

## Scientific Research Report

# Oral Health Behaviour and Predictors of Oral Health Behaviour Among Patients With Diabetes in the Republic of Mauritius



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## ABSTRACT

**Objectives:** To investigate the oral care habits and assess the determinants of oral care behaviour among people with diabetes in the Republic of Mauritius.

**Methods:** The present study draws on data collected from 589 dentate persons with diabetes by means of a close-ended questionnaire. Multivariate logistic regression analyses were used to estimate the association of different demographic and clinical factors with recommended dental hygiene practices.

**Results:** The majority of the participants brushed at least twice daily (84.2%), never flossed (88.6%), attended dental clinics on need only (87.1%), and did not monitor their blood glucose levels regularly (69.9%). Neither awareness about the increased risk of periodontal disease and xerostomia nor receiving advice from diabetes care providers was found to be associated with good oral hygiene or increased service utilisation. The experience of oral diseases did not encourage recommended oral health practice, with participants without experience with periodontal disease being 3 times more likely to floss (odds ratio [OR], 2.9;  $P = .045$ ). Regular dental visits were strongly associated with self-reported type 1 diabetes (OR, 7.8;  $P = .025$ ). Participants from urban areas were more than twice as likely to visit their dental care provider at least once annually (OR, 2.3;  $P = .006$ ). Regular dental attendance (OR, 3.7;  $P = .011$ ) and flossing (OR, 4.5;  $P = .012$ ) were strongly associated with one another.

**Conclusion:** There is widespread noncompliance with regular flossing and dental service utilisation. Our findings highlight the need for an emphasis on preventive care through the provision of integrated medical and dental interventions to high-risk individuals suffering from both diabetes and chronic periodontitis.

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## Introduction

Diabetes, a group of metabolic disorders characterised by hyperglycaemia, is a major global health crisis. In 2019, it was estimated that 463 million adults worldwide were living with diabetes mellitus, and it is expected that this number will increase to 700 million people by 2045.<sup>1</sup> The Republic of Mauritius has a very high prevalence of diabetes, with about one-

fifth of the population suffering from the disease.<sup>2</sup> Moreover, a high percentage (33%) of the country's known cases of diabetes have poor metabolic control.

Depending on the pathogenesis of the disease, diabetes is classified into 4 main groups: type 1 diabetes (T1DM), type 2 diabetes (T2DM), gestational diabetes (GDM), and specific types of diabetes due to other causes.<sup>3</sup> Persistent hyperglycaemia in uncontrolled or poorly controlled diabetes is associated with serious systemic complications. Hence, the treatment of diabetes focuses on the prevention or delay of these complications<sup>4</sup> and is mainly directed towards glycaemic control, which is assessed by measuring the level of glycated haemoglobin (HbA1c). Although there are no specific oral lesions associated with diabetes, prolonged

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hyperglycaemia can cause oral manifestations such as burning sensation of the oral mucosa, xerostomia, caries, and periodontal disease (gingivitis and periodontitis), leading to premature tooth loss.<sup>5</sup> Numerous studies have revealed an increased prevalence of dental caries, mainly root caries,<sup>6</sup> though there is no evidence of a causal relationship. Conversely, painful, mobile and missing teeth lead to bad nutrition, increasing the risk of incidence of T2DM or poorer glucose control in patients with diabetes.<sup>7</sup> Xerostomia among patients with diabetes is mainly due to old age and the side effects of medication. Of substantial importance is the link between diabetes and periodontitis, which is the irreversible form of periodontal disease and is characterised by the destruction of the supporting structures of the teeth: the periodontal ligament and alveolar bone. Consistent evidence has emerged showing a bidirectional relationship between the two diseases. Diabetes increases the risk for periodontitis, and periodontal inflammation negatively affects glycaemic control.<sup>8,9</sup> The increased severity of periodontal disease in patients with uncontrolled or poorly controlled diabetes has been found to potentiate the morbidity and premature mortality associated with systemic complications of diabetes.<sup>9</sup>

