JAFES

ORIGINAL ARTICLE

Clinical Utility of Self-Reported Oral Health Measures for Predicting Periodontitis among Adult Filipinos with Type 2 Diabetes Mellitus

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Abstract

Background. The likelihood of periodontitis among type 2 diabetes is thrice the non-diabetic population and progresses rapidly when uncontrolled. An inexpensive and easy way of dental assessment via self-reported oral health questionnaire has great potential as a screening tool.

Objective. This study aims to validate self-reported oral health measures, socio-demographic and medical variables in predicting the severity of periodontitis in Filipino adults with type 2 diabetes.

Methodology. The validated self-reported oral health questionnaires created by the CDC Periodontal Disease Surveillance Project was translated into Filipino and used. A cross-sectional study of 180 participants was conducted in a single institution. Multivariable logistic regression analyses were used to determine significant predictors of serious periodontitis.

Results. Male sex [OR=2.17], low educational status [OR=2.98], poor glycemic control [OR=2.58], less frequent dental visits [OR=2.77] and teeth loss >6 [OR=5.02] were considered to be predictive of serious periodontitis. Self-reported oral health variables like gum disease –Q1 [OR=8.33], state of gum health –Q2 [OR=0.39], loose teeth –Q3 [OR=63.0], brushing of teeth –Q4 [OR=0.65], use of mouthwash –Q4 [OR=0.69] and poor tooth appearance –Q5 [OR=48.42] were also shown to be significantly predictive of serious periodontitis. A recommended set of questions and proposed scoring system based on the logistic regression analysis of each predictor's strength was then formulated.

Conclusion. The use of specific self-reported oral health questions, certain socio-demographic and medical variables appeared to be highly predictive of serious periodontitis among Filipinos with type 2 diabetes. This provides a cost-effective and rapid method of screening patients who are in need of immediate dental evaluation.

Key words: Oral Health Questionnaire, periodontitis, type 2 diabetes mellitus, dental care

INTRODUCTION

The global prevalence of type 2 diabetes mellitus is rapidly increasing as a result of population ageing, urbanization and its associated lifestyle changes. Its prevalence has more than doubled over the past three decades.[1] In 2014, the global prevalence of diabetes was estimated to be 9% among adults, where 90% were considered as having type 2 diabetes.[2] By 2030, the prevalence is expected to increase to 7.7% affecting 439 million adults. Between 2010 and 2030, there will be a 69% increase in the number of adults with type 2 diabetes in developing countries and a 20% increase in developed countries.[3] In Asia, similar epidemiologic trends are being seen as more Asians adopt a westernized lifestyle. The Philippines is a country considered to have a high prevalence of type 2 diabetes, with an estimated 7.8 million cases and is projected to be ranked 9th overall by 2030.[2] In a recent local study, the 9-year incidence of type 2 diabetes was 16.3% while its prevalence was 28.0%.[4]

Diabetes mellitus is a chronic metabolic disorder characterized by a deficiency in insulin secretion or an increased insulin resistance, resulting in hyperglycemia. Type 2 diabetes (formerly called non-insulin-dependent or adult-onset) in particular results from the body's ineffective use of insulin and is largely the result of excess body weight and physical inactivity.[5] People with type 2 diabetes, especially when it is poorly controlled, have an increased susceptibility to chronic infections and inflammation of oral tissues, including periodontal diseases (chronic gingivitis and periodontitis), dental caries, and oral candidiasis. This contributes to substantial oral functional disability.[6] Oral complications are seen in 1/3 of people with type 2 diabetes.[7]

Type 2 diabetes is considered a risk factor for the development of periodontitis which is now considered to be the sixth complication of both type 1 and type 2 diabetes.[8-9] Severe periodontitis was more often found in

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patients with type 2 diabetes (60% vs 39%).[10] The likelihood of periodontitis among type 2 diabetics was 3 times greater than the general population, and progresses rapidly when poorly controlled.[11] Majority of well-controlled studies showed a higher prevalence and severity of periodontal disease in type 2 diabetes with similar local irritation including greater loss of attachment, greater alveolar bone loss, increased bleeding on probing, and increased tooth mobility resulting in tooth loss.[12-15] Similar trends were found in a local study where prevalence of periodontitis was noted to be at 68.23%.[16]

