ORIGINAL ARTICLE

Association between periodontal diseases and systemic illnesses: A survey among internal medicine residents in Nigeria

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Abstract *Objective:* To assess internal medicine residents' knowledge of associations between periodontal disease and systemic illnesses, and attitudes toward patients' periodontal health.

Methods: A cross-sectional survey using a self-administered questionnaire was conducted among internal medicine residents attending the Faculty of Internal Medicine 2014 Update Course organized by the National Postgraduate Medical College of Nigeria. Participants came from all over the country. Data on respondents' demographic characteristics, periodontal disease knowledge, knowledge of associations between periodontal disease and systemic illnesses, and attitudes toward patients' periodontal health were collected. Data were analyzed using Epi INFO software. The Pearson chi square test was used to measure significant association between categorical variables such as the knowledge of periodontal disease and gender, age group and designation of the participants ($p \leqslant 0.05$).

Results: Of 150 questionnaires distributed, 123 were returned (82% response rate); 109 questionnaires were completed properly and included in the analysis. The most common source of residents' information on oral health was television (59.4%). Only 11.2% of respondents were aware that

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gingival bleeding was the earliest sign of periodontal disease. Respondents correctly identified periodontal disease as a risk factor for coronary heart disease (45.9%), stroke (43.5%), hospital-acquired pneumonia (53.2%), diabetes mellitus (13.8%), and preterm birth (11%). Increased age ($p = 0.032$) and male gender ($p = 0.022$) were associated significantly with knowledge of periodontal disease as a risk factor for stroke. Higher designation ($p = 0.002$) and longer duration in residency training ($p = 0.004$) were associated significantly with knowledge of periodontal disease as risk factor for peripheral arterial disease. The majority (90.9%) of respondents had positive attitudes toward the referral of their patients for regular periodontal care.

Conclusions: Knowledge of periodontal disease as a risk factor for systemic illnesses among medical residents in Nigeria is inadequate. These relationships should be emphasized in continuing medical education courses.

1. Introduction

Periodontal disease is highly prevalent, contributing to the global burden of chronic diseases and constituting a major public health problem (Petersen and Baehni, 2012; Petersen and Ogawa, 2012). The importance of oral health, of which periodontal health is a key component, to general well-being has been well documented (USDHHS, 2000). Most periodontal diseases are inflammatory in nature and are initiated by plaque biofilm, resulting in gingivitis. When untreated, this mild form of the disease may progress to periodontitis and tooth loss (Petersen and Ogawa, 2012). The earliest sign of gingivitis is bleeding from the gingiva, especially during tooth brushing. Periodontal disease can be readily reversed by effective plaque control measures, such as daily tooth brushing and the use of interdental cleaning aids (e.g., dental floss) (Darby and Walsh, 2010).

Bilateral associations between periodontitis and a wide range of systemic conditions, such as cardiovascular disease (Demmer and Desvarieux, 2006), diabetes mellitus (Mealey, 2006), and poor pregnancy outcomes (Scannapieco et al., 2003), have been reported. Periodontitis may be a source of systemic inflammation that impacts overall health (Quijano et al., 2010). The successful prevention and management of periodontal disease depend to a large extent on awareness and good knowledge of its causes, early identification of symptoms, and effective treatment (Zhu et al., 2005).

In Nigeria, the level of awareness of oral diseases in the general population has been documented as being low (Sofola, 2010). This situation may have serious consequences for patients with medical problems and oral issues, such as periodontal disease. Given the grossly inadequate dentist-to-population ratio in Nigeria (Sofola, 2010), patients are more likely to seek oral health care from medical professionals than from dentists. Similar situations have been documented in other countries (Cohen and Manski, 2006; Cohen et al., 2008).

