Effect of an Educational Program for nurses about High Alert Medications on their Competence

E.M.Abd-Elrahman[1], G.M.Mostafa[2] and A.G.Hasanin[3]
[1]Teacher at Secondary Nursing School, M.Sc. Nursing 2018,
[2]Nursing administration, Dept., Faculty of Nursing, Helwan Univ., Cairo, Egypt
[3]Nursing Administration, Dept., Faculty of Medicine, Benha Univ., Benha, Egypt
E-mail: hemaamar70@gmail.com

Abstract

Background: High Alert Medications (HAMs) management is a vital part of nurses' responsibilities in their everyday practice. So, it is important to provide basic education and continued program for nurses to improve their competences about HAMs. *The study aimed to* evaluate effect of an educational program for nurses about HAMs on their competence. *Design*: Quasi experimental design was utilized to conduct this study. *Setting*: The study was conducted at Emergency Department at Benha University Hospital. *Subjects*: Consisted of all nurses (34) who are working at the above-mentioned setting. *Three tools were used for data collection*: HAMs knowledge questionnaire, Observational checklist for nurses' performance and Nurse's competence scale. *Results:* The majority (91.2%, 85.3%) of the studied nurse had satisfactory knowledge regarding HAMs at immediate post and follow up, respectively, most of them (85.3%, 79.4%) had high performance regarding HAMs at immediate post and follow up, respectively while the majority (88.2%, 85.3%) had high competence level regarding HAMs at immediate post and follow up, respectively. *Conclusion*: the current study concluded that the educational program was successful and lead to improvement in nurses' knowledge, performance, and competence regarding HAMs at immediate post program and follow up program (after 3 months). Also, there was highly statistically significant correlation between nurses' knowledge, performance and competence related to HAMs at pre, immediate post and follow up phases of program. *Recommendations*: Establishing job orientation for newly graduates' nurses regarding HAMs. Also, conducting training programs and workshops periodically for nurses to enhance their competence regarding HAMs.

Key words: Competence, educational program, high alert medications, nurses.

1. Introduction

Nowadays, worldwide health organizations consider medication safety as a corner stone in providing a high quality of care and patients' safety. Medications can be lifesavers and are the most common intervention provided by health care providers. Medication safety alerts advise on action to prevent future adverse events or to lessen the risk of medication errors. Medication errors are the most common cause of morbidity and mortality in medical profession and critical care [1].

Most medications in healthcare today have a wide margin of safety or a narrow therapeutic index, there remains some which can cause serious harm or death if they are misused. These medications are commonly referred to as high alert medications HAMs. HAMs are defined as drugs that bear a heightened risk of causing significant patient harm, even when used as intended or when they are used in error (e.g., wrong drug, wrong dose, wrong route, wrong resident). [2].

The HAMs may vary between hospitals and other health care settings depending on the types of medication used and patients treated. HAMs are commonly used in the Emergency Room (ER), Intensive Care Unit (ICU), Medical ward, Orthopedical ward, Surgical ward, Obstetrics and Gynecology unit and Pediatric ward [3]. These medications include high and low frequency medications. Although it is important to improve management of all these medications, some of them have been associated more frequently with harm, such as insulin, morphine, heparin, intravenous concentrated potassium chloride, anticoagulant, hydromorphone, narcotics and sedatives [4].

The HAMs management is a complex and high-risk activity forming a major part of nurses' responsibilities in their everyday practice. It involves professional tasks starting from identifying the need for these medication use, ordering, storage, safe handling and preparation of these medications for and administration to patients, monitoring and evaluating the effectiveness of treatment, as well as documentation and patient education [5].

So, nursing competencies are very important because the patient's life can depend on them. A nurse must independently monitor, treat (keep a nursing history) certain groups of patients and call the doctor for consultation only. Nurses having the best knowledge can do their job more efficiently, which will not only influence the well-being of patients, improve the provision of medical care and satisfy nurses with their work [6].

Nursing competence regarding HAMs is a critical factor that is directly related to improved and positive patient outcomes. Since competence is not constant, the individual practitioner is expected to continually re-evaluate their competence when faced with new practice situations [7].

The HAMs competence requires a solid knowledge base and the ability to apply that knowledge in real-life situations during often complex and dynamic patient medication processes **[8].** Nurses play a significant role in the medication process that include drug`s action, and site, drug`s name, preparation, factors affecting it`s action and monitoring the patient responses. So, competent nurses play an important role in prevention of HAMs errors **[9]**.

