Assessment of Nurses' Performance Regarding High Alert Medications in Cardiac Care Units

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Abstract

Background: High alert medications (HAMs) are medications that have an increased risk of causing significant patient harm when used erroneously. So, staff nurses should have adequate knowledge and practices to be able to manage HAM administration process in cardiac care units. **Aim of this study:** the aim of this study was to assess nurses' performance regarding high alert medications in Cardiac Care Units.

Subjects and Methods: Research design: A descriptive research design was utilized to conduct the aim of the study. **Setting:** The study was conducted in two Cardiac Care Units in Cardiac and thoracic building at Sednawy Hospital.

Subjects: The Study sample included a convenience sample involved available nurses composed of 40 nurses working in the previously mentioned setting.

Tools of data collection: Data were collected through two main tools. A structured interviewing questionnaire for nurses and Nurses practice observational checklist.

Results: There was a highly statistically correlation between nurses' knowledge level and their practice level regarding high alert medications, with a positive correlation between them. **Conclusion**: In the light of the present study findings, it can be concluded that most of the studied nurses had total unsatisfactory level of knowledge and most of them had total unsatisfactory level of practice regarding high alert medications. Moreover there was a highly statistically significant correlation between the studied nurses' total knowledge and total practice regarding HAMs.

Recommendation: The study recommended conducting training program and workshops periodically for nurses about high alert medications to improve their performance and enhancing the patient care level and the quality of care provided to this group of patients.

Key words: Cardiac Care Units, High Alert Medications, Nurses' Performance.

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Introduction

Safe medication administration is one of the vital processes that ensure patient safety and high quality of life. Also, for many governments and international health organizations, safety is crucial as evidenced in policies governing healthcare. With respect to these policies, the aim of the global patient safety challenge on medication safety is to deal with shortcomings in the healthcare system that lead to medication errors and their consequences **(Jafaru & Abubakar, 2022).**

HAM is a medication that carries a heightened risk of causing significant harm if it is used in error. Medications classified as HAMs have a narrow therapeutic index. Medication with a narrow therapeutic index is risky because small changes in dose or drug blood levels can lead to dose- or blood concentration-dependent critical events. With HAMs, adverse events are persistent, life-threatening, permanent, and can lead to disability or death **(Chakraborty et al., 2022).**

High-alert medications represent a subset of medications that pose a heightened risk of causing substantial patient harm when used incorrectly. HAMs can be classified into many categories. The top high-alert medications are potassium, calcium, dopamine, heparin and insulin. In addition to amiodarone, digoxin, epinephrine, norepinephrine, fentanyl, morphine, phenytoin and propofol. Additionally, sedatives such as chloral hydrate and narcotics/opioids (oral, transdermal, and IV), including liquid concentrates, formulations with both rapid and prolonged release, neuromuscular blockers such as succinylcholine **(Han et al., 2022).**

Nurses play a pivotal role in ensuring the safe administration and regulation of HAMs, as they are responsible for assessing patient needs, administering medications safely, and monitoring for adverse reactions. However, inadequate knowledge of HAMs among nurses often leads to medication errors with severe consequences for patients. Patient safety encompasses the recognition, analysis, and management of patient-related risks and occurrences to make patient care safer and prevent patient harm **(Aly et al., 2023).**

Significance of the Study

HAMs carry high risk for adverse drug effects if the administered dose and way of administration were wrong such as intravenous inotropic medications infusion presents a high risk for errors in their administration like myocardial ischemia and may induce hypotension in some cases. Apart from metabolic, cardiovascular and dermatologic side effects, these sympathomimetic medications may result in central nervous system stimulation including, tremors, restlessness, and even confusion and psychosis **(Allawy et al., 2020).**

It is estimated that a hospitalized patient is exposed to one adverse event from HAMs daily. In addition, The Institute of Medicine (IOM) Committee on Identifying and Preventing Medication adverse events estimated that at least 1.5 million preventable adverse drug events (ADEs) occur each year in the United States **(Yousef et al., 2018).** In Egypt, the Egyptian Medication Errors Reporting System disclosed that the most frequent high alert medications complications were from extra dose, dose and medication negligence. The most prevalent high

alert medications error occurred during prescription 54%, administration 16%, wrong dose 20% **(Mohamed & Abdalla, 2022)** So, this study was conducted to assess nurses' performance regarding high alert medications in Cardiac Care Units.