Current evidence suggests that regular dental visits can positively impact diabetes management and prevent diabetes complications by enabling prevention, early detection, and treatment of periodontal disease.<sup>10</sup> Intensive oral hygiene can reduce oral inflammation and slow periodontal deterioration in persons with diabetes. Although regular tooth brushing and dental visits can reduce periodontitis by 34% and 32%, respectively, poor oral health considerably increases the risk of having periodontitis 2- to 5-fold.<sup>11</sup> Nonetheless, people with diabetes have been shown to have poor compliance with recommended oral hygienic practices such as brushing twice a day, cleaning proximal and interdental surfaces at least once daily, and visiting a dental care provider at least once annually.<sup>12</sup> Considering the impact of periodontal disease on diabetes and the benefits of good oral health practices in minimising the risk of periodontal disease, it is important to ensure that people with diabetes are motivated to engage in good oral hygiene behaviours.

Notwithstanding the fact that noncommunicable diseases, which include, among others, diabetes and oral diseases, constitute nearly 80% of the burden of diseases in Mauritius,<sup>13</sup> there are limited studies on the oral hygiene practices of the Mauritian population in general and to our knowledge none pertaining strictly to oral care of people with diabetes. This study was designed to evaluate the oral hygiene practices as well as their determinants among people with diabetes in the country.

## Methods

### Ethics

The study protocol was reviewed and approved by the University of Western Australia Human Research Ethics Committee and the National Ethics Committee, Ministry of Health and Quality of Life of Mauritius.

### Study sample and inclusion criteria

Between 2016 and 2018, persons attending diabetes clinics and with self-reported diabetes were invited to participate in a survey by completing a close-ended questionnaire. Thirteen geographically distributed diabetes clinics were selected to provide access to a large number of patients with diabetes and to include patients with diabetes from both urban and rural areas. Data was collected to ensure that patients attending both private and public clinics participated. On the day of data collection, all attendees at the clinics were invited to participate. Participation was voluntary. All participants were provided with oral and written information about the study, and they provided their signed, informed consent before inclusion in this survey.

A total of 720 persons with diabetes filled in the questionnaire and 131 of them were edentulous. Only data from the questionnaires filled in by dentate participants were selected for the purpose of the present study.

### Questionnaire

The self-reported anonymous close-ended questionnaire was developed following a comprehensive review of the literature. Its feasibility was confirmed in a previous pilot study among patients with diabetes in Mauritius. Results of the pilot study indicated that some questions needed more response options; these were subsequently added. The questionnaire included 17 questions grouped under 5 categories: (i) demography (ie, age, gender, education, rural or urban residence); (ii) medical status (the number of years since diagnosed with diabetes, type of diabetes, treatment received); (iii) general health and oral hygiene practices (last glucose test, annual visits to diabetes care providers, visits to dental care providers, frequency of tooth brushing and flossing); (iv) knowledge about the association between diabetes and oral health (receiving advice from diabetes and dental care providers, knowledge about oral and systemic complications of diabetes), and (v) present and past experience of oral complications of diabetes (xerostomia and periodontal disease). Data about the experience of caries and systemic complications were not recorded.

In the case of unaccompanied patients with no reading and writing skills, the researcher asked the questions verbally in Creole (local spoken dialect) and filled in the form in their presence.

### Measures

The main outcome variables for this study were (i) brushing at least twice daily; (ii) flossing at least once daily; and (iii) visiting a dental care provider at least once annually. Demographic characteristics (age, gender, rural or urban residence, education); health status (number of years since diagnosis, self-reported type of diabetes); dental care habits (flossing and tooth brushing for dental visits, and dental follow-up for flossing and tooth brushing); receiving advice from diabetes or dental care provider; knowledge about oral and systemic complications of diabetes and the experience of periodontitis and xerostomia were considered as potential covariates.