Furthermore, poor perception of one's oral health status among people with type 2 diabetes had a strong negative impact on health-related quality of life.[17-18] Therefore, people with type 2 diabetes must be educated about the importance of removing oral plaque daily through meticulous oral hygiene, managing mouth dryness and diet, ceasing tobacco use and obtaining regular professional dental care and cleaning.[6] The early detection and treatment of periodontal disease has led to improved glycemic control in patients with type 2 diabetes[9] and was also confirmed in a recent study from the Philippines.[16]

Adults with diabetes are less likely to consult a dentist than to seek consult with a health care provider for diabetes care.[20] A Philippine study by Ofilada among Filipinos with type 1 diabetes revealed that financial insufficiency, fear and the lack of dentists who are willing to treat diabetic patients were the common barriers to dental care.[21] Patients with type 2 diabetes were more likely to receive more recommended elements of diabetes care whereas routine dental check-ups were commonly missed. They were also more likely to have numerous follow-ups with health care providers for aggressive glycemic control.[22] This provides an opportunity for health care providers to screen and educate patients regarding the possible oral complications that might develop.

Given the importance of good oral health among type 2 diabetes patients and the current outpatient encounters with health care providers, a simplified oral health screening questionnaire might be of use in assessing oral health status of all patients diagnosed with type 2 diabetes. This would translate to earlier detection and referral to a dental specialist which would then contribute to better glycemic control when treated. Currently, the International Diabetes Federation (IDF) guidelines on oral health recommends routine clinical screening questions as the basis for further referral and management by the dentist.[23] The Philippine Dental Association and the UNITE for Diabetes Philippine clinical practice guidelines both recommend screening for clinical symptoms and early referrals to dental service for better oral care and management.[24]

As of 2007, the Center for Disease Control and Prevention (CDC) in collaboration with the American Academy of Periodontology (AAP) has been working on the creation, formulation and evaluation of a self-report questionnaire in predicting the prevalence of periodontitis among adult population. Through a rigorous systematic process of selection and evaluation, the extensive CDC–AAP effort identified a set of eight self-report oral health questions that were considered promising for predicting the prevalence of periodontitis (Table 1).[25] These eight oral health questions were previously selected and tested cognitively in United States adults where revisions were recommended (Table 2).[26] An initial field assessment of these questions done in Australia demonstrated promising results for predicting the prevalence of periodontitis in adults.[27] Similar assessment of these questions were validated in a pilot study done in the U.S. by Paul Eke and Bruce Dye.[28] In addition to the oral health variables, several demographic and medical variables (age, sex, smoking history, education, diabetes duration, glycemic control) were also considered to be predictive of prevalence and severity of periodontitis.[16, 28]

Table 1. Self-report questions created by the CDC Periodontal Disease Surveillance Project

Preamble: Gum disease is a common problem with the mouth. People with gum disease might have swollen gums, receding gums, sore or infected gums, or loose teeth.

1. Do you think you might have gum disease?
   ☐ Yes   ☐ No   ☐ Don't know   ☐ Refused
2. Overall, how would you rate the health of your teeth and gums?
   ☐ Excellent   ☐ Very good   ☐ Good   ☐ Fair   ☐ Poor   ☐ Don't know   ☐ Refused
3. Have you ever had treatment for gum disease, such as scaling and root planing, sometimes called "deep" cleaning?
   ☐ Yes   ☐ No   ☐ Don't know   ☐ Refused
4. Have you ever had any teeth become loose on their own, without an injury?
   ☐ Yes   ☐ No   ☐ Don't know   ☐ Refused
5. Have you ever been told by a dental professional that you lost bone around your teeth?
   ☐ Yes   ☐ No   ☐ Don't know   ☐ Refused
6. During the past 3 months, have you noticed a tooth that doesn't look right?
   ☐ Yes   ☐ No   ☐ Don't know   ☐ Refused
7. Aside from brushing your teeth with a toothbrush, in the last 7 days, how many times did you use dental floss or any other device to clean between your teeth?
   _____ Number
8. Aside from brushing your teeth with a toothbrush, in the last 7 days, how many times did you use mouthwash or other dental rinse product that you use to treat dental disease or dental problems?
   _____ Number

