Family and health Quarterly, vol14, Issue 1, Spring 2024, ISSN: 2322-3065
https://sanad.iau.ir/Journal/fhj/Article/1122143

JFH

Original research

The effectiveness of teaching drug calculation skills on the way of drug performance (change in awareness) of nurses working in special departments

Somaye Talebi Shelimaki[1]*, Sakineh Pourhossein Fouklaei,[2] Hadi Darvish Khezri[3], Kolsoom Akbarnataj bishe[4], Homeira Akbarzadeh,[5] Homeira Tahmasebi[6]

Abstract:

Introduction: drug administration is one of the most important duty of a nurse. Some of the reasons for incomplete implementation of pharmaceutical calculations are poor skill and lack of proper training in pharmaceutical calculations in universities. The aim of this study was to investigate the effect of drug calculation skills education on the performance of nurses working in the Intensive Care Units.

Methods: This study was a semi-experimental type, and the studied population consisted of nurses working in the special departments of Fatemeh Al-Zahra Hospital in Sari city, and 45 people were randomly selected. In this way, the nurses who worked in the special departments in the morning, evening and night shifts during the week in the selected hospital and met the criteria for entering the research were examined in one group before and after the intervention, which lasted for two months. It lasted the data of this research was used through a two-part questionnaire for qualified nurses to measure their skill in pharmaceutical calculations. The first part of the questionnaire included 9 questions about the demographic characteristics of the research units, and the second part included 18 questions related to the cognitive skills of pharmaceutical calculation. The data collection tool was a researcher-made questionnaire with a pre-test and post-test design. The data was collected using SPSS software and descriptive statistics (to determine the mean, standard deviation) and inferential (paired t) and Cronbach's alpha. It was examined and analyzed.

Results: Mean (standard deviation) and median were equal to 15.6 (± 1.3) and 16 questions, respectively. Paired t-test showed a significant increase in the number of correct answers after the test compared to the number of correct answers before the test (Mean Difference: 5.91, 95% CI = 5.15 - 6.68; p-value: <0.0001). The mean scores obtained from the pre-test increased from 20% to the mean of 100% in the questionnaire after the intervention.

Conclusion: The results show that nurses do not have sufficient information and calculational skills of medicine and the authorities are suggested to hold training workshops for them.

Keywords: nurses' performance, pharmaceutical error, pharmaceutical calculations, teaching pharmaceutical skills

Received: 1/ March/ 2023 **Accepted: 1/ June/ 2023**

Citation: Talebi Shelimaki S*, Pourhossein Fouklaei S, Darvish KhezriH, Akbarnataj bishe K, Akbarzadeh H, Tahmasebi H. The effectiveness of teaching drug calculation skills on the way of drug performance (change in awareness) of nurses working in special departments, Family and health, 2024; 14(1): 89-100

[1]- (**Corresponding author**), Department of Medicine, Sari Branch, Islamic Azad University, Sari, Iran.
Tel: 09113528324, Email: somayyehtalebi1393@gmail.com
[2] - Department of Medicine, Sari Branch, Islamic Azad University, Sari, Iran
[3] - Thalassemia Research Center (TRC), Hemoglobinopathy Institute, Mazandaran University of Medical Science, Mazandaran, Iran
[4]- Assistant Professor, Department of nursing, Sari Branch, Islamic Azad University, Sari, Iran
[5] - Department of Medicine, Sari Branch, Islamic Azad University, Sari, Iran, akbarzadeh@iausari.ac.ir
[6] - Department of Medicine, Sari Branch, Islamic Azad University, Sari, Iran,

Introduction:

Nowadays, one of important challenges in the system of providing health and treatment services are maintaining patient safety (1). Ensuring patient safety is a major concern of health care professionals, so today in the health care delivery system, patient safety is a key concept and one of the important indicators of quality control of health services(2).

Medication error is one of the preventable incidents that if not managed can cause harm to the patient(3).Ensuring patient safety is a major concern of health care professionals, so today in the health care delivery system, patient safety is a key concept and one of the important indicators of quality control of health services(4). Among the issues related to patient safety such as patient identification, transfusion error, fall and suicide, the medication error is considered as a major indicator of quality of health care. Drug is the most common medical product in the units of health care providers (5). A drug is a chemical that affects a person's feeling and performance. Giving medicine is one of the most important nursing activities and is the most responsible duty of the nurse. Effective and safe prescribing of drugs requires knowledge in various fields, including theoretical and clinical knowledge of prescribing drugs, pharmacological knowledge and the ability to calculate drugs clinically. On average, nurses spend 40% of their time in the hospital on medication (6).

