Thank you for attending

**Gestational Diabetes:**
**New Concepts, New Guidelines**

*A Live and Archived Webcast*
*Sponsored by Community Health Association of Mountain/Plains States (CHAMPS)*
*Presented by Dr. Linda Barbour on Wednesday, February 28, 2007*

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**Supplementary Information Packet**

**Contents:**
- Learning Objectives
- AAFP
- Biography of Dr. Linda Barbour
- Description of CHAMPS
- Presentation Slides
- GDM Guidelines – Long
- GDM Guidelines – Short
Learning Objectives

- Understand the existing controversies in the diagnosis and management of gestational diabetes
- Interpret the findings from the most recent landmark trials which shaped the recommendations from the 5th International Workshop on Gestational Diabetes
- Describe how to use a fetal-based strategy for the optimal treatment of GDM
- Recognize the long term implications of GDM for both infant and mother and the appropriate postpartum recommendations

AAFP

This live webcast has been reviewed and is acceptable for up to 1.5 Prescribed credits by the American Academy of Family Physicians (AAFP). Application for 1.5 hours of Prescribed CME credit for the archived version of this webcast will be filed immediately after the live event. Linda Barbour has indicated that she has no relationships to disclose relating to the subject matter of his presentation. The AAFP invites comments on any activity that has been approved for AAFP CME credit. Please forward your comments on the quality of this activity to cmecomment@aafp.org.

Biography of Linda Barbour, MD, MSPH

Linda A. Barbour, MD, MSPH, is an Associate Professor of Medicine and Obstetrics and Gynecology in the divisions of Endocrinology, Metabolism, and Diabetes and Maternal-Fetal Medicine at the University of Colorado at Denver Health Sciences Center. She is Board Certified in Endocrinology and completed a second fellowship in Preventive Medicine and Biometrics. She is the Co-Director of the High Risk Obstetrics Clinic and Diabetes in Pregnancy Clinic. She chaired the Colorado Clinical Guidelines Collaborative on Gestational Diabetes and also co-authored the Endocrine Society Guidelines for Thyroid Disease in Pregnancy, soon to be published. Dr. Barbour is the past president of the North American Society of Obstetric Medicine, previous moderator and speaker for the Pregnancy and Reproductive Health Council for the American Diabetes Association, and the Director of Continuing Medical Education for the Department of Medicine. She is co-editor of the textbook, Medical Care of the Pregnant Patient, published in 2000, for which the 2nd edition is soon to be published. She is the principal investigator on a 5-year NIH grant which studies insulin signaling in gestational diabetes.

Description of CHAMPS

CHAMPS, the Community Health Association of Mountain/Plains States, is a non-profit organization dedicated to providing a coordinating structure of service to non-profit primary health care programs whose primary purpose is to serve the medically indigent and medically underserved of Region VIII (CO, MT, ND, SD, UT, and WY). CHAMPS also serves the Region VIII State Primary Care Associations that assist those nonprofit primary health care programs (CCHN, MPCA, CHAD, AUCH, and WYPCA). Currently, CHAMPS programs and services focus on education and training, collaboration and networking, policy and funding communications, and the collection and dissemination of regional data for Region VIII Community Health Centers and Primary Care Associations. For more information, please visit www.champsonline.org or call (303) 861-5165.

Community Health Association of Mountain/Plains States

Linda Barbour MD, MSPH
Associate Professor in Endocrinology and Maternal-Fetal Medicine, UCDHSC
Co-Director Diabetes in Pregnancy Clinic

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5th International Workshop on GDM
November 11-15, 2005 Chicago
(Metzger BE, Women's Health 2006; 2(2):211-16)

Objectives
- Appreciate the rapidly rising prevalence of GDM due to obesity epidemic
- Understand the importance of GDM on long term maternal and childhood outcomes
- Cite landmark studies that shaped the guidelines and studies pending in 2007
- Review the key elements of the guidelines
- Understand new management strategies including fetal-based approaches
- Underscore the importance of appropriate post partum management for both mother and infant

What Is Gestational Diabetes (GDM)?
- Glucose intolerance recognized for the first time during pregnancy
  - Does not exclude women with pre-existing diabetes previously undiagnosed
  - Undiagnosed Type 2 with T1AC have risk for major malformations
  - Most women diagnosed before 24 weeks have IGT (pre-diabetes) and are at very high risk for developing Type 2 postpartum

What Causes It?
- Vast majority of women who develop GDM are overweight and insulin resistant
- Placental hormones cause worsening insulin resistance in the late 2nd trimester intended to shunt nutrients to the fetus
- Moms are unable to produce enough insulin to overcome the overwhelming resistance to maintain euglycemia
- Fetuses are exposed to high levels of glucose, TGs and FFAs. Fetal hyperglycemia→→→→hyperinsulinemia→→→→pancreatic hyperplasia. Insulin is a growth hormone causing excess fat deposition
How Big Is the Problem?

- ~7.5% of mothers in Colorado have diabetic pregnancies (CO PRAMs data) ~5000 women
- Incidence has **Doubled** in the last 7-8 years from 2-5% of population to ~4-12%
- A leading high risk complication of pregnancy (after preterm birth and obesity)
- Tremendous economic costs for mother and infant
- **Self perpetuating cycle feeding the obesity and diabetes epidemic**

![Graph showing percent of women with diabetes during pregnancy, by race/ethnicity, 2002-2004.]

![Graph showing percent of women with diabetes during pregnancy, by age group, 2002-2004.]

![Graph showing percent of women with diabetes during pregnancy, by years of education received, 2002-2004.]

