

Scientific Research Report

Validity of Simple Self-Reported Periodontal Status Questions



Attawood Lertpimonchai^{a,b}, Supang Tuntrakul^a, Sasivimol Rattanasiri^c,
Pimchanok Sutthiboonyapan^{a,b}, Prin Vathesatogkit^d, Artit Udomsak^e,
Kanoknadda Tavedhikul^{a,b*}

^a Department of Periodontology, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand

^b Center of Excellence in Periodontal Disease and Dental Implant, Chulalongkorn University, Bangkok, Thailand

^c Department of Clinical Epidemiology and Biostatistics, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

^d Department of Medicine, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

^e Medical and Health Division, Electric Generation Authority of Thailand, Nonthaburi, Thailand

ARTICLE INFO

Article history:

Received 8 April 2022

Received in revised form

3 September 2022

Accepted 30 October 2022

Available online 29 November 2022

Key words:

Diagnosis

Epidemiology

Periodontitis

Self-assessment

Self-report

ABSTRACT

Objective: The aim of this research was to evaluate the validity of the questions developed by Thai periodontists on self-reported periodontal status and symptoms in identifying severe periodontitis amongst adults in Thailand.

Methods: Registered Electricity Generating Authority of Thailand (EGAT) employees completed medical examinations and full-mouth periodontal examinations. They also were interviewed using a self-reported questionnaire that was developed by Thai periodontists. The questions pertained to their periodontal status and symptoms comprising swollen gums, bad breath, loose teeth, bleeding on brushing, painful gums, and pus or abscesses. The participants were categorised as having nonsevere and severe periodontitis according to the Centers for Disease Control and Prevention in partnership with the American Academy of Periodontology (CDC/AAP) case definitions. Self-reported periodontal status and symptom results were compared with actual periodontal status. The area under the receiver operating characteristic curve (AUROCC), sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated.

Results: A total of 1393 EGAT employees participated in this study. The questions on self-reported periodontal status and all symptoms poorly identified patients with severe periodontitis, with an AUROCC of 0.52 to 0.60. The sensitivity was 5.0% to 40.2%; however, the specificity was good, at 73.2% to 99.1%. The validity of the self-reported questions was comparable amongst the sex, education, and income subgroups.

Conclusions: This study demonstrated that self-reported periodontal status and symptoms were inadequate in identifying patients with severe periodontal disease.

© 2022 The Authors. Published by Elsevier Inc. on behalf of FDI World Dental Federation.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

Periodontal disease is an inflammatory disease caused by an imbalance in the host immune response to periodontal pathogens.¹ The early signs of periodontal disease are red gingiva and gingival bleeding.² In general, the course of the disease is relatively slow with minimal symptoms, which might result in patients being unaware of disease initiation and progression.³ Hence, individuals only notice the presence of periodontal disease when it develops to the advanced stage

* Corresponding author. Kanoknadda Tavedhikul, Department of Periodontology, Faculty of Dentistry, Chulalongkorn University, 34 Henri-Dunant Road, Pathumwan, Bangkok 10330, Thailand.

E-mail address: kanok.kanok@gmail.com (K. Tavedhikul).

Attawood Lertpimonchai: <http://orcid.org/0000-0003-2501-1534>

Pimchanok Sutthiboonyapan: <http://orcid.org/0000-0003-4094-8210>

Kanoknadda Tavedhikul: <http://orcid.org/0000-0001-8560-5874>

<https://doi.org/10.1016/j.identj.2022.10.006>

0020-6539/© 2022 The Authors. Published by Elsevier Inc. on behalf of FDI World Dental Federation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

and might present moderate to severe symptoms, such as gingival swelling, pus discharge, or tooth mobility.⁴

