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Questionnaire Development for Perceptions Among Dental Practitioners on The Management of Periodontitis and Diabetes Risk

(Pembangunan Soal Selidik mengenai Persepsi di Kalangan Pengamal Pergigian terhadap Pengurusan Periodontitis dan Risiko Diabetes)

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Abstract

Diabetes and periodontitis are both highly prevalent diseases in Malaysia, with a strong bidirectional relationship. Therefore, encouraging shared care management is essential to ensure patients benefit from controlling both conditions. Our study aimed to develop and validate a questionnaire to investigate general dental practitioners' perceptions and current practices regarding the shared care management of periodontitis and diabetes. We developed an evidence-based questionnaire through a systematic literature search and pre-tested it on 30 dental practitioners in a public university. Three databases (Scopus, Web of Science, and Ovid MEDLINE), were used to access the available literature. All eligible articles were screened for duplicates and relevance, selecting those with questionnaires. The most relevant questions were chosen and organised thematically. The final section of the questionnaire included a validation sheet, where clinicians reviewed the questions and suggested potential improvements. Seven key aspects were assessed: clarity and directions of items, presentation and organisation of items, suitability of items, adequacy of the content, attainment of purpose/objective, and scale and evaluation rating. All aspects were deemed 'satisfactory' by the clinicians. The clinicians recommended the questionnaire, offering a few suggestions for improvement. More than 95% of the clinicians evaluated the questionnaire as satisfactory, concluding it was valid. Suggested improvements were implemented, such as bolding or italicising the instructions, changing the selection format of questions, and adjusting the direction of options for two questions. A final questionnaire was developed for future research on dental practitioners' knowledge and perceptions regarding the bidirectional relationship and management of diabetes and periodontitis.

Keywords: hyperglycaemia, periodontitis, shared care management, general dental practitioners, diabetes risk

Abstrak

Diabetes dan periodontits adalah dua penyakit yang lazim di Malaysia, dan mempunyai hubungan dua hala yang sangat kuat. Pengurusan penjagaan bersama adalah penting bagi memastikan pesakit mendapat manfaat daripada pengawalan kedua-dua penyakit ini. Kajian ini bertujuan untuk membangunkan dan mengesahkan soal selidik bagi menyelidiki persepsi dan amalan semasa pengamal pergigian am mengenai pengurusan penjagaan bersama diabetes dan periodontitis. Satu soal selidik berdasarkan bukti dibangunkan melalui carian sistematik kepustakaan dan diuji pada 30 pengamal pergigian di sebuah universiti tempatan. Tiga pangkalan data (Scopus, Web of Science dan Ovid MEDLINE) digunakan untuk mengenal pasti artikel yang berkaitain dan soalan-soalan dipilih dan disusun secara thematik. Bahagian akhir soal selidik termasuk helaian pengesahan di mana respondan menilai dan mencadangkan penambahbaikan. Tujuh aspek utama dinilai: kejelasan arahan, penyampaian, kesesuaian item, kecukupan kandungan, pencapaian tujuan/objektif, skala dan penilaian keseluruhan. Semua aspek yang dinilai dianggap memuaskan, dengan lebih 95% menyatakan soal selidik ini sah. Penambahbaikan seperti menebalkan atau memiringkan tulisan arahan, mengubah format pilihan jawapan, dan menyesuaikan arahan pilihan soalan telah dilaksanakan. Soal selidik akhir yang dibangunkan ini adalah sesuai untuk penyelidikan susulan untuk mengetahui pengetahuan dan persepsi pengamali pergigian tentang hubungan dua hala dan pengurusan diabetes serta periodontitis.

Kata kunci: hiperglisemia, periodontitis, pengurusan penjagaan bersama, pengamal pergigan am, risiko diabetes

INTRODUCTION

Periodontitis affects 45% of the adult population, with 10.8% exhibiting signs of severe periodontal breakdown (Rattu et al. 2022). This highlights its significance as a major public health concern. Diabetes is an increasingly prevalent chronic disease worldwide. According to the Australian Bureau of Statistics, approximately 4.9% of Australians were diagnosed with diabetes in 2018, an increase from 4.4% in 2012 (Do et al. 2021). Both periodontitis and diabetes are also highly prevalent in Malaysia. The Malaysian National Oral Health Survey for Adults (NOHSA) 2020 survey reported that 94.5% of Malaysian adults are affected by periodontal disease, slightly increasing from 94.0% in 2010. Furthermore, among individuals with deep periodontal pockets, 27.5% have diabetes, while 24.0% suffer from cardiovascular disease (Malaysia 2020). Additionally, the previous National Health and Morbidity Surveys (NHMS), showed the prevalence of diabetes in Malaysia rose from 11.2% in 2011 to 18.3% in 2019, before declining slightly to 15.6% in 2023. Among the adult population, 5.9% were unaware of their diabetic condition, with the highest proportion of undiagnosed diabetes cases observed in the 18–29 age group (Rifin et al.). These statistics underscore the importance of healthcare practitioners recognising the rising prevalence of both periodontitis and diabetes and taking an active role in managing the progression of these interrelated conditions in their patients.