Aim of the study:

The aim of the study was:

The present study aimed to assess nurses' performance regarding high alert medications in Cardiac Care Units.

Research questions:

1) What is the nurses' knowledge about high alert medications?
2) What is the nurses` practice while administrating high alert medications in cardiac care units?

Subjects and Methods:

The subject and methods of the current study discussed under the following four (4) designs:

I. Technical Design

II. Operational Design

III. Administrative Design

IV. Statistical Design

I. Technical design

Research design:

A descriptive design was used to conduct this study.

Setting:

The current study was conducted in two Cardiac Care Units at Sednawy Hospital in Cardiac and thoracic building. CCU (B) is located at 3rd floor of cardiac and thoracic building, Sednawy Hospital and CCU (A) is located at 4th floor in the same building. Each CCU contained of 10 beds, 3 mechanical ventilators, 10 monitor for each bed. Also, each CCU contained of 2 Electrocardiography devices and one emergency car.

Subject:

A Convenient sample of available nurses 40 nurses (22 nurses in CCU (A) and 18 nurses in CCU (B)) were working at the previously mentioned setting.

Tool for data collection:

In order to fulfill the aim of the study two tools were used to collect necessary data:

Tool I: Nurses' knowledge regarding HAMs self- administered questionnaire sheet: It was used for collecting the data for this study. It consists of two main parts:

This questionnaire was designed in simple clear Arabic language to avoid misunderstanding. It was developed by the researcher after reviewing of related literatures. **(Daif-Alla et al., 2019); (Yousef et al., 2018)& (Farag et al., 2017)** and opinions of experts for content of validity to assess nurses' performance regarding high alert medications in Cardiac Care Units.

Part I: Demographic characteristics of studied nurses: which were composed of seven closed ended questions covered nurses` age, gender, marital status, educational level, years of experience in nursing profession, years of experience in cardiac care units and the previous attendance of training courses related to high alert medications.

Part II: Nurses` knowledge assessment questionnaire: It was used to assess nurses' knowledge regarding high alert medications; it was designed by researcher in Arabic form to avoid misunderstanding and applied as pre and post implementation of instructional module, as well as in the follow up phase. It consisted of five sections which included (113) questions in the form of multiple choice questions (MCQ).It was covered the following sections:

Section I: Nurses` knowledge regarding general questions about high alert medications. It was composed of (8) MCQ questions about definition of HAM, drugs are considered high-risk, common mistakes when giving HAM, avoid mistakes when dealing with similar HAM, storing high alert medications, oral order about HAM in emergency, nurses role when giving HAM and the role of nursing towards the storage of high alert medications.

Section II: Nurses` knowledge regarding Inotropic drugs (adrenaline, noradrenaline, dopamine and digoxin). It was composed of (40) MCQ questions about types of Inotropic drugs, purpose of inotropic drugs, method for injecting inotropic drugs, side effects, other name for adrenaline, uses of adrenaline, complications of adrenaline, methods of adrenaline administration in cases of cardiac arrest, Excessive use of adrenaline can lead to, first dose of medication to start during the cessation of heart contraction, what is noradrenaline, the alternative name for noradrenaline, uses of noradrenaline, drugs that may enhance diuresis, nurses do when giving noradrenaline etc,……..

Section III: Nurses` knowledge regarding potassium chloride and calcium chloride. It was composed of (23) MCQ questions about nursing action, precautions when giving potassium chloride, normal range of potassium level, treat excess potassium, potassium chloride a high-alert drug , nursing intervention, symptoms, contraindications to potassium chloride, considered before giving potassium chloride, side effects of potassium chloride, diuretics, normal range of calcium, uses of calcium, contraindications of calcium, route, precautions, symptoms of excess calcium, symptom in hypocalcaemia, vitamins, role.