**1996→2006 GDM Costs**

- **Diet treated GDM** ~$11,000 per pt ($6,000)
- **Insulin Treated GDM** ~$20,000 ($11,000)
  - 1/3 patient require meds
  - 8% require ~1-2 days in NICU ~$4000 ($2300)
- 70,000 births X 7.5% = 5,250 births
  - 3,500 X $11,000 = $38.5 million
  - 1,750 X $20,000 = $35 million
- **2006 costs state of CO = ~$80 million (6%)**

**Why Is It a Problem to Mother?**

- Intensive monitoring of blood glucoses, diet restrictions, insulin injections or meds, increased frequency of prenatal visits, financial burden
- Higher risk of infections
- Higher risk of C-section
- ~50% Maternal risk of developing Type 2 DM in 5-10 years!!!
What About the Baby???

What’s So Bad About a Big Baby???

- Babies have central obesity and can’t get through the birth canal → birth trauma
- Babies at ↑ risk of stillbirth because they can outgrow their oxygen supply
- Babies develop hypoglycemia at birth due to inability to ↓ their own insulin production immediately and may require NICU. Also polycythemia, hyperbilirubinemia
- Babies develop enlargement of their pancreas, heart, and liver
- Babies at ↑ risk for developing childhood obesity and Type 2 DM

Fetal Programming: Long Term Implications

- Metabolic factors in the intrauterine environment have a profound effect on prenatal development and enhanced susceptibility to later chronic disease
- GDM → ↑ fetal Insulin, neonatal fat, insulin resistance, and enlargement of the pancreas
- Both Large (LGA) and Average for Gestational Age (AGA) infants from GDM moms have ↑ fat vs infants without GDM
- High fetal Insulin levels influence hunger centers (hypothalamus) involved in energy balance → neonatal obesity and impaired glucose tolerance
It's Not Only Mother's Glucose that Causes Big Babies

- Most macrosomic infants (>4000 g/~9 lbs) born to mothers without Diabetes
- Pre-pregnancy weight and maternal wt gain are strongest predictors of macrosomia
- BMI 30-34 → 2-4 fold ↑ macrosomia

Delaney Buzzell
"Big Enchilada"
June 23, 2005
13 lb 12 oz at 37 weeks

Increasing Birth Weights

- Denmark 1990-1999
  - >4000g (~9 lbs); 16.7→20%
- Sweden 1992-2001
  - LGA increased by 23%
- Canada Term LGA increased by 24% in 13 yrs
- Cleveland Medical Center
  - 1975-2003; B.W. ↑110 gms; Mat Weight 168→186 lbs (not lost PP)
  - Neonatal % Body fat vs at Body fat at 9 yrs significantly correlated

The Diabetes Explosion

Prevalence = 12% of the Adult Population
Prevalence up by 14% in 2 years!!!!!!

New Dx: Up by 100% in adults 30-39 yrs old
Up by >300% in adolescent TYPE 2 this decade

Childhood Type 2 DM diabetes has tripled!!!

1 IN 3 CHILDREN BORN IN THE YEAR 2000 WILL DEVELOP TYPE 2 DM IN THEIR LIFETIME

MetroHealth Medical Center, Cleveland

Birth Weight 1975-2003

Maternal Weight at delivery 1967-2000

Diabetes Begets Diabetes: The Cycle

INSULIN RESISTANCE
Environment

Decreased Insulin Secretion
Obesity Inactivity Diet

Fetal Metabolic Programming
But, Does Treatment Work????

**Effect of Treatment of Gestational Diabetes Mellitus on Pregnancy Outcomes**

Caryn A. Crowther, FRANZCOG, Jamie E. Hill, PHD, John F. Moss, FRCOG, Andrew J. Moffatt, FRACP, William S. Jeffery, FRACP, and Jeffrey S. Robinson, FRANZCOG, for the Australasian Cardiovascular Health in Pregnancy Women (ACHOIS) Trial Group

**ABSTRACT**

Blinded Randomized Controlled Trial of 1000 women Rx of GDM → Stillbirths/Neonatal Deaths and Macrosomia

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% serious outcomes</td>
<td>4% serious outcomes</td>
</tr>
<tr>
<td>– perinatal death (0), shoulder dystocia (1), bone fracture (0), nerve palsy (0)</td>
<td>– 1 IUFD (PE/IUGR), – 2 term IUFDs (ni growth), – 2 neonatal deaths (cong anomaly and asphyxia)</td>
</tr>
<tr>
<td>Admitted to nursery 71%</td>
<td>Admitted to nursery 61%</td>
</tr>
<tr>
<td>Macrosomia/LGA 10/13%</td>
<td>Macrosomia/LGA 21/22%</td>
</tr>
<tr>
<td>Induction/GA 39%/39 wks</td>
<td>Induction/GA 29%/39.3 wks</td>
</tr>
<tr>
<td>C-sec 31% (NS)</td>
<td>C-sec 32% (NS)</td>
</tr>
<tr>
<td>Preeclampsia 12%</td>
<td>Preeclampsia 18%</td>
</tr>
<tr>
<td>Depression 8%</td>
<td>Depression 17%</td>
</tr>
</tbody>
</table>

| 278/332 QOL outcomes | 295/350 QOL outcomes |
| 6 wks and 3 mos PP | 6 wks and 3 mos PP |
| 0 stillbirths/ neonatal deaths | 3 stillbirths/ 2 neonatal deaths |

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**Outcomes (ACHOIS NEJM 2005)**

**Effect of Treatment of GDM on Pregnancy Outcomes (ACHOIS)**

Crowther CA 2005 NEJM 352:2477

| 2005:352:2477800 women | WHO criteria: 75 gms FBG <140 (mean=86) 2 hr 140-199 (mean=155) |
| 490 Intervention | 510 Control (blinded) |
| Diet, HGM, 20% insulin | None (3% insulin) |
| 506 live births | 0 lost |
| 278/332 QOL outcomes | 295/350 QOL outcomes |
| 6 wks and 3 mos PP | 6 wks and 3 mos PP |
| 0 stillbirths/ neonatal deaths | 3 stillbirths/ 2 neonatal deaths |

