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Inequalities of the impact of pregnancy exposure on child health: Peking University birth cohort in Tongzhou (PKUBC-T)



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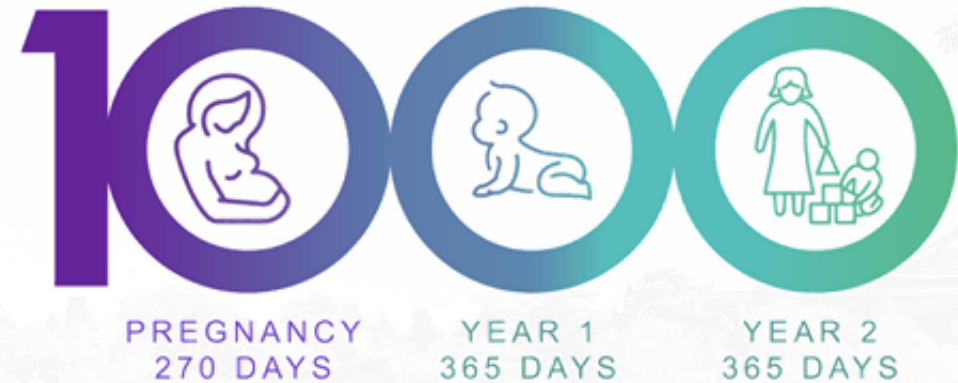
General Background



Background |First 1000 Days|

First 1000 days

- Woman's pregnancy
- Child's first two years



WHO: a unique window of opportunity to shape lifelong health



- Under age 5 mortality
- Obesity
- Respiratory disease
- Cardiovascular disease
- Motor development



