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## ■ DIP001: Temasek Foundation Cares GDM Programme: Challenges & Achievements of a New Care Model of GDM

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### Introduction

Gestational Diabetes Mellitus (GDM) is a common complication of pregnancy that affects about 15% of pregnant women and they are high risk of developing into T2DM. With the rising prevalence rate of GDM, it is important to ensure optimal management of GDM through good antenatal care and good compliance of postpartum follow up. Care model had been suboptimal in relation to use of non-evidence screening criteria, antenatal screening, postnatal follow-up and antenatal and postnatal education, In September 2016, The Transforming Care for Gestational Diabetes Programme (TC-GDP) was started, supported by IPRAMHO research.

### Aim

The aims were to improve uptake rates for antenatal and postnatal care programmes, following evidence based research findings.

### Methods

All pregnant women were advised to have the 3 point OGTT antenatal screening between 24- 28 weeks of gestation as part of the universal screening recommended by IPRAMHO and the College of Obstetricians and Gynaecologists, Singapore guideline that were formulated. When the women are diagnosed with GDM, they were advised to attend the 1 day Supervised Blood Sugar Profile (SBSP) in Obstetric Day Care (ODAC). Through this programme, they were educated on the basic management of this condition which included 7 points blood sugar profile and dietary advice from dietician. Attendance of the GDM women for SBSP were monitored and captured monthly. The programme would identify reasons and antecedent factors associated with non-compliance of the programmes, creating insights for early intervention for GDM patients.

### Results

The antenatal OGTT screening rate was increased from 64% to 94% till September 2018. ODAC faced the challenge of SBSP compliance rate of 52%. The main reason for defaulting the SBSP were due to patients feeling that it was unnecessary to attend, costly and inconvenient. In January 2018, the Basic Intervention for Gestational Diabetes (BIG) Programme was implemented. It aims to improve the education uptake rate for the GDM women in KKH. The women will be taught on the risks and complications involved if their blood glucose were poorly controlled during pregnancy. Reading materials on instructions to perform 7 points BSP, pictorial guide on steps in performing glucose check, basic dietary information and booklet on Diabetes Mellitus will be given to the women via email or during a meet up session with the nurse navigator. The compliance rate of SBSP was increased to 80% as well. With the implementation of BIG Programme, the percentage of education provided to the defaulters were increased to 90%.

Furthermore, to increase the postnatal OGTT attendance rate, the collaboration with the 3 polyclinic clusters were started in October 2018. It provided a seamless referral process for the patients who are continuing the follow-up care after their delivery. In addition, a Postnatal DM Review Clinic was also started in KKH to provide postnatal reviews for the GDM women.

### Conclusion

Women with GDM are equipped with more knowledge in managing their condition and optimizing glucose levels during their pregnancy and having better follow up postnatally.

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## ■ DIP002: Prevalence and Demographic Characteristics of Gestational Diabetes in a Large Multi-Ethnic Singapore Cohort – Impact of the new IADPSG Criteria (IPRAMHO Study)

Nicole Chew<sup>1</sup>, Khin Lay Wai<sup>2</sup>, Mor Jack Ng<sup>2</sup>, Shephali Tagore<sup>2</sup>, George Yeo<sup>2</sup>, Bernard Chern<sup>2</sup>, Tan Kok Hian<sup>2</sup>

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### Introduction

Universal screening of gestational diabetes mellitus (GDM) with the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria was recently introduced in Singapore. Despite concern that the IADPSG criteria may escalate global GDM prevalence rates, there have been no major studies in Singapore to evaluate its impact. The present study sought to assess the impact of implementing the IADPSG criteria on GDM prevalence and evaluate risk factors for GDM detected based on the IADPSG criteria.

### Methods

This was a retrospective study of all pregnant women who underwent antenatal GDM screening at KK Women's and Children's Hospital (KKH), from 1 July 2016 to 31 December 2016. Questionnaires investigating maternal characteristics were completed at recruitment. Screening was done using an oral glucose tolerance test with IADPSG three time-point criteria (fasting, 1-hour, 2-hour) and compared to former World Health Organization (WHO) 1999 criteria. Effect sizes of significant risk variables were determined using univariate and multivariate logistic regression.

