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DOI: 10.4103/jehp.jehp_132_18

# Concept mapping as a tool to improve medical student's learning about rabies surveillance

Narjes Sargolzaie<sup>1,2</sup>, Samaneh Sargazi<sup>3</sup>, Ghazaleh Lotfi<sup>4</sup>

## Abstract:

**CONTEXT:** Rabies is a viral zoonotic infection of the central nervous system. Annually more than 59,000 people die of rabies worldwide; human rabies can be prevented by using proper postexposure prophylaxis. A major component of successful rabies surveillance is well-educated medical professional.

**AIMS:** The aim of this study is evaluate the effect of concept mapping as an active teaching method on medical students' knowledge about rabies prophylaxis.

**SUBJECTS AND METHODS:** It was a pre- and post interventional study carried out on 80 medical interns. Our intervention included Group 1 – trained by concept maps – and Group 2: – trained by book reading. Data gathering tool was the researcher-made questionnaire that consisted of seven open-ended questions that assessed the interns' knowledge about animal bite surveillance.

**STATISTICAL ANALYSIS USED:** Students' scores of pre- and posttests have been analyzed with paired *t*-test and independent *t*-test.

**RESULTS:** Comparing the pre- and posttest scores of students in two groups by paired *t*-test showed that interventions have been effective in both the groups; posttest scores of both groups had increased significantly ( $P < 0.001$ ). Score mean difference in concept map group was significantly higher than book reading group based on independent *t*-test ( $P = 0.001$ ).

**CONCLUSIONS:** It seems that concept mapping as a visual training tool for transferring the concepts to medical students is more appropriate than the other traditional ones like book reading, but more research is needed to be sure that active methods are better than traditional ones.

## Keywords:

Active teaching, concept map, medical student, rabies

## Introduction

Rabies is a viral zoonotic infection of the central nervous system caused by a *Lyssavirus*. It is seriously fatal without proper postexposure prophylaxis (PEP) and causes high economic costs in different countries all over the world every year.<sup>[1,2]</sup> Annually more than 59,000 people die of rabies worldwide, which represents 160 deaths per day,<sup>[3]</sup> and dogs are responsible for 99% of rabies deaths worldwide.<sup>[4]</sup>

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Until 2003, averagely, 8.4 deaths caused by rabies occurred among human beings in Iran every year and about 130,000 people annually receive PEP.<sup>[2]</sup> Human rabies can be prevented by using proper PEP according to the WHO report.<sup>[5]</sup> A major component of a successful rabies surveillance is the formation of a well-educated medical professional with regard to rabies risks and control of this disease.<sup>[6]</sup> However, a lack of knowledge about the classification of animal bite wounds leading to improper care can be seen in different parts of the world.<sup>[5,7]</sup> According to several studies around the world, medical professional did not have

**How to cite this article:** Sargolzaie N, Sargazi S, Lotfi G. Concept mapping as a tool to improve medical student's learning about rabies surveillance. *J Edu Health Promot* 2019;8:132.

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<sup>1</sup>Infectious Disease and Tropical Medicine Research Centre, Medical School, Zahedan University of Medical Sciences,  
<sup>2</sup>Clinical Immunology Research Centre, Medical School, Zahedan University of Medical Sciences, Zahedan, Iran,  
<sup>3</sup>Department of Medical Education, Isfahan University of Medical Education, Isfahan, Iran,  
<sup>4</sup>Medical School, Zahedan University of Medical Sciences, Zahedan, Iran

## Address for correspondence:

Dr. Samaneh Sargazi,  
Department of Medical Education, Isfahan University of Medical Education, Isfahan, Iran.  
E-mail: [s.sargazi2010@gmail.com](mailto:s.sargazi2010@gmail.com)

