



Better Outcomes Registry & Network
Registre et Réseau des Bons Résultats dès la naissance



Obstetrics & Maternal
Newborn Investigations

Racial/ethnic variations in pre-pregnancy obesity and excessive gestational weight gain and their impact on fetal overgrowth in Ontario

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Background

- In Ontario, pre-pregnancy obesity and excessive gestational weight gain (GWG) were reported as 18% and 50%, respectively in 2013-2014.
- Pre-pregnancy obesity and excessive GWG are independently associated with delivering a large-for-gestational-age (LGA) neonate.
- LGA is associated with an increased risk of stillbirth, fetal hypoxia, shoulder dystocia, perineal lacerations, metabolic disturbances at birth, cesarean section and postpartum hemorrhage.

Background/Rational

- In 2016 Census data, visible minorities account for 22.3% of the total Canadian population and comprise 29.3% of Ontario's total population.
- The two largest visible minority groups are Asian and Black, with the total population exceeding three million in Canada.
- Racial/ethnic differences in pre-pregnancy obesity and excessive GWG and their impact on birth outcomes remain poorly understood in Canada.

Objectives

- To examine the racial/ethnic differences in pre-pregnancy obesity and excessive GWG in Ontario;
- To investigate the prevalence of LGA neonates among White, Asian, and Black women in Ontario;
- To investigate the role of pre-pregnancy obesity and excessive GWG on LGA by race/ethnicity.

Methods

- **Study design**

Population-based retrospective cohort study

- **Data sources**

- Better Outcomes Registry & Network (BORN) Ontario

- Maternal demographics, clinical information related to pregnancy, labor, birth and fetal and neonatal outcomes

- 2011 Canadian Census data

Methods

- **Study population**

All women who had prenatal screening and had a singleton birth in a Ontario hospital (fiscal year 2016-2017)

- **Study groups**

White, Asian, Black pregnant women

- **Outcome**

Neonatal LGA: birth weight $\geq 90^{\text{th}}$ percentile according to sex-specific Canadian birth weight reference for singleton.

- **Exposure variables**

Pre-pregnancy body mass index (BMI) and total GWG

Methods

Table 1. Pre-pregnancy BMI categories and recommended GWG

Pre-pregnancy weight categories	Pre-pregnancy BMI (kg/m ²)	Institute of Medicine (IOM) recommended total weight gain range (kg)*
Underweight	<18.5	12.5-18.0
Normal weight	18.5-24.9	11.5-16
Overweight	25.0-29.9	7-11.5
Obese	≥30.0	5-9