Clark conducted a research entitled drug computational skills in nurses and nursing students in Canada. He found that none of nurses and nursing students scored 29 out of a maximum test score of 29. The average score of nurses was 22.7 and that of nursing students was 17.8. The result of this study showed that the skill of drug calculations in nursing students and nurses do not have the desired level. Due to the role of the nurse in prescribing drugs, training in drug calculations is an important educational need for nursing students and nurses, which has not been properly addressed in the training program (7).

Coyne E et al. entitled enhancing student nurses' medication calculation knowledge; integrating theoretical knowledge into practice.Accurate calculation of dosages and safe administration of medications in clinical practice is an essential skill for the registered nurse. Appropriate educational preparation of student nurses is the key to ensuring they become safe practitioners in the workforce. A review of the literature on different approaches for teaching and assessing medication calculation with student nurses revealed three main factors that influenced student nurses' ability to calculate medications accurately and identify mistakes. These factors include mathematical ability, particularly around multiplying with decimals, understanding medication formulas, and conceptualising medication dose.This study evaluated teaching interventions that focused on improving the students' understanding of mathematical calculations, medication formulas and conceptualising medication doses. Evaluation study with teaching interventions and Time 1 and Time 2 medication tests.The teaching interventions over 8 weeks included teaching decimals and basic mathematical skills, using the correct mathematical formula for the medication and linking the medication to the patient case study. Time 1 and Time 2 medication tests out of ten, student demographics and reasons for attending tutorials were collected to evaluate the effectiveness of the teaching interventions.For Time 1 medication test pre interventions, the mean was 7.3 with a mode of 8 out of ten. Maths and incorrect medication formula were the most common mistake. For Time 2 medication test post interventions, the mean was 9.3 with a mode of 10. The most common reason for incorrect answer Time 2 was incorrect medication formula. The students identified that the smaller tutorial sizes and remediation

Family and health Quarterly, vol14, Issue 1, Spring 2024, ISSN: 2322-3065
https://sanad.iau.ir/Journal/fhj/Article/1122143
JFH

of errors was the main reason for continued attendance. The teaching intervention improved the accuracy of students' medication calculation, specifically, understanding the correct formula to use and identifying errors of calculation (8).

Abedi1 HA et al. entitled Empowerment of Nurses Drug one of the basic skills that nurses must have. The major cause of medication errors is wrong dose calculation prescribed by nurses. This study aims to enhance the drug calculation ability of nurses of Hazrate Fatemeh Zahra hospital of Najaf Abad. It was a quasi-experimental approach in which questionnaire was used to collect data. The population was nurses working in Hazrate Fatemeh Zahra hospital of Najaf Abad. Sampling method was convenience sampling. First, by using a researcher made questionnaire, pre-test was conducted from 43 people of the population. Then, intervention was done through workshops and after three weeks, the post-test was done. Reliability determined by using internal consistency and by split-half reliability and calculating Spearman-Brown reliability coefficient was 0.93. Data analysed with SPSS statistical software version 18 and statistical tests such as independent t-test, sign, Wilcoxon, Mann-Whitney, McNemar and Pearson's correlation coefficient was performed. Out of the 43 nurses participating in the study, 21 nurses (48.8%) were at the intermediate level before training and after training all the nurses (n=43, 100%) were at the advanced level and answered at least 83% of the questions correctly.

Before performing drug calculations course, the mean score of female nurses was 14.52 and the mean score of male nurses was 18.93 and the total mean score of nurses was 15.93. In the beginning, there was a significant difference between the scores of male and female nurses ($P<0.05$) and male nurses had higher total drug calculation score. After taking the course, the mean scores of female nurses increased to 23.03 and male nurses to 23.29 and the total mean score of nurses to 23.12, and a significant difference between the scores of the nurses in the sample and in both males and females in the drug calculation test before and after the course was observed ($P<0.05$). Conclusion: The results of this study indicate an increase in drug calculation abilities of nurses based on their score improvement in drug calculation in written test which was performed before and after intervention. According to the findings, the need for nurses in drug calculations was clear and by planned and ongoing training, these skills that are sensitive in preventing medication errors can be increased. Considering the importance of the issue and the reduced mastery of drug calculations that has been observed, it is suggested that these programs continue in different working periods of nurses so that they would be effective (9).

