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Negative/CON

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1

Where are we now? Global overview on the current screening practice and diagnostic criteria for gestational diabetes in early pregnancy.

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2

What are the issues relating to screening, diagnosis and treatment of hyperglycaemia in early pregnancy?

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3

Study design/sample handing/statistics

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4

Primary Outcomes of the TOBOGM Study

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5

How should we collect samples for glucose estimations Comparison of samples? TOBOGM sub-study

Helena Backman[1]
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6

Consumer perspectives on potential glycaemic thresholds

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7

Options for glycaemic thresholds and glycaemic measures including from the TOBOGM study

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Gestational diabetes mellitus in the first half of pregnancy and the TOBOGM Summit: Where to from here?

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Over the last 30 years, the management of gestational diabetes mellitus (GDM) has evolved from an almost randomised controlled trial (RCT) "evidence-free" condition, based upon historical, clinical experience, to a much studied, and discussed, clinical entity with varied guidelines around the world. While the guidelines continue to converge, based upon RCTs and robust cohort studies, differences in views on "best practice" remain. The Diabetes and Pregnancy Vitamin D And Lifestyle Intervention for Gestational Diabetes Mellitus Prevention (DALI) studies have now provided insight into reasons why the existing paradigm, that GDM largely commences at 24-28 weeks is seriously flawed. In fact, for many years, studies have shown that GDM diagnosed early in pregnancy is associated with worse outcomes than pregnancies with GDM developing later in pregnancy. Such early, "booking" or "prevalent" GDM is about 15-70% of all GDM[1], and a new debate is how its diagnosis should take place. To help address this need, the Treatment Of BOoking Gestational diabetes Mellitus (TOBOGM) study[2] is the only RCT of treatment of GDM in early pregnancy that involving masked controls. Participating women have diabetes risk factors and an oral glucose tolerance test (OGTT using WHO criteria) before 20 weeks gestation. Those with GDM by existing criteria (n=800) are randomised to either treatment or a repeat OGTT at 24-28 weeks gestation. Primary outcome is a composite of adverse pregnancy outcomes. A pilot has shown that early treatment may have both benefits and harms[3]. The results to the TOBOGM study will be presented at the TOBOGM Summit preceding the conference and the findings and their implications discussed. The discussions from the summit will be presented.

1. Immanuel J, Simmons D. Curr Diab Rep. 2017;17(11):115.
2. Simmons D et al. Med J Aust 2018;209:405-406.
3. Simmons D et al. BMC Pregnancy Childbirth. 2018;18(1):151

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Early Gestational Diabetes Screening in the Obese Gravida: A Randomized Controlled Trial

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Although ACOG recommends screening obese women early for gestational diabetes (GDM), no studies demonstrate an improvement in perinatal outcomes. We sought to determine if early GDM screening improves pregnancy outcomes in obese women. We performed a randomized controlled trial of obese women (BMI≥30 kg/m2) with non-anomalous, singleton gestations <20wks comparing early GDM screening (14-20 wks) to routine (24-28 wks). GDM screening was performed using a 50-g, 1-hr glucose challenge test followed by a 100-g, 3-hr glucose tolerance test if ≥135 mg/dL. GDM was diagnosed using Carpenter Coustan criteria. HbA1c was measured on all patients; the provider was notified and GDM diagnosed if ≥6.5%. Women not diagnosed at 14-20 wks were rescreened at 24-28 wks. Exclusion criteria were diabetes, major medical illness (cardiac, hemoglobinopathy, prednisone), bariatric surgery, and prior cesarean. The primary outcome was a composite of macrosomia (>4000g), primary cesarean, hypertensive disease of pregnancy (PIH), shoulder dystocia, neonatal hyperbilirubinemia, and neonatal hypoglycemia. We estimated a 50% incidence of the primary composite outcome; to detect a 50% reduction in the GDM patients (α=0.05, β=0.2), 58 GDM patients per group were necessary. The total sample size of 950 estimated a 14% incidence of GDM in obese women. This sample would also have 80% power to detect a 10% absolute change in the primary outcome for the entire population. Of 954 women enrolled, 912 (95.6%) had outcomes. Randomization groups were balanced at baseline for race, BMI, nulliparity, gestational age at randomization, and HbA1c. Of the 454 (49.7%) randomized to early screening, 69 (15.2%) were diagnosed with GDM: 29 (6.4%) <20 wks and 40 (8.8%) >24 wks. Of 458 randomized to routine screening, 56 (12.2%) had GDM. Early screening did not reduce the incidence of the primary outcome as it was nominally higher in the early group (59.0% vs 53.3%, p=0.08. PIH was not reduced in the early group (13.5% vs 9.6%, p=0.06). Use of insulin was significantly increased in the early group (2.6% vs 0.7%, p=0.02). These findings were consistent when only those with GDM were compared; considering only GDM, women in the early group were delivered earlier than the routine group. In this RCT, early GDM screening in obese women was not beneficial and may have been harmful. Recommendations for early GDM screening need to be reassessed in light of these findings.

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Dynamic changes in circulating Extracellular vesicles and their role inducing alterations in maternal insulin sensitivity across gestational diabetes mellitus

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Gestational diabetes mellitus (GDM) is one of the most common endocrine disorders during gestation and affects around 15% of all pregnancies worldwide, paralleling the global increase in obesity and type 2 diabetes. Normal pregnancies are critically dependent on the development of maternal insulin resistance balanced by an increased capacity to secrete insulin, which allows for the allocation of nutrients for adequate fetal growth and development. Several factors including placental hormones, inflammatory mediators and nutrients have been proposed to alter insulin sensitivity and insulin response and underpin the pathological outcomes of GDM. However, other factors may also be involved in the regulation of maternal metabolism and a complete understanding of GDM pathophysiology requires the identification of these factors, and the mechanisms associated with them. Recent studies highlight the potential utility of tissue-specific extracellular vesicles (EVs) in the diagnosis of disease onset and treatment monitoring for several pregnancy-related complications, including GDM. To date, there is a paucity of data defining changes in the release, content, bioactivity and diagnostic utility of circulating EVs in pregnancies complicated by GDM. Placental EVs may engage in paracellular interactions including local cell-to-cell communication between the cell constituents of the placenta and contiguous maternal tissues, and/or distal interactions involving the release of placental EVs into biological fluids and their transport to a remote site of action. Hence, the aim of this presentation is to discuss and provide evidence of the role of EVs regulating changes in maternal insulin sensitivity during pregnancy.

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Associations between insulin resistance and extracellular vesicle-associated proteins and miRNAs in gestational diabetes mellitus

Soumyalekshmi Nair[1], **Lilian Kessling**[1], **Andrew Lai**[1], **Dominic Guanzon**[1], **Flavio Carrion**[2], **Gernot Desoye**[3], **David Simmons**[4], **Mireille Van Poppel**[5], **David McIntyre**[6], **Carlos Salomon**[1, 2]

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Background: Small extracellular vesicles (sEVs) play key roles in regulating maternal metabolism by transfer of molecular signals (proteins and miRNAs) mediating cell communication. The aim of the present study is to determine the association between longitudinal changes in insulin sensitivity during pregnancy with changes in the protein and miRNA profile of circulating sEVs in healthy and gestational diabetes mellitus (GDM) pregnancies.

Method: Samples were obtained from a multicentre randomized controlled trial conducted from 2012 to 2014, the DALI (vitamin D and lifestyle intervention for GDM prevention) lifestyle study. sEVs were isolated from plasma samples from early (<20 weeks), mid (24-28 weeks) and late (35-37 weeks) gestation by differential centrifugation followed by size exclusion chromatography (NGT, n=67; GDM, n=63). sEVs were characterised by nanoparticle tracking analysis, western blots and electron microscopy. sEV-associated miRNAs and proteins were isolated and characterized by liquid chromatography mass spectrometry (LC-MS/MS) and next generation sequencing respectively. Insulin sensitivity was accessed using by Homeostatic model assessment (HOMA-IR) index. Using a longitudinal study design sEV-associated proteins and miRNAs were analysed in conjunction with HOMA-IR across gestation using linear mixed modelling and hierarchical clustering analysis.

Results: The sEV concentration increased across gestation in healthy and GDM pregnancies and sEV concentration correlated to HOMA-IR (p=0.0007) in GDM subjects. A total of 1155 proteins were identified with 50 proteins differentially expressed between healthy and GDM conditions. A total of 390 proteins were significantly correlated with HOMA-IR. This include proteins FABP4, SAMP and PAPP-A which are associated with fatty acid metabolism, inflammation and placental dysfunction. A specific set of miRNAs (miR-30c-5p, miR-574-5p, miR-378i, miR-503-5p, miR-548l and miR-218-5p) were differentially expressed in healthy and GDM pregnancies. When correlated to HOMA-IR, 24 miRNA were found to be significantly associated (22 positively correlated and 2 negatively correlated). Finally, bioinformatic analysis revealed the downstream pathways and targets of these miRNA and proteins associated with glucose metabolism and insulin signalling suggesting the role of sEV associated proteins and miRNAs in target cells.

Conclusion: The findings from this study elucidate the role of sEVs as mediators of insulin resistance in GDM and provide insights into the potential of sEVS as targeted therapeutics and early detection biomarkers in GDM.

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Selective placental and adipose tissue miRNA sorting in extracellular vesicles in gestational diabetes mellitus

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Background: Small extracellular vesicles (sEVs) play key roles in regulating maternal metabolism by transfer of molecular signals (miRNAs) mediating cell communication between placenta and metabolic tissues (for example adipose tissue). The aim of this study is to identify the mechanism of miRNA sorting in placenta and adipose tissue sEVs and its effect on insulin sensitivity in normal glucose tolerant (NGT) and GDM pregnancies

Method: Placenta and adipose tissue were obtained from NGT (n=5) and GDM (n=5) subjects at the time of delivery. Primary human trophoblast cell cultures and adipose tissue explant cultures were developed and sEVs were isolated from their cell-conditioned media. The miRNA profile in trophoblast cells and sEVs were analyzed using next generation sequencing. Using motif analysis tool, MDS2, the overexpressed motifs (4-6 base pairs long nucleotide sequences) in the sEV enriched miRNAs were identified. The role of RNA binding proteins in the selective packaging of miRNAs in sEVs were investigated using miRNA pull down assay and siRNA mediated knock down of candidate proteins.

Results: GDM is associated with changes in miRNA expression in placental and adipose tissue sEVs. A specific set of miRNAs were highly enriched in sEVs compared to their cells of origin in NGT and GDM, in placenta and adipose tissue. The abundance of these miRNAs in sEVs compared to their cell of origin highlight the specific nature of miRNA secretion and suggest specific packaging of these miRNAs into sEVs. Further, we identified a specific set of sEV-enriched miRNAs that were unique to placenta and adipose tissue and unique to NGT and GDM condition. We classified these miRNAs into four groups based on their unique expression as (1) Placenta NGT miRNAs, (2) Placenta GDM miRNAs, (3) Adipose tissue NGT miRNAs, and (4) Adipose tissue GDM miRNAs. We identified specific motifs in each group ([CG][AU][CG]CU, [UG]GG[AC][CUG], AGU[AG][AU], [CU]UAGAG) and candidate miRNAs expressing the specific motif were chosen (hsa-miR-151a-3p, hsa-miR-28-3p, hsa-miR-222-3p, hsa-miR-432-5p, hsa-miR-199b-5p, hsa-miR-548g-5p hsa-miR-182-5p, hsa-miR-517a-3p). Further, we identified that RNA binding proteins YBX3, GRSF1, HNRNPH2, FASTKD2, HDLBP, DISC3 and CW19L1 were associated with selective packaging of these miRNAs.

Conclusion: These findings provide insights into the mechanisms by which miRNA-protein interactions lead to selective packaging of miRNAs into sEVs in healthy pregnancy and GDM, and will further elucidate the potential of these mechanism as novel therapeutic platform in GDM

Funding: National Health and Medical Research Council (NHMRC, 1114013)

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Increased expression of amino acid transporters in placentae from pregnancies with Gestational diabetes mellitus

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Background and Aims

Pre-existing maternal obesity and Gestational diabetes mellitus (GDM) are two significant pregnancy complications. They lead to increased fetal adiposity which is associated with many adverse metabolic disturbances in the offspring. It is postulated that increased placental transport of nutrients such as glucose, fatty acids, and amino acids is one of the mechanisms responsible for metabolic disorders. While previous studies show increased placental expression of glucose and fatty acid transporters complicated by maternal obesity and/or GDM, there is a paucity of data on amino acid transporters. Thus, the aim of this study was to determine the mRNA expression of amino acid transporters in placentae from obese\non-obese women with GDM compared with BMI-matched uncomplicated pregnancies.

Methods

Placental mRNA expression of amino acid transporters was investigated in human placentae obtained from women with diet-managed GDM (n=22 non-obese and 12 obese), insulin-controlled GDM (n=19 non-obese and 16 obese) and BMI matched normal glucose tolerance (NGT) (n=18 non-obese and 15 obese). The mRNA expression of hCAT1, hCAT2, SNAT1, LAT1, NTRK2, 4F2hc, SLC6A4, SLC6A9, SLC6A12, and SLC6A2 was determined using a Fluidigm Biomark™ HD system. Data was analysed using the average of three housekeeping genes (18S rRNA, YWHAZ, and TBP) and relative quantification was performed according to the $2^{-\Delta\Delta CT}$ method. Statistical difference was performed using Mann-Whitney test and $p < 0.05$ was considered significant.

Results

SNAT1, hCAT2, and NTRK2 showed significantly increased mRNA relative to the three housekeeping genes. Specifically, placental SNAT1 and hCAT2 mRNA was significantly increased in diet-managed GDM non-obese and obese compared with BMI-matched NGT women. Placental NTRK2 mRNA was also significantly increased in obese women with insulin-controlled GDM when compared with BMI-matched NGT women. However, there was no significant difference in the placental mRNA expression was observed for any of amino acid transporters in NGT non-obese compared with NGT obese women.

Conclusion

This study reports that GDM-affected pregnancies (non-obese\obese) are associated with an increase in placental mRNA expression of SNAT1, hCAT2, and NTRK2 amino acid transporters. In these pregnancies increased supply of amino acids may lead to fetal overgrowth possibly via neoglucogenesis pathway. However, the placental protein expressions of SNAT1, hCAT2, and NTRK2 in GDM, obese, and non-obese pregnancies warrant further investigations.

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Serial FibroScan® Controlled Attenuation Parameter (CAP) scores were improved in pregnant women treated for gestational diabetes mellitus

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Aims:

To assess for changes in hepatic steatosis during pregnancy using the FibroScan® Controlled Attenuation Parameter (CAP) score and to determine its relationship with gestational diabetes mellitus (GDM) and gestational weight gain.

Methods:

A prospective longitudinal cohort study was conducted on singleton pregnant women enrolled from a multiethnic obstetrics service in Sydney, Australia. Women were advised to fast for at least 2 hours prior to their FibroScan®. A recruitment FibroScan® was performed between 10–24 weeks and a second FibroScan® between 30–36 weeks. A change in CAP (difference between serial and recruitment CAP) was calculated, along with whether CAP was reduced. GDM was diagnosed with the 1998 Australasian Diabetes in Pregnancy (ADIPS) diagnostic criteria. Maternal weight (kg) was collected at recruitment, serial FibroScan® and 1 week prior to delivery. Gestational weight gain was categorised as below, recommended and excess according to the Institute of Medicine (IOM). The cohort were separated by GDM status and categorical variables were compared with Pearson's chi–squared test or Fisher's exact test, and continuous variables with Mann–Whitney *U* test. Multiple logistic regression analysis was used to determine the predictors for a reduction in CAP, with odds ratios (OR) and 95% confidence intervals (CI) reported.

Results:

Three hundred and twenty–eight women were enrolled, where 263 had recruitment and serial FibroScan® performed and 250 were appropriately fasted prior to their FibroScan®. Of these, 56 (22.4%) women had GDM and were seen in the GDM clinic with multidisciplinary support. GDM women had similar recruitment body mass index (BMI) to non–GDM women (median 27.0, IQR 24.4–31.1kg/m^2 vs. median 26.5, IQR 23.8–31.2kg/m^2, p=0.64), but gained less weight between the two FibroScans® (median 5.15, IQR 2.2–7.0kg vs. median 6.3, IQR 4.2–9.0kg, p<0.01). Recruitment CAP scores were higher in GDM than non–GDM women (median 240, IQR 208–267dB/m vs. median 223, IQR 199–249dB/m, p=0.03) and their CAP scores improved more during pregnancy (median change -10, IQR -37–13 vs. median change -4, IQR -16–11, p=0.04). With IOM gestational weight gain targets, GDM–treated women were more likely to achieve below weight gain targets (48.2% vs. 21.6%, p<0.01). After adjustment for recruitment BMI and GDM status, a greater reduction in CAP was significantly associated with below target gestational weight gain (adjusted OR 2.10, 95% CI 1.11–3.99, p=0.02).

Conclusions:

Serial FibroScan® CAP scores were improved in women with GDM. This was significantly associated with below target gestational weight gain, possibly from more intensive lifestyle management achieved in GDM–affected women.

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Maternal depression and infant sleep in women with gestational diabetes

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Background/Rationale

Compared to healthy pregnant women, women with gestational diabetes mellitus (GDM) have higher symptoms of depression in the perinatal period. Maternal depression symptoms have been associated with infant sleep difficulties during the first year postpartum in the general population. However, this is still to be studied in women with GDM.

Aims

1) to assess prospective and cross-sectional associations between maternal symptoms of depression during their first first GDM booking in pregnancy, at 6-8 weeks postpartum, and at one year postpartum and infant sleep outcomes at one year postpartum.

2) to assess the association between maternal sleep perception and infant sleep defined as being above or below the mean recommended night-time sleep duration in Switzerland through a secondary analysis.

Methods

The population consisted of 95 women with GDM enrolled as a control group in the *MySweetheart trial* (NCT02890693) and their infants. The predictor consisted of maternal symptoms of depression that were assessed using the Edinburgh Postnatal Depression Scale at the first GDM booking during pregnancy, at 6-8 weeks, and at one year postpartum. The outcomes were infant sleep variables assessed through the Brief Infant Sleep Questionnaire at one year postpartum. Important covariates, such as socio-demographic and medical information were also collected and integrated in the regressions.

Results

Maternal symptoms of depression at the first GDM booking were inversely associated with infant nocturnal sleep duration at one year postpartum (β=-5.9, p=.046). Higher maternal symptoms of depression at 6-8 weeks postpartum were prospectively associated with lower infant nocturnal sleep duration (β=-9.35, p=.016). Higher maternal symptoms of depression at one year postpartum were also inversely associated with the perception that their infant's sleep was *not a problem at all* (β=-0.05, p=.006). The secondary analysis demonstrated that even when mothers considered their infant's sleep as *not a problem at all*, 34.7% of their infants slept less than the Swiss recommended mean amount for nocturnal sleep duration.

Discussion

As depression has an impact on infant sleep in the GDM population, an emphasis should be placed on providing interventions to reduce symptoms of depression in these women and on informing mothers on the importance of sleep duration in their infants.

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Roux-en-Y gastric bypass increases time spent in hypoglycemia during pregnancy

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Objective

Roux-en-Y gastric bypass (RYGB) and pregnancy markedly alter glucose metabolism, but evidence on glucose metabolism in pregnancy following RYGB is limited. Thus, the aims of the Bariatric surgery And consequences for Mother and Baby In pregnancy (BAMBI) study were to investigate interstitial glucose (IG) profiles during pregnancy, risk factors associated with hypoglycemia, and the association between fetal growth and hypoglycemia in pregnant women previously treated with RYGB compared to matched controls.

Research Design and Methods

In total, 23 pregnant women with RYGB and 23 BMI- and parity-matched pregnant controls were prospectively studied with continuous glucose monitoring (CGM) in the 1st, 2nd and 3rd trimester, as well as 4–6 weeks postpartum. Time in range (TIR) was defined as time with IG of 3.5–7.8 mmol/L.

Results

Pregnancies occurred 30 months (IQR: 15–98) following RYGB, which induced a reduction in BMI from 45 kg/m2 (IQR: 42–54) pre-surgery to 32 kg/m2 (IQR: 27–39) pre-pregnancy. TIR was significantly lower throughout pregnancy and postpartum for the RYGB group compared to controls (87.3–89.5% vs. 93.3–96.1%, p<0.01), due to an increase in both time above range and time below range (TBR)(Figure 1). Accordingly, the coefficient of variation was significantly higher in the RYGB group as a result of an increased diurnal glycemic variability. The women treated with RYGB ran significantly lower nocturnal IG (Figure 2), and the mean nocturnal IG significantly decreased as pregnancy advanced for women treated with RYGB. In the postpartum period, the median of mean nocturnal IG increased to a level higher than that of the 1st trimester. In the course of pregnancy, 48% of the women with RYGB spent increased TBR with highest mean TBR in mid-pregnancy (3.1%, SD 4.5). Women with increased time in hypoglycemia had longer surgery-to-conception interval, lower nadir weight, and greater weight loss following RYGB. Finally, women giving birth to small-for-gestational age neonates tended to spend more time in TBR.

Conclusions

Women with RYGB are more exposed to hypoglycemia during pregnancy compared to matched controls, especially in mid- and late pregnancy. Longer surgery-to-conception interval, a lower nadir weight, and a greater weight loss may be warning signs of hypoglycemia in pregnancy. Further research should investigate whether hypoglycemia during pregnancy in women with RYGB is associated with fetal growth restriction.

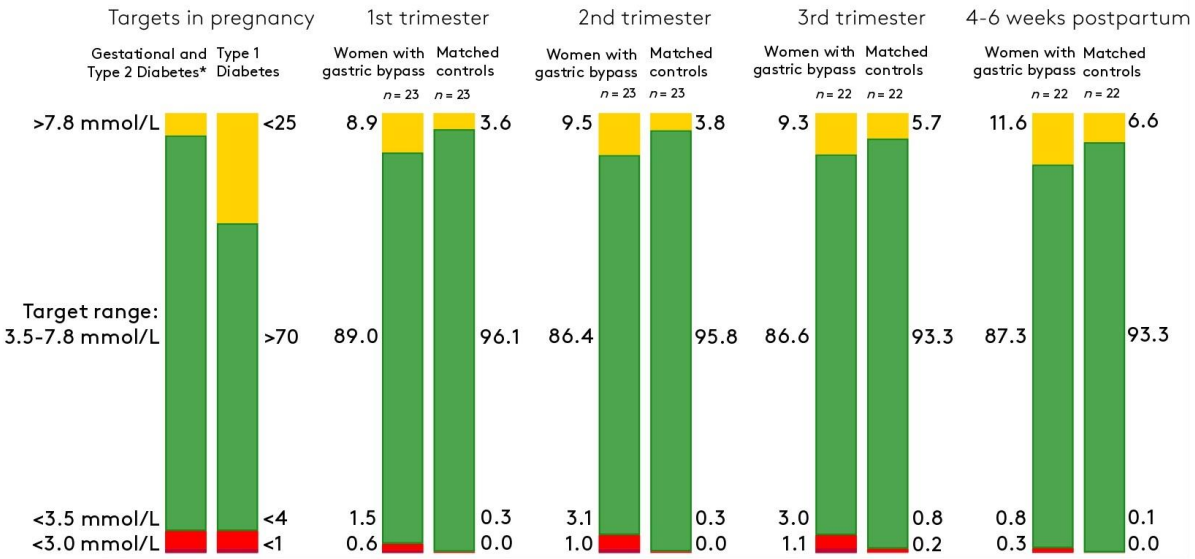

Figure 1 – Distribution of continuous glucose monitoring data according to trimester/postpartum. Reported in percentages. Reference targets according to the international consensus on glucose targets in pregnancy [20]. *Owing to limited evidence, no reference percentages exist for gestational and type 2 diabetes in pregnancy.

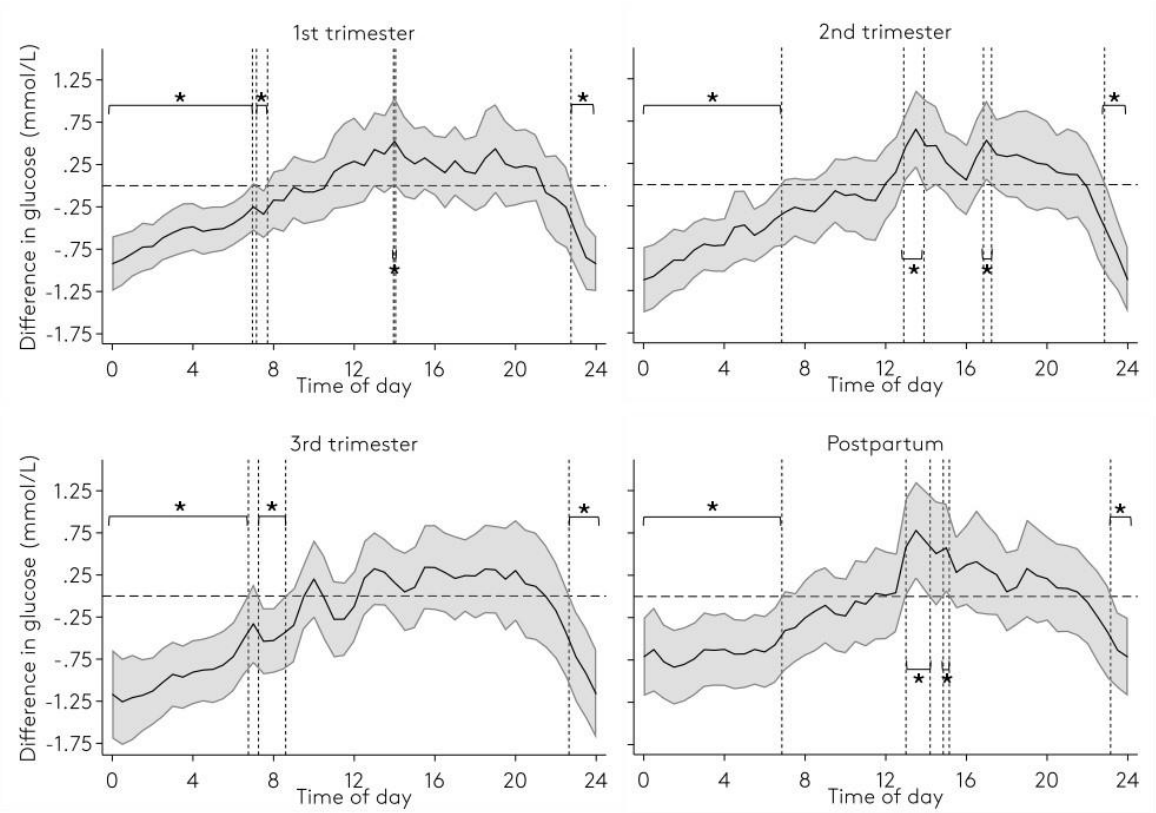

Figure 2 - Difference in glucose levels between women with gastric bypass (solid lines) and matched controls (represented by the horizontal zero level) with 95% CIs (gray areas). Significant differences between glucose levels are marked with *.

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Psychiatric morbidity in women with previous gestational diabetes mellitus – a nationwide register-based cohort study

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OBJECTIVE

Being diagnosed with gestational diabetes mellitus (GDM) can be a stressfull experience and impact mental health during pregnancy, yet evidence on the long-term impact of GDM on mental health is conflicting. The aims of this study were: 1) to examine associations between previous GDM and incidence of psychiatric morbidity in a large, Danish population; 2) to quantify the potential mediating effect of subsequent manifest diabetes after GDM on the risk of psychiatric morbidity; 3) to explore the potential role of proxies of insulin resistance during and after pregnancy on the psychiatric morbidity risk.

RESEARCH DESIGN AND METHODS

We conducted a nationwide register-based study including all women delivering in Denmark in 1997-2018. GDM exposure was based on diagnosis code and the outcome psychiatric morbidity was based on selected diagnosis codes and/or redemption of psychopharmacological medication. Proxy of insulin resistance during pregnancy was based on GDM status and insulin treatment during GDM pregnancy, whilst after pregnancy it was defined as development of manifest diabetes. Multiple Cox regression and mediation analyses were performed.

RESULTS

Of 660,017 women, 20,663 (3.1%) were diagnosed with GDM. Median follow-up was 9.5–12.4 years (range 0-21.9 years). Previous GDM was associated with increased risk of diagnosis of depressive disorders and anxiety disorders (aHR 1.32 (95% CI 1.22–1.42) and 1.23 (95% CI 1.11–1.36), respectively). Also, redemption of antidepressant and antipsychotic medication was associated with previous GDM (aHR 1.22 (95% CI 1.17–1.26) and 1.14 (95% CI 1.05–1.25), respectively). No significant differences were found regarding diagnosis of substance use disorders, psychotic disorders, bipolar disorders, psychiatric disease postpartum, and of anxiolytic medication. Subsequent diabetes after GDM mediated 35-42% of the association between GDM and psychiatric morbidity. Proxies of insulin resistance during pregnancy impacted risk of psychiatric morbidity as women with insulin-treated GDM were at increased risk compared to women with non-insulin-treated GDM; e.g., aHR for depression was 1.39 (95% CI 1.20–1.62) and 1.17 (95% CI 1.12–1.22) in women with insulin-treated and non-insulin-treated GDM, respectively (no GDM as reference)). However, this pattern was only evident in women without subsequent diabetes.

CONCLUSIONS

Overall, women with previous GDM were at increased risk of developing psychiatric morbidity, particularly depression and anxiety; however, some psychiatric outcomes were not significantly associated with GDM. Subsequent diabetes partly mediated the association between previous GDM and incident psychiatric morbidity, yet associations remained significant irrespective of subsequent diabetes. Special attention to the long-term mental health of women with GDM is warranted.

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Factors associated with maternal hyperglyceamia and neonoatal hypoglyceamia after antenatal betamethasone administration in women with diabetes

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Background: The importance of glycaemic control in pregnancy is well-established. The Pregnancy-IVI Is a validated, midwife-led, intravenous-insulin (IVI) algorithm, demonstrated to control maternal intrapartum glucose, and may reduce neonatal hypoglycaemia after betamethasone (1,2). Materno-fetal outcomes are presented from a large cohort of women with diabetes, managed with Pregnancy-IVI in a tertiary centre.

Methods: All women receiving Pregnancy-IVI following betamethasone (2017-2022) had data systematically extracted from eMR using a standardised template. Outcomes for mothers receiving two doses of 11.4mg betamethasone 24 hours apart, and infants born within 48-hours of betamethasone, were sub-analysed. Univariate analysis of factors associated with outcomes was performed.

Results: In the whole maternal cohort (n=435, GDM=79% T1DM=13%, T2DM=8%), mean age was 32.1±5.8 years and gestational age at betamethasone 33.5±3.4 weeks. 63% of women were treated with subcutaneous insulin pre-admission (GDM=54%, T1DM=100%, T2DM=89%). On-infusion maternal glucose time-in-range (TIR, 4.0-7.8mmol/l) was 83%[IQR 77–90%] and mean on-IVI glucose 6.6±0.6mmol/L. Maternal hypoglycaemia (<3.8mmol/L) was uncommon (0.54 hours/100 on-IVI woman-hours).