- Obesity
- Diabetes
- Hypertension
- Cardiovascular disease

Background |First 1000 Days|

**Growth in the
First 1000 days**

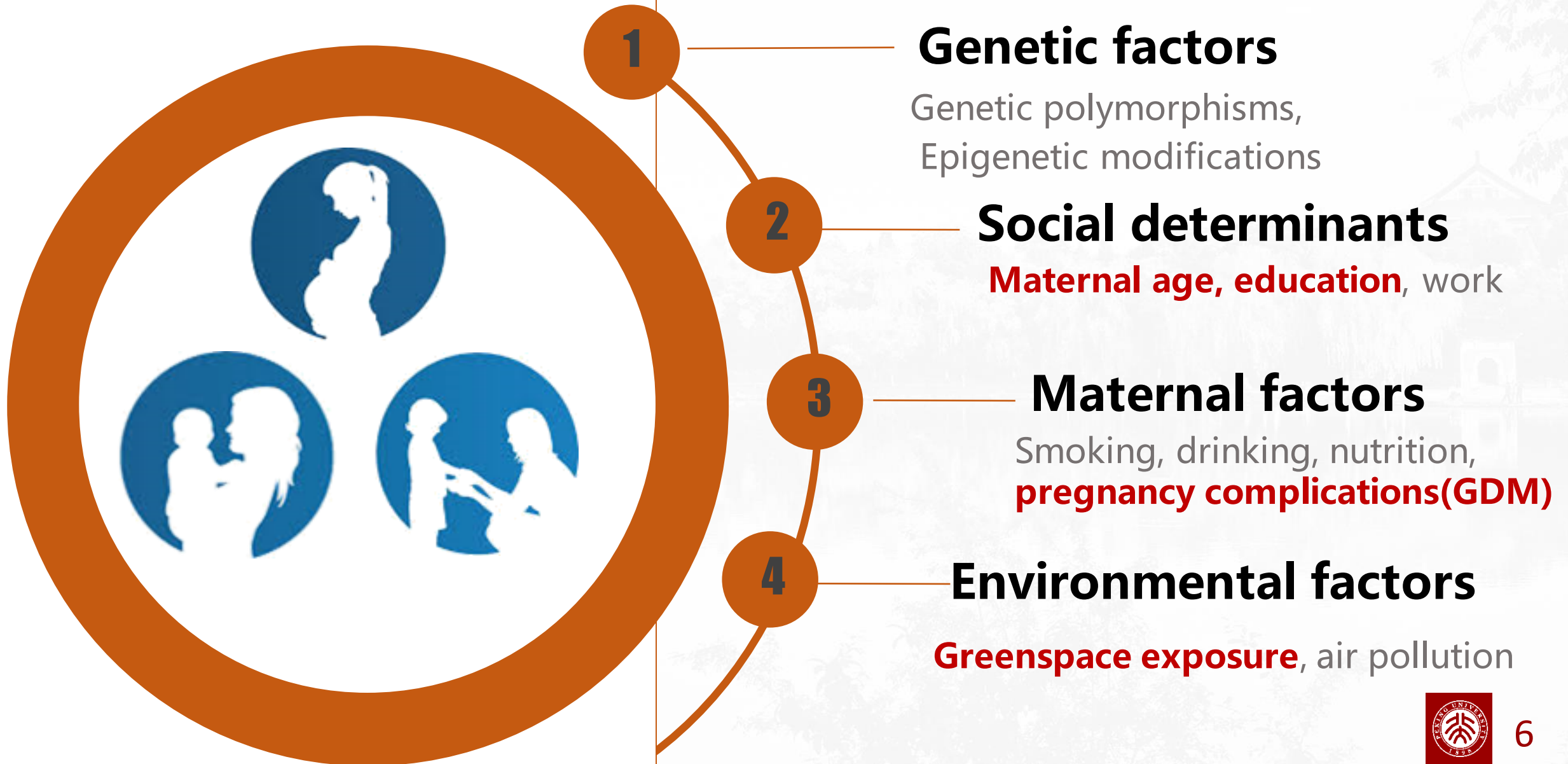
**Fetal
growth**

Preterm birth :
birth before gestational week 37

**Childhood
growth**

Body mass index (kg/m²)
Weight/Height²

Background |Risk factors|

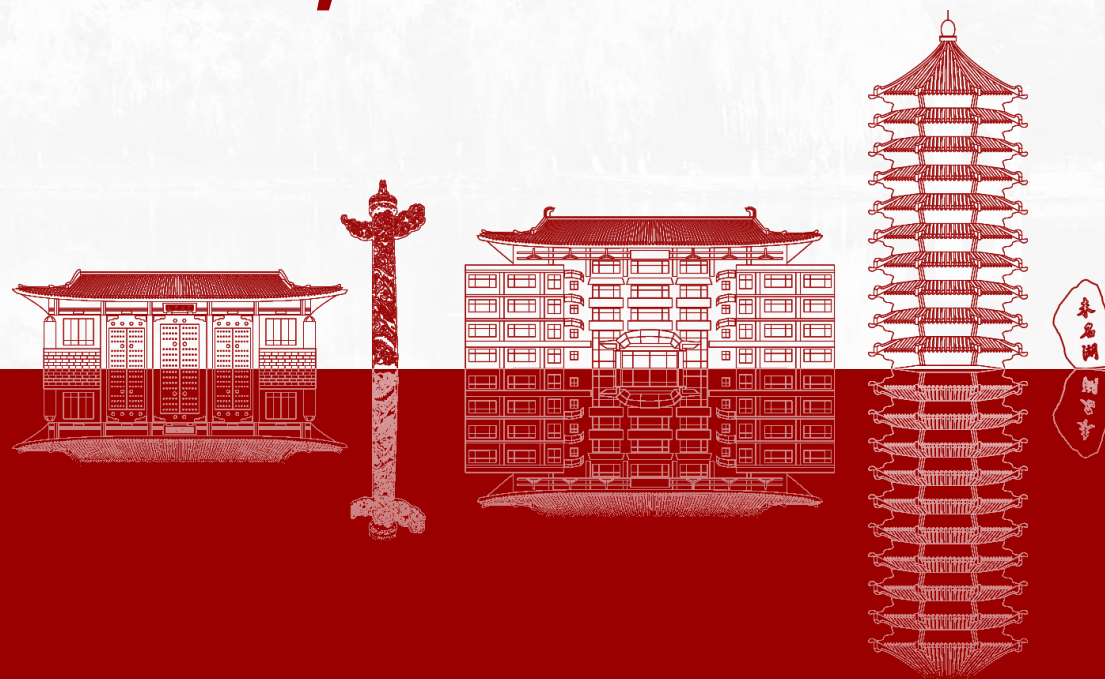




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Maternal Inequalities, GDM and preterm birth



Background | Definition, prevalence, and risk of **GDM** |

GDM

carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or first recognition during pregnancy

