

Mothers at Increased Risk for Gestational Diabetes in Massachusetts



Isabel Cáceres, MMath¹

Emily Lu, MPH²

Wanda Barfield, MD, MPH³

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1. Division of Research and Epidemiology, Bureau of Health Statistics, Massachusetts Department of Public Health.
2. Bureau of Family Health and Nutrition, Massachusetts Department of Public Health
3. Division of Reproductive Health, Centers for Disease Control and Prevention, Atlanta, GA

Background

- Gestational Diabetes Mellitus (GDM) is a global and national public health issue.
- Based on 2005 data, GDM affected 3.8% of all US births¹.
- GDM is associated with increased risk of overt diabetes mellitus (DM) for the mother and her offspring.
 - 35% of Swedish women with GDM, developed chronic diabetes within 15 years²
 - 48% of Latin American women with GDM developed chronic diabetes within 7 years³
 - GDM represents a significant risk factor for future DM development regardless of ethnicity⁴
- Risk of GDM increases with increased maternal weight (meta-analysis of 20 studies)⁵.
- Ethnic disparities in the development of GDM⁶ exist.
- Physical activity (PA) is associated with reduced risk of GDM⁷ in some studies and with no association in others.

Methods

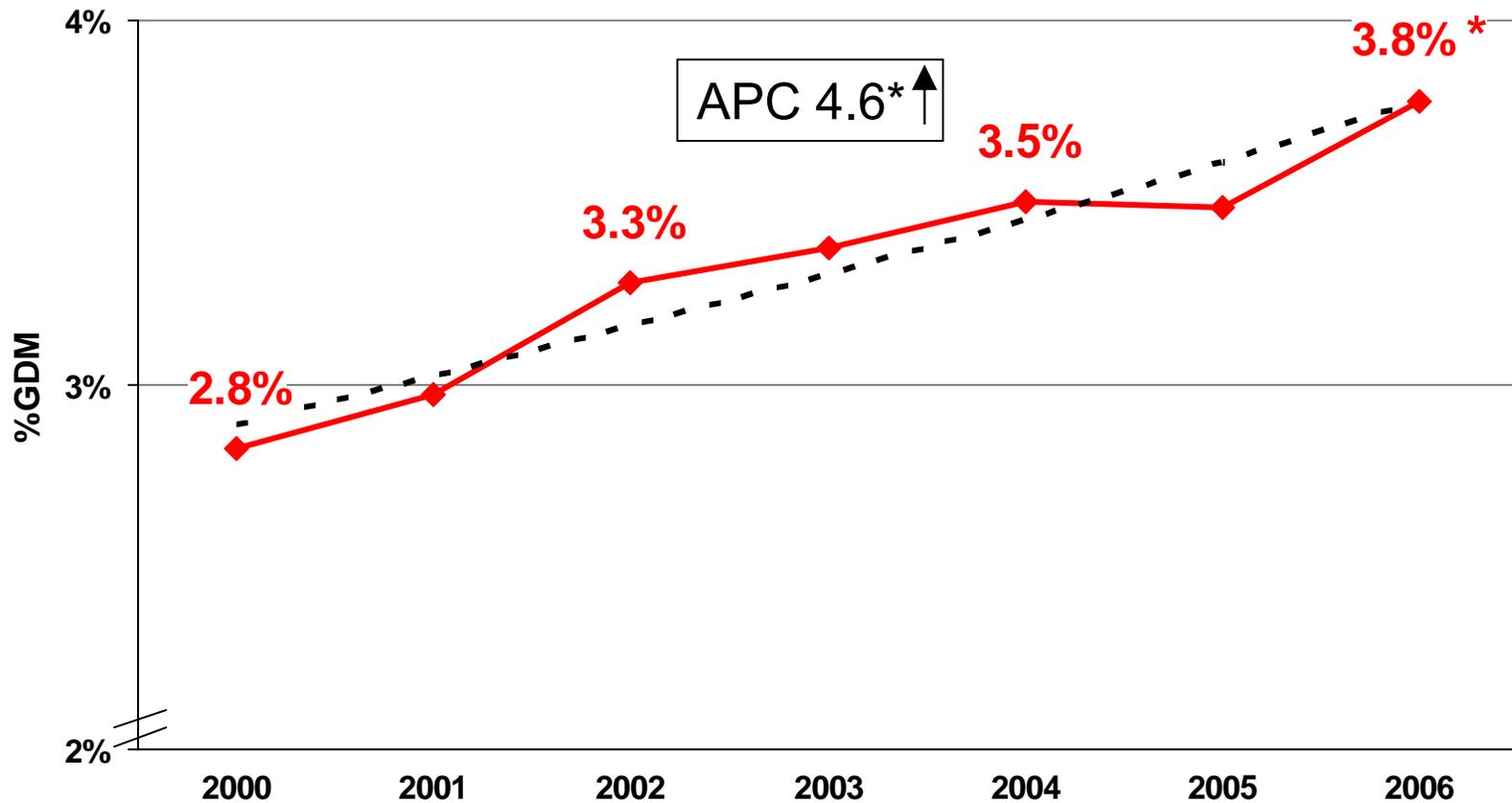
- Massachusetts Trends in GDM

- Analysis
 1. Massachusetts 2004-2005 Birth Cohort, from birth certificates (BC Data 2004-2005)
 - Bi-variate
 - Multivariate Logistic Regression
 2. MA BC-PRAMS pilot survey (BC-PRAMS Pilot)
 - Bi-variate
 - Multivariate Survey Logistic Regression

Trend Results

GDM

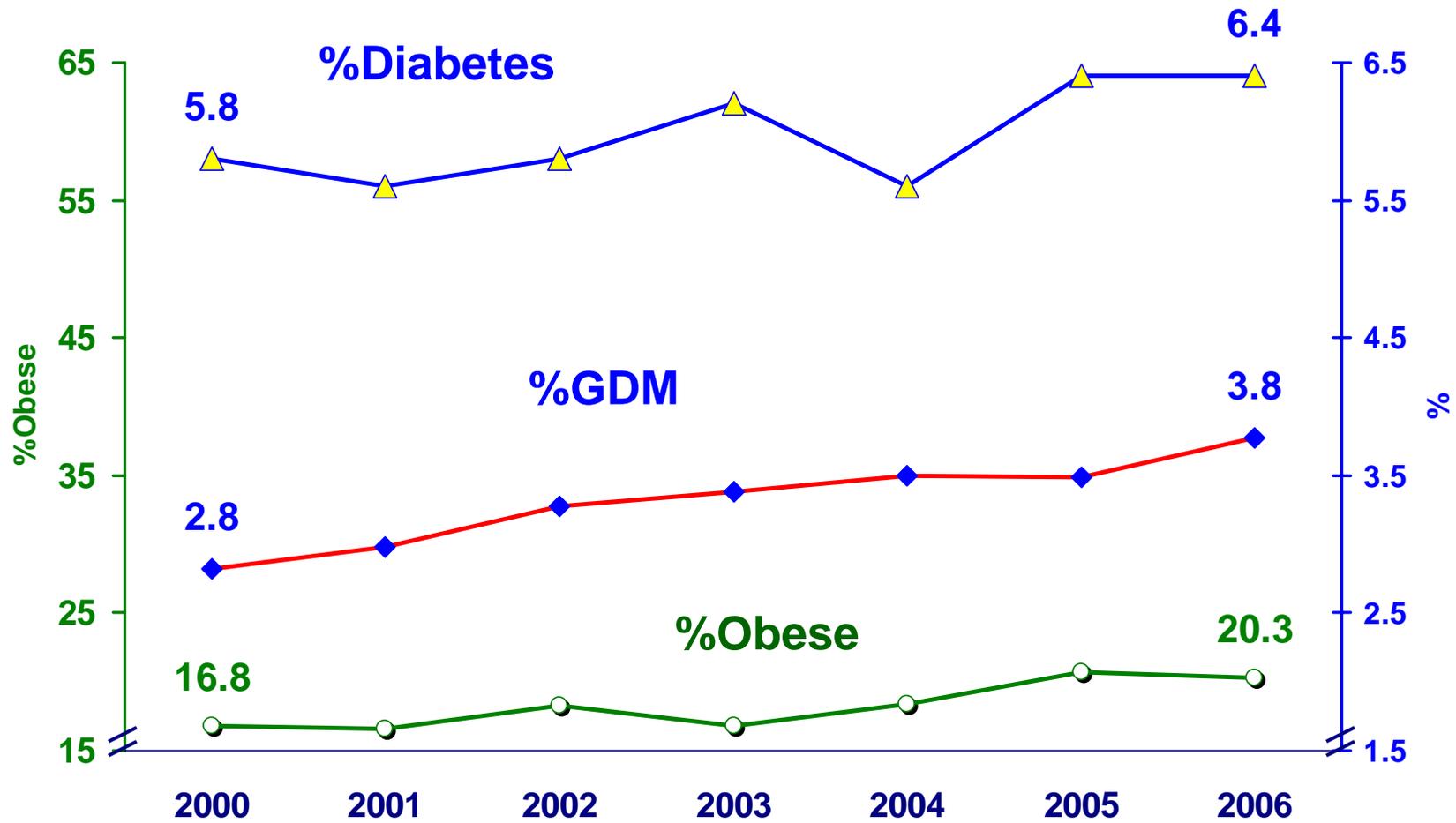
Massachusetts Births 2000-2006¹



* In 2006, %GDM increased by 9% from 2005, and by 36% from 2000 ($p < 0.05$).