The association between these two chronic inflammatory diseases has been extensively discussed in the literature. Diabetes is well established as a risk factor for periodontitis, and the risk of periodontitis increases two to threefold in individuals with diabetes compared to individuals without (Papapanou 1996; Preshaw et al. 2019). Furthermore, diabetes significantly influences the onset and progression of periodontal disease (Grigoriadis et al. 2019; Preshaw et al. 2012). The relationship between these two chronic diseases is considered bidirectional. Individuals with periodontitis are more likely to develop diabetes, as poor glycemic control increases the risk of diabetes onset (Graziani et al. 2018) (Preshaw et al. 2019)). This bidirectional association has been described as a "two-way" relationship between the two conditions (Graziani et al. 2018; Molina et al. 2016; Preshaw et al. 2019; Taylor 2001). Therefore, integrated care and management of both periodontitis and diabetes are essential for effectively controlling the progression of these interconnected diseases.

General dental practitioners (GDPs) are primary healthcare providers responsible for identifying whether a patient requires additional management or referral to specialist care. Ideally, patients first visit GDPs for an initial evaluation and are then referred to specialists when further intervention or advanced management is necessary. However, the referred individuals must adhere to the referral process. Failure to do so can delay the diagnosis and treatment, potentially leading to poorer health outcomes and higher costs (Van Esch et al. 2017). Given the link between periodontitis and diabetes risk, GDPs must be fully aware of the importance of identifying diabetes risk in patients with periodontitis. Early diagnosis can reduce complications in both the patient's general and oral health. Therefore, the perceptions and practices of GDPS regarding shared care management for periodontitis patients with diabetes risk are critical issues that need to be addressed promptly. This study aimed to generate a robust questionnaire to determine the practice and perception of GDPs on shared care management of periodontitis patients with diabetes risk.

MATERIALS AND METHODS

Systematic Literature Search

The study protocol received ethical approval from the Universiti Kebangsaan Malaysia (UKM) Research Ethics Committee (UKM PPI/111/8/JEP-2023-382.). A literature review was done using three databases, Scopus, Web of Science, and Ovid MEDLINE, to access the available literature published in English. All eligible articles related to the study were extracted and uploaded to Rayyan. ai (Anon 2016) then screened for replication, and relevant articles were selected. AT and MR conducted the screening for relevant papers, while disputes were rediscussed with SKRS and SMS during a discussion session.

Development of Questionnaire

The next step of the study involved the development of a questionnaire assessing GDPs' knowledge of the relationship between periodontitis and diabetes, as well as the management of related cases. The most appropriate and relevant questions were selected from the eligible papers and sorted thematically. The final section of the questionnaire was a validation sheet, where the clinicians assessed the questions included and proposed potential improvements.

For the validation of the questionnaire, seven key aspects were assessed: 1) clarity and directions of items, 2) presentation and organisation of items, 3) suitability of items, 4) adequacy of the content, 5) attainment of purpose (focusing on the instruments used or the questionnaire as a whole) 6) objective

(focusing on the specific of each item or question), and 7) scale and evaluation rating. The clinicians were instructed to evaluate each item on a scaleof 1 to 5, where 1 is *poor*, 2 is *fair*, 3 is *good*, 4 is *very good*, and 5 is *excellent*. To determine the efficiency and satisfactory level of the questionnaire, we categorised scales 1 and 2 as 'unsatisfactory' and 3 to 5 as 'satisfactory'.

Data Collection: Pre-Test of Developed Questionnaire for Validation

A cross-sectional study was conducted to evaluate the developed questionnaire based on the perception and practice of GDPs on shared care management for periodontitis patients with diabetes risk. The questionnaires were personally distributed to the participants. Participants eligible for inclusion were GDPs registered with the Malaysian Dental Council (MDC) with a valid Annual Practicing Certificate (APC) for the current year, who provided consent and were willing to fully participate in the study, and who were literate in Malay and/or English. Dental specialists registered with the MDC were excluded from the study (except for content validation by 3 experts who are registered periodontal specialists)

For sample size calculation, the initial sample size was calculated as 246, based on a margin of error of 5% and a Confidence Interval (CI) of 95% using unlimited population size and a population proportion of 80% as per Nordin et al 2021. Accounting for a 20% dropout (Nordin, 2021), the sample size is now: 295. The sample size for this study was calculated using the online calculator (Calculator.net) (Tse 2018).

To validate the questionnaire, 10% of the sample size that met all inclusion criteria was selected, making a total of 30 clinicians chosen to validate the questionnaire after the content validation by 3 specialists.

All the clinicians in this study were recruited from dental postgraduates and dental officers at the Faculty of Dentistry UKM. The dentists were approached personally and invited to participate. They were informed of the purpose of the questionnaire with a particular emphasis on confidentiality. All the GDPs understood that participation was voluntary, and they could withdraw from the study at any time. Finally, they were required to complete the questionnaire and to assess the questions on the validation sheet given. Seven key aspects were assessed: clarity and directions of items, presentation and organisation of items, suitability of items, adequacy of the content, attainment of purpose/objective, and scale and evaluation rating.

