

ORIGINAL ARTICLE

Delivering oral health care in gestational diabetes: an interview study to develop a theory and evidence-derived model for healthcare professionals

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Abstract

Introduction: Women with gestational diabetes mellitus (GDM) have a higher prevalence of periodontal disease, whilst oral health is implicated in blood glucose management and GDM development. Oral health may also impact birth weight and prematurity; however, it is often an overlooked topic in maternity care. The complexity and intensity of GDM, and the higher prevalence of psychological distress associated with this condition, call for a tailored approach to oral health care in GDM. Oral health deserves more attention in GDM considering its impact on diabetes and pregnancy-related outcomes.

Aim and methods: This study aimed to explore the support needs of women regarding oral health care within the context of GDM management and to identify specific intervention strategies to address these needs. Semi-structured interviews inspired by co-design principles were conducted, and thematic analysis was used to analyse the data. The output was the development of a theory and evidence-derived care delivery model for healthcare professionals (HCPs) to promote oral health in GDM.

Results and conclusions: The model instructs HCPs in oral health care delivery in GDM. Specifically, the model describes what is needed to engage women with GDM in oral health care and proposes specific intervention strategies to accommodate these needs. The model can also be applied in maternity care to provide HCPs with a structured approach to addressing oral health. The utilisation of our model may improve oral health status, blood glucose management, and health outcomes for women with GDM.

Keywords: *oral health; gestational diabetes; care delivery model; behaviour change*

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Gestational diabetes mellitus (GDM) entails glucose intolerance in pregnancy, and it is the leading cause of pregnancy complications. Treatment focused on diet, physical activity, and medicinal interventions is used to manage GDM.¹ GDM can be psychologically challenging because of the changes to lifestyles that are often required to manage the condition. This added burden can lead to heightened stress, anxiety, and feelings of being overwhelmed, making GDM a particularly complex condition to navigate during pregnancy.² The combination of medical management demands and emotional strain highlights the need for tailored support that addresses both the practical and psychological challenges associated with a GDM diagnosis. Oral health deserves more attention in GDM considering its impact on

diabetes and pregnancy-related outcomes. Oral health care entails dental review and assessment, the adoption of oral hygiene self-management behaviours, and patient education.² Gingivitis and/or periodontitis affect 40% of pregnant women, and its prevalence may be significantly higher in GDM pregnancies (77.4%) than in normoglycemic pregnancies (57.5%).³ Baseline periodontal disease is also associated with a 66% (odds ratio = 1.66, 95% confidence interval [CI]: 1.17–2.36; $p < 0.05$) increased risk of developing GDM.⁴ An inflammatory response is the hypothesised causal mechanism.^{5,6} Oral health status is furthermore associated with blood glucose management in diabetes,⁷ whilst hyperglycaemia negatively impacts periodontal health.⁸ Generic diabetes and pregnancy UK NICE Guidelines recommend an oral health review, and

this should cover GDM too. Specifically, the NICE Guidelines recommend that healthcare professionals (HCPs) should be: (1) advising all individuals with diabetes to attend regular dental check-ups, (2) encouraging those diagnosed with periodontitis to seek appropriate dental treatment, and (3) ensuring that individuals with diabetes know that they are at higher risk of developing periodontal disease.

Theoretical rationale

The COM-B Model and Behaviour Change Wheel (BCW),⁹ were chosen to guide this study (Figure 1a and 1b. See the supplementary file for their descriptions). They have increasingly been used in oral health research,¹⁰ and offer a structured framework for understanding how capability, opportunity, and motivation shape behaviour. Unlike other models, such as the Social Cognitive Theory, the COM-B links with specific intervention functions in the BCW, making it well-suited for identifying actionable intervention targets and translating qualitative insights into evidence-based strategies to support oral health in women with GDM.⁹

Study aim

The study aimed to explore the support needs of women regarding oral health care within the context of GDM management and to identify specific intervention strategies to address these needs.

