Comparison of the effect of interactive versus non-interactive virtual education on general physicians knowledge and attitude toward oral health in diabetic patients and evaluation of their satisfaction

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ABSTRACT

Introduction: Due to the high prevalence of diabetes in communities and the various oral health complications of this disease, a need for training the physicians treating diabetic patients is felt. This study aimed to compare the effect of interactive versus non-interactive virtual education on the knowledge and attitudes of physicians about oral health in diabetic patients and to assess their satisfaction from the programs.

Materials and Methods: The educational intervention was implemented through the online continuous medical education (CME) site of Tehran University of Medical Sciences. Physicians applying to participate in the CME entered in one of the interactive or the non-interactive groups. After the training, the study questionnaires to assess knowledge (7 questions), attitude (8 questions), and backgrounds (6 questions), and physicians' satisfaction (12 questions) with the training in this project, was provided to them through the same site. The analyzes were performed by linear regression test in SPSS version 26.

Results: Totally 57 physicians, 27 in the interactive and 30 people in the non-interactive group participated. The score of knowledge and attitude were not different between the two groups after the intervention. Physicians' satisfaction with interactive education was significantly higher. Physicians' age showed a significant direct association (p<0.100) and the percentage of diabetic patients examined by learners showed a significant negative association (p=0.024) with their knowledge score.

Conclusion: Since physicians' satisfaction with interactive education has been significantly higher, it is suggested that this method be used in online CMEs.

Keywords: Virtual learning; Interactive education; Continuous medical education; Knowledge; Attitude; Satisfaction.

Introduction

Today, diabetes is so prevalent that it is defined as a new epidemic. According to the latest statistics released by the World Health Organization, the number of people with diabetes in Iran is about 8 million [1]. Diabetes is the most common chronic and non-communicable disease in the world. Many studies and evidence show a link between diabetes and oral and dental disease so that periodontal disease is recently considered as the

sixth major complaint of diabetic patients. The first five major complaints of diabetic patients are neuropathy, nephropathy, retinopathy, cardiovascular problems, and delayed wound healing [2]. In addition, many studies show that controlling blood glucose improves periodontal symptoms, and also the treatment of periodontal disease has a great effect on controlling blood glucose in diabetics [3]. Given that many patients with diabetes rarely visit the dentist, it can be concluded that the oral health of these patients is not one of their treatment priorities, which reflects the low awareness of patients about the effects of the disease on their oral health [4]. Achieving oral health is one of the therapeutic goals in diabetic patients, and the realization of this depends in part on raising public awareness and attitude.

Among the people who play an important role in this field are doctors, whose knowledge and attitude can have a direct impact on the society under their care. Unfortunately, diabetics and physicians are less aware of the oral manifestations of diabetes [5]. This shows the importance of educating physicians about the oral manifestations of diabetes for faster diagnosis and referral of patients to dentists. Given the emerging trends in the world and Iran and the costly and time-consuming medical education, adopting an innovative approach to planning an educational strategy is essential [6]. Since the complex learning process should not be limited to the classroom space, so using virtual education, which is an emerging method, can overcome some of the barriers of traditional education and provide easy and flexible access to learning [7]. But what is important for the effectiveness of virtual education is that educational methods should be used that on the one hand can cover the limitations of not attending the class and direct contact with the teacher and on the other hand to satisfy learners of the course [8]. In the classification of this study, educational media can be divided into two categories. "Interactive or two-way media" and "Non-interactive or one-way media". Non-interactive media are media in which teachers convey information to the audience in a one-way way. Interactive or two-way media are media that create a two-way educational situation between the learner and the teacher. These media are programmed to demand learners' responses and can often even evaluate their responses and give feedback to learners [9]. Interactive learning can affect the effectiveness of ر as well as the motivation of learners to learn more or their satisfaction with the learning process [8]. Therefore, it is worthwhile to pay more attention to the issue of cre-

ating interaction in virtual education environments as a necessity and need. However, studies that have compared the types of virtual education methods with the dimensions of creating and interacting in learning are very limited and most studies have compared different methods of virtual education with traditional learning methods. In this article, we aim to compare the effect of interactive and non-interactive virtual education on physicians' knowledge and attitudes regarding oral health in diabetic patients and the extent of their satisfaction with these two methods [10].

