, 2015; O'Byrne *et al.*, 2016; Dante *et al.*, 2016). System approaches and analyses to reduce medication errors and ADEs include strategies such as electronic health records (EHR), computer physician order entry (CPOE), barcode medication administration systems (BCMA), and structured prescribing forms. Despite these strategies, ADEs, and more specifically, medication errors, have remained a common occurrence (Chenot and Daniel, 2010; Donaldson *et al.*, 2014).

One explanation for the lack of effectiveness in these system-level strategies is a lack of focus on the nursing role in medication errors. Approximately one-quarter to one-third of medication errors occur at the administration phase.

¹Corresponding author: Asmaa Saber Ahmed

Medication administration is almost solely under the bedside nurse's purview (Armstrong et al., 2017).

Focusing on nurses' knowledge, attitudes, and skills with updated safety concepts may provide insight into the design and implementation of effective system- and nurse-level interventions to minimize medication administration errors MAEs. Nurses need to recognize the challenges they face when administering medications to their patients. Because nurses consistently administer medications, they are well-positioned to prevent medication errors. Nurses must be prepared to catch their errors and the errors of healthcare providers, pharmacists, and others in the chain of medication administration (Choo et al., 2010).

The internship year is considered a transition from undergraduate nursing students to the beginning level registered nurses. During the internship year, nurse interns should acquire the values, attitudes, and goals fundamental to the nursing profession (Saintsing et al., 2011). At the beginning of the internship year, many nurse interns feel uncomfortable and inadequate as their skill levels do not match their expectations of the role and responsibilities of practicing as a registered nurse. During the internship year, nurse interns are expected to work in intensive care units (ICUs) under experienced, knowledgeable supervisors (Ruff, 2011).

2. Significance of the Study

The nurse internship program is a critical period because it facilitates the nurse intern's transition from theory to practice and prepares them to take responsibility for their performance. However, the researchers observed that nurse interns had inadequate medication administration performance by the intramuscular and oral route that led to medication errors. This finding might be due to limited knowledge and skills in actual clinical situations. So, the current study aims to assess the nurse intern's medication administration safety performance.

In Egypt, there are many studies conducted to assess medication administration errors by nurses. The study, which was done by (Mosa 2016) on nurses' application of safety measures related to Medication administration in medical-surgical departments at Naser City Hospitals. The most common errors during medication administration in preparing and administering medication by different routes. Also, the study of (Abu al-Majd,2002) investigates the relationship between the worksite and medication errors in Assiut University Hospitals. It was found that there were 87.0% errors in medication administration.

3. Aim of the study

The study aims to assess the nurse intern's medication administration safety performance.

4.Subjects & Methods

4.1. Research design

A descriptive design was used in carrying out this study. Descriptive research is a type of research that describes a population, situation, or phenomenon that is

being studied. It focuses on answering how, what, when, and where questions of a research problem, rather than the why (Nieswiadomy, 2009).

4.2. Research setting

The study was conducted at Ain-Shams University Hospitals (Ain Shams Medical Hospital, El-Demerdash Surgical Hospital, Pediatric Hospital, Cardiovascular Hospital), where nurse interns have their training in an internship program. In Ain Shams Medical Hospital, nurse interns have their training in four settings, namely stroke Intensive Care Unit (ICU), Coronary Care Units (CCU), neurological ICU, and endemic ICU. In El-Demerdash Surgical Hospital, they have their training in three surgical ICUs. Their training in the Pediatrics University Hospital included neonatal ICU, surgical ICU, and medical ICU. Lastly, in the Cardiovascular Hospital, they have their CCU training, pediatric ICU, and adult ICU.

4.3. Subjects

Study populations are nurse interns enrolled in the internship year 2018-2019. The sample size was 90 nurse interns out of 240. This number was calculated by a Relative Risk (RR) of 2.0 at a 95% confidence level and 80% study power and accounting for about 20% expected dropout rate using the Open-Epi computer software program. The subject of this study was selected randomly by using a simple random sample technique.

4.4. Tools of the study

The researchers used three tools to collect the necessary data concerning the medication administration process: A medication administration knowledge questionnaire, an attitude rating scale, and an observation checklist for nurse intern's safety performance.