In mothers receiving two betamethasone doses (n=347), factors associated with lower maternal glucose time-in-range included diabetes type (TIR GDM=85%, vs. T1DM=78% vs. T2DM=75%, p=0.01) and presence of intra-uterine infection (TIR 77%(n=47) vs. 83%(n=300), p<0.001). Maternal age, gestational age and BMI were not significant factors. Median on-IVI infused insulin dose was 59iu/24hours[IQR 40-86]. Higher infused insulin dose was associated with diabetes type (GDM=59[IQR 38-79 vs. T1DM=51[IQR 40-74] vs. T2DM=83[IQR 54-114]iu/24hours, p<0.001), increasing BMI (beta-coefficient=0.89, p<0.001) and earlier gestational age (beta-coefficient=–1.23, p=0.04). For women continuing pre-admission prescribed subcutaneous insulin during Pregnancy-IVI(n=123), the ratio of IVI to baseline subcutaneous insulin dose was 2.3[IQR1–4.3] for GDM, 0.7[IQR0.4-1] for T1DM, and 0.8[IQR0.5-1.8] for T2DM (p<0.001 GDM vs. T1DM/T2DM).

Neonates born within 48h of betamethasone(n=218) developed neonatal hypoglycaemia(<2.5mmol/L) at a rate of 33% for mothers with GDM, 64% for T1DM and 59% for T2DM. Of the sub-population of neonates with mothers receiving two doses of betamethasone (n=136), neonatal hypoglycaemia was more common in pre-existing diabetes (p<0.001). Neonatal hypoglycaemia was also associated with higher maternal glycaemic variability (coefficient of variation) (p=0.03), and lower with increasing glucose time-in-range 4.0-7.8mmol/l (p=0.02), but these measures were confounded by diabetes type.

Conclusion: The Pregnancy-IVI controls maternal glucose after betamethasone. After two doses of betamethasone, women with GDM require higher percentage increases in insulin compared to women with T1DM/T2DM. Pre-existing diabetes remains significantly associated with neonatal hypoglycaemia following betamethasone despite intensive peripartum glycaemic control .

1. (1) Rowe CW, Putt E, Brentnall O, Allabyrne J, Gebuehr A, Woods A, Wynne K (2018) An intravenous insulin protocol designed for pregnancy reduces neonatal hypoglycaemia following betamethasone administration in women with gestational diabetes. Diabetic Medicine https://doi.org/10.1111/dme.13864
2. (2) Rowe CW, Watkins B, Brown K, Delbridge M, Addley J, Woods A, Wynne K (2020). Efficacy and safety of the Pregnancy-IVI, an intravenous insulin protocol for pregnancy, following antenatal betamethasone in Type 1 and Type 2 diabetes. Diabetic Medicine. https://doi.org/10.1111/dme.14489

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Assessment of the impact of therapeutic education on well-being and the nutritional habits in pregnant women with gestational diabetes from the EDUGEST study.

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Introduction: The prevalence of gestational diabetes (GDM) in Argentina, which implies a higher risk of developing both maternal and newborn complications, reaches 9.8%. Maternal obesity is a very important risk factor for its development, also affecting perinatal outcomes and maternal well-being.

Objective: To verify the impact of a therapeutic education program for pregnant women with GDM on well-being and nutritional habits, in the city of Corrientes (Argentina).

Methods: The food intake (NutriQuid-GEST) and well-being (WHO-5) records of pregnant women with GDM who participated in the EDUGEST study in the city of Corrientes (Argentina) were used. The intervention consisted of educational workshops of 3 sessions of 2 hours each, with educational material specially developed for the project, reinforced with individual interviews with the nutritionist. The NutriQuid-GEST -validated for the pregnant population- and WHO-5 questionnaires were completed before and after the educational intervention. A pre-post intervention analysis was carried out, where food intake and well-being indicators were verified. A WHO-5 score of ≤50 indicates poor well-being and a score of 28 or below is indicative of depression. The results are presented as mean ± standard deviation (SD). Student's or Wilcoxon's t tests were used for comparisons, as appropriate, considering significant differences of p<0.05.

Results: We analyzed the nutritional and well-being records of 256 women with GDM, aged 30.6±6.6 years at the beginning of pregnancy and BMI 30.4±6.4. The educational intervention significantly decreases the prevalence of poor well-being (pre vs post: 21.5% vs 14.5%) and depression (3.9% vs 1.9%).

Parameter	Pre-intervention	Post-intervention
Water (ml)	1,214.6±538.9*	1,336.1±478.1*
Energy (Kcal)	2,745.0±1,421.9*	2,044.0±685.2*
Proteins (g)	123.4±52.7	115.6±39.3
Lipids (g)	114.5±67.4*	84.6±33.8*
Carbohydrates - total (g)	322.3±176.0*	228.1±80.6*
Refined sugars (g)	59.5±63.2*	20.0±24.7*
Fiber (g)	21.2±10.3*	24.7±10.2*
Cholesterol (mg)	520.7±312.8*	420.7±259.2*
Sodium (mg)	3,574.5±2,124.3*	2,734.3±1,351.2*
Potassium (mg)	3,768.1±1,620.9*	4,077.4±1,411.4*
Calcium (mg)	977.8±459.4*	1,138.0±415.1*
Vitamin A	1,216.7±1,148.8	1,387.5±1,366.8
B12 vitamin	15.3±17.4	13.6±20.6
Vitamin C	257.4±205.5*	376.1±223.0*
Saturated fatty acids (g)	37.2±22.9*	27.0±11.1*
Fruits and Vegetables (servings)	2.8±2.0*	4.6±2.3*

* p< 0,05.

Conclusions: The educational intervention significantly improved the well-being and eating behavior of pregnant women with GD, adopting healthy eating habits that are the basis for achieving optimal nutritional status in women at the beginning and throughout pregnancy.

WDF Project 15-1314

1. Silvia Gorban de Lapertosa,Jorge Alvariñas,Jorge F. Elgart,Susana Salzberg,Juan J. Gagliardino, on behalf of the EduGest group.The triad macrosomia, obesity, and hypertriglyceridemia in gestational diabetes.https://onlinelibrary.wiley.com/journal/15207560
2.SilviaGorbándeLapertosa,JorgeF.Elgart;ClaudioD.González;JorgeAlvariñas;PaulaCamin;LeonardoMezzabotta;SusanaSalzberg;JuanJ.Gagliardino.Educational interventions to improve maternal-foetal outcomes in women with gestational diabetes.Lifestyle Med.2021;2:e18.wileyonlinelibrary.com/journal/lim21of8https://doi.org/10.1002/lim2.18

22

Oral Hypoglycemic Agents use in Australian women of reproductive age: Implications for unplanned pregnancies

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Background: The prevalence of Type 2 diabetes among reproductive-aged women is increasing globally[1]. Several new oral hypoglycaemic agents (OHA) are now available for the management of type 2 diabetes but little is known about their uptake in women of reproductive age which is important given the lack of safety data in pregnancy.

Aims: To examine longitudinal trends in the prevalence of OHA use among reproductive-aged women in Australia between 2013 and 2021 and explore concurrent use of long-acting reversible contraceptives (LARCs) and other hormonal contraceptives at the time of first prescribing OHA (as a proxy of risk for unintended pregnancy).

Methods: We conducted a retrospective population-based study using Pharmaceutical Benefits Scheme (PBS) dispensing claims of a 10% random sample of females aged between 15-49 years with a dispensing claim for OHA. Prevalence was determined as the prescribing of at least one OHA within a class in a given year, calculated using population data from the Australian Bureau of Statistics (ABS) within each state/territory, and presented as a rate per 1000 women aged 15-49 years. Concurrent hormonal contraceptive use was identified where the date of supply plus the likely duration of efficacy overlapped with the first dispensing date of OHA.

Results: The use of OHA has risen from 15.7/1000 in 2013 to 24.2/1000 in 2021. Metformin was the most frequently prescribed OHA (12.2/1000 in 2013 to 17.8/1000 in 2021). Significant increases were evident in the prevalence of SGLT-2 inhibitors (0/1000 in 2013 to 2.9/1000 in 2021) and Incretin mimetics (0.4/1000 in 2013 to 2.7/1000 in 2021). The most significant increases in SGLT-2 inhibitors and Incretin mimetics were observed among women aged > 35 years, varying by State/Territory. Overall, 14.3% of women receiving an OHA for the first time were considered concurrent LARC users, with an additional 10% receiving other hormonal contraceptive methods. There was a statistically significant increase in the odds of having concurrent LARC usage for women dispensed alpha-glucosidase inhibitors (Odds Ratio (OR) 1.64 [95% Confidence Interval (CI) 1.12-2.39]), Incretin mimetics (OR 1.13 [95%CI 1.02-1.24]), and SGLT-2 inhibitors (AOR 1.09 [1.01-1.18]) when compared with biguanides, (adjusted for age, state, and concession status).

Conclusion: There is increasing use of newer classes of OHA such as SGLT-2 and incretin mimetics. While concurrent use of LARC appears higher among those prescribed newer OHAs that have less safety data during pregnancy, rates of LARC use remain low and raise potential concerns regarding the impacts of unplanned pregnancies in this setting.

1. International Diabetes Federation. IDF Diabetes Atlas, 10th edn. Brussels, Belgium: International Diabetes Federation, 2021.

23

Negative/CON

Jennifer M Yamamoto[1]

1. University of Manitoba, Winnipeg, MANITOBA, Canada

I will debate the CON side of the invited debate: “Women with GDM should be treated to a target fasting glucose of ≤5.0mmol/L”.

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Affirmative/PRO

Ruth Hughes[1], **Ian Philips**[2], **Chris Florkowski**[3], **Joanna Gullam**[4]

1. Canterbury District Health Board, Christchurch, New Zealand

2. Endocrine and Steroid Laboratory, Canterbury Health Laboratories, Christchurch, New Zealand

3. Chemical Pathology, Canterbury Health Laboratories, Christchurch, New Zealand

4. Department of Obstetrics and Gynaecology, University of Otago, Christchurch, New Zealand

Publish consent withheld

1. 1. The predictive value of the sFlt-1/PlGF ratio in suspected preeclampsia in a New Zealand population: A prospective cohort study. Hughes RCE, Phillips I, Florkowski CM, Gullam J. Aust N Z J Obstet Gynaecol.doi.org/10.1111/ajo.13549 Epub 2022 June

25

One step vs two step screening for gestational diabetes: evidence from trials in the United States

Christina Scifres[1]

1. Indiana University, Indianapolis, IN, United States

This presentation will summarize results from trials conducted in the United States comparing one-step versus two-step screening for gestational diabetes. We will discuss implications for clinical care and opportunities for future research.

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Lower versus higher glycaemic criteria for the diagnosis and treatment of gestational diabetes.

Caroline A Crowther[1]

1. Liggins Institute, University of Auckland, Auckland, New Zealand

Treatment of gestational diabetes improves the health of the mother and her baby but it has remained unclear what degree of maternal hyperglycaemia is needed for the diagnosis.

The Gestational Diabetes Mellitus Trial of Diagnostic Thresholds (GEMS) compared the use of the lower glycaemic diagnostic criteria recommended by the IADPSG with the use of the higher glycaemic diagnostic criteria currently recommended in New Zealand. The trial assessed whether use of the lower criteria would improve perinatal health without increasing maternal risks compared with use of the higher criteria and to determine any differences in use of health services between the two criteria groups.

At the population level, amongst the 4061 women participating, use of the lower criteria compared with the higher criteria increased the proportion of women diagnosed with gestational diabetes two and a half fold but did not reduce perinatal morbidity and use of health services was increased. For women with milder gestational diabetes there were health benefits for them and their baby, relating to preeclampsia, shoulder dystocia, and birth of a large for gestational age infant, from detection and treatment.

1. Crowther CA, Samuel D, McCowan LME, Edlin R, Tran T, McKinlay CJ. Lower versus higher glycemic criteria for diagnosis of gestational diabetes. N Engl J Med 2022; 387: 587-98. DOI: 10.1056/NEJMoa2204091.

27

Expanding Nutrition Options in Gestational Diabetes Choosing Healthy Options in Carbohydrate Energy: The CHOICE Diet Story

Teri L Hernandez[1]

1. University of Colorado, Centennial, CO, United States

Robust evidence for nutrition therapy for gestational diabetes (GDM) is lacking. Preliminary data suggested our CHOICE diet, higher in complex carbohydrate (60%) and lower in fat (25%) reduced fasting glucose (FBG), free fatty acids (FFA), and newborn adiposity (NB%fat). We tested the hypothesis that 7-8 wks of CHOICE would improve insulin resistance, reduce 24-hr glucose, FFA and NB%fat (2-wk PeaPod; 1° powered outcome) vs a conventional low-carbohydrate (40%), higher fat (45%) diet (LC/CONV). After diagnosis (~28-30 wks), 59 BMI-matched diet-controlled GDM women (mean±SD; BMI 32±5) were randomized to a eucaloric CHOICE or LC/CONV diet (7.2±1 wks; all meals provided). At baseline, a 2-hr 75g OGTT (with insulins) was performed and diet initiated. On day-4, a breakfast meal (30% of total calories) was given with fasting and hourly blood drawn x5 (glucose, insulin, FFA, triglycerides[TG]) for area-under-the curve (AUC). Measures were repeated at 36-37 wks. A CGM was worn for 72 hrs in wk 31 and 36. Of 59, 13 met exclusions (4 diet failures, 2/group). By ANCOVA (n=23/group), total and weight gain during diet were similar (CHOICE 1.9 vs LC/CONV 1.8 kg) as was delivery wk (39.2 vs 39.3 wks). At 37 wks, the meal glucose (p=0.001) and insulin AUCs (p=0.013) were lower for LC/CONV, though fasting glucose/insulin were similar. TG increased similarly. The FFA AUC decreased from 30-37 wks on CHOICE but rose on LC/CONV (p=0.016), and was lower for CHOICE at 37 wks (p=0.009). By the 37-wk OGTT, FBG decreased within both groups (CHOICE -7.2, LC/CONV -3.5 mg/dL, both p<0.01) but CHOICE led to improved (p=0.001) and lower glucose AUC (p<0.05)(similar insulin AUCs). Birthweight (3293 vs 3303 g), anthropometrics, NB%fat (10.8±4 vs 10.3±4%), and cord blood glucose, C-peptide, FFA and TG were similar. At wk 36, fasting (90±3 vs 86±3), 1-hr (117±4 vs 119±3), 2-hr PP (108±3 vs 106±3), 2-hr PP AUC, time in range (88±2 vs 88±1%), and 24-hr AUC remained highly similar between diets (p>0.05 all).This RCT shows that complex carbohydrate can be liberalized by 20% above conventional recommendations and may improve glucose tolerance and similarly normalize fetal growth, expanding nutrition options in GDM.

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Is Medical Nutrition Therapy for GDM too Glucocentric?

Robyn Barnes[1]

1. Bankstown-Lidcombe Hospital, Bankstown, NSW, Australia

Traditional GDM management is an evidence based approach which largely focuses on monitoring and treatment of maternal hyperglycaemia. Medical Nutrition Therapy (MNT) is first line therapy, although evidence on the optimal approach is limited. Other non-glycaemic variables may be confounders in randomised controlled trials investigating dietary interventions for GDM management. These same variable may also contribute to variations in therapeutic and pregnancy outcomes. Pre-pregnancy body mass index (BMI) and excessive maternal weight gain may drive insulin resistance and maternal hyperglycaemia. We conducted several studies investigated the relationship between pre-pregnancy BMI, maternal weight gain, and therapeutic and neonatal outcomes in women with GDM. One study of 3281 singleton GDM pregnancies (1992-2015) (1) women found that excessive gestational weight gain independently increased fasting plasma glucose on the oral glucose tolerance test. Further, continued excessive gestational weight gain during GDM management increased the risk of large for gestational age infants and insulin requirements. A further study (n=1034) involved women receiving a personalised weight targets, with supporting individualised dietary advice from a dietitian (2). Women who exceeded or gained less than their personalised target, had less favourable outcomes compared to those who achieved their target. The study findings suggested that weight management after gestational diabetes diagnosis does not appear to be too late, and provides additional benefits to glucose-lowering treatment. We also conducted a national survey which found that most dietitians delivering MNT for GDM provide precise guidance on carbohydrate intake – focusing on controlling post prandial blood glucose levels (3). Further, although a limited number of dietitians reported provision of maternal weight gain advice and routine weighing over 10 years ago, rates are now increasing (3). However as most weight is gained before GDM presentation, there are opportunities to support healthy eating, and maternal weight gain from earlier in pregnancy. This body of evidence shows that weight management before and during GDM management can improve therapeutic and pregnancy outcomes in addition to benefits achieved by management of maternal hyperglycaemia.

1. 1. Barnes RA, Wong T, Ross GP, Griffiths MM. Smart CE, Collins CE, MacDonald-Wicks L, Flack JR. Excessive Weight Gain Before and During Gestational Diabetes Mellitus Management: What Is the Impact? Diabetes Care. 2020;43(1):74-81.
2. 2. Barnes RA, Flack JF, Wong T, Ross GP, Griffiths MM, Stephens M, Kourloufas L, Smart CE, Collins CE, MacDonald-Wicks L. Does weight management after gestational diabetes mellitus diagnosis improve pregnancy outcomes? A multi-ethnic cohort study. Diabet Med. 2021;39(1)e14692.
3. 3. Barnes RA, Morrison M, Flack JR, Ross GP, Smart CE, Collins CE, MacDonald-Wicks L. Medical nutrition therapy for gestational diabetes mellitus in Australia: What has changed in 10 years and how does current practice compare with best practice? J Hum Nutr Diet. 2022 Apr 5.

29

Food insecurity as a determinant of health for women with diabetes in pregnancy

Julia Zinga[1]

1. Royal Women's Hospital, Flemington, VIC, Australia

Food insecurity, the limited access to sufficient healthy food for a healthy life, is a significant driver of poor health for millions of people globally, including in high income countries. Food insecurity is associated with adverse impacts on diet quality, mental health, and increased risk of chronic conditions. As a recognised 'social determinant of health', food insecurity undermines the physical and mental wellbeing of individuals across all life stages. Pregnancy is a life stage particularly important in which to consider the short- and long-term impacts of food insecurity, as optimal antenatal nutrition is associated with best outcomes for the mother and offspring. This presentation will outline current evidence regarding the health consequences of food insecurity during pregnancy, including for women with diabetes, and recommend actions within the clinical setting to identify and address this under-estimated public health concern.

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Obesity during pregnancy: a window of opportunity to improve the health of two generations

Susan Ozanne[1]

1. University of Cambridge, Cambridge, CAMBS, United Kingdom

Obesity prevalence is increasing in both the developed and developing world. This includes women of childbearing age, with recent UK statistics demonstrating that over half of women are now either overweight or obese during pregnancy. This is thought to contribute to the rising prevalence of gestational diabetes, with one in seven pregnancies globally estimated to be affected by this pregnancy condition. This is of concern as growing evidence suggests that, in addition to immediate detrimental consequences, developing *in utero* in an obesogenic/diabetic environment has a long-term impact on metabolic and cardiovascular health. This has been termed the Developmental Origins of Health and Disease and has been supported by studies in humans and in animal models. The strongest evidence from humans to suggest that development *in utero* in an obesogenic environment "programmes" increased risk of obesity and cardio-metabolic disease has come from the study of siblings born before and after maternal bariatric surgery [1]. These studies revealed that the sibling born after weight-loss surgery, when the mother was leaner, had reduced adiposity, lower blood pressure and increased insulin sensitivity compared to their sibling born prior to maternal weight-reducing surgery. We have used a mouse model of maternal diet-induced obesity to show that this relationship is causal and utilised it as a tool to define the mechanisms by which obesity during pregnancy impacts on the long-term cardio-metabolic health of the offspring [2]. In this model the obese dams have approximately double the adiposity of lean dams, are insulin resistant and develop impaired glucose in late gestation. Our studies have demonstrated that the offspring of obese dams develop insulin resistance, increased adiposity, cardiac dysfunction, hypertension and fatty liver when weaned onto a healthy low-fat diet. They are also more susceptible to diet-induced obesity. Characterisation of maternal physiology in the model identifies maternal hyperinsulinaemia as a key programming factor that could mediate the detrimental effects of maternal obesity on long-term health of the offspring [3]. Our findings therefore suggest that maternal insulin resistance may represent an important target of interventions to prevent the inter-generational transmission of poor cardio-metabolic health from mother to child. On-going studies are therefore exploring the effectiveness of maternal interventions known to improve maternal insulin sensitivity, such as increasing physical activity, as suitable approaches to improve both maternal and offspring health.

1. Guénard F, Deshaies Y, Cianflone K, Kral JG, Marceau P & Vohl M-C (2013) Differential methylation in glucoregulatory genes of offspring born before vs after maternal gastrointestinal bypass surgery. Proc. Natl. Acad Sci. 110: 11439-114444
2. Schoonejans JM & Ozanne SE (2021) Developmental programming by maternal obesity: lessons from animal models. Diabetic Medicine: e14694
3. Hufnagel A, Dearden L, Fernandez-Twinn DS & Ozanne SE (2022) Programming of cardio metabolic health: the role of maternal and fetal hyperinsulinaemia 253: R47-R63

31

Maternal diets enriched in unsaturated fatty acids to prevent fetal programming in DIP

Alicia Jawerbaum[1]

1. CEFYBO-CONICET. School of Medicine. University of Buenos Aires, Buenos Aires, BUENOS AIRES, Argentina

Diabetes in pregnancy (DIP) impairs fetal and placental development and leads to the programming of metabolic and cardiovascular diseases in the offspring. A prooxidant and proinflammatory intrauterine environment is involved in these developmental alterations. Peroxisome proliferator activated receptors (PPARs) are ligand activated transcription factors with key regulatory functions in developmental, metabolic and anti-inflammatory processes. PPARs can be activated by nutrients, being unsaturated fatty acids their natural ligands. Studies in our laboratory have addressed the effect of diets enriched in PUFAs and MUFAs, capable of activating PPARs, in experimental models of diabetes and pregnancy and in patients with GDM.

Using experimental models of pregestational diabetes, we provided evidence of the capacity of diets enriched in PUFAs in the F0 generation to improve decidual function and feto-placental development in the F0 generation and to ameliorate antioxidant and anti-inflammatory pathways in the placenta of the F1 generation. Besides, diets enriched extra virgin olive oil (EVOO), enriched in MUFAs, provided in the F0 generation, reduce prooxidant, proinflammatory and apoptotic markers in the offspring´s heart and prevent the reduced beta cell number in the offspring´s pancreas. When the EVOO enriched diet is provided to the F1 females that develop GDM we found regulation of PPAR pathways and microRNAs that regulate PPARs, prevention of lipid accretion in the fetal liver and reduction of prooxidant and proinflammatory markers in the placenta. Translational studies performed in GDM patients provided evidence of the capacity of EVOO supplementation to prevent maternal hypertriglyceridemia, to regulate placental PPAR pathways and to reduce placental proinflammatory markers. Our results suggest that diets enriched in unsaturated fatty acids that activate PPARs may be beneficial for the mothers, the placentas and the offspring in pregnancies complicated by maternal diabetes.

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microRNA biomarkers of diabetes in pregnancy

Anandwardhan Hardikar[1]

1. Western Sydney University, Campbelltown, NSW, Australia

It is now known that small (18-22 nucleotide long) protein non-coding RNA molecules called as "microRNAs" regulate the expression of protein-coding genes. These microRNAs have also been identified in the peripheral circulation, and several studies now demonstrate their role as a biomarker of disease progression. I will introduce these small RNA molecules, discuss the methodologies to test these in small to large clinical study/trial cohorts, and demonstrate how these could enhance the prediction of future diabetes. Overall, this presentation will help understand this new class of molecular biomarkers for predicting diabetes progression.

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Improving systems of care for hyperglycaemia in pregnancy in regional and remote Australia

Diana MacKay[1, 2], Renae Kirkham[2], Natasha Freeman[2], Jacqueline Boyle[3], Sandra Campbell[4], Alex Brown[5, 6], Jeremy Oats[7], Ashim Sinha[8], Mark Wenitong[9], Anthony Hanley[10], Louise Maple-Brown[1, 2]

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5. Telethon Kids Institute, Adelaide, SA, Australia

6. National Centre for Indigenous Genomics, Australian National University, Adelaide, SA, Australia

7. Melbourne School of Population and Global Health, University of Melbourne, Melbourne, VIC, Australia

8. Department of Diabetes and Endocrinology, Cairns and Hinterland Hospital and Health Service, Cairns, QLD, Australia

9. Apunipima Cape York Health Council, Bungalow, QLD, Australia

10. Department of Nutritional Sciences, Joannah & Brian Lawson Centre for Child Nutrition, University of Toronto, Toronto, Canada

Background: There are multiple barriers to providing optimal care to women with hyperglycaemia in pregnancy in regional and remote Australia. Between 2016 and 2019 a multi-component health systems intervention was implemented in Australia's Northern Territory (NT) and Far North Queensland (FNQ) aiming to improve care. Components included providing clinician education, improving recall and reminder systems, enhancing policies and guidelines, and embedding use of the NT and FNQ Diabetes in Pregnancy (DIP) Clinical Register in practice. The current study evaluates the health professional-reported impact of this intervention.

Methods: This mixed-methods evaluation was underpinned by the RE-AIM framework. Clinicians involved in the care of women with hyperglycaemia in pregnancy in NT and FNQ were surveyed prior to and following implementation. Constructs explored included usual practice, confidence in providing care, and satisfaction with care pathways and communication between services. Changes between baseline and post-intervention survey data was analysed using Pearson's Chi-squared test or Fisher's exact test. Following the final survey, qualitative semi-structured interviews were conducted with clinicians at six primary care evaluation sites and three tertiary referral hospitals, in addition to policymakers and study implementation team. Interviews explored participants' awareness of and engagement with the health systems intervention, and perceived impact on practice and systems of care. Qualitative data was analysed using a hybrid inductive-deductive method.

Findings: 183 and 137 participants completed the survey at baseline and follow-up, respectively. 46 participated in interviews. Practitioners "very confident" or "confident" in providing care increased (care during pregnancy - baseline 60.1%, post-intervention 72.3%, p=0.003; care postpartum - baseline 56.9%, post-intervention 72.4%, p=0.01). Improvements in glucose screening, including reported increases in use of recommended tests (72.0% using recommended first trimester screening test at baseline, 94.8% post-intervention, p<0.001) and timing of screening (28.3% screening at appropriate interval after gestational diabetes at baseline, 66.7% post-intervention, p<0.001), suggested improved practitioner knowledge. Health practitioners highly valued the hyperglycaemia in pregnancy clinician network which had developed as a result of the intervention. The NT and FNQ DIP Clinical Register supplied data that supported the allocation of additional resources to the care of women with hyperglycaemia in pregnancy.

Conclusions: A multi-component health systems intervention has resulted in a strong clinician network for providing care to women with hyperglycaemia in pregnancy in regional and remote Australia, with health practitioners reporting improvements in their own practice. Changes to practice will also be evaluated through an audit of primary care health records.

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Trends in outcomes of pregnancies complicated by diabetes among First Nations and non-First Nations women in the Northern Territory, Australia

Emily Burton[1], Federica Barzi[2], Danielle Longmore[3], Vanya Webster[4], Jacqueline A. Boyle[5], Jonathan E. Shaw[6], Steven Guthridge[1], Gurmeet R. Singh[1], Kiarna Brown[7], Sally Crispe[8], Louise J. Maple-Brown[1], Matthew J.L. Hare[1]

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5. Eastern Health Clinical School, Monash University, Melbourne, VIC, Australia

6. Clinical Diabetes and Epidemiology, Baker Heart and Diabetes Institute, Melbourne, VIC, Australia

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Background:

GDM and pre-existing diabetes in pregnancy (pre-existing DM) increase risk of obstetric and neonatal complications. In the Northern Territory (NT) of Australia, pregnant First Nations women have among the highest rates of pre-existing DM globally, with a 10-fold increase over the last 30 years.

Aim:

To gain contemporary risk estimates for and examine trends in obstetric and neonatal outcomes of GDM and pre-existing DM among pregnant First Nations and non-First Nations women in the NT.

Methods:

This retrospective population-based cohort study examined linked deidentified data from the NT Perinatal Data Collection and Hospital Inpatient Activity data relating to all births in the NT from 2002-2016. Poisson regression was used to assess relative risk and temporal trends by diabetes status in pregnancy separately among First Nations and non-First Nations women. Models were adjusted for maternal age, parity, remoteness and smoking.

Results:

Of 57,707 pregnancies 21,061 (37%) were in First Nations women. Rates of GDM and pre-existing DM were 9.6% and 3.4% respectively, among First Nations women; and 5.5% and 0.5% among non-First Nations women, respectively. Risk of large-for-gestational-age (LGA) declined among both First Nations women with GDM (-5.3% per annum (p.a), p<0.001) and non-First Nations women with GDM (-5.5% p.a., p<0.001), but remained unchanged for women with pre-existing DM (see Fig.). Preeclampsia risk declined among both First Nations women with GDM (-7.2% p.a., p<0.001) and non-First Nations women with GDM (-4.7% p.a., p=0.010), but remained stable for women with pre-existing DM. Risk of emergency Caesarean section declined for First Nations women with GDM (-3.3% p.a., p=0.001), but remained stable for all other groups. Risk of preterm birth remained unchanged over time for all groups.

Conclusion:

Over 15 years, risk of LGA and preeclampsia reduced substantially for women with GDM, which may reflect improvement in management and changes in screening. Risk of adverse pregnancy outcomes remains high among all women with pre-existing DM, necessitating work to strengthen models of care.

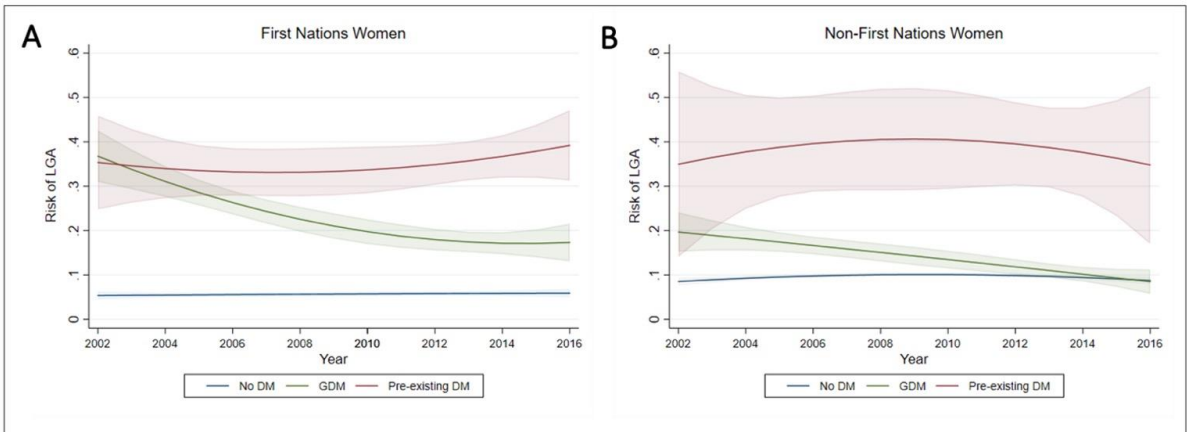

Fig. Risk of large-for-gestational-age (LGA) over time among pregnancies to (A) First Nations and (B) non-First Nations women with no diabetes in pregnancy (blue), GDM (green) or pre-existing DM (red) in the Northern Territory between 2002 and 2016. Shaded areas are 95% confidence intervals. Risks estimated using fractional polynomials.