Body mass index (BMI)=weight (kg)/ [height(m)]²

** Recommendations for total GWG apply to women delivering singleton infants at term*

Methods

Table 2. GWG categories by pre-pregnancy weight

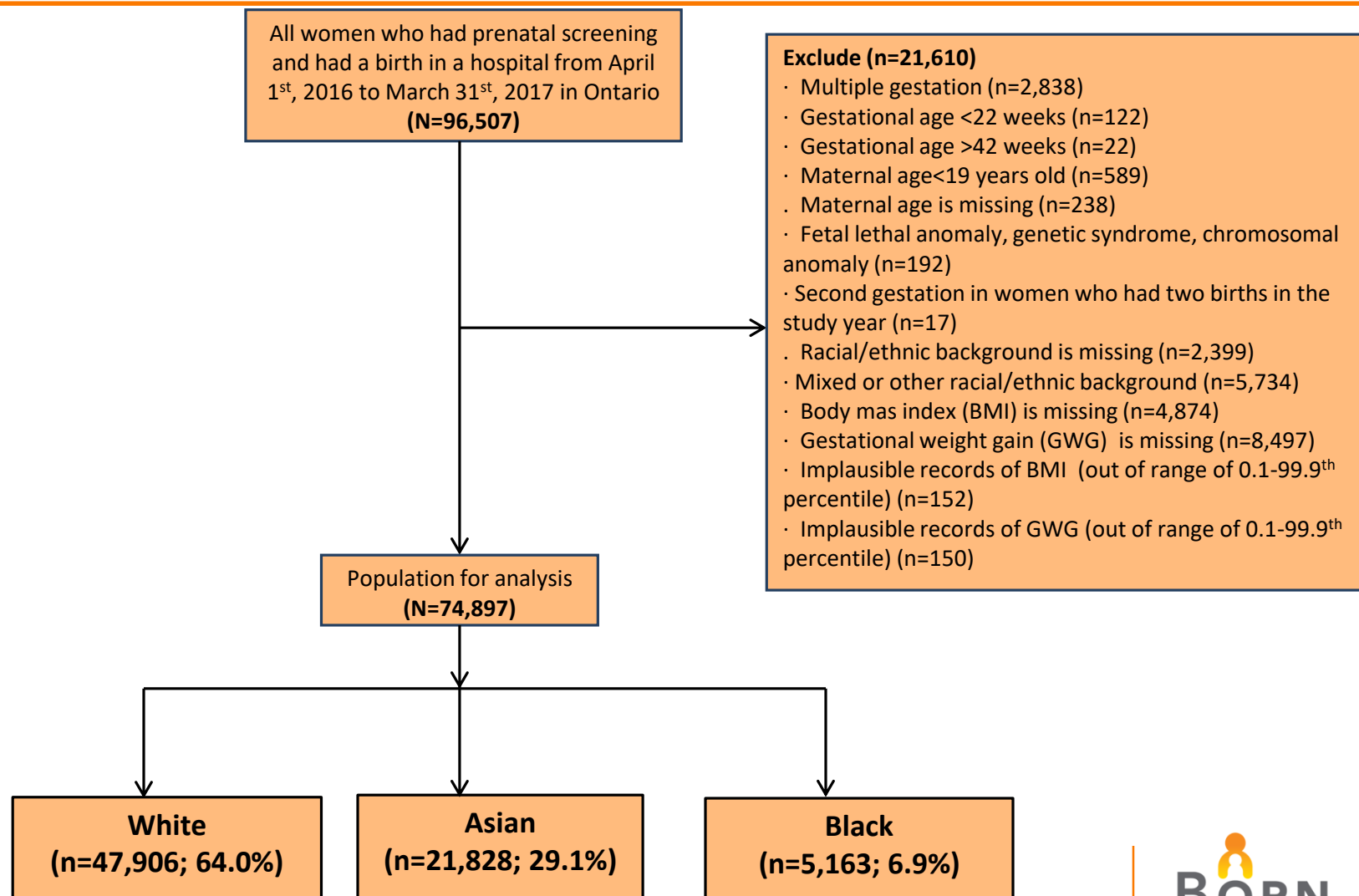
GWG categories	Total GWG (kg)			
	Underweight	Normal weight	Overweight	Obese
Inadequate GWG	<12.5	<11.5	<7	<5
Recommended GWG	12.5-18	11.5-16	7-11.5	5-9.0
Excessive GWG	>18	>16	>11.5	>9