Gestational
Diabetes Mellitus
GDM

Worldwide



China

2018 Meta-analysis 14.8%



Caesarean section, Preterm birth, Macrosomia, Diabetes, Cardiovascular disease



Obesity, Diabetes, Cardiovascular disease, Mental disease

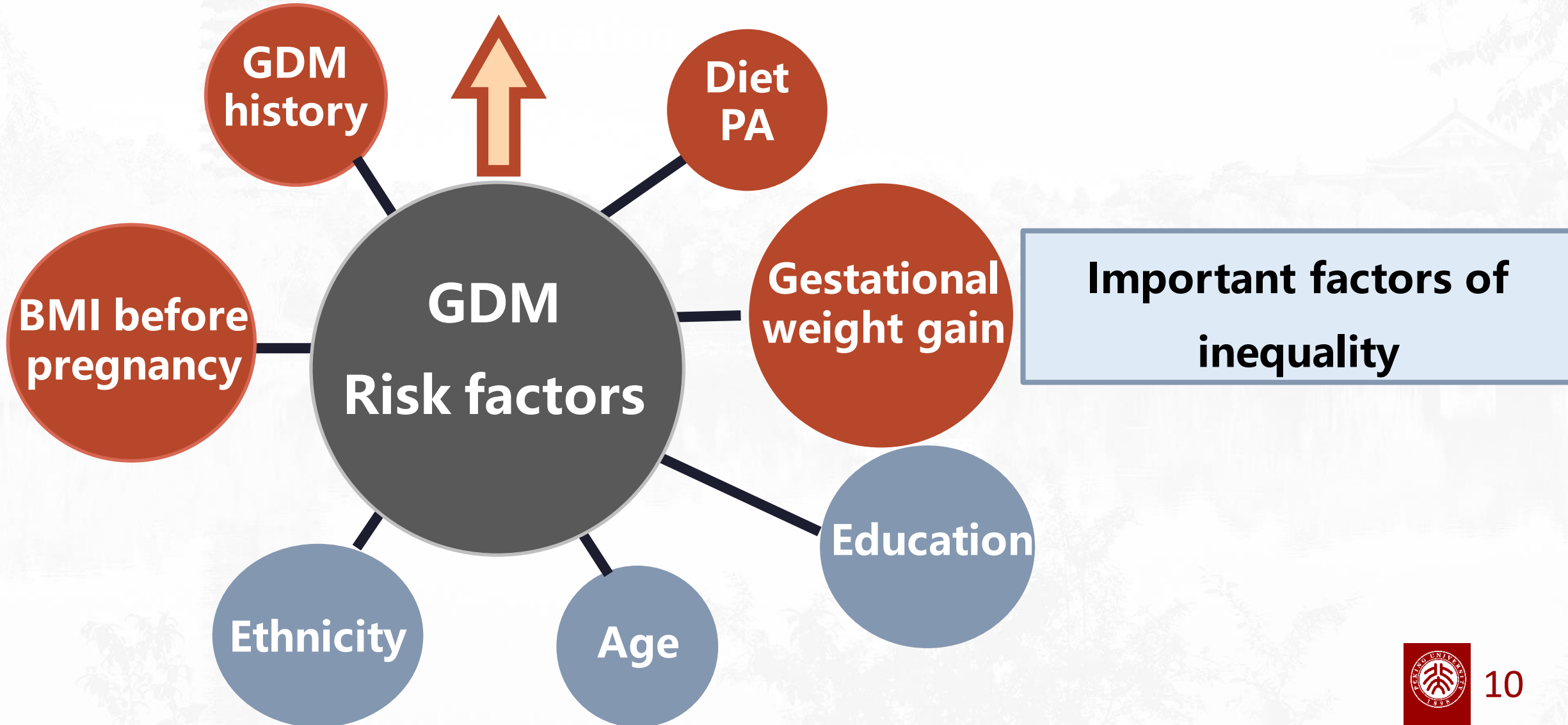
Background |Pathogenetic mechanisms, Risk factors|