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Early screening for gestational diabetes and birth outcomes among Aboriginal women in remote Northern Territory.

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Background: Aboriginal women are at high risk of gestational diabetes (GDM) and oral glucose tolerance test (OGTT) screening in early pregnancy is recommended. Rates of screening and outcomes in incompletely screened pregnancies are unclear. We aimed to determine uptake of diabetes screening as per guidelines and birth outcomes among women who had early (<20 weeks) OGTT screening, women who did not have early OGTT screening and women with pre-existing diabetes.

Methods: We conducted a retrospective study of all pregnancies among Aboriginal women (2017-2019) receiving antenatal care in 52 remote clinics across the Northern Territory (NT). Data were extracted from NT Primary Health Care Collection and NT Perinatal Data Collection, supplemented by manual review of individual records (n=902). Birth outcomes were assessed with logistic regression, stratified into three groups (early OGTT, no early OGTT and pre-existing diabetes). The combined primary outcome incorporated any of large for gestational age, caesarean section, neonatal admission to special care nursey, pre-term birth, and preeclampsia.

Results: Of 1191 pregnancies, 6.4% (n=76) had pre-existing diabetes (all type 2). Women without an early OGTT were younger and had lower BMI than both women who had an early OGTT and women with T2D (age: 24 years (SD 5.4) vs. 26 (5.6) vs. 30 (5.0), p=0.03; BMI 25 kg/m^2 (SD 6.4) vs. 27 (6.6) vs. 31 (5.6), p<0.01, respectively). Among women without pre-existing T2D, 19% (n=226) had an early OGTT, 50% (n=561) only had a routine OGTT (≥20 weeks), 26% (n=284) only had an HbA1c, 0.7% (n=8) had only a random plasma glucose, and 3% (n=36) had no glycaemic screening throughout their pregnancy. Compared to women with an early OGTT, odds of developing an adverse event were similar for women without an early OGTT (OR 0.8, 95% CI: 0.6-1.1, p=0.23) and higher for women with pre-existing T2D (OR 7.1, 95% CI: 3.3-15.7, p<0.01), with no meaningful change after adjustment for age, smoking, BMI or parity. Concerningly, the stillbirth rate with T2D was 9% (n=7).

Conclusions: Among Aboriginal women in remote NT, uptake of GDM screening with an early pregnancy OGTT was low, though more likely for older women with a higher BMI, suggesting clinicians are further risk stratifying. We report similar birth outcomes for women who did and did not have an OGTT in early pregnancy, yet significantly worse outcomes for women with T2D, highlighting a need to strengthen care for women with pre-existing T2D.

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Obesity as a driver of preeclampsia in women with Type 2 Diabetes

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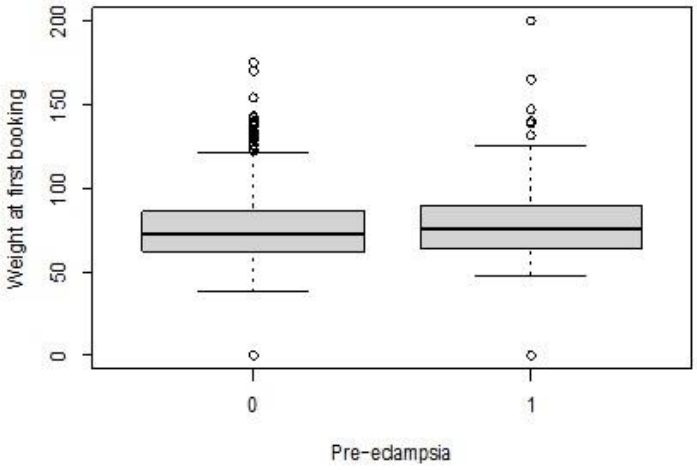
Background: Preeclampsia is a devastating complication of pregnancy that claims the lives of thousands of mothers and babies each year. Studies have suggested that maternal obesity is a driver of preeclampsia. Inflammatory factors and leptin/soluble leptin receptor are hypothesised as possible mediators linking these conditions. Although meta-analyses and multi-centre cohorts have supported the association between obesity and preeclampsia, there are no studies that have specifically explored this association in women with Type 2 Diabetes (T2D).

Methods: Using a single-centre retrospective database of pregnancy outcomes in women with T2D, we identified subjects with booking weight and height data and with known pregnancy outcomes. Exploratory analysis of relevant variables was conducted. Temporal trends in maternal weight and the incidence of pre-eclampsia were explored. A generalised linear model was used to examine the relationship between the log of the probability of pre-eclampsia with time of first visit and early pregnancy body weight. All analysis was performed using the statistical package R.

Results: Of the 648 subjects with T2D identified, 349 women had adequate anthropometric and pregnancy outcome data for inclusion in the analysis. Over the 20-year period, the incidence of preeclampsia increased (p and r). Preeclampsia occurred in 45/349 (13%) of the subjects. There was a statistically significant relationship between booking weight (<20 weeks gestation) and the development of preeclampsia (p=0.01), after controlling for the also statistically significant relationship with time (p=0.04).



	0 (no preeclampsia)	1 (preeclampsia)
1	38.0 kg	47.9 kg
2	62.0 kg	64.1 kg
3	73.0 kg	76.0 kg
4	86.0 kg	90.0 kg
5	120.8 kg	125.0 kg

***Figure 1**: Boxplot of weight at first booking in women who did and did not develop preeclampsia.*

Summary: In a population of women with pre-existing T2D, there was a significant correlation between body weight in early pregnancy and occurrence of preeclampsia. This study reinforces the need for mechanistic studies to understand the relationship between maternal obesity and preeclampsia.

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Changes in birth outcomes following a multi-component health systems intervention for hyperglycaemia in pregnancy in Australia's Northern Territory

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Background: In countries with a history of colonisation, hyperglycaemia in pregnancy disproportionately affects First Nations women. In regional and remote Australia there are many barriers to providing optimal care for women with hyperglycaemia in pregnancy. Since 2011, the *Diabetes Across the Lifecourse: Northern Australia Partnership* has aimed to improve systems of care for women with hyperglycaemia in pregnancy in Australia's Northern Territory (NT). Here we report on changes to birth outcomes in women with hyperglycaemia in pregnancy between 2012 and 2019.

Methods: This study included singleton births occurring between 2012 and 2019 to women with gestational diabetes (GDM), newly diagnosed overt diabetes in pregnancy (DIP) or pre-existing type 2 diabetes (T2D) enrolled in the NT Diabetes in Pregnancy Clinical Register. Changes in birth outcomes over the study period were assessed with odds ratios (OR) for each calendar year compared to the previous, estimated with logistic regression. Models were stratified by diabetes type and First Nations status and were adjusted for maternal age, body mass index, alcohol use, smoking status, pre-existing hypertension and study region (Top End or Central Australia).

Results: Data for 2603 births (47.6% to First Nations women) were included. GDM accounted for 68.8% of births, DIP 13.1% and T2D 18.1%, with proportions of DIP and T2D higher for First Nations women. The adjusted risk of macrosomia increased by 17% per year for First Nations women with GDM (OR 1.17 per year; 95%CI 1.01, 1.35); macrosomia risk was unchanged for First Nations women with DIP and T2D, and for all diabetes categories of non-First Nations women. Risk of neonatal hypoglycaemia decreased for non-First Nations women with GDM (OR 0.84; 95%CI 0.79, 0.90) and DIP (OR 0.80; 95%CI 0.65, 0.99). Exclusive breastfeeding at hospital discharge decreased in First Nations women across all diabetes types (GDM OR 0.83; 95%CI 0.71, 0.98; DIP OR 0.76; 95%CI 0.97; T2D OR 0.82; 95%CI 0.73, 0.93). Any breastfeeding at discharge increased among non-First Nations women with T2D (OR 1.48; 95%CI 1.03, 2.14). Large for gestational age, delivery by caesarean, gestational age at birth and admission to special care nursery were unchanged across all groups.

Conclusion: Despite efforts to improve systems of care, birth outcomes for Australian First Nations women with hyperglycaemia in pregnancy in the NT did not improve over the study period. Further work is needed to strengthen the cultural safety of models of care and address the social determinants of health.

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Overweight/obesity and other predictors of gestational diabetes among Aboriginal and non-Aboriginal women in Western Australia

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Background

Australian Aboriginal and Torres Strait Islander (hereafter respectfully called Aboriginal) women have a heavy burden of gestational diabetes (GDM) and of its main modifiable risk factor, overweight/obesity. However, the relationship between GDM and overweight/obesity has not been sufficiently studied within an Aboriginal context. This study aimed to investigate the predictors of GDM and the association between GDM and body mass index (BMI) in Aboriginal mothers.

Methods

We conducted a population-based retrospective cohort study that included all singleton births in Western Australia between 2012-2015 (n=133,215), using population health datasets linked by the Western Australian Data Linkage Branch. GDM status was ascertained from Midwives' Notification System and Hospital Morbidity Data Collection datasets. Associations between GDM and its predictors were estimated as relative risks (RRs) and 95% confidence intervals (CI) from multivariable generalised linear models. Ratio of relative risks (RRRs) compared RRs in the Aboriginal and non-Aboriginal mothers. Adjusted population attributable fractions estimated the contribution of overweight/obesity to GDM burden, and adjusted predicted probabilities for GDM were plotted against BMI levels.

Results

About 8.8% of Aboriginal (9.2% of non-Aboriginal) pregnancies were complicated by GDM. The following predictors had stronger associations with GDM in Aboriginal mothers than in non-Aboriginal mothers: maternal obesity (defined as BMI≥30) (RR: 3.16, 95% CI: 2.54-3.93; RRR: 1.57, 95% CI: 1.26-1.94), previous LGA (RR: 1.70, 95% CI: 1.37-2.12; RRR: 1.41, 95% CI: 1.13-1.76) and previous macrosomia (RR: 1.55, 95% CI: 1.24-1.94; RRR: 1.53, 95% CI: 1.22-1.91). About 48.5% (95% CI: 39.7%-56.0%) of GDM cases in the Aboriginal population (23.7% in non-Aboriginal mothers, 95% CI: 21.9%-25.4%) were attributed to overweight/obesity. Compared to non-Aboriginal mothers, the adjusted probabilities of GDM among Aboriginal mothers were higher at all BMI levels, and showed greater increase with BMI.

Conclusion

Overweight and obesity are key drivers of GDM among Aboriginal women. The stronger association between BMI and GDM among Aboriginal women compared to non-Aboriginal women may relate to differences in body fat distribution. Developing strategies in partnership with Aboriginal community members to optimise weight pre-conception (and across the life course) should be prioritised.

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Are there ethnic differences in the development of gestational diabetes mellitus across pregnancy? Results from the Treatment of Booking Gestational Diabetes Mellitus study

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11. Gender Medicine Unit, Division of Endocrinology and Metabolism, Department of Medicine III, Medical University of Vienna, Vienna, Austria

12. Royal Prince Alfred Hospital, Sydney, NSW, Australia

13. Fiona Stanley Hospital, Murdoch, Western Australia

14. Seethapathy Clinic and Hospital, Chennai, India

15. Örebro Hospital, Örebro, Sweden

Background: Non-Europid background is a known risk factor for gestational diabetes mellitus (GDM), and early screening is recommended for those from ethnic minority groups. This study investigates the specific risk associated with the presence of early (booking)GDM among women of non-Europid background.

Methods: Pregnant women with known risk factors for GDM enrolled in the Treatment of Booking Gestational Diabetes Mellitus (TOBOGM) trial, who underwent an oral glucose tolerance test (OGTT) at booking and at 24–28 weeks were studied. Ethnicity was self-reported. GDM was determined using World Health Organisation criteria. The association between ethnicity and GDM risk was tested using multivariate logistic regression analysis, adjusting for maternal age, booking BMI, previous GDM, family history of diabetes, and history of polycystic ovarian syndrome. Adjusted odds ratios (aORs) with 95%CI are reported.

Results: Among 3629 women, 42.2% were Europid, 33.0% were South Asian/Middle Eastern (SA/ME), and 24.7% were others. Total GDM prevalence was 33.3%, and the risk of GDM was greater with non-Europid ethnicity (aOR (95%CI) 1.85 (1.55–2.20), particularly with SA/ME ethnicity (aOR (95%CI) 2.07(1.70–2.52). The prevalence of booking and late GDM was 21.8% (n = 791) and 11.5% (n = 461), respectively. Mean (sd) age of the booking GDM cohort was 32.4(4.8) years; and of those with late GDM was 31.5(4.8) years (p = 0.002). Mean (sd) BMI for booking and late GDM were 32.5 (8.1) and 29.8 (6.7) kg/m2, respectively (<0.001). Ethnic distribution was similar (Europid, SA/ME, others: 39.1%, 36.5%, and 24.4% vs. 37.0%, 36.8%, and 26.2%, respectively (p = 0.72). Compared with Europid, SA/ME and others in the booking GDM group had higher 1-hour and 2-hour glucose values (fasting glucose (mmol/l): 5.1(0.4), 5.1(1.6), vs 5.0 (0.6), p = 0.11; 1-hour glucose: 8.7(2.0), 9.3(2.0), vs 9.4(2.0), p = 0.001; 2-hour glucose: 7.0(1.6), 7.5(1.6), vs 7.6 (1.7), p<0.001), whereas OGTT values did not differ among ethnic groups in the late GDM group. While non-Europid women had a higher risk of developing both booking and late GDM (aOR (95%CI) 1.75 (1.44–2.12) and aOR (95%CI) 1.62 (1.26–2.07), respectively), among those with GDM, the proportion with GDM present in early pregnancy was similar between non-Europid and Europid women (aOR (95%CI) 1.25 (0.94–1.66)).

Conclusion: Among women with risk factors, ethnic differences exist both in the proportion of women identified with booking and late GDM and in the glucose profile of those diagnosed. Ethnic variations in booking 1-hour and 2-hour glucose should be further studied to elucidate their implications on pregnancy outcomes.

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Affirmative/PRO

Fionnuala Breathnach[1]

1. Royal College of Surgeons in Ireland, Rotunda Hospital Dublin, Parnell Square, DUBLIN, Ireland

Pregestational type I and type II diabetes confer an unacceptably high perinatal mortality rate, up to tenfold the background population risk. This renders pregestational diabetes among the highest risk medical conditions in obstetrics. Pregestational diabetes represents a particularly high-risk for evolution of preeclampsia (PET), with incidence rates of PET within this group at approximately 20%. The combination of diabetes and preeclampsia places the pregnancy at heightened risk for hypoxia and stillbirth. The aetiology of PET remains unclear, although placental dysfunction, due to disordered early placental development, is central to the disease process. Early placental disease is followed months later by clinical manifestations of PET, which reflect widespread endothelial dysfunction resulting in vasoconstriction, ischaemia and increased vascular permeability. While not all adverse perinatal outcomes in women with pregestational diabetes are attributed to hypertensive disorders, any therapy that offers the potential to reduce the incidence of preeclampsia in this group deserves close attention. Low-dose aspirin has been investigated for the prevention of preeclampsia owing to its negative effect on thromboxane production, and its safety record in pregnancy is well-established. Therefore, consideration should be given to treating all diabetes-affected pregnant women with aspirin from the first trimester until 36 weeks' gestational age.

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EMERGE: A Randomised Placebo-Controlled Trial of the effectiveness of Early Metformin in Addition to Usual Care in the Reduction of Gestational Diabetes Mellitus Effects

Fidelma Dunne[1]

1. National University of Ireland, Galway Ireland (NUIG), Galway, CO GALWAY, Ireland

Pregnancies affected by gestational diabetes mellitus (GDM) are associated with an increased risk of adverse maternal and foetal outcomes. Current treatments for GDM involve initial medical nutritional therapy (MNT), exercise and pharmacotherapy in those with persistent hyperglycaemia. Insulin is considered first-line pharmacotherapy in many countries but is associated with hypoglycaemia, excessive gestational weight gain (GWG) and an increased caesarean delivery rate. Metformin is also used and is safe in selected groups (BMI >30) of women with GDM but is not first-line therapy in many countries. To date a randomised placebo controlled trial of metformin in the treatment of women with GDM has not been completed. The EMERGE trial will address this gap and will evaluate the effectiveness of early initiation of metformin in women with GDM across all BMI categories and where the GDM diagnosis is made using WHO 2013 criteria. The presentation will cover the rationale and background to the trial, the protocol, impact of COVID, drug adherence and baseline characteristics of women randomised.

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Medical Optimization and Management of Pregnancies with Overt Type 2 Diabetes (MOMPOD)

Ashley Battarbee[2, 1]

1. on behalf of the MOMPOD Consortium, -

2. University of Alabama at Birmingham, Mountain Brook, ALABAMA, United States

Background: Metformin is recommended for treatment of type 2 diabetes among non-pregnant individuals. Although oral hypoglycemic agents such as metformin have gained acceptance for the treatment of gestational diabetes, insulin is the recommended first-line treatment for pregnant individuals with type 2 diabetes. The added benefit of metformin in pregnancies complicated by insulin-treated type 2 diabetes is unknown.

Objective: Thus, the objective of this trial was to compare the safety and efficacy of insulin plus metformin versus insulin alone for the treatment of type 2 diabetes in pregnancy.

Study Design: This was a multicenter, randomized, double-blind trial of individuals with insulin-treated type 2 diabetes (known diagnosis prior to pregnancy or diagnosed at <20 6/7 weeks' gestation) who were carrying a singleton gestation with no known fetal anomalies. Enrolled participants were given metformin (or matching placebo) and instructed to take 500mg twice daily for 1 week followed by 1000mg twice daily until delivery. Insulin was titrated at the discretion of the obstetric provider to achieve glycemic control. The primary outcome was an adverse neonatal composite of neonatal hypoglycemia, birth trauma, hyperbilirubinemia, preterm delivery <37 weeks' gestation, large-for-gestational-age, small-for-gestational-age, or fetal or neonatal death. Key secondary outcomes included neonatal anthropometrics and maternal hypoglycemia.

Results: Of 2,667 screened individuals at 18 centers, 831 were enrolled and randomized. Overall, the mean maternal age at enrollment was 33 ± 6 years. The cohort was racially diverse with 41% participants who self-identified as White, 30% Black or African American, 3% Asian, 1% mixed, and 24% not reported. Approximately 50% were of Hispanic ethnicity. The majority (77%) had diabetes diagnosed prior to pregnancy. The mean gestational age at birth was 37 ± 2 weeks' gestation with preterm birth in 31% of participants. Overall, the mean birthweight was 3164 ± 768g with equal distribution of male and female neonates.

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MITY Kids

Denice Feig[1]

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Publish consent withheld

46

Translating technology into clinical care

Denice Feig[1]

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Content not provided at the time of publishing

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Update on closed loop systems in T1DM.

Katrien Benhalima[1]

1. UZ Leuven, Leuven, VLAAMS BRABANT, Belgium

Publish consent withheld

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Use of technology for Indigenous women with diabetes in pregnancy.

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Aboriginal and Torres Strait Islander women are disproportionately impacted by type 2 diabetes (T2DM) at a young age and have high rates of pre-existing diabetes in pregnancy. Maternal hyperglycaemia is one of the most important modifiable risk factors which can improve pregnancy and birth outcomes. T2DM in younger people is associated with challenging social determinants of health, remoteness, smoking and obesity. Enhancing culturally appropriate referral pathways, communication, workforce capacity and skills, health literacy of both health professionals and women are measures which are crucial to diabetes in pregnancy care. As part of a current health systems improvement project in Far North Queensland (Diabetes across the Lifecourse: Northern Australia Partnership) these issues are being addressed, and an interim evaluation has identified early successes.

Diabetes technology such as continuous glucose monitoring is a promising adjunct to other measures, however, has not been widely accessible or studied among Aboriginal and Torres Strait Islander women, or with T2DM in pregnancy. Continuous glucose monitoring has been shown to improve neonatal outcomes for women with type 1 diabetes in pregnancy. Flash glucose monitoring is a type of intermittently scanned continuous glucose monitoring (iscCGM) system. We conducted a pilot study to assess the feasibility and acceptability of using iscCGM for women with pre-existing T2DM in pregnancy. Three quarters of participants were Aboriginal or Torres Strait Islander and 30% lived remotely (>100km from the city). We found that iscCGM was acceptable for the majority of women and preferable to finger-stick monitoring. Feasibility assessment revealed a wide variability of sensor use and indicated that earlier referrals, culturally appropriate systems of care and access to diabetes educators and are vital to optimise iscCGM use. These results will inform future randomised trials which are needed to demonstrate improvements in pregnancy outcomes.

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Insulin Analogues in HIP - Indian Experience

Anand Dr Shankar[1]

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Insulin Analogues in HIP - Indian Experience ABSTRACT – Hyperglycaemia in pregnancy (HIP) is associated with higher risks of adverse pregnancy outcomes, and could be because of pre-existing diabetes, or insulin resistance caused by pregnancy. Indian guidelines recommend initiating insulin therapy when lifestyle modifications are unable to adequately control hyperglycaemia. Newer insulin analogues are now being used more frequently in pregnancy since they are safer and could provide a glycaemic profile similar to non-diabetics. Insulin aspart, a short-acting analogue, has sufficient evidence for its use in pregnancy, and a study by Deepaklal MC et al, further reinforces the safety of aspart in gestational and pregestational diabetes. Premixed formulation of aspart, containing a protaminated crystallized component, was studied by V Balaji et al, and was concluded to be non-inferior to premixed human insulin in efficacy and safety. Another short-acting insulin, lispro, was also concluded to be a safe and effective option in HIP by Deepaklal MC et al in his retrospective study in GDM. There is no adequate data for use of glulisine in pregnancy, and it was considered FDA category C. Insulin detemir is the only long-acting analogue that can be considered for use in pregnancy in India. Insulin degludec, an ultra long-acting insulin is not approved in pregnancy yet, but the recent EXPECT study to assess efficacy and safety in pregnant women with T1D indicates non inferiority of degludec with detemir. Most studies on glargine are small and retrospective. Glargine was previously considered FDA category C, now the Indian label guidance classifies under "No clinical data".

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Insulin Analogues in Pregnant- The EXPECT randomized controlled trial

Fidelma Dunne[1]

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The EXPECT RCT examines insulin Degludec (Tresiba) compared to insulin detemir (Levemir) in pregnant women with Type 1 Diabetes. The presentation will describe the rationale for the study. The trial is a multi-national, multi-center, randomized, open-label, parallel group, treat to target trial. Women were randomized to the trial either pregnant (8-14 weeks gestation) or in a pre-pregnancy phase and planning to become pregnant within 1 year of randomization. The study protocol was designed to demonstrate non inferiority of Degludec when compared to Detemir. The presentation will discuss the trial results of all pregnant women from both arms of the trial demonstrating non-inferiority and focusing on maternal efficacy and safety and neonatal outcomes.

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Neonatal therapies for neonatal hypoglycaemia

Jane M Alsweiler[1]

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Neonatal hypoglycaemia is a common complication following a diabetic pregnancy and is associated with adverse later neurodevelopment, particularly visuo-motor and executive function impairment. As neonatal hypoglycaemia is common and frequently asymptomatic in at-risk babies, these babies are screened for hypoglycaemia in the first 1-2 days after birth with frequent blood glucose measurements. Neonatal hypoglycaemia can be prevented and treated with buccal dextrose gel, and it is also common to treat hypoglycaemic babies with formula and intravenous dextrose. However, it is uncertain if screening, prophylaxis or treatment improves long-term outcomes of babies at risk of neonatal hypoglycaemia. This presentation will assess the latest evidence for screening, prophylaxis and treatment of babies at risk to improve long-term neurodevelopmental outcomes.

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In the wake of HAPO

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There was widespread hopeful expectation that the HAPO study (published in 2007) would result in uniform protocols and criteria for the detection and classification of hyperglycemia in pregnancy. Some fifteen years later, this expectation remains unfulfilled,

with vigorous and sometimes heated "controversy" still surrounding these questions. The HAPO study did not, in itself, propose diagnostic criteria, but HAPO's results helped inform the subsequent consensus process coordinated by IADPSG.

Although the approach of universal 75 gram OGTT testing at 24 - 28 weeks' gestation has been endorsed (with varying degrees of enthusiasm) by many major national and international bodies, dissent persists. Notable points of contention include the recommendation for universal testing (risk factor based testing still recommended, for example, in the UK and Denmark), the use of one - or two - step diagnostic protocols (in particular in North America), the assignment of a GDM "diagnosis" on the basis of a single elevated OGTT value (in particular in the USA) and the IADPSG choice of diagnostic thresholds (fasting 5.1 / 1 hour 10.0 / 2 hour 8.5 mmol/L) which, in particular, lowered the fasting glucose threshold for GDM compared to previous thresholds used in many countries leading to fears of a GDM tsunami.

Recent population based studies suggest than lower glucose diagnostic thresholds do not improve overall pregnancy outcomes on the population level, but a variety of lines of evidence suggest that treatment of women who fall in the "grey zone" - GDM positive on IADPSG criteria but negative on previous criteria - may suffer increased pregnancy complications if untreated and may benefit from active intervention.

Preanalytic and laboratory protocols for glucose measurement have also become a topical issue, with minor variations with accepted laboratory norms, particularly in fasting glucose results, leading to large changes in GDM frequency.

These contentious issues continue to delay any true global consensus and occur on the backdrop of the dual global epidemics of diabetes and obesity, which means, in some countries (e.g. the USA), that the prevalence of impaired glucose metabolism (IFG and IGT) in women of childbearing age greatly exceeds the reported prevalence of GDM. Despite being a non-sequitur, the prevalence of GDM is then considered excessive and unreasonable.

This presentation will attempt to balance these multiple contentious issues and suggest a path forwards on the global HIP / GDM journey.

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Health system strategies in Australia to improve the Outcomes of Diabetes in Pregnancy

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A Goal of the National Diabetes Strategy 2021-2030, and the preceding 2016-2020 Strategy, in Australia focusses on reducing the impact of diabetes in pregnancy whether complicated by pre-gestational diabetes or by gestational diabetes. Key areas for action include pre-pregnancy care, reducing impact of diabetes and pregnancy for Aboriginal and Torres Strait Islander peoples. support for women who develop gestational diabetes during and after pregnancy and also provision of paediatric follow up for the offspring.

This presentation will highlight some of the related national programmes and work being done to support women with diabetes and their health professionals, and the diabetes technology funding situation in Australia.

1. Australian National Diabetes Strategy 2021-2030
https://www.health.gov.au/sites/default/files/documets/2021/11/australian-national-diabetes-strategy-2021-2030_0.pdf

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-National approach to diabetes in pregnancy and its management in Sweden

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2. Örebro University, Örebro, Sweden

In Sweden national Guidelines for Diabetes in Pregnancy have not existed. The talk will show a brief overview over the health care organization in Sweden and

positive and negative aspects of the current health care system. The talk will give an example how changes are now under work by using research, national quality registers and

professional collaboration.

Hopefully the CDC4G trial (Changing Diagnostic Criteria for gestational Diabetes) results can be presented; as an example of making policy changes nationally in Sweden.

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The Health Economics of Screening and Treatment for Gestational Diabetes

William H Herman[1]

1. University of Michigan, Ann Arbor, MICHIGAN, United States

In this presentation, I review the essential elements of economic analyses of health care programs; the screening tests, interventions, and health outcomes associated with gestational diabetes (GDM); and the cost-effectiveness of screening and interventions for GDM. The cost-effectiveness of screening programs and interventions depend on the comparator (usual care vs. no screening or treatment), the perspective (healthcare sector vs. society), and the time horizon. In general, screening is cost-effective or even cost-saving compared to no screening when GDM is prevalent, screening detects a large proportion of high-risk women, adverse outcomes of GDM are common, and treatment improves outcomes. IADPSG screening criteria are cost-effective compared to Carpenter-Coustan criteria if the analysis adopts a longer time horizon. Key variables that make screening and

interventions more cost-effective include high GDM prevalence and poor GDM outcomes; less screening and intervention in the comparison group; high uptake, good detection, and low cost of screening; good effectiveness and low cost of intervention; high incidence of maternal T2DM; good effectiveness and low cost of postpartum interventions; longer time horizon; and higher willingness to pay.

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Consumer Perspectives of Diabetes and Pregnancy: how consumers and community shape and influence interventions for women with diabetes

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Diabetes and pregnancy studies have found better outcomes when interventions were developed with consumer involvement. When consumers are central to development and delivery of interventions, study participants have better engagement and outcomes, particularly for culturally and linguistically diverse (CALD) and/or lower socio-economic people. Women with pre-existing diabetes planning pregnancy place a higher value on recommendations from peers, demonstrating the value consumers place on community engagement during pregnancy journeys. We discuss how consumer perspectives and community engagement throughout policy/practice and intervention research development delivers better outcomes and strengthens HCPs and consumer ties in advocating for better health.

A systematic literature review was conducted on consumer involvement and women's perspectives in pre-existing diabetes and pregnancy interventions to identify common themes across studies. These were: barriers to accessing pre-pregnancy care (PPC) such as negativity and stigma in care from behaviours/attitudes/perceptions of HCPs and limited appointment availability not aligning with work/life commitments; fear of losing a "normal" pregnancy journey; awareness of risk but unwillingness to discuss if consumers have not established trust with HCPs; inaccessibility to CALD appropriate PPC and contraception; and digitisation of PPC information resources including peer support and social media. From these results, a PPC Consumer-Driven Intervention Framework for Women with Pregestational Diabetes was developed consisting of:

1) Consumers as active stakeholders, with representation in all components and renumeration to acknowledge lived experience & knowledge contributions

2) Improved communication methods, including appropriate empowering language and messages

3) Greater and earlier information and accessibility on contraception options (linkage with transition clinics)

4) Digital intervention methods, with apps and podcasts (e.g. MamaBetes – consumer-created showcasing lived experience)

5) Peer support and social media integration (formalised linkages with existing/new Facebook and Twitter diabetes communities)

An example of a consumer-led initiative we have established with this framework in mind but for Gestational Diabetes Mellitus will be provided:

- Community Engagement Event: Opportunity open to consumers to share perceptions and experiences on GDM criteria, who should deliver a GDM diagnosis, using what words, how the message should be delivered and what supports for women and families are important. Findings can inform GDM-tailored intervention frameworks and service models.

To assist community involvement in diabetes pregnancy intervention design and delivery we created a new framework, for improving clinical and social outcomes in healthcare, empowering relationships between HCPs and consumers, and highlighting the value of lived experience and women-centred care for increased community engagement.

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Pre-Pregnancy Care for Women with Diabetes

Aoife M Egan[1]

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In this lecture Dr Egan will provide an overview of the evidence base for pre-pregnancy care for women with diabetes. She will also review the various models of care described in the published literature, discuss barriers to attendance at pre-pregnancy care, and outline potential mechanisms to improve access to care for those that need it most.

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Hyperinsulinism: implications before and after pregnancy

Mary Louise Hull[1]

1. University of Adelaide, Adelaide, SA, Australia

Publish consent withheld

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A Randomised Controlled Trial of Text-Messaging to Improve Lifestyle following Gestational Diabetes: Smart Mums with Smart Phones 2

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4. Westmead Applied Research Centre, University of Sydney, Sydney

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6. Reproduction and Perinatal Centre, University of Sydney, Sydney

7. School of Public Health, Westmead Hospital, Sydney

8. University of Sydney, Sydney

Women with gestational diabetes (GDM) are at high risk for the development of diabetes later in life. There is evidence that intensive lifestyle interventions can reduce this risk. However these are not practical for many women and health systems have not been willing to fund such interventions. Hence they have not been translated into routine care. Text messaging is a simple, accessible, scalable and affordable means of supporting a lifestyle intervention, which potentially can be widely implemented.

