

# Effect of An Evidence-Based Nursing Intervention on the Diagnosis of Oral Mucositis in the Pediatric Stem Cell Transplant Unit

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## ABSTRACT

**Objective:** This quasi-experimental, single-group study with a pre- and post-repeated measures design was carried out at the Pediatric Stem Cell Transplant Unit of a University Hospital. The study was aimed at investigating the effect of an evidence-based nursing intervention program, held for nurses providing care for pediatric stem cell transplant patients, on their skills in diagnosing oral mucositis (OM). **Methods:** Before training, data were collected from all the nurses using a sociodemographic characteristics questionnaire. Six patients who were admitted to the clinic and started chemotherapy (CT) were followed up for a maximum of 1 month during their hospitalization to find whether the diagnosis of OM was performed. During the intervention stage, the researcher provided nurses with training on the importance of the use of evidence-based research results in the clinic, including evidence regarding OM. After the training, the records of six patients who were admitted to the clinic and started CT were tracked for up to 1 month during their hospitalization to find whether the diagnosis of OM was performed. **Results:** At

the end of the study, the rate of OM diagnosis was performed by nurses, which was 2.8% before the program and increased to 8.7% after the program. The difference between the percentages of performing OM diagnosis by the nurses before and after the program was 5.9%, which was considered statistically significant ( $\chi^2 = 11.004, P < 0.01$ ). The postprogram rate of diagnosis of OM was 3.12 times higher (212% increase) than the preprogram rate ( $P < 0.01$ ). **Conclusions:** One of the most important recommendations of the present study is to provide regular and continuous training sessions for nurses to improve and update their knowledge on oral care. It is also concluded that the establishment of oral diagnosis as a follow-up parameter, similar to vital signs in the clinic, will enable nurses to improve their skills in performing daily diagnosis and keeping proper records of the patients' outcomes.

**Key words:** Oral diagnosing, oral mucositis, pediatric stem cell transplant

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## Introduction

Oral mucositis (OM), the painful inflammation and ulceration of the oral mucous layer, is one of the most common side effects of cancer treatments.<sup>[1-3]</sup> OM develops in 20%–40% of patients receiving chemotherapy (CT), 80% of patients having undergone hematopoietic stem cell transplantation (HSCT), and almost all patients receiving head-and-neck radiotherapy (RT).<sup>[4]</sup> The risk increases if the therapy includes medication such as 5-fluorouracil, methotrexate, etoposide, vinblastine, and doxorubicin.<sup>[3,5]</sup> Mucositis usually begins to develop 7 days after CT application and heals after 21 days.<sup>[6]</sup> The most common adverse effect reported by patients receiving CT is mucositis-related pain.<sup>[7]</sup> Pain lowers the quality of life of patients and causes difficulties in chewing, swallowing, and communicating.<sup>[5,7]</sup> It also adversely affects the patient's adequate nutrition and thus leads to nutrition deficiency and consequent weight loss.<sup>[6,8,9]</sup> There is a significant relationship between mucositis and infection. Bacterial, fungal, or viral infections develop more easily in mucous membranes of patients with neutropenia. The mucositis itself provides a portal of entry for microorganisms and thus creates an environment for the transition from primary infection to systemic infection. OM progresses much more severely with oral infections, especially with herpes simplex virus infections.<sup>[8]</sup> Mucositis-related complications have also been reported to increase mortality rates, the length of hospital stays, and hospital charges.<sup>[7]</sup> In addition, OM adversely affects a person's personal and social life.<sup>[3,5]</sup>

Development of mucositis varies from one patient to the other. Cancer type and the location of the tumor affect mucositis risk. Patients with soft-tissue sarcomas of the head and neck, nasopharynx carcinomas, or non-Hodgkin's lymphomas are at a higher risk of mucositis. Suppression of the patient's immune system due to CT increases the risk of mucositis.<sup>[3]</sup> In addition, malnutrition, periodontal problems, poor oral hygiene, and inadequate salivary gland function have been reported to affect the frequency of OM.<sup>[10,11]</sup> In patients with severe mucositis, the CT medicine dose may be restricted or the therapy could even be delayed.<sup>[4]</sup>

