WILLIAM SANSUM
DIABETES CENTER

Diagnosis, Treatment and Prevention Of Diabetes During Pregnancy

Kristin Castorino, DO

www.sansum.org

WILLIAM SANSUM
DIABETES CENTER

Mission

To improve the lives of people impacted by diabetes through research, education and care

Core Values

Advocate for patients
Embrace and drive change
Build partnerships locally and globally
Integrity
Build open honest and respectful relationships
Governance
Pursue growth and lifelong learning

Specialty Areas

Artificial Pancreas
Pregnancy and Diabetes
Exercise and Diabetes
Travel and Diabetes

Today's Objectives:

- Define the different types of diabetes during pregnancy
- Identify the Key Windows for treating diabetes during pregnancy and the goals for treatment
- Discuss methods for preventing GDM
- Q&A

Case Study:

MD is a 35 yo G4P2 woman who presents to your clinic for her annual well woman exam. She is using condones for contraception and has no problems or concerns. Upon questioning, she notes that her last period was 3 ½ months ago but she wasn't really thinking about it because of life stressors.

What should we do? ....

Case Study:

...+ b-HCG... She's pregnant!

Let's get more history:

1st pregnancy: 2005 (male) delivered in Mexico
2nd pregnancy: 2008 (female) GDM A2 (used insulin)
3rd pregnancy: 2012 miscarriage
4th pregnancy: Current

Case Study:

MD is a 35 yo G4P2 at approximately 12 weeks gest.
1st pregnancy: 2005 (male) delivered in Mexico
2nd pregnancy: 2008 (female) GDM A2 (used insulin)
3rd pregnancy: 2012 miscarriage
4th pregnancy: Current

Health History:
Largely unremarkable, however BMI is 32

Family History:
Mother has T2D with renal failure, just started dialysis

Physical Exam:

Case Study:

MD is a 35 yo G4P2 at approximately 12 weeks gest.

You order _____

Case Study:

MD is a 35 yo G4P2 at approximately 12 weeks gest.

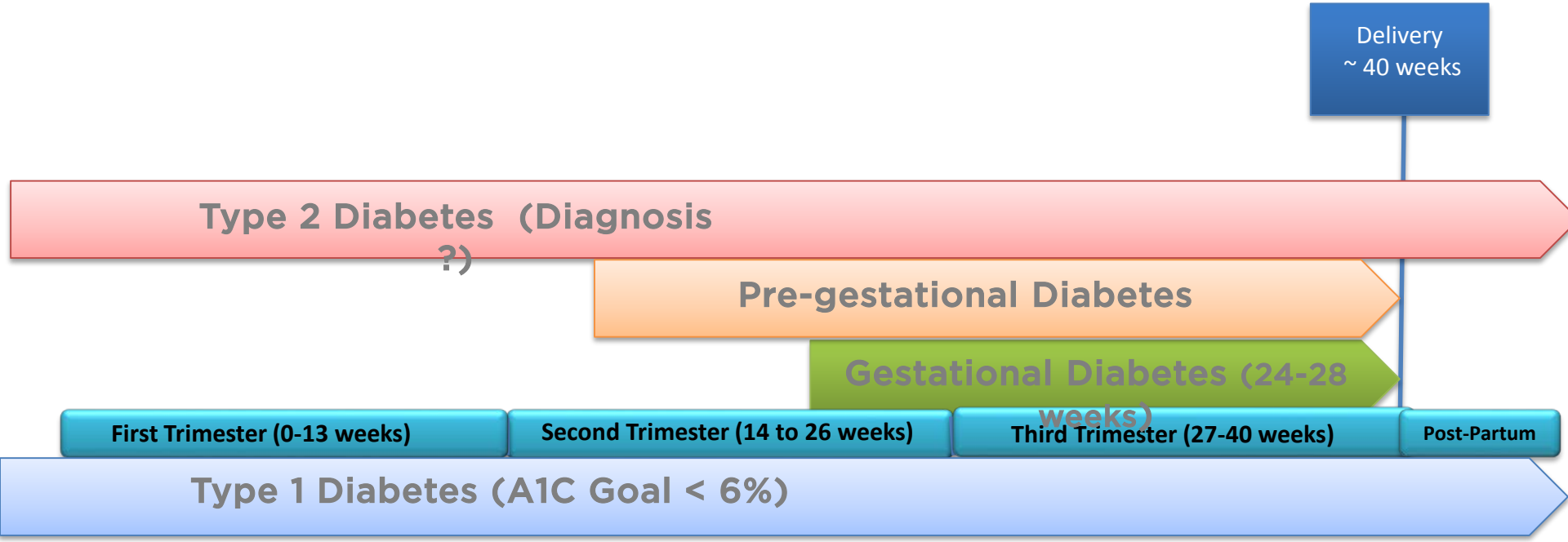
You attended this lecture, then went home and implemented a protocol for testing high risk women for diabetes at the first prenatal visit, using:

- A1C

Or

- Oral glucose tolerance test (OGTT)

Overview of Diabetes and Pregnancy



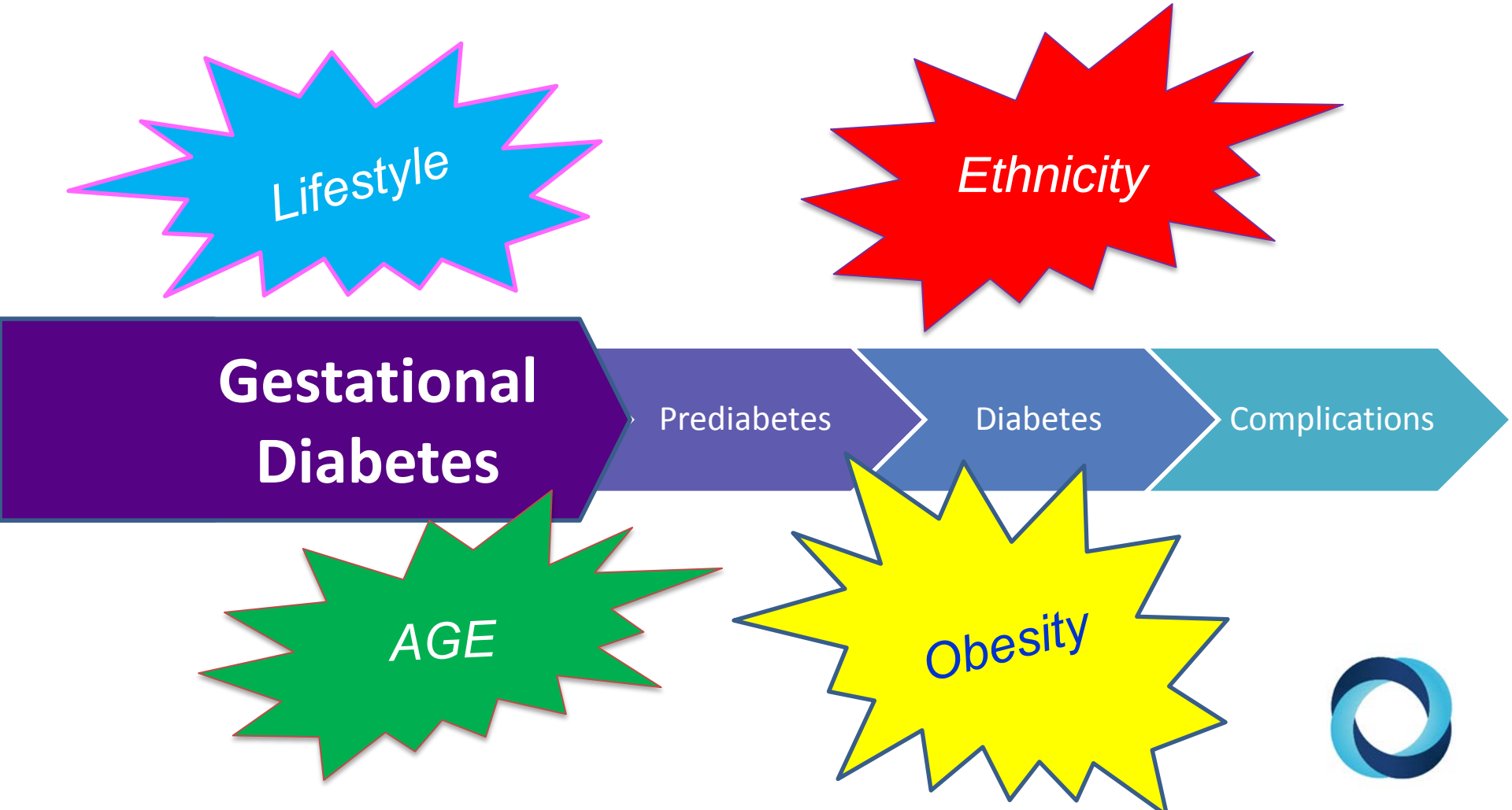
Summary of Complications by Gestational Age

- **Birth defects**
- Miscarriage
- Glycemic variability

- **Abnormal metabolic blueprint in exposed neonates**
- Stillbirth (uncommon)
- Other complications (preeclampsia)
- Changing Insulin Requirements and
- Insulin Resistance (2-3x pre-pregnant requirements)

- **Delivery trauma for mother and baby**
- Neonatal adaptation to new glycemic environment
- Glycemic variability

When does does diabetes start?