2009 Institute of Medicine (IOM) recommendations, which were adopted by Health Canada in 2010

Statistical analysis

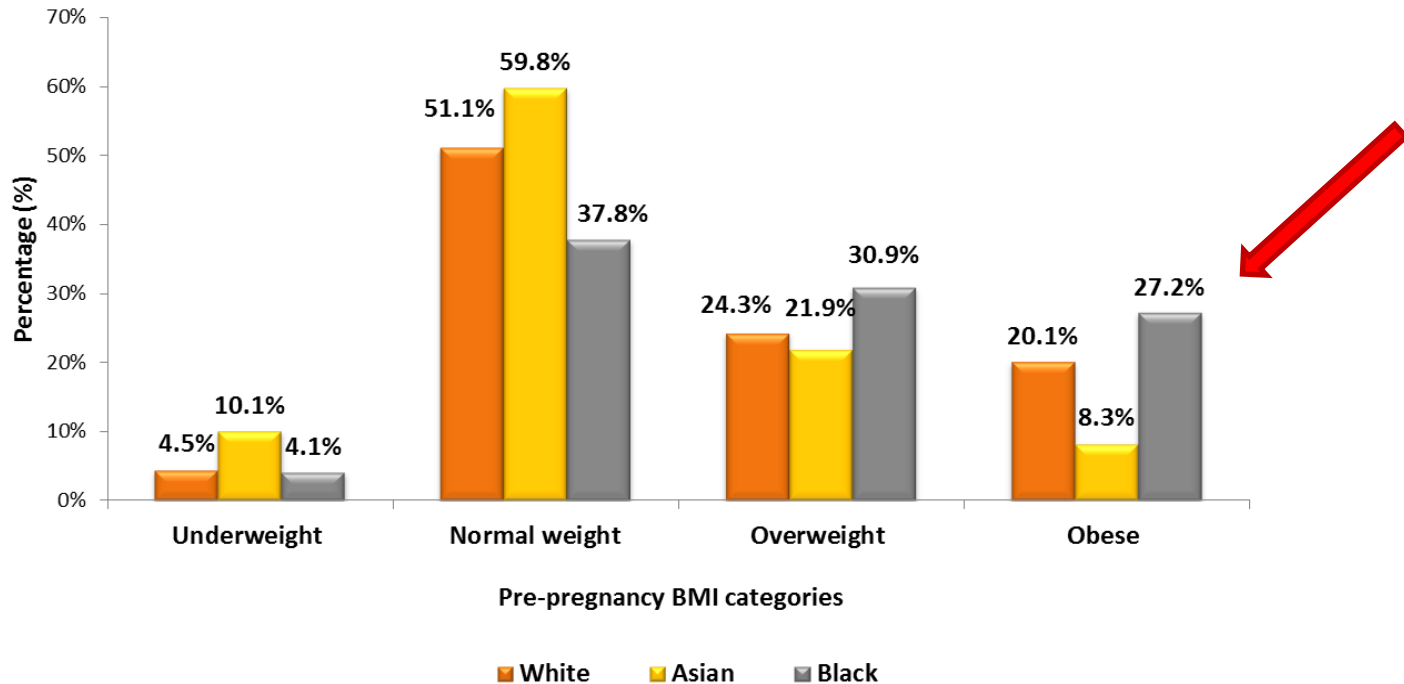
- Multinomial logistic regression model was conducted to estimate adjusted relative risks (ARR) in racial/ethnic differences in excessive GWG.
- Multivariable log-binomial regression models were used to estimate ARR for the association between BMI and GWG with LGA.
- The population attributable fractions (PAFs) were calculated to estimate the percentage of LGA cases attributable to obesity and excessive GWG.

Study population flow chart



Results

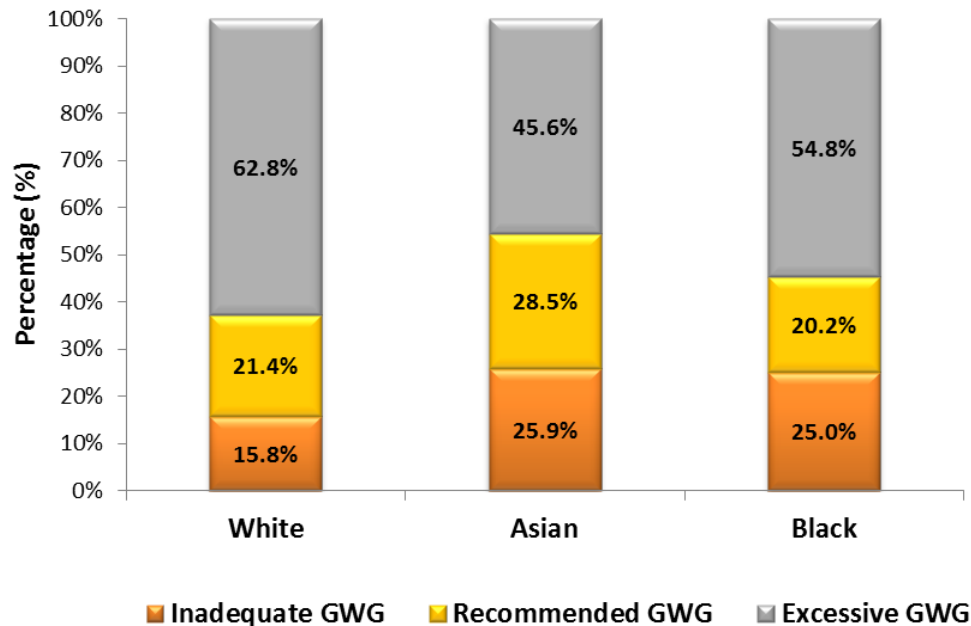
Figure 1. Prevalence of pre-pregnancy obesity among pregnant women by race/ethnicity in Ontario, 2016-2017