Table 2.   Recommended revised questions for periodontal disease surveillance

1. Gum disease is a common problem with the mouth. People with gum disease might have bleeding in the gums around the teeth, swollen gums, receding gums, or sore or infected gums that lasts for >2 weeks and is not caused by injury or problems with partials or dentures.
   Do you think you might have gum disease?   ☐ Yes ☐ No
2. Overall, how would you rate the health of your teeth and gums?
   ☐ Excellent ☐ Very good ☐ Good ☐ Fair ☐ Poor ☐ Don't know ☐ Refused
3. Have you ever...
   ...had surgery to clean underneath your gums? (not root canals or cleanings done at regular checkups)
   ☐ Yes ☐ No
   ...had scaling or root planing, sometimes called "deep" cleaning? (not root canals or cleanings done at regular checkups)
   ☐ Yes ☐ No
   ...had any teeth that became loose on their own, without an injury? (not baby teeth)   ☐ Yes ☐ No
   ...been told by a dental professional that you lost bone around your teeth?   ☐ Yes ☐ No
4. In the last 7 days, how many times did you.......
   ...brush your teeth with toothpaste?   _____ Number
   ...use dental floss or dental tape?   _____ Number
   ...use mouthwash or other dental rinse product?   _____ Number
5. During the past 3 months, have you noticed that you have a tooth that doesn't look right? ☐ Yes ☐ No

As of now, there is still no locally validated clinical oral health screening questionnaire. Application of the validated CDC self-reported oral health questionnaire can help in predicting diabetic patients at risk for periodontitis and warrant earlier dental consults. An inexpensive and easy tool for clinical assessment would be useful especially in a developing country like the Philippines where resources for health care access are limited.

This paper aims for the following:
1. To determine the prevalence and severity of periodontitis among patients with type 2 diabetes categorized according to tooth loss, medical and socio-demographic variables;
2. To determine the response rates of patients with type 2 diabetes for each self-reported oral health questions;
3. To determine the predictors of the seriousness of periodontitis among self-reported oral health variables, clinically determined number of teeth loss and socio-demographic and medical variables;
4. To present a culturally accepted and validated self-reported oral health questionnaire and propose a scoring system that will predict severity of periodontitis among patients with type 2 diabetes.

METHODOLOGY

Self-Reported Oral Health Questionnaire

The validated self-reported oral health questionnaire created by the CDC Periodontal Disease Surveillance Project was used in this study (Table 2). The content of the questionnaire was carefully translated into the Filipino language by expert linguists. One linguist translated the English questionnaire to Filipino, while another translated the Filipino version back to English. The resulting translation was then compared to the original English version for verification until a final Filipino version of the questionnaire was created.

The translated Filipino version of the questionnaire was then incorporated with the original English version to create a questionnaire that would be expressed in two languages (English and Filipino). A pilot testing of the newly translated questionnaire was conducted with 20 Filipinos with type 2 diabetes who criticized and observed the applicability of the translated version. All suggestions, comments and criticisms were noted and resolved during the discussion thereby formulating a revised and improved version of the questionnaire.

Sample Size Calculation

Using PASS (Power Analysis and Sample Size) 2008 software, the minimum sample size requirement was computed using the parameters for logistic regression analysis: alpha (α) = 0.05, power (1-β) = 80%, X1 (percent of patients with tooth loss) = 67.6%, P0 (percent of periodontitis among patients without tooth loss) = 8.8%, P1 (percent of periodontitis among patients with tooth loss) = 30%. Except for the alpha level and power which were set by the researers, all other parameters were taken from the literature. The computed 136 minimum sample size was increased to 180 accounting for possible 20% non-response.

Selection of Participants

Inclusion Criteria
1. Adult (Age $\geq$35 years) Filipino diagnosed with type 2 diabetes for at least 1 year. Diagnosis of Type 2 diabetes will be based on the American Diabetes Association criteria[29] as follows: fasting blood sugar $\geq$126 mg/dl on 2 determinations; symptoms of hyperglycemia and random blood sugar $\geq$200 mg/dl; 2-hour plasma glucose $\geq$200 mg/dl after a 75 grams oral glucose tolerance test; standardized HbA1C $\geq$6.5%;
2. Dentulous persons with $\geq$6 teeth present;
3. Able to read, comprehend and respond to the series of questions;
4. Willingness to undergo a dental examination.

Exclusion Criteria
1. Patients with heart murmurs that would require antibiotics prior to dental examination.

Data Collection
This was a cross-sectional study conducted at the out-patient clinics of Philippine General Hospital. This study was reviewed and approved by the University of the Philippines Manila Research Ethics Board (UPMREB) Panel.