Insulin resistance and/or insufficient insulin secretion

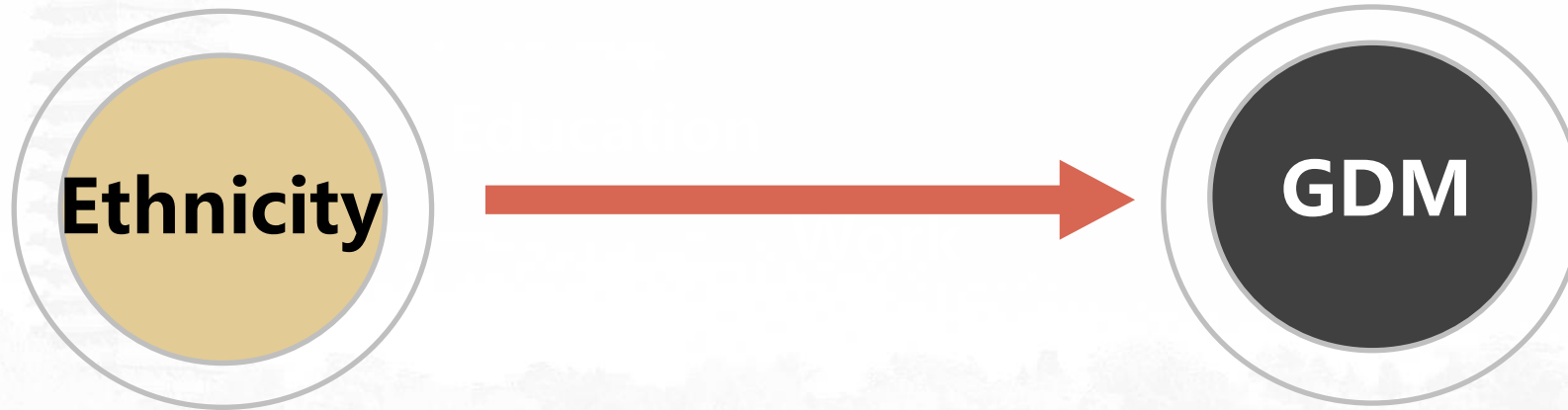


Background | Pathogenetic mechanisms, Risk factors |

Insulin resistance and/or insufficient insulin secretion

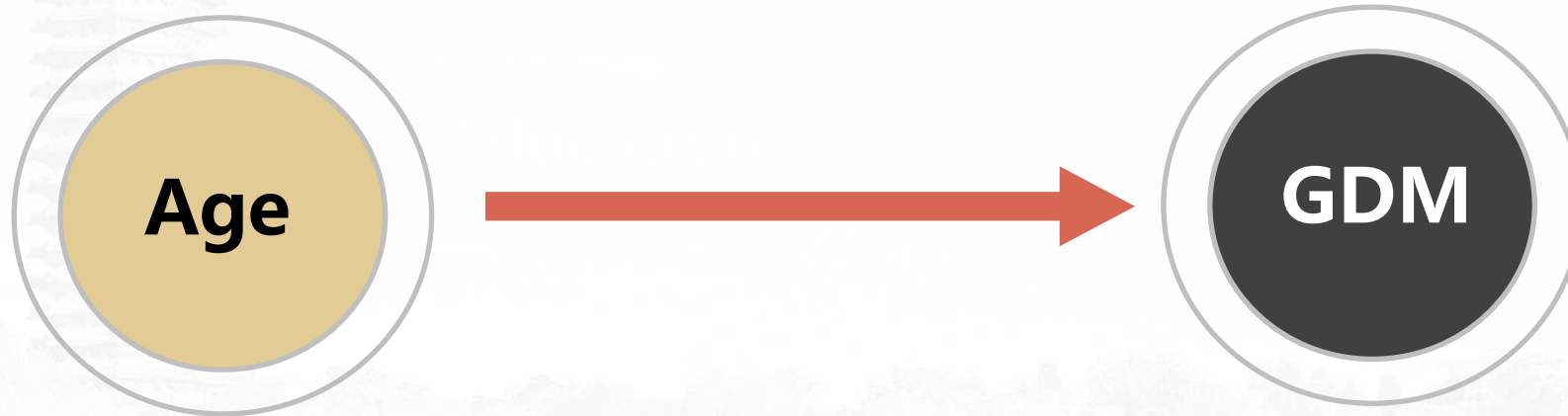


Background |Ethnicity and GDM|



- **South, South-East and East Asian, Middle-Eastern, South European and Australian-born backgrounds → GDM ↑**
- **However, limited studies on the association of ethnicity (Han vs Minority) and GDM in China had inconsistent results**

Background |Age and GDM|



2020 Meta analysis : over 12 millions women

Compared with 20-24 years(ref)

25-29 years:1.69(95%CI:1.49~1.93)

30-34 years:2.73(95% CI: 2.28~3.27)

35-39 years:3.54 (95% CI: 2.88~4.34)

Ethni >40 years: 4.86 (95% CI: 3.78~6.24)

Background |Education and GDM|



2019 Meta analysis : 62,609 women

Highest level vs lowest level:0.68 (95% CI: 0.57-0.80)

However, significant heterogeneity ($I^2=92.8\%$)

Background |GDM and Preterm birth|



46,230 women in Northern California

GDM was associated with higher risk of preterm :1.42(95%CI: 1.15-1.77)

Background |Limitations of previous studies|

There was no study on the mediation effect of GDM on the association of inequality and preterm birth.

A better understanding of the relation between inequality and preterm birth and its underlying pathways may provide novel opportunities to prevent preterm birth and its adverse health outcomes in later life.

