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# POSTER ABSTRACTS

## ■ **Weight Gain During Pregnancy – NORA Antenatal Cohort**

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### **Introduction**

To determine the characteristics of gestational weight gain in the Singapore population.

### **Methods**

619 patients from the Neonatal Obstetric Risk Assessment (NORA) cohort were classified accordingly to their first antenatal visit BMI: Normal-weight (NW), Underweight (UW), Overweight (OW) and Obese (OB) groups. Optimal weight gain for each group was 11kg-16kg, 8kg-13kg, 7kg-11kg and 5kg-9kg respectively according to the Institute of Medicine (2009) criteria. Weight gain was calculated as the difference between the first antenatal visit weight (< 14 weeks GA) and the final pregnancy weight (≥ 37 weeks GA).

### **Results**

Average height of the cohort was 158.6 (sd±5.9) cm. At the first antenatal visit, the average weight of the cohort was 59.7 (sd±12.5) kg and BMI was 23.7kg/m<sup>2</sup>. The distribution of the cohort was 57.8% (NW), 8.7% (UW), 23.6% (OW) and 9.9% (OB). At the final antenatal visit, the average cohort weight was 71.8 (sd±12.5) kg. Average weight gain from the first to final visit was 12.1 (sd±4.5) kg.

41% of the cohort gained weight appropriately, while 58.5% gained weight inappropriately. Normal recommended weight gain was achieved in 47.8% of the NW group, 42.6% of the UW group, 35.6% of the OW group and 52.5% of the OB group. Inappropriately poor weight gain was achieved in 34.6% of the NW group, 11.1% of the UW group, 15.1% of the OW group and 29.5% of the OB group. Inappropriately high weight gain was achieved in 17.6% of the NW group, 46.3% of the UW group, 49.3% of the OW group and 52.5% of the OB group. Average weight gain for the groups were 12.7kg (NW), 12.5kg (UW), 11.5kg (OW) and 9.2kg (OB). Multivariate analyses showed that being overweight and obese significantly increased risk of gaining weight above IOM guidelines during pregnancy.

### **Conclusion**

There is a significant portion of the population especially the obese and overweight patients that did not gain appropriate weight for a healthy and safe pregnancy. More could be done to educate these patients on this.

## ■ **To Explore the Health Beliefs and Self-Care Behaviours during the Antenatal and Postnatal Period among Women with Gestational Diabetes Mellitus in Singapore - A Research Proposal**

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### **Introduction**

Having a history of gestational diabetes mellitus (GDM) poses a seven-fold increase in the risk of developing type 2 diabetes mellitus (DM) after delivery. Despite knowing the healthy behaviours to prevent and/or treat these conditions, most struggle to adopt and adhere to them. Each individual's healthy behaviours, or the lack of, are driven by health beliefs. Hence, this study explores the health beliefs and self-care behaviours, during the antenatal and postnatal period, among women diagnosed with GDM in Singapore.

### **Methods**

A GDM Health Belief Model Questionnaire will be developed to explore the health beliefs of women diagnosed with GDM. In addition, the Summary of Diabetes Self-Care Activities Measure will be modified to contextualise the self-care behaviours to the local setting. Both questionnaires will be administered and data collected will determine whether the health beliefs and behaviours change over the antenatal to the postnatal period.

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## Results

The GDM Health Belief Model Questionnaire and Summary of Diabetes Self-Care Activities Measure will be tested for validity and reliability. Any associations amongst the measures, if any, will be ascertained.

## Conclusion

Understanding the health beliefs and behaviours of women with GDM will reveal the complex interplay of the factors on those behaviours. Findings will contribute to the design of future health promotion programmes, beginning with raising awareness of the GDM women's health beliefs. Furthermore, by addressing the unfavourable health beliefs using a more targeted approach for those who need it more, may lead to more success in promoting the self-care behaviours. Using this questionnaire as a screening tool may also optimise patient activation so that the women will continue to adopt and maintain the healthy behaviours beyond delivery. In this way, their risk of DM will be reduced and thereby may delay, if not even avoid, the onset of DM in the future.

