

Nurses' Competence Level toward High Alert Medications in Critical Care Units: Designed Nursing Protocol

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Abstract

Background: Nurses' competencies related to high alert medications include their knowledge of these drugs, its indications, contraindications, side effects and interactions with other drugs. Nurses have to be able to accurately calculate dosages and administer medication using the correct route and technique. **Aim of the:** This study was carried out to assess nurses' competence level toward high-alert medications before and after application of the designed nursing protocol. **Design:** One group quasi-experimental research utilized to fulfill the aim of this study. **Sample:** All critical care nurses on duty regardless of their personal data were included (n=67 nurses). **Settings:** present study was conducted in five critical care units including (trauma ICU, coronary care unit, medical intensive care unit, urology ICU and nephrology ICU) at Minia university hospitals. **Tools of data collection:** Data was collected through utilization of two tools. **First:** Demographic data sheet of nurses. **Second:** Competence level evaluation tool. The second tool was consisting of three parts: first part was knowledge assessment domain, second part was observational checklist (practice domain) and third part was attitude assessment domain. **Results:** The studied nurses had significant differences in knowledge, practice and attitude levels toward HAMs at pre and post the application of a designed nursing protocol. **Conclusion:** Based on the results of this study, the designed nursing protocol about HAMs improved nurses' knowledge, practice and attitude toward HAMs. **Recommendations:** Greater attention and frequently evaluation of nurses' competence level toward HAMs should be maintained by continuous in service training and replication of this study should be done on a larger sample in different CCUs.

Keywords: Critical care units, High alert medications, Nursing competence, & Nursing protocol

Introduction

High alert medications" (HAMs) refers to drugs with a higher risk of hazardous reactions when accidentally administered to patients in the emergency room (ER) & intensive care units (ICUs). Each step of the medicine administration process needs to be done with great attention (Subbaiah et al., 2021) and (Schepel, 2018).

Intensive care unit nurses (ICU nurses) are considered the corner stone of the health care team as they help to ensure patient safety by enhancing patient outcomes, lowering morbidity and mortality, and minimizing complications, mistakes, and overall expenditures. So that, critical care nurses must be aware of the indications, contraindications, and monitoring measures of HAMs (Chapuis et al., 2019) & (Marshall et al., 2017).

The development of educational strategies that aim to reduce errors involving HAMs assumes knowledge of the complexity of the drug use system and takes into account that all health care professionals should be involved in the outline of interventions that seek patients' safety. Previous studies have highlighted the need for training nurses by focusing on pharmacological knowledge about HAMs (Zakaria and Mohamed, 2017).

Significance

More than half of the prescriptions of medication in intensive care units (56.6%) contained two or more high-alert medications and almost all were injectable (95.4%), mainly opioid analgesics (31.2%), glucose 50% (24.7%) and regular insulin (24.3%) (Maia et al., 2020).

Shaji et al., (2017) reported that, 42 percent of avoidable adverse drug events (ADEs) in one research of ADEs conducted in six hospital units were linked to the use of several sedatives. Insulin and the anticoagulant warfarin are

thought to be responsible for more than a quarter of all estimated hospitalizations and one in every seven adverse medication events handled in emergency rooms.

Aim of the study:

Assess nurses' competence level toward HAMs before and after applying the designed nursing protocol.

Research Hypothesis

1. Nurses' competence level (knowledge domain) will be increased significantly after implementation of designed nursing protocol
2. Nurses' competence level (practice domain) will be increased significantly after implementation of designed nursing protocol.
3. Nurses' competence level (attitude domain) will be more positive after implementation of designed nursing protocol.
4. There will be relationship between nurses' competence domains (knowledge, practice and attitude).

Subjects and Methods

Designed nursing protocol:

The designed nursing protocol in this study include updated knowledge, necessary practice and needed positive attitude in handling high alert medications.

Study design

Quasi experimental research design (One group pre & post-test) was utilized.

Setting:

- The current study was carried out at five critical care units including; Trauma Intensive Care Unit, Coronary Care Unit, medical care unit, Urology Intensive Care Unit and Nephrology Intensive Care Unit at Minia University Hospitals.