We have conducted a multi-centre randomised controlled trial of a text-message based intervention for women with GDM, commencing shortly after delivery, and continuing for 6 months post-partum. The intervention comprises 4 customised and personalised text messages a week promoting physical activity, healthy eating, general health and parenting, as well as feedback from activity monitors provided by the study. The primary outcome is the achievement of a composite weight, physical activity and dietary target at 6 months.

One hundred and seventy six women were recruited into the study, and the trial has just been completed. Preliminary outcomes will be presented.

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Shoulder dystocia in Australian Aboriginal babies born to mothers with diabetes

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7. Division of Obstetrics and Gynaecology, The University of Western Australia, Perth, WA, Australia

8. Maternal Fetal Medicine Service, King Edward Memorial Hospital, Subiaco, WA, Australia

9. Ngangk Yira Research Centre, Murdoch University, Perth, WA, Australia

10. Wellbeing and Chronic Preventable Diseases Division, Menzies School of Health Research, Charles Darwin University, Darwin, NT, Australia

11. Department of Endocrinology, Royal Darwin Hospital, Darwin, NT, Australia

Background

Australian Aboriginal and Torres Strait Islander (hereafter respectfully called Aboriginal) women with diabetes in pregnancy (DIP) are more likely to have glycaemic levels above the target range, and their babies are thus at higher risk of excessive fetal growth. Shoulder dystocia, defined by failure of spontaneous birth of fetal shoulder after birth of the head requiring obstetric maneuvers, is an obstetric emergency that is strongly associated with DIP and fetal size. The aim of this study was to investigate the epidemiology of shoulder dystocia in Aboriginal babies born to mothers with DIP.

Methods

This retrospective cohort study included all singleton births in Western Australia between 1998-2015, using routinely collected linked health datasets (Midwives' Notification System and Hospital Morbidity Data Collection). Stratifying by Aboriginal status, characteristics of births complicated by shoulder dystocia in women with and without DIP were compared, and the incidence and time trends of shoulder dystocia were described. Compliance with guidelines aiming at preventing shoulder dystocia in women with DIP was compared by Aboriginal status. Post-regression estimation was used to calculate adjusted population attributable fractions (PAFs) for shoulder dystocia associated with DIP, and to estimate adjusted probabilities of shoulder dystocia in babies born to mothers with DIP at different birthweights.

Results

There were 510,761 births over the study period. Rates of shoulder dystocia in Aboriginal babies born vaginally to mothers with DIP were double that of their non-Aboriginal counterparts (6.3% vs 3.2%, p<0.001), and the disparities did not improve over time. Among mothers with DIP whose pregnancies were complicated by shoulder dystocia, Aboriginal mothers were more likely than non-Aboriginal mothers to have a history of shoulder dystocia (11.1% vs 4.0%, p=0.003). The rates of guideline-recommended caesarean section in pregnancies with diabetes and birthweight >4.5 kg were lower in Aboriginal women (28.6%) compared to non-Aboriginal women (43.1%) (p=0.004). PAFs indicated that 13.4% (95% CI: 9.7%-16.9%) of shoulder dystocia cases in the Aboriginal population (2.7% (95% CI: 2.1%-3.4%) in non-Aboriginal mothers) were attributable to DIP. Among mothers with DIP, the probabilities of shoulder dystocia among babies born to Aboriginal mothers were higher at all birthweights compared to those born to non-Aboriginal mothers.

Conclusions

Aboriginal mothers with DIP had a higher risk of shoulder dystocia and a stronger association between birthweight and shoulder dystocia. Many cases were recurrent. These factors should be considered in clinical practice and when counselling women. Barriers to appropriate access to caesarean sections should be explored.

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Does Providing Fruit and Vegetables, or Supermarket Vouchers Increase Adherence to a Reduced Carbohydrate Diet in Women with Gestational Diabetes?

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Background: Recommended carbohydrate (CHO) consumption in pregnancy is <175g/day; however many women consume significantly lower amounts[1]. Beneficial effects on glycaemic control and pregnancy weight gain have been reported in women with gestational diabetes (GDM) following a reduced carbohydrate (CHO) diet[2–4], but maternal and fetal outcomes, or micronutrient adequacy, remain uncertain[5,6].

Aims: To explore whether adherence to a reduced CHO diet is improved, and micronutrient adequacy met, by the provision of weekly fruit and vegetables or food vouchers, for those with GDM.

Participants/methods: A randomised controlled trial recruited women with newly diagnosed GDM, to one of three interventions: i) provision of weekly fruit and vegetables, provided at no cost or ii) weekly supermarket vouchers or iii) supermarket vouchers to an equivalent value provided at the end of the study. Participants had weekly reviews with a dietitian. The primary outcome variable was CHO intake assessed by a food diary, at baseline, and at 36 weeks gestation. Secondary outcomes were the evaluation of micronutrient adequacy by food diaries.

Results: There were 20 participants recruited at a mean (SD) 30.9 (1.6) weeks gestation, age 34.7 (5.2) years, and pre-pregnancy BMI of 28.3 (5.8) kg/m^2. There were no statistically significant differences in CHO or micronutrient intake between the three intervention groups. For all participants combined there was significant reduction in CHO intake at 36 weeks gestation, 136 (19) g/day compared to baseline, 165 (47) g/day; paired difference (95% CI) 29 (7.2 to 49.8), P=0.011. There was also a difference in sugar intake at 36 weeks gestation; 49 (14) g/day compared to baseline, 59 (23) g/day; paired difference 10 (0.06 to 20.7), *P* = 0.049. There were no significant differences in micronutrient, fibre, or energy intake at 36 weeks compared to baseline. The frequency of ketones remained unchanged during the intervention compared to baseline.

Conclusion: Providing fruit and vegetables at no cost did not increase adherence to a low CHO diet, compared to usual food provision. However, over all groups combined there was evidence of a 29 g/day reduction in CHO intake compared to baseline and an associated reduction in sugar intake of 10 g/day, with no detrimental effect on micronutrients. Dietitian support may be the most important factor to encourage women with GDM to successfully follow a low CHO diet.

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Can self-monitoring of blood glucose measurements be discontinued during pregnancy?

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Objective:

Introduction of insulin therapy in gestational diabetes mellitus (GDM) is determined by whether or not target blood glucose levels are achieved by using self-monitoring of blood glucose (SMBG) under nutritional therapy. However, in women who achieved the target glucose under nutritional therapy, there are no certain consensus on how long SMBG should be maintained during pregnancy. In this study, we examined the timing of the introduction of insulin therapy in women with GDM diagnosed during the second trimester and estimated the gestational age when SMBG could be discontinued.

Methods:

In a single-center, retrospective study, singleton pregnancies diagnosed with GDM at 24-32 weeks' gestation were included. We examined the week of gestation when insulin therapy was initiated by using SMBG assessment under nutritional therapy after GDM diagnosis. Insulin therapy was indicated if the SMBG value did not reach approximately ≥80% of the fasting and postprandial target glucose values, respectively.

Results:

Among 311 GDM patients included in the study, 179 (58%) and 132 (42%) were treated with diet alone throughout pregnancy (diet group) and with insulin therapy (insulin group), respectively. The insulin therapy was begun at 29±2 (range 24-36) weeks' gestation, the time from diagnosis to introduction of insulin therapy was 1.8±1.6 (0-10) weeks, and the maximum insulin dose was 32±23 (4-148) units/day. The introduction after 33 and 34 weeks' gestation was observed in 13 patients (10% of the insulin group) and only one patient (0.8%), respectively. In the diet group, 30% of patients continued SMBG until delivery, and the gestational age at discontinuation of SMBG was 31±3 (25-39) weeks' gestation.

Conclusion:

In most of the patients with GDM diagnosed during the second trimester, insulin therapy was initiated by 33 weeks' gestation. It was suggested that SMBG for the decision of insulin induction may be discontinued after 34 weeks of gestation.

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Circulating beta-hydroxybutyrate levels in overweight and obese pregnant women at 28 weeks gestation are not associated with dietary carbohydrate

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Background: Late pregnancy is associated with an accelerated starvation response, with increased production of ketone bodies including beta-hydroxybutyrate (B-OHB) from stored lipids. Normal B-OHB levels are considered to be less than 0.5 mmol/L. Maternal serum ketone levels ranging from 0.05 – 0.25 mmol/L have been found to be inversely associated with childhood IQ. However studies have found conflicting results. Current dietary guidelines advise pregnant women to consume 175g of carbohydrates daily to prevent ketogenesis. The aim of this study was to analyse the relationship between dietary carbohydrate intake and circulating B-OHB levels at 28 weeks gestation.

Methods: B-OHB levels were measured by Liquid Chromatography-Mass Spectrometry in fasting blood samples of 107 overweight and obese participants in the SPRING (Study of PRobiotics IN Gestational diabetes) trial with carbohydrate intakes between 73 and 374 g/d as assessed by food frequency questionnaire at 28 weeks gestation. Differences in B-OHB levels were evaluated by Mann-Whitney U tests given that the data was not normally distributed. B-OHB levels were correlated with carbohydrate and other macronutrient intake, biochemical markers, OGTT levels and clinical characteristics.

Results: The median circulating B-OHB level was 0.062 mmol/L (IQR 0.038 – 0.098, range 0.0001-0.297 mmol/L) . Circulating B-OHB levels did not correlate with carbohydrate intake (Spearman's rho = 0.14, P= 0.16) nor intake of any other macronutrient, maternal BMI, age, gestational weight gain, infant birthweight or infant length. The 1-hour OGTT blood glucose level was the only biochemical marker that was marginally correlated with B-OHB levels (rho 0.19, P = 0.056). When comparing women with B-OHB levels below and above the median of 0.062mmol/L, the only marginal difference was in 1-hour OGTT blood glucose level (below median B-OHB: 6.7 mM *vs.* above median B-OHB: 7.3 mM, P = 0.085).

Conclusion**:** Detectable circulating B-OHB levels were present in all participants and within the range associated with reduced childhood IQ. Carbohydrate intake at 28 weeks gestation does not affect circulating B-OHB levels in overweight and obese pregnant women. The higher 1-hour OGTT glucose values in women with higher fasting B-OHB concentrations could reflect a lower carbohydrate intake in the 24 hours before the OGTT, which was not recorded in this study. In summary, low levels of circulating B-OHB are common in late pregnancy and are not associated with routine dietary macronutrient intake.

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Women with Gestational Diabetes Mellitus with managed plasma glucose levels, exhibit dyslipidaemia that may contribute to fetal adiposity and warrants treatment

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Hyperglycaemia and hypertriglyceridaemia are well known characteristics in women with Gestational Diabetes Mellitus (GDM). However, women with tight glucose control can still have fat babies. The aims of this study were to determine 1) if the triglyceride content/enrichment of maternal lipoproteins in women with GDM treated for blood glucose levels, could potentially provide more fatty acids to the placenta compared to normoglycaemic pregnant women and 2) if there was any evidence of fetal lipid overload that may ultimately contribute to fetal adiposity in the offspring.

Pregnant women were recruited from the Royal Brisbane and Women's Hospital Queensland, Australia and the National Health Service Greater Glasgow and Clyde maternity units, Scotland. Fasted blood samples were collected at trimesters 2 (T2) and 3 (T3) and cord bloods were obtained at delivery. GDM was diagnosed using standard institutional clinical criteria of the time. Lipoprotein fractions were isolated from plasma via sequential ultracentrifugation (Havel et al., 1955). The fit model included the outcome (GDM status); Trimesters (T2 and T3); and GDM status and outcome*trimesters interaction, for all outcome variables. The model also included gestation at blood sampling as a covariate to correct for the difference at T2 between GDM status groups. Cord plasma means were compared using t-tests. All statistical analyses were conducted using JMP Pro and significant level was set at $P<0.05$. Sensitivity analyses were performed both including and excluding women of non-Caucasian ethnicity and women requiring pharmacological therapy for management of their gestational diabetes.

Plasma glucose did not differ between women with GDM and normoglycaemic women. Plasma VLDL and IDL lipids were higher in GDM compared to normoglycaemic women at T2 and reached a plateau by T3 for all women, suggesting this is related to increased insulin resistance in women with GDM. Plasma triglycerides were higher in GDM and increased from T2 to T3 in all women. VLDL- and IDL- triglyceride enrichment was 5-26% lower in GDM compared to normoglycaemic women. HDL triglyceride per HDL protein was 40% lower in GDM, suggesting this is due to reduced cholesteryl ester transfer protein activity in GDM (Liao et al 2018). This allows for more maternal VLDL-, IDL-triglyceride to be transported across the placenta to the fetus. Cord blood VLDL, IDL and LDL from women with GDM were triglyceride enriched, double that compared to normoglycaemic women.

In conclusion, despite normal blood glucose levels in women with GDM, the offspring had double the triglyceride load in their lipoproteins and tended to a 14% higher birth weight centile: highlighting the need to treat the maternal dyslipidaemia.

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The effect of COVID lockdown on physical activity in postpartum women with gestational diabetes

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Introduction

Gestational diabetes is one of the most common complications of pregnancy. Its rising prevalence is of concern not only due to its known association with perinatal complications but its long term 6-7 fold increased risk of type 2 diabetes mellitus which has substantial individual and public health burdens. Lifestyle interventions targeting diet and exercise shown to prevent progression of pre-diabetes have been applied to women with gestational diabetes. However, the emergence of the COVID-19 pandemic led to lockdowns and social distancing policies to reduce the spread of disease across many countries which also resulted in a reduction in physical activity and increase in weight. We explored how lockdown impacted on the exercise habits of this vulnerable postpartum population.

Methods

This was an observational sub study of Smart Mums With Smart Phones 2 (SMs2), a randomised controlled trial postpartum lifestyle intervention for women with GDM. It targeted weight, diet and physical activity using text messages customised from activity monitor data. Women were supplied with a wrist worn activity monitor as part of the intervention, which could track their step count. We compared the step count of women at 1-3 months postpartum with 3-5 months postpartum before lockdown and also interrupted by lockdown to assess the effect of progression of physical activity from delivery. We also compared women who were of similar times postpartum before and after lockdown to assess the effect of lockdown on step count.

Results

We found that there was no significant increase in steps based on months after delivery. However, there was an increase in step count during lockdown as compared to before lockdown which contrasts to trends found for the general population.

Conclusion

There are several possibilities that may explain these results including the change in caregiver roles, altered social and working demands and potentially a more motivated cohort already enrolled in a lifestyle intervention. Concerns that lockdown might increase diabetes risk for these women because of reduced physical activity are unfounded.

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From Diagnosis to Delivery: Postprandial Walking as a Non-Pharmaceutical Treatment for Gestational Diabetes Mellitus.

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Aim: Exercise is a useful adjunct to the standard treatment of all people with diabetes. The primary intention of this study was to investigate the effect of prescribing 10-minutes of post meal walking (PMW) three times daily on glucose levels (postprandial, 24h and nocturnal), physical activity and birth outcomes in women with gestational diabetes mellitus (GDM).

Methods: A randomised clinical trial. Women with GDM (diet controlled) <30wk gestation (n=40, 33±4 y, 28.2±5.5 $kg.m^{-2}$) were randomised to i) standard-care alone (CTL; includes recommendation ~30-minutes physical activity most $days.week^{-1}$), or ii) PMW (standard-care with advice to perform daily 10-minute walks within 1-hour of main meals) for ~seven weeks. Interstitial glucose was measured for 7-days at ~28- and ~35-weeks' gestation using continuous glucose monitoring (CGM). Physical activity and adherence was measured for 7-days at 28-, 32-, and 35-weeks' gestation using an inclinometer (ActivPal). Birth outcomes (e.g., type of birth, weeks' gestation, birth weight) were collected. Demographics and birth outcomes were compared using unpaired t-test and chi-square analyses and Fixed effects Linear Mixed Model and Tukey post hoc analysed main outcomes.

Results: Adherence to prescribed physical activity was higher for PMW vs CTL at 28 and 32 (by 20.9 ± 15.7 $minutes.day^{-1}$) but not at 35 wks (interaction: p=0.01). Mean 3h postprandial glucose (dinner) was significantly higher for PMW vs CTL (by 0.29 ± 0.58 $mmol.L^{-1}$; group: p=0.04), with no difference for postprandial glucose (breakfast and lunch). iAUC was 9% higher for PMW compared to CTL (group: p=0.05). Sitting time and incidental activity (stepping time) were higher and lower, respectively for PMW compared to CTL (group: both p<0.05). Across the cohort, 14% of deliveries presented macrosomia (birth weight>4000g), and 4.5% any incidences of hypoglycaemia in the neonate (birth outcomes no significance).

Discussion: Findings from this clinical trial show that whilst PMW had greater adherence to recommended physical activity, the glucose responses, sedentary (sitting) time and incidental activity were worse compared to CTL. In contrast to our hypothesis, accumulating walking in 10-min bouts was not an effective alternate to continuous physical activity recommendations. PMW may not have been of sufficient duration or intensity to mitigate postprandial hyperglycaemia in women with GDM. Future research could explore the impact of different types of physical activity behaviour, to assist in helping to control maternal glucose levels.

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Compliance with postpartum screening recommendations: an audit of a single site from the TOBOGM study

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Background: The ADIPS consensus guidelines for testing and diagnosis of hyperglycaemia in pregnancy recommend that women with a diagnosis of gestational diabetes (GDM) be re-tested with a 75 gram 2 hour oral glucose tolerance test (OGTT) between 6 and 12 weeks postpartum. The aim of this study was to compare the uptake of the postpartum OGTT among women with GDM diagnosed in pregnancy with research team follow up or standard care at one hospital.

Method: TOBOGM (Treatment of Booking GDM) study is an international multi-centre study. TOBOGM is investigating whether women who meet the diagnostic criteria for having GDM in early pregnancy, benefit from treatment, or whether their treatment can safely be deferred until after a 28 week (late pregnancy) confirmation of GDM. Women with GDM risk factors were recruited sequentially into TOBOGM and allocated to either "early GDM treatment", "await 28 week test results" (both groups defined as active participants) or "non-active" follow up based on their early pregnancy OGTT result. Women with either early or late (at ~28 weeks gestation) pregnancy GDM in the "active" but not the "non-active" arm were followed up by the local TOBOGM team. After birth, these "active" women were strongly encouraged by the study team to complete the postpartum test, including giving pathology OGTT request forms, receiving reminders from the study team and, in some cases, having their postpartum test booked by the study team. Women in the "non-active" arm of the study, received local standard practice.

Results: Overall, 714 women were recruited at the study site. Follow up OGTT was recommended at 6-12 weeks for those with a diagnosis of GDM at any stage of pregnancy. In the active arm, there were 83 women who were advised of an early pregnancy diagnosis of GDM and 65 women who were advised of a late pregnancy diagnosis. In the "non-active arm", 60 women were diagnosed with GDM at approximately 28 weeks gestation. We will present the results of an audit of compliance with the ADIPS consensus guidelines for postpartum screening, examining how many women have completed the postpartum OGTT per the ADIPS guidelines and how many have completed any kind of testing up to 2 years postpartum.

Conclusion: We will discuss factors that may be predictive of compliance with the ADIPS consensus guidelines and what measures might improve compliance with screening/surveillance for persisting diabetes after GDM.

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Pre-pregnancy planning in a woman with diabetes mellitus secondary to familial partial lipodystrophy type 3

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Case

A 30-year old former elite gymnast was referred to a tertiary maternity hospital for pre-pregnancy planning with "complex type 1 diabetes mellitus (DM)" of 10 years duration.

At presentation, the patient's HbA1c was 6.5%. She was taking gliclazide MR 60mg and empagliflozin 25mg daily with dulaglutide 1.5mg weekly. Metformin had been used but was ceased due to limited efficacy. She was injecting pre-mixed insulin 20 units bd but had previously been administering up to 400 units of insulin daily at a time when her HbA1c was 10.3%. There was dramatic improvement in glycaemic control when dulaglutide was introduced with concurrent reduction in insulin dosage. Further improvement occurred after transitioning to semaglutide as a GLP-1 agonist.

Notably, the patient was diagnosed with non-alcoholic fatty liver disease (NAFLD) at age 15. She had no diabetes complications but had a number of co-morbidities including hypothyroidism and chronic back pain. On examination, her body mass index (BMI) was 27.3kg/m^2. On investigation, the C-peptide level was elevated at 2.52 nmol/L paired with a glucose level of 6.5 mmol/L.

The presentation was not consistent with type 1 DM nor was it typical of type 2 DM. A monogenic cause of DM associated with severe insulin resistance was hypothesised. On genetic testing, the patient was heterozygous for a pathogenic PPAR gamma gene variant. This correlates with a clinical diagnosis of familial partial lipodystrophy (FPLD) type 3.

Discussion

FPLD type 3 due to a PPAR gamma gene variant is extremely rare. It is one of a group of familial partial lipodystrophies that lead to altered body fat distribution, sometimes resulting in a Cushingoid appearance. FPLD type 3 is associated with multi-system complications including DM, NAFLD, hypertriglyceridemia and atherosclerotic cardiac disease.[1] A BMI ≤27 kg/m^2 with >100 units of insulin/day increases the likelihood of identifying lipodystrophy.[2]

We identified only two case reports of pregnancy in women with FPLD type 3. Both described poor obstetric outcomes.[3,4] For our patient, optimising management for pregnancy presents a significant challenge. Semaglutide has been highly effective for glucose lowering but is not approved for use in pregnancy. There are reports of three women conceiving on semaglutide in the SUSTAIN 1-6 trials. No congenital abnormalities were reported, although fetal exposure likely occurred for <9 weeks. Our current challenge is how to manage pregnancy when prescribing metformin and insulin would create a suboptimal glycaemic response thus exposing the fetus to the known effects of hyperglycaemia.

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Modified gestational diabetes screening and testing criteria during the COVID-19 pandemic: what were the views of consumers and clinicians during this time?

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Background

In March 2020, Queensland Health introduced modified screening and diagnostic recommendations for gestational diabetes mellitus (GDM) in response to the COVID-19 pandemic. The recommendations included a two-step procedure [fasting blood glucose (FBG) test, followed by an oral glucose tolerance test (OGTT) for FBG > 4.7 and < 5.1 mmol/. A FBG under 4.7 mmol/l was negative for GDM and over 5.1 mmol/l was positive. In the context of the ongoing GDM diagnosis debate, we saw an opportunity to investigate the perceptions of both consumers and clinicians regarding the usual vs modified GDM diagnosis recommendations.

Methods

Consumers (mothers who had undergone GDM testing under standard and modified recommendations), and clinicians (antenatal health care professionals) were recruited via emails, social media and media releases for telephone interviews between March and May 2021. Data were analysed separately using a reflexive thematic approach.

Results

Twenty-nine consumers and 17 clinicians participated in telephone interviews. The main themes expressed by consumer participants included: the need for information provision, evidence and informed decision making; acceptability of GDM screening (often influenced by previous screening and GDM diagnosis experiences); individualisation of screening; preferred GDM screening methods for the future. Clinician responses focused on the communication and implementation of changes; perceptions and value of the evidence base; and diversity in perception of GDM screening. Women were more likely to welcome the ease and convenience of the changes, unless a previous GDM experience made them cautious of a definitive diagnosis. Although many clinicians understood women's dislike or inability to tolerate the OGTT, they largely felt the benefits of the OGTT outweighed the discomfort. In areas where GDM was more prevalent, clinicians expressed their concern about missed diagnoses while others felt that overdiagnosis was common and would support continued changes. Some clinicians indicated the need for a stronger evidence base to support ongoing changes and believed that many GDM patients would be missed under the modified criteria.

Conclusion

There remains ongoing debate over the best way to screen and the criteria to diagnose GDM. This study highlighted that while many women welcome a simplified screening and testing procedure, they wanted clear communication from antenatal care providers and the opportunity actively participant in their pregnancy care. Clinicians had diverse (and often strongly held) views when it came to the screening and diagnosis of GDM.

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Oral glucose tolerance test and continuous glucose monitoring for gestational diabetes diagnosis: a survey study of women's and health care professionals' perception.

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Background

The oral glucose tolerance test (OGTT) has been used for gestational diabetes mellitus (GDM) diagnosis for over 65 years[1]. Its poor acceptability has been repeatedly mentioned in literature[2]. Continuous glucose monitoring (CGM) is currently being considered a potential alternative to OGTT for GDM diagnosis[3].

Purpose

Aim of our study was to formally assess women's and health care professionals' perception of OGTT and CGM as a diagnostic test for GDM.

Methods

A-hundred-and-six women participating to the Abbott pilot study on the use of the Freestyle Libre PRO 2 for GDM diagnosis, were invited to fill two online questionnaires on the acceptability of OGTT and CGM. Each questionnaire consisted of 6 Likert-scale questions and one optional open-ended question. Midwives, obstetricians, diabetes educator and endocrinologist where also invited to fill a questionnaire on their perception of both methods. The questionnaire consisted of 13 Likert scale-based questions and 7 optional open-ended questions.

Finding

Sixty women filled the questionnaire on OGTT and 70 that on CGM. OGTT glucose beverage and timeframe were reported as poorly acceptable by women. CGM was described by them as significantly more tolerable (82% vs 27% of 5/5 general acceptability rates, $p<0.001$). Among the participants, 93% would recommend CGM as a diagnostic test for GDM to other pregnant women. Thirty HCP completed the survey. Most of them (73%) had confidence in OGTT as a diagnostic test for GDM, while recognising (66%) that there are some issues with the current method of GDM diagnosis.

In the free text section on the OGTT, women defined it "such an inconvenience" and HCP an "unpleasant test that women do not want to do". Most of the free comments on CGM were about the minimal impact on daily life: "didn't even notice it" and women's willingness of recommending this test over OGTT for GDM diagnosis. Doubts on CGM for GDM diagnosis were raised by HCP in terms of costs, accessibility and accuracy due to "lack of evidence for effectiveness in identifying the highest risk patients".

Conclusions CGM could represent the solution to the many limits of OGTT for pregnant women while providing HCP with a better insight of their glucose homeostasis. Studies on correlation between CGM parameters and pregnancy outcomes and cost-analysis are needed to strengthen the role of CGM as diagnostic test for GDM.

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Freestyle Libre Pro 2 for the diagnosis of gestational diabetes mellitus: a pilot study.

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Background

The "gold standard" for gestational diabetes mellitus (GDM) diagnosis, the oral glucose tolerance test (OGTT), has disadvantages including suboptimal sensitivity and specificity, and poor tolerability. However, no potential substitute tests currently have sufficient evidence for their use. Continuous glucose monitoring (CGM) potentially represents a more acceptable and comprehensive test for GDM. The aim of this study was to explore the Freestyle Libre Pro 2 as a diagnostic test for GDM, assessing its acceptability in pregnancy and correlating CGM results with OGTT results and with the risk factors of GDM.

Methods

Prospective cohort study at two Sydney metropolitan hospitals. Women wore the CGM device for 7 days at 24-28 weeks gestation, undergoing a 75-grams glucose OGTT (IADPSG criteria) on day 7. Participants then evaluated CGM/OGTT acceptability via two online surveys. CGM distribution/variability parameters and percentage of time spent in the recommended range for pregnancy (3.5-7.8), combined in the CGM Score of Variability (CGMSV) [1] were triangulated with OGTT results and GDM risk factors.

Results

Of the 107 women recruited, 87 (81%) were included in the study: 77 (88%) had negative and 10 (12%) positive OGTT (NGT, GDM). No significant difference was found in terms of demographics and CGM parameters between NGT and GDM. Although not statistically significant, CGM distribution parameters (mean, standard deviation and coefficient of variation) and variability parameters (mean amplitude of glycemic excursion and mean of daily differences) resulted higher in GDM, whereas the time spent in the range was higher in NGT. Women evaluated CGM as significantly more acceptable than OGTT (81% vs 27% 5/5 general acceptability, p<0.001).

Of the 58 NGT for which risk-factor score-OGTT-CGMSV triangulation was completed, we considered 35 were true negative (risk-factor score concordant with OGTT and CGMSV). We considered four women false negative (FN) (OGTT discordant with both risk-factor score and CGMSV). Triangulation identified one potentially false positive (FP) woman (positive OGTT but normal CGMSV and low risk-factor score).

Conclusions

CGM represented a more acceptable alternative to the OGTT for GDM diagnosis in this study. Its triangulation with GDM risk factors could allow an independent evaluation of the OGTT results. Further research on larger cohorts of patients evaluating additional triangulation elements, as GDM outcomes, is needed to confirm the results of this study and to progress the use of CGM for GDM diagnosis.

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Factors associated with higher risk of small-for-gestational-age infants in women treated for gestational diabetes

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Aims: To characterise risk factors associated with having a small-for-gestational-age (SGA) infant in women being treated for gestational diabetes (GDM).

Methods**:** This was a retrospective observational cohort study of 308 women with GDM. Women were split into groups based on their infant's size at delivery (SGA, appropriate-for-gestational-age (AGA), or large-for-gestational-age (LGA)). Literature review and expert opinion helped to determine several predictors of women with GDM delivering an SGA infant and statistical analysis was used to produce odds ratios (OR) for these predictors.

Results: The sample included primiparous women with a mean pre-pregnancy body mass index (BMI) of 25.72 (SD 5.75). Metabolic risk factors associated with delivering an SGA infant included a lower pre-pregnancy BMI (adjusted OR 1.13, p=0.04, 95% CI 1.01 to 1.26), a lower fasting blood glucose level (BGL) (adjusted OR 3.21, p=0.01, 95% CI 1.30 to 7.93) and growth that was high risk for SGA at baseline ultrasound (US) scan (adjusted OR 7.43, p<0.001, 95% CI 2.93 to 18.79).

Conclusions: Lower pre-pregnancy BMI, fasting BGL and baseline US growth measurements may indicate a need for less aggressive glucose management in women with GDM to prevent SGA infants.

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Outcomes of pregnancies following bariatric surgery delivering 2013-2018 in Queensland: A data-linkage study

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Bariatric surgery to treat obesity is increasing in frequency, doubling between 2005 and 2015. In 2014-15, 79% of the 22,700 hospital separations for bariatric surgery in Australia were performed on women, particularly in women of child bearing age. [1]Gastric sleeve (68%) and gastric band (19%) outnumber the gastric bypass (roux en y or biliopancreatic diversion surgeries) (10%) [1]. Pregnancy following bariatric surgery is associated with lower rates of hypertensive disorders but higher rates of small

for gestational age infants and pre term delivery [2]. This data-linkage project aims to analyse the outcomes of Queensland pregnancies and neonatal outcomes in women following bariatric surgery between 2013-2018 and matched controls.

The Queensland Hospital Admitted Patient Data Collection (QHAPDC) contains statewide data capturing information from all hospitals permitted to admit patients. The statewide Perinatal Data Collection collects information on all births in Queensland. Recorded data include maternal demographics, obstetric history, antenatal care, labour and delivery details, neonatal outcomes and postnatal details. In total, 2,018 births in 1,677 women were registered in the statewide perinatal dataset with evidence of prior maternal bariatric surgery via QHAPDC between 2013-2018. The first pregnancy following bariatric surgery for each woman was used for analysis. Of these 1,351 singleton births were matched on BMI, smoking, age and parity to 13,510 controls using a matching ratio of 1 case to 10 controls.