Deficiencies in nurse HAMs competences led to harm on patient. All health care provider should have to acquired knowledge, skills and innate individual traits to each situation and be able to adapt that knowledge and those skills to different situations to become competent nurses **[10].**

2.Significant of the study:

High alert medication is one of critical concept for improving of patient safety. Adverse effect of high alert medication is a major cause of morbidity and mortality in medical profession and critical care. About 80% of all deaths from medication errors are caused by high alert medications errors. Also, investigators have reported that 2/3 of emergency admissions for adverse medication reactions were related to warfarin, insulin, oral antiplatelet agents and oral hypoglycemic agents *[11].*

Most of studies done by *[12, 13, 14, 15, 16]* reported that medication administration is an important part of the nurse's role. Nurses often have a lack knowledge and competence to safely administer medications. Nurses would need a very high level of knowledge about this medication. The nurses' responsibility for updating their knowledge of drugs has increased greatly. Nurses must have knowledge and skills in order to improve medications management and administration, to recognize potential medication errors before they occur and to monitor, evaluate and improve the quality and safety of this process and to maintain high level of nursing competence. So, this study was done to evaluate effect of an educational program for nurses about high alert medications on their competence.

3.Aim of the Study:

The study aimed to evaluate effect of an educational program for nurses about high alert medications on their competence through:
1. Assessing knowledge of nurses regarding high alert medication thorough program phases.
2. Assessing practice of nurses regarding high alert medication thorough program phases.
3. Assessing level of competence among nurses thorough program phases.
4. Designing an educational program for nurses about high alert medication.
5. Implementing an educational program for nurses about high alert medication.

6. Determining effect of an educational program for nurses about high alert medication on their competence.

Research hypothesis:

It is hypothesized that an implementation of educational program will lead to significant improvement in nurses' knowledge and practice regarding high alert medications and this will have a positive effect on their competence.

4.Subjects and methods:
Study design:
A quasi- experimental design was used in carrying out this study.
Study setting:
▪ The present study was conducted at Emergency department at Benha University Hospital
Study subjects:
▪ all nurses (34) who working at previously mentioned settings were included in this study.

Tools of data collection:
Three tools were be used to collect data for this study.
I. **High alert medication knowledge questionnaire:** It was developed by the investigator after reviewing the related literature *[16, 15, 17]* to assess nurses' knowledge about high alert medications. It consisted of two parts:

First part: Included personal data about nurses including age, sex, marital status, qualification, experience and have you ever attended courses and training programs on high-risk medications.

Second part: Composed of 50 questions (multiple choice questions) to assess nurse's knowledge regarding HAMs. It was divided in to six dimensions as following: Definitions and types of HAMs (12 questions), preparation of HAMs (3 questions), administration of HAMs (9 questions), receiving and storing of HAMs (6 questions), indications and side effect of HAMs (16 questions) and documentation and medication calculation (4 questions).

Scoring system
The total score for knowledge questions was 100. For answer in each question, score was allocated as follow: 2 for correct answer, 1 for incorrect answer. Nurses' level of knowledge regarding HAMs was determined as follow: Staff nurse who had a percent more than 60% with score 61 to 100 this indicates satisfactory level of knowledge. Staff nurse who had a percent less than 60% with score 0 to 60 this indicated unsatisfactory level *[4].*

II. **Observational checklist**: It was developed by *[18]* and was modified by the investigator based on review of related literature as *[15,20,21,22]*. It was used to assess nurses' performance regarding HAMs. It consisted of 111 items divided into 3 main dimensions as following: Pre-administration of HAMs (41 items), during administration of HAMs (38 items) and post administration of HAMs (32 items).

Scoring system:
The total score for performance checklist was 222. For answer in each question, score was allocated as follow: 2 for done and 1 for not done. Nurses' level of performance regarding HAMs was determined as follow: Staff nurse who had a percent 75 to 100% with score 167 to 222 indicates high level of performance. Staff nurse who had a percent 60 < 75% with score 133 < 167 indicates moderate performance level. Staff nurse who had a percent < 60% with score <133 indicated low performance level *[15]*.