Sample:

All critical care nurses on duty and willing to participate was involved (n=67 nurses).

Operational definition:

Nurses' competence level:

Nurses Competence level intensive study including nurses knowledge, practice and attitude regarding high alert medications that most commonly used in predetermined setting.

High alert medications:

The categories of HAMs frequently used in selected areas of the present study and included ; antiarrhythmic drugs & concentrated electrolytes; anticoagulant & thrombolytic drugs; antiepileptic drugs; opioids, insulin; nitroglycerin and adrenergic drugs.

Data collection tools:-

Tool (I): Nurses' demographic data include their name, age, gender, marital status, qualification, working unit, years of experience, and current position in critical care unit, nurse /patient ratio and previously attendance of courses about high alert medications.

Tool (II): Competence level evaluation Tool:

This tool was consisted of three parts: first part include knowledge assessment domain, second part cover practice assessment domain and third part presented attitude assessment domain.

First part: knowledge assessment domain is divided into eight sections including general information's about HAMs, anti-arrhythmic drugs and concentrated electrolytes, thrombolytic and anticoagulant drugs, opioids drugs, insulin, adrenergic drugs, nitrates and antiepileptic drugs. Total numbers of close ended questions were 40.

Scoring system:-

- Unsatisfactory knowledge level: Less than 50%
- Satisfactory knowledge level: from 50% to 74%
- Good knowledge level: from 75% to 100%

Second part: observational check list to assess practice domain that described nurses' practice during medication administration process in all phases (preparation, administration, monitoring and documentation phase). Total number of steps is 46 steps

Scoring system:-

- Less than 75% was considered unsatisfactory practice level.
- From 75% to 100% was considered satisfactory practice level practice.

Third part: attitude assessment domain that describe nurses' attitude toward high alert medications. This part is consisting of eight items only.

Scoring system:-

- Less than 70% is considered negative attitude.
- From 70% to more than 100% is considered positive attitude.

Validity and Reliability:

To establish validity, the tools were examined by a panel of five experts in the field of medical surgical nursing staff (Minia University)

Pilot study:

A pilot study was carried out on 10 % of the sample (7 nurses) to test feasibility, objectivity and applicability.

Ethical consideration: Official permission to conduct the study was obtained from ethical committee of faculty of Nursing, Minia University Hospitals' directors and the critical care units' directors. Oral consent was obtained from each nurse after explanation of the nature and purpose of the study and informs them that they had the right to withdraw from the study at any time without any explanation; that obtained data would not be included in any further research without a second consent. Confidentiality and anonymity of each subject were ensured through coding of all data and protecting the obtained data.

Results:

Table (1): Percentage Distribution of the Study Participants regarding to their Demographic Characteristics (n=67)

Demographic Characteristics	No.	%
Age / Years		
18-30	63	94
31-45	4	6
Gender		
Male	45	67.2
Female	22	32.8
Level of Education		
Diploma	9	13.4
Technical institute	53	79.1
Bachelor	5	7.5
Working Units		
CCU	23	34.3
Trauma ICU	15	22.4
Medical ICU	7	10.4
Nephrology ICU	11	16.4
Urology ICU	11	16.4

Demographic Characteristics	No.	%
Previous Attendance of Similar Courses		
Yes	13	19.4
No	54	80.6

Table (1) presented that more than two thirds of study participants were males, vast majority of them aged between 18:30 years, graduated from technical institute of nursing and hadn't attended similar courses while one third of them was work in CCU.

Hypothesis (1) covered in figure (1).

