Is early screening of diabetes necessary in Korean women ?

SNUH
분당서울대학교병원

Obstetrics and Gynecology
Joon-Seok Hong MD. PhD.

Contents

1 Introduction

2 Data of Korean women of reproductive age

3 Conclusion

Definition of Gestational Diabetes Mellitus

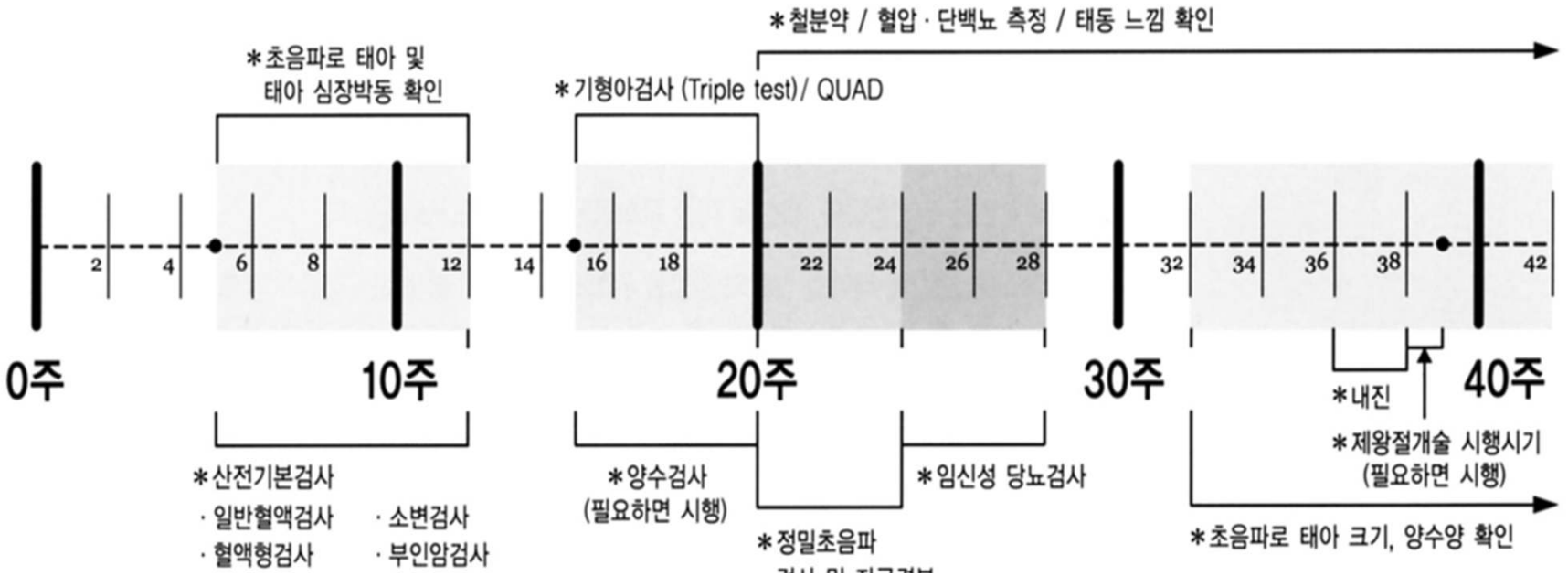
- Carbohydrate intolerance
  of variable severity
  with onset or first recognition
  during the present pregnancy.

* "Gestational" diabetes implies that this disorder is induced by pregnancy, perhaps due to exaggerated physiological changes in glucose metabolism

Third International Workshop-Conference on GDM, 1991
ACOG Practice Bulletin, 2001

Limitation of GDM Definition

- Definition dose not exclude the possibility that unrecognized glucose intolerance may have antedated or begun concomitantly with the pregnancy (Pregestational diabetes/ Overt DM)



Congenital malformations in offspring of women with hyperglycemia first detected during pregnancy

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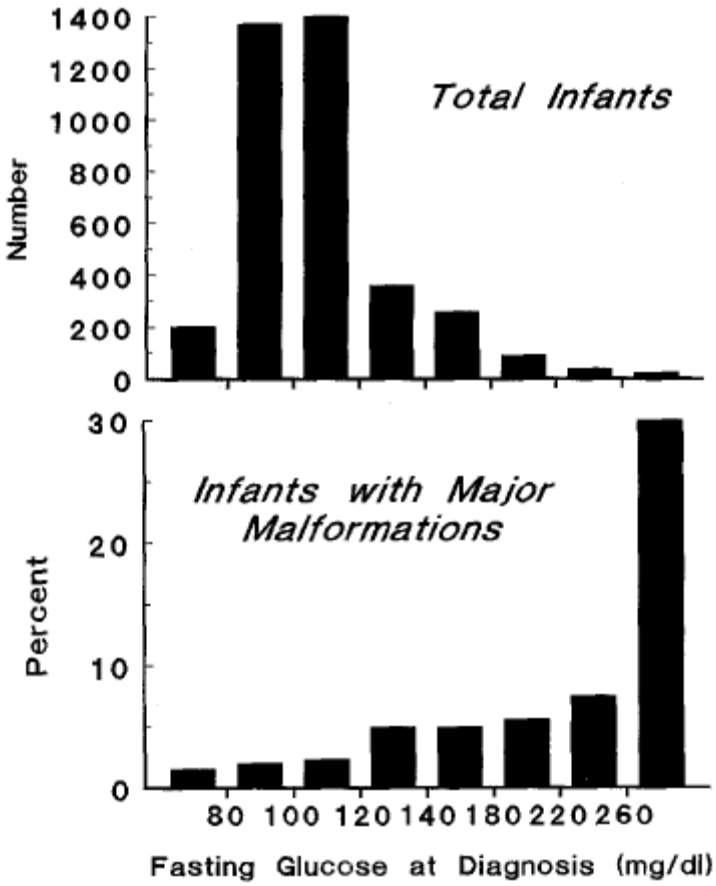
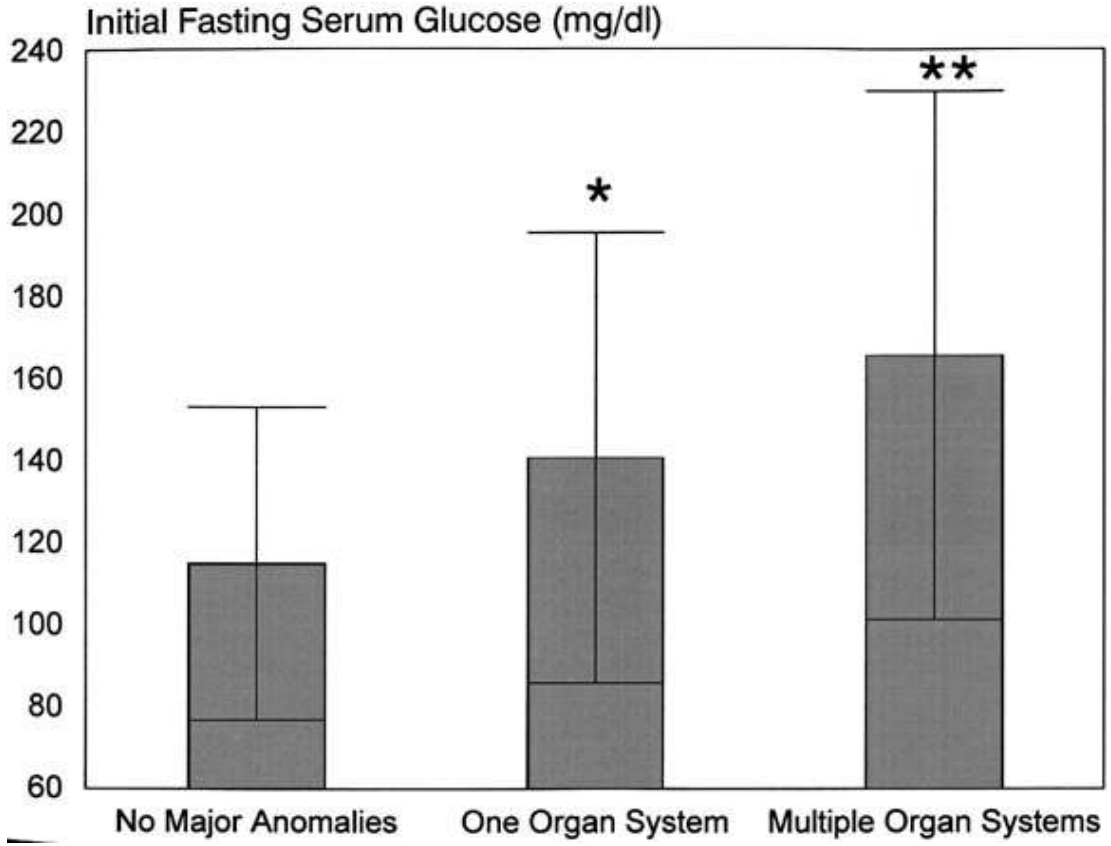
Los Angeles, California, and Berlin, Germany



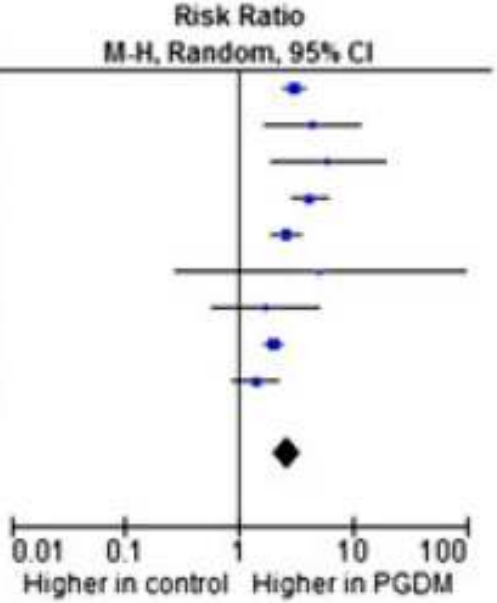


A

Study or Subgroup	Pregestational DM Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Janssen 1996	111	1511	214	8926	19.1%	3.06 [2.45, 3.83]	1996
Moore 2000	4	68	299	22377	5.7%	4.40 [1.69, 11.47]	2000
Lazalde 2001	7	30	4	103	4.2%	6.01 [1.88, 19.15]	2001
Sheffield 2002	25	410	2075	142509	15.1%	4.19 [2.86, 6.14]	2002
Queisser-Luft 2002	37	207	2090	30572	17.4%	2.61 [1.95, 3.51]	2002
Abdelgadir 2003	3	69	0	50	0.8%	5.10 [0.27, 96.58]	2003
Savona-Ventura 2003	3	47	318	8547	4.6%	1.72 [0.57, 5.15]	2003
Sharpe 2005	96	946	14257	282260	19.8%	2.01 [1.66, 2.43]	2005
Peticca 2009	18	891	727	50914	13.2%	1.41 [0.89, 2.25]	2009
Total (95% CI)		**4179**		**546258**	**100.0%**	**2.66 [2.04, 3.47]**	
Total events	304		19984				

Heterogeneity: $Tau^2 = 0.08$; $Chi^2 = 25.48$, df = 8 (P = 0.001); $I^2 = 69\%$

Test for overall effect: Z = 7.24 (P < 0.00001)

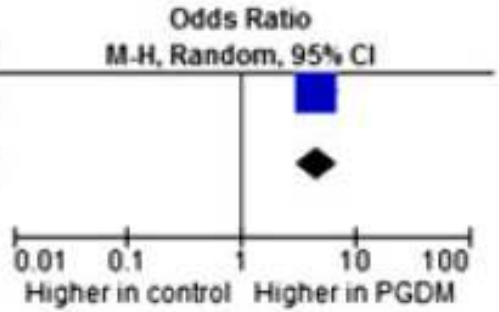


B

Study or Subgroup	Pregestational Events	Total	Control Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Correa 2008	283	307	12087	16776	100.0%	4.57 [3.01, 6.95]
Total (95% CI)		**307**		**16776**	**100.0%**	**4.57 [3.01, 6.95]**
Total events	283		12087			

Heterogeneity: Not applicable

Test for overall effect: Z = 7.13 (P < 0.00001)

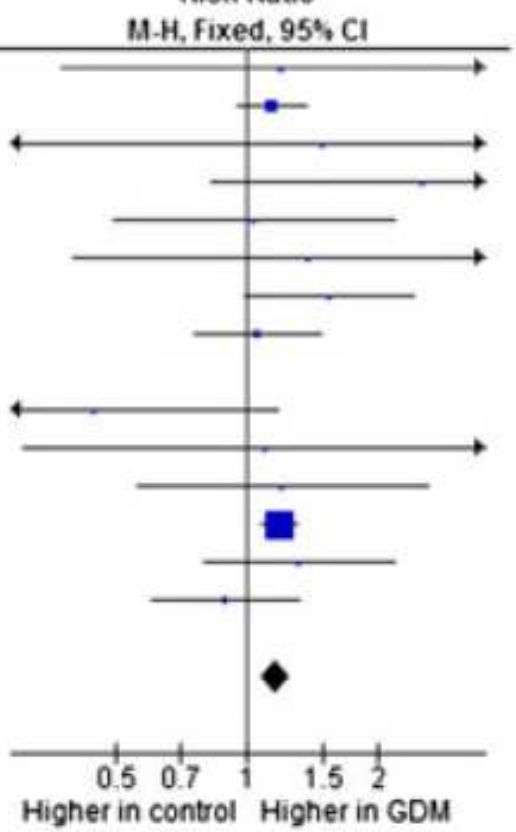


Diabetes/Metabolism Res & Review 2012:28:252-257

A

Study or Subgroup	GDM Events	GDM Total	Control Events	Control Total	Weight	Risk Ratio M-H, Fixed, 95% CI	Year
Hod 1996	9	470	4	250	0.5%	1.20 [0.37, 3.85]	1996
Janssen 1996	242	8868	214	8926	19.3%	1.14 [0.95, 1.36]	1996
Djelmis 1997	1	94	0	46	0.1%	1.48 [0.06, 35.74]	1997
Ramachandran 1998	5	211	8	851	0.3%	2.52 [0.83, 7.63]	1998
Moore 2000	7	506	299	22377	1.2%	1.04 [0.49, 2.18]	2000
Lazalde 2001	6	112	4	103	0.4%	1.38 [0.40, 4.75]	2001
Queisser-Luft 2002	17	161	2090	30572	2.0%	1.54 [0.98, 2.43]	2002
Sheffield 2002	35	2277	2075	142509	5.9%	1.06 [0.76, 1.47]	2002
Abdelgadir 2003	0	19	0	50		Not estimable	2003
Savona-Ventura 2003	4	242	318	8547	1.6%	0.44 [0.17, 1.18]	2003
Bo 2004	3	135	10	496	0.4%	1.10 [0.31, 3.95]	2004
Chico 2005	7	404	84	5844	1.0%	1.21 [0.56, 2.59]	2005
Sharpe 2005	405	6735	14257	282260	60.2%	1.19 [1.08, 1.31]	2005
Ricart 2005	17	819	133	8451	2.1%	1.32 [0.80, 2.17]	2005
Peticca 2009	26	2046	727	50914	5.1%	0.89 [0.60, 1.31]	2009
Total (95% CI)		**23099**		**562196**	**100.0%**	**1.16 [1.07, 1.25]**	
Total events	784		20223				

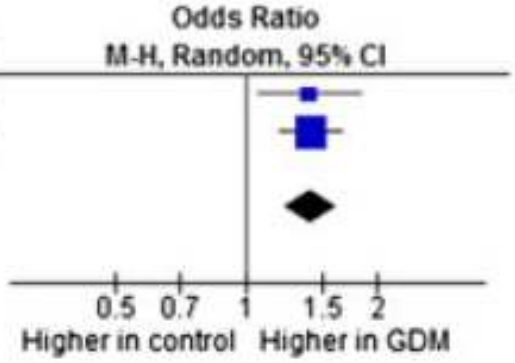
Heterogeneity: Chi² = 10.03, df = 13 (P = 0.69); I² = 0%
Test for overall effect: Z = 3.76 (P = 0.0002)