1. Massachusetts Births 2006 are preliminary

Trends in Obesity, GDM, and Diabetes Massachusetts: 2000-2006¹

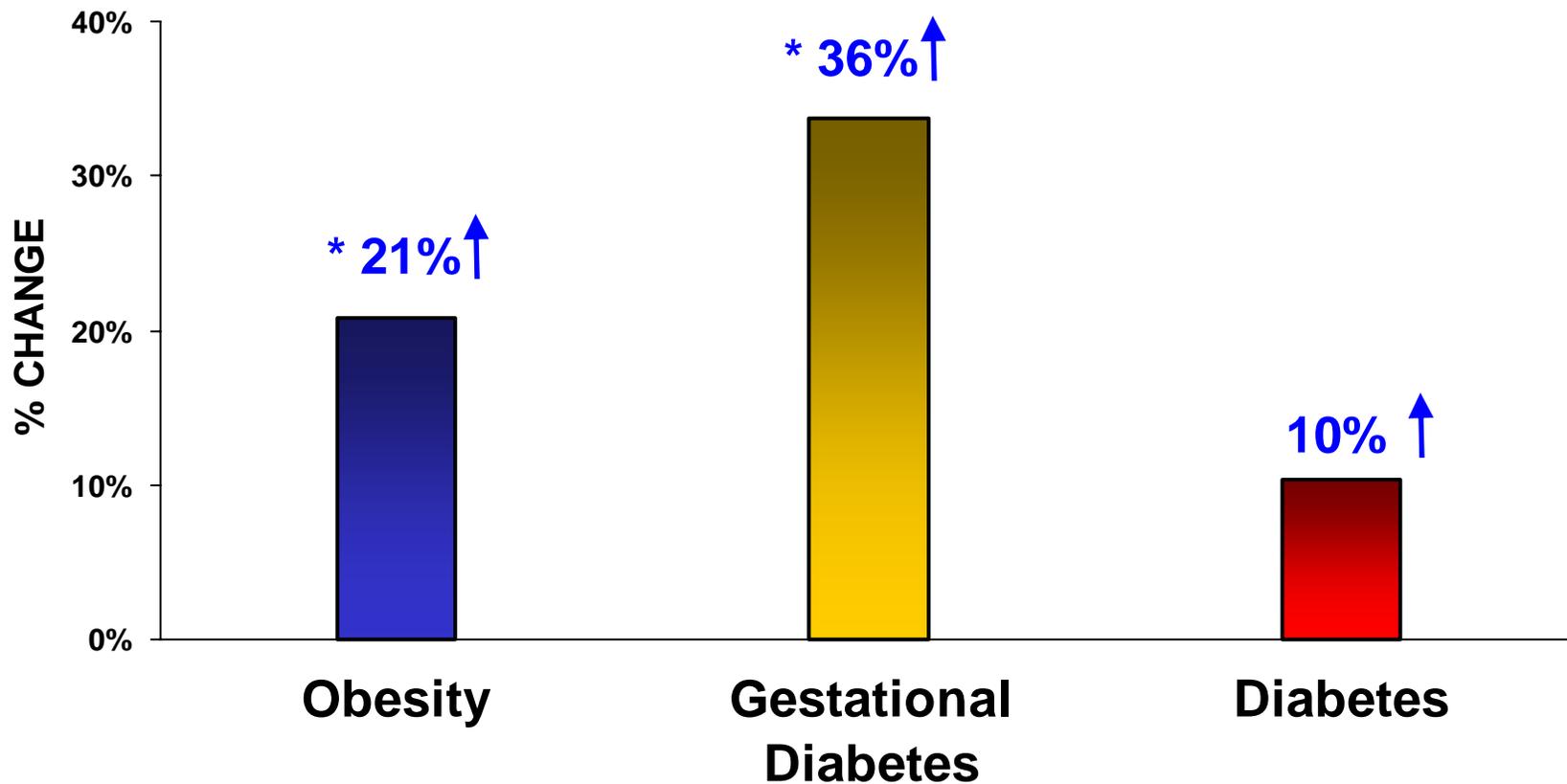


Diabetes and Obesity are crude percentages of the MA adult population ages 18 and over.

1. Preliminary Massachusetts Births 2006

Source: Massachusetts Department of Public Health, BHISRE and BFHN

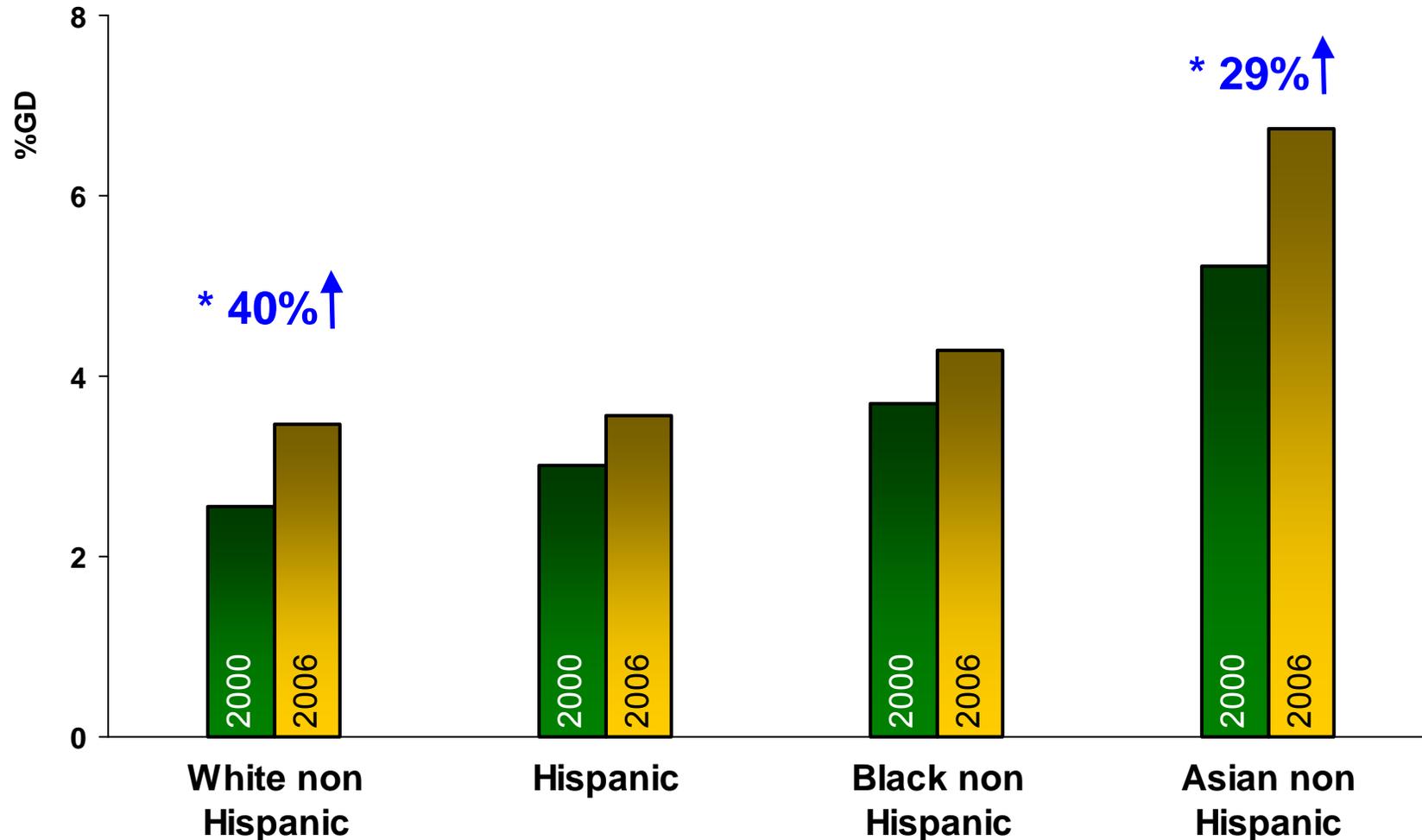
Changes in Obesity, GDM, and Diabetes Massachusetts 2006 vs. 2000



