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BMJ Open Psychologically informed oral health interventions in pregnancy and type 2 diabetes: a scoping review protocol

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ABSTRACT

Introduction Periodontal health is becoming a recognised component in managing gestational diabetes. Gestational diabetes is characterised as raised blood glucose levels first discovered in pregnancy and managed similarly to type 2 diabetes. Currently, the standard intervention for gestational diabetes in the UK entails dietary modifications and physical activity interventions. However, considering the literature discussed in this review, it is argued that oral health advice and support should also become an integrated part of gestational diabetes management.

Objective The objective of this scoping review is to map out psychologically informed oral health interventions in pregnancy and type 2 diabetes. This will inform the development of a new behavioural intervention to promote oral health-related behaviours in women with gestational diabetes. As no literature exists on oral health interventions in gestational diabetes, it was deemed appropriate to synthesise the evidence on oral health interventions designed for pregnant women and individuals with type 2 diabetes.

Methodology The scoping review will be conducted using the Joanna Briggs Institute's methodology for scoping reviews. Studies including pregnant women and individuals with type 2 diabetes over 18 years of age will be included. Only studies including a psychologically informed oral health intervention will be considered. The authors will consider experimental and quasi-experimental research designs. The Ovid Interface including EMBASE, Medline, Global Health, APA PsychInfo, Health Management Information, Maternity, Infant Care Database and the Cochrane Library will be used as information sources. The planned searches will commence on the week of the 25 July 2022. Only articles in Danish and English will be considered. The study selection will follow the Preferred Reporting Items for Scoping Reviews process. The data will be presented using narrative synthesis.

Ethics and dissemination No ethical approval is needed for this review. The results will be published in a relevant scientific journal.

INTRODUCTION

Periodontal disease (PD) is a chronic, inflammatory disease of the periodontium¹ caused by biofilm bacteria.² It can be grouped into gingivitis (inflammation of the gums) and periodontitis, which is the advanced form

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The search strategies were developed with a librarian ensuring comprehensiveness.
- ⇒ This review will not assess the risk of bias or publication bias.
- ⇒ The language eligibility criteria may exclude relevant studies.

of gum disease with destruction of the periodontal tissues, bone and tooth supporting tissues.² PD affects approximately 45% of the adult British population² and 20%–50% of the global population.³ A recent surveillance study⁴ used data from the WHO's data bank⁵ and found that Belarus (76%), Germany (73%) and Nepal (64%) were the countries with the highest prevalence of PD among adults, while approximately half of the adult populations in Poland, Malaysia, Libya, Taiwan and Iran had PD. A review conducted on patient perceptions in dentistry found that fear of pain was a significant barrier to dental-seeking behaviour which may explain the high prevalence of PD.⁶

PD is associated with gradual tooth loss and loose teeth, bad breath, pocket formation in the periodontium, receding and bleeding gums, and tooth exfoliation. PD may cause poor food uptake, leading to vitamin and nutritional deficiencies.⁷ It may also negatively affect the individuals' quality of life as demonstrated in a recent systematic review.⁸ Treatment of PD involves removal of gingival bacterial plaque performed by the dental team, and surgery to remove deep residing bacterial plaque in periodontal lesions is regularly needed.⁹ It is the patient's responsibility to undertake daily, rigorous oral hygiene behaviours to maintain what the dental team has achieved.³

Psychological approaches to oral health behaviour

The maintenance of good oral health is dependent on the patients' efforts involving behaviours such as daily oral hygiene practices and treatment help seeking.¹⁰ However, given the high prevalence of PD globally,² it is evident that the general population's oral hygiene practices and treatment help seeking behaviours are suboptimal. While it is recommended to brush teeth two times a day to maintain good oral health, a recent survey suggested that 29% of British people brushed their teeth once per day, while 2% stated that they do not brush at all.² This is of concern given the severe consequences PD can have for the individual's health and quality of life. However, it appears that tooth brushing frequency has increased in other countries. Research shows that the prevalence of more-than-once-a-day tooth brushing has increased in countries such as Russia, Norway and Belgium from 1994 to 2010,¹¹ suggesting a shift in the right direction concerning oral health behaviours.

There is substantial evidence to suggest that psychologically informed interventions to improve health behaviours are effective.¹⁰ For example, in a systematic review conducted on psychologically informed interventions for oral health behaviour, it was found that interventions incorporating planning of the behaviour, goal setting (eg, brushing two times per day) and behaviour monitoring were effective in changing behaviour. Interventions with a feedback component were furthermore effective in inducing oral health behaviours.¹⁰ Another systematic review demonstrated that psychologically informed interventions versus educational interventions were superior in reducing plaque index, while psychologically informed interventions were significantly better in promoting oral health behaviours and increasing self-efficacy in tooth brushing compared with other types of interventions.¹² Psychologically driven interventions targeting oral health are therefore necessary to improve oral health behaviours and the oral health status among the general population.

