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[原著]

Effectiveness of an educational program on nurses' oral management practices for patients with diabetes: A pilot study

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Abstract

Nurses require assistance to practice oral management of patients with diabetes. This study aimed to identify the effect and utilization of an educational program on nurses' ability to perform oral assessments in patients with diabetes. Semi-structured interviews were conducted with three nurses engaged in diabetes care to identify the effects and utilization of the educational program, and the data obtained from the interviews were examined using content analysis. Five categories were identified: 1) nurses began to observe the patient's oral cavity, 2) nurses could use the learning contents to collaborate with dentistry and explain procedures to certified diabetes nurse educators (CDNEs) in the facility and create an oral checklist and poster, 3) nurses were inspired to start oral management, 4) nurses started oral management with multidisciplinary cooperation in the facility, and 5) and nurses recognized the scope of oral management that nurses could perform in diabetes outpatient departments. This program is expected to support nurses in practicing patient education regarding oral management of patients with diabetes.

Keywords: Diabetes mellitus; Education; Nurse; Oral assessment

Introduction

Diabetes mellitus, a chronic disease affecting individuals of all ages, is a serious condition characterized by poorly controlled hyperglycemia, which can lead to a series of complications, including nephropathy, neuropathy, and retinopathy (1). Periodontal disease is a form of plaque-induced chronic inflammation that gradually damages periodontal tissue and can lead to tooth loss with increasing age (2). Gum symptoms are present in 80% of the Japanese population aged > 40 years, and the incidence of tooth loss due to periodontal disease in Japan is among the highest worldwide (3).

Increasing scientific evidence supports a reciprocal adverse relationship between diabetes and periodontal disease (4). Evidence supports diabetes as a risk factor for

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periodontal disease and suggests that periodontal disease may be a complication of diabetes that adversely affects glycemic control by increasing blood glucose levels (1,5). Therefore, patients with diabetes are at greater risk of poor oral health than those without diabetes (4). Periodontal disease complicated with diabetes mellitus can cause tooth loss (6), exacerbate insulin resistance (7), and lead to a decline in plasma glucose control and quality of life (8,9). It may also influence the initiation and development of heart disease and nephropathy (10).

Patients with diabetes have inadequate knowledge and low awareness of the increased risk of oral problems associated with diabetes and a poor understanding of the need to maintain good oral hygiene (11,12). Moreover, patients with diabetes are less likely to undergo regular dental checkups and may experience ineffective tooth brushing without receiving dental guidance (13). In addition, these patients are often not informed about the relationship between diabetic control and oral problems or do not receive dental referrals from medical staff (11,12). Hence, it is essential for patients with diabetes to be educated about the necessity of regular oral management, appropriate oral hygiene methods, and regular dental checkups (13).

Certified diabetes educators (CDEs) in Japan, who are medical experts with a high level and broad expertise, support self-management for patients with diabetes (14). Nurses, as CDEs, account for 43% (7,530 of 17,310) of the total number of nurses (14) and play a primary role in providing patient education in medical settings (15). In other countries, most diabetes care providers do not perform oral management owing to a lack of knowledge and unwillingness to engage in patient oral management (16). A recent study reported the barriers associated with the provision of oral management by certified diabetes nurse educators (CDNEs) for outpatients with diabetes in medical settings in Japan (17), showing that educational programs for CDNEs must emphasize the enhancement of their knowledge, skills, and confidence in oral assessments. Previous research has pointed out that nurses need practice performing oral observations and assessments of patients' oral cavities. However, the education provided to CDNEs regarding oral management consists of only general information about teeth and gums (19), and few studies on support for nurses in this context have been conducted. One study has verified the feasibility of using a nursing guide to practice oral management in an outpatient department for diabetes (20), and another has clarified nurses' perceptions of using this nursing guide (21). Therefore, to fill this research gap, we devised an educational program for nurses to perform oral medical assessments of patients with diabetes.

