Original Article

Effect of the peer mentoring method on the occurrence of medication errors among nursing students

Seyed Kazem Mousavi [1*] iD, Mohsen Kamali [1] iD

[1]Department of Nursing, Abhar School of Nursing, Zanjan University of Medical Sciences, Zanjan, Iran.

Article Info

*****Corresponding author:**
Seyed Kazem Mousavi, Department
of Nursing, Abhar School of
Nursing, Zanjan University of
Medical Sciences, Zanjan, Iran.
Email: kazemmoosavi69@gmail.com

Abstract

Background & Objective: Medication errors are one of the most serious concerns in the process of treatment and patient care. According to the conducted studies, the proportion of medication error reporting among nursing students is relatively high. The present study aimed to assess the effect of the peer mentoring method on nursing students' medication errors.

Materials & Methods: In this quasi-experimental study, 63 fifth-semester nursing students (starting in fall and winter semesters) of Abhar Nursing College were selected in 2022 and randomly assigned to two intervention and control groups based on the entry semester. Data collection tools included demographic and medication administration error (MAE) questionnaires. Initially, the mentor students were selected and participated in three sessions of group education. Thereafter, a joint meeting was held with the students, mentors, and clinical instructors, and while explaining the work method, the questionnaires were completed by the students. In the next phase, two mentors were placed in the group for every seven students, and during the three-week internship, they took responsibility for clinical education (with an emphasis on drug administration education) with the instructor. After one semester, the study participants completed the MAE questionnaire again. The collected data were analyzed in SPSS software (version 26) using descriptive and inferential statistics.

Results: After the intervention, the mean score of medication errors in the intervention group decreased significantly, and a significant difference was detected between intervention and control groups. Therefore, students in the intervention group had fewer medication errors than their peers in the control group (P<0.001).

Conclusion: The obtained results pointed to the effectiveness of the peer mentoring method in the mitigation of medication errors among nursing students. Therefore, it is recommended that this method be used in their clinical education, and future studies assess the effect of the virtual peer mentoring method on the occurrence of medication errors among these students.

Keywords: mentoring, medication errors, students, nursing

Introduction

Implementing medication orders as an essential part of the patient care process and one of the main pillars of the nursing profession requires sufficient scientific and practical skills (1). On average, nurses in the hospital spend 40% of their time in the hospital to administer medicines. Nurses and nursing students are directly involved in administering medicines to patients in hospitals and are known as the first group responsible for medication errors (2). Medication errors are defined as deviations from doctor's orders and constitute the second most common medical and nursing error, accounting for 10%-18% of all injuries reported in hospitals (3).

During the implementation of medication therapy, common errors may occur, including mistakes in medication administration, failure to observe the correct time of medication administration, failure to observe the correct method of medication administration, administration of more than the prescribed amount of medication, wrong concentration of medication, and administration of medication to the wrong patient (4). The primary and natural consequences of medication errors include increased hospital length of stay, increased costs imposed on the patient and treatment system, severe injury, and even the death of the patient (5).
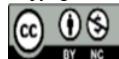
Based on studies, medication errors harm an estimated 1.5 million people every year, resulting in an estimated $3.5 billion in added healthcare costs plus unknown damage to the economy due to lost wages and productivity (6). In Iran, medication errors and their associated complications harm 45,000 people and claim 3,000 lives (7). Today, there are more than 20 thousand types of drugs in the world, and all of them, despite their therapeutic effects, have complications. Therefore, medical staff, especially nursing students, should gain a thorough knowledge of the importance of administering correct medicines in order to prevent their possible side effects due to medication errors (8).

According to the conducted studies, the proportion of medication error reporting among nursing students is relatively high (9, 10, 11). Even though nursing students take pharmacology courses during their undergraduate studies, how much they have actually learned about medication therapy implementation is unpredictable and uncontrolled (12). Studies in this field demonstrated that according to the principles of medication therapy, nursing students participate in nursing programs, such as administering medicines to patients under the supervision of a clinical instructor (13,14). Despite the traditional clinical teaching method in which each student in a group of seven to eight spends an average of 40 minutes in a one-on-one interaction with the instructor in a five-hour clinical shift, this monitoring is not sufficient and continuous, and nursing students are exposed to medication errors, which can sometimes have irreparable consequences for patients, students, and instructors (13).

