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Effect of hemovigilance education on nursing students' knowledge: the application of a conceptual map

Original Article

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Abstract: **Objective:** Given the importance of having knowledge on the hemovigilance process in nursing care, the present study was conducted to investigate the effect of the hemovigilance education on nursing students' knowledge using a conceptual map. The current research was a semi-experimental study.

Methods: The samples consisted of 60 nursing students who were selected based on the inclusion criteria using the census sampling method. Thereafter, these participants were randomly assigned into the two groups: experimental and control groups. The required data were collected before, immediately after, and 1 month after the education using the hemovigilance knowledge questionnaire. Accordingly, the validity of this questionnaire was confirmed, and its reliability using the Cronbach's alpha coefficient was reported as 0.83. The education process was conducted during a 4-week period. Thereafter, the collected data were analyzed using descriptive and inferential statistics by SPSS v25.

Results: The results reveal that a significant difference existed between the knowledge scores of students in the experimental group compared with that of the control group during different times (including before, immediately after, and 1 month after the education) ($P < 0.0001$). Of note, hemovigilance education had a significant effect on the students' knowledge ($P < 0.0001$).

Conclusions: Due to the effect of the hemovigilance education on the students' knowledge and by applying the conceptual map in the easy transfer of the educational concepts, it is recommended that the results of the present study be used to strengthen the theoretical and clinical education of nursing students.

Keywords: *concept map • hemovigilance • knowledge*

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1. Introduction

It was indicated that the use of blood products may possibly cause several complications as well as some types of allergic and non-allergic reactions in patients.[1] The complications that resulted from blood transfusions can consequently lead to shock and even to death eventually in patients.[2] In this case, providing nursing care for recipient patients can prevent the occurrence of these complications. Hemovigilance covers the whole blood transfusion chain from the blood collection stage to its transfusion stage.[3] The hemovigilance knowledge helps nurses to evaluate the information on the management of the blood product's use, especially when complications occur in patients.[4] During the hemovigilance process, nurses can report the complications caused by the use of the blood products.[5] Therefore, nursing information and documentation on the hemovigilance reduces the possibility of recurrence of these complications in patients.[6,7] Knowledge of nurses on hemovigilance consequently results in better management of this process and the cycle of blood transfusion in patients, and increase in their knowledge level leads to the promotion of patients' health and their concentration on these patients when caring for them.[8] On the one hand, nurses can immediately recognize and diagnose the complications caused by blood transfusions in patients by increasing their knowledge in this area; on the other hand, nurses can help in further planning for and prevention of serious incidents in patients by recording the information.[5,9] Nurses having knowledge on hemovigilance subsequently increased their understanding of different types of the blood products, the ways to transfuse and maintain blood products, the way to transfer the products, different blood types and tests required for the blood transfusion process, the required facilities and equipment, and the reactions to blood and the blood products.[10] The nurse's knowledge in this field makes it possible to monitor the transfusion process and the management of the blood carefully and to record all the incidents and then use them for further evaluations while monitoring patients closely and continuously.[11,12] Controlling the orders, caring patients, obtaining their consent, and educating them about health issues are known as the most important tasks of nurses during the hemovigilance process; so, they should have knowledge on them. Correspondingly, knowledge is defined as a set of experiences achieved during the consciousness times.[13,14] Therefore, having knowledge and experience would be effective on this issue.[15] Nurses, as the patients' caregivers, should have knowledge on the actions and issues performed in different circumstances.[16] It is better for nursing students, as the individuals learning to care patients in the real-world situations, to increase their knowledge on some serious issues like hemovigilance during their education period.[17,18] Learning is a process in which students acquire the necessary knowledge about a subject.[19] So, proposing a correct and effective method can be effective on shaping both knowledge and learning.[20] Traditional teaching methods alone would not be effective in the current situation.[21] Applying new teaching methods by engaging students more in the learning process has been welcomed worldwide.[22] Accordingly, these new teaching methods make the education more effective by engaging all the learner's senses.[23] In this regard, learning concepts in a more framed, purposeful way in the mind facilitate the learning process by engaging the student's senses.[24] Currently, one of the useful methods is the application of conceptual maps as an educational tool in which the instructor draws a map regarding a summary of the subject in a concise and purposeful way and also conveys the desired concepts to the students more easily and effectively.[25,26] Based on the above-mentioned statements, the present study was conducted with the aim of investigating the effect of the hemovigilance education on the nursing students' knowledge using a conceptual map.

