Study Title: p-GDm: A qualitative study of pregnant women's attitudes and willingness to engage with interventions to prevent gestational diabetes

Internal Reference Number / Short title: p-GDm: Prevention of gestational diabetes

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Funder:	Oxford Biomedical Research Centre
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The investigators declare no conflict of interests

Confidentiality Statement

This document contains confidential information that must not be disclosed to anyone other than the Sponsor, the Investigator Team, host organisation, and members of the Research Ethics Committee, HRA (where required) unless authorised to do so.

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1. KEY STUDY CONTACTS

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Funder(s)	Oxford Biomedical Research Centre Mary Logan Senior Scientific Officer/BRC Theme Manager Nuffield Department of Primary Care Health Sciences Radcliffe Primary Care Building Radcliffe Observatory Quarter Woodstock Road, Oxford, OX2 6GG Email: mary.logan@phc.ox.ac.uk
Academic Advisor(s) or Supervisor(s)	N/A

2. LAY SUMMARY

Gestational diabetes (GDM) is a common pregnancy-related condition which causes high blood glucose (sugar) levels, and which increases the risk of damaging effects for both mother and baby. The prevalence of GDM has increased by about a third over the past decade, and this is mainly explained by an increase in obesity.

GDM is usually diagnosed at 24-28 weeks of pregnancy and little is known about blood glucose levels in early pregnancy. Although preventing GDM is recognised as a priority by Diabetes UK, the most effective strategies have yet to be identified.

In Oxford, a remote monitoring digital application called GDm-Health™ has been developed. GDm-HealthTM supports management of GDM by a smart phone app that automatically transmits blood glucose measurements to a secure web site and allows for communication between healthcare professionals and women with GDM via texts. This system is clinically reliable and highly satisfactory to women with GDM, but has only been proven in women in later pregnancy with a confirmed diagnosis of GDM.

We are interested in applying this technology earlier in pregnancy to investigate its usefulness for prevention or earlier detection and management of GDM. However, asking women to test blood glucose levels before a formal diagnosis may be challenging and for this reason we intend to conduct a qualitative study asking women for their opinions about this. We intend to recruit 40 women at risk of developing GDM at their routine 12-week nuchal scan and invite them to take part in a recorded interview that lasts approximately 30 minutes. We will ask a series of open questions about blood testing and strategies for GDM prevention transcribe the interviews and apply thematic analysis. The results will inform our future research in this area, and provide data for designing trials for the prevention of GDM

3. SYNOPSIS

Study Title	p-GDm: A qualitative study of pregnant women's attitudes and willingness to engage with interventions to prevent gestational diabetes
Internal ref. no. / short title	p-GDm: Prevention of gestational diabetes
Sponsor	Oxford University Hospitals NHS Foundation Trust Oxford University Hospitals NHS Foundation Trust Second Floor, OUH Cowley Unipart House Business Centre, Garsington Road Oxford, OX4 2PG Ouh.sponsorship@ouh.nhs.uk
Funder	Oxford Biomedical Research Centre Mary Logan Senior Scientific Officer/BRC Theme Manager Nuffield Department of Primary Care Health Sciences Radcliffe Primary Care Building Radcliffe Observatory Quarter Woodstock Road, Oxford, OX2 6GG Email: mary.logan@phc.ox.ac.uk
Study Design, including methodology	Qualitative research involving individual interviews with thematic analysis
Study Participants, including	Pregnant women in the first trimester of pregnancy who are at risk

sampling strategy	of gestational diabetes
Sample Size	40
Planned Study Period	Total length of project: October 2020 to September 2021 Individual participation: <60 minute (informed consent and interview)
Planned Recruitment period	October 2020 to September 2021
Aim/Research Questions/Objectives	
Primary	To assess the willingness of at-risk women to engage with using GDm-Health technology to monitor blood glucose levels for the purpose of identifying hyperglycaemia before the current clinical practice of an oral glucose tolerance test (OGTT) at 24-28 weeks gestation.
Secondary	To assess women's views about: 1. Acceptability of: – Being informed they are a high risk of GDM – Testing blood glucose levels before a formal diagnosis of GDM – Different interventions to reduce the risk of GDM 2. Use of technology: – Blood glucose meters – App 3. Feedback: – Blood glucose levels – Text messages