Data source: BORN Ontario, fiscal year 2016-2017

Results

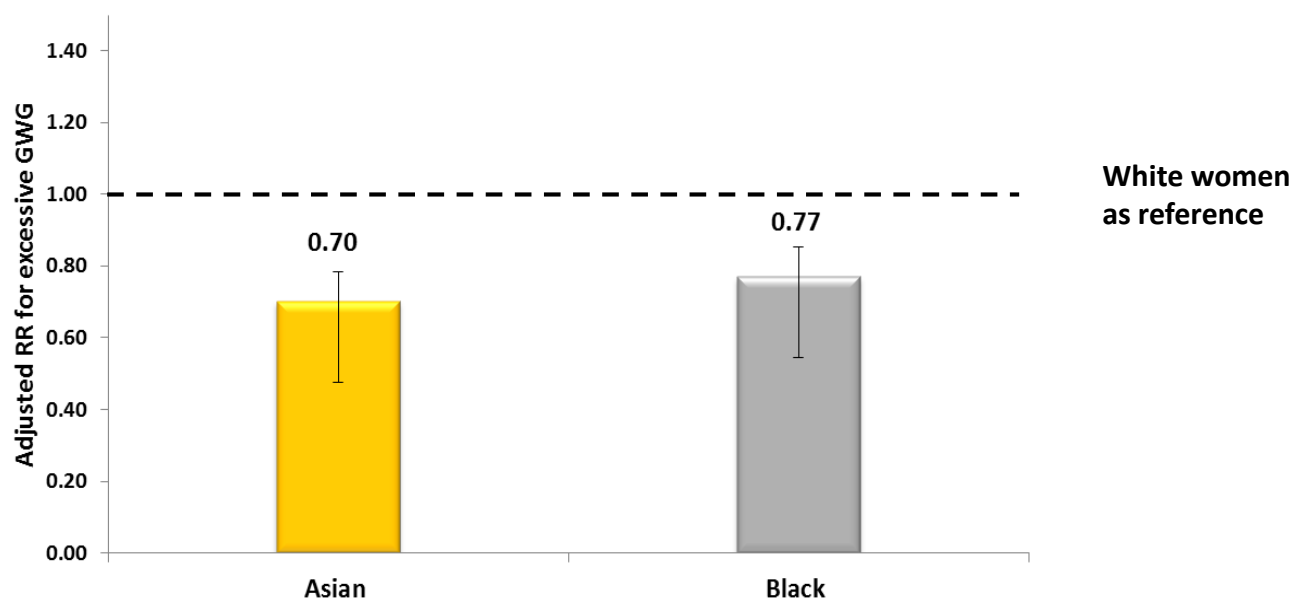
Figure 2. Distribution of gestational weight gain (GWG) among pregnant women by race/ethnicity in Ontario, 2016-2017



