Original Article

JHSMR Journal of Health Science and Medical Research

Effectiveness of a Case-based Educational Intervention Focusing on Blood and Body Fluid Exposure Prevention among Nursing Students

Mai Thi Lan Anh, Ph.D.[1], Nujjaree Chaimongkol, Ph.D.[2], Truong Tuan Anh, Ph.D.[1], Le Thi Thanh Tuyen, Ph.D.[3], Do Thi Kim Thu, M.Sc.[4], Hoang Thi Minh Thai, M.Sc.[1], Nguyen Thi Thanh Huong, M.Sc.[1], Dao Trong Quan, M.Sc.[5], Do Thi Thu Hien, Ph.D.[6]

[1]Namdinh University of Nursing, Nam Dinh City, Nam Dinh 420000, Vietnam.

[2]Faculty of Nursing, Burapha University, Mueang, Chon Buri 20131, Thailand.

[3]Faculty of Nursing, Da Nang University of Medical Technology and Pharmacy, Da Nang 50000, Vietnam.

[4]Faculty of Nursing and Midwifery, Ha Noi Medical University, Ha Noi 100000, Vietnam.

[5]Thai Nguyen University of Medicine and Pharmacy, Thai Nguyen 250000, Vietnam.

[6]Faculty of Nursing, Hai Duong Medical Technical University, Hai Duong 170000, Vietnam.

Received 15 December 2022 ● Revised 31 January 2023 ● Accepted 21 March 2023 ● Published online 11 May 2023

Abstract:

Objective: There is a relative lack of research regarding case-based educational interventions to improve blood and body fluid exposure prevention practice among nursing students. Hence, this study aimed to investigate the effect of case-based educational intervention on knowledge, attitudes, and behaviors regarding blood and body fluid exposure prevention among nursing students, at some universities in Vietnam.

Material and Methods: This study employed a randomized control trial design. Simple random sampling was used to recruit the target population, to obtain 87 nursing students. Students' knowledge, attitude and self-reported behavior scale on exposure prevention were used to collect data at three time-points. The 4-week case-based educational intervention was provided to the intervention group (42 students); whereas, the control group received only regular training.

Results: The findings revealed that there were significant, positive differences in students' knowledge, and attitude toward blood and body fluid exposure prevention in the intervention groups than in the control group after receiving the intervention, which remained over time.

Contact: Mai Thi Lan Anh, Ph.D.
Namdinh University of Nursing, Nam Dinh City, Nam Dinh 420000, Vietnam.
Email: lananh.ndun@gmail.com

J Health Sci Med Res .....
doi: 10.31584/jhsmr.2023953
www.jhsmr.org

Conclusion: Higher educational institutions should provide case-based educational intervention to nursing students, so as to enhance their blood and body fluid exposure prevention practices.

Keywords: blood and body fluid exposure prevention, case-based educational intervention, nursing students, Vietnam

Introduction

While performing patient care activities, healthcare workers are at risk of occupational exposure to blood and body fluids. They are at high risk of various infections and also victims of social ills, due to their stressful work schedules and high level of professional responsibility. In the United States, there were an estimated 503,000 sharp-point injuries and 146,000 dermal exposures in 2014[1]. However, it is estimated that more than 90% of occupational exposure worldwide occurs in developing countries[2]. In Vietnam 2012, a study estimated that the cases of hepatitis B virus (HBV) infection were 50 cases per 100,000 patients; with human immunodeficiency virus (HIV), due to infection exposure, at 0.2 cases per 100,000 patients.

Nursing students develop clinical practice skills through performing care procedures that involve handling sharp objects and bodily secretions. Research data has shown that nursing students had a higher risk of occupational exposure than graduate students and healthcare workers[3]. Some of the factors that contributed to this high risk of injury among students were: lack of experience, knowledge, attitudes, or skills in equipment handling; supervisory support; protective means, at the same time also due to anxiety; being tired and lacking confidence[4].

In the training program, students take a required course in infection prevention and control (IPC) that provides knowledge and practice on exposure prevention. However, the lack of confidence in patient care has resulted in students' knowledge of exposure prevention being insufficient, a careless attitude and a lack of confidence in clinical practice. While practicing in the clinical settings, students considered preventive behavior as a regular and repetitive practice; and will therefore gradually lose their positive attitude and safe behavior[5,6]. A comparative study performed on nursing students after a six-month clinical practice identified that 75.6% of the students were exposed to blood and body fluids[7,8]. A two-year study in Vietnam on the exposure rates of students indicated that nursing students were the most exposed. The causes of exposure were mainly due to a lack of proficiency in practice, unsafe applied protective measurements and unfollowed standard precautions[8].

