

Assessment Competency of Nurses in Biological Incidents

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Abstract

Background: There are two main areas within emergency care which focus on departmental and staff preparedness in biological incidents. Despite the importance, little is known about the nurse's preparedness in facing these events.

Objectives: The aim of this study was to assess the effect of two teaching methods (multimedia instructional module versus lecture presentation) on nurse's competency in biological incidents.

Materials and Methods: In this quasi-experimental study, 90 nurses were randomly divided into three groups (lecture presentation, multimedia- compact disk, and control). Data were collected by thirty-four multiple-choice questions for measuring knowledge, and a visual analogue scale graded 0 - 100 for assessing attitude. Data were analyzed using a paired t-test and one-way ANOVA with SPSS version 17.0. A P value less than 0.05 was considered as statistically significant.

Results: The results revealed no statistically significant difference in nurse's competency mean scores between the lecture and multimedia CDs groups.

Conclusions: It is recommended to use multimedia CDs for in-service education of nurses.

Keywords: Biological Agents, Competency, Nursing, Preparedness, Multimedia, Teaching

1. Background

A biological incident can be described as an overt or covert natural, accidental or deliberate release of a biological agents (1-4). Occurrence of natural or intentional infectious disease emergencies (bioterrorism) is a significant challenge for healthcare providers. Nurses play a key role in this regard. So, they should have the necessary skills to prepare and protect themselves, their patients and families from becoming infected (5). The competency of all nurses and healthcare providers should be evaluated to provide safe care, protect people, and maintain the credibility of nurses (6).

Gebbie and Merrill define competency as a "combination of knowledge, attitude, and skills demonstrated by the healthcare personnel" (7). Competencies are actions which are visible in the implementation of a task. On the other hand, competencies are applied skills and knowledge that enable people to perform work. The traditional approach to education and training is to determine what contents should be learned and taught, and then assess if the content has been learned. A research in education supports the transition to competency-based training, which is alignment of training with the outcomes and assessment of personnel performance in

relation to specific work conditions (8). The initial set of emergency preparedness competency was developed by the Columbia university school of nursing in 2002. These competencies were subsequently approved and adopted by CDC (center for disease control and prevention) (9). Health resources and services administration assists awardees in shifting from content-focused training toward competency-based training. For example, hospital staff would be expected to be able to describe and demonstrate their roles in emergency response instead of acquiring content knowledge about smallpox or anthrax (10). Nurse's educational competency for mass casualty incidents (MCIs) was developed by the International nursing collation for mass casualty education (INCMCE) (11). Competency can be achieved not only via formal training, but also through experience, performance support systems, and service trainings. In formal training programs, acquiring competency may have require that classroom experience be complemented by opportunities for practice (12). The studies carried out in this regard show that there is insufficient evidence about the effectiveness of training interventions for emergency preparedness (13). Based on the world

health organization (WHO) reports , pandemic swine influenza and the future risk of inducing surge of pandemic avian flu (WHO, 2005) (2-4). Also, the chance of influenza transmission increases in epidemics. Because of concerns about the ongoing pandemic influenza A (H1N1), and the potential for transmission in crowded settings such as the Hajj, and Umra (14). In Iran, a country with a lot of refugees, frequent visits to crowded cities and holy places of pilgrimage increase the risks. So, it is necessary to increase the surge capacity as well as competence and preparedness of healthcare personnel. Nurses are in a key position of the healthcare system and are first points of medical contact (15). Miller and Jackson examined the effectiveness of a multimedia instructional module versus a traditional lecture method in the education of pharmaceutical students and their survey results showed that the two methods of teaching had similar effect (16). Some researchers like Jenkins et al. (17) and Gallagher et al. (18) found that an electronically-based teaching method was more efficient than traditional-lecture based. Gallagher et al. (18) compared two delivery web-based formats with traditional classroom instruction in gerontology for gerontological courses in dental hygiene curricula.

2. Objectives

The aim of this study was to evaluate the effects of two teaching methods on nurse's competency in biological incidents and to identify an efficient and cost-effective method for nurse education within a short time frame.