Ideally, every nurse providing care for a patient developing OM should determine its severity and assess the risk by giving priority to preventive measures for OM.<sup>[12]</sup> To prevent the development of OM and to provide care to cure it when it develops, nurses should know the physiopathology of mucositis, risk factors, physical, psychosocial and economic effects, grading systems, and oral care practices. In addition, they should ensure the prevention of OM development and increase the quality of life by monitoring and educating individuals.<sup>[13]</sup> Although the importance of management

of OM is well known, OM management is not carried out adequately in clinics. For instance, in a study conducted by Yildirim, nurses' knowledge on mucositis was determined to be insufficient.<sup>[14]</sup>

The basic principle in nursing is that all nursing care, as OM management, should be evidence based. The Promoting Action on Research Implementation in Health Services (PARIHS) model, developed by Kitson *et al.* and used as a model for initiatives in the present study, provides a comprehensive perspective on how to put research results into practice.<sup>[15]</sup> The main elements of the PARIHS model are "evidence, environment, and facilitation." The evidence dimension, which is in the conceptual framework of the PARIHS, includes research evidence, clinical experience, patient preferences, and local information.<sup>[16]</sup> The environment, which is the institution where the change is implemented, is divided into three main components: understanding the dominant culture, leadership roles, and the institution's approach toward the routine monitoring of systems and services, in other words, evaluation.<sup>[15]</sup> In institutions/environments, which cover these three elements effectively, it is more likely to transfer evidence into practice.<sup>[16]</sup> Facilitation is a technique, in which a person makes things easier for others. This term defines the support needed to help people change their attitudes, habits, skills, ways of thinking, and ways of working.<sup>[15]</sup> In many studies conducted under the conceptual framework of PARIHS, it has been shown that the use of evidence in clinical care has been successfully achieved.<sup>[17-19]</sup>

Although the significance of the diagnosis of OM is well known, clinical observations suggest that there are problems in the way nurses monitor routine OM diagnoses. The purpose of this study was to investigate the effect of an evidence-based nursing intervention program, held for nurses providing care for pediatric stem cell transplant patients, on their skills to diagnose OM.

## Research hypothesis

H1: The evidence-based OM nursing intervention program develops/improves/increases OM diagnosis performing skills of nurses who provide care for pediatric stem cell transplant patients.

- Research variables
- Dependent variables – performance of OM diagnosis
- Independent variables – Evidence-based mucositis management program.

## Methods

This quasi-experimental, single-group study with a pre- and post-repeated measures design was carried out at

the Bone Marrow Transplant Unit of a University Hospital between January 2017 and June 2017.

### Study sample

The sample of the study consisted of all the pediatric patients in the unit and the nurses who took care of them. The unit, in which 12 nurses' work, has six beds. In the unit, every year, about 40–50 patients undergo transplantation. All the patients were included in the study, not only the ones who developed OM. Before training, records of six patients who were admitted to the clinic and started CT were followed up for a maximum of 1 month during their hospitalization to find whether the diagnosis of OM was being performed or not. After training, the records of another six patients who were admitted to the clinic and started CT were tracked for up to 1 month during their hospitalization to find whether the diagnosis of OM was made. Twelve patients' records (before: 360 records, after: 300 records) were examined in total. It was recorded whether the nurses performed oral diagnosis in all patients.

### Data collection tools

In the study, the following data collection tools were used:

#### Sociodemographic characteristics questionnaire

The questionnaire includes 13 items inquiring the sociodemographic characteristics of the nurses who took care of the children that underwent stem cell transplantation.

#### Oral mucositis diagnosis and intervention monitoring form

A form was developed to determine whether and how frequently the diagnosis of OM was performed by the nurses who took care of the children that underwent stem cell transplantation.

#### Children's International Mucositis Evaluation Scale

The scale was developed by Dr. Tomlinson to determine the absence/presence of OM in pediatric patients receiving CT; if mucositis develops, the severity of pain in the mouth/throat due to mucositis and the child's difficulty swallowing his/her saliva, eating, or drinking due to the pain in the mouth/throat. A validity and reliability study of the Turkish version of the scale was performed by Yavuz *et al.*<sup>[1]</sup> The Children's International Mucositis Evaluation Scale (ChIMES) consists of the following six items: (1) degree of oral pain, (2) pain caused by swallowing, (3) pain caused by eating, (4) pain caused by drinking, (5) need and reason for analgesics, and (6) presence/absence of oral cavity ulcers. In this scale, a maximum of 5 and a minimum of 0 points are given to each one of the first 4 items, a maximum of 2 and a minimum of 0 points are given to the 5<sup>th</sup> item, and a maximum of 1 and a minimum

of 0 points are given to the 6<sup>th</sup> item. The possible maximum score to be obtained from the scale when all the items are answered is 23. The higher the total score obtained from the scale, the higher the severity of the mucositis.

