

The effect of clinical supervision model on high alert medication safety in intensive care units nurses

Asghar Khalifehzadeh Esfahani¹, Fatemeh Ramezany Varzaneh¹, Tahereh Changiz²

ABSTRACT

Background: Medication errors and adverse drug events of high alert medication are one of the major problems in therapeutic system. The purpose of the present study was to investigate the effect of clinical supervision model on high alert medication safety in intensive care units nurses.

Materials and Methods: This was a quasi-experimental study conducted on 32 nurses of intensive care units. The researcher observed the administration of high alert drugs including heparin, warfarin, norepinephrine, dobutamine, and dopamine by nurses and recorded the scores of “the work in preventing medication errors,” “the work in preventing adverse drug events,” and “medication safety.” Then, the researcher performed clinical supervision model and during performance of the model, the researcher reassessed the score of “the work in preventing medication errors,” “The work in preventing adverse drug events” and “medication safety”. Tool of data collection was “action plan of high alert medication safety” checklists (heparin, warfarin, norepinephrine, dobutamine, and dopamine checklists).

Results: The result of the statistical trials showed that before and after applying the clinical supervision model, there was a statistically significant difference between the average scores of medication safety of heparin (15.7 vs 18.73), warfarin (11.08 vs 15.67), norepinephrine (14.60 vs 19.72), dobutamine (13.80 vs 19.30), and dopamine (14.25 vs 19.47).

Conclusions: Based on the results of this study, it seems that administration of clinical supervision model in intensive care units can lead to improving the status of safety of high alert medication.

Key words: Clinical supervision model, critical care, drug safety, high alert medication, intensive care nurses, Iran, medication safety, nurses

INTRODUCTION

Medication safety is among the fundamental components of comprehensive safety program that completes the quality of patients' care. It includes the concepts of prevention of adverse medication errors and events,^[1] which account for at least one death per day in the US and impose a financial

burden of 77 billion dollars.^[2] In Iranian hospitals, these errors occur once out of each 20 medication administrations.^[3] In the US, 3.5 billion dollars are annually spent on adverse medication events whose side effects impose heavy costs, such as extra treatment, emotional traumas, and even death, to the patients and their families.^[4] Nurses are the main administrators of medication orders. The most common causes for adverse medication errors and events are nurses' inadequate knowledge and skills such as not knowing about the patient's name and diagnosis or medication purpose, wrong venous catheters, incapability in preparation of medication before administration, no knowledge about how to work with infusion pump, and being unaware of medication's side effects.^[2-5]

¹School of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran, ²Medical Education Development Center, Isfahan University of Medical Sciences, Isfahan, Iran

Address for correspondence: Asghar Khalifehzadeh Esfahani, School of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.

E-mail: khalifehzadeh@nm.mui.ac.ir

Submitted: 04-Aug-14; Accepted: 06-Jan-16

Access this article online	
Quick Response Code:	Website: www.ijnmrjournal.net
	DOI: 10.4103/1735-9066.193394

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite: Esfahani AK, Varzaneh FR, Changiz T. The effect of clinical supervision model on high alert medication safety in intensive care units nurses. Iranian J Nursing Midwifery Res 2016;21:482-6.

High-risk drugs include heparin, warfarin, insulin, chemotherapy drugs, potassium chloride (IV), opioids, neuromuscular blockers, anticoagulants, and adrenergic agonists. Although they account for 7% of all medication errors, they comprise 65% of serious adverse medication events.^[6] In addition, the highest frequency of events associated with high-risk medications such as heparin, warfarin, and vasoconstriction drugs such as norepinephrine, dopamine, and dobutamine occurs in the ICUs and among patients with unstable hemodynamic status and in a critical condition, for whom a minor medication error can lead to irreversible complications.^[7]

Nurses are the most accountable staff in prevention of adverse medication errors and events and in improvement of medication safety. In ICUs, despite presence of experienced and well-trained staff and empowerment of their knowledge by continuing education courses, the prevalence of adverse medication errors and events is high, especially for high-risk medications, and at times, it results in irreversible complications.