We developed the educational program in three steps. First, we conducted a nationwide survey to identify and prioritize factors contributing to the provision of periodontal care by CDNEs to outpatients with diabetes in medical settings in Japan (17). In our survey, the practice of oral management was assessed using factors contributing to oral management through items developed based on the capability, opportunity, and motivation–behavior models (17,22,23).

From the survey, we identified

that education for nurses is needed to improve their knowledge, skills, and confidence in oral assessments and to ensure regular oral management. Therefore, we developed an educational program to help nurses confidently educate patients with diabetes using knowledge and skills related to oral management. The program was designed to be conducted once and last for 80 min, targeting nurses who are currently engaged in diabetic nursing care in medical settings. It was held at an exchange meeting during an annual conference related to diabetes nursing.

Second, we developed a four-step educational method to improve oral assessment knowledge, skills, and confidence based on the results of a nationwide survey: In the first step, information on the management of periodontal disease in patients with diabetes is provided. The second step consists of oral observation and assessment practices. The third step involves oral observation and assessment practice (exercise) using role-playing. That is, participants are paired up and asked to take turns role-playing as nurses and patients to acquire skills in oral observation and assessments. During the role-playing activity, the researcher involves the participants in a way that enhances their confidence by praising them for appropriate practices and successes. In the final step, participants exchange opinions on how to solve problems in oral observation and assessment in diabetes outpatient departments. Additionally, medical expert (a diabetologist, dentist, and certified nurse) consultations are conducted to generate recommendations for intervention, and materials for programs are revised based on their suggestions. Third, we planned to assess how the knowledge and skills acquired in the educational program were subsequently affected and utilized in clinical practice through semi-structured interviews 2–3 months after the educational program was completed. Therefore, as the next step in the development of an educational program, this study aimed to identify how the program affected and was utilized by the participants.

Definition of terms

The definition of "oral management" by nurses used in this study refers to the observation and evaluation of a patient's oral cavity; patient education regarding oral management, (e.g., maintaining oral hygiene, oral moistures, and denture care); and keeping records to determine the course of action (24).

Materials and Methods

We identified the effects and utilization of the educational program through semi-structured interviews with the study participants.

Data collection procedures

The researchers held an exchange meeting on an 80-min educational program during the annual conference related to diabetes nursing on September 18, 2022 and recruited nurses from among the participants between September 18 and October 3, 2022. Nurses interested in this study and currently engaged in diabetes nursing care in an outpatient setting were verbally briefed by the researchers using an explanatory document and a consent form asking for their cooperation. Nurses engaged in diabetes nursing care in medical facilities were included in this study. Participants who were unwilling to participate or did not work at medical facilities at the time of recruitment were

excluded. After written consent was obtained from the participants, the researcher contacted them to arrange a time and venue for an interview 2−3 months after the educational program. To reduce the burden on participants, as a general rule, the researcher conducted interviews at a venue selected by each participant. The researcher and participants agreed on the time and venue of the interviews, which were semi-structured and conducted online. Most qualitative interviews are semi-structured, guided, or organized around a set of open-ended questions (25). The degree of guide may be as minimal as having a few initial questions or prompts or as structured as multiple predefined questions to narrow the interview to specific aspects of the phenomenon being studied (25). We conducted semi-structured interviews to allow participants to expand their perspectives. Moreover, we used an interview guide to ensure consistency in data collection and enhance the reliability of the study. The interview guide was reviewed by a researcher with expertise in chronic nursing and a nursing researcher with expertise in the oral management of diabetes in the same setting to ensure content validity. The researchers conducted the interviews in a quiet room within a research institution where privacy could be maintained. The interviews lasted between 20 and 40 min. Each interview was recorded after verbal consent was obtained from each participant before the interview began. We also collected the participants' background information using a face sheet to summarize their information. The face sheets were emailed to participants in advance and returned at the beginning of the interview.
The interview guide and face sheet comprised the following sections:

Interview guide

1) Why did you participate in this educational program?
2) Please tell us how you applied what you learned from the educational program to the observation and assessment of oral health in patients with diabetes.
3) How did what you learned in the educational program help you to observe and assess patients' oral cavities?
4) How did your patients react when you performed the oral observations and assessments that you learned about in the education program?
5) Please tell us what you have noticed from observing and assessing patients' oral cavities regarding the oral management you perform and its effects on the surrounding medical staff.
6) To what extent do you think nurses can provide oral management support in diabetes outpatient departments?
7) In addition to the training content of this educational program, what innovations do you think will help nurses and patients accept the ongoing practice of oral management in diabetes care settings?
8) Would you be willing to participate in future educational programs on oral management of patients with diabetes? If so, what would you like to learn in addition to what was covered in this session?