Diagnosing T2D

(Pre-gestational Diabetes)

A1C ≥ 6.5%

OR

Fasting Plasma Glucose ≥ 126 mg/dl

OR

Plasma Glucose ≥ 200 mg/dl

(Random or 2-h 75g OGTT)

ADA. Diagnosis and Classification of diabetes mellitus. Diabetes Care 2014

Diagnosing Pre-diabetes

(Early Diabetes)

A1C 5.7 - 6.4%

OR

Impaired Fasting Plasma Glucose

(100 - 125 mg/dl)

OR

Impaired Glucose Tolerance

(2-hr 75g OGTT 140-199 mg/dl)

ADA. Diagnosis and Classification of diabetes mellitus. Diabetes Care 2014

Risk Factors for GDM and T2D are Identical

- Family history of diabetes
- Overweight or obese
- Age greater than 25 yrs
- Previous LGA baby
- Personal history of pre-diabetes
- Pesonal history of GDM
- Personal history of LGA birthweight
- PCOS
- Metabolic syndrome
- Inactivity
- Ethnicity is in higher risk group
  - Hispanic-American
  - African-American
  - Native American
  - South or East Asian
  - Pacific Islander
- Previous unexplained perinatal loss or birth of malformed infant
- Glycosuria at the first prenatal visit
- Hypertension

ADA. III Detection and Diagnosis of GDM. Diabetes Care 2012, 3(SUPPL 1):S15
Coustan, Jovanovic, et al. Diagnosis of diabetes mellitus during pregnancy.

UpToDate September 26, 2013 update. www.uptodate.com. Accessed October 2013

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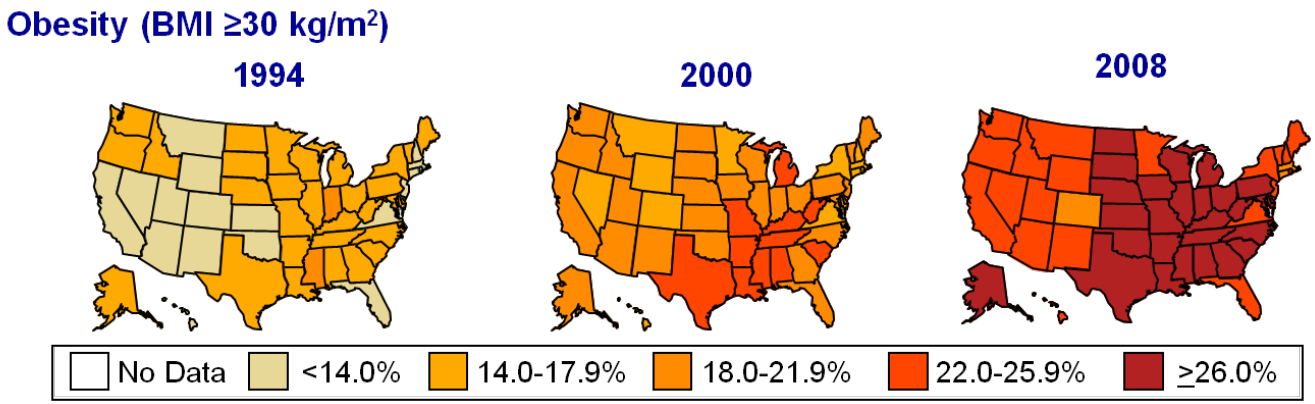
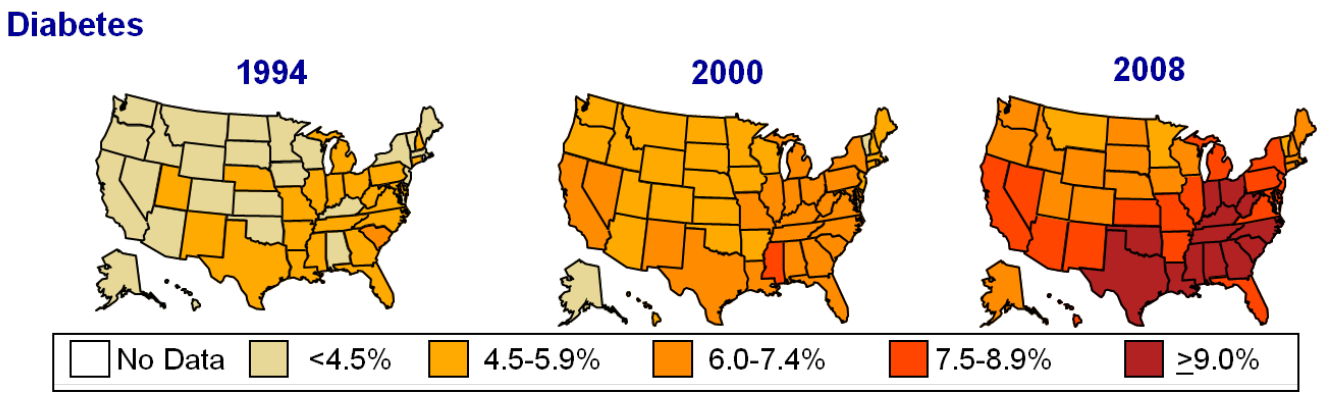
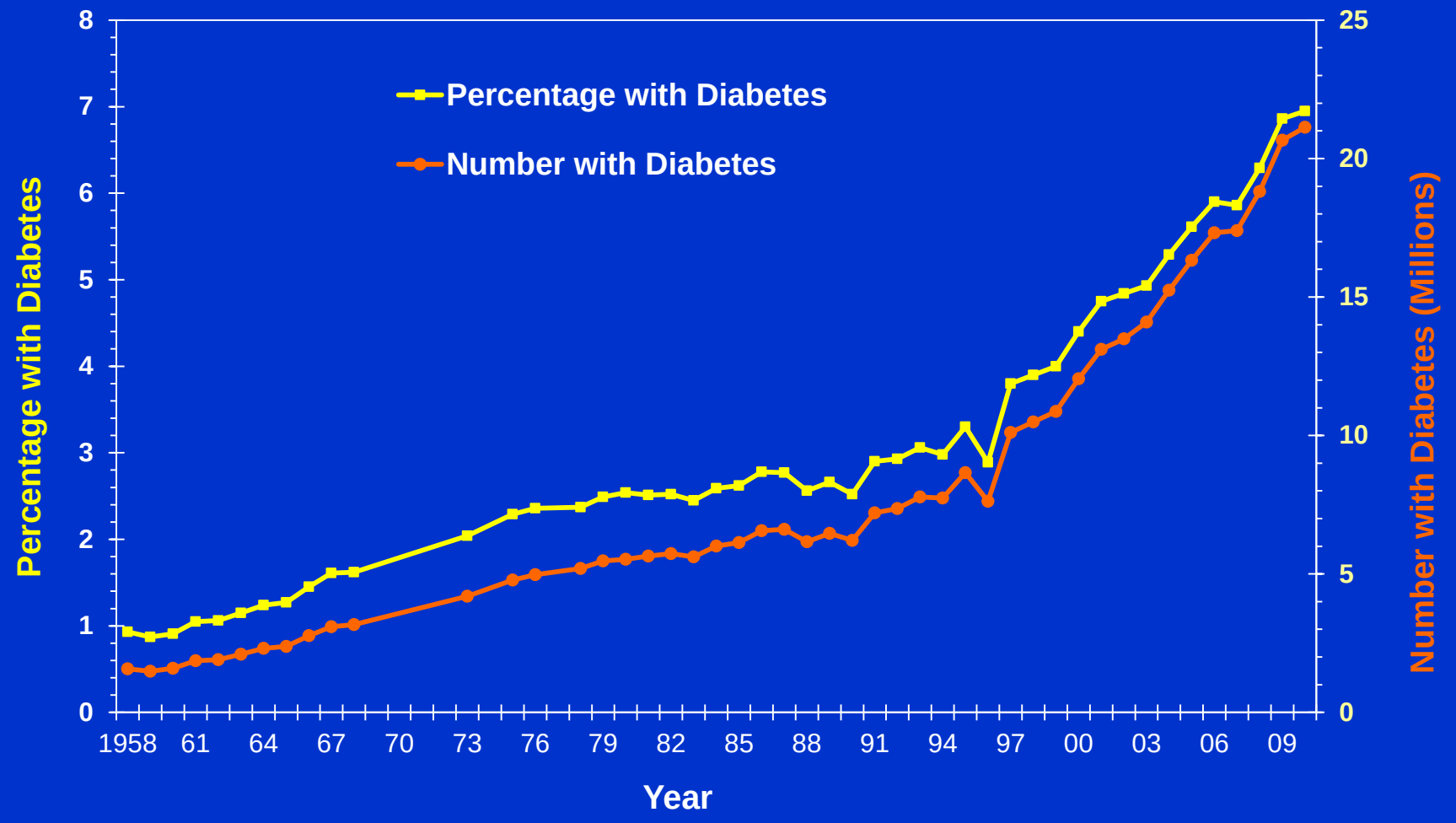
Age-adjusted Percentage of U.S. Adults Who Were Obese or Who Had Diagnosed Diabetes





