



Knowledge and Practice Regarding High Alert Medications Among Critical Care Nurses in Tertiary Health Care Hospitals Peshawar

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Declaration

Authors' Contribution

All authors contributed to the study and approved the final manuscript.

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ABSTRACT

Background: High alert medications are also called as high-risk medications because of having a greater risk of injuries when it is not administered according to the recommended procedure and protocols. When high alert medication is not used in a proper way it may cause a greater chance of medications errors or serious incidents that causes death to the recipients. These are not common drugs. High alert medications have separate storage from other drugs, need to use distinctive labelling techniques, having special precautions during administrations to the clients. For example, if potassium chloride is injected too fast it may cause cardiac arrest, therefore, it's not a common drug that can be mixed with other drugs in a common place. To assess critical care nurses' knowledge and practice regarding high alert medication administration in public sector hospitals Peshawar. To determine association between critical care nurses' knowledge and practices regarding high alert medication administration. To find association between nurses' knowledge and practices regarding high alert medication administration with sociodemographic variables. **Methods:** A descriptive cross-sectional study was conducted among nurses in tertiary care hospitals Peshawar. Participants of the study (184 nurses) were included through simple random sampling from Lady Reading Hospital, Hayatabad Medical Complex and Khyber Teaching Hospitals Peshawar. Data was collected through an adopted and validated questionnaire. Data was analyzed through SPSS Version-24 for its proper analysis and presentation **Results:** Results of the study showed that only 10% of the nurses were having correct knowledge and scored more than 80% while 90% of them were noted to score less than 80% on the administered survey questionnaire. **Conclusion:** Based on the results of the current study, it has been concluded that nurses in the critical care units of the public sectors hospitals had poor and unsatisfactory knowledge and practices regarding the administration of high alert medications. **Keywords:** Coronary care unit. Intensive care unit, Emergency Department, World Health organization. Medical intensive care unit. Medication, Administration. Satisfactory knowledge.

INTRODUCTION

High alert medications are also called as high-risk medications because of having a greater risk of injuries when it is not administered according to the recommended procedure and protocols. When high alert medication is not used in a proper way it may cause a greater chance of medications errors or serious incidents that causes death to the recipients.(1) These are not common drugs. High alert medications have separate storage from other drugs, need to use distinctive labelling techniques, having special precautions during administrations to the clients.(2)(3) For example, if potassium chloride is injected too fast it may cause cardiac

arrest, therefore, it's not a common drug that can be mixed with other drugs in a common place. It should be kept separate place. Adrenaline and adrenaline are continued to patients and some body suddenly stop it from the patients it causes a severe drop in blood pressure and the patient may suffer and happen in cardiogenic shock.18.17% of all medications in a health care setting can generate an error alert of which more than 50% were because those medications belong to the high alert medications category. It has been reported that annually in the United States of America that 450000 medication errors harm the patients, in which 25% of the medication wrong administration incidents can be prevented. 7000

deaths happened due to these preventable errors.(4)(5) These drugs are sometime responsible for the majority of injuries to clients due to their adverse effects and repeatedly use, but still this is a great issue and major concern around the globe even in the United States, United Kingdom, France, China and Russia.13 There has been a reported data that different ratios of medications errors exist in developed countries and this was very low compared to developing countries. Studies regarding medications safety and its concerns were mostly carried out in developed countries which reported variation in incidence and prevalence rates such as data received from developed countries are showing that around 3.3% to 22.2% incidents occur due to mishandling with the medication administration. Similarly, studies from developing countries regarding medications administration shows around 56.4% to 74% medications incidents occurs. This data report was a sign of threats for the public of developing countries and it was devastating. In such countries, health care worker needs strong appropriate measures to reduce medications errors for the best public interest.(6)(7). Limited work has been done on this topic. That's why the knowledge of High Alerts Medications among critical care nurses is necessary because this is related to a patient's life and death. Knowledge and practice regarding high alert medications which could have led to hazardous practice and more dangerous complications for patients.(7). Therefore, this would be a first kind of study in Pakistan to address the issue of critical care nurses' knowledge and practices regarding administering the high alert medication. Limited literature in Pakistan reflects the nurse's knowledge and practices regarding administration of high alert medication therefore this study would be an addition to assess the actual status of nurses' knowledge and practices in this regard.(8)(9).Furthermore, this study will assess nurses' knowledge and practices regarding high alert medication in public sector hospitals in Peshawar. In addition to this associations of knowledge, practices and demographics will be investigated.

