https://nmsjournal.kaums.ac.ir/
Nursing and Midwifery Studies. 2023; 12(4): 190-196
https://doi.org/10.48307/NMS.2023.412822.1251

Research Article Open Access

The effect of clinical supervision model on nursing interns medication safety competence and knowledge: A clinical trial

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Received: 15 July 2023 **Revised:** 18 September 2023 **Accepted:** 26 October 2023 **e-Published:** 5 December 2023

Abstract

Background: Medication errors are the most serious and common events threatening patient safety. Nursing interns make medication errors due to inexperience and inadequate supervision.

Objectives: This study aimed to examine the effects of the clinical supervision model (CSM) on medication safety competency and knowledge of nursing interns.

Methods: This clinical trial was conducted in 2022 on 70 nursing interns. Data were collected using the Medication Safety Critical Element Checklist, the Medication Safety Knowledge Assessment, and the Manchester Clinical Supervision Scale. The CSM and routine supervision were conducted in six sessions for the intervention and control groups, respectively. Data were analyzed using the independent t-test, paired t-test, chi-square test, and repeated measures analysis of variance.

Results: Between-group analysis showed that the difference between medication safety competence and knowledge scores in the control and intervention groups was not significant at baseline (P>0.05). Within-group analysis showed that medication safety scores in the intervention group increased significantly over time (P<0.001), in contrast to the control group (P=0.137). Within-group analysis revealed significant changes in medication safety knowledge scores in both the control and intervention groups before and after the intervention (P<0.05). However, between-group analysis showed that the increase was higher in the intervention group than in the control group (P<0.001). The mean Manchester Scale score for the intervention group was 127.2, indicating the significant effect of the CSM.

Conclusion: Implementation of the CSM improves the competence and knowledge of nursing interns in the area of medication safety.

Keywords: Clinical supervision model, Medication safety, Knowledge, Competency, Student, Nursing.

Introduction

Medication safety refers to the activities performed by healthcare providers, including nurses and nursing students, to prevent or correct adverse events and medication errors.[1,2] Medication errors are among the most common and significant events that threaten patient safety.[3] Approximately 400,000 medication errors are reported annually in the United States,[1] and the prevalence of medication errors in Middle Eastern countries, including Iran, has been reported to range from 7% to 90%.[4] According to the Institute of Medicine, 1.5 million medication errors that occur annually are preventable.[5]

Studies have shown that approximately half of nursing students make medication errors during their undergraduate years.[6,7] The rate of medication errors is even higher among final-year nursing students because they receive less supervision.[8] Nursing students are more prone to make medication errors than nurses due to their high anxiety, lack of confidence, and lack of experience and knowledge.[9] Also, many undergraduate nursing curricula do not adequately educate students about the

factors contributing to medication errors and possible strategies to prevent them.[10]

Several strategies such as 'simulation,' 'medication error encouragement training,' and 'problem-based scenarios' have been used to enhance students' medication safety skills.[11-13] However, a study found that nursing students were not well prepared for medication administration.[14] Although there is no definitive solution to prevent medication errors in senior nursing students (nursing interns), proper education can reduce their stress, anxiety, and distraction.[15] Clinical supervision is a clinical teaching model for effective training and to reduce the gap between theory and practice.[16] The clinical supervision model (CSM) consists of three stages: planning, checklist-based observation and feedback, and evaluation.[17] It is a problem-based learning model that incorporates critical thinking, responsibility for one's own learning, problem-solving, and peer learning. Students actively seek information to solve their problems, and the professor primarily guides and provides feedback to help students succeed.[18]

Compared to other teaching methods that are conducted in classrooms or laboratories, CSM is performed in a clinical setting.[11,13,19] This model prepares students to apply safety principles in real settings.[20] Some studies have examined and confirmed the effectiveness of CSM in improving the overall performance and clinical skills (including medication administration) of nurses.[17,19,21,22]. However, no study examined the impact of CSM on the medication safety competence and knowledge of Iranian nursing interns.