1. Preliminary Massachusetts Births 2006
* Statistically higher than 2000 rate ($p < 0.05$)

Changes in GDM by Maternal Race and Hispanic Ethnicity

Massachusetts Births 2006¹ vs. 2000

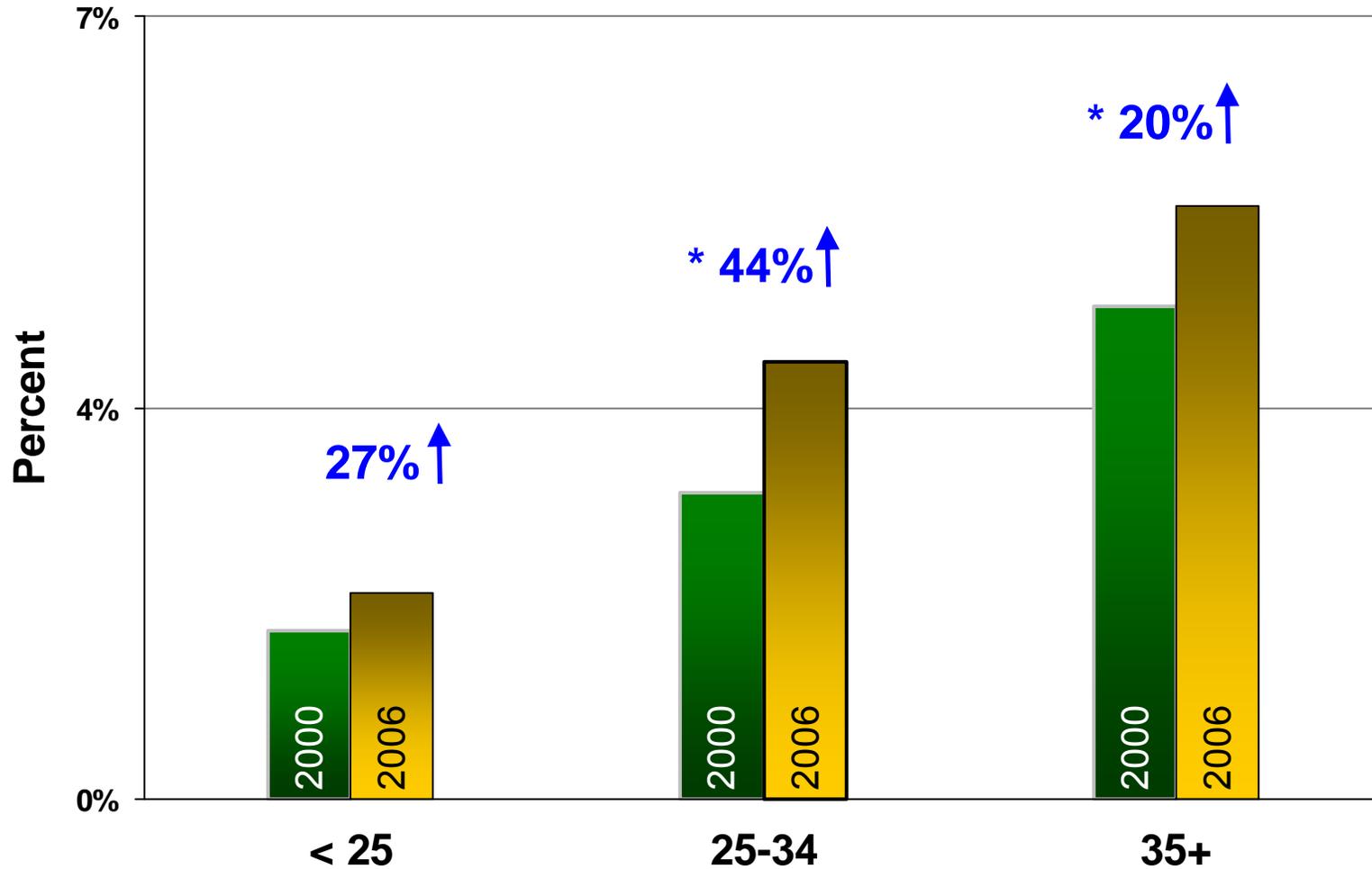


1. Preliminary data, Births 2006

* Statistically higher than 2000 rate ($p < 0.05$)

Changes in GDM by Maternal Age

Massachusetts Births 2006¹ vs. 2000

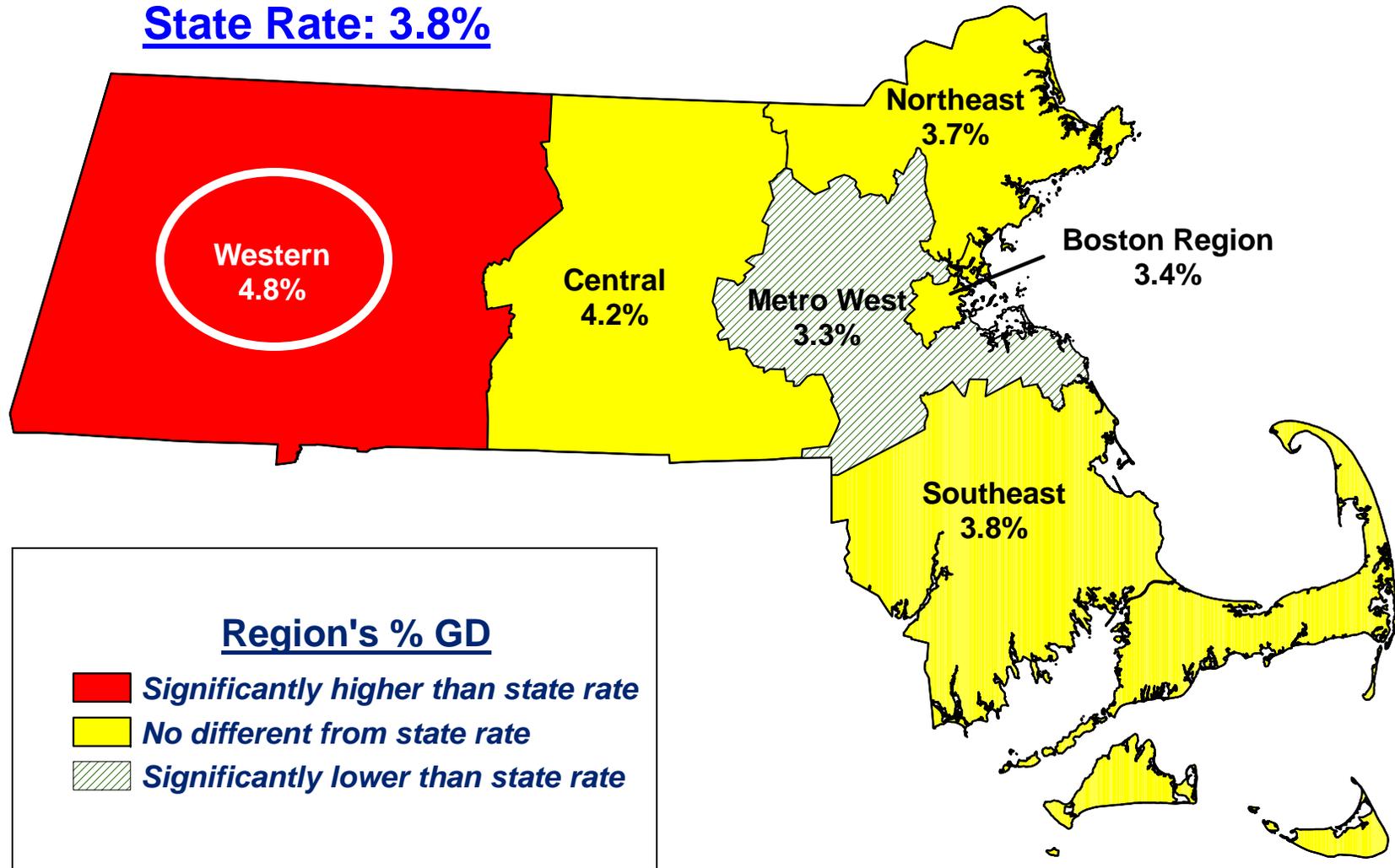


1. Preliminary data, Births 2006

* Statistically higher than 2000 rate ($p < 0.05$)

GDM By Regions Massachusetts Births 2006¹

State Rate: 3.8%

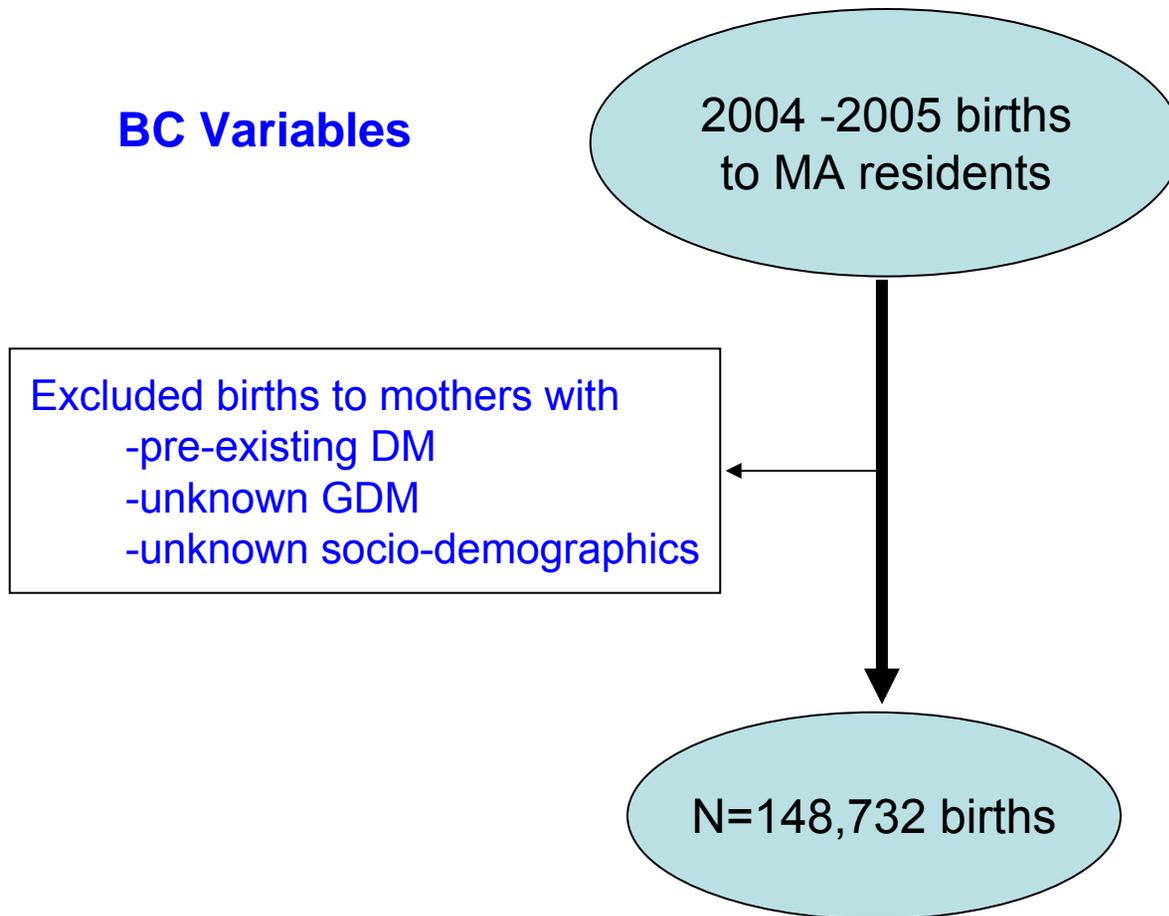


Study Question:

Who is at increased risk for **gestational diabetes mellitus (GDM)** in Massachusetts?