For the purpose of statistical analyses oral health habit items were dichotomised as follows:

- brushing at least 2 times a day versus less frequently
- flossing at least once daily versus less frequently
- visiting a dental care provider at least once annually versus on need only

### Statistical analysis

The data were analysed using SPSS version 25 for Mac OS X. Univariate statistical analysis of differences between subgroups was performed using the  $\chi^2$  test. All tests were 2-sided with  $P < .05$  set as the significance level. Further analysis using multiple logistic regression was performed to identify the variables most strongly associated with the dental care habits of persons with diabetes.

### Results

Of a total of 589 dentate participants, 247 (41.9%) were aged 60 years and older; 332 (56.4%) were female, 316 (53.8%) had less than secondary education (data missing for 2 participants), and 316 (53.7%) lived in rural areas.

The study results show that though a high percentage of the participants had visited their treating doctor at least once during the year preceding this study (94.5%, 5 participants did not remember), the majority could not tell which type of diabetes they suffered from (Table 1). More than half of the cohort had not monitored their blood sugar level for more than a week prior to this survey (54.5%). Though the majority of the participants (84.2%) brushed their teeth at least twice daily, there was limited adherence to recommended daily flossing (3.4%) and at least once annual dental visits (12.9%). A high percentage of participants did not receive advice from their diabetes care provider about the importance of regular dental check-ups (82.0%) or from their dental care providers about the importance of glycaemic control (73.5%). Awareness about systemic complications of diabetes (68.4%-82.2%) was more widespread than that about oral complications (30.1%-53.8%).

Univariate analyses identified the following variables to be significantly associated with the recommended oral care practices: age, gender, self-reported type of diabetes, and knowledge about renal and cardiac complications of diabetes with brushing at least twice daily (Table 2); education, number of years prior to this study since diagnosis of diabetes and frequency of dental visits with flossing frequency (Table 3); and age, education, address, self-reported type of diabetes, receiving advice from diabetes and dental care providers, flossing frequency, awareness about caries as a possible complication of diabetes, and experience of periodontal disease with annual dental visits (Table 4).

Multivariate logistic regression analyses were performed to find, after adjusting for confounders, the variables most strongly associated with recommended oral health behaviours (Table 5).

### Brushing

Participants who were in the 40-59 and 60 and older age groups were, respectively, 8 (odds ratio[OR], 8.0; CI, 2.31-27.78) and 7 (OR, 6.8; CI, 1.95-23.44) times more likely to observe the recommended brushing frequency. Brushing twice daily was most prevalent among women (OR, 2.8; CI, 1.72-4.64), participants with self-reported T2DM (OR, 3.5; CI, 1.20-10.28) and persons aware about their increased risk of renal complications (OR, 2.8; CI, 1.05-3.02). Only a small number of participants ( $n = 15$ ) had gestational diabetes, and they brushed their teeth at least twice daily.

### Flossing

The likelihood of flossing at least once daily was highest among participants diagnosed with diabetes between 5 and 9 years prior to this study (OR, 5.1; CI, 1.52-16.85) and with annual dental check-ups (OR, 3.7; CI, 1.35-9.91). After adjusting for confounders, experience of periodontal disease replaces education as a factor associated with regular flossing. Participants with no experience of periodontal disease were nearly 3 times more likely to floss at least once daily (OR, 2.9; CI, 1.02-8.48).

### Dental visits

After adjusting for confounders, dental service utilisation was highest among participants with tertiary education (OR, 5.4; CI, 2.04-14.38), city dwellers (OR, 2.3; CI, 1.27-4.31), and amongst participants with self-reported T1DM (OR, 7.8; CI, 1.29-46.78). Similarly, receiving advice about the importance of glycaemic control from dental care providers (OR, 2.9; CI, 1.57-5.40), regular flossing (OR, 4.5; CI, 1.39-14.42), and being aware of caries as a possible complication of diabetes (OR, 2.2; CI, 1.25-3.90) increased the odds of regular dental visits. Recent diagnosis of diabetes gained significance as a strong predictor of regular dental visits (OR, 2.5; CI, 1.25-5.04).