Potential study participants were provided with an overview of the study, its nature, purpose and significance. Once eligibility status was determined, recruited participants provided written informed consent (Appendix A) and contact information obtained. The interviewer then asked additional questions about gender, age, smoking status, education level, duration of diabetes and recent HbA1C level. Participants were then given the self-reported oral health questionnaire. All recruited patients were finally referred to a dentist for formal dental and periodontal evaluation. Results of the periodontal evaluation were given to the patient and subsequent intervention and follow up were advised accordingly to ensure proper treatment of periodontitis. All patient's data obtained were recorded individually using a patient data sheet while periodontal evaluation results were recorded using a separate dental sheet.

Periodontitis was determined from a full-mouth periodontal examination using the basic elements from the NHANES periodontal examination protocol. This included measuring gingival recession and probing depth (PD), to calculate loss of attachment, using a color-banded probe graduated at 2, 4, 6, 8, 10, and 12 mm. Measurements were made on six sites per tooth (mesio-buccal, buccal, distobuccal, mesio-lingual, lingual, and disto-lingual) for all teeth (excluding 3rd molars) by one examiner. Number of remaining teeth and lost teeth were also documented.[30]

Variables
From each participant, we collected socio-demographic and medical variables using a standard data collection form. Pertinent socio-demographic variables included age in years (specified as both continuous and categorical with two categories: 35-59, and ≥60), gender and educational attainment (high school graduate or lower and some college education or higher). Pertinent medical variables included cigarette smoking status (current smokers were subjects who had smoked ≥100 cigarettes in their lifetime and were currently smoking; former smokers were subjects who had smoked ≥100 cigarettes in their lifetime and not currently smoking; non-smokers were subjects who had not smoked ≥100 cigarettes in their lifetime),[31] duration of diabetes (grouped into ≤10 years and >10 years), frequency of dental visits within a year and recent HbA1C level (within the last 3 months). Number of teeth

remaining and number of teeth lost were also recorded and determined.

In this study, periodontitis was defined as a disease state in which there is an active destruction of the periodontal supporting tissues as evidenced by the presence of >3 mm probing depth and ≥3 mm periodontal attachment loss at the same site. Serious periodontitis was considered for participants fulfilling the criteria for moderate or severe periodontitis. Participants were classified according to severity of periodontitis using the following criteria (NHANES III protocol, 1988-1994).[32]

Severe periodontitis: 1) two or more teeth (or 30% or more of the teeth examined) having ≥5 mm probing depth, or 2) four or more teeth (or 60% or more of the teeth examined) having ≥4 mm probing depth, or 3) one or more posterior teeth with grade II furcation involvement.

Moderate Periodontitis: 1) one or more teeth with ≥5 mm probing depth, or 2) two or more teeth (or 30% or more of the teeth examined) having ≥4 mm probing depth, or 3) one or more posterior teeth with grade I furcation involvement and accompanied with ≥3 mm probing depth.

Mild periodontitis: 1) one or more teeth with ≥3 mm probing depth, or 2) one or more posterior teeth with grade I furcation involvement.

No periodontitis: persons with 6 or more teeth present who did not fulfill any of the above criteria.

Data Analysis
Data analysis was done using the software Stata SE version 12. Different socio-demographic and medical variables, number of teeth lost and responses to self-reported oral health questionnaire were tabulated and recorded using descriptive statistics (mean, percentage). Multivariable logistic regression analyses were used to determine significant predictors that predicted the prevalence of serious periodontitis (created as moderate and severe disease versus mild and no disease combined). The predictive power of each variable was calculated and expressed using odds ratio, 95% confidence interval and p-value. The multivariate logistic regression analysis was then used to create a scoring system.

RESULTS

In total, 93.9% of the study participants had clinically defined periodontitis: 29.4% had mild periodontitis, 64.5% had serious periodontitis (moderate and severe periodontitis). Serious periodontitis was significantly higher among males, persons with low educational background, persons with current and smoking history, long diabetes duration, less frequent dental visits, poorly controlled glycemic state (Hba1c ≥7%) and persons who lost ≥6 teeth.

Table 3 summarizes the response rates to each self-reported oral health questions by periodontitis status. In general, understanding and responses to all oral health questions were very high and consistent. The states of gum health in question number 2 were converted to numerical equivalents upon recording ranging from 0 to 5. As observed, a bigger percentage of participants with serious periodontitis answered yes for gum disease (Q1), loose teeth (Q3), bone loss (Q3) and tooth appearance (Q5) while no for gum surgery (Q3) and scaling or root planing (Q3). Surprisingly, almost (>98.3%) all participants reported brushing their teeth regularly regardless of their eventual periodontitis state. On the other hand, most (>70%) did not report regular dental flossing and mouthwashing regardless of their final periodontal state. Majority of participants with serious periodontitis were also observed to report poor state of their gum health in response to question 2.