Yousefiasl M et al. entitled The Relationship between ethical commithical commitment and medication error among nurses in centers affiliated to urmia universityof medical sciences in 2018 – 9.This review aims to examine the literature available to ascertain whether medication errors in clinical practice are the result of nurses' miscalculating drug dosages. The research studies highlighting poor calculation skills of nurses and student nurses have been tested using written drug calculation tests in formal classroom settings [Kapborg, I., 1994. Calculation and administration of drug dosage by Swedish nurses, student nurses and physicians. International Journal for Quality in Health Care 6(4): 389 -395; Hutton, M., 1998. Nursing Mathematics: the importance of application Nursing Standard 13(11): 35-38; Weeks, K., Lynne, P., Torrance, C., 2000. Written drug dosage errors made by students: the threat to clinical effectiveness and the need for a new approach. Clinical

Effectiveness in Nursing 4, 20-29]; Wright, K., 2004. Investigation to find strategies to improve student nurses' maths skills. British Journal Nursing 13(21) 1280-1287; Wright, K., 2005. An exploration into the most effective way to teach drug calculation skills to nursing students. Nurse Education Today 25, 430-436], but there have been no reviews of the literature on medication errors in practice that specifically look to see whether the medication errors are caused by nurses' poor calculation skills. The databases Medline, CINAHL, British Nursing Index (BNI), Journal of American Medical Association (JAMA) and Archives and Cochrane reviews were searched for research studies or systematic reviews which reported on the incidence or causes of drug errors in clinical practice. In total 33 articles met the criteria for this review. There were no studies that examined nurses' drug calculation errors in practice. As a result studies and systematic reviews that investigated the types and causes of drug errors were examined to establish whether miscalculations by nurses were the causes of errors. The review found insufficient evidence to suggest that medication errors are caused by nurses' poor calculation skills. Of the 33 studies reviewed only five articles specifically recorded information relating to calculation errors and only two of these detected errors using the direct observational approach. The literature suggests that there are other more pressing aspects of nurses' preparation and administration of medications which are contributing to medication errors in practice that require more urgent attention and calls into question the current focus on calculation and numeracy skills of pre registration and qualified nurses (NMC 2008). However, more research is required into the calculation errors in practice. In particular there is a need for a direct observational study on paediatric nurses as there are presently none examining this area of practice (10).

In Iran, there are no accurate statistics on the incidence of medication errors and there is no control action to detect medication errors or special centers and facilities for voluntary reporting of medication errors. However, experts speculate that this is a very high rate. The increase in referrals from doctors and nurses to the medical system and the courts could be evidence of this. One of the principles that nurses must follow to properly prescribe medication is proper medication calculations (11). The ability of pharmaceutical calculations is an integral part of safe administration of drugs, and the lack of this skill is considered a serious risk for errors and as a result, harm to the patient (12).

Kim KS et al. entitled Nurses’ perceptions of medication errors and their contributing factors in South Korea. Journal of nursing management.Medication error is the most common medical error and it is one of the factors involved in patient safety and it can create complications caused by the combination of both human and systemic factors. The ethical commitment of nursing staff is one of the important variables of organizational behavior that affect their job performance. The purpose of this study was to determine the relationship between ethical commitment and medication error among nurses working in centers affiliated to Urmia University of Medical Sciences in 2018-9 Materials & Methods: This descriptive correlational study was performed on 326 nurses working in 5 medical centers of Urmia. Subjects were selected by multistage sampling method. Data were collected using the Cadozier's ethical commitment questionnaire and the researcher-made questionnaire of self-reported medication errors. Finally, after data collection, data were analyzed by SPSS18 software using descriptive and analytical statistics. In this study, most of the samples were female (71.8%) with a bachelor's degree (88.7%). The mean incidence of medication error in the last three months was 1.64 ± 1.1 per nurse. The most common type of error was the wrong drug with the wrong dosage and incorrect documentation. 29.5% of the errors occurred at moderate to high levels of significance,

Family and health Quarterly, vol14, Issue 1, Spring 2024, ISSN: 2322-3065
https://sanad.iau.ir/Journal/fhj/Article/1122143
JFH

and 26.7% of the errors resulted in injury to patients. There was a significant relationship between work experience and error rate. The majority of nurses had a low ethical commitment score (30.67 ± 7.6). No significant correlation was found between ethical commitment and error score (frequency of errors) (p = 0.52, r = 0.035). Although there was no significant relationship between medication error and ethical commitment as an individual factor, the role of organizational factors in medication errors seems to be important. It is essential to focus on individual factors to eliminate medication errors. Also, managers and health providers should work to improve organizational factors so as to reduce medication errors and increase patient safety (13).