Methods

This was a qualitative study, which falls under the theory and modelling phase of the MRC Framework. The institution’s research ethics committee gave full ethical clearance of this study in December 2023 with reference LRS/DP-23/24-39927. This study used reporting guidelines from the Standards for Reporting Qualitative Research (SRQR).¹¹

Study population and recruitment

The study population comprised UK women over 18 years of age with a recent history of GDM (a diagnosis within 12 months of participating in the study). Access to a device with an internet connection was an eligibility criterion because the study was conducted online, and the principal researcher (CBK) was residing in Denmark at the time of data collection. Participants were also required to speak and understand conversational English. We previously collaborated with Gestational Diabetes UK to recruit women with current GDM in early 2023. The prospective participants filled in a registration questionnaire and could consent to have their contact information stored in our ‘database’ and to be contacted for future studies. Women who fulfilled the eligibility criteria and had consented to be contacted for future studies were approached in December 2023 and January 2024 to participate in the current study. This method was employed as we experienced difficulties reaching Gestational Diabetes UK to recruit women with current GDM, despite previous successful collaborations.² Prior to participation in the study, the women were informed of the study aims, including the reimbursement (a £15 Amazon voucher), in a participant information sheet.

Data collection and procedure

Individual semi-structured interviews were used to collect the data. An interview guide based on co-design principles was developed with questions such as ‘How would we make oral health important to you, and how would oral health care best be communicated: at what time point, by whom and how regularly?’. In this study, co-design referred to collaboration with key stakeholders in the intervention development process.¹² Demographic

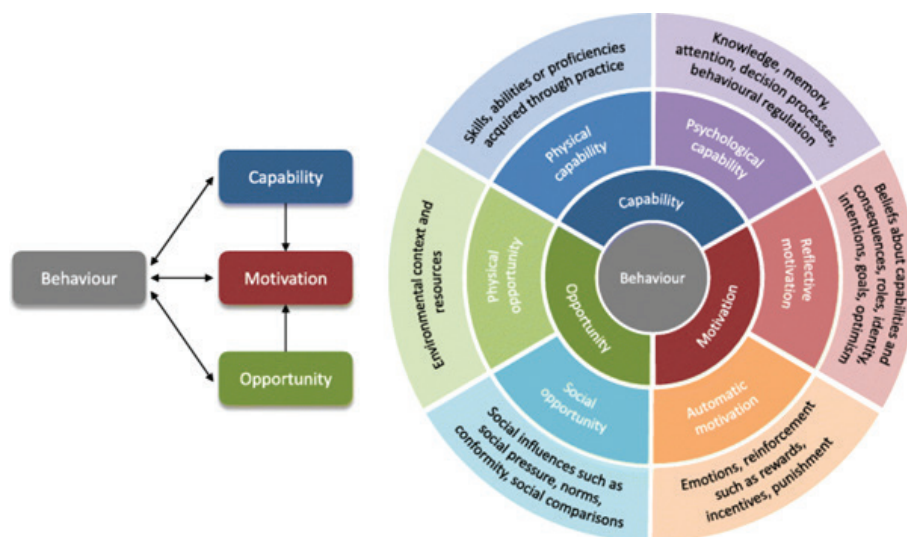


Fig. 1a. The COM-B Model is a system of factors that is proposed to impact behaviour.¹⁰