Analysis 1: BC Data 2004-2005

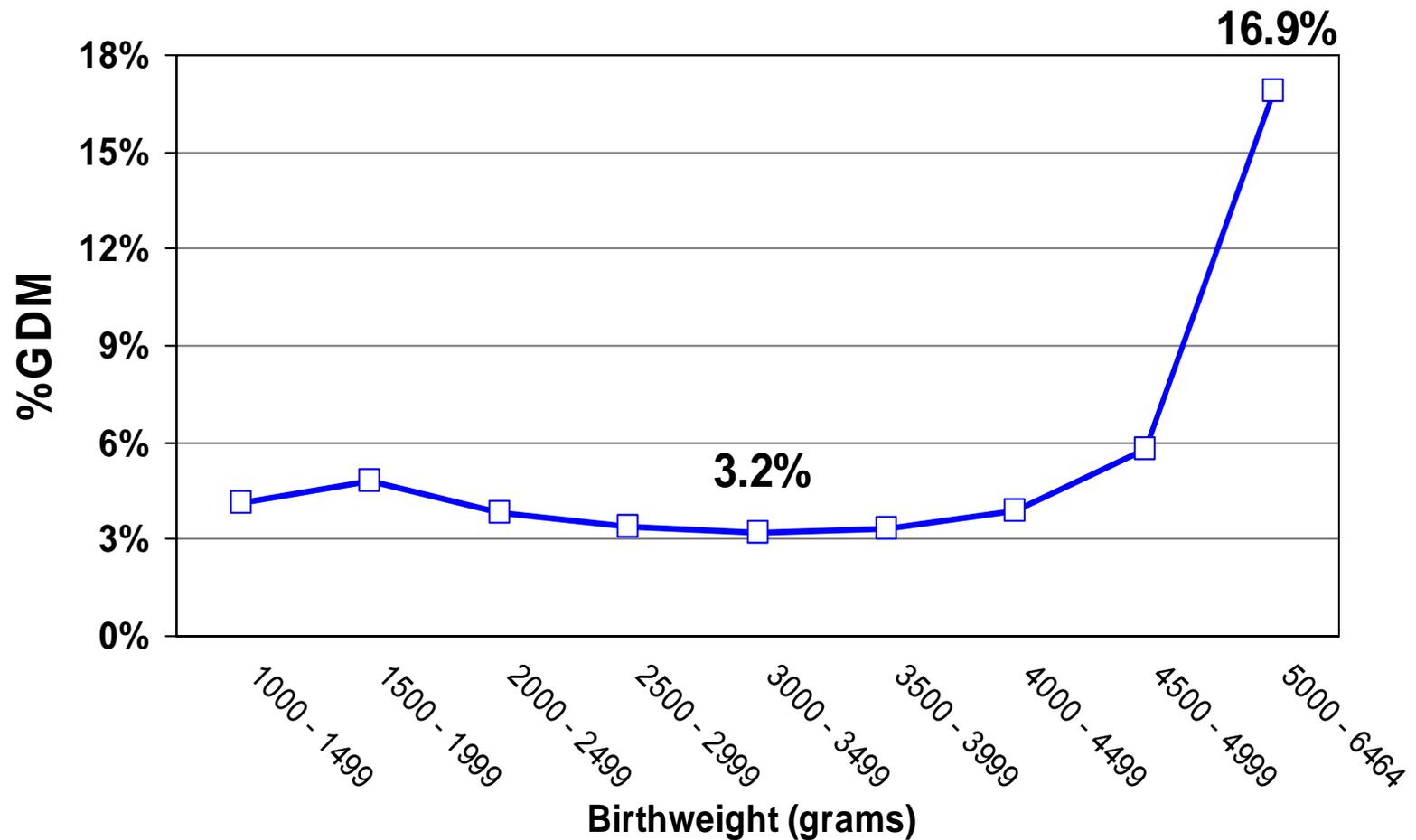
BC Variables



GDM

by Infant Birth Weight, Singletons

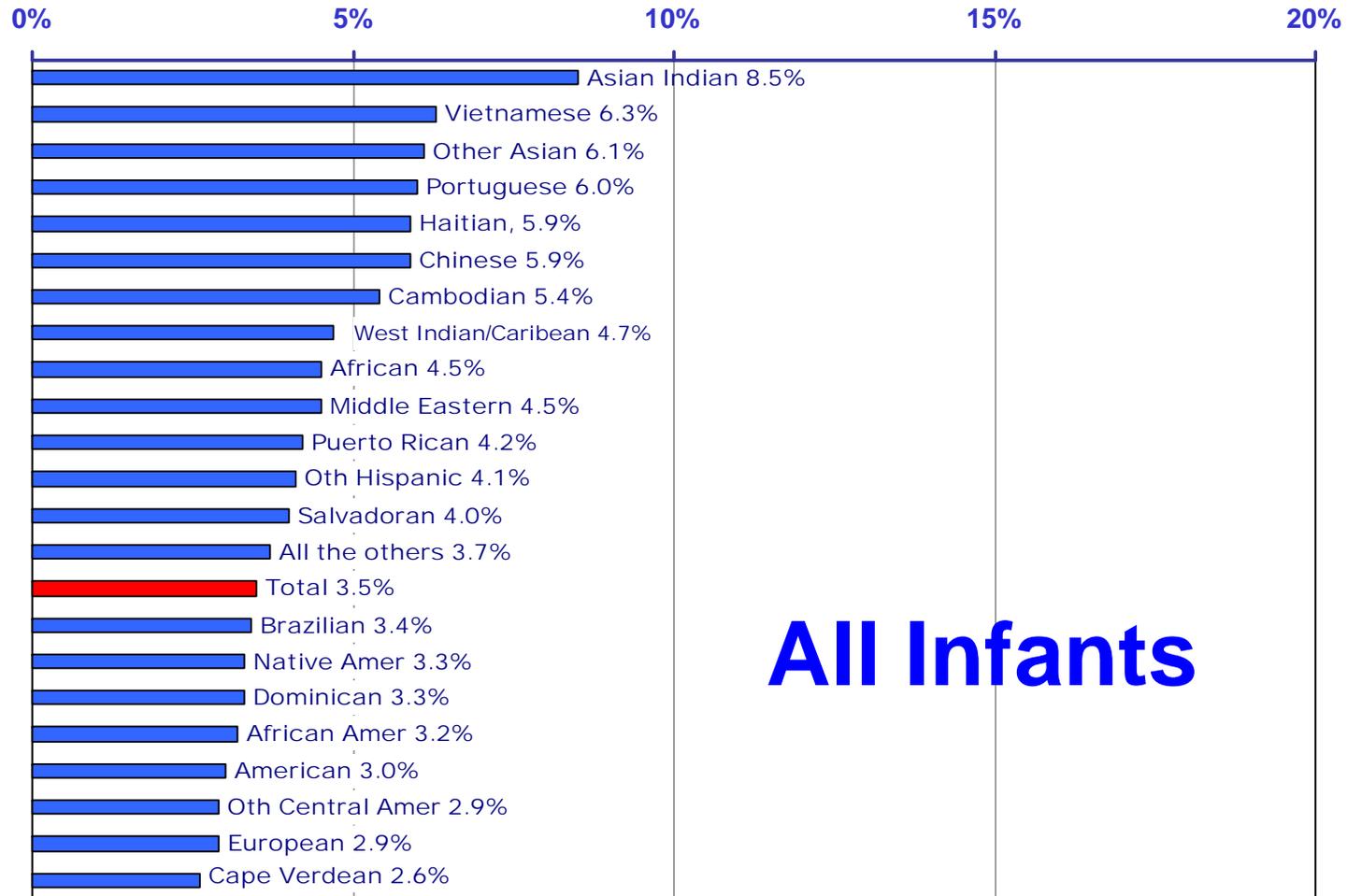
Massachusetts Births 2004-2005



GDM

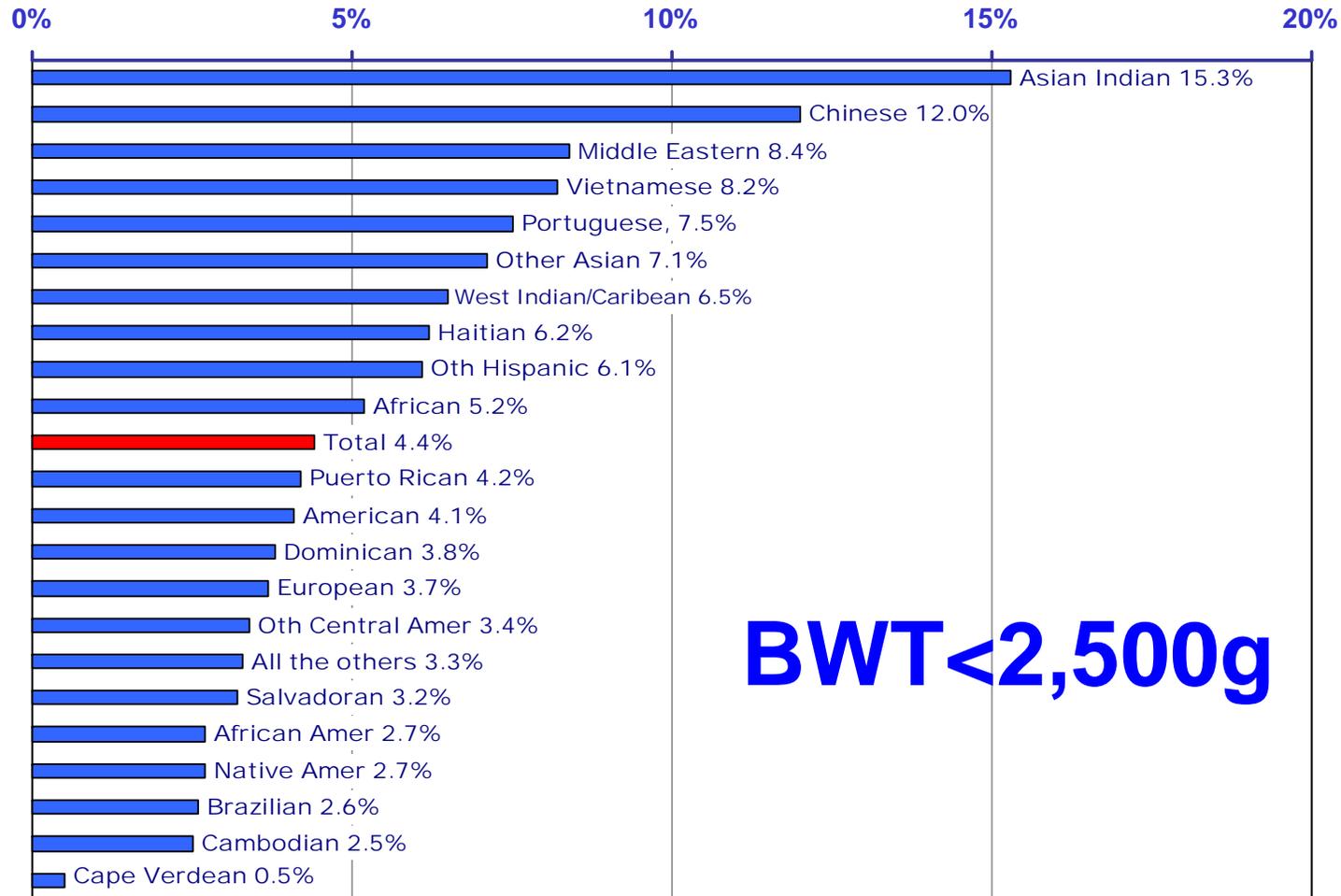
by Maternal Ethnicity for All Infants

Massachusetts Births 2004-2005



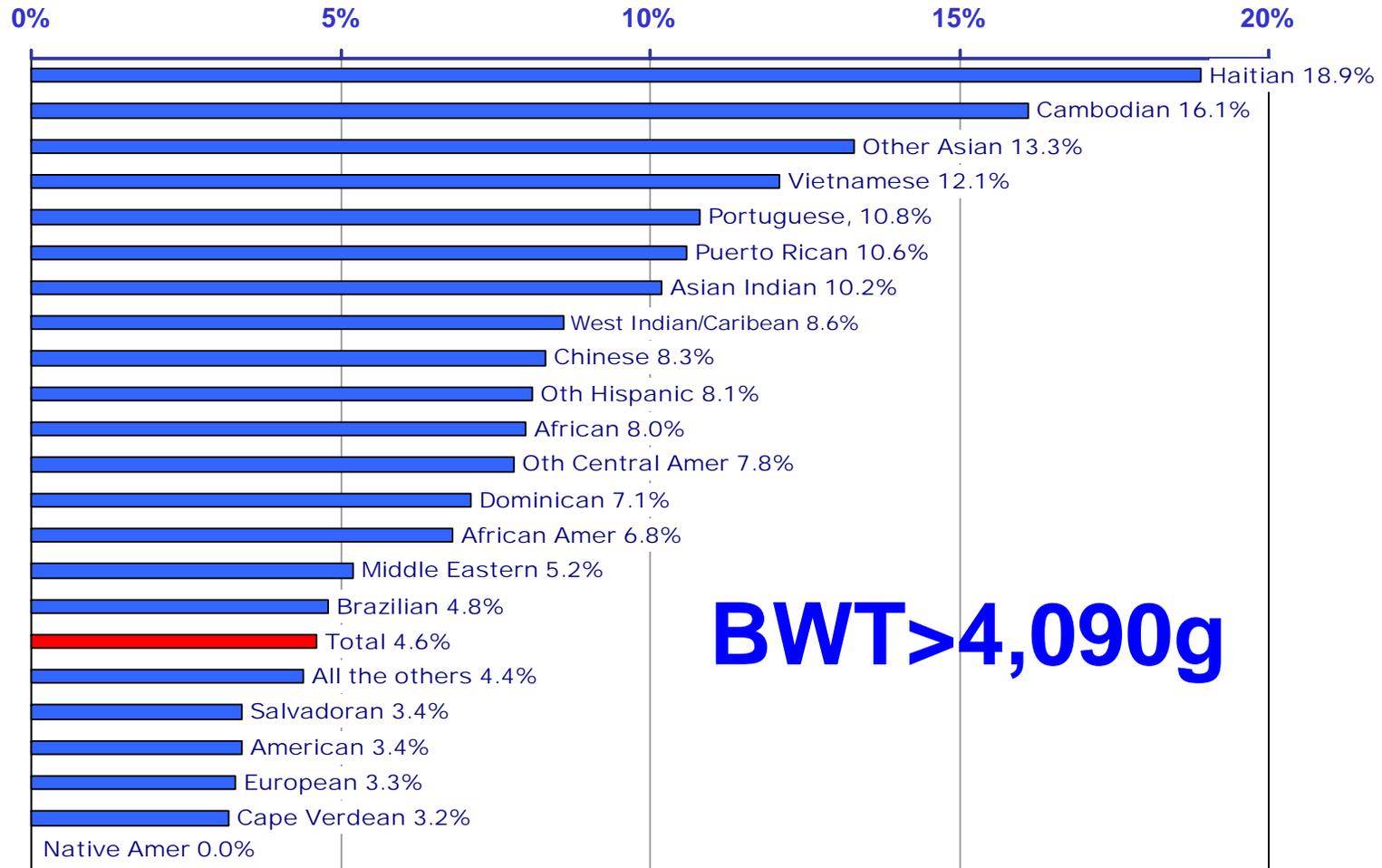
GDM

by Maternal Ethnicity for Infants BWT<2,500g Massachusetts Births 2004-2005



GDM

by Maternal Ethnicity for Infants BWT>4,090g Massachusetts Births 2004-2005



Analysis 1: BC Data 2004-2005

Multivariate Logistic regression to model GDM

Maternal Characteristics included

Age: <25, 25-34, 35+

Ethnicity: Puerto Rican
Dominican
Salvadoran
Other Central American
Other Hispanic
Chinese
Vietnamese
Cambodian
Asian Indian
Other Asian
Cape Verdean
All the others
Brazilian
Portuguese
Haitian
West Indian/Caribbean
African American
African
Middle Eastern
Native American
American
European
missing ancestry

Education: < high school, high school, some college, college, postgraduate

Multivariate Analysis BC Data 2004-2005 (cont'd)

Maternal Characteristics included

Area of residency: West, Central, Northeast, Metro West,
South East, and Boston regions of
Massachusetts