According to the review of studies and the importance of nurses' skills in giving Medicine in Intensive Care Units and related problems, the researcher conducted this research on the effect of teaching pharmacological calculation skills on the performance of nurses working in Intensive Care Units in Fatemeh Al-Zahra Hospital in Sari to find a solution to this problem.

Research method:

The method of this study is semi-experimental. Nurses who worked in the special departments of Fatemeh Al-Zahra Hospital and had a bachelor's or master's degree in nursing and met the criteria for participation in the research constituted the population of this study. A simple random sampling method was used in this research. In this way, the nurses who worked in the special departments in the morning, evening and night shifts during the week in the selected hospital and met the criteria for entering the research were examined in one group before and after the intervention, which lasted for two months. In this study, the research samples were nurses who worked in the special departments of the selected hospital and met the criteria for entering the research, and in order to determine the sample size, and according to the opinion of the respected Professor of Statistics, the formula for determining the sample size was used and at the confidence level of 95% and The error was estimated to be less than 5% and the sample size was 45 people**.**

Sample estimation formulas are: $$N = \frac{(z_{1-\frac{\alpha}{2}}+z_1-\beta)^2[p_1(1-p_1)+(p_2(1-p_2)]}{(p_1-p_2)^2}$$

In which according to previous studies: $z_{1-\frac{\alpha}{2}} = 1.96$ $z_1 - \beta == 0.80$

$\beta = 0.20$ $\propto = 0.05$

The proportion of correct answers before the intervention$= p_1$

The proportion of correct answers after the intervention$= p_2$

$$45 = N = \frac{(o.80-1.96+0.80-0.20)^2[20\%(1-20\%)+(100\%(1-100\%)]}{(20\%-100\%)^2}$$

The inclusion criteria for nurses include; having a university education of at least a bachelor's degree in nursing, at least six months of work experience in the desired departments, and having the desire to participate in research. And exclusion criteria for patients including; There were nurses who worked part-time or as assistants in special departments.The data of this research was collected through a data collection tool which was a questionnaire made by the researche the first part of the questionnaire included 9 questions about the demographic characteristics of the units under research and the second part included 18 questions related to the cognitive skills of pharmaceutical computing. The checklist also included 33 visible items that, by directly observing the process of preparing drugs

and how to give drugs to the patient, the researcher recorded the performance in the relevant form. The questions of cognitive computational skills had four options, of which one options is the correct answer and marked with a cross. Scoring the answers in measuring the cognitive skills of pharmaceutical calculations was done according to the number of correct answers to the questions. So the correct answer has the point (1) and the wrong answer (0). In total, the score obtained from the correct answers is considered as the score of cognitive skills of pharmaceutical calculations. The scores are classified in three levels: good (more than 66%), moderate (33%-66%), weak (less than 33%) and thus the levels of cognitive skills of good, moderate and weak drug calculations were created and measured in the Likert scale.

In this study, the content validity method was used to evaluate the validity of the designed questionnaire (scientific validity). First, a questionnaire was prepared by studying new books and articles related to the research topic and using the opinions of supervisors. Then it was given to ten faculty members of the Faculty of Nursing and Midwifery, university professors and 3 cardiologists. After collecting the comments, we made necessary changes and corrections, and prepared the final questionnaire. The retest was used and the questionnaire was given to 10 nurses who met the inclusion criteria in the research population. A retest was performed one week apart and also the Cronbach alpha method was used for the validity of the questionnaire and checklist with emphasis on internal coordination of the questions. The correlation over 8% was accepted.