Material and Methods

General description of the study and sampling

The present study is interventional in terms of method and applied in terms of purpose. The research population consisted of physicians applying to participate in online continuous medical education (CME) in the period from March 3 to September 6, 2019. According to the results of a previous study [11], Using the two sample T. test power analysis soft Pass 11 software considering $\alpha=0.05$ and $\beta=0.2$ and standard deviation equal to 14% and 11% to find a 5% difference in training score, the minimum sample size required for each of the 2 groups is about 25 people. Inclusion criteria were having a doctorate in general medicine or a specialized doctorate in medicine and answering the final questions and exclusion criteria included participation in the same study but in the opposite group. The samples were entered by convenience sampling method. How to access the educational content that was in the continuing education system of Tehran University of Medical Sciences, at http://cme.tums.ac.ir as an information message was explained to the participants. Physicians applying to participate in retraining entered in the interactive training group until June 16th, and physicians applying to participate in retraining after June 16 were in the non-interactive training group.

Interactive and non-interactive interventions

The contents of each of these two types of training had received a retraining license from the Ministry and will be available on the site (cme.tums.ac.ir) until February 22, 2022. The contents of these two intervention methods included the initial description of diabetes and its oral symptoms and manifestations, the diagnosis of healthy gums from the inflamed gums and the introduction of tooth decay, the introduction of symptoms of dry mouth, and strategies to prevent and eliminate it, tasks to prevent oral diseases in diabetic patients, study and express the relationship between oral diseas-

es and diabetes, training on how to brush and floss, which was prepared from the relevant sections of Harrison's book of internal medicine [12] and Karanza's periodontology [13]. In the non-interactive group, the above content, in the form of multimedia resembling an audio e-book was placed on the continuing education site of Tehran University of Medical Sciences.

In the interactive group, the contents were designed as text with numerous interactive questions and related scenarios, so that according to the educational content, the learner was first asked a question and then, if the answer was correct or incorrect, feedback was given to the learner and finally, the text file containing the desired educational content was displayed. In this way, while training and studying the content, the interaction was established between the educational content and the participants, and learners were introduced to some common examples of oral complaints and gained applicable knowledge by receiving constructive feedback.

Questionnaires of the study

In both groups, physicians answered the questions of the study questionnaire, In addition, they completed a course satisfaction questionnaire after the educational intervention. The training course was held online in both groups and the samples could access the educational content 24 hours a day. The data collection tool in this study was based on a previous valid questionnaire of the study "Knowledge, attitude and practice of internal medicine specialists about periodontal disease and diabetes mellitus" [14]. with minor changes and re-evaluation and approved qualitatively in terms of content and face validity by a group of 5 community oral health experts, one epidemiologist, and one e-learning expert. Knowledge questions were in the form of four multiple choice questions and and eight 5-point Likert scale attitude questions about oral health in patients with diabetes. Learners' satisfaction was assessed using 12 Likert scale questionnaire. In order to assess the participants' satisfaction with the training course, a researcher-made questionnaire was used. This questionnaire consisted of 12 questions that physicians' satisfaction with the ease of working with the site, system speed, graphic and visual appearance, timely information, site adequacy, comprehensive needs, site support services, satisfaction with performance details, online class quality The quantity of online class, the quality of resources, the quantity of resources, the availability of resources were examined. This questionnaire was also qualitatively examined for content and face validity. Also, at the end, demographic and occupational characteristics of physicians participating in

the study such as age, sex, level of education, history of health care, percentage of diabetic patients and the amount of hours of medical education program about oral health were asked and recorded.

Statistical Analysis

The scoring of the questionnaire was such that in the knowledge questions, for each correct answer, a positive score was given, and for each incorrect answer, a score of zero. A higher score indicated a higher level of awareness. The options of the attitude questions are scored from 0 to 4. The satisfaction questionnaire also included the options of weak, I have no opinion, average, and very good, which is scored from 0 to 3. After sampling in two groups, the collected data were analyzed using SPSS software version 26. 2 data from the interactive group and 5 data from the non-interactive group were deleted due to non-response to questions. Levene test was used to compare the data of the two groups, ANOVA test was used to compare personal and occupational characteristics, and regression test was used to examine the effect of background information on the findings.