### Results

Of 2216 women, GDM prevalence using IADPSG criteria (14.0%) was slightly higher than that of WHO 1999 criteria (13.1%). There was significantly lower GDM prevalence in Malays (10.8%) than Indians (18.7%), with Chinese in between (14.3%). Significant risk factors, after multivariate adjustment, include advanced maternal age >35 years (OR 1.63, 95% CI 1.14-2.35), overweight (OR 2.89, 95% CI 1.95-4.29), obese (OR 3.66, 95% CI 2.37-5.66), previous history of GDM (OR 2.45, 95% CI 1.38-4.35) and immediate family history of diabetes (OR 1.48, 95% CI 1.08-2.04). Malays had lower GDM risk than Chinese (OR 1.61, 95% CI 1.10-2.35) and Indians (OR 1.64, 95% CI 1.02-2.64).

### Conclusion

Our IPRAMHO Study showed that there was a relative 6.9% increase in GDM prevalence with adoption of the IADPSG criteria in Singapore. Ethnic differences play a role in GDM prevalence, with Malay ethnicity having lower risk. Knowledge of modifiable risk factors may facilitate intervention for risk reduction.

## ■ DIP003: Maternal Weight and Gestational Weight Gain – IPRAMHO NORA Study Cohort

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### Introduction

To determine the characteristics of maternal weight and 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),

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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 9.1kg (OB). Multivariate analyses showed that being overweight and obese significantly increased risk of gaining weight above IOM guidelines during pregnancy.

## Conclusion

There was a significant portion of the overweight pregnant population and many of the obese and overweight patients did not gain appropriate weight during pregnancy. Preconception and antenatal education are vital.

## ■ DIP004: Association between Gestational Weight Gain and Pregnancy Outcomes (IPRAMHO Study)

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## Introduction

We aimed to study gestational weight gain (GWG) in a Singaporean population and its association with pregnancy outcomes, including intrauterine growth restriction (IUGR), macrosomia, gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy, and caesarean section secondary to failure to progress (FTP) or cephalo-pelvic disproportion (CPD).

## Methods

926 women with low-risk singleton pregnancy were enrolled in a prospective cohort study from 2010 to 2014 in a Singapore tertiary maternity hospital. 704 patients without pre-existing diabetes or hypertension and had maternal weight information till term pregnancy were included in analyses.

Participants were categorized according to their first antenatal visit body mass index (BMI) as underweight, normal weight, overweight and obese. Total GWG for each BMI group was compared to Institute of Medicine (IOM) 2009 GWG guidelines. Univariate and multivariate logistic regression analyses were performed to assess the association of GWG with pregnancy outcomes.

## Results

GWG below IOM guidelines was associated with an increased risk of IUGR (adjusted odds ratio: 2.97 [1.71, 5.15];  $p < .0001$ ). GWG above IOM guidelines significantly increased the risk of caesarean section due to FTP or CPD (adjusted odds ratio: 2.10 [1.09, 4.01];  $p = 0.0275$ ).

GWG above IOM guidelines was associated with an increased risk of macrosomia in univariate analysis (unadjusted odds ratio: 2.12 [1.09, 4.14];  $p = 0.0275$ ), while GWG below IOM guidelines was associated with a reduced risk of macrosomia (adjusted odds ratio: 0.16 [0.05, 0.57];  $p = 0.0046$ ). GWG below or above IOM guidelines had no statistically significant association with GDM or hypertensive disorders of pregnancy.

## Conclusion

Inadequate GWG is associated with an increased risk of IUGR whereas excessive GWG is associated with increased risks of macrosomia and caesarean section due to FTP or CPD. Results of the current study add to our understanding on the association of GWG with pregnancy outcomes in Asia and suggest that appropriate weight management during pregnancy is important.

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## ■ DIP005: Postnatal Diabetes Screening in Women Diagnosed with Gestational Diabetes Mellitus: A Clinical Audit

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### Background

Prevalence of diabetes mellitus in Singapore is high, and diabetes screening 6-12 weeks postpartum is recommended for women with gestational diabetes mellitus (GDM) to identify those with glucose intolerance.

### Aim

The aim was to evaluate the postnatal diabetes screening rate in Singaporean women after a GDM pregnancy, examine the proportion of women with pre-diabetic conditions (IFG and IGT) or diabetes after pregnancy, and describe demographic factors associated with attendance for postnatal screening.

### Method

This was a clinical audit of 452 women diagnosed with GDM between 2016 and 2017 at Singapore General Hospital (SGH).

### Results

47.8% of women diagnosed with GDM returned for postnatal diabetes screening. The non-attendance rate of Chinese women (35.3%) was lower than that of other ethnic groups. There was no significant difference ( $P = 0.306$ ) between the mean age of women who attended postnatal diabetes screening, as compared to those who did not, but there was a significant difference ( $P = 0.041$ ) in mean pre-pregnancy BMI between these two groups. 11.1% of women obtained abnormal postnatal screening results, of which 8.3% had impaired fasting glucose (IFG), 66.7% had impaired glucose tolerance (IGT) and 25.0% had diabetes. 54.2% of the women with either IGT or diabetes had normal fasting measurements but abnormal 2-hour glucose measurements.