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**Awaiting Results**

- HAPO, anticipated June 2007
  - 25,000 pts in 15 centers, 9 countries
  - Observational trial of blinded, untreated GDM (FBG <105; 2 hr <200)
  - Outcome based criteria for the diagnosis and classification of GDM
- NICHD MFM Network, anticipated 2007
  - 15 centers, RCT of 950 pts if FBG <95
- MIG, anticipated 2007
  - 750 pts in Australia/New Zealand
  - Metformin versus Insulin

Linda Barbour, MD, MSPH
Update: 5th Int Workshop on GDM, Nov 11-13, 2005

- Newer trials:
  - Crowther, NEJM, 2005
  - Blind RCT on Rx GDM
  - CGMS data
  - RCT of Fetal Based Strategy to guide Rx
  - Glyburide trials 2004-2006
  - Jacobson, Chait, Conway, Kremer, Kahn/Barbour
  - Postpartum Diabetes Prevention
  - DPT, PIPOD

Screening and Diagnosis

- No significant change; universal screening if high prevalence
  - If 130 mg/dl chosen; sens 90% but specificity 80%
  - If 140 mg/dl picked, sens 80% but spec 90%
- Repeat 3 hr OGTT in 3-4 wks if 1 abnormal value
- Awaiting for HAPO trial results

Screening

- **Low Risk**: (must meet ALL criteria not to screen)
  - Age <25
  - Normal weight
  - Caucasian
  - No DM in 1st degree relative
  - No hx of glucose intolerance
  - No hx of poor obstetric outcome
- **High Risk**: (must meet ANY criteria to screen EARLY)
  - Obesity
  - Hx GDM (High prevalence of undiagnosed Type 2 DM)
  - Hx macrosomic infant
  - Glicosuria
  - FH DM
  - PCOS (40% gluc intolerance) Legro RS 2005 JCEM:90:3236
- Advanced maternal age (>35 yrs) and high risk ethnic pop ↑ risk

Diagnostic Criteria-100 g OGTT (Carpenter and Coustan)

- FBG ≥ 95 mg/dl
- 1 hr ≥ 180 mg/dl
- 2 hr ≥ 155 mg/dl
- 3 hr ≥ 140 mg/dl
- 2 or more values diagnostic

Screening/Diagnostic Strategies

- If glucose on 50 gm glucola ≥200 mg/dl
  - Check FBG; If ≥ 95 mg/dl, treat as GDM
- Glucola abnl early but 3 hr nl→ repeat 3 hr at 24-28 wks
- If 1 abnl value on 3 hr→ repeat 3 hr in 3-4 wks; recommend MNT and physical activity
- If GDM dx <24 wks; consider A1C to r/o malformation risk
- Bariatric surgery pts: self gluc monitoring if unable to drink 100 g OGTT

Self Glucose Monitoring

- FBG and 1 or 2 hr postprandial
- No data to support testing < q.i.d
- Cost issue: vary times of testing, usually FBG and after largest meal, attempt at least bid
- Always check glucose meter memories for true values; do not rely on written values
- Be suspicious of values ending in 0, 5, and less than 15 points variation at given time
- Calibrate glucose meters often
- Make sure fingertips are clean before sample

Screening

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**Medical Nutrition Therapy**

- Macronutrient percentages dropped (min 175 g carbs)
- Concerns about substituting high fat
  - High fat intake may ↑ risk GDM Saldana TM 2004
  - ↑ Maternal TGs associated with macrosomia
  - Ideal macronutrient composition unknown
- Avoid simple carbs, saturated fats
- Carb counting may be useful to blunt PP glucose
- Avoid excessive weight gain (1990 IOM guidelines)
  - BMI 20-25: 25-35 lbs
  - BMI 26-29: 16-25 lbs
  - BMI >29: 13 lbs-
  - 1600 cals: ↓ gluc, TGs without ketonuria Knopp RH 1991

**Physical Activity**

- Adopt population recommendations unless obstetric or medical contraindication
  - 30 mins 5 days a week
  - HR <140, Avoid overheating, dehydration
  - May be split into shorter increments more frequently

**Initiation of Medical Therapy**

<table>
<thead>
<tr>
<th></th>
<th>FBG</th>
<th>1 hr PP</th>
<th>2 hr PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA, 2004 (plasma)</td>
<td>105 mg/dl</td>
<td>155 mg/dl</td>
<td>130 mg/dl</td>
</tr>
<tr>
<td>*ACOG, 2001; 4, 5th Workshop</td>
<td>95 mg/dl</td>
<td>130-140 mg/dl</td>
<td>120 mg/dl</td>
</tr>
<tr>
<td>Jovanovic</td>
<td>90 mg/dl</td>
<td>120 mg/dl</td>
<td></td>
</tr>
</tbody>
</table>

**Continuous Glucose Monitoring Sensor (CGMS)**

- FBG in normal pregnancy: 75 mg/dl
- Peak postprandial: 110 mg/dl
- Peak ~70-90 mins but differs with fat intake Yogev Y AJOG 2004
- No changes in recommended targets or timing until HAPO out

**Is Maternal Glucose Best Endpoint? Fetal Based Strategy**

- Maternal Glucoses Are Deceptive and Do Not Reflect Accurately Excess Nutrition to Fetus
  - Fetal-Placental Glucose Steal Syndrome
  - Progressive siphoning of gluc by fetus with hyperinsulinemia
- Fetal Criteria to Dictate Maternal Therapy
- ↑ Abdominal circumference (AC) on US due to sq fat and visceral fat in liver (abd sq fat accounts for 63% variance of fetal AC)
- Correlates with amniotic fluid insulin levels (AFI)

**Rationale for Fetal Based Strategy**

- Measurement of fetal response to excessive glucose transport
  - "Diabetic Fetopathy" ↑ AC on US at 30-32 wks
**RCT's of Selected Insulin Therapy Based on Fetal US**

