

Evaluating the Effectiveness of a Continuing Education Program for Prevention of Occupational Exposure to Needle Stick Injuries in Nursing Staff Based on Kirkpatrick's Model

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Abstract: *Background:* Nurses are the most vulnerable group that are faced with occupational injuries caused by exposure to needle stick injuries. This study evaluated the effectiveness of a continuing education program about the prevention of occupational exposure to needle stick injuries in the nursing staff, based on the Kirkpatrick model.

Methods: In this study, 120 nurses were selected in the experimental and control groups. A continuing education program for experimental group was performed. After the education program, its effectiveness has been evaluated across four levels (Reaction, Learning, Behavior, Results) of the Kirkpatrick model. Data analysis was conducted using Pearson's correlation coefficient, chi-square test, paired t-test, independent samples t-test, and descriptive statistics. The data were analyzed using the SPSS statistical software (V. 22).

Results: The mean score for knowledge in the experimental group improved significantly from 8.32 ± 2.17 to 13.98 ± 1.2 ($p < 0.05$). The experimental group of 24 nurses (40%) were exposed to needle stick injury before education, but this number was reduced to 9 (15%) after intervention. The chi-square test showed a significant difference ($P = 0.013$). However in the experimental group, 15 nurses (25%) were exposed to blood and body fluids before intervention, but again it was reduced to 6 (10%) after education. The chi-square test showed a significant difference ($P = 0.002$).

Conclusion: The results from the execution of continuing education program showed that through designing training programs and raising awareness in nursing personnel, we can reduce occupation exposure to needle stick injuries.

Keywords: Continuing education ■ Effectiveness ■ Occupational exposure ■ Kirkpatrick's model

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BACKGROUND

In every organization, the most important resource is the staff; ensuring the personnel's health, especially their occupational health, plays an important role in

increasing the organization's efficiency.¹ Generally, healthcare workers deal with biological hazards such as; patients' blood and body fluids.² Results from Martins et al., study showed that among healthcare workers, nurses are the most vulnerable group that are faced with occupational injuries caused by exposure to needle stick injuries.³ Foley in this regard wrote that due to lack of proper educational programs and not reporting them, needle stick injuries have turned into a serious problem for nurses which threaten their occupational health.⁴ Annually, approximately three million healthcare workers in the world are exposed to blood transferred viruses, which leads to 16,000 cases of hepatitis C, 66,000 cases of hepatitis B and 200 to 5000 cases of HIV infection.⁵ Denis & et al., stated that injuries caused by exposure to needle stick and blood and body fluids are the most common way for transmission of viral infections.⁶ The medical costs of infections caused by occupational exposure to needle stick injuries is estimated at one million dollars; these expenses include lab tests, follow-ups, costs of disability and being absence from work.^{7,8} According to reports from the National Institute for Occupational Safety and Health (NIOSH), the best way to prevent infections transmitted through occupational exposure to sharp objects is to educate workers on taking preventive measures.⁹ Staff training programs are only valuable if concrete evidence reveals their effectiveness in changing the participants' behavior and performance; this process is called evaluating the effectiveness of training.^{10,11}

Donald Kirkpatrick's model is one of the most popular models for evaluation of training effectiveness; this model evaluates effectiveness across four levels. Level 1 (Reaction) evaluates if the learners are satisfied with the program. Level 2 (Learning) measures if the program was able to increase the knowledge of learners to a favorable degree. Level 3 (Behavior) evaluates if the program could make a favorable change in the behavior of learners. Level 4 (Results) assesses if the educational program was able to solve the existing problems and meet the organizational goals.¹²

Evaluating the effectiveness of a continuing education program, based on Kirkpatrick's model leads to making a

decision for continuing the program and determining the effectiveness and improvement of program.^{13,14} Considering the importance of occupational health, and the high prevalence of occupational injuries with sharp objects, blood and body fluids among nursing staff, and the necessity to evaluate the effectiveness of education programs in the nursing profession, the present study aimed to evaluate the effectiveness of a continuing education program for prevention of occupational exposure to needle stick injury, blood and body fluids in a nursing staff based on Kirkpatrick model.