Data Analysis

Data analysis was done using the Microsoft Excel application, and the pre-test questionnaires' sociodemographic information, validation questions, suggestions, and recommendations were analysed, interpreted and described quantitatively. Lastly, corrections to the questionnaire were made according to the suggestions received from the clinicians of the pre-test to improve the quality and efficiency of thedeveloped questionnaire.

RESULTS

Literature Review

Full paper articles were searched using keywords and search string, which were "(healthcare professionals OR healthcare practitioners OR healthcare personnel OR health care OR healthcare OR healthcare) AND (periodontitis OR periodontal disease OR gum disease NOT gingivitis) AND (diabetes mellitus OR diabetes OR glucose intolerance OR prediabetes OR hyperglycemia OR t2dm OR tiidm OR T2DM OR type 2 diabetes) AND (shared care OR multidisciplinary OR interdisciplinary OR interprofessional OR intersectoral OR integrated OR collaborative OR patient care OR joint care OR partnership".

All the articles that were the results of the selected search were extracted from the databases on the UKM e-resources and uploaded to Rayyan. ai. We found 112 references from Scopus, 73 from Web of Science, and 742 from Ovid, and full papers were uploaded to Rayyan.ai. After a thorough filtering, duplicate deletion, review and reading of the uploaded articles, 912 articles were chosen to be excluded, and 15 were included in the literature review. The 15 articles included were then further read to gain knowledge about previously performed studies and research and to get the questions included in the previous questionnaires. The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA-2020) diagram below summarises the literature search findings (Figure 1).

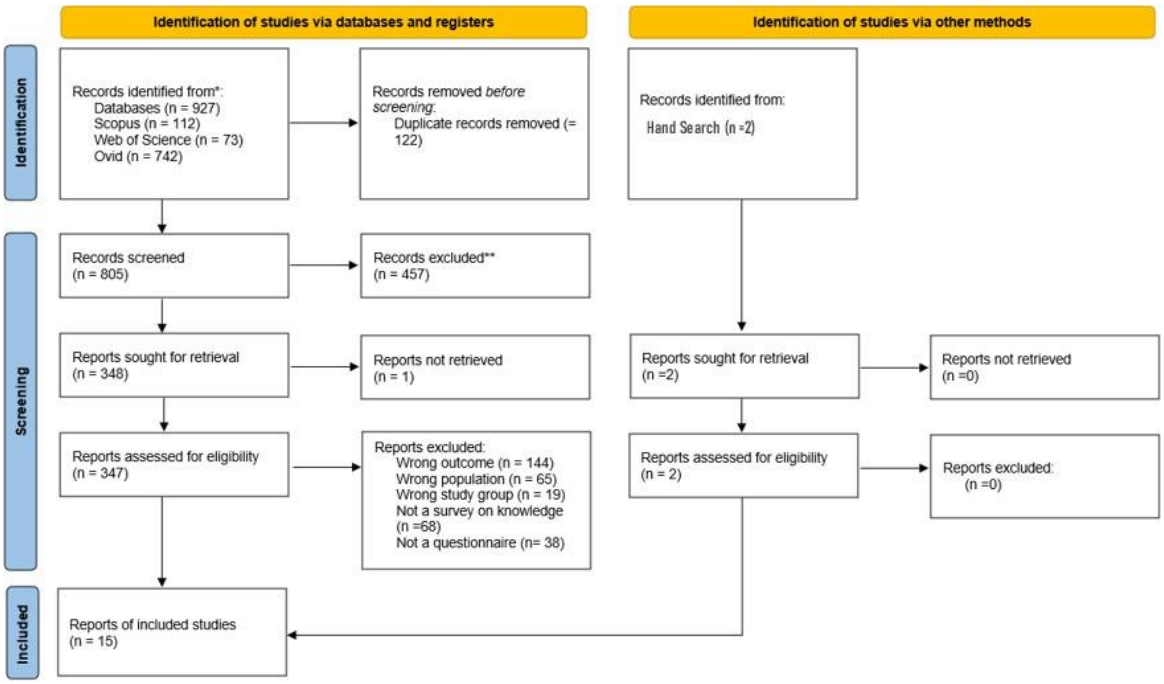

Figure 1. PRISMA 2020 flow diagram for new systematic reviews, which included searches of databases and other methods.

A total of 15 articles (A) were included in this review. The selected articles originated from various countries, reflecting diverse geographic representations as described in Figure 2. Two studies each were conducted in Australia (Chinnasamy et al. 2020; Lau et al. 2021), Malaysia (Mohd Norwir et al. 2025; Nordin et al. 2021), and Saudi Arabia (Al-Habashneh et al. 2010; Alsharif et al. 2023). One study each from Africa and China (Sede et al. 2015; Yun et al. 2022). 3 studies were from India (Ahuja et al. 2014; Sethna et al. 2020; Shanmukappa et al. 2017) and 4 from America (Glurich et al. 2018; Laniado et al. 2021; Paquette et al. 2015; Shimpi et al. 2021).