4. ABBREVIATIONS

CI	Chief Investigator
CRF	Case Report Form
GCP	Good Clinical Practice
GDM	Gestational Diabetes
HRA	Health Research Authority
ICF	Informed Consent Form
NHS	National Health Service
OGTT	Oral Glucose Tolerance Test

RES	Research Ethics Service
PIL	Participant/ Patient Information Leaflet
RCOG	Royal College of Obstetricians and Gynaecologists
R&D	NHS Trust R&D Department
REC	Research Ethics Committee
SMBG	Self-monitored Blood Glucose
SOP	Standard Operating Procedure

5. BACKGROUND AND RATIONALE

Gestational diabetes (GDM) is a common pregnancy-related condition characterised by hyperglycaemia, and which increases the risk of adverse outcomes for both mother and child (HAPO, 2008; Chiefari et al, 2017). Risk factors for the development of GDM include obesity (BMI >30kg/m^2), previous diagnosis of GDM or a large baby (birth weight >4.5kg), a first-degree relative with diabetes and belonging to a high-risk ethnic group (South Asian, Chinese, Afro-Caribbean or Middle Eastern) (NICE, 2015). The global prevalence of GDM has increased by 30% over the past decade, reflecting not only changes in diagnostic thresholds and screening criteria, but also an increase in the proportion of women who are obese and from high-risk ethnic groups (Zhu et al, 2016). It is challenging to assess the prevalence of GDM in the UK, but past studies have reported that 6.5-16.8% of pregnant woman developed GDM (Farrara et al, 2016), and the Royal College of Obstetricians and Gynaecologists (RCOG) has estimated an overall prevalence rate of 16% (RCOG, 2011).

GDM is commonly diagnosed at 24-28 weeks gestation, and both prevention and earlier diagnosis and treatment have been suggested in order to improve outcomes (Egan et al, 2019; Wexler et al, 2018). However, the results from individual GDM prevention trials are modest at best and it appears that current approaches are not successful for the majority of at-risk women. In addition, many interventions are introduced later in pregnancy when the developing fetus has already been exposed to excess energy intake, and there is limited evidence that earlier interventions may be more effective (Egan et al, 2019). A recent workshop explored the effect of early diagnosis and treatment of GDM and concluded that more information was needed about the association between early pregnancy glycaemia and pregnancy outcomes, and this was identified as a research gap (Wexler et al, 2018). In summary, little is known about the effects of early intervention in at-risk women and whether this can affect prevention of GDM or improve outcomes.

In Oxford, a remote monitoring digital application called GDm-Health™ has been developed to support management of GDM (MacKillop et al, 2014). GDm-Health comprises a smart phone application that interfaces with a standard blood glucose meter via Bluetooth and automatically transmits blood glucose measurements to a secure web site, which is accessed and monitored by health professionals. The system allows for annotations about diet and medication and has a built-in capability for communication between healthcare professionals and women with GDM via text messaging. This system is clinically reliable, highly satisfactory to women with GDM and has been shown to improve compliance of blood glucose monitoring in women with GDM (MacKillop et al, 2018). This system has only been proven in

women in later pregnancy with a confirmed diagnosis of gestational diabetes, and we are interested in applying the technology earlier in pregnancy to investigate its efficacy for prevention or earlier detection and management of GDM.

Preventing and managing GDM is recognised as a research priority by Diabetes UK and a recent patient priority setting exercise highlighted that research on more convenient screening tools, and dietary interventions for GDM were of interest to women (Rees et al, 2017). In addition, it is likely that prevention of GDM is potentially cost-effective or cost-saving, although there is limited data, at present, to support this (Werbouck et al, 2019). Despite the fact that the results from previous prevention trials have been somewhat ambiguous, a recent review identified four key aspects to improve the preventive effect of interventions: targeting the high-risk population, an early initiation of the intervention, the correct intensity and frequency of exercise and gestational weight gain management (Guo et al, 2019). We intend to address two of these factors with an early intervention trial assessing the effect of using GDm-Health from 12 weeks gestation. Although we have considerable clinical experience of the management of gestational diabetes and in the practical aspects of the GDm-Health technology (MacKillop et al, 2014; Mackillop et al 2018), there remain some areas of uncertainty. The first, and probably the most important of these is whether at-risk women will engage with blood glucose monitoring before a formal diagnosis of gestational diabetes. Amongst women with GDM, the perceived barriers to testing include the fear of needles and pain, inconvenience, playing a musical instrument and not being able to test due to the nature of their work (Martis et al, 2018). There are no studies investigating monitoring in women at risk of GDM in the literature, but two studies in women with diagnosed GDM reported that 94% adhered to the assigned frequency of blood glucose monitoring (Mendez-Figueroa et al, 2018) and women who were asked to test 4 times daily recorded 3.7 tests/day (Hawkins et al, 2009) suggesting that adherence is high in those already diagnosed. However, no published studies have included women before their diagnosis of GDM.