This issue reveals the inefficiency of such education and other interventions in this context.^[8] With regard to the importance of prevention of medication errors and events, as well as promotion of medication safety, especially for high-risk medications, new and applicable methods should be used. Sharifi *et al.* conducted a study on the effect of new educational strategies on reduction of medication errors in prescription of high-risk drugs and reported the positive effect of such interventions.^[3]

One of the clinical educational models for making the learning process more applicable and narrowing the gap between practice and theory is clinical supervision model. There are numerous positive outcomes suggested for this model, including improvement of patients' safety when the patients are exposed to possible risks due to medical and nursing interventions, increasing the efficacy of treatment intervention and reducing the medical errors, promotion of staffs' evidence-based clinical skills in treatment, detection, and determination of clinical standards, and filling the gap between the present condition and standards. This model also leads to modification of learning process and periodical empowerment of knowledge through a positive feedback and process system.^[9] This model has different features, of which external model version is applied in ICUs. This model includes three stages of before intervention, intervention, and after intervention.^[10] Heshmati *et al.*, in a study on investigation of the effect of clinical supervision model on nurses' educational function, reported positive effects.^[11] In another qualitative study on nurses' experience, the participants (nurses) indicated that standard supervision

was a useful experience. They stated that this model could improve the treatment process effectively.^[12] On the contrary, in a clinical trial, the researcher obtained no significant positive results in investigation of the effect of clinical supervision model on nursing students' professional and communicational skills.^[13] With regard to the existing controversy, poor knowledge, and lack of adequate research on the effect of clinical supervision model, especially in the domain of medication and high-risk drugs, the researchers decided to plan and conduct the present study in order to use its results to prevent adverse medication errors and events and improve medication safety of high-risk drugs in ICUs.

MATERIALS AND METHODS

This is a quasi-experimental one-group before-after prospective study. It was approved by the ethics committee of Isfahan University of Medical Sciences. Study population comprised all nurses in selected ICU wards of Al-Zahra hospital affiliated to Isfahan University of Medical Sciences. Nurses who had a bachelor's degree or over with at least 2 years of experience in ICU participated in the study. Subjects who were not interested to stay in the study or could not continue in the study due to presence of any other events were excluded.

Finally, the subjects ($N = 32$) were selected from nurses working in Al-Zahra hospital ICUs. Sampling was done by random stratified method, so that with regard to the number of the staff in the wards and their portion in sampling, 12 nurses in central ICU, 13 nurses in ICU2, 4 nurses in ICU3, and 3 nurses in CCU were selected. Then, the list of nursing staff in each ward meeting the inclusion criteria was prepared, and then, they were given a number.

Through random numbers table and the obtained numbers, the researcher referred to the selected nurses, and after obtaining their informed consent, they were selected as the research subjects. Data were collected by observation and a demographic characteristics questionnaire and five checklists of "high-risk drugs safety instructions program" (heparin, dopamine, dobutamine, norepinephrine, and warfarin). Each of these checklists included two sections. The first section was on measurement of "function in prevention of medication errors," of which the items were on nursing care to prevent medication errors. This section contained 12 items for heparin, 8 items for warfarin, 13 items for norepinephrine, 12 items for dopamine, and 12 items for dobutamine. The second section included checklists on measurement of "function in prevention of adverse medication events," of which the items were on the major side effects of each medication, which any person who is

to supervise adverse medication events should know. This section contained 12 items for norepinephrine, 10 items for warfarin, 8 items for norepinephrine, 9 items for dopamine, and 9 items for dobutamine. The items were answered with the options “yes,” “no,” and “not available.”