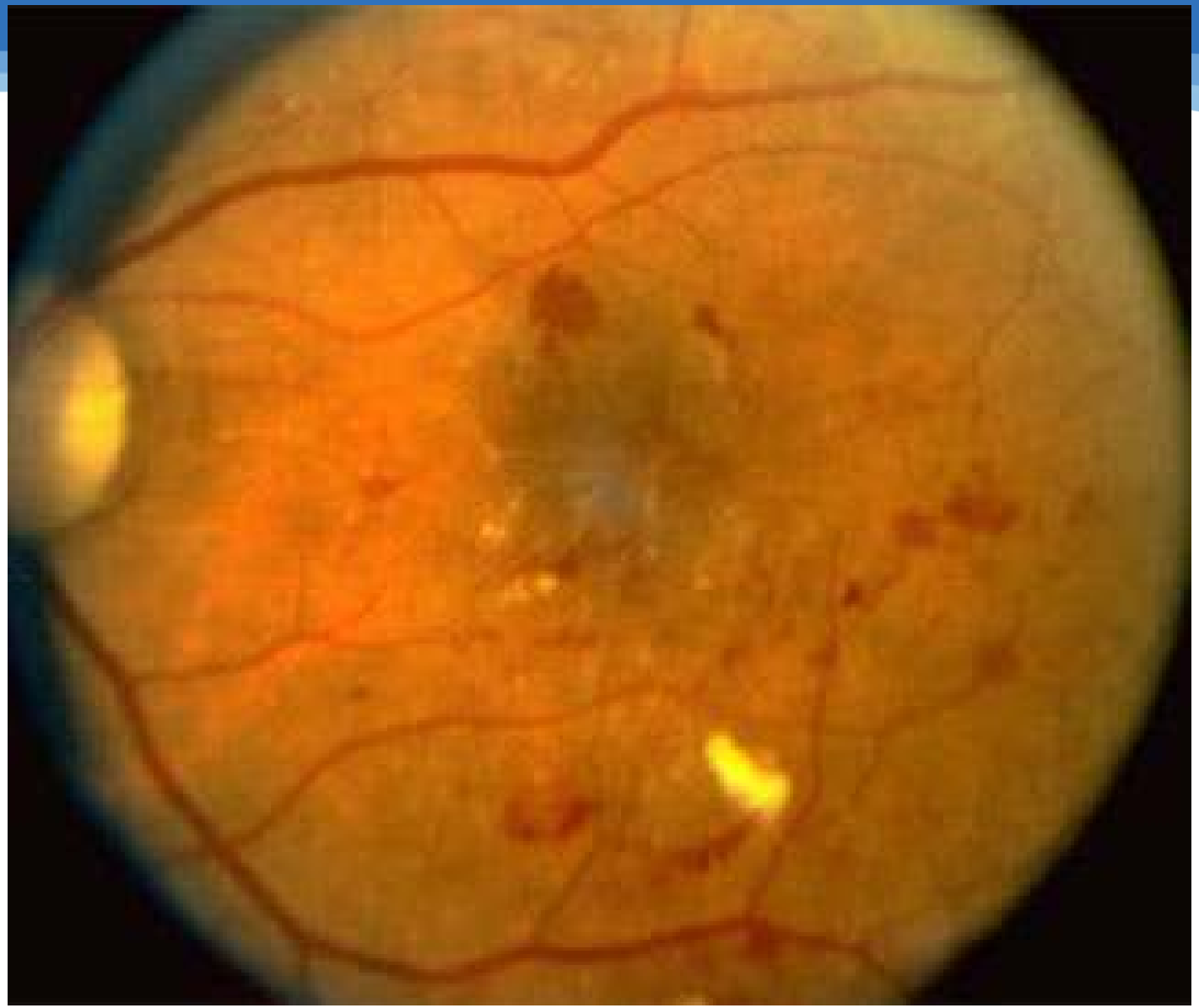


B

Study or Subgroup	GDM Events	GDM Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Martinez-Frias 2005	72	302	1335	7265	27.6%	1.39 [1.06, 1.82]	2005
Correa 2008	660	842	12087	16776	72.4%	1.41 [1.19, 1.66]	2008
Total (95% CI)		**1144**		**24041**	**100.0%**	**1.40 [1.22, 1.62]**	
Total events	732		13422				

Heterogeneity: Tau² = 0.00; Chi² = 0.01, df = 1 (P = 0.94); I² = 0%
Test for overall effect: Z = 4.65 (P < 0.00001)





Gestational diabetes mellitus diagnosed during early pregnancy

Jose L. Bartha, MD, Pilar Martinez-Del-Fresno, MD, and Rafael Comino-Delgado, MD
Puerto Real, Spain

Table I. Characteristics of study sample

	Early-onset gestational diabetes (n = 65)	*Late-onset gestational diabetes (n = 170)*	*Statistical significance*
Gestational age (wk, mean ± SD)	18.1 ± 6.5	33.1 ± 3.9	$P < .000001$
Age (y, mean ± SD)	33.6 ± 5.4	32.6 ± 5.3	NS
Pregestational body mass index (kg/m^2, mean ± SD)	29.1 ± 6.9	25.3 ± 3.8	$P = .00006$
Gestational body mass index (kg/m^2, mean ± SD)	31.8 ± 6.5	29.0 ± 3.8	$P = .001$
Total weight gain (kg, mean ± SD)	6.7 ± 4.3	9.5 ± 3.8	$P < .000001$
Twin gestations (No.)	2/65 (3.1%)	3/170 (1.8%)	NS
Nulliparous (No.)	36/65 (55.4%)	94/170 (55.3%)	NS
Previous spontaneous abortion (No.)	12/65 (18.5%)	31/170 (18.2%)	NS
Previous cesarean delivery (No.)	6/65 (9.2%)	10/170 (5.9%)	NS

(Am J Obstet Gynecol 2000;182:346-50.)

Table II. Pregnancy complications

	Early-onset gestational diabetes (n = 65)		*Late-onset gestational diabetes (n = 170)*		
	No.	*%*	*No.*	*%*	*Statistical signif*
Hypertension (total)	12	18.5	10	5.9	*P* = .006
Chronic hypertension	7	10.8	4	2.4	*P* = .01
Preeclampsia	2	3.1	0	0	*P* = .07
Superimposed preeclampsia	2	3.1	1	0.6	NS
Total preeclampsia (preeclampsia plus superimposed preeclampsia)	4	6.2	1	0.6	*P* = .02
Gestational hypertension	1	1.5	5	2.9	NS
Hydramnios	2	3.1	7	4.1	NS
Preterm labor	2	3.1	6	3.5	NS
Fetal anomalies	0	0	0	0	NS
Oligohydramnios	0	0	11	6.47	*P* = .02

(Am J Obstet Gynecol 2000;182:346-50.)

Table III. Glycemic control and insulin therapy

	Early-onset gestational diabetes (n = 65)	*Late-onset gestational diabetes (n = 170)*	*Statistical significance*
Fasting glucose level (mg/dL, mean ± SD)	91.4 ± 16.1	79.8 ± 14.2	$P < .00001$
Glucose level after breakfast (mg/dL, mean ± SD)	104.6 ± 29.3	95.9 ± 20.6	$P = .03$
Glucose level after lunch (mg/dL, mean ± SD)	102.6 ± 19.4	91.57 ± 16.2	$P = .00009$
Glucose level before dinner (mg/dL, mean ± SD)	82.1 ± 17.3	77.1 ± 14.6	$P = .039$
Glucose level after dinner (mg/dL, mean ± SD)	102.8 ± 26.0	93.7 ± 17.3	$P = .01$
Mean glycemic profile (mg/dL, mean ± SD)	96.7 ± 15.0	87.6 ± 10.4	$P = .00002$
Glycosylated hemoglobin (%, median and interquartile range)	4.5 (4.2-5.2)	4.6 (4.3-4.9)	NS
Insulin therapy (No.)	22/65 (33.9%)	12/170 (7.1%)	$P < .00001$

NS, Not significant.

Table IV. Obstetric and neonatal outcomes

	Early-onset gestational diabetes (n = 50)	*Late-onset gestational diabetes (n = 133)*	*Statistical signific*
Vaginal births	38 (76%)	107 (80.5%)	NS
Cesarean deliveries for fetal distress	1 (8.3%)	2 (7.7%)	NS
Cesarean deliveries for fetopelvic disproportion	4 (33.3%)	12 (46.2%)	NS
Cesarean deliveries for failed induction	1 (8.3%)	1 (3.9%)	NS
Gestational age at birth (wk, mean ± SD)	39.0 ± 2.7	39.3 ± 1.7	NS
Preterm births	3 (6%)	7 (5.3%)	NS
5-min Apgar score <7	1 (2%)	4 (3.0%)	NS
1-min Apgar score <6	6 (12%)	6 (4.5%)	NS
Neonatal weight (g, mean ± SD)	3419.6 ± 643.3	3281.4 ± 580.9	NS
Small for gestational age	5 (10%)	20 (15.0%)	NS
Macrosomia (>4000 g)	7 (14%)	11 (8.3%)	NS
Meconium passage	9 (23.1%)	24 (21.8%)	NS
Special care baby unit admission	5 (10%)	14 (10.5%)	NS
Neonatal hypoglycemia	4 (8%)	0 (0%)	$P = .005$
Low birth weight (<2500 g)	0 (0%)	6 (4.5%)	NS
Perinatal deaths	3 (6%)	0 (0%)	$P = .02$

NS, Not significant.

Proposal for the Reconsideration of the Definition of Gestational Diabetes

In 1997, the American Diabetes Association (ADA) announced a new diagnostic criterion for diabetes and set the definition of gestational diabetes mellitus (GDM). Before 1991, GDM was defined as "a transient abnormality of glucose tolerance during pregnancy" (2–4). However, the 1997 definition of GDM by the ADA includes diabetes diagnosed during pregnancy. This definition ignores the added risks to the mother and to the fetus when the mother has undiagnosed type 2 diabetes. We propose reconsideration of the definition, which would separate diabetes and slight abnormal carbohydrate, so-called GDM, to provide a better model of care for type 2 diabetic pregnant women.

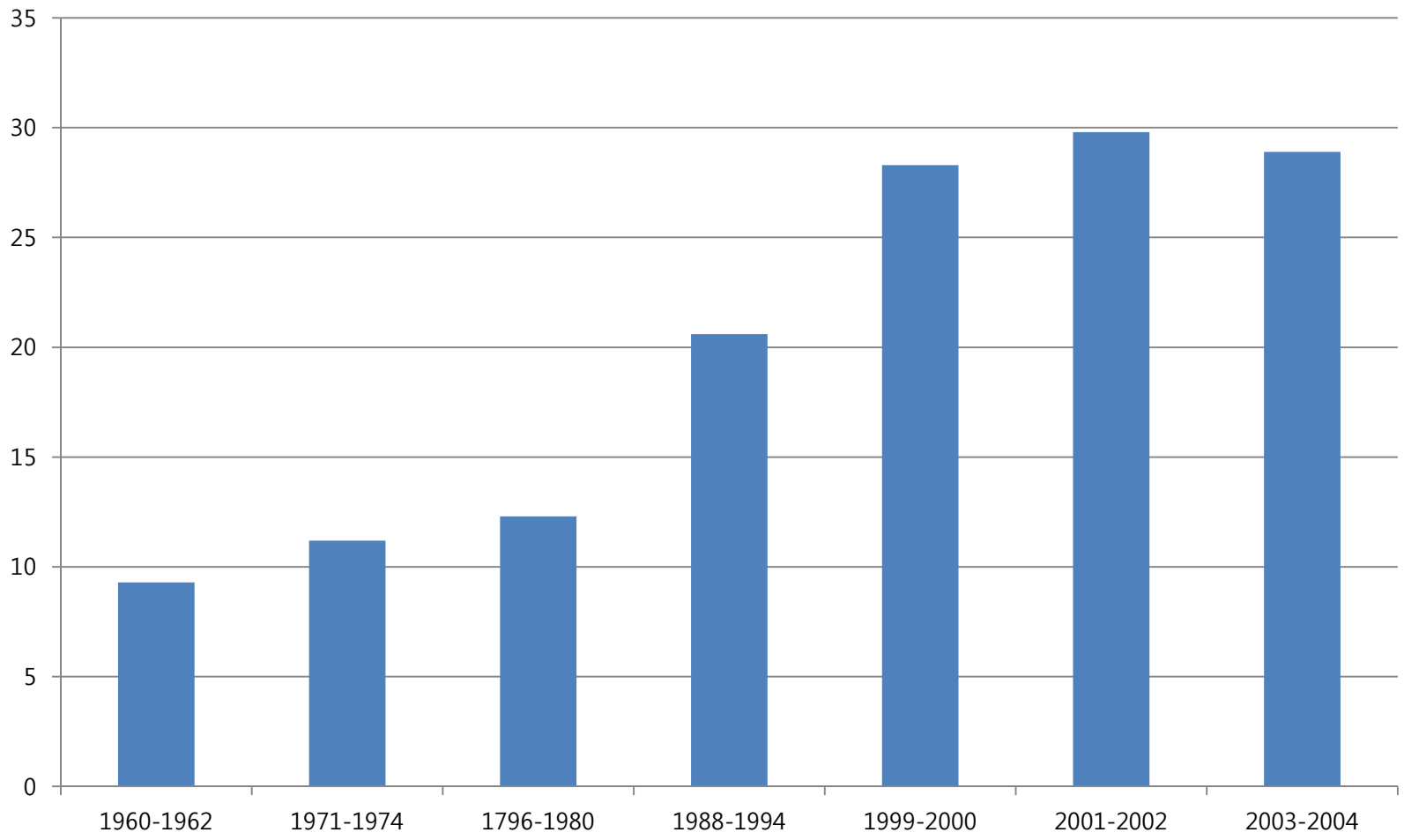
There are three problems concerning an undiagnosed type 2 diabetic woman that are not major issues in pregnant women who are first diagnosed with abnormal glucose tolerance in pregnancy

In this cohort, the congenital malformation rate from GDM patients was 1.9% and was no different from the rate in the general Japanese population. In contrast, the congenital malformation rate in infants of type 2 diabetic mothers diagnosed during pregnancy was higher than that of children from pregestational diabetic mothers treated during pregnancy, 12.7 vs. 4%, respectively.

There were no GDM patients with retinopathy. However, the rate of background retinopathy was 12.7% and proliferative retinopathy was 4.2% in the type 2 diabetic women diagnosed for the first time during pregnancy.

Similar rates and complications were seen in a cohort of pregnant women in Santa Barbara, California, where a total of 49,861 pregnancies occurred in our Mexican-American population from 1997 to 2004. A total of 4,133 (8.3%) had a positive OGTT based on the ADA criteria (1). However, 40% of the GDM women had type 2 diabetes first diagnosed during pregnancy based on our criteria: acanthosis nicgrans, requiring insulin before the 12th week of gestation, because they failed to maintain goals with dietary intervention alone (6). Five percent of the type 2 women had retinopathy, and 7% had significant proteinuria at time of diagnosis.

Percent of obesity among 20 to 39 year-old nonpregnant U.S. women



BMI ≥ 30 National Academy of Science, 2007

Trends in Deliveries, Prenatal Care, and Obstetrical Complications in Women With Pregestational Diabetes

A population-based study in Ontario, Canada, 1996–2001

Table 1—*Characteristics of women who gave birth in Ontario hospitals, 1996–2001*

Year	Total deliveries	Deliveries in Women with PGD	Age (years)	
			Women with PGD	Women without PGD
1996	133,316	1,122 (0.8)	30.7 ± 5.5	28.9 ± 5.4
1997	131,685	1,191 (0.9)	30.7 ± 5.3	29.0 ± 5.5
1998	129,470	1,296 (1.0)	30.9 ± 5.3	29.1 ± 5.5
1999	128,679	1,352 (1.1)	31.0 ± 5.3	29.2 ± 5.5
2000	124,605	1,455 (1.2)	31.2 ± 5.5	29.3 ± 5.6
2001	128,745	1,532 (1.2)	31.2 ± 5.4	29.5 ± 5.5

Data are n (%) or means ± SD.