Hence, medical doctors, especially physicians, must be well informed about periodontal disease and its bilateral associations with systemic conditions to ensure best practices in patient care. Previous studies have shown varying levels of awareness among doctors (Weidlich et al., 2008; Gur and Majra, 2011; Nagarakanti et al., 2013; Nasir et al., 2013), with limited awareness in developing countries like Nigeria (Gur and Majra, 2011; Nasir et al., 2013). A few studies have shown reduced awareness and poor referral practices among physicians in Nigeria (Sofola and Ayankogbe, 2009; Opeodu et al., 2014). The aim of this study was to assess the knowledge of periodontal disease, its associations with systemic conditions, and professional attitudes toward periodontal health among internal medicine residents from health institutions across Nigeria.

2. Methods

This cross-sectional survey was conducted among internal medicine residents from several residency training institutions in Nigeria attending the Faculty of Internal Medicine 2014 Update Course, organized by the National Postgraduate Medical College of Nigeria. All resident doctors attending the course were invited to participate in the study. Self-administered questionnaires were distributed to consecutive consenting resident doctors during their break times and retrieved thereafter.

The questionnaire consisted of three sections. Section A solicited information on respondents' demographic characteristics, training institution, geopolitical zone in which the residency training institution is located, number of years since graduation from medical school, number of years in the residency training program (This refers to the number of years the participants have spent in the residency training program in their various institutions), and sources of information on oral health.

Section B assessed respondents' knowledge of periodontal disease, including the meaning of the term "periodontal diseases," their primary cause, earliest symptom/sign, and best prevention method. The knowledge of the bidirectional relationships between periodontal disease and different systemic conditions and medications was also assessed. This subsection assessed respondents' knowledge of the effects of some systemic illnesses on periodontal disease, as well as the knowledge of periodontal disease as a risk factor for some systemic illnesses. The scoring criteria for the four questions assessing the knowledge of periodontal disease were based on score 1 for each correct response, and score 0 for wrong answers. This gave a score range of 0–4 which was then dichotomized into 0–2 (inadequate) and 3–4 (adequate) levels of knowledge about periodontal disease. The subsections on periodontal disease and systemic illnesses/medications had "yes," "no," and "not sure" response options.

Section C contained four items assessing respondents' attitudes toward the periodontal health of their patients and their referral patterns using a 5-point Likert scale ranging from 1 to 5 (strongly agree, agree, neutral, disagree, and strongly disagree). Non-response was scored as 0. A total score (maximum, 20) was computed for each respondent. The face validity of the questionnaire was established by experts in a related field. The procedure was by first giving a draft of different questions assessing the knowledge of periodontal disease/systemic illnesses to some experts in the fields of periodontology and internal medicine to determine the appropriateness of the questions and some were modified subsequently based on their recommendations.

The study was approved by the Health Research and Ethics Committee of the Lagos University Teaching Hospital. Data were analyzed with Epi INFO software version 3.5.4 (Centers for Disease Control and Prevention (CDC), USA) and the results are presented as means and frequencies. The Pearson chi-squared test was used to measure significant differences for categorical variables, and analysis of variance was used for continuous variables. The mean attitude score was determined and examined in a bivariate analysis according to respondents' socio-demographic characteristics. The level of significance was set at $p \leqslant 0.05$.

3. Results

3.1. Demographic characteristics

Of 150 questionnaires distributed, 123 were returned (82% response rate). Of these, 109 questionnaires were completed properly. Table 1 shows the sociodemographic characteristics of respondents. Males represented 67.9% of the sample, with an overall mean age of 33.1 ± 4.0 (range, 27–45) years. Male medical residents were significantly older than their female counterparts (33.7 ± 4.2 vs. 31.8 ± 3.1 years, $p = 0.020$).

Table 1 Socio-demographic characteristics of internal medicine residents.

	n	(%)
Age (years)		
26–35	82	75.2
36–45	27	24.8
Gender		
Male	74	67.9
Female	35	32.1
Designation		
Junior Registrar	91	83.5
Senior Registrar	18	16.5
Geopolitical zones of training institutions		
South-West	33	30.3
South-East	29	26.6
South-South	17	15.6
North-Central	18	16.5
North-West	7	6.4
North-East	5	4.6
Mean number of years of graduation from medical school (n = 107)	7.4 ± 2.9	
Mean number of years in residency training program (n = 108)	2.7 ± 1.7	

The most common sources of respondents' oral health information were television (59.4%), undergraduate training in medical school (51.9%), dentists/other dental health professionals (50%), books/journals (39.8%), radio (31.8%), family/friends (28%), newspapers (25.9%), continuing medical education (CME; 23.1%), and seminars/conferences (23.1%).