## ■ The Comprehensive Assessment of Food Parenting Practices: The Home Self-administered Tool for Environmental Assessment of Activity and Diet Family Food Practices, Adaptation and Applicability in Parents of Singaporean Children aged Three- to Five- Years

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## Introduction

The American Association of Pediatrics emphasized parents' role in altering children's risks for obesity by setting the appropriate context, habits, practices around food and eating. Eight validated tools assess feeding practices among parents of three- to five- year olds [Child Feeding Questionnaire; Feeding Practices and Structure Questionnaire; Preschooler Feeding Questionnaire; Overt and Covert Control; Comprehensive Feeding Practices Questionnaire; Parental Feeding Style Questionnaire; Child Feeding Style Questionnaire; Home Self-administered Tool for Environmental Assessment of Activity and Diet Family Food Practices (HomeSTEAD)]. HomeSTEAD had been used in USA for mostly White and African American parents of children aged between three and 12 years old. HomeSTEAD, consisting three main scales, Coercive, Autonomy Support and Structure was found to have good internal reliability, construct validity and reliability.

## Methods

HomeSTEAD required adaption to reflect the Asian diet and the approach included: 1. Permission for use and modification; 2. Question and expression evaluation; 3. Test for Content Validity Index (CVI); and 4. Test adapted questionnaire to perform test-retest reliability on 20% of the sample to obtain intra-class correlation and perform Cronbach's Alpha on the subscales to test for internal consistency.

## Results

The examination of the HomeSTEAD necessitated four main changes: 1. Include a wider variety of cooking methods; 2. Include staple food from the major races; 3. Use of locally known terms; and 4. Adding an item describing the distractions during meals from handheld devices or television

## Conclusion

The process of cultural adaptation and communication with the tool originator strives to achieve equivalence between the locally adapted tool and its predecessor. The locally adapted HomeSTEAD will reveal prevailing parenting practices common locally among three- to five- year olds. With the establishment of stability, internal reliability and construct validity, this tool can be adequately used in other Southeast Asian countries with similar diets.

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## ■ Retinal Vasculature and 5-Year Metabolic Syndrome among Women with Gestational Diabetes Mellitus

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### Introduction

Women with gestational diabetes mellitus (GDM) are at greater risk of metabolic syndrome (MetS). We studied the association between second-trimester retinal microvasculature and 5-year MetS incidence in women with GDM.

### Methods

A total of 142 mothers with GDM were recruited and followed up 5 years after delivery. Retinal photography was performed at 26-28 weeks gestation and metabolic outcomes were assessed at the 5-year postpartum follow-up visit. GDM and MetS were defined based on World Health Organization (WHO) guidelines and Adults Treatment Panel (ATP) III guidelines, respectively. Modified-Poisson regression was applied to study the association between second-trimester retinal microvasculature and incident 5-year maternal MetS, after adjusting for major confounders. Area under the curve (AUC) was calculated based on the final model.

### Results

Our prospective cohort reported a 9.2% incidence rate of 5-year MetS among women with GDM. After adjusting for maternal age, ethnicity, college degree, pre-pregnancy BMI and fasting glucose at 26-28 week gestation, each 10 µm widening in retinal venular caliber was associated with an increased relative risk of 1.6 (95% confidence interval [CI]: 1.0, 2.8) in incident MetS. In addition to traditional risks of pre-pregnancy BMI and fasting glucose level at 26-28 week gestation, retinal venular caliber mildly increased the prediction of 5-year maternal MetS by 1.8%.

### Conclusion

Second-trimester retinal venular widening was associated with incident 5-year maternal MetS in women with GDM. Our study suggests that mother with GDM at risk of future MetS development may have already presented retinal microvascular abnormalities during pregnancy.

## ■ Gestational Retinal Microvasculature and the Risk of 5 year Postpartum Abnormal Metabolism

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### Introduction

Changes in retinal microvasculature may reflect insulin resistance. We examined the association of changes in retinal microvasculature during pregnancy and risk of subsequent abnormal glucose metabolism in a cohort of mothers at baseline and 5 years postpartum.

### Methods

Of the participants from the Singapore birth cohort (Growing Up in Singapore Towards Healthy Outcomes [GUSTO]), 276 mothers attended both baseline (at 26-28 weeks of gestation) and follow-up (5 year postpartum) visits. At baseline we performed retinal photography and assessed retinal microvascular variables using a validated grading system. At follow-up, we assessed glucose tolerance using a 75 g OGTT.

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We defined abnormal glucose metabolism if participants: (1) had onset of gestational diabetes mellitus (GDM) in subsequent pregnancies within a 5 year follow-up period (n = 103) or (2) had prediabetes (impaired fasting glucose, impaired glucose tolerance or HbA1c 5.7-6.4% [39-46 mmol/mol]) and diabetes diagnosed at the 5 year follow-up visit (n = 84), according to WHO guidelines.