Matching was effective. There was no difference between case and control women for age category, parity, smoking or BMI, p=1.00, p=0.24, p=0.97 and p=0.82 respectively. Assisted reproductive technology use was different with 11.2% (n=151) women with previous bariatric surgery requiring assisted conception compared to 8.2% (n=1,109) control women (p<0.001). Women were aged between 25-29 years in 25.7% (n=3,817), 30-34 years in 34.5% (n=5,138) and 35-39 years in 23.9% (n=3,553). Less than a tenth of women were less than 20 or greater than 40 years of age. Gestational age at delivery and infant birthweight were different between women who had undergone previous bariatric surgery and controls with a median age of 38 weeks vs 39 weeks (p<0.001) and a mean birthweight of 3219 grams vs 3415 grams (p<0.001).

Initial findings indicate that women with previous bariatric surgery have higher rates of assisted conception and earlier delivery compared to matched controls. Ongoing analysis including multivariable regression models will be performed.

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The impact of preconception weight loss interventions on pregnancy outcomes in women with Polycystic Ovary Syndrome

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Background

Polycystic Ovary Syndrome (PCOS) is a common condition affecting up to 26% of women with overweight and obesity [1]. PCOS is associated with a longer time to spontaneous or assisted conception, greater risk of early pregnancy loss, three- to four-fold increased risk of gestational diabetes (GDM) and pre-eclampsia, and an almost two-fold increased risk of still birth [2, 3, 4].

Weight loss prior to pregnancy improves the metabolic and hormonal profile of women with PCOS and reduces their risk of pregnancy complications [5]. However, it is unclear which type of weight loss intervention is most effective for improving these reproductive, metabolic and hormonal parameters.

Aim

We conducted a systematic review to assess the impact of pre-pregnancy lifestyle, surgical or pharmacological weight loss interventions on fertility and pregnancy outcomes in women with PCOS and overweight or obesity.

Method

A comprehensive literature search was performed on PubMed, Embase and Cochrane CENTRAL from the inception of the databases dating up to May 2022. We included all randomized controlled trials (RCTs) comparing lifestyle, surgical or pharmacological weight loss interventions in women of reproductive age between 18-40 years with PCOS and a body mass index (BMI) greater than or equal to 25 kg/m^2. The Cochrane Handbook of Systematic Reviews and the Quality of Reporting of Meta-Analyses checklist was used to conduct quality analysis.

Main outcome measures

Primary outcomes: Preconception weight loss, rates of spontaneous pregnancy, live birth, spontaneous abortion. Secondary pregnancy outcomes: Time to conception, GDM, pre-eclampsia, hypertension in pregnancy, stillbirth, preterm delivery or NICU admission.
Secondary reproductive measures: anthropometric, androgenic and metabolic parameters associated with PCOS.

Results

5908 studies were extracted for screening. Our review is ongoing, results will be available by the time of the IADPSG meeting.

Significance and Objectives

This data will inform the methodology for our PreBabe PCOS Substudy, nested within the MRFF funded PreBabe study (MRF1200791), a multi-centre RCT evaluating a pre-conception weight loss intervention on reducing perinatal complications for women with overweight and obesity [6].

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Does the method of insulin delivery impact the frequency of consultations during antenatal care for patients with Type 1 Diabetes Mellitus?

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Availability of technology assisting antenatal glycemic control in maternal Type 1 diabetes has increased over the last 5 years; due to Australia's national diabetes support scheme (ndss) funding continuous glucose monitoring (CGM)/flash sensor since March 2019. A need for frequent adjustments to insulin therapy in pregnancy are commonplace. We sought to examine if mode of insulin delivery; multiple daily injection(MDI) or insulin pump(CSII) differ in demand on clinical resources.

Aims:

In a Melbourne public antenatal diabetes clinic, we sought to determine:

(i) the proportion of patients using CGM/Flash sensor, MDI and CSII

(ii) the number of antenatal appointments, for glycemia review, according to method of insulin delivery

Method: This is a retrospective review of patients with pre-existing T1DM, who received antenatal care at Mercy hospital for Women, over 4 consecutive years, January 2018-December 2021. Data included glucose monitoring, mode of insulin delivery, total number of clinic appointments, and gestation at each appointment. Only appointments from CDE and/or diabetes physician/registrar for glycemic control were counted . Pre-pregnancy, pregnancy loss <16 weeks, postpartum appointments and patients transferred for delivery only were excluded. Data is expressed as mean(sd).

Results:

A total of 89 patients (41 MDI, 48 CSII). Mean gestation at delivery was 36 (1.8) weeks, (range 30 to 38weeks). 3 patients commenced CSII in pregnancy. Pre and post ndss subsidy, 56% vs 100% of patients used cgm/flash sensor. Approximately half of patients used CSII (Table 1). The overall number of glycemic appointments per pregnancy, was 14.2(4.5) and did not differ between MDI vs CSII 13.8(4.1) vs 14.1(4.6) respectively, p = 0.7). The glycemic appointments range per pregnancy 2 - 24.

Table 1: CGM/Libre sensor use and mode of Insulin delivery during pregnancy

	2018	2019	2020	2021
Total patients	16	19	24	30
Use of CGM/flash sensor n (%)	9 (56%)	17 (89%)	22 (92%)	30 (100%)
MDI	8	9	12	12
CSII n (%)	8 (50%)	10 (53%)	12 (50%)	18 (60%)

Table 2: Number of glycemic reviews per pregnancy according to mode of insulin delivery

	MDI	CSII	P Value
2018	11.8 (3.6)	12.5 (4.0)	
2019	13.0 (4.5)	15.1 (6.2)	
2020	15.0 (5.2)	14.8 (6.4)	
2021	14.4 (2.2)	14.9 (3.1)	
Overall	13.8 (4.1)	14.1 (4.6)	0.74 (ns)

Conclusion:

The uptake of CGM/flash sensor use since ndss subsidy for pregnancy increased. Pregnancy is an intense period for glycemic review, with average 14 visits per pregnancy, with no difference between MDI or CSII.

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Does bariatric surgery reduce the risk of obesity-related adverse pregnancy outcomes in women with gestational diabetes mellitus? – A retrospective cohort study.

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Aim: Obesity is a risk factor for many adverse pregnancy outcomes, and bariatric surgery (BS) is an effective treatment option for obesity. This study assessed whether BS reduces obesity-related adverse outcomes in women diagnosed with gestational diabetes mellitus (GDM) by comparing pregnancy outcomes between women with a prior history of BS and women with elevated body mass index (BMI) but without undergoing BS.

Method: A retrospective cohort study on women with GDM delivered between 2016 and 2021 at Liverpool Hospital (NSW, Australia) was conducted. A total of 29 women had previously undergone BS, and 655 women with a pre-pregnancy BMI≥35kg/m^2 who had not undergone BS were the control. Pregnancy outcomes were analysed and compared between the two groups.

Results: Women in the BS group were older and had lower BMI compared to the control group. Approximately 72.4% of bariatric women tolerated the 75g-oral glucose tolerance test (OGTT). Mean HbA1c at screening and fasting blood glucose levels (BGL) on OGTT were significantly lower in the BS group compared to control. BS group had higher 1-hour BGL but lower 2-hour BGL on OGTT; more bariatric women had 2-hour BGL<4.0mmol/L than the control group. During pregnancy, women from both groups had comparable weight gain and there was no difference in the need for insulin therapy. However, newborns born to BS group had lower birthweight; there was also a trend towards fewer large-for-gestational-age neonates, but more small-for-gestational-age neonates when compared to control. There was no statistically significant difference in other pregnancy outcomes between the two groups.

Conclusions: Compared to women with elevated BMI who had not undergone BS, women with GDM after BS had more favourable diabetic measures and gave birth to lower birthweight neonates. Other obesity-related outcomes were comparable between the two groups.

Outcomes	**BS(n=29)***	**Control(n=655)***	***P* value**
Maternal age(years)	33.8±4.6	31.2±5.6	**0.016**
Pre-pregnancy BMI(kg/m^2)	34.1±7.0	40.9±5.2	**<0.001**
OGTT:fasting BGL(mmol/L)	4.8±0.6	5.4±0.7	**<0.001**
OGTT:1-hour BGL(mmol/L)	11.6±1.2	9.7±1.9	**<0.001**
OGTT:2-hour BGL(mmol/L)	6.1±2.3	7.3±1.7	**<0.001**
2-hour BGL<4.0mmol/L on OGTT	6(28.6)	8(1.4)	**<0.001**
HbA1c(%)	5.2±0.4	5.4±0.5	**0.018**
Insulin requirement	13(44.8)	391(60.3)	0.096
Metformin requirement	5(17.2)	131(20.2)	0.701
Gestational weight gain(kg)	11.5±9.4	9.3±9.7	0.269
Hypertension	1(3.4)	82(12.6)	0.140
Pre-eclampsia	1(3.4)	32(6.4)	0.605
Caesarean delivery	8(27.6)	257(41.4)	0.139
Preterm delivery	3(10.3)	75(12.0)	0.784
Birthweight(g)	3195.2±523.9	3470.3±611.3	**0.018**
Birthweight<2500g	4(13.8)	33(5.3)	0.056
Birthweight>4000g	1(3.4)	103(16.7)	0.058
Neonatal intensive unit admission	4(13.8)	115(18.6)	0.511
Neonatal hypoglycaemia	4(13.8)	110(17.9)	0.573
Intrauterine/neonatal death	0	5(0.8)	0.627

*Data are presented as Mean±SD/frequency(%).

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Comparison of insulin requirements in women diagnosed with gestational diabetes on oral glucose tolerance test.

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Introduction

Gestational diabetes mellitus (GDM) affects 16% of Australian pregnancies.[1] In Australia, women are routinely screened for GDM with a 75g oral glucose tolerance test (OGTT) at 26-28 weeks' gestation, or earlier if high risk.[2] Using the Hyperglycaemia and Adverse Pregnancy Outcomes criteria, GDM is diagnosed if blood glucose levels (BGLs) are elevated during OGTT (fasting ≥5.1mmol/L; 1-hour ≥10mmol/L; 2-hour ≥8.5mmol/L).[3]

Women are required to monitor BGLs fasting and 2-hours post-prandially, but not 1-hour post-prandially. Treatment targets remain controversial,[2] with our centre utilising BGL targets of <5.5mmol/L for fasting and <6.5mmol/L 2-hours post-prandially. If dietary and lifestyle modification fails to achieve targets, pharmacotherapy is required.

Presently, it is unclear whether the time points at which BGLs are elevated on an OGTT influence treatment outcomes. In particular, the frequency of insulin use in women diagnosed on an elevated 1-hour BGL is unknown, given monitoring is not undertaken 1-hour post-prandially. This study aims to determine whether there are differences in insulin requirements based on OGTT results.

Method

A single-centre retrospective study was conducted on women diagnosed with GDM on OGTT during 2020. Patients were identified from a database maintained by diabetes nurse educators. Electronic medical records were used to collect demographic data, mode of delivery, gestational age at delivery, and neonatal birthweights.

Results

GDM was diagnosed in n=873 patients; median age 33 years (IQR 30,36); median BMI 27 kg/m^2 (IQR 23.5,30.5); n=276 primigravida; n=858 singleton and n=15 twin pregnancies; early OGTT in n=209 and routine OGTT in n=664.

Diagnosis was established by the following elevated results: Fasting only (n=204), 1-hour only (n=177), 2-hour only (n=140), Fasting and 1-hour (n=91), Fasting and 2-hour (n=19), 1 and 2-hour (n=145) and Fasting, 1 and 2-hour (n=97).

Frequencies of insulin requirement in these groups were: Fasting (n=88/204, 43%); 1-hour (n=40/177, 23%); 2-hour (n=32/139, 23%); Fasting and 1-hour (n=47/91, 52%); Fasting and 2-hour (n=7/19, 37%); 1 and 2-hour (n=50/145, 34%) and fasting, 1 and 2-hour (n=57/97, 59%). Metformin was used in n=2 patients.

The median gestational age at delivery was 38 weeks (IQR 37,39). Deliveries occurred via normal vaginal delivery (n=377), instrumental delivery (n=105), caesarean section (n=386), unknown (n=5).

Conclusion

Being diagnosed with GDM solely on an elevated 1-hour result on an OGTT conferred the lowest risk of insulin treatment, however, almost a quarter still required insulin. Conversely, women diagnosed with GDM based on elevated readings throughout the OGTT were at highest risk of requiring insulin.

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Glycemic profile using continuous glucose monitoring system (CGMS) of women with gestational diabetes mellitus missed using diagnostic strategies alternative to WHO 2013 criteria.

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Publish consent withheld

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Does a reduced carbohydrate diet in women with gestational diabetes optimise gestational weight gain and glucose control?

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Background: Gestational diabetes (GDM) is associated with adverse effects for women and their offspring which is exacerbated by excess gestational weight gain (GWG). Nutrition therapy is the primary treatment for GDM but little evidence exists to support any particular dietary approach[1,2]. Anxiety at the diagnosis of GDM triggers spontaneous carbohydrate (CHO) restriction[3] and potential benefits have been observed with CHO intake lower than the recommended 175g/day[4,5]. With appropriate support, and avoidance of potentially harmful ketone production, reducing CHO may optimise GWG and metabolic outcomes for mother and infant.

Aims: To investigate whether a diet lower in carbohydrate without ketosis, provided with dietetic support, will optimise GWG and improve glycaemic control.

Participants/methods: Women with newly diagnosed GDM were randomised to a reduced CHO diet, or standard nutritional advice based on national guidelines. Dietitians provided regular support and resources for women to consume an intervention diet of 135g/day CHO or standard CHO intake of 215g/day. The primary outcome was the proportion of women who gained weight

within their Institute of Medicine (IOM) BMI category[6]. Secondary outcomes were glucose and metabolic variables in women and baby.

Results: Fifteen women, recruited after a diagnosis of GDM were followed for a mean(SD) of 47.8(14.5) days in the reduced CHO group and 54(25) days in the standard diet until delivery. Baseline CHO intake was 151.4g/day(SD 51.0). By 36 weeks gestation average CHO intake in the reduced CHO group was 136.1g/day CHO (SD 17.8), and 198.7g/day (SD 46.9) in the control group ($p<0.004$). Only one woman in each group recorded ketones on one occasion. Rate of weight change of 0.3kg increase per week was not different between randomised groups ($p=0.94$). Only 13% of women had weight gain within their IOM BMI category: 50% above and 37.5% below in the reduced CHO group; 57.1% above, 28.6% below in the standard diet group. There was no evidence of a difference between groups in HbA1c, insulin use, blood pressure, pre-eclampsia, mode of delivery, infant birth weight or head circumference, or admission to neonatal intensive care.

Conclusion: This feasibility study demonstrated that a significant reduction in CHO intake in women with GDM is achievable, without detrimental effects for mother or infant, and may be preferred. Weight gain per week during the intervention was small in both groups with intensive dietetic support. Supporting reduced CHO intake for a longer duration in pregnancy is required to determine effects on GWG and metabolic factors.

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Haemoglobin A1c screening in early pregnancy among Aboriginal women in remote communities of the Northern Territory, Australia

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Background: Aboriginal women in the Northern Territory (NT) experience a high diabetes burden. Early pregnancy oral glucose tolerance test (OGTT) screening is recommended but infrequently undertaken. Local guidelines suggest haemoglobin A1c (HbA1c), at threshold 5.7% (39 mmol/mol) as an alternative, although evidence for this is limited. We aimed to assess rates of early (<20 weeks) HbA1c screening and associations of HbA1c with adverse pregnancy outcomes.

Methods: A retrospective study of all pregnancies among Aboriginal women receiving antenatal care in 52 remote clinics across the NT from 2017-2019 was undertaken. Data were extracted from NT Primary Health Care Collection and NT Perinatal Data Collection, supplemented by manual review of individual healthcare records for 902 pregnancies. Outcomes included early gestational diabetes using ADIPS OGTT criteria (early GDM), GDM diagnosed at any gestation, large-for-gestational-age (LGA), neonatal special care nursery admission, caesarean section, preeclampsia and pre-term birth. Associations were assessed using logistic regression.

Results: Of 1184 singleton pregnancies, 75 (6.3%) had pre-existing type 2 diabetes and were excluded. Early pregnancy HbA1c screening was performed in 770 (69%) pregnancies, with 31 (4.0%) having HbA1c ≥5.7% and only one ≥6.5%. Early pregnancy OGTT was undertaken in 182 (24%) of these 770 pregnancies, with 32 (18% of early OGTTs) meeting criteria for GDM, of which 5 (2.3% of early OGTTs) met overt diabetes criteria. Median gestation at time of HbA1c was 7 weeks (IQR 5.1-10.6), compared to 10 weeks (IQR 6.4-14) for early OGTT ($p<0.001$). HbA1c ≥5.7% had 31% sensitivity and 97% specificity for early GDM, 60% sensitivity and 93% specificity for overt diabetes on early OGTT, and 16% sensitivity and 98% specificity for GDM diagnosed at any gestation. Women with HbA1c ≥5.7% (compared to those with HbA1c <5.7%) had increased risk of LGA (OR 4.1, 95% CI 1.7-10, $p=0.002$) and neonatal special care admission (OR 2.5, 95% CI: 1.2-5.3, $p=0.015$), but not caesarean section (OR 1.5, 95% CI: 0.71-3.1, $p=0.291$), preeclampsia (OR 2.4, 95% CI: 0.68-8.2, $p=0.174$) or pre-term birth (OR 1.4, 95% CI: 0.56-3.5, $p=0.469$). There was minimal change in estimates after adjustment for age, smoking, parity and BMI.

Conclusion: Compared to OGTT, uptake of early HbA1c screening was higher and occurred at earlier gestation. Sensitivity of HbA1c against current GDM criteria is poor. Nevertheless, our findings suggest routine HbA1c is worthwhile in this context. Women with HbA1c ≥5.7% carry a higher risk of pregnancy complications and do not require further confirmation with OGTT.

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Flash Glucose Monitoring – Heralding Impaired Placental Flows with Glucometric Lows

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Insulin resistance is a key feature in pregnancy for women with gestational or pre-existing diabetes[1]. Insulin requirements steadily increase throughout the second and third trimesters[2]. Falling insulin requirements (FIR) and/or hypoglycaemia after the first trimester is considered an early indicator of placental insufficiency[3]. We present a case of flash glucose monitoring (FGM) detected hypoglycaemia heralding placental insufficiency in a Type 1 diabetes (T1D) pregnancy.

TT, a 24-year gravida 1 parity 0 woman, presented at 6-weeks' gestation, with an unplanned pregnancy and suboptimal glycaemic management (HbA1c 9.1%). T1D was diagnosed at age 5 and managed with insulin glargine and aspart at mealtimes. Significant background history included a developmental delay.

At initial review, FGM was commenced, and she was transitioned to detemir and mealtimes insulin aspart. Glycaemic management was challenging due to cognitive impairment, limited health literacy and social supports. Low dose aspirin was started, and she developed gestational hypertension in the second trimester requiring labetalol therapy.

Ultrasonographic examination at 33-weeks demonstrated polyhydramnios with accelerated anthropometric growth with both estimated fetal weight and abdominal circumference >90th percentile.

At 35-weeks, she had increasing time below range (TBR), rising from 9% to 35% on FGM whilst insulin requirements decreased by 29% over a 4 week period. She was admitted for suspected fetoplacental compromise. Her BP was increased at 132/100 mmHg. A feto-maternal unit assessment showed abnormal umbilical and middle cerebral arterial flows and in the context of non-reassuring cardiotocography, she was delivered via emergency caesarean section. A male 3.36kg fetus, Apgar scores 8, 9, 9 was admitted to the special care nursery and received treatment for neonatal hypoglycaemia and jaundice. The placenta histology report later confirmed focal chronic villitis and villous stromal vascular karyorrhexis suggestive of low grade fetal vascular malperfusion.

FIR of ≥15% from the peak daily dose after 20 weeks' gestation are associated with an increased risk of complications related to placental dysfunction (pre-eclampsia, small for gestational age, stillbirth, prematurity, and placental abruption)[4,5]. Evidence guiding the management of patients with FIR is limited, leading to varied clinical interventions[6]. Unlike traditional blood glucose monitoring, which looks only a few points in time, continuous glucose monitoring (CGM) or FGM provides a comprehensive data that track 24 hours. Increased use of CGM or FGM in pregnancies affected by T1D, may assist clinicians in detecting and quantifying the proportion of time glucose levels are below targets and provides a useful indirect indicator of fetoplacental compromise.

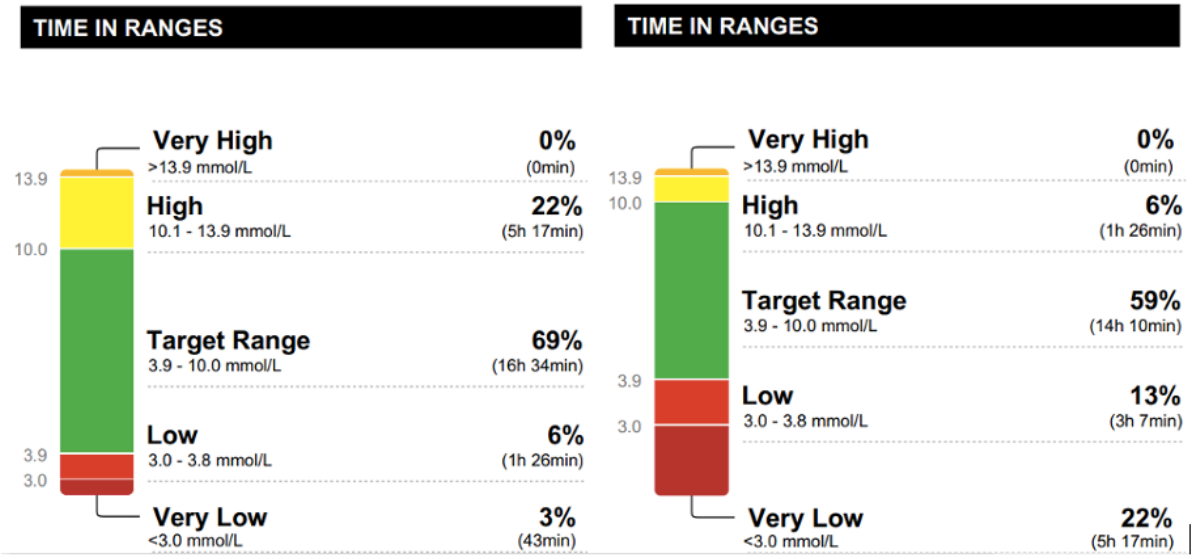

Figure: Time in ranges from FGM: increasing time below range (TBR), rising from 9% at 31 weeks (Left) to 35% at 35 weeks (Right)

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Is high dose insulin therapy in gestational diabetes (GDM) associated with adverse pregnancy outcomes?

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Background

High dose (HD) insulin therapy was previously considered an indication by our obstetrics team for induction of labour around 38 weeks' gestation in GDM pregnancies. We investigated whether HD insulin therapy is associated with adverse pregnancy outcomes and neonatal complications.

Methods

This was a retrospective, observational study of prospectively collected data. Singleton pregnancies of GDM women (diagnosed by ADIPS 2014 criteria), delivered from March 2016 to May 2022 were included. Women presenting at >36 weeks' gestation, having <2 clinical reviews, or with last weight measured >4weeks before delivery were excluded. Initial exploratory analysis demonstrated an inflection point for most adverse pregnancy outcomes at >50 units/day. Patients were grouped as HD (≥50 units insulin/day) versus low dose (LD) (<50 units insulin/day or diet managed). Clinical outcomes assessed included early delivery (<37weeks), caesarean section, large for gestational age infant (LGA, >90th percentile), small for gestational age (SGA, <10th percentile), neonatal hypoglycaemia (<2.6mmol/L), jaundice (requiring phototherapy) and shoulder dystocia. Univariate analyses included independent sample t-tests (continuous variables) and chi-square analyses (categorical variables). Logistic regression models were undertaken to adjust for baseline characteristics differences. Statistical significance p<0.05. Metformin was not used.

Results

HD insulin therapy was significantly associated with increased maternal age, gravida, parity, pre-pregnancy BMI, gestational weight gain (GWG) following first presentation, fasting, 1-hour and 2-hour blood glucose (on 75g OGTT) and lower gestational age at delivery. The HD insulin group were more likely to have excessive GWG (according to the Institute of Medicine weight gain targets), have prior GDM, prior macrosomia and family history of diabetes. There were more South Asian and less East/South-East Asian women in the HD group. There were no significant differences in proportions of European or Middle Eastern ethnicities. On univariate analyses, HD women were more likely to have early delivery [10.1 vs 6.0%, OR 1.8 (95% CI 1.0 – 3.2), p<0.05], caesarean section (53.6 vs 34.1%, OR 2.2 (95% CI 1.6 – 3.2), p<0.001], LGA infant [20.3 vs 10.9%, OR 2.1 (95% CI 1.3 – 3.2), p< 0.001] and neonatal hypoglycaemia [23.9 vs 19.2, OR 3.1 (95% CI 2.4 – 4.7), p<0.001] compared to the LD group. Following adjustments, only neonatal hypoglycaemia remained significant [adjusted OR 2.1 (95% CI 1.2 – 3.6), p<0.01].

Conclusion

On univariate analyses, HD insulin therapy was associated with increased risk of early delivery, caesarean section, LGA and neonatal hypoglycaemia. Following adjustment, a two-fold increased risk of neonatal hypoglycaemia remained, but other outcomes were no longer significant.

Table 1. Outcomes According to High vs Low dose Group

	High dose Insulin >50 units/day n (%) Total = 138	Low dose (Diet controlled or Insulin < 50 units/day n (%) Total = 1830	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Premature Delivery (<37 weeks)	14 (10.1)	109 (6.0)	**1.8 (1.0 – 3.2)***	1.0 (0.4 – 2.2)
Caesarean Section	74 (53.6)	624 (34.1)	**2.2 (1.6 – 3.2)*****	1.5 (1.0 – 2.3)
LGA	28 (20.3)	200 (10.9)	**2.1 (1.3 – 3.2)*****	1.1 (0.6 – 2.0)
SGA	6 (4.3)	153 (8.4)	0.5 (0.2 – 1.1)	0.7 (0.3 – 1.8)
Neonatal Hypoglycaemia	33 (23.9)	169 (9.2)	**3.1 (2.0 – 4.7)*****	**2.1 (1.2 - 3.6)****
Neonatal Jaundice	9 (6.5)	89 (4.9)	1.4 (0.7 - 2.8)	0.9 (0.4- 2.2)
Shoulder Dystocia	1 (0.7)	10 (0.5)	1.3 (0.2 – 10.5)	1.8 (0.1 – 29.1)

***p<0.05, **p<0.01, ***p<0.001**

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Die Rolle des Glukosestoffwechsels im Klimakterium – Einfluss der Hormonsituation auf das Diabetesrisiko

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Abstract

Introduction:

Throughout life, the female body is subject to hormonal fluctuations. The transition to menopause is particular dominated by a drop and a rapid rise of female hormones. This transition has considerable effects on the control of glucose metabolism and therefore on the manifestation of diabetes mellitus associated secondary diseases. The prevalence of developing diabetes increases at the age of 45, while expectancy of life increases at the same time. The aim of this work is to investigate the relationship between changes in the female hormonal situation (particularaly estrogens (E2) and follicle-stimulating hormones (FSH)) during the menopausal transition and the occurrence of insulin resistance as a precursor to diabetes. Based upon this, possible preventive recommendations to reduce the risk of diabetes should be derived in order to be able to improve the women's quality of life. In the context of this work, the following question is investigated: *„How does the hormonal situation during menopause influence glucose metabolism and the associated risk of developing type 2 diabetes?"*

Methods:

The corresponding topic was tackled by a systematic literature review in five electronic databases and a manual search in scientific journals. Afterwards the studies were analyzed and interpreted. A self-developed assessment tool was used to assess study quality; the assessment of the evidence level was carried out using a tool from the Oxford Center of Evidence Based Medicine.

Results:

The results indicate that high estrogen levels have a protective effect on developing diabetes. The treatment of early postmenopausal women with 0.15 mg transdermal E2 for just one week increased ERα gene expression in adipose tissue and improved SAT insulin sensitivity. Furthermore, higher FSH rise rates at least two years before the last period showed a significantly lower risk of diabetes.

Discussion and Conclusion:

The studies showed that ERa plays an important role in glucose homeostasis and insulin sensitivity. High FSH levels influence the risk of diabetes. The question arises whether preventive hormone administration can protect against diabetes in vulnerable risk groups. Further long-term studies covering the period from adolescence to senility are needed to clarify this question. In order to reduce the development of diabetes and to break the stigma surrounding the climacteric subject, comprehensive educational programs that also include the areas of „healthy nutrition" and „exercise" are important.

Keywords:

climacteric, glucose metabolism, hormones, risk of diabetes, estrogen

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Hyperglycaemia in Pregnancy: A new paradigm for adverse perinatal outcome risk stratification

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Background

Women from rural and remote WA have increased risk for Hyperglycaemia in Pregnancy (HIP), yet poor OGTT completion (50%) and non-adherence to pre-analytical laboratory standards results in significant under-diagnosis (estimated 62%). Measurement of HbA_{1c} and glycated albumin (GA) may improve screening outcomes.

Aims

To determine combined HbA_{1c} and GA cut-points to stratify low- and high-risk for HIP as diagnosed by OGTT (≥24-week gestation) and evaluate accuracy of risk-stratification for detecting adverse birth outcomes.

Methods

Twenty-seven rural and remote WA clinics recruited 694 pregnant women (2015-2018). OGTT were conducted following local pathology guidelines. Paired-sample OGTT time-course comparison of glucose in fluoride/oxalate to fluoride/citrate/EDTA samples informed linear regression correction of OGTT ($OGTT^c$) by delay to analysis (n=12; 363 time-points).

At OGTT, HbA_{1c} (Roche Diagnostics) and GA (AsahiKasei Pharma) were measured and maternal characteristics recorded. Two GP-Obstetricians, blinded to pathology results, defined adverse perinatal outcomes independently as potentially HIP-related.

Outcome measures included: receiver operator characteristics curve derived low-risk (sensitivity ≥95%) and high-risk (specificity ≥90%) cut-points for HbA_{1c} and GA (stratified by BMI: not-obese <30kg/m^2; obese ≥30kg/m^2), for abnormal $OGTT^c$; OR [95% CI] for composite adverse perinatal outcome (model adjustment: maternal BMI, age, height, ethnicity, and smoking; gestation at OGTT and delivery). To validate thresholds 180 participants were recruited (2020-2022) with OGTT collected into fluoride/citrate/EDTA tubes.

Results

Complete OGTT, HbA_{1c} and GA data was available for 357 participants. Adverse perinatal outcome was common (*n* =106, 30.7%), however most at-risk women (85.8%) had a normal OGTT (unadjusted OR 1.8 [0.9-3.7], *P* =0.11 for adverse perinatal outcome). Correction of OGTT by delay to analysis improved identification of risk (unadjusted OR 1.8 [1.1-3.1], *P* =0.003).