Participant characteristics

The participants' background information included sex, age, work experience after becoming CDNEs and type of work institution. Information regarding education on the oral management of patients with diabetes, existence of an outpatient department specializing in diabetes care at their work institution, and existence of a

dentistry department at their institution were assessed using a dichotomous scale (1 = yes, 0 = no).

Data analysis

All analyses were performed using Microsoft Excel (Microsoft Japan, Tokyo, Japan). The data obtained from the interviews were examined using content analysis, which is a qualitative data analysis tool (25). This technique classifies words in a text into categories based on repeated ideas or patterns of thought (26). A content analysis was performed to describe and infer the characteristics and effects of the data (26).

Content analysis was performed as follows. First, a transcript was prepared for each audiotaped interview. Next, to gain an overall impression of the transcript and formulate tentative ideas, the two authors independently read all of the transcripts several times and identified key phrases and sentences. As the analysis progressed, the authors categorized the data according to content similarity and then organized them into categories and subcategories.

To ensure methodological rigor and trustworthiness of the analysis, we employed several strategies:

Data Analysis Process:

Two authors independently conducted the initial coding of all interview transcripts.

Regular meetings were held between authors to compare coding decisions and resolve any discrepancies.

An audit trail documenting all analytical decisions and category development was maintained.

Data saturation was continuously assessed during the analysis process.

Trustworthiness Enhancement:

Peer debriefing: Regular discussions were held with colleagues experienced in qualitative research to examine potential biases and explore alternative interpretations.

Detailed description: Detailed contextual information and participant quotes were included to support findings.

Consensus Building: When disagreements arose in coding or categorization, the authors:

a. independently reviewed the original transcripts,

b. documented their rationale for different interpretations,

c. held detailed discussions to reach consensus, and

d. consulted with an independent researcher when necessary.

Ethical considerations

The Ethics Committee of the Institute of Medicine, University of Tsukuba approved the study protocol (approval number: 1768; approval date: 07/11/2022). Written informed consent was obtained from all the participants.

Results

Initially, nine nurses participated in the educational program. Among them, four expressed an interest in participating in the study, and of these, only three provided written informed consent and completed the interviews. One nurse who initially expressed interest did not provide written consent due to a scheduling conflict. The five nurses who did not express interest in the study cited various reasons such as time constraints, workload (n=3), and an inability to commit to follow-up interviews (n=2). Semi-structured interviews were conducted with the three nurses who provided written informed consent. Table 1 presents the participants' characteristics. Table 2 lists the effects and utilization of educational programs. Figure 1 shows a model of the