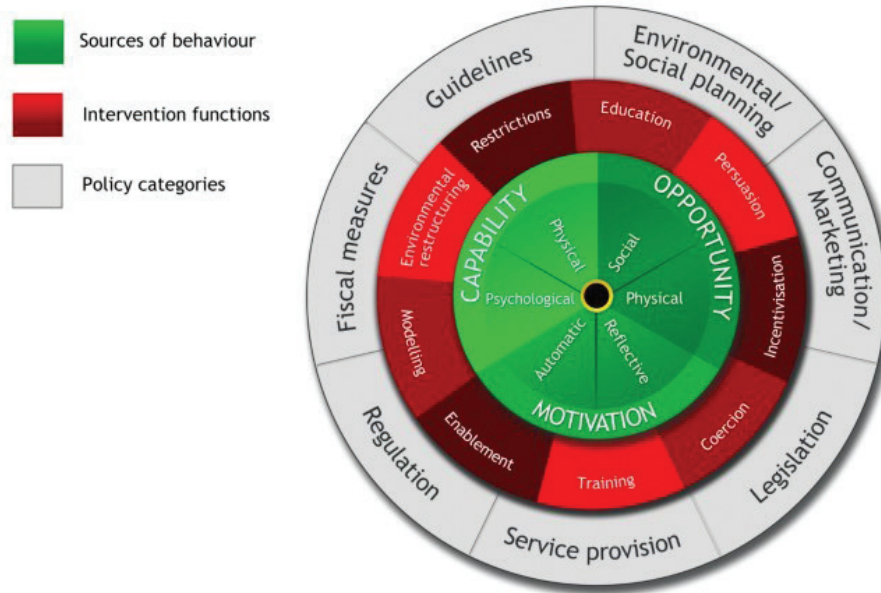


Fig. 1b. The BCW is a method for designing behavioural interventions.¹⁰

information relevant to GDM, such as age and previous GDM¹ was also collected. The interviews were conducted by a female researcher (CBK) in January and February 2024. CBK had received training in qualitative interview techniques from courses at her affiliated research institution and had conducted previous qualitative interviews for research purposes.² The interview guide was piloted on two academic peers experienced before the main data collection to check comprehension. The interviews were held on Microsoft Teams. Field notes with reflections were made by CBK post-interview.

Data management and analysis

The audio files were recorded and transcribed on Microsoft Teams. The transcription function is reasonably accurate; however, CBK reviewed the transcripts and edited any errors or misspellings where needed, as recommended.¹³ The participants were not offered to review the transcripts for comments due to time restrictions. The NVivo version 14 software was used for data management. An inductive and deductive analysis approach was used in this study, as seen in Parsons et al.¹⁴ Firstly, inductive Framework Analysis¹⁵ was used to analyse the data. After inductively deriving the themes, they were deductively mapped onto the COM-B Model to orient the data into different behavioural concepts. The data analysis consisted of the following five steps:

Familiarisation: CBK read the transcriptions repeatedly to achieve familiarisation with the data.

Identifying a thematic framework: A thematic framework was developed by coding the data. Coding was conducted by CBK and supervised by KA and AF.

Coding and indexing: After identifying a thematic framework, it was applied to the data to capture all the aspects. CBK, KA, and AF met to collaborate on this stage of the analysis.

Charting: A framework matrix was developed to illustrate the themes and their supporting data.

Mapping and interpretation: The themes were mapped and interpreted, which became the results of the study. The themes were then deductively mapped onto the COM-B Model.

Results

Data saturation was reached at the 15th interview, when no new themes or concepts were emerging from consecutive interviews, and the information collected sufficiently addressed the study's research questions.¹⁶ Nine women had previously participated in the study conducted in 2023. Table 1 shows the sample demographic characteristics.

Qualitative findings

Three themes were identified (Figure 2). These are presented further in the text and in Table 2 with supporting quotes and their associated COM-B domains. Although not all participants are directly quoted in the presentation of findings, the analysis was informed by the full dataset. Quotations were selected to illustrate the core dimensions of each theme, rather than to represent each individual participant. This approach is consistent with qualitative research practice, where illustrative excerpts are used to capture shared experiences while maintaining clarity and avoiding unnecessary repetition.¹⁷