2. Methods

The present research was a semi-experimental study. The included samples consisted of 60 nursing students studying at Saveh University of Medical Sciences in Saveh city. Sampling was done using the census sampling method. After obtaining a list containing the names of the students from the education department of the nursing faculty, the students were assigned into the experimental and control groups by simple randomization (30 samples in each group). In this study, the inclusion criteria were as follows: students being in the 3rd and 5th semesters, studying at the faculty, having experience in clinical practice for at least two semesters, and willingness to participate in the study. As well, the exclusion criteria were as follows: students having a probation record, being a guest student at the faculty for less than 2 semesters, and participating in hemovigilance workshops or classes prior to the study. After receiving the ethics code and obtaining the permission from the authorities, hemovigilance knowledge on the most precise method of blood transfusion and its complications questionnaire was used to collect the required data. Accordingly, the questionnaire consisted of the following two parts: the first part was related to demographic information and the second part included some questions related to having knowledge on the most precise method of blood transfusion. In order to achieve the research objectives, this

questionnaire was used to examine some items such as clinical and vital signs associated with the processes of preparation, maintenance, injection, and care before, during, and after the blood transfusion process. Moreover, the questionnaire investigated some other items such as the ideal temperature for the protection of blood product, the best time for blood storage, the time of blood injection, how to deal with the situation when a patient is reacting to the blood product, and the volume of blood product, in order to increase nursing students' knowledge in terms of the hemovigilance process. The questionnaire included 20 questions on the most precise method of blood transfusion. Each question was scored based on a Likert scale with scores ranging from 1 to 5, showing very low to very high awareness level, respectively. Questionnaire scoring includes three levels, including low awareness (0–33), moderate awareness (34–67), and high awareness (68–100). Of note, the face validity of the questionnaire was confirmed by experts. Additionally, its content validity was confirmed by experts and nursing faculty members. Two content validity indices (CVI) were used to check the necessity of the items and content validity ratio index (CVR) was used in four levels of relevance, simplicity, clarity and necessity. This tool's CVI was 0.9, and CVR was 0.9. As well, the reliability of the questionnaire using Cronbach's alpha coefficient was reported to be 0.83.

The required data were collected before, immediately after, and 1 month after the education. No education was provided for the control group. In the experimental group, the objectives of the study were firstly explained to the subjects, and then, they were provided with an education package containing a conceptual map illustrating the contents related to hemovigilance based on the guidelines of the Iranian Blood Transfusion Organization. Thereafter, the contents were taught by a member of the nursing faculty for a 4-week duration (including 4 sessions, each one lasted for 40 min). The education package was prepared using iMindMap Ultimate v9.0.1 mind mapping software made by Tony Buzan Online. In the first step, after the pre-test, the necessary explanations were provided by the instructor regarding the conceptual map method. In the second step, the educational contents, including different stages of hemovigilance care (including how to request and to reserve blood, completing the blood request form, getting the delivery from the blood bank, examining the blood bag, controlling the product, preparing for transfusion, venipuncture, diagnosing the complications and caring the recipient during and after the transfusion stage, and dealing with the complications during blood transfusion) were taught to the students in the experimental group using the conceptual map. At the third stage, after completing the educational course and by passing 1 week from the intervention, the post-test was taken by students in the experimental and control groups simultaneously. The follow-up data were collected by passing 1 month from the education. Finally, the collected data were analyzed using descriptive and inferential (repeated measures ANOVA and Bonferroni tests) statistics via SPSS v25.