For this reason, we propose to conduct a qualitative study investigating pregnant women's attitudes and willingness to use the GDm-Health technology from the first trimester of pregnancy.

6. AIM / RESEARCH QUESTIONS / OBJECTIVES

Aim/Research Questions/Objectives	
Primary	To assess the willingness of at-risk women to engage with using GDm-Health technology to monitor blood glucose levels for the purpose of identifying hyperglycaemia before the current clinical practice of an oral glucose tolerance test (OGTT) at 24-28 weeks gestation.
Secondary	To assess women's views about: 1. Acceptability of: – Being informed they are a high risk of GDM – Testing blood glucose levels before a formal

	diagnosis of GDM – Different interventions to reduce the risk of GDM 2. Use of technology: – Blood glucose meters – App 3. Feedback: – Blood glucose levels – Text messages

STUDY DESIGN

6.1 Methodology

This is a qualitative study designed to elicit women's opinions about testing blood glucose levels in early pregnancy, and will be conducted using thematic analysis. Responses from eligible women will be collected through one-to-one interviews. Individual interviews, rather than focus groups, were selected as they allow for in-depth analysis, a higher potential for insights, have less bias than groups and can be coded thematically and analysed.

6.2 Sampling Strategy

This study will utilise volunteer, convenience sampling in women attending their routine 12-week nuchal scan. Women will be given a Participant Information Sheet and asked to contact the researcher for further information. Informed consent will then be taken remotely and a mutually convenient date and time arranged for a telephone interview. As thematic analysis will be undertaken immediately after each interview, this will ensure that a full range of responses are recorded and once saturation is reached, recruitment will cease.

6.3 Methods of Data Collection

Individual interviews will only take place over the telephone. As it may be challenging for those taking part to imagine how they would feel about testing blood glucose levels and using the GDM-Health technology, a vignette had been written describing the process from the woman's point of view. Participants will be sent this either by email or in the post and asked to read it before the interview takes place. They will be asked a series of questions using an interview schedule by the research dietitian, who has undergone training in qualitative interviewing. All interviews will be recorded for transcribing using a portable audio recording device. Once each interview is finished, it will be downloaded onto a secure computer in the Oxford Centre for Diabetes, Endocrinology and Metabolism, and deleted from the portable device. All interviews will be anonymised by coding with a study identifier, and will be encrypted and sent to a transcription service, where they will be transcribed. The transcriber will have signed a confidentiality agreement. The written transcript and the recording will then be returned to the

investigator and the written transcript stored securely and the recorded interview deleted. The end of the interview marks completion of the study for the participant.

6.4 Methods of Data Analysis

Thematic analysis will be used as it offers a flexible way to analyse data and results in an organised and detailed description about the subject under analysis. It allows for the evolution of categories from the data and different themes can be identified and reported. It is a useful strategy when attempting to identify themes from structured interviews in order to produce a report to inform future study design.

6.5 Study Sequence and Duration

Participants who are recruited and who consent to interview will be in the study for no longer than one hour, allowing time for informed consent and a short interview of 30-40 minutes. No follow-up visits are planned

7. PARTICIPANT IDENTIFICATION

7.1 Study Participants

Eligible participants are women in the first trimester of pregnancy who have been identified as at risk of developing GDM.