3.2. Knowledge of periodontal disease

Respondents' knowledge of periodontal disease is characterized in Table 2. Although 70.1% of respondents' knew that the term "periodontal disease" was synonymous with gum disease, only 12 (11.2%) knew that gum bleeding was its earliest symptom. Overall, only 28.4% (n = 31) of the internal medicine residents had adequate knowledge of periodontal disease, whereas the majority (71.6%, n = 78) had inadequate knowledge. Knowledge of periodontal disease was not associated with age, gender, designation, geopolitical zone, number of years since graduation from medical school, or number of years of residency training (all $p > 0.05$) in Table 3.

3.3. Knowledge of associations between periodontal disease and systemic illnesses and medications

More than 50% of the residents were aware of possible associations between periodontal disease and smoking, HIV/AIDS, diabetes, leukemia, stress, and Chronic Kidney Disease (Table 4). Periodontal disease was correctly identified as a risk factor for hospital-acquired pneumonia (53.2%), coronary heart disease (45.9%), stroke (43.5%), peripheral arterial disease (28.4%), and preterm/low-birth-weight babies (11%; Table 5).

Table 2 Internal medicine residents' knowledge of periodontal disease.

Variables	n	(%)
Understanding of the term " Periodontal disease"		
Same as gum disease*	75	68.8
Same as tooth decay	22	20.2
Same as oral cancer	0	0
Didn't know	12	11
Primary cause of Periodontal disease		
Dental plaque*	58	53.2
Sweets/sugary foods	28	25.7
Vitamin C deficiency	4	3.7
Didn't know	19	17.4
Earliest sign of periodontal disease		
Swollen gum	46	42.2
Bleeding gum*	12	11
Bad breath	28	25.7
Holes in the teeth	12	11
Didn't know	11	10.1
Best method for preventing periodontal disease		
Daily Tooth brushing, fluoride paste, dental flossing*	62	56.9
Daily tooth brushing, fluoride paste, mouth rinses	40	36.7
Daily Tooth brushing, any toothpaste, mouth rinses	4	3.7
Didn't know	3	2.8
Knowledge level of periodontal disease		
Adequate	31	28.4
Inadequate	78	71.6

* Correct response.

Table 3 Association between socio-demography and knowledge of periodontal disease.

Variable	Adequate (%)	Inadequate (%)	p value
Age group (years)			
26–35	31.7	68.3	0.285
36–45	18.5	81.5	
Gender			
Male	24.3	75.7	0.247
Female	37.1	62.9	
Designation			
Junior	29.7	70.3	0.372
Senior	22.2	77.8	
Years of graduation from medical school			
1–7	29.0	71.0	0.945
⩾8	26.3	73.7	
Years in residency training program			
1–4	30.4	69.6	0.263
5–9	18.8	81.3	

Table 4 Medicine Residents' knowledge of association between systemic conditions and periodontal disease.

Systemic condition	Yes n (%)	No n (%)	Not sure n (%)
Smoking	100 (91.7)	1 (0.9)	8 (7.3)
HIV/AIDS	87 (79.8)	6 (5.5)	16 (14.7)
Diabetes mellitus	85 (77.9)	5 (4.6)	19 (17.4)
Leukemia	68 (62.4)	7 (6.4)	34 (31.2)
Stress	59 (54.1)	11 (10.1)	39 (35.8)
Chronic Kidney Disease (CKD)	56 (51.4)	10 (9.2)	43 (39.4)
Downs syndrome	40 (37.0)	9 (8.3)	59 (54.6)
Pregnancy	38 (34.9)	19 (17.4)	52 (47.7)
Osteoporosis	33 (30.6)	11 (10.2)	64 (59.3)
Erectile dysfunction	18 (16.5)	32 (29.4)	59 (54.1)
Rheumatoid arthritis	10 (9.2)	40 (36.7)	59 (54.1)

The majority (69.7%, $n = 76$) of internal medicine residents correctly identified medications associated with periodontal disease, including phenytoin/cyclosporine (44%, $n = 48$), oral contraceptives (26.6%, $n = 29$), and nifedipine (16.5%, $n = 18$).