3. Materials and Methods

In a quasi-experimental study, the effect of education on nurse's competency in biological incidents was assessed (biological incidents knowledge and attitude). At first, a biological incidents curriculum was planned using the 3-round-Delphi method (Figure 1). In a descriptive survey, curriculum development we are used via 3-rounds of Delphi's method by e-mail, fax and post and face to face follow-up, with expert group collaboration. Two open-ended questions were used in the first round and a semi-structured framework was created based-on the previous round results. Then, preparedness domains, topics and hours necessary for each topic were identified. The results showed that there were three main domains for preparing nurses against biological incidents including overviews, treatment and caring; then safety and prophylaxis and finally required preparedness management. The experts' consensus achievements were 35 course topics in the three main domains determining 34 hours equal to 2-code courses (19). The training objectives (cognitive and affective domains) were taken into account via Bloom's taxonomy. A part of the designed curriculum was used to provide training content for two methods of teaching (lecture and multimedia-CD) with a pretest/posttest program.

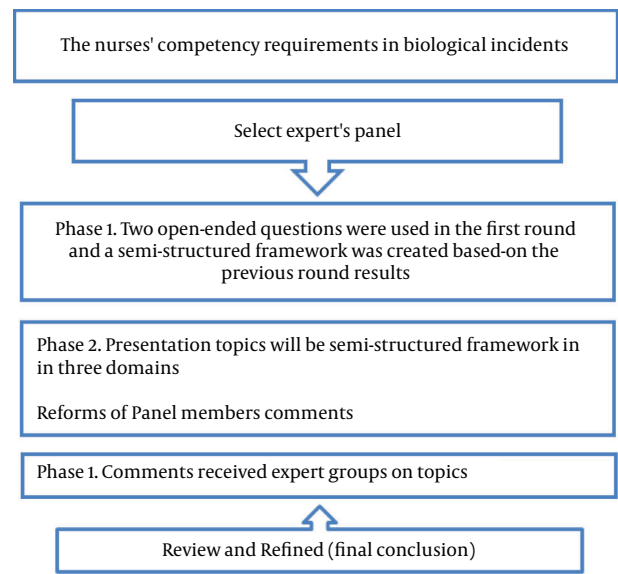


Figure 1. Delphi's Method for Curriculum Development

3.1. Participants

This study was conducted on 90 nurses. The inclusion criteria were at least one year of work experience, no education concerning biological incidents, having computer skills and ability to use a personal computer and multimedia CD. The subjects were randomly divided into three groups of 30 (lecture presentation, multimedia-CD, and control). Two groups (multimedia-CD, and control) were in different wards.

3.2. Ethical Considerations

This study was approved by the human research and ethics committee of our university and the ethics committee. A written informed consent was obtained from all participants.

3.3. Interventions

The training content was the same for the two groups. It was reviewed by a panel of experts. It had four parts and it addressed competencies in two domains (knowledge and attitude). The content included four parts. Part one over-viewed biological agents; parts two and three contained two examples of biological agents group, medical interventions, care, infection control and frequently asked questions and part four was divided into three sections about immunity against incidents induced by biological agents and personal protective equipment (PPE) use.

1- The lecture presentation group: A manuscript was provided. The content was based on the research literature review and experts' viewpoints.

2- The multimedia CD group: A learning package (CD) was provided by multimedia experts.

3.4. Data Collection Tools for the Evaluation of Teaching Methods, Validity and Reliability

Data were collected using thirty-four multiple-choice questions for measuring knowledge and visual analogue scale (VAS) graded (0 - 100) for assessing attitude. The multiple-choice questions were validated by content validity and expertise-oriented approach and the VAS scale.

3.5. Procedure

At first, a pretest was administered for the three groups, and then the task went on as follows:

Interventions for the two groups:

1- Lecture presentation (a four-hour lecture, using slides, PPEs, manuscript questions and replies). The principles of the advance-organizer pattern were used for the lecture group.

2- Multimedia CDs including sound, picture, text, slides, films and questions.

3- Control group with no intervention

A posttest was administered for the three groups two weeks after the lecture class and distributing the learning package (CD) to the participants.

3.6. Data Analysis

Data were analyzed using SPSS Inc version 17 (SPSS, Inc. Chicago, Illinois, USA). A paired-sample t-test was used to compare the mean scores of knowledge and attitude competency pre and post-interventions, and one-way ANOVA and Tukey post-hoc test were also used to compare mean scores in the three groups. In this survey, the

competency mean score was the average of the knowledge mean score plus attitude mean score.

4. Results

60.5 % of the subjects were females and 39.5% were males with a clinical experience of one to 28 years. The comparison of awareness between the three groups at baseline (cognitive domain) with one-way ANOVA indicated no significant difference in prior knowledge pre-interventions ($P > 0.05$); however, a significant difference was found in prior knowledge among the three groups in post-interventions ($P < 0.001$). The level of awareness mean score was raised significantly in the two test groups; however, it was decreased in the control group (Table 1).