Place of Birth: US, US Territories, Foreign born

Smoking before pregnancy: Yes, No

English Language Preference Yes, No

Pregnancy/Infant characteristics included

Preterm(<37wks): Yes, No

Birth weight: <2500g, 2500-4090g, >4090g

Singleton: Yes, No

Labor/Delivery complication: None, Any

Prior Cesarean: Yes, No

First child Yes, No

Pay Source for PNC Public, Private

Results

Multivariate Analysis BC Data 2004-2005

Logistic Regression Final Model for GDM

Adjusted Odds Ratios (aOR)

Characteristic Effect on GDM	aOR	95% CI	
Maternal Age			
35+ vs < 25	4.43	3.98	4.94
25-34 vs < 25	2.82	2.55	3.12
Maternal Ethnicity			
Asian Indian vs American	3.86	3.20	4.65
Other Asian vs American	2.28	1.88	2.74
Chinese vs American	2.22	1.83	2.68
Cambodian vs American	1.98	1.48	2.59
Portuguese vs American	1.97	1.64	2.35
Vietnamese vs American	1.92	1.51	2.42
Haitian vs American	1.76	1.42	2.17
Middle Eastern vs American	1.57	1.20	2.01
West Indian/Caribbean vs American	1.52	1.11	2.04
Salvadoran vs American	1.50	1.15	1.93
Puerto Rican vs American	1.44	1.22	1.70
Other Hispanic vs American	1.35	1.10	1.64
African Amer vs American	1.28	1.08	1.51

Source: Massachusetts Department of Public Health, BHISRE and BFHN

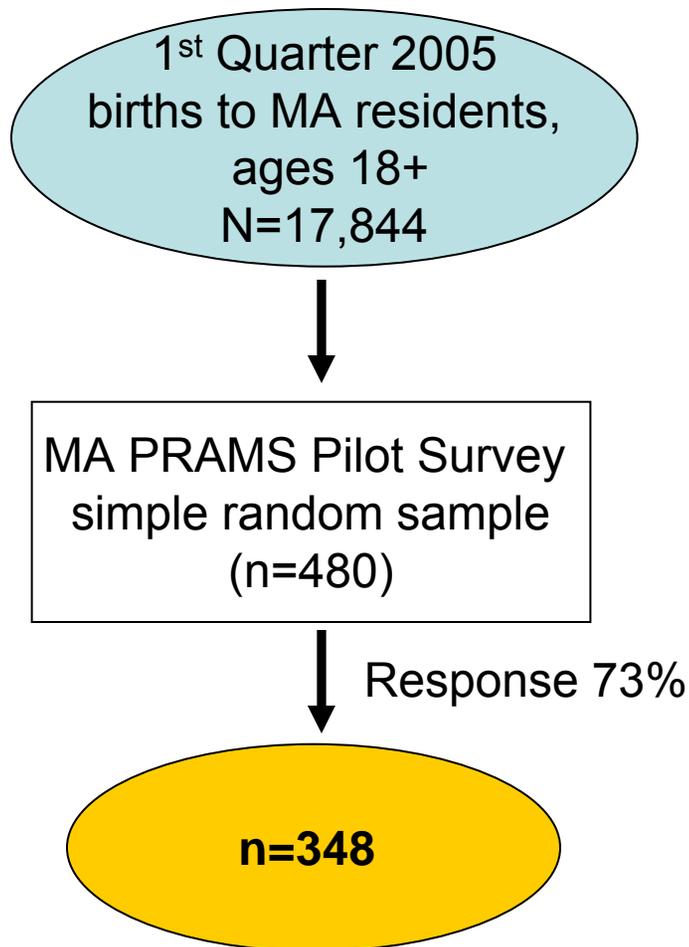
Adjusted Odds Ratios (aOR) (cont'd)