The conventional diagnosis of periodontal diseases aims to address aetiologic factors, clinical signs of inflammation, and periodontal destruction. This usually requires a full-mouth examination measuring bleeding on probing (BOP), probing depth (PD), and clinical attachment level (CAL),⁵ which might be a time-consuming protocol and underutilised by general practitioners.⁶⁻⁸ Self-report is a widely used method in medical surveillance. It is found to be valid in assessing serious disease conditions and chronic diseases requiring regular management.^{9,10} Self-report is also used as alternative method in screening oral health condition. It was shown to be reasonably valid for number of teeth remaining, fillings, and root canal treatment, whereas it was less so in assessing periodontal disease and dental caries.^{11,12}

The constructive prediction models, which combined multiple self-reported questions and other participants' characteristics, showed moderate to good predictive ability.^{6,7} Various models have been developed and suggested as screening tools for periodontitis in many populations.¹²⁻²¹ These models would be substantially beneficial in identifying periodontal disease in a large group of the population.^{6,7} However, they have not been widely used in the actual clinical setting. Mostly, the decision-making process of clinicians is intuitive rather than analytical. In addition, high-workload environments may not allow smooth integration of prediction models into the clinician's workflow.²²

Thus, in practice, researchers opted for a few simple questions. The most common question used to assess self-reported periodontal status is "Do you think you have gum disease?"^{11-21,23} Apart from periodontal status, presence of periodontal symptoms was considered in the additional screening questions for periodontitis. These items were engaging because they were simple and routinely queried in a clinical environment. However, their predictive performance had not been specifically investigated, and results from previous studies were inconclusive. Although, a moderate to high level of specificity was consistently reported, the sensitivity varied across studies from 18% to 71%.¹²⁻²¹ The heterogeneity of sensitivity values may be associated with various periodontitis case definitions used and differences of oral health perceptions across populations.

Therefore, the aim of this diagnostic study was to evaluate the validity of the simple questions developed by Thai periodontists on self-reported periodontal status and symptoms including gingival swelling, halitosis, tooth mobility, bleeding on brushing, painful gums, and pus exudate in identifying severe periodontitis amongst adults in Thailand.

Methods

This cross-sectional study used the secondary data from the cohort of Electricity Generating Authority of Thailand (EGAT) employees.²⁴ Only the data from the survey in 2018 were included in our analysis. The study protocol was approved by the Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (HREC-DCU 2020-020). This study was conducted as a cross-sectional study that conformed with the STROBE (Strengthening the Reporting of Observational

Studies in Epidemiology) guidelines for reporting observational studies (Appendix A).

Study population

EGAT employees who registered for the health survey in 2018 (EGAT 2/5) and completed the periodontal self-reported questions interview and the periodontal examination were included. Participants were excluded from the study if they were fully edentulous or had a contraindication for periodontal examination, such as being at high risk for infectious endocarditis or requiring antibiotic prophylaxis prior to periodontal examination.²⁵ Eligible participants underwent medical and oral examinations and were interviewed using the health questionnaires.

Interview with periodontal self-reported questions

A set of questions concerning self-reported periodontal status and oral health behaviours was adapted from previous studies.^{13-15,17,18,20,23} All selected items were then modified and translated into the Thai language by periodontists. Structure, sequence, understanding, and linguistics of questions were evaluated by the test-retest reliability amongst a group of 30 patients who were attending as general patients at Faculty of Dentistry, Chulalongkorn University. Then, the pilot testing of the questionnaire was performed and reevaluated in the 2017 EGAT survey. These questions are detailed in Appendix B in both English and Thai.

In this study, only the items concerning self-reported periodontal status and periodontal symptoms were analysed. For self-reported periodontal status, the participants were asked what they thought of their current gum health, whether there was no problem, or whether they had gum disease. If the response was that they "do not know," information about the common features of periodontal disease would be provided. Afterwards, they were questioned about their perception on current symptoms comprising swollen gums, bad breath, loose teeth, bleeding on brushing, gum pain, and pus from their gums. Only "yes" or "no" answers were allowed for each item of current periodontal symptoms.

Participants were interviewed individually in Thai by 2 trained dental assistants without time constraints prior to their periodontal examination. The examiners were totally blinded to the questionnaire responses.

