Oral health seeking behaviour among Malaysians with type II diabetes

Norhafizah Sahril 1*, Tahir Aris 1, Ahmad Sharifuddin Mohd Asari 1, Siew Lian Yaw 2, Natifah Che Saleh 2, Mohd Azahadi Omar 1, Chien Huey Teh 1, Khairiyah Abdul Muttalib 2, Mohd Feisul Idzwan 1, Low Lee Lan 4, Nooral Zeila Junid 2, Fatanah Ismail 5, Noor Aliyah Ismail 2 and Norain Abu Talib 6

*Correspondence: norhafizah_s@moh.gov.my

1Institute for Public Health, National Institutes of Health, Ministry of Health Malaysia, Malaysia.
2Oral Health Division, Ministry of Health Malaysia, Malaysia.
3Disease Control Division, Ministry of Health Malaysia, Malaysia.
4Family Health Development Division, National Institutes of Health, Ministry of Health Malaysia, Malaysia.
5Family Health Development Division, National Institutes of Health, Ministry of Health Malaysia, Malaysia.
6MAHSA University College, Malaysia.

Abstract
Background: Chronic periodontitis has been recognised as one of the complications of diabetes mellitus. Individuals with diabetes are at higher risk of destructive periodontal disease. The objective of this study was to examine the oral health seeking behaviour of diabetic patients in Malaysia in order to improve their oral health condition.

Methods: A cross-sectional study on Type II diabetes patients was conducted at selected public sector health clinics across four states, using self-administered questionnaires. Descriptive data analysis was performed using SPSS version 19.

Results: Of the 4,017 respondents, only 35.5% (95% CI: 34.10-37.10) acknowledged the association of diabetes and oral health. Less than half (48.4% (95% CI: 46.90-50.00)) had dental check-up since their diagnosis of diabetes. Of these, only 35.3% (95% CI: 33.10-37.40) had their last dental visit within the past one year. This accounted for only 16.7% of all respondents. Among those who had dental check-up, majority of them (95.4% (95% CI: 94.30-96.30)) were self-motivated while the remaining (4.6% (95% CI: 3.70-5.70)) were referred by healthcare staff. About 79.2% (95% CI: 77.90-80.40) claimed that dental check-up is important for diabetes patients. However, only 59.9% (95% CI: 58.30-61.40) wanted to be referred for dental care. Three main reasons for not wanting a referral were perceived lack of necessity for a dental check-up, the absence of dental problems and the perception that dental problems were not serious.

Conclusion: Despite majority of diabetes patients claiming the importance of dental check-up (79.2%), the demand for dental referral (59.9%) and actual oral healthcare utilisation (48.4%) were low. Referral of diabetes patients for oral healthcare by healthcare workers was very low. There is a need to increase the oral health awareness of diabetes patients and to improve their utilisation of oral healthcare. Healthcare workers need to routinely refer diabetes patients for a dental check-up.

Keywords: Diabetes patients, oral health-seeking behaviour, dental check-up, diabetes mellitus

Introduction
Diabetes mellitus is a chronic metabolic disorder that affects millions of people worldwide. Diabetes patients need continuous medical care and meticulous patient self-management including monitoring and maintaining good glycaemic control in order to prevent acute complication, which can reduce the risk of long term complications.

Medical complications associated with diabetes include neuropathy, retinopathy, peripheral vascular disease, coronary heart disease and also oral health complications [1-4]. These oral health complications include chronic periodontitis, gingivitis, dental caries, mucosa, burning mouth syndrome, tooth loss, mouth dryness, taste impairment and sialosis [3,5-10].

Many studies have proven that the prevalence, severity and progression of periodontal diseases are significantly increased in patients with diabetes [11]. In a nationwide survey, people with especially poorly controlled diabetes have a significantly higher prevalence of severe periodontitis [12].

Findings from a previous study also indicate that periodontal destruction is higher in children and adolescents with diabetes [13]. Children with diabetes had significantly more dental plaque and gingival inflammation than non-diabetic children [14]. In addition, patients with diabetes were found to be more likely to develop periodontal diseases [15] and certain oral mucosal disorders compared to non-diabetic individuals [16]. There is also evidence that patients with diabetes are more prone to developing caries [8,17-19] and suffering tooth loss [9,10], and children with diabetes have a greater risk of developing gingivitis [20]. Hence, the prevalence of gingivitis among children and adolescents with diabetes is nearly twice than...
those without diabetes [21].