### Conclusion

Postnatal diabetes screening in Singapore is currently suboptimal. A 75-g OGTT is superior to a FPG test in identifying women at increased risk of developing diabetes, as well as those who have undiagnosed diabetes.

## ■ DIP006: Contributors to High Caesarean Section Rates in Diabetes Patients: An Analysis Using the Robson 10-Group Classification System

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### Introduction

Diabetes is one of the most common medical disorder in pregnancy and is associated with increased adverse outcomes and caesarean section (CS) rates. This study aims to determine the effect of Gestational Diabetes (GDM) and pre-existing Diabetes (DM) on CS rates and identify the main group/s (according to Robson 10-Group Classification System) contributing to high CS rates in Diabetic patients.

### Methods

We conducted a retrospective study of patients with GDM and pre-existing DM who delivered in Singapore General Hospital from 1 Jan 2013 to 31 Dec 2017. Non-diabetic patients served as controls. Data such as parity, singleton/multiple pregnancy, presentation, previous CS, labour onset, gestational age were collected and patients were stratified based on Robson 10-Group Classification System.

### Results

There were 8256 deliveries during the study period. 1073(13.0%) had GDM and 152(1.8%) had pre-existing DM. CS rate was 40.0% among GDM patients, 48.0% in patients with pre-existing DM, and 34.7% in the control group. The major contributor to CS rates in GDM patients was group 5(previous CS in a singleton term cephalic pregnancy), at 33.6%. Group 2(nulliparous singleton cephalic pregnancies which had induction or planned CS) and 10(singleton cephalic preterm deliveries) were the second and third largest contributors

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respectively. Group 10 and group 5 were the largest contributors to CS rates in patients with pre-existing DM, accounting for 28.8% and 27.4% of CS respectively.

## Conclusion

Diabetic mothers have significantly higher risks of having CS, particularly pre-existing DM, where almost one in two delivers by CS. Having a previous CS was a predominant contributor, reflecting the clinical reticence to induce labour for these mothers in the presence of Diabetes. Induction of term primiparous GDM patients also contributed to the CS rate, suggesting a high incidence of failed induction. The high contribution of preterm deliveries to the overall CS rate, especially pre-existing DM, reflects its association with other obstetric complications necessitating intervention.

## ■ DIP007: A Promising Food-Coaching Intervention Program for Optimal Gestational Weight Gain in Pregnant Overweight and Obese Women: A Pilot Randomized Control Trial of a Smartphone App

Ling-Jun Li<sup>1,2</sup>, Izzuddin M Aris<sup>3,4</sup>, Nur Syaza Razali<sup>1</sup>, Nur Ain Binte Mohd Zonar<sup>1</sup>, Nyo Mie Win<sup>1</sup>, Wee Meng Han<sup>5</sup>, Kok Hian Tan<sup>1,2</sup>

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## Background

Traditional food recommendation practice to obtain optimal gestational weight gain (GWG) is ineffective. In this pilot, we aimed to study the feasibility of a novel food coaching smartphone app in controlling GWG and macronutrients intake, among overweight and obese pregnant women.

## Methods

We designed a randomized controlled trial (RCT) and recruited 30 overweight and obese pregnant women (1:1 ratio) during 18-20 weeks of gestation and followed them up in 4 and 8 weeks, respectively. Both groups received standard pregnancy dietary orientation at recruitment, while intervention group received an 8-week's real-time food coaching via a smartphone app. We collected detailed characteristics during recruitment and examined anthropometry at all visits. We compared the mean difference of 8-week's GWG and macronutrients intake between two groups.

## Results

Upon study completion, 3 subjects dropped out from intervention while 1 gave birth prematurely from control. The acceptance of smartphone app is 90%. A half in intervention and a third in controls achieved optimal weight gain per week. Food coaching smartphone app seemed to help in reducing GWG and cholesterol intake in intervention.

## Conclusion

Our pilot showed that food coaching smartphone app is feasible among overweight and obese pregnant women, and its utility is worth studying further.