The one-way ANOVA results showed that there was no significant difference among the three groups in the attitude mean scores (affective domain) in the pretest ($P > 0.05$), but indicated a significant difference in the attitude mean score in the posttest ($P < 0.001$). Moreover, the results of the post-hoc Tukey test showed a significant difference in the attitude mean score between the control group and the two test groups ($P < 0.05$, Table 2).

The comparison of competency in the three groups' pre and posttests no significant difference in preintervention ($P > 0.05$); however, a significant difference was found in competency between the three groups after interventions ($P < 0.001$). Also, the post-hoc Tukey test showed that there was a significant difference in competency between the control group and the two test groups ($P < 0.05$, Table 3).

Table 1. Comparing the Mean Scores of Nurse's Knowledge

Group	Results ^a		
	Preintervention	Postintervention	Paired t-test
Multimedia	16.1 ± 4.1	24.3 ± 5.1	$P < 0.001^b$
Lecture	14.2 ± 3.3	22.6 ± 4.4	$P < 0.01^b$
Control	15.6 ± 2.5	13.9 ± 3.2	$P > 0.05$
One-way ANOVA	$P > 0.05$	$P < 0.001^b$	

^aData are presented as mean ± SD.

^bStatistically significant.

Table 2. Comparing Nurse's Attitude Mean Scores

Group	Results ^a		
	Preintervention	Postintervention	Paired t-test
Multimedia	69.9 ± 16.28	81.59 ± 15.21	$P < 0.001^b$
Lecture	63.64 ± 20.45	80.46 ± 13.68	$P < 0.01^b$
Control	58.56 ± 20.88	54.40 ± 20.24	$P > 0.05$
One-way ANOVA	$P > 0.05$	$P < 0.001^b$	

^aData are presented as mean ± SD.

^bStatistically significant.

Table 3. Comparing the Mean Scores of Nurses' Competency

Group	Results ^a		
	Preintervention	Postintervention	Paired T-test
Multimedia	54.24 ± 8	74.05 ± 10.31	P < 0.001 ^b
Lecture	52.0 ± 10.39	71.30 ± 9.43	P < 0.001 ^b
Control	48.14 ± 12.13	47.92 ± 11.5	P > 0.05
One-way ANOVA	P > 0.05	P < 0.001 ^b	

^aData are presented as mean ± SD.^bStatistically significant.

5. Discussion

Both methods of teaching resulted in positive shifts in knowledge and attitude. The results showed that the two employed methods of teaching were effective in preparedness (cognitive and affective domains) as well as in competency, i.e., the scores of both groups improved after the interventions. The two interventions had similar effects. Aly et al. (20) and Jeffries et al. (21) also reported the same findings. Aly et al. compared instructional multimedia program versus lecture for teaching the undergraduate orthodontic curriculum (20). Jeffries et al. also compared the efficacy of an interactive multimedia CD-ROM with usual methods of education on the skill of performing a 12-lead ECG Electrocardiogram in baccalaureate nursing students in a required senior-level critical-care course at a large Midwestern university in the United States. There were no significant difference in pretest scores between the two groups and no significant differences by group in two cognitive gains, student satisfaction with their learning method, or perception of self-efficacy in performing the skill. General results revealed that both groups were satisfied with their educational method and were the same in their ability to display skills in live properly, simulated patient. This evaluation study is an initial step to assess recent and potentially more cost-effective education methods and their effects on student learning consequences and behaviors, including the transfer of skill acquisition via a computer simulation to a real patient (21). Miller and Jackson examined the effectiveness of a multimedia instructional module versus a traditional lecture in the education of pharmaceutical students (16). There are some other surveys in which an electronic teaching method compared with a traditional lecture method. Gordon et al compared simulator-based teaching with traditional instruction method among clinical medical students (22). Howerton et al. compared computer-assisted instruction (CAI) with lecture method, using recent hardware and advanced software techniques in university of north Carolina (UNC) for dental students passing introductory radiology course (23). Also, Hal-loran assessed the differences in the success between a