Characteristic Effect on GDM	aOR	95% CI	
Maternal Education			
Less than high school vs Post grad	1.84	1.60	2.11
High school vs Post grad	1.85	1.67	2.06
Associate vs Post grad	1.75	1.58	1.93
Bachelor vs Post grad	1.18	1.07	1.31
Maternal Area of Residency			
West vs Metro West	1.73	1.55	1.92
Central vs Metro West	1.64	1.49	1.81
North East vs Metro West	1.39	1.27	1.52
South East vs Metro West	1.38	1.25	1.52
Maternal Place of Birth			
US territories vs US	1.36	1.11	1.67
Foreign Born vs US	1.15	1.04	1.28
Smoking Before Pregnancy			
Yes vs No	1.22	1.12	1.32

Adjusted Odds Ratios (aOR) (cont'd)

Characteristic Effect on GDM	aOR	95% CI	
Infant/Pregnancy Characteristics			
Pre-term vs. Full-term	1.60	1.44	1.79
BWT>4090g vs BWT 2500-4090	1.45	1.32	1.60
Multiple vs Singleton	1.35	1.19	1.53
Labor/Delivery Complications: Any vs None	1.28	1.21	1.36
Prior Cesarean vs none	1.24	1.16	1.34

Analysis 2: BC-PRAMS Pilot BMI and Physical Activity



BC variables:

- Diabetes (GDM & DM), chart abstraction
- Socio-demographic, infant/pregnancy vars.

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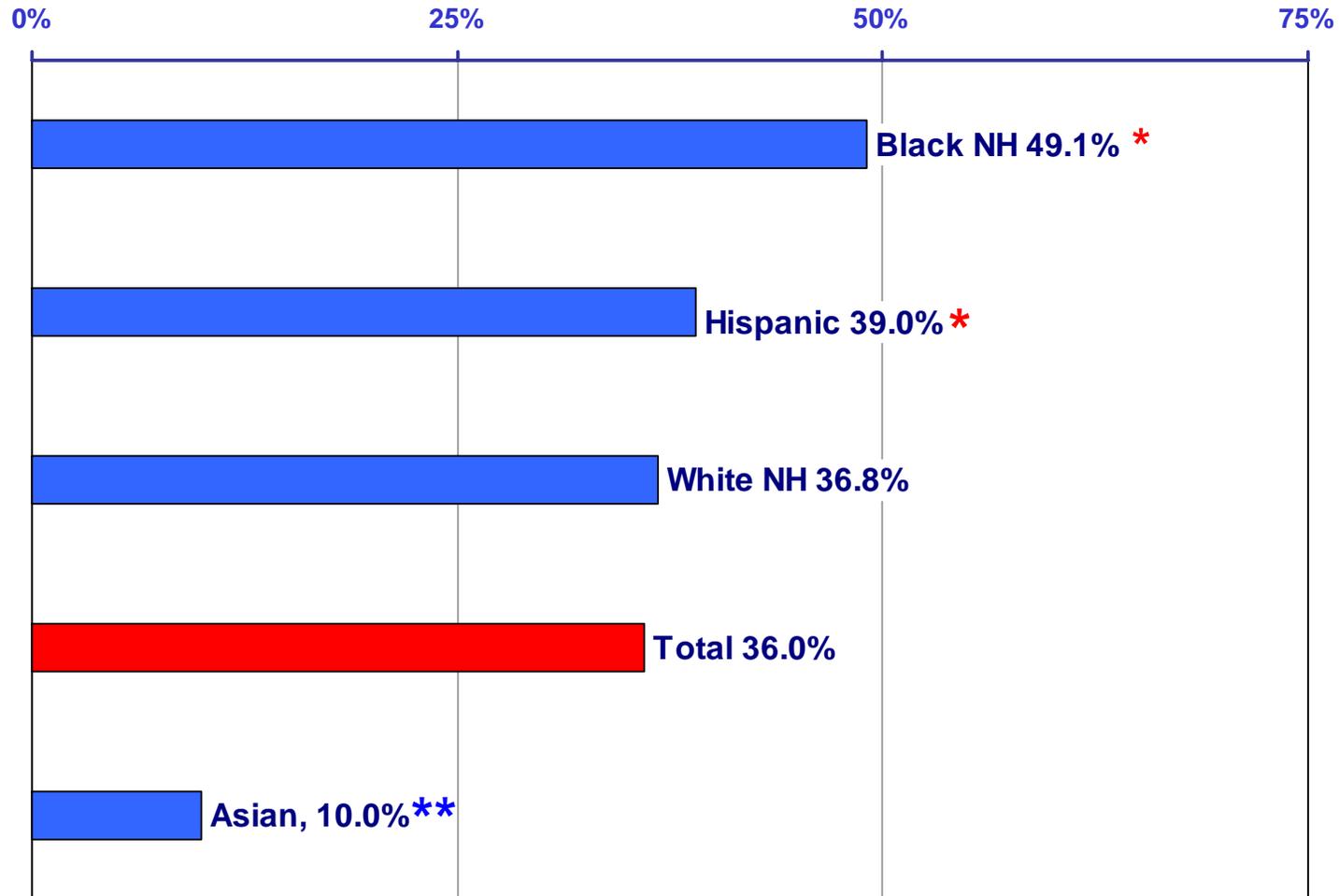
PRAMS variables (maternal report):

- Diabetes (GDM & DM)
- Pre-pregnancy BMI & Physical Activity (PA)

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BC-PRAMS variables

Overweight or Obese¹ Mothers by Race and Hispanic Ethnicity Massachusetts BC-PRAMS Pilot

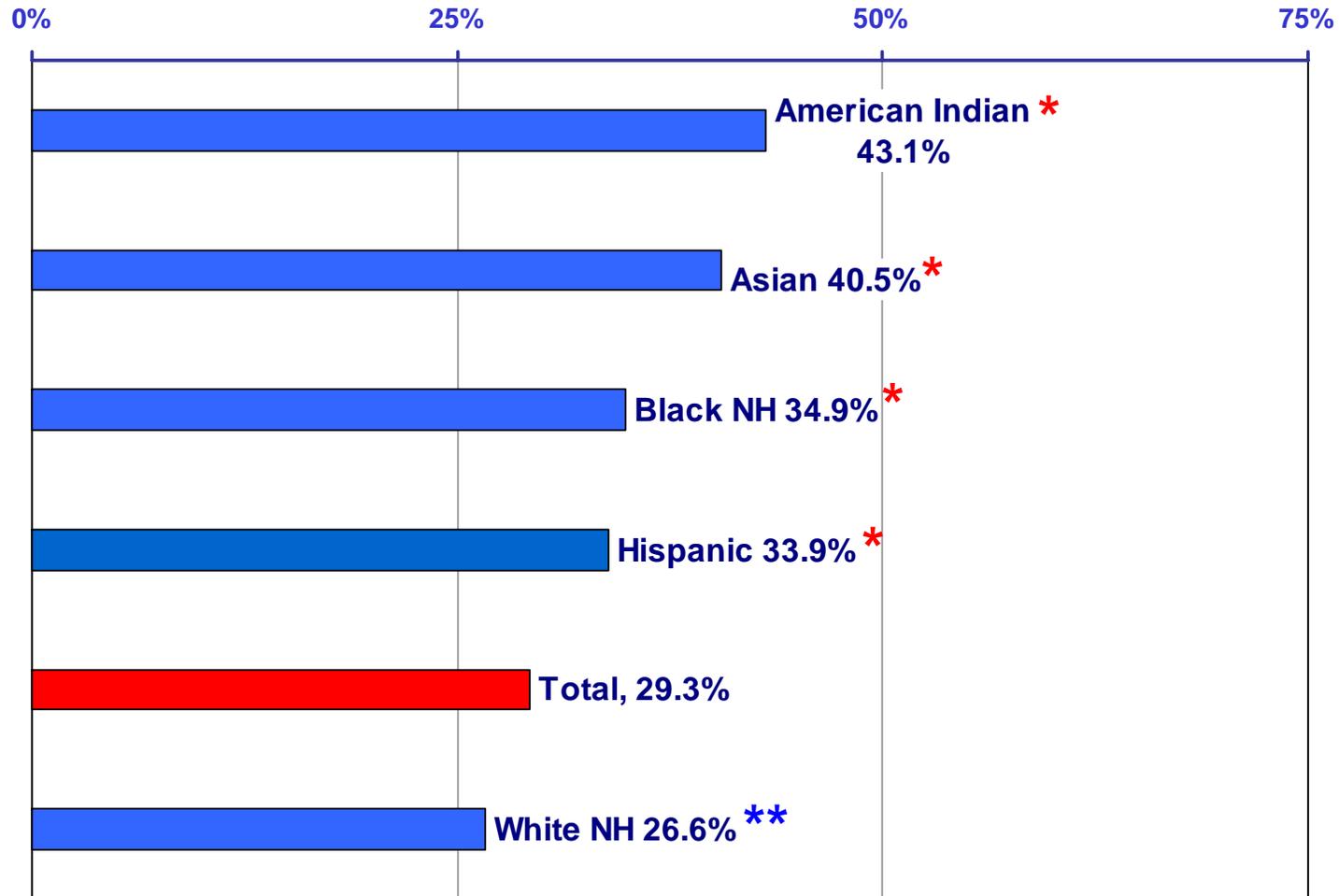


1. BMI \geq 25

* Statistically higher than state rate ($p < 0.05$)