Table 1. Sample characteristics

Participant	Age	Ethnicity	Educational level	Location (urban/rural)	Civil status	Employment status	Months since giving birth	Number of children	Number of pregnancies	Number of GDM pregnancies
1*	40	Caucasian	Undergraduate	Urban	Married	Employed	10	2	3	2
2	39	Caucasian	Postgraduate	Rural	Co-habiting	Employed	11	2	4	2
3*	30	Mixed ethnicity	Undergraduate	Urban	Married	Employed	12	2	2	2
4*	42	Mixed ethnicity	Further education ^a	Urban	Married	Employed	10	2	3	1
5	33	Caucasian	Further education	Rural	Married	Employed	12	2	4	2
6	29	Caucasian	Undergraduate	Urban	Married	Employed	11	2	2	1
7*	38	Caucasian	Undergraduate	Rural	Married	Employed	9	2	3	2
8*	33	Caucasian	Undergraduate	Urban	Married	Self-employed	9	2	3	2
9*	30	Caucasian	Postgraduate	Rural	Married	Employed	8	3	3	3
10*	39	Prefer not to say	Secondary ^b	Rural	Married	Employed	10	1	1	1
11	35	Caucasian	Postgraduate	Rural	Co-habiting	Employed	11	1	2	1
12	30	Caucasian	Further education	Rural	Married	Employed	11	1	1	1
13*	35	South Asian	Postgraduate	Urban	Married	Employed	8	3	4	4
14*	36	Caucasian	Postgraduate	Rural	Married	Employed	11	2	3	2
15	36	Caucasian	Further education	Urban	Married	Unemployed	7	2	2	1

^aFor example, A levels or sixth form college.

^bGeneral Certificate of Secondary Education.

*Participated in our previous study.

Theme 1: Support when receiving the GDM diagnosis

The accounts from the participants highlight the perceived lack of structured support at the point of receiving a GDM diagnosis. Several participants described feeling inadequately informed by HCPs, with limited guidance provided beyond the diagnosis itself. This left them responsible for independently seeking out information to understand and manage their condition. Such accounts suggest a disconnect between the clinical delivery of the diagnosis and the provision of practical, patient-centred education and support, which is vital for effective self-management. The need for clarity around the implications of GDM was also emphasised by participants, both in relation to general health and the lifestyle adjustments needed to manage the condition. This points to the importance of comprehensive explanations at the time of diagnosis, as insufficient understanding may heighten anxiety, create confusion, or hinder adherence to management strategies. Taken together, these narratives highlight the central role of HCPs in providing tailored, comprehensible, and holistic support at the point of diagnosis. A lack of such support risks leaving patients to fill information gaps through independent searches, which may increase exposure to misinformation or misconceptions. For women with GDM, receiving structured education at diagnosis is therefore not only critical to effective self-management but also to reducing misinterpretations about the condition and its wider health implications (quotes: 'I didn't get a lot of information from the

NHS when I had gestational diabetes' P. 15; 'I feel like you have to find out a lot by yourself when you have gestational diabetes...' P. 8).

Theme 2: Clarifying the uncertainty about oral health and its role in pregnancy and GDM

Participants highlighted uncertainty around the meaning of oral health, with some questioning what the term encompassed. Others emphasised the need for clear, practical guidance. These reflections suggest that without a shared definition, oral health behaviours may not be prioritised or effectively adopted. The accounts also revealed a general lack of awareness about how pregnancy and GDM may affect oral health. One participant acknowledged not knowing that oral health could change during pregnancy. Another questioned whether oral health risks were specific to GDM or common to all pregnancies. To address this, the women expressed a desire to understand not only the *what* but also the *why* behind the oral health and GDM connection. This suggests that health messages need to go beyond simple advice by explaining the mechanisms linking GDM and oral health, thereby fostering both awareness and motivation to adopt protective behaviours (quotes: 'It needs to be specific on what oral health is and how to get it' P. 4; 'I didn't know that pregnancy can change your oral health... So, I think it should be included as wider messaging but especially as part of GDM' P. 5; 'I don't see how... I mean, is it specific for GDM? Or is it anyone pregnant who can get bleeding gums?' P. 15).

