Turning Discovery into Healthier Communities

First reported in 1985 - 1.3%
Next reported in 1988 - 13.1%
Excess of Malay and Indian patients
More stringent screening and/or increased occurrence?

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GESTATIONAL DIABETES:
WHAT SIZE THE PROBLEM?
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E K M Chua, D Vengadasalam, Y T Tan

SYNOPSIS
Diabetes Mellitus is a common chronic disease in Singapore. Its occurrence in pregnant women was 1.3% in a previous report. In a survey of 145 consecutive pregnant women registered at Alexandra Hospital the incidence of gestational diabetes was 13.1%, when a total screen with 75 gm oral glucose challenge was used. The mean age of this sample was 27 years and the mean gestation at screening 33 weeks. There was an excess of Malay and Indian patients. Fifty percent had traditional risk factors for gestational diabetes. Whether this higher incidence is a result of more stringent screening and/or increased occurrence remains to be confirmed.
Commonly used guidelines for GDM diagnosis

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Fasting Plasma glucose</th>
<th>Glucose Challenge</th>
<th>1-h plasma glucose</th>
<th>2-h plasma glucose</th>
<th>3-h plasma glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO 1999***</td>
<td>≥ 7.0</td>
<td>75g OGTT</td>
<td>Not required</td>
<td>≥ 7.8</td>
<td>Not required</td>
</tr>
<tr>
<td>American Congress of Obstetricians and Gynecologists**</td>
<td>≥5.3</td>
<td>100g OGTT</td>
<td>≥10.0</td>
<td>28.6</td>
<td>≥7.8</td>
</tr>
<tr>
<td>Canadian Diabetes Association***</td>
<td>≥5.3</td>
<td>75g OGTT</td>
<td>≥10.6</td>
<td>28.9</td>
<td>Not required</td>
</tr>
<tr>
<td>IADPSG****</td>
<td>≥5.1</td>
<td>75g OGTT</td>
<td>≥10.0</td>
<td>28.5</td>
<td>Not required</td>
</tr>
</tbody>
</table>

*one value is sufficient for diagnosis  
** two or more values are required for diagnosis  
*** two or more values required for diagnosis  
**** one value is sufficient for diagnosis

Hyperglycemia and adverse pregnancy outcomes (HAPO study)

25,505 pregnant women at 15 centers in nine countries

Country-specific prevalence of GDM

A new diagnostic criterion was proposed by IADPSG (2010) and recently adopted by the WHO since 2013.

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<tr>
<th>Organization and condition (plasma glucose levels in mmol/l)</th>
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<th>Glucose challenge</th>
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<th>2-h plasma glucose</th>
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<td>5.1 - 6.9</td>
<td>75g OGTT</td>
<td>≥10.0</td>
<td>8.5 - 11</td>
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* Diagnosis if one or more of the criteria are met
GDM in Singapore

Up to...

1 in 4 pregnant women gets affected by GDM every year.

- > 1,200 women are diagnosed with GDM at KK Women’s and Children Hospital (KKH) each year.
- About 800 women are diagnosed with GDM at National University Hospital (NUH) each year- 4 fold increase in the last decade.
- Figures are expected to rise further.


Importance of Universal screening

Proportion of detected GDM in GUSTO cohort using Universal vs, high-risk screening

Selective screening (high-risk) failed to detect nearly half the women with GDM.

YS Chong et al., 2014. Ethnic differences translate to inadequacy of high-risk screening for gestational diabetes mellitus in an Asian population: a cohort study.
Implications on Maternal and Birth Outcomes

Risk of Pre-term birth

- Among Hong Kong Chinese women (n=2,168), incidence of preterm birth before 37 weeks and before 32 weeks’ gestation were significantly correlated with increasing glucose tolerance, even when treatment was given to all women diagnosed with GDM (Lao TT, 2003).
- 1.5 times more likely to deliver preterm in Vietnam women (n=2772) if diagnosed by IADPSG criteria (Hirst JE, 2012).

Effect of Maternal Glycemia on Neonatal Adiposity in a Multiethnic Asian Birth Cohort


A continuous relationship between maternal glycemia and excessive neonatal adiposity extends across the range of maternal glycemia.

Associations of infant milk feed type on early postnatal growth of offspring exposed and unexposed to gestational diabetes in utero

Izuddin M. Aris1,2, Shu E. Soh2,3, Mya Thway Tint4, Seang Mei Saw4, Victor S. Rajadurai5, Keith M. Godfrey6, Peter D. Gluckman6, Fabian Yap8, Yap Seng Chong9, Yung Seng Lee10,11

The reduced weight gain in early years of life conferred by greater breastmilk intake was observed in non-GDM children, but not GDM children.
The Influence of Gestational Diabetes on Neurodevelopment of Children in the First Two Years of Life: Prospective Study

Gestational diabetes and maternal blood glucose levels are associated with offspring neuronal activity during an attentional task at both six and eighteen months.