Since the human factor plays the most important role in the occurrence of medication errors among nurses, it can be stated that the training methods used so far suffer from some drawbacks and fail to provide nurses with the necessary knowledge and skills required to work in the complex clinical environment. Therefore, a shift from traditional methods to new approaches to teaching and learning is necessary in nursing education methods (15). Different studies have confirmed the positive effect of using these methods on improving theoretical knowledge (16,17) and clinical skills (18,19) of nurses and nursing students. The peer mentoring method is one of the new methods of clinical training that has received assiduous attention in recent years (20). Peer mentoring learning is divided into two main types: near peers and partner peers. Partner peers are equal in academic rank and, therefore, relatively inexperienced, while close peers are students who are always at a higher level; that is to say,

near peers are at least one year senior to the students they teach. Since differences between peers are necessary for knowledge transfer, the near peer method seems to contribute more to learning.

In this model, students benefit as teachers and learners at the same time (21). The peer mentoring method has been introduced as an effective educational intervention for medical students, involving students in learning and increasing their responsibility (22). So far, a wide array of studies has been conducted on the use of this method and confirmed its positive effect on variables, such as improvement of clinical skills (23), satisfaction and improvement of learning (24), reduction of stressors in the clinical environment (25), scientific development and integration of knowledge, attitude, and skills (26), increasing self-confidence (27) and strengthening leadership skills (28). Despite the decisive role of using the peer method in improving nursing students' clinical skills, limited studies have been conducted on the effect of using this method on medication errors among nursing students. Meanwhile, about half of nursing students commit medication errors (3,9), and traditional clinical education has been highlighted as one of the most important causes of these errors (29). Therefore, according to the stated necessities and the importance of the subject, the present study aimed to assess the effect of implementing the peer mentor program on the occurrence of medication errors among nursing students.

Materials & Methods

Design and setting(s)

This quasi-experimental research assessed the effect of the implementation of a peer mentoring program on medication errors from nursing students' perspective in 2021-2022. The research population included all fifth-semester students studying for one year at Abhar Nursing School, affiliated to Zanjan University of Medical Sciences, and the research environment included two medical training centers where these students were trained.

Participants and sampling

The participants of this research included all fifth-semester nursing students of this faculty in the first and second semesters who had taken the 3rd adult nursing internship course. They were selected since, firstly, they had passed the theoretical and clinical pharmacology courses, and secondly, according to the rules of employment of students in the clinical environment, they could not have on-campus jobs. Thirdly, due to passing

several training courses in the hospital, they had higher clinical work experience, and according to the BSN curriculum in Iran, they could carry out medication orders under the supervision of the instructor.

The inclusion criteria were as follows: (willingness to participate in the study, not having a diploma in practical nursing, not having employment experience in clinical environments, such as hospitals and clinics, no history of academic probation, passing theoretical and practical pharmacology courses, and taking 3rd adult nursing internship course for the first time). Thereafter, based on the entrance semester, students starting in the fall semester were assigned to the test group, and those starting in the winter semester were allocated to the control group using the simple random sampling method.

Tools/Instruments

The data collection tools included a demographic characteristics form and medication administration error (MAE) questionnaire. The demographic questionnaire included information, such as age, gender, marital status, number of units passed, score obtained in the pharmacology course, and grate point average (GPA) of the students. Moreover, in order to assess the probability of medication errors, MAE questionnaire was used. This questionnaire was designed in 2005 by Wakefield et al. and includes questions related to the type and rate of medication errors and categorizes the medication errors into two general groups: non-injection medication errors (9 questions) and injection medication errors (11 questions) (30).

Taheri et al. (2011), in their study on nurses, reported the validity and reliability of this tool as 0.76 and 0.75, respectively (31). Moreover, in the study by Ramezani et al. (2015), the test-retest reliability coefficient of this questionnaire was obtained at 0.63-0.80 (32). In the present study, the reliability of this questionnaire was confirmed, rendering a Cronbach's alpha of 0.90. According to the studies conducted by Wakefield et al., although there are several approaches to collecting data on medication errors, voluntary reporting provides more accurate information; therefore, despite the limitations of self-reporting, this method was selected to investigate factors related to medication errors (30).