The treatment guideline produced by the Centre of Disease Control and Prevention (CDC) recommends dental care for diabetics patients at least once in every 6 months. More frequent dental visits are recommended for those with periodontal disease [22]. Furthermore, the American Diabetes Association (ADA) standards also recommend that examination of the oral cavity be carried out as part of the patient's initial visit [23]. However, the referral practice of diabetes patients for dental care is not included in the current Clinical Practice Guidelines (CPG) for the management of diabetic patients in the public health sector in Malaysia. The objective of this study was to examine the oral health seeking behaviour of diabetes patients and their utilisation of oral healthcare services. The findings of this study will contribute invaluable input to the holistic management of diabetes patients.

Material and methods

Study design

This is a cross-sectional descriptive study conducted among Type II diabetes patients attending public sector health clinics in four states (Kedah, Negeri Sembilan, Terengganu and Johor). In this study, data obtained from the states of Kedah and Negeri Sembilan will serve as baseline data for a further intervention study (with Kedah and Negeri Sembilan as the ‘test’ states and, Terengganu and Johor as the ‘control’ states). The selections of these states were based on the prevalence of diabetes as reported by the Third National Health and Morbidity Survey 2006 [24].

Sampling

The sample size for each state was calculated using the formula for prevalence study with estimated prevalence of only 50% of the diabetes patients had dental referral, precision of 0.05 and 20% non-respondents. This gave rise to the estimated sample size of 460. The sample size was multiplied by design effect of 2.0 since the sampling was cluster sampling. There were four clusters for each state:

1. Clinic with Family Medicine Specialist in Urban area.
2. Clinic without Family Medicine Specialist in Urban area.
3. Clinic with Family Medicine Specialist in Rural area.
4. Clinic without Family Medicine Specialist in Rural area.

Total sample size was increased to 1000 per state for ease of sampling (i.e., 250 sample for each cluster). For each cluster, one health clinic was chosen randomly and 250 patients were selected from each clinic to be included in the study.

The classification of urban or rural locality described in this study was provided by Department of Statistics Malaysia where areas with population greater than 10,000 are gazetted as ‘urban’ and those below 10,000 populations as ‘rural’ [25].

All patients who fulfilled the inclusion criteria of age 18 years old and above, and with a confirmed diagnosis of Type II diabetes were included in the study. Non-Malaysians, patients with Type I diabetes and pregnant mothers were excluded.

Instrument

Two sets of pre-coded questionnaire were designed for this study, one set for the healthcare workers managing diabetes patients and another set for the diabetes patients. All healthcare workers who managed diabetes patients in the selected clinics were invited to participate in this survey. However, the findings on healthcare workers are not presented in this paper.

For the diabetes patients, the questionnaire was prepared in Malay, English and Mandarin. Using a forward-backward technique, the original English-language questionnaire designed for this study was translated into Malay language, and translated back to English. Similarly, for the Mandarin-English language questionnaire, the English-language questionnaire was translated to Mandarin, and the translated Mandarin questionnaire was translated back to the English language. Only the Malay and English questionnaire were pre-tested for clarity of content at a public clinic in Federal Territory Kuala Lumpur (was not involved in the survey), prior to the commencement of the survey. The final questionnaire consisted of eight questions on diabetes mellitus and oral health, oral health seeking behaviour and oral healthcare utilisation.

The self-administered questionnaire was distributed to all eligible diabetes patients attending the selected clinics. Illiterate patients were assisted by healthcare workers in administering the questionnaire. Field data collection was conducted from November 2011 to February 2012.

Data analysis

Data analysis was performed using SPSS version 19.0. Simple descriptive data for socio-demographic characteristics such as gender, race, age and residency were illustrated. Bivariate analysis was performed to determine oral health seeking behaviour of patients with diabetes and their utilisation of oral health services by socio-demographic profiles.

Results

Socioeconomic characteristics of respondents

There were 4,017 Type II diabetes patients recruited in this study. More than half of them (55.7%) resided in rural areas. Majority of them were females 62.3%. The sample was mainly constituted by Malays (71.1%), followed by Chinese (15%), Indians (13.8%) and other ethnicity (0.1%).

Patients in the age group of 55-59 years made up the highest percentage (35.2%), followed by those aged 60-69 years (30.2%). About 15.2% of patients were 70 years and above and 14.6% were between 40-49 years. A small percentage of patients (3.7%) were between 30-39 years while 1.1% were between 18-29 years (Table 1).