4.4.1. Medication Administration Knowledge Assessment Questionnaire

This tool was developed by the researchers based on a literature review *Institute of Safe Medication Practice [ISMP] (2017); Potter and Perry (2016); Medication Management Standards (2020)*. It was intended to assess nurse interns' knowledge of medication administration. The tool consisted of two main parts as follows.

Part 1: This was for collecting data about the nurse interns' characteristics, such as age, gender, marital status, residence, pre-university education, and previous training.

Part 2: It aimed to assess the nurse intern's knowledge regarding the safe medication administration process. It consisted of 40 MCQs grouped under sections reflecting the 4 phases of medication administration, namely general, pre-, during-, and post- medication administration guidelines.

General guidelines (12 questions): e.g., administering the medication must be based on a medication order, medication order elements, and performance of the third checks before medication administration.

Pre-medication administration stage (15 questions): e.g., medication preparation must include mixing and

calculating of medication, the unacceptability of pre-pouring medication, and the problem with mixing of medications.

During medication administration stage (8 questions): e.g., who is the person assigned to give medication order according to pharmacy manufacturer, the crucial points to be followed by the nurse involved in cosmetic procedures, and when the prescribed prn medication can be given.

Post-medication administration stage (5 questions): e.g., the precautions that should be followed for proper handling with waste and sharp objects, observing the patient for any medication reaction, and the meaning of Over The Counter (OTC) Medication.

Scoring system

For each knowledge question, a correct answer had a score "1" and the incorrect "0." These scores were converted into percent scores. The nurse intern's knowledge was considered satisfactory if the percent score was 60% or above and unsatisfactory if less than 60%.

4.4.2. Medication Administration Safety Attitude Rating Scale

This tool was developed by the researchers based on a related literature review of *the World Health Organization (2017); Institute for Safe Medication Practices [ISMP], (2015); Australian Commission on Safety and Quality in Health Care (2009)*. It was used to assess nurse interns' attitudes toward medication administration safety. The tool consisted of 21 items with a five-point Likert scale. They are grouped under three phases: pre-, during-, and post-medication administration.

Pre-medication administration (6 statements), e.g., "I think that performing an independent double-check before administering medication is a necessary task." "I think it is essential for a nurse intern to attend training to be competent in medication administration", and "I see a nurse intern who prepares the medication should be the one who administers it."

During- medication administration (10 statements), e.g., "I feel unable to gain control of the critical situation during medication administration," "I feel confident in my skills during medication administration," and "I see it is vital to use aseptic technique."

Post- medication administration (5 statements): e.g., "I think the documentation of medication errors leads to decreased punishment," "It is essential to care for medication after medication administration," and "the nurse intern has to care for equipment after medication administration."

Scoring system

The responses ranged from "strongly agree" to "strongly disagree" scored from 5 to 1, respectively. The scoring was reversed for negative statements so that a higher score indicates a positive attitude. The nurse intern's attitude was considered positive if the percent score was 60% or higher and negative if less than 60%.

4.4.3. Medication Administration safety Observation checklist

This tool was developed by the researchers based on a pertinent literature review (*Institute for Safe Medication Practices (ISMP), 2017; Potter and Perry, 2016; Mohamed, 2004*). This tool consisted of

It was intended to assess nurse interns' practice of medication administration phases. It consisted of 2 main checklists, one for oral and another for IM medication administration, which were the main routes of administering medication by the nurse intern during their training.

4.4.3.1. Oral Medication Administration checklist

This part consisted of 23 items with several sub-items covering the 3 phases of the safe medication administration process.

Pre-medication administration (7 items and their sub-items): e.g., assess patient condition, take informed verbal consent before administering medication, and prepare equipment.

During-medication administration (8 items): e.g., identify the patient by using at least two patient identifiers, remain with the patient until nurse intern ensure that each medication is swallowed, never leave the medication at the patient bedside, and assist the patient to a comfortable position.

Post-medication administration (8 items): e.g., observe the patient for the therapeutic effect of medication and any reaction according to the medication type, record any reaction to the medication, and collect all equipment.

4.4.3.1. Intramuscular Medication Administration checklist

This checklist involved 26 items grouped under the 3 phases of medication administration as following.