Conceptual framework and review of literature

This study was guided by the Health Belief Model (HBM)[9]. This is a psychological model used to explain and predict health behaviors by focusing on the attitudes and beliefs of individuals. It is a conceptualization of three key components of modifying factors: individual beliefs and actions, construct into perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and health actions or behaviors. In the study, the researcher provided knowledge and cases to emphasize appropriate prevention. For this, students were given evidence of real danger (perceived sensitivity) and serious risk (perceived severity) for exposure to blood and body fluids in clinical practice settings. They were familiar with the benefits (perceived benefits) and barriers (perceived barriers) of appropriate prevention therefore, they were more likely to conduct prevention behavior for the procedure of initial exposure steps; and post-exposure prophylaxis, monitoring and evaluation. Their self-efficacy was enhanced by an action plan and reflective diary that the students committed to performing prevention, and that could lead them towards adopting prevention behaviors[10].

A number of studies in developed and developing countries have shown that educational interventions can effectively reduce student exposure rates[11-15]. Handiyani evaluated the effectiveness of a needle and sharp injury prevention intervention program in clinical training for nursing students. The program significantly improved the knowledge and practice of nursing students in concerns to the needle and sharp object intervention program[13]. A study to evaluate the effectiveness of the intervention on awareness related to HIV, HBV & hepatitis C virus (HCV) prevention for nursing students confirmed that the educational program was effective in improving the awareness of nursing students[16]. Sudhir Singh 2020, indicated that the intervention related to needle-injured and preventive measures knowledge were effective on nursing students; the difference was statistically significant with a p-value<0.05[17].

In Vietnam, a study, which evaluated the effectiveness of the occupational exposure prevention program at Cho Ray Hospital, showed that after implementing training the rate of exposure to HIV and HBV sources decreased significantly[18]. Research by the group of authors Le Thi Oanh and colleagues, in an intervention study to improve the adherence to injection and infusion techniques of nurses at North Thang Long Hospital, showed that after the intervention both knowledge and practice were improved[19]. A study conducted by a research team at a nursing university evaluated the effectiveness of a case-based educational intervention program on nursing students[20]. The study results provided evidence of the positive effect of a case-based educational intervention program on students' positive thinking, and problem-solving decisions related to the prevention of blood, and body fluids exposure. However, the design of the intervention program was complicated, the intervention sessions were not clear, and the students had difficulty exploiting the entire intervention program. In addition, the study recruited students in one university, without a control group; which limited the comparison as to the effectiveness of the intervention program.

The literature review indicated that most of the educational interventions on infection prevention and control education had some things in common; such as receiving positive feedback from students and helping to increase knowledge, attitudes and behaviors on the prevention of exposure to blood and body fluids. However, the interventions had their own strengths and limitations. Therefore, educational intervention programs need to be simplified and structured according to certain sessions. This would enable the students to monitor and maximize the effectiveness of this intervention. The sessions with only PowerPoint presentations may not be enough for students to develop critical thinking and help them to make appropriate decisions on the prevention of exposure to blood and body fluids; whereas, students had previously been given content on the required courses in their nursing program. During the training program, students should be provided with more specific cases to improve their knowledge, attitudes and skills in the prevention of exposure to blood and body fluids. Therefore, intervention programs should be more structured and feasible to accommodate students. These interventions could also have an additional follow-up period after the intervention, so as to assess the long-term impact of the intervention program.

Vietnam is a developing country, with unsynchronized and incompleted facilities and equipment related to the prevention of exposure to blood and body fluids. The shortage of clinical teachers and tutors results in inadequate supervision and instruction for students; especially in practices of prevention and management of student blood and body fluids exposure[21]. In addition, there is a relative lack of studies on educational interventions on students› knowledge, attitudes and behaviors related to the prevention of exposure to blood and body fluids. Therefore, it was of interest to examine the effectiveness of a case-based intervention for nursing students in Vietnam. The program was guided by the HBM, from findings of relevant studies on the prevention of exposure to blood and body fluids for

nursing students, and adapted from the case-based intervention program.

Study aim and hypotheses

This study aimed to determine the effectiveness of a case-based intervention on knowledge, attitude and behavior among nursing students. The hypotheses were:

1. Participants in the intervention group would have significantly higher mean scores on knowledge, attitude and behavior than that of the control group in the immediate post-intervention (week 4), and follow-up period (week 8).

2. Within the intervention group, the mean score on knowledge, attitude and behavior increased from pre-intervention, post-intervention (week 4), and follow-up period (week 8).

Material and Methods

This study employed a Randomized controlled trial design. This report followed the CONSORT 2010, checklist of information to include when reporting a randomized trial.

Sample and sampling

The target population was third-year nursing students, at three universities that practiced in clinical settings. Randomized sampling was used to recruit the target population, in three universities, so as to obtain 87 nursing students. The inclusion criteria were: third-year nursing students that were practicing in clinical settings, had completed the requirements for the infection prevention and control module, and had no serious mental health problems or physical conditions. Exclusion criteria were students that repeated the internship and were unable to complete all sessions of the intervention.