- Buchanan, Kjos 1994 *Diabetes Care* 17:275
- 59 A1GDM, good control; fetal AC>75% at 29-33 wks
- RCT HGM, Diet Vs HGM, Diet, Insulin (1.3 units/kg)
- LGA 45% vs 13% (3878 vs 3647 gms)
- Kjos 2001 *Diabetes Care* 24:1904
- Schaefer-Graf, Kjos 2004 *Diabetes Care* 2004;27:297
- Bonomo 2004 *Diabetes & Metab* 2004;30:237

**RCT of GDM Based on Fetal US Growth (Bonomo, Diab & Metab 2004;30:237)**

- RCT of 229 GDM in Italy
- Rx Goals:
  - Conventional 90/120 mg/dl
  - Modified: AC<75% 100/140; AC>75% 80/100
- Insulin Used 17% conv vs 30% in modified
- Outcomes:
  - Macrosomia: 11.5% in conv vs 3.3% in modified
  - LGA: 18% vs 8%; SGA 9% vs 6%
- Concentrate therapeutic efforts based on US evidence of Fetal Hyperinsulinemia

**Fetal Based Therapy 5th Int Workshop**

- There are 5 RCTs which demonstrate that using a fetal based strategy (AC>75% at 28-32 wks) to guide therapy can be useful in identifying patients who may benefit from more intensive medical management

**Insulin Therapy**

- Short acting insulin analogues have advantage to blunt postprandial glucose
  - Lispro (>500 pregnancies); *Wyatt JW 2005 Diabetic Med*;22:803
  - Aspart *Pettit DJ 2003 Diab Care*26:183
- Not enough data with Glargine (Lantus)
  - Concern with affinity for IGF-1 receptor, especially with proliferative retinopathy

**Insulin pharmacokinetics**

<table>
<thead>
<tr>
<th></th>
<th>Lispro / Aspart</th>
<th>Regular</th>
<th>NPH</th>
<th>Glargine</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 hr</td>
<td>Glyburide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 hr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 hr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 hr</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Traditional insulin therapy Split mixed Regular/ NPH BI D**

- 2/3 total dose in a.m. (2/3 N; 1/3 R)
- 1/3 in p.m. (1/2 N; 1/2 R)

<table>
<thead>
<tr>
<th>AM meal</th>
<th>Noon meal</th>
<th>PM meal</th>
<th>HS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td></td>
<td>NPH</td>
<td></td>
</tr>
</tbody>
</table>
Physiologic Glucose Profile

<table>
<thead>
<tr>
<th>Glucose</th>
<th>∆30-40 mg/dL</th>
<th>∆30-40 mg/dL</th>
<th>∆30-40 mg/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM meal</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Noon meal</td>
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<tr>
<td>PM meal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;100 mg/dL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Physiologic insulin therapy

- NPH/Glargine
- lispro / aspart

Basal amount ~50%
Bolus amount ~50%

Insulin dosing with Humalog/Aspart
- Use weight based (0.5-1U/kg) or present dose (add % if poor control)
- Give ½ total dose as NPH
  - Split equally in a.m. and p.m. (consider qhs and more NPH in p.m. than a.m.)
- Give ½ as Humalog or Novolog
  - Give 1/3 with each meal
  - Give according to % carbs at each meal
  - Give according to pre-meal correction factor and carb ratio

Glyburide
- October 2000; Langer’s landmark RCT of Glyburide Vs Insulin in 404 women, NEJM – NS difference in LGA, macrosomia, neonatal outcomes; only 4% pts switched to insulin
- Conway, 2004 (Univ Texas): 75 pts
- Kremer, 2004 (Univ Florida): 73 pts
- Chmait, 2004 (Univ CA, San Diego): 69 pts
- Jacobson, 2005 (Kaiser, Northern Calif): 236 pts
- Kahn, Barbour 2006 (Univ CO) 95 pts

Success Versus Failure

<table>
<thead>
<tr>
<th>Successes (81)</th>
<th>Failures (20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Age = 29 yrs</td>
<td>*Age = 35 yrs (p=0.0001)</td>
</tr>
<tr>
<td>Gravidity = 2.7</td>
<td>*Gravidity = 4.4 (p=0.004)</td>
</tr>
<tr>
<td>BMI = 30</td>
<td>BMI = 32</td>
</tr>
<tr>
<td>Mat Wt gain = 26 lbs</td>
<td>Mat Wt gain = 27 lbs</td>
</tr>
<tr>
<td>Hx GDM = 17%</td>
<td>*Hx GDM = 35% (p=0.08)</td>
</tr>
<tr>
<td>FBG = 100 mg/dl</td>
<td>*FBG = 111 mg/dl (p=0.03)</td>
</tr>
<tr>
<td>Gest Age at Dx = 28 wks</td>
<td>**Gest Age at Dx = 22 wks (p=0.003)</td>
</tr>
</tbody>
</table>

* Multiple regression model; Gest age < 25 wks; OR=5.5

Predictors of Glyburide Failure in the Treatment of Gestational Diabetes

*Obstet Gynecol 2006;107(6):1303*

Bronwen Kahn, Jill Davies, Anne Lynch, Regina Reynolds, Linda Barbour
University of Colorado Health Sciences Center
Departments of OB-Gyn, Medicine, and Pediatrics
Glyburide Troubleshooting

- Peaks at 3-4 hours
- Give 30 mins-1 hr before breakfast/dinner
- Eat portion of breakfast mid morning (instead of adding snack)
- Hypoglycemia common mid morning
- May need to add NPH qhs to treat ↑ FBG
  - Glyburide b.i.d. with meals; NPH qhs

Oral Hypoglycemic Rx
5th Int Workshop

- Glyburide can be a useful adjunct to therapy in women not controlled on MNT
- 20% failure rate, especially women diagnosed prior to 25 weeks of pregnancy, marked hyperglycemia, and obesity
- Dose 30-60 mins before meals due to 3-4 hour peak
- Inadequate data for continuing Metformin
  - Readily crosses the placenta but no ↑ anomalies
  - RCT Palomba S JCEM 2005 ↓ pregnancy loss in PCOS women but was not continued

Stay Tuned..............

