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Evaluating a Web-Based Educational Module on Oral Cancer Examination Based on a Behavioral Framework

Alvin G. Wee,

Department of Prosthodontics, Creighton University School of Dentistry, 2500 California Plaza, Omaha, NE 68178, USA; Veterans Affairs Nebraska-Western Iowa Health Care System, Department of Surgery - Dental Services, 4101 Woolworth Avenue, Omaha, NE 68105, USA

Lani M. Zimmerman,

Lincoln Division, College of Nursing, University of Nebraska Medical Center, Room CCRT 114, Commerce Court, 1230 O Street, Suite #131, Lincoln, NE 68588-0220, USA

Carol H. Pullen,

Department of Community Based Health, College of Nursing, University of Nebraska Medical Center, Room 4056, 985330 Nebraska Medical Center, Omaha, NE 68198-5330, USA

Carl M. Allen,

College of Dentistry, Ohio State University, 305 W 12th Ave, Columbus, OH 43210, USA

Paul M. Lambert, and

Oral and Maxillofacial Surgeon, Idaho State University - Meridian, 1311E Central Drive, Meridian, ID 83642, USA

Electra D. Paskett

Department of Internal Medicine, College of Medicine, Ohio State University, Suite 5251590 N High Street, Columbus, OH 43210, USA

Abstract

Patients at risk of developing oral and/or oropharyngeal cancer (OPC) are more likely to see primary care providers (PCPs) than a dentist. Many PCPs do not regularly perform oral cancer examination (OCE). The purpose of this study was to design a web-based educational program based on a behavioral framework to encourage PCPs to conduct OCE. PCPs were solicited to provide feedback on the program and to evaluate their short-term knowledge. The integrated behavioral model was used to design the program. Fifteen PCPs (five in each group: physicians, physician assistants, and nurse practitioners) reviewed the program and took a posttest: (1) index of knowledge of risk factors for oral cancer (RiskOC) and (2) index of knowledge of diagnostic procedures for oral cancer (DiagOC). Findings from the process evaluation were mainly positive, with comments on the length of the program comprising the ten negative comments. No significant difference among groups of PCPs (physicians, physician assistants, and nurse practitioners) was detected for DiagOC ($p=0.43$) or RiskOC ($p=0.201$). A program on OPC for PCPs should be less than 40 min. Postviewing knowledge outcomes were similar for all PCPs. The

web-based program on OPC based on a behavioral framework could have similar short-term knowledge outcomes for all PCPs and may increase the number of PCPs performing OCEs.

Keywords

Oral cancer examination; Screening; Medical professionals; Web-based education

Introduction

Approximately, 42,380 individuals were diagnosed with oral and/or oropharyngeal cancers (OPCs) in 2013, with approximately 7890 deaths [1]. OPC is commonly diagnosed at a late stage, resulting in a low 5-year survival rate and high morbidity due to treatment with the modalities such as surgery, radiation, and chemotherapy [2]. The number of individuals who received an oral cancer examination (OCE) by any health care professional in the past year in the USA is small, with 29.4 % reported in 2008 [3], an improvement from the 14 % reported in 1992 [4]. Approximately 80 % of dentists carry out routine OCE [5]; unfortunately, the frequency of self-reporting by physicians (MDs) conducting routine OCE ranges from less than 24 % in 2002 in Maryland [6] to 49 % of MDs in Massachusetts in 2009 [7]. Compounding the problem of delayed diagnosis, however, is the reality that many patients at risk of developing OPC may not see a dentist regularly. Such patients are more likely to see medical professionals for their medical problems. Unfortunately, medical professionals often are not familiar with OPC and do not regularly conduct nonsymptomatic OCEs [8]. The literature provides evidence that patients with advanced OPC had seen a physician in the previous 1 or 2 years [9, 10], and opportunities to detect these OPC lesions in the early stages of development were missed. Routine nonsymptomatic OCEs performed by primary care providers (PCPs) (i.e., physicians, physician assistants, or nurse practitioners) at routine clinical visits could help in the early detection of OPC lesions [11, 12].