G*Power 3.1.9.2 was used to calculate the sample size. The F-test, repeat measurement ANOVA was used to compare the differences within the intervention group and between the intervention group and the control group. The knowledge, attitude and behavior of students for prevention of blood and body fluids exposure were measured three times; including at baseline, immediately after the intervention and four weeks after the intervention. The influence coefficient of educational intervention from the previous study was 0.5[14]. According to Cohen's mean coefficient of influence, with a significance level of 0.05 and power of 0.8, the minimum sample size was 65 participants. Considering the percentage of students that were unable to complete the study being 20.0-25.0%, the study selected a sample of 87 students; for which 42 students were in the intervention group and 45 students were in the control group.

At each university, a class of students was randomly selected from the target population. Then 87 students, who met the selection criteria, were selected by the simple random sampling method using a computer program. These students were randomly assigned to either; the control or intervention group via a random number assigned by a person in the study group who was blind to the identity of the student. The students in the intervention groups practiced in the hospital in the morning, while the control groups practiced at the hospital in the afternoon.

Development of the case-based educational intervention

The case-based educational intervention was adapted from the intervention program, by Thai and colleagues (2019) and intensively reviewed relevant literature concerning educational intervention studies in the prevention of body fluid and blood exposure. For the convenience of students to participate fully in the entire intervention program, the intervention protocol included four-weekly online real-time sessions. The sessions provided summative knowledge and cases in the areas of prevention of body fluid and blood exposure. These were structured discussions by primary investigators through case studies involving topics,

discussions of knowledge, attitude and skill development, and individual action plans. The cases were examples of real-life body fluid and blood exposure situations that often occur in clinical settings. These cases were selected to strengthen the fluid and blood exposure capacity of the nursing students. In addition, participants were assigned the roles of moderators, idea persons, passive persons, optimists, and pessimists in clinical settings to encourage active participation. At the end of each session, the research team guided the students to develop their own action plans to practice their skills related to fluid and blood exposure. Google form links were used to collect and provide individually reflective diaries of students. The participants' reflective diaries allowed them to reflect on their experiences with practiced skills, and the research team provided feedback to the diaries weekly.

The program plan included groups of 8 to 12 students, over four sessions; with each session lasting 120 minutes. The content for the short presentations was based on the difficulties and challenges of students concerning IPC within 15 minutes[20]. Discussions were followed after each presentation regarding the designed cases. An individual action plan was developed at the end of each session. The content was in the student booklet, with a schedule of sessions; readings; designed cases with suggestions on prevention of exposure to blood and body fluids; an action plan, links to reflective diaries and an evaluation form at the end of the intervention program.

The student's booklet

The content of the intervention program was included in the student's booklet. The booklets were distributed to the students during the first session. The research team instructed students to use the booklet in clinical settings, in the intervention sessions and in the future after finishing the intervention program. The intervention program was presented in the Table 1.

Instruments

In assessing the differences in knowledge, attitudes, and self-reported behaviors as to the prevention of blood and fluid exposure, students completed the questionnaires at three time-points: baseline, post-intervention and follow-up.

A demographic questionnaire was developed by the research team to record the information on gender, a final grade of infection prevention and control course, second-year final scores, infected hepatitis, and HBV vaccination. The Students' blood and body fluid exposure prevention knowledge questionnaire included ten items to assess blood and body fluid exposure prevention. It was developed by the research team, using the test bank of infection prevention and control module within each university. Each correct answer received 1 point, with a total knowledge score ranging from 0 to 10. The higher score indicated a better knowledge as to the prevention of exposure to blood and body fluids. In this study, Cronbach's alpha reliability of the knowledge scale was 0.8.

The students' blood and body fluid exposure prevention attitude questionnaire, developed by Hoang Minh Thai et al. (2020), was used to assess exposure prevention attitudes. The questionnaire consists of 28 questions, with 5 domains of exposure prevention attitude including: (a) results of exposure to blood and body fluids (5 items), importance of preventive measures (5 items); attitudes toward post-exposure management, reporting, treatment and monitoring (6 items), confidence in prevention practice (6 items) and barriers in preventive measures (6 items). The questionnaire is scored on a 5-point Likert scale showing: strongly agree (5), agree (4), neutral (3), disagree (2) and strongly disagree (1). The total score ranges from 28 to 140, calculated from the scores of all questions, and higher scores showed a more positive exposure prevention attitude of students. Thai and colleagues (2020), indicated that the questionnaire exhibited good reliability of 0.8[20].