Section IV: Nurses` knowledge regarding anticoagulants. It was composed of (14) MCQ questions about cases should not be given anticoagulants, nursing action, sentences are true about heparin, instructions, signs and symptoms, conditions in which anticoagulant therapy is used, contraindications, complications, laboratory tests, drugs interact with anticoagulants, drugs increase the effect of anticoagulant, precautions, heparin should not be given intramuscularly, right thing to do if you forget to give a dose of anticoagulant drugs on time.

Section V: Nurses` knowledge regarding sedatives and opioids. It was composed of (28) MCQ questions about indications, sedatives affect blood pressure, side effects, action, medicines should be given slowly and carefully, medication produces adverse effects, rate at which sedative drugs are given, conditions requires careful attention, symptoms of withdrawal, side effects of sedatives, right action if the patient has a weak pulse, role of the nurse before giving any sedative, signs and symptoms of allergy to sedatives, time of assessing the patient's pain level, the most serious side effect of opioids, most important nursing diagnosis occur to a patient receiving opioid, patient`s evaluation before administer morphine, opioids considered high alert drugs, common warning signs and symptoms of opioid or intravenous drug addiction, side effects when using opioids such as nalofen, correct action before giving the patient an anesthetic drug such as morphine, most important vital signs which must be observed when giving any opioid medication, frequency of vital signs measurements when administer any opioid, frequency of assess patient consciousness level under influence of opioids, drugs can increase the concentration of morphine, serious symptoms that can occur when treatment with tramal and antidote medication to the effects of morphine overdose.

Scoring system:

The scoring system for nurses` knowledge questionnaire was 113 points (100%) graded according to the items of interviewing questionnaire. The answer of respondents (nurses) was evaluated using model key answer prepared by researcher. Each correct answer scored "one" and "zero" for incorrect answer. For each section of knowledge, the scores of the items were summed up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into percent scores was classified as the following:

< 75 unsatisfactory knowledge.

≥ 75 satisfactory knowledge

Tool II: Nurses` practice observational checklists: It was used to assess nurses' practices regarding high alert medications in cardiac care unit. It was be adapted by researcher as guided by **(ASHP, 2016), (Daif-Alla et al., 2019); (Yousef et al., 2018)& (Farag et al., 2017)** It was divided into 9 checklists of high alert medications**.**

Scoring system:

For observational checklists consisted of given score one for done step and score zero for the not done, the scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into percent scores was classified as the following:

< 80 unsatisfactory practices

≥ 80 satisfactory practices

II- Operational Design:

Preparatory phase:

This phase included reviewing literature related to the performance of nurses regarding high alert medications in cardiac care units. This served to develop the study tools for data collection. During this phase, the researcher also visited the selected places to be acquainted with the personnel and the study setting. Development of the tools was under supervisors' guidance and experts' opinions considered.

Validity and Reliability:

Content validity was conducted to determine whether the content of the tool cover the aim of the study. This stage developed by a jury of five experts, one of them professor and one assistant professors and three of them lecturers of Medical Surgical Nursing who reviewed the tool`s content for clarity, relevance, comprehensiveness, understanding and ease for implementation. Reliability of the developed tools was done statistically through Chronbach`s Alpha test to measure the internal consistency of the tool. That was 0.83 for nurse`s knowledge questionnaire and 0.91 for nurse`s practice observational checklist.

Pilot study:

A pilot study was carried out prior to data collection in order to test the clarity, applicability, feasibility, relevance of the data collection, and to identify any possible obstacles that may hinder the data collection. For this study, the researcher selected 10% of the study subjects (4 nurses) random to participate in the pilot testing of the questionnaire and checklist from CCU. Nurses involved in the pilot study were included in the study sample because of no modifications in the tools.

Fieldwork:

The actual fieldwork of this study was carried out over 6 months period started from the beginning of June 2023 till the end of November 2023. The researcher was available in the study setting three days per week in morning shift. Each nurse was interviewed individually to gather the necessary data of the study. As regards the nurses' practices, it was assessed by the researcher throughout their daily care in the study setting. The nurses were asked to give their responses according to the study tools .the required time to collect data from each nurse about 45 minutes.