METHODOLOGY

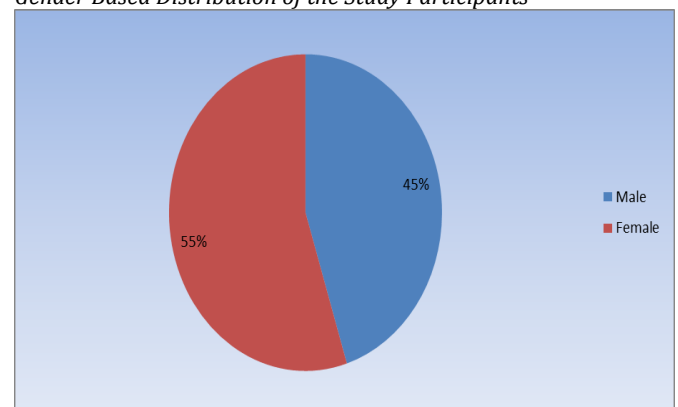
The descriptive cross-sectional study design was used to collect data randomly through lottery method from March 16, 2026 to December 2025 from registered nurses working in intensive care units at tertiary care hospitals of Peshawar. The sample size consisted of 184 participants calculated online by using OpenEpi software considering 95% confidence interval, 0.5% margin of error and total population was 350. Of the sample, 30, 113 and 41 intensive care nurses were recruited from Khyber Teaching Hospitals Peshawar (KTH), Lady Reading Hospitals (LRH) and Hayatabad Medicals Complex (HMC) respectively. These are the public tertiary care hospitals of Peshawar. The registered nurses who had one-year experience in intensive care units were included in the study while those who were working at administrative level and were not directly involved in medication administration were excluded from the study. (10)(11) An adopted questionnaire and checklist were utilized as a research tool to collect the required data (reference). The questionnaire had two sections, consisted of demographic

variables and knowledge related questions. To assess the practices of the nurses another adopted instrument in the form of a checklist was used. Both the tools were reliable and valid for the data collection. The questionnaire had a reliability of 0.75 while the checklist was having reliability of 0.86 with Cronbach's alpha. (reference) There were total 29 knowledge-based items to assess the level of knowledge of nurses regarding high alert medication. Highest score 29 and lowest was 0 based on the correct and incorrect responses of the study participants. Every item was given 1 score for the final calculation of knowledge assessment. The mean knowledge score was divided into two categories for its interpretation. Similarly, for practice, the practice observational checklist consists of fifty steps. The participants were observed whether they follow the steps correctly or incorrectly or miss the steps completely. Correct options were labelled with 2-Points, incorrect were given 1-point while the missing step was graded as 0. The result of this study is divided into two levels. Above 80% of the correct practices were termed as satisfactory level of practices while less than 80% were classified as unsatisfactory level of practices regarding the high alert medication administration.(12) Study approval was obtained from the ethical review committee, advanced board & research study (ASRB) of the Khyber medical university Peshawar. Purpose of the study was explained to the participants, and informed consent was signed to ensure voluntary participation. Privacy and confidentiality of the participants were maintained. Questionnaires were distributed among the participants and then each of the nurses were observed for all their practices and crosschecked with checklist steps for scoring while handling and administering the high alert medications. Data were analyzed with the help of a Statistical Package for Social Sciences (SPSS) Version-24. Descriptive statistics of frequency and percentages were utilized to calculate demographic characteristics. Mean scores, standard deviation for level of knowledge and practice. Correlation coefficients and independent t test was used for the comparison of knowing any of the statistical difference and significance while considering $P \leq 0.05$.

RESULTS

Figure 1

Gender Based Distribution of the Study Participants



The findings showed that majority (55%) of the participants were female while 45% of the were male to work in their respective clinical areas.