Table 1 Summary of the case-based educational intervention

Week/day	Objectives	Activities
Week 1–day 1 (120 m)	Overview of case-based educational intervention on prevention of blood and body fluid exposure	•Welcome and class introduction •Researcher's presentation of overview of case-based educational intervention on prevention of exposure to blood and body fluids •Cases and group discussions •Action planning •Link of reflection •End of the session
Week 2 (120 m)	Prevention for exposure to blood/body fluids in clinical practice	•Feedback/problem solving on students' action plans and reflective diaries •Researcher's presentation of prevention for exposure to blood and body fluids in clinical practice settings •Cases and group discussions •Action planning •Link of reflection •End of the session
Week 3 (120 m)	Processing the initial exposure steps, generating exposure reports and assessing the risk of exposure.	•Feedback/problem solving on students' action plans and reflective diaries •Researcher's presentation of procedure for initial exposure steps •Cases and group discussions to generate exposure reports according to available forms and assess exposure risks. •Action planning •Link of reflection •End of the session
Week 4 (120 m)	Reviewing the specific prophylactic measures available to each case, and post-exposure monitoring and evaluation.	•Feedback/problem solving on student action plans and reflective diaries •Researcher's presentation of post-exposure prophylaxis, monitoring and evaluation •Cases and group discussion for prophylactic measures, and post-exposure monitoring and evaluation. •Action planning •Link of reflection •End of the intervention program, survey immediately after the intervention, evaluate the intervention program and make an appointment for the survey after 4 weeks

The students' self-reported exposure prevention behavior scale was developed under the Vietnam Ministry of Health standard prevention guidelines (2012)[22]. The scale is used to measure students' perception of exposure prevention behavior during clinical practice. The behaviors were: hand washing, glove-wearing and needle handling. The questionnaire consisted of 5 items, scored on a 5-point Likert scale showing: always (5), often (4), sometimes (3), rarely (2) and never (1). The total summed score ranged from 5 to 25, with higher scores indicating safer behavior of exposure prevention. The reliability of the scale in this current study was 0.8.

Validity of the case-based educational intervention

The case-based educational intervention program was evaluated for content and construct validity by three experts; including a lecturer of the infection prevention and

control module, the head of the Infection Control Department and a chief nurse. The content validity index was used to validate the content validity. The research team then revised the content of the intervention according to the comments and suggestions of experts.

Regular training

The clinical instructors guided the students in the control and intervention groups on the daily bedside care practices, with an emphasis on infection prevention and control skills as well as giving weekly feedback on students' safe care practice skills. The control group received regular training and intervention materials for self-study at the end of the intervention program.

Data collection

Due to the COVID-19 situation in Vietnam in 2021, the data collection was conducted from March to September 2021, in three universities. The three research assistants (RAs) were faculty, who taught the students in infection prevention and control modules and who instructed students in clinical settings. They were trained how to collect data, using the three research instruments. The RAs recruited students and sent the intervention materials and questionnaire links to the participants. The participants rated the questionnaires at three time-points: before the intervention (T1), immediately after the intervention (T2), and at follow-up time (T_3). While conducting the pilot study, the RAs also were trained to become familiar with recruitment, intervention materials and questionnaire links. The details are presented in Figure 1.

Data analysis

Frequencies, means, and standard deviations were used to describe the characteristics of the students, and outcome variables. The t-test and chi-square were used to compare the differences between the intervention and control groups at baseline. The differences in knowledge, attitude and behavior between the intervention and control groups; and between time frames were analyzed using the two-way repeated measures ANOVAs. The main effect of the variable's mean scores indicated the differences between groups. The interaction effect (time and group effect) of the variable's mean scores indicated the differences between groups over time. Data were analyzed using International Business Machines (IBM®) Statistical Package for the Social Science (SPSS®) statistical software, version 26, and statistical significance was set at p-value<0.05.

Ethical issues

This study was approved by the Institutional Review Board of the Nam Dinh University of Nursing, Vietnam (Approval No 348/GCN-HĐĐĐ). Prior to data collection, permission was received from each university. The participants were informed as to the study's purpose, data collection procedure, benefits and risks, and confidentiality of information. They had the right to participate voluntarily, withdraw during data collection and the intervention, or terminate the study without penalty. After indicating their willingness, they signed electronic informed consent.

Results

The general participants' characteristics

In the intervention group, the majority of students were female (81.0%) and unvaccinated (88.0%). None of the students had any type of hepatitis. The students' average overall score for the infection prevention and control course, and their second-year grade-point average were 7.9 (±2.1) and 7.1 (±2.3). There were no statistically significant differences between the intervention group and the control group (p-value>0.05). Details are presented in Table 2.