Table 3. Prevalence and severity of periodontitis by responses to self-reported oral health variables

Question	Response	Total Sample N	Total Periodontitis N (%)	Mild Periodontitis N (%)	Serious Periodontitis N (%)
N		180 (100)	169 (93.9)	53 (29.4)	116 (64.5)
Gum Disease (Q1)	Yes	53 (29.4)	53 (31.4)	5 (9.4)	48 (41.4)
Health of Gums (Q2)	Excellent (5)	14 (7.8)	11 (6.5)	8 (15.1)	3 (2.6)
	Very Good (4)	16 (8.9)	13 (7.7)	11 (20.8)	2 (1.7)
	Good (3)	37 (20.6)	34 (20.1)	11 (20.8)	23 (19.8)
	Fair (2)	40 (22.2)	40 (23.7)	19 (35.8)	21 (18.1)
	Poor (1)	58 (32.2)	57 (33.7)	3 (5.6)	54 (46.6)
	Don't Know (0)	15 (8.3)	14 (8.3)	1 (1.9)	13 (11.2)
Gum Surgery (Q3)	No	170 (94.4)	159 (94.1)	49 (92.4)	110 (94.8)
Scaling or Root Planing (Q3)	No	163 (90.6)	154 (91.1)	49 (92.4)	105 (90.5)
Loose Teeth (Q3)	Yes	59 (32.8)	59 (34.9)	1 (1.9)	58 (50)
Bone Loss (Q3)	Yes	10 (5.6)	10 (5.9)	0 (0)	10 (8.6)
Toothbrush (Q4)	0	3 (1.7)	3 (1.8)	0 (0)	3 (2.6)
	1	20 (11.1)	19 (11.2)	4 (7.5)	15 (12.9)
	2	65 (36.1)	64 (37.9)	18 (34)	46 (39.7)
	3	88 (48.9)	79 (46.8)	31 (58.5)	48 (41.4)
	4	4 (2.2)	4 (2.3)	0 (0)	4 (3.4)
Dental Floss (Q4)	0	156 (86.7)	148 (87.5)	44 (83)	104 (89.7)
	1	13 (7.2)	11 (6.5)	6 (11.3)	5 (4.3)
	2	6 (3.3)	5 (3)	1 (1.9)	4 (3.4)
	3	5 (2.8)	5 (3)	2 (3.8)	3 (2.6)
Mouthwash (Q4)	0	128 (71.1)	121 (71.6)	32 (60.4)	89 (76.8)
	1	31 (17.2)	28 (16.6)	12 (22.6)	16 (13.8)
	2	9 (5)	9 (5.3)	3 (5.7)	6 (5.2)
	3	12 (6.7)	11 (6.5)	6 (11.3)	5 (4.3)
Tooth Appearance (Q5)	Yes	112 (62.2)	111 (65.7)	8 (15.1)	103 (88.8)

Table 4. Predictive value of number of tooth loss, socio-demographic, medical variables and self-reported oral health measures for serious periodontitis (moderate + severe)