Periodontal examination

The examination consisted of the number of remaining teeth, plaque score, BOP, PD, and recession (RE). The PD and RE were measured using a UNC-15 periodontal probe at 6 sites per tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, and distolingual). All teeth were examined, except for third molars and retained roots. Standardisation for periodontal measurements was performed amongst 8 periodontists. The weighted kappa (± 1 mm) coefficients of intra-examiner reliability on PD and RE were 0.86 to 1.00 and 0.91 to 1.00, respectively. Additionally, the weighted kappa coefficients of inter-examiner reliability on PD and RE were 0.74 to 1.00 and 0.72 to 1.00, respectively.

Table 1 – Distribution of baseline demographic characteristics in each periodontal category.

Characteristics	Total N* (%)	Non-severe periodontitis	Severe periodontitis
Sex			
Female	442 (31.7)	342 (37.6)	100 (20.7)
Male	951 (68.3)	568 (62.4)	383 (79.3)
Educational level			
Less than high school	162 (12.2)	71 (8.2)	91 (20.0)
High school/vocational	425 (32.1)	244 (28.0)	181 (40.0)
Bachelor's degree or higher	737 (55.7)	556 (63.8)	181 (40.0)
Income (USD/year)			
<7500	93 (7.0)	50 (5.8)	43 (9.5)
7500–18,500	138 (10.5)	72 (8.3)	66 (14.6)
≥18,500	1088 (82.5)	745 (85.9)	343 (76.9)
Diabetes mellitus			
No	1157 (86.9)	774 (88.6)	383 (83.8)
Yes	174 (13.1)	100 (11.4)	74 (16.2)
Smoking status			
Nonsmoker	807 (58.1)	596 (65.6)	211 (44.0)
Former smoker	415 (29.9)	249 (27.4)	166 (34.6)
Current smoker	166 (12.0)	63 (7.0)	103 (21.4)

* Total number in study sample may vary depending on missing values.

The severity of periodontitis was determined according to the Centers for Diseases Control and Prevention and American Academy of Periodontology (CDC/AAP) case definitions.²⁶ Participants with “severe periodontitis” were categorised into the severe periodontitis group. Participants with “no,” “mild,” and “moderate periodontitis” were categorised into the non-severe periodontitis group.

Statistical analysis

Periodontal parameters between participants who reported the absence of gum disease and those who reported having gum disease were compared by independent-samples *t* test or Mann–Whitney *U* test, where appropriate. The response to each question was compared with the participant's actual

periodontal condition using the chi-square test. A *P* value <.05 was considered statistically significant. Then, the area under the receiver operating characteristic curve (AUROCC), sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated from self-reported periodontal status and symptoms questions. All analyses were performed using SPSS version 22.

Results

Of the 1479 employees registered for the health survey, 36 declined to participate in either the medical or dental examination, 4 were excluded due to a medical contraindication for periodontal examination, and 6 were fully edentulous. Forty patients had an incomplete record on either the periodontal

Table 2 – Periodontal parameters according to self-reported periodontal status.

Periodontal parameters	Self-reported periodontal status		P*
	No problem (n = 1172)	Periodontal disease present (n = 221)	
Number of remaining teeth	22.9 ± 6.5	22.5 ± 5.6	.525
Plaque score (%)	77.8 ± 20.1	79.9 ± 19.2	.320
Bleeding score (%)	38.1 (0.0, 100.0)	40.4 (0.9, 100.0)	.555
PD (mm)	3.0 ± 0.7	3.2 ± 0.8	.048
% sites with PD ≥6 mm	1.6 (0.0, 38.6)	7.0 (0.0, 69.2)	.016
CAL (mm)	3.9 ± 1.4	4.1 ± 1.2	.190
% sites CAL ≥5 mm	20.8 (1.2, 100.0)	23.8 (2.5, 97.6)	.121

PD, probing depth; CAL, clinical attachment level.

Results are mean ± SD or median (minimum, maximum) depending on the data distribution.

* *t* test/Mann–Whitney *U* test.