Data source: BORN Ontario, fiscal year 2016-2017

Results

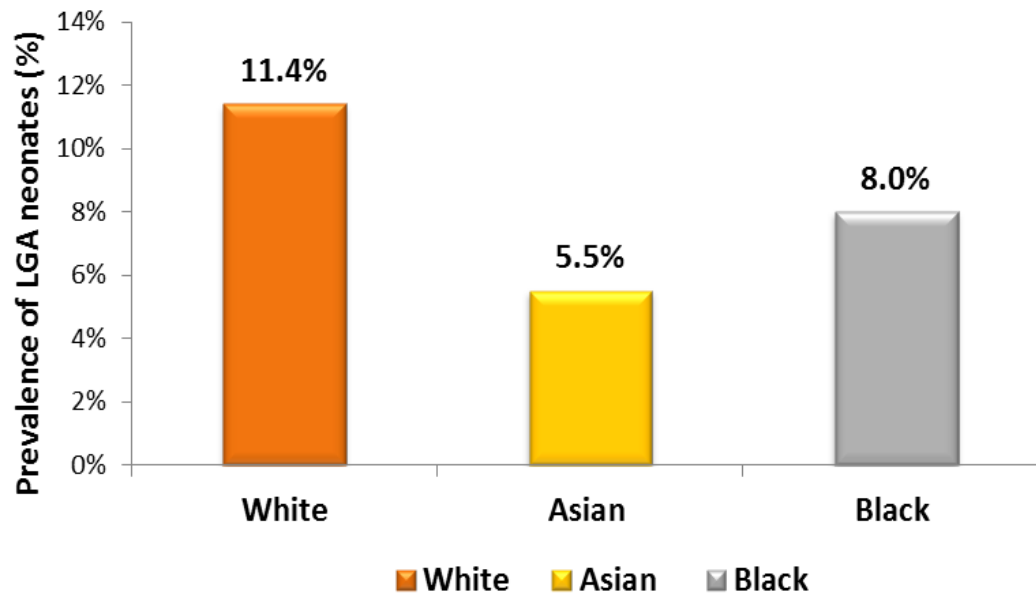
Figure 3. Adjusted relative risk (RR) for racial/ethnic differences in risk of excessive GWG among pregnant women in Ontario, 2016-2017



- White women as reference
- Multinomial logistic regression models and NLEstimate macro were used to estimate the relative risk.
- Models adjusted for maternal age, parity, maternal neighbourhood household median income level, neighbourhood education level, smoking during pregnancy, maternal pre-existing health problem, pregnancy complications, gestational age, infant sex and birth weight.
- Multiple imputation methods were used to impute missing values of covariates.

Results

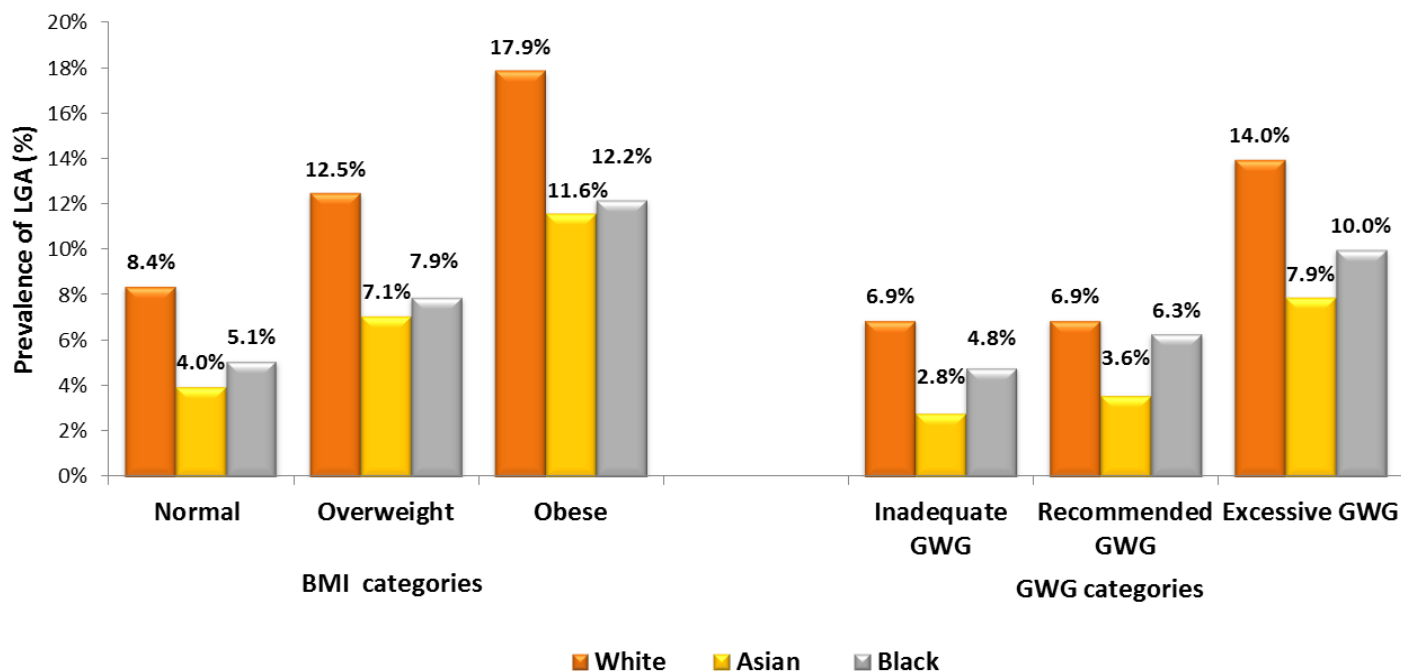
Figure 4. Prevalence of LGA neonates among pregnant women by race/ethnicity in Ontario, 2016-2017