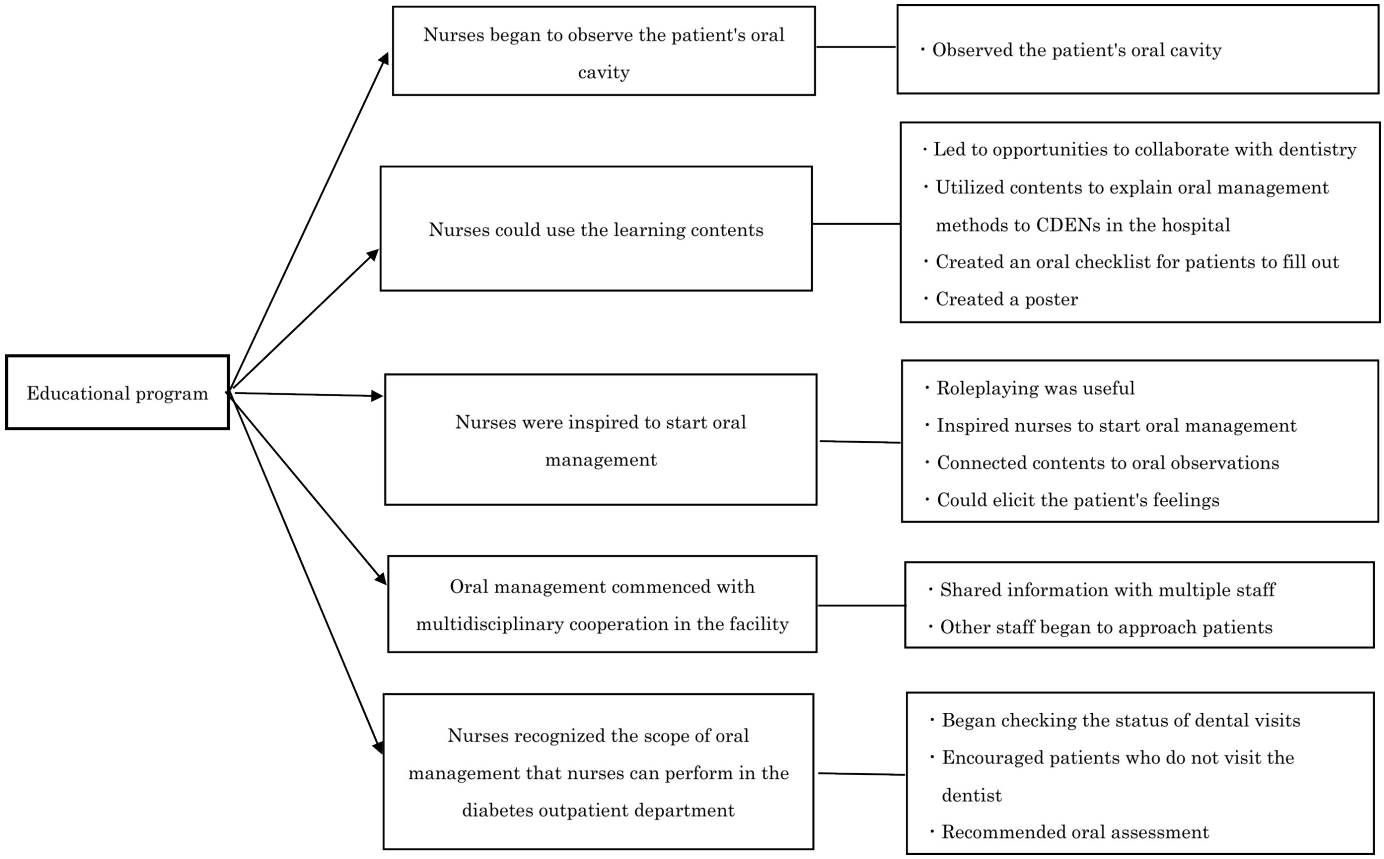

Figure 1 Model of effects and utilization of educational programs

effects and utilization of educational programs.

The effects and utilization of educational programs

Five categories were identified: 1) nurses began to observe the patient's oral cavity, 2) nurses could use the learning contents to collaborate with dentistry and explain procedures to CDNEs in the facility and create an oral checklist and poster, 3) nurses were inspired to start oral management, 4) nurses started oral management with multidisciplinary cooperation in the facility, and 5) and nurses recognized the scope of oral management that nurses could perform in diabetes outpatient departments.

Nurses began to observe the patient's oral cavity.

All participants stated that they began observing the patient's oral cavity after the educational program.

Nurses could use the learning contents to collaborate with dentistry and explain procedures to CDNEs in the facility and create an oral checklist and poster.

Participants stated that the educational program was an opportunity to collaborate with dentistry. The participants explained the oral management methods learned in the educational programs to CDNEs in hospitals. One participant created an oral checklist that patients could complete easily, may have led to dental visits. Another participant created a poster on oral management of diabetes after participating in the educational program. The participants felt that they had more opportunities to talk about oral management with their patients after completing the poster.