Incidence of T2DM amongst GDM women in different countries

<table>
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<tr>
<th>Country</th>
<th>Incidence Rate</th>
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<tr>
<td>Singapore</td>
<td>49.40%</td>
</tr>
<tr>
<td>Germany</td>
<td>48.30%</td>
</tr>
<tr>
<td>Australia</td>
<td>26%</td>
</tr>
<tr>
<td>Taiwan</td>
<td>40.80%</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>61.30%</td>
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</tbody>
</table>

Preliminary Data from the GUSTO cohort
Follow up: 4-6 years
N=304

Follow up: 19 years
N=102

Follow up: 15 years
N=71

Follow up: 9 years
N=170

Why are Asians at higher risk of GDM?

Long term implications of GDM on child

Child of mother who suffered from GDM has

- **At age 5 years**, higher BMI than those whose mothers had impaired glucose tolerance (Lee H, 2007, Korean prospective follow-up study).

- **At age 8 years**, higher blood pressure, more adverse lipid profile, lower HDL cholesterol than whose mothers had normal glucose tolerance (Tam WH, 2008, Hong Kong prospective follow-up study).

- **At age 15 years**, higher body weight, has signs of metabolic syndrome and arterial stiffness (Tam WH, 2010 & 2012)

Persistent impact of the hyperinsulinaemic intrauterine environment on long term cardiometabolic risk in the offspring
Visceral adiposity and impaired insulin response identified as major pathophysiological abnormalities in Korean GDM women (Lim S, 2007)

East and South Asians were more insulin resistant in early pregnancy compared with Europeans in a multi-ethnic cohort in Norway (Morkrid K, 2012)

In an Australian study, older maternal age and non-Australian birth increased a woman's risk of developing GDM (Carolan M, 2012)
Maternal dietary patterns associated with risk of GDM

### VEGEABLE, FRUIT AND RICE-BASED (VFR)
- Vegetables
- Fruits
- Wholegrain bread
- Nuts and seeds
- White rice
- Fried potatoes
- Burger
- Carbonated Drinks
- Flavoured rice
- Sweetened Drinks
- Fried Meat / Meat in curry

### SEAFOOD AND NOODLE-BASED (SFN)
- Soup
- Fish & seafood products
- Flavoured noodles
- Noodles in soup
- Red meat (healthy prep)
- Seafood
- Soya sauce based gravy
- Legumes and pulses
- Ethnic Bread
- Rice
- Curry gravy
- Other Grains

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### Imbalance Folate and B12 associated with higher risk of GDM

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<tr>
<th>B12-insufficient (&lt;221pmol/L)</th>
<th>B12-sufficient (&gt;221pmol/L)</th>
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<tr>
<td><strong>OR and 95% CI for GDM</strong></td>
<td></td>
</tr>
<tr>
<td>Ref.</td>
<td>1.94</td>
</tr>
<tr>
<td>P = 0.034 (T2 vs T1)</td>
<td>P = 0.179 (T1 vs T3)</td>
</tr>
<tr>
<td>18.2(11.6, 24.6)</td>
<td>34.5(32.3, 37.7)</td>
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<td>Median (IQR) of plasma folate (nmol/L)</td>
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<tr>
<td>Ref.</td>
<td>1.42</td>
</tr>
<tr>
<td>P = 0.669 (T2 vs T1)</td>
<td>P = 0.493 (T3 vs T1)</td>
</tr>
<tr>
<td>18.2(11.6, 24.6)</td>
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Higher PA associated with lower 2 h post-glucose & lower prevalence of GDM, particularly among overweight pregnant Asian women in Singapore (Padmapriya N, 2017)
Intensive lifestyle vs pharmacological treatments to prevent transition to T2DM

Women without prior GDM

Women with prior GDM

Programs and Guidelines for GDM

New Model of Care for women with GDM

Temasek Foundation Cares has committed $1.09 million to the GDM Care programme to be piloted over a 3 year period.¹

Objective

1. Establish an effective system for early diagnosis of GDM, optimal care and follow-up during pregnancy.
2. Pilot a structured follow-up after delivery to diagnose T2DM yearly and allow good care for disease.

Guidelines for the Management of Gestational Diabetes Mellitus

College of Obstetricians and Gynaecologists, Singapore

12 January 2018

- The College of O&G (Singapore) launched Singapore’s first clinical guidelines for the management of GDM.
- More comprehensive than previous ones
- Focus on screening for ALL women (following 3 pt IADPSG) and not just those at high risk

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<td>≥ 7</td>
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* Diagnosis if one or more of the criteria are met
** In the presence of diabetes symptoms
Future plans

- Latest guidelines follows IADPG and WHO. Should there be Asian specific cut-offs OR ethnic-specific cut-offs?
- A registry to follow-up women who had a GDM pregnancy and her offspring e.g. regular yearly follow-up at polyclinics

Key takeaways

- Pregnancy is an important point in the life of a women when she has regular contact with the healthcare system - GDM presents a window of opportunity for early prevention of T2DM.
- A graded association exist between maternal glycemia and adverse pregnancy outcomes.
- GDM and progression to T2DM has long term implications on the health of women and their offspring, the next generation at risk of diabetes.
- Guidelines and programs in place can support mothers in early screening and adopting a healthy lifestyle to manage risk of GDM and progression to T2DM.

Acknowledgments

- **GUSTO team** led by A/Prof Chong Yap Seng
- **SICS team**
- **Epigen team** led by Keith Godfrey
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- **Students and interns**
- Hazel, Sumali, Kenneth, Darren, Yi Chieh
- **GUSTO mothers and children**
Thank you for your kind attention!