3. Results

The mean and standard deviation of individuals' ages in the experimental group was 21.13 ± 2.67 years and 21.7 ± 4.48 years in the control group, respectively. Of note, no significant difference was observed in this regard (P = 0.555). In terms of the demographic information, a significant difference was observed between the experimental and control groups in terms of the treatment ward (P = 0.0001) (Table 1).

The mean and standard deviation of nursing students' knowledge scores in the experimental group increased during the three different times (including before, immediately after, and 1 month after the education), while in the control group, no difference was found (Table 2).

Demographic information	Intervention		Comparison		*Sig.*
	N	Percent	N	Percent	
Sex					0.431**
Male	17	56.66	14	46.67	
Female	13	43.34	16	53.33	
Marital status					0.020*
Unmarried	27	90.00	27	90.00	
Married	3	10.00	3	10.00	
Ward					0.001**
Psychiatric	8	26.66	-	-	
EM	12	40.01	-	-	
Surgical	10	33.33	-	-	
Medical	-	-	18	60.00	
Acute EM	-	-	12	40.00	

Note: *Fisher and **Chi-square tests were used.

Table 1. Determining the frequency and percentage of demographic information among nursing students included in the experimental and control groups.

Group	Pre-test	Post-test	Follow-up
Intervention	27.333 ± 2.590	68.633 ± 7.549	68.133 ± 7.881
Comparison	27.333 ± 2.638	23.533 ± 2.582	23.833 ± 2.614

Table 2. The mean and standard deviation of the nursing students' knowledge score in the experiment and control groups during different times (including before, immediately after, and 1 month after the education) (mean ± SD).

Variables	Type III sum of squares	df	Mean square	F	Sig.	Partial Eta squared
Student awareness						
Sphericity assumed	13,690.30	2	6845.150	472.979	0.0001	0.891
Greenhouse-Geisser	13,690.30	1.027	13,329.540	472.979	0.0001	0.891
Group × student awareness						
Sphericity assumed	20,344.90	2	10,172.450	702.886	0.0001	0.924
Greenhouse-Geisser	20,344.90	1.027	19,808.450	702.886	0.0001	0.924

Table 3. Repeated measurements of the effects of the education on the knowledge of the nursing students included in the experimental and control groups during different times (including before, immediately after, and 1 month after the education).

Variable	Test	Value	F	Hypothesis df	Error df	Sig.	Partial Eta squared
Student awareness	Wilks' lambda	0.096	268.262	2	57	0.0001	0.904
Group × student awareness	Wilks' lambda	0.063	425.317	2	57	0.0001	0.937

Table 4. Repeated measurements of the effects of the education on the intergroup knowledge of the studied students.

Variable	Type III sum of squares	df	Mean square	*F*	Sig.	Partial Eta squared
Student awareness	39,605	1	39,605	895.971	0.0001	0.939

Table 5. The difference between the students' knowledge levels during different times (including before, immediately after, and 1 month after the education).

It was shown that the education had a significant effect on the knowledge of students in the experimental group during the three different times (including before, immediately after, and 1 month after the education) ($P < 0.0001$) (Table 3).

In terms of the effect of the education on students' knowledge, a significant difference was observed between the two study groups during three different times (including before, immediately after, and 1 month after the education) ($P < 0.0001$) (Table 4).

In addition, there was a significant difference between the two groups in terms of the knowledge of students during three different times (including before, immediately after, and 1 month after the education) ($P < 0.0001$) (Table 5).

According to the results of Bonferroni post hoc test, a significant difference was observed between the pre-test and the post-test and also between the pre-test and the follow-up stages ($P < 0.0001$), while no significant difference was found between the post-test and the follow-up stages ($P = 1.0$) (Table 6).

Student awareness	Mean difference (I-J)	Std. error	Sig.
Pre-test-post-test	−18.550	0.828	0.0001
Pre-test-follow-up	−18.450	0.865	0.0001
Post-test-follow-up	0.100	0.120	1.0

Table 6. The results of the Bonferroni post hoc test regarding the effect of the education on nursing students' knowledge level.