Table 3 – Self-reported periodontal status and symptoms according to actual periodontal status.

	Total N (%)	Non-severe periodontitis	Severe periodontitis	P*
Self-reported questions				
1. Do you think you might have gum disease?				
No problem	1172 (84.1)	815 (89.6)	357 (73.9)	<.001
Having gum disease	221 (15.9)	95 (10.4)	126 (26.1)	
2. Currently, do you have any of these symptoms?				
2.1 Swollen gum				
No	1248 (89.6)	850 (93.4)	398 (82.4)	<.001
Yes	145 (10.4)	60 (6.6)	85 (17.6)	
2.2 Bad breath				
No	960 (68.9)	671 (73.7)	289 (59.8)	<.001
Yes	433 (31.1)	239 (26.3)	194 (40.2)	
2.3 Wobbly tooth				
No	1218 (87.4)	859 (94.4)	359 (74.3)	<.001
Yes	175 (12.6)	51 (5.6)	124 (25.7)	
2.4 Bleeding on brushing				
No	1220 (87.6)	825 (90.7)	395 (81.8)	<.001
Yes	173 (12.4)	85 (9.3)	88 (18.2)	
2.5 Gum pain				
No	1237 (88.8)	839 (92.2)	398 (82.4)	<.001
Yes	156 (11.2)	71 (7.8)	85 (17.6)	
2.6 Pus from gum				
No	1361 (97.7)	902 (99.1)	459 (95.0)	<.001
Yes	32 (2.3)	8 (0.9)	24 (5.0)	
Combination of symptoms				
At least 1 symptom				
No	805 (57.8)	590 (64.8)	215 (44.5)	<.001
Yes	588 (42.2)	320 (35.2)	268 (55.5)	
At least 2 symptoms				
No	1130 (81.1)	796 (87.5)	334 (69.2)	<.001
Yes	263 (18.9)	114 (12.5)	149 (30.8)	
At least 3 symptoms				
No	1261 (90.5)	863 (94.8)	398 (82.4)	<.001
Yes	132 (9.5)	47 (5.2)	85 (17.6)	
At least 4 symptoms				
No	1320 (94.8)	890 (97.8)	430 (89.0)	<.001
Yes	73 (5.2)	20 (2.2)	53 (11.0)	
At least 5 symptoms				
No	1350 (96.9)	899 (98.8)	451 (93.4)	<.001
Yes	43 (3.1)	11 (1.2)	32 (6.6)	
At least 6 symptoms				
No	1378 (98.9)	908 (99.8)	470 (97.3)	<.001
Yes	15 (1.1)	2 (0.2)	13 (2.7)	

* Chi-square test.

examination or the self-reported questions. Therefore, the data from 1393 participants were analysed (Supplemental Figure 1).

The demographic data are presented in Table 1. The study comprised 1393 patients, with a mean age of 61.1 ± 4.4 years (range, 53–75 years), and 68% were male. The educational level was mostly high school and bachelor's degree with an income of ≥18,500 USD/y. More than half of the participants were nonsmokers, and 12.0% (n = 166) were current smokers.

The periodontal parameters in each self-reported periodontal status group are seen in Table 2. The number of teeth, plaque score, bleeding score, and mean CAL were comparable between the 2 groups. However, the mean PD (3.0 vs 3.2 mm) and proportion of sites with PD ≥6 mm (1.6% vs 7.0%) was significantly higher in the group who reported having periodontal disease.

Although 15.9% (n = 221) of total participants reported that they had gum disease, the periodontal examination revealed that 34.7% (n = 483) had severe periodontitis. The distribution of the self-reported periodontal status and symptoms according to the participants' actual periodontal status is presented in Table 3. Amongst participants with severe periodontitis, 26.1% (95% CI, 22.2–30.3) reported having gingivitis/periodontitis, whereas the remaining 73.9% did not think that they had the disease. In addition, 55.5% of the participants with severe periodontitis reported having at least 1 periodontal symptom. Halitosis (bad breath) was the most frequently reported symptom (40.2%) by participants with severe periodontitis, and only 5.0% reported having pus from their gums.