Epidemiology/Health Services Research
ORIGINAL ARTICLE

Trends in the Prevalence of Preexisting Diabetes and Gestational Diabetes Mellitus Among a Racially/Ethnically Diverse Population of Pregnant Women, 1999–2005

JEAN M. LAWRENCE, SCD, MPH, MSSA[1]
WANSU CHEN, MS[1]
RICHARD CONTRERAS, MS[1]
DAVID A. SACKS, MD[2]

Table 1—*Annual number of singleton births, mean maternal age, and prevalence of preexisting diabetes per 100 births by matern race/ethnicity among 209,287 births by year, Kaiser Permanente Southern California, 1999–2005*

	1999	2000	2001	2002	2003	2004	2005
No. births	32,089	31,377	29,980	29,877	29,598	28,135	28,231
Mean age (years)	28.2	28.3	28.5	28.8	29.0	29.1	29.1
No. with diabetes†	245	333	315	377	451	526	537
All women							
Crude	0.76 (0.05)	1.06 (0.06)	1.05 (0.06)	1.26 (0.06)	1.52 (0.07)	1.87 (0.08)	1.90 (0.08)
Age-adjusted	0.81 (0.02)	1.10 (0.02)	1.06 (0.02)	1.25 (0.02)	1.50 (0.03)	1.81 (0.03)	1.83 (0.03)
Age- and race/ethnicity-adjusted	0.81 (0.02)	1.10 (0.02)	1.06 (0.02)	1.24 (0.02)	1.50 (0.03)	1.82 (0.03)	1.82 (0.03)

SEOUL NATIONAL UNIVERSITY B.U.N.D.A.N.G HOSPITAL

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MAY 8, 2008 VOL. 358 NO. 19

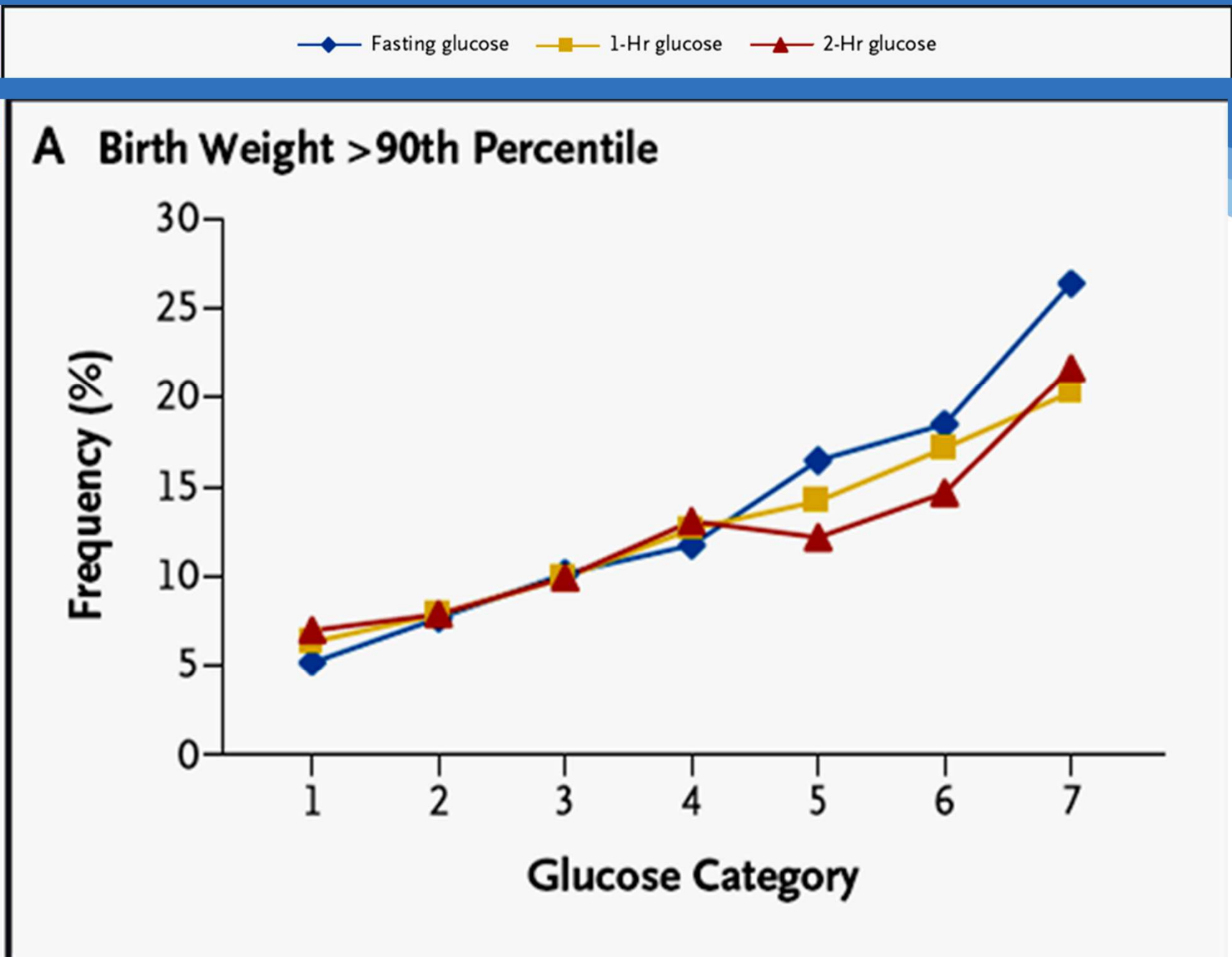
Hyperglycemia and Adverse Pregnancy Outcomes

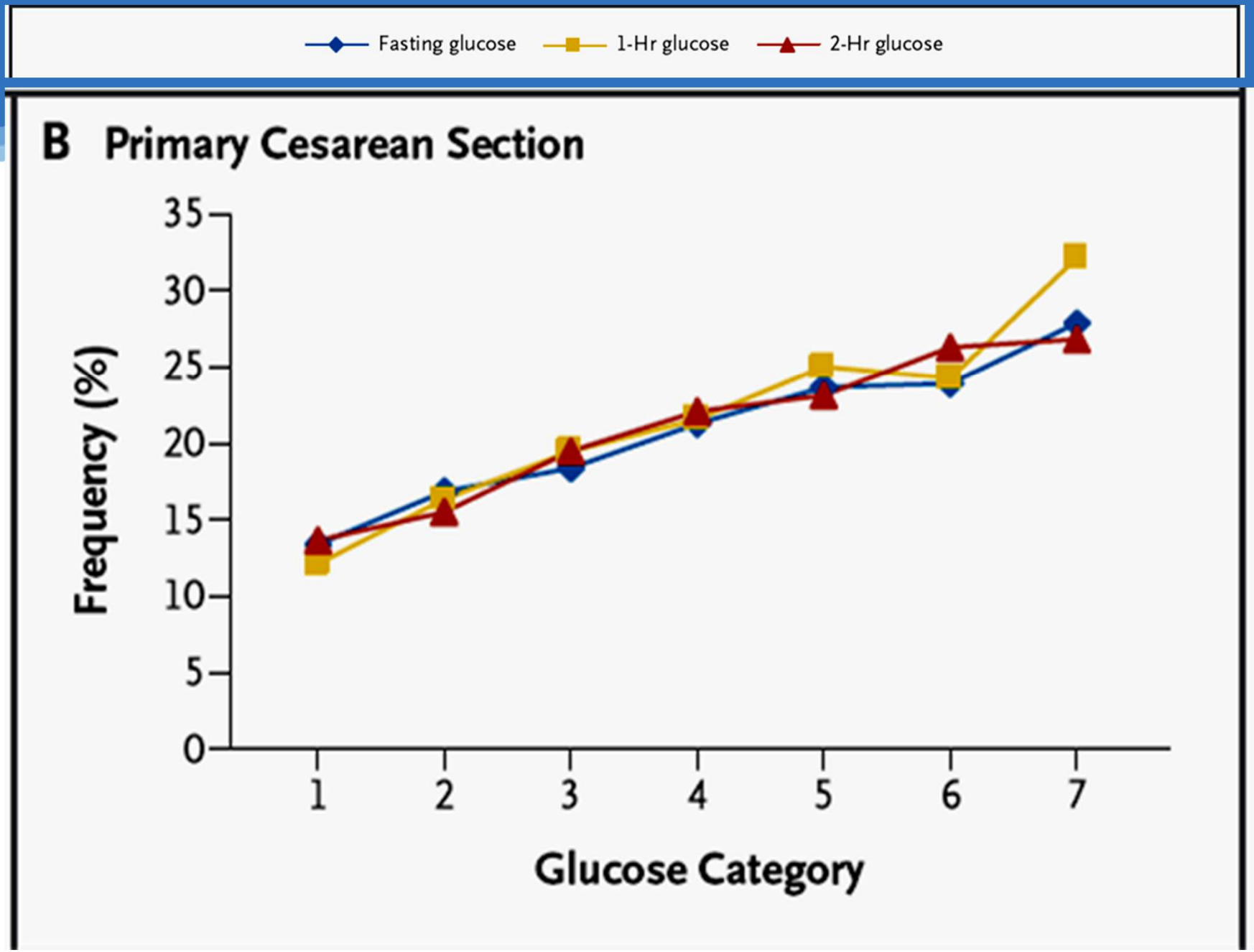
The HAPO Study Cooperative Research Group*

The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study reported in this issue of the Journal is an elegantly designed, very large, international study that answers previous questions by clearly demonstrating that **there is a continuum of risk, without clear thresholds, between carbohydrate intolerance in pregnancy and adverse pregnancy outcomes.** The HAPO study investigators assessed the pregnancy outcomes of more than 23,000 women with glucose values of less than 200 mg per deciliter 2 hours after a 75-g glucose load.

Glucose categories

	FPG	1hr plasma glc	2hr plasma glc
1	~75	~105	~90
2	75~79	106~132	91~108
3	80~84	133~155	109~125
4	85~89	156~171	126~139
5	90~94	172~193	140~157
6	95~99	194~211	158~177
7	100~	212~	178~


Fasting glucose
1-Hr glucose
2-Hr glucose
A Birth Weight >90th Percentile
Frequency (%)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Glucose Category


Fasting glucose
1-Hr glucose
2-Hr glucose
B Primary Cesarean Section
Frequency (%)
35
30
25
20
15
10
5
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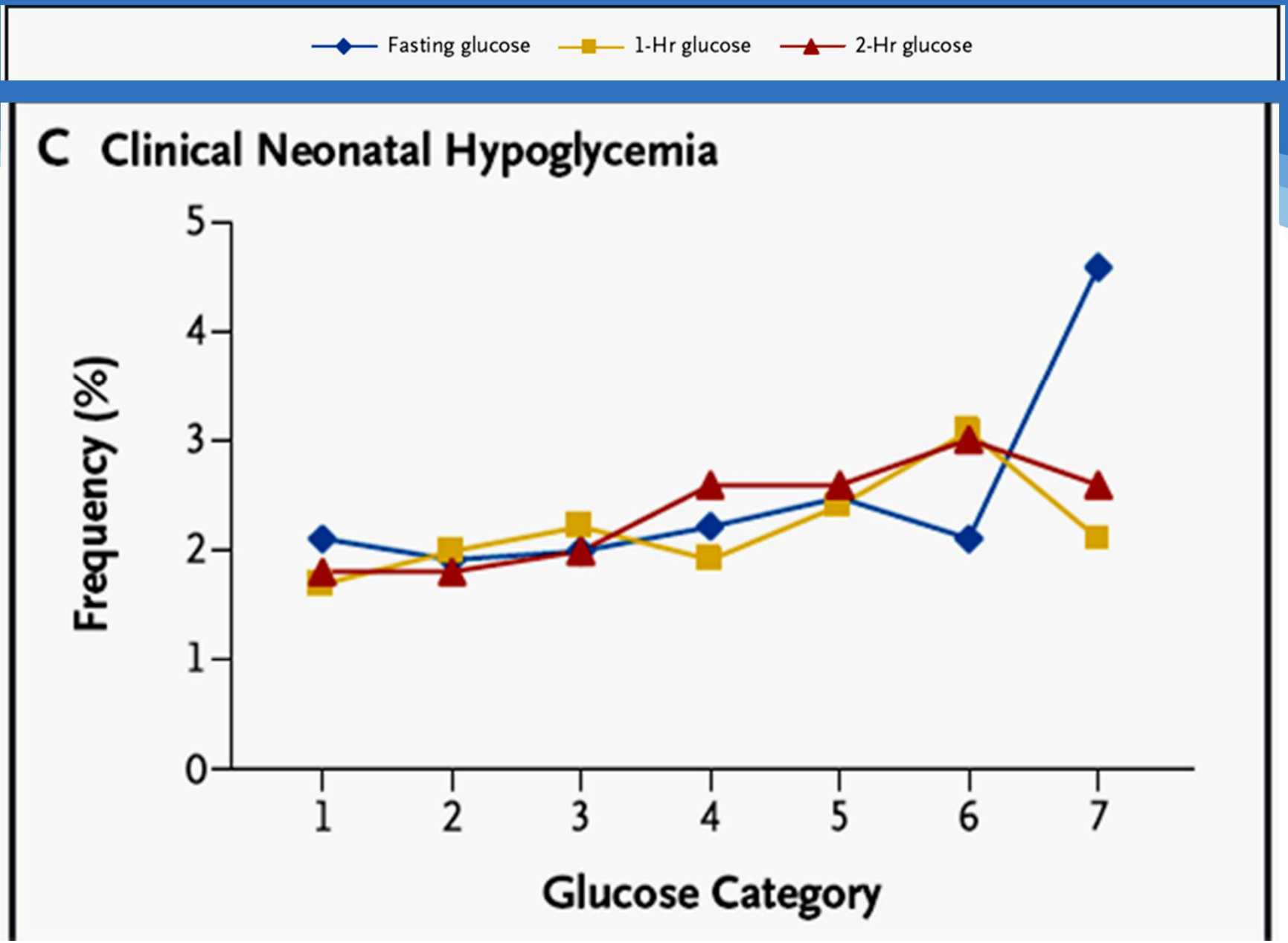
6
7
Glucose Category


Fasting glucose
1-Hr glucose
2-Hr glucose
C Clinical Neonatal Hypoglycemia
Frequency (%)
0
1
2
3
4
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1
2
3
4
5
6
7
Glucose Category

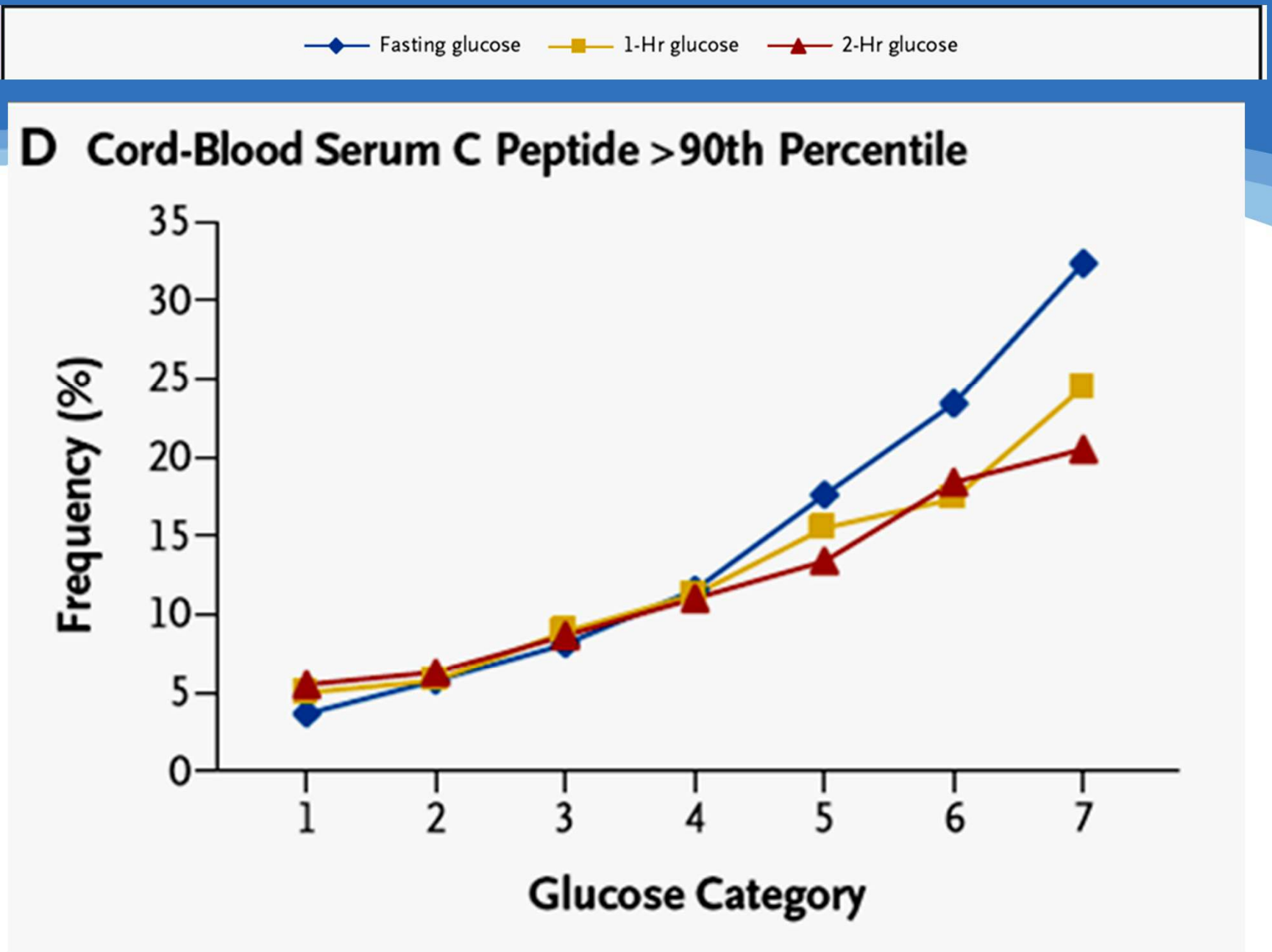

Fasting glucose
1-Hr glucose
2-Hr glucose
D Cord-Blood Serum C Peptide >90th Percentile
Frequency (%)
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
Glucose Category