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## ■ DIP008: Effect of Gestational Diabetes and Hypertensive Disorders of Pregnancy on Postpartum Cardiometabolic Risk

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### Aims

The cumulative effect of gestational diabetes mellitus (GDM) and hypertensive disorders of pregnancy (HDP) on postpartum cardio-metabolic diseases is equivocal. We aimed to assess the associations of GDM and HDP's individual and synergic contribution to risks of postpartum cardio-metabolic diseases [metabolic syndrome (MetS), abnormal glucose metabolism and hypertension (HTN)].

### Methods

Of participants from a Singapore birth cohort, 276 mothers attending the 5-year postpartum visit were included in this study. During this visit, we collected mothers' history of GDM and HDP in all live births in a chronicle sequence, and assessed cardio-metabolic risks based on blood pressure, anthropometry and a panel of serum biomarkers. We diagnosed MetS, abnormal glucose metabolism and HTN according to Adult Treatment Panel III 2000 and World Health Organization guidelines.

### Results

Of 276 mothers, 157 (56.9%) had histories of GDM while 23 (8.3%) had histories of HDP. After full adjustment, we found associations of GDM episodes with postpartum abnormal glucose metabolism (single episode: relative risk [RR] 2.9 [95% CI: 1.7, 4.8]; recurrent episodes ( $\geq 2$ ): RR=3.8 [2.1-6.8]). Also, we found association between histories of HDP and HTN (RR=3.6 [1.5, 8.6]). Having either (RR 2.6 [1.7-3.9]) or both gestational complications (RR 2.7 [1.6-4.9]) was associated with similar risk of postpartum cardio-metabolic disease.

### Conclusions

Mothers with GDM or HDP had a three-fold increased risk of postpartum abnormal glucose metabolism or HTN, respectively. Having both GDM and HDP during past pregnancies was not associated with additional risk of postpartum cardio-metabolic diseases beyond that associated with either complication alone.

## ■ DIP009: History of Gestational Diabetes Mellitus and Postpartum Retinal Microvascular Changes Retinal Microvascular Structure and Function

Kuan Hao Yee<sup>1</sup>, Kok Hian Tan<sup>2,3</sup>, Izzuddin M Aris<sup>4,5</sup>, Ecosse L. Lamoureux<sup>2,6</sup>, Yap Seng Chong<sup>5</sup>, Jie Jin Wang<sup>7</sup>, Tien Yin Wong<sup>6</sup>, Ling-Jun Li<sup>3,6,8</sup>

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### Aims

The pathophysiological mechanism on how gestational diabetes mellitus (GDM) contributes to postpartum development of maternal cardio-metabolic disease remains unknown. We aimed to investigate the association of GDM and maternal postpartum retinal microvascular structural and functional changes.



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## Methods

This is a hospital-based cohort study of mothers who were recruited from a Singapore birth cohort since 2009 and followed up 5-year after delivery in 2014-2015. We recruited a total of 237 mothers, including 112 mothers who developed GDM at baseline index pregnancy and 125 mothers without GDM, matched for age, ethnicity and pre-pregnancy body mass index, and followed them up 5 years after delivery. At 5-year follow-up visit, we collected history of self-reported GDM and performed fundus photography and dynamic retinal vessel analysis. We further assess static retinal vessel calibres (e.g. retinal arteriolar and venular calibre) and dynamic retinal vascular functions in response to flickering light (e.g. retinal arteriolar and constriction, retinal venular dilation).

## Results

At 5-year follow-up, we divided 237 mothers into 3 subgroups: no GDM (n=100; mean age [SD]: 38.2 [4.7] years), 1 GDM episode (n=98; 37.5 [4.9] years), and  $\geq 2$  recurrent GDM episodes (n=29; 38.3 [5.0] years). Using multiple linear regression models adjusting for major determinants, recurrent GDM had significantly reduced retinal venular dilation in response to flickering light (-2.2%; 95% CI: -3.9%, -0.4%), compared to mothers without a history of GDM.

## Conclusion

Recurrent GDM was associated with a reduction in retinal venular dilatory response, an indicator of endothelial dysfunction that contributes to future development of cardio-metabolic risk.

## ■ DIP010: Do Changes in Retinal Microcirculation Mediate the Association between Antenatal Blood Pressure and Post-Delivery Cardiovascular Risk in Mothers?