Duration of diabetes and perceived association between diabetes and oral health

Overall, the mean years of duration for which the patients
had diabetes was 7.22±5.95. More than a third of the patients, [39.4% (95% CI: 37.9-40.9)] have been diagnosed with Type II diabetes since four years ago. About 30.4% (95% CI: 29.0-31.9) claimed that they have had diabetes between 5 to 9 years, and 18.5% (95% CI: 17.4-19.8) between 10-14 years. About 6.0% (95% CI: 5.3-6.8) had diabetes for 15-19 years and the remaining 5.6% (95% CI: 4.9-6.4) have had diabetes for 20 years and above (Table 2).

Only 35.5% (95% CI: 34.1-37.1) of patients perceived there was an association/relationship between diabetes and oral health, and it did not differ significantly across socio-demography. Of note, more than 60.0% of the patients did not know the association between diabetes and oral health, regardless of the duration of illness.

Dental check-up, mode of referral and reasons for not seeking dental care since being diagnosed with diabetes

Overall, 48.4% (95% CI: 46.9-50.0) of the patients sought dental check-up since the diagnosis of diabetes. Similar prevalence of dental visits since were seen since being diagnosed with diabetes among males, 48.8% (95% CI: 46.3-51.4) and females 48.1% (95% CI: 46.2-50.1) and also for those living in urban, 49.8% (95% CI: 47.5-52.1) and rural areas 47.4% (95% CI: 45.3-49.4).

By ethnicity, the highest prevalence of diabetes patients who had a dental visit since their diagnosis of diabetes were among the Indians 50.9% (95% CI: 46.7-55.1), followed by Malays, [49.1% (95% CI: 47.2-50.9)] and Chinese [42.5% (95% CI: 38.6-46.5)].

Comparing across age groups, those aged 18-29 years reported the highest dental visit while the lowest was among those aged 70 years and above. However, there were no significant statistical differences for dental check-up by other socio-demographic characteristics.

Overall, 16.7% (95% CI: 15.6-17.9) of the respondents had a dental check-up in the last one year. Of those who had a dental check-up, only 35.3% (95% CI: 33.1-37.4) had their last dental visit within the last year (Table 3).

Majority of the patients [95.4% (95%CI: 94.3-96.3)] who have ever had a dental check-up since their diagnosis with diabetes were self-motivated to do so and only 4.6% (95% CI: 3.7-5.7) were referred by the healthcare staff.

Among the patients who claimed that they have never sought dental care since being diagnosed with diabetes, the two most commonly reported reasons for not seeking care were that their teeth problems were not serious (51.3%) and...
Sahril et al. Journal of Public Health Aspects 2014, http://www.hoajonline.com/journals/pdf/2055-7205-1-1.pdf
doi: 10.7243/2055-7205-1-1

the lack of awareness on the need for dental check-up (18.1%).

Perceived importance for diabetes patient to seek dental care
About 79.2% (95% CI: 77.9-80.4) of the patients perceived that it was important for them to seek dental care while, 6.8% (95% CI: 6.0-7.6) reported that it was not important and the rest, 14.1% (95% CI: 13.0-15.2) claimed they did not know the importance of seeking dental care with, prevailing diabetic conditions. Males, 80.3% (95% CI: 78.2-82.2), rural dwellers, 83.8% (95% CI: 82.2-85.3) and Malays, 85.6% (95% CI: 84.3-86.9) were more acknowledged on the importance of seeking dental care compared to their counterparts (Table 4).

Demand for dental care and reasons for not wanting a referral
More than half of the patients, 59.9% (95% CI: 58.3-61.4) wanted to be referred for dental care while the rest 40.1% (95% CI: 38.6-41.7) responded that they did not want to be referred. The three main reasons for refusing a dental referral were; the perceived lack of necessity for a dental check-up, [52.7 (95% CI: 50.3-55.2)], the absence of dental/gum problems, [28.9% (95% CI: 26.7-31.2)] and the perception that dental/gum problem was not serious, [9.2% (95% CI: 7.9-10.8)] (Figure 1).