Table 3. Adjusted Odds Ratios for Associations between Maternal Glycemia as a Continuous Variable and Primary and Secondary Perinatal Outcomes.*

Outcome	Plasma Glucose Level		
	Fasting	At 1 Hr	At 2 Hr
	odds ratio (95% CI)		
Primary outcome			
Birth weight >90th percentile	1.38 (1.32–1.44)	1.46 (1.39–1.53)	1.38 (1.32–1.44)
Primary cesarean section†	1.11 (1.06–1.15)	1.10 (1.06–1.15)	1.08 (1.03–1.12)
Clinical neonatal hypoglycemia	1.08 (0.98–1.19)‡	1.13 (1.03–1.26)	1.10 (1.00–1.12)
Cord-blood serum C peptide >90th percentile	1.55 (1.47–1.64)	1.46 (1.38–1.54)	1.37 (1.30–1.44)
Secondary outcome			
Premature delivery (before 37 wk)	1.05 (0.99–1.11)	1.18 (1.12–1.25)	1.16 (1.10–1.23)
Shoulder dystocia or birth injury	1.18 (1.04–1.33)	1.23 (1.09–1.38)	1.22 (1.09–1.37)
Intensive neonatal care	0.99 (0.94–1.05)	1.07 (1.02–1.13)	1.09 (1.03–1.14)
Hyperbilirubinemia	1.00 (0.95–1.05)	1.11 (1.05–1.17)	1.08 (1.02–1.13)
Preeclampsia	1.21 (1.13–1.29)	1.28 (1.20–1.37)	1.28 (1.20–1.37)

* Odds ratios were for an increase in the glucose level of 1 SD (6.9 mg per deciliter [0.4 mmol per liter] for the fasting plasma glucose level, 30.9 mg per deciliter [1.7 mmol per liter] for the 1-hr plasma glucose level, and 23.5 mg per deciliter [1.3 mmol per liter] for the 2-hr plasma glucose level). The model for preeclampsia did not include adjustment for hospitalization or mean arterial pressure, and presence or absence of family history of hypertension or prenatal urinary tract infection was included in the model for preeclampsia only. See Table 2 for other details about adjustments in each model.
† Data for women who had had a previous cesarean section were excluded.
‡ The P value for the quadratic (nonlinear) association was 0.013.

Reviews/Commentaries/ADA Statements
REVIEW ARTICLE

International Association of Diabetes and Pregnancy Study Groups Recommendations on the Diagnosis and Classification of Hyperglycemia in Pregnancy

INTERNATIONAL ASSOCIATION OF DIABETES AND PREGNANCY STUDY GROUPS CONSENSUS PANEL*

DIABETES CARE, VOLUME 33, NUMBER 3, MARCH 2010

SEOUL NATIONAL UNIVERSITY B.U.N.D.A.N.G HOSPITAL

Table 1—*Threshold values for diagnosis of GDM or overt diabetes in pregnancy*

To diagnose overt diabetes in pregnancy

Measure of glycemia	Consensus threshold
FPG‡	≥7.0 mmol/l (126 mg/dl)
A1C‡	≥6.5% (DCCT/UKPDS standardized)
Random plasma glucose	≥11.1 mmol/l (200 mg/dl) + confirmation§

DIABETES CARE, VOLUME 33, NUMBER 3, MARCH 2010

Table 2—*Strategy for the detection and diagnosis of hyperglycemic disorders in pregnancy**

First prenatal visit
Measure FPG, A1C, or random plasma glucose on all or only high-risk women†
If results indicate overt diabetes as per Table 1
Treatment and follow-up as for preexisting diabetes
If results not diagnostic of overt diabetes
and fasting plasma glucose ≥5.1 mmol/l (92 mg/dl) but <7.0 mmol/l (126 mg/dl), diagnose as GDM
and fasting plasma glucose <5.1 mmol/l (92 mg/dl), test for GDM from 24 to 28 weeks' gestation with a 75-g OGTT‡

Universal vs. Selected

1) Background population prevalence of diabetes in young women

2) extent of previous testing for metabolic disturbance

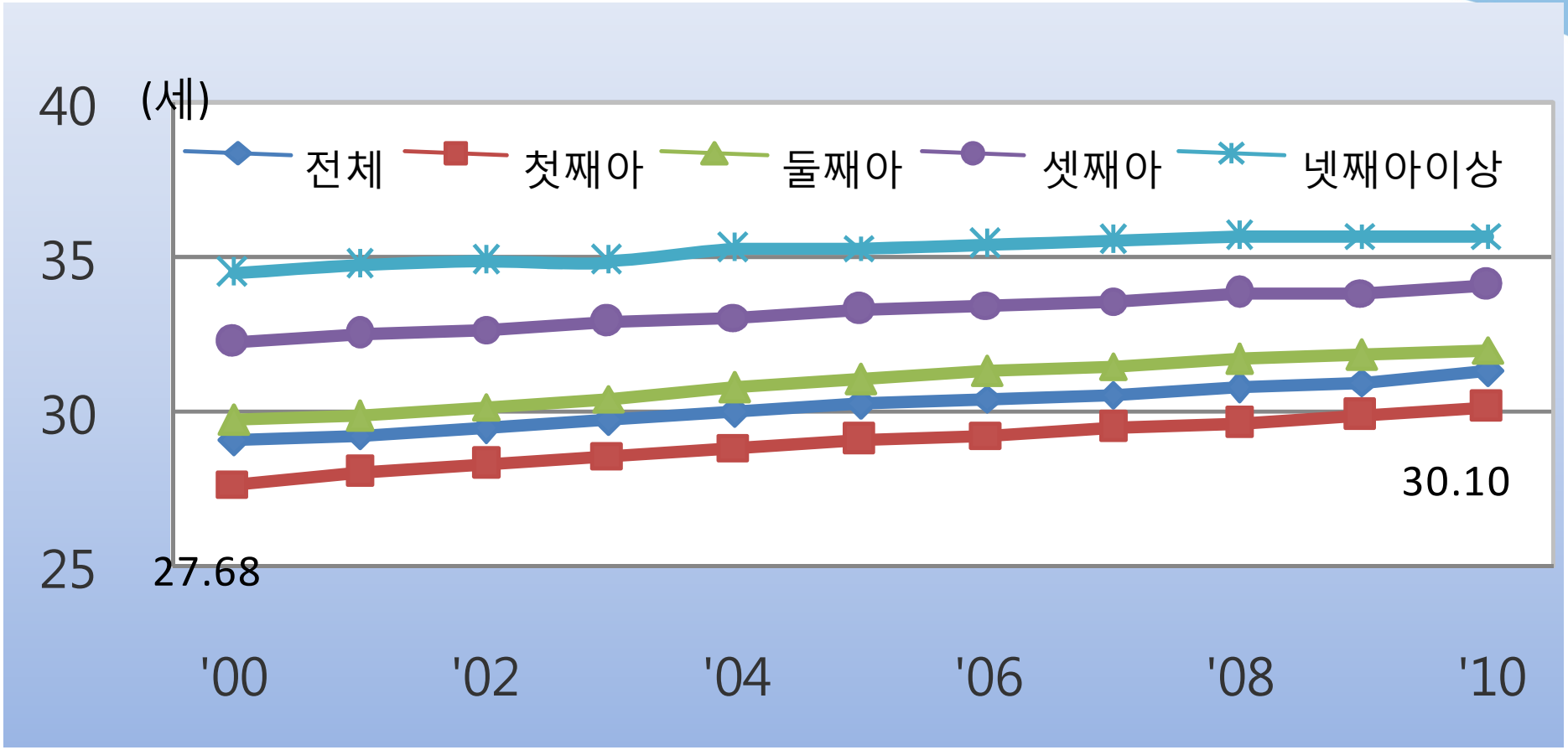
→ Universal early testing in populations with a high prevalence of type 2 diabetes is recommended,

especially if metabolic testing in this age-group is not commonly performed outside of pregnancy.

Data of Korean women

1. Maternal age
2. Incidence of obesity and diabetes
3. Incidence of Metabolic syndrome
4. Metabolic test of nonpregnant women

Mean maternal age: 31.26 years old



http://kostat.go.kr

Percent of live births according to maternal age

Age		2008	2009	**2010**
Live births	Total	100	100	**100**
	<20	0.60	0.63	0.62
	20~24	6.05	5.60	5.21
	25~29	36.25	35.05	31.31
	30~34	42.65	43.19	45.64
	35~39	12.79	13.65	15.06
	40~44	1.40	1.64	1.87
	≥ 45	0.09	0.09	0.11

http://kostat.go.kr

KNHANES

국민건강영양조사 Korea National Health & Nutrition Examination Survey | 질병관리본부 | 보건복지부

- **K**orea **N**ational **H**ealth **a**nd **N**utrition **E**xamination **S**urvey (KNHANES) http://knhanes.cdc.go.kr

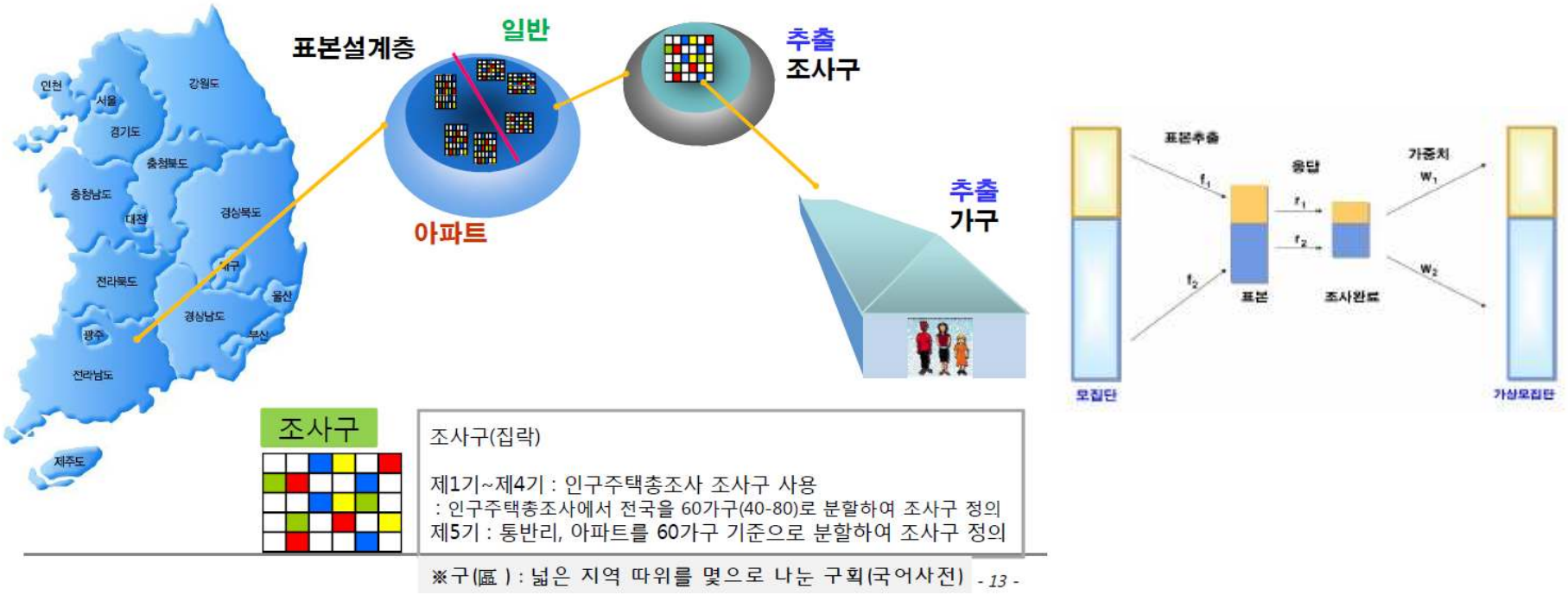
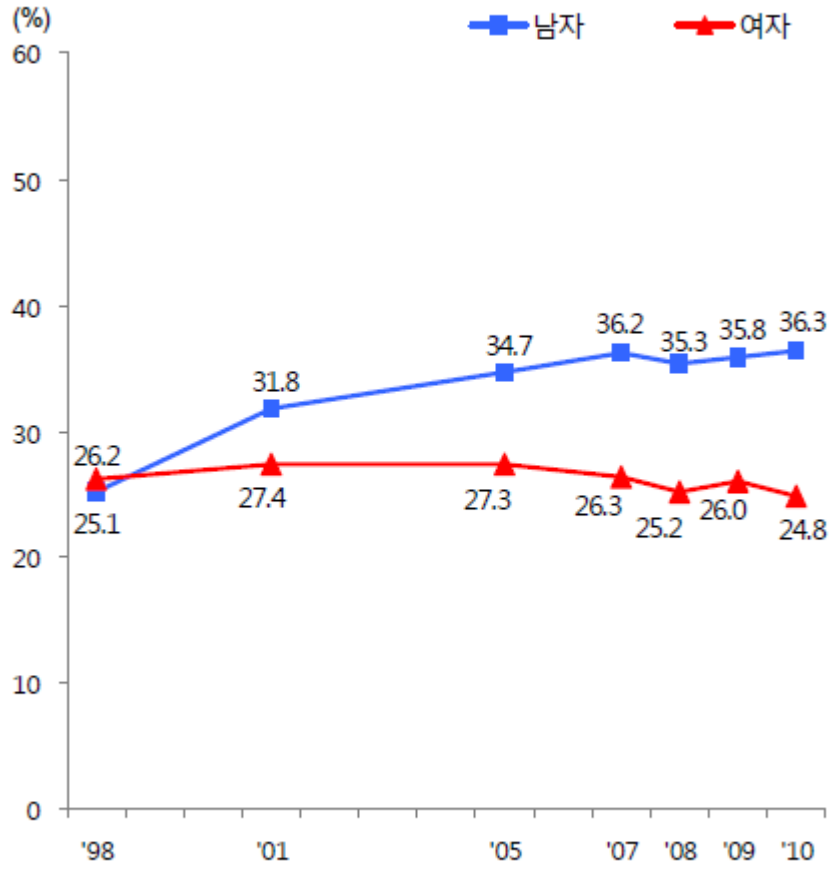
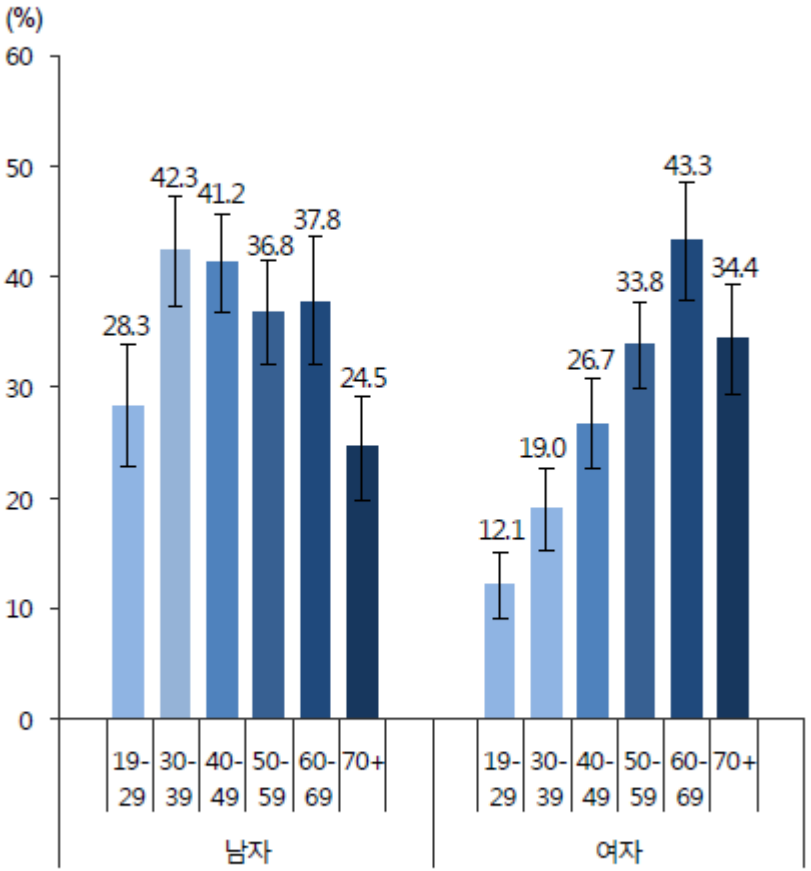