Nurse's competence scale: It was developed by *[23]* and was modified by the investigator based on review of related literature as *[24, 25, 26]*. It was used to assess level of competence among nurses. It consisted of 121 items divided into 13 main dimensions as following: Medication principles (6 items), patient assessment (14 items), medication order (16 items), resources and information (10 items), medication dosages (4 items), medication preparation (11 items), medication administration (11 items), injections (14 items), support and teaching (9 items), monitoring (7 items), storage and disposal (6 items), drug counts (2 items) and professional accountability (11 items).

Scoring system:
The total score for competence scale was 605. For answer in each question, score was allocated as follow: 5 for expert 4 for advanced, 3 for intermediate, 2 for basic and 1 for awareness. The staff nurse who had a percent 75 – 100% with score 454 to 605 indicates high level of competence. Staff nurse who had a percent 60 < 75% with score 363 < 454 indicated moderate level of competence. Staff nurse who had a percent < 60% with score <363 indicated low level of competence *[27]*.

Tools validity and reliability:
The tools were tested for content validity to make sure that the tool accurately measure what supposed to measure, this done by five professors and assistant professors of nursing: two professors in nursing administration at Tanta University, one professor and one assistant professor of nursing administration at Menoufia University and one assistant professors in nursing medical surgical at Benha University

Statistical reliability of used tools were measured by using Cronbach's Alpha. The internal consistency for first tool was (0.720), second tool was (0.742) and third tool was (0.803).

Ethical consideration:
The investigator informed the nurses about the purpose and benefits of the study. Nurses were given opportunities to accept or refuse to participate in the study. In addition, confidentiality and anonymity of the subjects was secured when coding the data. They also allowed knowing that their participation is voluntary, and they have the right to withdrawal from the study at any time without giving any reason.

Pilot study:
A Pilot study was carried out on 10 % of the total sample size; they were 4 nurses who working at previously mentioned settings and included in the study sample, to evaluate the clarity and applicability of the tools and also to determine the time needed for filling the structured questionnaire.

Field work:
These phases were carried out from the beginning of June 2021 to the end of December 2021.

The study was conducted through the following four phases:

A-Assessment phase
- The process of data collection was carried out in June 2021 to assess nurses' knowledge regarding HAMs, assess nurses' practice regarding HAMs, assess nurses' competence level before implementation of the educational program.
- The investigator was available at the previously mentioned settings three days weekly at morning and afternoon shifts to collect baseline data.
- At the beginning, the investigator welcomed nurses gave a brief idea about the aim and activity of the program for all nurses.
- Then, the investigator collected data by using the different tools of data collection in the available hospital classroom.
- The time required for finishing high alert medication knowledge questionnaire was around; 30-35 minutes
- The time required for finishing observational checklist was around; 30-35 minutes
- The time required for finishing nurses' competence scale was around; 40-45 minutes.

B- Planning phase:
Based on baseline data obtained from pre-test assessment and relevant review of literature, the program was developed by the investigator. This was taken one-month July 2021.

- An education program was developed based on determined needs and relevant review of literature.
- Program was constructed in a form of printed Arabic form and included different topics to enhance HAMs knowledge, nurse 'practice regarding high alert medication and nurses' competence level. Also, the investigator prepared power point presentation of the topics.
- Different instructional strategies, method of teaching, media and method of evaluation were selected to suit the learner's needs and achieve the objectives and contents of the program.

C- Implementation phase:

This phase was initiated in August 2021.

- The investigator visited each previous mentioned setting in the two shifts (morning and afternoon), three days/week. Then, the investigator divided the subjects to five groups, each group composed of 7 nurses except one group composed of 6 nurses. The educational program involved 7 sessions and were implemented according to working circumstances. The teaching sessions were 16 hours distributed as 7 sessions. These sessions were repeated with the same to each group of 7 nurses. The duration of each session lasted for 2 hours, achieved by using available resources, relevant contents, and instructional strategies for each session.

D- Evaluation phase:

During this phase, the impact of the education program was evaluated. Immediate evaluation included immediate post program implemented for all subjects using the same tools which were used before the program. Follow up after three months of program implementation, all the study tools were applied for nurses to test the follow up gain in the nurses' knowledge regarding high alert medications, nurse' practice level and nurse' competence level. The time of the data collection lasted for three months from the beginning of September 2021 to end of December 2021.