Data collection methods

In order to conduct this research, after obtaining permission from the Ethics Committee of Zanjan University of Medical Sciences, the researcher referred to Abhar Nursing Faculty. After obtaining permission from the managers of this department, introducing

himself, and stating the objectives and method of conducting the research, research participants who met the inclusion criteria were invited to cooperate, and informed written consent to participate in the study was obtained from them.

In the first stage, the mentors were selected based on the opinion of the director and professors of the nursing department of the faculty from among the eighth-semester students and based on their prior knowledge of their academic level and skills as well as their willingness to participate in the study, they underwent group training for three sessions after completing the consent form. The content of these sessions included the general principles of pharmacology and drug calculations, as well as common drugs used in cardiac and respiratory patients. Each of these topics was planned and implemented by the researcher in a two-hour session in the form of lectures, questions and answers, and PowerPoint.

In the second stage, a joint meeting was held in the presence of the students of the test group, mentors, and clinical trainers. The participants completed the demographic questionnaire and MAE questionnaires while learning about the goals and method of implementing the plan. Since there was a one-semester gap between the sampling of the intervention and control groups, such a meeting was held separately for the students of the control group and after explaining the research implementation method, the questionnaire was completed by them. In the third stage of the study, for every seven fifth-semester students, two students were selected as peer instructors and during a three week-internship, they took the responsibility of clinical education (with an emphasis on teaching medication administration skills), while in the control group, the only direct supervisor and guide of the student was the corresponding instructor.

It is worth noting that since the time interval between the implementation of the peer mentor program for the students of the test group and the regular program for the participants of the control group was considered to be one academic semester, there was a faint possibility of information exchange between the students of the two groups. After a semester, MAE questionnaire was completed again by the study participants (Diagram 1). Moreover, in order to comply with research ethics, at the end of the course, a two-day clinical pharmacology workshop was held for the students of the control group, and they were also taught the common medicines used in these departments.

Data analysis

The collected Data were analyzed in SPSS software (version 26) using descriptive statistics (frequency, percentage, mean, and standard deviation) and inferential (chi-square, Fisher's exact test, independent t-test, and paired t). A p-value less than 0.05 was considered statistically significant.
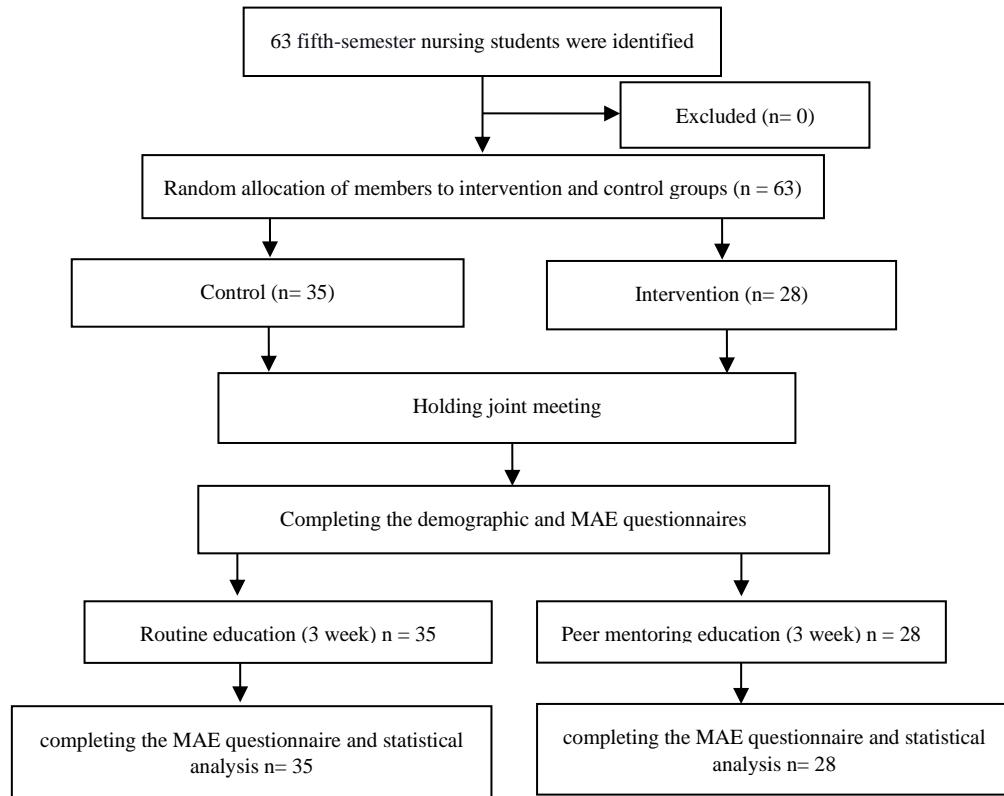