Significant associations were detected between respondents' designation and knowledge of associations with systemic conditions such as smoking ($p = 0.039$) and HIV/AIDS ($p = 0.013$; Table 6); junior registrars were more knowledgeable about these associations than were senior registrars. Significant associations were also found between respondents' age ($p = 0.032$) and gender ($p = 0.022$) and their knowledge of periodontal disease as a risk factor for stroke (Table 7).

Knowledge of periodontal disease as a risk factor for peripheral arterial disease was associated significantly with residents' designation ($p = 0.002$) and number of years in the residency training program ($p = 0.004$). There were no significant associations between the knowledge of periodontal diseases and these medications.

3.4. Attitudes toward patients' periodontal health

The attitudes of internal medicine residents toward their patients' periodontal health are characterized in Table 8. Ninety-nine (90.9%) residents agreed that screening of patients regularly for periodontal disease was important, and 88 (80.7%) agreed that they should refer their patients for routine dental checkups. No significant association between socio-demographic characteristics and mean attitude scores was detected (all $p > 0.05$; Table 9).

4. Discussion

The present study was predicated on the establishment of periodontal disease as a novel/emerging risk factor for many systemic diseases (Otomo-Corgel et al., 2012). Physicians managing these systemic illnesses must be aware of these associations. The major findings of our study were that internal medicine residents in Nigeria had inadequate knowledge of periodontal disease, modest knowledge of the associations between periodontal disease and some systemic diseases, and limited awareness of periodontal disease as a risk factor for many systemic diseases. The respondents, however, had positive attitudes about referring their patients for regular dental checkups.

The observation that the majority of residents in the present study had inadequate knowledge of periodontal disease is in agreement with the results of a previous study conducted among Nigerian physicians (Sofola and Ayankogbe, 2009). This result may reflect the limited exposure of medical residents participating in the present study to dental health education, particularly during undergraduate training in medical school (51.9%) and CME during postgraduate training (23.1%).

Knowledge of the association of diabetes with periodontal disease was particularly limited among the participants in this study compared with Nigerian medical doctors, assessed in a previous study (Ayanbadejo et al., 2012). Given the rising prevalence of diabetes in Nigeria, physicians must be aware of this association and collaborate more with dentists in the management of diabetes, to improve patient care and outcomes. Participants in the present study also had poor knowledge of associations of periodontal disease with common conditions such as pregnancy (38.9%) and erectile dysfunction (16.5%). A previous study has shown that Nigerian Specialists

Table 5 Internal medicine residents' knowledge of periodontal disease as a risk factor for systemic illnesses.

Systemic illnesses	Yes n (%)	No n (%)	Not sure n (%)
Hospital acquired pneumonia	58 (53.2)	19 (17.4)	32 (29.4)
Coronary heart disease	50 (45.9)	23 (21.1)	36 (33.0)
Stroke	47 (43.1)	22 (20.2)	40 (35.7)
Peripheral arterial disease	31 (28.4)	26 (23.9)	52 (47.7)
Diabetes mellitus/poor glycemic control	15 (13.7)	3 (0.0)	91 (86.3)
Preterm/low birth weight babies	12 (11.0)	28 (25.7)	69 (63.3)

Table 6 Association between socio-demography and knowledge of association between systemic conditions and periodontal disease.