Objectives

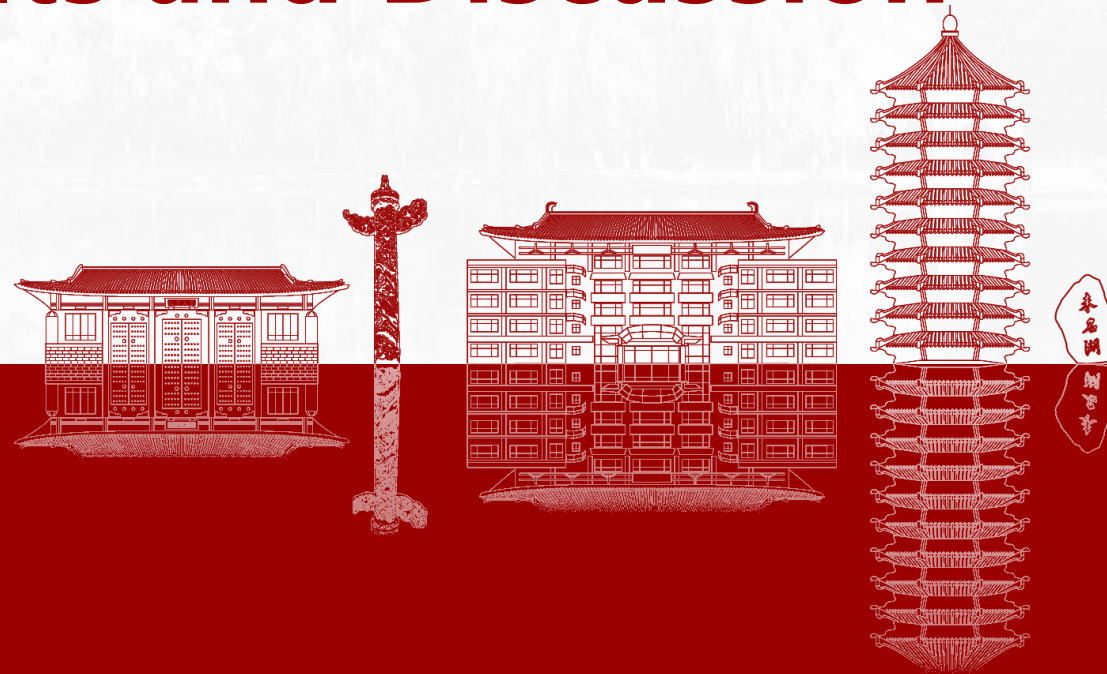
- 1. To investigate the association of inequality (education, age, ethnicity) and GDM.**
- 2. To investigate the association between GDM and preterm birth.**
- 3. To evaluate the mediation effect of GDM on the association between inequality and preterm birth.**



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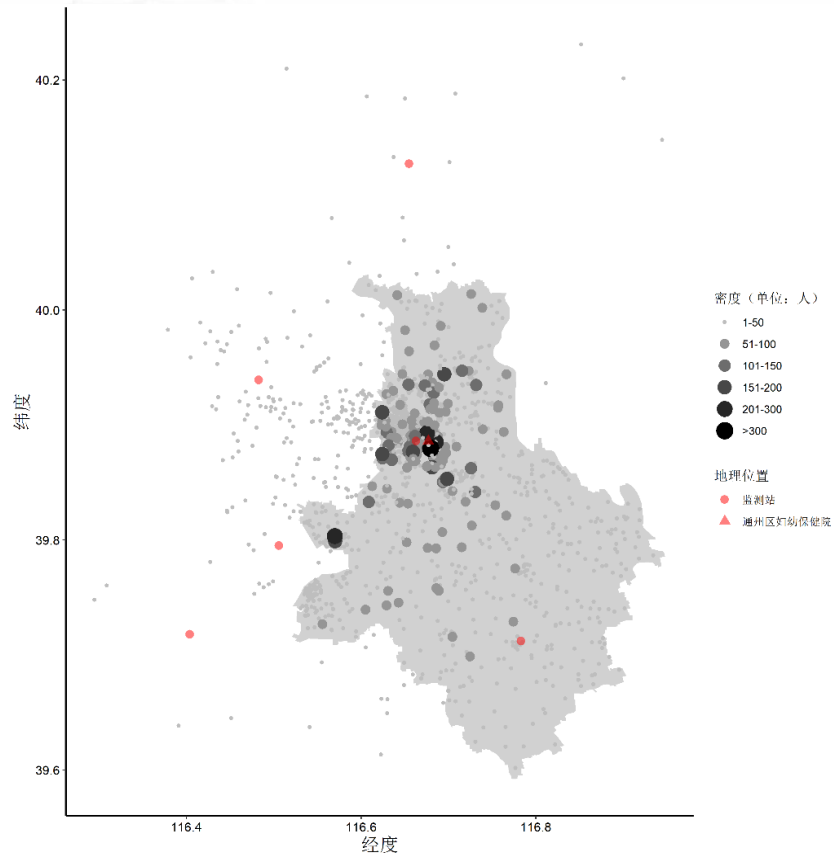
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Methods, Results and Discussion



Methods

Peking University Birth Cohort in Tongzhou (PKUBC-T)



Tongzhou, Beijing

Methods

Peking University Birth Cohort in Tongzhou (PKUBC-T)

Inclusion and exclusion criteria

First trimester

Second trimester

Third trimester

Delivery

Childhood birth to 6 years

- Informed consent and perinatal profile
- First prenatal examination
- Questionnaire (Early pregnancy)
- Venous blood collection (Early pregnancy)

- Prenatal examination
- Questionnaire (Middle and late pregnancy)
- Venous blood collection (Middle and late pregnancy)

- Birth information
- Sample collection
 - Umbilical cord blood
 - Placenta
 - Umbilical cord tissue

- Physical examination @
 - 42 d
 - 3 mo, 6 mo, 8 mo, 12 mo, 18 mo
 - 2 y, 2.5 y, 3 y
- Questionnaire (42 d after birth)