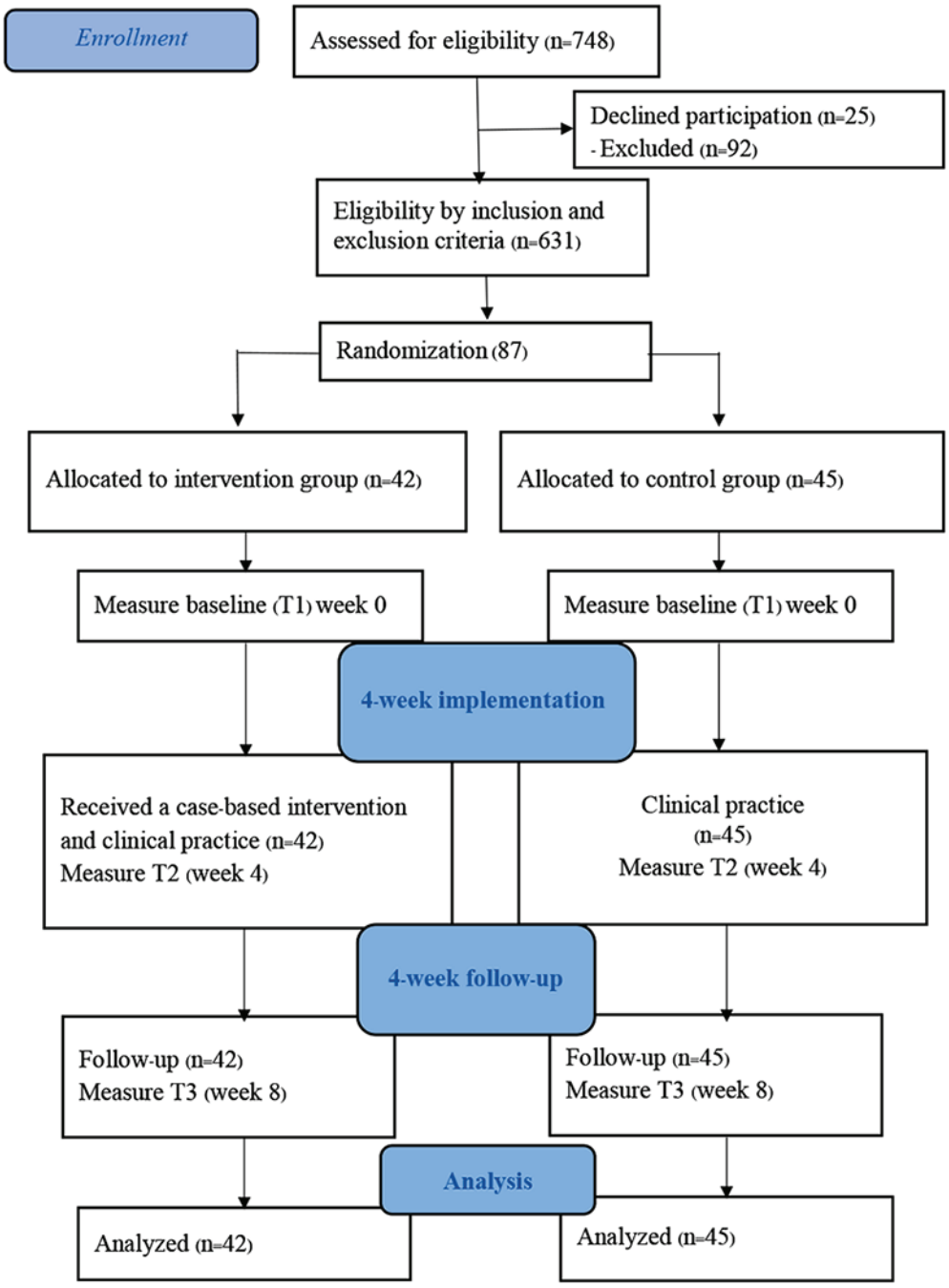

Figure 1 Summary of data collection procedures

Table 2 Participants' characteritics

Characteristic	Group		*t*	χ^2	p-value
	Intervention (n=42) n (%)	Control (n=45) n (%)			
Gender				1.7	0.3
Male	8 (19)	7 (16)			
Female	34 (81)	38 (84)			
Vaccinated				2.1	0.7
Yes	5 (12)	8 (18)			
Not yet	37 (88)	37 (82)			
Infected hepatitis	0 (0.0)	0 (0.0)		0.00	1.0
Hepatitis A					
Hepatitis B					
Hepatitis C					
Hepatitis D					
Hepatitis E					
HIV					
Final score of infection prevention and control module	M=7.9. S.D.±2.1 range=5.0-9.5	M=7.7. S.D.±2.2 range=5.5-9.5	-0.8		0.4
Final score of the second year	M=7.1. S.D.±2.3 range=5.3-9.1	M=7.3. S.D.±2.4 range=5.7-9.4	0.3		0.5

S.D.=standard deviation, HIV=human immunodeficiency virus

The effectiveness of the intervention program

The outcome variables; including knowledge, attitude and self-reported behavior regarding exposure prevention of students were evaluated at three time-points: week 0 (T1), week 4 (T2) and week 8 (T3). The mean and standard deviation of the knowledge, attitude, and self-reported behavior of students with concerns about exposure prevention in the intervention and control groups at three-time points are presented in Table 3.

The two-way repeated measures ANOVA indicated a significant, main effect of the group in both knowledge ($F_{2, 85}$=79.8, p-value=0.01) and attitude of exposure prevention ($F_{2, 85}$=13,3, p-value=0.02) (Table 4), indicating that mean scores of knowledge and attitude of exposure prevention in the intervention and control groups were different. In contrast, the between-group differences in self-report behavior were not statistically significant. Moreover, there was a significant change in mean scores of knowledge ($F_{2, 85}$=5.4, p-value=0.03) and attitude ($F_{2, 85}$=66.9, p-value=0.05) of exposure prevention over time. The time-group interaction of attitude ($F_{2, 85}$=24.1, p-value=0.04) and self-report behavior ($F_{2, 85}$=7.3, p-value=0.01) was also significant; indicating the attitude and self-report behavior mean total scores between the intervention and control group were different over time (Table 4).