Gestational diabetes mellitus

Gestational diabetes mellitus (GDM) is characterised as raised blood glucose levels (hyperglycaemia) with first onset in pregnancy.¹³ The cause of hyperglycaemia is the body's inability to effectively use or produce enough of the hormone insulin which is responsible for carrying glucose from food into the body's cells.¹³ Blood glucose levels often return to normal after delivery, making GDM a temporary condition only encountered in pregnancy.¹³ GDM affects approximately 15% of the global population,¹³ and four to five women in 100 of the British population will develop GDM.¹⁴ It also accounts for ~80% of pregnancy complications today.¹³ Older age (>35 years), overweight and obesity, diabetes in the immediate family, infants with large birth weight (>4 kg), higher number of births (fetuses >24 weeks), previous history of GDM and previous perinatal complications are risk factors for GDM development.¹⁵ Management of GDM includes dietary

changes, increase in physical activity and blood glucose monitoring.^{13 16}

GDM is associated with adverse outcomes both for the mother and the infant. For the mother, some of the adverse outcomes include hypertension, antepartum and postpartum haemorrhage, premature rupture of membranes^{13 17} and a sevenfold increased risk of future type 2 diabetes (T2D) development.^{13 18} GDM also has adverse outcomes for the fetus including large birth weight, hypoglycaemia (low blood glucose levels), shoulder injury during delivery, nerve damage and still-birth.^{13 19}

Emerging literature suggests that periodontal health has multidirectional relationships with systemic diseases including diabetes mellitus (DM),^{20–24} and more recently GDM.^{25 26} Poor periodontal health has also been implicated in adverse pregnancy outcomes.^{27–32} Yet, to date, no evidence on what oral health support women with GDM receive exists. In light of the following discussions of the multidirectional relationships between periodontal health, GDM and pregnancy, it is argued that oral health support should be an essential component in managing GDM.

Periodontal health, gestational diabetes and pregnancy

Normoglycaemic pregnancies are associated with compromised oral health due to the hormonal changes occurring during pregnancy, with oestrogen levels increasing 30-fold and progesterone levels increasing 10-fold when compared with hormonal levels in the non-pregnant female population.^{33 34} The literature further suggests a bi-directional relationship between periodontal health and GDM. Citing GDM as a risk factor for PD, one study reported that women with GDM had a higher prevalence of PD compared with pregnant women without GDM (77.4% vs 57.5%), after controlling for confounding factors (OR=2.6, 95% CI: 1.1 to 6.1).²⁵ Concerning poor oral health as a risk factor for GDM development, random-effects meta-analysis of 5724 participants found that baseline PD was associated with an increased risk of GDM development by 66% (OR=1.66, 95% CI: 1.17 to 2.36).²⁶

PD in pregnancy is moreover independently associated with adverse pregnancy outcomes^{27 30 32 35} including low birth weight and pre-term birth, but this association is impacted by PD case definition.³¹ Case definition refers to the different methods of assessing PD.³¹ There are currently no uniform criteria to define PD, and to assess the extent and severity of it.³¹ This has led to inconsistent findings across studies on the association between PD and adverse pregnancy outcomes. Therefore, the significance of the relationship between PD and adverse pregnancy outcomes depends on the definition used to assess PD.³¹

Type 2 diabetes and oral health

Like GDM, T2D is a metabolic disease characterised by hyperglycaemia.¹³ T2D affects ~7% of the British population and 462 million people globally, making it one of

the fastest growing health emergencies worldwide. Risk factors for T2D include age, family history of diabetes and overweight and obesity. T2D management is like interventions seen in GDM and include lifestyle changes, blood glucose monitoring and eventually medication as the disease progresses.¹³ As observed in women with GDM, emerging evidence suggests a bi-directional relationship between oral health and T2D. For example, one study found that PD is more prevalent in individuals with T2D compared with diabetes-free controls (23.8% vs 19.5%, OR=1.22, 95% CI: 1.03 to 1.45),²¹ and recent cross-sectional evidence suggested that 95.1% of individuals with T2D had some periodontal destruction.³⁶ Baseline PD has furthermore been found to be an independent risk for incident T2D two decades later in 9296 T2D-free individuals at baseline, after controlling for diabetes-relevant factors such as body mass index (OR=2.26, 95% CI: 1.56 to 3.27).²⁴