The AUROC, sensitivity, specificity, PPV, NPV, and accuracy of the self-reported periodontal status and symptoms are presented in Table 4. The self-reported periodontal status question demonstrated a low discrimination ability, with an

Table 4 – AUROCC, sensitivity, specificity, predictive values, and accuracy of self-reported periodontal status and symptoms.

Self-reported	AUROCC (95% CI)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Self-reported periodontal status	0.58 (0.56–0.60)	26.1	89.6	57.0	69.5	67.6
Symptoms						
Swollen gum	0.56 (0.54–0.57)	17.6	93.4	58.6	68.1	67.1
Bad breath	0.57 (0.54–0.60)	40.2	73.7	44.8	69.9	62.1
Wobbly tooth	0.60 (0.58–0.62)	25.7	94.4	70.9	70.5	70.6
Bleeding on brushing	0.54 (0.52–0.56)	18.2	90.7	50.9	67.6	65.5
Gum pain	0.55 (0.53–0.57)	17.6	92.2	54.5	67.8	66.3
Pus from gum	0.52 (0.51–0.53)	5.0	99.1	75.0	66.3	66.5
Combined symptoms						
≥1 symptom	0.60 (0.57–0.63)	55.5	64.8	45.6	73.3	61.6
≥2 symptoms	0.59 (0.57–0.61)	30.9	87.5	56.7	70.4	67.8
≥3 symptoms	0.56 (0.54–0.58)	17.6	94.8	64.4	68.4	68.1
≥4 symptoms	0.54 (0.53–0.55)	11.0	97.8	72.6	67.4	67.7
≥5 symptoms	0.53 (0.52–0.54)	6.6	98.8	74.4	66.6	66.8
6 symptoms	0.51 (0.50–0.52)	2.7	99.8	86.7	65.9	66.1

AUROCC, area under the receiver operating characteristic curve; PPV, positive predictive value; NPV, negative predictive value.

AUROCC of 0.58, that is, using the self-reported periodontal status had 58% probability of correctly identifying patients with severe periodontitis. When evaluating the predictive ability of the periodontal symptoms, the AUROCC varied amongst symptoms, with 0.52 to 0.60 (Supplemental Figure 2). There was a 52% to 60% chance that the participants who reported having any symptom actually had severe periodontitis. The highest sensitivity amongst the symptoms was 40.2% for bad breath. In contrast, the specificity of all the periodontal symptoms asked about was excellent, except for bad breath, which had moderate specificity (73.7%). No combinations of any of the periodontal symptoms increased the discriminative ability of the diagnostic tools in terms of AUROCC and sensitivity.

The subgroup analysis based on sex, education level, and income indicated that the AUROCCs of self-reported periodontal status were similar amongst the subgroups, with 0.57 to 0.60 (Table 5). The sensitivity and specificity rates did not improve with either increased income or increased education level.

Discussion

This study evaluated the performance of simple questions on self-reported periodontal status and symptoms in identifying participants with severe periodontitis in Thailand. Our results indicated that self-reported periodontal status had low validity for identifying periodontitis, and the performance was not affected by sex, income, or education level. Moreover, questions about an individual's periodontal symptoms also had a low level of validity, based on sensitivity and AUROCC.

According to the CDC-AAP case definitions, patients with severe periodontitis had an increased risk of disease progression and tooth loss. Prompt diagnosis and proper periodontal treatment should be provided. Therefore, it would be of significant benefit if the screening tool could identify patients with severe periodontitis. Because periodontal status questions were self-reported, the responses mainly relied on the perception of patients. Amongst those with mild to moderate periodontitis, the symptoms may be much less pronounced and may not be

noticed. Hence, in cases in which all stages of severity were combined, the self-reported questions would achieve lower accuracy and lower sensitivity (Supplemental Table 1).