Centers for Disease Control and Prevention: National Diabetes Surveillance System
http://www.cdc.gov/diabetes/statistics

Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958–2010



CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at http://www.cdc.gov/diabetes/statistics

Age-adjusted Rates in Los Angeles County, 1991-2003

Gestational Diabetes

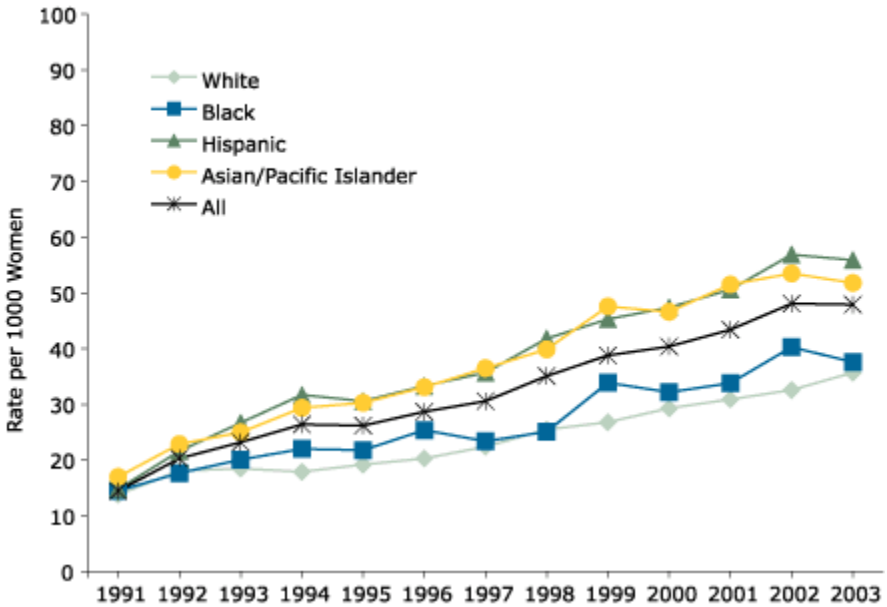


Figure 1. Age-Adjusted Rates of Gestational Diabetes Among All Women and by Race/Ethnicity — Los Angeles County, California, 1991–2003

Pregnancy-Related HTN

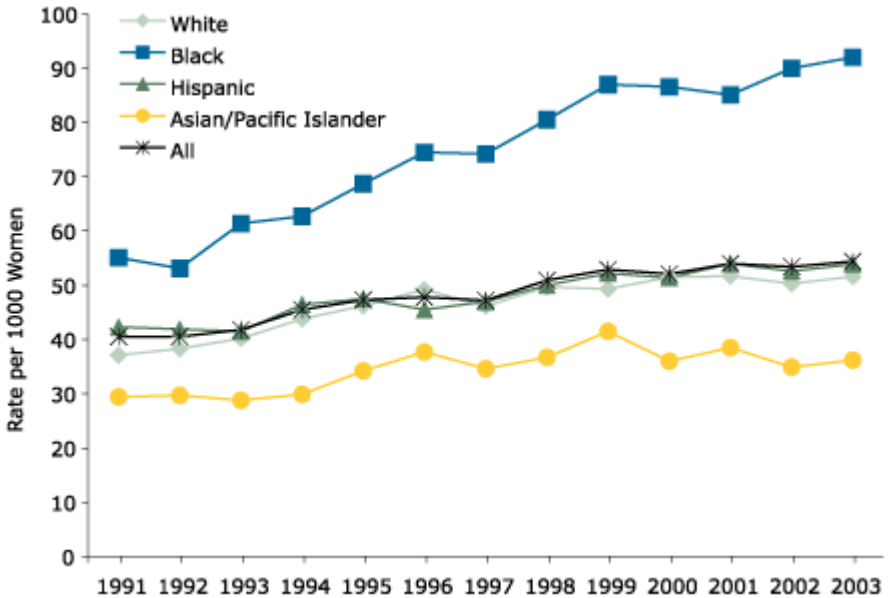


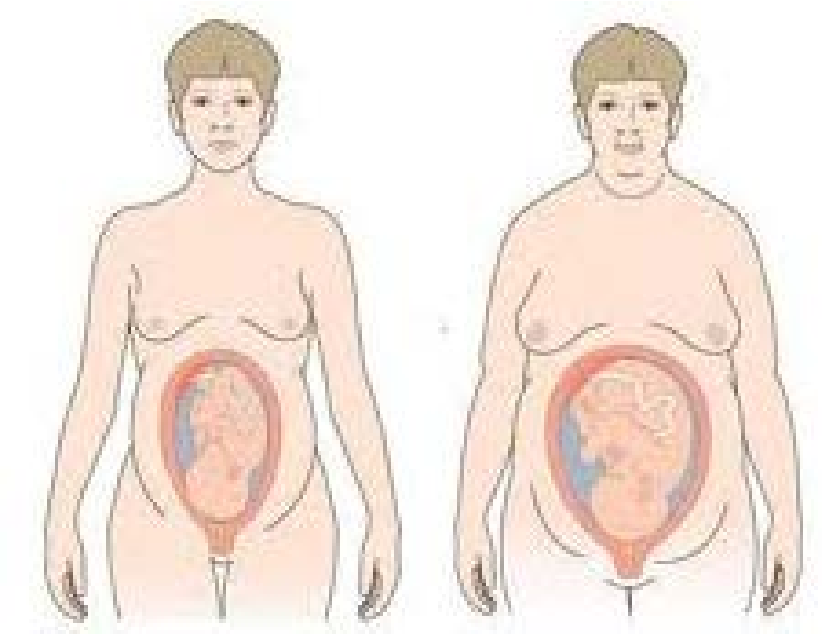
Figure 2. Age-Adjusted Rates of Pregnancy-Related Hypertension Among All Women and by Race/Ethnicity — Los Angeles County, California, 1991–2003

Baraban E, McCoy L, Simon P. Increasing prevalence of gestational diabetes and regnancy-related hypertension in Los Angeles County, California, 1991–2003. Prev Chronic Dis 2008;5(3). http://www.cdc.gov/pcd/issues/2008/jul/07_0138.htm. Accesse October 20, 2013

Chronic Metabolic Dysfunction Begins In-utero

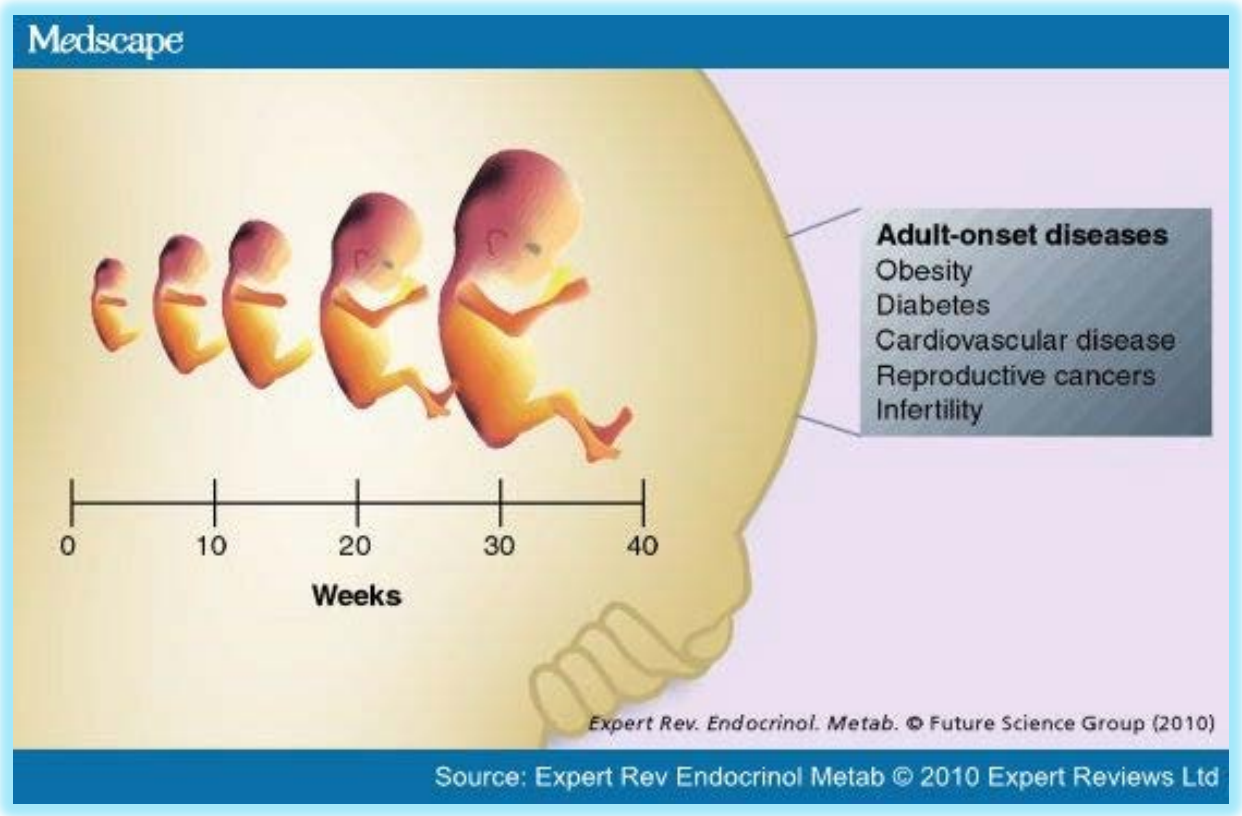
These women are identical...