Inclusion Criteria

- Participant is willing and able to give informed consent for participation in the study.
- Female, aged 18 years or above
- First trimester of pregnancy
- At risk of GDM, assessed by one of the following:
    - Pre-pregnancy obesity (BMI>30kg/m2) or
    - Previous diagnosis of GDM or
    - Previous large baby (birth weight >4.5kg) or
    - A first-degree relative with diabetes or
    - Belonging to a high-risk ethnic group (South Asian, Chinese, Afro-Caribbean or Middle Eastern)

7.2 Exclusion Criteria

The participant may not enter the study if ANY of the following apply:

- Severe congenital anomaly found on ultrasound
- Planned termination
- Significant pre-pregnancy comorbidity including renal failure, severe liver disease, organ transplant, cardiac failure, psychiatric conditions requiring in-patient admission, history of eating disorder

- Diagnosed diabetes or gestational diabetes
- Hyperemesis gravidarum
- Unable to understand English

8. STUDY ACTIVITIES

This is a single-interview, single-centre study taking place from the Women's Centre at the John Radcliffe Hospital in Oxford. Screening will take place at the 12-week nuchal scanning clinic. Both the research midwife and the research dietitian (Pamela Dyson) will be present at scanning clinics for the duration of the study.

8.1 Screening and Eligibility Assessment

The research midwife will be responsible for identifying eligible participants from their medical notes and will inform the sonographer.

Recruitment will take place after the scan is completed and the pregnancy has been confirmed as viable by the sonographer. The sonographer will invite potential participants to read the full information sheet. Women will be given sufficient time to read the information sheet, and invited to contact the research dietitian by email or telephone to discuss the study further and to ask any questions. They will then be invited to join the study by the research dietitian. They will be given as much time as they need to think about it and if they agree, consent will be taken remotely by the research dietitian.

There will be no exceptions made regarding eligibility and each participant must satisfy all the approved inclusion and exclusion criteria of the protocol.

8.2 Informed Consent

Written and verbal versions of the Participant Information and Informed Consent will be presented to the participants detailing no less than: the exact nature of the study; what it will involve for the participant; the implications and constraints of the protocol; any risks involved in taking part. It will be clearly stated that the participant is free to withdraw from the study at any time for any reason without prejudice to future care, and with no obligation to give the reason for withdrawal.

The participant will be allowed as much time as wished to consider the information, and the opportunity to question the Investigator, their GP or other independent parties to decide whether they will participate in the study. Women will then contact the research dietitian by either telephone or email to discuss the study further.

Evidence of informed consent will be obtained in one of two ways, either in writing through the post (1) or verbally by telephone (2), depending on the preference of the participant:

1. In writing. The consent form will be sent to the participant by post, signed and dated by the participant and returned to the investigator, with the option to telephone or email the research dietitian if they would like more information. A copy of the completed consent form will be sent to the participant.

2. Verbally over the telephone. Once the participant had contacted the research dietitian and indicated that they wish to participate in the study, the investigator will go through the consent process and document verbal informed consent. A copy of the completed consent form will be sent to the participant.

The OWL study (Ethics Ref: 19-SC-0210) has recently demonstrated successfully that it is possible to ethically and appropriately obtain informed consent remotely by providing participants with all necessary information, allow them to review it in their own time and indicate informed consent where they wish to give it. Remote consent has been chosen for this study to avoid unnecessary face-to-face contact with pregnant women during the COVID-19 pandemic and as this study is of low- to no- risk of harm to participants, remote consent is considered appropriate and proportional

The research dietitian will obtain consent and has completed Good Clinical Practice (GCP) training. She is suitably qualified and experienced and has been authorised to do so by the Chief Investigator. The original consent form will be retained in a secure location in OCDEM accessed only by the researchers, and a copy will be placed in the maternity notes.

8.3 Structured Interview

The majority of interviews will be conducted by one researcher (dietitian) trained in qualitative techniques. The research midwife will only undertake interviews in the case of illness.

Each woman will be allocated an identifying code once they have consented to the study, and only this code will be used to identify interviews. The interviews will follow a structured pattern, using a prepared script. The participant will be sent a vignette either by post or by email illustrating specific interventions in early pregnancy designed to reduce the risk of gestational diabetes and they will be given sufficient time to read this before the interview takes place. They will then be asked a series of open-ended questions to elicit their responses. The interviews will take place over the telephone and will be audio-recorded on a Dictaphone. Once the interview is completed, the recording will be down-loaded onto a secure computer in OCDEM and the recording deleted from the Dictaphone The recording will then be encrypted and transferred to a transcriber who is on the HERG list of approved transcribers and who has a confidentiality agreement with the Oxford BRC in place. Once the transcription is complete, both the written record and the recorded interview will be returned to the researcher in OCDEM and the written transcript stored securely and the encryted interview deleted.

8.4 Subsequent Visits

This study involves one telephone interview, and no subsequent follow-up is planned.