Table 1
Other Demographic Characteristics of the Study Participants

Variables	Frequency	Percentage
Age of the Study Participants		
20-25 years	24	13.00%
26-35 years	127	69.00%
above 35 years	33	17.90%
Mean ± SD	31.09±5.320	
The Educational Level of the Study Participants		
Diploma	80	43.50%
Bachelor	104	56.50%
Years of Experience in Nursing		
1-5 years	95	51.60%
6-10 years	72	39.10%
11-15 years	17	9.20%
Mean ± SD	5.90±3.192	
Years of Experience in Working Units		
1-3 years	133	72.30%
4-7 years	48	26.10%
Above 7 years	3	1.60%
Mean ± SD	2.8114±1.87661	
Working Units of the Study Participants		
CCU	24	13.00%
Emergency	19	15.00%
ICU	131	71.00%

Demographic variables analysis shows that majority (69%) of the participants had age 26-35 years of age while 17.90% of them were having age above 35 years of their ages. A minor fraction of 13% of them had age between 20 to 25 years of age with an overall mean age score of (31.09±5.320). Similarly, the education level reflects that majority (56.5%) of the participants had bachelor degree in nursing while 43.5% of them had qualification with diploma in nursing. Experienced Based analysis showed that 51.6% of the participants had 1-5 years of professional experience in nursing, 39.10% had experience from 6 to 10 years while only 9.20% had experience 11 to 15 years of their practices with mean years of experience (5.90±3.192). Intensive care units specific experience was found more in the range of 1-3 years which reflected 72.3% of the study respondents while only 1.6% of the participants had 7 years or above experience in critical care units with a mean score of 2.8114±1.87661. Demographic analysis further showed that 71% of participants were employed in ICUs, 15% were in emergency and 13% of them were CCU to perform their duties.

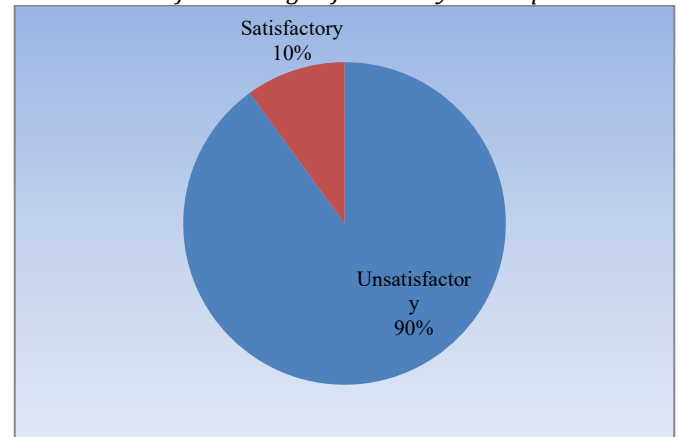
Table 2
Knowledge Level Among Participants

Item	Total Score	Mean ± SD
Total Knowledge Score about HAM	29	18.85 ± 3.99
General Knowledge about HAM	5	2.98 ± 1.11
Knowledge about Adrenaline	5	2.91 ± 1.17
Knowledge about nor-adrenaline	5	3.45 ± 1.35
Knowledge about dopamine	5	3.39 ± 1.14
Knowledge about dobutamine	4	2.73 ± 1.07
Knowledge about KCL	5	3.38 ± 1.25

Percentage of correct and incorrect answers concerning adrenaline questions about HAM showed that adrenaline related correct dosage got the highest percentage of 64.7%, and lowest scores was about adrenaline indications that was found as 17.4%, first drug during

asystole question got 33.2% and adrenaline antidote got a score of 67.9% and adrenaline via ETT got 38% scores respectively. Incorrectly marked question percentages were 33.2%, 64.7%.17.4%, 32.15%, 62% respectively.

Figure 2
Overall Level of Knowledge of the Study Participants



Analysis of the collected data showed that the overall 89.7% (165) of the participants were having the correct scores less than 80% on the prescribed questionnaire and was categorized as unsatisfactory level of knowledge among the participants. Only 10.3% of the participants scored more than 80% of the correct responses and they were categorized as to have satisfactory level of knowledge regarding the correct administration of high alert medication among patients admitted in the critical care units.