### Discussion

Diabetes and oral self-care practices are essential in the prevention of systemic and periodontal complications of diabetes. Diabetes self-care includes ongoing self-monitoring of blood glucose levels for people using insulin, for people on medication that may cause hypoglycaemia, and during pregnancy or other conditions in which data on glycaemic patterns is required.<sup>14</sup> Self-monitoring may help with self-management and medication adjustment.<sup>15</sup> Recommended oral hygiene practices include brushing twice daily, flossing at least once daily, and regular dental visits.<sup>16</sup> The present study provides evidence that in Mauritius, despite the high prevalence of both diabetes<sup>17</sup> and oral diseases,<sup>18</sup> the majority of individuals with diabetes fail to comply with recommended diabetes and oral hygiene practices.

The national health care system in Mauritius includes public and private infrastructure, with care provided in the public sector being free of any user cost at the point of use.<sup>13</sup> Nonetheless, a high percentage of people diagnosed with

**Table 1 – Demographic and clinical characteristics.**

Demographic and clinical characteristics		Number (n)	Percentage (%)
Age (years)	<20	36	6.1
	20-39	66	11.2
	40-59	240	40.7
	≥60	247	41.9
Gender	Male	257	43.6
	Female	332	56.4
Education	None	53	9.0
	Primary	263	44.8
	Secondary	237	40.4
	Tertiary	34	5.8
Address	Rural	316	53.7
	Urban	273	46.3
Years since diagnosis of diabetes	<5years	220	37.8
	5-9 years	129	22.2
	≥10	233	40.0
Self-reported type of diabetes	Type 1	73	12.4
	Type 2	70	11.9
	Gestational	15	2.5
	Do not know	431	73.2
	Treatment	Insulin only	135
	Oral hypoglycaemic only	346	58.8
	Insulin and oral hypoglycaemic	79	13.4
	Diet	28	4.8
Last glucose test	Same day	177	30.1
	Week before	91	15.4
	Month before	181	30.7
	More than a month	140	23.8
Annual medical visit	Yes	552	94.5
	No	32	5.5
Frequency of dental visits	Every 6 months	32	5.4
	Annually	44	7.5
	On need	501	85.1
	Never	12	2.0
Toothbrushing frequency	Once daily	93	15.8
	At least twice daily	496	84.2
Flossing frequency	Never	522	88.6
	Occasionally	47	8.0
	At least once daily	20	3.4
Received advice from diabetes care provider	Yes	106	18.0
	No	483	82.0
Received advice from dental care provider	Yes	156	26.5
	No	433	73.5
Aware about complications: Ocular	Yes	484	82.2
	No	105	17.8
Renal	Yes	456	77.4
	No	133	22.6
Cardiac	Yes	403	68.4
	No	186	31.6
Caries	Yes	177	30.1
	No	412	69.9
Periodontal disease	Yes	220	37.4
	No	369	62.6
Xerostomia	Yes	317	53.8
	No	272	46.2
Experience of periodontal disease	Yes	299	50.8
	No	290	49.2
Experience of xerostomia	Yes	295	50.4
	No	290	49.6

diabetes have poor metabolic control. This coupled with the high mortality and morbidity<sup>19</sup> rate among Mauritians suffering from diabetes highlights the urgency of implementing measures for better glycaemic control, including regular monitoring of blood sugar level. The American Diabetes

Association recommends that when self-monitoring blood glucose levels, diabetes care providers need to ensure that patients receive ongoing instruction and regular evaluation of technique, results, and their ability to use data from self-monitoring of blood glucose to adjust therapy.<sup>15</sup> The observed