## Results

The incidence of GDM in subsequent pregnancy and abnormal glucose metabolism 5 years postpartum was 25.2% and 30.4%, respectively. Each 10  $\mu\text{m}$  widening in retinal venular calibre was associated with a significant risk of postpartum abnormal glucose metabolism (RR 1.2 [95% CI 1.0, 1.5]), independent of maternal age, college education, ethnicity, pre-pregnancy BMI and GDM at baseline. Narrower retinal arteriolar calibre and venular branching angle at baseline was associated with a higher insulin resistance index (1.4 [95% CI 1.1, 1.7] and 1.3 [95% CI 1.1, 1.6], respectively) at follow-up.

## Conclusion

Retinal microvasculature in pregnant women was associated with abnormal glucose metabolism 5 years postpartum. Alteration of microvascular structure during pregnancy may signal subclinical changes that underlie the development of prediabetes and diabetes.

## ■ Gestational Diabetes Mellitus and Retinal Microvasculature

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## Introduction

Small-vessel dysfunction may be an important consequence of chronic hyperglycemia. We examined the association between gestational diabetes mellitus (GDM), a state of transient hyperglycemia during pregnancy, and retinal microvascular changes in pregnant women at 26-28 weeks of pregnancy.

## Methods

A total of 1136 pregnant women with singleton pregnancies were recruited during their first trimester at two major Singapore maternity hospitals in an on-going birth cohort study. Participants underwent an oral glucose tolerance test and retinal imaging at 26-28 weeks gestation (n = 542). We used the 1999 World Health Organization (WHO) criteria to define GDM:  $\geq 7.0$  mmol/L for fasting glucose and/or  $\geq 7.8$  mmol/L for 2-h post-glucose. Retinal microvasculature was measured using computer software (Singapore I Vessel Analyzer, SIVA version 3.0, Singapore Eye Research Institute, Singapore) from the retinal photography.

## Results

In a multiple linear regression model adjusting for age, ethnicity and maternal education, mothers with GDM had narrower arteriolar caliber (-1.6  $\mu\text{m}$ ; 95% Confidence Interval [CI]: -3.1  $\mu\text{m}$ , -0.2  $\mu\text{m}$ ), reduced arteriolar fractal dimension (-0.01 Df; 95% CI: -0.02 Df, -0.001 Df), and larger arteriolar branching angle (1.8°; 95% CI: 0.3°, 3.3°) than mothers without GDM. After further adjusting for traditional risks of GDM, arteriolar branching angle remained significantly larger in mothers with GDM than those without GDM (2.0°; 95% CI: 0.5°, 3.6°).

## Conclusion

GDM was associated with a series of retinal arteriolar abnormalities, including narrower caliber, reduced

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fractal dimension and larger branching angle, suggesting that transient hyperglycemia during pregnancy may cause small-vessel dysfunction.

## ■ Effect of Maternal Body Mass Index on the Retinal Microvasculature in Pregnancy

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### Introduction

To estimate the effects of maternal body mass index (BMI) and pregnancy weight gain on the retinal microvasculature among pregnant women.

### Methods

We studied 814 pregnant women aged 18-46 years who were recruited as part of the Growing Up in Singapore Toward Health Outcomes study, an ongoing birth cohort study from two government hospitals in Singapore since 2009. Recalled prepregnancy weight was recorded, and maternal anthropometric measurements of weight and height were performed at 26 weeks of gestation together with retinal photography.

### Results

In multiple linear regression models, each standard deviation increase of 26-week pregnancy BMI (4.57) was associated with narrower retinal arteriolar caliber (by 1.58 micrometers,  $P < .001$ ), wider venular caliber (by 1.28 micrometers,  $P = .02$ ), and increased retinal venular tortuosity ( $P = .01$ ). Compared with mothers with normal weight, obese mothers (pregnancy BMI greater than 30.0) had narrower retinal arteriolar caliber (118.81 compared with 123.38 micrometers,  $P < .001$ ), wider retinal venular caliber (175.81 compared with 173.01 micrometers;  $P < .01$ ), and increased retinal venular tortuosity (129.92 compared with  $121.49 \times 10^{-6}$ ;  $P < .01$ ). Pregnant women whose BMI-specific weight gain from pre-pregnancy to 26 weeks of gestation was above Institute of Medicine recommendations had narrower retinal arteriolar caliber (120.68 micrometers) than women with ideal (121.91 micrometers) and less than ideal weight gain (123.17), respectively ( $P$  trend = .05).

### Conclusion

These data indicate that greater pre-pregnancy BMI and pregnancy BMI are associated with adverse retinal microvascular measures, suggesting that maternal obesity has an effect on her microcirculation.