그림 3-1. 비만 유병률 추이(체질량지수 기준)



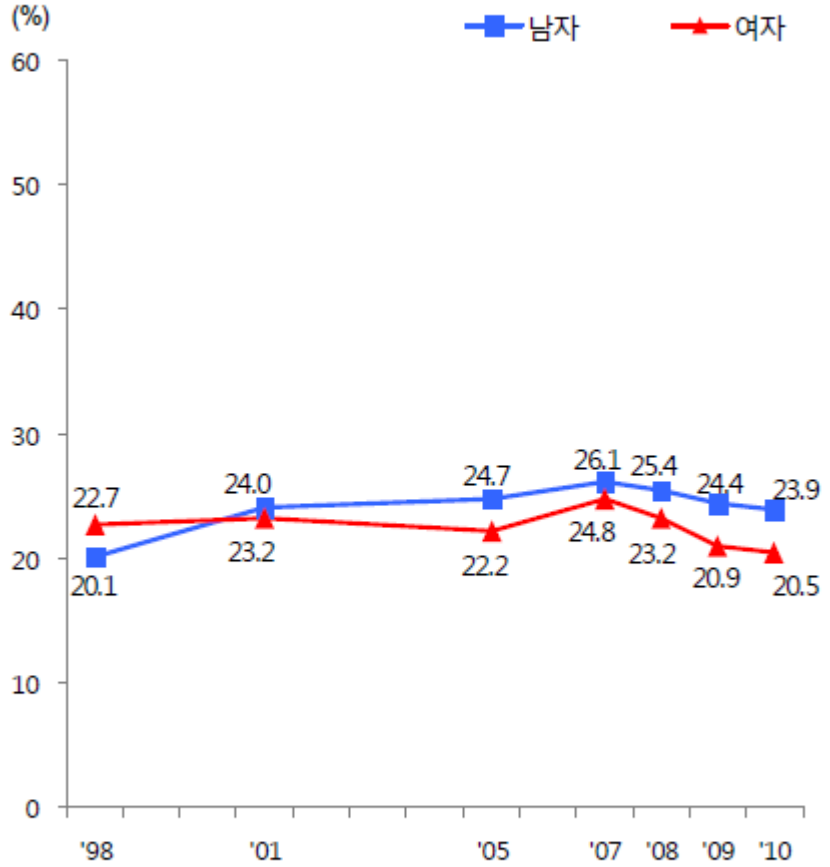
※비만 유병률 : 체질량지수(kg/m^2) 25 이상인 분율, 만19세이상
※2005년 추계인구로 연령표준화

그림 3-2. 연령별 비만 유병률(체질량지수 기준)



※비만 유병률 : 체질량지수(kg/m^2) 25 이상인 분율, 만19세이상

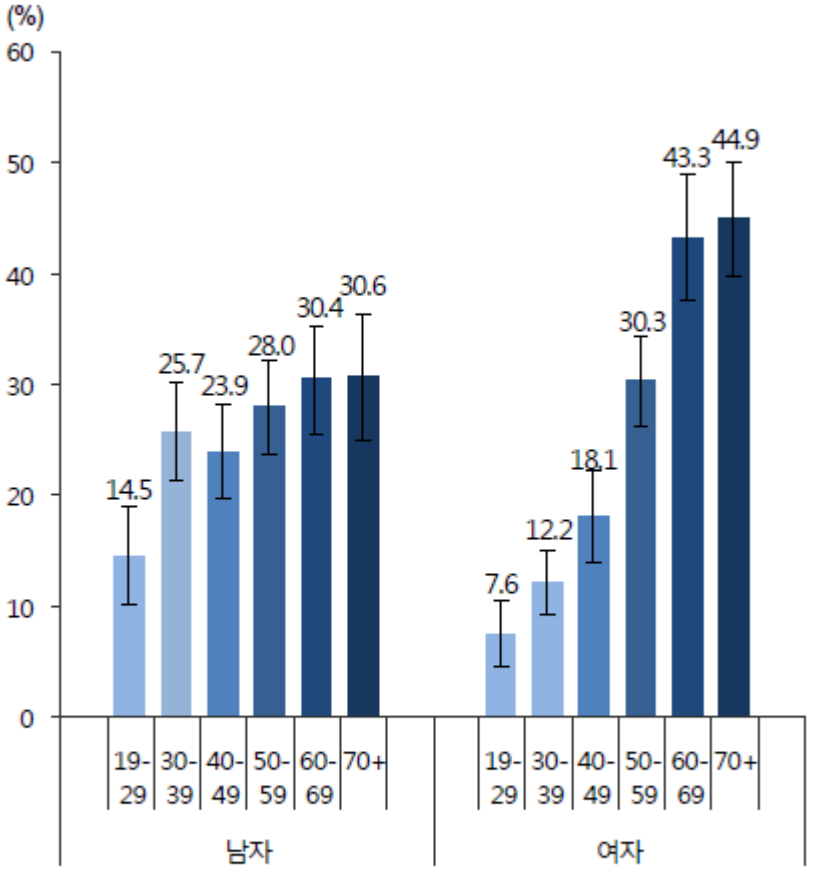
그림 3-3. 비만 유병률 추이(허리둘레 기준)



※비만 유병률(허리둘레 기준) : 허리둘레가 남자 90cm 이상, 여자 85cm 이상인 분율, 만19세이상

※2005년 추계인구로 연령표준화

그림 3-4. 연령별 비만 유병률(허리둘레 기준)

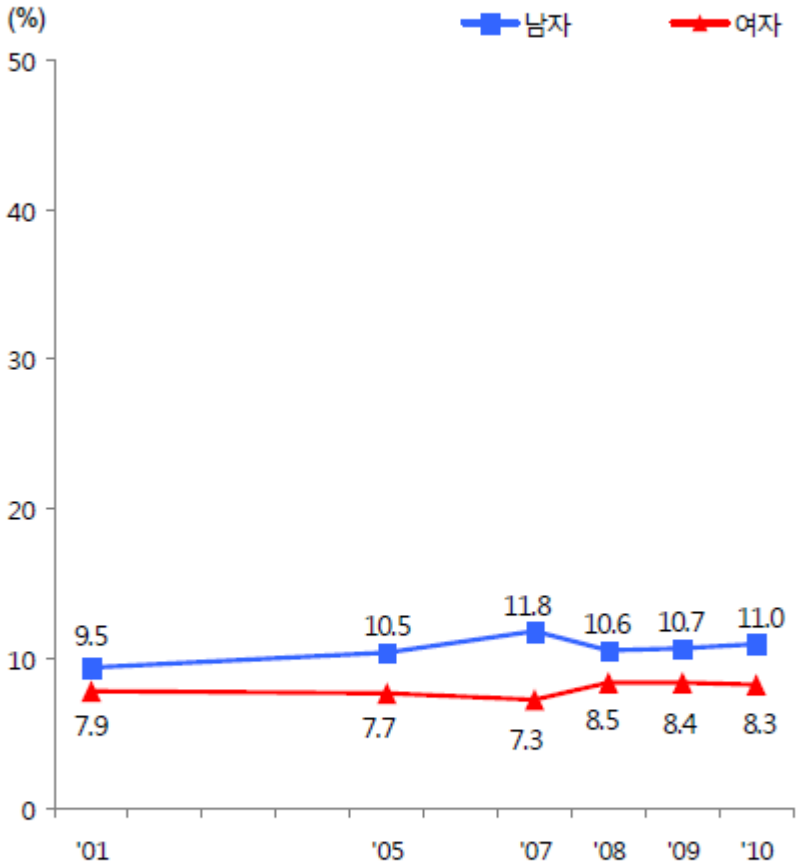


※비만 유병률(허리둘레 기준) : 허리둘레가 남자 90cm 이상, 여자 85cm 이상인 분율, 만19세이상

Incidence of obesity

	2008 (N=2067)		2009 (N=2216)		2010(N=1797)	
age	BMI (25-30)	BMI (≥ 30.0)	BMI (25-30)	BMI (≥ 30.0)	BMI (25-30)	BMI (≥ 30.0)
20-24	10.82%	1.87%	9.38%	1.39%	8.07%	3.61%
25-29	11.63%	4.37%	13.80%	3.51%	9.80%	3.46%
30-34	13.90%	3.98%	11.18%	4.14%	15.24%	3.02%
35-39	15.82%	1.94%	19.01%	4.62%	14.60%	4.34%
40-44	22.87%	3.16%	19.97%	5.98%	20.05%	3.44%
45-49	23.72%	3.70%	23.78%	5.05%	22.68%	6.88%

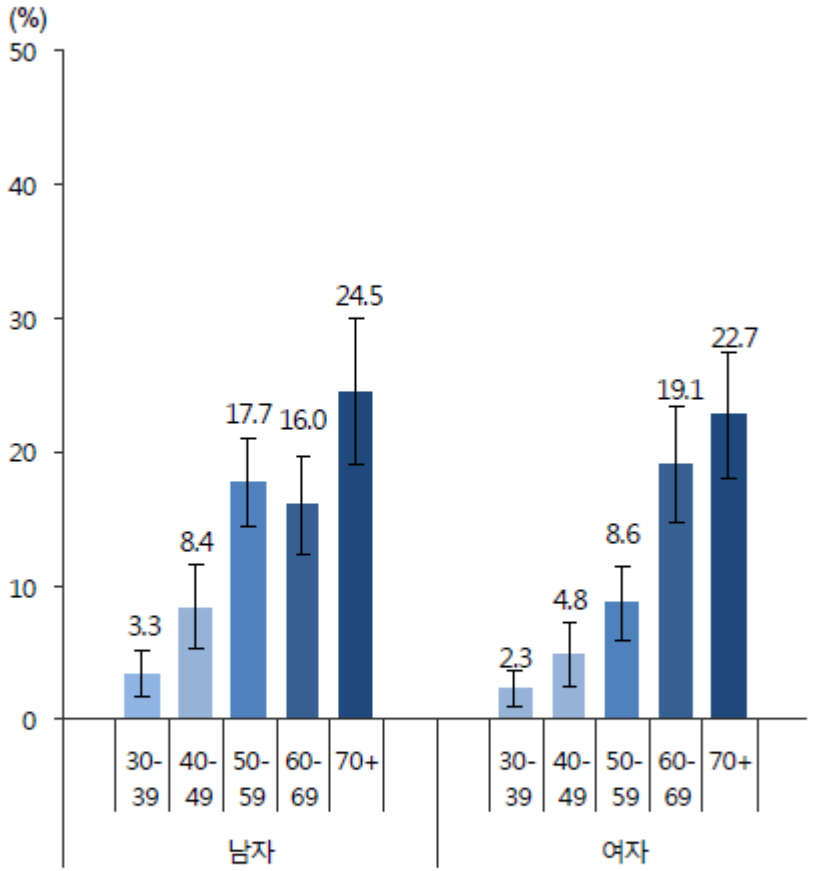
그림 3-8. 당뇨병유병률 추이



※당뇨병 유병률 : 공복혈당이 126mg/dL 이상이거나 의사진단을 받았거나 혈당강하제복용 또는 인슐린 주사를 투여 받고 있는 분율, 만30세이상

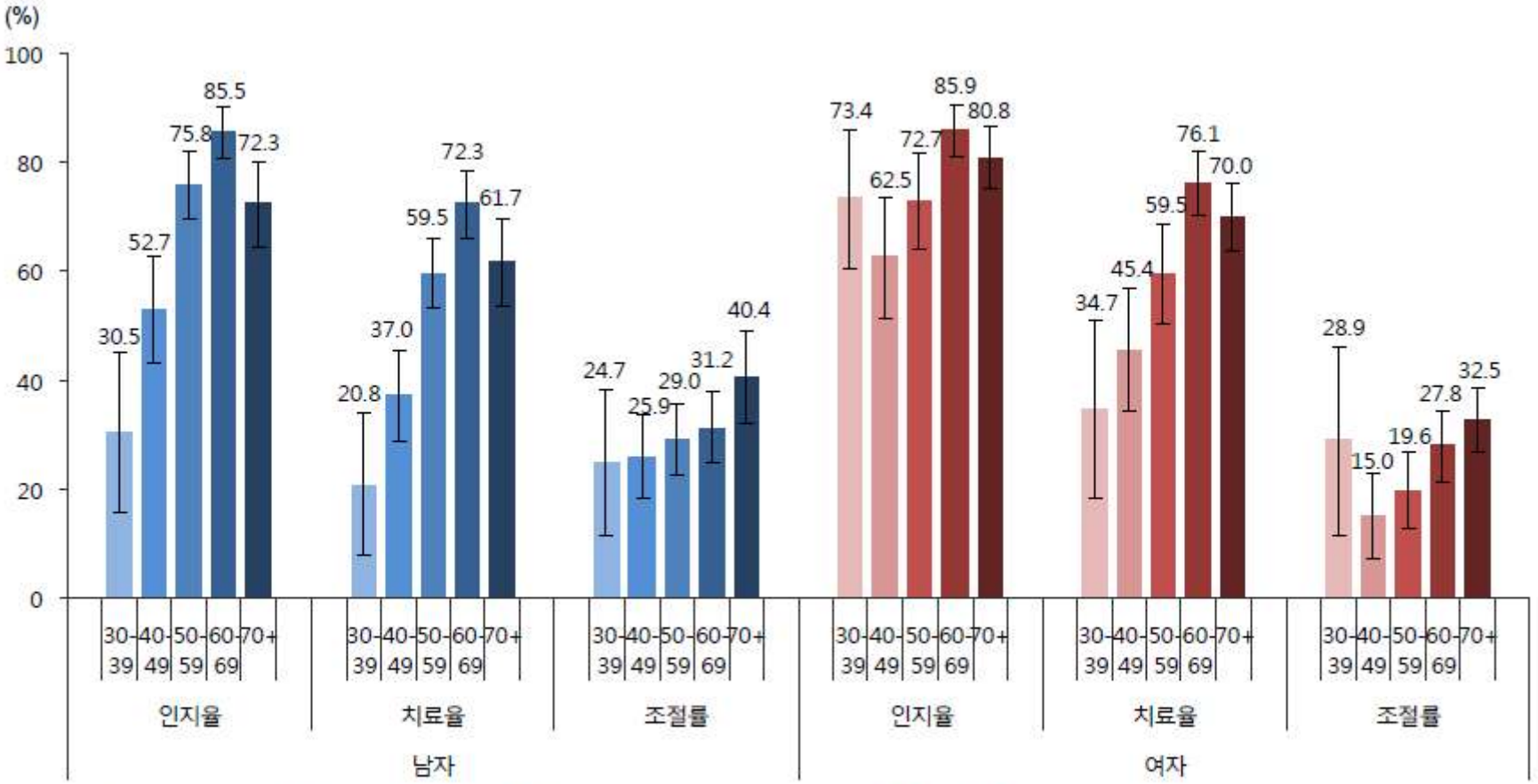
※2005년 추계인구로 연령표준화

그림 3-9. 연령별 당뇨병유병률



※당뇨병 유병률 : 공복혈당이 126mg/dL 이상이거나 의사진단을 받았거나 혈당강하제복용 또는 인슐린 주사를 투여 받고 있는 분율, 만30세이상