control group taught by Traditional Classroom Lecture (TCL) and an experimental group using computer-managed (CMI) and keypad questions in nursing education (24). Moreover, Cropley compared the use of Traditional Lecture Method (TLM) and CAI in teaching congenital heart disease (CHD) to associate degree nursing (AND) students. The finding of the study showed that both TLM and CAI are same effective when teach students about CHD. This study have the same results that found in the 1999 study (25). Finally, Jenkins et al. compared CAI versus TLM for medical students in the teaching of dermatological morphology. However, some researchers found that electronically-based teaching method was more efficient than traditional-lecture based (17). Gallagher et al. compared two delivery web-based formats with traditional classroom instruction in gerontology for gerontological courses in dental hygiene curricula (18). Abutarbush et al. evaluated traditional instruction versus a self-learning-computer module in teaching veterinary students that how to insert nasogastric tube in horses (26). In a study by Terndrup et al. (15) screensavers were developed and tested in an emergency ward for rotating senior medical students and medical interns. Screensavers were designed as "billboards" to attract the subjects' attention towards the educational domain. Five rotating images sequenced at five second intervals incorporated a teaser question in an interactive toolbar. The interactive toolbar was linked to a website that provided content on smallpox and anthrax for hospital-based specialties. The results showed that screensavers and website combination deployed on computers significantly increased the percentage of correct responses to five standardized bioterrorism questions in the emergency department. Screensavers and websites can be used to increase awareness of bioterrorism (15). In other studies, Song et al. (27), and Terndrup et al. (15) also compared the efficacy of web-based diabetes self-management education for recently diagnosed patients with type II diabetes as an alternative to the lecture-method group. The results revealed the superiority of the web-based program over lecture-method for diabetes self-

management education (15, 27). As to the global appeal to distance learning effects, there was a project sponsored by the agency for healthcare research and quality (AHRQ) to develop a competency-based education approach called “noncontinuous education” as a method for educational hospital staff, the skills demanded to respond to bioterrorism or other broadly general health incidents. Competency-based education increases the relationship between training and workforce applicability. The concepts of non-continuous education have borrowed from the U.S. navy’s afloat training practice and management system. A Naval ship is similar to a hospital in disaster emergency training in that you just could not stop a ship through a training day and then let it go again; similarly, hospitals cannot stop their normal functions to take part in an operation (10).

In conclusion, multimedia CD and traditional lecture were effective methods on nurses’ teaching curricula that increase their knowledge and create positive shift in their attitude. The two methods had equal effects on improving competency and preparedness.

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Footnotes

Authors’ Contribution: Abbas Ebadi, and Shahla Yousefi: Study design, searching, data gathering and writing the manuscript; Morteza Khaghanizadeh, and Yaser Saeid: Study design, data gathering and writing the manuscript.