Results from the one-way ANOVA (Table 5) revealed that at baseline (week 0) there were not statically differences in knowledge, attitude and self-report behavior mean scores between the intervention and control group; however, immediately after intervention (week 4), the mean score of knowledge ($F_{2, 85}$=13.0, p-value=0.004), attitude ($F_{2, 85}$=35.21, p-value<0.001) and self-report behavior ($F_{2, 85}$=72.2, p-value=0.01) in the intervention group was significantly higher than that of the control group. One month after the intervention (T3), there was only a difference in the mean score of attitude between the intervention group and the control group ($F_{2, 85}$=21.4, p-value=0.004)

Table 3 Means and standard deviations of the scores of knowledge, attitude and behavior of exposure prevention; at the three time periods of both groups

Variables	Week	Intervention (n=42)		Control (n=45)	
		Mean	S.D.	Mean	S.D.
Knowledge	0	6.1	2.1	5.9	2.1
	4	7.1	2.2	6.2	3.3
	8	7.5	3.1	5.2	2.9
Attitude	0	82.6	22.6	83.2	21.9
	4	91.0	18.2	77.9	20.1
	8	87.0	20.2	80.0	19.2
Behavior	0	14.4	4.1	15.9	4.0
	4	20.2	3.9	18.7	4.2
	8	18.4	4.0	18.6	4.2

S.D.=standard deviation

Table 4 Two-way repeated measures ANOVAs of knowledge, attitude, and self-reported behavior scores across three time periods

Variables	SS	Df	MS	*F*	p-value
Knowledge					
Within subjects					
Time	21.5	2	10.8	5.4	0.03
Time* Group	53.2	2	26.6	13.3	0.6
Between subjects					
Group	79.8	2	79.8	37.0	0.01
Attitude					
Within subjects					
Time	122.1	2	61.1	1.4	0.8
Time* Group	2041.6	2	1020.8	24.1	0.04
Between subjects					
Group	2714.2	2	2714.2	71.6	0.02
Behavior					
Within subjects					
Time	899.5	2	449.7	66.9	0.05
Time* Group	98.7	2	49.4	7.3	0.01
Between subjects					
Group	0.5	2	0.5	0.1	0.8

SS=sum score, MS=mean score, Df=degrees of freedom, *F*=ratio of two variances

Table 5 Simple effect of groups on knowledge, attitude, and self-reported behavior; between 2 groups, at 3-point times

Variables	SS	Df	MS	*F*	p-value
Knowledge					
Pre-intervention (T_1)	25.1	2	21.1	4.4	0.8
Post-intervention (T_2)	29.2	2	18.2	13.0	0.004
Follow-up (T_3)	22.4	2	19.7	37.0	0.6
Attitude					
Pre-intervention (T_1)	107.8	2	79.4	12.5	0.5
Post-intervention (T_2)	209.1	2	203.2	35.2	<0.001
Follow-up (T_3)	197.3	2	156.2	21.5	0.004
Behavior					
Pre-intervention (T_1)	207.8	2	43.4	21.5	0.4
Post-intervention (T_2)	109.1	2	143.2	72.2	0.01
Follow-up (T_3)	107.3	2	336.2	31.5	0.07

SS=sum score, MS=mean score, Df=degrees of freedom, *F*=ratio of two variances

Table 6 Pairwise comparisons of means of knowledge, attitude, and self-reported behavior between each time point of both and within the intervention and the control groups

Time	M_{diff}	SE	p-value
Knowledge			
Intervention group			
T_1 vs. T_2	-1.1	0.2	0.005
T_1 vs. T_3	-1.4	0.2	0.009
T_2 vs. T_3	-0.3	0.2	0.7
Control group			
T_1 vs. T_2	-0.3	0.3	0.8
T_1 vs. T_3	1.1	0.4	0.2
T_2 vs. T_3	0.8	0.3	0.5
Attitude			
Intervention group			
T_1 vs. T_2	-8.4	0.9	<0.001
T_1 vs. T_3	-4.0	1.0	0.03
T_2 vs. T_3	-4.5	1.2	0.05
Control group			
T_1 vs. T_2	-5.8	0.1	0.2
T_1 vs. T_3	-4.1	0.1	0.4
T_2 vs. T_3	1.8	1.1	0.3
Behavior			
Intervention group			
T_1 vs. T_2	-5.8	0.4	0.007
T_1 vs. T_3	-4.1	0.4	0.08
T_2 vs. T_3	1.8	0.4	0.01
Control group			
T_1 vs. T_2	-2.8	0.4	0.04
T_1 vs. T_3	-2.7	0.4	0.5
T_2 vs. T_3	0.1	0.4	0.7

M_{diff}=mean difference, SE=standard error

Pairwise comparisons were used to determine the difference in knowledge, attitude and self-report behavior mean scores at three-time points. In the experiment group, the mean score of knowledge, attitude and behavior increased significantly from baseline (T_1, week 0), and post-intervention (T_2, week 4); however, these were a little bit lower from post-intervention (T_2, week 4) to follow-up (T_3, week 8); with the exception of behavior. In contrast, the mean scores of knowledge, attitude and behavior in the control group were not statistically significant across three point-times (Table 6); therefore, both hypotheses were mostly supported.