- HAPO; new screening guidelines and thresholds for Rx
- MFMU; Rx recommendations
- MIG; Metformin

US and Fetal Surveillance

- No significant change
- Fetal activity records in all GDM women
- Consider NST’s in women not controlled on MNT alone
- US for growth at 28-32 wks may be helpful to dictate aggressiveness of therapy
- EFW at term poor PPV but if >4200 gms and ↑ AC, higher risk of shoulder dystocia

Labor and Delivery

- Delivery at 38-39 weeks in pts with good dates and favorable cervix was shown in one RCT to decrease macrosomia without increasing Cesarean delivery rate Kjos SL 1993 AJOG;169:611
- Delivery prior to 38 wks requires amniocentesis
- Timing of delivery relatively open
- Cesarean delivery for obstetric indications
- No new data

What Happens to Mother Postpartum?

- Pregnancy is a “Stress Test” for the development of Type 2 DM
- ~50% Diabetes risk in 5-10 yrs
- 75 gm Oral Glucose Tolerance Test at 6-12 wks PP
  - If Impaired Glucose Tolerance/Pre-diabetes (~15%) → ~80% risk of Type 2 DM in 5-10 yrs
- Diabetes Prevention Trial showed a 17% progression per year to Type 2 Diabetes in moms with a hx of GDM and IGT
75 G OGTT Postpartum

- Recommended for all GDM women
- Normal Gluc Tolerance
  - FBG <100 AND 2 hr <140 mg/dl
- Pre-diabetes or IGT
  - FBG 100-125 OR 2 hr 140-199 mg/dl
- Diabetes
  - FBG ≥126 OR 2 hr ≥200 mg/dl

What Can Be Done to Prevent Type 2 DM?

- Diabetes Prevention Trial showed 17% progression per yr to DM; ~8% with Diet/Exercise or Metformin
- TRIPOD (PIPOD): ↓ rate DM from 12.1 to 5.4% at 30 mos
  - Rosiglitazone → Pioglitazone
- Overweight women do not return to pre-pregnancy wts
- Higher BMI with each subsequent pregnancy
- Multiple pregnancies is a risk factor for Type 2 DM
  - 50% pregnancies in U.S. unplanned
- Undiagnosed or inadequately treated Type 2 DM causes birth defects

Contraception

- Low dose OCPs- no change in DM risk but can ↑ TGs
- IUDs safe; no ↑ risk of infection
- Progesterone pills and Depo-Provera may ↑ risk of progression to DM associated with ↑ wt gain Xiang AH Diabetes Care 2006;29:613
- Superior to no contraception due to ↑ risk of developing Type 2 DM in GDM women with recurrent pregnancies Peters RK 1996 Lancet;347:227
- Each subsequent pregnancy ↑ risk Type 2 DM

Breastfeeding

- Nursing in healthy moms ↓ childhood obesity Dewey KG 2003
- May ↓ maternal progression to Type 2 DM
- Diabetic breast milk for 1st wk of life from Type 1 mom ↑ obesity at 2 yrs vs banked donor milk Plagemann A 2002
- No GDM data at time; Since then....
  - Protective of overweight ~5 yrs Schaefer-Graf 2006 Diab Care;29:1105
  - ≥ 3 mos nursing OR=.52; Mat Obesity OR=2.7; B.W. >90% OR=1.8
  - Childhood obesity in DM moms 0.62 Mayer-Davis 2006 Diab Care 29:2331

Postpartum Management

- Target GDM women for primary prevention postpartum
- 75 gm OGTT at 6-12 wks PP
  - If IGT (15%) → diet, exercise, and possibly meds; reevaluate in 1 yr; No IGT → 1-3 yr follow-up
- Preconception counseling; wt loss below pre-pregnancy weight, DM evaluation (A1C)
- Breastfeeding encouraged

If we don’t make some changes, the status quo will remain the same. Bill Clinton
Gestational Diabetes Act
www.diabetes.org/advocacy

- Understanding and Monitoring GDM
  - Research Advisory Committee headed by CDC
  - Multi-site projects for identification and data collection
  - Track mothers and prevent Type 2 DM
- Demonstration Grant Programs
  - Expand community-based activities
  - Support state-based prevention programs
  - Train health providers
- Research Expansion of GDM and Obesity
  - Expand basic, clinical and public health research
  - Investigative therapies
  - Facilitate enrollment into clinical trials for high prevalence populations
  - Develop better screening and diagnostic methods
  - Elucidate causal factors

In my beginning, is my end.

T.S. Eliot, Four Quartlets, The Dry Salvages

Thank You for Joining CHAMPS and Dr. Barbour for this Distance Learning Event!

Your opinions are very important to us.
Please take a few minutes to complete the Evaluation for this webinar. If you are applying for Continuing Medical Education (CME) credit, you must complete the CME questions found at the end of the Evaluation.

Only one person per computer may use the online version of the Evaluation/CME form.
Click on the link to the side of your screen to download a printable form that can be completed by additional participants and faxed to CHAMPS.
The AAFP invites comments on any activity that has been approved for AAFP CME credit. Please forward your comments on the quality of this activity to cmecomment@aafp.org.

We hope you will join us again!
Community Health Association of Mountain/Plains States (CHAMPS)
www.CHAMPSonline.org - 303-861-5165
SCREENING

Universal Risk Assessment at First Prenatal Encounter

• Complete risk assessment for gestational diabetes mellitus (GDM) accounting for patient history and clinical risk factors.

• Classify high-risk with one or more of the following risk factors:
  - Advanced maternal age (age ≥ 35 years).
  - Obesity (BMI > 29 kg/m²).
  - High-risk ethnic population (Asian/Pacific Islander, American Indian, Hispanic, Black).
  - Personal history of GDM.
  - Previous macrosomic infant.
  - History of GDM related obstetric complications.
  - First degree relative with diabetes.
  - Polycystic Ovary Syndrome (PCOS).
  - Glycosuria.

• If woman does not meet any of the above criteria, complete Universal Screening between 24–28 weeks.