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Although studies have shown that antenatal blood pressure (BP) might lead to higher postpartum cardiovascular risk, the underlying pathophysiological mechanism remains unclear. In this study, we examined whether the association between antenatal BP and postpartum cardiovascular risks was potentially mediated by postpartum retinal microcirculation. We included 276 Singaporean mothers attending both baseline index pregnancy (2009-2010) and 5-year postpartum follow-up visits (2014-2015). We measured BP at the baseline visit. We assessed retinal microvascular structure and function and cardiovascular risk using the 2008 Framingham Risk Score (FRS) at the follow-up visit. We performed a traditional 4-step mediation analysis using linear regression by adjusting for a series of baseline characteristics: age, ethnicity, college degree, pre-pregnancy body mass index and gestational diabetes diagnosis. We found that each 10mmHg increase in baseline systolic BP was significantly associated with elevated FRS (6.3 points; 95% CI: 3.6, 12.3), enlarged retinal venular branching angle (0.2 degrees; 0.03, 0.30) and greater retinal arteriolar constriction (0.05; 0.00, 0.10) at 5 years postpartum. However, we did not find any association between postpartum retinal microvascular measures and FRS. Our study suggested that changes in postpartum retinal microcirculation did not appear to mediate the association between antenatal SBP and postpartum cardiovascular risks.

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## ■ DIP011: Leptin Trajectories from Birth to Mid-Childhood and Cardio-Metabolic Health in Early Adolescence

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### Objectives

Leptin is a hormone produced by adipose tissue that promotes satiety, and some evidence suggests that greater early life leptin exposure prevents excessive adiposity gain in later life. However, few studies have analyzed dynamic changes in leptin throughout childhood in relation to later cardio-metabolic health. Our study aims to identify distinct leptin trajectories in childhood, and to examine their associations with cardio-metabolic outcomes in adolescence.

### Methods

Among children in the Project Viva cohort born 1999-2002 in Massachusetts, we used latent class growth models to identify leptin trajectories independent of maternal BMI, child sex, race/ethnicity, size at birth and current age and size among 1360 children with leptin measured at least once at birth, early childhood (mean  $3.3 \pm$  SD 0.3 years), or mid-childhood ( $7.9 \pm$  0.8 years). At research visits in early adolescence ( $13.2 \pm$  0.9 years), we assessed cardio-metabolic outcomes including adiposity measures, fasting biomarkers, and blood pressure among 855 children. We then applied multiple regression models to examine associations of the leptin trajectories with these cardio-metabolic outcomes in early adolescence, adjusting for child age at outcome, maternal age, education, prenatal smoking and glucose, total gestational weight gain and paternal BMI.

### Results

The latent class growth model identified 3 distinct leptin trajectories: "low stable" ( $n = 1031$ , 75.8%), "high-decreasing" ( $n = 219$ , 16.1%) and "intermediate-increasing" ( $n = 110$ , 8.1%). In adjusted models, the intermediate-increasing leptin trajectory was associated with higher early adolescence adiposity measures (e.g. BMI z-score: 0.62 units; 95% confidence interval: 0.28, 0.96 and odds of obesity: 2.84: 1.17, 6.94), but lower systolic blood pressure (-0.46 z-score units; -0.74, -0.18), compared to the low-stable group.

### Conclusion

Our findings on leptin trajectories in childhood suggest important differences and associations with later metabolic outcomes.

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## ■ **DIP012: Associations of Maternal and Cord Blood Adipokines with Offspring Adiposity in Project Viva: Is there an Interaction with Child Age?**

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### **Objectives**

Higher leptin and lower adiponectin correlate with adult and childhood adiposity, but it is unclear how exposure to these adipokines during gestation relates to offspring growth. We aimed to investigate the relationships of maternal and cord adipokines with offspring adiposity across childhood to early adolescence, as well as interactions with child age.

### **Methods**

In mother-child pairs in the Project Viva cohort, we measured adipokines in mothers at second trimester (n=1106) and in cord blood at birth (n=657). We measured offspring adiposity indices at early childhood (mean 3.3±s.d. 0.3 years), mid-childhood (7.9±0.8 years) and early adolescence (13.2±0.9 years). We analyzed associations of maternal and cord adipokines with offspring longitudinal adiposity using a linear mixed model adjusting for pre-pregnancy body mass index (BMI), gestational weight gain (GWG), and other confounders.

### **Results**

Mothers with higher BMI and GWG had higher leptin. Offspring born to mothers with the highest vs lowest quartile of leptin had lower BMI z-score (-0.49 units, 95% confidence interval (CI): -0.72, -0.26), waist circumference (-2.6 cm, 95% CI: -3.7, -1.5) and sum of subscapular and triceps skinfolds (-2.8 mm, 95% CI: -4.1, -1.4) in early life. An interaction term between maternal leptin and child age was positive, suggesting that the associations between maternal leptin and child adiposity were not constant over time. Offspring born to mothers with lowest vs highest quartile of maternal adiponectin had lower early life adiposity (BMI z-score -0.27 units, 95% CI: -0.48, -0.05). Results were similar for cord leptin but not cord adiponectin.