Statistical design:

Data were verified prior to before computerized entry. The statistical package for social sciences (SPSS version 11.0) was used for that purpose. The obtained data were organized, analyzed and represented in tables and graphs as required. Data were presented using descriptive statistics in the form of (Percentage, Mean score, Standard deviation (SD), P value, Chi-square, frequency, T-test). (x^2) Test was utilized to compare percentages between study variables. Statistically significant was considered at P-value < 0.05 and statistical highly significant was considered at P-value < 0.001.

5. Results

Table (1): this table displays personal characteristic of nurses. This table reveals that more than two fifth (44.1%) of nurses aged from 30 to less than 40 years old with mean scores of ages (33.4±7.4) and all of them are female. Concerning marital status, the majority (82.4%) of them were married. More than three fifth (61.8%) of them had diploma degree in nursing and had 10 years and more of experience with mean score 13.32 ± 7.98. In addition, all of them didn't attend any training courses about HAMs.

Table (2): This table clarifies that, the program had a great effect on improving total nurses' knowledge regarding HAMs throughout immediate post and follow-up phases (after three months) of the program compared with the preprogram phase, more than one third (35.3%) of nurses had satisfactory knowledge regarding HAMs through pre-program phase and increased to 91.2% at immediately post program phase and decreased to 85.3% through follow up phase (after three months) but still more than preprogram phase.

Table (3): This table shows that, the program had a great effect on improving total nurses' performance regarding HAMs throughout immediate post and follow-up phases (after three months) of the program compared with the preprogram phase. More than one quarter (26.6%) of nurses had high performance level regarding HAMs through pre-program phase which increased to 85.3% at immediately post program phase and decreased to 79.4% through follow up phase (after three months) but still more than preprogram phase.

Table (4): This table displays that the program had a great effect on improving total nurses' competence regarding HAMs throughout immediate post and follow-up phases (after three months) of the program compared with the preprogram phase. More than one quarter (29.4%) of nurses had high competence level regarding HAMs through pre-program phase and increased to 88.2% at immediately post program phase and slightly decreased to 85.3% through follow up phase (after three months) but still more than preprogram phase.

Table (5): This table displays there was a highly statistically significant correlation between total performance and competence during pre-program and immediately post- program phase and there was statistically significant correlation between total knowledge, performance, and competence of studied nurses during immediately post-program phase and follow up (after 3monthes) of the program phase.

Table (1) Frequency distribution of studied nurses regarding their personal characteristics (n= 34)

Personal data		No	%
Age			
20 < 30		11	32.4
30 < 40		15	44.1
≥ 40		8	23.5
Min –Max	22-49		
Mean ±SD	34.17±7.73		
Sex			
Female		34	100
Marital status			
Married		28	82.4
Unmarried		6	17.6
Qualification			
Diploma degree in nursing		21	61.8
Associated degree in nursing		10	29.4
Bachelor's degree in nursing		3	8.8
Years of experience			
1 < 5		6	17.6
5 < 10		7	20.6
≥ 10		21	61.8
Min –Max	2-29		
Mean ±SD	13.32±7.98		
Attending courses about HAMs			
No		34	100.0

Table (2) Frequency distribution of studied nurses regarding their total knowledge level about HAMs through the program phases (n=34).

Total knowledge levels	Pre-program phase		Immediately post - program phase		Follow up - program phase		t1	p-value	t2	p-value	t3	p-value
	No	%	No	%	No	%						
Satisfactory	12	35.3	31	91.2	29	85.3	22.83	0.000**	0.567	0.452	17.75	0.000**
Unsatisfactory	22	64.7	3	8.8	5	14.7						

* Statistically significance p < 0.05   ** highly statistically significance p<0.001
t1 between pre and post program
t2 between post and follow-up program
t3 between pre and follow-up program

Table (3) Frequency distribution of studied nurses regarding their total performance levels related to HAMs through the program phases (n=34).

Total performance levels	Pre-program phase		Immediately post - program phase		Follow up - program phase		t1	p-value	t2	p-value	t3	p-value
	No	%	No	%	No	%						
High level	9	26.6	29	85.3	27	79.4						
Moderate level	14	41.1	4	11.8	5	14.7	24.41	0.000**	0.516	0.773	19.49	0.000**
Low level	11	32.3	1	2.9	2	5.9						

* Statistically significance p < 0.05   **** highly statistically significance p<0.001**
t1 between pre and post program
t2 between post and follow-up program
t3 between pre and follow-up program

Table (4) Frequency distribution of studied nurses regarding their total competence level in relation to HAMs through the program phases (n=34).