Systemic link between periodontal disease, gestational diabetes and type 2 diabetes

PD produces an inflammatory host-response characterised by dysregulated secretion of host-derived inflammation such as IL-1 β , an interleukin-1 made by the white cell count, macrophage, which helps the lymphocyte (another type of white cell count) fight infection.³⁷ The level of inflammation is dependent on the genetic, environmental and epigenetic factors of the host.³⁷ In animal studies, it has been suggested that inflammatory responses caused by PD may disseminate systemically to the foetal-placenta unit via blood circulation and cause adverse pregnancy outcomes.^{38 39} For example, in one study, pregnant hamsters were injected with a periodontal pathogen and had PD induced in another study. Results from both studies indicated a significant reduction in growth for the fetuses,^{38 39} suggesting the importance of good oral health in promoting healthy pregnancies and fetus outcomes. Bacteria from PD may also enter the bloodstream and spread systemically into the body and affect metabolic control in diabetes, and periodontal therapy has been shown to improve HbA1c (glycated haemoglobin is a form of haemoglobin that is chemically linked to a sugar and is used to help diagnose and monitor diabetes (retrieved from www.diabetes.org.uk)).⁴⁰ Successful periodontal therapy leading to improvements in periodontal status can also change metabolic status and cardiovascular (CV) markers and signs.^{24 41}

Concerning the systemic link between PD and T2D, evidence suggests a two-way relationship.^{20 42} For example, it was demonstrated that severe PD at baseline was linked with poor glycaemic control in T2D at a 2-year follow-up,⁴³ while non-oral diabetes-related complications such as CV complications were linked with severe PD.^{22 44–46} T2D is also associated with increased markers of inflammation which is associated with CV complications.⁴⁷ Moreover, it is evident that systemic inflammation can contribute to hyperglycaemia by impacting the insulin's ability to transport glucose into cells.⁴⁸

Rationale

The prevention and treatment of PD is a collaboration between the dental team and the patient. However, the maintenance of good oral health relies on the patients' ability to undertake daily oral hygiene behaviours.¹⁰ Given the high prevalence of PD globally,³ evidence suggests that the general population is not undertaking the recommended oral hygiene behaviours. Nevertheless, substantial evidence suggests that psychologically informed interventions are effective in inducing oral health behaviours^{10 49 50} and can therefore be used as an effective mean to improve oral health behaviours and oral health status in the general population.

It has furthermore been established that GDM independently poses adverse risks to the mother and infant,^{13 51} and that PD independently predicts adverse pregnancy outcomes.^{27 30 31 35} PD is also associated with GDM development as demonstrated in meta-analysis,²⁶ while PD is more prevalent in women with GDM, compared with pregnant women with normoglycaemia,²⁵ and in people with T2D compared with diabetes-free individuals.⁵² Online supplemental figure 1 describes the multidirectional relationships between PD, GDM, T2D and adverse pregnancy outcomes.

Achieving normoglycaemia through self-management behaviours is the foremost important strategy to effectively manage GDM and T2D.¹³ However, PD negatively affects glycaemic control in diabetes.²⁰ This, therefore, highlights the need for oral health interventions for women with GDM to ensure healthy pregnancies and outcomes for the mother and infant. The effective management of hyperglycaemia in GDM also decreases the risk of later T2D development for the mother.¹³ Dietary modifications and physical activity interventions are standard care for GDM management today in the UK.¹³ However, given the presented introductory evidence, it is argued that oral health advice and support should form part of standard GDM management. As no evidence currently exists on oral health interventions in GDM, and given the similar aetiology between GDM and T2D,¹³ and the availability of literature on oral health interventions in pregnancy⁵³ and T2D,⁵⁴ a scoping review was deemed appropriate to map out the existing literature on this topic.

Objectives

The objective of this scoping review is, therefore, to map out existing psychologically informed oral health interventions for pregnant women and individuals with T2D, including their theoretical underpinnings. Psychologically informed interventions refer to interventions that are designed to target patient knowledge, beliefs, attitudes, emotions and behaviours.⁵⁵ The scoping review will further examine an additional three outcomes: (1) the precise behaviours targeted in the identified oral health interventions, (2) the extent to which these behaviours map on to the COM-B model⁵⁶ and the Theoretical Domains Framework (TDF)⁵⁷ and (3) who (eg, healthcare professionals) deliver these oral health interventions. The

outcome of this review will be used to guide the development of a novel oral health intervention for women with GDM which forms part of a PhD project conducted by the first author of this protocol. To our knowledge, this is the first attempt in creating a psychologically informed oral health intervention for women with GDM in the UK. The proposed oral health intervention will assist in managing the compromised oral health experienced in GDM pregnancies and assist in improving glycaemic control which will decrease the likelihood of adverse outcomes for the mother and infant.