After receiving the letter of introduction from the officials of the faculty and obtaining permission from the officials of Fatemeh Al-Zahra Hospital, the researcher first selected the nurses who met the criteria of the research by random sampling from among the nurses working in the special departments. Male and female nurses with bachelor's or master's degrees working in the special departments of Fatemeh Al-Zahra (specialized and subspecialized heart of Mazandaran province) were randomly selected and investigated. In this study, the research samples were nurses who worked in the special departments of Fatemeh Al-Zahra Hospital and met the criteria for entering the research (nurses who were working in the special departments of Fatemeh Al-Zahra Hospital (specialized and subspecialized heart of Mazandaran province) and willing to participate in to have the research).In order to determine the sample size and according to the opinion of the respected Professor of Statistics, the formula for determining the sample size was used and the confidence level was 95% and the error was less than 5% and the sample size was estimated to be 45 people.
After receiving permission from the faculty officials and obtaining permission from the officials of Fatemeh Al-Zahra Hospital, by stratified random sampling (quota) the researcher first selected the nurses who met the criteria of the inclusion criteria for participating in research. Male and female nurses with bachelor's or master's degrees working in Intensive Care Units of Fatemeh Al-Zahra (specialized and sub-specialized heart wards of Mazandaran province) were randomly selected and examined. In this study, the research sample was nurses who worked in Intensive Care Units of Fatemeh Al-Zahra Hospital and met the inclusion criteria (nurses who worked in Intensive Care Units of Fatemeh Al-Zahra Hospital (specialized and sub-specialized heart wards of Mazandaran province) and wanted to participate in research. In order to determine the sample size and with the opinion of the esteemed professor of statistics, the formula for determining the sample size was used and was estimated at a confidence level of 95% and an error less than 5% and a sample size of 45 people.
The researcher explained the objectives of the study to them. Then, necessary explanations were given about how to complete the pre-test and questionnaire and to assure them about the

Family and health Quarterly, vol14, Issue 1, Spring 2024, ISSN: 2322-3065
https://sanad.iau.ir/Journal/fhj/Article/1122143
JFH

confidentiality of the answers. The research subjects were asked to read the questions. The researcher left them alone to freely choose their answers, but remained in their presence if they wished. Otherwise, regarding the completion of the tool, refer to them regularly to solve their possible problems. First, a pre-test was conducted in relation to the cognitive skill of pharmaceutical calculations. These completed pre-tests were collected on the same day from the research units. Then, they were given a training booklet and a training CD on the executive skills of pharmaceutical calculations. After a week, the questionnaire was given to them and collected on the same day.Then the evaluation results were checked based on the educational objectives before and after the intervention.

Limitations and exclusion criteria for participating in the research included nurses who worked part-time or as assistants in Intensive Care Units and personal dissatisfaction of the research samples. Before and after answering the questions, all the subjects were thanked and appreciated. Hospital officials were assured that the results of the study would be made available to them if they so wished. This research has received code of Ethics to number (IR.IAU.SARI.REC.1397.012) from the Ethics committee Azad University unit Sari and written agreement obtained from research samples.

Research samples were able whenever they wanted get out from research and warrant them, remains confidential information and grads of research samples

Findings:

According to the statistical analysis of the findings of this research, we can say that the minimum and maximum number of correct answers of the pre-test was between 2 and 16 questions. The mean (±standard deviation) and median were 9.7 (± 2.7) and 10 questions, respectively. Also, the minimum and maximum number of correct answers in the post-test was between 13 and 18 questions. The mean (±standard deviation) and median were 15.6 (± 1.3) and 16 questions, respectively. Paired t-test showed a significant increase in the number of correct answers after the test compared to the number of correct answers before the test (Mean Difference: 5.91, 95% CI = 5.15 - 6.68; p-value: <0.0001).

Most nurses were moderate in terms of knowledge of medication calculations before the intervention. Only 20% of nurses were at a good level in terms of knowledge of medication calculations which increased to 100% after training. A total of 45 people participated in the study and all nurses completed the questionnaire. 18 people (40%) worked in the ICU, 17 people in the CCU (37.8%) and 10 people in the emergency department (22.2%). Demographic and basic information of the nurses under study are given in Table 1.

Table 1: Demographic and basic information of the nurses under study - Fatemeh Al-Zahra Hospital - 2018-2019

Variable		**Number (percentage)**
Age (year)	25-35	(86.7) 39
	36-46	(13.3) 6
Gender	Male	(37.8) 17
	Female	(62.2) 28
Type of employment	Contractual	(62.2) 28

	Tenurel	(37.8) 17
Work experience (year)	0-10	(84.4) 38
	11-20	(11.1) 5
	21-30	(4.4) 2
Education	MSc	(15.6) 7
	BSc	(84.4) 38
Participation in courses		(22.2) 10
Shift	Morning	(40) 18
	Evening	(28.9) 13
	Night	(31.1) 14
Interested		(71.1) 32

The minimum and maximum number of correct answers of the pre-test were between 2 and 16 questions. The mean (±standard deviation) and median were 9.7 (± 2.7) and 10 questions, respectively. Also, the minimum and maximum number of correct answers in the post-test was between 13 and 18 questions. The mean (±standard deviation) and median were 15.6 (± 1.3) and 16 questions, respectively. Paired t-test showed a significant increase in the number of correct answers after the test compared to the number of correct answers before the test (Mean Difference: 5.91, 95% CI = 5.15 - 6.68; p-value: <0.0001).