### **Conclusion**

Our findings showed higher maternal and cord leptin, and lower maternal adiponectin are associated with lower offspring adiposity from childhood to early adolescence, independent of maternal BMI and GWG. However, the strength of these associations was not constant over time.

## ■ **DIP013: Sleep in Pregnancy: Is there a Co-relationship with Neonatal Birth Weight? (IPRAMHO Study)**

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### **Aim**

Studies have suggested positive co-relation between sleep in pregnancy with fetal birth weight. However, the literature on it is scarce. We aim to review the association between sleep and birth weight to see look for correlation between the two factors.

### **Methods**

A total of 1013 patients were enrolled into the Neonatal and Obstetric Risk Assessment (NORA) pregnancy cohort study between September 2010 and October 2014. A total of 926 patients remained in the study. Their sleep quality was analysed based on Pittsburgh Sleep Quality Index (PSQI) survey at 4 time points: booking visit, between 18-22 weeks, between 28-32 weeks and after 34 weeks. The PSQI scores were co-related to their fetal estimated birth weight at that visit. Results were analyzed by linear regression using SPSS 22.0.

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## Results

The mean birth weight in this population was  $3105 \pm 457.6$  g. The average BMI in the first trimester was  $24.2 \pm 4.7$  kg/m<sup>2</sup>. The average duration of sleep reduced from 7h at booking visit to 6.5 h after 34 weeks. Sleep efficiency also reduced from the first to the third trimester. For women with body mass index (BMI) of less than 25, there was statistical correlation in birth weight with PSQI survey scores from 18-22 weeks. Increase in PSQI scores correlated inversely with birth weight, and this was statistically significant at 18-22 weeks ( $p=0.012$ ), 28-32 weeks ( $p=0.008$ ) and after 34 weeks ( $p=0.006$ ). Increase in sleep duration also correlated positively with birth weight at 18-22weeks ( $p=0.030$ ), 28-32 weeks ( $p=0.002$ ) and after 34 weeks ( $p=0.015$ ). This relationship was not seen when the BMI was more than 25.

## Conclusion

Factors affecting sleep should be analyzed to improve sleep quality, as poor sleep quality and reduced sleep duration can impact negatively on birth weight, especially for women with BMI of less than 25.

## ■ DIP014: Poor Sleep is associated with Higher Blood Pressure during Pregnancy – a Prospective Cohort Study

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## Introduction

Sleep disturbances have long been recognized as a significant complication during pregnancy which can lead to multiple adverse maternal and fetal outcomes. Multiple studies have shown that sleep disturbances such as obstructive sleep apnea is associated with pregnancy induced hypertension and pre-eclampsia. However, there is no systemic study on the progression of sleep disturbances and their correlation with blood pressure throughout pregnancy.

## Methods

In this prospective cohort study, we aim to elucidate the correlation between sleep disturbances and blood pressure during pregnancy in women with no hypertension. 926 subjects were recruited for this study in the outpatient specialist clinics at KK Women's and Children's Hospital, Singapore, between September 1, 2010, and August 31, 2014. Their sleep quality was assessed at 4 antenatal visits throughout pregnancy via the P Pittsburgh Sleep Quality Index (PSQI) questionnaire. Non-invasive blood pressure was recorded throughout 4 antenatal visits as well.

## Results

Our study showed that sleep was progressively worse as pregnancy advances. Stepwise linear regression analysis suggested that shorter sleep duration and poorer sleep efficiency were associated with higher blood pressure, especially in the first trimester. Mixed model analysis demonstrated overall positive correlation between overall sleep quality represented by PSQI score and diastolic blood pressure (DBP) ( $p<0.001$ ) and mean arterial pressure (MAP) ( $p=0.005$ ) during pregnancy after considering all trimesters. Sleep duration was found to be negatively correlated with both systolic blood pressure (SBP) ( $p=0.029$ ) and DBP ( $p=0.002$ ) while sleep efficiency is negatively correlated with DBP ( $p=0.002$ ) only.

## Conclusion

In summary, our prospective study demonstrated that sleep quality during pregnancy is significantly correlated with blood pressure with most obvious effect in the first trimester.