Pre-medication administration (7 items and their sub-items): e.g., check ten medication rights, prepare medication from vial/ampoule by appropriate techniques, perform hand hygiene, and wear gloves.

During- medication administration (11 items): e.g., inject the medication with appropriate technique, gently and quickly remove the needle, and apply gentle pressure.

Post- medication administration (8 items): e.g., discard the uncapped needle in the sharp box, wash hands, and record any medication reaction.

Scoring system

Each item observed to be done was scored "1" and "0" if not done. These scores were converted into percent scores. The nurse intern practice was considered adequate if the percent score was 60% or higher and inadequate if less than 60%.

4.5. Procedures

The operational design had included three stages preparatory stage, pilot study, and fieldwork.

Preparatory stage: In this stage, the researcher has reviewed the current and past, national and international related literature and theoretical knowledge of various aspects of the study using books, articles, periodical journals to develop the study tools. The data collection tools were prepared during this phase. They were presented to experts for the assessment of their face and content validity. The jury group who performed validation consisted of seven experts: Two professors of Nursing Administration and two professors of Medical-Surgical Nursing at the Faculty of Nursing, Ain Shams University, in addition to two professors of Nursing Administration at the Faculty of Nursing, Cairo University, and one professor of Nursing Administration at the Faculty of Nursing, Tanta University.

Before carrying out the study work, permission to conduct this study was granted from each department's head. Additionally, individual oral consent was obtained from each participant in the study.

The reliability of the attitude scale was assessed by testing its internal consistency. It proved to be highly reliable with Cronbach's alpha coefficient of 0.81. As for the observation checklists, their reliability was assessed using the inter-rater agreement method. This assessment was done by the researcher and a trained colleague using the same checklist and independently observing the same nurse intern at the same time. The reliability proved to be high with 100% agreement.

The pilot study aimed to examine the clarity of the tools' language and applicability and their relevance to the study. It also helped to estimate the time needed for filling the questionnaires and the feasibility of the research process. This pilot study was conducted on nine nurse interns representing about 10% of the study sample. Necessary modifications were established in the form of re-wording and re-phrasing of some items. Those participants in the pilot study were excluded from the main study sample.

Ethical considerations: Before the study's actual fieldwork, ethical approval was obtained from the Scientific Research, and Ethical Committee of Nursing Faculty at Ain Shams University. Besides, verbal approval was obtained from each participant. They were assured about anonymity, confidentiality, and the right to withdraw from the study would be guaranteed.

The actual fieldwork started at the beginning of September 2018 after securing all official permissions. It was completed by the end of November 2018. The researchers were collected the data by themselves by meeting the nurse interns in their training areas. Then,

explaining the aim of the study and methods of filling out the questionnaires. The time needed to fill the observation checklists by the researchers ranged from 25 to 30 minutes, while the filling of knowledge questionnaire by nurse interns ranged from 20 to 25 minutes and the attitude scale from 10 to 15 minutes. The data were collected four days per week, from 10: am to 3: pm.

4.6. Data analysis

Data entry and statistical analysis were done using SPSS 20.0 statistical software package. Data were presented using descriptive statistics in frequencies and percentages for qualitative variables and means and SDs and medians for quantitative variables. Cronbach alpha coefficient was calculated to assess the developed attitude rating scale's reliability by testing its internal consistency. Fischer's exact test was used instead of Spearman rank correlation for assessing the interrelationships among quantitative variables and ranked ones to identify the independent predictors of the knowledge, attitude, and practice scores. statistical significance was considered at p-value ≤ 0.05

5. Results

The study sample consisted of 90 nurse interns whose ages ranged between 21 and 25 years, median 22.0 years, as presented in Table 1. The majority were females (64.4%), with the majority being single (85.6%). More than half were residing in urban areas (53.3%) and had previous work training (52.2%).

Figure 1 displays that most nurse interns in the study sample came from general pre-university high school education (84.4%).

Table 2 indicates that the minority of nurse interns (4.3%) had satisfactory medication administration knowledge, and 95.7% had unsatisfactory knowledge about medication administration.