Total competence level	Pre-program phase		Immediately post - program phase		Follow up - program phase		t1	p-value	t2	p-value	t3	p-value
	No	%	No	%	No	%						
Low level	9	26.5	1	2.9	2	5.9						
Moderate level	15	44.1	3	8.8	3	8.8	24.40	0.000**	0.350	0.839	21.71	0.000**
High level	10	29.4	30	88.2	29	85.3						

* Statistically significance p < 0.05   ** highly statistically significance p<0.001
t1 paired t test between pre and immediately post program
t2 paired t test between immediately post and after 3 months
t3 paired t test between pre and after 3 months.

Table (5) Correlation matrix among studied nurses' total knowledge, performance regarding HAMs and their total competence level through the program phase (n=34)

Variables			Total knowledge	Total performance	Total competence
Pre- program phase	Total knowledge	r	……	0.627	0.682
		p-value	……	0.006*	0.008*
	Total performance	r	0.627	……	0.728
		p-value	0.006*	……	0.000**
	Total competence	r	0.682	0.728	……
		p-value	0.008*	0.000**	……
Immediately post - program phase	Total knowledge	r	……	0.547	0.418
		p-value	……	0.017*	0.004*
	Total performance	r	0.547	……	0.948
		p-value	0.017*	……	0.000**
	Total competence	r	0.418	0.948	……
		p-value	0.004*	0.000**	……
Follow up - program phase	Total knowledge	r	……	0.742	0.807
		p-value	……	0.007*	0.043*
	Total performance	r	0.742	……	0.418
		p-value	0.007*	……	0.014*
	Total competence	r	0.807	0.418	……
		p-value	0.043*	0.014*	……

* Statistically significance p < 0.05   ** highly statistically significance p<0.001.

6. Discussion

Medication safety is a serious responsibility that is vital to the sustainability of healthcare organizations. HAMs are drugs that bear a heightened risk of causing significant patient harm when they are used in error. Although mistakes may or may not be more common with these drugs, the consequences of an error are clearly more devastating to patients. On average, hospitalized patients experience one HAMs error each day. So, specialized training and practice experience in HAMs is vital to maintain patient safety *[28]*.

The present study results clarified that, the program had a great effect on improving nurses' knowledge regarding HAMs throughout immediate post and follow-up phases (after three months) of the program compared with the preprogram phase. More than one third of nurses had satisfactory knowledge regarding HAMs through pre-program phase and increased at immediately post program phase and slightly decreased through follow up phase but still more than preprogram phase. This result might be due to the majority of studied sample had nursing diploma not bachelor's degree and weren't newly graduated, so they are forgetting most of the knowledge about HAMs. Also, this improvement in knowledge could be related to effective educational program regarding HAMs.

These findings are in the same line with *29* who conducted a study about "Impact of instructional module on intensive care nurses' performance regarding intravenous infusion of HAMs" and reported that most of nurses had unsatisfactory knowledge regarding HAMs through pre-program phase and satisfactory level at immediately post program phase and at follow up phase. Also, *30* who conducted a study about "Nurses' knowledge of HAMs: A randomized controlled trial" and reported that nurses have insufficient knowledge about HAMs pre-intervention and the post-test showed significant improvement in the intervention knowledge group.

In this respect, *4* who conducted a study about "Effect of designed nursing protocol on nurses' knowledge and practice regarding HAMs" emphasized that education is recommended to improve nurses' knowledge and correct misconceptions related to HAMs. In addition, *31* revealed in their study about "Effect of educational intervention on knowledge and practice regarding high alert medications among nurses in hospitals of Navi Mumbai" reported that near ninety of nurses had satisfactory knowledge regarding HAMs.

On the other hand, *17* showed in their study about "Knowledge about the administration and regulation of HAMs among nurses in Palestine" that majority of nurses were found to have inadequate knowledge of HAMs at interventions phases and needed continuous training and education.

According to nurses' performance regarding HAMs. The study findings revealed that the program had a great effect on improving total nurses' performance regarding HAMs throughout immediate post and follow-up phases of the program compared with the preprogram phase. More than one quarter of nurses had high performance level regarding HAMs through pre-program phase which increased at immediately post program phase and decreased through follow up phase but still more than preprogram phase. This result might be due to the effectiveness of educational program and using different teaching methods and media which resulted in improvement of the nurses' performance regarding HAMs management process (pre, during and post administration). So, their performance improved.