- ✓ In order to achieve the goal (2), determining the effect of cognitive skills of pharmaceutical calculations on the performance of nurses after the intervention in 2018-19, we have compiled table (1).
- ✓ In order to achieve the goal (3), comparing the effect of cognitive skills of pharmaceutical calculations on the performance of nurses after the intervention in 2018-19, we have compiled table (1).

Most nurses were at a moderate level before the intervention in terms of the level of pharmacological computing skills. Only 20% of nurses were at a good level in terms of medication calculation skills which increased to 100% after training. A comparison of the frequency of correct answers before and after training in terms of the level of pharmacological calculation skills is given in Table 2.

Table 2: Comparison of the frequency of correct answers before and after training - Fatemeh Al-Zahra Hospital - 2018-2019

Observations (correct answer percentage)	**Before training (n=45)**		**After training (n=45)**	
	Number	Percentage	Number	Percentage
Weak (less than 33%)	4	8.9	-	-
Moderate (33 to 66%)	32	71.1	-	-
Good (more than 66%)	9	20	45	100

Family and health Quarterly, vol14, Issue 1, Spring 2024, ISSN: 2322-3065
https://sanad.iau.ir/Journal/fhj/Article/1122143
JFH

Findings of Table (2) show that the highest percentage of the units under study had a moderate level of performance (71.1%) before the intervention and had a good level of performance (100%) after the intervention.

The results of paired t-test show a statistically significant relationship between the mean performance scores before and after the intervention (P = 0.000).

Discussion and conclusion:

The general aim of this study was to investigate the Effectiveness of drug calculation skills education on the performance of nurses working in the Intensive Care Units.
Findings of this research indicate that the intervention of drug calculations has been effective in nurses' learning. It also showed a statistically significant increase in the number of correct answers after the test compared to the number of correct answers before the test.
Dietzen conducted a research to evaluate drug computational skills in second-year nursing students. In this research, a test was performed in the field of cognitive skills of pharmacological calculations among second year nursing students. The maximum score of this test was 30 points, but the students' score was between 7 and 29 and no student managed to get all the points. The majority of students stated that they should be given the opportunity to practice these skills in the clinical environment to improve their computational skills (14). The result of this study also showed that students need training in this field. The results of this study are consistent with the present study, so that in the present study we concluded that nurses need more training in pharmaceutical computing. Holding training classes or in-department conferences can be helpful in this regard. It is also better to teach students about drug calculations in universities and to address this issue in more time (14).
On the other hand, in a study entitled "Mathematical calculations anxiety in determining the dose of drugs in nursing students", Glaiser addressed the issue of human errors in computing the dose of drugs. In this research, he showed that mathematical calculation anxiety can lead to negative effects on the power of drug dose calculations in nurses and due to the stress of the nursing profession it can make the occurrence of calculation errors in drug dose more likely. The results showed that with classical education, the skills of students and nurses in computing the dose of drugs can be improved. It was also concluded that teaching mathematical calculations to nursing students is also effective in this improvement (15).

Miracle has conducted a research aimed at investigating drug computational skills in nurses. He believes that continuous training of nurses is essential to improve the quality of nursing care. The results of his research showed that, in order to properly perform their duties for the preparation and distribution of prescribed drugs, the nurses need to have more classical and theoretical training and also the continuation of training within the framework of continuing education programs (16). The result of the present research also indicates that nurses need educational programs, educational booklets, educational CDs, educational pamphlets, etc. in the field of drug calculations for the correct implementation of medicine. In the present study, the level of medication calculation skills in nurses in Intensive Care Units was moderate before the intervention, and since correct medication

calculation is a vital skill for the nurse to perform medications correctly, it is better to focus on its continuous training.

Rubin et al. conducted a descriptive study at Monash University in Australia with the aim of examining some demographic data and attitudes toward performing drug calculation and basic math education and drug calculation discussions in nursing students. The results showed students answered the questions correctly, 28% answered incorrectly and did not try to answer. In general, the results of these studies show that complete training in mathematics is needed for nursing students to be able to perform medication calculations correctly (17). In the present study, we concluded that teaching pharmacological calculations is of effect on nurses' performance. Hospital educators should strive to enhance nurses' knowledge through training programs or classes in drug computing and the use of professors in this field to increase the quality of their work in drug delivery.