**Table 2 – Toothbrushing frequency according to demography and health status.**

Factors		Brushing frequency				P value
		Once daily		At least twice daily		
		n	%	n	%	
Age	<20	16	44.4	20	55.6	.000*
	20-39	11	16.7	55	83.3	
	40-59	28	11.7	212	88.3	
	≥60	38	15.4	209	84.6	
Gender	Male	60	23.3	197	76.7	.000*
	Female	33	9.9	299	90.1	
Education	None and primary	46	14.6	270	85.4	.374
	Secondary	39	16.5	198	83.5	
	Tertiary	8	23.5	26	76.5	
Address	Rural	54	17.1	262	82.9	.352
	Urban	39	14.3	234	85.7	
Years since diagnosis	<5 years	39	17.7	181	82.3	.522
	5-9 years	17	13.2	112	86.8	
	≥10 years	36	15.5	197	84.5	
Self-reported DM type	Type 1	20	27.4	53	72.6	.001*
	Type 2	4	5.7	66	94.3	
	Do not know	69	16.0	362	84.0	
	GDM	0	0.0	15	100.0	
Dental visits	At least once annually	12	15.8	64	84.2	1.000
	On need	81	15.8	432	84.2	
Received advice from DM care provider	Yes	19	17.9	87	82.1	.506
	No	74	15.3	409	84.7	
Received advice from dental care provider	Yes	25	16.0	131	84.0	.925
	No	68	15.7	365	84.3	
Aware about complications: Ocular	Yes	71	14.7	413	85.3	.109
	No	22	21.0	83	79.0	
Renal	Yes	61	13.4	395	86.6	.003*
	No	32	24.1	101	75.9	
Cardiac	Yes	54	13.4	349	86.6	.019
	No	39	21.0	147	79.0	
Caries	Yes	22	12.4	155	87.6	.143
	No	71	17.2	341	82.8	
Periodontal disease	Yes	33	15.0	187	85.0	.685
	No	60	16.3	309	83.7	
Xerostomia	Yes	50	15.8	267	84.2	.990
	No	43	15.8	229	84.2	
Experience of periodontal disease	Yes	45	15.1	254	84.9	.617
	No	48	16.6	242	83.4	
Experience of xerostomia	Yes	47	15.9	248	84.1	.800
	No	44	15.2	246	84.8	

DM = diabetes mellitus; GDM = gestational diabetes mellitus.

\*  $P < .05$ .

nonadherence to regular monitoring in the present study may point to limited awareness about the importance of glycaemic control in the prevention of diabetes complications as well as a lack of confidence in using a glucometer and in interpreting the results.

The present study supports the evidence that people with diabetes appear to neglect flossing as a recommended oral care habit<sup>12,20</sup> and are more likely to visit a diabetes care provider than a dental care provider for an annual check-up.<sup>21</sup> The observed nonadherence to recommended oral health practices may be linked to limited awareness about the risks and consequences of poor oral health and poor diabetes management.<sup>12,22</sup> Similarly, misconceptions about oral health that promote harmful behaviours such as avoiding flossing in the presence of bleeding<sup>23</sup> may explain the findings that experience of periodontal disease negatively

impacted flossing. Lack of knowledge amplified by the fact that diabetes and dental care providers in Mauritius do not address oral health care as an essential component of diabetes care<sup>24</sup> highlights the need for preventive interventions to raise awareness about the bidirectional association between diabetes and oral health and to promote recommended health behaviours as a routine part of clinical care. However, neither awareness about the increased risk of oral diseases (periodontal disease and xerostomia) nor receiving advice from diabetes care providers about the importance of regular dental visits was found to be associated with increased service utilisation. Similarly, receiving advice about the importance of glycaemic control from dental care providers did not predict regular glucose self-monitoring ( $p = .803$ ) or annual visits to the diabetes care provider ( $p = .232$ ). These findings may point to an inadequacy in the advice being provided<sup>23</sup> or