Uncontrolled Diabetes During Pregnancy

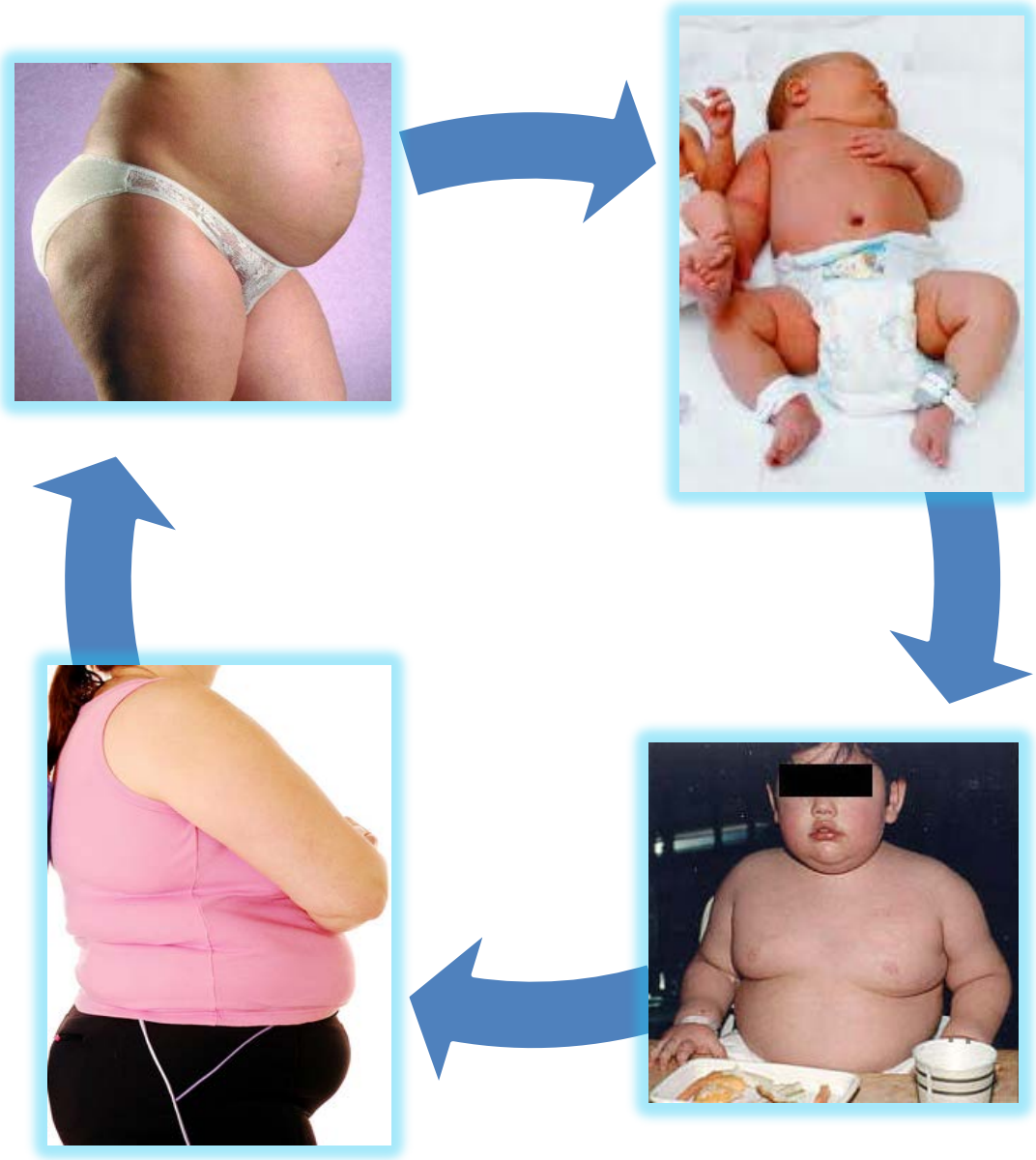


SANSUM DIABETES RESEARCH INSTITUTE

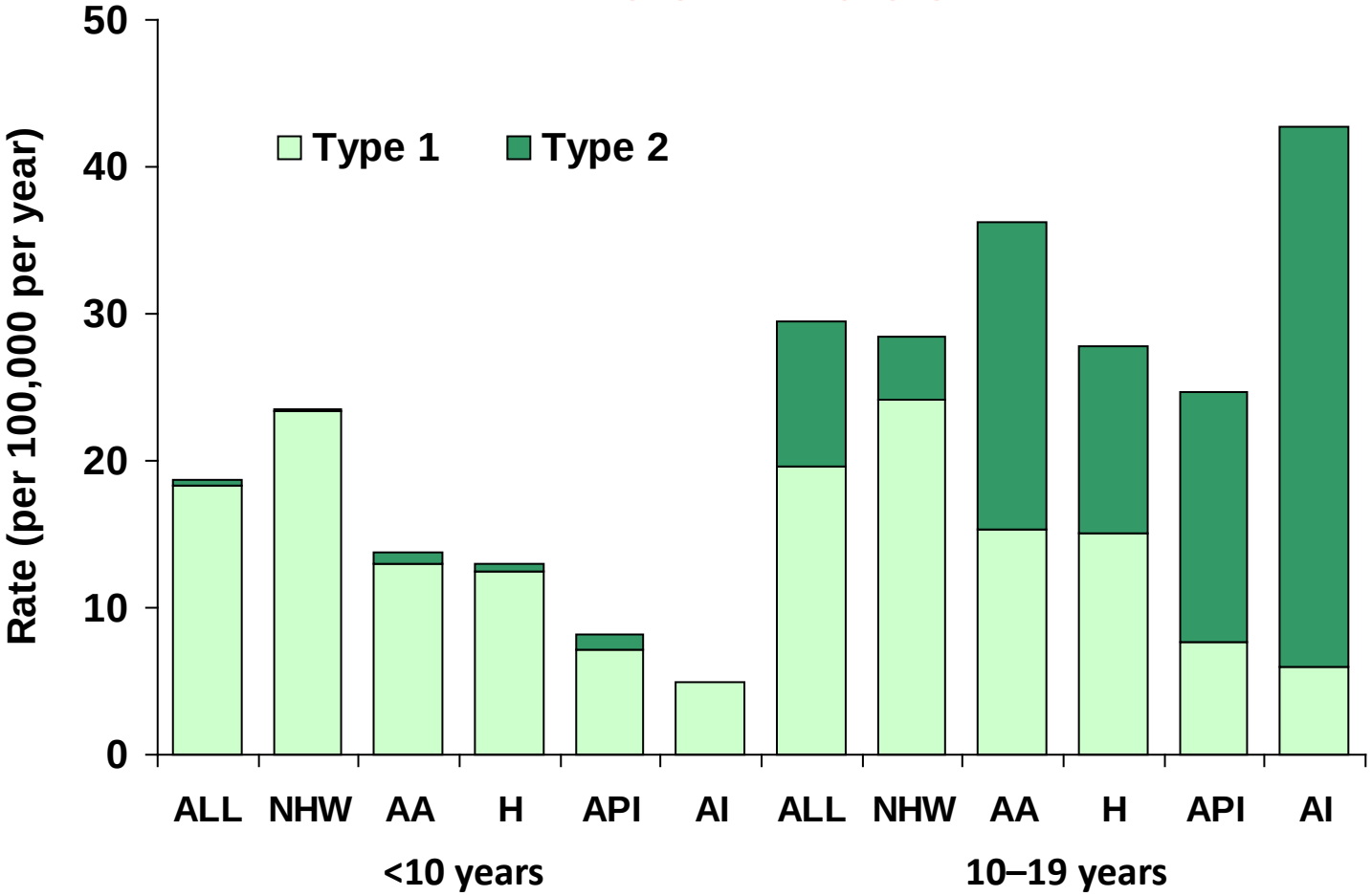
Diabetes in Pregnancy: Fetal Metabolic "Blueprint"