Alim Mohammadi et al. conducted a study entitled "Medical errors of nurses in intensive care units and preventive strategies". They showed that 80% of participants had drug errors in the past month and the most common causes were overwork, illegible drug prescriptions and drug preparation without rechecking it. Most drug errors occurred in pediatric and adult intensive care units. Most reports were made in the morning shift. Participants said that continuous monitoring of nurses in terms of compliance with the law of five correct is the most important way to prevent medication errors. Considering that the most common cause of medication error in the participants under study was high workload and illegible medication prescriptions, it was suggested that health care centers provide the necessary infrastructure for computer prescribing and establishing an appropriate reporting system to take steps to prevent, reduce medication errors, and improve patient safety by adjusting the working environment of nurses, such as observing the correct ratio of nurse to patient (18).

Therefore, nurses should be aware of the importance of knowing and giving the correct medication to prevent possible risks and side effects due to medication errors. The nurse prescribing the medication needs basic information about the medication, including the name of the medication – preparation, classification, and the side effects of the medication. These indicate that nurses should be trained in medication calculations and educational administrators should pay more attention to this point.

In a research for determining the effect of weekly training classes on improving nurses' skills in computing the dose of prescription drugs, Hogan surveyed 99 nursing students. The results showed that with classical education, the skills of students and nurses in computing the dose of drugs can be improved. He believes that some of the reasons for the incomplete execution of drug calculations include poor skills, the existence of automatic equipment to perform calculations, long shifts, factors of lack of proper training in drug calculations in universities and also inaccuracy in performing drug calculations. Nurses who teach in universities should pay more attention to this issue and more educational programs should be held for students (19). The result of this study is consistent with the result of the present study.

In the present study, we came to the conclusion that training can strengthen the skills of drug computing in nurses and that the nurses do not have enough information and drug computing skills and the authorities are recommended to hold training workshops for them. It is better for the

Family and health Quarterly, vol14, Issue 1, Spring 2024, ISSN: 2322-3065
https://sanad.iau.ir/Journal/fhj/Article/1122143
JFH

educational officials of the hospitals to increase the scientific level of the nurses in the field of pharmaceutical calculations with educational programs so that they can take better care of the patient in carrying out the prescriptions. The results of this research confirmed the improvement of nurses' knowledge and skills in computing and determining the dose of prescribed drugs based on the improvement of the scores obtained in the questionnaire, which was done before and after the educational intervention.

Acknowledgments: The authors of this article thank the Islamic Azad University of Sari. The article is the result of a project approved by this university, and we thank the colleagues participating in this study and all those who cooperated in the sampling.

Ethical considerations:

In this research, the researcher considers himself obliged to comply with the following ethical principles:
1- Obtaining a letter of introduction from the vice president of research of the university to the relevant officials of the research hospitals and the vice president of research of the faculties of medical sciences in Mazandaran province in order to obtain their approval after stating the objectives of the research.
2- Reassurance to the beneficiary centers in order to be aware of the results of the research
3- The researcher introduced himself to the research units and the objectives of the research were explained to the research subjects (nurses) in order to obtain informed consent.
4- Voluntary and optional participation in the research, without naming the research subjects in the questionnaire and keeping the research results confidential
5- Reassuring the subjects of the research to present the results in general and not case by case
6- Sending the present research to the ethics committee of Islamic Azad University, Sari branch, to get the code of ethics (IR.IAU.SARI.REC.1397.012).
7- The colleagues and officials of the hospital and research units were thanked.

Research limitations*:*

A) Restrictions on the authority of the researcher
1) The physical and mental condition of nurses in answering questions such as fatigue, nervous tension and family problems that are effective in learning when completing the questionnaire, affects the way they answer, which by choosing the right time when the samples are balanced in terms of They are mentally and physically, we tried to remove this limitation as much as possible.
2) The noise of the environment and inappropriate place creates difficulties in completing the questionnaire by the research unit, so the questionnaire was completed at a suitable time and in a separate place.
B) Restriction beyond the authority of the researcher
1) Individual differences and the way of working with different work shifts have an effect on how to complete the questionnaire, which cannot be controlled by the researcher.
2) Personal studies and learning of research samples through group media and informal training during data collection have an effect on the results that are beyond the researcher's control

Acknowledgement: The authors of this article thank the Islamic Azad University of Sari branch. The article is the result of a project approved by this university, and we thank the colleagues who participated in this study and all those who collaborated in sampling.

References:

1.Di Simone E, Giannetta N, Auddino F, Cicotto A, Grilli D, Di Muzio M. Medication Errors in the Emergency Department: Knowledge, Attitude, Behavior, and Training Needs of Nurses. Indian J Crit Care Med. 2018;22(5):346-52. doi: 10.4103/ijccm.IJCCM_63_18.