METHODS

This was a two-group before-after quasi-experimental design, which was done in mid-2016 in the Valiasr hospital associated with Fasa University of Medical Sciences, southern Iran. Selected subjects were nurses working in the ER, the internal ward, the surgical unit, the maternity ward and the infection units. The reason for this particular selection was that based on previous studies, there are higher chances of being exposed to sharp objects in these units.

With consideration of similar studies and using the formula for comparing two proportions, with the values $\alpha = 0.05$, Power = 80%, P1 = 15%, P2 = 39% and $n1 = n2 = 50$, total sample size was determined at 100 individuals.¹⁵ Due to probabilities of losing subjects, we increased sample size to 120 individuals (60 in each group). The researcher visited the Valiasr hospital with a list of its nursing staff in hand; using Systematic Random Allocation and by considering the weekly schedule, odd numbers were placed in the experimental group and even numbers occupied the control group. In this study, experimental and control groups were both involved in all hospital wards, and there were 60 nurses in each group. Inclusion criteria were willingness to participate and not having taken related educational courses in the past six months prior to their participation. Exclusion criteria were refusal to continue and being absent in the training program. To uphold ethical standards, we obtained permission from the hospital management, didn't indicate their first and last names, and ensured them about the confidentiality of information. Due to ethical issues, at the end of the research, we handed out booklets related to prevention of occupational exposure to the control group as well.

We used the following tools to evaluate the effectiveness of our education program in prevention of occupational exposure based on Kirkpatrick's model. The first level of Kirkpatrick's model (Reaction) measures satisfaction levels. For this purpose we used a questionnaire consisting of 12 questions in 3 domains; program contents (5 questions), questions about teacher (4 questions), and

questions related to facilities (3 questions). The questionnaire was distributed immediately after the training workshop, and the average score obtained from each domain was reported as the suitable number for the mentioned factors. This questionnaire was rated based on a Likert scale (Poor = 1, Average = 2, Good = 3, Very good = 4 and Excellent = 5). Content validity of the questionnaire was verified by 15 nursing professors, and its reliability was verified using Cronbach's alpha (87%). The second level (Learning) determines the amount of which the taught skills and techniques are learned.¹⁶ In this level, evaluation was done via awareness questionnaire. This questionnaire consisted of 15 multiple choice items with 4 answers. Each item was rated from zero (minimum) to one (maximum), and the sum of all questions made the total awareness score. Zero showed the minimum awareness level of subjects and 15 the maximum. Awareness levels were classified in 3 levels (Poor, Average and Good); Poor: scores 0–7, Average: scores 8–11, Good: scores 12–15. The reliability of this questionnaire was previously verified by Patterson and Askarian through Cronbach's alpha, which was 87% and 85%, respectively.^{17,18} Level 3 of Kirkpatrick's model (Behavior) evaluates the changes in behavior or performance. The performance questionnaire was used to evaluate this level; the questionnaire had 15 multiple choice questions. Method of rating and grading was the same as for the awareness questionnaire. Validity of the questionnaire was verified by 15 nursing professors, and its reliability was verified with a Cronbach's alpha of 78%. Level 4 (Results) determines the effects of the training program outcome.¹⁶ For this section, we used the questionnaire for exposure to sharp objects, blood and body fluids. Patterson evaluated the reliability of this questionnaire using the test-retest method; correlation coefficient between the scores obtained from being tested twice was 0.89 ($r = 0.89$). Askarian as well, assessed the reliability of this questionnaire with the test-retest method and arrived at the correlation coefficient of 0.87 ($r = 0.87$).^{17,18} In the project execution phase, necessary information on completing the questionnaires was given to nurses during briefings. Before execution of the continuing education program, awareness and performance levels were tested in both control and experimental groups. In order to determine the level of exposure to needle stick, blood and body fluids, the exposure questionnaire was distributed among studied subjects, and they were asked to report their incidents of exposure during the next 2 months. Then the program was executed for the experimental group, with an emphasis on standard precautions, taking appropriate measures when exposed to needle stick and how to report exposures (the control group received no intervention). Duration of

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