Diagram1. Consort Flow Diagram

Results

The mean age scores of participants in the control and test groups were 23.15±1.27 and 22.02±1.4, respectively. Regarding gender, 42.8% of participants in the intervention group were male, and 57.1% of subjects in the control group were female. The majority of participants in the control group (57.2%) and the test group (67.9%) had completed between 60-80 academic credits. Moreover, 42.9% and 46.4% of participants in the control and intervention groups had a GPA of 14-16 of 20, respectively. Based on the results of chi-square and Pearson correlation tests, the two groups had no statistically significant difference in terms of age, gender, marital status, number of credits passed, pharmacology score, and GPA (P<0.05) (Table 1). In addition, the Shapiro-Wilk test was used to determine the

normality of the main research variable, and the results showed that the medication error variable had a normal distribution (P<0.05).

Thereafter, paired t-tests and independent t-tests were used to test the research hypothesis. Accordingly, the results of the independent t-test pointed to a significant difference between the two groups after the intervention in terms of medication error rate (P<0.001). Moreover, based on the paired t-test, the mean scores of medication errors in both injection and non-injection sections in the control group before and after the intervention were not significant (P<0.05). While there was a statistically significant difference between the mean scores of medication errors in both injection and non-injection sections in the test group before and after the intervention (P<0.001) (Table 2).

Table1. Demographic characteristics of research participants

Varibale		Intervention group	Control group	Test and statistic	P-value
Age		22.02±1.4	23.15±1.23	Pearson correlation (r=0.129)	0.114
Gender	Male	12 (42.8%)	15 (42.9%)	Chi-square (F=0.089)	0.510
	Female	16 (57.2%)	20 (57.1%)		
Marital status	Single	21 (75%)	27 (77.1%)	Chi-square (F=0.143)	0.256
	Married	7 (25%)	8 (22.9%)		
Number of credits passed	40>	2 (7.1%)	5 (14.3%)	Chi-square (F=0.206)	0.453
	40-60	5 (17.9%)	8 (22.8%)		
	60-80	19 (67.9%)	20 (57.2%)		
	>80	2 (7.1%)	2 (5.7%)		
GPA	14>	4 (14.3%)	5 (14.3%)	Chi-square (F=0.063)	0.671
	14-16	13 (46.4%)	15 (42.9%)		
	16-18	9 (32.2%)	12 (34.2%)		
	18<	2 (7.1%)	3 (8.6%)		
Pharmacology score	14>	7 (25%)	8 (22.9%)	Chi-square (F=0.897)	0.101
	14-16	12 (42.8%)	17 (48.5%)		
	16-18	6 (21.4%)	6 (17.2%)		
	18<	3 (10.8%)	4 (11.4%)		

Table 2. Results of independent t-test and paired t-test to compare the mean score of medication error among students in control and test group

Medication prescription error	Time Group	Before intervention (mean± standard deviation)	After intervention (mean± standard deviation)	Sig (t**, p)
Injectable medications	Control	4.78 ± 1.14	4.57 ± 1.71	(0.34, 0.147)
	Test	4.61 ± 1.37	3.23 ± 1.87	(2.11,<0.001)
	T* (P-value)	(0.29, 0.152)	(2.04,<0.001)	
Non-Injectable medications	Control	4.82 ± 1.75	4.46 ± 2.04	(0.83, 0.68)
	Test	5.04 ± 1.54	3.15 ± 1.72	(2.93, <0.001)
	T* (P-value)	(-0.37, 0.143)	(1.99, <0.001)	