8.5 Discontinuation/Withdrawal of Participants from Study

During the course of the study a participant may choose to withdraw early at any time. This may happen for several reasons, including but not limited to:

- The occurrence of significant distress during study interviews. If this occurs, the interviewer will offer support and stop the interview immediately
- Inability to comply with study procedures

- Participant decision

If a participant wishes to withdraw early, their interview will be deleted immediately. Once the interviews have been completed, recorded and transcribed, participants who choose to stop their active involvement in this study will not have their interviews deleted.

The reason for withdrawal by the participant, if this information is volunteered, will be recorded in a study file.

8.6 Definition of End of Study

The end of study is the date of the last visit of the last participant.

9. ANALYSIS

9.1 Description of Analytical Methods

Calculating sample sizes for qualitative studies is challenging as there are no computations or power analyses that can be performed to determine a priori a minimum number. Experts in the field of social science recommend a range of 12-101 participants, with a mean of 30-40, with some guidelines recommending 10-50 for participant generated text, as is the case here. Sufficient participants are required to fulfil exhaustive saturation i.e. when the researcher no longer receives new information to add to the theory that has been developed. This will be achieved by concurrent thematic analysis after each individual interview. After discussion with an experienced qualitative researcher, a pragmatic approach based on the above information was taken and the sample size was calculated as 40 participants. If saturation is reached before 40 participants have been interviewed, recruitment will cease.

Thematic analysis will be used to analyse the interviews. Thematic analysis is a method for identifying, analysing and reporting patterns within data and is usually applied using 6 clearly defined steps:

1. Familiarisation with the data (listening to the taped interviews and reading the transcripts)

2. Generating initial codes (manually highlighting data under separate headings e.g. positive/negative feelings)

3. Searching for themes (sorting all codes into themes)

4. Reviewing themes (formulating a thematic map incorporating all identified themes)

5. Defining and naming themes

6. Final analysis and report writing.

Themes will be identified for each topic (based on the objectives of the study, including e.g. acceptability of blood glucose testing, use of technology). Using this approach establishes confirmability by mean of a clear audit trail which sets out each step in the analysis of data and provides a rationale for the decisions

made. This will provide evidence that the study's findings accurately portray participants' responses, and do not reflect any personal bias or beliefs of the researcher. Credibility and transferability will be established by ensuring that interviews are conducted until saturation is reached, or until 40 participants have been interviewed. Saturation ensures that an exhaustive exploration of the various themes has taken place.

The data used for analysis will be based on identified themes from the original interview transcripts from the participants.

10. DATA MANAGEMENT

10.1 Access to Data

Direct access will be granted to authorised representatives from the Sponsor or host institution for monitoring and/or audit of the study to ensure compliance with regulations.

10.2 Data Recording and Record Keeping

Participants will be allocated an ID code before the interview takes place and members of the study team will have access to anonymised information using this code. The name and any other identifying detail of the participants will not be included in any study data.

Interviews will be recorded on a Dictaphone and immediately downloaded onto a secure computer using the non-identifiable code. Once the interviews have been downloaded from the personal recording device, they will be deleted from that device. Established encrypted secure data transfer protocols will be used to transfer the anonymised recordings from the secure computer to the transcriber as soon as they have been completed. All study data will be stored on an OUH server that only the research team have access to. Any data collected in paper form, including forms with participants' details will be stored in a secure filing cabinet. The computer used for this study is password-protected and both computer and filing cabinet are in an office in a building with controlled access limited to security card holders only. The office is kept locked when not in use and only the researcher working there has access. All data will be kept for five years.

Local policies for ensuring confidentiality will be observed, including the Oxford University Hospitals Information Protection Policy and Information Governance Policy which are guided by the Caldecott Principles and the Confidentiality NHS Code of Practice. All participants will be allocated an ID code and members of the study team will have access to anonymised information using this code. The only source of identifiable data will be a paper copy of participant's details and this will be stored in a locked filing cabinet. All non-identifiable data will be stored electronically on a secure computer.

11. QUALITY ASSURANCE PROCEDURES

The study may be monitored, or audited in accordance with the current approved protocol, relevant regulations and standard operating procedures.

12. ETHICAL AND REGULATORY CONSIDERATIONS

Qualitative studies such as this that involve eliciting opinions from participants have little obvious evidence of benefit, apart from the altruistic feeling that by taking part they may be contributing to other women's well-being in the future. Some individuals have reported that they appreciate the therapeutic outcomes of being able to discuss their personal challenges and feel validation that their opinions are being sought (Dennis, 2014).