Barriers to PCPs performing annual opportunistic OCE have been shown to be related to many factors. A Cochrane systematic review [13] stated one reason for PCPs not carrying out OCE is their lack of understanding of the epidemiology and course of OPC [14]. PCPs' concerns about patients' psychological trauma resulting from false positives was suggested [13], which was related to the lack of confidence of PCPs in detecting OPC [14, 15], which may result in higher false positives. Lack of time and adequate equipment [14], lack of training [14, 16], lack of specialists for referrals [16], and lack of reimbursement have been shown to be barriers for PCPs to carry out OCE [16]. The only study that has used a behavioral framework in this area showed that the subjective norm (perception of whether significant others would approve) in the theory of planned behavior construct was found to be a significant predictor of "intention" to carry out OCE [14]. Unfortunately, another barrier contributing to PCPs not performing OCE may be the US Preventive Services Task Force [17] finding insufficient evidence to recommend that PCPs perform OCE. In the UK, opportunistic screening of oral cancer by all health professionals is only encouraged [18]. Understanding all of these factors is important so that they can be included and addressed in

an intervention to encourage PCPs to carry out opportunistic, nonsymptomatic OCE in the medical clinical setting.

For many professionals, web-based continuing education is an efficient, highly satisfying [19], cost-effective, and efficacious mechanism [20] for pursuing continuing education [21]. A study at the University of Arkansas for Medical Sciences evaluated satisfaction with a distance continuing education program that used interactive video and the Internet to deliver the programs from 1995 to 2007 [19]. The study showed the mean total satisfaction score for the 2219 programs presented to 7047 physicians; 21,264 nurses; 3230 allied health professionals; and 305 dentists was 4.44 (1 to 5 score range). Nurses and physicians had significantly greater satisfaction regarding the use of information in practice to enhance patient care ($p<0.01$). The first choice for 89 % of PCPs who worked at federally qualified health centers in Michigan to learn about OPC and how to perform OCE was continuing medical education [16], especially if it was part of a course on primary care review [6].

In this study, a web-based educational program was designed and framed using the integrated behavioral model (IBM) [22] to encourage PCPs to conduct a brief, routine, nonsymptomatic OCE on their patients. The IBM as shown in Fig. 1 is the entire IBM framework that was selected as the conceptual model to develop the web-based educational program. This model includes constructs from the theory of reasoned action, the theory of planned behavior, and other influential theories. Only relevant constructs (asterisk and in a red box) of the IBM model that could be addressed in a web-based educational program and OCE were addressed, including the following: (1) instrumental attitude, (2) descriptive norms, (3) self-efficacy, (4) knowledge and skills to perform the behavior, (5) salience of the behavior, and (6) environmental constraints.

The main aim of the study was to evaluate the developed web-based educational program among three groups of PCPs (e.g., physicians, physician assistants, and nurse practitioners) to obtain their relevant comments to improve the program by using an institutional process evaluation tool. The secondary aim for this manuscript was to determine the short-term effectiveness of the web-based educational program to improve the following: (1) index of knowledge of diagnostic procedure for oral cancer (DiagOC) and (2) index of knowledge of risk factors for oral cancer (RiskOC).

Methods

Design

The Institutional Review Board at Creighton University (CU) approved the study's protocol in March 2012 (no. 11–16281). A behavioral change model was selected, and relevant constructs of that model were selected based on how it could be emphasized in a web-based educational program. The program was then outlined to ensure that the selected constructs were incorporated and then developed. Relevant PCPs were then solicited to view the program and immediately complete the progress evaluation and posttests.

Sample

Total convenience samples of 15 PCPs, five in each category of provider, were recruited. The subjects were compensated with a free 1-h continuing educational credit from the host institution. Once the web-based educational program was completed, an e-mail with a link to the program was sent to invite PCPs who fit the inclusion criteria to review and suggest improvements to the web-based educational program, as well as to mention any barriers to completion. The e-mail stated that participation was voluntary and could be done at their leisure without any additional cost. After reviewing the program, the participants completed two posttests: (1) DiagOC [23] and (2) RiskOC [23], as well as completed an evaluation of the web-based educational program.