Note: Significance level: 0.05

Abbreviations:* ,independent T; **, paired T

Discussion

As evidenced by the results of this study, the rate of medication errors among nursing students in both groups before the intervention was around 40%-50%, indicating the average level of medication errors among them. This result is consistent with the findings of two systematic review and meta-analysis studies conducted in Iran by Dehvan et al. (2021) (9) and Vaziri et al. (2019) (3) in which the prevalence rates of medication errors among nursing students were reported as 39.68% and 52% respectively. A number of similar studies abroad have also yielded similar results. For example, in the studies by Cebeci et al. (2015) in Turkey (33), Treiber et al. (2018) in the United States (34), and Kuo et al. (2021) in Indonesia, Taiwan, and Thailand (35), 38.6%, 55%, and 50% of nursing students committed medication errors. Nonetheless, the rate of medication errors among nursing students has been reported to be higher or lower than the findings of this research in some studies, especially in other countries. In explaining these findings, it can be stated that various studies have referred to different causes for the occurrence of medication errors among nursing students. However, by reviewing these studies, it can be claimed that the most important reason for the difference in the statistics of medication errors among students is the diversity of undergraduate nursing education programs in different countries (36, 21, 11). In this way, since the educational curricula of different fields of study, including nursing, in Iran are determined by the Ministry of Health and are implemented in the same way throughout the country, the statistics of medication errors in nursing students in different regions of the country are almost similar.

Nevertheless, in many other countries, curricula are approved and implemented by the state, and since their educational content is different in terms of some factors, such as pharmacology course credits (21) and the clinical teaching method (16); therefore, it can be predicted that the rate of medication errors vary across different states and cities. Moreover, based on the findings, the mean score of medication errors in both injection and non-injection sections before the intervention in the control

and test groups did not have a statistically significant difference, and the two groups were homogeneous in terms of this variable. However, after the intervention, in the test group compared to the control group, the rate of medication errors in both injection and non-injection sections significantly decreased, indicating the positive effect of peer mentoring method on the rate of medication errors among nursing students.

In line with the current research, Nasiriyani et al. (2020), in a quasi-experimental study on 60 nursing students, stated that the use of a combined program of peer mentors and clinical supervision reduces stress factors in the clinical environment (25). In addition, the results of the study by Raymond et al. (2018) demonstrated that using the peer mentoring program reduces the stress perceived by nursing students and increases their sense of belonging and self-efficacy (37). In their study, Cust et al. (2023) also pointed out the positive effect of the peer mentoring program on creating a safe environment, reducing stress in the clinical environment, and boosting the sense of belonging among nursing students (38).

In a similar vein, in their study, Öztürk Şahin et al. (2023) indicated that using this method improves self-efficacy and reduces clinical stress among nursing students. Their argument was that improving self-efficacy and reducing stress in students would decrease the rate of medication prescription errors among them (39). In another study by Seshabela et al. (2020), undergraduate nursing students indicated that their professional relationships improved significantly after benefiting from the peer mentoring program (40). Along the same lines, Joung et al. (2020) highlighted the positive effect of this method on nursing students' experiences of professional competence development during education (41).

In this context, in their qualitative study, Musharyanti et al. (2019) stated that the lack of necessary clinical knowledge and skills is one of the most important reasons for medication errors from the nursing students' perspective (42). In another review study, Stolic et al. (2022) suggested the use of new educational methods, more supervision, and improved communication in the clinical environment as the most important strategies to reduce medication errors among nursing students (36). Comparing the studies conducted regarding the use of the peer mentoring program among nursing students and investigating the causes of medication errors among them, it can be concluded that the use of the peer education program has improved the main variables affecting the rate of medication errors among nursing

students; therefore, these studies indirectly confirm the findings of the current research.

The most important limitation of this study was the short duration of the intervention (three weeks) due to the interference of the internship program of the mentor and mentee students. It is suggested that in future studies while prolonging the intervention time, the internship should be planned in such a way as to create minimal interference in the clinical training program of these students. Another limitation was the possibility of information exchange between the two control and test groups during the study. In order to minimize this limitation, the studied students were assigned to control and test groups based on the entrance semester so that the minimum exchange of information between the two groups takes place.