Variables	Categories / Responses	Non-serious Periodontitis	Variables	Categories / Responses	Non-serious Periodontitis
SOCIO-DEMOGRAPHIC AND MEDICAL VARIABLES					
Age	Age ≥60	17 (26.6)	33 (28.5)	1.10	0.787
	Age 35-59	47 (73.4)	83 (71.5)		
Sex	Male	17 (26.6)	51 (44.0)	2.17	0.020
	Female	47 (73.4)	65 (56.0)		
Education	Elementary to High School	30 (46.9)	84 (72.4)	2.98	0.001
	College	34 (53.1)	32 (27.6)		
Smoking Status	Never	46 (71.9)	76 (65.5)	1.48	0.200
	Former	18 (28.1)	35 (30.2)		
	Current	0 (0)	5 (4.3)		
Diabetes Duration	≥10 years	27 (42.2)	63 (54.3)	1.63	0.121
	<10 years	37 (57.8)	53 (45.7)		
Glycemic Control	HbA1C ≥7%	33 (51.6)	85 (73.3)	2.58	0.004
	HbA1C <7%	31 (48.4)	31 (26.7)		
Dental Visits	Almost none per year	38 (59.4)	93 (80.2)	2.77	0.003
	At least once per year	26 (40.6)	23 (19.8)		
Tooth Loss	≥6	45 (70.3)	107 (92.2)	5.02	0.001
	<6	19 (29.7)	9 (7.8)		
ORAL HEALTH MEASURES					
Gum Disease (Q1)	Yes	5 (7.8)	48 (41.4)	8.33	0.001
Health of Gums (Q2)	1=Poor; 2=Fair; 3=Good; 4=Very good; 5=Excellent	3 (2-4)	1 (1-3)	0.39	0.001
Gum Surgery (Q3)	Yes	4 (6.3)	6 (5.2)	0.82	0.763
Scaling or Root Planing (Q3)	Yes	6 (9.4)	11 (9.5)	1.01	0.981
Loose Teeth (Q3)	Yes	1 (1.6)	58 (50.0)	63.0	0.001
Bone Loss (Q3)	Yes	0	10 (8.6)	-	-
Toothbrush (Q4)	Number of times per day	2.5 ± 0.6	2.3 ± 0.8	0.65	0.045
Dental Floss (Q4)	Number of times per day	0.3 ± 0.7	0.2 ± 0.6	0.81	0.361
Mouthwash (Q4)	Number of times per day	0.7 ± 1.0	0.4 ± 0.8	0.69	0.038
Tooth Appearance (Q5)	Yes	9 (14.1)	103 (88.8)	48.42	0.001

Table 5. Multivariate logistic regression analysis and proposed scoring of significant oral health predictors for serious periodontitis

Predictors	Odds Ratio [95%CI]	p-Value	Proposed Score
Low Education Status	5.02 [1.47- 17.11]	0.010	+ 3
Tooth Loss >6	8.17 [1.63- 40.98]	0.011	+ 4
Health of Gums (Q2)	0.56 [0.34- 0.90]	0.017	- 1 (5)
Loose Teeth (Q3)	29.56 [2.99- 292.35]	0.004	+ 7
Tooth Appearance (Q5)	31.63 [8.87- 112.75]	0.001	+ 7

Table 6. Recommended oral health questionaire and proposed scoring system predictive of serious periodontitis

Oral Health Questions	Response	Score
1. What is your highest educational attainment?	High school or lower	+ 3
	College or higher	0
2. How many teeth did you lose?	≥6	+ 4
	<6	0
3. Overall, how would you rate the health of your teeth and gums?	Excellent	- 5
	Very Good	- 4
	Good	- 3
	Fair	- 2
	Poor	- 1
4. Have you ever had any teeth that became loose on their own, without an injury? (not baby teeth)	Yes	+ 7
	No	0
5. During the past 3 months, have you noticed that you have a tooth that doesn't look right?	Yes	+ 7
	No	0
Total Score		

As shown in Table 4, socio-demographic and medical variables considered to be significantly predictive of serious periodontits were male sex [OR =2.17; 95%CI 1.12-4.35], low educational status [OR =2.98; 95%CI 1.57-5.63], poor glycemic control [OR =2.58; 95%CI 1.36-4.88], less frequent dental visits [OR =2.77; 95%CI 1.41-5.44] and teeth loss >6 [OR =5.02; 95%CI 2.11-11.94]. Self-reported oral health variables shown to be significantly predictive of serious periodontitis included gum disease –Q1 [OR =8.33; 95%CI 3.11-22.30], state of gum health – Q2 [OR =0.39; 95%CI 0.28-0.54], loose teeth –Q3 [OR =63.0; 95%CI 8.45-469.58], brushing of teeth –Q4 [OR =0.65; 95%CI 0.43-0.99], use of mouthwash –Q4 [OR = 0.69; 95%CI 0.49-0.98] and poor tooth appearance –Q5 [OR = 48.42; 95%CI 19.48-120.38].

DISCUSSION

Overall, the results of this study showed that the self-reported oral health questionnaire was specific and valid in predicting serious periodontitis. This is expected as the presence of type 2 diabetes is already a risk for the presence of periodontitis.[9-11,16] The higher prevalence of periodontitis (94% vs 68%) among the participants with type 2 diabetes in this study can be attributed to the socioeconomic status of patients seen in our institution that mostly caters to the indigent population of the country.[16]

Screening patients with serious periodontitis seems to be a more clinically relevant application as these patients would warrant immediate dental referral. A single model where all of the predictive factors were included and analyzed appeared to be the most predictive and useful.[28] Misclassification of periodontal disease in this study was minimized using a full mouth periodontal examination "gold standard" which resulted in reduction in errors in our validity assessments.