## ■ Impact of Intervention Effectiveness and Disease Prevalence on Cost Effectiveness Analysis of Gestational Diabetes Mellitus Screening Strategies

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## Introduction

The objective is to assess the impact of intervention effectiveness and disease prevalence in the context of cost effectiveness analysis of GDM screening strategies.

## Methods

A decision tree model assessed the primary outcome: incremental cost per quality- adjusted life year (QALY) gained. Probabilities, costs, and utilities were derived from the literature, the Growing Up in Singapore Towards healthy Outcomes (GUSTO) birth cohort study, and the KK Women's and Children's Hospital's database. Monte-Carlo simulations, Tornado Plot and Two-way sensitivity analysis were performed.

## Results

Relative to targeted screening using risk factors, universal screening generated an incremental cost-effectiveness ratio (ICER) of \$USD10, 630/QALY gained. Sensitivity analysis showed that disease prevalence rates and intervention effectiveness of glycemic management have the biggest impacts on the ICERs.

## Conclusion

Based on the model and best available data, universal screening is a cost-effective approach for reducing the complications of GDM in Singapore as compared to the targeted screening approach or no screening. The high intervention effectiveness and high GDM prevalence rate favour universal screening.

## ■ IADPSG Criteria – Better Choice of GDM Screening and Diagnosis

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## Introduction

Gestational diabetes mellitus (GDM) is diabetes that is diagnosed in the second or, more commonly, third trimester. In Singapore, one in five women are at risk of developing diabetes in pregnancy. The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study conducted in 2008 formed the basis of a re-evaluation of diagnosis and screening for diabetes. Besides demonstrating that there were correlations between plasma glucose levels and adverse pregnancy outcomes, it also showed that these associations were independent of other known risk factors for these outcomes. After stepwise considerations of the HAPO study data, International Association of Diabetes and Pregnancy Study Groups (IADPSG) consensus panel recommended the diagnostic values of GDM with 75gram oral glucose tolerance test (OGTT): fasting glucose 5.1mmol/L or 1hour OGTT glucose 10.0mmol/L or 2hour OGTT glucose 8.5mmol/L. The O&G department in SGH adapts the IADPSG criteria.

## Methods

All OGTT results performed between 1 January 2016 and 31 October 2017 were retrieved. IADPSG criteria was used for diagnosis of GDM. 2points OGTT refers to glucose level at fasting and 2hours after OGTT, while 3points OGTT refers to glucose level at fasting, 1hour and 2hours after OGTT.

## Results

1071 patients and 1078 patients underwent 2points and 3points OGTT, respectively. 195 patients (18.2%) in the 2points OGTT group and 224 patients (20.8%) in the 3points OGTT group were diagnosed with GDM. About 60.7% of patients had raised glucose value at 1hour OGTT. In this group, one third of them had normal glucose value at fasting and second hour. Malay (33.7%) and Chinese (30.5%) ethnicity each made up about one third of GDM patients.

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## Conclusion

The IADPSG criteria using 3points OGTT increases the number of GDM diagnosis. One third of GDM patients have elevated glucose level at first hour OGTT only, demonstrating the importance of 3points OGTT as GDM may be underdiagnosed with the conventional 2points OGTT. These will hopefully reduce the rate of adverse outcomes.

## ■ A Study on the Geospatial Variation of Gestational Diabetes in Singapore

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## Introduction

Gestational diabetes mellitus (GDM) incidence rates are affected by maternal characteristics like age, obesity and parity. Given its increasing prevalence, geospatial, environmental and socioeconomic factors may be additional determinants. We aim to investigate the geospatial distribution of GDM in Singapore.

## Methods

The study population was 50,027 singleton-pregnancy women in KK Women's and Children's Hospital (KKH) from 2010 to 2015. Maternal postal codes were geo-referenced to 30 residential areas. Residential GDM rates were adjusted using multiple logistic regression model. Moran's I statistic was used to assess geospatial distribution of GDM. Associations between adjusted GDM rates and socioeconomic disadvantage index (SEDI), number of MacDonald outlets and supermarkets were examined using Pearson correlation analysis.