Received: 03-06-2018

Accepted: 29-03-2019

enough knowledge for managing a wound based on PEP.<sup>[5,8,9]</sup> For the best teaching outcome, an educator has to use different teaching methods which make learners active. Active learners can learn deeply, their knowledge would last much more, and learning outcomes would be improved.<sup>[10]</sup> There are different types of active teaching methods such as group discussion, brain storming, problem-solving, portfolio, role play, snowball groups, and concept map.<sup>[11,12]</sup> Concept mapping has been developed based on meaningful learning theory of David Ausubel which mentioned that meaningful learning occurs by hierarchically locating concepts, differentiation of concepts in the cognitive structure, and connection between different concepts.<sup>[13]</sup> Concept maps can be used in different fields such as education, assessment, communication, staff development, and critical thinking. In the field of education, it has been used teaching or learning of new concepts in undergraduate education, for reviewing previous knowledge, and for assessment of education.<sup>[13,14]</sup> We tried to evaluate the effect of concept map as an educational tool on medical students' learning about rabies prophylaxis and compared this method with routine book reading.

## Subjects and Methods

It is a pre- and postinterventional study carried out on medical interns. The sample size was estimated to be 22 for each group, by considering mean score and standard deviation in case and control groups as  $78.2 \pm 5.5$  and  $72.5 \pm 7.8$ , respectively, with  $\alpha = 0.05$  and  $\beta = 20\%$ .

According to the following formula:

$$\frac{\left[ \left( z_1 - \frac{\alpha}{2} + z_1 - \beta \right)^2 \left( (s_1)^2 + (s_2)^2 \right) \right]}{(\bar{x}_1 - \bar{x}_2)^2}$$

Finally, 40 students were given to each two groups. The intervention was done on interns entering community medicine wards since the beginning of 2017 and was available for the study.

Our intervention included Group 1 – trained by concept maps – and Group 2: – trained by book reading. The content reference for both the trainings included the national guideline for animal bite surveillance that was published by the Iranian Ministry of Health and Medical Education. The same teacher who was not a contributor to this study taught all the students in a similar way using lecture. After teaching, principles of making concept map were given to case groups and they drew a concept map and finally the concept map which was designed by researchers was given to them for studying, but control groups used book reading method.

The duration of community medicine internship course was 1 month. Students were alternatively allocated to each case–control groups until completing sample size. Details and the aim of the study were explained to the students in the beginning of the research, but they were not informed of their training method difference with the second group; therefore, we tried to keep them blinded to the training method.

Data gathering tool was the researcher-made questionnaire that consisted of seven open-ended questions that assessed the interns' knowledge about animal bite surveillance. Community medicine specialists verified the construct validity of this questionnaire. To determine the reliability of this questionnaire, a test–retest pilot study was carried out on 30 internship course medical students. Data were interpreted by SPSS version 20 software (SPSS Inc., Chicago, IL, USA). Correlation coefficient of test–retest was estimated to be 0.78 and its internal consistency was 72 by calculating Cronbach's alpha. Hints that had to be mentioned for each open-ended question were defined, and a specific score was considered for each hint. Finally, the total score of the questionnaire was determined as 25.

Designed questionnaire in the beginning of community medicine course was given to students as a pretest, then the concept mapping instruction based on PEP or book of animal bite surveillance was given to them, and at the end of the course, the questionnaire was presented to them again. Students' scores of pre- and posttest were finally entered to SPSS version 20. We used mean and standard deviation to describe the results and used paired *t*-test and independent *t*-test for analysis with a significance level of 0.05.

## Results

The current study was carried out on 80 intern medical students who were 39 (48.8%) males and 41 (51.3%) females. Gender distribution of the two groups did not have a significant statistical difference ( $P = 0.502$ ).

As it is shown in Table 1, according to independent *t*-test, there was no significant statistical difference among mean of age, total average score, and pretest score in the two groups.

Comparing the pre- and posttest scores of students in two groups by paired *t*-test showed that interventions have been effective in both the groups; posttest scores of both groups had increased significantly ( $P < 0.001$ ) [Table 2].