These checklists were prepared by the help of references, library search, and internet texts, as well as the researcher’s experiences and observations in clinical wards, especially in ICUs. Content validity was used for checking the validity of the checklists, wherein they were given to 10 academic members of Nursing and Midwifery School, 1 academic member in pharmacology school, and 4 head nurses of ICUs in research environment. After obtaining their comments and suggestions, necessary modifications were made and the checklists were approved. To determine the reliability of each checklist, Cronbach alpha for heparin, warfarin, norepinephrine, dobutamine, and dopamine was calculated as 0.78, 0.80, 0.75, 0.85, and 0.80, respectively, through observation of nurses’ function and after they completed the forms. After obtaining subjects’ informed consents in the form of before intervention test stage in each studied ward, the researcher recorded the checklists of high-risk medication instruction program, the scores of prevention of medication errors, adverse medication events, and medication safety during observation of subjects’ medication preparation and administration of heparin, warfarin, norepinephrine, dobutamine, and dopamine. It should be noted that the subjects were informed that supervision would not have any effects on their evaluation. After completion of primary evaluation, at the stage of “before administration of clinical supervision model,” a session was conducted by each subject in the form of discussion to exchange viewpoints of communication confounding factor-free conditions, a session was made by each subject in form of discussion to exchange viewpoints.

The session consisted of giving the subjects notable reports of hospital mortality committee concerning adverse medication errors and events of high-risk drugs, roles and responsibilities of nurses in promotion of high-risk drugs and the goals expected from them, the ways to achieve such goals based on clinical supervision model and presentation of safety action program of heparin, warfarin, norepinephrine, dobutamine, and dopamine, and discussing about their items in the checklists. Then, in the stage of intervention, the researcher attended the ward, and each subject administered the medication and the checklists were ticked. These checklists were made with the consensus between the researcher as the supervisor and the nurse as the supervised. The subjects received feedback in case of having adequate or inadequate knowledge, or any

problem. A week after these interventions, at the “after intervention stage,” the researcher attended the ward again and evaluated the subjects by the checklists and recorded the related scores. Finally, at “after intervention stage” of the model, the researcher interviewed the subjects and recorded their viewpoints concerning clinical supervision model and the related checklists based on their experiences in the ward, although this section has not undergone data analysis (due to being qualitative data) and was conducted as a stage of clinical supervision model. The data were analyzed by inferential and descriptive statistics and paired *t*-test.

RESULTS

Findings of the study are as follows: Subjects’ age ranged between 22 and 42 years; 28 nurses were female and 4 were male; and 30 subjects had a bachelor’s degree and 2 had a master’s degree. Paired *t*-test showed a significant increase in the mean scores of function in prevention of medication errors for heparin, warfarin, norepinephrine, dobutamine, and dopamine before and after administration of clinical supervision model ($P < 0.001$) [Table 1].

Comparison of mean scores of function in prevention of adverse medication events of heparin, warfarin, norepinephrine, dobutamine, and dopamine through paired *t*-test showed a significant increase before and after administration of clinical supervision model ($P < 0.001$) [Table 2].

Paired *t*-test also showed a significant increase in the mean scores of medication safety of heparin, warfarin,

Table 1: Comparison of average of the scores of “work in preventing medication errors” before and after intervention

Stage Variant	Mean (SD)		Paired <i>t</i> -test	
	Before intervention	After intervention	<i>t</i>	<i>P</i>
“Work in preventing medication errors” of heparin	9.54 (1.25)	11.13 (0.09)	6.22	<0.001
“Work in preventing medication errors” of warfarin	5.74 (1.02)	7.04 (0.81)	6.67	<0.001
“Work in preventing medication errors” of norepinephrine	9.90 (1.21)	12.29 (0.93)	10.31	<0.001
“Work in preventing medication errors” of dobutamine	9.20 (1.43)	11.23 (0.098)	8.15	<0.001
“Work in preventing medication errors” of dopamine	9.31 (1.43)	11.41 (0.95)	6.86	<0.001

SD: Standard deviation

norepinephrine, dobutamine, and dopamine after clinical supervision model, compared to before clinical supervision model ($P < 0.001$) [Table 3].

