**#CCU064 Protocol – Impact of Covid-19 Clinical Care Pathway Changes on Gestational Diabetes Incidence and Pregnancy Outcomes in England**

**BACKGROUND**

Gestational diabetes (GDM) is defined as glucose intolerance that first develops during pregnancy. In the UK, women with GDM are the largest high-risk group accessing antenatal care with prevalence of up to 25%. Categories of women at greatest risk are those with body mass index (BMI) >25, women from Black, Asian and ethnic minority backgrounds, and women from the lowest sociodemographic groupings. GDM is associated with an increased risk of cardiometabolic complications during the pregnancy (including hypertensive disorders) as well as long term complications. For mothers, these include development of type 2 diabetes and, for offspring, increased rates of childhood and adulthood obesity and an increased cardiometabolic risk, including subsequent development of type 2 diabetes.

At the start of the COVID-19 pandemic, the UK Royal College of Obstetricians and Gynaecologists (RCOG) issued guidance on ‘service modifications’ that included GDM diagnosis to protect the maternity population. Implementing these guidelines led to changes in biochemical tests and glucose thresholds for screening, diagnosis, and management of GDM. New pathways included use of HbA1c, fasting blood glucose and random plasma glucose rather than traditional oral glucose tolerance test (OGTT) for screening and diagnosing GDM. In addition to changes in diagnostic testing, a large emphasis was placed on reducing face-to-face consultations with the multidisciplinary team, with the introduction of remote education and monitoring of glycaemic control.

These pandemic-related changes to standard antenatal care led to concerns about potential indirect harms of COVID-19 on pregnancy outcomes for women with GDM. Small studies using retrospective data reported the potential for a decrease in the prevalence of GDM and poorer pregnancy outcomes. In the general population, the pandemic exposed the extent of pre-existing ethnic inequalities in the health outcomes, access to, and experiences of care for people from other non-White ethnic backgrounds. Of particular concern is the effect changes in GDM care pathways may have had on widening existing health disparities for women and their offspring from Black, Asian, and minority ethnic groups. This is a priority area identified in the recently commissioned Women’s Health Strategy. On the other hand, it is possible that the new pathway may be associated with benefits, such as detection of pre-diabetes and type 2 diabetes in early pregnancy by HbA1c testing (as opposed to deferral of testing and diagnosis until 28 weeks’ gestation).

Our objective is to determine the impact of changes in antenatal care delivery during COVID-19 pathway on the incidence of GDM and clinical outcomes in England, and specifically identify the impact this may have had on women from minority ethnic groups and the lowest socioeconomic groups.

Identifying women and offspring at greatest risk of long-term cardiovascular disease, in particular those who have been negatively impacted by changes during COVID-19 will allow us to target those at greatest benefit of enhanced surveillance during pregnancy and beyond. This study will gather information to target future obesity, diabetes, and cardiovascular risk for both mothers and babies. This study could identify if tailored clinical approaches might be effective in reducing adverse outcomes in GDM. This aligns with the key aim of COVID-IMPACT, as well as those of the nationwide Diabetes Prevention Programs and Women’s Health Strategy.

**RESEARCH OBJECTIVES AND HYPOTHESES**

**AIM 1:** To understand disease incidence and estimate the burden of GDM before and during COVID-19 across different geographical regions of England.

*Rationale*: Significant changes to care pathways during 2020-2021 may have led to a change in the detection of GDM and in the demographics of the GDM population. Understanding how these changes have affected the population of women with GDM will allow us to inform future practice for screening and diagnosing GDM.

**AIM 2:** To assess maternity and neonatal outcomes on a national level for women with GDM in England.

*Rationale*: Screening of women for GDM was streamlined during COVID-19 and a large proportion of clinical management was conducted remotely through remote glycaemic control and virtual consultations. Pressures on the NHS have led to many of these practices continuing into the post pandemic era without an evidence base. Information on whether changes in care pathways, during COVID-19, have had an impact on short term clinical outcomes will be beneficial in establishing how these interventions could be best evaluated in the future. In addition, this study will give us new insights into evaluating population level interventions in high-risk maternity populations.

**AIM 3:** To identify women at greater risk of adverse pregnancy outcomes.

*Rationale*: COVID-19 led to wide spread disruption to maternity services, many of which have continued without a strong evidence base. This may affect known disparities in maternity health care outcomes for women from the lowest socioeconomic groupings and those from ethnic minority groups. This will allow us to identify the degree of health disparities in high risk maternity populations who receive intensive medical management throughout pregnancy. This information will accurately identify the at risks groups and provide new insights into interventions to target such groups.