Combined cut-points used to stratify low-risk were HbA_{1c} <4.8% and GA <10.53% (non-obese) or <10.09% (obese); and high-risk were HbA_{1c} ≥5.5% and/or GA ≥12.90% (non-obese) or ≥12.37% (obese). Most women were in the medium risk category (low: 17.6%, medium: 60.5%, high: 21.8%). There was some discordance between abnormal $OGTT^c$ and HbA_{1c}-GA risk stratification (low: 14%, medium: 20%, high: 51%). However, the latter was highly predictive of adverse perinatal outcome (47.4%

high-risk v 27.6% medium-risk; adjusted OR 2.0 [1.1-3.5] *P* =0.020) and no abnormal uncorrected-OGTT were missed by low-risk classification. Threshold validation analysis is underway.

Conclusion

As a screening test the OGTT has low sensitivity for identifying women at risk of HIP-related adverse birth outcomes. Combined HbA_{1c}-GA risk-stratification presents an alternative paradigm to detect HIP and reduce the burden of conducting OGTTs.

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Oral glucose tolerance test to diagnose gestational diabetes mellitus: impact of variations in specimen handling

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Aim

To conduct a narrative review of contemporary approaches to minimise preanalytical glycolysis in oral glucose tolerance test (OGTT) samples with a focus on GDM diagnosis using criteria derived from the Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study. The challenges of implementing each approach across a diverse Australian healthcare setting were explored.

Results

Many Australian sites currently collect and transport OGTT samples at ambient temperature in sodium fluoride (NaF) tubes which likely leads to missed diagnosis of GDM in a significant proportion of cases. Alternative preanalytical solutions should be pragmatic and tailored to individual settings and as close as possible to the preanalytical conditions of the HAPO study for correct interpretation of OGTT results.

Rapid centrifugation of barrier tubes to separate plasma could be suitable in urban settings provided time to centrifugation is strictly controlled (estimated 1.8-fold increase in GDM). Tubes containing NaF and citrate could be useful for remote or resource poor settings with long delays to analysis but the impact on the interpretation of OGTT results should be carefully considered (estimated 1.4- to 4.2-fold increase in GDM). Testing venous blood glucose at the point-of-care bypasses the need for glycolytic inhibition but requires careful selection of devices with robust analytical performance (estimated impact on GDM not reported).

Conclusions

Studies to evaluate the potential error of each solution compared to the HAPO protocol are required to assess the magnitude of misdiagnosis and inform clinicians regarding the potential impact on patient safety and healthcare costs.

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Fetal programming of impaired decidualization in the offspring of diabetic rats

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INTRODUCTION: Diabetes mellitus is a metabolic pathology that leads to placental, fetal and offspring's alterations. Little is known regarding putative alterations in the uteri of the offspring of diabetic mothers. Peroxisome proliferator activated receptors (PPARs) are nuclear receptors involved in metabolic, anti-inflammatory and developmental pathways. PPARs regulate the

expression of prolactin, insulin like growth factor binding protein 1 (IGFBP1) and fatty acid binding protein 4 (FABP4), endocrine mediators of decidualization.

AIM: To address decidualization by evaluating the expression of genes codifying for PPARalpha, PPARgamma, prolactin and IGFBP1 and the protein levels of prolactin and FABP4 in the decidualized uteri of prepubertal offspring of diabetic and control rats.

METHODS: A mild pregestational diabetic rat model was induced in F0 females by neonatal administration of streptozotocin (90 mg/kg sc). Control and diabetic females were mated with healthy males. The uteri of the female offspring (F1) were evaluated on postnatal day 30, after induction of decidualization with PMSG (50 UI) and hCG (50 UI). In the decidualized uteri, *Ppara, Pparg, Prl1* and *Igfbp1* mRNA levels were evaluated by RT-qPCR and prolactin and FABP4 levels were evaluated by Western blot.

RESULTS: The offspring of diabetic rats showed an increase in *Ppara* mRNA levels compared to controls (0.84 fold-change, $p<0.05$) and an increase in *Pparg* mRNA levels (1.33 fold-change, $p<0.05$ vs Control Group) in the decidualized uteri. The *Igfbp1* mRNA levels were increased in the decidualized uteri of the offspring from diabetic rats (2.5 fold-change, $p<0.05$ vs Control Group). Differently, the *Prl1* mRNA levels were reduced in the decidualized uteri of the offspring from diabetic rats (0.38 fold-change, $p<0.05$ vs. Control Group). Prolactin protein levels were also reduced in the decidualized uteri of the offspring from diabetic rats (47%, $p<0.05$ vs Control Group). Differently, FABP4 levels were increased in the decidualized uteri of the offspring from diabetic rats (142%, $p<0.01$ vs Control Group).

CONCLUSIONS: The expression of *Ppara* and *Pparg*, as well as different proteins and genes involved in decidualization and regulated by these nuclear receptors, were altered in the decidualized uteri of diabetic rat offspring at a prepubertal stage. These alterations, evident at a prepubertal stage, may lead to reproductive impairments in the offspring of diabetic mothers.

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Neonatal Outcomes of a New Model of Care for Gestational Diabetes.

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Background: With introduction of the 2014 ADIPs criteria for GDM, a new model of care (MOC) was needed to manage the predicted 30% increase in women diagnosed with gestational diabetes mellitus (GDM) at Nepean Hospital. Following diagnosis, women attended an education session with diabetes educators and dietitians. They were then referred to either the diabetes in pregnancy clinic (DIPC) pathway if 75 g oral glucose tolerance (OGTT) levels were higher (fasting glucose ≥5.5mmol/l, 1 hour ≥10.5 or 2 hour ≥9.0) or continued their existing pre-GDM care pathway (EPGDM) with obstetrician or midwife if OGTT blood glucose levels (BGLs) were lower. EPGDM clinicians checked glycaemic control and referred to the DIPC for insulin therapy if BGLs were above targets.

Aim: To determine whether adverse neonatal outcomes are different for women managed via the 2 new MOC pathways.

Methods: 310 women were randomly selected from women referred to Nepean Hospital for GDM management between July 2018 and December 2019. Fifty two were excluded due to twin pregnancy, inadequate pregnancy or birth data available, or referral for hypoglycamia without GDM. Data were analysed for 257 women. Pregnancy data and adverse neonatal outcome data were collected from the electronic medical record.

Results: 127 women were triaged to the EPGDM and 126 to the DIPC pathway. Mean maternal age was 31.9 years. EPGDM pathway women were older, 33.6 ± 5.2 y compared with DIPC pathway women 32.3 ± 5.3 years (p=0.008). As expected, OGTT glucose levels were significantly higher at 1h and 2 h for DIPC women but not different for fasting venous glucose: 4.9±0.4 mmol/l for the EPGDM and 5.0±0.7mmol/l for the DIPC pathway (p=0.17). Fewer existing EPGDM pathway women received insulin 33.1% than DIP clinic pathway women 46.8% (p=0.03, OR 0.55, 95% CI 0.33-0.91). There was no significant difference between groups in mean parity (1.2) or gestational age at delivery (38.4 weeks). There was no significant difference in adverse neonatal outcomes between the EPGDM and the DIPC pathways for: neonatal LGA 16.5% versus 14.5%; SGA 2.4% versus 5%; hypoglycaemia 36.2% versus 38.1%; respiratory distress 22.1% versus 16.7%; NICU admission 37% versus 29.4% or jaundice 16.5% versus 23% (all p values > 0.2).

Conclusion: The new model of care using the EPGDM care pathway for women with lower glucose levels on OGTT is associated with less insulin use than the DIP clinic pathway but no significant difference in adverse neonatal outcomes.

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Peripartum glycemic management in women with pre-existing diabetes: Challenges and Opportunities

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The management of women with pre-existing diabetes is inherently complex due to the potential for significant adverse maternal and neonatal outcomes with enduring consequences.

The peri-partum phase is a high-risk period during pregnancy due to the number of factors that are difficult to control and due to the increased risk for developing poor outcomes. It is complicated by the variable demands of labour, the dynamic nature of presentations necessitating quick decision making, confounding factors which influence outcomes such as need for antenatal corticosteroid therapy and potential dietary restrictions especially in anticipation of an operative delivery, Increasing access to diabetes technology has complicated this further especially with complexity around responsibility of blood glucose monitoring and decision-making regarding insulin administration. While this is challenging, diabetes technology also provides an immense opportunity to optimise outcomes with its efficient and effective use.

The South Australian Perinatal Practice Guidelines (SAPPG), Australasian Diabetes in Pregnancy Society (ADIPS) guidelines and Diabetes Technology Standards developed by the National Association of Diabetes Centres (NADC) provide a framework to assist with delivery of care in this setting. A continuous improvement project was conducted by the Diabetes in Pregnancy team at Flinders Medical Centre in April 2022 to evaluate existing processes and to optimise peri-partum care and consequently improve maternal and neonatal outcomes.

The patient journey was mapped, and the processes involved in peri-partum planning and management of women with pre-existing diabetes was examined for areas of variability. A root cause analysis was undertaken to identify causes of variability and the effects of these were delineated. The findings of this project illustrate the challenges and opportunities faced by clinical teams working at the patient's bedside in translating research into practice and the resources that would be necessary to make this viable and sustainable.

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2. 2) Umesh Dashora, Nicholas Levy, Ketan Dhatariya, Nina Willer, Erwin Castro, Helen R. Murphy, Managing hyperglycaemia during antenatal steroid administration, labour and birth in pregnant women with diabetes – an updated guideline from the Joint British Diabetes Society for Inpatient Care, Diabetic Medicine, 10.1111/dme.14744, 39, 2, (2021).
3. 3) South Australian Perinatal Practice Guideline Diabetes Mellitus and Gestational Diabetes - https://www.sahealth.sa.gov.au/wps/wcm/connect/146238004ee2144cb404bdd150ce4f37/Diabetes+Mellitus+and+GDM_+PPG_v5_0.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE-146238004ee2144cb404bdd150ce4f37-n8V9het accessed 10 August 2022

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OGTT the imperfect gold standard: a qualitative study of rural and remote clinicians' experience

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Background

OGTT screening for GDM commenced in Western Australia (WA) in 2012. Subsequent audits in 2013 and 2022 showed significant numbers of women were not screened with OGTT in rural WA. Additional issues in implementing a universal OGTT screening program include pre-analytical factors and patient factors.

Aims

This study explored challenges and enablers of universal OGTT screening from the clinicians' point of view.

Methods

We interviewed eight health professionals delivering obstetric care in rural and remote WA. Participants included obstetric general practitioners, midwives, and specialist obstetricians in primary and secondary health care, including hospital-based clinics, Aboriginal Community Controlled Health Services, general practice, and remote clinics. Interviews were professionally transcribed into individual Microsoft Word documents, imported into NVivo 12, then coded and analysed using a directed qualitative content analysis approach.

Results

Participants reported diversity of patients based on ethnicity, socioeconomic status, geographic distribution, patient health views and clinical risk profiles. First trimester glucose screening involved a range of approaches including risk profiling, OGTT and alternative tests. Choice of test was moderated by local protocols and patient preference. Mid trimester screening comprised an OGTT, with alternative glucose measures if it was not completed. In third trimester clinicians used serial growth scans, four-point glucose profiles, and rarely the OGTT.

Participants made significant efforts in screening women, ensuring patient comfort (physical environment), safety (COVID, culturally safety), trust and good rapport with their healthcare provider. Participants reported several problems with the OGTT including nausea, vomiting, dumping syndrome after bariatric surgery, conflict with patients' health beliefs, needle phobia, controlling partners, time constraints, and late antenatal presentation.

GDM screening in rural settings is complex requiring coordination across regional jurisdictions and clinical settings. Primary care was the commonest first point of contact. Participants felt the OGTT underdiagnosed GDM, commenting on discordance between clinical presentations during pregnancy and OGTT result, for example large for gestational age babies after normal OGTT. Some participants were aware of a continuum of glucose levels and risk of adverse outcomes and incorporated this into their practice rather than using a dichotomous risk assessment.

Conclusions

There is a need for better service level integration of GDM screening across rural populations and better recognition of the skills and complexity of care in rural centres. The dichotomous diagnostic model of GDM poorly reflects the observed clinical experience. GDM is better described by a graded paradigm of low, medium, and high risk.

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Glycaemic control and pregnancy outcomes in a multicultural cohort of women with type 1 diabetes

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Aim: To assess the glycaemic control and adverse pregnancy outcomes in a multicultural cohort of women with type 1 diabetes.

Method: An audit of the Diabetes in Pregnancy service at Blacktown Hospital was undertaken to identify women with type 1 diabetes between 2010-2020. Data was acquired from the Electronic Medical Record for demographics, medication use in early pregnancy, incidence of diabetes complications, trimester specific HbA1c, treatment modality, and adverse pregnancy outcomes. The primary outcome was to evaluate the proportion of women meeting optimal glycaemic control according to ADIPS guidelines (HbA1c ≤ 6.5% in 1st trimester, ≤6.0% in 2nd and 3rd trimesters). Secondary outcomes included the assessment of adverse maternal outcomes (pregnancy loss, pre-eclampsia, pre-term labour) and neonatal outcomes (macrosomia, SGA/IUGR, neonatal hypoglycaemia, respiratory distress), and comparison between women utilising fingerprick or continuous (CGM) glucose monitoring.

Results: Data on 66 pregnancies were analysed. Fifty-six percent of women took folic acid during early pregnancy, whilst 26% of women were prescribed aspirin. Diabetic retinopathy was the most observed diabetes-related complication, noted in 13 women (20%) compared with nephropathy in 5 women (8%). The mean HbA1c in the 1st, 2nd and 3rd trimesters were 7.6%, 6.6% and 6.9% respectively with 26%, 17% and 14% of the cohort achieving respective trimester specific glycaemic targets. A total of 102 adverse pregnancy outcomes occurred (44% maternal, 69% neonatal) in the cohort. Pre-term delivery (32%), macrosomia (28%), and neonatal hypoglycaemia (48%) were the most common events. Nineteen women (29% of cohort) utilised CGM. Glycaemic control based on HbA1c was similar between the CGM and non-CGM groups at each trimester time point. Macrosomia occurred less frequently in the CGM (16%, n=3) vs non-CGM group (33%, n=14; p= 0.172), with other outcomes similar between groups.

Conclusion: The achievement of tight glycaemic control in pregnancies complicated by type 1 diabetes remains a challenge with glycaemic targets achieved in only a subset of women, and adverse pregnancy outcomes remain frequent in this high-risk group of women.

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Excessive gestational weight gain in women with gestational diabetes is associated with less available Medical Nutritional Therapy: results from a tertiary maternity centre in Western Australia

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Background:

- Excessive gestational weight gain (GWG) is a risk factor for adverse maternal and neonatal outcomes.
- Medical Nutrition Therapy (MNT) which meets the Academy of Nutrition and Dietetics (AND) evidence based guidelines for GDM is known to assist women achieve blood glucose and GWG targets, reduce requirement for insulin, attain a nutritionally adequate dietary intake, and optimise maternal and neonatal outcomes, including rates of Neonatal Intensive Care (NICU) admission.
- The level of MNT available to women with diet controlled GDM at our site does not meet AND guidelines with resources exhausted managing high numbers of women requiring insulin.

Aim:

- To identify differences in attainment of GWG targets between women who manage their GDM with diet or insulin.

Method:

- Digital medical records of consecutive GDM women commencing insulin and remaining on dietary treatment were audited.
- Data collected included pre-pregnancy weight and Body Mass Index (BMI), weight at each antenatal visit, mode of delivery, birthweight and admission to NICU.
- Institute of Medicine (IOM) GWG targets were calculated based on pre-pregnancy BMI categories. GWG was assessed as either achieving the target, exceeding or not achieving.
- Results are presented as percentages due to categorical data with small sample size.

Results:

- The final sample size was 59, 29 in the insulin treated group (GDM-Insulin) and 30 in the diet treated group (GDM-Diet).

- Women in GDM-Diet group had on average 1.9 MNT appointments as compared to GDM-Insulin women who had on average 3.3 appointments.
- A larger percentage of GDM-Diet women started their pregnancy in the healthy weight range (43 % versus 27.5 % of GDM-Insulin group).
- Of the women who required insulin therapy, 45 % were obese prior to pregnancy, versus 17% of GDM-Diet group.
- The percentage of women who exceeded GWG targets was 50 % in the GDM-Diet group compared to 28 % of the GDM-Insulin group, consistent with a moderate association (Cramer's V effect size = 0.25).
- Admission to NICU [n = 7 (23 %)] was higher for the GDM-Diet group compared to GDM-Insulin [n = 2 (7 %)].
- Small for Gestational Age was higher in the GDM-Diet group [n = 3 (10 %) vs 0].

Conclusion:

Lower levels of Medical Nutrition Therapy are associated with greater risk of excessive gestational weight gain and poorer outcomes at our site. Increased education of women regarding appropriate gestational weight gain, increasing monitoring of gestational weight gain and increasing dietetic FTE are priorities for our service.

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Combined HNF4A (MODY 1) and INSR mutations diagnosed in pregnancy: a case report and literature review

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MODY1 is a rare condition that can complicate pregnancy. This case highlights the importance of diagnosis and utility of non-invasive prenatal testing to guide management.

A 25-year-old primigravida presented to a tertiary obstetric centre at 6 weeks gestation. She had a history of Type 2 diabetes (T2DM), diagnosed age 17, treated with metformin. Preconception HbA1c was 7.3%. Co-morbidities included PCOS with insulin resistance and hyperandrogenism, but without fertility complications. Her family history was significant for diabetes in her father and paternal grandmother. Early pregnancy BMI was 22.2kg/m^2. Following commencement of insulin, she was noted to have labile blood glucose levels. Type 1 diabetes antibodies were negative. C-peptide was normal 0.80 nmol/L (NR 0.4-1-5 nmol/L). Maturity Onset Diabetes of the Young (MODY) was suspected. Genetic testing revealed heterozygous splice site mutation at the HNF4A gene, pathogenic for MODY 1. Interestingly, she was also diagnosed with a heterozygous missense mutation at the insulin receptor (INSR), associated with type A insulin resistance. Non-invasive prenatal testing using cell-free foetal DNA revealed foetal inheritance of the HFN4A, but not the INSR, mutation. The mother was treated with insulin reaching 1.1 U/kg with a stable dose of Protaphane, increasing doses of Novorapid and the resumption of metformin. Foetal ultrasounds showed progressive increase in abdominal circumference to the 86th centile at 33 weeks. She underwent preterm premature rupture of membranes at 34 weeks, requiring vacuum-assisted delivery. Neonatal weight at delivery was 2.86kg (90-95th centile) and birth was complicated by neonatal hypoglycaemia of 0.9mmol/L requiring NICU admission, IV dextrose and diazoxide. Neonatal bloods showed elevated insulin levels of 11mIU/L, but normal cortisol, ACTH and GH. A fasting challenge was performed at 2 weeks of age which allowed cessation of diazoxide. Following delivery, insulin was ceased, metformin continued and euglycaemia maintained while breastfeeding.

The young age at diagnosis, 'normal' BMI and family history raised suspicion of MODY. The INSR mutation likely accounted for some of the features of PCOS. This mutation results in type A insulin resistance featuring hirsutism, acanthosis nigricans and high insulin requirements. Foetal genetic testing is useful as maternal and foetal genotype guides management to mitigate macrosomia and informs risk of neonatal hypoglycaemia. An affected foetus is at risk of macrosomia and persistent and severe hypoglycaemia which needs to be monitored for. Affected mothers require management of maternal hyperglycaemia to avoid additive effect on growth in an affected foetus and mitigation of possible peri-partum morbidity.

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Ngā Hua o Te Kōpū: Indigenous research methodology for diabetes in pregnancy

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The primary goal of health research is to learn more about human health to prevent and appropriately treat diseases. Many lives have benefited from research yet, on occasion, research can cause harm to indigenous populations (Baydala et. al, 2006, Dingwall, 2008 & Hayward, et. al, 2021). Conducting research 'on' or 'about' indigenous populations results in findings that do not align with indigenous principles or values and resulting in poorer health outcomes, promoting acculturation and increasing health inequity.

This is evident in the health of the indigenous population of Aotearoa (New Zealand) (Te Kaunihera Rata O Aotearoa, 2019). This is also relevant to wāhine Māori (Māori women) with diabetes in pregnancy (DiP) an example of this is, Māori with Gestational Diabetes Mellitus (GDM) have a higher risk of developing Type 2 diabetes (T2DM) or Impaired Glucose Tolerance (IGT) in a

shorter time frame of two years than the predicted five years in the overall general GDM population. (Reid et. al 2018, New Zealand Society for the Study of Diabetes, 2022)

Indigenous research methods allows opportunities to amplify the voice of indigenous women in healthcare delivery.

Founded in Kaupapa Māori qualitative research, the Masters Research project ***Ngā Hua o Te Kōpū*** aims to understand the experience of wāhine Māori and their whānau (families) who have had a pregnancy with diabetes. Kaupapa Māori methodology can be simply defined as research done by Māori, for Māori and with Māori from conception, through to implementation and transformation.

Focusing on amplifying Māori voice to improve DIP outcomes and how care is delivered, ten to twelve wāhine Māori (and their whānau) have participated in five focus groups in geographically diverse areas of the Waikato region, Aotearoa.

While the collection of data is currently ongoing, preliminary themes following Kaupapa Māori grounded analysis will be presented, alongside a deeper consideration of the role of indigenous methodology in research with indigenous pregnant individuals. Findings will be presented in the following three areas 1) healthcare needs of Māori wāhine hapū (pregnant women) with diabetes, 2) indigenous research with wāhine hapū and 3) the learnings of an developing indigenous researcher.\

Datta (2018) states that in indigenous methodology "both the research and researcher increasingly require decolonisation so that the researcher can create a positive impact on participants and the community and conduct research ethically". As an emerging indigenous researcher, how this work has decolonised both the research and the researcher will be discussed.

While Western health research has led to significant developments in pregnancy care, refining and improving health care practices requires the inclusion of indigenous research, that looks human health in a different angle and light and that is focussed on improving health outcomes for indigenous populations around the world.

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Prediabetes and pregnancy: A lower first trimester HbA_{1c} threshold of 5.6% identifies preconception prediabetes and high risk for adverse perinatal outcome

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Background

ADIPS recommend that women with preconception prediabetes are managed as having GDM from the start of their pregnancy. However, clinical implementation is problematic: prediabetes screening in high-risk women of reproductive age is low, there is considerable variation in guidelines for early screening for hyperglycaemia in pregnancy (HIP), and thresholds fail to account for the drop in glucose and HbA_{1c} levels in first trimester. A lower first trimester HbA_{1c} threshold may improve detection of preconception prediabetes.

Methods

Twenty-seven rural and remote clinics in Western Australia recruited 694 pregnant women (39% Aboriginal women) from 2015-2018. Another 951 pregnant women (96.2% Aboriginal women) attending a Kimberley Aboriginal Community Controlled Health Service (ACCHS) in 2018-2021 were included in a retrospective audit. HbA_{1c} was measured with first antenatal investigations (<20-weeks gestation). OGTT collection and measurement was conducted following local pathology guidelines; to prevent glycolysis Kimberley ACCHS adopted fluoride/citrate/EDTA (FC) tubes in September 2019. Large-for-gestational-age (LGA) newborn was defined as birthweight greater than 90th centile (calculated using Perinatal Institute GROW v8.0.1). Outcome measures included: area under the curve (AUC), receiver operator characteristics (ROC) curve derived high-risk (specificity ≥90%) cut-point for HbA_{1c} for abnormal corrected-OGTT; RR [95% CI] for LGA newborn.

Results

Five-hundred and ninety women (397 prospective, 193 retrospective) had an HbA_{1c} <20-weeks and OGTT after 24-weeks gestation. Stratifying ROC curves by Aboriginal status improved the AUC of early HbA_{1c} for an abnormal routine OGTT for women at high risk of preconception prediabetes (all women: 0.63; Aboriginal women: 0.70; non-Aboriginal women: 0.57). An early HbA_{1c} ≥5.6% was the optimal cut-point to identify women with an abnormal OGTT. Women above this threshold had 2.16 [1.33-3.51, *P* =0.002] relative risk for LGA newborn compared to women below the threshold and with a normal routine OGTT. Using a first trimester HbA_{1c} ≥5.6% as the threshold for preconception prediabetes we estimate 16% of Aboriginal women will need appropriate management from early in pregnancy. Another 12% of Aboriginal women will develop GDM later in pregnancy.

Conclusions

Lowering the first trimester HbA1c threshold to 5.6% should simplify early pregnancy screening for preconception prediabetes in high-risk populations and identify more than half of the women who would later have an abnormal OGTT. Women who are normoglycaemia in first trimester will need to complete an OGTT ≥24-weeks gestation to identify development of GDM.

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Perception of Diabetes Risk Among Australian Women With Gestational Diabetes

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INTRODUCTION: The risk of type 2 diabetes is 6-10 times[1-3] higher for women with a history of gestational diabetes (GDM), yet women are not adhering to healthy lifestyles nor having routine diabetes screening tests.[4]

AIM: To examine whether women with GDM perceive their risk of diabetes to be high and the factors associated with this perception.

METHODS: The SMARTMUMS2 trial[5] recruited women with GDM antenatally who were then randomised post-partum to usual care or a patient-centred diabetes prevention program via customised mobile phone text messages, facilitated using an activity monitor. Baseline data from this trial were analysed to estimate the proportion who perceived the risk of future diabetes diagnosis as low (very low, low and not low or high) or high (very high and high). This risk perception was based on the question: 'What do you think your risk of getting diabetes in the future is?' Logistic regression with lasso selection of the final model was used to explore the association of perceived risk (high or low) with patient characteristics such as ethnicity, obesity (body mass index ≥ 30), eating habits, physical activity levels, family history of diabetes, smoking status, and medical conditions such as depression, polycystic ovarian syndrome, hyperlipidaemia or hypertension.

RESULTS: SMARTMUMS2 recruited 177 women with mean age 32.2 (±4.6) years from three teaching hospitals in Western Sydney. Most (53.0%, CI: 45.6, 60.4) women felt that they had low risk of developing diabetes. The final model for whether women perceived themselves at high risk for future diabetes included: family history of diabetes (OR=4.0, CI: 2.1, 8.1), history of polycystic ovarian syndrome (OR=2.7, CI:1.1, 7.5) and self-reported depression diagnosis (OR=7.9, CI: 2.3, 37.7). Ethnic origin was significant at the univariate level, with those identifying as Australian or New Zealander more likely to perceive their risk as high (61.0%, CI: 53.9, 68.1) compared to those identifying as other ethnic origins (43.0%, CI: 35.8, 50.2). However, because of its strong association with self-reported depression it was not retained in the final model.

CONCLUSION: Despite diabetes education and participation in a trial aimed at reducing diabetes risk, over half the women with GDM did not perceive themselves to be at risk of future diabetes, especially those who identify as non-Australian origin and those without other medical history. Better targeting and communication of the message of substantial heightened diabetes risk for all women after a gestational diagnosis is needed.

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Pre-gestational Diabetes and Pregnancy: What Obstetricians Need to Know

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Introduction: Pre-gestational diabetes confers an increased risk of antenatal complications and adverse pregnancy outcome.

Design: Retrospective cohort study of women with pre-gestational diabetes attending for pregnancy care at the Royal Women's Hospital (RWH), Melbourne, Australia's largest quaternary level maternity centre.

Method: Women with pre-gestational diabetes, including type I (T1DM) and type II diabetes (T2DM), attending for antenatal care at RWH between January 2010 and December 2020, were identified from the hospital database. Maternal demographic data, antenatal complications such as hypertensive disease in pregnancy or pre-eclampsia, mode of delivery, birthweight and labour complications were collected.

Results: Our study cohort comprised of 792 women; 48% had T1DM (n=382) and 52% had T2DM (n=410). This corresponds to a steady number of 72 pregnant patients seen each year through our multi-disciplinary obstetric endocrine service. Women with T1DM were younger (mean age 30 vs 33 years) and more commonly nulliparous (49% vs 36%) than their T2DM counterparts. The rate of obesity (BMI>35) was significantly higher in the T2DM group (33% vs 8%). The rate of hypertensive complications in pregnancy was similar between the groups, with 1 in 5 women developing either pregnancy induced hypertension or pre-eclampsia. Women with T1DM delivered at a mean gestational age of 36 weeks (range 21-39) with 38% giving birth prior to 37 weeks. The mean birthweight was 3403g (range 390-5860g) and 8% of infants weighed over 4500g. Overall 69% of women with T1DM gave birth by Caesarean section. Women with T2DM gave birth later (mean GA 36.4 weeks) with a lower rate of macrosomia (mean BW 3041g; 3% weighing more than 4500g). More women in the T2DM group achieved a vaginal birth (41% vs 31%). Women with T1DM had a higher rate of shoulder dystocia (1.8% vs 1.16%) and admission to the neonatal unit for postnatal management of their newborn (53% vs 34%) than women with T2DM. The perinatal mortality rate was similarly high in both groups including 18 stillbirths and 7 neonatal deaths in the entire cohort of 792 women with pre-gestational diabetes (PNMR 31.6 per 1000 births).

Conclusion: These contemporary data provide useful information on pregnancy outcomes in women with pre-gestational diabetes, which can be utilised for counselling in the antenatal setting.

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Gestational Diabetes: Are we Making a Mountain out of a Molehill?

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Introduction: The introduction of universal glucose tolerance testing in pregnancy together with revised diagnostic criteria for gestational diabetes mellitus (GDM) resulted in a marked increase in the number of pregnancies complicated by GDM.

Design: Retrospective cohort study of women with gestational diabetes attending for pregnancy care at the Royal Women's Hospital (RWH), Melbourne, Australia's largest quaternary level maternity centre.

Method: Women with gestational diabetes attending for antenatal care at RWH between January 2010 and December 2020, were identified from the hospital database. Maternal demographic data, antenatal complications such as hypertensive disease in pregnancy or pre-eclampsia, mode of delivery, birthweight and labour complications were collected.

Results: Our study cohort comprised of 6980 women with GDM. The rate of GDM more than doubled during the 11-year study period with 417 women seen annually in 2010 compared to 923 seen in 2020. Consequently, 13% of our patients attending for pregnancy care in 2020 were diagnosed with GDM. The mean maternal age was 32 years (range 15-55) and the mean parity was 0.91 (range 0-10). All patients received advice on dietary and exercise intervention, and 51% required insulin treatment. Obesity (BMI>35) was more commonly observed in the insulin-dependent group than the diet-controlled group (19% vs 8%). Rates of hypertensive disease, pregnancy-induced hypertension (PIH) and pre-eclampsia (PET), remained stable over the decade and were similar among both, diet and insulin-controlled patients (6% and 7% respectively). The mean gestational age at birth was 37.9 weeks (range 20-42) with 13% giving birth prior to 37 weeks. The mean birthweight was 3191g with similar rates of macrosomia in both groups: overall 6% of infants weighed over 4000g and 1% weighed over 4500g. The rates of Caesarean section were consistently higher in the insulin-controlled group for both nulliparous and multiparous women representing 45% and 49%, compared with 35% and 41% in the diet-controlled group. Overall rates of admission to Neonatal Intensive Care Unit (NICU) and Special Care Nursery (SCN) were similar in both groups with 17% of infants needing newborn care. There were 50 stillbirths and 22 neonatal deaths in the entire cohort of 6980 women with gestational diabetes corresponding to a perinatal mortality rate of 10.3 per 1000 births.