## Results

The overall GDM rate was 7.8%. GDM rates were higher in Indians (11.9%), women above 35 years old (16.6%), obese women (13.1%) and multiparous women (8.2%). Adjusted GDM rates across residential areas ranged from 4.91% to 10.71% but this difference was not significant by multiple logistic regression analysis ( $p=0.321$ ). Geospatial analysis showed no significant difference in adjusted GDM rates across residential areas using Moran's I statistic ( $p=0.109$ ). However, interestingly, adjusted GDM rates were significantly correlated to areas with lower SEDI (Pearson correlation =  $-0.437$ ,  $p=0.016$ ) but not to the number of MacDonald outlets (Pearson correlation =  $0.111$ ,  $p=0.559$ ) or supermarkets (Pearson correlation =  $-0.002$ ,  $p=0.992$ ).

## Conclusion

There is no significant geospatial variation of GDM in Singapore. However, higher adjusted GDM rates are observed in areas with better socioeconomic status.

## ■ Barriers to Gestational Diabetes Mellitus Management and Preferred Intervention in Women with Gestational Diabetes Mellitus in Singapore: A Mixed-Method Study

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## Introduction

Gestational diabetes mellitus (GDM) is associated with risks for mother and child, as well as greater healthcare utilization, prompting a search for ways to better support women with GDM during pregnancy. This study aimed to understand the barriers to GDM management and preferred interventions in women with GDM.

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## Methods

The current mixed-method study, a convergent parallel design, used a survey and in-depth interviews to collect data from women with GDM and health care providers directly treating GDM patients. Participant recruitment was carried out at two specialized GDM clinics at National University Hospital, Singapore.

## Results

216 women participated in the survey, while in-depth interviews were held with 15 patients and eight providers. Patients were predominantly Chinese, had higher education, were employed, and were seeing a private obstetrician. Most reported already being on diet control, and receiving support and information from either the GDM clinic, online sources, or family. Women most preferred getting such support directly from health care providers, whether at the GDM clinic or elsewhere. Common barriers to GDM management included lack of reminders for blood glucose monitoring, issues related to diet control, and lack of time for exercise; these were particularly reported by working women. Women and care providers identified smartphone applications as the most preferred means of additional intervention, compared to other methods such as in-person counselling. Desirable intervention features identified by patients included more information on GDM, diet, and exercise options, reminders for blood glucose testing, a platform to record blood glucose readings and illustrate/understand trends, and a means to communicate with health care providers.

## Conclusion

A GDM-focused smartphone application that is able to integrate testing, education and communication may be a feasible and acceptable intervention to provide support to women with GDM, particularly for working women.

## ■ Investigating the Effects of Structured Exercise on HbA1c Level on Pregnant Women with Newly Diagnosed Gestational Diabetes Mellitus (GDM) – a Pilot Randomized Study

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## Introduction

The prevalence of gestational diabetes mellitus (GDM) in Singapore is on the rise, according to a local cohort (GUSTO) study. Most of the current literature on Type 2 diabetes mellitus demonstrated that lifestyle interventions such as exercise sufficiently controls hyperglycaemia. Exercise improves the uptake of glucose in the working muscle. This small-scale, preliminary study aims to compare the effects of structured exercise with conventional management of GDM on Hba1c level in GDM women.

## Methods

Ten women with newly diagnosed GDM in KKH were randomised to exercise group (n=5) or non-exercise group (n=5). Participants in the exercise group received patient education on the role of exercise in glycaemic control and attended structured exercise group class once weekly for 8 weeks. All participants received conventional GDM management in KKH. A pedometer was given to both groups to track their daily physical activity levels. Hba1c levels were measured at baseline and after 8 weeks of structured exercises.

## Results

HbA1c levels of the exercise (intervention) group (4.80% to 4.90%; p=0.72) did not increase significantly after 8 weeks. But HbA1c levels of the non-exercise group increase significantly from 5.10% to 5.38%; p=0.048. There is also a significant difference of HbA1c levels between the non-exercise group and exercise group after 8 weeks of exercise (5.38% vs 4.90%; p=0.04). BMI, average daily steps and average daily blood glucose for both before and after meal did not differ significantly between both groups.



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## Conclusion

The preliminary result shows that when women with GDM undergo 8 weeks of structured exercises, they demonstrated better glycaemic control, hence no significant increase in HbA1c level after 8 weeks. Better control of GDM during pregnancy may result to lower maternal and fetal complications. Long-term benefits of improved GDM control may include decreased risk of cardiovascular disease, GDM in subsequent pregnancy, type 2 diabetes mellitus and childhood obesity.

## ■ Maternal Circadian Eating Time and Frequency are Associated with Blood Glucose Concentrations during Pregnancy

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## Introduction

Synchronizing eating schedules to daily circadian rhythms may improve metabolic health, but its association with gestational glycemia is unknown. This study examined the association of maternal night-fasting intervals and eating episodes with blood glucose concentrations during pregnancy.