#### Treatment-specific daily mouth care protocol for children receiving chemotherapy

The treatment-specific daily mouth care protocol for children receiving CT used by Yavuz and Yılmaz in their study was also used in the present study. In this protocol, instructions about what children should do in the morning, at noon, in the evening, and before going to bed for their mouth care are included in the study.<sup>[2]</sup>

Procedure – The procedure is explained in Table 1.

The treatment-specific daily mouth care protocol for children receiving CT used by Yavuz and Yılmaz in their study was used for the management of OM. OM management training was conducted by the researchers based on this protocol.

### Data analysis

The study data were analyzed with the program SPSS software version 22.0 for Windows (IBM SPSS Statistics V 25, Maltepe, Istanbul, Turkey). For the statistical analysis, numbers, percentage analysis, Pearson's Chi-square test, and rate ratio increases (RRI) were used. OM diagnosis rates were calculated according to the data obtained from the patient's files.

### Ethical approval

In the present study, permission was obtained from the Ethics Committee for NonInterventional Clinical Investigations of the İzmir Katip Çelebi University (Approval No. 296, date: November 16, 2016) and the Ege University Medical Faculty Hospital (Approval No. 23918, date: March 20, 2017). During the data collection phase and after the patients and/or the patients' relatives and nurses were told that their credentials and the study data would be kept confidential, their consent was obtained. Permission to use the Children's International Mucositis Evaluation Scale in the study was obtained from the researcher who developed the scale.

## Results

The results of the study were described as sociodemographic characteristics and rates of performing OM diagnosis by nurses before and after the evidence-based OM management program.

As seen in Table 2, of the nurses participating in the study, 83.3% ( $n = 10$ ) had a bachelor's degree and 66.7% ( $n = 8$ ) worked day and night, alternately. The mean age of the participating nurses was  $30.58 \pm 4.21$  (minimum: 25, maximum: 39) years. The participating nurses' mean length of service in the profession and in the pediatric stem cell

**Table 1: Study procedure**

	Preparation phase	Receiving permissions to conduct the study
Preintervention phase	Pretest	Data were collected from all the nurses working in the bone marrow transplant unit using the sociodemographic characteristics questionnaire The records of six patients admitted to the clinic and started chemotherapy were observed to find whether the diagnosis of oral mucositis was performed or not. (Since the length of their hospital stays was different, the patients were followed up for a maximum of 1 month during their hospitalization)
Intra-intervention phase	Evidence dimension within the conceptual framework of the PARIHS	The nurses were provided with evidence-based information on oral mucositis management. The Children's International Mucositis Evaluation Scale whose Turkish version's validity and reliability study was conducted by Yavuz (2012) was used as a tool for the diagnosis of mucositis. The treatment-specific daily mouth care protocol for children receiving chemotherapy used by Yavuz in her study was used for the management of oral mucositis
	Environment dimension within the conceptual framework of the PARIHS	In the bone marrow transplant unit, there were no evidence-based oral mucositis guidelines. It was made ready to use in the clinic. (Algorithm was printed in large font size and hung in patient rooms and nurse stations, and Oral Mucositis Diagnosis and Intervention Monitoring Forms were printed and put on the nurses' desk). Whether the guidelines were used or not was observed
	Facilitation dimension within the conceptual framework of the PARIHS	The researcher provided nurses with training on the importance of the use of evidence-based research in clinics and evidence on oral mucositis The oncology charge nurse and researcher encouraged the nurses to use oral mucositis guidance
Postintervention phase		The records of six patients who were admitted to the clinic and started chemotherapy were tracked to find whether the diagnosis of oral mucositis was performed or not. (Since the length of their hospital stays was different, the patients were followed up for a maximum of 1 month during their hospitalization)