• The option to preclude universal screening at any time during pregnancy, although not recommended due to the increasing incidence of GDM in Colorado, may be considered only when ALL the following criteria are met:
  - Age < 25 years.
  - BMI ≤ 26 kg/m².
  - Caucasian.
  - No known diabetes in a 1st degree relative.
  - No history of abnormal glucose tolerance.
  - No history of poor obstetric outcome.

Early Screening for High-Risk Women

• Evaluate high-risk women for glucose tolerance as soon as prenatal care is established. Do not delay testing until 24–28 weeks.
  - Perform laboratory screening with a 50-g, 1-hour oral glucose challenge test (OGCT), administered without regard to time elapsed since the last meal.
  - If OGCT is ≥ 135 mg/dl, follow with a diagnostic 100-g, 3-hour oral glucose tolerance test (OGTT).
- If OGTT reflects GDM diagnosis, and there is strong suspicion of pre-existing diabetes, obtain an HbA1c.
- Possible signs of pre-existing diabetes include an early positive OGTT, very high fasting glucose ≥ 110 mg/dl, or very high values on the 100-g, 3-hour OGTT > 250 mg/dl.
- HbA1c > 6.5% in any gestation indicates need for an anatomy scan and echocardiogram to rule out major malformations and possible further diagnostic testing.

- If all values on the 3-hour OGTT are normal, repeat OGTT between 24–28 weeks.

- If OGCT < 135 mg/dl, rescreen between 24–28 weeks.

**Universal Screening between 24–28 weeks**

- Perform laboratory screening with a 50-g, 1-hour OGCT administered without regard to time elapsed since the last meal.

- If OGCT is ≥ 135 mg/dl, follow with a diagnostic 100-g, 3-hour oral glucose tolerance test (OGTT).
  - If OGCT ≥ 200 mg/dl*, test serum fasting blood glucose (FBG) before 100-g, 3-hour OGTT is given.
    - If serum FBG < 95 mg/dl, proceed with OGTT.
    - If serum FBG ≥ 95 mg/dl, diagnose GDM. No OGTT necessary.
    - If FBG result is not immediately available, continue with OGTT.
  * There are no accepted criteria or literature to support the 1-hour test alone.

- If suspect glucose intolerance due to macrosomia, polyhydramnios, or any other clinical indicators, rescreen anytime in the 3rd trimester.

- If OGCT < 135 mg/dl, no further testing required.

**DIAGNOSIS**

- The diagnostic test indicated for GDM is a 100-g, 3-hour OGTT in a fasting state after a 3-day unrestricted diet (150-g of carbohydrate or 10 carbohydrate servings per day).
  - Most healthy women consume ≥ 150-g of carbohydrate per day.
  - If there is concern that carbohydrate intake is inadequate due to a low-carbohydrate diet, hyperemesis gravidarum, acute medical or lifestyle stress, chronic malnutrition, restricted diet due to philosophical/religious/health beliefs or eating disorders, instruct to consume at least 10 carbohydrate servings per day for 3 days prior to test.

- Follow these guidelines for the OGTT:
  - No food or beverage 8–14 hours before test, except water.
  - No smoking during the test.
  - Remain at rest during the test.
  - Drink glucose solution in less than 5 minutes.

**OGTT Diagnostic Criteria for Gestational Diabetes**

- If only one value meets or exceeds thresholds, repeat 100-g, 3-hour OGTT in 3–4 weeks and recommend physical activity and nutrition counseling because 30% of women subsequently develop GDM.
- If 2 or more values meet or exceed thresholds, diagnose GDM.

<table>
<thead>
<tr>
<th>Time</th>
<th>mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>≥ 95</td>
</tr>
<tr>
<td>1-hour</td>
<td>≥ 180</td>
</tr>
<tr>
<td>2-hour</td>
<td>≥ 155</td>
</tr>
<tr>
<td>3-hour</td>
<td>≥ 140</td>
</tr>
</tbody>
</table>

*American Diabetes Association, Carpenter and Coustan.
MEDICAL NUTRITION THERAPY (MNT)

Optimally, a registered dietitian (RD) and/or certified diabetes educator (CDE) should provide MNT, focusing on healthy food choices and blood glucose control. If this resource is not available in your community, an RN or trained community health worker may provide nutrition counseling.

Assess

- **Individualize** the specific calorie level based on an assessment of pre-pregnancy weight (PPW), physical activity level, and pregnancy weight gain to date.

### Weight Gain and Calorie Intake Recommendations for Women with GDM

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Recommended weight gain (lbs.)</th>
<th>Estimated calorie intake kcal/kg/day PPW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (&lt; 19.8)</td>
<td>28–40</td>
<td>36–40</td>
</tr>
<tr>
<td>Normal weight (19.8–26)</td>
<td>25–35</td>
<td>30</td>
</tr>
<tr>
<td>Overweight (26.1–29)</td>
<td>15–25</td>
<td>24</td>
</tr>
<tr>
<td>Obese* (&gt; 29)</td>
<td>15</td>
<td>12–18</td>
</tr>
</tbody>
</table>

* For obese women, a 30–33% calorie restriction (~1600 kcals) has shown reduced hyperglycemia and plasma triglycerides with no increase in ketonuria.

**Instruct**

- Inform women they will be using a structured, short-term meal plan to control GDM.
- Educate on healthy food choices and smaller, frequent meals evenly spaced throughout the day.
  - Avoid simple carbohydrates such as desserts, candy, regular soda pop, and other sweets.
  - Limit fruit juice to only a ½ cup of 100% juice, dependent on blood glucose response.
  - Maintain a minimum intake of 175-g of carbohydrate (12 carbohydrate servings) per day, or approximately 700 kcals from carbohydrates. Choose from high fiber foods such as whole grains and fresh fruits and vegetables.
- Teach carbohydrate counting and/or the plate method to control portion sizes.
- Instruct how to read food labels for counting carbohydrates and determining portion sizes.
- Encourage healthy maternal weight gain for optimal birth outcomes and wellness of mother.
  - The GDM meal plan may not always emphasize low-fat, heart-healthy eating because the fetus requires cholesterol from the mother.
- Instruct to keep a record of food and beverage intake including what, amount (cups, etc.), meal and snack times, and results of fasting and postprandial blood glucose levels.