The comparison of mean of scores difference after intervention between two groups using independent *t*-test showed that the score mean difference in the

**Table 1: Baseline data in two groups (concept map and book reading)**

variables	Group	n	Mean±SD	P
Age	Concept map	40	25.8±1.09	0.632
	Reading book	40	25.6±1.22	
Average score of the whole medical course	Concept map	40	15.79±0.77	0.913
	Reading book	40	15.81±0.82	
Pretest score	Concept map	40	9.12±2.96	0.312
	Reading book	40	8.50±2.51	

SD=Standard deviation

**Table 2: Comparing the mean of scores difference after intervention in two groups (concept map and book reading)**

Group	Pretest mean score±SD	Posttest mean score±SD	P*	Mean difference±SD
Concept map	9.12±2.96	20.57±3.76	<0.001	11.45±4.06
Reading book	8.50±2.51	17.32±3.39		8.82±4.25
P				<0.001**

\*Based on paired t-test, \*\*Based on independent t-test. SD=Standard deviation

concept map group was significantly higher than that in the book reading group ( $P = 0.001$ ).

## Discussion

To transfer some concepts that are of great clinical importance such as disease surveillance, effective and active training methods are needed.<sup>[15]</sup> Learning in a meaningful way means that medical students actively seek out ways to link new information and experience with what they already know, and concept mapping is one strategy to promote meaningful learning which is based on the work of David Ausubel (1963, 2000) and has been used in education for over 30 years.<sup>[16]</sup> Mapping helps medical students to organize and integrate information, assess existing knowledge, and relate basic sciences concepts to clinical presentation of the patient.<sup>[17]</sup>

This study showed that concept maps can be more useful than the book reading method for increasing students' knowledge; the mean of knowledge score difference about animal bite surveillance was higher in the concept map group than in the book reading group.

Concept mapping is a technique and tool for visualizing the relationships between different concepts and facts. It was developed during 1970s by Novak and his team at Cornell University.<sup>[15]</sup>

“Visual argument” theory states that the human mind can analyze patterns and images in CMs faster and deeper than to interpret an essay word-based structure.<sup>[18,19]</sup>

Bhusnurmath used concept map as a tool to teach pathology to students and concluded that concept map

is a great tool for teaching;<sup>[15]</sup> also, Kaddoura in his research which was about teaching critical thinking to a nursing student by the use of concept map achieved a similar result.<sup>[20]</sup>

Saeidifard *et al.* in 2014 in the cross-sectional study compared the diabetic ketoacidosis teaching via two methods: lecture and concept mapping on 75 senior medical students. They showed that concept mapping was the preferred method which has been more effective.<sup>[13]</sup>

Rendas *et al.* studied the effect of concept mapping as a teaching strategy in medical physiopathology period in Lisbon University from 2003 to 2004. They designed 36 concept maps related to short cases for the students. Concept mapping in their study could have acceptable results and could increase reasoning skills and could stimulate meaningful learning within a problem-based learning course.<sup>[17]</sup>

D'Antoni *et al.* carried out a study in 2010 on 131 freshmen medical students. They compared the effect of concept mapping with standard note-taking method on abstract thinking and reminding. There was no significant difference between pre- and posttraining tests, and its results also showed that concept mapping did not increase reminding and abstract thinking; moreover, because their comparison method was different from our study, it might not be comparable to our study.<sup>[21]</sup> Researchers could not find any article which shows that concept mapping had less impact in comparison with book reading.

Having considered various studies it seems that most of them have concluded that concept mapping method is superior to many other teaching methods in transferring the concepts.

## Conclusions

It seems that concept mapping as a visual training tool for transferring the concepts to medical students is more appropriate than the other traditional ones like book reading, but more research is needed to be sure that active methods are better than traditional ones. It should be considered that students liked the concept map and they said that it is one of the best learning experiences during their school days.

## Acknowledgment

The authors would like to acknowledge the community medicine specialists and medical interns who participated in this project.

## Financial support and sponsorship

This work was supported by Zahedan University of Medical Sciences.

## Conflicts of interest

There are no conflicts of interest.

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