Objectives

This study examined the effects of CSM on medication safety competence and knowledge of nursing interns.

Methods

Study design and participants

This clinical trial was conducted in selected hospitals affiliated to Isfahan University of Medical Sciences, Iran, in 2022. The nursing internship program was first introduced in 2018 at Isfahan University of Medical Sciences. Under this program, nursing students spend 10 months in their final year of study independently in different hospital wards as nursing interns, working 20 rotating shifts (morning, evening, and night) in each month under the supervision of the head nurse and ward nurses.

The sample size was estimated based on the findings of a previous study investigating the effect of a simulation-based intervention on medication safety competency of nursing students. After 4 weeks, the mean medication safety competency of the intervention and control groups were 14.69±2.92 and 11.98±3.12, respectively.[12] Then, considering S1=2.92, S2=3.12, μ1=14.69, μ2=11.98, α=0.05, and β=0.1, and assuming a potential dropout of 20%, 35 students was estimated to be needed in each study group.

There were 120 nursing interns, of whom 70 eligible students were conveniently selected and -using a random allocation software- randomly assigned to either an intervention or a control group [Figure 1]. Inclusion criteria included the students' willingness to participate in the study, starting the internship course in a medical or surgical ward, and passing the pharmacology credit. Exclusion criteria included participation in off-curriculum medication safety courses.

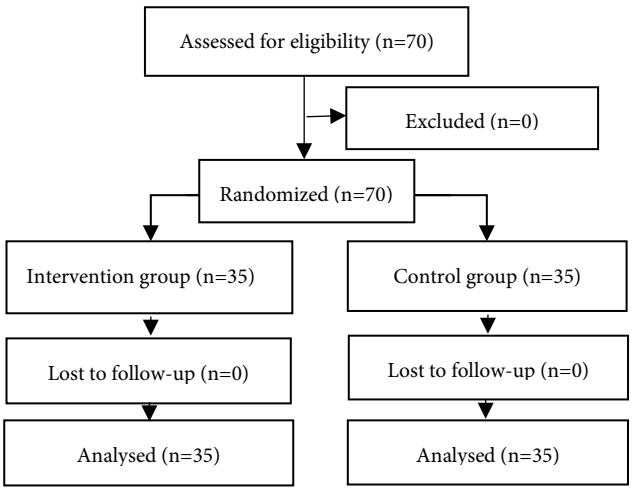

Figure 1. The study flow diagram

Data collection instruments

Data were collected using a demographic questionnaire, the Medication Safety Knowledge Assessment (MSKA), the Medication Safety Critical Element Checklist (MSCEC), and the Manchester Clinical Supervision Scale (MCSS).

The demographic questionnaire included questions on the students' age, gender, marital status, mean monthly shift, and pharmacology mark.

The MSKA questionnaire contains 25 multiple-choice items that asks students to employ critical thinking to interpret medication orders, complete medication calculations, identify errors, and respond to patient safety and medication administration scenarios.[19] We translated the MSKA into Persian and assessed its content and face validity by consulting 10 experts in nursing education and medication safety. The content validity ratio, content

validity index, and face validity scores were obtained as 0.936, 0.92, and higher than 1.5, respectively. We also assessed the reliability of MSKA through test-retest, and its intraclass correlation coefficient (ICC) was 0.895.

The MSCEC contains 10 Yes/No items to assess competence in safe medication administration according to ten rights. Each item is scored zero or 2 (score zero for missing and score 2 for completion).[12] The total score of this questionnaire is 20. We translated the MSCEC into Persian and consulted 10 experts in nursing education and medication safety to assess its content and face validity. The scores of the content validity ratio, content validity index, and face validity were obtained as 0.92, 0.93, and higher than 1.5, respectively. We also assessed the reliability of the MSCEC through test-retest and its intraclass correlation coefficient (ICC) was 0.843.