**Evaluate**

- Review food and blood glucose records to assess MNT compliance and blood glucose control.
- Ensure that appropriate weight gain, normoglycemia, and the absence of ketonuria are achieved through MNT.
- Assess that food intake is not restricted to less than 12–18 kcal/kg/day PPW in an attempt to avoid medication therapy.
PHYSICAL ACTIVITY

- Develop an individualized exercise plan based on a physical assessment by the provider.

- Regular physical activity (30 minutes/day, 5 days/week) has clear benefits, including reduced insulin resistance, reduced postprandial hyperglycemia, and prevention of excessive weight gain.

- Recommend moderate physical activity after meals to achieve postprandial blood glucose goals. This is especially effective following the largest meal of the day.

- Actual heart rate should not exceed 140 beats/minute.

- Ensure adequate hydration and avoid overheating during all physical activity.

- Contraindications to physical activity include: preeclampsia, growth restriction, abruption, placenta previa, or vaginal bleeding.

BLOOD GLUCOSE MONITORING

- Train on self-monitoring of blood glucose (SMBG). Supply with a glucose meter and testing strips, as possible, to ensure SMBG throughout pregnancy. A glucose meter with memory is ideal.

- Instruct to check blood glucose 4 times/day; fasting and 1 or 2-hours postprandial.

- Considerations of SMBG:
  - Postprandial glucose levels peak approximately 90 minutes from time of meal.
  - Postprandial glucose values are the most effective in determining the likelihood of macrosomia and other adverse pregnancy outcomes. Daily SMBG may reduce adverse outcomes such as macrosomia.
  - SMBG is an essential guide for evaluating MNT.
  - Continue testing 4 times/day or more throughout the pregnancy if possible.

<table>
<thead>
<tr>
<th>Time</th>
<th>mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>&lt; 95</td>
</tr>
<tr>
<td>1-hour postprandial</td>
<td>&lt; 130–140</td>
</tr>
<tr>
<td>2-hour postprandial</td>
<td>&lt; 120</td>
</tr>
</tbody>
</table>

- Identify all abnormal values and determine if attributable to diet. If so, adjust or reinforce meal plan.

- When reliable blood glucose values have been collected for a minimum of 1–2 weeks, assess need for medication management. Consider medication therapy if patient is following the prescribed nutrition and physical activity plan and:
  - 20% of blood glucose values exceed the target goals or;
  - Two or more elevated blood glucose values taken at the same time of day meet or exceed the target range (e.g. two abnormal fasting values, two abnormal postprandial dinner values).

- If frequency of SMBG is decreased, rotate SMBG with different meals each day.

- Never discontinue SMBG during GDM. Remain vigilant because glucose intolerance increases as pregnancy progresses.
MEDICATION MANAGEMENT

• Allow up to two weeks for blood glucose to optimize in response to MNT before prescribing medication. Initiate medication therapy if unsuccessful with MNT.

• For fasting blood glucose > 115 mg/dl begin medication therapy without prior MNT because MNT alone is likely to fail.

Insulin

• Prescribe human insulin.
  - Insulin Lispro (Humalog) and Aspart (Novolog) more effectively reduce postprandial glycemic excursions than Regular insulin. However, NPH and Regular have also been used safely in pregnancy.
  - Due to insufficient evidence, Glargine (Lantus) is not yet recommended for routine use during pregnancy and is especially discouraged when retinopathy is present. However, there is no evidence that Lantus crosses the placenta and experience with its use is growing.

• SMBG should guide the doses and timing of the insulin regimen.

• Insulin therapy has shown benefits for pregnancies in which the fetal abdominal circumference (AC) is greater than the 75th percentile at 28–33 weeks gestation on ultrasound.

Oral Hypoglycemic Agents

• The FDA has not approved the use of any oral hypoglycemic agents in women with GDM.

• Glyburide has proved successful in recent controlled trials for treatment of hyperglycemia during pregnancy. Glyburide is the only oral hypoglycemic agent that should be considered as an alternative to insulin.
  - Glyburide can be an option for individuals refusing insulin.
  - Glyburide peaks 2–3 hours after meals, therefore the dose should be given 30–60 minutes before breakfast and dinner, and should not be given before bedtime.
  - Glyburide is more likely to fail in women who are diagnosed with GDM at < 24 weeks, have significant fasting hyperglycemia (especially >110 mg/dl), are morbidly obese, and have advanced maternal age (age ≥ 35 yrs old).

• Metformin should not be initiated during pregnancy. Unlike Glyburide, Metformin crosses the placenta and there is inadequate data at this time to determine its safety. If used to manage PCOS, discontinue use of Metformin after 1st trimester.

• For pre-existing diabetes mellitus controlled by oral hypoglycemic agents, discontinue oral agents and initiate insulin. The literature remains too weak at this point, especially with thiazolidinediones, to continue use during pregnancy. Acarbose appears safe, but is usually poorly tolerated due to GI complaints.

PRENATAL SURVEILLANCE

• Initiate daily fetal movement determinations (“kick counts”) at 28 weeks.

• Prenatal surveillance includes a twice-weekly Non-stress Test (NST), weekly Amniotic Fluid Indices (AFI), weekly Biophysical Profile or Contraction Stress Test.
  - If woman is euglycemic with diet only, may delay surveillance until 40 weeks.
  - If medication therapy is not required, but euglycemia has not been documented, initiate surveillance at 36 weeks.
- If medication therapy is required, initiate surveillance in women with otherwise uncomplicated GDM at 32–34 weeks.
- If woman has pre-existing diabetes, evidence of growth abnormalities, abnormal amniotic fluid levels, hypertension, or other adverse obstetric history, consider earlier surveillance.