Discussion
The findings of this study showed that all the patients had a fairly long duration of Type II diabetes, with at least four years history of the condition. Importantly, the findings also showed that only 35.5% of the diabetic patients perceived there was an association between diabetes and oral health. Conversely, more than 60.0% did not know the association/relationship between diabetes and oral health. This finding is supported by studies conducted by Valerio MA et al., and Bowyer V et al., which showed that the awareness and understanding on relationship between oral health and diabetes were minimal among the patient population [26,27]. Evidence was also observed that the lack of knowledge concerning the relationship between diabetes and oral health can lead to poor oral health-related behaviour [28,29].

The strong relationship between periodontal disease and glycaemic control is documented [12] and patients with diabetes who have better oral self-care will also have better glycaemic control [9,30,31]. As such, diabetes patients should be alerted that poor glycaemic control has negative consequences on their general health and health-related quality of life. As this study showed a low awareness of diabetes patients on the association between diabetes and oral health, multidisciplinary effort is needed to raise the awareness of the bi-directional

Table 3. Respondents who had a dental check-up and timing for last dental visit since diagnosed with type II diabetes.

| Socio-demographic Characteristics | Had dental check-up since diagnosed with diabetes (n=4008) | Timing for last dental visit since diagnosed with diabetes (n=1941) |
|----------------------------------|----------------------------------------------------------|---------------------------------------------------------------|
|                                  | Yes (n=1941) | No (n= 2067) | Less than 1 year | More than 1 year |
|                                  | %            | %            | %              | %              |
| ALL                             | 48.4 | 51.6 | 50.00-53.10 | 35.3 | 33.10-37.40 | 64.7 | 62.60-66.90 |
| Gender                          |              |              |                |                |                |                |                |
| Male                            | 48.8 | 51.2 | 48.60-53.70 | 37.0 | 33.60-40.60 | 63.0 | 59.40-66.40 |
| Female                          | 48.1 | 51.9 | 40.90-53.80 | 34.3 | 31.60-37.10 | 65.7 | 62.90-68.40 |
| Location                        |              |              |                |                |                |                |                |
| Urban                           | 49.8 | 50.2 | 47.90-52.50 | 39.3 | 36.10-42.60 | 60.7 | 57.40-63.90 |
| Rural                           | 47.4 | 52.6 | 50.60-54.70 | 31.9 | 29.10-34.80 | 68.1 | 65.20-70.90 |
| Ethnicity                       |              |              |                |                |                |                |                |
| Malay                           | 49.1 | 50.9 | 49.10-52.80 | 35.8 | 33.30-38.40 | 64.2 | 61.60-66.70 |
| Chinese                         | 42.5 | 57.5 | 53.50-61.40 | 34.7 | 29.00-40.90 | 65.3 | 59.10-71.00 |
| Indian                          | 50.9 | 49.1 | 44.90-53.30 | 33.6 | 28.20-39.40 | 66.4 | 60.60-71.80 |
| Age Group                       |              |              |                |                |                |                |                |
| 18-29 years                     | 60.9 | 39.1 | 26.20-53.80 | 44.4 | 27.20-63.10 | 55.6 | 36.90-72.80 |
| 30-39 years                     | 54.4 | 45.6 | 37.70-53.70 | 53.8 | 42.80-64.60 | 46.2 | 35.40-57.20 |
| 40-49 years                     | 55.9 | 44.1 | 40.20-48.20 | 41.6 | 36.40-47.00 | 58.4 | 53.00-63.60 |
| 50-59 years                     | 50.4 | 49.6 | 47.00-52.30 | 37.4 | 33.80-41.00 | 62.6 | 59.00-66.20 |
| 60-69 years                     | 46.2 | 53.8 | 51.00-56.60 | 31.4 | 27.60-35.40 | 68.6 | 64.60-72.40 |
| 70 years and above              | 39.0 | 61.0 | 57.00-64.80 | 21.2 | 16.40-27.00 | 78.8 | 73.00-83.60 |
Socio-demographic Characteristics | The perceived importance of seeking dental care among diabetes patients (n=3996)  
--- | ---  
Important | Not Important | Do not Know  
% | CI | % | CI | % | CI  
ALL | 79.2 | 77.90-80.40 | 6.8 | 6.00-7.60 | 14.1 | 13.00-15.20  
Gender  
Male | 80.3 | 78.20-82.20 | 6.3 | 5.20-7.70 | 13.4 | 11.70-15.20  
Female | 78.6 | 77.00-80.20 | 7.0 | 6.00-8.00 | 14.4 | 13.10-15.90  
Location  
Urban | 73.3 | 71.20-75.30 | 9.3 | 8.10-10.80 | 17.3 | 15.60-19.20  
Rural | 83.8 | 82.20-85.30 | 4.7 | 3.90-5.70 | 11.5 | 10.20-12.80  
Ethnicity  
Malay | 85.6 | 84.30-86.90 | 3.7 | 3.10-4.50 | 10.7 | 9.60-11.90  
Chinese | 57.5 | 53.40-61.40 | 14.6 | 12.00-17.70 | 28.0 | 24.50-31.70  
Indian | 69.6 | 65.60-73.30 | 14.2 | 11.50-17.40 | 16.2 | 13.30-19.60  
Age Group  
18-29 years | 91.3 | 79.00-96.70 | 2.2 | 0.30-13.90 | 6.5 | 2.10-18.40  
30-39 years | 89.0 | 82.90-93.20 | 2.7 | 1.00-7.10 | 8.2 | 4.70-13.90  
40-49 years | 86.2 | 83.10-88.70 | 5.5 | 3.90-7.60 | 8.4 | 6.40-10.90  
50-59 years | 81.6 | 79.50-83.50 | 5.6 | 4.50-7.00 | 12.8 | 11.10-14.60  
60-69 years | 75.6 | 73.10-77.90 | 8.0 | 6.60-9.70 | 16.3 | 14.40-18.50  
70 years and above | 70.6 | 66.80-74.10 | 9.4 | 7.30-12.00 | 20.0 | 17.00-23.40  