Data source: BORN Ontario, fiscal year 2016-2017

Results

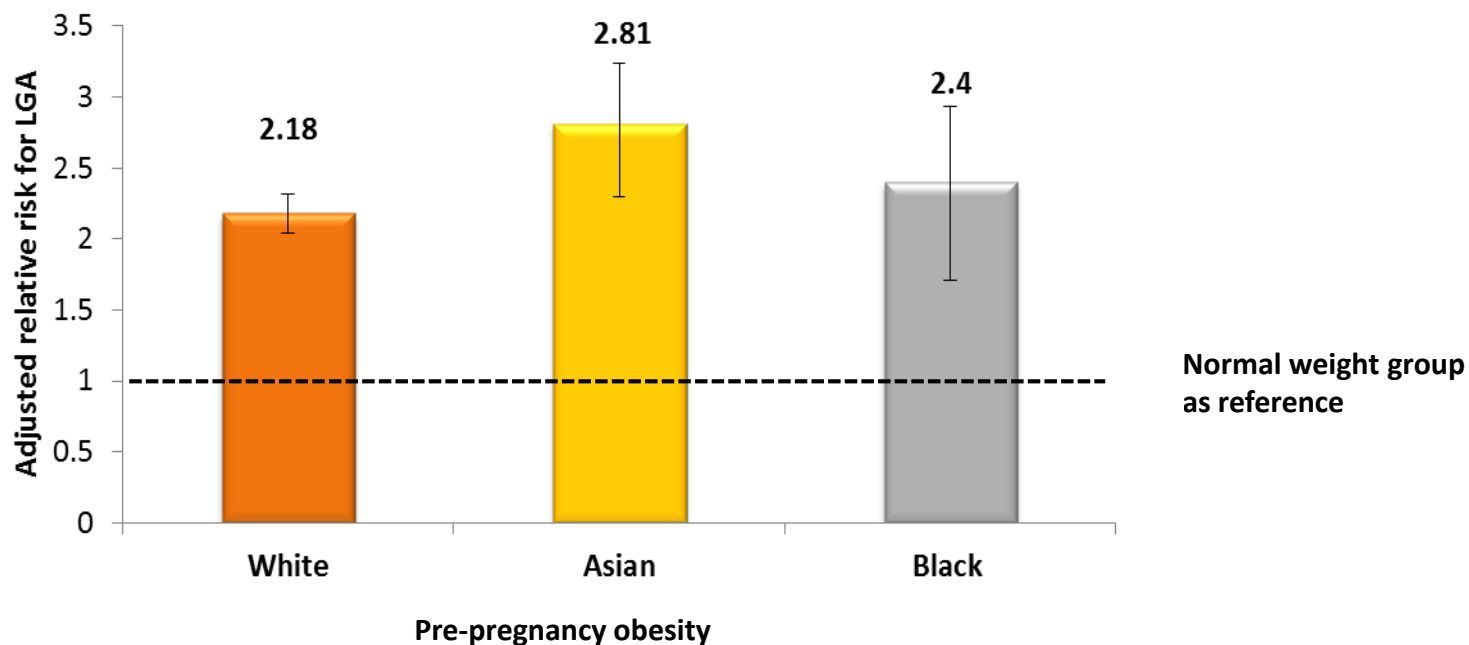
Figure 5. Prevalence of LGA neonates by pre-pregnancy BMI and GWG by race/ethnicity in Ontario, 2016-2017