Diabetes and Obesity: A Vicious Cycle

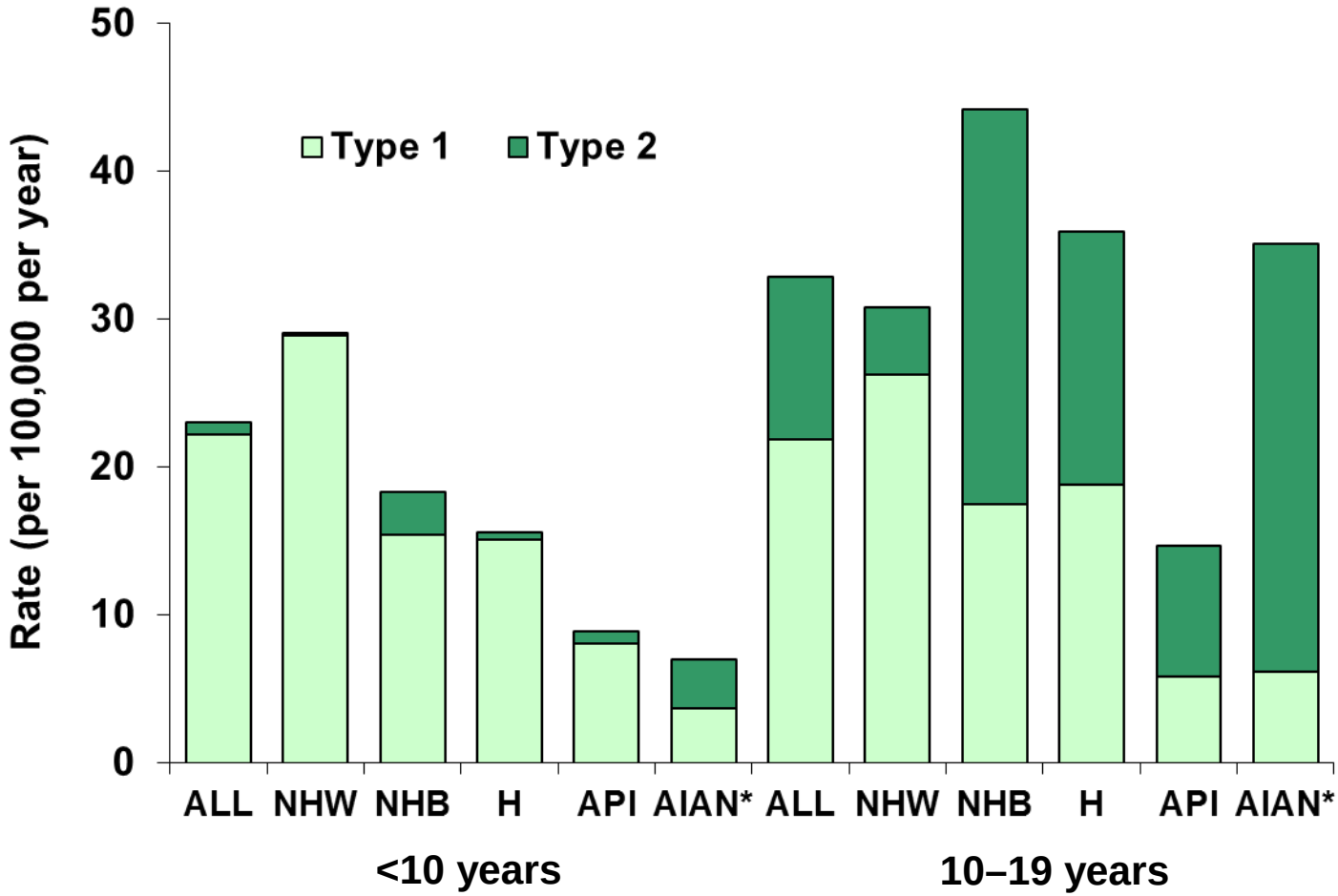


Rate of new cases of type 1 and type 2 diabetes among youth aged <20 years, by race/ethnicity, 2002–2003



CDC. National Diabetes Fact Sheet, 2007.
Source: SEARCH for Diabetes in Youth Study
NHW=Non-Hispanic whites; AA=African Americans; H=Hispanics; API=Asians/Pacific Islanders; AI=American Indian

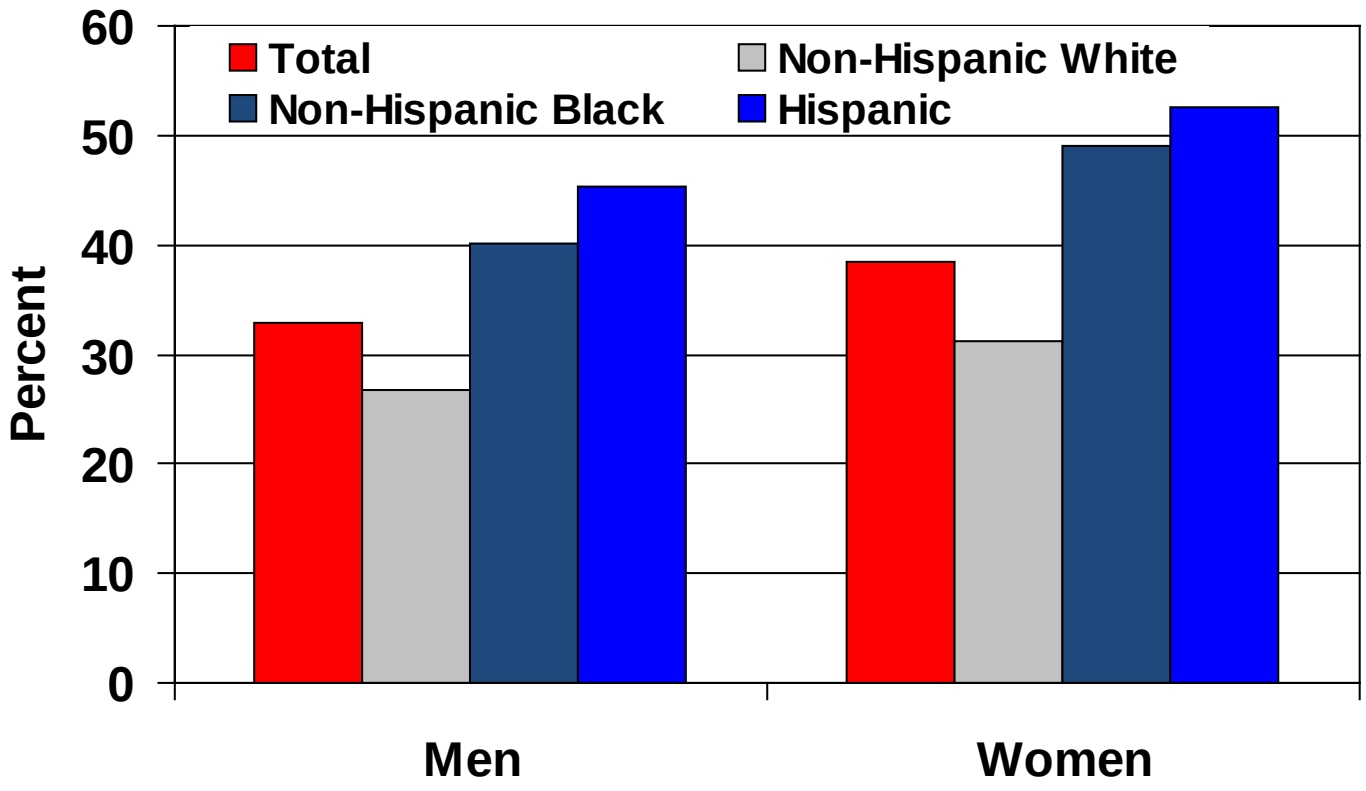
Rate of new cases of type 1 and type 2 diabetes among people younger than 20 years, by age and race/ethnicity, 2008–2009



Source: SEARCH for Diabetes in Youth Study. NHW=non-Hispanic whites; NHB=non-Hispanic blacks; H=Hispanics; API=Asians/Pacific Islanders; AIAN=American Indians/Alaska Natives.