** Statistically lower than state rate ($p < 0.05$)

Physically Inactive¹ Mothers by Race and Hispanic Ethnicity Massachusetts BC-PRAMS Pilot

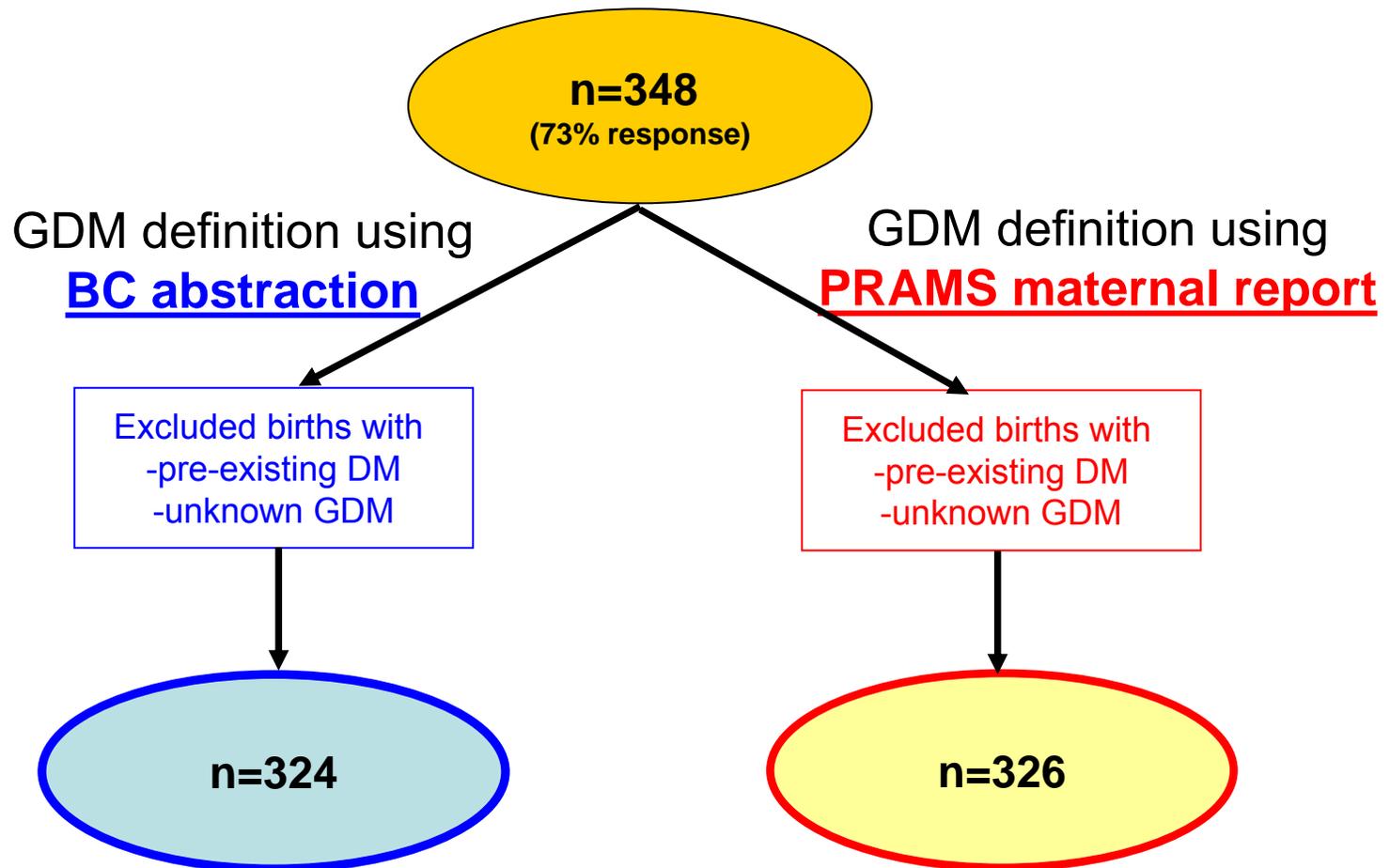


1. Exercise 30 minutes or more <1 time/week

* Statistically higher than state rate (p<0.05)

** Statistically lower than state rate (p<0.05)

Analysis 2: BC-PRAMS Pilot GDM



Results

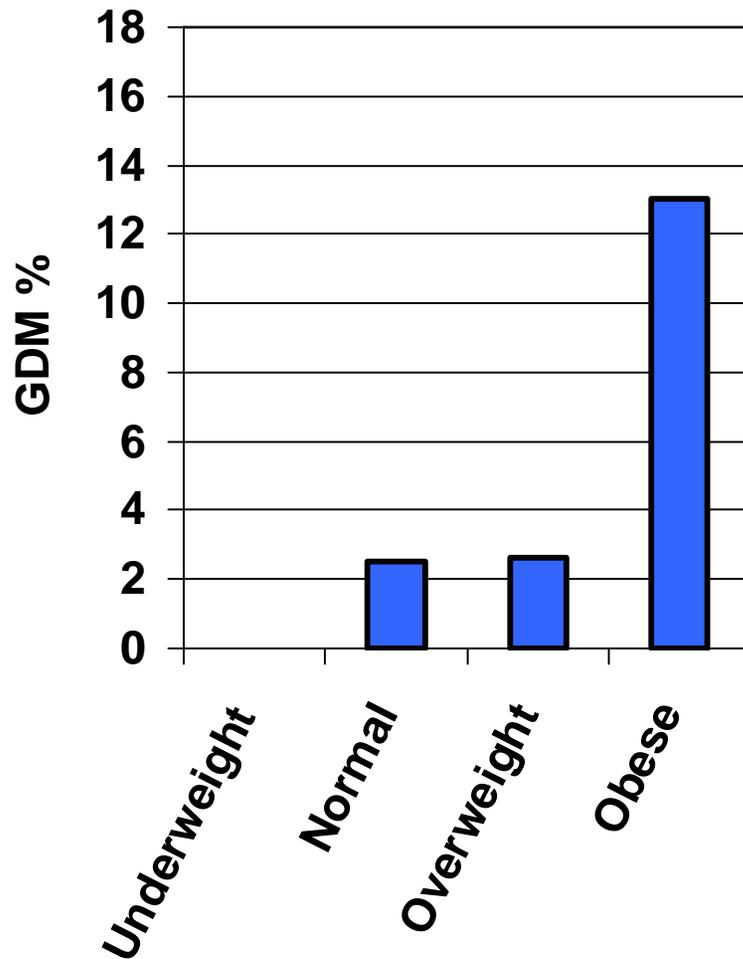
BC-PRAMS Pilot Analysis

GDM by Maternal Characteristics

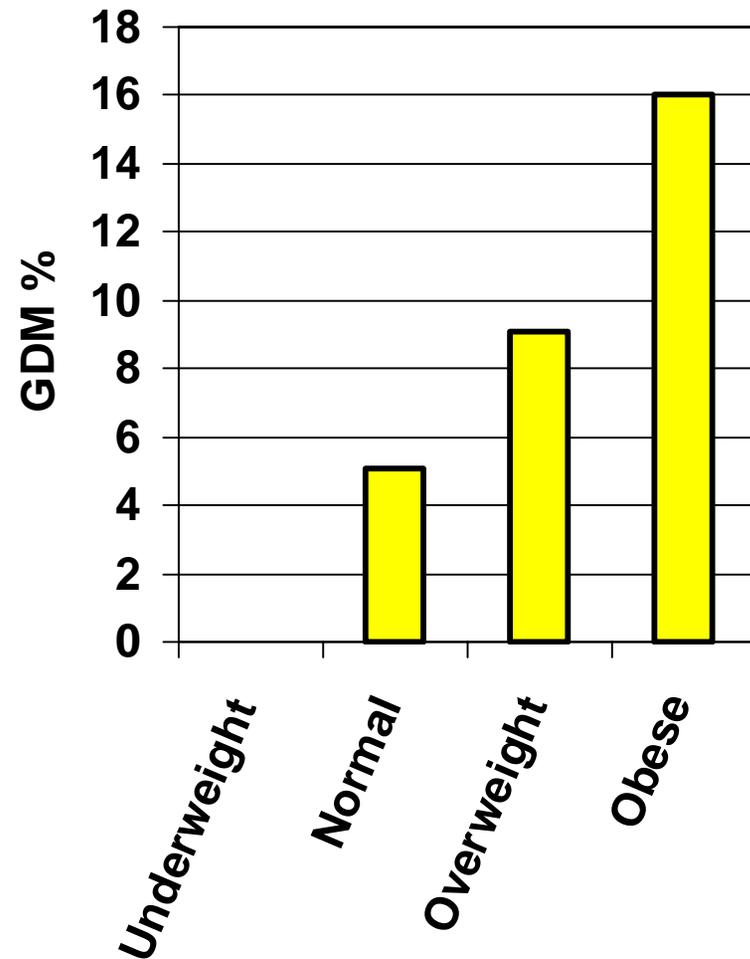
	<u>GDM based on BC</u> (n=324)		<u>GDM based on PRAMS</u> (n=326)	
	%GDM (weighted cases)	95% CI	%GDM (weighted cases)	95% CI
Overall	4.0 (667)	1.9 – 6.2	7.4 (1,232)	4.5 – 10.3
Maternal race & Hispanic ethnicity				
White, non-Hispanic	3.6 (434)	1.2 – 5.9	6.6 (804)	3.5 – 9.6
Black, non-Hispanic	10.7 (167)	0.0 – 22.3	16.1 (253)	1.3 – 31.0
Hispanic	3.6 (66)	0.0 – 10.6	3.6 (66)	0.0 – 10.6
Asian, non-Hispanic	0.0 (0)		11.2 (109)	0.0 – 25.8
Maternal age (yrs)				
18–24	0.0 (0)		0.0 (0)	
25–34	3.7 (371)	1.0 – 6.5	6.7 (670)	3.0 – 10.5
≥35	7.6 (297)	1.7 – 13.5	14.2 (562)	6.7 – 21.7
Maternal education				
< High school	0.0 (0)		0.0 (0)	
High school or GED	4.7 (170)	0.0 – 10.0	7.2 (256)	0.2 – 14.1
> High school	4.3 (497)	1.7 – 6.9	8.3 (976)	4.8 – 11.9