**HYPOTHESES:**Following the change in care pathways implemented during the pandemic, there will be a change in the incidence of GDM and an increase in the rates of adverse pregnancy complications associated with GDM. Women from Black, Asian, and other minority groups will be more likely to have adverse pregnancy outcomes than women from White ethnicity, as will women from the more deprived backgrounds compared to women from less deprived backgrounds.

**STUDY DESIGN AND POPULATION**

We will conduct a cross section observational cohort study of pregnant women using data from routinely collected maternity datasets in England. We will seek to extract data on 140,000 to 240,000 GDM pregnancy episodes (based on ~2,800,000 pregnancies in England (2017-2022) and GDM incidence of 5-8.8%). The COVID cohort will start from 1st April 2020 (after implementation of new care pathways) and include all women with ongoing pregnancies <23 weeks gestation at that date (as GDM is usually diagnosed at 24-28 weeks gestation) as well as all new pregnancies from that date. We will include singleton live births to pregnant women with a diagnosis of GDM, aged between 16-50. Women with a diagnosis of pre-gestational diabetes (type 1 or 2) will be excluded. The pre COVID cohort will include all GDM pregnancies with a date of conception from January 2018 and delivered by 1st April 2020, to act as historical controls and allow quasi-experimental analyses.

We will specifically compare pregnancy outcomes among women with GDM from Black, Asian, and minority ethnic pregnant individuals with GDM and women from the lowest sociodemographic groupings. To report and meaningfully compare ethnic group–specific outcome rates and associations we will include individuals who identified as biracial or multiracial. We will exclude women with unknown or missing ethnicity.

**DATA SOURCES AND LINKAGE**

Data will be sourced from NHS England and linked through the anonymized NHS identifier:

· Hospital Episode Statistics Admitted Patient Care (HES APC)

· Maternity extension of HES (HES MAT)

· Primary care dataset (GDPPR)

**EXPOSURES, OUTCOMES AND CONFOUNDERS**

**EXPOSURES:**

· Diagnosis of GDM, as recorded in the HES diagnosis fields of the birth episode (ICD-10 coding).

· Timing of pregnancy episode/birth, obtained through HES episode dating fields and allocated to pre COVID or COVID cohorts.

· Ethnicity.

· Socioeconomic deprivation.

**KEY OUTCOMES:**

· Incidence of GDM

· Pregnancy outcomes such as small for gestational age (SGA) child, large for gestational age (LGA) child, preterm birth.

**SECONDARY OUTCOMES:**

· Mode of delivery

· Induction of labour

· Perineal trauma

· Post-partum haemorrhage

· Gestational hypertension of pre-eclampsia

· Maternal death

· Length of stay

· Readmission within 6 weeks of giving birth

· Macrosomia

· Neonatal unit admission

· Birth outcome

**CONFOUNDING VARIABLES**

· Maternal age

· Ethnicity

· Socioeconomic deprivation

· Smoking status

· Year of delivery

· Body mass index

· Parity

· Chronic hypertension

· Offspring sex

· Offspring birth weight

**STATISTICAL ANALYSIS**

The characteristics of women pre and post implementation will be described in relation to GDM status and the primary and secondary outcomes of interest, focusing on:

1) Any change in GDM incidence between the before and during COVID-19. Incidence will be determined by the number of pregnancy episodes recorded with GDM per total live births per year (2017-2021) for the total population and by ethnicity and socioeconomic subgroups. This will also be presented by Cohort (pre COVID and COVID)

2) The number of events (maternal and neonatal outcomes) per 1000 live births among individuals with GDM per year for the total population and per Cohort. We will also report the number of events by ethnicity and socioeconomic subgroups per year and Cohort.

3) To estimate the differences in obstetric intervention and pregnancy outcome rates between the pandemic and the corresponding pre-pandemic period we will use modified Poisson regression with robust error variance. Multi-level logistic regression models will be used in terms of odds ratios (ORs) and their 95% confidence intervals (CIs).

4) To assess changes in ethnic and sociodemographic disparities over time we will calculate health disparity ratios for the pre COVID and COVID cohorts, which is the relative risk between each ethnic group and white individuals and between the lowest and highest socioeconomic groups for key obstetric interventions and pregnancy outcomes.

Missing data for covariates will be represented in the model with a categorical-variable term given the low frequency of missing values, rather than as imputed values.

We note that data for BMI and smoking status may not be available for all the pre-pandemic cohort as the GP records dataset from which these data will be extracted only includes patients alive as at or born after 1 Nov 2019.

**DISSEMINATION**

Findings will be submitted for rapid scientific peer-review, and be disseminated through professional organisations e.g. RCOG, RCP and guideline committees (including NICE and SIGN committees on which our research team have representation) to ensure that clinical guidance is updated accordingly, and also through Diabetes UK social media channels to reach pregnant women directly.