Methods |Study participants|

PKUBC-T

Inclusion criteria (5426)

- ① Gestational week $\leq 13^{+6}$
- ② Aged 18~49 years
- ③ Plan to have childbirth in Tongzhou Maternal and Child Health Hospital
- ④ Agree to provide blood samples in routine examinations during pregnancy

Exclusion criteria (2399)

- ① History of diabetes, hypertension, kidney diseases, heart diseases, chronic hepatitis or tuberculosis
- ② Without OGTT between 24 and 28 weeks
- ③ No response during follow-up
- ④ Multiple pregnancies
- ⑤ Abortion, labor induction and pregnancy termination
- ⑥ Birth defect or death

Finally, 3027 participants were included in the analysis

Methods |Data collection|

At the first prenatal visit (7–13 gestational weeks)

Questionnaires:

Demographic data, socioeconomic information, pregnancy history, GDM history, diet, and physical activity

At 25–28 gestational weeks

Biological sample collection:

Venous blood samples, **OGTT**

At delivery

Medical record:

Information of gestational age

Methods | Outcome Assessment|

Preterm Birth:

defined as birth before gestational week 37



Methods | Exposure Assessment|

Maternal Inequalities	
Maternal age	Maternal age ≤ 35 (ref) Maternal age > 35
Education	University or above (ref) Junior college or below
Ethnicity	Han (ref) Minority

Methods | Exposure Assessment|

GDM	
Fasting glucose value	≥ 5.1 mmol/L
1-hour postglucose	≥ 10.0 mmol/L
2-hour postglucose	≥ 8.5 mmol/L

Methods | Covariate Assessment|

Covariate	
Parity	Primipara Multipara
Employment	No Yes
Total caloric intake	discontinuous 2-day 24-hour dietary recall(kcal/d)
Physical activity	PA in the past week: International Physical Activity Questionnaire (IPAQ) short form, low middle high
Smoking	Smoke in the past three months No Yes
Drinking	Drink in the past three months No Yes
GDM history	No Yes

Methods | Statistical analyses|

Descriptive analysis: t-test or χ^2 test

Women with GDM vs Women without GDM

Association analysis: Modified Poisson/Linear Regression Models

The association between Inequality (ethnicity, education, and advanced maternal age) and GDM, GDM and preterm birth or GA

Mediation analysis: Mediation package in R

Mediation effect of GDM on the association of Inequality and preterm birth or GA

Results | Descriptive analysis|

	Women without GDM (n=2608)	Women with GDM (n=905)	<i>P</i> -value
Maternal age (years)	28.6 (3.7)	29.9 (3.8)	<0.001
GDM history			
Yes	7.2%	1.1%	<0.001
No	92.8%	98.9%	
Preterm birth			
Yes	107 (4.1%)	54 (6.0%)	0.021
No	2501 (95.9%)	851 (94.0%)	
Gestational age (days)	276.4 (10.0)	274.3 (10.7)	<0.001

Results | Ethnicity and GDM |

Ethnicity	RR (95% CI)*	<i>P</i> -value
Han	Ref	
Minority	0.972 (0.927, 1.019)	0.241

*Adjusted for parity, employment, maternal age, education, diet, PA, smoking, drinking, GDM history, and gender of children.

Results and Discussion | Education and GDM |

Education	RR (95% CI)*	P -value
University or above	Ref	
Junior college or below	1.039 (1.008, 1.071)	0.008

**Consistent with the Meta-analysis in 2019:
Highest vs lowest education
0.68 (95%CI: 0.57-0.80)**

*Adjusted for parity, employment, maternal age, ethnicity, education, diet, PA, smoking, drinking, GDM history, and gender of children.

Results and Discussion | Maternal age and GDM |

Maternal age	RR (95% CI)	<i>P</i> -value
≤35 years	Ref	
>35 years	1.211 (1.141, 1.288)	<0.001

Consistent with the Meta analysis in 2020:

Compared with 20-24 years(ref)

25-29 years:1.69 (95%CI:1.49~1.93)

30-34 years:2.73(95% CI: 2.28~3.27)

35-39 years:3.54 (95% CI: 2.88~4.34)

>40 years: 4.86 (95% CI: 3.78~6.24)

*Adjusted for parity, employment, education, ethnicity, diet, PA, smoking, drinking, GDM history and gender of children.