Table 2. The themes with supporting quotes and relevant COM-B domains

Illustrative quotes	COM-B domains
Theme 1: Support when receiving the GDM diagnosis	
'It makes sense if the person has already understood what gestational diabetes is... ' (P. 2)	Psychological capability
'I didn't get a lot of information from the NHS when I had gestational diabetes. I'm seven months postpartum now. I was really in the dark about how it works' (P. 15)	Psychological capability
'I feel like you have to find out a lot by yourself when you have gestational diabetes...' (P. 8)	Psychological capability
'Possibly some complications around understanding GDM and what it is...' (P. 11)	Psychological capability
'Maybe people misunderstand that poor oral hygiene is the reason why they have gestational diabetes?' (P. 9)	Psychological capability
Theme 2: Clarifying the uncertainty about oral health and its role in pregnancy and GDM	
'What does oral health mean? Does it mean having cold sores? Does it mean dry lips?' (P. 3)	Psychological capability Physical capability
'It needs to be specific on what oral health is and how to get it' (P. 4)	Psychological capability Physical capability
'I guess people might want to know why... Why are your teeth affected?' (P.10)	Psychological capability Reflective motivation
'Does it mean that when you have gestational diabetes, you may have worse oral hygiene?' (P. 3)	Psychological capability Reflective motivation
'Well, why should your blood sugar levels affect your teeth? What does that mean?' (P. 6)	Psychological capability Reflective motivation
'I don't see how... I mean, is it specific for GDM? Or is it anyone pregnant who can get bleeding gums?' (P.15)	Psychological capability Reflective motivation
'Maybe people misunderstand that poor oral hygiene is the reason why they have gestational diabetes?' (P. 9)	Psychological capability Reflective motivation
'I didn't know that pregnancy can change your oral health... So, I think it should be included as wider messaging but especially as part of GDM' (P. 5)	Psychological capability Reflective motivation
Theme 3: Awareness of the NHS dental scheme and how to access it	
'People don't know about it... It's awareness, isn't it? And knowing that it's free because I think a lot of people won't attend dentist appointments because they are quite expensive' (P. 3)	Psychological capability Physical opportunity
'I think it should be a general message that the NHS puts out, especially over social media, and that kind of thing' (P. 5)	Psychological capability Physical opportunity
'I think not all women know about the free NHS dental treatment. I've only heard it like word of mouth...' (P. 7)	Psychological capability Physical opportunity
'People maybe need some more help on how to get to an NHS dentist...' (P. 11)	Psychological capability

Theme 3: Awareness of the NHS dental scheme and how to access it

Participants consistently highlighted the fact that the availability of the free NHS Dental Scheme, which provides free-of-charge dental treatment to pregnant women, was not widely known. This lack of awareness represents a missed opportunity to support oral health during pregnancy, particularly for women managing GDM. For some, greater awareness of the scheme was viewed as a means to encourage dental attendance by addressing the financial barriers usually associated with dental treatment. Cost avoidance was seen as a significant deterrent, reinforcing the importance of promoting the scheme proactively. Beyond awareness, the participants also emphasised the need for practical guidance on how to access the NHS Dental Scheme. This was

especially important for women who were not registered with a dentist, but who wished to do so. Together, these accounts highlight the fact that increasing visibility of the NHS Dental Scheme and providing clear information on navigating the system are essential steps to improving uptake and ensuring equitable access to oral health care in pregnancy (quotes: '*I think not all women know about the free NHS dental treatment. I've only heard it like word of mouth...*'. P. 7; '*People don't know about it... It's awareness, isn't it? And knowing that it's free because I think a lot of people won't attend dentist appointments because they are quite expensive*' P. 3).

Mode of delivery

We also explored the participants' preferences for oral health care delivery in terms of who should tell them,