Figure 1. Reasons for refusing a dental referral.

The perceived importance of seeking dental care among diabetes patients.

Table 4. The perceived importance of seeking dental care among diabetes patients.

relationship between diabetes and oral health among the diabetics. Promoting this awareness is essential and important in the management of diabetes patients.

In this study, less than half of the patients had a dental check-up since their diagnosis of diabetes. Indians and those aged 18-29 years old had frequent dental check-up, however the prevalence did not differ by sex and locality. Contradictory to our finding, a previous study has reported that regular dental check-up habits were more frequently found among diabetics in urban than in rural areas [32]. Good oral health has been shown to be strongly associated with frequent dental visits [33]. Although regular dental check-ups are important to maintain good oral health in diabetes patients, several studies clearly showed that the attitude of the diabetes patients
with regard to regular dental check-ups for oral health was poor. These studies showed that the percentages of diabetes patients who went for dental check-up were 37% [34], 47% [35], 59% [36] and 14% [37] and the figures were fairly similar to the finding in this study.

The findings in this study also indicated that among those who had a dental check-up since their diagnosis of diabetes, only about 1 in 3 patients (35.3%) had their dental visit within the last year. It has been reported that diabetes patients were significantly less likely to see a dentist within a year than non-diabetes [14]. Compared to this study, a study conducted in United Arab Emirates (UAE) showed a slightly higher percentage (40%) of yearly visits by diabetics [37]. Another study found that people who were diagnosed with diabetes were less likely to have seen a dentist within the preceding 12 months (64.5%) compared to have seen a physician or other healthcare provider for diabetes care (86.3%) [38]. Study by the Indian Health Service also showed relatively low level of compliance with recommended regular dental visit [39]. Swedish aged 20-70 years old with type 1 diabetes of a long duration (mean 29 years) or a short duration (mean 5 years) were found less likely to have seen a dentist within the preceding 2 years (89% and 83% respectively ) than those without diabetes 97% [40]. However in contrary to the Behaviour Risk Factor Surveillance System (BRFSS 2004) conducted in United States, most of dentate adults with diabetes were reported to have had a dental visit during the preceding 12 months of the survey [41]. The lack of awareness on the association of oral health and diabetes in this study is a possible contributing factor to the low proportion of diabetes patients who had their last dental visit a year ago. For the betterment of diabetic self-management behaviours, it is befitting that health care providers strengthen their role in improving their patient’s knowledge about their disease [42,43].

Notably, less than 5% of diabetes patients who last went for a dental check-up were referred by healthcare workers. This showed the referral of diabetes patients for oral healthcare by public sector healthcare workers is very low. All healthcare workers need to be aware of the bi-directional relationship between diabetes and oral health. Thus, more emphasis should be given to healthcare workers in improving the perceptions of diabetes patients towards oral health care and referring them for such services.