## Methods

This was a cross-sectional study within a prospective cohort in Singapore. Maternal 24-h dietary recalls, fasting glucose, and 2-h glucose concentrations were ascertained at 26–28 week gestation for 1061 women (aged 30.7 + 6 5.1 y). Night-fasting intervals were based on the longest fasting duration during the night (1900–0659). Eating episodes were defined as events that provided >50 kcal, with a time interval between eating episodes of ≥15 min. Multiple linear regressions with adjustment for confounders were conducted.

## Results

Mean + SD night-fasting intervals and eating episodes per day were 9.9 + 1.6 h and 4.2 + 1.3 times/d, respectively; fasting and 2-h glucose concentrations were 4.4 + 0.5 and 6.6 + 1.5 mmol/L, respectively. In adjusted models, each hourly increase in night-fasting intervals was associated with a 0.03 mmol/L decrease in fasting glucose (95% CI: 0.06, 0.01 mmol/L), whereas each additional daily eating episode was associated with a 0.15 mmol/L increase in 2-h glucose (95% CI: 0.03, 0.28 mmol/L). Conversely, night-fasting intervals and daily eating episodes were not associated with 2-h and fasting glucose, respectively.

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## Conclusions

Increased maternal night-fasting intervals and reduced eating episodes per day were associated with decreased fasting glucose and 2-h glucose, respectively, in the late-second trimester of pregnancy. This points to potential alternative strategies to improve glycemic control in pregnant women.

## ■ Universal Screening versus Targeted Screening for Gestation Diabetes Mellitus in Singapore

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## Introduction

From 1 January 2016, KKH adopted a universal screening model using a modified IADPSG diagnostic criteria. The aim of this study was to compare universal screening versus targeted screening models in the Singapore context.

## Methods

Retrospective review comparing universal screening model with two risk-based models (modified NICE and the KKH models) using IADPSG and WHO 1999 diagnostic criteria from 1 January 2016 to 31 May 2016. Women were screened by oral glucose tolerance test (OGTT). Advanced maternal age (AMA), BMI > 30kg/m<sup>2</sup>, family history of diabetes, multiple pregnancy, GDM in previous pregnancy and history of baby weighing > 4kg were used for the KKH model. BMI > 30kg/m<sup>2</sup>, family history of diabetes, previous GDM, previous macrosomic baby, and South Asian origin were used for the modified NICE model.

## Results

2175 women who underwent GDM screening were analysed. 72.0% of these women had at least one risk factor. Detection and screen rates were highest for universal screening compared to KKH and modified NICE models using modified IADPSG [11.8% (screened 100%), 10.0% (67.9%), 9.5% (59.9%), p=0.037] and WHO 1999 (15.5%, 12.4%, 11.2%, p<0.001) criteria respectively.

Based on modified IADPSG criteria, AMA (OR 1.65, 95% CI 1.07-2.54), BMI > 30 kg/m<sup>2</sup> (OR = 1.76, 95% CI 1.16-2.64), previous history of GDM (OR = 3.31, 95% CI 1.86-5.90) and South Asian ethnicity (OR 1.64, 95% CI 1.04-2.56) were significantly associated with increased risk of GDM. Based on WHO 1999 criteria, AMA (OR = 1.99, 95% CI 1.35-2.93) and previous history of GDM (OR 2.88, 95% CI 1.65-5.03) were significantly associated with increased risk of GDM.

## Conclusion

Universal screening had a significantly higher detection rate compared to targeted screening regardless of the diagnostic criteria.

## ■ Analysis of Factors Affecting Compliance to Management Care Programmes of Gestational Diabetes Mellitus

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## Introduction

Gestational Diabetes Mellitus (GDM) is a common complication of pregnancy that affects about 15% of

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pregnant women and they are at high risk for developing into T2DM. It is important to ensure optimal management of GDM through good antenatal care and good compliance of postpartum follow up. The aim of the study is to determine uptake rates for antenatal and postnatal care programmes and to identify reasons and antecedent factors associated with non-compliance of such programmes, creating insights for early education and intervention for GDM patients.

## Methods

Delivery records from 9671 patients who delivered from September 2016 to June 2017 in KK Hospital were matched with antenatal OGTT results, out of which about 70.2% were screened through antenatal OGTT. 956 patients (14.1%) of these 6788 screened patients have a positive IADPSG result and were diagnosed with GDM. Postnatal OGTT compliance rates were determined by matching delivery records of GDM patients with OGTT tests done within 3 months from the delivery date. Antecedent factors such as patient demographics, antenatal OGTT results and reasons for no-show and declining appointments were analyzed to determine any significant risk factors for defaulting on the postnatal OGTT.