III. Administrative design:

Necessary official approval to conduct the study was obtained from the Dean of the faculty of Nursing and from the director of Zagazig University Hospital before conducting the study. Then Permission to carry out the study was obtained from the head of mentioned setting after explaining the purpose of the study and a verbal consent was obtained from the nurses for participation in the study.

Ethical consideration:

An approval of the research protocol was taken from the scientific research ethics committee in the Faculty of Nursing at Zagazig University before starting the study. The researcher clarified the aim of the study and its maneuvers to the nurses to be included in the study. Each participant was informed about the right of voluntary participation and of withdrawing from the study at any time without giving any reasons. They were also, reassured about anonymity and

confidentiality of any collected data.

IV. Statistical Design:

All data were collected, tabulated and statistically analyzed using **SPSS** 20.0 for windows (SPSS Inc., Chicago, IL, USA 2011)). Quantitative data were expressed as the mean ± SD and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). **Mc nemar** test was used to compare between two dependent groups of categorical data. **Paired t-test** was used to compare between two dependent groups of normally distributed variables. Percent of categorical variables were compared using Chi-square test or **Fisher's exact** test when appropriate. ANOVA (One way analysis of variance) test was used for comparison between more than two different groups of quantitative data which were normally distributed. The student "t" test was used for comparison of means of two independent groups of quantitative data which were normally distributed. **Spearman correlation coefficient** was calculated to assess relationship between study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation. Multiple linear regression (step-wise) was also used to predict factors which affect practice score. **Cronbach alpha coefficient** was calculated to assess the reliability of the scales through their internal consistency. P-value < 0.05 was considered statistically significant, p-value < 0.001 was considered highly statistically significant, and p-value ≥ 0.05 was considered statistically non-significant (NS).

Results:

Table (1):

Shows the demographic characteristics of the studied nurses. It was found that majority of the studied nurses (80.0%) aged less than 33 years old with mean ± SD (28.82± 5.70). More than two thirds (70 %) were females and more than half (55 %) were married. Besides, less than half (42.5%) of them had technical institute education. While, most of them (92.5%) had less than ten years of experiences in the nursing profession and more than two thirds of them (70%) had less than three years of experiences in cardiac care unit. Lastly, all of the studied nurses (100.0%) didn`t attended any previous training courses regarding high alert medications.

Table (2):

Illustrates (95%, 92.5%, 92.5% 92.5%) of the studied nurses had unsatisfactory knowledge regarding General knowledge regarding HAMs, Inotropic drugs, Anticoagulants, Sedatives and opioids.

Table (3):

Shows that, (92.5%) of the studied nurses had unsatisfactory knowledge about high alert medications, while (7.5 %) of them had satisfactory knowledge about high alert medications

Table (4)

Illustrates (95%,) of the studied nurses had unsatisfactory practice scores related to adrenaline infusion, anticoagulant drugs (Heparin), sedatives and narcotics medications.

Table (5): Reveals that, (92.5%) of the studied nurses had unsatisfactory practice regarding high alert medications, while (7.5 %) of them had satisfactory practice about high alert medications.

Figure (1):

Clarifies that; There was a highly statistically correlation between nurses' knowledge level and their practice level regarding high alert medications, with a positive correlation between them.

Discussion:

Medication safety is an integral component of patient safety, aiming to prevent, detect, and mitigate adverse medication events throughout the medication use process. Despite the challenges in accurately quantifying medication errors, it is evident that they contribute significantly to patient harm and mortality rates in hospitals. **(Aziz et al., 2024).**

High-alert medications represent a subset of medications that pose a heightened risk of causing substantial patient harm when used incorrectly. These medications include neuromuscular blocking agents, chemotherapeutic agents, opiates, anticoagulants, cardiovascular drugs, electrolytes, and benzodiazepines. They are commonly used in critical care areas such as emergency departments, intensive care units, and medical and pediatric wards. Due to their potential for harm, special precautions are necessary in their administration to mitigate the risk of errors **(Aradhya et al., 2023).**