PARIHS: Promoting action on research implementation in health services

**Table 2: Sociodemographic characteristics of nurses participating in the study**

Characteristics	Nurses working in the unit (n = 12), n (%)	
Gender		
Female	11 (91.7)	
Male	1 (8.3)	
Education status		
Bachelor's degree	10 (83.3)	
Postgraduate	2 (16.7)	
Work schedule		
Always at nights	2 (16.7)	
Always daytime	2 (16.7)	
Day and night alternately	8 (66.7)	
Keeping up with the scientific literature		
Yes	5 (41.7)	
No	7 (58.3)	
Participation in scientific meetings		
Yes	11 (91.7)	
No	1 (8.3)	
Performing research in nursing		
Yes	4 (33.3)	
No	8 (66.7)	
Numeric variables	Minimum-maximum	Mean ±SD
Age (yr)	25-39	30.58±4.21
Length of service in profession (yr)	2-12	6.75±3.73
Length of service in the unit (yr)	1-10	4.08±2.67
The number of shifts per month	0-11	7.17±3.41

SD: Standard deviation

transplant unit was 6.75 ± 3.73 (minimum: 2, maximum: 12) years and 4.08 ± 2.67 (min: 1, max: 10) years, respectively. The mean number of shifts per month was 7.17 ± 3.41 (min: 0, maximum: 11). While 58.3% (n = 7) of the participating nurses stated that they did not regularly keep

up with scientific literature, 91.7% (n = 11) said that they have participated in scientific meetings, and 66.7% (n = 8) stated that they do not do any scientific research activities.

Even though 91.7% of the nurses stated that they had not performed any evidence-based practices, 91.7% stated that they had received information about OM; 75% stated that they received this information during their in-service training, whereas 75% stated that they do not diagnose OM regularly. Among the reasons for not performing OM diagnosis were the absence of standard OM diagnosis parameters in the clinic (88.9%), intensive working environment (excessive workload) (33.3%), and lack of knowledge (11.1%) [Table 3].

The rate of performing OM diagnosis by nurses providing care to pediatric stem cell transplant patients, which was 2.8% before the evidence-based OM management program, became 8.7% after the program. The difference between the percentages of performing OM diagnosis by nurses before and after the program was 5.9%, and this difference was considered statistically significant ( $\chi^2 = 11.004, P < 0.01$ ). The rate of the postprogram OM diagnosis was 3.12 times higher (212% increase) than the preprogram rate [ $P < 0.01$ , Table 4].

Comparison of the frequencies of performing OM diagnosis by nurses in the morning and in the evening before and after the evidence-based practice program revealed that:

- The morning rate, which was 5% before the program, increased to 10.7% after the program and the difference was highly significant ( $P < 0.01$ ); in other words, the rate increased 3.12 times (212% increase) [ $P < 0.05$ , Table 5]
- The evening rate, which was 2.2% before the program, increased to 6.7% after the program and the difference



was statistically significant ( $P < 0.01$ ); in other words, the rate increased 3 times (200% increase) [ $P < 0.05$ , Table 5]. However, this increase was not significant in terms of the confidence interval values

- The rates of performing OM diagnosis in the morning and evening before the program were similar to each other (morning: 3.3%, evening: 2.2%) and the difference was not statistically significant [ $P > 0.05$ , Table 5]
- After the program, the rate of performing OM diagnosis in the morning was higher than that in the evening (morning: 10.7%, evening: 6.7%); however, the difference was not statistically significant [ $P > 0.05$ , Table 5].

## Discussion

The present study was conducted to investigate the effect of an evidence-based practice program held for nurses