*The American Indian/Alaska Native (AI/AN) youth who participated in the SEARCH study are not representative of all AI/AN youth in the United States. Thus, these rates cannot be generalized to all AI/AN youth nationwide.

Estimated lifetime risk of developing diabetes for individuals born in the United States in 2000



Narayan et al, JAMA, 2003

Original Article

Hyperglycemia and Adverse Pregnancy Outcomes

The HAPO Study Cooperative Research Group

N Engl J Med
Volume 358(19):1991-2002
May 8, 2008

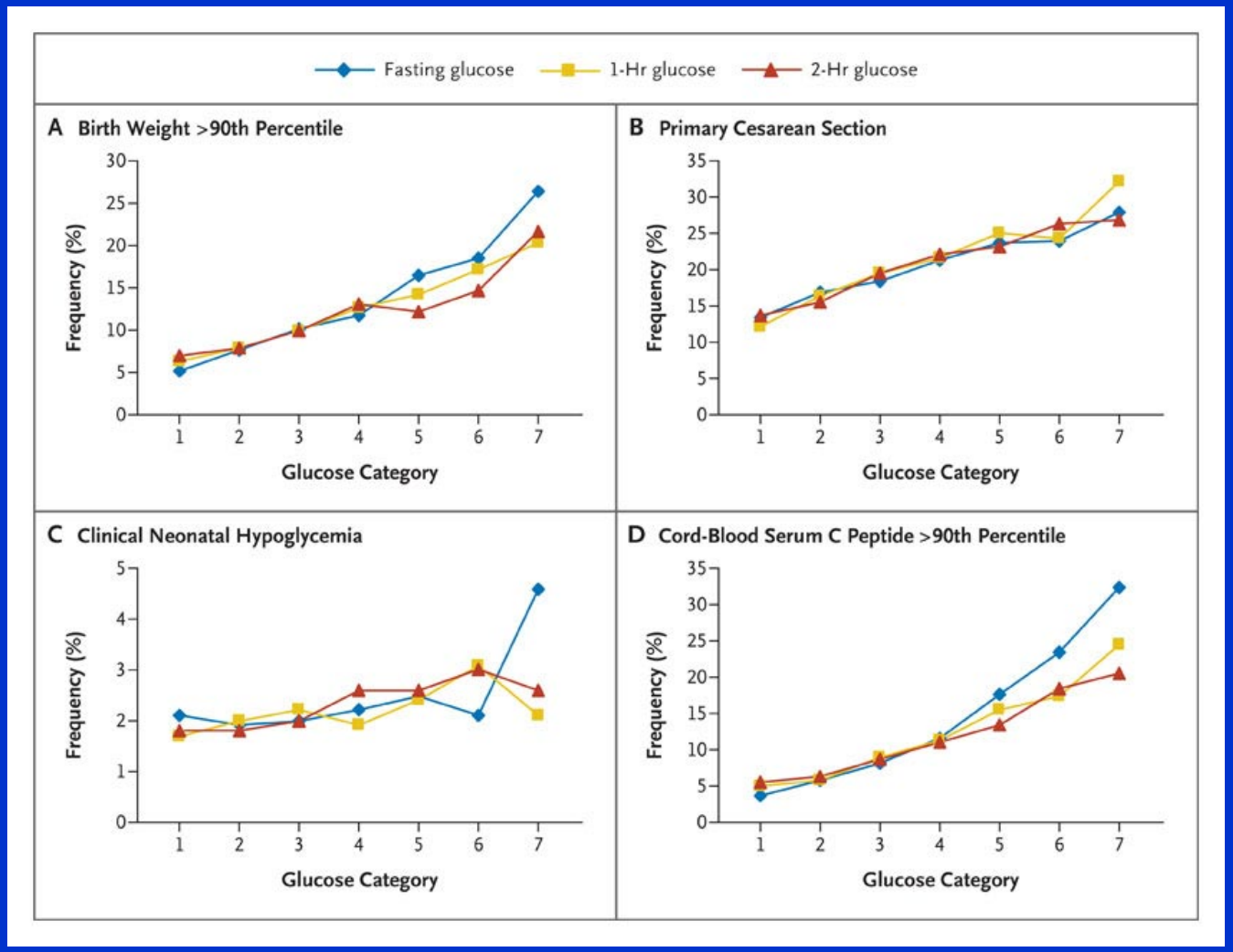
The NEW ENGLAND JOURNAL of MEDICINE

Study Overview

- In this large, multinational study, glucose levels that were increased during pregnancy but were below levels diagnostic of diabetes were significantly associated with increased risks of birth weight above the 90th percentile and C-peptide levels above the 90th percentile, as well as with other adverse pregnancy outcomes
- These results indicate the need to reconsider current thresholds for diagnosing and treating hyperglycemia during pregnancy

The NEW ENGLAND JOURNAL of MEDICINE

Frequency of Primary Outcomes across the Glucose Categories



The HAPO Study Cooperative Research Group. N Engl J Med 2008;358:1991-2002

The NEW ENGLAND JOURNAL of MEDICINE


February 18, 1956
THE SATURDAY EVENING POST
Born gentle
PROUD mothers, please forgive us if we too feel something of the pride of a new parent. For new Philip Morris, today's Philip Morris, is delighting smokers everywhere. Enjoy the gentle pleasure, the *fresh unfiltered flavor*, of this new cigarette, born gentle, then refined to special gentleness in the making. Ask for new Philip Morris in the smart new package.
Philip Morris
Cigarettes
King Size or Regular Snap-open Pack
©1956, Philip Morris Inc.
New Philip Morris...gentle for modern taste


7up
Watch "Soldiers of Fortune"
For exciting adventure, see this 7-Up TV show every week.
Why we have the youngest customers in the business
This young man is 11 months old—and he isn't our youngest customer by any means.
For 7-Up is so pure, so wholesome, you can even give it to babies and feel good about it. Look at the back of a 7-Up bottle. Notice that all our ingredients are listed. (That isn't required of soft drinks, you know—but we're proud to do it and we think you're pleased that we do.)
By the way, Mom, when it comes to toddlers—if they like to be coaxed to drink their milk, try this: Add 7-Up to the milk in equal parts, pouring the 7-Up gently into the milk. It's a wholesome combination—and it works! Make 7-Up your family drink. *You like it . . . it likes you!*
Avoid imitations served from taps or vending machines. Seven-Up is sold in bottles only.
Nothing does it like Seven-Up!


Uno de nosotros, no es como los otros.
¿Sabías que 9 de cada 10 niños no obtienen suficiente fibra?
Estos cereales de Kellogg's® son una manera fácil y divertida de ayudar a tus niños a obtener la fibra y el grano entero que necesitan.
Estos cereales contienen por lo menos 9 gramos de grano entero por porción.
Kellogg's hace de la fibra algo DIVERTIDO™
®, TM, © 2011 Kellogg NA Co.


Cheetos
Crunchy
IT AINT EASY BE-ING CHEESY
Frito Lay
food for the fun of it!
Dangerously Cheesy
Cheetos Baked!

Does treatment work?

...even for mild GDM?

Treating Mild GDM is Beneficial

Landon MD, Spong CY, Thom E, et al. A multicenter, randomized trial of treatment for mild gestational diabetes. N Engl J Med 2009; 361:1339.
Crowther CA, Hiller JE, Moss JR, et al. Effects of treatment of gestational diabetes mellutus on pregnancy outcomes. N Engl J Med 2005; 352:2477

Benefits of Treating Mild GDM

Table 2. Primary Perinatal Outcome.*

Outcome Variable	Treatment Group (N=485)	Control Group (N=473)	Relative Risk (97% CI)	P Value
Gestational age at birth — wk	39.0±1.8	38.9±1.8		0.87
Composite end point — no./total no. (%)†	149/460 (32.4)	163/440 (37.0)	0.87 (0.72–1.07)	0.14
Hypoglycemia‡	62/381 (16.3)	55/357 (15.4)	1.06 (0.73–1.53)	0.75
Hyperbilirubinemia‡	43/450 (9.6)	54/418 (12.9)	0.74 (0.49–1.12)	0.12
Elevated cord-blood C-peptide level‡	75/423 (17.7)	92/403 (22.8)	0.78 (0.57–1.05)	0.07
Stillbirth or neonatal death	0	0		
Birth trauma§	3/476 (0.6)	6/455 (1.3)	0.48 (0.10–2.20)	0.33

* Plus–minus values are means ±SD.
† The composite perinatal outcome included stillbirth, neonatal death, hypoglycemia, hyperbilirubinemia, elevated cord-blood C-peptide level, and birth trauma.
‡ The results of some blood tests were not available either because samples were not obtained or were not obtained according to protocol or because they could not be assayed owing to a laboratory processing error.
§ Data were not available in some cases because some women delivered at outside institutions.