Variables	Age group (years)		p value	Gender		p value	Designation		p value
	26–35%	36–45%		Male %	Female %		Junior %	Senior %	
Smoking	91.5	92.6	0.607	89.2	97.1	0.150	94.5	77.8	**0.039**[*]
HIV/AIDS	78	85.2	0.308	78.4	82.9	0.773	84.6	55.6	**0.013**[*]
Diabetes mellitus	74.4	88.9	0.091	87.7	80	0.919	76.9	83.3	0.402
Leukemia	64.6	55.6	0.538	59.5	68.6	0.481	65.9	44.4	0.146
Stress	56.1	48.1	0.620	54.1	54.3	0.855	58.2	33.3	0.093
CKD	51.2	51.9	0.869	48.6	57.1	0.533	52.7	44.4	0.700
Downs syndrome	35.8	40.7	0.818	40.5	29.4	0.369	36.7	38.9	0.929
Pregnancy	34.1	37	0.968	31.1	42.9	0.323	34.1	38.9	0.903
Osteoporosis	29.6	33.3	0.904	28.4	35.3	0.617	31.1	27.8	1.000
Erectile dysfunction	14.6	22.2	0.534	18.9	11.4	0.244	14.3	27.8	0.289
Rheumatoid arthritis	23.5	25.9	1.000	25.7	20.6	0.740	25.6	16.7	0.318

Chronic Kidney Disease = CKD.
[*] Statistically significant

Table 7 Association between socio-demography and knowledge of periodontal disease as a risk factor for systemic illnesses.

Variable	Hospital acquired pneumonia (%)	Peripheral arterial disease (%)	CHD (%)	Stroke (%)	DM/poor diabetic control (%)	Preterm babies (%)
Age group (years)						
26–35	53.7	23.2	45.1	36.6	15.9	9.8
36–45	51.9	44.4	48.1	65.4	22.7	14.8
p value	0.841	0.089	0.611	**0.032**[*]	0.688	0.362
Gender						
Male	54.1	31.1	43.2	50.7	12.2	10.8
Female	51.4	22.9	51.4	28.6	17.1	11.4
p value	0.883	0.674	0.235	**0.022**[*]	0.684	0.995
Designation						
Junior	53.8	22	42.9	39.6	12.1	11
Senior	50	61.1	61.1	64.7	22.2	11.1
p value	0.178	**0.002**[*]	0.318	0.110	0.444	0.933
Years of graduation from medical school						
1–7	53.6	21.7	46.4	40.2	13	7.2
⩾8	50	42.1	44.7	66.7	15.8	18.4
p value	0.165	0.082	0.970	0.130	0.920	0.186
Years in residency training program						
1–4	53.3	22.8	42.4	42	13	12
5–9	50	62.5	62.5	48.6	18.8	6.3
p value	0.264	**0.004**[*]	0.319	0.807	0.828	0.777

CHD = coronary heart disease; DM = diabetes mellitus.
[*] Statistically significant

exhibit general apathy and lack of knowledge about periodontal disease, particularly periodontitis as a risk factor for conditions such as infertility (Nwhator et al., 2013).

This study also highlighted the poor knowledge of residents about the side effects of some commonly prescribed medications, such as nifedipine. This antihypertensive drug, one of the most commonly prescribed, is associated with the important side effect of gingival enlargement (Sunil et al., 2012). The better knowledge observed among junior registrars relative to their senior counterparts about associations between periodontal disease and systemic conditions such as smoking and HIV/AIDS may be attributed to their exposure to lectures on these topics during undergraduate training and CME programs. It is worthwhile to note that not all residency training

institutions in Nigeria have dental schools in them. Hence, this might have influenced the level of exposure of the different participants to some aspects of dentistry.

Further assessment of the residents in this study revealed poor knowledge of periodontal disease as a risk factor for systemic conditions, such as coronary heart disease, stroke, peripheral arterial disease, diabetes/poor glycemic control, and preterm/low-birth-weight babies. Such poor awareness has been documented among other internal medicine trainees (Quijano et al., 2010; Nasir et al., 2013). The release of bacterial products, such as endotoxins (lipopolysaccharides), into the systemic circulation during periodontal inflammation may trigger a vascular response in patients with many systemic conditions, such as diabetes mellitus, coronary heart disease,

Table 8 Internal medicine residents' attitude towards patients' periodontal health.