Table 3
Total and Subtotal Means Practice Scores about Administration

Variable	Total score	Mean ± SD
Sub Item Practices		
Pre administration phase	12	10.06 ± 2.66
During administration phase	74	60.7 ± 14.7
General administration	18	6.04±2.00
Adrenaline administration	14	4.9±1.4
Noradrenaline administration	10	3.19±1.40
Dopamine administration	14	11.7±3.2
Dobutamine administration	8	6.4±2.1
KCL administration	10	8.0±2.9
Post administration phase	14	11.5±3.5

Practices of administering high alert medication were computed for its total and subtotal means as under table-10. The practice mean scores were computed for all the responses was 82.42 ± 19.2.

Nurses overall practice level in critical care units regarding high alert medication figures reflected that only 5% of studied participants got with the satisfactory level concerning high alert medication and corrected answers more than 80% scores on the administered scale. While 95% of participants scored less than 80% of the allocated score and they were considered as an unsatisfactory score as presented in Figure 8

Figure 3
Nurses Overall Practice Level about High Alert Medication Administration

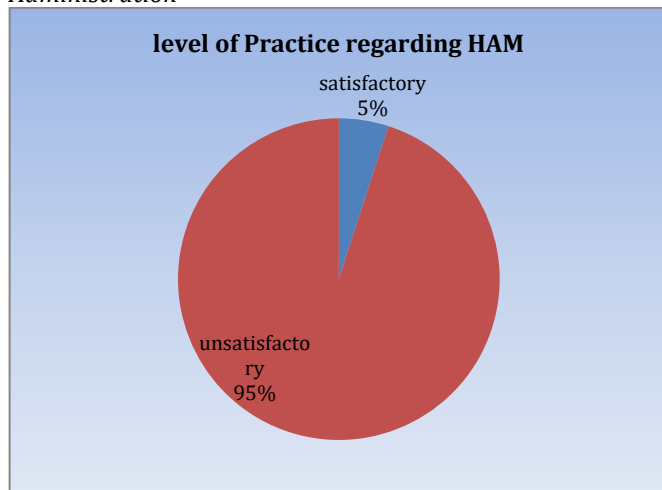


Table 4
Correlation of Total Knowledge & Practice Score with Demographic Variables

Variables	Test Value	P-Value	Correlation
Knowledge Score & Age	r=-0.120	0.104	Statistically Not Significant
Knowledge Score & Total Years of Experience	r=0.026	0.725	
Knowledge Score & Years of Experience in ICU	r=0.069	0.353	
Knowledge score & Qualification	t= -0.885	0.377	

The following table-19 and table-20 evaluate that there was an association to some extent of the calculated scores of different high alert medication administration means scores with the selected demographic variables such as age, years of experience in nursing, and experience in ICUs with total Knowledge score as calculated ($r=0.120$, $p=0.104$, $r=0.026$, $p=0.725$, $r=0.069$, $p=0.353$, $t= -0.885$, $p=0.377$) respectively.

Table 5
Relationship Between Total Knowledge Score and Total Practice Scores

Variables	Test Value	P-Value	Correlation
Practice Score & Age	r=0.120	0.106	Statistically non-significant
Practice Score & Total Years of Experience	r= 0.166	0.052	
Practice Score & Years of Experience in ICU	r= 0.177	0.061	
Practice Score & Qualification	t= 0.963	0.337	

Statistical analysis was computed between total knowledge and practice score to determine the association among total scores of both the parameters. Table-21 portrays that there was statistically a significant correlation between the knowledge and practices ($r=.139$ value $P=0.05$ based on the overall means scores