DISCUSSION

This study aimed to investigate clinical supervision model on medication administration safety of high-risk drugs. Findings show that score of medication safety of such drugs increased after administration of clinical supervision model. In a clinical trial on high-risk drugs, intervention increased medication safety.^[2] This two-group study with a control group, compared to the present study, was conducted on a higher number of subjects and its intervention was in the form of educational workshop with group education method to increase nurses' knowledge of high-risk drugs in order to diminish medication errors. On the contrary, the present

study was one- group and tried to make the education process of high risk drugs more applicable and fills the gap between theory and practice to reduce medication errors and events and to promote medication safety of such drugs.

Another experimental study reported a lower number of adverse medication events of high-risk drugs.^[14] This study aimed to investigate the effect of computer recording of medical orders on the number of adverse medication events and errors, and was a two-group study with a control group and a higher number of subjects compared to the present study. In another study, the researchers reported positive results in investigation of the effect of interactional education on reduction of medication errors of high-risk drugs in ICUs.^[3] In their study, like the present study, during administration of clinical supervision model, there was an interaction with the subjects. They were also given constructive feedbacks with just a difference. The difference was that through presentation of checklists of high drugs safety action program, the goals and duties expected from the nurses were emphasized, and overall, educational interventions were in the form of a clinical model, which resulted in more organization of actions and deeper and more applicable learning. In another study, application of an inter-professional approach to reduce medication errors gave results consistent with the present study.^[15] In the present study, intervention in the form of clinical supervision model included not only medication errors, but also adverse medication events, as both are important in medication safety. In a clinical trial with clinical supervision model aiming at investigation of administration of this model on nursing students' skills such as medication therapy skills, no positive significant results were reported.^[13] The authors claimed that the reason for such results was lack of subjects' familiarization with clinical supervision model. In a qualitative study, nurses stated that clinical supervision model was useful and application of such a model was effective in clinical education, especially nurses' medication skills education,^[12] which is consistent with the present study.

With regard to previous research and the results of the present study, it seems that clinical supervision model can promote medication safety of high-risk drugs as in clinical supervision model and the function of the group under supervision is supervised in the direction of specific goals during the supervision sessions. Then, viewpoints and suggestions of the group members are stated and new meanings are extracted from the events, which lead to modification, approval, and stability of clinical function of the nurses, especially in the domain of high-risk drugs. Generally, adverse medication errors and events are a multidimensional problem, for which multi-dimensional

Table 2: Comparison of average of the scores of "work in preventing adverse drug events" before and after intervention

Stage Variant	Mean (SD)		Paired t-test	
	Before intervention	After intervention	t	P
"Work in preventing adverse drug events" of heparin	6.15 (1.45)	7.59 (0.057)	5.95	<0.001
"Work in preventing adverse drug events" of warfarin	5.34 (1.94)	8.26 (1.04)	7.86	<0.001
"Work in preventing adverse drug events" of norepinephrine	4.70 (1.03)	7.42 (0.82)	10.94	<0.001
"Work in preventing adverse drug events" of dobutamine	4.60 (1.18)	8.07 (0.58)	16.57	<0.001
"Work in preventing adverse drug events" of dopamine	4.92 (1.21)	8.12 (0.74)	13.32	<0.001

SD: Standard deviation

Table 3: Comparison of average of the scores of "medication safety" before and after intervention

Stage Variant	Mean (SD)		Paired t-test	
	Before intervention	After intervention	t	P
Medication safety of heparin	15.72 (2.26)	18.73 (1.12)	6.76	<0.001
Medication safety of warfarin	11.08 (2.55)	15.67 (1.42)	8.90	<0.001
Medication safety of norepinephrine	14.60 (1.67)	19.72 (1.22)	14.67	<0.001
Medication safety of dobutamine	13.80 (1.85)	19.30 (1.27)	16.32	0.001
Medication safety of dopamine	14.25 (2.03)	19.47 (1.46)	12.17	<0.001

SD: Standard deviation

methods and strategies should be considered. The probability of such errors and events should be diminished through detection of potential risks and application of preventive strategies, and consequently, the safety of proper medication process, especially patient medication, can be promoted.