Attitude	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)	Non- response n (%)
Importance of assessing their patients regularly for periodontal disease	55 (50.5)	44 (40.4)	7 (6.4)	3 (2.8)	0 (0)	0 (0)
Referring their patients for routine dental check up	47 (43.1)	41 (37.6)	15 (13.8)	5 (4.6)	0 (0)	1 (0.9)
Referring their patients for dental care only when they had complaints	7 (6.4)	18 (16.5)	12 (11)	50 (45.9)	19 (17.4)	3 (2.8)
Referring their patients only on their request	1 (0.9)	16 (14.7)	12 (11)	49 (45)	26 (23.9)	5 (4.6)

Table 9 Association between socio-demography and attitude towards patients' periodontal health.

Variable	Mean attitude score	p value
Age group (years)		
26–35	15.5	0.707
36–45	15.8	
Gender		
Male	15.5	0.821
Female	15.7	
Designation		
Junior	15.8	0.142
Senior	14.6	
Years of graduation from medical school		
1–7	15.6	0.938
⩾8	15.7	
Years in residency training program		
1–4	15.7	0.194
5–9	14.6	

stroke, hospital-acquired pneumonia, and preterm labor. Periodontal disease may thus act as an independent risk factor for some of these diseases. The significant association observed between greater age and knowledge of periodontal disease as a risk factor for stroke among internal medicine residents in this study may be attributed to their longer durations in the residency training program. This finding is comparable to the results of another Nigerian study (Sofola and Ayankogbe, 2009), and is strengthened by the present finding of better knowledge among medical residents with 5–9 years training experience (66.7%) compared with those who had been in the residency program for < 5 years (40.2%). The duration of residency training probably equates to experience gained, which in turn translates to knowledge applied to patient care and the management of common illnesses, such as stroke. Stroke is among the most common causes of medical admissions in Nigeria and accounted for 72.2% of all neurological admissions to medical wards in a teaching hospital in Nigeria (Ezeala-Adikaibe et al., 2014). The association between male gender and knowledge of periodontal disease as a risk factor for stroke could be due to the significantly greater age of male doctors compared with their female counterparts in the study sample, again associated with more experience in the residency training program. The associations of higher designation and greater number of years in residency with better knowledge of periodontal disease as a risk factor for peripheral arterial disease is comparable with the findings of another Nigerian study (Sofola and Ayankogbe, 2009). Peripheral arterial disease is caused mainly by atherosclerosis in Nigeria and is a common systemic condition that medical residents are likely to have encountered. Sofola and Ayankogbe (2009) found that the duration of clinical experience significantly affected resident doctors' perceptions of the relationship between oral and general health.

The overall limited knowledge displayed by the internal medicine residents participating in this study highlights a gap between the specialties of dentistry and medicine, and the need for increased dental education in undergraduate and postgraduate medical training programs in Nigeria. The positive attitudes observed among the respondents on the importance of regular screening of their patients for periodontal disease as well as their willingness to refer their patients for routine dental checkups was very encouraging. These findings are in agreement with those of a study conducted in Tehran, which documented physicians' positive attitudes toward oral health care for their patients, with 77% of respondents reporting willingness to take preventive measures (Rabiei et al., 2012). Almost all physicians in that study recognized the need to know more about oral health and to examine their patients' oral cavities during routine practice (Rabiei et al., 2012). The similarity of these findings to the results of the present study may reflect medical residents' recognition of the need to fill their knowledge gaps, and perhaps to contribute to the promotion of periodontal health among their patients.

5. Conclusions

Our study showed that internal medicine residents in Nigeria had inadequate knowledge of periodontal disease, and its importance as a risk factor for many systemic diseases. Respondents, however, had positive attitudes toward the referral of patients for regular dental checkups. We recommend the inclusion of more dental health courses in the undergraduate and postgraduate medical curricula in Nigeria.

Conflicts of interest

The authors declare that there are no conflicts of interest associated with this study.

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