The risks associated with this study include the possibility that the nuchal scan may have detected a non-viable pregnancy or a foetal abnormality, resulting in significant maternal distress. These women should not be invited to consider the study and will be excluded by the research midwife, who will not approach any potential participants until the scan has been completed, and the sonographer has confirmed a viable pregnancy in the medical notes. There is also the possibility that potential participants are unaware that they are at risk of GDM, and it may cause distress if they are invited to join this study while ignorant of this risk. GDM risk is routinely assessed and discussed at booking appointments, which take place at 8-12 weeks gestations and before the nuchal scan, so women should be aware of their risk and should have already received lifestyle advice about risk reduction as recommended by NICE guidelines. GDM risk should be documented in their medical notes and will be checked by the midwife before they are invited to join the study. If women are unaware of their risk, they will be referred to their ante-natal team for further support. Women may feel distressed during the interview when asked to consider interventions for the prevention of GDM, and if this is the case the interview will be terminated at their request, and they will be advised to discuss their feelings with their healthcare team.

12.1 Declaration of Helsinki

The Investigator will ensure that this study is conducted in accordance with the principles of the Declaration of Helsinki.

12.2 Approvals

Following Sponsor approval the protocol, informed consent form and participant information sheet will be submitted to an appropriate Research Ethics Committee (REC), HRA and host institution for written approval.

The Investigator will submit and, where necessary, obtain approval from the above parties for all substantial amendments to the original approved documents.

12.3 Other Ethical Considerations

There are no further ethical considerations associated with this study.

12.4 Reporting

This is a short-term study predicted to last no more than one year an Annual Progress will be submitted if the study has not completed in this time. An End of Study notification and final report will be submitted to the REC Committee, HRA, host organisation and Sponsor.

12.5 Participant Confidentiality

The study will comply with the General Data Protection Regulation (GDPR) and Data Protection Act 2018, which require data to be de-identified as soon as it is practical to do so. The processing of the personal data of participants will be minimised by making use of a unique participant study number only on all study documents and any electronic database. All documents will be stored securely and only accessible by study staff and authorised personnel. The study staff will safeguard the privacy of participants' personal data.

12.6 Expenses and Benefits

Reasonable travel expenses for any visits additional to normal care will be reimbursed on production of receipts, or a mileage allowance provided as appropriate. Women who wish to complete the interview on the day of the nuchal scan will be offered additional parking expenses.

13. FINANCE AND INSURANCE

13.1 Funding

The funding for this study has been provided by a grant from the Oxford Biomedical Research Centre (BRC) to cover training for the researchers, equipment, participants travelling expenses and transcription. The salaries of the researchers are already supported by the Oxford BRC.

13.2 Insurance

NHS bodies are legally liable for the negligent acts and omissions of their employees. If a participant is harmed whilst taking part in a clinical research study as a result of negligence on the part of a member of the study team this liability cover would apply.

Non-negligent harm is not covered by the NHS indemnity scheme. The Oxford University Hospitals NHS Foundation Trust, therefore, cannot agree in advance to pay compensation in these circumstances.

In exceptional circumstances an ex-gratia payment may be offered.

13.3 Contractual arrangements

Appropriate contractual arrangements will be put in place with all third parties.

14. PUBLICATION POLICY

The main objective of this study is to identify themes that may be used to inform future GDM prevention studies and as such, an internal report is the main expected outcome. If there is sufficient novelty, the investigators may decide to publish externally in a scientific journal. In this case, all investigators will be involved in reviewing drafts of the manuscripts, abstracts, press releases and any other publications arising from the study. Authors will acknowledge that the study was funded by the Oxford Biomedical Research Centre and authorship will be determined in accordance with the ICMJE guidelines, and other contributors will be acknowledged.

15. DEVELOPMENT OF A NEW PRODUCT/ PROCESS OR THE GENERATION OF INTELLECTUAL PROPERTY

Not applicable

16. ARCHIVING

All study data will be stored on a password protected OUH server in OCDEM that only the research team have access to and will be retained for 5 years.

17. REFERENCES

Chiefari E, Arcidiacono B, Foti D, Brunetti A. Gestational diabetes mellitus: an updated overview. J Endocrinol Invest. 2017;40(9):899-909.