NOVELTY STATEMENT

A preliminary search of the Ovid Interface (EMBASE, Medline and Global Health) found that one systematic review with narrative synthesis was conducted on oral health interventions for pregnant women by Vamos *et al.*⁵³ However, new oral health interventions for pregnant women may have emerged which will be presented in this review. No current or underway systematic reviews on oral health interventions in T2D or GDM were identified on the Cochrane Database or PROSPERO. This protocol is registered on the Open Science platform.

METHODOLOGY

The authors will conduct the scoping review in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews.⁵⁸

Eligibility criteria

The participants, concept, context and study design will be used to guide the study selection.⁵⁸ The eligibility criteria are summarised in online supplemental table 1. The participants refer to the population under study, the concept refers to details about the intervention and the outcomes, the context refers to details about the setting and geographical location of the study and the study design refers to the methodology used.⁵⁸

Eligible participants

Studies which have recruited pregnant women at any gestational age, who are over the age of 18 years will be considered. A minimum age of 18 years has been selected as first-time mothers in the UK are 28.9 years on average,⁵⁹ and recent data from the USA suggest an average age of 30.7 years for first-time Asian mothers, 27.8 years for first-time Caucasian mothers and 27.9 years for first-time Hispanic mothers, respectively. The likelihood of identifying oral health interventions designed for teenage mothers is therefore relatively low. Moreover, individuals under the age of 18 who are pregnant may be considered a high-risk population to recruit for research purposes resulting in limited available literature.

Studies with individuals over 18 years of age with a medically or self-reported diagnosis of T2D will be considered for synthesis. A self-reported diagnosis was deemed

eligible as evidence suggests that self-reported history of a doctor diagnosis of a medical condition is a valid measure of a medical diagnosis.⁶⁰ The average age of onset for T2D is ~45 years of age,¹³ thus, the likelihood of identifying studies including individuals under the age of 18 years of age with T2D is unlikely. Studies including individuals with T2D, and common comorbidities associated with T2D such as hypertension, depression, obesity and CV disease⁶¹ will be considered. Studies including participants who are new to insulin or who have been administering insulin for a longer period will be included. Studies with individuals who have non-insulin dependent T2D will also be considered. To the authors' knowledge, no literature on oral health interventions and GDM exists; however, if literature on said topic is identified through searches, participants with medically confirmed diagnoses of GDM will also be considered.

Lower socioeconomic status,⁶² educational level and ethnicity⁶³ are risk factors associated with poor oral health. Therefore, all demographic factors such as ethnicity, race and education level will be considered for inclusion, as the objective of this review is to examine oral health interventions in the pregnant and diabetic populations as a general, rather than subgroups within these populations. This review will also consider pregnant women with existing T2D to enhance the diversity of the sample and breadth of literature.

Ineligible participants

Studies including women who are not pregnant and pregnant women under the age of 18 years will not be considered. Studies including individuals with type 1 diabetes (T1D) will not be considered, as women with a history of GDM are more likely to develop T2D in future,^{13,51,64} while management of T2D is more like that of GDM compared with T1D,¹³ making oral health interventions designed for individuals with T2D more relevant for the purposes of this review.

Eligible concepts

This review will consider all types of psychologically driven oral health interventions designed to increase oral health-related behaviours such as oral health behaviours, oral health knowledge and oral health self-efficacy. Psychologically informed interventions refer to interventions that are designed to target patient knowledge, beliefs, attitudes, emotions and behaviours.⁵⁵ Interventions designed with different modes of delivery such as in-person or remotely, individually delivered or delivered in a group will be considered. Different types of interventions such as educational interventions on oral health, instructional interventions on oral health (eg, demonstration of tooth brushing) and provision of dental supplies will be considered. Studies including outcomes such as self-reported and/or observed oral health behaviours including tooth brushing, interdental cleaning, oral health knowledge, self-efficacy, attitudes, beliefs, and perceptions about oral

health, and clinical or biological markers of periodontal status such as bleeding on probing will also be considered.

Ineligible concepts

This review will not consider studies which do not have a psychologically driven intervention. Example of these include oral health interventions involving periodontal therapy only and where outcomes are solely clinically assessed (eg, bleeding on probing) and when no oral health-related outcomes involving the participants behaviours or knowledge, or attitudes in relation to oral health are assessed.