Results

Totally 57 physicians, 27 in the interactive and 30 individuals in the non-interactive, entered the study. Of these, two people from the interactive group and five people from the non-interactive group had not answered the questions at the end of the program. According to the findings (Table 1, backgrounds), (56.1%) of the participants in the study were over 50 years old and seven% were under 30 years old. The majority of physicians surveyed were male (63.2%) and often general practitioners (94.7%). Nearly one-third of the participants (31.6%) had more than twenty years of experience providing health services to patients with diabetes and (42.1%) Participants reported that more than 70% of their patients were diabetic. In response to the question "How many hours of your medical education program have been about oral/gum health?" More than a third of the participants mentioned 3 to 5 hours, while 19.3% of the people admitted that they had not passed any training hours with this subject. According to the findings (Table 2), the most frequent correct answer in the interactive group was related to the question "What is the definition of gingivitis?" as (100% correct answer) and in the non-interactive group to the question "What is the first sign of gum disease?" (90% correct answer). While the lowest percentage of correct answer were related to the question "Can gum

disease treatment improve the patient's glycemic control?" in both interactive and non-interactive groups. In terms of attitude (Table 3), the majority of people in both the interactive and non-interactive groups agree with the phrase "Do studies confirm a strong association between gum disease and systemic health?" "Oral health plays an important role in the general health of the body," and "I am aware of studies linking gum disease to diabetes," and "Physicians should be trained to examine the mouth of patients with diabetes." And "Do I need more information about gum disease and its effects on diabetes?" The "I do not know" option was chosen. The highest percentage of agreement in both groups was with the statement "daily brushing and flossing are necessary to maintain healthy gums and teeth."

In terms of physicians' satisfaction with the "ease of working with the site" plan, only one of the two groups chose the "weak" option, and in response to the statements "system speed", "timely information" and "adequacy". The majority of people in both groups were satisfied with the "comprehensive needs" and "site support services" and "performance detail satisfaction". In response to "graphic desirability and appearance" in the interactive group 96.3% and in the non-interactive group 73.4% chose the options "very good" and "average". But in terms of "online class quality", "online class quantity", "resource quality" and "resource quantity", a higher percentage of learners in the non-interactive group chose the "very good" and "average" options compared to the interactive group. According to the results of the t-test, physicians' satisfaction with interactive training was significantly higher. According to Table 4, the average knowledge and attitude score in the interactive group were 4.7 from 7 (SD=1.2) and 19.0 from 32 (SD=3.7), and in the non-interactive group were 4.8 from 7 (SD=1.2) and 19.1 from 32 (SD=3.7). the difference in knowledge and attitude score after interactive and non-interactive training is not statistically significant, while the level of satisfaction of participants in interactive training was higher. Linear regression analysis revealed that the parameter "age" has a significant positive association (p<0.001) and the parameter "percentage of diabetic patients learners" has a significant negative relationship (p=0.024) with the average knowledge of learners. Moreover "age" showed a borderline (p=0.055) significant positive relationship with the mean score of learners' attitudes. However, the "gender", "level of education", "history of providing health care", and "hours of a medical education program on oral health" were not associated with the

knowledge and attitude of the participating physicians.

Table 1. Demographic and occupational characteristics of physicians participating in the study.

Characteristic		Interactive training group		Non-interactive training group		All participants	
		Number	Percent	Number	Percent	Number	Percent
Age	Under 30 years	4	14.8	0	0	4	7.0
	30-50 years	7	25.9	14	46.7	21	36.8
	Over 50 years	16	59.3	16	53.3	32	56.1
Gender	Male	19	70.4	17	56.7	36	63.2
	Famale	8	29.6	13	43.3	21	36.8
Level of Education	General	26	96.3	28	93.3	54	94.7
	Internal expertise	1	3.7	1	3.3	1	1.8
	Endocrinology	0	0	0	0	0	0
	Other	0	0	0	3.3	2	3.5
History of providing health services	5year≤	5	18.5	4	13.3	9	15.8
	10-6 years	3	11.1	10	33.3	13	22.8
	20-11 years	8	29.6	9	30.0	17	29.8
	More than 20 years	11	40.7	7	23.3	18	31.6
Percentage of diabetic patients	%10>	13	48.1	12	40.0	25	43.9
	%40-11	1	3.7	4	13.3	5	8.8
	%60-41	2	7.4	1	3.3	3	5.3
	%69<	11	40.7	13	43.3	24	42.1
Hours of medical education program on oral health	Lack of this issue	8	29.6	3	10.0	11	19.3
	Less than 3 hours	5	18.5	1	33.3	15	26.3
	3-5 hours	12	44.4	10	33.3	22	38.6
	More than 5 hours	2	7.4	7	23.3	9	15.8

Table 2. Participants' answers to knowledge questions in two groups of interactive and non-interactive (correct answer is hatched).