The MCSS was used to assess the effectiveness of CSM. The MCSS includes 32 items in seven subscales. Items are scored on a 5-point Likert scale from "strongly disagree: 1" to "strongly agree: 5." The content validity and reliability of the Persian translation of the MCSS have been confirmed by Khani *et al*. and the Cronbach's alpha value for the total scale was 0.954.[23]

Procedures

To assess the baseline MSKA score, all students were gathered in the hospital conference hall to complete the MSKA. To determine students' baseline MSCEC scores, clinical supervisors used the MSCEC to evaluate their medication safety score through direct observation of medication administration to patients on hospital wards. The CSM[17] was conducted in the intervention group as follows:

First Stage: At this stage, two nurse educators expert in the CSM acted as clinical supervisors. They held individual face-to-face meetings outside the student's shift schedule to discuss the importance of medication safety, the preventability of medication errors and their adverse effects on students and patients, the CSM and its stages, and the supervisors' and students' duties. Then, students' questions were answered, and ambiguities were resolved. Students were then given a medication safety checklist and asked to comment on the checklist items. At the end of the meeting, a comprehensive agreement was reached between the supervisor and the students. The supervisors advised the students to administer the medications to their patients according to the checklist. This session lasted about 50 minutes.[24]

Second stage: For three months, faculty supervisors visited each medical and surgical ward every two weeks to conduct supervisory meetings, assess student's performance in medication safety (using the MSCEC), provide feedback, and answer students' questions.[25] Each of these clinical supervision sessions lasted 40-60 minutes.[26]

Third stage: At this stage, the supervisors evaluated the effectiveness of the CSM by attending medical and surgical wards of selected hospitals and talking with students in the intervention group about clinical supervision, its strengths, and their recommendations for improving the model implementation. The MCSS was used to evaluate the effectiveness of the CSM.

Individual sessions were initially held outside of the shift schedule for members of the control group to discuss research goals and the number of visiting sessions. They were also informed that their medication performance would be assessed using the MSCEC during the visiting sessions, but the checklist was not given to them. In this group, six routine sessions were held fortnightly for three months, during which the supervisor assessed and documented student medication safety adherence using the MSCEC, and answered students' questions about medication administration.

After implementing CSM in the intervention group and routine supervision in the control group, all students were again gathered in the hospital conference hall to complete the MSKA to reassess their medication safety knowledge.

Ethical considerations

This study was approved by the ethics committee of Isfahan University of Medical Sciences (ethics approval code: IR.MUI.NUREMA.REC.1400.138) and registered with the Iranian Registry of Clinical Trials (IRCT20170731035424N3). All participants were briefed on the study objectives, were assured that their personal data would be kept confidential, that their participation was voluntary, and that they could leave the study at any time. They all signed an informed consent form to participate in the study.

Data Analysis

To analyze the data, SPSS software version 16 (SPSS, Inc., Chicago, IL, USA) was used. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to describe the data. The normality of quantitative variables was assessed using the Kolmogorov–Smirnov test. The chi-square test was used to compare the two groups in terms of categorical variables. Independent and paired t-tests were used to compare means between and within groups. Also, repeated-measures analysis of

variance was used to compare the mean scores of the six measurement time points. The level of significance was set at <0.05.

Results

There were no significant differences between the intervention and control groups with respect to demographic characteristics (P>0.05, Table 1).

The independent t-test showed that the two groups did not differ significantly in their mean baseline medication safety scores. Repeated-measures analysis showed that changes in medication safety scores depended on the group type, such that mean MSCEC scores increased significantly over time in the intervention group (P<0.001) but did not change significantly in the control group (P=0.137) [Table 2]. Given the significant interaction between the measurement time point and the type of intervention (P<0.001), the independent *t*-test was used to conduct pairwise comparisons between the two groups at the six measurement time points. The results showed that the mean MSCEC scores were significantly different between the two groups at all consecutive measurements (P<0.001), except for the first and second time points [Table 2].