How the Model Informs the Intervention

The web-based educational program was entitled “Importance of Conducting Routine Oral Cancer Examinations by Medical Professionals.” This 40-min presentation was framed in Microsoft® PowerPoint slides with transitions and an audio component. The PCP was able to fast-forward or rewind the slides and jump to individual slides, thus having the flexibility to navigate the entire presentation. The intent was to ensure flexibility and to reduce frustration on the part of the PCPs viewing the program. The objectives of the program were as follows: (1) to recall information on OPC profile, risk factors, survival, treatment, and morbidity; (2) to explain the rationale for medical professionals carrying out routine OCE; and (3) to recognize normal, variant from normal, premalignant, and cancerous lesions in the OPC region. Table 1 discusses the content, submodules, and targeted IBM components.

In developing the web-based educational program, only IBM constructs that could be incorporated into the web-based educational program were included. In this context and using the IBM model (Fig. 1), if the PCP has strong intention (motivation) to perform the behavior (OCE), then four other factors are needed to result in behavioral performance, including (1) having the knowledge and skill to perform the behavior, (2) with no or few environmental constraints; behavior has also has to be (3) salient (important) to the PCP, and finally, the PCP has (4) experience or habit of performing the behavior. The constructs that were addressed by the program are outlined in red boxes (Fig. 1) and also elaborated in Table 1. The program addressed the four factors above except habit (i.e., performing OCE), as the web-based education did not offer the opportunity for a workshop or practical session. Regarding knowledge and skills, the program provided knowledge about normal and variant from normal oral cavity anatomy. Furthermore, the program provided a downloadable one-page back-to-back handout entitled “Oral Cancer Examination Checklist” to guide the medical professionals if they detected an oral lesion. This form also included a link to the ADA Dental Symptom Checker (www.mouthhealthy.com), which can help PCPs identify possible oral conditions, treatments, and actions to be taken when an oral lesion is detected. The website also allows the PCP to find the closest referring dentist. To address salience of the behavior or importance to the person, the program provided information on OPC and the importance of conducting OCE. For elimination or minimization of environmental constraints to perform the behavior, the program emphasized that the OCE takes only 1 min not imposing a time burden when faced with a busy clinical schedule.

Intention is the most important determinant of behavioral change, and the factors that influence this motivation include attitude, perceived norm, and personal agency (Fig. 1). The web-based intervention can only target these factors that influences intention, but practically speaking, it was not possible to present materials that directly increase intention (motivation). Attitude, which is composed of experiential and instrumental attitude, is the PCP's overall favorableness toward performing OCE. *Experimental attitude* is the PCP's feeling about performing the OCE, while *instrumental attitude* is a person's belief about the outcomes of the behavior to be performed. For this program, experimental attitude was not included in the program, while instrumental attitude was targeted by emphasizing the information on OPC and the potential outcomes of PCPs performing OCE for early diagnosis of OPC (Table 1).

Perceived norms reflect social pressures that one feels to perform the behavior. This norm is composed of injunctive and descriptive norms. *Injunctive norm* is the normal belief of what others think one should do (e.g., policy) and motivation to comply to carry out OCE; this was not included in the program. *Descriptive norm* is a perception about what others in one's social or personal networks are doing with regard to this behavior. As part of descriptive norms, a prominent PCP via video stream promoted and supported the concept of PCPs carrying out OCE. A physician educator provided a welcome and introductory video (Table 1).

Personal agency in IBM consists of self-efficacy and perceived control. *Self-efficacy* is the degree of confidence in one's ability to perform the behavior, while *perceived control* is one's perceived amount of control over behavioral performance. To assist in increasing self-efficacy, the program informed the professionals what is needed and how to systematically perform an OCE. In addition, a video stream was shown providing an overview of how the OCE is performed in a medical clinic environment.

For this program, it was felt that it was not practically possible to address improving the PCPs' intention to perform OCE within the web-based educational intervention. It was also not possible to address changing the PCPs' experimental attitude, injunctive norm, nor perceived control; thus, they were not included in the web-based educational intervention. The intention of the PCPs within the intervention group was evaluated after viewing the education program through the evaluation question posed "Did you learn something from this webinar that will have an impact on your professional/practice?" Furthermore, other factors were not included in the program because they have not been shown to be contributory factors to PCPs performing OCE.