providing care for pediatric stem cell transplant patients on their performance of diagnosis of OM, 75% ( $n = 9$ ) of the nurses reported that they did not perform the diagnosis of OM regularly. This result is consistent with the results of other studies in the literature conducted on the same subject. Potting *et al.* found that more than 50% of the nurses who were knowledgeable about oral hygiene did not diagnose their patients.<sup>[20]</sup> Chan *et al.* found that most of the nurses in Singapore believed that good oral hygiene was important to their patients; however, they failed to perform oral hygiene practices.<sup>[21]</sup> Southern found that there was a significant lack of training in terms of oral care in 94.5% of the nurses.<sup>[22]</sup> OM occurs in 20%–40% of patients receiving CT, 80% of people having undergone HSCT, and in almost all people receiving head-and-neck RT.<sup>[4]</sup> Mucositis-related complications have been reported to increase mortality, duration of hospital stays, and hospital charges.<sup>[7]</sup> In addition, OM adversely affects the individual's personal and social life.<sup>[3,5]</sup> The Multinational Association of Supportive Care in Cancer/International Society of Oral Oncology recommends that hematology/oncology physicians and nurses should perform oral diagnosis of patients who have received cancer treatment.<sup>[23]</sup> Every nurse providing care to patients who have developed OM should rate its severity and assess the risks by prioritizing preventive measures for OM.<sup>[12]</sup> In the present study, the reason why nurses failed to perform effective diagnosis of OM may have been due to the fact that OM diagnosis was not one of the routine monitoring parameters, or that the nurses may not have kept record of the diagnosis, even though they might have performed it. It is considered that in stem cell transplantation units, OM diagnosis should be one of the standard and routine monitoring parameters and that using the same parameter by every nurse can positively contribute to their daily oral diagnosis performance.

**Table 3: Nurses' characteristics related to the diagnosis of oral mucositis**

Characteristics	n (%)
Implementation of evidence-based practice in the clinic	
Evidence-based practice is implemented	1 (8.3)
Evidence-based practice is not implemented	11 (91.7)
Obtaining information about oral mucositis	
Yes	11 (91.7)
No	1 (8.3)
Source of information*	
In-service training	9 (75.0)
College/faculty	3 (25.0)
Congress/seminar	2 (16.6)
Course	1 (8.3)
Did not receive any information	1 (8.3)
Performing diagnosis of oral mucositis (self-report)	
Yes	3 (25.0)
No	9 (75.0)

\*>1 option was marked

**Table 4: Comparison of pre- and post-program performing oral mucositis diagnosis rates of nurses ( $n = 360/300$ )**

Diagnosis of mucositis	Preintervention, n (%)	Postintervention, n (%)	$\chi^2/P$	RRI (95% CI)	Z/P
Performed	10 (2.8)	26 (8.7)	11.004/0.001	3.12 (1.53-6.37)	3.128/0.002
Not performed	350 (97.2)	274 (91.3)			

RRI: Rate ratio increases, CI: Confidence interval

**Table 5: Comparison of pre- and post-program performing oral mucositis diagnosis rates of nurses according to daily diagnosis schedule**

Daily diagnosis schedule (h)	Before the program		After the program		$\chi^2/P$	RRI (95% CI)	Z/P
	Performed, n (%)	Not performed, n (%)	Performed, n (%)	Not performed, n (%)			
Morning (between) 8 a.m. and 4 p.m.	6 (3.3)	174 (96.7)	16 (10.7)	134 (89.3)	7.071/0.008	3.20 (1.28-7.97)	2.497/0.013
Evening (between) 4 p.m. and 8 a.m.	4 (2.2)	176 (97.8)	10 (6.7)	140 (93.3)	3.978/0.046	3.00 (0.96-9.37)	1.890/0.059
$\chi^2$		0.411			1.516		
P		0.521			0.218		

RRI: Rate ratio increases, CI: Confidence interval

In the present study, the rate of performing OM diagnosis after the evidence-based practice program was 3.12 times (212% increase) higher than the rate before the program. In the Tringali and Kanaskie's study, the participating nurses' knowledge scores of evidence-based OM management and OM management practices increased significantly after the training.<sup>[24]</sup> In the Potting *et al.*'s study, training given to nurses on OM management reduced their negative attitudes toward oral care and improved their knowledge and skills.<sup>[20]</sup> This increase is encouraging because the training increased the nurses' awareness of oral care. It may be useful to include OM diagnosis as a follow-up parameter in health-care protocols for the continuity of performing OM diagnosis. Chan *et al.* determined that more information is needed on evidence-based oral care standards and that an oral care protocol is necessary to standardize and improve oral care practices.<sup>[21]</sup> According to the study by Farrington, Cullen, and Dawson, evidence-based OM diagnosis guidelines were developed by a multidisciplinary OM committee at Iowa University Hospital, where an evidence-based program was implemented.<sup>[25]</sup> At the end of the program, nurses performed the diagnosis of OM in 99% of the patients.<sup>[25]</sup>