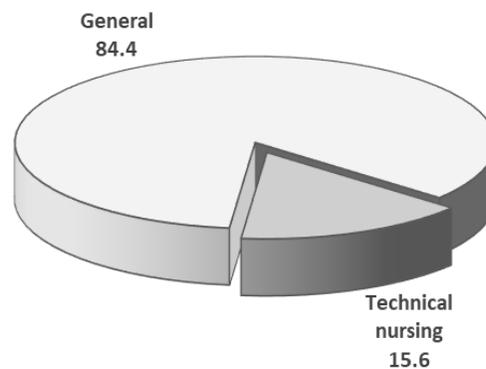
Table 3 indicates more than half of them (62.6%) having a positive attitude towards medication administration safety practice.

Table 4 demonstrates that around two-thirds (60%) of nurse interns had inadequate total safety practices.

Table 5 demonstrates a statistically significant weak positive correlations between nurse interns' attitude scores and their scores of knowledge and practice. It also shows that the knowledge and practice scores had a moderate positive correlation ($r=0.604$). Meanwhile, age was not correlated to any of these scores.

Table (1): Frequency and percentage distribution of the nurse interns' characteristics (n=90).

Personal characteristics	Frequency	Percent
Age		
21-22	58	64.4
23+	32	35.6
Range		21.0-25.0
Mean±SD		22.5±0.8
Median		22.0
Gender		
Male	32	35.6
Female	58	64.4
Marital status		
Single	77	85.6
Married	13	14.4
Residence		
Urban	48	53.3
Rural	42	46.7
Previous work training		
No	43	47.8
Yes	47	52.2
Training duration (months)		
Range		0.0-8.0
Mean±SD		1.7±1.9
Median		1.0

**Figure 1: Percentage distribution of the studied nurse interns by type of pre-university education (n=90).****Table 2: Frequency and percentage distribution of nurse interns' total knowledge of medication administration safety (n=90).**

Knowledge items	Satisfactory		Unsatisfactory	
	No.	%	No.	%
General medication administration	0	0.0	90	100
Premedication administration	0	0.0	90	100
During medication administration	3	3.3	87	96.7
Post medication administration	12	13.3	78	86.6
Total knowledge of medication administration	3.8	4.3	86.2	95.7

Table 3: Frequency and percentage of nurse interns' total attitude towards medication administration safety practices (n=90).

Variables	Positive		Negative	
	No.	%	No.	%
Premedication administration	62	68.9	28	30.1
During medication administration	33	36.7	57	63.3
Post medication administration	74	82.2	16	17
The total attitude of medication administration	56	62.2	34	37.7

Table (4): Frequency and percentage of nurse interns' total medication administration safety practices (n=90).

The practice of safe medication administration	Adequate (60%+)		Inadequate (60%-)	
	No.	%	No.	%
Oral				
Premedication	21	23.3	69	76.7
During	37	41.1	53	58.9
Post-medication	16	17.8	74	82.2
Total oral medication	25	27.8	65	72.2
Intramuscular injection				
Premedication	35	38.9	55	61.1
During	90	100.0	0	0.0
Post-medication	12	13.3	78	86.7
Total IM medication	45	50	45	50
Total medication administration	35	38.9	55	61.1

Table (5): Correlation matrix of nurse interns' scores of knowledge, attitude, and practice and their age.

Variables	Spearman's rank correlation coefficient		
	Knowledge	Attitude	Practice
Knowledge			
Attitude	r 0.184*		
Practice	r 0.604**	r 0.191**	
Age	r 0.013	r -.012	r -.044

(**) Statistically significant at $p < 0.001$. (*) Statistically significant at $p < 0.01$.

6. Discussion

Successful internship programs should be those in which teaching, and learning are provided to help the new graduate nurse transition from novice to advanced beginner who can demonstrate acceptable performance and cope in real situations (Al-mahmoud et al., 2013). The administration of medication to patients is one of the significant tasks in nursing responsibilities. Although nurses might have acquired knowledge during their studies, they must keep abreast of new developments during their internship training. Such an assessment of the current situation of nurse interns' knowledge and practice will help in matching internship training with interns' needs (Van Camp & Chappy, 2017; Brook et al., 2019).

The present study was carried out to assess the nurse intern's medication administration safety performance. The results indicated that most nurse interns had unsatisfactory knowledge, inadequate practices, and a positive medication administration attitude toward safe medication administration practice.