In the same line, *32* who conducted a study about "Nurses' performance regarding safety measures of high alert medications" reported that nurses practices related to dealing with HAMs were unsatisfactory and this may be due to a combination of several factors; some were related to the hospital system, and the other may related to the nurses themselves. Also, this unsatisfactory score may be due the absence of hospital written protocol or guidelines in dealing with these types of medications, shortage of the nurses and inadequate supervision.

Moreover, this finding is consistent with *18* who conducted a study about "Effectiveness of training program for nurses regarding dealing with high alert medication" and reported that program had a great effect on improving total nurses' performance regarding HAMs throughout immediate post and follow-up phases (after three months). Also, *15* who conducted a study about "High alert medication among critically ill patients at El-Manial University Hospital: Assessment of nurses´ knowledge and practice" showed that nurses' knowledge and practices were improved after implementing the nursing guidelines, but they were slightly declined at second months of follow up.

Furthermore, the present study clarified that the program had a great effect on improving total nurses' competence regarding HAMs throughout immediate post and follow-up phases (after three months) of the program than the preprogram phase. More than one quarter of nurses had high competence level regarding HAMs through pre-program phase which increased at immediately post program phase and slightly decreased through follow up phase (after three months) but still more than preprogram phase. This finding might be due to educational program effect on improving nurses' knowledge and skills regarding HAMs which reflected on improving their competence regarding HAMs .

This result is supported with *33* who conducted a study about "Nurse students' high alert medication competence - An integrative review of the associated factors" and proved that attention needs to be paid to nurses competence areas as well, such as HAMs

administration and patient medication education skills. Also, *34* who conducted a study about "The competency level on safe administration of HAMS and quality nursing care among the selected graduating students" and revealed that nursing professionals needed continuous education and training methods for improving their competence levels.

Furthermore, this result is in congruent with *35* who conducted a study about "Effect of developing and implementing nursing care standards on outcome of patients undergoing cardiac catheterizations" illustrated that continued nursing education programs increased both knowledge and practice and can also improve attitudes which enhance the nurses" competencies as a whole.

The present study displayed that there was a highly statistically significant correlation between total performance and competence during pre-program and immediately post- program phase and there was statistically significant correlation between total knowledge, performance, and competence of studied nurses during immediately post-program phase and follow up (after 3monthes) of the program phase. This result might be due to effective educational program which lead to improvement of the nurses' knowledge and skills regarding HAMs and accordingly their competence improved. This mean that when nurses knowledge and performance regarding HAMs increased their competence improved

This result is in agreement with a study conducted by *36* about "Nurse managers' attitude and competency towards delegation in Jeddah city public health nursing department" who reported that nurse's knowledge, performance and competence are decidedly related to each other. Also, *37* had pointed in their study about "Effect of simulation on nursing students' medication administration competence" that nurse knowledge and practice are essential in preparing nurses for safe HAMs competence. Similarity, *38* who conducted a study about "Administering and monitoring high-alert medications competence in acute care" reported that knowledge, performances and competences were the basis of the HAMs management and are essential and interrelated components of nurse' job.

Conclusion:

Based on the findings of the current study, it was concluded that the educational program was effective and there was improvement in studied nurses' knowledge, performance and competence regarding high alert medications at immediate post program and follow up program (after 3 months) as compared to preprogram phase. Moreover, there was highly statistically significant correlation between nurses' knowledge, performance and competence related to HAMs at pre, immediate post and follow up phases of program.

7. Recommendations

Based on important findings of the study, the following recommendations were suggested:

Hospital level:

1. Establishing a list of HAMs and posting it in different departments in hospital and maintaining its regular updating.
2. Head nurses must pay more attention and observation to nurses' performance especially during preparation, administration and post administration of HAMs.
3. Establishing a clinical pharmacy service at Emergency Department which had a role in reduction or prevention of HAMs errors.
4. Designing an instructional guideline or protocol about HAMs management.
5. Developing a reward system for nurses who follow hospital policies regarding HAMs.
6. Nurse managers should redesign work plans and conduct early assessment and intervention to reduce workload and work pressure on nurses for reducing HAMs errors.
7. Establishing job orientation for newly graduates' nurses regarding HAMs.