Table 1. The baseline characteristics of the nursing interns in the intervention and control groups

Variable	Intervention group	Control group	P Value [a]
Gender			
Male	15 (42)	16 (45)	0.81
Female	20 (58)	19 (55)	
Marital status			
Single	32 (91)	32 (91)	0.99
Married	3 (9)	3 (9)	
Mean shift (Number per month)	20.85 ± 3.53	20.71 ± 3.00	0.85
Pharmacology mark	12.42 ± 2.61	12.66 ± 2.29	0.68
Age (Year)	22.20 ± 1.41	22.57 ±1.78	0.33
Medication safety score before intervention	9.26 ± 2.79	9.14 ± 2.62	0.86
Medication safety knowledge score before intervention	14.54 ± 2.27	14.11 ± 2.01	0.41

Data presented as Mean±SD or n (%), SD: Standard Division, [a] P values are based on the independent sample t- test or chi square

Table 2. Medication safety scores of interventions and control group during clinical supervision sessions according to Medication Safety Critical Element Checklist [a]

Session	**Intervention Group** (n=35)	**Control Group** (n=35)	**P-value** (t-test)
Before Intervention	9.26 ± 2.79	9.14 ± 2.62	0.86
First	10.34 ± 2.72	9.43 ± 2.76	0.16
Second	12.29 ± 2.66	9.77 ± 2.86	< 0.001
Third	13.77 ± 2.21	9.54 ± 2.47	< 0.001
Forth	14.69 ± 2.32	9.77 ± 2.86	< 0.001
Fifth	16.40 ± 2.26	9.37 ± 2.46	< 0.001
Sixth	17.09 ± 1.77	9.54 ± 2.38	< 0.001
P-value –Time [b]	< 0.001	0.13	
Power	1	0.64	
Partial Eta Squared	0.86	0.048	
P-value – Interaction [b]	< 0.001		
Power	1		
Partial Eta Squared	0.63		
P-value – Intervention[b]	< 0.001		
Power	1		
Partial Eta Squared	0.42		

[a] Maximum possible score = 20, [b] Repeated measure ANOVA

The independent t-test showed that the two groups did not differ significantly in their mean baseline safety knowledge scores (P=0.41). However, the mean safety knowledge score was significantly higher in the intervention group at the end of the study (P<0.001). The paired t-test showed that the mean scores of the intervention group were significantly different before and after the clinical supervision sessions (P<0.001). Likewise, the change in the mean scores in the control group was significantly different before and after the intervention (P=0.004) [Table 3].

The mean total score of the Manchester scale was 127.2, indicating the excellent effectiveness of the CSM from the students' perspective [Table 4].

Table 3. Difference in pre-post medication safety knowledge between the intervention and control groups according to Medication Safety Knowledge Assessment questionnaire [a]

Time	Intervention group	Control group	P value [c]
Before intervention	14.54 ± 2.27	14.11 ± 2.01	0.41
After intervention	18.08 ± 3.67	14.68 ± 2.25	< 0.001
Difference	3.54 ± 2.62	0.57 ± 1.09	
P value [b]	< 0.001	0.004	

[a] Maximum possible score = 25, [b] Paired sample t-test, [c] Independent sample t-test

Table 4. Manchester Clinical Supervision Scale: subscales and total scores

Subscale	Possible score range	Actual score range	Mean±SD[a]
Trust and rapport	6 – 30	18 – 30	24.60±3.15
Supervisor advice and support	5 – 25	16 – 25	20.88±2.30
Improved care and skill	7 – 35	14 – 35	26.31±4.34
Importance and value	4 – 20	13 – 20	17.08±1.66
Finding time	4 – 20	9 – 20	15.51±2.73
Personal issues	3 -15	6 – 15	11.05±1.99
Reflection	3 -15	8 – 15	11.82±1.61
Total score	32 – 160	91 – 155	127.28±13.48

[a] Standard Deviation

Discussion

The present study showed that the CSM could effectively increase the medication safety score in the intervention group. Consistent with our results, an earlier study in Iran examined the effect of CSM on high-alert medication safety in ICU nurses and reported that the model effectively improved high alert medication safety among nurses.[17] Another study in Urmia, Iran, also implemented the CSM to nursing students and reported that this intervention improved students' performance and clinical skills such as medication administration, team participation, patient education, patient safety, and infection prevention.[21]

The results showed that medication safety knowledge improved significantly in the intervention group after implementing the CSM. An Indonesian study also implemented CSM to nurses and reported that the intervention not only improved the nurses' knowledge, attitude, and satisfaction with patient care, but also significantly improved their technical skills and performance in patient education and support.[22] This indicates the positive effect of CSM in improving nurses' knowledge and performance.