Conclusion: Over the 11-year study period, the rate of GDM diagnosis has increased significantly within the maternity population, causing significant burden to the healthcare systems, increased antenatal attendances and intervention.

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Perinatal Mortality and Diabetic Pregnancy: Why Babies Die?

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Introduction: Women with diabetes are at an increased risk of perinatal mortality. This applies in particular to women with pre-gestational diabetes, both type I (T1DM) and type II (T2DM) diabetes, who carry a nearly 4-fold increased risk of perinatal death than the general maternity population. The aim of our study was to describe perinatal mortality rates for women with pre-gestational and gestational diabetes.

Methods: Retrospective analysis of women with diabetes attending for antenatal care at the Royal Women's Hospital, Melbourne, a quaternary maternity centre in Victoria, Australia, over an 11-year period (2010-2020). All perinatal deaths (stillbirths, neonatal deaths, terminations for congenital and/or genetic anomalies at or beyond 20 weeks gestation and a birthweight over 400g) were reviewed.

Results: This study included 7,772 women with diabetes; the vast majority of those had gestational diabetes (n=6,980; 89.8%); 10.2% had pre-gestational diabetes, comprising of 382 women with T1DM and 410 women with T2DM. There were 53 stillbirths, 10 neonatal deaths and 17 terminations of pregnancy for fetal anomalies in the GDM cohort; this correlates to a PNMR of 11.5:1,000 maternities (corrected PNMR 9:1,000). Women with pre-gestational diabetes had a 3.8-fold increased rate of perinatal mortality with 17 perinatal deaths among women with T1DM and 20 perinatal deaths among women with T2DM. Overall, women with T2DM had the highest PNMR (48.8:1,000 maternities) owing to an excess in congenital anomalies. The corrected PNMR for women with pre-gestational diabetes was 34:1,000.

Conclusion: Our study describes a 3.8-fold increase in perinatal mortality in women with pre-gestational diabetes when compared to women with gestational diabetes. In particular women with T2DM are at highest risk of perinatal death, due to an excess in congenital anomalies in this cohort of women. Women with T2DM should undergo the same surveillance and care (including pre-conception counselling) as women with T1DM.

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Insights from co-designing a dietary intervention to prevent gestational diabetes: woman-centred care and implications for clinicians

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Background

Co-designing research with consumers is critical to the translational impact and applicability/acceptability of interventions and research findings. Co-designing lifestyle interventions with consumers provides researchers with rich information regarding consumers' views, priorities, and behavioural drivers. We undertook a co-design project to develop a dietary intervention for preventing gestational diabetes mellitus (GDM) with women who had a lived experience of GDM. The aim of this study was to report on the experiences, perspectives and needs of co-design participants, in the context of the proposed dietary intervention.

Methods

Queensland mothers with a history of GDM were recruited via social media community groups to participate in 3 x 2-hour online co-design workshops with the research team. The workshops explored women's previous experiences of GDM management, perceptions of the dietary intervention, intervention delivery, and preferences for behaviour change support to produce positive diet changes.

Results

Eleven women and seven researchers participated in the co-design workshops including a consumer co-lead and external researcher who co-facilitate the workshops. In workshop 1, women shared positive and negative aspects of having GDM, often a driver for their participation in the co-design process. Women who had experienced difficult GDM management or reported a lack of shared autonomy over care were more likely to choose alternative care pathways for subsequent pregnancies. All women believed that preventing GDM was important, expressing initial interest in the proposed dietary intervention and the potential positive effects for mothers and families. Workshop 2 uncovered advantages and disadvantages of different education approaches where individualisation and choice of delivery mode was a strong theme. Specific behavioural influencers involving capability (knowledge/skills), opportunity (time/social norms), and motivation (messaging incorporating long-term and family benefits) that would either help or hinder achieving the intervention's target behaviours were also uncovered during this workshop. This enabled the researchers to prioritise behaviour change techniques for the intervention. The final workshop was designed to allow the entire co-design team to vote on the best intervention approaches.

Conclusion

Co-design is a powerful tool to ensure interventions are designed in an emancipatory and collaborative manner to produce research that is meaningful to end-users. Women's previous experiences of GDM were diverse but played an important role in their choices around future antenatal care. This co-design process provided unique insights into what women want/need from interventions with individualisation and flexibility being perceived as key factors for success.

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Models for predicting postpartum glucose intolerance among women with a history of gestational diabetes mellitus: a systematic review

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Background: Due to the increased global burden of glucose intolerance and type 2 diabetes (T2D) among women who have had gestational diabetes mellitus (GDM), prediction models are prioritised for early risk stratification and timely intervention. This systematic review aimed to examine methodological characteristics, risk of bias and reporting quality of existing prognostic models predicting postpartum glucose intolerance and T2D following GDM.

Method: A systematic review was conducted searching seven databases (MEDLINE, Embase, Scopus, Web of science, CINHAL, Maternity & Infant Care Database (MIDIRS), and Global Health 1910 to 2022 Week 18) with no date restriction. The Checklist for critical Appraisal and data extraction for systematic Reviews of prediction Modelling Studies (CHARMS) was applied. To assess the risk of bias and applicability, Prediction models Risk Of Bias Assessment Tool (PROBAST) was used. The protocol was registered at PROSPERO CRD42022327239.

Results: The systematic review retrieved 15 eligible publications. Models were developed in the USA (n=4), Europe n=6), Australia (n=2), Asia (n=1), Canada (n=1), and Ethiopia (n=1) between 1995 and 2022. Only two prognostic models were identified to have low overall risk of bias based on the PROBAST tool. Traditional statistical models were used most, with only few applying machine learning (13.3%). Common predictors included in the final models were body mass index (73%), fasting glucose concentration during pregnancy (53%), maternal age (40%), family history of T2D (33%), biochemical variables (lipid metabolites, triacylglycerols, cholesterol) (27%), oral glucose tolerance test result during pregnancy (27%), use of insulin during pregnancy (20%), postnatal fasting glucose level (20%), genetic risk factors (13%), Haemoglobin A1c (13%), and weight (13%). Of the 15 prognostic models, **only 4 were internally validated and none externally validated**. Model discrimination and calibration were reported in 13 and 4 studies, respectively. Only seven studies (47%) included model presentations, mostly using a risk score.

Conclusions: This systematic review identified that existing prognostic models for glucose intolerance following GDM were not externally validated and only a few were internally validated. In addition, there were high risk of bias, unreported model calibration, and low use of model presentation methods. Future research should focus on the development of robust, high-quality risk prediction models through incorporating easily accessible prognostic determinates to enhance the practical application and accuracy of risk prediction models for glucose intolerance and T2D following GDM. External validation and safety, clinical and cost effectiveness assessments are also required before implementing these prediction models in clinical practice.

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Maternal characteristics and pregnancy outcomes of women diagnosed with gestational diabetes at an early oral glucose test

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Aim

To identify the baseline characteristics and pregnancy outcomes of women who were diagnosed with gestational diabetes (GDM) on an early oral glucose test (OGTT) at <24 weeks gestation compared to those diagnosed on routine OGTT at 24-28 weeks' gestation.

Research design and methods

Women who attended the GDM clinic at The Canterbury Hospital (TCH) over a 12-month period (June 1st 2020 to June 1st 2021) were evaluated in this retrospective audit. They were categorised as diagnosed on an early OGTT (<24 weeks) or standard OGTT (24-28 weeks). Statistical analysis was performed using SPSS.

Results

383 women were included in the audit with 184 diagnosed on early OGTT and 199 diagnosed on standard OGTT. Compared to standard OGTT, women with an early OGTT were more likely to be older (32.23 ± 0.39 years vs 30.51 ± 0.32 years), of a higher gravida (2.77 ± 0.13 vs 2.36 ± 0.10) and have a higher pre-pregnancy BMI (28.2 ± 0.44 vs 26.57 ± 0.41). They were also more likely to come from a high-risk ethnicity (85.87% vs 76.38%), have previous GDM (42.93% vs 20.10%) and have a positive family history (64.67% vs 53.27%) (all $p<0.05$).

Hba1c (5.09 ± 0.03 vs 5.00 ± 0.03) and 1hr OGTT (10.30 ± 0.12 vs 9.892 ± 0.10) readings were also higher in women diagnosed on an early OGTT ($p<0.05$).

Women diagnosed at an early OGTT were more likely to require insulin (71.74% vs 52.76%) and metformin (10.33% vs 3.02%), and less likely to be diet controlled (27.17% vs 46.23%) (all $p<0.05$).

Respiratory distress in newborns was more common in women who had an early OGTT (11.96% vs 5.03%) ($p=0.01$). All other pregnancy complications including macrosomia, small for gestational age and NICU admissions were comparable between the 2 groups.

Conclusions

From this retrospective audit we were able to conclude that early GDM is highly prevalent, as the diagnosis was made in approximately half of the pregnant women. These women also had the established risk factors associated with GDM. In women diagnosed with early GDM, despite standard treatment approaches and a greater use of pharmacotherapy, poorer foetal outcomes were noted. These findings suggest the need for further research into the management of these women to improve pregnancy outcomes.

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Does substantial preconception weight loss in women with obesity modify the epigenetic signature of the offspring? A pilot study

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One in five Australian women are obese (Body Mass Index (BMI) >30) at initial antenatal presentation(1). The Hyperglycaemia and Adverse Pregnancy Outcome (HAPO) Follow-Up Study demonstrated the metabolic state of the mother during pregnancy, resulted in offspring with greater risk of metabolic disease in late childhood (2).

We aim to determine if substantial pre-conception weight loss in women with obesity alters the epigenome of the offspring. This would support the concept of bi-directional metabolic programming, and the importance of pre-conception weight management.

A two arm, parallel group, non-blinded randomized control trial was conducted at four hospitals in Melbourne, Australia. Women with obesity (BMI 30-55) who were planning pregnancy were randomised in to one of the two 12-week weight loss intervention - a standard lifestyle program and a Very Low Energy Diet (VLED) - followed by a 4 week weight maintenance program and 12 month observation period while trying for pregnancy. Study protocol and pregnancy outcomes have previously been published (4, 5). In a sub-group of consenting participants, buccal swabs (x2) were collected from neonates within 72 hours of delivery. DNA was extracted from these swabs and methylation analysed using the Human Genomics Facility at Erasmus MC. Methylation patterns will be analysed as discrete data according to group allocation and as a continuous variable according to preconception weight loss achieved.

Mean preconception weight loss in the standard lifestyle program and VLED was 3.2kg and 13.0kg ($p<0.01$) respectively. Singleton livebirth rate was 22/79 (28%) and 37/85 (44%) respectively. DNA was extracted from 29 neonates (7 from mothers randomised to the lifestyle arm and 18 from mothers allocated to the VLED arm); 4 samples were deemed unsuitable.

At the time of writing, epigenetic results are pending. It is anticipated that results will be available and analysis complete within 3 months of abstract submission.

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Employing fasting plasma glucose to safely limit the use of oral glucose tolerance tests in pregnancy: a pooled analysis of four Norwegian prospective studies with universal screening for gestational diabetes

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Objective

To investigate the use of fasting plasma glucose (FPG) to identify women at low risk for gestational diabetes mellitus (GDM) and GDM-related adverse outcomes, limiting the need for an oral glucose tolerance test (OGTT).

Design and setting

Pooled data from four Norwegian pregnancy cohorts, collected between 2002 and 2013.

Population

2960 pregnant women universally screened with mid-pregnancy 75g OGTT measuring FPG and 2-hour glucose.

Methods

For a range of FPG thresholds, we calculated sensitivity to predict elevated 2-hour glucose, number of OGTTs needed and percentage of GDM cases missed, applying modified ^{2013}World Health Organization (^{2013}WHO) and ^{2017}Norwegian criteria. We analyzed pregnancy outcomes such as large-for-gestational-age newborns, cesarean section and operative delivery for women above and below our selected threshold.

Results

The prevalence of GDM was 16.6% with the ^{2013}WHO criteria and 10.1% with the ^{2017}Norwegian criteria. A FPG threshold of 4.7mmol/L had a sensitivity of 76% (^{2013}WHO) and 80% (^{2017}Norwegian) for detecting elevated 2-hour glucose, with few missed GDM cases (7% for ^{2013}WHO, 8% for ^{2017}Norwegian). Excluding women with FPG <4.7mmol/l and those with GDM based on FPG, only 24% (^{2013}WHO) and 29% (^{2017}Norwegian) would require OGTT. Women with FPG <4.7mmol/l, including missed GDM cases, had low risk of large-for-gestational-age newborns, cesarean section and operative delivery.

Conclusion

A FPG threshold of 4.7mmol/l as a first step when screening for GDM could potentially eliminate the need for OGTT in 70-77% of pregnancies. Women with FPG below this threshold appear to carry low risk of GDM-associated adverse pregnancy outcomes.

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Fasting plasma glucose values 5.1-5.6 mmol/l in the first trimester of gestation

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Objective: The aim of this study was to investigate the effect of intervention in women who had fasting plasma glucose (FPG) 5.1-5.6 mmol/l in the first trimester on maternal and neonatal outcomes.

Study Design: We conducted a secondary analysis of a randomized community non-inferiority trial of GDM screening. All pregnant women with FPG values range 5.1-5.6 mmol/l in the first trimester of gestation were included in the present study (n=3297). They were labeled as (i) GDM-T[1] who received standard treatment (n=1,198) or (ii) non-GDM-T[1] who received usual prenatal care (n=2,099); the 2nd group was further screened for GDM at 24–28 weeks of gestation using either a one-step or a two-step screening approach. Macrosomia/large for gestational age (LGA) and primary cesarean-section (C-S) were considered as primary outcomes and preterm birth, hyperbilirubinemia, preeclampsia, "neonatal intensive care unit (NICU) admission, birth trauma, low birth weight (LBW) and Intrauterine fetal death (IUFD) were considered as secondary outcomes A modified Poisson regression for binary outcome data with a log link function and robust error variance was used to RR (95% CI) for the associations between GDM-T[1] status, and incidence of pregnancy outcomes.

Results: The mean (SD) pregnancy week for the first prenatal visit in GDM-T[1] and non-GDM-T[1] groups were 8.2 (3.3) and 9.1 (3.3) weeks, respectively.

There was no statistically significant difference between groups in the frequency of the adverse pregnancy outcomes of macrosomia, primary C-S, preterm birth, hyperbilirubinemia, hypoglycemia, hypocalcemia, preeclampsia, NICU admission, birth trauma, LBW, and IUFD considering multiplicity-adjustment The prevalence of maternal and neonatal outcomes, except for hypoglycemia and hypocalcemia, were similar in GDM-T[1] in compared to those subgroup of non-GDM-T[1] who developed GDM in the second trimester; the frequency of hypoglycemia and hypocalcemia in the latter group were significantly higher than GDM-T[1] (6.8% vs. 2.6%, P-value <0.001 and 4.5% vs. 1.6%, P-value = 0.001, respectively). There were no statistically significant differences in the adjusted risks of adverse pregnancy outcomes in GDM-T[1] compared to non-GDM-T[1] considering multiplicity adjustment. There were no statistically significant differences in the adjusted-risks of adverse pregnancy outcomes in those groups, considering multiplicity adjustment, except for hypocalcemia (RR=2.05; 95% CI: (1.12, 3.75); P=0.02)

Conclusion: It is found that treating women with first-trimester FPG values of 5.1-5.6 mmol/l could not improve adverse pregnancy outcomes. Therefore, extrapolating the FPG cut-off point of the second trimester to the first –which has been proposed by the IADPSG, might therefore not be appropriate.

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Comparison of point-of-care glucose values and continuous glucose monitor values in intrapartum patients with Type 1 diabetes

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Objective:

The use of continuous glucose monitors (CGM) for management of Type 1 diabetes mellitus (T1DM) is increasing in pregnancy. We aim to describe the concordance of point-of-care glucose (POC) and CGM in gravidas presenting for delivery with T1DM.

Study Design:

This was a retrospective study of T1DM patients with Dexcom CGM use intrapartum and postpartum between 2016-2020. Data from POC and CGM was compared from admission for delivery until discharge(Figure 1). Patients were excluded if POC or CGM data were unavailable. POC data and outcomes were obtained from the electronic medical record. CGM data was obtained from Clarity report. The primary outcome was the mean absolute relative difference (MARD) between the CGM and POC glucose values.

Results:

15 pregnancies (14 patients) were included (Table 1). The mean age at diagnosis of T1DM was 14.7 ± 5.3 years and the mean first trimester hemoglobin A1c was 7.1 ± 1.1%. The average first neonatal glucose was 47.6 ± 12.7 mg/dL. Seven infants (46.7%) required admission to the neonatal intensive care unit and 5 (33.3) required dextrose infusion for treatment of hypoglycemia. 17,392 CGM values were compared to 583 POC values. The mean glucose value on POC versus CGM before delivery was 123.2 mg/dL vs. 118.1 mg/dL, respectively, and 134.5 mg/dL vs. 134.8 mg/dL postpartum (Table 2). There was a high degree of accuracy between the CGM and POC glucose values with a MARD of 11.49% and 98% of points in zones A and B of the Clarke Error Grid (Figure 2).

Conclusion:

To our knowledge this is the first study to describe the MARD between Dexcom CGM and POC glucose values in the intrapartum and postpartum period. CGM devices may be useful for glycemic monitoring during the intrapartum and postpartum period. Larger studies are needed to validate our results.

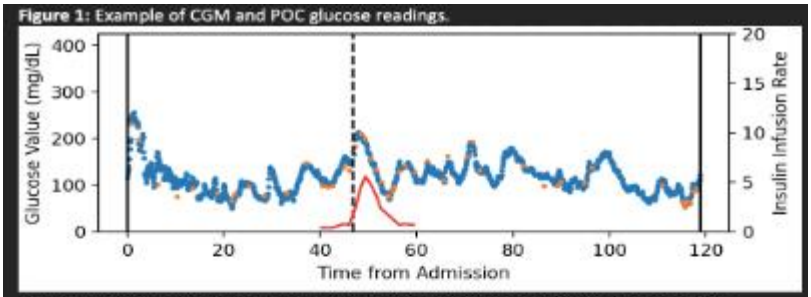
Table 1. Maternal characteristics and select outcomes.

Maternal Age (years)	29.3 ± 4.1
Race	
Hispanic	2 (13.3)
Non-Hispanic White	11 (73.3)
Non-Hispanic Black	1 (6.7)
Asian	1 (6.7)
First trimester Hb A1c (n=4,%)	7.1 ± 1.1
Age at diabetes diagnosis (years)	14.7 ± 5.3
Insulin	
MDI	2 (13.3)
Pump	13 (86.7)

Gestational age at delivery (weeks)	37.3 ± 1.5
First neonatal glucose (mg/dL)	47.6 ± 12.7
Birthweight (g)	3476 ± 702
Dextrose infusion for neonate	5 (33.3)

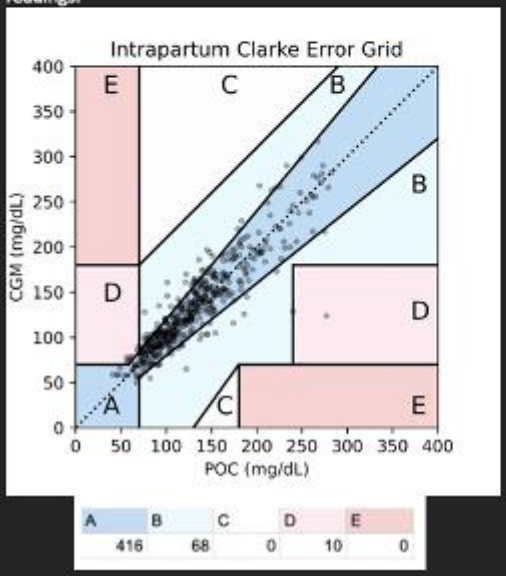
Continuous variables are reported as mean ± standard deviation. Categorical variables are reported as N(%). BMI: body mass index, Hb A1c: hemoglobin A1c.

Figure 1: Example of CGM and POC glucose readings.



Blue line represents CGM data points. Orange dots represent POC data points. Red line demonstrates the time of insulin infusion. Vertical dashed line shows time of delivery

Figure 2. Clarke error grid comparing the continuous glucose monitor and point of care glucose readings.



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The association between birthweight and maternal glycemic control in type 1 diabetes

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Objectives

Pregestational diabetes may lead to excessive fetal growth which is associated with perinatal complications such as shoulder dystocia, perinatal mortality and caesarean delivery. These complications are closely related to the maternal glycemic control (1-6).

Previous studies have shown a significant association between maternal HbA1c at second and third trimester and fetal macrosomia (7-9). However, such association was not demonstrated in early pregnancy or at the time of conception.

This study aims to investigate the association between birthweight and HbA1c in type 1 diabetes (T1DM).

Methods

This is a retrospective cohort study, including all singleton pregnancies with T1DM at Aalborg University Hospital between January 2010 and December 2019. Data on maternal characteristics, fetal and perinatal outcomes were collected from patient records.

HbA1c values were included preconceptionally and from each trimester of pregnancy; gestational week 8-12, 18-22 and 30-34.

Birthweight deviation was calculated using the Scandinavian reference by Marsál et al (10), and large for gestational age (LGA) at birth was defined as birthweight deviation ≥22% of the expected for gestational age.

The association between HbA1c and birthweight deviation was investigated by linear regression, and the prediction of LGA was investigated by logistic regression and receiver-operating characteristic (ROC) curves.

Results

A total of 243 pregnancies complicated by T1DM were included in the study. The predictive performance of HbA1c in relation to LGA was increased as pregnancy advances, with significant values only for the second (OR=1.03, p=0.03, AUC=0.604) and the third trimester (OR=1.04, p<0.01, AUC=0.669).

To explore this association further HbA1c was plottet against birthweight deviation (Figure 1). Linear regression was performed stratified on HbA1c using 60 mmol/mol as a cutoff value, and a significant difference between the coefficients was demonstrated (Table 1). For HbA1c values <60 mmol/mol there was a positive correlation between HbA1c and birthweight deviation. However, for HbA1c values ≥60 mmol/mol, the correlation between HbA1c and birthweight deviation was non-significant or even negative.

Conclusions

This study demonstrates a positive correlation between maternal glycemic control and birthweight when HbA1c is < 60 mmol/mol. However, in very dysregulated diabetic pregnancies, birthweight may even be negatively correlated to HbA1c. One could hypothesize, if this negative correlation could be a result of placental dysfunction, thus further research is needed in this area. These correlations likely explain the rather poor performance of HbA1c in the prediction of LGA especially in early pregnancy.

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Pregnancy outcomes in pre-existing diabetes: A 10-year retrospective study

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Background: Pregestational diabetes is associated with adverse maternal and perinatal outcomes. Appropriate preconception optimisation and antenatal care may mitigate these risks and have been increasingly emphasised in international and local guidelines. The local impact of increasing awareness of these risks and adoption of recommendations for pre-existing diabetes in pregnancy on maternal and perinatal outcomes is unclear. We aimed to evaluate changes over time in the local characteristics and outcomes of pregnancies complicated by pre-existing diabetes.

Methods: Retrospective analysis of pregnant women with pre-existing type 1 or type 2 diabetes delivering at a single tertiary referral hospital in Western Sydney between 2012 and 2022. Sociodemographic, medical and obstetric data, pre-pregnancy weight and gestational weight gain, first trimester and third trimester HbA1c, total daily insulin requirement at delivery, presence of microvascular complications, and maternal and perinatal outcome data were collected and Poisson regression was used to assess for changes in outcomes over time.

Results: There were 376 pregnancies with pregestational diabetes over the 10 years studied (87 [23.1%] type 1 diabetes and 289 [76.9%] type 2 diabetes with mean diabetes duration 6.6±6.8 years). Age at conception was 32.5±5.7 years with pre-pregnancy BMI 30.2±7.0 kg/m^2. Of 340 pregnancies, 63 (18.5%) were complicated by preeclampsia, 3/343 (0.9%) by stillbirth, 26/350 (7.4%) by cardiac congenital anomaly, 94/373 (25.2%) by preterm delivery <37 weeks, 101/364 (27.7%) by large for gestational age (LGA) and 34/364 (9.3%) by small for gestational age (SGA). Pregnancies achieving first trimester HbA1c<6.5% decreased (p<0.001) whereas there were no changes over time in the rate of microvascular complications or preeclampsia. Rate of preterm delivery was 1.09 times less likely each year (p=0.007) and there was a trend towards decreasing SGA (β=0.9, p=0.056). There were no significant changes over time in cardiac congenital anomaly, LGA or neonatal hypoglycaemia (glucose<2.6mmol/L).

Summary: Type 2 diabetes comprised the majority of pregnancies in this 10-year analysis of pre-existing diabetes in pregnancy. Preterm delivery decreased over time but there were no significant changes in other maternal and perinatal outcomes.

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Adoption of a pregnancy-specific intravenous insulin protocol (Pregnancy-IVI) at a regional centre has equivalent safety and efficacy outcomes as a tertiary hospital

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Aims: Glycaemic instability may occur in women with diabetes in pregnancy following betamethasone, during intercurrent illness and labour. The Pregnancy Intravenous-Insulin Infusion (Pregnancy-IVI) algorithm safely maintains maternal glucose and may consequently reduce neonatal hypoglycaemia (tinyurl.com/pregnancy-ivi) (1, 2). This study aims to establish the efficacy and safety of Pregnancy-IVI when implemented outside a tertiary-care hospital.

Method: A retrospective cohort of all admitted pregnant women treated with the Pregnancy-IVI at a tertiary level 6 (n = 344) or regional level 4 (n = 67) hospital for glycaemic instability following betamethasone administration (n=202), during intercurrent illness (n=45) or labour (n=167) during 2020-2021. Women with type 1 diabetes were excluded as guidelines required level 6 care. Primary outcomes were on-IVI maternal glycaemic time-in-range (4.0-7.8mmol/L), and hours of on-IVI maternal hypoglycaemia (<3.8mmol/L or <3.0mmol/L) per 100 woman-IVI-hours. Outcomes were assessed using Mann-Whitney or 95% CI of risk difference, stratified by indication for Pregnancy-IVI.

Results: Participant demographics (age, gravida, parity, BMI, diabetes type, gestational age, Pregnancy-IVI duration) were comparable between hospitals. Gestational diabetes was diagnosed in 76% and type 2 diabetes in 24%. Pregnancy-IVI glycaemic time-in-range was similar at the tertiary and regional site after betamethasone (82%[IQR 75-90%] vs 77%[IQR 68-86%] p=0.06), illness (87%[IQR 77-94%] vs 87%[IQR 64-94%] p=0.66) and labour (90%[IQR 73-100%] vs 94%[IQR 80-100%] p=0.53). Any maternal hypoglycaemia (<3.8mmol/l) was uncommon, and similar rates occurred at the tertiary and regional hospitals: following betamethasone (0.46 vs 0.61h/100wh, p=0.41), illness (0.69 vs 1.37h/100wh, p=0.13), and labour (1.62 vs 0.63h/100wh, P=0.09). Moderate maternal hypoglycaemia (<3.0mmol/L) was rare, with similar rates at both sites: betamethasone (0.05 vs 0.0h/100wh, p=0.46), illness (0.13 vs 0.27h/100wh, p=0.46, and labour (0.11 vs 0.0h/100wh, p=0.63).

Conclusions: This study provides evidence of the efficacy and safety of the Pregnancy-IVI algorithm in pregnant women with diabetes admitted to a level 4 regional hospital.

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Insulin secretion and insulin resistance in patients with gestational diabetes mellitus diagnosed during earlier pregnancy.

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Introduction: We hypothesized that the pathophysiology of glucose intolerance might differ when comparing women in earlier pregnancy (before 20 weeks of gestational age) and those at mid-pregnancy (26–30 weeks of gestational age). We used the homeostasis model assessment of β-cell function (HOMA-β) and HOMA-IR as indicators of insulin secretion and insulin resistance, respectively. Methods: This retrospective study looked at insulin secretion and resistance in women with normal glucose tolerance (NGT) or gestational diabetes (GDM) diagnosed by 75g oral glucose tolerance tests using criteria of the Japan Society of Obstetrics and Gynecology during both earlier pregnancy (NGT: n=170, GDM: n=62) and mid-pregnancy (NGT: n=204, GDM: n=124) using HOMA-β and HOMA-IR. Results: There was no difference in HOMA-β when comparing the NGT and GDM groups in earlier pregnancy (120 ± 85% vs. 108 ± 53%). The HOMA-IR was significantly higher in the GDM group than in the NGT group (1.9 ± 1.1 vs. 1.3 ± 0.6). The NGT and GDM groups had similar HOMA-β levels at 26–30 weeks, but the HOMA-IR was again higher in the GDM group compared to the NGT group. Conclusions: Insulin secretion levels were maintained and levels of insulin resistance were elevated in GDM diagnosed during both earlier and later gestational ages. GDM diagnosed earlier in the pregnancy did not show different characteristics using HOMA-β and HOMA-IR.

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PRECeDe Pilot: Prevention of neonatal Respiratory distress with antenatal corticosteroids prior to Elective Caesarean section in women with Diabetes - A Feasibility Randomised Trial

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Introduction:

Babies born to women with pre-gestational diabetes (PGDM)[1-4] or gestational diabetes (GDM)[3,5] are more likely to be born by caesarean section (CS) and have increased rates of respiratory morbidity. Several studies have reported benefits when antenatal corticosteroids (ACS) are given to women who give birth by elective CS after 35 weeks'.[6] Women with diabetes were specifically excluded from these studies, hence, whether these benefits are the same for infants born to women with diabetes is uncertain.

The PRECeDe Pilot Trial was designed to determine the feasibility of undertaking a larger multicentre, randomised, placebo-controlled trial to assess the efficacy of administration of ACS within 7 days prior to elective CS in women with PGDM or GDM on maternal and neonatal outcomes.

Methods:

We undertook a triple blind, placebo-controlled, pilot RCT at Western Health between June 2020 and May 2022 to assess the feasibility of undertaking a larger multicentre trial. The trial was registered prior to commencement of recruitment (ACTRN12619001475134) and institutional ethics approval was obtained from Melbourne Health Human Research Ethics Committee. Eligible participants with either PGDM or GDM were randomised to receive 2 injections of either betamethasone 11.4 mg or normal saline placebo in identical masked syringes, 24 hours apart within 7 days prior to planned CS scheduled between 35^{+0} and 38^{+6} weeks' gestation.

The primary outcome for the trial was the proportion of all eligible women who consented and were randomised. The secondary outcomes included additional assessments of feasibility and the full range of primary and secondary maternal and neonatal outcomes proposed for the multicentre trial.

Results:

Of 537 women eligible and 182 approached, 47 women were recruited to the PRECeDe Pilot Trial. Of these, 22 were allocated to the betamethasone group and 25 allocated to the placebo group, representing 8.8% of all eligible women and 25.8% of eligible women who were approached for participation in the trial.

Of 28 women who responded to a survey question regarding future participation in a similar trial, 22 women (78.5%) responded that they would be 'likely' or 'very likely' to participate in a similar trial in future.

Conclusion:

It is feasible to undertake a triple blind, placebo-controlled randomised trial investigating the efficacy of ACS in preventing neonatal respiratory morbidity in infants of women with PGDM or GDM who are undergoing an elective CS between 35^{+0} to 38^{+6} weeks.