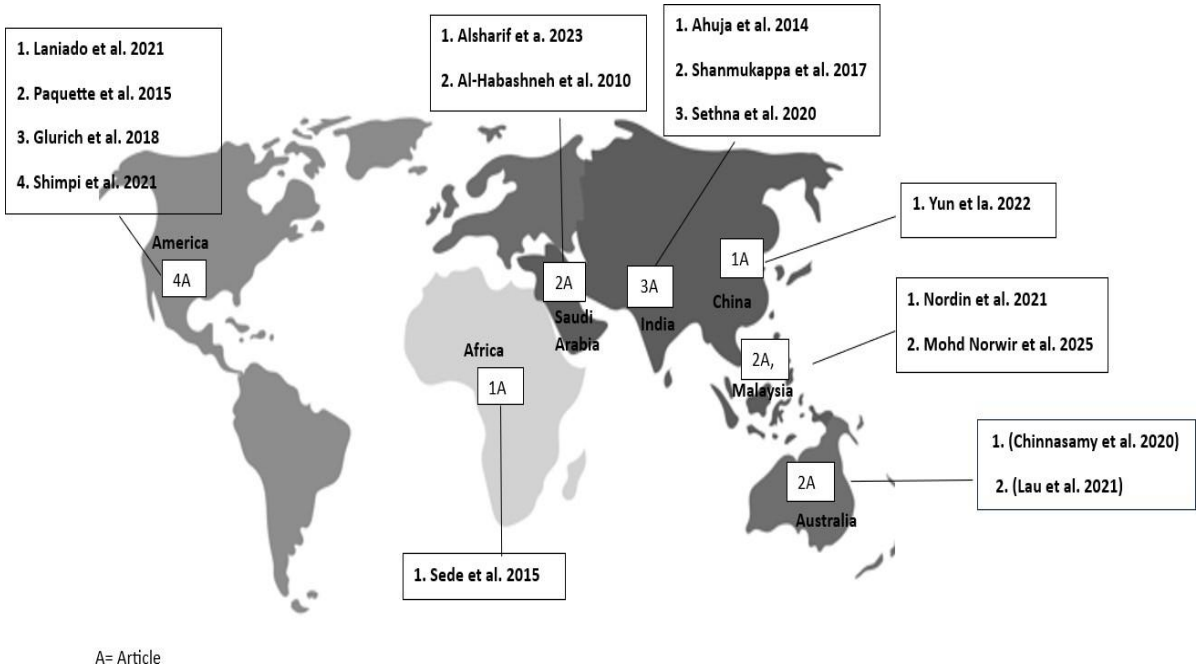

Figure 2. Origin of the literature included in this study

Development of questionnaire

One hundred twenty-three questions from the selected papers were listed, removed replicates, analysed thematically and re-arranged by subtopics through a consensus between all researchers. The subtopics consisted of eight parts: firstly, the personal information and sociodemographic data. Part two included questions assessing the general awareness of GDPs regarding oral health and diabetes mellitus. Part three of the questionnaire was to determine the knowledge of GDPs on the bidirectional relationship between diabetes and periodontitis. Part four of the questionnaire assessed standard practice guidelines and parameters for periodontitis. Part five of the questionnaire evaluated the knowledge of GDPs regarding standard practice guidelines and parameters for diabetes. Questions on the current practice in their private clinics were included in part six. Part seven was to identify their opinion on dental-medical integrated patient management.

Questions on personal information and sociodemographic data were extracted from (Shimpi et al. 2021), General awareness of oral health and diabetes mellitus from (Ahuja et al. 2014; Alsharif et al. 2023; Chinnasamy et al. 2020; Mohd Norwir et al. 2025), and questions on the bidirectional relationship between diabetes and periodontitis were extracted from (Ahuja et al. 2014; Al-Habashneh et al. 2010; Alsharif et al. 2023; Chinnasamy et al. 2020; Lau et al. 2021; Mohd Norwir et al. 2025 Nordin et al. 2021; Sethna et al. 2020; Shanmukappa et al. 2017; Yun et al. 2022). Additionally, standard practice guidelines and parameters for periodontitis and diabetes were from (Chinnasamy et al. 2020; Laniado et al. 2021; Sede et al. 2015; Sethna et al. 2020; Shimpi et al. 2021). Questions on current practice were taken from (Chinnasamy et al. 2020; Glurich et al. 2018; Lau et al. 2021; Sede et al. 2015; Yun et al. 2022), and the opinion on dental-medical integrated patient management (Laniado et al. 2021; Lau et al. 2021; Paquette et al. 2015; Yun et al. 2022) as described in Table 1.