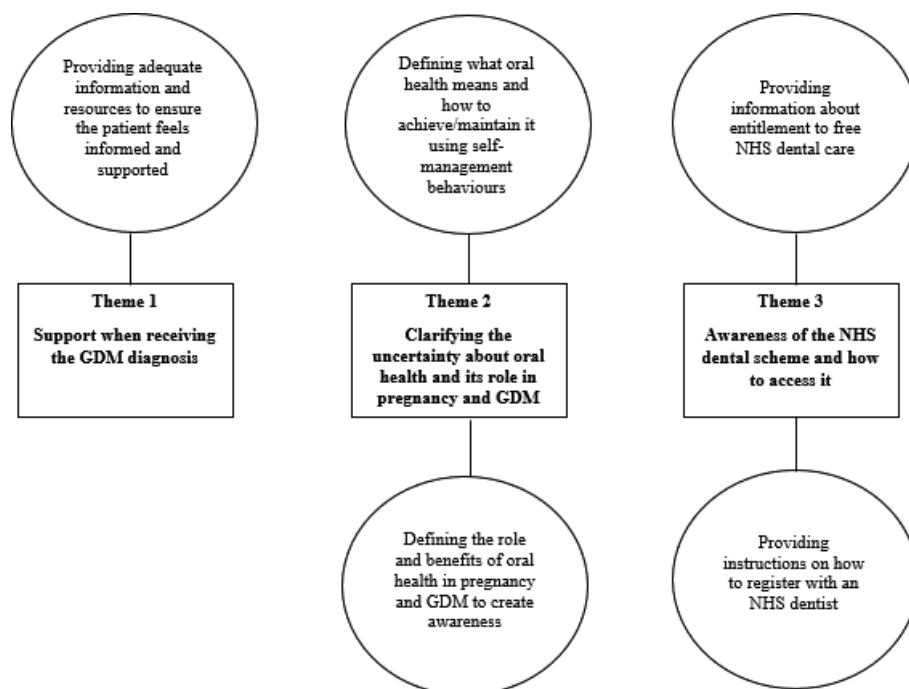


Fig. 2. The identified themes (square) and the associated actions (circles) needed to incite oral health behaviour among women with GDM.

when, and how much. Most participants expressed that oral health care should be delivered by the diabetes team, specifically the diabetes nurses, whilst one participant preferred the diabetes consultant to discuss oral health with her. Other participants preferred the midwives to deliver oral health care. Two participants also felt that oral health care could feature on the NHS website and GDM-related social media platforms such as the Gestational Diabetes UK Facebook group. Most women stated that it would be relevant to receive oral health information around the time of receiving the GDM diagnosis. A few participants also felt that it should be communicated at the pregnancy booking appointment. Finally, when exploring ‘how much’ oral health care should be communicated, most participants preferred to receive this information once, potentially alongside some written information to take home. Other participants felt that oral health information should be discussed several times (quote: ‘I think when you go to see the diabetic midwife for the first appointment and when they’re going through all your blood check measurements and that kind of information, it (oral health information) probably should just be on there somewhere’ P. 1).

Discussion and logic model

This study aimed to explore the support needs of women regarding oral health care within the context of GDM management and to identify specific intervention strategies to address these needs. Using inductive and deductive analyses, we mapped the themes onto the COM-B

Model to identify relevant behaviour change techniques and conceptualised the findings in a logic model to guide the tailored delivery of oral health care in GDM. The co-design approach was central to this process, as the participants’ perspectives directly informed the identification of needs and the development of potential intervention strategies.

The first theme highlighted the fact that participants often felt unsupported and ‘in the dark’ when receiving their GDM diagnosis. This aligns with existing evidence that GDM is associated with significant psychological and emotional distress.^{2,14} Tailored care that considers the women’s emotional well-being is therefore critical, not only during pregnancy but also in the post-partum period, where women often report feelings of abandonment.¹⁸ Psychosocial interventions focusing on informational support, goal setting, relaxation techniques, and emotional support may alleviate distress, enhance self-efficacy, and support adherence to self-management behaviours, including oral health. Such interventions can be delivered by multidisciplinary teams including diabetes nurses, dieticians, and midwives.¹⁹ Integrating psychological support into GDM care is thus a requirement for promoting effective behaviour change in women with GDM.