Several key concepts were diagrammatically developed for the program to simplify their use by PCPs in clinical practice. The first was a conceptual framework regarding the steps to diagnosis (Fig. 2), whose three main components are screening, clinical decision, and referral. For the screening portion, the clinician first evaluates signs by visualizing the area, followed by palpation to differentiate between normal, variant of normal, and suspicious oral lesions. Symmetry, symptoms, and time are used as a guide to determine whether the lesion is suspicious. Most normal and variant of normal anatomy are symmetrical on both sides of the mouth. Most oral lesions have symptoms of pain, while possible dysplastic or early

cancerous lesions have no symptoms of pain. Time is relevant because most traumatic oral lesions resolve after 2 to 3 weeks, while suspicious lesions last longer. In summary, if an oral lesion is not symmetrical, has no symptoms of pain, and has been in the patient's mouth for 2 to 3 weeks, the lesion is suspicious for dysplasia or OPC. PCPs are recommended to refer for consultation or biopsy if the lesion is not a variant from normal.

The second concept that was emphasized was that the OCE must be a repeatable routine to ensure that the PCP adequately visualizes all mucosal surfaces. It was recommended to begin at a patient's upper right cheek and alveolus, then continue to midline and across to the posterior upper-left cheek and alveolus, going down to the left posterior cheek and alveolus, and then continuing back across midline to the right-lower posterior cheek and alveolus. The clinician was then directed to look at the hard palate, the soft palate, tonsil and posterior pharyngeal wall, and finally to the tongue and floor of mouth. The program also included a diagram for visualization.

The final concept that was emphasized was that the PCP should be looking *at* the mouth, not *through* it. PCPs routinely look through the mouth and examine the posterior pharynx with a tongue depressor. The emphasis was that it is not difficult to extend their visual field from looking at the back of the throat to a quick additional OCE. The educational slide used to emphasize this idea darkened, with only the central portion showing the back of the throat. The slide then revealed the rest of the mouth and stated, "Remember, one extra minute of looking *at* the patient's mouth after looking *through* it can save lives. Develop a habit of looking at the mouth, not through it."

Measures

Two posttests were requested to be completed by the PCPs immediately after they viewed the program, including the DiagOC [23] and RiskOC [23]. Both instruments have no published psychometrics (validity or repeatability data) in the literature but have been used multiple times in the dental literature, thus giving it content validity. Its face validity appears to be reasonable. DiagOC, which includes 12 questions on oral diagnostic procedures that examine knowledge of OPC in general, the nature of early oral cancer lesions, and OCE procedures/findings, produces a total score of 12. The RiskOC originally had 14 yes/no questions on risk factors for OPC. The risk factor of OPC related to infection with human papillomavirus was added per the literature, increasing the maximum score in this study to 15.

The program evaluation was completed by the PCPs immediately after they viewed the program and took both posttests. The evaluation was used by one of the Midwestern Health Science Continuing Education process evaluation for its continuing education programs. The first evaluation requested rating of the webinar and allowed one of the five categories to be selected (strongly agree, agree, neutral, disagree, and strongly disagree). The three questions asked whether the time was appropriate, if the presentation was organized, and if the slides were easy to read. The second question asked if whether the objectives of the presentation were met using the similar five-response scale mentioned above. The third question addressed whether participants learned something that would have an impact on their professional/practice, as a means to assess "intention to change." A question was also asked

regarding barriers that participants anticipated in implementing the information gained from the webinar, with the following categories: (1) administrative policies, (2) insurance costs, (3) needed resources/technology, (4) patient noncompliance, and (5) other. There was one open-ended question regarding overall comments.

Analysis of the Data

Percentage distribution of the program evaluation is presented, including the summary of the open remarks section. Descriptive statistics were carried out (i.e., means, standard deviations, and/or frequency distributions) and percentages on all variables collected for this study. Nonparametric testing (Kruskal-Wallis test) was conducted to compare DiagOC and RiskOC among the three groups.