Table 1. Categorisation and numbers (n) of questions based on items

		Items						
Literature no.	**Reference**	**1.Personal information & Sociodemographic data.**	**2. General Awareness of Oral Health and Diabetes Mellitus**	**3. Bidirectional relationship between diabetes and periodontitis**	**4. Standard practice guidelines parameter for periodontitis**	**5. Standard Pra practice guidelines or parameters for diabetes**	**6. Current practice in your clinic**	**7. Opinion on dental-medical integrated patient management**
1	(Ahuja et al. 2014)		✔(4)	✔(1)				
2	(Al-Habashneh et al. 2010)			✔(5)				
3	(Alsharif et al. 2023)		✔(2)	✔(6)				
4	(Chinnasamy et al. 2020)		✔(4)	✔(3)	✔(1)	✔(5)	✔(5)	
5	(Glurich et al. 2018)						✔(4)	
6	(Laniado et al. 2021)					✔(6)	✔(1)	✔(5)
7	(Lau et al. 2021)			✔(2)			✔(11)	✔(3)
8	(Mohd Norwir et al. 2025)		✔(5)	✔(2)				
9	(Nordin et al. 2021)			✔(3)				
10	(Paquette et al. 2015)							✔(11)
11	(Sede et al. 2015)			✔(2)			✔(1)	
12	(Sethna et al. 2020)				✔(5)			
13	(Shanmukappa et al. 2017)			✔(5)				
14	(Shimpi et al. 2021)	✔(6)				✔(2)		
15	(Yun et al. 2022)			✔(2)			✔(4)	✔(7)

The selected questions were subsequently reviewed by reviewers SKRS and SMS. Any disagreements between reviewers regarding study selection were resolved by a third reviewer (NMNA) through discussion. The level of agreement between the first and second reviewers was assessed using Cohen's Kappa statistic (https://www.statisticshowto.com/cohens-kappa-statistic/). It resulted in an average of 86% with decisions made to either accept, reject or modify them without altering the context of the questions. Where necessary, new questions were created to tailor the questionnaire to the Malaysian sociodemographic. This process is summarised in Table 2.

Table 2. Summary of the questionnaire development process

Items	Literature	Accepted	Rejected	Modified	Added
Personal information & Sociodemographic	(Shimpi et al. 2021)	0	1	5	2
	(Mohd Norwir et al. 2025)	2	2	1	0
General knowledge of oral health and diabetes mellitus	(Chinnasamy et al. 2020)	0	1	3	0
	(Alsharif et al. 2023)	0	1	1	0
	(Ahuja et al. 2014)	0	3	1	0
	(Nordin et al. 2021)	0	3	0	0
	(Chinnasamy et al. 2020)	0	1	2	0
	(Mohd Norwir et al. 2025)	0	1	1	0
	(Alsharif et al. 2023)	0	6	0	0
Bidirectional relationship between diabetes and periodontitis	(Shanmukappa et al. 2017)	0	5	0	0
	(Sede et al. 2015)	0	0	2	0
	(Ahuja et al. 2014)	0	1	0	0
	(Al-Habashneh et al. 2010)	0	4	1	0
	(Lau et al. 2021)	0	2	0	0
	(Yun et al. 2022)	0	2	0	0
	(Chinnasamy et al. 2020)	0	1	0	0
Standard practice guidelines or parameters on periodontitis	(Sethna et al. 2020)	0	5	0	0
	-	0	0	0	1
	(Chinnasamy et al. 2020)	0	1	4	0
Standard practice guidelines or parameters on diabetes	(Laniado et al. 2021)	0	6	0	0
	(Shimpi et al. 2021)	1	0	1	0
	(Sede et al. 2015)	0	0	1	0
	(Laniado et al. 2021)	0	0	1	0
	(Chinnasamy et al. 2020)	0	4	1	0
Current practice in your clinic	(Glurich et al. 2018)	0	4	0	0
	(Lau et al. 2021)	2	6	3	0
	(Yun et al. 2022)	0	0	4	0
	(Lau et al. 2021)	0	2	1	0
	(Yun et al. 2022)	1	5	1	0
Opinion on dental-medical integrated patient management	(Laniado et al. 2021)	0	5	0	0
	(Paquette et al. 2015)	1	9	1	0

Pre-Test Findings: Demographic Information

Table 3 summarises the demographic profile of the clinicians who participated in this questionnaire pre-test.

Table 3. Participant's demographic information

Demographic Profile	Number (%) of respondents
Age group, mean 33.2, range 26-43 (years old)	
<25	0
26-29	5 (16.67)
30-34	13 (43.33)
>35	12 (40)
Gender	
Male	10 (33.33)
Female	20 (66.67)
Practice	
General Dental Practitioner	30 (100)
Dental Specialist	0
Dental Therapist	0
Place of Practice	
Government	19 (63.33)
Private	6 (20.0)
Both	5 (16.67)
Years of Practice, mean: 8.3, range 2.5-16 (years)	
<5	5 (16.67)
6-10	22 (73.33)
11 -15	2 (6.67)
>16	1 (3.33)

All 30 postgraduates and GDPs involved were over 25 years old, as a minimal level of clinical experience is required before continuing postgraduate studies. Five (16.7 %) clinicians were 26 to 29 years old. Meanwhile, 13 clinicians (43.33%) were 30 - 35 years old, and 12 (40%) were above 35. Ten clinicians recruited among the postgraduate students of UKM were male, and the remaining 20 were female.