GDM by Body Mass Index (BMI)

GDM based on BC



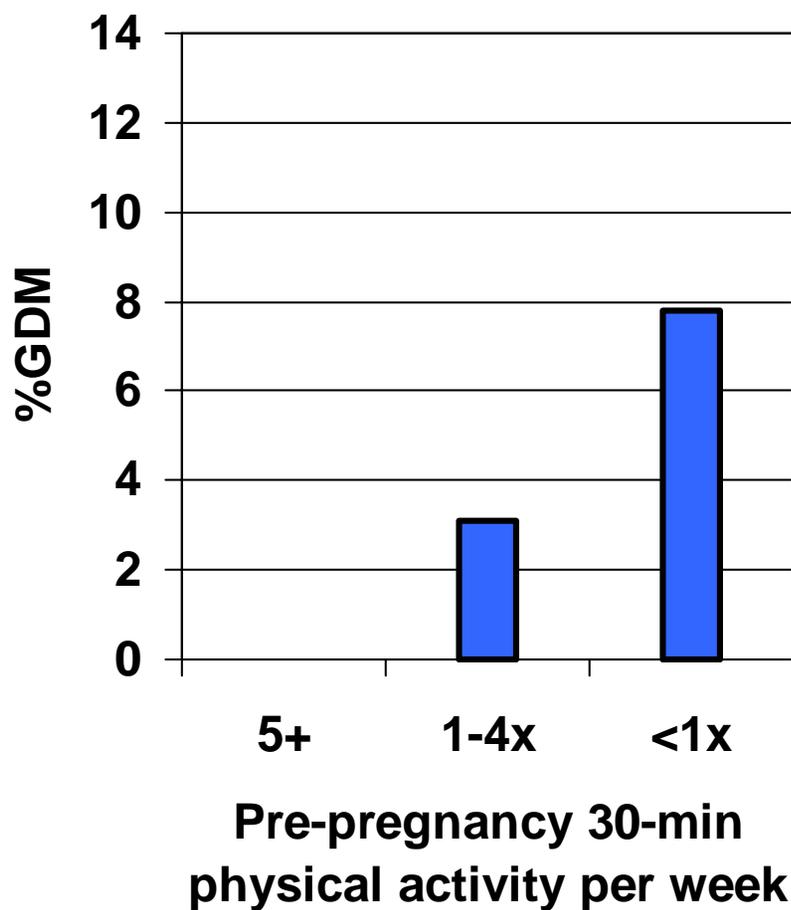
GDM based on PRAMS



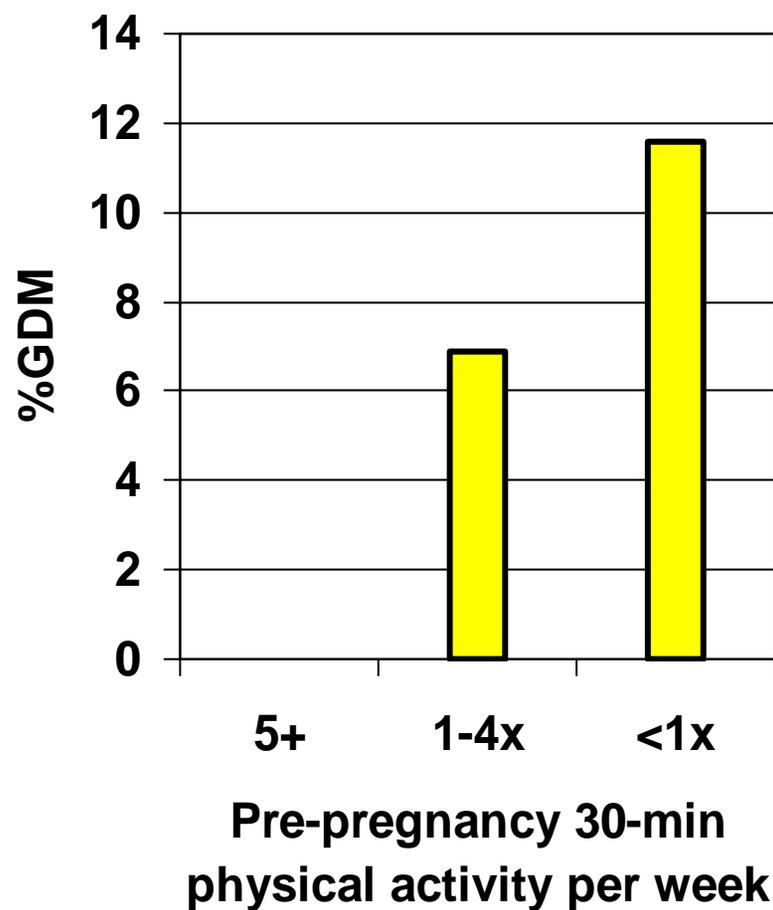
BMI level: underweight <18.5; normal 18.5-24.9; overweight 25-29.9; obese ≥ 30

GDM by Physical Activity (PA)

GDM based on BC



GDM based on PRAMS



BMI level: underweight <18.5; normal 18.5-24.9; overweight 25-29.9; obese ≥ 30

Source: Massachusetts Department of Public Health, BHISRE and BFHN

Analysis 2: BC-PRAMS Pilot

Multivariate survey logistic regression to model GDM

➤ GDM based on BC (chart abstraction)

Maternal Characteristics

Age: 18-34, 35+

Race and Hispanic Ethnicity:

White non-Hispanic, Black non-Hispanic, Hispanic, and Asian non-Hispanic

Education:

< high school, high school, > high school

Body Mass Index (BMI):

Normal (BMI 18.5 -24.9)

Overweight (BMI 25.0-29.9)

Obese (BMI ≥ 30)

Physical Activity (PA)- exercise ≥ 30 minutes:

<1 time/week

1-4 times/week

≥ 5 times/week

➤ GDM based on PRAMS (maternal report)

Maternal Characteristics

Same as above

Final Model for GDM, BC-PRAMS Pilot

GDM based on BC

Adjusted Odds Ratios (aOR)

Characteristic Effect on GDM	aOR	95% CI	
Maternal Characteristics			
BMI: Obese vs Normal	4.75	1.18	19.25

GDM based on PRAMS

Adjusted Odds Ratios (aOR)

Characteristic Effect on GDM	aOR	95% CI	
Maternal Characteristics			
BMI: Obese vs Normal	5.12	1.34	19.61
Age >=35 vs 18-34	3.07	1.27	7.42

Conclusions

Results from Massachusetts BC analysis

- GDM occurs in about 4% of births to Massachusetts residents
- Risk of GDM increases with increasing maternal age and with lower education
- GDM is associated with early deliveries, delivery of infant with high birth weight (>4,090g or 9lb), multiple births, labor/delivery complications, prior cesarean, and pre-pregnancy smoking status
- GDM occurs disproportionately among US territory-born and foreign mothers; among specific ethnic groups, and in some geographic areas
 - Ethnic Disparities: Asian Indian, Other Asian (Philippine, Japanese, Korean, Pakistanis), Chinese, Cambodian, Portuguese, Vietnamese, Haitian, Middle Eastern, West Indian/ Caribbean, mothers
 - Mothers living in the Western, Central, North East and South East regions of MA have increased risk for GDM

Conclusions

Results from Massachusetts BC-PRAMS pilot analysis

- GDM occurs in about 7% of births to Massachusetts residents
- Pre-pregnancy obese mothers (BMI \geq 30) have an (5X) increased risk of GDM
- Older mothers (ages \geq 35) have an increased risk of GDM
- Pre-pregnancy physical activity (PA) was not associated with reduced risk of GDM

Limitations

- MA Birth certificates
 - Do not capture pre-pregnancy maternal weight and physical activity
 - Potential bias
 - cases may vary with access to prenatal care
 - cases with more symptoms
 - Potential under reporting of cases (about 16% of mothers did not receive adequate prenatal care between 2004 and 2005)
- MA BC-PRAMS pilot
 - Small sample
 - Self reported data
 - Potentially no distinction between pre-existing DM and GDM
 - Recall bias
 - Possibly unclear question 'high blood sugar'

Strengths

- MA Birth certificates
 - Population based
 - Detailed maternal socio-demographic variables

- MA PRAMS
 - Population based
 - Pre- and post-pregnancy maternal characteristics
 - Maternal health experiences

Public Health Implications

- Identification of MA women most vulnerable for GDM
- Programs that assess women at risk for GDM may need to incorporate maternal age, education, ethnic, and cultural environments in order to reduce disparities.
- Differing infant birth weight may affect appropriate surveillance of infants at future risk for diabetes
- Starting with Births in 2006, MA DPH has included GDM rates in its annual surveillance report, providing:
 - State and regional trends
 - Maternal ethnic-specific rates
 - City-specific rates
 - Health care facility-specific rates

Future Work

- GDM is viewed largely as evolving diabetes. This can be taken as an opportunity for epidemiological studies that will help to prevent or delay DM
 - Cross sectional studies (MA PRAMS)
 - Longitudinal studies (PRAMS/PELL)
- Implementation of recommendations from the MA Gestational Diabetes Summit, Oct. 2007. A collaborative effort among MA DPH, CDC, PH professionals, HC providers and academics
- Improve GDM in BC and improve the distinction between pre-existing diabetes and gestational diabetes
- Improve adequacy of preconception and prenatal care
- Improve identification of diabetes before, during, and after pregnancy

Questions

isabel.caceres@state.ma.us

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