In the current study, unique features of CSM, such as regular supervision sessions, friendly and stress-free interpersonal relationships prevailing in the sessions, and effective feedback on students' performance, progressively improved students' competence and knowledge in medication safety. Butterworth *et al.* also believe that the using this model improves nurses' performance by providing regular supervision and effective feedback.[27] The scores of the Manchester scale also showed the high effectiveness of CSM. Snowdon *et al.* also examined the effectiveness of CSM in allied health professionals. The health professional who participated in the latter study were satisfied with this model and believed that CSM would be more effective when their professional development is the focus of clinical supervision; the supervisor has the skills and attributes required to facilitate a constructive supervisory relationship, and the organization provides an environment that fosters this relationship.[28]

In this study, the MSCEC checklist and the MSKA questionnaire were used to assess students' medication safety competence and knowledge. These two scales have been used in previous studies to examine the effects of simulation on medication safety and medication safety knowledge,[12,19] Despite positive results, the latter studies were conducted in laboratory settings that are usually far from real-world conditions and are not a substitute for real clinical experiences.[29] However, CSM is a method used in clinical settings that exposes students to different clinical experiences, narrow the gap between theory and practice,[21] and can ensure patient safety.[28]

One of the limitations of this study was the routine supervision of the control and intervention groups by other faculty members to score their internship credits and the interrupted attendance of some students for three consecutive months in the medical and surgical wards because of participation in other internship credits. Such issues were largely controlled by randomizing the control and intervention groups. One of the strengths of this study was that the supervisors were clinical professors. Clinical professors can also serve as clinical supervisors for nursing professional development programs, provide an opportunity to strengthen partnerships between educational institutions and the health care center.

Conclusions

Medication errors made by students endanger patient safety. New teaching methods, such as CSM, must be used to reduce the gap between theory and practice and to enhance safe medication administration by nursing students, especially final-year students (nursing interns) who act with greater independence and under less clinical supervision. The results showed that the students' medication safety competence and knowledge scores increased significantly after implementing the CSM. The effectiveness of this model was also high from the students' point of view. Nursing professors are encouraged to use this model for clinical supervision and training of nursing interns to improve students' medication safety competence and knowledge.

Acknowledgment

This article was derived from a master thesis of nursing with project number 3400478, Isfahan University of Medical Sciences, Isfahan, Iran. The authors would like to acknowledge the research deputy at Isfahan University of medical sciences for their support. We also are thankful of all patients who participated in this study.

Abbreviations

Clinical supervision model: CSM;
Medication Safety Knowledge Assessment: MSKA;
Medication Safety Critical Element Checklist: MSCEC;
Manchester Clinical Supervision Scale: MCSS;
Intraclass correlation coefficient: ICC.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors read and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding

This study was financed by the Vice Chancellor for Research of Isfahan University of Medical Sciences (Project number: 3400478).

Role of the funding source

None.

Availability of data and materials

The data used in this study are available from the corresponding author on request.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. This study was approved by Vice Chancellor for Research of Isfahan University of Medical Sciences (Ethics code: IR.MUI.NUREMA.REC.1400.138).

Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

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How to Cite this Article:
Shahzeydi A, Farzi S, Tarrahi MJ, Babaei S. The effect of clinical supervision model on nursing interns medication safety competence and knowledge: A clinical trial. Nurs Midwifery Stud 2023;12(4):190-196. doi: 10.48307/NMS.2023.412822.1251