Nurses were inspired to start oral management.

The participants admitted that the role-playing conducted in the educational

Table 1 Participants' characteristics

Participants' characteristics		A	B	C
Sex		Male	Female	Female
Age (s)		40	40	40
Work experience as a CDNE[a] (y)		6	6	10
Experience in oral management education of patients with diabetes	Basic nursing education	Yes	No	No
	Study session in the hospital	No	No	No
	Training out of the hospital	Yes	No	Yes
	Society related to diabetes	No	No	Yes
Work institution type		Clinic	Hospital	Hospital
Number of patients visiting an outpatient department specializing in diabetes care per day		150	60	16
Existence of a dentistry department at the work institution		Yes	No	Yes

[a]Note: CDNE: certified diabetes nurse educator

program was useful and provided them with the opportunity to think carefully about how to perform oral management. In addition, the educational program inspired them to start oral management, and they could now connect the contents to oral observations when their patients talked about having difficulty eating because of a lack of teeth. One participant stated that the educational program enabled them to relate to patients in a manner that elicited patients' feelings. The participants acknowledged that their patients were generally aware of their oral problems such as wobbly teeth. The participants also admitted that their patients were not troubled about their oral problems and tended not to seek medical and dental attention until their symptoms became severe. In addition, the participants felt that patients' financial problems made dental visits difficult.

Nurses started oral management with multidisciplinary cooperation in the facility.

The participants stated that they shared information with multiple staff members regarding the relationship among diabetes, periodontal disease, and the oral condition of the patients. One participant stated that other medical staff began to approach patients through oral observations and referrals to dentistry.

Nurses recognized the scope of oral management that nurses can perform in diabetes outpatient departments

The participants realized that the scope of oral management that nurses can perform in diabetes outpatient departments involves checking the status of patients' dental visits and encouraging patients who are aware of their oral problems but do not visit dentists or undergo oral assessments.

Discussion

We identified the effects and utilization of an educational program that aimed to improve nurses' knowledge, skills, and confidence in performing oral assessments based on a previous survey that examined factors contributing to oral management through items developed based on the capability, opportunity, and the motivation–behavior model (17,22,23).