Results

For the main aim of the study, evaluating the developed web-based educational program among three groups of PCPs to improve the program by using a process evaluation tool, all 15 participants completed the evaluation. Most responses were either *strongly agree* or *agree* (from a five-point Likert scale: strongly agree, agree, neutral, disagree, and strongly disagree). For the subjects who rated the program, only 73.3 % indicated that they strongly agreed that the time allotted was appropriate, while 20 % agreed, and 6.7 % were neutral. Approximately 80 % stated that the information was organized and the slides were easy to read. In rating the objectives of the program, 93.3 % strongly agreed that the first (to recall information on OPC profile, risk factors, survival, treatment, and morbidity) and second objectives (to explain the rationale for medical professionals carrying out routine OCE) were met, and 100 % strongly agreed with regard to the third objective (to recognize normal, variant from normal, premalignant, and cancerous lesions in the OPC region). More than 93 % indicated that they learned something that would impact their professional practice, which demonstrates intention to perform OCE. Participants were asked what barriers they anticipated in trying to implement the information they obtained from the program; 13.3 % indicated that insurance cost was a barrier, 6.7 % needed additional resources, and 13.3 % stated that patient noncompliance would be a factor. In addition, 66 % thought that there were other factors (e.g., learning curve, few oral lesions encountered in their practice) that would be barriers to implementing routine OCE in their practices.

Open-ended comments were categorized into four sections: positive comments, suggestions for improvements, hygiene concerns, and length of the program. A total of 14 positive comments were received. The participants agreed the program exhibited a good overview, balance of knowledge acquisition, and clinical tips on oral and/or oropharyngeal cancer (OPC). In general, the participants felt the program was clear, systematic, and applicable to their current practice, and that the video of how to perform OCE was helpful. They agreed that important points were emphasized, with the closing statement giving an overall summary. One noted that he/she currently screens for OPC but had learned some pointers through the program, including the OCE attachment.

There were four comments stating that the total length of the program time was too long, especially for a busy PCP. Suggestions included breaking the educational program into 15-

min segments and that the pace of the content could be faster. There was a single comment about hygiene concerns, as the PCP was not comfortable with regard to the provider repeatedly touching the otoscope inside the mouth without changing gloves. The PCP stated that not everyone uses gloves with an otoscope in primary care. There were five comments on other suggested improvements, including changing the terminology from “physician” to a more neutral word such as “clinician,” and to simplify complex slides or slides with large tables by using an overview. It was also recommended that slides have pictures to help maintain viewer interest.

For the secondary aim of evaluating the short-term effectiveness of the web-based educational program to improve the two posttests, DiagOC and RiskOC, the tests were taken by all 15 participants. The mean standard deviation for DiagOC (maximum of 12) was as follows: physicians=10.7 (1.09), physician assistants=10 (1.0), and nurse practitioners=10.4 (0.74). The mean±standard deviation for RiskOC (maximum of 15) was as follows: physicians=12.0 (1.58), physician assistants=13.2 (2.2), and nurse practitioners=13.8 (0.45). No significant difference between groups was detected for DiagOC ($p=0.43$) or RiskOC ($p=0.201$).

Discussion

The outcomes for the two posttests (DiagOC and RiskOC) among three different medical professional groups after viewing the web-based educational program did not differ. This indicates that the web-based educational program did not transfer knowledge about OPC differently to the three PCP groups. This program could thus be used as a knowledge and behavioral intervention for a variety of health care providers.

The recruitment method for this study was a convenience sample, recruited by approaching PCPs known to the authors at either the University of Nebraska Medical Center or Creighton University via e-mail and asking who among them might be interested in viewing and assessing the program. The PCPs recruited for this study may have had more interest in oral health than PCPs who could not be recruited for this study.

There are several limitations to the study, including how the subjects were sampled, the flexibility of the program, and not having a pretest. The feedback from this study may have been skewed toward positivity due to the subjects’ interest. Ideally, subjects would be randomly selected from a nationwide database of PCPs and requested to view the program and provide feedback.

In this study, the PCPs had the flexibility to fast-forward and accelerate the 40-min program. It was felt that this would be more acceptable to the participants, resulting in a higher completion rate. If the fast-forward capability was not possible, the PCPs may have felt that the intervention would be too long and would then not complete it. Even though this intervention was only 40 min, four of the participants felt that it was too lengthy. On the other hand, if the PCPs in the intervention group were busy, they had the ability to fast-forward through the slides, thus reducing the potential knowledge gained through the program. This ability to fast-forward is also a limitation of the study because it may have

decreased the fidelity of the intervention, as participants may not have listened to the web-based educational intervention thoroughly.