CONCLUSION

Clinical supervision model can be applied as an organized system to promote nurses' function in reduction of adverse medication errors and events in administration of high-risk drugs, especially in ICUs. Further research is needed to investigate the effect of this model in different domains of nursing, especially for high-risk drugs.

Acknowledgment

This article was derived from a research project (No. 392399) approved in Isfahan University of Medical Sciences. Researchers greatly appreciate vice-chancellery for research of Isfahan University of Medical Sciences, the Nursing and Midwifery School, and the nursing and managerial personnel of Al-Zahra Hospital affiliated to Isfahan University of Medical Sciences.

Financial support and sponsorship

Medical and Science University of Isfahan.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Lesar TS, Mitchell A, Sommo P. Medication safety in critically ill children. *Clinical Pediatric Emergency Medicine* 2006;7:215-25.
2. Lu MC, Yu S, Chen IJ, Wang KW, Wu HF, Tang FI. Nurses' knowledge of high-alert medications: A randomized controlled trial. *Nurse Educ Today* 2013;33:24-30.
3. Sharifi N, Alipour A, Ranjbar KH. The influence of new educational methods in reducing errors of administering of intravenous drugs. *J Educ Med* 2010;11:590-9.
4. Kouhestani HR, Baghcheghi N, Khosravi S. Assessing of measure, type and reason of drug errors in nursing students. *J Iranian Nursing* 2007;21:17-26.
5. Jennings J, Foster J. Medication safety: Just a label away. *AORN J* 2007;86:618-25.
6. Cohen MR, Smetzer JL, Westphal JE, Comden SC, Horn DM. Risk models to improve safety of dispensing high-alert medications in community Pharmacies. *J Am Pharm Assoc* (2003) 2012;52:584-602.
7. Tang FI, Sheu SJ, Yu S, Wei IL, Chen CH. Nurses relate the contributing factors involved in medication errors. *J Clin Nurs* 2007;16:447-57.
8. Rinke ML, Bundy DG, Shore AD, Colantuoni E, Morlock LL, Miller MR. Pediatric antidepressant medication errors in a national error reporting database. *J Dev Behav Pediatr* 2010;31:129-36.
9. Häggman-Laitila A, Elina E, Riitta M, Kirsi S, Leena R. Nursing students in clinical practice--developing a model for clinical supervision. *Nurse Educ Pract* 2007;7:381-91.
10. Gallon S, Hausotter W, Bryan MA. Models of clinical supervision. *J Technology Transfer Center* 2005;8:1-6.
11. Nabavi H, Z Maemarian R, Vanaki Z. The effect of clinical supervision on educational work of nursing. *Iranian J Med Educ* 2005;7:257-66.
12. Reid-Searl K, Hapell B. Supervising nursing students administering medication: A perspective from registered nurses. *J Clin Nurs* 2011;21:1998-2005.
13. Khalifezadeh A, Salehi SH, Hasanzadeh V. Applying of clinical supervision model on nursing student practices. *J Med Educ* 2002;4:36-40.
14. Piazza G, Nguyen TN, Cios D, Labreche M, Hohlfelder B, Fanikos J, *et al.* Anticoagulation-associated adverse drug events. *Am J Med* 2006;12:1136-42.
15. Romero CM, Salazar N, Rojas L, Escobar L, Griñén H, Berasaín MA, *et al.* Effects of the implementation of a preventive interventions program on the reduction of medication errors in critically ill adult patients. *J Crit Care* 2013;28:451-60.