Context

Studies including all cultural/subcultural, geographic locations and settings will be considered for synthesis, hence no exclusion criteria apply.

Eligible study designs

This review will consider studies using experimental and quasi-experimental designs such as randomised controlled trials, non-randomised controlled trials, before and after studies and interrupted time-series studies. Systematic reviews that meet the inclusion criteria will also be considered if the research questions are deemed appropriate for the purpose of this review. Mixed method studies will be considered.

Ineligible study designs

Studies including a qualitative methodology will be excluded, as will observational analytical, cohort, cross-sectional and case–control studies.

Search strategy

The search strategy (online supplemental figure 2) was developed by CK by reviewing the search strategies of systematic reviews on oral health interventions in pregnancy and T2D from the Cochrane Library (2022), and by following the recommended guidelines from JBI.⁵⁸ KA and a librarian from King's College London provided comments and feedback for the proposed search strategy and recommended changes were made. CK further emailed the main author from the Vámos *et al*⁵³ systematic review on oral health interventions in pregnancy to request their search strategy as this was not readily available online. The outcome of this email will be addressed in the scoping review.

The search terms were derived from four categories: oral health, intervention, pregnancy and T2D. The reference lists of included literature will be sought for additional studies to ensure a comprehensive search. Studies published in Danish and English will be included as these are the language abilities of the authors. No resources are available for the utilisation of professional translational services of studies published in other languages as this review is part of a PhD project with limited funds. There is no limitation to the dates of the studies considered for this review.

Information sources

The Ovid Interface (2022) will be used to access the following databases: EMBASE+EMBASE Classic (1974–2022), Ovid MEDLINE(R) (1946–2022), Global Health (1973–2021), APA PsychInfo (1806–2022), HMC Health Management Information (1979–2021), Social Policy and Practice and Maternity and Infant Care Database (1971–2022). The Cochrane Library will be sought for any relevant systematic reviews. The EU Clinical Trials Register (<https://www.clinicaltrialsregister.eu/>) and the OpenGrey database will be searched to identify grey and/or unpublished literature.

Data management and study selection

Following the searches, all identified studies will be collated and uploaded to Covidence. Two independent researchers (CK and KA) will screen identified sources against the inclusion criteria summarised in online supplemental table 1.

The study selection will follow the Preferred Reporting Items for Systematic Reviews with Meta-analysis process (online supplemental figure 3).⁶⁵ The first phase is *Identification* and involves collating and counting all identified citations from each of the searches (CK only). In the second phase (*Screening*), CK will remove the duplicate citations using the 'de-duplicate' function in Covidence. Phase three (*Eligibility*) involves assessing the identified citations against the inclusion criteria (CK and KA). The screening will initially be based on the title and abstract of the source, and if eligible, the full text of the source will be assessed (CK and KA). Any disagreements will be resolved with discussions between the independent reviewers. If consensus cannot be reached, a third independent person, MI, will help resolve the disagreement. Online supplemental table 2 will be populated with the studies that were deemed eligible based on the title and abstract screening.

Data extraction

Two independent reviewers (CK and KA) will extract the data from the included papers using the data extraction tool developed by CK. The data extraction tool was developed based on JBI guidelines and recommendations and was designed to extract information relating to the research objectives.⁶⁵ (online supplemental table 3). Therefore, the data extraction tool will extract information involving details of the study methodology and study participants, theoretical basis for the intervention, behaviours targeted in the intervention and the extent to which these behaviours map on to the COM-B model⁵⁶ and the TDF, and who (ie, healthcare professional) delivered the intervention. The extraction tool will be modified as necessary during the data extraction process if CK and/or KA find this necessary to achieve the objectives of the scoping review. Any modifications and deviations from this protocol will be clearly addressed in the scoping review.

Data analysis and presentation

The results and data will be presented in text and tables using narrative synthesis. See online supplemental table 4 for how the data will be presented in the Results section.

Ethics and dissemination

No ethical approval is needed for this scoping review. The authors plan to publish the results of this review in a relevant scientific journal such as the BMJ Open.

Patient and public involvement

No patient and public involvement took place in the development or conduct of this protocol.

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Collaborators N/A. Everyone who has been involved with the development of this manuscript are mentioned in the authors list or in the acknowledgements.

Contributors CK has contributed to the planning and conduct of the abstract, introduction and methodology section, including the development of the search strategy and data extraction tables. MI has contributed to the introduction section regarding periodontal health. AF has contributed to the introduction section concerning the diabetes literature. KA has contributed to the introduction section surrounding psychological approaches in oral health behaviours. All above mentioned persons have given their permission to be mentioned in this manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. Not applicable.

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