When assessing the performance of our simple self-reported questions, we found that most of the disease-free participants reported not having gum disease or not having symptoms (high true-negative rate); however, a low proportion of patients with gum disease reported having the disease or having disease related symptoms (high false-negative rate). Our results showed a poor ability of self-reported periodontal status and symptoms to identify cases of severe gum disease, with an AUROCC of 0.52 to 0.60. Our findings were comparable with previous studies that demonstrated that the AUROCC from a single question on self-reported periodontal status ranged from 0.57 to 0.64.^{13,17,19,20}

Ideally, screening tools should have high sensitivity and specificity. However, sensitivity and specificity occasionally have an inverse relationship. To select the appropriate

Table 5 – Subgroup analysis of performance of self-reported periodontal status.

Subgroup	AUROCC (95% CI)	Sensitivity (%)	Specificity (%)
Total participants	0.58 (0.56–0.60)	26.1	89.6
Sex			
Male	0.58 (0.55–0.60)	26.6	88.6
Female	0.58 (0.53–0.62)	24.0	91.2
Education level			
Less than high school	0.60 (0.54–0.66)	29.7	90.1
High school/vocational	0.59 (0.55–0.62)	26.5	91.0
Bachelor's degree or higher	0.57 (0.54–0.61)	25.4	89.6
Income (USD/year)			
<7500	0.58 (0.50–0.66)	27.9	88.0
7500–18,500	0.57 (0.50–0.63)	27.3	86.1
≥18,500	0.59 (0.56–0.61)	26.5	90.5

AUROCC, area under the receiver operating characteristic curve.

screening tools based on sensitivity and specificity, seriousness of disease and treatments must be considered. A test with high sensitivity achieves a low false-negative rate, whilst high specificity achieves a low false-positive rate.²⁷ With periodontitis, a high-prevalence and low-morbidity disease, many people have the disease but are unaware of it. Predictable treatment outcomes can be expected especially in early stages, and there are few adverse events related to treatment. Hence, periodontitis surveillance should identify and enroll as many high-risk participants as possible and then persuade them to have a standard periodontal examination and undergo appropriate treatment. Thus, a self-assessment screening tool with high sensitivity is preferable.

When focused on a question concerning self-reported periodontal status, previous studies usually reported the acceptable specificity rate^{6,7}; however, the sensitivity varied widely across studies from a poor to a fair level. Our results demonstrated poor sensitivity, which concurred with a majority of studies,^{12-15,17,19} although they contrasted with others.^{16,18,20,21} Wu et al²⁰ developed the prediction model in a Chinese population using the CDC-AAP periodontal case definitions. The question "Do you think you have gum disease?" was an item within their final model. Their results showed that the sensitivity of this individual question to detect moderate to severe periodontitis was modest, at around 64%. However, the small sample size of only 114 participants was a limitation. Joshipura et al¹⁶ validated the self-report question amongst health professionals including physicians, dentists, pharmacists, and veterinarians. From 140 total participants, 68 were classified as having periodontitis based on bitewing radiographs. Amongst patients with periodontitis, 71% reported that they had had periodontal disease with bone loss. This could imply that this single question was suitable for periodontitis screening in a group of health care professionals who had a good perception of their periodontal status. When several periodontal symptoms were combined, we found that the sensitivity was increased similarly with the previous study. Saka-Herrán et al found that the combination of 2 to 4 periodontal symptoms had high accuracy (AUROC, 0.73–0.87) and can also improve the sensitivity (66.7%–90.2%).¹⁸ However, our analysis indicated that its validity was still low, with a sensitivity of 55.5%.

Based on our sensitivity and specificity results derived from Thai adults, simple self-report questions are not appropriate screening tools for severe periodontitis. We also found that periodontitis self-recognition remained low even in the high-income and high-education groups. These results indicate that increased income and education level was not associated with increased periodontal health perception amongst our population.