Another limitation of this study was not offering a pretest, but there appears to be an increase in mean scores for the posttest compared to previously published articles, using very similar instruments. For the DiagOC, the baseline (pretest) for Maryland family physicians was 89.2 % [6] and for nurse practitioners was 45.6 % [24]. For this study, the posttest after viewing the program was 91.1 % for physicians and 86.7 % for nurse practitioners. For the RiskOC, the baseline (pretest) for Maryland family physicians was 35.7 % [5] and nurse practitioners was 49.2 % [24]. For this study, the posttest after viewing the program obtained from physicians was 90 % and nurse practitioners was 92 %, which is an approximately at least a 40 % increase in knowledge score.

Barriers to carrying out routine OCE in participants' practices in this study were also mentioned in previous studies: insurance cost [16], need for additional resources (which is similar to needing additional time and equipment) [14], and not being able to find additional specialists for referral to if oral lesions are detected [16]. Since there is a learning curve to this behavioral change [14, 16], additional or repeated review of the program would help the PCPs become more familiar with performing OCEs; unfortunately, this was not possible. The use of a behavioral framework seems like a logical approach to formulating the web-based educational program, but its effectiveness compared to a nonframework-guided program [25] has not been tested. The only other known study used the theory of planned behavior [14] to identify potential modifiable barriers to OCE in UK general medical practice.

Future research includes evaluating this web-based program for not only short-term but also long-term knowledge retention gain and whether it changes PCPs' behavior in their actual practice (e.g., to carry out routine nonsymptomatic OCEs on their patients). The next phase of this research would be to offer a pretest and posttest with a larger sample of PCPs in a clustered randomized control trial. The strength of the intervention (web-based educational program) to either increase knowledge gain and/or behavioral change should also be assessed. Other factors that may potentially influence the behavioral change of PCPs to carry out OCE should also be evaluated, including policies for PCPs to carry out OCE, insurance reimbursement for PCPs to carry out OCE, or having easier access to knowledge about oral health. Evaluation of whether breaking up the program, as suggested by the study participants, into three 13-min parts should be completed to increase knowledge update and acceptability.

Conclusions

A web-based educational program guided by a behavioral framework has been developed and viewed by three groups of PCPs. The feedback for this short program was mainly positive, and the outcomes through a posttest showed a positive increase in knowledge gain, without any significant difference among the groups of PCPs.

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Fig. 1.
Relevant constructs of the integrated behavioral model used to develop the web-based educational program

Fig. 2.
Oral cancer—steps to diagnosis

Table 1

Content of the web-based education program

Importance of conducting routine oral cancer examinations by medical professionals			
Time (min)	Content	Submodules	Targeted IBM components
2.21	Introduction	Objectives Welcome video from physician educator, Chair of a Department of Family Medicine	Perceived norms: descriptive norms
0.46		Biography of presenters	
10.02	Information on OPC	Location, age/gender, risk factors, patient long-term and 5-year survival, and treatment morbidity	Attitude: instrumental attitude
4.34	Reasons for conducting routine OCE	Percentage of public being screened for OCE, groups at high risk for OPC, medical practices, and proposed solution	Salience of the behavior
8.38	OCE techniques	Why the 1-min OCE is easy to carry out, equipment needed, introduction to framework for steps to diagnosis, oral cancer horseshoe, proposed OCE sequence, and video stream OCE being done in medical practice setting	Personal agency: self-efficacy
3.11	Oral and pharyngeal anatomy	Overview of normal anatomy while going through the proposed OCE sequence	Knowledge and skills to perform the behavior
9.55	Clinical characteristics of selected oral lesions	Steps to diagnosis: lesions that are variant from normal, suspicious oral lesions, leukoplakia, erythroplakia, and oral cancer signs	
1.36	Incorporating into daily practice routine	Emphasis that it takes only one minute to conduct OCE and providers already look down the patient's throat, and steps for referral	Environmental constraints
		Downloadable form "Oral Cancer Examination Checklist with ADA Dental Symptom Checker"	Knowledge and skills to perform the behavior
2.02	Summary and test	Thank you message and summary from a prominent MD supporting this effort, acknowledgments, and CE credits	Perceived norms: descriptive norm

Total time: 43 min and 5 s