All 30 recruited clinicians were GDPs who met the inclusion criteria. Although the initial aim was to pre-test the questionnaire with the original target group, private GDPs, due to limitations and the availability of postgraduates, only 11 of the clinicians were GDPs who worked in the private sector. Among these, 6 worked in the private sector only, while the remaining five worked in both the government and private sectors. Nineteen of the clinicians were GDPs who worked in the government sector only.

The clinicians were further categorised by years of practice to assess differences in perception across generational gaps and evaluate whether experience and credibility influenced their responses. However, we acknowledged that knowledge does not solely depend on the length of practice. Five clinicians have under 5 years of practice experience; 22 clinicians had an experience range of 6 - 10 years. Two clinicians had 11 -15 years of practice, and 1 had more than 16 years of practice experience, showing the variety of experienced clinicians that adds value to the validation of this pre-test questionnaire.

Validation of Questionnaire

For item 1, clarity and direction of the items, all 30 clinicians were generally satisfied with the questionnaire, stating that the instructions and items were clear and easy to understand. Item 2 is the presentation and organisation of the items, for which 100% of the clinicians were satisfied with the questionnaire. Thus, it can be confirmed that the items are logically presented and organised.

Item 3 focuses on the suitability of the items, with 29 clinicians evaluating the item as satisfactory and only one clinician finding it unsatisfactory, suggesting that the items appropriately presented the substance of the research and the questions were designed to measure the intended skills. However, one clinician who rated the item as satisfactory suggested that questions 1 to 14 were difficult to use with a scale to measure knowledge. Since this suggestion came from a participant who still found the item satisfactory, we concluded that no changes to the questions were necessary.

Next, item 4 assessed the adequacy of the content, with 29 clinicians expressing satisfaction and only one clinician expressing dissatisfaction with the questionnaire. This finding indicates that the number of questions per area sufficiently represents all the topics needed for the research.

Item 5 was to identify the attainment of purpose, where all 30 clinicians were satisfied with the questionnaire. Thus, it can be concluded that the instrument as a whole fulfils the objectives needed for the research. Next, item 6 evaluates the aim of this questionnaire, in which 100% of the clinicians are satisfied. So, it can be shown that each item question requires only one specific answer or measures only one behaviour, and the questions were able to achieve the objectives of this study. The final item assessed the scale and evaluation rating, with 29 clinicians expressing satisfaction and only one clinician expressing dissatisfaction with the questionnaire. The response indicates that the scale

used is appropriate for the items. The dissatisfaction likely stemmed from question 21, where the instructions directed respondents to select A, B, C, D, or E, while the options provided were 1, 2, 3, 4, and 5. Seven clinicians highlighted this issue in their suggestions for improvement. Consequently, we decided to rectify this mistake and correct it for the final questionnaire. The summary for this section is shown in Table 4 below.

Table 4. Satisfactory level of validation items, n(%)

Item	Satisfactory (3-5)	Unsatisfactory (3-5)
1	30 (100)	0
2	30 (100)	0
3	29 (96.67)	1 (3.33)
4	29 (96.67)	1 (3.33)
5	30 (100)	0
6	30 (100)	0
7	29 (96.67)	1 (3.33)

SUGGESTIONS FOR IMPROVEMENT.

Only nine of the 30 clinicians suggested comments for questionnaire improvements (Table 5). This limited feedback may be attributed to their busy schedules, as they kindly completed the questionnaire between attending to patients. Specifically, one clinician commented that rating knowledge on a scale in Questions no.1 to no.14 was difficult, as the content is more qualitative than quantitative.

Seven suggestions were about Question no.21 under the 5th domain, Standard Practice Guidelines or Parameters for Diabetes. The instructions have stated to please select (A): Very Willing, (B): Somewhat willing, (C): Not sure, (D): Somewhat unwilling, and (E): Very unwilling for question no.21, but the choices of the answer given were 1, 2, 3, 4, 5. The clinicians reported that certain aspects of the questionnaire were confusing and disrupted the flow.

Additionally, another respondent commented that the scale for questions no.25 and no.26 felt inappropriate, as it ranged from (1) Very confident, (2) Confident, (3) Not confident, to (4) Not confident at all, moving from a positive to a negative note. It was found inconsistent with other questions, such as no.32 and no.33, which used a scale from negative to positive, ranging from (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, to (5) Strongly Agree. Moreover, another respondent suggested bolding or italicising the instructions to differentiate them from the questions. All three suggestions were implemented in the final questionnaire.

Table 5. Suggestions for Questionnaire Improvement

No	Suggestions
1	'Question 21 scale info is wrong. I prefer all questions to have a scale of 1-5.'
2	'Question 21: (A, B, C, D, E) or (1,2,3,4,5)?'
3	'The scale on fifth domain item no 21 is confusing. Selection includes (A, B, C, D, ...) but options given in numeric (1,2,3, ...)'
4	'The numbering for Question 21 did not match.'
5	'The Q21 description is in the alphabet, but the selection is based on the number.'
6	'Error in 5 and 21 answer selection'
7	'To correct part Q21'
8	'Q1 to 14, it is a bit hard to use the scale to measure knowledge, and it is hard to pick the accurate answer. The Q25 and 26 scales are a bit weird because, suddenly, score 4 is in the opposite direction from the previous questions.'
9	'Perhaps we can bold or italic the instruction site to differentiate it from the question itself.'