The study sample consisted of the randomly selected nurse interns enrolled in the internship program of the academic year 2018/2019. They represent the nurse interns' population in all national programs, with an average age of 22 years, and mostly unmarried, given that the age at marriage is gradually increasing, especially among the highly educated and the professionals. It is also noticed that the percentage of male nurse interns in the sample exceeds one-third, which reflects the increasing numbers of male students enrolled in nursing school worldwide, as discussed by Schwamm (2019).

According to the current study findings, most of the nurse interns had unsatisfactory knowledge of medication administration. This finding was noted in all areas of knowledge tested. Such deficiency might be attributed to the learning style and educational system in most schools and universities, where learning is mainly dependent on recall. In such a system, the acquired knowledge fades out quickly. Thus, the nurse interns would undoubtedly forget most of the knowledge they have acquired during their study years. Congruently, a study in Saudi Arabia revealed that the recall of knowledge was influenced by the educational system and learning styles (AlMohanna et al., 2018).

The forgoing present study finding is consistent with Elsayed (2013), whose study in intensive care units at Ain Shams University hospitals reported that most of the studied nurses had unsatisfactory knowledge regarding medication order, preparation, administration, storage, and documentation. On the same line, Alsulami et al. (2019) founded that nurses had insufficient knowledge of the definition of medication and types of medication errors in a study conducted in Saudi Arabia. Similarly, low levels of medication knowledge were shown among Ethiopian (Abdela et al., 2017), Egyptian (Abd Eltwab, 2018), and Spanish (Escriva Gracia et al., 2019) nurses.

However, and in disagreement with these present study findings, Johari et al. (2013) revealed that most nurses had good medication knowledge. Similarly, Zakria and El sayed (2017), in a study made in Egypt, reported that most nurses under the study had sufficient knowledge regarding general pharmacology, medication order, preparation, administration, and high alert medication. Such

discrepancies among various studies may reflect differences in the educational systems and the continuing nursing education programs in these studies' setting.

Unlike knowledge, the present study results demonstrate that around three-fourth of the nurse interns had a positive attitude toward medication administration safety. This finding indicates that most of these nurse interns are convinced of their crucial role in safe medication administration and are willing to fulfill this role despite their deficient knowledge. A similarly high percentage of nurses having a positive attitude towards medication administration and open to adopting new medication preparation approaches were revealed by *Küing et al. (2019)* in a study in Germany.

On the same line, *Johnson and Thomas (2103)* stated that most nurses had a positive attitude towards safe medication administration and avoided errors. Additionally, *Di Muzio et al. (2016)* reported that most nurses positively responded to medication administration's safety management.

The present study results concerning nurse interns' attitudes are congruent with the results reported by *Elsayed (2013)*, who stated that only one-fourth of the nurses in intensive care units at Ain Shams University hospitals had a negative attitude regarding medication administration.

The present study has also targeted nurse interns' practices of safe medication administration. The results indicate that the majority of them had an inadequate practice of medication administration. This result might be due to lack of knowledge, lack of facilities, lack of supervision, lack of experience, fear of blaming and punishing, and lack of training programs related to medication administration.

Regarding nurse interns' practice during administration, the current study's findings generally indicated high percentages of unacceptable oral and IM administration practice. However, specific necessary steps were practiced by only a minority of them. One of these steps not practiced by most nurse interns, is identifying the patient by using at least two patient identifiers. This finding might be because the facility does not offer different types of identifiers in routine medication administration. In congruence with this, a study in the United States revealed that although a small percentage of the nurses failed to comply with the two patient identifiers in medication administration, this was associated with medication errors (*Bicket et al., 2017*).

7. Conclusion

The study concluded that most nurse interns in the study had insufficient knowledge, inadequate practice, and a positive medication administration attitude.

8. Recommendations

Given the main study findings, the following recommendations are proposed.

For practice

- Adopting national and international medication administration guidelines to be implemented in nursing internship programs.

For education

- Nursing internship programs should emphasize medication administration knowledge and practice with more focus on identified gaps and deficiencies.

Further research

- Assess the effect of training strategies on the nurse intern's medication administration safety.

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