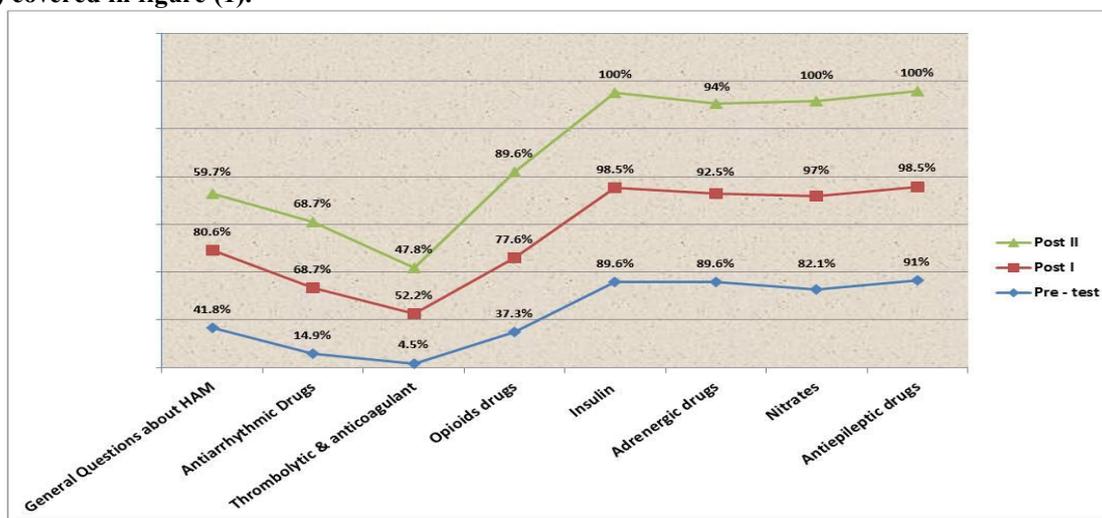


Figure (1) percentage distribution of nurses' knowledge about HAMs according to good level in pre-test, post I and post II (n=67):

Figure (1) Cleared that the least percentage of nurses that had good knowledge level before application of the designed nursing protocol was regarding anticoagulant drugs, antiarrhythmic drugs, opioids and general information about HAMs which increased to (47.8%, 68.7, 89.6% and 59.7%) respectively post application of the designed nursing protocol while the majority of nurses who had good level in knowledge domain before application of the protocol was about insulin, adrenergic drugs, nitrates & antiepileptic drugs which increased to (100%,94%, 100% & 100%) respectively post application of the protocol.

As cleared hypothesis (1) is supported by result presented in fig. (1).

Hypothesis (2) covered in table (2).

Table (2): Percentage distribution of Study Participants according to Satisfactory Level in Subtotal and Total Practice levels regarding HAMs at Pre, Post I and Post II (n=67).

Nurses' practice in all HAMs phases	Pre-application	post-one month-application	post-2 month-application	Friedman test	P value
	N (%)	N (%)	N (%)		
Preparation Phase	21 (31.3)	67 (100)	66 (98.5)	95	0.001**
Administrating phase	22 (32.8)	67 (100)	67 (100)	130	0.001**
Monitoring phase	38 (56.7)	67 (100)	66 (98.5)	58	0.001**
Documentation phase	51(76.1)	67 (100)	67 (100)	134	0.001**
Total Practice	21(31.3)	67 (100)	66 (98.5)	106	0.001**

** P- value is highly statistically significant

Table (2) presented that nurses' satisfactory practice levels increased significantly in preparation, administration, monitoring and documentation phase regarding High Alert Medications from (31.3%, 32.8% & 56.7% respectively) before application of the designed nursing protocol to (98.5%, 100% & 98.5% respectively) in post II after application of the protocol.

Table (2) supported hypothesis (2).

Hypothesis (3) covered in figure (2).

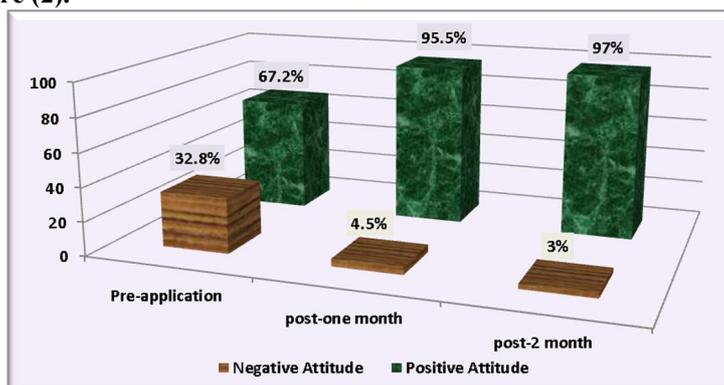


Figure (2): Percentage distributions of Nurses' Attitude regarding HAMs at Pre – test, Post I and Post II (n=67).