4. Discussion

The present study aimed to determine the effect of hemovigilance education on the nursing students' knowledge using a conceptual map. It was previously demonstrated that having knowledge on hemovigilance can help students and nurses to prevent the complications that resulted from the blood transfusions and blood products. In the current study, the nursing students' knowledge before the intervention was found to be low in both the experimental and control groups. In a previous study, the results showed that students' knowledge on hemovigilance was low.[27] In another study, the results showed that nursing students' knowledge on hemovigilance was unfavorable.[28] It seems that neglecting the provision of necessary and sufficient education in this regard leads these students to have no knowledge on the hemovigilance process. Moreover, in another study, the results showed that both the knowledge and the clinical decision-making skills of the nursing students were low.[29] What can be

deduced from the results of the present study is the good effect of hemovigilance education on the level of knowledge of students in the experiment group. Correspondingly, the application of a conceptual map to convey the intended educational concept was effective. In a previous study, researchers compared the effects of the conceptual map and traditional methods on students' creativity and concluded that students in the conceptual map group were more creative.[30] The results of another study showed that the conceptual map method is more effective on providing education for nursing students compared with the traditional methods.[31] Moreover, in another study, it was indicated that teaching using the conceptual map method in the experimental group had increased the critical thinking power of nursing students compared with the control group.[32] In comparison to the results of the present study, it can be concluded that the application of the conceptual maps could be very useful for teaching and conveying information in terms of the hemovigilance process to nursing students. In the experimental group, the level of students' knowledge after the education was significantly different from that of before the education with an increasing trend in the level of knowledge; even during the 1-month follow-up period, the effects of the education remained stable. However, in the control group, students' knowledge did not change before, immediately after, and 1 month after the education, and students in the control group still had little knowledge in this regard. In a previous study conducted on evaluating the knowledge of nurses after the educational intervention, the results showed that the knowledge of individuals on the blood transfusion process has increased compared with that before the intervention.[33] In another study with the aim of determining the effect of the use of hemovigilance checklist on the blood transfusion performance in nursing students, the obtained results indicated that the performance of students in the checklist group was better than that of other study groups.[34] In another study performed on evaluating the knowledge of the healthcare workers in terms of hemovigilance in hospitals, the results showed that the level of nurses' knowledge was higher than that of other medical staff.[35] Having adequate knowledge and awareness on hemovigilance, which is a process of managing both the preparation and transfusion of blood to patients, can properly prevent fatal complications in patients. Nursing students, as the future nurses, can consciously use this obtained knowledge while providing care for patients, as well as during implementing a quality care process by enhancing their knowledge on hemovigilance.

One of the limitations of the present study was the lack of enough time to perform the study because of having interference with the students' educational process. However, some necessary attempts were made to reduce this limitation by explaining the objectives of the study to the students and conducting the research at a time other than the times of their classes.

5. Conclusions

Considering the effect of educating hemovigilance using a conceptual map on nursing students' knowledge as well as the importance of having knowledge on hemovigilance for nurses, building a foundation for this knowledge in nursing students, as future nurses, can help to prevent the development of some serious complications that resulted from blood transfusions and the blood products. On the one hand, the purpose of the hemovigilance process was to strengthen and frame the students' minds to provide care. On the other hand, the application of the conceptual map method by maximizing students' participation in the educational process, besides transferring the concepts, can increase their learning ability and knowledge level. It is recommended to apply the conceptual map method in nursing students' educational courses for having a more effective transfer of concepts. Additionally, in regard to hemovigilance education, according to the results obtained in the present study, the issue of hemovigilance should be comprehensively included in the curriculum. As well, in the clinical education of nursing students, the conceptual map method should be used more to provide education and during the internship, and the subject of the hemovigilance should be taught in a more purposeful and practical way to these students.

Ethical approval

The present study obtained the ethical permission from Saveh School of Medical Sciences (No. IR.SAVEHUMS.REC1396.40).

Conflicts of interest

All contributing authors declare no conflicts of interest.

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