The second theme revealed uncertainty around the concept of oral health and its relevance during pregnancy and GDM. Previous studies similarly report limited awareness of oral health risks in pregnancy.^{2,20,21}

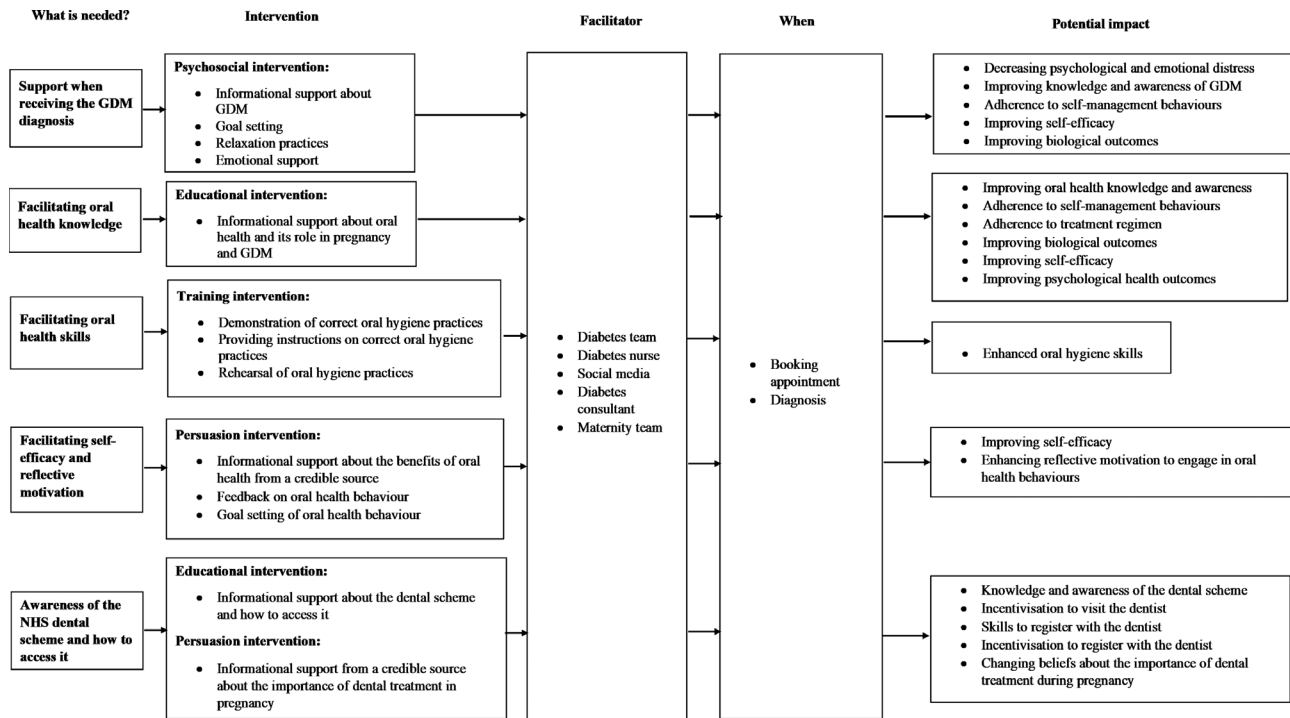


Fig. 3. A model conceptualising the care delivery process of oral health in GDM.

Oral health knowledge is a key determinant of behaviour, influencing daily oral hygiene practices and overall health literacy.^{22–25} Our findings suggest that women need to understand both ‘what oral health means’ and ‘why it matters’ in the context of GDM. Addressing this gap represents an opportunity for educational interventions, which target the psychological capability domain of the COM-B Model; strategies which are commonly used in oral health promotion.^{26–28} Such interventions can be delivered in multiple formats (face-to-face, group, remote) and may include interactive presentations or information media.

It is, however, important to note that educational interventions may need to be coupled with other strategies that support other aspects (COM-B domains) of behaviour change.²⁹ This is reflected in the current study, where physical capability was also identified as relevant, particularly the skills required for daily oral hygiene practices. Demonstration and practice of techniques, such as brushing and flossing, can enhance skill acquisition, supporting adherence to oral health behaviours.³⁰ Given the higher prevalence of periodontal disease in women with GDM,³¹ providing skills-based training is an important component of a tailored oral health intervention, particularly for women with limited access to dental treatment.