Questionnaire finalisation.

Finally, the questions were organised into a concise, reader-friendly questionnaire format of eight pages. Clear instructions were provided for the participants to answer the questions, which included 33 questions, as listed in Figure 3

Figure 3. Questions included in the questionnaire

Questions
Socio-demographics. 1. Age: _____ years old 2. Gender: □ Male □ Female 3. Practice: □ General Dental Practitioner □ Dental Specialist □ Dental Therapist 4. Place of practice: □ Government □ Private □ Both 5. District and state of current practice e.g, Shah Alam, Selangor: _____ 6. Year of graduation (First Degree eg: BDS 1996): _____ 7. Years of practice: _____
General Awareness of Oral Health and Diabetes Mellitus. 1. Which of these factors influence periodontal health in patients with diabetes? Age, Smoking, Obesity, Stress. 2. Normal fasting blood sugar is between 4 to 6 mmol/L. 3. An individual may not be aware of his/her DM status for many years. 4. Patients with glycated hemoglobin level (HbA1C) of < 5.7% have good glycemic control. 5. If a diabetic person's fasting blood sugar level in the morning is in the normal range, he or she can eat anything for that day. 6. Early identification of at-risk individuals can delay or prevent the onset of DM. 7. Bleeding-on-probing (BOP) is the most indicative sign of periodontal disease than gingival swelling. 8. If the blood sugar level is high for long period, it may cause other health problems such as blindness.
Bidirectional relationship between diabetes and periodontitis. 9. Periodontitis is one of the major complications of diabetes mellitus. 10. A diabetic patient with periodontal disease is more likely to have poor glycaemic control. 11. Diabetic patients are three times more likely to get periodontal disease and oral health problems than non-diabetic patients. 12. Patients with diabetes are 2 - 3 times at increased risk for severe periodontal disease. 13. Patients with uncontrolled DM are difficult to recognize as they respond to periodontal therapy similarly to non-diabetics. 14. Scaling and root surface debridement may improve periodontitis and glycaemic control in individuals with DM.
Standard practice guidelines or parameters for periodontitis. 15. Are you familiar with the following periodontal health screening assessments? a. Basic periodontal examination, BPE b. Community periodontal index for treatment needs, CPITN c. Periodontal screening and recording, PSR d. Complexity levels for periodontal patient referral (BSP) e. Management guidelines for periodontitis stage I-III (EFP) f. Management guidelines for periodontitis stage IV (EFP g. Panduan Diagnosis periodontitis dan peri-implantitis (KKM) h. Clinical Practice Guidelines for Management of Type-2 diabetes, CPG (KKM)

Standard practice guidelines or parameters for diabetes.

16. Dental practitioners are pivotal in screening patients for DM in the dental setting.
17. Dental practitioners are vital in conducting chair-side DM screening.
18. Diabetes screening in the dental setting will help patients understand the link between poorly controlled diabetes and periodontal health.
19. Diabetes screening in dental clinics will benefit in detecting undiagnosed diabetes in patients.
20. In your opinion, will the following benefit in managing at-risk/diabetic periodontitis patients?
a. Educate patients about diabetes and oral health connection
b. Refer at-risk/diabetic patients to a medical provider
c. Consult physicians for evaluation prior to a dental treatment
21. If you were considering the incorporation of diabetic screening chairside into your practice, how willing would you be to do each of the following?
a. Conducting finger stick blood glucose screening
b. Incorporating non-invasive methods to determine at-risk patients
c. Referring at-risk patients to a medical provider

Current practice in your clinic

22. Have you managed a diabetic patient in your dental practice before?
23. What are/would you expect to be the challenges when conducting chairside diabetes risk assessment at your practice?
a. Amount of time required to obtain and discuss a patient's test results
b. Lack of reimbursement for the time taken to obtain and discuss a patient's test result
c. Lack of confidence in my ability to obtain and discuss patient's test results
d. Patient resistance to having a HbA1c test in the dental office
e. Lack of adequate referral knowledge
f. Lack of insurance reimbursement for testing
g. Cost of in-office monitoring equipment and supplies
24. I look for DM risk factors in my patients as this may have important implications for their oral health.
25. How confident are you in identifying the risk factors associated with type 2 diabetes?
26. How confident do you feel about managing a patient with diabetes or risks of diabetes and oral health issues (including periodontal disease) in your practice?
27. How comfortable are you to talk about the subject of diabetes with your dental patients?
28. How often do you consult with medical practitioners on patients with periodontal conditions and suspected diabetes?
29. How often do you refer patients who present with periodontal disease and suspected diabetes to a medical practitioner?

Opinion on dental-medical integrated patient management

30. In your view, would better collaboration between medical and dental teams benefit patients with risk factors for Type 2 diabetes?
31. Would you welcome the opportunity for continuing education and training in the links between oral health and diabetes?
32. Dentists should be trained to actively manage patients with systemic diseases (e.g., diabetes, respiratory disease, CVD).
33. Medical colleagues expect me to play a more active role in the management of my patients' systemic health issues (diabetes, respiratory disease, CVD, etc.).