The referral of diabetes patients for dental care is not yet included in the Clinical Practise Guideline (CPG) for the management of diabetes patients in this country. This may possibly be one of the contributory reasons for the low referral of diabetes patients for dental care by healthcare workers. The standards for medical care of diabetes mellitus patients by the American Diabetes Association has outlined the need for the referral of diabetes patients to a dentist for oral health assessment as part of the overall management of Diabetes Mellitus [44]. Awareness by both diabetes patients and healthcare workers of the role of periodontal disease in the glycaemic control of diabetes is crucial to maintain good oral health and general health in diabetics. Proper glycaemic control may possibly delay the onset of diabetic complication.

The findings in this study showed that while 8 in 10 diabetes patients perceived it was important for them to seek dental care, only 6 in 10 wanted to be referred for such care. This is indicative of a gap between perception and demand for dental care. The three most common reasons for not wanting a referral was the perceived lack of necessity for a dental check-up, the absence of dental problems and the perception that their dental problem was not serious. Bowyer V et al, reported that individuals with diabetes may be unaware of the importance of maintaining good oral health as part as their diabetes management plan, and often do not perceive a need to visit a dentist [45]. A study on adults with diabetes in the United States reported that, among dentate individuals aged 25 years old and above, the most common reason for not seeing a dentist within the preceding 12 months was the absence of perceived need to visit a dentist (37.2%) [38].

Limitations of the study
The study is a cross-sectional descriptive study of diabetes patients and healthcare workers managing diabetes patients at the selected clinics. As such, the findings in this study cannot be inferred to the population of diabetes patients in the country and needs to be interpreted with caution. Another potential bias of the findings could arise from the possibility that only physicians who treat with an above-average quality and only patients who are treated with an above-average quality are likely to participate in such a study. Nevertheless, the study had provided some measure of information for the parameters studied, and may serve as valuable input for improving the oral healthcare for diabetes patients.

Conclusion
In this study, it was found that patients with diabetes lack important knowledge about the association of oral health and diabetes mellitus. Although the majority of diabetes patients perceived the importance of dental check-up, the demand for dental referral was low among these patients. Notably, the findings also pointed towards a very low referral of diabetes patients for oral healthcare by healthcare workers. The poor oral health seeking behavior and the utilization of oral health services indicates a need to establish a comprehensive oral health promotion program for the diabetic population in healthcare settings as part of the management of diabetes patients. Additionally, there is a need for healthcare workers to routinely refer these patients for oral healthcare as part of the holistic care for diabetes patients.

Competing interests
The authors declare that they have no competing interests.
Acknowledgement

The authors would like to thank the Director General of Health Malaysia, for his permission to publish this paper. Special appreciation is extended to the State Director of Health and State Deputy Director of Oral Health of the four states in Malaysia i.e., Kedah, Negeri Sembilan, Terengganu and Johor, and their staff for the support in data collection.

Publication history

Editor: Pekka Puska, National Institute for Health and Welfare, Finland.
Received: 04-Feb-2014 Final Revised: 09-Apr-2014 Accepted: 25-Apr-2014 Published: 15-May-2014