All predictor variables were combined in a single model using a multivariate logistic regression analysis to determine the performance of significant predictive factors in predicting periodontal state. As shown in Table 5, only low educational status [OR =5.02; 95%CI 1.47-17.11], teeth loss >6 [OR =8.17; 95%CI 1.63-40.98], state of gum health – Q2 [OR = 0.56; 95%CI 0.34-0.90], presence of loose teeth –Q3 [OR =29.56; 95%CI 2.99-292.35] and poor tooth appearance – Q5 [OR =31.63; 95%CI 8.87-112.75] were significant predictors for serious periodontitis. A recommended set of questions and proposed scoring system based on the logistic regression analysis of each predictor's strength was then formulated. Total score ranged from (-5) considered least likely to have serious periodontitis to (+20) considered most likely to have serious periodontitis (Table 6).

The state of gum health appeared to be a protective predictive factor for both the presence and seriousness of periodontitis. A score of (-) 5 for excellent gum health and (-) 1 for poor gum health was used for easier scoring. Several dental hygiene practices like brushing teeth, dental flossing and use of mouthwash did not appear to be predictive of periodontitis since other local practices like betel nut chewing and use of toothpicks were reported. Low educational status was the only demographic variable found to be a significant predictive factor for serious periodontitis. Only 3 questions (state of gum health, loose teeth, tooth appearance) were found to be useful and valid in predicting serious periodontitis for this study population. Gum surgery, scaling and root planing were less frequently reported due to inaccessibility of most of the participants to regular dental visits as most belonged to lower socio-economic status.

CONCLUSION

The use of specific self-reported oral health questionnaire, certain socio-demographic and medical variables

appeared to be highly predictive of serious periodontitis among Filipinos with type 2 diabetes. This provided a cost-effective and rapid method of screening patients who were in need of immediate dental evaluation.

Limitations and recommendations

The performance of these variables in different racial and ethnic groups was not explored due to the small number of participants. Although Filipino language was the main medium used to state the questions in this study, several other local dialects might be more applicable for other ethnic groups and in other hospital institutions in the country. The medical institution where this study was conducted only represented the local tertiary government hospital in an urban setting acting as an end referral center for difficult cases of diabetes. Considering the different overall profile of target Filipino participants, a scoring system based on this local validation study of predictive factors would be better suited to screen candidate patients in need for immediate dental evaluation. Further studies using the recommended questions and proposed scoring will be needed to validate the questionnaire as a screening tool and to determine the cut off score that would be highly sensitive and specific in predicting presence of serious periodontitis among diabetic patients consulting a physician.

Statement of Authorship

All authors have given approval to the final version submitted.

Author Disclosure

All the authors declared no conflicts of interest.

Funding Source

None.

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Appendix A

PATIENT'S INFORMED CONSENT

Validation of Self-Reported Oral Health Measures for Predicting Periodontitis among Adult Filipinos with Type 2 Diabetes Mellitus

The following have been fully explained to me and I understand them well enough before signing this consent.

1. This study is being done by Dr. Tom Edward N. Lo, who is the primary investigator for this study. It will be made up of 180 participants.

2. The objective of this study is to determine the relationship and predictive power of several measures and oral health questions in determining presence and severity of periodontitis among patients with type 2 diabetes mellitus.

3. This study will involve answering interviews on personal and medical information, answering self-administered oral health questionnaire and undergoing formal dental examination lasting for 1-2 hours. The formal dental examination will be covered by this study.

4. My participation in this study is voluntary and I am free to leave the study at any time and doing so will not in any way affect the medical care that I am receiving currently or in the future.

5. I give consent for the Ethics committee and the primary investigator to have direct access to my medical records.

6. The results of this study may be published, but my identity will remain confidential.

7. I can call the primary investigator at 554-8400 loc. 3230 at any time to ask questions regarding the study.

8. This study is approved by the UPMREB ethics review panel and can be reached at 522-2684 and asked about study participant's rights.

_____   _____   _____
Name of patient   Signature   Date

_____   _____   _____
Person who obtained informed consent   Signature   Date