The nurse role in managing the safety of high alert medications is currently seen as one of the hardest, most complex roles in healthcare. Nowadays, little is known about what nurses are doing in practice to ensure and improve the safety of high alert medications. If nurses understanding is better, as well as her practicing, the health cares organizations are able to anticipate and solve any errors that could arise in the future. Also, they achieve many benefits regarding the patient, nurses, and heath careoutcomes **(Chen et al., 2024).**

Nurses play a pivotal role in ensuring the safe administration and regulation of high-alert medications (HAMs), as they are responsible for assessing patient needs, administering medications safely, and monitoring for adverse reactions. However, inadequate knowledge of HAMs among nurses often leads to medication errors with severe consequences for patients **(Aly et al., 2023).**

Therefore, this study aimed to assess nurses' performance regarding high alert medications in Cardiac Care Units.

The current study sample consisted of 40 nurses. who was working in Cardiac Care Units at Sidnawy Hospital. Regarding to the age of studied nurses, the result of present study showed that majority of studied nurses less than 33 years. From the researcher`s point of view, this may be related to most of nurses were newly graduated.

This result was in agreement with **(Zyoud et al., 2019)** who studied "Knowledge about the administration and regulation of high alert medications among nurses" and found that majority of studied nurses less than 33 years. On the same line, this finding supported in a study by **(Aziz et al., 2024)** "Knowledge about Administration and Regulation of High Alert Medication

among Nurses in Oncology Department" who stated that majority of the nurses in their study were ranged from 22 to 31 years. Additionally, this finding disagreed with **(Aly et al., 2023)** whose study was about "Medication safety climate: managing high-alert medication administration and errors among nurses in intensive and critical care units" and reported that majority of their studied nurse`s age was more than 30 years old.

In respect to educational level of the studied nurses in present study showed that slightly less than half of studied nurses were graduated from the technical institute of nursing. From the researcher`s point of view this might be due to the fact that technical institutes of nursing provide the health care agencies with large numbers of graduated nurses than nursing faculties as they graduated after 2 years of education. This finding was consistent with **(Farouk et al., 2023).** whose study was about" Nurses' Competence Level toward High Alert Medications in Critical Care Units: Designed Nursing Protocol" and demonstrated that half of studied nurses were graduated from technical institute of nursing. This finding was at odds with **(Shebl et al., 2020).** who conducted a study entitled "Critical Care Nurses' Knowledge and Practices Regarding Medication Administration Errors at Mansoura University Hospital", which showed that most of the studied nurses had bachelor`s degree.

Concerning years of experience in nursing profession and in Cardiac Care Unit, the study findings revealed that most of studied nurses had experience less than 10 years with the mean years of experience in nursing profession 4.70±5.21 years and more than two thirds of them had experience in CCU less than 3 years with mean 2.87±1.24. From researcher`s point of view this might be rationalized as the fact that majority of the studied nurses were newly graduated. This finding come in the line with **(Zyoud et al., 2019)** who reported in study about "Knowledge about the administration and regulation of high alert medications among nurses" that majority of studied nurses had less than10 years of experience in nursing profession and had less than 5 years of experience in ICU. Also, this result was consistent with **(Shebl et al., 2020)** who conducted a study entitled "Critical Care Nurses' Knowledge and Practices Regarding Medication Administration Errors at Mansoura University Hospital" which mentioned that majority of studied nurses had less than 10 years of experience.

This study illustrated that all of the studied nurses didn`t attended any previous training courses regarding high alert medications. From the researcher`s point of view this might be due to numerous factors, such as limited time, workload, lack of facilities, poor payment, and lack of motivation to learn or advance their practice. On the same line with **(Abd-Elrahman et al., 2022)** who studied was about "Effect of an Educational Program for nurses about High Alert Medications on their Competence" and reported that all of studied nurses didn`t attended training courses about high alert medications. But this finding is disagreed with study of **(Taslim et al., 2024)** entitled about "Comparative assessment of high-risk cardiovascular medication knowledge between practicing and student nurses" and indicated that more than half of studied nurses attended training courses.

The current work clarified that, most of the studied nurses had unsatisfactory knowledge regarding general high alert medications. In researchers' opinion, this may be because those nurses didn't receive any prior training program about high alert medications, and are

overworked due to staff nursing shortage. Consequently; they had inadequate time to enrich their critical care knowledge.