Figure (2) Showed that nurses' positive attitude regarding HAM improved from (67.2%) before application of the designed nursing protocol, to (95.5% & 97% respectively) in post I and post II with definite decrease in their negative attitude (32.8%, 4.5% & 3%) respectively.

Figure (2) supported hypothesis (3)

Hypothesis (4) covered in figure (3) & table (3)

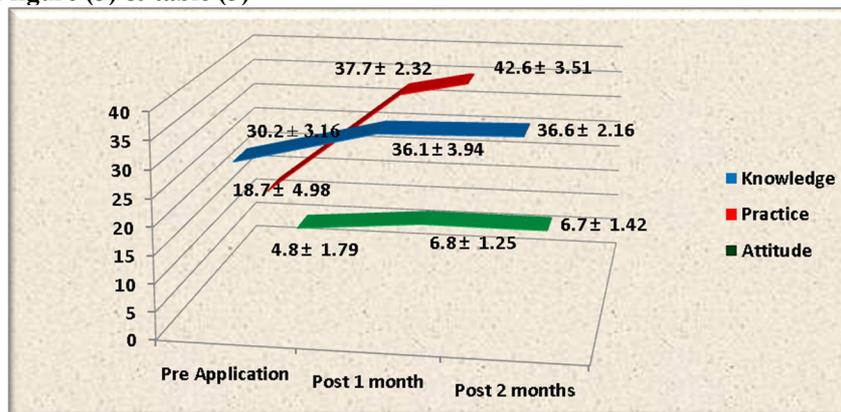


Figure (3) Mean nurses' Knowledge, Practice and Attitude Scores regarding HAM at Pre – Test, Post I and Post II (N=67).

Figure (3) demonstrated that the designed nursing protocol had prominent improvement in all nurses' competence domains regarding HAMs. This obvious in the study participants' total mean scores regarding knowledge, practice and attitude which were (30.2 ± 3.16, 18.7 ± 4.98 & 4.8 ± 1.79 respectively) before application of the designed nursing protocol & improved to (36.6 ± 2.16, 42.6 ± 3.51 & 6.7 ± 1.42 respectively) in post II after application of the protocol

Table (3) Relationship between nurses' Knowledge, Practice and Attitude Levels regarding High Alert Medication at Pre-test Post I and Post II (n=67).

	Knowledge Level								
	Pre – test			Post I			Post II		
	Uns. level	Satis. Level	Good level	Uns. level	Satis. level	Good level	Uns. level	Satis. level	Good level
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Practice									
Unsatisfactory level	1 (1.5)	31 (46.2)	21 (31.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.5)
satisfactory level	0 (0)	6 (8.9)	8 (11.9)	0 (0)	5 (7.5)	62 (92.5)	0 (0)	1 (1.5)	65 (97)
<i>Fisher exact (P value)</i>	1.71 (0.497)					0.862 (0.030*)		
Attitude									
Negative	0 (0)	15 (22.3)	7 (10.4)	0 (0)	0 (0)	3 (4.5)	0 (0)	0 (0)	2 (3)
Positive	1 (1.5)	22 (32.8)	22 (32.8)	0 (0)	5 (7.5)	59 (88)	0 (0)	1 (1.5)	64 (95.5)
<i>Fisher exact (P value)</i>	2.41 (0.271)			0.249 (0.617)			0.805 (0.041*)		

Table (3) Show that there are positive relation between nurses' knowledge level practice and attitude levels regarding HAMs with significance in post II after application of the designed nursing protocol.

Table (3) & figure (3) supported hypothesis (4).