DISCUSSION

This study aimed to create an effective questionnaire to assess the current practices and perceptions of private general dental practitioners (GDPs) regarding shared care management for patients with diabetes and periodontitis. The lack of acceptable and usable guidelines highlights the need to evaluate current practices and perceptions among GDPs, with the goal of introducing new guidelines or protocols to standardize the process. To date, there has not been a specific questionnaire designed to assess this topic. The domains of this questionnaire were generated from the perspectives of dentists and dental students, based on existing and published literature, ensuring the questions are highly appropriate, accurate, and relevant.

Self-reported questionnaires have been widely used in similar investigations globally (Barbara et al. 2010; Bissett et al. 2019; Pakdaman et al. 2015; Panakhup et al. 2021; Popat et al. 2016), particularly in dentistry, allowing information to be collected, quantified, standardised, and compared quickly and easily. The initial design of the questionnaire involved two key actions: a literature review to identify similar previous research and surveys conducted globally and discussions with experts, specifically, two specialists from the periodontics department with extensive experience in treating periodontitis patients with diabetes risk. This dual approach ensured the questionnaire's content validity, quality, and comprehensibility. The experts carefully evaluated the strengths and weaknesses of the questionnaire, providing valuable feedback that guided its refinement.

Content validation included expert evaluation which included 3 peridodontists and target population feedback to obtain holistic results. We approached 30 postgraduates from various specialities and general dental practitioners at UKM to participate in the pre-test, ensuring diverse opinions and perceptions. The pre-test results showed that the clinicians universally agreed upon and accepted items related to clarity and directions, presentation and organisation, attainment of purpose, and objectives, indicating complete accuracy in these domains. Other items, such as the suitability of items, adequacy of content, and scale and evaluation rating, were accepted with a satisfaction rate of 96.67%, suggesting some room for improvement.

The primary suggestion involved the scale for Question No. 21, where the instructions asked participants to choose A, B, C, D, and E, but the options were given in numerical order. Additionally, there was a recommendation to synchronise the scales across all questions to ensure a consistent flow—from positive to negative—to facilitate easier participant understanding. These suggestions were implemented in the final questionnaire, enhancing its clarity and usability. The main suggestions were primarily about the scale and evaluation rating, indicating that while the questionnaire content was highly appropriate and relevant, the flow might confuse future participants.

The study had several limitations. Convenience sampling was used, selecting participants who happened to be available at the time or period of the research, which may limit the generalizability of the results. In our study, we chose postgraduates from the Faculty of Dentistry at UKM, trying to select participants who fulfilled the inclusion criteria as much as possible. Another limitation was the use of physical forms for the questionnaires, which incurred difficulties such as being tedious and time-consuming. However, it increased the likelihood of participants filling out the questionnaires compared to online forms, which are often overlooked. The questionnaire was six pages long, excluding the information sheet and consent form. Due to their busy schedules, most participants could not fill out the questionnaire on the day it was given out, requiring extra time and extending the research period as the questionnaires had to be collected another day.

The development of this questionnaire is important for standardising the assessment of GDPs' knowledge and perception regarding shared care management for patients with diabetes risks and periodontitis. Given the strong bidirectional relationship between these conditions, early identification and intervention are important in reducing complications and improving outcomes. Similar studies have been conducted in different social and healthcare settings such as the United Kingdom (UK) Bissett et al. 2019 and Iran Pakdaman et al. 2015 where researchers assessed dentists' awareness of periodontal – diabetes correlations. In the UK, where shared care between medical and dental professionals is more established, findings show a higher level of awareness among GDPs' though, gaps remained in integrating diabetes screening into routine dental care. Conversely, in Iran, where healthcare structures differ, a significant proportion of GDPs lacked formal training in managing patients with periodontitis and diabetes, reflecting disparities in education and healthcare integration. These comparisons emphasise the need for a culturally tailored and practice-specific questionnaire to address local gaps in knowledge and encourage standardised guidelines suited to Malaysian dental practice.

CONCLUSION

In conclusion, the developed questionnaire is a valid and reliable tool for assessing GDPs' shared care management practices for patients with diabetes and periodontitis. The newly developed questionnaire underwent validation and demonstrated a high level of agreement among reviewers, reinforcing its credibility as an assessment tool. The pre-test participants' high satisfaction rates and constructive feedback indicate their potential for broader application in future studies. Implementing suggested improvements has enhanced the questionnaire's clarity and effectiveness, making it a valuable resource for ongoing research in this field. This questionnaire will be used to further assess the dental practitioners' knowledge and perceptions regarding the bidirectional relationship and management of diabetes and periodontitis with implications for future policy development, educational programs, clinical practice integration and guidelines.

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We have used Grammarly to proofread and improve the language of the manuscript. The context, idea and materials are originally from the authors.

COMPETING INTERESTS

The authors declare that they have no competing interests.

ETHICAL CLEARANCE

We obtained approval from the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM PPI/111/8/JEP-2023-382), registered under DD-2023-022

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