Table 2 Effects and utilization of educational programs

Category	Subcategory	Comments
Nurses began to observe the patient's oral cavity	Observed patient's oral cavity	I observed patients' oral cavity after obtaining permission while confirming the oral checklist written by the patient during the waiting period in the outpatient department. (Nurse C) I observed patients' oral cavity by approaching them in the outpatient department. Since I had never observed before, I think my oral management practice has improved. (Nurse B) When patients talked about difficulty biting, unfitting dentures, or caries, I was allowed to observe their oral cavity. (Nurses A and B)
Nurses could use the learning contents to collaborate with dentistry, explain procedures to CDNEs in the facility, and create an oral checklist and poster	Led to opportunities to collaborate with dentistry	The educational program led to the establishment of a system to refer patients to the dentists. Dental hygienists and doctors cooperated with me, which led to collaboration between medicine and dentistry. (Nurse C) I talked to a dental hygienist about the relationship between diabetes and periodontal disease after the program, and the dental hygienist began to cooperate with me. (Nurse A)
	Explained oral management methods to CDNEs in the hospital	I wrote the points of observation of patients' oral cavity on a small piece of paper and gave them to the CDNEs. (Nurse A) I mentioned to all six CDNEs that I wanted them to encourage to visit the dentist more regularly. (Nurse A)
	Created an oral checklist for patients to fill out	The educational program led to the creation and distribution of an oral checklist that patients could easily answer within 3–5 minutes and that would lead to a dental visit. (Nurse C)
	Created a poster	I decided to create a poster and put it up in both the dental and diabetes outpatient departments after participating in educational program because I thought it might make people more aware of oral management. (Nurse A) I feel like I have more opportunities to talk about oral management with patients after making the poster. (Nurse A)
Nurses were inspired to start oral management	Role-playing was useful	Role-playing helped me visualize how I should something, and I was even more motivated to try oral management. (Nurse C) Role-playing was really useful. (Nurses A and C) Role-playing was great because I was able to think carefully about how to perform oral management through it for the first time. (Nurse A)
	Inspired me to start oral management	I got my first opportunity to start oral management. (Nurses A, B, and C) The educational program inspired me to start oral management. I had no idea how much I should get involved in oral management, not even how to start until I joined the program. (Nurse C) After participating in the program, I thought it is better to actually observe patients' oral cavities and that we need to do more to alert patients to the need to prevent oral problems. (Nurse A) I realized that I should have encouraged my patients to manage their oral health earlier. (Nurse B)
	Connected content with oral observations	I never used to check patients' teeth when I heard from them that they only ate soft foods such as bread, but now I think I should check their teeth. (Nurse B) I was able to observe patients' oral condition when they told me about having difficulty eating due to a lack of teeth. (Nurse A, B)
	Could elicit patient's feelings	Patients are generally aware of their own [oral problems], such as a wobbly tooth. (Nurse B) Patients are not that troubled [about oral problems]. They don't care as long as they can eat, even if they are bleeding or missing teeth. (Nurse B) Patients do not see a dentist about oral problems if it is just a little thing, just like they do not see a doctor until they cannot feel their feet and they start to turn black. (Nurse B) Many patients do not seek dental treatment because of financial problems. (Nurse B)
Nurses started oral management with multidisciplinary cooperation in the facility	Shared information with multiple staff	Doctors and dentists were not very aware of the relationship between diabetes and periodontal disease, but sharing this information increased their interest. (Nurse C) I began to inform the doctor about the oral condition of the patients I observed. (Nurse B)
	Other staff began to approach patients	Some staff member, including technicians, reported having observed the patients' oral cavities. (Nurse A) Some staff members, including dietitians, reported having referred patients to the dentistry. (Nurse A)
Nurses recognized the scope of oral management that they can perform in diabetes outpatient department	Checked the status of dental visits	Nurses can only perform up to check on the status of dental visits. (Nurse B) Nurses need to check that patients make regular dental visits at least annually. (Nurse B)
	Encouraged patients who do not visit the dentist	Nurses can encourage patients who are aware of their oral problems but do not visit the dentist. (Nurse B) Patients need to be informed of the necessity of dental visits. (Nurse A)
	Recommended oral assessment	It would be better if an oral assessment could be done. (Nurse A)

§Note: Comments are excerpts.

Five categories emerged, and the findings were as follows. First, all nurses in this study began to observe the patient's oral cavity. Second, nurses applied the learning contents of educational programs to real clinical situations. Finally, nurses were inspired to start oral management, and this influenced the practice of oral management and utilization of educational programs.

Nine nurses participated in the educational program, and semi-structured interviews were conducted with three nurses. One factor that may have contributed to the low number of participants was that the annual conference related to diabetes nursing was held in a hybrid style, and a typhoon hit the area where the conference was held on the day of the exchange meeting.

Our results revealed that all of the study participants began observing patients' oral cavities after the educational program. Observation and evaluation of oral cavities are essential aspects of oral management support (24). Oral management should be planned based on the daily oral assessment of individual patients, and pre-intervention oral assessment can reduce the incidence and severity of oral complications (27). Educational programs can promote nurses' initiation of oral observation, which is an essential aspect of oral management. The use of the learning

content of the educational program provided an opportunity to collaborate with dentistry and to create an oral checklist for patients and posters. The present results suggest that these behaviors might create opportunities to discuss oral management with patients and encourage dental visits. Role-playing, an approach to teaching and learning, is designed to analyze individual values and behaviors and establish solutions to interpersonal problems (28). The educational program was beneficial to participants as they admitted that the patient–nurse role-playing activity conducted in was useful and provided the opportunity to think carefully about how to perform oral management. In medical education, role-playing provides learners with opportunities to communicate with patients, identify feelings related to various behaviors, and practice new behaviors and attitudes in safe situations that resemble real conditions (28). The present results suggest that participants could learn new practices and attitudes toward oral management through role-playing. Additionally, the findings showed that the educational programs enabled them to relate to patients in a manner that elicited patients' feelings. In this study, the patients with diabetes were generally aware of their oral problems, and this result was unexpected. Since previous studies have reported that patients with diabetes are unaware of their periodontal disease (6,29,30), further studies are required to collect data on these findings. The participants also admitted that their patients were not troubled about oral problems and tended not to seek medical and dental attention until their symptoms became severe. Moreover, financial issues may limit dental visits. The patients' feelings toward oral management as elicited by the nurses in this study may be valuable in considering future strategies to support oral management in patients with diabetes.