Reflective motivation, including self-efficacy, was another key factor. Women with GDM are often motivated by concern for their baby’s health,² yet managing GDM can be challenging due to psychological, physiological, and

sociodemographic factors.^{32–35} Intervention strategies such as persuasion, feedback on behaviour, and goal setting can strengthen reflective motivation, thereby enhancing adherence to oral hygiene behaviours. For example, tracking daily brushing and flossing with feedback from HCPs, or collaboratively setting oral health goals, may improve both self-efficacy and behavioural outcomes.⁹

Finally, social and environmental factors, including awareness of the NHS Dental Scheme, were identified as facilitators for oral health care. The participants reported that knowledge of the scheme was limited, highlighting the need for clear communication from HCPs during the booking appointment and at GDM diagnosis. Addressing beliefs about the safety and importance of dental care during pregnancy is also crucial to encourage attendance, which is consistent with evidence linking beliefs and health behaviours.³⁶

Overall, the findings demonstrate that supporting oral health in women with GDM requires an integrated approach addressing capability, opportunity, and motivation, as captured in our logic model. The co-design process ensured that the intervention strategies were grounded in the lived experiences and expressed needs of women with GDM, fulfilling the study aim to identify tailored approaches for this population. By linking the participants’ perspectives with COM-B domains, the study utilised a theory and evidence-based approach that is responsive to both the psychological and practical barriers to oral health care.

Figure 3 illustrates the care delivery process we have developed based on the data collected. It is important to note that our model assumes a patient-centred approach, thereby tailoring the care to individual patient preferences, needs, and capacities.³⁷

Strengths and limitations

This study is, to our knowledge, the first to develop a theory and data-driven model to illustrate the care delivery process of oral health in GDM. The following study limitations should, however, be noted. While we managed to obtain a decent sample size of women with previous GDM, we acknowledge that the participants are predominantly Caucasian; hence, the findings may not be replicated among women with GDM of other ethnic backgrounds. Likewise, the sample was educated, which may pose issues with the transferability of the findings to women with GDM from other socioeconomic backgrounds. Furthermore, the online study setting may have overlooked participants who did not have access to the internet, leading to bias in the sample. Moreover, whilst the incentive of a £15 Amazon voucher was useful for attracting participants, we cannot deny that some individuals only participated for monetary purposes. However, all interviews conducted were generally in-depth, and the women seemed invested in the study. Finally, the application of the COM-B Model might have caused the oversight of other relevant factors in oral health behaviour. However, we attempted to overcome this limitation by inductively analysing the data first. Future studies may need to collaborate with women with current GDM from various ethnic and sociodemographic backgrounds and HCPs to further refine this model for clinical practice.

Conclusions and implications for practice

This study found that women with recent GDM required increased support when receiving their diagnosis. This would enable them to better understand the implications of the diagnosis and assist them with self-management behaviours. Furthermore, we found that increased knowledge and awareness of what oral health means, how to achieve it, and its implications in pregnancy and GDM were needed to facilitate oral health behaviour. Lastly, promoting awareness of the NHS Dental Scheme and providing informational support about how to access this was needed. Intervention strategies such as patient education, emotional and informational support, feedback on behaviour, and goal setting were identified as possible strategies to support these needs. The model instructs HCPs in oral health care delivery in GDM. It can also be applied in maternity care to provide HCPs with a structured approach to addressing oral health. The utilisation of our model may improve oral health status, blood glucose management, and health outcomes for women with GDM.

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Conflict of interest and funding

This study is funded by the Faculty of Dentistry, Oral and Craniofacial Sciences at King's College London as part of a Doctoral research project. AF has a conflict of interest because he is a co-editor on the International Diabetes Nursing journal. CBK, KA and MI have no conflicts of interest.

Data availability statement

The data are available upon reasonable request.

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