## Results

The mean SBSP attendance rate and postnatal OGTT compliance rate over the study period were about 76.2% and 50.3% respectively. Common reasons related to no-shows include uncontactable patients, preference for self-monitoring and childcare reasons. Univariate and multivariate analysis of antecedent factors indicated that patient age (younger), ethnicity (Malay), admit ward class(C,B2), delivery type (LSCS), birth order (higher) and antenatal OGTT results (fasting glucose) were significant factors related to non-compliance of postnatal OGTT.

## Conclusion

The results of the analyses identified possible reasons and factors that are associated with non-compliance and no-shows for various care programmes. These insights can potentially aid in guiding interventions and processes to improve the care of GDM patients.

## ■ The Relationship between Pre-pregnancy Obesity and Antenatal Psychological Distress: NORA Antenatal Cohort

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## Introduction

Pre-pregnancy obesity is associated with a number of adverse outcome for both the mother and the developing foetus. Past work has suggested that maternal obesity may also increase the risk of postnatal depression; however, little is known about the influence of maternal obesity on antenatal psychological distress. The present study sought to investigate the relationship between maternal obesity and depression and anxiety.

## Methods

The present analyses involved 926 participants from the Neonatal Obstetric Risk Assessment (NORA) cohort. Participants with a Body Mass Index (BMI) of  $\geq 30$  at their first antenatal visit (prior to 14 weeks of gestation) were classified as obese ( $n = 106$ ; 11%). Symptoms of antenatal depression (using the Edinburgh Postnatal Depression Scale; EPDS) and anxiety (using the state subscale of the State-Trait Anxiety Inventory; STAI-S) were measured at four time points throughout the pregnancy. An average of the total scores were used as a proxy of symptoms experienced throughout the pregnancy; scores  $\geq 13$  on the EPDS and  $\geq 41$  on the STAI-S were used to determine 'caseness' of depression and anxiety.

## Results

One in 10 women were classified as obese; of these, one in five had significant levels of depression and close

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to two in five had significant levels of anxiety across the pregnancy. Obese women had higher levels of depression ( $8.6 \pm 4.3$  vs.  $7.6 \pm 4.1$ ;  $t[924] = 2.51$ ,  $p = .012$ ) and anxiety ( $37.4 \pm 8.3$  vs.  $35.1 \pm 8.5$ ;  $t[924] = 2.50$ ,  $p = .01$ ). These women were also at 79% increased odds of potentially developing significant symptoms of antenatal depression (OR = 1.79, 95% CI [1.08, 2.96]). They may also potentially be at an increased risk of developing significant symptoms of antenatal anxiety (OR = 1.49, 95% CI [0.98, 2.28]).

## Conclusion

Obese women may be at a higher risk of developing antenatal depression and anxiety, possible physiological and psychological sequelae.

## ■ The Relationship between First-Trimester Depressive Symptoms and Gestational Weight Gain: NORA Antenatal Cohort

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## Introduction

Inadequate or excessive weight gain during pregnancy is associated with poorer maternal-foetal outcomes; however, past work has been inconclusive as to the influence of antenatal depression on gestational weight gain (GWG). The present study sought to investigate the associations between symptoms of depression in the first trimester and suboptimal (inadequate or excessive) GWG.

## Methods

The present analyses involved 818 participants from the Neonatal Obstetric Risk Assessment (NORA) cohort with term births for whom final pregnancy weights were available. GWG was calculated as the difference between participants' weights at the first antenatal visit ( $\leq$  GA 14 weeks) and the final pregnancy weight ( $\geq$  GA 37 weeks). Participants were classified into adequate and suboptimal weight gain groups according to the Institute of Medicine (2009) guidelines for their pre-pregnancy Body Mass Index (BMI). Symptoms of antenatal depression were measured using the Edinburgh Postnatal Depression Scale (EPDS) at the first antenatal visit; women with EPDS total scores  $\geq 11$  were classified as having significant depressive symptoms. Analyses were adjusted for ethnicity, education level, and the presence of co-morbidities such as diabetes and hypertension.

## Results

Three in five women were classified as having either inadequate or excessive weight gain; of these, one in five had significant levels of depression. Women with suboptimal GWG were found to have higher levels of depression in the first trimester (adjusted means = 8.2 vs. 7.6;  $F[1,812] = 4.16$ ,  $p = .042$ ) as compared to those whose GWG was in the adequate range for their BMI. Women with significant levels of depressive symptoms during their first trimester were also at 45% increased odds of developing suboptimal GWG (OR = 1.45, 95% CI [1.04, 2.02]).