Results and Discussion | GDM and Preterm Birth |

GDM	RR (95% CI)	<i>P</i> -value
No	Ref	
Yes	1.373 (0.978, 1.927)	0.067

Directionally consistent with the study in Northern California (RR=1.42, 95%CI: 1.15-1.77)

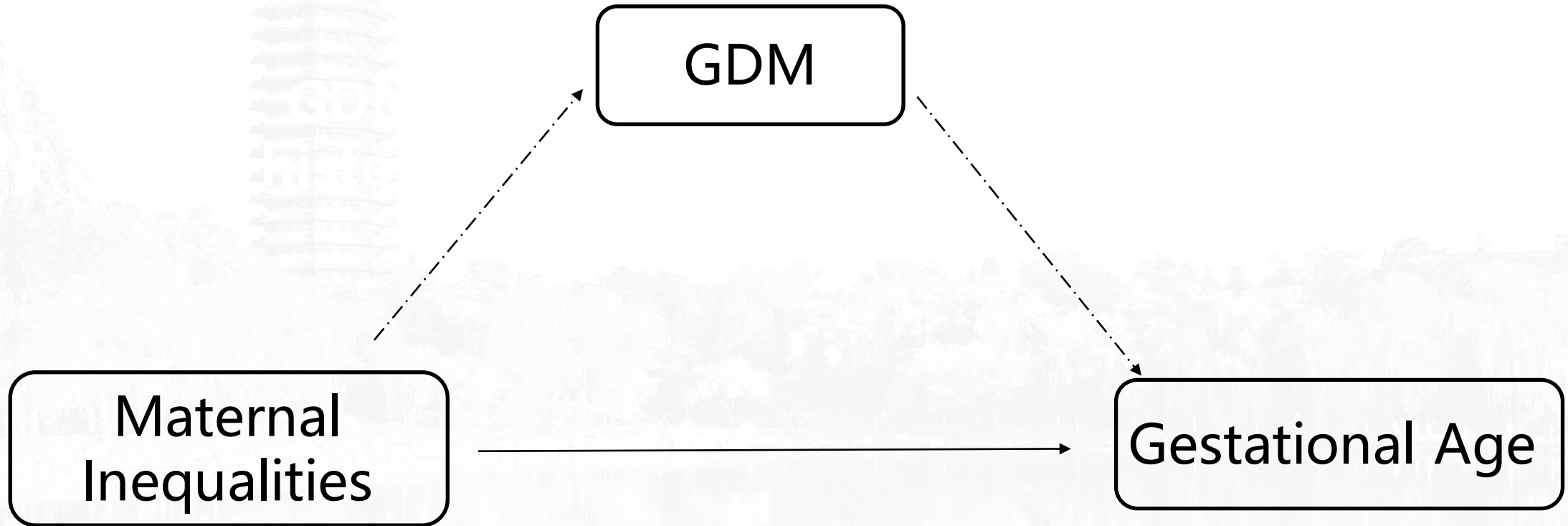
*Adjusted for parity, maternal age, employment, education, ethnicity, diet, PA, smoking, drinking, GDM history and gender of children..

Results | GDM and Gestational Age |

GDM	Estimates (95% CI)	<i>P</i> -value
No	Ref	
Yes	-1.792 (-2.566, -1.018)	<0.001

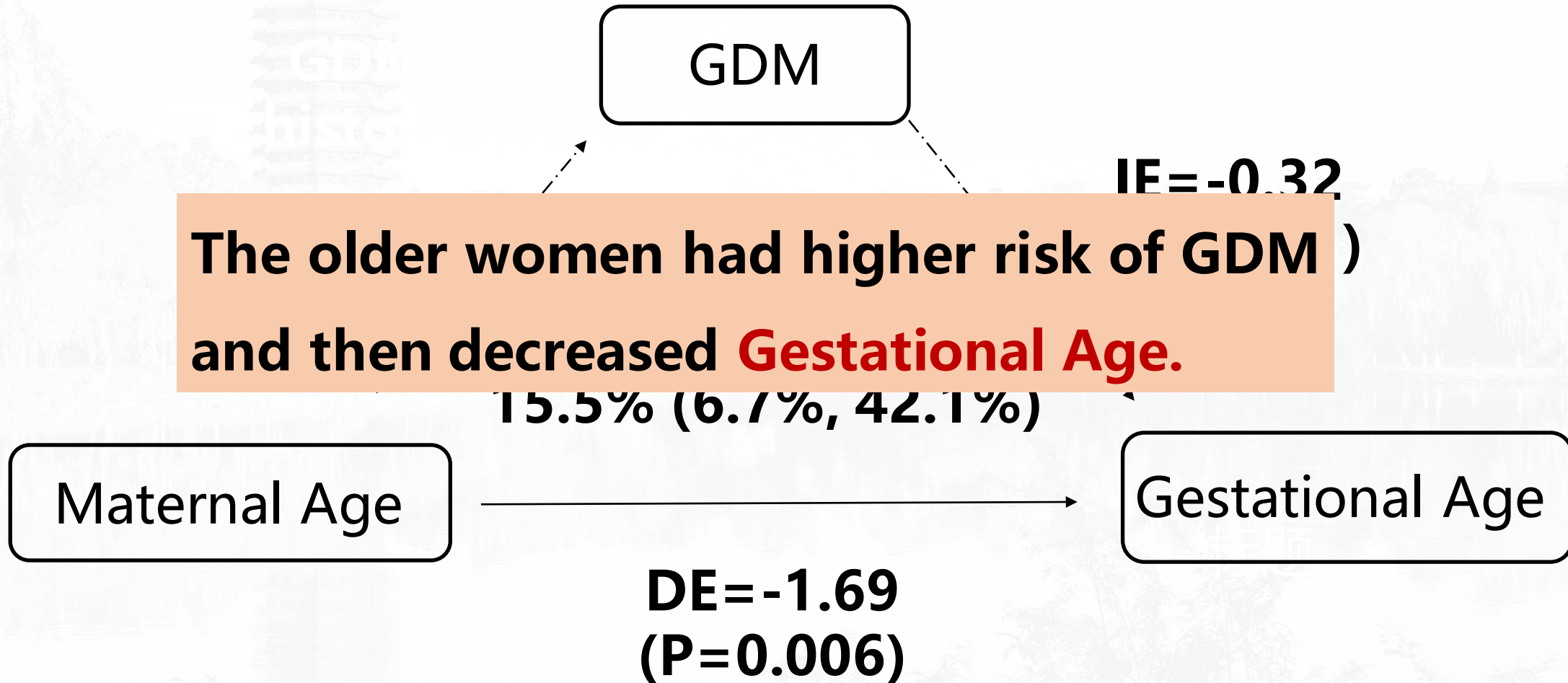
*Adjusted for parity, maternal age, employment, education, ethnicity, diet, PA, smoking, drinking, GDM history and gender of children..