Variables	Total Practice Score	
	r value	P-Value
Total Knowledge Score	.139	0.05

DISCUSSION

The findings have significant similarity with previous study revealed that 89.7% of the participants scored less than 80% on the administered questionnaire and they were categorized as unsatisfactory with their overall level of knowledge while 10.3% of the participant performed with their satisfactory level of knowledge by getting more than 80% of the overall scores. This means that out of a hundred subjects only 10% had excellent knowledge and know well about the high alert medication and its administrations with all its guidelines and parameters while 89.7% of the nurses didn't have admirable level of knowledge about high alert medicines. The knowledge satisfactory score of the nurses was too low. The same kind of results and findings have been reflected a study conducted in emergency where the satisfactory level of nurses was low(13).(14) The mean score of correctness was high than the incorrect answer but again it did not fill the targeted criteria as set as a standard for the safe medication administration of high alert drugs. Similarly, noradrenaline, dopamine, and intravenous potassium chloride medicines had also mean scores of the correct answers were more than the mean scores of the incorrect answers, but it was still unsatisfactory knowledge for clinical purposes. In the clinical area, strict policy should be implemented because every mistake is considered as a crime that may lead a patient to death. Dobutamine had a mean score of correct answers less than incorrect scores. (15) Studies revealed that most of the nursing staff working in ICU have insufficient knowledge of pharmacology, furthermore concluded that literature-based results strongly suggest that nurses have inappropriate knowledge regarding high risks medications and could increase their knowledge by drugs workshop in-service training particularly regarding the high alert medication administration.(16) In addition, the current study findings are also supported by another study that has been conducted by a literature search based practice project to decrease the medications bad effects events, the intravenous heart medication administration on post-op orthopedics units that pointed out the nursing interventions and practices for safe heart medications administration to make the patient safety more secure inside this units. (17)(18) The nurse's knowledge was assessed before the implementation of the educational program and then after the implementation of the educational program, the knowledge was reassessed. There was a measurable difference in knowledge scores in pre and post-assessment. The knowledge was improved significantly. This study concluded that nurse's needs to gain further continued education to prevent or reduce adverse drugs events and to improve their knowledge level. Literature further confirms that Mostly medications errors happen in clinical settings from all medications administration.(19)(20). The general medications that are administered in the general ward are not so dangerous and errors from such medications cannot cause death but errors of the high alert medications are very fatal and could cause death. From the literature study, it has been pointed out that nurses of the hospital organizations need to implement an educational policy regarding medications practices to overcome this issue. (21)(22).Furthermore;

knowledge score and practice scores were significantly correlated because the current study shows that p values were equal to or less than the 0.05 which indicated the significant association between total knowledge scores and total practice scores of the nurses regarding the administration of high alert medications. These findings were supported with the previous literature. (23) A study conducted on patient safety pointed out that there was a significant relationship between knowledge scores and practice scores of nurses' compliance to patient safety practices regarding high alert medications. These variations in findings may be associated to certain factors in public sector hospitals. Lack of resources, lack of alertness to the drug administration protocols, deficient training, lack of research environment and lack evidenced based practices are some the areas that need to be work on to improve the level of knowledge and practices of nurses towards the safe administration of high alert medications.(24)

Findings of the current study concluded that nurses working in the critical care units of the public sectors hospitals tries to perform their responsibilities however they have still flawed and deficiencies in their level of knowledge and practices regarding the administration of high alert medication as per the standard set criteria. A minor portion of the nurses corrected the responses more than 80% for both the knowledge and their practices however majority of the nurses scored less than 80% on the prescribed and administered questionnaire. Overall, the findings were poor and unsatisfactory and were supposed to be taken in thoughtful consideration for its rectifications. These findings reflect that nurses need and must be trained for their knowledge and skills to ensure the safe administration of high alert medication. Safe administration of high alert medications would bring quality in patient care as well as it will reduce the burden on the hospitals for their resource's utilization effectively(25)(26).

Strengths and Limitations of the Study: This was its first

kind of study to assess the nurse's level of knowledge and practices about high risk or high alert medications administration in public sectors tertiary care hospitals of Peshawar. This study would provide a baseline information for further studies in different other contexts and settings. Sampling was taken through simple random sampling to make it more representative. Further the study was kept limited to only the three major tertiary care hospitals of the provinces due to certain limitations of time, access and approvals from the concerned forums and departments. One of the limitations was to keep the study limited to few of the high alert medications administration instead of all. Furthermore; this was a cross-sectional study and many other approaches may be used by the researchers in future.

Recommendations

- Nurses must be trained for their pharmacological education that covers the knowledge and skills of the nurses working in their domains.
- In-service training of the critical care nursing staff regards practices of high alert medications need to be encouraged
- Medication safety policies need to be incorporated by the nurses' clinical settings. Workload need to be compensated by increasing nursing staff to improve practices Administration of high alert medication need to be reflected effectively in the nursing curricula.

CONCLUSION

All in all, it can be seen that knowledge and practices regarding's high alert medications among critical care nurses effect the patient's recovery significantly. If nurses have proper knowledge, then patient's condition will be boost up therefor in-service training is mandatory.

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