그림 3-10. 연령별 당뇨병 관리현황



※당뇨병 인지율 : 당뇨병 유병자 중 의사로부터 당뇨병 진단을 받은 분율, 만30세이상

※당뇨병 치료율 : 당뇨병 유병자 중 현재 혈당강하제를 복용 또는 인슐린 주사 투여 분율, 만30세이상

※당뇨병 조절률(유병자 기준) : 당뇨병 유병자 중 당화혈색소가 6.5%미만인 분율, 만30세이상

※2008-2010년 통합 산출

Diabetes

One or more of the following criteria

(1) Fasting glucose ≥ 126 mg/dL

(2) Diagnosed by doctor

(3) medication use (insulin or oral agents)

Incidence of Diabetes

	2008 (N=1922)		2009 (N=2064)		2010(N=1673)	
age	Percent	Std Err	Percent	Std Err	Percent	Std Err
20-24	0.43%	0.43	1.27%	0.98	1.50%	0.94
25-29	2.90%	1.12	0.29%	0.28	0.60%	0.43
30-34	1.06%	0.55	0.68%	0.39	2.06%	1.09
35-39	1.85%	0.58	3.41%	0.93	2.49%	0.92
40-44	4.32%	1.10	5.33%	1.30	3.53%	1.43
45-49	4.85%	1.29	4.70%	1.19	6.01%	1.80

Trends in Deliveries, Prenatal Care, and Obstetrical Complications in Women With Pregestational Diabetes

A population-based study in Ontario, Canada, 1996–2001

Table 1—*Characteristics of women who gave birth in Ontario hospitals, 1996–2001*

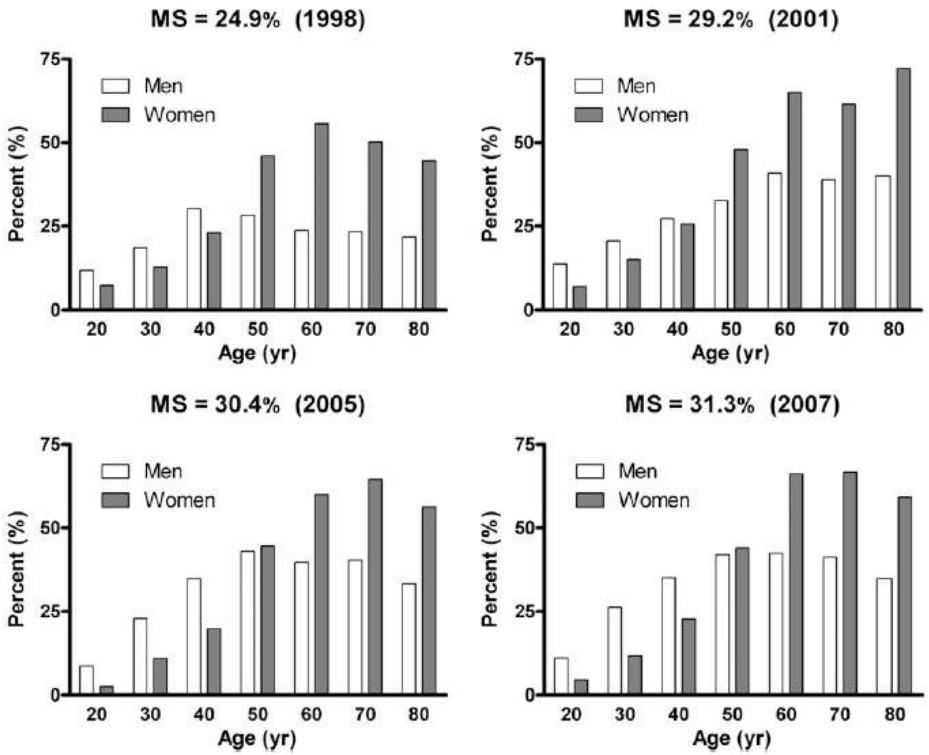
Year	Total deliveries	Deliveries in Women with PGD	Age (years)	
			Women with PGD	Women without PGD
1996	133,316	1,122 (0.8)	30.7 ± 5.5	28.9 ± 5.4
1997	131,685	1,191 (0.9)	30.7 ± 5.3	29.0 ± 5.5
1998	129,470	1,296 (1.0)	30.9 ± 5.3	29.1 ± 5.5
1999	128,679	1,352 (1.1)	31.0 ± 5.3	29.2 ± 5.5
2000	124,605	1,455 (1.2)	31.2 ± 5.5	29.3 ± 5.6
2001	128,745	1,532 (1.2)	31.2 ± 5.4	29.5 ± 5.5

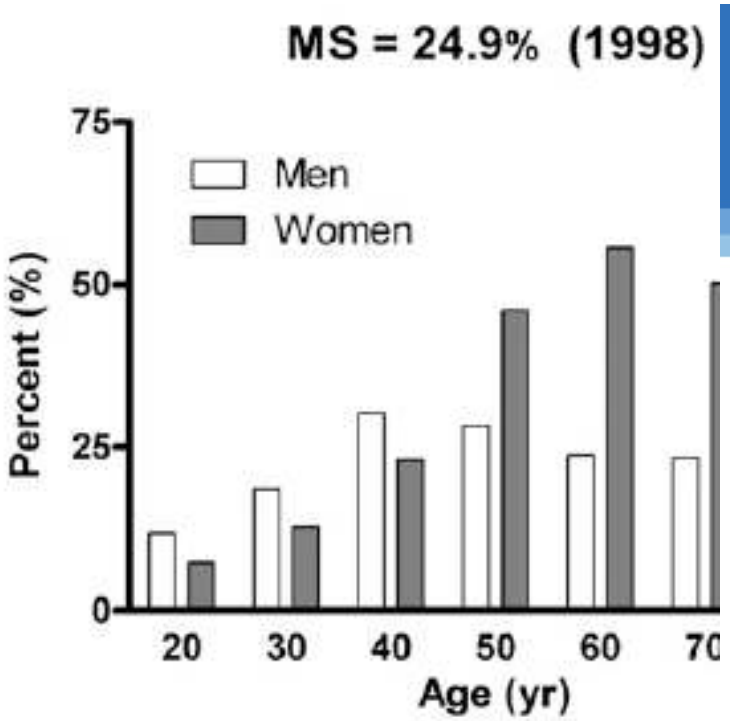
Data are n (%) or means ± SD.

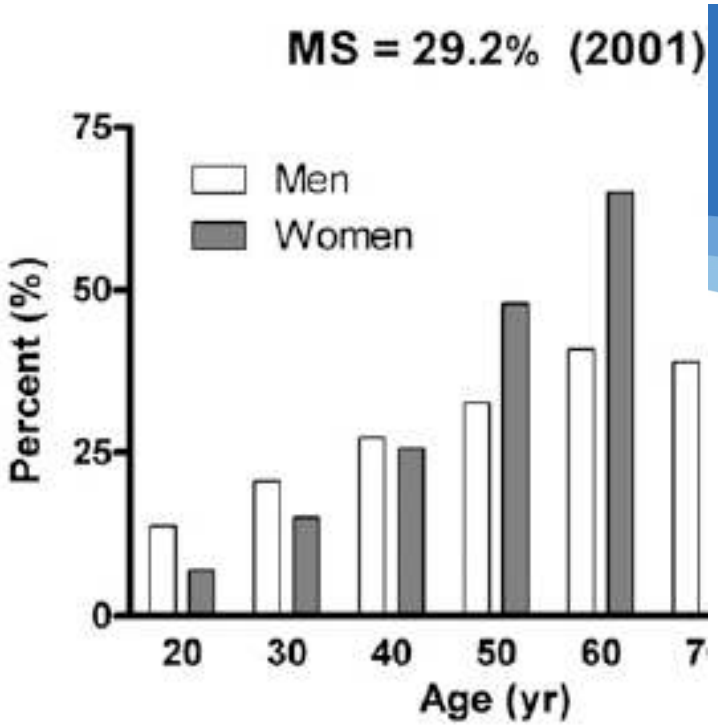
Epidemiology/Health Services Research
ORIGINAL ARTICLE

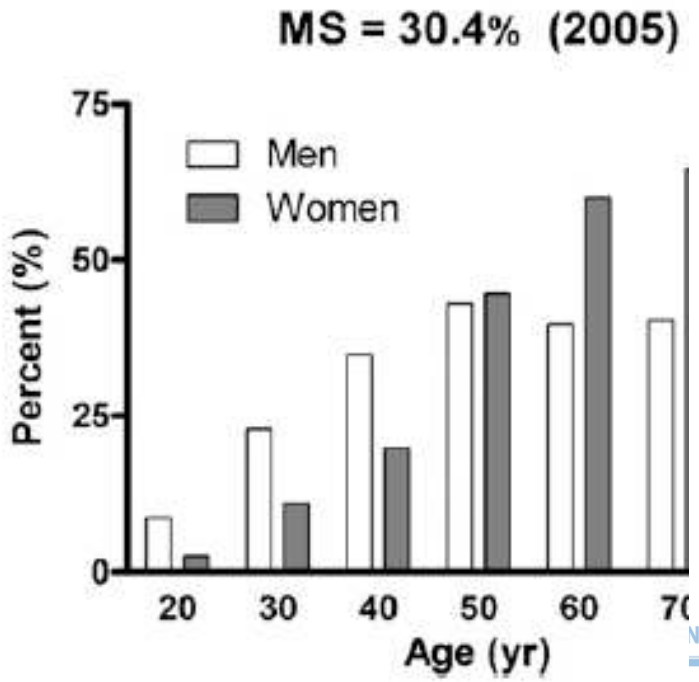
Increasing Prevalence of Metabolic Syndrome in Korea

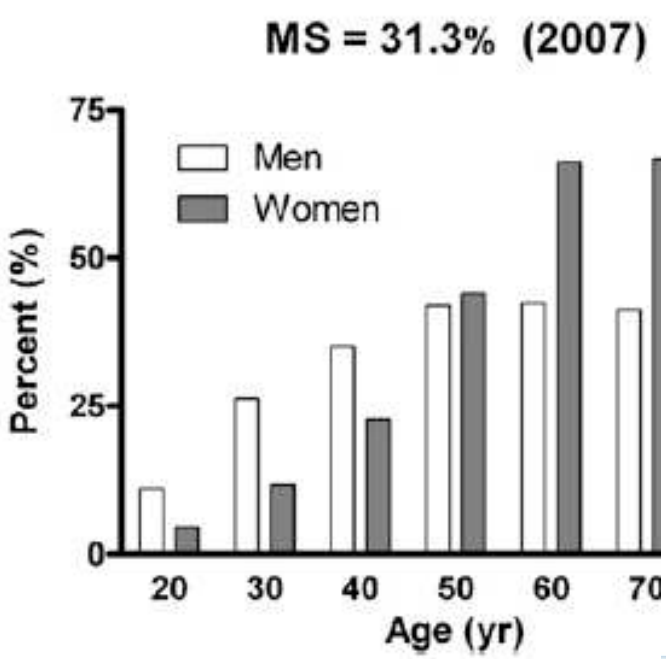
The Korean National Health and Nutrition Examination Survey for 1998–2007




MS = 24.9% (1998)
Men
Women
Percent (%)
75
50
25
0
20
30
40
50
60
70
Age (yr)


MS = 29.2% (2001)
Men
Women
Percent (%)
75
50
25
0
20
30
40
50
60
Age (yr)


MS = 30.4% (2005)
Men
Women
Percent (%)
75
50
25
0
20
30
40
50
60
70
Age (yr)


MS = 31.3% (2007)
Men
Women
Percent (%)
75
50
25
0
20
30
40
50
60
70
Age (yr)

Metabolic syndrome

Three or more of the following criteria

(1) Waist circumference > 80 cm

(2) Triglycerides ≥ 150 mg/dL or medication use

(3) HDL cholesterol < 50 mg/dL or medication use

(4) Blood pressure ≥ 130/85 mmHg or antihypertensive medication

(5) Fasting glucose≥ 100 mg/dL or medication use (insulin or oral agents)

Metabolic syndrome

	2008 (N=1996)		2009 (N=2133)		2010(N=1713)	
age	Percent	Std Err	Percent	Std Err	Percent	Std Err
20-24	1.82%	1.08	2.84%	1.28	1.52%	1.08
25-29	3.92%	1.17	6.35%	1.84	4.09%	1.39
30-34	5.97%	1.42	3.55%	0.96	5.30%	1.60
35-39	9.49%	1.79	10.77%	1.68	5.13%	1.25
40-44	14.25%	1.89	10.53%	1.88	11.38%	2.45
45-49	18.53%	1.29	16.78%	2.13	12.73%	2.21

Metabolic test of non pregnant women

Age	Population	No of candidate	Percent of candidate	No. of tested	Perecent of tested
total;	24,149,865	7,270,428	**30.1**	4,834,597	**20.0**
≤ 19	5,358,730	12,465	**0.2**	10,993	**0.2**
20 ~ 24	1,430,019	191,326	**13.4**	160,548	**11.2**
25 ~ 29	1,736,144	540,826	**31.2**	438,798	**25.3**
30 ~ 34	1,828,951	510,884	**27.9**	367,099	**20.1**
35 ~ 39	2,038,914	468,069	**23.0**	333,142	**16.3**
40 ~ 44	2,059,992	850,333	**41.3**	509,749	**24.7**
45 ~ 49	2,028,717	959,386	**47.3**	617,930	**30.5**

총인구: 통계청
건강검진: 국민건강보험공단

Considerations (1)

** Fasting plasma glucose

→ impractical at first prenatal visit in many settings

→ Additional visit for test of FBS ???

Considerations (2)

plasma glucose : 1140 won

HbA1C: 6840 won

Conclusions

- In Korean women with 25-39 years old,

1. Prevalence of diabetes may be 0.6-2.5%.

2. Prevalence of metabolic syndrome may be 4-11 %

3. Metabolic test is performed in only 16-25% in this age group.

Thank you for your attention

The American College of Obstetricians and Gynecologists
Women's Health Care Physicians

COMMITTEE OPINION

Number 504 • September 2011

Committee on Obstetric Practice

This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

Screening and Diagnosis of Gestational Diabetes Mellitus

ABSTRACT: *Gestational diabetes mellitus* (GDM), defined as carbohydrate intolerance that begins or is first recognized during pregnancy, is associated with increased maternal, fetal, and neonatal risks. The prevalence of GDM in the United States is increasing, probably because of increasing rates of overweight and obesity. A universal recommendation for the ideal approach for screening and diagnosis of GDM remains elusive. At this time, the Committee on Obstetric Practice continues to recommend a two-step approach to screening and diagnosis. All pregnant women should be screened for GDM, whether by patient history, clinical risk factors, or a 50-g, 1-hour glucose challenge test at 24–28 weeks of gestation. The diagnosis of GDM can be made based on the result of the 100-g, 3-hour oral glucose tolerance test, for which there is evidence that treatment improves outcome.