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## ■ DIP015: Postpartum Dietary and Physical Activity-related Beliefs and Behaviors among Women with Recent Gestational Diabetes Mellitus: A Qualitative Study

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### Introduction

Singapore has one of the highest prevalence rates of gestational diabetes mellitus (GDM) worldwide, with approximately 21% of women having GDM using the 2013 World Health Organization (WHO) criteria for GDM diagnosis. A history of GDM increases a woman's lifetime risk of developing type 2 diabetes mellitus (T2DM) by at least seven-fold, compared to women who have normoglycemic pregnancies. Postpartum lifestyle modification is crucial as it has been shown to reduce postpartum weight retention and prevent the progression to T2DM. The aim of this study is to explore the postpartum dietary and physical activity-related beliefs and behaviors among women residing in Singapore who had GDM in their most recent pregnancies.

### Methods

Semi-structured interviews were conducted with women who are up to 3 months postpartum and had GDM in their most recent pregnancies at National Healthcare Group Polyclinics. A purposive sample of 7 participants was recruited. The interviews were audio-recorded and transcribed verbatim. To date, thematic content analysis has been used to analyse 3 interviews.

### Results

Four main themes emerged from the data analysis: low risk perception of developing T2DM in the future, awareness of the need for healthy diet and exercise in the postpartum period, non-adherence to diet control due to breastfeeding, and insufficient physical activity after delivery. Participants also suggested having more education materials on postpartum lifestyle advice to support women who had GDM.

### Conclusion

Our preliminary findings highlight the gap between knowledge and behaviors in relation to postpartum diet and physical activity in women who had GDM. These insights point to the need to better support women with a history of GDM in their postpartum period, for instance through the provision of tailored materials and programs, ultimately to reduce their risk of developing T2DM in the future.

## ■ DIP016: Application and Utility of Continuous Glucose Monitoring in Pregnancy: A Systemic Review

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### Background

Gestational diabetes (GDM) prevalence has been increasing worldwide. GDM monitoring during pregnancy using self-monitoring of blood glucose (SMBG) relies heavily on patient compliance and has several barriers to use including pain and inconvenience. In the past decade, continuous glucose monitoring (CGM) has been proven to have similar accuracy to SMBG and yet provides better therapy optimization and detects trends in glucose values due to higher frequency of testing. Even though the feasibility and utility of CGM has been proven successfully in Type 1 and 2 diabetes, there is a lack of knowledge of its application and effectiveness in pregnancy, especially in GDM. In this review, we aim to summarize and evaluate the updated scientific evidence on the application of CGM in pregnancies including GDM.

### Methods

A search using keywords related to CGM and GDM on PubMed was conducted and articles were filtered based on full text, year of publication (1998 – to date), human subject studies, and written in English. Reviews and duplicate articles were removed. A total of 20 articles were included in this review.

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## Results

Two randomized controlled trials (RCTs) found no significant differences in macrosomia, mean birth weight, gestational age at delivery, and other maternal and fetal outcomes in pregnancy complicated by GDM after treatment of either CGM or SMBG. One prospective cohort found a lower incidence of cesarean section and macrosomia in patients using CGM. Several studies (n=6) concluded that CGM detected more hypoglycemia and hyperglycemic episodes compared to SMBG. Four studies also found that glycemic variability was increased in patients with GDM compared to women with non-diabetic pregnancies (NDP). Last but not least, two studies found that postprandial glucose time to peak was longer in GDM pregnancies vs NDP.

## Conclusion

Current updated evidence suggests that CGM may be more effective in improving maternal outcomes when compared to SMBG in GDM pregnancies, in terms of detecting more hypoglycemic and hyperglycemic episodes. Furthermore, CGM shows a wider glycemic variability in GDM mothers than non-GDM controls. Further research with much larger sample size and longer pregnancy coverage is needed to explore the clinical diagnostic and predictive values of CGM in GDM.

## ■ DIP017: Review on Clinical Practice of Diabetes Screening in Pregnancy – IPRAMHO Survey of the Asia-Pacific Region

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## Background

In recent years, the International Association of Diabetes and Pregnancy Groups (IADPSG) guidelines have been the most widely adopted for screening of gestational diabetes (GDM). However, little is known about the screening practices in most Asia-Pacific countries which are known to have increasing prevalence of GDM. In order to fill this gap, we conducted a GDM screening survey during the 1st Integrated Platform for Research in Advancing Metabolic Health Outcomes of Women and Children (IPRAMHO) Asia-Pacific workshop.

## Methods

A total of 13 survey forms with 100% response rate were sent to attendees from 13 hospitals in 9 different Asia-Pacific countries: China, Thailand, Malaysia, Japan, Myanmar, Australia, Philippine, Singapore and Sri Lanka. Information collected included respondent demographics, GDM policy, screening for pre-existing diabetes, screening for GDM, GDM policy at delivery, and GDM policy after delivery.