## Conclusion

There is a significant number of pregnant women who may be under- or over-nourished during their pregnancy, which may increase their risk of obstetric complications. Reducing significant depressive symptom during the first trimester may potentially facilitate the development of adequate GWG. More still needs to be done to further investigate the influence and subsequently develop synergistic biopsychosocial interventions targeting women with suboptimal antenatal weight gain.

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## ■ The Relationship between Antenatal Anxiety and Gestational Weight Gain: NORA Antenatal Cohort

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### Introduction

Inadequate or excessive weight gain during pregnancy is associated with poorer maternal–foetal outcomes. Symptoms of anxiety may potentially exacerbate behaviours associated with such suboptimal weight gain; however, little, if any, is known about the relationship between antenatal anxiety and gestational weight gain (GWG). The present study sought to investigate the associations between symptoms of anxiety throughout the pregnancy and suboptimal (inadequate or excessive) GWG.

### Methods

The present analyses involved 819 participants from the Neonatal Obstetric Risk Assessment (NORA) cohort with term births for whom final pregnancy weights were available. GWG was calculated as the difference between participants' weights at the first antenatal visit ( $\leq$  GA 14 weeks) and the final pregnancy weight ( $\geq$  GA 37 weeks). Participants were classified into adequate and suboptimal weight gain groups according to the Institute of Medicine (2009) guidelines for their pre-pregnancy Body Mass Index (BMI). Symptoms of antenatal anxiety were measured using the state subscale of the State–Trait Anxiety Inventory (STAI-S) that participants completed at four time points in the pregnancy (during their first, second, and third trimester, and before parturition). Participants were classified into either Persistently High or Low/Moderate Anxiety based on the trajectory of their anxiety symptoms throughout their pregnancy (Lim et al., manuscript in preparation). Analyses were adjusted for ethnicity, education level, and the presence of co-morbidities such as diabetes and hypertension.

### Results

Three in five women were classified as having either inadequate or excessive weight gain; of these, 15% were classified as being in the persistently high anxiety trajectory. Women with persistently high anxiety symptoms throughout the pregnancy were at 52% increased odds of developing suboptimal GWG (OR = 1.52, 95% CI [1.00, 2.45]).

### Conclusion

There is a significant number of pregnant women who may be under- or over-nourished during their pregnancy, which may increase their risk of obstetric complications. Improving significant anxiety symptoms, especially for women with persistently high levels during the pregnancy, may potentially reduce the development of suboptimal GWG. There may thus potentially be an even greater imperative to intervene early and develop sustainable behavioural interventions for pregnant women with significant levels of anxiety.

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## ■ Use of IADPSG Criteria for Screening of Gestational Diabetes Mellitus

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### Introduction

Singapore has one of the highest incidences of gestational diabetes mellitus (GDM) in the world. There is limited data on the impact of the new IADPSG (International Association of the Diabetes and Pregnancy Study Groups) criteria on the diagnosis for gestational diabetes (GDM) in South East Asia.

### Methods

KK Women's and Children's Hospital (KKH) offers gestational diabetes (GDM) screening to all pregnant patients at their 24 to 28 weeks gestation. Screening is done by the 75-gram Oral Glucose Tolerance Test (OGTT), increasingly with fasting, 1 and 2 hr glucose levels using the IADPSG criteria, a switch from the old WHO 1999 criteria.

### Results

A cohort of 8732 patients was screened with the three-point IADPSG criteria criteria from July 2016 to June 2017. Based on the three-point IADPSG criteria, the incidence of GDM was 15.2%. Based on the old WHO 1999 criteria (two-point 0 & 2 hour), the GDM incidence was 14.5% which was lower. Both were higher than the two-point IADPSG (0 & 2 hr) GDM incidence of 10.6%. Adding the 1 hr parameter to the two-point test of 0 & 2 hr using IADPSG criteria, increased the incidence of GDM from 10.6% to 15.2% (an absolute increase of 4.6% with a relative increase of 43.4%).

### Conclusion

With the increasing adoption of the three-point IADPSG criteria, it is expected that the incidence of GDM will rise significantly. The 1 hr IADPSG parameter is important and should best not be omitted, to ensure optimal detection. However the extent of incidence rise is not high as doubling or tripling of the rates as initially feared in our hospital in this large study.