Discussion

The majority of our study participants were between the ages of 18 and 30. This result is consistent with (Yousef et al., 2018) and (Bakr et al., 2019), findings that the bulk of the analyzed sample was between the ages of 20 and less than 30. However, studies by Abeer, Eweda, and El Sayed (2017), and Zyoud et al. (2019) revealed that less than 25% of the sample had ages under 30.

In my opinion, the fact that the majority of the study sample were recently graduated nurses who worked as bedside nurses may be related to the fact that the sort of job in these critical care units required more physically demanding tasks and required workers to be younger in order to perform more tasks with patients.

The present study revealed that more than two-thirds of the study participants were males. This result corroborated with (Zyoud et al., 2019) that showed that more than half

were males nurses. While (Abeer, Eweda and El Sayed, 2017), (Salman et al., 2020), (Yousef et al., 2018) and (Apolinario et al., 2019) noted that the majority of nurses participate in their study were female.

This result may be due to most of nursing graduates were males as this study done in Minia in Upper Egypt (EL-SAEED) and still nursing profession can be not preferred to some people.

Regarding their level of education, results found that the majority of our study participants had graduated from technical institute of nursing. On the other hand, Bakr et al., (2019) viewed that less than two-third of the sample were had technical degree of nursing.

This finding was at odds with that of (Yousef et al., 2018), which claimed that more than half of respondents had a nursing diploma. In addition, Zyoud et al., (2019) revealed that more than half of respondents had a bachelor's degree.

This may be related to All graduates of the Technical Institute of Nursing in Minia are assigned to Minia University Hospitals.

As regards the working unit, one-third of the study participants were in CCU as it can be need more staff for cardiac patient. While (Salman et al., 2020) showed that more than one-thirds of nurses were providing services in the acute & emergency departments followed by less than one-quarter were in cardiology and gynecology unit.

According to the findings of our study, the majority of the study sample had not taken similar courses. This finding is consistent with those of Apolinario et al. (2019) and Bakr et al. (2019), who also found that the majority of participants had not taken similar courses. On the other hand, this result disagreed with (Zyoud et al., 2019) said that the vast majority had HAMs training courses and got knowledge from hospital files and administrative rules. This result made us to have more attention to establish educational course about HAMs in Minia university hospitals.

The current study stated that less than five percent of nurses (4.5%) had good knowledge level regarding anticoagulant drugs before application of the designed nursing protocol. The current results consistent with El Rasheedy et al., (2019) and Mousavi et al., (2019) who stated that majority of nurses had inadequate knowledge about anticoagulant drugs. This result is changed with significant improvement in nurses' knowledge about this drugs post implementation of the protocol and this matched with (Lopez et al., 2019) who stated that there was improvement in nurses' knowledge after receiving formal training about this category of drugs.

The recent study showed that only about (14.9%) of nurses had good knowledge level regarding antiarrhythmic drugs pre-application of the designed nursing protocol which significantly improved to be (68.7%) post application of the protocol. This result was on the line with Al Shahrani et al., (2019), who found that about half of nurses had good knowledge regarding antiarrhythmic drugs post receiving educational course about this drugs

The present study stated that only one third of nurses had good knowledge level regarding opioids pre-application of the designed nursing protocol. This result supported by (Al mutairi et al., 2020) and (Al- Dosari et al., 2019) who stated that majority of nurses had poor knowledge level about opioids and safe dealing with this drugs especially morphine and its derivatives. This has changed and there was significant improvement in nurses' knowledge regarding opioids post application of the designed nursing protocol and this results was matched with (Krenz et al., 2020) who stated that there was significant improvement in nurses knowledge post receiving specialized education about this drugs.

The current study stated that the majority of nurses had good level of knowledge regarding insulin pre application of the designed nursing protocol as insulin was widely used for almost patients in different ICUs. This result agreed with Khan et al., (2019) stated that about half of nurses had adequate knowledge. The current study found that there was significant improvement in nurses' knowledge regarding insulin post application of the designed nursing protocol. This result agreed with Cheng et al., (2019) that stated there was significant improvement in nurses' knowledge regarding insulin.