As mentioned above, several studies have suggested constructing prediction models, which had more reliable accuracy from multiple self-reported questions, demographic characteristics, and oral health care behaviours.^{6,7} These prediction models had moderate to good predictive value for periodontitis prevalence (AUROC, 0.7–0.9; sensitivity, 75%–90%; specificity, 60%–90%).^{6,7,11,13,17-19,21,23} From our findings, using only independent and simple questions was obviously inferior to modeling the risk score. The risk model modality should be made simpler and promoted in clinical practice and community settings for more valid periodontitis screening.

There are several reasons for the poor performance of the self-report questions. The symptoms of periodontal diseases may not be obvious to patients.^{28,29} Earlier studies reported low self-awareness of periodontal status amongst patients with periodontitis. Less than a quarter of patients noticed their periodontal symptoms.^{15,30} Furthermore, there are no specific symptoms of periodontal diseases. Periodontitis may be confused with other dental disease, for example, an endodontic lesion or impacted tooth. Last, lacking knowledge or having insufficient information provided by dentists regarding periodontal health may be related to patients low awareness of periodontal disease. Thus, even when an individual notices a symptom, they may not realise the association with the disease. Previous studies found that 60% to 80% of patients lacked knowledge concerning the cause of periodontal disease, its symptoms, and its treatment. In addition, most patients had never been educated about periodontal diseases by a dentist, including those who had regular annual dental visits.^{3,31} This indicates the need to improve dental and periodontal awareness and education for better self-care and early disease detection.

The main strength of our study was the large sample size. In addition, our outcome was measured in a valid manner according to full-mouth examinations and standard case definitions. However, it also had some limitations. Our samples were derived from a specific cohort of workers. Thus, generalisation should be limited within middle- to high-socioeconomic classes of Thai adults. Other periodontal parameters such as tooth mobility and gingival inflammation were not recorded. Hence, we could not compare periodontal symptoms related to these parameters. Moreover, the self-reported periodontal status relied on only one question, and common features of periodontal disease were explained only to individuals who asked (3%–4% of total participants). Information bias may be possible. However, a systematic protocol for developing the set of questions as well as strict and trained interview procedures were performed to minimise that bias.

In conclusion, this study reveals that the self-reported periodontal status and symptoms did not effectively identify patients with severe periodontitis in Thailand. Further investigations need to be conducted to develop a set of questions that could offer better validity in detecting periodontal disease, which would be of substantial benefit and practical as a periodontal screening tool.

Conflict of interest

None disclosed.

Supplementary materials

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.identj.2022.10.006](https://doi.org/10.1016/j.identj.2022.10.006).