Regarding the effects of multidisciplinary cooperation, other medical staff began to approach patients, such as oral observations and referrals to dentistry, through shared information with multiple staff members regarding the relationship between diabetes and periodontal disease and the oral condition of patients. Multi-professional collaboration is also an important aspect of oral management (24). The educational program might help facilitate oral management for patients through multi-professional collaboration, improve the quality of patient education regarding oral management, and promote medical-dental collaboration. Participants stated that the scope of oral management that nurses could perform in diabetes outpatient departments involved checking the status of patients' dental visits and encouraging patients who were aware of their oral problems but did not visit a dentist or undergo oral assessments. Thus, the contents of the educational program need to be further developed by considering nurses' opinions regarding the scope of oral management that they can perform in diabetes outpatient departments.

Our results suggest that this educational program can support nurses practicing oral assessment and may be useful for patient education regarding the oral management of patients with diabetes. If nurses can practice oral management of diabetes on their own initiative by participating in an educational program, they can observe patients' oral cavities and realize early

detection and intervention.

This study has several limitations that should be considered when interpreting the results. First, given that there were only three participants, the findings may not be representative of the broader population of diabetes care nurses. However, the rich and detailed data obtained through the in-depth interviews provided valuable insights into how nurses implemented oral assessment knowledge in their daily practice. Although future studies with larger sample sizes are required to confirm the generalizability of these findings, the small sample size allowed for a deeper analysis of individual experiences. Second, the cross-sectional design of this study prevented examination of the effects and utilization of educational programs. However, further prospective studies are needed to confirm these findings. Future research directions should include:
a large-scale mixed-methods study combining a quantitative assessment of an educational program's effectiveness with a qualitative exploration of implementation experiences,
longitudinal follow-up to examine the sustainability of practice changes, and
3. investigation of organizational factors that facilitate or hinder the implementation of oral assessment practices.

In conclusion, the effects and utilization of an educational program on participants included the following: nurses began to observe the patients' oral cavities, nurses used the learning contents of educational programs in real practice, nurses were inspired to start oral management, and nurses started oral management with multidisciplinary cooperation in the facility. This program is expected to support nurses in practicing patient education regarding the oral management of patients with diabetes.

Declarations

The authors declare no potential conflicts of interest concerning the research, authorship, or publication of this manuscript.

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糖尿病患者への看護師の口腔管理実践に関する教育プログラムの効果：パイロットスタディ

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要旨

看護師が糖尿病患者の口腔管理を実践できるようにするためには、看護師への支援が必要である。本研究では、糖尿病患者の口腔内の評価を可能にするための看護師向けの教育プログラムが、参加した看護師に与えた影響と活用状況を明らかにすることを目的とした。教育プログラムの影響を明らかにするために、糖尿病看護に従事している看護師 3 名を対象に半構造化面接を行った。インタビューから得られたデータは、内容分析を用いて検討された。教育プログラムの効果および活用として、患者の口腔内の観察を開始した、教育プログラムで学習した内容を使用して歯科との連携や施設内の看護師への説明、口腔内チェックリストやポスターの作成に活用できた、口腔管理を始めるきっかけになった、施設内で多職種連携による口腔管理を開始した、看護師が糖尿病外来で実施できる口腔管理の範囲を認識した、の 5 つのカテゴリーが抽出された。本プログラムにより、看護師による糖尿病患者の口腔管理に関する患者教育の実践を支援できることが期待される。

キーワード：糖尿病、教育、看護師、口腔内評価