Conclusion

According to the findings of the present study, the use of the peer mentoring program reduces medication errors among nursing students. Therefore, it is suggested to use this effective method in teaching nursing students' clinical courses. Furthermore, it is recommended to investigate the effectiveness of this method in teaching theoretical and practical courses to these students. Moreover, since medication error is a complex issue, in order to analyze it more deeply, it is suggested that future studies be conducted based on a qualitative or mixed approach.

Ethical considerations

Students participated in the research with written informed consent and could withdraw from the research at any stage. Their information was kept confidential. This study was registered in the Ethics Committee of Zanjan University of Medical Sciences with code IR.ZUMS.REC.1400.476.

Acknowledgments

Conflict of Interest

The researchers declare that they have no conflict of interest in any of the research stages

Disclosure

Zanjan University of Medical Sciences has financially supported this study.

Author contributions

Both authors participated in the design of the study, data collection, and analysis, as well as writing the article. In addition, the authors accept responsibility for the correctness of the content and data and confirm the final version of the article.

Data availability statement

The dataset used and analyzed in the present study is available from the corresponding author upon request.

References

1. Wondmieneh A. Alemu W, Tadele N, Demis A. Medication administration errors and contributing factors among nurses: a cross sectional study in tertiary hospitals, Addis Ababa, Ethiopia. BMC Nursing. 2020; 19(4): 1-9. [https://doi.org/10.1186/s12912-020-0397-0]
2. Vaismoradi M, Jordan S, Vizcaya-Moreno F, Friedl I, Glarcher M. Prn medicines optimization and nurse education. pharmacy. 2020; 8(4): 1-15. [https://doi.org/10.3390/pharmacy8040201]
3. Vaziri S, Fakouri F, Mirzaei M, Afsharian M, Azizi M, Arab-Zozani M. Prevalence of medical errors in Iran: a systematic review and meta-analysis. BMC Health Service Research. 2019; 19(1): 1-11. [https://doi.org/10.1186/s12913-019-4464-8]
4. Nkurunziza A, Chironda G, Mukeshimana M. Perceived contributory factors to medication administration errors (MAEs) and barriers to self-reporting among nurses working in paediatric units of selected referral hospitals in Rwanda. International Journal of Research in Medical Sciences. 2018; 6(2): 401-7. [https://dx.doi.org/10.18203/2320-6012.ijrms20180276]
5. Elliott RA, Camacho E, Jankovic D, Sculpher M, Faria R. Economic analysis of the prevalence and clinical and economic burden of medication error in England. BMJ Quality & Safety. 2021; 30 (2): 96-105. [https://doi.org/10.1136/bmjqs-2019-010206]
6. Da silva BA, Krishnamurthy M. The alarming reality of medication error: a patient case and review of pennsylvania and national data. Journal of Community Hospital Internal Medicine Perspectives. 2016; 6(4): 1-6. [https://doi.org/10.3402/jchimp.v6.31758]
7. Fatemi A. Every year 3000 Iranians become victims of medication error / death instead of treatment. updated 1397/06/07; cited 2020 mar 9, Available from: [http://www.salamatnews.com/]
8. Dionisi S, Giannetta N, Liquori G, De Leo A, D'Inzeo V, Orsi GB, Di Muzio M, Napoli C, Di Simone E.