References

1. Orchard TJ, Dorman JS, Maser RE, Becker DJ, Drash AL, Ellis D, LaPorte RE and Kuller LH. Prevalence of complications in IDDM by sex and duration. Pittsburgh Epidemiology of Diabetes Complications Study II. Diabetes. 1990; 39:1116-24. [Article] [PubMed]
2. Iacopino AM. Periodontitis and diabetes interrelationships: role of inflammation. Ann Periodontol. 2001; 6:125-37. [Article] [PubMed]
3. Skamagas M, Breen TL and LeRoith D. Update on diabetes mellitus: prevention, treatment, and association with oral diseases. Oral Dis. 2008; 14:105-11. [Article] [PubMed]
4. Report of the expert committee on the diagnosis and classification of diabetes mellitus. Diabetes Care. 2003; 26 Suppl 1:55-20. [Article] [PubMed]
5. Loe H. Periodontal disease. The sixth complication of diabetes mellitus. Diabetes Care. 1993; 16:329-34. [PubMed]
6. Hintao J, Taneapaisarn R, Chongsuvivatwong V, Ratarasan C and Dahlen G. The microbiological profiles of saliva, supragingival and subgingival plaque and dental caries in adults with and without type 2 diabetes mellitus. Oral Microbiol Immunol. 2007; 22:175-81. [Article] [PubMed]
7. Moore PA, Guggenheimer J and Orchard T. Burning mouth syndrome and peripheral neuropathy in patients with type 1 diabetes mellitus. J Diabetes Complications. 2007; 21:397-402. [Article] [PubMed]
8. Moore PA, Weyant RJ, Etzel KR, Guggenheimer J, Mongelluzza MB, Myers DE, Rossie K, Hubar H, Block HM and Orchard T. Type 1 diabetes mellitus and oral health: assessment of coronal and root caries. Community Dent Oral Epidemiol. 2001; 29:183-94. [Article] [PubMed]
9. Oliver RC and Tervonen O. Diabetes—a risk factor for periodontitis in adults? J Periodontol. 1994; 65:530-8. [Article] [PubMed]
10. Emrich LJ, Shlissman M and Genco RJ. Periodontal disease in non-insulin-dependent diabetes mellitus. J Periodontol. 1991; 62:123-31. [Article] [PubMed]
11. Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: an epidemiologic perspective. Ann Periodontol. 2001; 6:99-112. [Article] [PubMed]
12. Tsai C, Hayes C and Taylor GW. Glycemic control of type 2 diabetes and severe periodontal disease in the US adult population. Community Dent Oral Epidemiol. 2002; 30:182-92. [Article] [PubMed]
13. Manouchehr-Pour M and Bissada NF. Periodontal disease in juvenile and adult diabetic patients: a review of the literature. J Am Dent Assoc. 1983; 107:766-70. [Article] [PubMed]
14. Lalla E, Cheng B, Lai S, Tucker S, Greenberg E, Goland R and Lamster IB. Periodontal changes in children and adolescents with diabetes: a case-control study. Diabetes Care. 2006; 29:295-9. [Article] [PubMed]
15. Albandar JM, Brunelle JA and Kingman A. Destuctive periodontal disease in adults 30 years of age and older in the United States, 1988-1994. J Periodontol. 1999; 70:13-29. [Article] [PubMed]
16. Guggenheimer J, Moore PA, Rossie K, Myers D, Mongelluzza MB, Block HM, Weyant RJ and Orchard T. Insulin-dependent diabetes mellitus and oral soft tissue pathologies. I. Prevalence and characteristics of non-candidal lesions. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2000; 89:563-9. [Article] [PubMed]
17. Lin BP, Taylor GW, Allen DJ and Ship JA. Dental caries in older adults with diabetes mellitus. Spec Care Dentist. 1999; 19:8-14. [Article] [PubMed]
18. Mealey BL. Periodontal disease and diabetes. A two-way street. J Am Dent Assoc. 2006; 137 Suppl:265-315. [Article] [PubMed]
19. Taylor GW, Manz MC and Borgnakke WS. Diabetes, periodontal diseases, dental caries, and tooth loss: a review of the literature. Compend Contin Educ Dent. 2004; 25:179-84, 186-8, 190; quiz 192. [PubMed]
20. Jenkins WM and Papapanou PN. Epidemiology of periodontal disease in children and adolescents. Periodontol 2000. 2001; 26:16-32. [Article] [PubMed]
21. de Pommereau V, Dargent-Pare C, Robert L and Brion M. Periodontal status in insulin-dependent diabetic adolescents. J Clin Periodontol. 1992; 19:628-32. [Article] [PubMed]
22. Centre for Disease Control and Prevention, Diabetes Public Health Resource. Take Charge of Your Diabetes. 2014. [Website]
23. American Diabetes Association. Standards medicare expands coverage for bone density measurement and diabetes self-management. 1998. [Website]
24. Letchuman G, Wan Nazaimoon W and Wan Mohamad W, et al. "Prevalence of diabetes in the malaysian national health morbidity survey III 2006." Med J Malaysia. 2010:180-6. [Pdf]
25. Labour Force Survey Report Malaysia. Department of Statistics Malaysia. 2010. [Website]
26. Valiero MA, Kanjirath PP, Klausner CP and Peters MC. A qualitative examination of patient awareness and understanding of type 2 diabetes and oral health care needs. Diabetes Res Clin Pract. 2011; 93:159-65. [Article] [PubMed]
27. Bowyer V, Sutcliffe P, Ireland R, Lindenmeyer A, Gadsby R, Graveney M, Sturt J and Dale J. Oral health awareness in adult patients with diabetes: a questionnaire study. Br Dent J. 2011; 211:E12. [Article] [PubMed]
28. Masood Mirza K, Khan AA, Ali MM and Chaudhry S. Oral health knowledge, attitude, and practices and sources of information for diabetic patients in Lahore, Pakistan. Diabetes Care. 2007; 30:3046-7. [Article] [PubMed]
29. Syrjala AM, Ylostalo P, Niskanen MC and Knuttila ML. Relation of
different measures of psychological characteristics to oral health habits, diabetes adherence and related clinical variables among diabetic patients. Eur J Oral Sci. 2004; 112:109-14. 