Knowledge Questions		Interactive training group		Non-interactive training group	
		Number	Percent	Number	Percent
What causes of gum disease?	Microbial plaque	15	55.6	25	83.3
	I do not know	11	40.7	4	13.3
	Genetics	1	3.7	1	3.3
	Tooth decay	0	0	0	0
What is the definition of gingivitis?	Gum infection	0	0	1	3.3
	Reversible gingivitis	27	100	25	83.3
	I do not know	0	0	2	6.7
	Bleeding gums	0	0	2	6.7
What is the first sign of gum disease?	Bleeding from the gums	18	66.7	27	90.0
	I do not know	8	29.6	3	10.0
	Loose teeth	1	3.7	0	0
	Gingival analysis	0	0	0	3.3
What is the definition of periodontitis?	Bleeding gums	5	0	0	0
	Redness of the gums	0	18.5	4	13.3
	I do not know	22	0	1	3.3
	Bone resorption around teeth	11	81.5	15	50
Diabetics have a high risk of tooth decay	Yes	11	59.3	15	50
	No	16	3.7	4	13.3
Treatment of gum disease can improve the patient›s glycemic control	Yes	8	29.6	14	46.7
	No	19	70.4	16	53.3
Patients with poor blood sugar control are more likely to develop gum disease	Yes	8	29.6	14	46.7
	No	19	70.4	16	53.3

Table 3. Participants' answers to attitude questions in two interactive and non-interactive groups.

Knowledge Questions		Interactive training group		Non-interactive training group	
		Number	Percent	Number	Percent
Studies confirm a strong link between gum disease and systemic health	I do not know	15	55.6	14	50.0
	I quite agree	12	44.4	14	46.7
	I completely disagree	0	0	0	0
	I agree	0	0	0	0
	I disagree	0	0	1	3.3
Oral health plays an important role in the general health of the body	I do not know	14	51.9	19	63.3
	I quite agree	8	29.6	10	33.3
	I completely disagree	0	0	1	3.3
	I agree	5	18.5	0	0
	I disagree	0	0	0	0
Brushing and flossing daily is essential for maintaining healthy gums and teeth	I do not know	9	33.3	7	23.3
	I quite agree	0	0	0	0
	I completely disagree	0	0	0	0
	I agree	17	63	23	76.7
	I disagree	1	37	0	0
I am aware of studies that confirm the link between gum disease and diabetes	I do not know	16	59.3	17	56.7
	I quite agree	5	18.5	7	23.3
	I completely disagree	2	7.4	0	0
	I agree	0	0	1	3.3
	I disagree	4	14.8	5	16.7
General practitioners should be trained to examine the mouths of patients with diabetes	I do not know	11	40.7	15	50.0
	I quite agree	2	7.4	4	13.3
	I completely disagree	4	14.8	1	3.3
	I agree	10	37.0	10	33.3
	I disagree	0	0	0	0
I am interested in screening and oral health education when i visit my patient	I do not know	13	48.1	9	30.0
	I quite agree	10	37.0	14	46.7
	I completely disagree	2	7.4	2	6.7
	I agree	0	0	3	10.0
	I disagree	2	7.4	2	6.7
I need more information about gum disease and its effects on diabetes	I do not know	18	66.7	18	60.0
	I quite agree	6	22.2	8	26.7
	I completely disagree	0	0	1	3.3
	I agree	1	3.7	3	10.0
	I disagree	2	7.4	0	0
I'm sure i can do oral health screening for my diabetics	I do not know	13	48.1	8	26.7
	I quite agree	12	44.4	16	53.3
	I completely disagree	1	3.7	1	3.3
	I agree	0	0	4	13.3
	I disagree	1	3.7	1	3.3

Table 4. Comparison of standard deviation and mean of knowledge , attitude and satisfaction scores in two interactive and non-interactive groups.