Problems of old criteria

- None of the currently recommended Dx criteria are based on pregnancy outcome

- The differing glucose challengers and Dx criteria

→ Exceedingly difficult in comparison of prevalence and pregnancy outcomes across the world

The NEW ENGLAND JOURNAL of MEDICINE

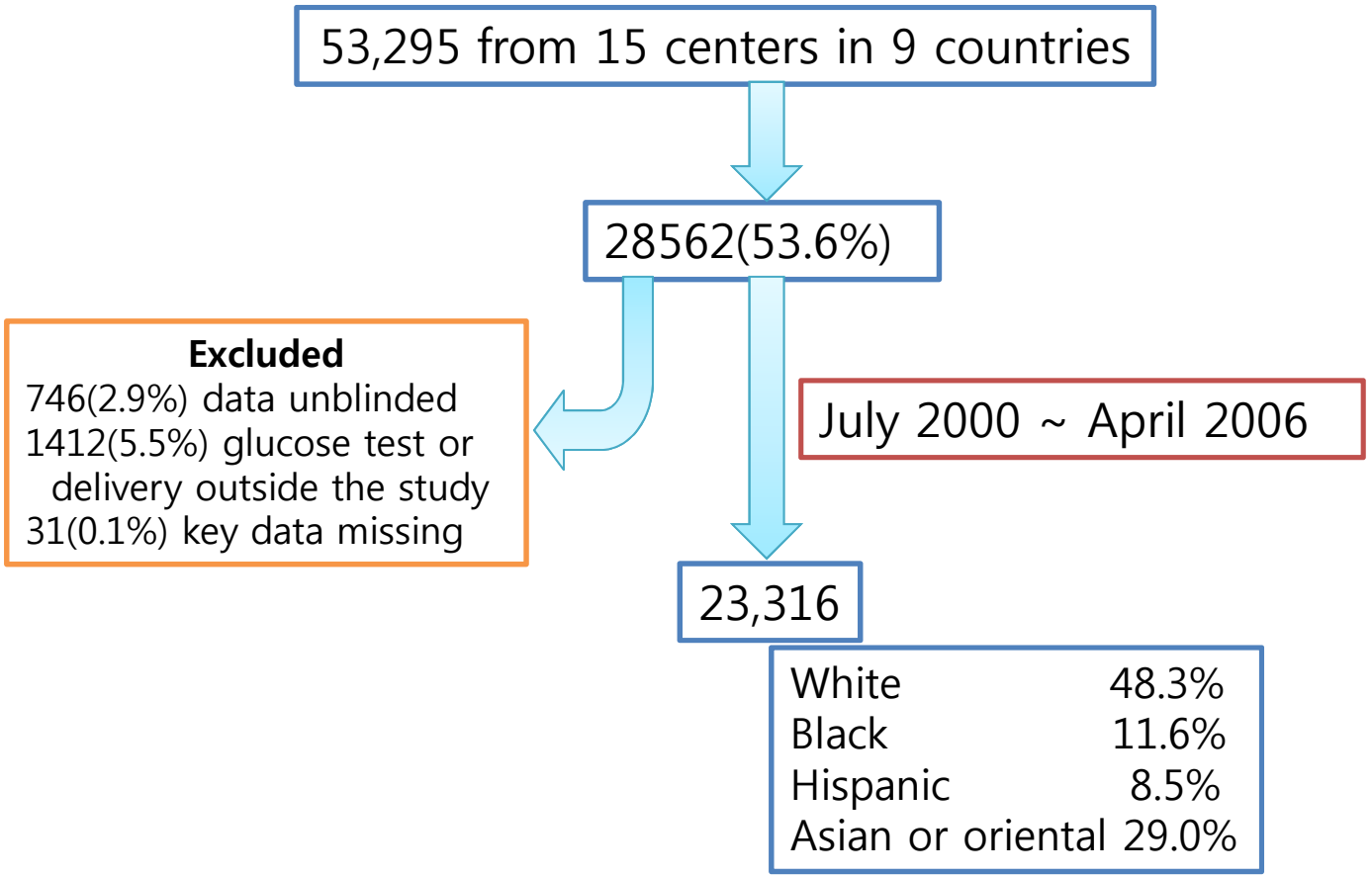
ESTABLISHED IN 1812 MAY 8, 2008 VOL. 358 NO. 19

Hyperglycemia and Adverse Pregnancy Outcomes

The HAPO Study Cooperative Research Group*

The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study reported in this issue of the Journal is an **elegantly designed, very large, international study** that answers previous questions by clearly demonstrating that there is a continuum of risk, without clear thresholds, between carbohydrate intolerance in pregnancy and adverse pregnancy outcomes. The HAPO study investigators assessed the pregnancy outcomes of more than 23,000 women with glucose values of less than 200 mg per deciliter 2 hours after a 75-g glucose load.

HAPO study


53,295 from 15 centers in 9 countries
28562(53.6%)
Excluded
746(2.9%) data unblinded
1412(5.5%) glucose test or delivery outside the study
31(0.1%) key data missing
July 2000 ~ April 2006
23,316
White 48.3%
Black 11.6%
Hispanic 8.5%
Asian or oriental 29.0%

Primary and Secondary Outcomes

Primary outcomes

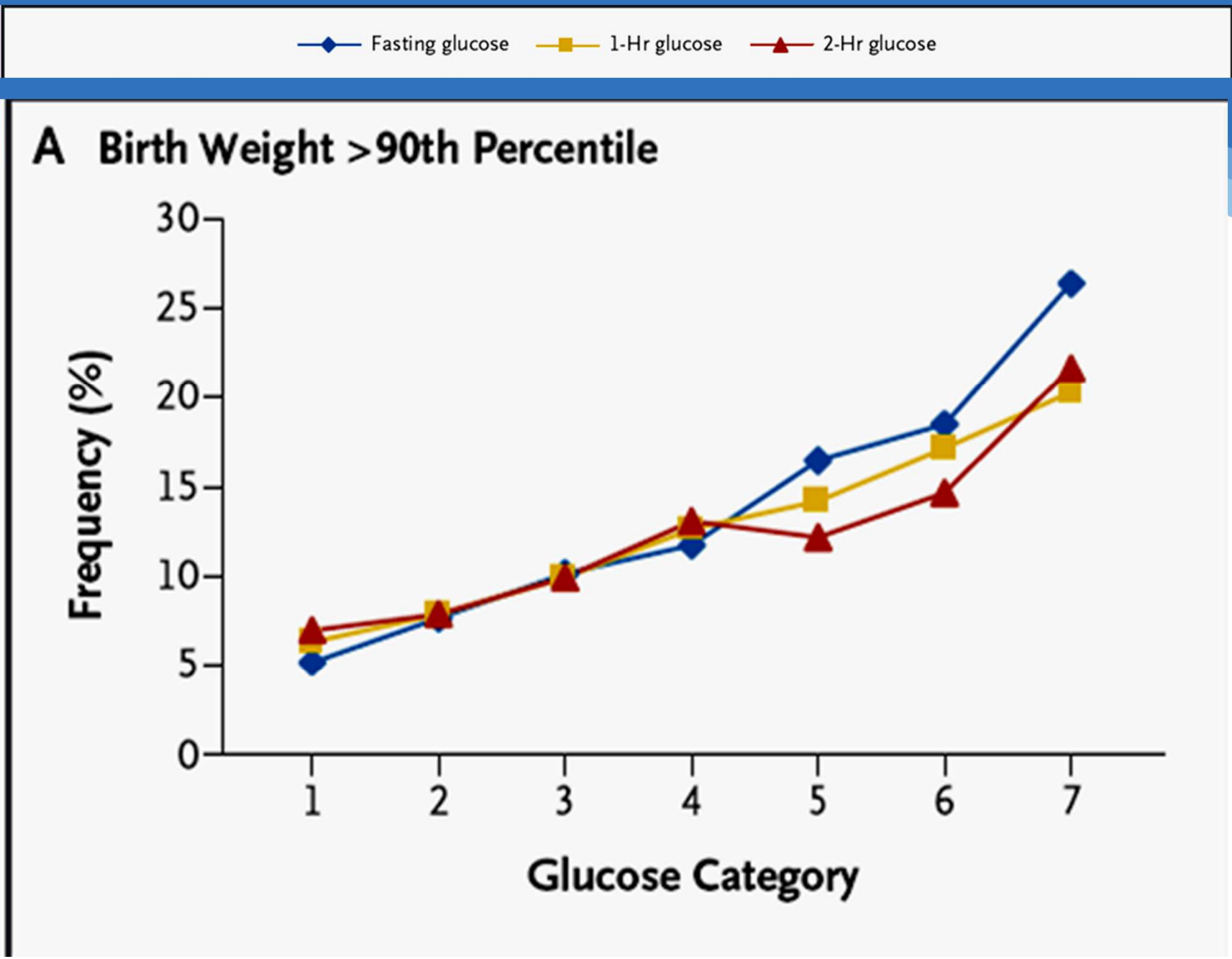
1. birth weight above the 90th percentile for gestational age
2. primary cesarean delivery
3. clinical neonatal hypoglycemia,
4. cord-blood serum C-peptide level above the 90th percentile (fetal hyperinsulinemia) or 1.7 microg/Liter

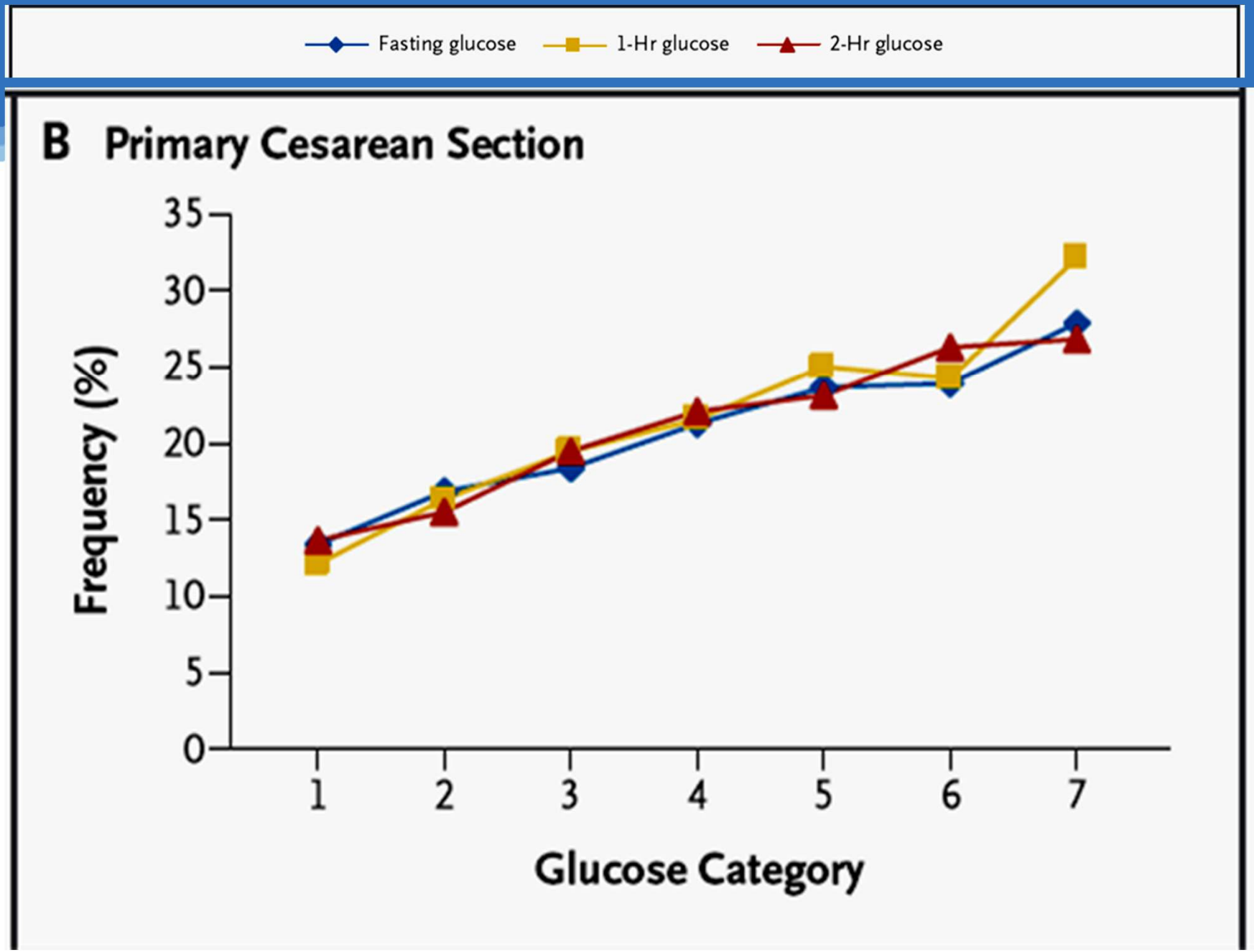
Secondary outcomes

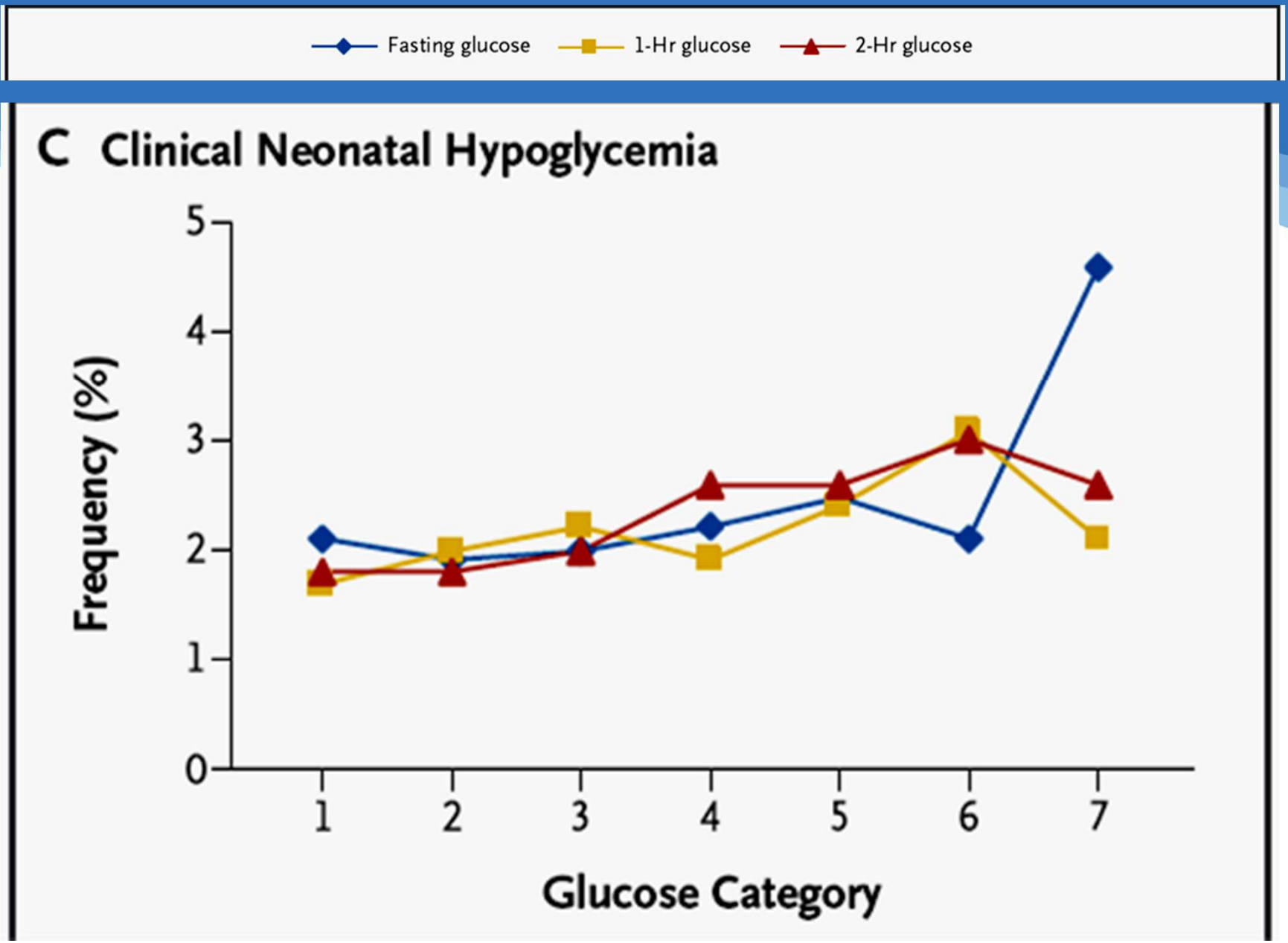
1. premature delivery (before 37 weeks of gestation)
2. shoulder dystocia or birth injury
3. need for intensive neonatal care
4. hyperbilirubinemia,
5. preeclampsia

Glucose categories

	FPG	1hr plasma glc	2hr plasma glc
1	~75	~105	~90
2	75~79	106~132	91~108
3	80~84	133~155	109~125
4	85~89	156~171	126~139
5	90~94	172~193	140~157
6	95~99	194~211	158~177
7	100~	212~	178~


Fasting glucose
1-Hr glucose
2-Hr glucose
A Birth Weight >90th Percentile
Frequency (%)
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Glucose Category


Fasting glucose
1-Hr glucose
2-Hr glucose
B Primary Cesarean Section
Frequency (%)
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
Glucose Category