Data source: BORN Ontario, fiscal year 2016-2017

Results

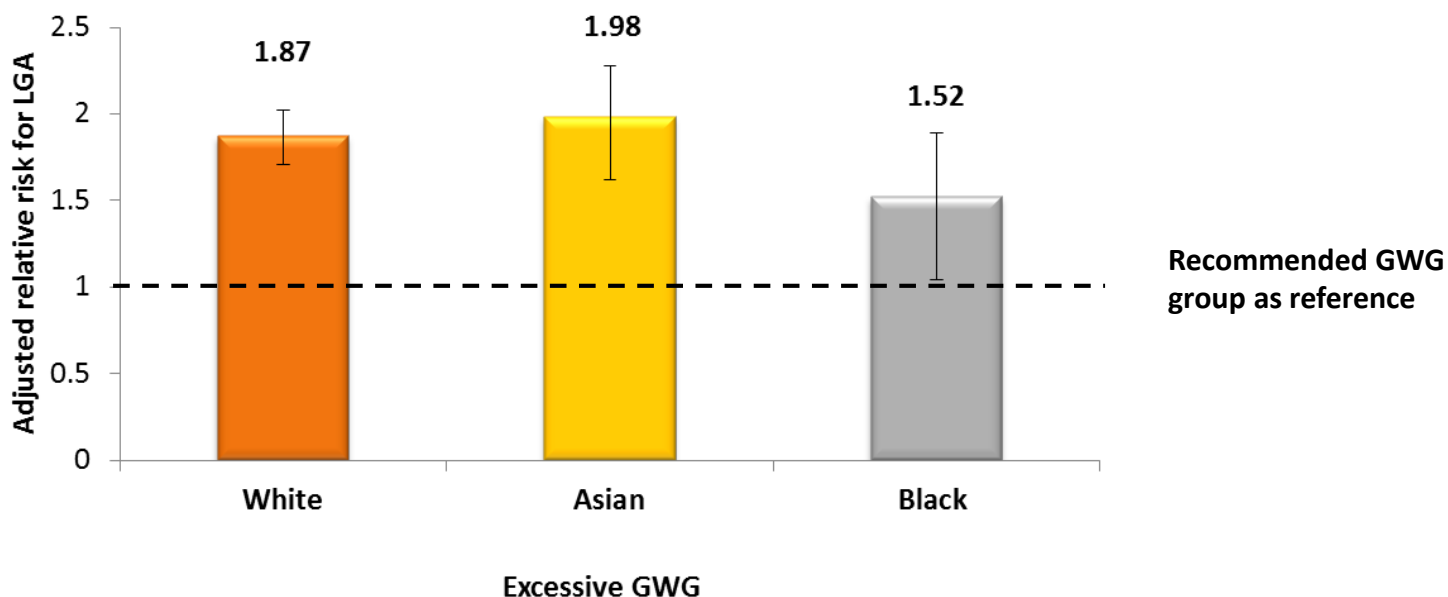
Figure 6. Adjusted risk ratio (RR) for LGA due to pre-pregnancy obesity by race/ethnicity



- Normal weight as reference group
- Multivariable log-binomial regression models were used to estimate the relative risk.
- Models were adjusted for maternal age, parity, maternal neighbourhood household median income level, neighbourhood education level, conception type, smoking during pregnancy and maternal pre-existing health problem.