Dennis BK. Understanding participant experiences. IJQM. 2014;13:395-410.

Egan AM, Simmons D. Lessons learned from lifestyle prevention trials in gestational diabetes mellitus. Diabet Med. 2019;369(2):142-50.

Farrar D, Simmonds M, Griffin S, Duarte A, Lawlor DA, Sculpher M, Fairley L, Golder S, Tuffnell D, Bland M, Dunne F, Whitelaw D, Wright J, Sheldon TA. The identification and treatment of women with hyperglycaemia in pregnancy: an analysis of individual participant data, systematic reviews, meta-analyses and an economic evaluation. Health Technol Assess. 2016 Nov;20(86):1-348.

Guo XY, Shu J, Fu XH, Chen XP, Zhang L, Ji MX, Liu XM, Yu TT, Sheng JZ, Huang HF. Improving the effectiveness of lifestyle interventions for gestational diabetes prevention: a meta-analysis and meta-regression. BJOG. 2019;126(3):311-20.

HAPO Study Cooperative Research Group, Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, Coustan DR, Hadden DR, McCance DR, Hod M, McIntyre HD, Oats JJ, Persson B, Rogers MS, Sacks DA. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008;358(19):1991-2002.

Hawkins JS, Casey BM, Lo JY, Moss K, McIntire DD, Leveno KJ. Weekly compared with daily blood glucose monitoring in women with diet-treated gestational diabetes. Obstet Gynecol. 2009;113:1307–12.

Mackillop L, Loerup L, Bartlett K, Farmer A, Gibson OJ, Hirst JE, Kenworthy Y, Kevat DA, Levy JC, Tarassenko L. Development of a real-time smartphone solution for the management of women with or at high risk of gestational diabetes. J Diabetes Sci Technol. 2014;8(6):1105-14.

Mackillop L, Hirst JE, Bartlett KJ, Birks JS, Clifton L, Farmer AJ, Gibson O, Kenworthy Y, Levy JC, Loerup L, Rivero-Arias O, Ming WK, Velardo C, Tarassenko L. Comparing the Efficacy of a Mobile Phone-Based Blood Glucose Management System With Standard Clinic Care in Women With Gestational Diabetes: Randomized Controlled Trial. JMIR Mhealth Uhealth. 2018;6(3):e71.

Martis R, Brown J, McAra-Couper J, Crowther CA. Enablers and barriers for women with gestational diabetes mellitus to achieve optimal glycaemic control - a qualitative study using the theoretical domains framework. BMC Pregnancy Childbirth. 2018;18(1):91.

Mendez-Figueroa H, Schuster M, Maggio L, Pedroza C, Chauhan SP, Paglia MJ. Gestational Diabetes Mellitus and Frequency of Blood Glucose Monitoring: A Randomized Controlled Trial. Obstet Gynecol. 2017;130(1):163-170.

National Institute for Health and Care Excellence. *Diabetes in pregnancy: Management from preconception to the post-natal period [NG 3]*. London: NICE, 2015.

Royal College of Obstetricians and Gynaecologists. *Diagnosis and Treatment of Gestational Diabetes. Scientific Impact Paper No 23*. London: RCOG, 2011.

Werbrouck A, Schmidt M, Putman K, Benhalima K, Verhaeghe N, Annemans L, Simoens S. A systematic review on costs and cost-effectiveness of screening and prevention of type 2 diabetes in women with prior gestational diabetes: exploring uncharted territory. Diabetes Res Clin Pract. 2019;147:138-48.

Wexler DJ, Powe CE, Barbour LA, Buchanan T, Coustan DR, Corcoy R, Damm P, Dunne F, Feig DS, Rees SE, Chadha R, Donovan LE, Guitard AL, Koppula S, Laupacis A, Simpson S, Johnson JA. Engaging Patients and Clinicians in Establishing Research Priorities for Gestational Diabetes Mellitus. Can J Diabetes. 2017;41(2):156-163.

Zhu Y, C. Zhang. Prevalence of Gestational Diabetes and Risk of Progression to Type 2 Diabetes: a Global Perspective. Curr Diab Rep. 2016;16(1):7.

APPENDIX A: STUDY FLOW CHART

APPENDIX B: AMENDMENT HISTORY

Amendment No.	Protocol Version No.	Date issued	Author(s) of changes	Details of Changes made