Discussion

The purpose of this current study was to investigate the effect of the case-based educational intervention on knowledge, attitudes and behaviors of exposure prevention among nursing students. The results found that integrating the case-based educational sessions and reflective support in the practice of exposure prevention effectively improves knowledge, attitude and behaviors to prevent exposure to blood and body fluids of nursing students. These results supported the HBM[9] as well as previous studies[11-17].

In the intervention process, the researcher provided summative knowledge and cases related to the prevention of exposure to blood and body fluids in clinical practice settings (perceived sensitivity and perceived severity), the procedure for initial exposure steps; and post-exposure prophylaxis, monitoring and evaluation (perceived benefits and perceived barriers). Moreover, prevention practices were enhanced by using an action plan and reflective diary (self-efficacy and cue to actions). Therefore, the intervention improved knowledge, attitudes and behaviors in regard to exposure prevention among nursing students[9,10,13-15,17].

At some universities in Vietnam, it is reflected in the improvement of preventive knowledge, attitudes and behaviors. However, the research results showed that the case-based educational method did not maintain the safe behavior of students in exposure prevention. This result corresponded to a number of previous studies on the effectiveness of the case-based education method in improving the preventive knowledge, attitudes and behaviors of nursing students[11-15,17].

Research by Hoang Thi Minh Thai et al. (2020), on final-year nursing bachelor's students, revealed that educational methods improved students' knowledge and attitudes about blood exposure prevention, and body fluids[20]. The research results of author Sadeghi et al in Iran in 2018, indicated that educational methods supported students to gain and maintain good confidence in clinical practice and exposure prevention[14]. Addtionally, the research results of Dogra et al. (2015), recommended implementing interventions according to a multimodal approach; including a combination of videos, PowerPoint presentations and practical modeling to help students apply and practice Infection prevention and control[23]. The recommendations from the above studies were that further research is needed to identify the strengths and areas for improvement of the case-based educational intervention[11-15,17].

Limitations

This study had certain limitations that could be improved upon in the future. Firstly, the 1-month follow-up period was relatively short, and the long-term effects of exposure prevention need further investigation. Secondly, students self-reported exposure prevention behavior; rather than the direct observation of clinical practice, reducing their objective study outcomes. Thirdly, there may be different reporting biases; wherein, nursing students participating in the exposure prevention intervention group may be more likely to over-report exposure prevention attitudes and behaviors compared to the reality of the attitude and behavior as well as those compared with the control group.

Conclusion

The case-based education intervention improved the knowledge, attitudes and behaviors of exposure prevention among nursing students. This study provided empirical evidence to support the integration of exposure prevention training into clinical curricula. This study suggests that universities should provide similar training regularly in Vietnamese nursing universities, so as to reduce the risk of exposure to blood and body fluids in clinical practice settings among nursing students. Faculty and higher education institutions should obtain and implement this program as a part of their nursing education, for further testing its effectiveness in different situations.

Acknowledgement

The authors thank all participants, who greatly contribute to this study and the universities for supporting the survey.

Funding sources

The authors thank Nam Dinh University of Nursing (Vietnam) for the financial support to carry out this study.

Conflict of interest

The authors declare that there are no conflicts of interest.