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Benefits of Treating Mild GDM

Table 3. Secondary Neonatal Outcomes.*

Outcome Variable	Treatment Group (N=485)	Control Group (N=473)	Relative Risk (97% CI)	P Value
Birth weight — g	3302±502.4	3408±589.4		<0.001
Birth weight >4000 g — no./total no. (%)	28/477 (5.9)	65/454 (14.3)	0.41 (0.26–0.66)	<0.001
Large for gestational age — no./total no. (%)†	34/477 (7.1)	66/454 (14.5)	0.49 (0.32–0.76)	<0.001
Fat mass — g	427.0±197.9	464.3±222.3		0.003
Preterm delivery — no./total no. (%)‡	45/477 (9.4)	53/455 (11.6)	0.81 (0.53–1.23)	0.27
Small for gestational age — no./total no. (%)§	36/477 (7.5)	29/455 (6.4)	1.18 (0.70–1.99)	0.49
Admission to NICU — no./total no. (%)	43/477 (9.0)	53/455 (11.6)	0.77 (0.51–1.18)	0.19
Intravenous glucose treatment — no./total no. (%)	25/475 (5.3)	31/455 (6.8)	0.77 (0.44–1.36)	0.32
Respiratory distress syndrome — no./total no. (%)	9/477 (1.9)	13/455 (2.9)	0.66 (0.26–1.67)	0.33

* Plus–minus values are means ±SD. There were 10 women in the treatment group and 19 women in the control group for whom at least some delivery data were missing. NICU denotes neonatal intensive care unit.
† Large for gestational age refers to a birth weight above the 90th percentile.
‡ Preterm delivery refers to delivery before 37 weeks of gestation.
§ Small for gestational age refers to a birth weight below the 10th percentile.

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Benefits of Treating Mild GDM

Table 4. Maternal Outcomes.*

Outcome Variable	Treatment Group (N=476)	Control Group (N=455)	Relative Risk (97% CI)	P Value
Induction of labor — no. (%)	130 (27.3)	122 (26.8)	1.02 (0.81–1.29)	0.86
Cesarean delivery — no. (%)	128 (26.9)	154 (33.8)	0.79 (0.64–0.99)	0.02
Shoulder dystocia — no. (%)	7 (1.5)	18 (4.0)	0.37 (0.14–0.97)	0.02
Preeclampsia — no. (%)	12 (2.5)	25 (5.5)	0.46 (0.22–0.97)	0.02
Preeclampsia or gestational hypertension — no. (%)	41 (8.6)	62 (13.6)	0.63 (0.42–0.96)	0.01
Body-mass index at delivery†	31.3±5.2	32.3±5.2		<0.001
Weight gain — kg‡	2.8±4.5	5.0±3.3		<0.001

* Plus–minus values are means ±SD. The number in each group refers to the number of women for whom all delivery data were available.
† The body-mass index is the weight in kilograms divided by the square of the height in meters.
‡ Weight gain refers to weight gain from enrollment in the trial until delivery.

The NEW ENGLAND JOURNAL of MEDICINE

Summary of Benefits of Treating Mild GDM

Significant reduction:

- Fetal overgrowth
- Shoulder dystocia
- Cesarean delivery
- Hypertensive disorders
- Weight gain during pregnancy

No significant reduction:

- Stillbirth
- Perinatal death
- Several neonatal complications

Landon MD, Spong CY, Thom E, et al. A multicenter, randomized trial of treatment for mild gestational diabetes. N Engl J Med 2009; 361:1339.

Lapolla A, Dalfra MG, Ragazzi E, et al. New IADPSG recommendations for diagnosing gestational diabetes compared with former criteria: a retrospective study on pregnancy outcome. Diabet Med 2011; 28:1074.

WHO, ADA and IADPSG Recommendations: Detection of Pre-existing Diabetes

Universal screening/testing at Initial Prenatal Visit

– A1C
– Glucose tolerance test
– Other?

ADA. III Detection and Diagnosis of GDM. Diabetes Care 2012, 3(SUPPL 1):S15
Coustan, Jovanovic, et al. Diagnosis of diabetes mellitus during pregnancy.

UpToDate www.uptodate.com. Accessed October 2014

Diagnosis of GDM

You Choose:

ACOG:

- 2-Step (50g screen, then 100g OGTT)

IADPSG (International Association for Diabetes and Pregnancy Study Group)

- 75g OGTT at 24-28 weeks

American Diabetes Association:

- This year: flipped back to ACOG recommendation

You should Screen/Test:

- Women without risk factors, or
- Women who had a normal early screen

ADA. III Detection and Diagnosis of GDM. Diabetes Care 2012, 3(SUPPL 1):S15
ACOG Position Statement 2012

What is your approach?

Simple Solutions:

- ✓ A1C with prenatal labs
- ✓ Team approach to care
- ✓ Utilize our strongest medicines: Food and Activity
- ✓ Strive for NORMAL…
  - ✓ Blood glucose levels
  - ✓ Weight gain before, during and after pregnancy
- ✓ Use insulin – especially with meals


THE BIGGEST LOSER
SECOND CHANCES

Let's return to our client:

MD is a 35 yo G4P3 s/p c/section delivery at 38 weeks for worsening HTN.

Her initial A1C was 9.4%, and her A1C before delivery was 5.9%. Infant was AGA but had a small ventricular septal defect which will require surgery. During pregnancy, MD developed progressive vision loss due to retinal hemorrage related to uncontrolled diabetes in the setting of pregnancy.

Now all of this is resolved...and MD is continuing with condoms for her preferred family planning method...

Now for a story about another patient…

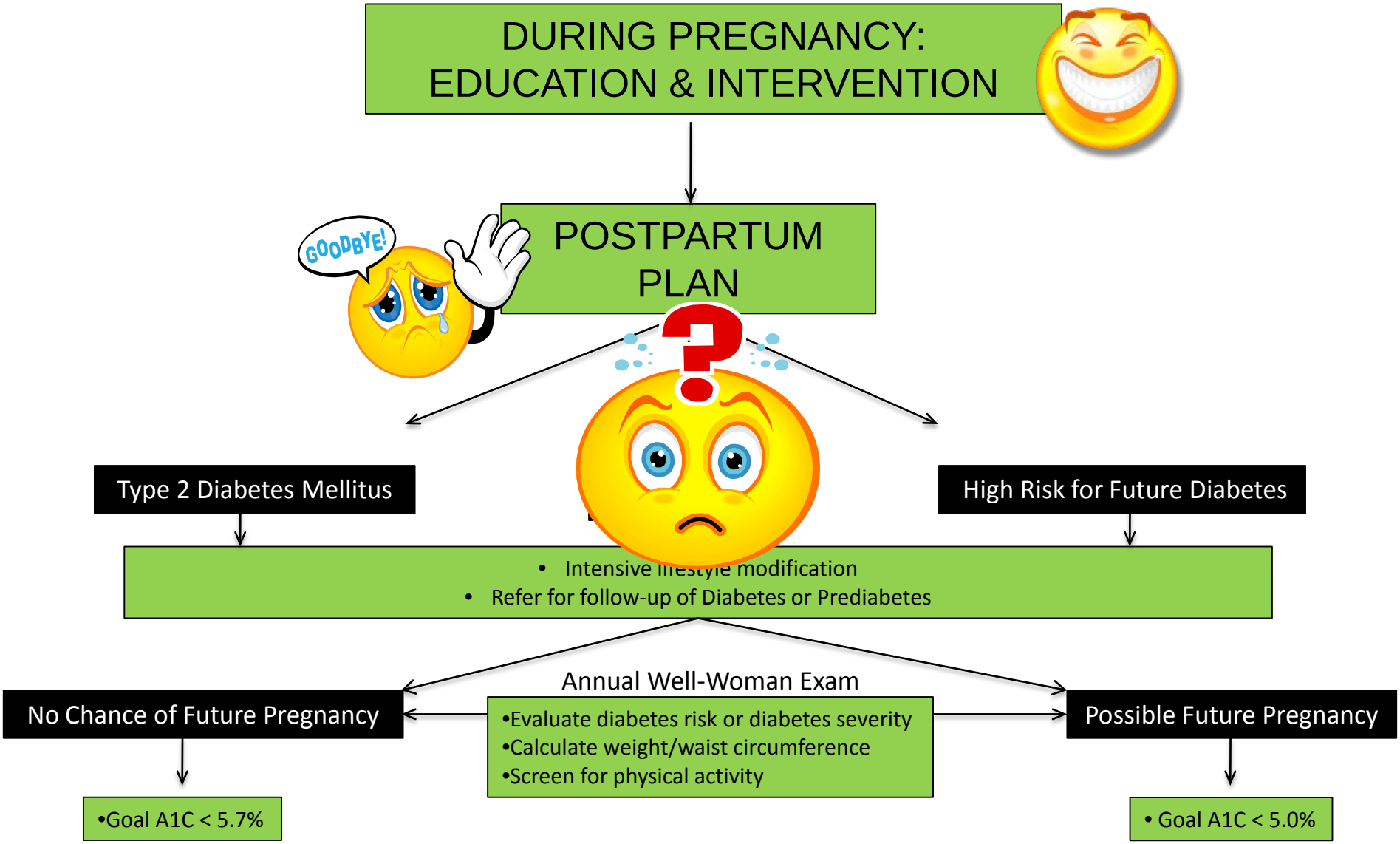
Once upon a time, I met JP, who was a 32 G3P2 with uncontrolled T2D who was currently pregnant with twins…