Fasting glucose
1-Hr glucose
2-Hr glucose
C Clinical Neonatal Hypoglycemia
Frequency (%)
0
1
2
3
4
5
1
2
3
4
5
6
7
Glucose Category

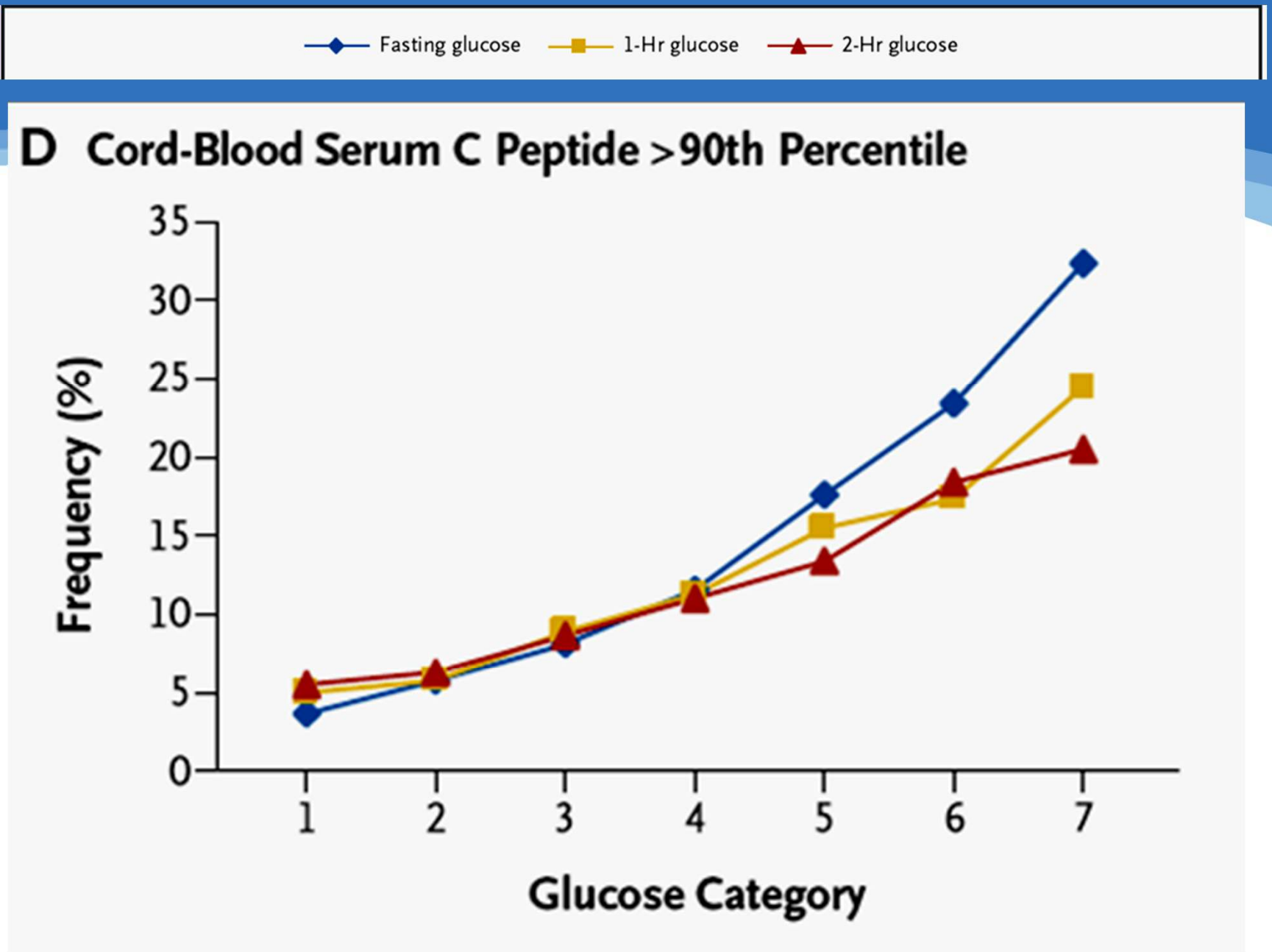

Fasting glucose
1-Hr glucose
2-Hr glucose
D Cord-Blood Serum C Peptide >90th Percentile
Frequency (%)
0
5
10
15
20
25
30
35
1
2
3
4
5
6
7
Glucose Category

Table 3. Adjusted Odds Ratios for Associations between Maternal Glycemia as a Continuous Variable and Primary and Secondary Perinatal Outcomes.*

Outcome	Plasma Glucose Level		
	Fasting	At 1 Hr	At 2 Hr
	odds ratio (95% CI)		
Primary outcome			
Birth weight >90th percentile	1.38 (1.32–1.44)	1.46 (1.39–1.53)	1.38 (1.32–1.44)
Primary cesarean section†	1.11 (1.06–1.15)	1.10 (1.06–1.15)	1.08 (1.03–1.12)
Clinical neonatal hypoglycemia	1.08 (0.98–1.19)‡	1.13 (1.03–1.26)	1.10 (1.00–1.12)
Cord-blood serum C peptide >90th percentile	1.55 (1.47–1.64)	1.46 (1.38–1.54)	1.37 (1.30–1.44)
Secondary outcome			
Premature delivery (before 37 wk)	1.05 (0.99–1.11)	1.18 (1.12–1.25)	1.16 (1.10–1.23)
Shoulder dystocia or birth injury	1.18 (1.04–1.33)	1.23 (1.09–1.38)	1.22 (1.09–1.37)
Intensive neonatal care	0.99 (0.94–1.05)	1.07 (1.02–1.13)	1.09 (1.03–1.14)
Hyperbilirubinemia	1.00 (0.95–1.05)	1.11 (1.05–1.17)	1.08 (1.02–1.13)
Preeclampsia	1.21 (1.13–1.29)	1.28 (1.20–1.37)	1.28 (1.20–1.37)

* Odds ratios were for an increase in the glucose level of 1 SD (6.9 mg per deciliter [0.4 mmol per liter] for the fasting plasma glucose level, 30.9 mg per deciliter [1.7 mmol per liter] for the 1-hr plasma glucose level, and 23.5 mg per deciliter [1.3 mmol per liter] for the 2-hr plasma glucose level). The model for preeclampsia did not include adjustment for hospitalization or mean arterial pressure, and presence or absence of family history of hypertension or prenatal urinary tract infection was included in the model for preeclampsia only. See Table 2 for other details about adjustments in each model.
† Data for women who had had a previous cesarean section were excluded.
‡ The P value for the quadratic (nonlinear) association was 0.013.

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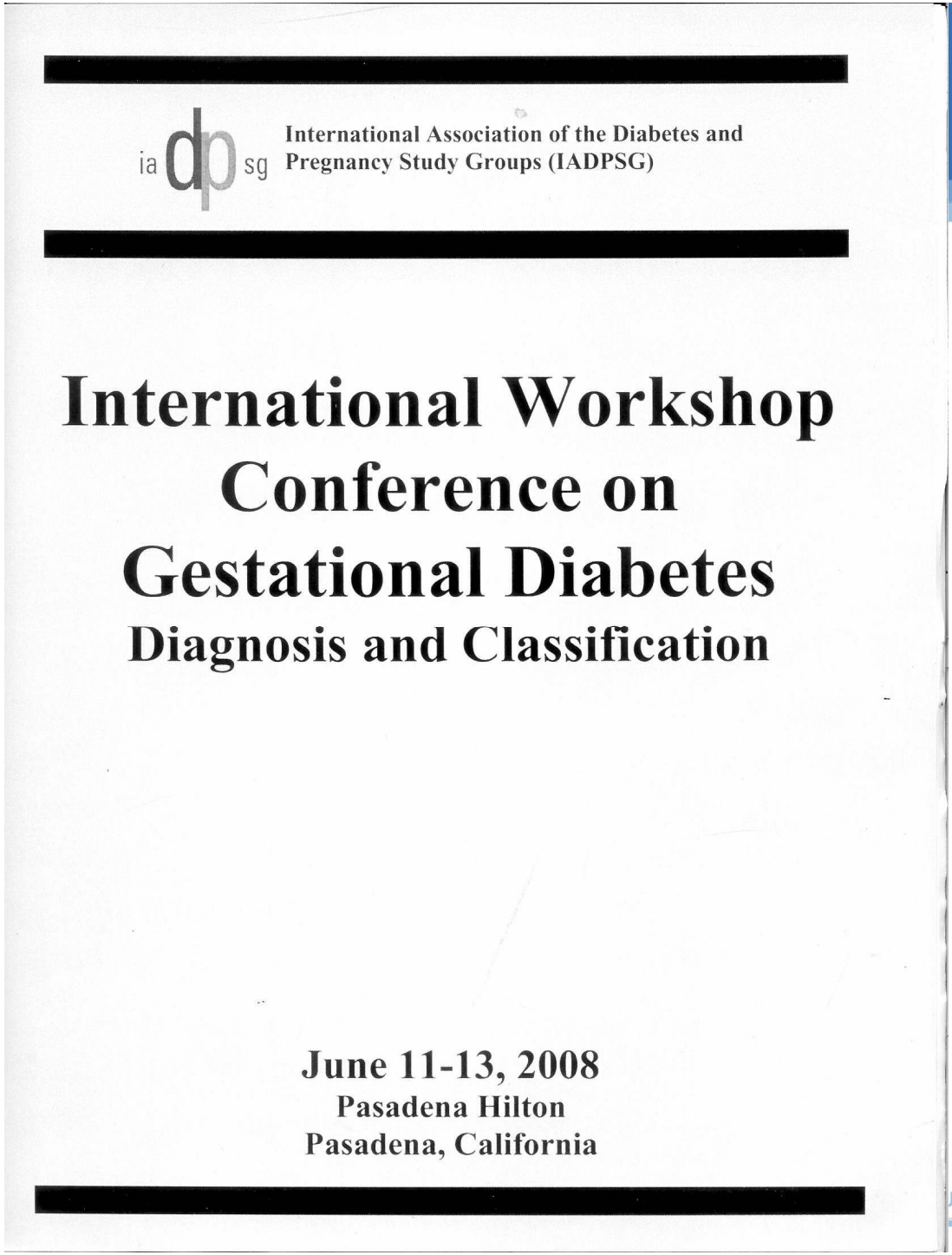
Hyperglycemia and Adverse Pregnancy Outcomes

The HAPO Study Cooperative Research Group*

The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study reported in this issue of the Journal is an elegantly designed, very large, international study that answers previous questions by clearly demonstrating that **there is a continuum of risk, without clear thresholds, between carbohydrate intolerance in pregnancy and adverse pregnancy outcomes.** The HAPO study investigators assessed the pregnancy outcomes of more than 23,000 women with glucose values of less than 200 mg per deciliter 2 hours after a 75-g glucose load.



Potential Glycemic Thresholds from HAPO study

- Don Coustan
- 75–g OGTT

- Fasting >90 mg/dl
- 1-hr ≥172 mg/dl
- 2-hr ≥ 140 mg/dl

AGOS PAPERS www.AJOG.org

The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study: paving the way for new diagnostic criteria for gestational diabetes mellitus

Donald R. Coustan, MD; Lynn P. Lowe, PhD; Boyd E. Metzger, MD; Alan R. Dyer, PhD

The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study was performed in response to the need for internationally agreed upon diagnostic criteria for gestational diabetes, based upon their predictive value for adverse pregnancy outcome. Increases in each of the 3 values on the 75-g, 2-hour oral glucose tolerance test are associated with graded increases in the likelihood of pregnancy outcomes such as large for gestational age, cesarean section, fetal insulin levels, and neonatal fat content. Based upon an iterative process of decision making, a task force of the International Association of Diabetes and Pregnancy Study Groups recommends that the diagnosis of gestational diabetes be made when any of the following 3 75-g, 2-hour oral glucose tolerance test thresholds are met or exceeded: fasting 92 mg/dL, 1-hour 180 mg/dL, or 2 hours 153 mg/dL. Various authoritative bodies around the world are expected to deliberate the adoption of these criteria.

TABLE 5

Comparison of proposed thresholds to current thresholds for 75 gram OGTT in pregnancy (ADA)

Sample time	Proposed glucose threshold, mg/dL	Current ADA recommendations
Fasting	92	95
1-h	180	180
2-h	153	155

Proposed: gestational diabetes is diagnosed if ≥1 of the thresholds is met or exceeded.[16] Current ADA recommendations: gestational diabetes is diagnosed if ≥ 2 thresholds are met or exceeded.[12]
ADA, American Diabetes Association; *OGTT*, oral glucose tolerance test.

Coustan. The HAPO study: paving the way. Am J Obstet Gynecol 2010.

SMFM DEBATES www.AJOG.org

The editors of the Journal and the SMFM Publication Committee are pleased to provide this summary of a debate conducted at the 31st annual meeting of the Society for Maternal–Fetal Medicine (The Pregnancy Meeting), San Francisco, CA, Feb. 7-12, 2011. One entry in this series will run every month from May through October 2011.

Gestational diabetes—Staying with old or marrying new guidelines

THE ISSUE: Gestational diabetes mellitus is associated with increased neonatal morbidities and higher cesarean delivery rates; women with gestational diabetes mellitus are at increased risk for type II diabetes mellitus later in life. The current recommendation for screening includes a glucose tolerance test either early in pregnancy and/or at 24-28 weeks' gestation followed by a diagnostic 100-g oral 3-hour glucose tolerance test with a rate of 5%. The results of a large prospective observational study (HAPO study) and 2 randomized trials lead the International Association of Diabetes in Pregnancy Study Group to recommend a 1-stage screening and diagnosis method that includes a 75-g 2-hour glucose tolerance test that will result in an 18% gestational diabetes mellitus rate. However, there is uncertainty about the clinical implications of the adoption of the latter recommendation.

Staying with old guidelines

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5% (4-7%)

Marry old and new guidelines

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Estimated to 18%

The American College of Obstetricians and Gynecologists
Women's Health Care Physicians

COMMITTEE OPINION

Number 504 • September 2011

Committee on Obstetric Practice

This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

Screening and Diagnosis of Gestational Diabetes Mellitus

ABSTRACT: *Gestational diabetes mellitus* (GDM), defined as carbohydrate intolerance that begins or is first recognized during pregnancy, is associated with increased maternal, fetal, and neonatal risks. The prevalence of GDM in the United States is increasing, probably because of increasing rates of overweight and obesity. A universal recommendation for the ideal approach for screening and diagnosis of GDM remains elusive. At this time, the Committee on Obstetric Practice continues to recommend a two-step approach to screening and diagnosis. All pregnant women should be screened for GDM, whether by patient history, clinical risk factors, or a 50-g, 1-hour glucose challenge test at 24–28 weeks of gestation. The diagnosis of GDM can be made based on the result of the 100-g, 3-hour oral glucose tolerance test, for which there is evidence that treatment improves outcome.

국가별	2009			2010		
	과체중(여자) (%)	비만(여자) (%)	과체중+비만(여자) (%)	과체중(여자) (%)	비만(여자) (%)	과체중+비만(여자) (%)
한국	22.4	4.1	26.4	21.0	4.7	25.7
일본	17.3	3.5	20.8	17.9	3.2	21.1
터키	–	–	–	28.4	21.0	49.3
미국	–	–	–	28.2	36.3	64.5
칠레	33.6	30.7	64.3	–	–	–
체코	–	–	–	28.0	21.0	49.0
덴마크	–	–	–	26.3	13.1	39.4
에스토니아	–	–		28.4	16.8	45.2
프랑스	–	–	–	23.3	13.4	36.7
독일	29.1	13.8	42.9	–	–	–
그리스	31.7	17.3	49.0	–	–	–
헝가리	30.3	30.4	60.7	–	–	–
아이슬란드	–	–	–	31.1	19.3	50.4
이탈리아	27.7	9.3	37.0	27.6	9.6	37.2
룩셈부르크	29.2	19.0	48.2	29.2	21.0	50.2
네덜란드	29.5	12.4	41.9	30.3	12.6	42.9
폴란드	29.4	15.2	44.6	–	–	–
스페인	29.9	14.7	44.6	–	–	–
스웨덴	27.6	10.7	38.3	27.1	13.1	40.2
영국	32.8	23.9	56.7	31.7	26.1	57.8
뉴질랜드	32.8	27.8	60.6	–	–	–