Medication errors in intensive care units: An umbrella review of control measures. Healthcare. 2022; 10(7): 1-16. [https://doi.org/10.3390/healthcare10071221]
9. Dehvan F, Dehkordi AH, Gheshlagh RG, Kurdi A. The prevalence of medication errors among nursing students: A systematic and meta analysis study. International Journal of Preventive Medicine. 2021; 12(21): 1-6. [https://doi.org/10.4103/ijpvm.IJPVM_418_19]
10. Secginli S, Nahcivan NO, Bahar Z, Fernandez R, Lapkin S. nursing students' intention to report medication errors: application of theory of planned behavior. Nurse Education. 2021; 46 (6): E169-72. [https://doi.org/10.1097/NNE.0000000000001105]
11. Bam V, Safowaa A, Lomotey AY, Nkansah AS. Nursing students' perception of medical errors: A cross-sectional study in a university. Nurse Open. 2021; 8(6): 3152-60. [https://doi.org/10.1002/nop2.1028]
12. Khalili Z, Molavi Vardanjani M, Shamsizadeh M, Alimohammadi N, Tohidi S, Fallahinia G. Medication errors in nursing students. Scientific Journal of Nursing, Midwifery and Paramedical Faculty. 2018; 3(3): 8-16. [https://doi.org/10.29252/sjnmp.3.3.8]
13. Pourghane P, Rajabpour -Nikfam M. Experiences of nursing students and clinical teachers about clinical pharmacology course: A qualitative study. Research in Medical Education. 2016; 8(3): 53-60. [https://doi.org/10.18869/acadpub.rme.8.3.53]
14. Fallahi S, Kamalzadeh H, Yousefi P, Abedini S. The relationship between the components of clinical pharmacology curriculum and nursing students' clinical skills. Development Strategies in Medical Education. 2022; 9(2):3-10.
15. Mutair AA, Alhumaid S, Shamsan A, Zaidi ARZ, Mohaini MA, Al Mutairi A, Rabaan AA, Awad M, Al-Omari A. The Effective Strategies to Avoid Medication Errors and Improving Reporting Systems. Medicines. 2021; 8(9): 1-12. [https://doi.org/10.3390/medicines8090046]
16. Pivač S, Skela-Savič B, Jović Avdić D, Avdić M, Kalender-Smajlović S. Implementation of active learning methods by nurse educators in undergraduate nursing students' programs – a group interview. BMC Nursing. 2021; 173(20): 1-10. [https://doi.org/10.1186/s12912-021-00688-y]
17. Forouzan Jahromi F, Pournoroz, N, Golestan M, Mahdood B. The effect of new training on nursing students' learning. International Journal of Medical Investigation. 2023; 11(4): 82-92. [http://intjmi.com/article-1-941-en.html]
18. Doğan P, Şendir M. Effect of different simulation methods in nursing education on critical thinking dispositions and self-efficacy levels of students. Thinking Skills and Creativity. 2022; 45(1): 1-7. [https://doi.org/10.1016/j.tsc.2022.101112]
19. Hosseini Masoumian M, Ruhabadi F, Gazerani A, et al. Investigating the improvement of nursing students'

clinical competence through the mastery learning approach compared to the traditional method in the oncology department: A mixed-methods study. Journal of Medical Education Development. 2023; 16(51): 1-12

20. Harrison HF, Kinsella EA, DeLuca S, Loftus S. "We know what they're struggling with": student peer mentors' embodied perceptions of teaching in a health professional education mentorship program. Advances in Health Sciences Education. 2022; 27(1): 63-86. [https://doi.org/10.1007/s10459-021-10072-9]

21. Nelwati, Abdullah KL, Chan CM. A systematic review of qualitative studies exploring peer learning experiences of undergraduate nursing students. Nurse Education Today. 2018; 71(1): 185-192. [https://doi.org/10.1016/j.nedt.2018.09.018]

22. Zhang Y, Maconochie M. A meta-analysis of peer-assisted learning on examination performance in clinical knowledge and skills education. BMC Medical Education. 2022; 147(22): 1-15. [https://doi.org/10.1186/s12909-022-03183-3]

23. Salehi S, Safavi M, Mashoof S, Parchebafieh S, Fesharaki M. Effects of peer education on clinical skills in nursing students, including interns and trainees. Medical Sciences. 2016; 26(1): 36-45.

24. Imani A, Moradi F. A comparative study on the effect of lecture-based education, role-playing and learning through peers on learning and satisfaction of nursing students in Zanjan University of Medical Sciences. Future of Medical Education Journal. 2022; 12(2): 50-55. [https://doi.org/ 10.22038/FMEJ.2021.58549.1410]

25. Nasiriani K, Zare reshkoeyeh M, Arman M, Mirzaei S. The effect of Peer instructor teaching and clinical supervision on the status and stressors of clinical nursing education. Journal of Medical Education Development. 2020; 15(2): 96-106. [https://doi.org/10.18502/jmed.v15i2.4229]

26. Heidarpoor P, Mousavikashi S. Effectiveness of peer assisted learning in improving HIV knowledge, attitude, and perception among community health workers. Research and Development in Medical Education. 2023; 12(6): 1-6. [https://doi.org/10.34172/rdme.2023.33096]