REFERENCES

1. Kornman KS. Mapping the pathogenesis of periodontitis: a new look. *J Periodontol* 2008;79:1560–8.

2. Kinane DF. Causation and pathogenesis of periodontal disease. *Periodontol* 2000;25:8–20 2001.
3. Varela-Centelles P, Diz-Iglesias P, Estany-Gestal A, et al. Periodontitis awareness amongst the general public: a critical systematic review to identify gaps of knowledge. *J Periodontol* 2016;87:403–15.
4. Kumarswamy A, Jin L, Iacono V, et al. Group E. Consensus paper. Interprofessional education and multidisciplinary teamwork for prevention and effective management of periodontal disease. *J Int Acad Periodontol* 2015;17:84–6.
5. Caton JG, Armitage G, Berglundh T, et al. A new classification scheme for periodontal and peri-implant diseases and conditions - introduction and key changes from the 1999 classification. *J Periodontol* 2018;89(Suppl 1):S1–8.
6. Abbood HM, Hinz J, Cherukara G, et al. Validity of self-reported periodontal disease: a systematic review and meta-analysis. *J Periodontol* 2016;87:1474–83.
7. Blicher B, Joshupura K, Eke P. Validation of self-reported periodontal disease: a systematic review. *J Dent Res* 2005;84:881–90.
8. Wolf DL, Lamster IB. Contemporary concepts in the diagnosis of periodontal disease. *Dent Clin North Am* 2011;55:47–61.
9. Bergmann MM, Jacobs EJ, Hoffmann K, et al. Agreement of self-reported medical history: comparison of an in-person interview with a self-administered questionnaire. *Eur J Epidemiol*. 2004;19:411–6.
10. Okura Y, Urban LH, Mahoney DW, et al. Agreement between self-report questionnaires and medical record data was substantial for diabetes, hypertension, myocardial infarction and stroke but not for heart failure. *J Clin Epidemiol* 2004;57:1096–103.
11. Genco RJ, Falkner KL, Grossi S, et al. Validity of self-reported measures for surveillance of periodontal disease in two western New York population-based studies. *J Periodontol* 2007;78:1439–54.
12. Pitiphat W, Garcia RI, Douglass CW, et al. Validation of self-reported oral health measures. *J Public Health Dent* 2002;62:122–8.
13. Cyrino RM, Miranda Cota LO, Pereira Lages EJ, et al. Evaluation of self-reported measures for prediction of periodontitis in a sample of Brazilians. *J Periodontol* 2011;82:1693–704.
14. Dietrich T, Stosch U, Dietrich D, et al. The accuracy of individual self-reported items to determine periodontal disease history. *Eur J Oral Sci* 2005;113:135–40.
15. Gilbert AD, Nuttall NM. Self-reporting of periodontal health status. *Br Dent J* 1999;186:241–4.
16. Joshupura KJ, Douglass CW, Garcia RI, et al. Validity of a self-reported periodontal disease measure. *J Public Health Dent* 1996;56:205–12.
17. Montero E, La Rosa M, Montanya E, et al. Validation of self-reported measures of periodontitis in a Spanish population. *J Periodontol Res* 2020;55:400–9.
18. Saka-Herrán C, Jané-Salas E, González-Navarro B, et al. Validity of a self-reported questionnaire for periodontitis in Spanish population. *J Periodontol* 2020;91:1027–38.
19. Taylor GW, Borgnakke WS. Self-reported periodontal disease: validation in an epidemiological survey. *J Periodontol* 2007;78:1407–20.
20. Wu X, Weng H, Lin X. Self-reported questionnaire for surveillance of periodontitis in Chinese patients from a prosthodontic clinic: a validation study. *J Clin Periodontol* 2013;40:616–23.
21. Iwasaki M, Usui M, Ariyoshi W, et al. Author correction: validation of a self-report questionnaire for periodontitis in a Japanese population. *Sci Rep* 2021;11:17673.
22. Kappen TH, van Loon K, Kappen MA, et al. Barriers and facilitators perceived by physicians when using prediction models in practice. *J Clin Epidemiol*. 2016;70:136–45.
23. Eke PI, Dye BA, Wei L, et al. Self-reported measures for surveillance of periodontitis. *J Dent Res* 2013;92:1041–7.
24. Vathesatogkit P, Woodward M, Tanomsup S, et al. Cohort profile: the electricity generating authority of Thailand study. *Int J Epidemiol* 2012;41:359–65.
25. Wilson W, Taubert KA, Gewitz M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *J Am Dent Assoc* 2008;139(Suppl):3s–24s.
26. Eke PI, Page RC, Wei L, et al. Update of the case definitions for population-based surveillance of periodontitis. *J Periodontol* 2012;83:1449–54.
27. Saah AJ, Hoover DR. “Sensitivity” and “specificity” reconsidered: the meaning of these terms in analytical and diagnostic settings. *Ann Intern Med* 1997;126:91–4.
28. Al Habashneh R, Khader Y, Hammad MM, et al. Knowledge and awareness about diabetes and periodontal health among Jordanians. *J Diabetes Complications* 2010;24:409–14.
29. Needleman I, McGrath C, Floyd P, et al. Impact of oral health on the life quality of periodontal patients. *J Clin Periodontol* 2004;31:454–7.
30. Taani DQ. Periodontal awareness and knowledge, and pattern of dental attendance among adults in Jordan. *Int Dent J* 2002;52:94–8.
31. Lie T, Mellingen JT. Periodontal awareness, health, and treatment need in dental school patients. I. Patient interviews. *Acta Odontol Scand* 1987;45:179–86.