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References

- Brown N, Crawford I, Carley S, Mackway-Jones K. A Delphi-based consensus study into planning for biological incidents. *J Public Health*. 2006;**28**(3):238–41.
- Fox DJ. *Fundamentals of Research in Nursing* Appleton-Century-Crofts. New York: Appleton-Century-Crofts.; 1982.
- de Boer MR, Moll AC, de Vet HC, Terwee CB, Volker-Dieben HJ, van Rens GH. Psychometric properties of vision-related quality of life questionnaires: a systematic review. *Ophthalmic Physiol Opt*. 2004;**24**(4):257–73. doi: 10.1111/j.1475-1313.2004.00187.x. [PubMed: 15228503]
- Grealy B, Chaboyer W. Essential nursing care of the critically ill patient. *ACCCN’s Crit Care Nurs*. 2011;105.
- Rebmann T. Defining bioterrorism preparedness for nurses: concept analysis. *J Adv Nurs*. 2006;**54**(5):623–32. doi: 10.1111/j.1365-2648.2006.03866.x. [PubMed: 16722960]
- Axley L, editor. Competency: a concept analysis.; *Nurs Forum*.; 2008; Wiley Online Library; pp. 214–22.
- Gebbie K, Merrill J. Public health worker competencies for emergency response. *J Public Health Manag Pract*. 2002;**8**(3):73–81. [PubMed: 15156628]
- Gebbie K, Standish Gill E. *Core-Competency To Curriculum Toolkit 2004*. Centers for Disease Control and prevention(CDC) and the Association of Teachers of Preventive Medicine(ATPM); 2004.
- Hites LS, Lafreniere AV, Wingate MS, Anderson AC, Ginter PM, Santacaterina L, et al. Expanding the public health emergency preparedness competency set to meet specialized local and evolving national needs: a needs assessment and training approach. *J Public Health Manag Pract*. 2007;**13**(5):497–505. doi: 10.1097/01.PHH.0000285203.56211.64. [PubMed: 17762695]
- Cioffi J, Spear T, Allswede M., Weiner B. *Surge Capacity :Education and Training for Qualified Workforce*. AHRQ Pub; 2004. Available from: <http://archive.ahrq.gov/news/ulp/btbriefs/btbrief7.pdf>.
- Polivka BJ, Stanley SA, Gordon D, Taulbee K, Kieffer G, McCorkle S. Public health nursing competencies for public health surge events. *Public Health Nurs*. 2008;**25**(2):159–65. [PubMed: 18294184]
- Gebbie K, Standish Gill E. *Competency To Curriculum Toolkit Centers for Disease Control and prevention(CDC) and the Association for Prevention Teaching and Research (APTR)*. 2008. Available from: http://www.phf.org/resourcestools/Documents/Competency_to_Curriculum_Toolkit08.pdf.
- Williams J, Nocera M, Casteel C. The effectiveness of disaster training for health care workers: a systematic review. *Ann Emerg Med*. 2008;**52**(3):211–22. doi: 10.1016/j.annemergmed.2007.09.030. [PubMed: 18069087]
- Kandeel A, Deming M, Kereem EA, El-Refay S, Afifi S, Abukela M, et al. Pandemic (H1N1) 2009 and Hajj pilgrims who received pre-departure vaccination, Egypt. *Emerg Infect Dis*. 2011;**17**(7):1266. doi: 10.3201/eid1707.101484.
- Terndrup T, Nafziger S, Weissman N, Casebeer L, Pryor E. Online bioterrorism continuing medical education: development and preliminary testing. *Acad Emerg Med*. 2005;**12**(1):45–50. doi: 10.1197/j.aem.2004.08.040. [PubMed: 15635137]
- Miller SW, Jackson RA. A comparison of a multi-media instructional module with a traditional lecture format for geriatric pharmacy training. *Am J Pharm Educ*. 1985;**49**(2):173–6. [PubMed: 10315675]
- Jenkins S, Goel R, Morrell DS. Computer-assisted instruction versus traditional lecture for medical student teaching of dermatology morphology: a randomized control trial. *J Am Acad Dermatol*. 2008;**59**(2):255–9. doi: 10.1016/j.jaad.2008.04.026. [PubMed: 18499299]
- Gallagher JE, Dobrosielski-Vergona KA, Wingard RG, Williams TM. Web-based vs. traditional classroom instruction in gerontology: a pilot study. *J Dent Hyg*. 2005;**79**(3):7. [PubMed: 16197772]
- Yoosefi S, Ebadi A, Hosseini SMJ, Khaghanizadeh M, Izadi M, Ahmadi K, et al. Curriculum development for nurses’ preparedness face to biological incidents by Delphi method. *J Mil Med*. 2009;**11**(1):19–23.
- Aly M, Elen J, Willems G. Instructional multimedia program versus standard lecture: a comparison of two methods for teaching the undergraduate orthodontic curriculum. *Eur J Dent Educ*. 2004;**8**(1):43–6. [PubMed: 14717690]
- Jeffries PR, Woolf S, Linde B. Technology-based vs. traditional instruction. A comparison of two methods for teaching the skill of performing a 12-lead ECG. *Nurs Educ Perspect*. 2003;**24**(2):70–4. [PubMed: 12743975]
- Gordon JA, Shaffer DW, Raemer DB, Pawlowski J, Hurford WE, Cooper JB. A randomized controlled trial of simulation-based teaching versus traditional instruction in medicine: a pilot study among clinical medical students. *Adv Health Sci Educ Theory Pract*. 2006;**11**(1):33–9. doi: 10.1007/s10459-004-7346-7. [PubMed: 16583282]
- Howerton WJ, Enrique PR, Ludlow JB, Tyndall DA. Interactive computer-assisted instruction vs. lecture format in dental education. *J Dent Hyg*. 2004;**78**(4):10. [PubMed: 16197750]
- Halloran L. A comparison of two methods of teaching. Computer managed instruction and keypad questions versus traditional classroom lecture. *Comput Nurs*. 1995;**13**(6):285–8. [PubMed: 8529142]

25. Cropley A, Gross P. The Effectiveness of Computer-Assisted Instruction. *Alberta J Educ Res.* 1970;**16**(4):203-10.
26. Abutarbush SM, Naylor JM, Parchoma G, D'Eon M, Petrie L, Caruthers T. Evaluation of traditional instruction versus a self-learning computer module in teaching veterinary students how to pass a nasogastric tube in the horse. *J Vet Med Educ.* 2006;**33**(3):447-54. [PubMed:17035223]
27. Song M, Choe M, Kim KS, Yi MS, Lee I, Kim J, et al. An evaluation of Web - based education as an alternative to group lectures for diabetes self - management. *Nurs Health Sci.* 2009;**11**(3):277-84. [PubMed:19689636]