Results | Mediation effect of GDM



We further evaluated the mediation effect of GDM on the association of Maternal Inequalities and **Gestational Age** (instead of preterm birth).

Results | Mediation effect of GDM



Discussion

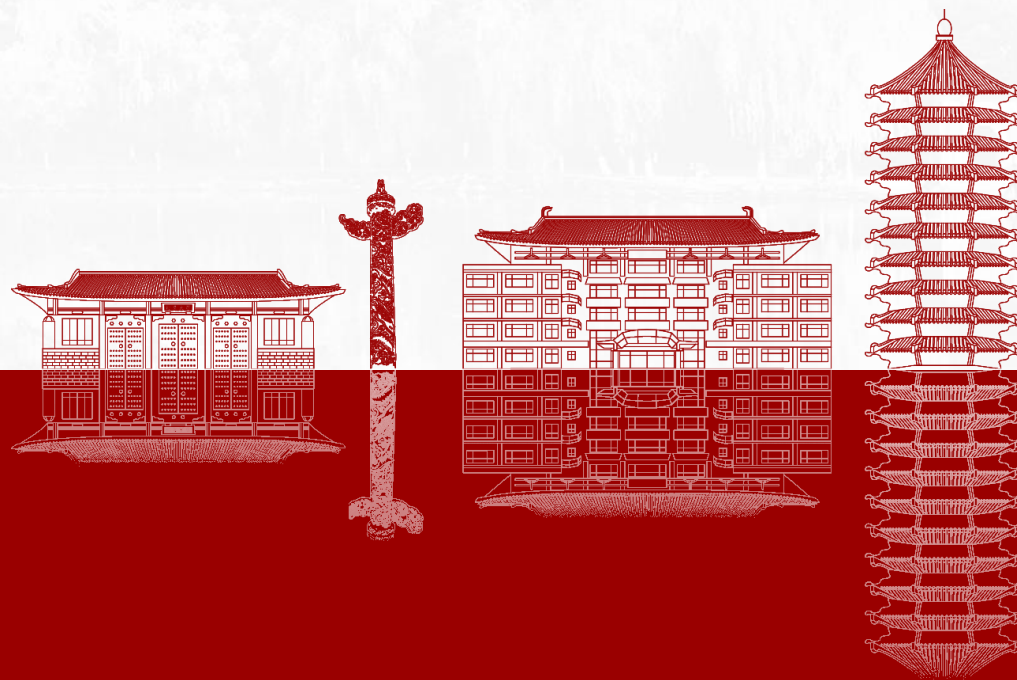
- **Lower education level, older maternal age was associated with higher risk of GDM.**
- **GDM was associated with decreased gestational age.**
- **GDM could partly mediate the association between maternal age and gestational age.**



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Conclusion



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朗潤亭

Conclusion

- **This is the first prospective birth cohort in China to investigate the association of maternal inequality, GDM and preterm birth.**
- **Maternal Inequalities could influence the association of pregnancy exposure (GDM) and child health (decreased gestational age).**

Acknowledgement

- **the colleagues and graduate students in the Department of Maternal and Child Health, School of Public Health, Peking University**
- **the support of Tongzhou Maternal and Child Health Hospital, Beijing**
- **all the pregnant women and children in the study.**

Thanks!

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