This was in agreement with **(Shittaya et al., 2019)** who studied "Performance of nurses regarding high alert medications in critical care units" showed that, most of the studied nurses had unsatisfactory knowledge regarding general high alert medications. Also, This was matched with **(Yousef et al., 2018)** who studied "Effect of nursing education guidelines about high alert medications on critical care nurses' knowledge and practices" who declared that majority of the studied nurses had unsatisfactory knowledge regarding general high alert medications.

As regard the knowledge of the studied nurses about inotropic drugs. The current study showed that, most of the studied nurses had unsatisfactory knowledge about inotropic drugs. In researchers' opinion, this may be because those nurses didn't receive any prior training program about inotropic drugs and this effect on their knowledge regarding the administration of Inotropic drugs. This result corroborated with **(Allawy et al., 2020)** whose study was about "Effect of Implementing Guidelines Regarding Administering Inotropic Medications for Critically Ill Patients on Nurses' Knowledge viewed that most of nurses in critical care units had an unsatisfactory knowledge regarding inotropic drugs.

In addition to supporting the study result with **(Diaa et al., 2023)** in the study entitled "Nurses' Awareness Regarding Patients' Safety Receiving Vasoactive Medication in Critical Care Units" which concluded the most of the studied nurses had incorrect knowledge.

The current study assessed nurses' level of knowledge regarding Anticoagulants medication in cardiac care units most of the studied nurses had unsatisfactory knowledge. In my opinion this may be due to nurses didn't receive previous training program about anticoagulants medication and there isn't motivation from administration, no pre-employment orientation program, insufficient number of nurses and lack of instructions. Also may be due to lack of updating information, this result concurs with **(Mohammed et al., 2019)** in the study entitled "Effect of teaching program on nurses' performance regarding drugs that affect blood coagulation in coronary care unit" who mentioned that total score of nurses' knowledge about drugs affecting blood coagulation was poor.

Also, this compatible with **(Abd Elrahman et al., 2019)** in the study entitled "Assessment of Nurses' Performance Regarding Caring Of Patients On Anticoagulant Therapy In Port-Said Hospitals" which reported that studied nurses had marked unsatisfactory level in their total knowledge.

The current study assessed nurses' level of knowledge regarding Sedatives and opioids medications in cardiac care units most of the studied nurses had unsatisfactory knowledge. In my opinion this may be due to the unavailability of written policies and protocols to be followed by nurses for usage of sedatives and opioids, absence of specific system to determine maximum dosage, deficiency knowledge about sedatives and opioids pharmacological effect and adverse effects, antidotes as well as limited usage of advanced technology as Smart" Patient Control Analgesia pump, pulse oximetry, and noninvasive capnography modules. All of these important measures to deal effectively with sedatives, opioids and to avoid errors. This result agreed with **(Farag et al., 2024)** who studies "Effect of Training Program on Nurses Knowledge and

Performance in Dealing with High Alert Medications" which concluded that most of the studied nurses had incorrect knowledge regarding sedatives and opioids medications.

As regards the total nurses' knowledge about high alert medications in CCUs, the study findings showed that most of the studied nurses had unsatisfactory total knowledge. These results could be because the training programs about high alert medications safe using were not offered in the nursing in-service training programs. In addition, the studied nurses' units didn't include a manual of nursing procedures and policies about safe using of HAMs. This study results is congruent with **(Yousef et al., 2018)** entitled "Effect of nursing education guidelines about high alert medications on critical care nurses' knowledge and practices" in which concluded that most of nurses had unsatisfactory knowledge regarding HAMs. Also, this result was supported by **(Abd-Elrahman et al., 2022)** displayed that majority of studied nurses had poor level of total knowledge about high alert medications.

Also, this finding was in agreement with **(Naheed & Arif, 2024)** who conducted a study titled: "Assessment of Knowledge Regarding High Alert Medications Administration and Regulation among Nurses" who found that most of the staff nurses had unsatisfactory total level of knowledge regarding HAMs.