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PRECeDe Pilot: Prevention of neonatal Respiratory distress with antenatal corticosteroids prior to Elective Caesarean section in women with Diabetes – Can we blind participants, clinicians and researchers in a placebo-controlled randomised trial?

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INTRODUCTION

The PRECeDe Pilot Trial was designed to determine the feasibility of undertaking a larger multicentre, triple blind, placebo-controlled randomised trial (RCT) to assess the efficacy of administration of antenatal corticosteroids (ACS) within 7 days prior to elective caesarean section (CS) in women with pregestational diabetes (PGDM) or gestational diabetes (GDM) on maternal and neonatal outcomes. Hyperglycaemia following ACS administration is common and raises the concern that blinding participants and researchers in the RCT may not be feasible. We assessed blinding of treatment allocation for participants and staff within the pilot trial.

METHODS

We undertook a triple blind, placebo-controlled, pilot RCT at Western Health between June 2020 and May 2022 to assess the feasibility of undertaking a larger multicentre trial. The trial was registered prior to commencement of recruitment (ACTRN12619001475134) and institutional ethics approval obtained. Eligible participants with either PGDM or GDM were randomised to receive 2 injections of either betamethasone 11.4mg or normal saline placebo in identical masked syringes, 24 hours apart within 7 days prior to planned CS scheduled between 35^{+0} and 38^{+6} weeks' gestation.

Participants, and clinical and research staff interacting with the patient were asked to predict which treatment group the participant was allocated to. Fleiss's Kappa statistic (κ) was used to assess the agreement between participant or staff assessment and the true allocation.

RESULTS

Forty-seven women were recruited to the pilot trial with 22 participants allocated to receive betamethasone and 25 allocated to receive placebo.

There was moderate agreement between participant's prediction and their true treatment allocation (κ=0.69; 95% CI: 0.39, 0.98). Both the midwife administering the study medication (κ=0.84; 0.68,1.00) and the midwife collecting the research outcome data (κ=0.81; 0.54, 1.00) demonstrated the highest agreement with the true treatment allocation. Medical staff involved in the CS had poor agreement with the true treatment allocation (κ=0.24; -0.21, 0.71), followed by the endocrinologists involved in the titration of insulin (κ=0.33; -0.01, -0.67). Staff providing care on the postnatal ward demonstrated intermediate agreement (κ=0.43; -0.10, 0.96).

CONCLUSION

Blinding of participants was not optimal, however, clinicians providing clinical care antenatally and postnatally had poor agreement with the true allocation. Since these clinicians will make the decisions regarding patient care (maternal and neonatal), which will form the primary outcomes, it is feasible to proceed with a triple blinded study. We have identified strategies to improve the syringe masking to ensure that staff administering the study medication can remain blinded.

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Untreated gestational diabetes diagnosed by WHO2013-criteria is associated with high rates of adverse maternal and neonatal outcomes - a Danish cohort study

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Background:

Diagnosing gestational diabetes mellitus (GDM) remains controversial, with ongoing disagreement regarding optimal diagnostic criteria to identify and treat women at risk despite the stricter diagnostic criteria recommended by the WHO in 2013. These WHO2013 criteria for GDM ($GDM_{WHO2013}$) identify pregnancies with milder degrees of hyperglycaemia compared to the current practise in several countries. Fasting glucose levels vary markedly between populations and have been reported high in Danish pregnant women suggesting a high prevalence of $GDM_{WHO2013}$.

We evaluated maternal and neonatal outcomes in untreated women who met WHO2013 diagnostic criteria for GDM using universal screening.

Methods:

Universal screening for GDM at 24-28 weeks was performed by a 75 g oral glucose tolerance test with assessment of venous plasma glucose at 0, 1-hour and 2-hours in a prospective unselected cohort. GDM diagnosis was defined by current Danish "2-hour glucose ³9.0mmol/L only" criterion (GDM_{DK}) and by WHO2013 criteria (fasting ³5.1, 1-hour ³10.0 or 2-hour glucose ³8.5 mmol/L, $GDM_{WHO2013}$). Presence of GDM_{DK}, $GDM_{WHO2013}$ and New-GDM ($GDM_{WHO2013}$ positive and GDM_{DK} negative) was reported.

Results:

Universal GDM screening was completed by 465 pregnant women at 25.7 weeks, of whom 62% fulfilled the Danish indications for risk-factor-based screening. $GDM_{WHO2013}$ prevalence was 21.5% (N=100) and GDM_{DK} 2.2% (N=10). New-GDM was seen in 19.4% (N=90/465), of whom 90% (N=81) had a fasting glucose ³5.1 mmol/L and these women were left untreated. New-GDM-women had higher frequencies of pregnancy-induced hypertension (13.3 vs 4.1%, *P*=0.002) and caesarean section (28.9 vs

18.7%, *P*=0.042) than No-GDM-women. Neonates of the New-GDM-women had higher birth weight z-scores (0.43 vs -0.11, *P*<0.0001) and frequencies of large-for-gestational-age (22.2 vs 9.9%, *P*=0.004), neonatal hypoglycaemia (8.9 vs 1.9%, *P*=0.004) and admission to intensive care unit (16.7 vs 5.8%, *P*=0.002).

Conclusion:

GDM prevalence increased 10-fold to one out of five when applying the WHO2013 diagnostic criteria in a Danish population. The untreated women diagnosed by WHO2013 criteria and their offspring had clinically relevant higher risks of adverse outcomes than women without GDM and would probably have benefitted from lifestyle advice.

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Screening for gestational diabetes mellitus and hyperglycemia in pregnancy with the glucose challenge test.

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Screening for gestational diabetes mellitus (GDM) has been traditionally undertaken in the third trimester with the glucose challenge test (GCT) and this continues to be the current practice according to the American College of Obstetricians and Gynecologists. There were significant limitations to the GCT with a sensitivity of only 78% which would miss a significant number with GDM. Following the recommendations of the International Association of Diabetes and Pregnancy Study Group (IADPSG), the GCT has been abandoned and testing of all patients in now undertaken with the 75-gram 2-hour glucose tolerance test (GTT) at 24 – 28 weeks gestation. However, there are also problems with this program of testing for the detection of GDM. The 75-gram 1-hour GCT can also be administered in early pregnancy and has been found to be effective in screening not only for GDM but also for other abnormalities carbohydrate metabolism. We present our findings in 1500 patients who had both a 75-gram 1-hour GCT at the booking visit and a 75-gram 2-hour GTT in the third trimester. We have calculated the cut-off value for the a 75-gram 1-hour GCT in early pregnancy to be 6.0mmol/L (108mg/dL) with a sensitivity of 83.5% and a specificity of 49.2%. In a small proportion of patients with a GCT ≥10.0mmol/L (180mg/dL), an early GTT allowed the detection of pre-existing abnormalities of glucose metabolism associated with pregnancy. The false-positive GCT could also diagnose the disorder of gestational hyperglycemia and the false-negative GCT was able to detect mild GDM when the GTT was performed in the presence of risk-factors for GDM. We have concluded from our study that universal screening with the 75-gram 1-hour GCT in early pregnancy and also selective testing on the basis of risk-factors for GDM will detect the full range of abnormalities of carbohydrate metabolism encountered in pregnancy.

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Association of poor foetal growth with Maternal Glucose-Insulin Adjustment Fail During Gestation

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Background: In well-fed Western populations, insulin resistance and maternal insulin levels rise gradually during pregnancy to support foetal growth. There is a scarcity of data on undernourished women from LMICs. We explored the relationship between offspring birth weight and lipid concentrations and serial glucose-insulin in urban and rural Indian women from early to late pregnancy.

Methods: Women in early pregnancy were recruited from prenatal clinics. Fasting glucose, insulin, cholesterol, and triglyceride levels were tested at 16, 28, and 33 weeks of gestation, and a 75 gm OGTT was conducted at 28 weeks. The prevailing WHO 1999/ IADPSG 2011 criteria were used to diagnose GDM. Demographic and anthropometric information was gathered, and new-borns were measured at birth.

Results: A total of 250 women (155 rural, 95 urban) were enrolled: they were 23 years old, 153 cm tall, and had a BMI of 20.7 kg/m^2 at 16 weeks gestation. The study eliminated 34 GDM women (18 of whom were rural). Fasting plasma glucose decreased with increasing gestation in 206 normal glucose tolerant women, although insulin concentrations and HOMA-IR remained constant (51 percent decreased); total and triglyceride and HDL cholesterol concentrations elevated. When compared to rural women, urban women were older, taller, and heavier, with significantly higher glucose, insulin, and HOMA-IR levels; they gained 7 kilograms, while rural women gained 6 kilograms between early and late visits. The average birth weight was 2.8 kilograms, with 39 percent of infants being small for gestational age (SGA) and 1 percent being large for gestational age (LGA). Fasting plasma glucose concentrations and maternal size (BMI, weight, height) were linked with birth weight. HOMA-IR was not shown to be linked on its own.

Conclusion: The insulin resistance of the petite and undernourished Indian women did not increase with increasing gestation. This could offer a fresh explanation for foetal growth limitation in India, as well as its short and long-term consequences, including the risk of diabetes.

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Hypovitaminosis D or Vitamin D deficiency may anticipate gestational diabetes

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Background and objectives: Pregnancy is a gift from nature that should be cherished for 9 months with no detrimental aspects. Depending on the demographic investigated, Gestational Diabetes Mellitus impacts 3 to 10 percent of pregnancies. The pathogenesis of gestational diabetes mellitus is complicated by the steady rise in insulin resistance found during pregnancy (GDM). It is debatable if vitamin D deficiency correlates to poor glycemic control during pregnancy.

Materials and methods: In a tertiary care centre prospective cohort of pregnant women, we examined the correlations between first trimester 25-hydroxyvitamin D3 (25OHD3) levels and the risk of developing GDM. Participants (n = 200) were seen for blood samples during the first (6-13 weeks) and second (24-28 weeks) trimesters. Each participant was chosen during their first trimester, and demographic information was collected. Height was measured in centimetres, and weight was measured in kilogrammes. BMI was determined as weight (kg) divided by height (m^2). Diabetes family history, history of past abortion, obstetric score for gravidity, and previous history of GDM were all reported. Fasting blood sugar was tested, and those with HbA1c levels greater than 92 mg/dl were eliminated. Those having FBS values of 140 mg/dl underwent an oral glucose tolerance test (OGTT) and were diagnosed with GDM or NGT using ACOG criteria.

Results: According to ACOG criteria, 17 subjects (4 percent) developed GDM. The 25 (OH) Vitamin D level was insufficient in 191 (96 percent) of the individuals, and subgroup analysis revealed a 25 (OH) Vitamin D3 level of <20 nmol/l in 48% of the subjects. In a logistic regression analysis of GDM risk factors, increasing age, increased BMI, and a 25 (OH) Vitamin D3 level of <20 nmol/l were found to be substantially linked with GDM risk. Although a 25 (OH) Vitamin D3 level of <20 nmol/l was found to be positively associated with an elevated risk of GDM, our investigation indicated that this risk was only apparent in advanced maternal age (29.07 ± 1.68).

Conclusion: 48 percent of research subjects had severe hypovitaminosis D. Pregnant females with very low vitamin D levels (<20 nmol/l) have a 2.45 chance of developing Gestational Diabetes Mellitus. In our investigation, we discovered that advanced maternal age, combined with a very low vitamin D level, may make a significant contribution to insulin resistance and an increased risk of GDM.

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GDM outcomes during the COVID pandemic: an observational dietetic study

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Aim: Nutrition therapy is a key component in the management of gestational diabetes mellitis (GDM). Therapy can be delivered in various formats, including in-person, tele-health, individual and group settings. The COVID pandemic in 2020 limited the capacity to provide in-person therapy and potentially impacted the lifestyles of patients, including dietary habits. This study investigated glycaemic, dietary and pregnancy outcomes of women with GDM during the pandemic.

Methods: Retrospective observational GDM data was collected prior to and during the COVID pandemic. A pre-COVID cohort (n=96, 2019) received initial nutrition education via a one-hour in-person group, whereas a during-COVID cohort (n=100, 2020) received a written information package and 0-10 minute group session. Blood glucose (BG) ranges and elevations were noted one week later, along with carbohydrate intake ranges, meal/snack skipping, food group inadequacies and dietary knowledge deficits. Subsequent commencement of diabetes medications and birth outcomes were noted (mode of delivery, small and large for gestational age infants, neonatal hypoglycaemia, admission to neonatal intensive care, perinatal death).

Results: Fasting and postprandial BG ranges the week following initial education were lower during the COVID period (all P <0.02). For example the average difference between lowest and highest BG post dinner was 0.5 vs 0.9 mmol/L (P=0.01). Even so, there were no significant differences in BG elevations. A higher number during COVID had an inadequate intake from the fruit (43% vs 30%, P=0.043) and meat/alternatives groups (29% vs 17%, P=0.043). There were no significant differences for other core food groups, carbohydrate ranges or meal/snack skipping. More women during the COVID period were diagnosed with dietary knowledge deficits (57% vs 25%, P<0.001), however fewer women subsequently commenced diabetes medications (insulin 40.0% verses 54.2%, P=0.047; metformin 16.7 verses 6.0%, P=0.018). There were no differences in birth outcomes between the cohorts.

Conclusions: This study produced mixed findings in BG, dietary and medication outcomes for women with GDM prior to and during the COVID pandemic. Women had lower BG ranges the week following initial education and lower rates of subsequent diabetes medication commencement during COVID. This may suggest a favourable impact of the pandemic on lifestyles, however the findings may have been susceptible to fictitious reporting during telephone consultations. Conversely, dietary knowledge and the intake of two food groups were poorer in the COVID period the week following initial education. Overall, no major impacts on GDM outcomes were identified during the pandemic, despite changes in service delivery.

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Evaluation of an app-assisted remote surveillance programme for gestational diabetes

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Incorporation of information and communication technology into healthcare management has provided novel solutions to combat operational and financial challenges through the development of telemedicine pathways. Gestational diabetes is a perfectly suited condition on which to model such strategies through the potential for remote surveillance of self-monitored glycaemia. We sought to evaluate the impact of a smartphone app-assisted self-management programme for GDM on a variety of maternal and neonatal outcomes.

We developed a bespoke smartphone app linked to a secure hospital portal following focus group discussions and guidance from key end user stakeholders. All women with a first time diagnosis of GDM treated with lifestyle and medical nutrition therapy were invited to participate. Bluetooth enabled glucometers and a secure link to the patient-facing app were provided to consenting patients. Glycemic indices, perinatal outcome and service usage data were assessed and compared with a matched historical control. Continuous data were assessed using independent samples t-test and categorical data were assessed using Chi squared and Fischer's exact tests.

169 women engaged with app-assisted care and their data were compared with 162 patients from a historical cohort. A greater number of glycemic indices were logged for those in the app group compared with the matched historical control. App-use was associated with a 2-point reduction in the mean fasting blood glucose level (p=0.022), a 5-point reduction in mean postprandial blood glucose level (p< 0.001) and fewer instances of above threshold blood glucose values. The interval time between diagnosis and requirement for supplemental hypoglycaemic therapy was increased among the app-assisted care group (p=0.008). Maternal and neonatal outcome data were similar between the groups however, rates of caesarean delivery were lower among app users primarily due to fewer elective CS. Among app-assisted care patients fewer clinical encounters and shorter postnatal stays were identified (p< 0.012 ; p< 0.0045). Cost effective analysis significantly favoured an app-based approach.

App-assisted care resulted in the achievement of optimised glycemic control for 80% of participants with reductions in both mean fasting and postprandial blood glucose levels. This improvement in glycemic control was associated with maintenance of high standards related to maternal and perinatal outcomes while facilitating patient centred care. Translation of this telemedicine solution into clinical practice has a beneficial impact on the number of patients requiring in-person review for treatment intensification resulting in a significant reduction in health economic metrics for both the patient and their healthcare provider.

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Implementation of fluoride-citrate tubes to stabilise glucose for detecting GDM in Kimberley Aboriginal Community Controlled Health Services: a mixed methods assessment.

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Background:

OGTT completion by women in rural and remote Western Australia is low (50.5%) and an estimated 62% of GDM is missed due to glucose instability in fluoride-oxalate (FLOX) samples and long delay to laboratory analysis. In September 2019 Kimberley Aboriginal Community Control Health Services (ACCHS) implemented fluoride-citrate (FC) tubes to immediately stabilise OGTT samples.

Aims:

To describe implementation of FC tubes and evaluate the impact on detection of GDM.

Method:

A mixed methods approach was used: a retrospective audit and qualitative interviews with clinicians. Electronic medical records for 951 women attending a Kimberley ACCHS with an estimated date of delivery between 2018-2021 were audited for maternal characteristics and risk-factors, OGTT (ADIPS criteria) and birth outcomes (large- and small-for-gestational-age (LGA >90th centile; SGA <10th centile) calculated using Perinatal Institute GROW v8.0.1). Clinicians delivering antenatal care in rural and remote primary and secondary health care (hospitals clinics, ACCHS, general practice, remote clinics) were interviewed. Interviews were professionally transcribed into individual Microsoft Word documents, imported into NVivo 12, then coded and analysed using a directed qualitative content analysis approach.

Results:

Of 698 (672 Aboriginal) women eligible for an OGTT ≥24-weeks, 51.7% completed testing (152 FC tubes; 209 FLOX tubes). Clinicians reported a discordance between clinical presentation during pregnancy and OGTT result when using FLOX tubes. This was often confirmed when women delivered a LGA newborn. No significant differences in GDM risk-factors were observed between FLOX- and FC-groups, however as expected GDM incidence was 2.8-fold higher in the FC-group (37.5% v 15.8% FLOX, *P* <0.001). Three-quarters of women with GDM in the FC-group were diagnosed with fasting glucose. When FC tubes were first introduced clinicians were concerned that women were being over diagnosed, however with time they realised that they were detecting women with GDM. This was reflected in the 3.7-fold increase in pharmaceutical intervention (metformin and/or insulin; 12.1% v 3.2% FLOX, *P* <0.001). Induction of labour and birth weight outcomes were similar between groups (FC v FLOX, induction: 43.6% v 37.3%, *P* = 0.217; LGA: 13.5% v 9.0%, *P* = 0.369; SGA: 18.4% v 14.6%, *P* = 0.602).

Conclusions:

As expected, implementation of FC tubes significantly increased GDM diagnosis. A concurrent increase in pharmaceutical intervention was observed, likely reflecting increased clinician awareness and concern about GDM during the timeframe. Larger cohorts are required to evaluate whether improved detection and management of GDM translates to improved birth outcomes.

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StUdy of Gestational diabetes And Risk using Electronic Data (SUGARED)

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Background: Gestational diabetes (GDM) affects 1 in 6 pregnancies within Australia [1]. The incidence of GDM increased due to changed diagnostic criteria, implemented as a result of the Hyperglycaemia and Adverse Pregnancy Outcome (HAPO) study [2]. Bayesian methods are better at modelling complex data relationships compared to traditional methods of analysis. Hence, we reanalysed the HAPO data using Bayesian methods to identify subgroups of women with GDM with low or high risk of adverse outcomes.

Method: Bayesian regression analysis was applied to the HAPO dataset (> 23,000 women unclouded by treatment interference). This involved modelling birth outcome (birth weight >90th percentile) as a function of glucose levels on the 75g oral glucose tolerance test and selected maternal variables (field centre, ethnicity, age and BMI), assuming a linear combination of fixed and random effects. Random intercepts and random slopes were associated with clusters in the maternal variables of interest.

Results: The model, including fasting, 1-hour and 2-hour glucose levels and selected covariates, predicted birth weight >90th percentile. Change in each glucose measure's response as a function of the other two measures, with a single covariate, BMI, are seen in Figure 1. The model was then extended to include covariates field centre, ethnicity, age and BMI.

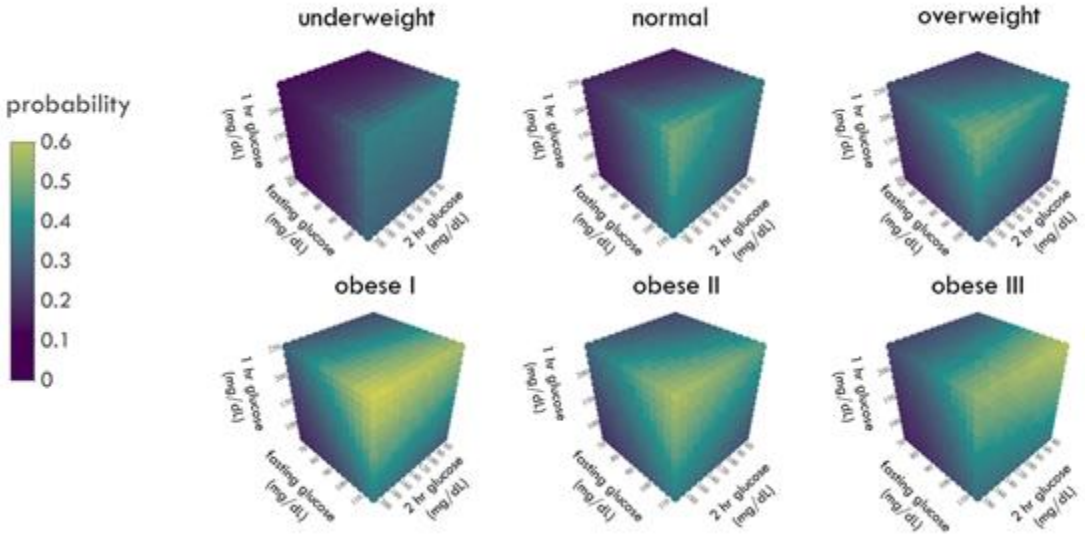

Figure 1: Mixed effects model. Estimated probability of birth weight >P90 by plasma glucose measures and BMI class

Conclusion: Our sophisticated statistical methods allow us to understand the complex inter-relationships between factors affecting adverse birth outcomes, and have established subgroups of women based on BMI and glucose levels at varying risk of birth weight >90th percentile. This model will be expanded to develop a personalised risk prediction tool, assisting clinicians and women to make more individualised decisions regarding treatment, thereby minimising unnecessary obstetric intervention and allowing for a focusing of resources on women at high risk of adverse outcomes.

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Prevalence of prediabetes and type 2 diabetes (T2D) during postpartum follow up of women with history of early pregnancy gestational diabetes mellitus (eGDM): A systematic review and meta-analysis

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Background

Presence of hyperglycemia in pregnancy is called gestational diabetes mellitus (GDM) and typically diagnosed between 24 and 28 weeks of gestation (conventional GDM; cGDM). Increasingly, such hyperglycaemia is detected early in pregnancy termed as *'early pregnancy GDM (eGDM)'*. (3) It has been reported that the lifetime risk of progression to T2D post GDM is around 10-fold, but this is typically following cGDM.(1, 2) There is limited information on the rates of postpartum dysglycemia (prediabetes and T2D) in women diagnosed with eGDM.

Aim

To estimate the prevalence of postpartum dysglycemia [T2D, prediabetes, impaired fasting glucose (IFG) and impaired glucose tolerance (IGT)] in women diagnosed with history of eGDM

Methods

A systematic review and meta-analysis of observational studies following up women with history of eGDM to report prevalence of postpartum dysglycemia was conducted. eGDM was defined if the GDM was diagnosed before 24 weeks of gestation. Databases including PubMed, Ovid, Embase, CINAHL, and Web of Science were searched from inception until July 2022. This identified 214 studies, 54 duplicates removed. Using Covidence, two independent reviewers (HW and SC) screened 160 abstracts stating 141 studies as irrelevant. After full text screening, 6 studies were included for meta-analysis and 13 studies were excluded. Data on rates of postpartum dysglycemia was extracted for eGDM group and comparison group wherever relevant. Meta-analysis was performed using R Studio. Findings are presented as prevalence rates and publication bias was ascertained using Egger's test. Risk of bias was ascertained.

Findings

Postpartum screening was performed between 4 and 18 weeks in six studies that followed up women with eGDM.(4-9) About one third of women with eGDM had some degree of dysglycemia (IFG/IGT/T2D) during postpartum screening. The prevalence of T2D ranged from 0% to 26.7% while that of prediabetes ranged between 13.3% and 100.0%. The pooled prevalence of T2D (n=1072) and prediabetes (n=1072) in women with eGDM during postpartum screening was 5.0% and 27.7% respectively. Most studies employed cGDM as a comparison group for eGDM in postpartum diabetes screening. Women diagnosed with eGDM had 5.6 times (95% CI: 3.6 – 8.7) higher relative risk for conversion to T2D compared with women diagnosed with cGDM. Similarly, eGDM women had 1.9 times (95% CI: 1.4 – 2.7) higher relative risk for developing prediabetes compared to cGDM women.

Conclusion

Postpartum dysglycemia in women with eGDM is very common but more studies are needed, especially in high-risk populations like south and southeast Asia.

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Early pregnancy gestational diabetes mellitus (eGDM): Prevalence and its risk factors compared to conventional gestational diabetes mellitus (cGDM) in south Asian Indian women

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Background: Typically, gestational diabetes mellitus (GDM) is diagnosed between 24-28 weeks (called conventional GDM; cGDM for this study). However, hyperglycemia can be present in the first trimester of pregnancy (called early pregnancy GDM; eGDM for this study) and if left undetected could result in adverse outcomes in pregnancy and adverse metabolic programming of the offspring.(1-4) However, the exact prevalence of eGDM and the risk factors are not known even in high-risk populations such as India.

Aim: To estimate prevalence of eGDM, its risk factors and to compare them with cGDM

Methods: The **ST**ratification of **Ri**sk of **D**iabetes in **E**arly pregnancy (STRiDE) study recruited pregnant women during first trimester from seven antenatal clinics in south India. Overall, 2,703 women underwent fasting plasma glucose (FPG) screening before 16 weeks of gestation. Based on International Association for Diabetes in Pregnancy Study Group (IADPSG) FPG criteria, (5) the women were categorised as follows: FPG ≥7.0 mmol/L- overt diabetes, FPG between 5.1 and 6.9 mmol/L – eGDM, FPG <5.1 mmol/L - screened again at 24-28 weeks by IADPSG criteria to classify cGDM and normal glucose tolerance (NGT). Women categorised as eGDM, cGDM and NGT were included in the analysis. Binary logistic regression models were built to assess the risk factors for eGDM and cGDM compared to NGT group.

Findings: The prevalence of eGDM was 21.5% (n=566). Of these 566 women, 16.3% had FPG levels ≥5.6mmol/l (American Diabetes Association criteria) and 5.8% had FPG levels ≥6.0mmol/l (National Institute of Health Care Excellence criteria). The prevalence of cGDM was 19.5%. The eGDM group had significantly higher early pregnancy weight (64 vs. 61 kg), BMI (26 vs. 25 kg/m^2), HbA1c (5.3% vs. 5.1%) and previous history of GDM (8.5% vs. 5.3%) compared to the cGDM group. Elevated early pregnancy HbA1c (OR: 5.410, 95% CI: 3.930 - 7.447, p <0.001), high BMI (OR:1.056, 95% CI:1.032 - 1.081, p <0.001), and history of GDM (OR:1.894, 95% CI: 1.216 - 2.950, p 0.005) in previous pregnancy were identified as eGDM risk factors. For cGDM the risk factors were older age, elevated early pregnancy HbA1c, family history of diabetes, and family history of GDM.

Conclusion: There is a high prevalence of eGDM among south Asian Indian women, which highlights the need for screening for GDM in the first trimester. Modifiable risk factors like early pregnancy BMI and HbA1c may play a vital role in prepregnancy planning in such high-risk women.

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An Update in Methodology to the International Diabetes Federation Atlas Estimation of Hyperglycaemia in Pregnancy

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INTRODUCTION

The International Diabetes Federation (IDF) Atlas [1] has traditionally reported age-adjusted rates to estimate prevalence of hyperglycaemia in pregnancy (HIP). As a result, many studies that do not report prevalence rates aggregated into three or more age-groups may be excluded from the estimation of HIP prevalence. We aimed to determine whether removing age adjustment of prevalence would increase the yield of studies for inclusion into the IDF Atlas.

METHODS

We looked at all studies that were identified for the IDF Atlas, including those excluded due to not having three or more age groups. Additionally in order to focus on grey literature from underrepresented regions, we undertook a Google Scholar search of gestational diabetes prevalence studies published between 2017 and 2020 relating to 110 low or middle income countries. For each country, we included the highest scoring study according to the IDF methodology criteria as reported in Linnenkamp [2].

RESULTS

Using our updated approach, 48 new studies from 43 countries were identified, a 94% increase from the IDF Atlas selection of 51 studies. 22 studies were identified from countries which were not represented in the IDF Atlas HIP prevalence estimation. Of these, only 10 (20.8%) studies had three or more age groups reported.

CONCLUSION

A revision of the IDF Atlas methodology is suggested. In allowing studies which do not report three or more age groups would enable newer and higher quality studies to be included in its HIP prevalence estimation.

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Impact of Obesity on Pregnancy Outcomes in People with T2DM vs T1DM: A Retrospective Cohort Study

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In the context of rising rates of obesity in children/youth, the prevalence of type 2 diabetes mellitus onset in youth/young adults (YT2DM) has surpassed that of type 1 diabetes mellitus (T1DM) in many regions.[1] YT2DM is now recognised as a more severe diabetes phenotype, with higher BMI, worse glycaemia, and early and rapid progression of macrovascular and microvascular complications , when compared to T2DM onset later in life.[2-6] In people with YT2DM, cardiometabolic risk factors manifest earlier, and there is heightened insulin resistance, higher metformin failure rates, and accelerated deterioration in beta-cell function when compared to usual T2DM.[2-6] We have shown that diabetes-related complications and mortality are more prevalent and occur earlier amongst those with YT2DM compared with T1DM, but are frequent in both groups.[5] People with YT2DM have an excess of long term renal complications compared to T1DM and a higher risk for retinopathy than older-onset T2DM.[5,6]

Contemporaneously, overweight and obesity are also increasingly common in people with T1DM, affecting ~50% of people with T1DM in our clinics which is consistent with published data[7]. Obesity is the most common health condition in women of reproductive age.[8] Maternal obesity is associated with worse pregnancy outcomes in women with T2DM but there is limited data in people with T1DM.[9, 10] This project aims to explore the impact of obesity on pregnancy outcomes in women with T1DM compared to YT2DM. We will present a retrospective analysis of prospectively collected pregnancy data (2010-2019) from women with T1DM/T2DM who were managed at and gave birth at Royal Prince Alfred Hospital, Sydney. This project will present much-

needed local data from an Australian tertiary centre on the impact of overweight/obesity on pregnancy outcomes in women with T1DM vs YT2DM. Analysis of preliminary data showed that women with T2DM (n=66), when compared with women with T1DM (n=55), were older, and had shorter diabetes-duration, higher pre-pregnancy BMI (33.8±7.6 vs 25.7±5.3kg/m^2), and higher 1st-trimester gestational weight-gain ($p \leq 0.002$ for all). Despite similar mean pregnancy HbA1c and less favourable maternal weight indices, the offspring of women with T2DM had lower mean birth-weight centiles, and lower incidences of LGA babies and NICU admission. However, pre-eclampsia and congenital malformations appeared to be more frequent in T2DM pregnancies. Overall, adverse pregnancy outcomes were high for women with both types of diabetes, but there appeared to be a difference in the types of adverse outcomes seen in women with T2DM compared to those with T1DM.