2. Farzi S, Alimohammadi N, Moladoost A. Medication errors by the intensive care units' nurses and the Preventive Strategies. Anesthesiology and Pain. 2016;6(4):33-45. URL: http://jap.iums.ac.ir/article-1-5231-en.html.

3. Jember A, Hailu M, Messele A, Demeke T, Hassen M. Proportion of medication error reporting a nd associated factors among nurses: a cross sectional study. BMC nursing. 2018;17(1):9. DOI:10.1186/s12912-018-0280-4.

4. Dirik HF, Samur M, Seren Intepeler S, Hewison A. Nurses' identification and reporting of medication errors. J Clin Nurs. 2019;28(5-6):931-8. https://doi.org/10.1111/jocn.14716.

5. Kim KS, Kwon SH, Kim JA, Cho S. Nurses' perceptions of medication errors and their contributing factors in South Korea. Journal of nursing management. 2011;19(3):346-53. https://doi.org/10.1111/j.1365-2834.2011.01249.

6. Wright K. Do calculation errors by nurses cause medication errors in clinical practice? A literature review. Nurse education today. 2010;30(1):85-97. DOI:10.1016/j.nedt.2009.06.009.

7. Clark LA. A study of the relationship between student nurse characteristics and calculation abilit]; 2009 Available from: https://doi.org/10.1016/j.nedt.2009.06.009.

8. Coyne E, Needham J, Rands H. Enhancing student nurses' medication calculation knowledge; integrating theoretical knowledge into practice. Nurse Educ Today. 2012; 8. [Epub ahead of print]. DOI:10.1016/j.nedt.2012.04.006.

9. Abedi HA, Ghavi MR, Mannani R. Empowerment of Nurses Drug Calculations. 9 January 2014. URL: http://ijnr.ir/article-1-1334-en.html.

10. Yousefiasl M, naderi R, Baghaei R, khalkhali H R, cheraghi R. The relationship between ethnical commitment and medication error among nurses in centers affilated to urmia university of medical sciences in 2018- 9. Nursing and Midwifery Journal 2020; 17 (11) :878-88. URL: http://unmf.umsu.ac.ir/article-1-4009-en.html.

11. Hogan CA. Pediatric Patient Safety: Factors pediatric nurses identify as contributing to medication administration errors: Loyola University Chicago; 2006. DOI:12. Cleary-Holdforth J, Leufer T.Thestrategic role of education in the prevention of medication errors in nursing: Part 2. Nurse Educ Practice 2013;13(3): 217-20. DOI: 10.1016/j.nepr.2013.01.012 .

13. Kim MS, Kim CH. Canonical correlations between individual self-efficacy/organizational bottom-up approach and perceived barriers to reporting medication errors: a multicenter study BMC Health Serv Res. 2019;19(1). DOI:10.1186/s12913-019-4194-y

14. Deitzen DM. Mathematical calculation ability of registered nurse. [cited 2007 Dec 10]; 2008 Available from:

Family and health Quarterly, vol14, Issue 1, Spring 2024, ISSN: 2322-3065
https://sanad.iau.ir/Journal/fhj/Article/1122143

http://proquest.umi.com/pqdweb?index=0&did=743238771&SrchMode=1&sid=1&Fmt=6&VInst=PRD&VType=PQD&RQT=309&VName=PQD&TS=1197361302&clientId=48024O.

15. Glaister K. The presence of mathematics and computer anxiety in nursing students and their effects on medication dosage calculations. Nurse Education Today. 2007;27(4):341-7. DOI:10.1016/j.nedt.2006.05.015

16. Miracle VA(2009). Medication errors. Dimensions of Critical Care Nursing, 2009: 51-80.

17. Robyn Fairhall.et al. Numeracy skills of nursing students. Nurse Education Today, 2011; 20 (2):815-818. DOI:10.1016/j.nepr.2005.12.002

18. khajeali n, baghaei r. Comparison of pharmacological knowledge and skills in pharmaceutical calculations in nurses of general and ICU wards in educational hospitals in Ahvaz. Quarterly Journal of Nersing Management. 2014;2(4):48-55. URL: http://ijnv.ir/article-1-146-en.html.

19. Alteren J, Hermstad M, White J, Jordan S. Conflicting priorities: observation of medicine administration. J Clin Nurs.2018;27(19-20):3613-21. DOI:10.1111/jocn.14518.