As regards nurses` practices regarding adrenaline infusion, the result revealed that most of the studied nurses have unsatisfactory practice scores related to adrenaline infusion, anticoagulant drugs (Heparin), sedatives and narcotics medications. This unsatisfactory score may be due the absence of hospital written protocol or guidelines in dealing with these types of medications, inadequate supervision by the nurse's supervisors, scarce orientation or training in services programs related to these types of medications, high work load.

The findings of present study revealed that most of the studied nurses had unsatisfactory practice scores related to adrenaline infusion. In this respect **(Allawy et al., 2020).** who conducted a study about "Effect of Implementing Guidelines Regarding Administering Inotropic Medications for Critically Ill Patients on Nurses' Knowledge" emphasized that most of nurses in critical care units had an unsatisfactory practice regarding adrenaline infusion.

Furthermore, the present study clarified that most of the studied nurses had unsatisfactory practice scores related to anticoagulant drugs (Heparin).These nursing mal practices probably could be related to incomplete assessment, incomplete review of medication orders, neither carrying out

independent double check by other nurses,

nor checking other medication that might

affect the action of anticoagulants.

These findings were in the same line with **(Abd Elrahman et al., 2019)** in the study entitled "Assessment of Nurses' Performance Regarding Caring Of Patients On Anticoagulant Therapy In Port-Said Hospitals" which reported that majority of studied nurses had unsatisfactory practice scores related to anticoagulant drugs.

Also the present study reveals that the most of the studied nurses have unsatisfactory practice scores related to sedatives and narcotics medications. These nursing mal practices could be due to some significant factors, all of the nurses were not carrying out independent double check before giving sedatives and opioid orders, the majority of them were not doing complete assessment

and recording especially for high risk patients before administration of sedatives and opioid, also they were neither measure level of pain, level of consciousness during administration of sedatives and opioids.

The finding of the present study was in agreement with a study done by **(Farag et al., 2017)** entitled "Nurses knowledge and practice in dealing with high alert medications" revealed that the majority of the studied nurses practices related to sedatives and opioid medications were

unsatisfactory.

In relation to the satisfactory level of practice regarding high alert medications, the current study results revealed that; the most of the studied nurses had unsatisfactory practice regarding high alert medications. This result may be due to attributed lack of staff nurses' knowledge which reflects on their practice and inadequate training session to staff nurses. The finding of the current study was consistent with **(Gomaa et al., 2020)** who conducted a study titled: "Staff Nurses' Performance Regarding Safety Measures of High Alert Medications" who reported that the majority of staff nurses had unsatisfactory level of practice regarding to safety measures of HAMs.

The present study demonstrates that there was high statistically significant difference between the total knowledge of the studied nurses and their total practices regarding high alert medications with positive correlation between them.. This result may be due to fact that the higher knowledge level among the staff nurses increases the expectation of having more satisfactory level of practice as the unknowledgeable staff nurses impossible to be practically professional in their career. This finding was in agreement with **(Aly et al., 2023)** who studied "Medication safety climate: managing high-alert medication administration and errors among nurses in intensive and critical care units" who revealed statistically significant positive correlation between knowledge and practice of HAMs. Additionally, this finding disagreed with **(Farag et al., 2024)** whose study was about "Effect of Training Program on Nurses Knowledge and Performance in Dealing with High Alert Medications" who revealed that there was no significance correlation between knowledge and performance improvement.

Conclusion:

In the light of the present study findings, it can be concluded that most of the studied staff nurses had total unsatisfactory level of knowledge and most of them had total unsatisfactory level of practice regarding high alert medications. Moreover there was a highly statistically significant correlation between the studied nurses' total knowledge and total practice regarding HAMs. These findings answer the research question which stated that what are the nurses' knowledge and practice regarding high alert medications?

Recommendations:

Based on results of the present study, the following recommendations were suggested:

- Conducting training programs and workshops periodically for nurses about high alert medications to improve their performance at health care setting and enhancing the patient care level and the quality of care provided to this group of patients.
- Offer updated in-service training program for staff nurses regarding high alert medication preparation, administration, storage, calculation and documentation.
- Close supervision and teaching on spot is needed to ensure high quality of nurses' performance.
- Conduct a session about HAM in orientation program for newly hired staff.
- In order to help generalize the findings, it is important to repeat the study with a larger sample from a different geographic area.