In the present study, according to the nurses' statements, 58.3% ( $n = 7$ ) of them did not regularly keep up with scientific publications, but 91.7% ( $n = 11$ ) participated in scientific meetings. In a study conducted by Kelleci *et al.*, 45.1% of the nurses did not keep up with scientific publications, but 78.9% of them participated in scientific meetings.<sup>[26]</sup> Bahar *et al.* conducted a study with nurses of two university hospitals in different regions of Turkey to determine the barriers for accessing scientific publications. They found that 83% of the nurses in the Hospital of the Faculty of Medicine in the Eastern region and 52.7% of the nurses in the Medical Faculty Hospital in the Western region had difficulty in accessing scientific publications due to economic inadequacy.<sup>[27]</sup>

Of the nurses who participated in the present study, 66.7% ( $n = 8$ ) stated that they do not conduct any scientific research and 91.7% ( $n = 11$ ) stated that no evidence-based intervention is performed in the clinic. Kelleci *et al.* found that while 54.4% of the nurses did not participate in the research, 80.6% utilized research results in patient care.<sup>[26]</sup> Ünlü *et al.* found that 84.9% of the oncology nurses did not do any research on their own, 38.2% were not willing to do research, and 67.5% thought that the institution they worked in did not support nursing-related studies.<sup>[28]</sup>

In the present study, 91.7% ( $n = 11$ ) of the nurses stated that they had received information about OM and 75% ( $n = 9$ ) stated that their source of information was in-service trainings. Although the majority of the nurses

stated that they had received information about OM, it is disappointing that the number of nurses who performed the diagnosis of OM was very low ( $n = 3$ ). Potting *et al.* found that more than 50% of the nurses knowledgeable about oral hygiene did not diagnose their patients.<sup>[20]</sup> Chan *et al.* found that only 66.3% of the nurses were trained in oral care and more than 65.8% believed that it was crucial to participate in appropriate oral hygiene training.<sup>[21]</sup> McGuire demonstrated that not only a lack of knowledge but also confidence in traditional practices, inconsistencies in oral diagnosis, presence of different oral care practices, inadequacies in evidence, noncompliance with universal oral care standards, managerial and clinical problems, and lack of interdisciplinary cooperation affected the management of OM.<sup>[29]</sup> Therefore, it may be useful to carry out studies aimed at revealing the factors, apart from lack of knowledge, that prevent nurses from making oral diagnosis.

## Conclusion

According to the results of the present study, the rate of performing diagnosis of OM by nurses who provided care for pediatric stem cell transplantation patients was 2.8% before the evidence-based OM management program and increased to 8.7% after the program. The difference between the percentages of OM diagnosis performed by nurses before and after the program was 5.9%, and the difference was considered statistically significant ( $\chi^2 = 11.004$ ,  $P < 0.01$ ). The rate of OM diagnosis performed by the nurses after the program was 3.12 times (212% increase) higher than the rate before the program ( $P < 0.01$ ). This result confirmed the research hypothesis H1 that stated: "The evidence-based OM management program develops/improves/increases OM diagnosis skills of nurses who provide care for pediatric stem cell transplant patients."

Nurses providing care for patients having undergone stem cell transplantation should use evidence-based practices, find appropriate research evidence, aim at developing statistical evidence when interpreting the research findings, and assess the effect of the initiative on the patient. Since evidence-based care and symptom management can improve OM to a great extent, nurses should assume responsibility for the use of evidence-based practices in the prevention, treatment, and care of OM.

The most important recommendation of the present study is to provide regular and continuous training sessions for nurses to improve and update their oral care knowledge. In addition, determination of oral diagnosis as a follow-up parameter, similar to vital signs, will improve nurses' skills in performing daily diagnosis, making possible to keep records of the patients' outcomes. It is also recommended

that clinical arrangements should be made in health policies to support the management of OM.

In the present study, only evidence-based practice program effects on nurses' performance of oral diagnosis were investigated. Thus, it is recommended that in the future, observational studies aiming to improve the overall management of OM should be conducted.

### Limitations

In the present study, it was only observed whether the nurses performed the diagnosis of OM. Patients were neither observed nor compared in terms of developing OM. The research was conducted in a small sample of a single center.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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