References

1. WHO. Health care worker safety: AIDE-MEMOIRE for a strategy to protect health workers from infection with bloodborne viruses. [homepage on the Internet]. Geneva: WHO; 2015 [cited 2021 Oct 12]. Available from: http://www.who.int/injection_safety/toolbox /en/AMHCW_Safety_EN.pdf
2. Ismail S, Awan S, Naeem R, Siddiqui S, Afzal B, Jamil B, et al. Occupational exposure to HIV in a developing country: assessing knowledge and attitude of healthcare professional before and after an awareness symposium. BMC Res Notes 2018;11:131. doi: 10.1186/s13104-018-3231-y.
3. Souza-Borges FR, Ribeiro LA, Oliveira LC. Occupational exposures to body fluids and behaviors regarding their prevention and post-exposure among medical and nursing students at a Brazilian public university. Rev Inst Med Trop Sao Paulo 2014; 56:157-63. doi: 10.1590/S0036-46652014000200012.
4. Dantas F, Fábio F. Risk factors affecting occupational exposure to blood and body fluids among dental students: a cross-sectional study in a brazilian federal university. Clin Biomed Res [serial on the Internet]. 2017 [cited 2020 Dec 7]. Available from: https://seer.ufrgs.br/hcpa/article/view/68843).
5. Albaqawi HM, Alquwez N, Balay-odao E, Bajet JB, Alabdulaziz H, Alsolami F, et al. Nursing students' perceptions, knowledge, and preventive behaviors toward COVID-19: a multi-university study. Front Public Health 2020;8:573390. https://doi.org/10.3389/fpubh.2020.573390.
6. Nalunkuma R, Nkalubo J, Abila DB. Knowledge on infection prevention and control and associated factors among undergraduate health professional students at Makerere University College of Health Sciences, Uganda. PLoS One 2021;16:e0255984. doi: 10.1371/journal.pone.0255984.
7. Tawiah PA, Oppong K, Effah ES, Abaka-Yawson A, Arhin-Wiredu K. Occupational exposure to blood and body fluids among medical laboratory science students of the university of health and allied sciences during vocational internship in the Volta Region of Ghana. Sci World J 2020 1;2020:4878315. doi: 10.1155/2020/4878315.
8. Shaghaghian S, Golkari A, Pardis S, Rezayi A. Occupational exposure of shiraz dental students to patients' blood and body fluid. J Dent (Shiraz) 2015;16:206-13.
9. Becker MH. The Health Belief Model and personal health behavior. Health Educ Monogr 1974;2:324–508.
10. Khodaveisi M, Salehi Khah M, Bashirian S, Karami M, Khodaveisi M. The effect of health belief model-based training on preventive behaviors of hepatitis B in addicts. Int J High Risk Behav Addict 2018;7:e58579.
11. Huang H, Yi Q, Tang S, An R. Occupational exposure among Chinese nursing students: current status, risking factors and preventive interventions. 2016;9:16578-86.
12. Mohammed W, Taha H. The Effect of an Educational Program on Nurses' Knowledge about Hepatitis B Virus (HBV) in Ninavah Covernorate Hospitals. Mosul J of Nurs 2016;2:81-7. doi: 10.33899/mjn.2016.160041.

13. Handiyani H, Meily Kurniawidjaja L, Irawaty D, Damayanti R. The effective needle stick injury prevention strategies for nursing students in the clinical settings: a literature review. Enferm Clin 2018;26(Suppl 1):167-71.
14. Sadeghi R, Hashemi M, Khanjani N. The impact of educational intervention based on the health belief model on observing standard precautions among emergency center nurses in Sirjan, Iran. Health Educ Res 2018;33:327-35.
15. Kshirsagar R, Pande V. Effect of Training on Awareness about Pep against HIV, HBV & HCV, among dental and nursing students. Am J Sci Res 2020;8:755-62.
16. Krishna PD, Ravindra NH, Pavan JK. Effectiveness of planned teaching programme on knowledge regarding "prevention of needle stick injury" among B.Sc. nursing students in selected Colleges of Gujarat. Int J Nurs Educ 2015;7:144.
17. Singh S. A pre-experimental study to assess the effectiveness of structured teaching programme regarding knowledge of needle stick injury and its prevention among nursing students in selected nursing Institutes Faridabad, Haryana. Int J Sci Healthcare Res 2020;5:407-12.
18. Phu TV et al. Awareness and attitude of nurses to the prevention of blood and epidemic exposure in hospitals in Nam Dinh city. J Nurs 2012;6:2-13.
19. Oanh LK. Status of nurses' compliance with safe injection procedures at Bac Thang Long Hospital in 2012. Vietnam J Prac Med 2013;5:12-9.
20. Thai HM, Dung VM, La VT, Huong VT, Hang PT, Ngoc PT, et al. Knowledge and attitude of final year students of Nam Dinh University of Nursing on prevention of exposure to blood and body fluids after education interventions in 2020. Vietnam J Nurs Scie 2020;5:12-7.
21. Tomczyk S, Storr J, Kilpatrick C, Allegranzi B. Infection prevention and control (IPC) implementation in low-resource settings: a qualitative analysis. Antimicrob Resist Infect Control 2021;10:113. doi: 10.1186/s13756-021-00962-3.
22. Vietnam Ministry of Health. Guidelines for safe injections in medical examination and treatment establishments. Issued together with Decision No. 3671/QD-BYT of the Minister of Health on approving the Infection Control Guidelines [homepage on the Internet]. 2012 [cited 2021 Oct 12]. Available from: https://thuvienphapluat.vn/ van-ban/The-thao-Y-te/Quyet-dinh-3671-QD-BYT-2012-Huong-dan-kiem-soat-nhiem-khuan-205394.aspx
23. Dogra S, Mahajan R, Jad B, Mahajan B. Educational interventions to improve knowledge and skills of interns towards prevention and control of hospital-associated infections. Int J Appl Basic Med Res 2015;5(Suppl 1):S54-7. doi: 10.4103/2229-516X.162279