30. Taylor GW and Borgnakke WS. Periodontal disease: associations with diabetes, glycemic control and complications. Oral Dis. 2008; 14:191-203. 

31. Syrjala AM, Kneckt MC and Knuuttila ML. Dental self-efficacy as a determinant to oral health behaviour, oral hygiene and HbA1c level among diabetic patients. J Clin Periodontol. 1999; 26:616-21. 

32. Zhu L, Petersen PE, Wang HY, Bian JY and Zhang BX. Oral health knowledge, attitudes and behaviour of children and adolescents in China. Int Dent J. 2003; 53:289-98. 

33. Karikoski A, Ilanne-Parikka P and Murtomaa H. Oral self-care and periodontal health indicators among adults with diabetes in Finland. Acta Odontol Scand. 2001; 59:390-5. 

34. Kelly M, Steele J, Nuttal N, Bradnock G, Morris J, Nunn J, Pine C, Pitts N, Treasure E and White D. Adult Dental Health Survey-Oral Health in the United Kingdom 1998. London: The Stationery Office. 2000. 

35. Allen EM, Ziada HM, O’Halloran D, Clerehugh V and Allen PF. Attitudes, awareness and oral health-related quality of life in patients with diabetes. J Oral Rehabil. 2008; 35:218-23. 

36. Bakhshandeh S, Murtomaa H, Vehkalahti MM, Mofid R and Suomalainen K. Oral self-care and use of dental services among adults with diabetes mellitus. Oral Health Prev Dent. 2008; 6:279-86. 

37. Eldarrat AH. Diabetic patients: their knowledge and perception of oral health. Libyan J Med. 2011; 6. 

38. Tomar SL and Lester A. Dental and other health care visits among U.S. adults with diabetes. Diabetes Care. 2000; 23:1505-10. 

39. Mayfield JA, Rith-Najarian SJ, Acton KJ, Schraer CD, Stahn RM, Johnson MH and Gohdes D. Assessment of diabetes care by medical record review. The Indian Health Service model. Diabetes Care. 1994; 17:918-23. 

40. Thorstenson H, Falk H, Hugoson A and Kuylenstierna J. Dental care habits and knowledge of oral health in insulin-dependent diabetics. Scand J Dent Res. 1989; 97:207-15. 

41. Centres for Disease Control and Prevention. Dental visits among dentate adults with diabetes--United States, 1999 and 2004. MMWR Morb Mortal Wkly Rep. 2005; 54:1181-3. 

42. Al-Qazaz HK, Hassali MA, Shafie AA, Syed Sulaiman SA and Sundram S. Perception and knowledge of patients with type 2 diabetes in Malaysia about their disease and medication: a qualitative study. Res Social Adm Pharm. 2011; 7:180-91. 

43. Vermeire E, Hearnshaw H, Ratsep A, Levasseur G, Petek D, van Dam H, van der Horst F, Vinter-Repalust N, Wens J, Dale J and Van Royen P. Obstacles to adherence in living with type-2 diabetes: an international qualitative study using meta-ethnography (EUROBOSTACLE). Prim Care Diabet. 2007; 1:25-33. 

44. Standards of medical care in diabetes--2008. Diabetes Care. 2008; 31 Suppl 1:S12-54. 

45. Oh J, Gjelsvik A, Fuller D, Walsh E, Paine V and Leonard L. Less than optimal dental care among Rhode Island adults with diabetes: the need to assure oral health care for all adults with diabetes. Med Health R I. 2012; 95:91-3. 

Citation: Sahril N, Aris T, Mohd Asari AS, Yaw SL, Omar MA, Teh CH, Abdul Muttalib K, Idzwan MF, Lan LL, Junid NZ, Ismail F, Ismail NA and Abu Talib N. Oral health seeking behaviour among Malaysians with type II diabetes. J Public Health Aspects. 2014; 1:1. http://dx.doi.org/10.7243/2055-7205-1-1