**Table 3 – Flossing frequency according to demography and health status.**

Factors		Flossing frequency				P value
		Never/Occasionally		At least once daily		
		n	%	n	%	
Age (years)	<20	34	94.4	2	5.6	.703
	20-39	63	95.5	3	4.5	
	40-59	234	97.5	6	2.5	
	≥60	238	96.4	9	3.6	
Gender	Male	248	96.5	9	3.5	.900
	Female	321	96.7	11	3.3	
Education	None and primary	310	98.1	6	1.9	.043*
	Secondary	226	95.4	11	4.6	
	Tertiary	31	91.2	3	8.8	
Address	Rural	304	96.2	12	3.8	.562
	Urban	265	97.1	8	2.9	
	Total	569	96.6	20	3.4	
Self-reported DM type	Type 1	68	93.2	5	6.8	.236
	Type 2	67	95.7	3	4.3	
	Do not know	420	97.4	11	2.6	
	GDM	14	93.3	1	6.7	
Years since diagnosis	<5	216	98.2	4	1.8	.005*
	5-9	119	92.2	10	7.8	
	≥10	228	97.9	5	2.1	
Dental visits	At least once annually	69	90.8	7	9.2	.003*
	On need	500	97.5	13	2.5	
Received advice from DM care provider	Yes	100	94.3	6	5.7	.155
	No	469	97.1	14	2.9	
Received advice from dental care provider	Yes	152	97.4	4	2.6	.504
	No	417	96.3	16	3.7	
Aware about complications: Ocular	Yes	466	96.3	18	3.7	.352
	No	103	98.1	2	1.9	
Renal	Yes	438	96.1	18	3.9	.171
	No	131	98.5	2	1.5	
Cardiac	Yes	388	96.3	15	3.7	.520
	No	181	97.3	5	2.7	
Caries	Yes	172	97.2	5	2.8	.616
	No	397	96.4	15	3.6	
Periodontal disease	Yes	213	96.8	7	3.2	.825
	No	356	96.5	13	3.5	
Xerostomia	Yes	308	97.2	9	2.8	.421
	No	261	96.0	11	4.0	
Experience of periodontal disease	Yes	293	98.0	6	2.0	.059
	No	276	95.2	14	4.8	
Experience of xerostomia	Yes	287	97.3	8	2.7	.343
	No	278	95.9	12	4.1	

DM = diabetes mellitus; GDM = gestational diabetes mellitus.

\*  $P < .05$ .

the ineffectiveness of actions focussed solely on oral self-care, clinical treatment, and chairside preventive advice at the individual level.<sup>25</sup>

Common oral diseases shares common economic, psychosocial, environmental, political, and cultural risk factors with other major chronic diseases. As such, effective management of periodontal disease may be enhanced with adequate public health policies that recognise the impact of social determinants of disease as well as the role that dental professionals could play in chronic disease management.<sup>26</sup> In 2007, the government of Mauritius implemented the National Service Framework for Diabetes (NSFD)<sup>27</sup> with the aim to decrease the incidence of diabetes, review the clinical management of people with diabetes to prevent or delay the onset of complications, and to minimise the impact of long-term

complications. However, the key interventions of the NSFD exclude measures for the prevention of oral complications, thus confirming the difficulty in identifying chronic periodontitis as a public health problem and maintaining the neglected role of dental care providers in diabetes management. Based on this and on the findings of our study, the implementation of public health policies to improve chronic disease management in Mauritius may include the following: establishing a dental public health service that will facilitate research, identify barriers for oral health care, and build capacity for public health intervention; since data show that oral health initiatives operating in isolation often lead to duplication of effort and lack of consistency with health messages and wasted resources,<sup>25</sup> increase the dental workforce from the current 3.3 per