Education level:

1. Conducting training programs and workshops periodically for nurses to enhance their competence regarding HAMs.
2. Conducting educational program for preparation of new graduated nurses to undertake responsibilities of HAMs management skills and competence.

Further research

1. Studying effect of an educational program for nurses about High Alert Medications on patient safety
2. Studying factors that affect high alert medications competence at the clinical setting.
3. Replicating the study for large sample in other departments at clinical settings and other hospitals with different circumstances to prove its effectiveness.

References

[1] S. Resident, B. Kar, S. Choudhury., A. Ghosh, K. Samanta. and A. Hazra. Knowledge, Attitude and Practice Survey Regarding High Alert Medication among Resident Doctors in a Tertiary Care Teaching Hospital in Eastern India. Curr Drug Saf. vol.12 (2), pp.12-17,2022.

[2] R. A. Tariq. V. R. ashisht., A. Sinha. and Y. Scherbak, Medication Dispensing Errors and Prevention. 2021 Nov 14. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing.vol.22(20), pp.120-150,2021.

[3] L. A. Fusco., C. M. Alfes, A. Weaver. and E. Zimmermann. High Alert Medication safety competence of undergraduate nursing students. Clinical Simulation in Nursing.vol.52(5), pp.1-7,2021.

[4] N. M. Mohamed. Effect of designed nursing protocol on nurses' knowledge and practice regarding high alert medications, medical journal Cairo university. vol.83(2), pp.2016-2019,2015.

[5] M. Zieber. and M. Sedgewick. Competence, confidence and knowledge retention in undergraduate nursing students a mixed method study. Nurse Education Today: 62, 16–21, 2018.

[6] L. Yan, L. Yao, Y. Li. and H.: Chen, Assessment and analysis of patient safety competency of Chinese nurses with associate degrees: A cross-sectional study. Nursing open Journal: vol 8(1): 395–403, (2020).

[7] Z. Yang, F. Chen, Y. Lu. and H. Zhang, Psychometric evaluation of medication safety competence scale for clinical nurses. BMC Nursing. vol. 20, pp.165-170,2021.

[8] M. Bahrami., Z. Purfarzad. and M. Rafiei. The Components of Nursing Competence in Caring for Older People in Iranian Hospitals: A Qualitative Study. Iran J Nurs Midwifery Res; vol. 24 (2), pp:124-130، 2019.

[9] A. Efstratios. High Alert Medication Safety Practices in Clinical Nursing: Nurses' Characteristics, Skills, Competencies, Clinical Processes, and Environment. International Journal of Caring Sciences.vol.14 (3), pp. 2019-2028,2021.

[10] Y. E. Bader. Improving nurses' performance regarding medication administration by using pdca cycle. Unpublished doctora thesis. Benha University. pp.90-105,2021.

[11] A. Otero. Developing a list of high-alert medications for patients with chronic diseases. Eur J Intern Med. vol.25(10), pp.900–8,2014.

[12] R. Meretoja, H. Isoaho. and H. Leino-kilpi. Nurse competence scale: development and psychometric testing. Journal of Advanced Nursing.vol.47(2), pp.124–133,2004.

[13] G. Y. Hsaio., I. J. Chen, S. Yu, I. L. Wei., Y. Y. Fang, and F. Tang. Nurses' knowledge of high-alert medications: instrument development and validation, Journal of Advanced Nursing.vol.66(1), pp.177–190,2010.

[14] A. M. Farag. Nurses Knowledge and Practices in Dealing with High Alert Medications. Published master thesis. Alex University, ASNJournal.vol.14, pp.15-20,2017.

[15] R. S. Mohamed. High alert medication among critically ill patients at El-Manial University Hospital: assessment of nurses´ knowledge and practice, Germany, LAMBERT Academic Publishing.vol.70, pp.32-45,2016.

[16] A. G. Fahmy. Nursing performance regarding intravenous infusion of look-alike sound alike medications at Intensive Care Unit, Unpublished Master thesis, Ain Shams University. pp.52-57,2018.

[17] H. S. Zyoud., S. M. Khaled., B. M. Kawasmi., A. M. Habeba., A. T. Hamadneh and H. H. Anabosi. Knowledge about the administration and regulation of high alert medications among nurses in Palestine: a cross-sectional study. BMC Nurs: vol 18 (1): pp. 8 -11, 2019.