Results

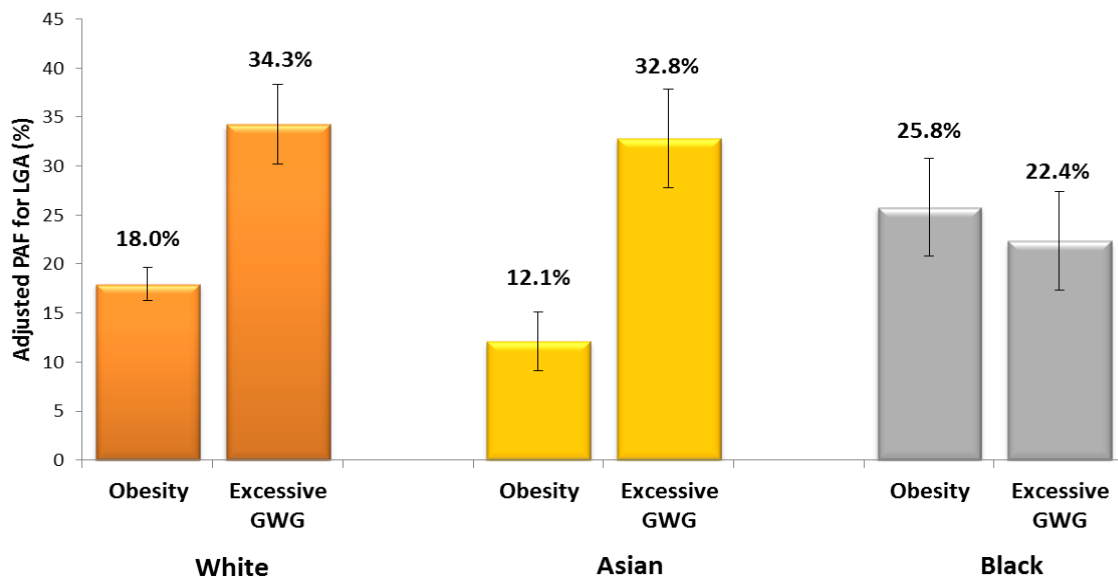
Figure 7. Adjusted risk ratio (RR) for LGA due to excessive GWG by race/ethnicity



- Recommended GWG group as reference
- Multivariable log-binomial regression models were used to estimate the relative risk.
- Models were adjusted for maternal age, parity, maternal neighbourhood household median income level, neighbourhood education level, pre-pregnancy BMI, conception type, smoking during pregnancy and maternal pre-existing health problem. Pre-pregnancy BMI was treated as continuous variable.

Results

Figure 8. Adjusted population attributable fractions (PAFs) for LGA due to pre-pregnancy obesity and excessive GWG by race/ethnicity



- Adjusted PAF calculation was based on adjusted relative risks.
- For BMI as the main exposure, models were adjusted for maternal age, parity, maternal neighbourhood household median income level, neighbourhood education level, conception type, smoking during pregnancy and maternal pre-existing health problem.
- For GWG as the main exposure, models were adjusted for maternal age, parity, maternal neighbourhood household median income level, neighbourhood education level, pre-pregnancy BMI, conception type, smoking during pregnancy and maternal pre-existing health problem. Pre-pregnancy BMI was treated as continuous variable.

Summary

- Black women were more likely to be obese when entering pregnancy, compared to White and Asian women.
- Excessive GWG is an important issue for all racial/ethnic groups. Compared to minority women, White women were more likely to gain excessive weight during pregnancy.
- Both pre-pregnancy obesity and excessive GWG play strong roles in development of LGA, with variations by race/ethnicity.
- The excessive GWG contributes more to LGA than obesity among White and Asian women, while pre-pregnancy obesity and excessive GWG almost equally contribute to LGA among Black women.

Strengths

- This is the first population-based study in Canada that examines racial/ethnic differences in GWG among White, Asian, and Black women.
- This is the first study in Canada that has comprehensively examined the impact of pre-pregnancy obesity and excessive GWG on LGA neonates by race/ethnicity.
- We used one multinomial logistic regression model instead of two separate binary logistic regression models to generate relative risks of excessive GWG among racial/ethnic groups.

Limitations

- We used self-reported data on pre-pregnancy weight and weight at delivery, which may lead to underestimate the prevalence of obesity and excessive GWG.
- Misreporting race/ethnicity may occur.
- We didn't use race-specific fetal growth curve to estimate LGA, which might lead to underestimate LGA, especially in Asian women.
- We were unable to differentiate subgroups of South Asian and East Asian women in BORN.
- Although adjustment was conducted for a range of potential confounders, residual confounding may still exist.

Implications

- Individualized counseling regarding appropriate gestational weight gain is universally recommended.
- Additional consideration of racial/ethnic variations may help to promote healthy gestational weight gain in Canada.
- For prevention of fetal overgrowth, health professionals should consider variations in racial/ethnic groups when they provide consultation for counsel pregnant women.

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Questions?



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