**Table 4 – Frequency of dental visits according to demography and health status.**

Factors		Frequency of dental visits				P value
		At least once annually		On need only		
		n	%	n	%	
Age (years)	<20	14	38.9	22	61.1	.000*
	20-39	16	24.2	50	75.8	
	40-59	27	11.3	213	88.8	
	≥60	19	7.7	228	92.3	
Gender	Male	37	14.4	220	85.6	.341
	Female	39	11.7	293	88.3	
Education	None and primary	21	6.6	295	93.4	.000*
	Secondary	40	16.9	197	83.1	
	Tertiary	15	44.1	19	55.9	
Address	Rural	31	9.8	285	90.2	.016*
	Urban	45	16.5	228	83.5	
Years since diagnosis	<5	30	13.6	190	86.4	.662
	5-9	19	14.7	110	85.3	
	≥10	27	11.6	206	88.4	
Self-reported DM type	Type 1	28	38.4	45	61.6	.000*
	Type 2	17	24.3	53	75.7	
	Do not know	29	6.7	402	93.3	
	GDM	2	13.3	13	86.7	
Received advice from DM care provider	Yes	31	29.2	75	70.8	.000*
	No	45	9.3	438	90.7	
Received advice from dental care provider	Yes	34	21.8	122	78.2	.000*
	No	42	9.7	391	90.3	
Brushing frequency	Once daily	12	12.9	81	87.1	1.000
	At least twice daily	64	12.9	432	87.1	
Flossing frequency	Never/occasionally	69	12.1	500	87.9	.003*
	At least once daily	7	35.0	13	65.0	
Aware about complications: Ocular	Yes	68	14.0	416	86.0	.075
	No	8	7.6	97	92.4	
Renal	Yes	65	14.3	391	85.7	.070
	No	11	8.3	122	91.7	
Cardiac	Yes	52	12.9	351	87.1	1.000
	No	24	12.9	162	87.1	
Caries	Yes	38	21.5	139	78.5	.000*
	No	38	9.2	374	90.8	
Periodontal disease	Yes	35	15.9	185	84.1	.093
	No	41	11.1	328	88.9	
Xerostomia	Yes	39	12.3	278	87.7	.639
	No	37	13.6	235	86.4	
Experience of periodontal disease	Yes	30	10.0	269	90.0	.035*
	No	46	15.9	244	84.1	
Experience of xerostomia	Yes	30	10.2	265	89.8	.053
	No	45	15.5	245	84.5	

DM = diabetes mellitus; GDM = gestational diabetes mellitus.

\* P < .05.

10,000 population<sup>28</sup> to allow inclusion of dental care providers in multidisciplinary teams involved in the management of chronic diseases; invest in the training of periodontists as to date the public dental service of Mauritius does not include any; ensure equitable access to oral health facilities in both rural and urban areas to counter the observed disparity in the likelihood of dental visits between the 2 areas; drive the reorientation of dental health services towards an evidence-based led preventive approach because according to the last published National Health Accounts<sup>13</sup> curative services predominate over promotive and preventive services in Mauritius; and encourage establishing dedicated health units and nonprofit organisations to complement government actions. The

higher adherence to annual dental visits among participants with T1DM compared to T2DM may be linked to the existence of the Diabetes and Vascular Centre and of the nongovernmental organisation T1Diams (<https://www.t1diams.org>), which are 2 entities that cater to the clinical and educational needs of patients with T1DM respectively. Additional measures may include increasing affordability of oral hygiene necessities such as toothbrushes, interdental cleaning aids, and fluoride toothpaste for those at a socioeconomic disadvantage.

Periodontal disease is a complex chronic disease, the management of which includes active periodontal treatment (APT; scaling, root planning, and periodontal surgery whenever indicated<sup>29</sup>) and supportive periodontal treatment (SPT;