William Sansum Diabetes Center
Seeds of Change
(*Semillas de Cambio*)

Inter-Conception Education

- *What it is*
- *Why it matters*
- *How we help*

Inter-conception Diabetes Education



How We Help

Seeds of Change:
We help by planting seeds of change for a healthier tomorrow

Overview of the Seeds of Change Program:

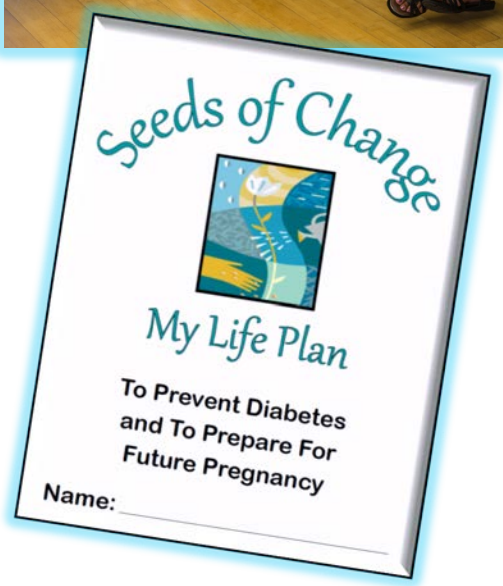
Goals of program:

- Highly effective diabetes prevention education for women who had a previous pregnancy complicated by diabetes
- Reproducible
- Cost-effective

Overview of the Seeds of Change Program:

OUTCOMES:

- ✓ Seven 90 minute classes
- ✓ Scripted curriculum
- ✓ Life Plan
- ✓ Classes led by Promotoras
- ✓ Class series paired with quarterly health outcome measurements



Overview of the Seeds of Change Program

Meg Beard of Santa Barbara County WIC educating SDRI staff and Promotoras on brestfeeding practices.

OUTCOMES, continued:

- ✓ Comprehensive Promotora Training Program
- ✓ Partnerships with:
  - ✓ Maternal Child and Adolescent Health Department
  - ✓ WIC
  - ✓ SBC Promotora Program
  - ✓ Madre a Madre

Why are we taking action?

- **Need for early intervention** – It is usually too late to prevent birth defects, as most women do not receive screening for diabetes until well after their first trimester
- **Need a socio-economic safety net** – without this, women would not receive any care between pregnancies
- **Address the obesity epidemic** – diabetes and obesity go hand in hand
- **Prevent type 2 diabetes** in both the mother and the next generation; two for the price of one!

Our approach:

Empowering women and their families through community-based peer-led health education programs


Bienvenidos a la classe # 7
De SEMILLAS DE CAMBIO
1. Firme la hoja de participación
La leche materna tiene más
Diabetes tipo 2

Connect

Educate


A Healthy Habit:
Read Food Labels
Nutrition Facts
Serving Size: 6 crackers (28g)
Servings Per Container: About 13
Amount Per Serving
Calories 120
Calories from Fat 40
% Daily Value*
Total Fat 4.5g
Trans Fat 0g
Polyunsaturated Fat 2.5g
Monounsaturated Fat 1.5g
Cholesterol 0mg
Sodium 180mg
Total Carbohydrate 19g
Dietary Fiber 3g
Sugars 0g
Protein 3g
Vitamin A 0%
Vitamin C 0%
Calcium 0%
Iron 8%
Start Here
Limit These
Get More of These
Footnotes
La leche materna tiene más
Leche materna
Fórmula

Empower

Reinforce

We are looking for partners...

Announcing:

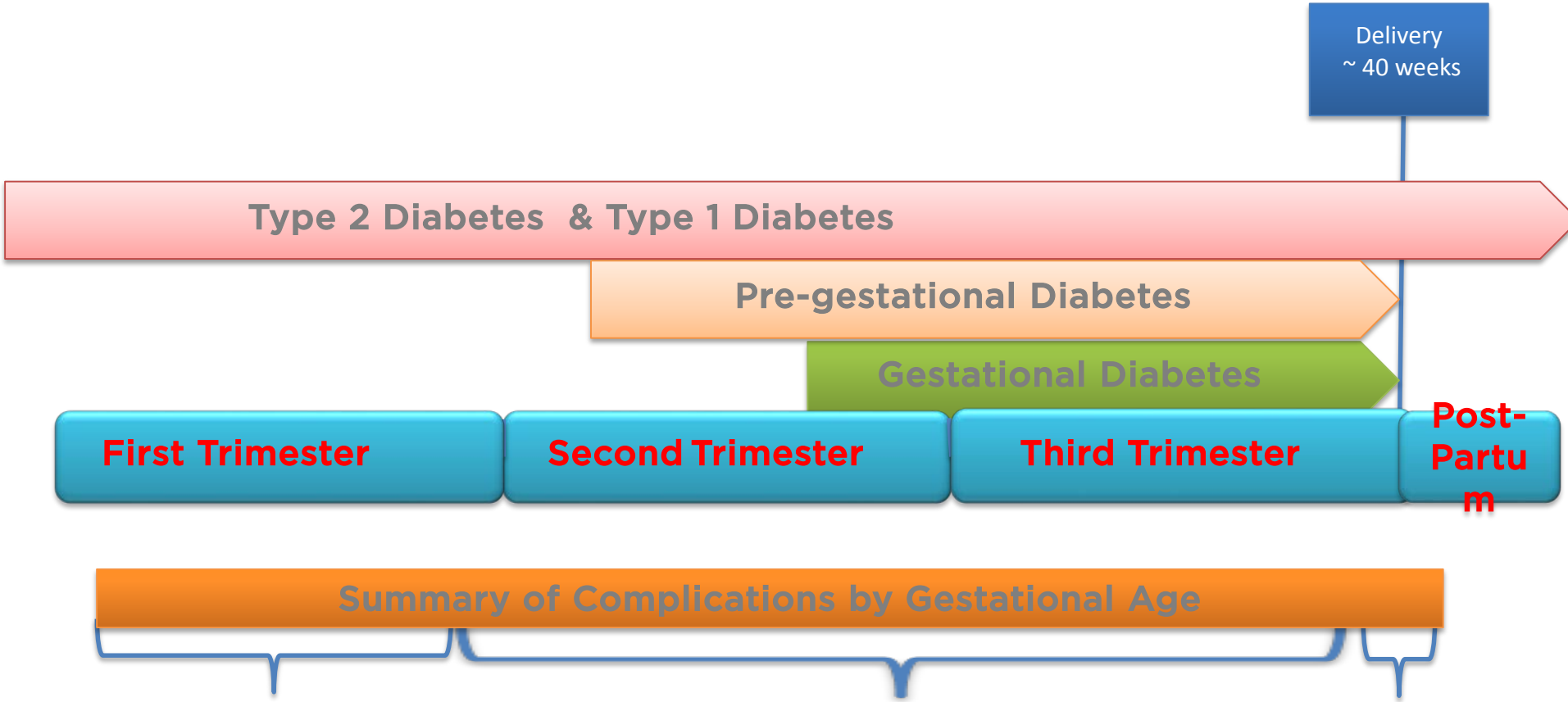
Seeds of Change Train-the-Trainer

Spring 2015

Summary

- Discussed the different types of diabetes during pregnancy
- Identified the Key Windows for treating diabetes during pregnancy and the
- Discussed the various goals for treatment
- Discuss methods for preventing GDM
- Q&A

Summary of Diabetes and Pregnancy



Pre-Pregnancy & First Trimester

- **Birth defects**
- Miscarriage
- Glycemic variability

Second Trimester

- **Abnormal metabolic blueprint in exposed neonates**
- Stillbirth (uncommon)
- Other complications (preeclampsia)
- Changing Insulin Requirements and
- Insulin Resistance (2-3x pre-pregnant requirements)

Delivery

- **Delivery trauma for mother and baby**
- Neonatal adaptation to new glycemic environment
- Glycemic variability

WILLIAM SANSUM
DIABETES CENTER

Thank You!

Kristin Castorino, DO
kcastorino@sansum.org
www.sansum.org
805.708.2630

A special thanks to Louise Davis, PSC for Santa Barbara County – for inspiring me to reach farther