Table (1): Frequency and Percentage Distribution of Demographic Characteristics of Studied

Nurses at Cardiac Care Units (n=40).

Items	Frequency	Percent
Age		
23-<33	32	80.0
33-<43	5	12.5
≥43	3	7.5
Mean ±SD	28.82± 5.70	
Range	23-46	
Gender		
Female	28	70.0
Male	12	30.0
Marital status		
Married	22	55.0
Not married	18	45.0
Level of education	9	22.5
Postgraduate Studies	7	17.5
Bachelor of Nursing	0	0.0
Health Technical Institute	17	42.5
Nursing Technical Institute	7	17.5

Diploma in Nursing		
Number of years of experience in the nursing profession		
1<10	37	92.5
10<20	1	2.5
≥20	2	5.0
Mean ±SD	4.70±5.21	
Range	1-24	
Number of years of experience in cardiac care units		
<3	28	70.0
≥3	12	30.0
Mean ±SD	2.87±1.24	
Range	1-5	
Training courses regarding high-alert medications		
Yes	0	0.0
No	40	100.0

Table (2): Frequency and Percentage Distribution of Total Satisfactory Scores of High Alert Medications knowledge and its domains as reported by studied nurses (no = 40):

Items	Satisfactory		Unsatisfactory	
General knowledge regarding HAMs	**No**	**%**	**No**	**%**
Inotropic drugs	2	5.0	38	95
potassium chloride and calcium chloride	3	7.5	37	92.5
Anticoagulants	4	10.0	36	90
Sedatives and opioids	3	7.5	37	92.5
Total	3	7.5	37	92.5
	3	7.5	37	92.5

Table (3): Frequency and Percentage distribution of the studied nurses according to their total knowledge about high alert medications (no = 40)

Items	No	%
Satisfactory	3	7.5
Unsatisfactory	37	92.5

Table (4): Frequency and Percentage Distribution of Total Satisfactory Scores of High Alert Medications practice and its domains as reported by studied nurses (no = 40):

Items	Satisfactory		Unsatisfactory	
Adrenaline infusion	No	%	No	%
Noradrenaline infusion	2	5.0	38	95
Dopamine infusion	3	7.5	37	92.5
Calcium chloride infusion	4	10.0	36	90
Potassium chloride infusion	3	7.5	37	92.5
Digoxin (intravenous route)	3	7.5	37	92.5
Anticoagulant drugs (Heparin)	3	7.5	37	92.5
Sedatives medications	2	5.0	38	95
Narcotics (opioids) medications	2	5.0	38	95
Total	2	5.0	38	95
	3	7.5	37	92.5

Table (5): Frequency and Percentage distribution of the studied nurses according to their total Practice regarding high alert medications (no = 40)

Items	No	%
Satisfactory	3	7.5
Unsatisfactory	37	92.5

Figure (1): Correlation between the total knowledge of the studied nurses and their total practices regarding high alert medications (n= 40)

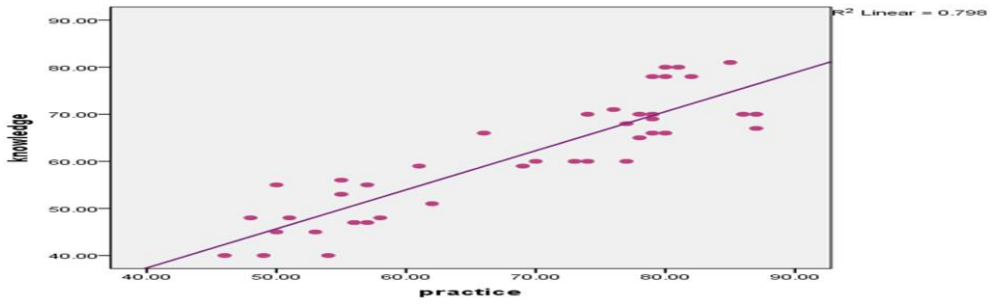

Figure: scatter dot graph showing correlation between knowledge and practice

r=0.893

p= <0.001**

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