[18] N. A. Mohamed. Effectiveness of training program for nurses regarding dealing with high alert medication, Unpublished Master thesis, Ain Shams University. pp. 44-55,2014.

[19] N. A. Aly., T.A. Ghoneim. and O. S. Hassan. Role of Head Nurses in Managing the Safety of High Alert Medications in Critical Care Units. Journal of Natural Sciences Research. vol. 6, pp.80-89,2016.

[20] J. Bataille, S. Prot-Labarthe, O. Bourdon. P. Joret, F. Brion. and J. F. Hartmann. High-alert medications in a French paediatric university hospital. J Eval Clin Pract.vol.21(2), pp.262-70,2015.

[21] A. Z. Yousef. Effect of Nursing Education Guidelines about High Alert Medications on Critical Care Nurses Knowledge and Practices. published master degree, Cairo university, IOSR Journal of Nursing and Health Science (IOSR-JNHS). vol.7(1), pp. 47-54,2018.

[22] Ü. Güneş, H. Ozturk. and E. Ülker. Nurses' Knowledge Level about High-Alert Medications. World Journal of Pharmaceutical Research.vol.18 (33), pp.150- 157,2021.

[23] I. J. Chen., K. W. Wang. and H. F. Wu. Nurses' knowledge of high-alert medications: Nurse Educ. vol. 33, pp.24–30,2013.

[24] A. Heydari,, H. Kareshki, and M. R. Armat. Is Nurses' Professional Competence Related to Their Personality and Emotional Intelligence A Cross-Sectional Study. Journal of Caring Sciences.vol.5, pp.121-150,2016.

[25] I. Notarnicola., C. Petrucci. and M. De Jesus. Clinical competence in nursing: a concept analysis. Prof Inferm. vol. 69, pp.174–181,2016.

[26] M. Nobahar. Competence of nurses in the intensive cardiac care unit. Electronic Physician. vol. 8, pp.23-95,2016.

[27] D. Russo. Competency measurement model. European Conference on Quality in Official Statistics. vol. 8(9), pp.7-25,2016.

[28] A. M. Abdalhamid. Nurses Knowledge and Practice in Dealing with High Alert Medications ASNJ.vol.19 (2), pp.20- 25,2017.

[29] S. A. Mohammed. Impact of instructional module on intensive care nurses' performance regarding intravenous infusion of high alert medication, Unpublished Doctoral thesis, Helwan University. pp. 70-75,2017.

[30] M. C. Lu., S. Yu., I. J. Chen., K. W. Wang., H. F. Wu. and F. I. Tang. Nurses' knowledge of high-alert medications: A randomized controlled trial. Nurse Educ Today; vol 33: pp. 24–30, 2013.

[31] S. B. Mohanty. Effect of educational intervention on knowledge and practice regarding high alert medications among nurses in hospitals of Navi Mumbai. Iaetsd Journal for Advanced Research in Applied Sciences: vol 7(1): pp1-9, (2020).

[32] M. G. Ahmed. Nurses' Performance Regarding Safety Measures of High Alert Medications. Unpublished master thesis. Ain Shams University. pp.150-155,2020.

[33] V. Sulosaari., S. Kajander., M. Hupli., R. Huupponen and H. Leino-Kilpi. Nurse students' high alert medication competence - An integrative review of the associated factors. Nurse education today. Vol 32. pp399-405, (2011).

[34] C. M. Palomares., J. T. Dalman. and J. V. Mahilum. The Competency Level on Safe Administration of High Alert Medications and Quality Nursing Care among the Selected Graduating Students. Liceo Journal of Higher Education Research, vol 9(1), pp290, (2013).

[35] S. Abd-ElMohsen. Effect of developing and implementing nursing care standards on outcome of patients undergoing cardiac catheterizations. IOSR Journal of nursing and heath science. Pp. 45, (2019).

[36] S. Gassas. Nurse Managers' Attitude and Competency Towards Delegation in Jeddah city. American journal of nursing science, vol 6(2), pp72-79, (2017).

[37] M. Jarvill, S. Jenkins, O. Akman. K. S. Astroth., C. Pohl. and P. J. Jacobs. Effect of simulation on nursing students' medication administration competence. Clin Simul Nurs.vol.20 (18), pp.3–7,2018.

[38] J. R. Cajanding. Administering and monitoring high-alert medications competence in acute care. Nurs Stand.vol. 19 (47), pp.42-52,2017.