## Results

For screening of GDM after 24 weeks gestation, 41.7% of surveyed hospitals had adopted one-step IADPSG guidelines. 66.7% conducted universal screening while 33.3% conducted risk-based screening. Regarding screening for pre-existing diabetes, only 58.3% of surveyed hospitals had a policy using assessment of the risk profile. The proportion of pregnant women who actually receive screening varied widely. Postpartum follow-up was generally performed at 6-12 weeks with OGTT (75%). The screening frequency varied more from unsure

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(41.6%), no screening (8.3%), annual screening (33%), every 2 years (8.3%), and every 3 years (8.3%).

### Conclusion

Our IPRAMHO survey findings showed that IADPSG is the most commonly adopted guideline in Asia-Pacific countries for GDM screening. Countries varied widely, however, regarding pre-existing diabetes screening and postpartum follow-up for GDM. Further research studying the association between IADPSG and maternal and fetal outcomes in different Asia-Pacific countries is needed.

### ■ DIP018: Trajectories of Antenatal Psychological Stress and Associations with Gestational Age and Neonatal Anthropometry: NORA Antenatal Cohort

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### Objective

To determine temporal change patterns of antenatal psychological stress, and to examine associations between these identified trajectories and birth outcomes.

### Methods

926 Asian women with uncomplicated singleton pregnancies completed the Perceived Stress Scale (PSS) in their first, second, and third trimesters, and just prior to parturition. Gestational age, neonatal weight, length, and head circumference (OFC) were recorded at birth. Longitudinal trajectories of antenatal psychological stress were characterized with group-based trajectory modelling, while associations between trajectories and neonatal outcomes were assessed with analysis of covariance and covariate-adjusted linear regressions.

### Results

Three distinct non-fluctuating trajectories of antenatal psychological stress were identified, with 43% of women experiencing a significant level of stress throughout pregnancy. Women in this persistently-higher psychological stress trajectory delivered neonates who were 57.5g lighter and with OFC of 20mm less than their counterparts in the other trajectories. Each one-point increase on the PSS was associated with a decrease of 5.64g in birth weight and 0.4mm in OFC.

### Conclusion

With meaningful trajectories identified, this study suggests that persistently-higher antenatal psychological stress is associated with lower birth weight and possibly smaller head circumference. Further research is needed to understand the clinical relevance of these findings.

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## ■ GDIP019: Dietary Risk Assessment of the Singapore Child

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Singapore has the second-highest prevalence of overweight children and being overweight increases the risk for metabolic disorders especially diabetes. One of the strategies to fight against diabetes is through the promotion of a healthy diet which has to start from young. Hence, there is a need to understand what our children are eating and the factors that could contribute to this dietary risk. Dietary risk refers to any inappropriate dietary pattern that may impair health. Overconsumption and underconsumption of essential foods; and increase in discretionary foods contribute to higher dietary risk in the child.

513 parents, with children below the age of 6 years old, were invited to complete a questionnaire. The questionnaire, which was modified according to HPB recommendation and after in consultation with a nurse clinician specialized children health, consisted of 13 demographic, health and socio-environmental questions; and 27 dietary intake questions based on a 7-day recall.

81% of the children were in the normal BMI range with 7% underweight and 12% overweight. Children in the normal range of BMI had lower total dietary risk than those under or overweight and though there were observable differences, it was not sufficient to produce a significant difference. Influence of poor diet on BMI status may not yet have manifested and other factors such as physical activities and beverages were not taken into consideration.

Total dietary risk was significantly higher in children <1 year old and dietary risk for discretionary food was significantly higher in children  $\geq 5$  years old ( $p < 0.001$ ). Children with 3 or more elder siblings ( $p < 0.001$ ) and those staying in 1-2 room flats ( $p < 0.001$ ) had higher risk in discretionary food while Chinese children ( $p < 0.001$ ) and children cared by nanny/maid ( $p = 0.001$ ) had lower risk in discretionary food. 42% of the variance in dietary risk for discretionary food could be predicted by race, type of residence, age, birth order and who is the caregiver ( $F = 18.147$ ,  $df = 18$  and  $452$ ,  $p < 0.001$ ).

The results suggested that mothers of multiple children and children staying in 1-2 room flats are the main target populations for intervention. Effective specific diet for Malay and Indian populations should be recommended. Working with schools in providing dietary education is potentially another good move. This study opens the door for nurses to work with pediatric nutritionists in developing dietary advice especially in preparing affordable nutritious food.