The current study stated that, majority of nurses had good knowledge level regarding adrenergic drugs pre-

application of the designed nursing protocol which improved post application of the protocol as this category of drugs were commonly used for patients in life threatening conditions like cardiac arrest or during cardio-pulmonary resuscitation in different ICUs . This result agreed with Karamin et al., (2018) who stated that about half of nurses had good knowledge about adrenergic drugs.

The current study stated that there was significant improvement in nurses' knowledge regarding nitrates post application of the designed nursing protocol. This result agreed with Barnett et al., (2018) and Chaudhry et al., (2020) who stated that there was significant improvement post receiving specialized training course about safe dealing with this drugs.

The current study stated that there was significant improvement in nurses' knowledge regarding AEDs post application of the designed nursing protocol. This result agreed with Mecarelli et al., (2018) who stated that there was significant improvement post receiving specialized training about safe dealing with this drug.

As regards nurses' practice score in HAMs documentation phase the current study showed increased from (76.1%) before the application of the designed nursing protocol to (100%) post application of the protocol . This is online with (Yousef et al., 2018) who stated that nurses' practice satisfactory level in documentation phase increased from (18.2%) pre -test to (59.1%) in post II.

This can be returned to nurses' fear of medical-legal responsibility and accountability. So, they give great attention to documentation concerns.

The majority of nurses in the current study had positive attitude toward the hazards results from using HAMs in wrong manner post application of the designed nursing protocol. So, they felt a major responsibility regarding administrating this medication for patients. This study agreed with Luo et al., (2018) as they showed a significant improvement in nurses' attitudes toward medication safety after application of medication safety education.

The current study made it clear that the nursing protocol created results in a notable improvement in all areas of nurses' competence with relation to HAMs. The total mean scores for the knowledge, practice, and attitude domains of the study participants improved from (30.2 3.16, 18.7 4.98, and 4.8 1.79, respectively) before the application of the designed nursing protocol to (36.6 2.16, 42.6 3.51, and 6.7 1.42, respectively, at post II after the application of the protocol.

This is in same line with Abeer, Eweda and El Sayed, (2017) who stated that, nurses' knowledge of HAMs in general had a mean percentage score of (10.47±1.57) with a mean percentage score of (74.81±11.22). The average scores for procedures involving HAMs as a whole are (23.02 ± 2.50) with mean score percentage (39.70 ± 4.30). Additionally, Yousef et al., (2018) demonstrated that the overall knowledge score for HAMs in the pre-test and in post- test was (48± 13.6 & 86.0±5.7) respectively and total practice scores regarding HAMs was (39.7 ± 14) in pre- test and 80.0±5.7 in post- test.

According to the results of the current study, there is a statistically significant relationship between the investigated nurses' knowledge, practice, and attitude levels. The nursing protocol that was created might be very helpful and provide additional information about HAMs and their various categories, which would benefit all of the nurses' competency areas (knowledge, practice, and attitude).

The association between the nurses' competence domains (knowledge, practice, and attitude) and high alert medications is supported by numerous prior investigations, which led to the conclusion in this study. These studies (Raza et al., 2020; Wu et al., 2019; Almalki et al., 2018; Al-Rawajfah et al., 2017; and Tavares et al., 2021) found that nurses with higher knowledge levels had more positive attitudes towards the use of these medications and safer medication practices were less likely to make medication administration errors.

Conclusion

Based on the result of current study it can be concluded that: the studied nurses competence has improved post application of the designed nursing protocol and there was significant increases in their knowledge, practice and attitude regarding HAMS in all phases of administration (preparation, administration, monitoring and documentation) and also there are significant statistical positive relation between nurses' knowledge, practice and attitude.

Recommendations;

Based on the findings of the present study the researcher suggested that:

- Frequent educational and training courses are needed to elevate nurses' competencies about HAMS for nurses in all CCUs.
- Replication of the study on a large probability sample from another geographic area in Egypt to get more generalized data to improve nursing competence in all hospitals regarding safe HAMS administration.
- Establish software copy about high alert medications safety in each critical care unit and keep it to be updated annually

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