27. Jassim T, Carlson E, Bengtsson M. Preceptors' and nursing students' experiences of using peer learning in primary healthcare settings: a qualitative study. BMC Nursing. 2022; 21(1): 1-12. [https://doi.org/10.1186/s12912-022-00844-y]

28. Bright AL. Practicing Leadership Skills through Peer Mentoring and Teaching: The Lived Experience of BSN Students. International Journal of Nursing Education Scholarship. 2019; 16(1): 1-8. [https://doi.org/10.1515/ijnes-2019-0022]

29. Latimer S, Hewitt J, Stanbrough R, McAndrew R. Reducing medication errors: Teaching strategies that increase nursing students' awareness of medication errors and their prevention. Nurse Education Today. 2017; 52(1): 7-9. [https://doi.org/10.1016/j.nedt.2017.02.004]

30. Wakefield BJ, Uden-Holman T, Wakefield DS. Development and validation of the medication administration error reporting survey. Advances in Patient Safety: From Research to Implementation. 2005; 4(1): 475-89.

31. Taheri HabibAbadi E, Noorian M, Rassouli M, Kavousi A. Nurses' perspectives on factors related to medication errors in neonatal and neonatal intensive care units. IJN. 2013; 25(80): 65-74.

32. Ramazani T, Hosseini Almadvari SM, Fallahzadeh H, Dehghani Tafti A. The study of type and rate of medication errors and their causes from the perspectives of neonatal and neonatal intensive care units nurses in yazd hospitals, 2014. Community Health journal. 2016; 10(1): 63-71.

33. Cebeci F, Karazeybek E, Sucu G, Kahveci R. Nursing students' medication errors and their opinions on the reasons of errors: A cross-sectional survey. The Journal of the Pakistan Medical Association. 2015; 65(5): 457-62. [https://pubmed.ncbi.nlm.nih.gov/26028376/]

34. Treiber LA, Jones JH. After the medication error: Recent nursing graduates' reflections on adequacy of education. J Nurse Education. 2018; 57(5): 275-280. [https://doi.org/10.3928/01484834-20180420-04]

35. Kuo SY, Thadakant S, Warsini S, et al. Types of medication administration errors and comparisons among nursing graduands in Indonesia, Taiwan, and Thailand: A cross-sectional observational study. Nurse Education Today. 2021; 107(1): 105-120. [https://doi.org/10.1016/j.nedt.2021.105120]

36. Stolic S, Ng L, Southern J, Sheridan G. Medication errors by nursing students on clinical practice: An integrative review. Nurse Education Today. 2022; 112(1): 1-8. [https://doi.org/10.1016/j.nedt.2022.105325]

37. Raymond JM, Sheppard K. Effects of peer mentoring on nursing students' perceived stress, sense of belonging, self-efficacy and loneliness. Journal of Nursing Education and Practice. 2018; 8(1): 16-23. [https://doi.org/10.5430/jnep.v8n1p16]

38. Cust F, Cope L, Brown L, Baker T. Evaluation of a pilot study of peer mentoring in undergraduate nursing programmes. Journal of Practice Teaching & Learning. 2023: 19(3): 72-83.

39. Öztürk Şahin Ö, Aközlü Z, Taşdelen Y. Pediatric nursing students' self-efficacy regarding medication administration and clinical comfort and worry: A pre-posttest comparative study of nurse mentoring versus peer mentoring. Nurse Education Practice. 2023; 71(1): 103712. [https://doi.org/10.1016/j.nepr.2023.103712]

40. Seshabela H, Havenga Y, Cathrina de Swardt H. Nursing student peer mentorship: the importance of professional relationships. Africa Journal of Nursing and Midwifery. 2020; 22(1): 1-17. [https://doi.org/10.25159/2520-5293/6964]

41. Joung J, Kang KI, Yoon H, Lee J, Lim H, Cho D, Cha M, Choi B. Peer mentoring experiences of nursing students based on the caring perspective: A qualitative study. Nurse Education Today. 2020; 94(1): 1-6. [https://doi.org/10.1016/j.nedt.2020.104586]

42. Musharyanti L, Claramita M, Haryanti F, Dwiprahasto I. Why do nursing students make medication errors? A qualitative study in Indonesia. Journal of Taibah University Medical Sciences. 2019; 14(3): 282-288. [https://doi.org/10.1016/j.jtumed.2019.04.002]