**Table 5 – Logistic regression analysis with recommended dental behaviours as dependent variables.**

Dependent variable	Factors in final model		Adjusted OR	95% CI	P value
Brushing at least twice daily	Age (years)	<20	1.0 (Ref)		.004
		20-39	2.5	0.78-8.06	.128
		40-59	8.0	2.31-27.78	.001
		≥60	6.8	1.95-23.44	.003
	Gender	Male	1.0 (Ref)		.000
		Female	2.8	1.72-4.64	.000
	Self-reported DM type	Do not know	1.0 (Ref)		.004
		Type 1	2.0	0.71-5.84	.186
		Type 2	3.5	1.20-10.28	.022
		GDM	—*	—*	.998
	Aware of renal complications	No	1.0 (Ref)		.035
		Yes	1.8	1.05-3.02	.032
Flossing at least once daily	Years since diagnosis	<5 years	1.0 (Ref)		.011
		5-9 years	5.1	1.52-16.87	.008
		≥10 years	1.4	0.36-5.23	.647
	Dental visits	On need	1.0 (Ref)		.017
		At least once annually	3.7	1.35-9.91	.011
	Experience of periodontal disease	Yes	1.0 (Ref)		.034
		No	2.9	1.02-8.48	.045
	Dental visits at least once annually	Education	None and primary	1.0 (Ref)	
Secondary			1.8	0.97-3.41	.061
Tertiary			5.4	2.04-14.38	.001
Address		Rural	1.0 (Ref)		.005
		Urban	2.3	1.27-4.31	.006
Years since diagnosis		≥10 years	1.0 (Ref)		.023
		<5 years	2.5	1.25-5.04	.010
		5-9 years	1.1	0.54-2.46	.716
Self-reported DM type		GDM	1.0 (Ref)		.000
		Type 1	7.8	1.29-46.78	.025
		Type 2	3.4	0.56-19.96	.183
		Do not know	1.2	0.21-6.72	.833
Received advice from dental care provider		No	1.0 (Ref)		.001
		Yes	2.9	1.57-5.40	.001
Flossing frequency		Never or occasionally	1.0 (Ref)		.016
		At least once daily	4.5	1.39-14.42	.012
Aware of caries as complication		No	1.0 (Ref)		.007
		Yes	2.2	1.25-3.90	.006

CI = confidence interval; DM = diabetes mellitus; GDM = gestational diabetes mellitus; OR = odds ratio.

\* OR is high, and 95% CI for brushing at least twice daily cannot be calculated.

history update, oral examination, periodontal evaluation, radiographic review, scaling, root planning, polishing, review of plaque removal efficiency<sup>30</sup>) essential for preventing disease progression. The outcomes of SPT depend on multiple factors,<sup>31-33</sup> including adherence to SPT, which in addition decreases with increasing periodontal risk profile.<sup>30</sup> This added to the evidence that level of oral hygiene maintained by patients during healing and maintenance is critical for periodontal treatment success<sup>34</sup> and highlights how the participants' limited annual (7.5%) or every 6 months (5.4%) utilisation of dental care may compromise diabetes management and increase their risk of systemic complications. Our findings point out the need to target individuals more at risk of developing periodontal disease and more likely to benefit from intensive interventions for prevention and management.<sup>35</sup> Focussing specific preventive measures towards high-risk individuals such as people with both diabetes and chronic periodontal disease through a common risk factor approach will ensure continuity of care and ease of compliance.

### Limitations

Self-reported data provided by study participants were not validated against their medical or dental records. Response bias may have influenced respondents to overreport attendance at diabetes clinics as well as tooth brushing behaviour. Memory bias may have influenced responses about the number of years since diagnosed with diabetes and about receiving advice from health care providers.

### Conclusion

This is the first study that investigated dental care practices and dental service utilisation among patients with diabetes in Mauritius. Based on the participants' visits to diabetes and dental care providers and on their oral care habits, it is clear that although regular tooth brushing is widespread, oral health is not a major priority and a routine practice for this group of participants. The insights gained from the present



study suggest several opportunities for improving diabetes and periodontal disease management in the country. These include interventions at both the individual and population levels, such as increasing awareness about the bidirectional association between diabetes and oral disease and the importance of adhering to recommended health practices; focusing on prevention; establishing continuity of care by including dentists in the multidisciplinary team involved in diabetes management; and ensuring access to dental care irrespective of geographical location and type of diabetes.

### Author contributions

NP planned the study, collected and analysed the data, drafted and revised the manuscript, approved the final manuscript; EK contributed to study planning and data analysis, critically commented on the manuscript, approved the final manuscript; MT critically commented on the draft manuscript and approved the final manuscript.

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### Conflict of interest

None disclosed.

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