	Type of intervention	number	average	Standard deviation	P_value
Knowledge	Interactive group	27	4.7	1.2	>0.05
	Non-interactive group	30	4.8	1.2	>0.05
Attitude	Interactive group	27	19.0	3.7	>0.05
	Non-interactive group	30	19.1	3.6	>0.05
Satisfaction	Interactive group	27	26.7	3.7	<0.05
	Non-interactive group	30	24.6	5.8	<0.05

Discussion

In previous studies in recent years, physicians 'knowledge about oral health has been less than expected, and researchers have recommended that appropriate educational interventions improve the level of physicians' knowledge [14-18]. By adopting effective methods in virtual education, increasing physicians' awareness will lead to faster diagnosis and referral of diabetic patients to dental treatment centers, which will prevent the wide physical and psychological costs that will develop oral symptoms for diabetic patients. In a study that examined the knowledge, attitude, and practice of internal medicine specialists about periodontal disease and diabetes mellitus [14], it was stated that the score of knowledge, attitude of internal medicine specialists among participants was 26±57, 12±61, respectively. This study also showed that internal medicine specialists' knowledge and performance as regards the relationship between periodontal disease and diabetes mellitus were not desirable. In the present study, the final knowledge level (4.7 out of 7) and attitude level (19.0 out of 32) of physicians was moderate despite the education intervention was which emphasized the importance of more educational programs in this subject area.

This study showed that there is no difference between the knowledge and the attitude score of physicians in the two methods of interactive and non-interactive virtual education. The result of the present study is similar to the result of a study conducted by Al-Rawi et al. They also did not find a statistically significant difference between the interactive and textual virtual education groups on students' learning about the interpretation of CT scan images [19]. In Sun Hsu's study, the three methods of virtual education (plain text, plain text with online presence, plain text with online presence, and the possibility of text communication and the existence of an interactive user interface page) increase the level of student's knowledge about IT topics [20]. Mahdiun et al.'s study also showed that both interactive and non-interactive virtual education methods can improve nurses' awareness [8], However, the study of Zang et al. Showed that virtual education with interactive video compared to the non-interactive video has significantly increased students' knowledge about search engines on the Internet [21]. The results of this study contradict the present study. Of course, the type of interaction and the subject used in this study are probably different from the present study, and this difference has caused differences in the results. On the other hand, one of the reasons for the lack of significant differences in the results of the present study can be due to the limitations of the study. Considering that in the continuing education site where the educational content of the study was uploaded, after viewing the questions, it was possible to return to the educational content in both interactive and non-interactive groups, it is possible that some participants, after reading the questions, Answer them with the help of content. With this in mind, in order to determine the real impact of this educational method, the need for further studies in this field is felt.

In this study, physicians' satisfaction score was about 75% in the interactive education intervention and 68% in the non-interactive educational intervention which indicates that In both interventions, physicians 'satisfaction was rather high and the participant's satisfaction with the training course in the interactive virtual education group was significantly higher than the non-interactive virtual education group. Sun Hsu, Zhang, et al. Have also stated that there is a direct relationship between the level of interaction in virtual education courses and learners' satisfaction with these

training courses [20, 21]. Also in the study of Mahdiun et al. It was shown that nurses' satisfaction with interactive training was significantly higher [8]. Shah Hosseini et al. Stated that the overall performance score for promoting oral health in older internal medicine physicians, higher average weekly working hours, and those who had completed a course in clinical and periodontal examinations as part of their curriculum, The result was significantly higher [14].

In the present study, according to the results of regression analysis, the age parameter has a significant positive relationship with the average knowledge and attitude of learners. It seems that with increasing age and consequently the work experience of physicians, there is a greater need for gaining oral health information and in this regard, physicians have increased their knowledge. Physicians with a higher percentage of their patients with diabetes showed less knowledge, although it seems that there may be other confounding factors, such as the total number of patients examined by the physician, that can reduce his or her time to care and study for each patient. These confounding factors should be included in future studies to make the results easier to interpret. Given that most studies in Iran have compared the effectiveness of virtual education and face-to-face training, this study is unique and valuable in that it examines both interactive and non-interactive virtual education methods. However, due to the limitations of the study, such as the impossibility of holding a pre-test, the limitation in the number of questions presented to the learners, and the impossibility of randomization of the samples, there is a possibility of potentially confounding variables in the result. It is also suggested to compare different levels or types of interaction in virtual education, such as the effect of comprehensive interaction with the teacher or comprehensive interaction with other learners or the use of methods such as interactive video and the use of new technologies in the field of simulation.

Conclusion

Although there was no difference in the level of attitude and knowledge of physicians in the two types of virtual education, the method of interactive virtual education was revealed to lead to more satisfaction in participants. Therefore it is recommended to use interactive virtual training where it is affordable and feasible.

Acknowledgments

Conflict of Interest

There is no conflict of interest to declare.

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