• Using a fetal based strategy (AC > 75th %ile at 28–33 weeks) to guide therapy may help identify women that may benefit from more intensive medical management.

• Selection of the prenatal test, whether NST, AFI, Biophysical Profile, or Contraction Stress Test, is at the discretion of the practitioner.

LABOR AND DELIVERY MANAGEMENT

• Do a clinical or ultrasound estimate of fetal weight (EFW) within 2 weeks of delivery.

• Timing of delivery remains relatively open. There is no data to support delivery prior to term or cesarean delivery purely on the basis of GDM.
  - Well-controlled GDM pregnancies on MNT have little indication for delivery prior to 38–39 weeks gestation.
  - Delivery at ~39 weeks gestation has been shown to decrease macrosomia in women with good dating criteria and a favorable cervix.
  - Consider fetal lung maturity documentation by amniocentesis in women undergoing induction of labor or cesarean delivery prior to 38 weeks.

• Counsel all women regarding possible cesarean delivery.

• To determine mode of delivery when EFW is 4,000–4,500-g, consider past delivery history, clinical pelvimetry, evidence of body to head disproportion (fetal AC three weeks ahead of biparietal diameter measurement on ultrasound), and progression of labor.

• Manage as a high-risk delivery if woman has poor glycemic control, hypertensive disorder, or previous stillbirth.

POSTPARTUM FOLLOW-UP

Immediately Postpartum

• It is crucial women return to their provider to receive the appropriate postpartum counseling, testing, and follow-up after delivery. All women following GDM pregnancies have an approximate 50% risk for developing type 2 diabetes within the next 5–10 years and ~80% if they have impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) postpartum.

• Encourage breastfeeding, emphasizing the following benefits:
  - May decrease maternal progression to type 2 diabetes.
  - Reduces insulin resistance in mothers.
  - Promotes weight loss for the mother.

• Encourage women to aim for their pre-pregnancy weight 6 to 12 months after the baby is born. Then, if overweight, work to lose at least 5 to 7 percent (10 to 14 pounds for someone who weighs 200 pounds) of body weight slowly, over time, and keep it off.

• Educate on lifestyle modifications to lessen insulin resistance and prevent or delay the onset of type 2 diabetes.

• Schedule a follow-up 75-g, 2-hour oral glucose tolerance test (OGTT) in 6–12 weeks.
6–12 Weeks Postpartum

• Perform a 75-g, 2-hour OGTT for reclassification of maternal glycemic status.

Reclassification Criteria for Postpartum Maternal Glycemic Status*

<table>
<thead>
<tr>
<th>Time</th>
<th>Normoglycemia</th>
<th>Pre-diabetes</th>
<th>Type 2 Diabetes Mellitus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 100 mg/dl</td>
<td>≥ 100 mg/dl and &lt; 126 mg/dl</td>
<td>≥ 126 mg/dl</td>
</tr>
<tr>
<td>Fasting</td>
<td></td>
<td>Impaired Fasting Glucose (IFG)</td>
<td></td>
</tr>
<tr>
<td>2-hour</td>
<td>&lt; 140 mg/dl</td>
<td>≥ 140 mg/dl and &lt; 200 mg/dl</td>
<td>≥ 200 mg/dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impaired Glucose Tolerance (IGT)</td>
<td></td>
</tr>
</tbody>
</table>

* American Diabetes Association criteria

- If glucose levels are normal following 2-hour OGTT, reassess glycemia at a minimum of 1–3 year intervals.
- If fasting or 2-hour values reflect diagnosis of pre-diabetes (IFG or IGT), test for diabetes annually. Refer to a primary care physician, advise to continue MNT, and follow an individualized exercise program. Women with pre-diabetes have ~17% risk per year of developing type 2 diabetes.
- If fasting or 2-hour values reflect diagnosis of type 2 diabetes, refer to providers for diabetes self-management skills; PCP, CDE or nurse for SMBG education, RD, social worker, pharmacist, exercise physiologist, trained community health worker.

• Include contraceptive education to ensure optimal glycemic regulation from the start of any subsequent pregnancy. Given ~50% of pregnancies are unplanned in women with a history of gestational diabetes, women should be using adequate contraception starting 6–12 weeks postpartum.
  - Combined estrogen and progesterone containing oral contraceptives do not appear to cause significant effects on glucose metabolism, but should not be given to women with elevated triglycerides.
  - Depo-Provera has been associated with an increased likelihood of weight gain and glucose intolerance; therefore postpartum weight loss and maintaining a healthy weight should be stressed.
  - Intrauterine devices have not been shown to cause an increased risk of infection in women with a history of GDM and may be a highly effective method for some women.

• It is critical that children born to women with GDM be followed closely for the development of obesity and/or abnormalities of glucose tolerance. Counsel on the importance of a healthy lifestyle for their newborn child and other family members as well.

PRE-EXISTING DIABETES MELLITUS

The management of pre-existing diabetes is beyond the scope of this document, however the following highlights some of the important steps to take preconception and initially once a woman has entered into prenatal care.

Preconception

Diabetes and its coexisting medical complications may result in adverse maternal medical and obstetrical outcomes. Therefore all women with diabetes should have preconception counseling, which addresses both obstetrical and medical considerations.

• Counsel on the importance of near normal blood glucose control prior to conception (HbA1c < 6.5 %).
  Preconception euglycemia decreases the risk of both miscarriage and congenital anomalies to levels near equal to normal pregnancies. Document euglycemia by HbA1c and SMBG monitoring in the 3–6 months prior to conception.

• Discontinue statins, ace inhibitors and angiotensin receptor blockers prior to conception due to possible adverse effects.
• Ascertain that proliferative retinopathy is in remission or controlled before conception.

• Recommend that women actively trying to become pregnant discontinue oral agents and initiate insulin to achieve optimal glycemic control before becoming pregnant.

• Recommend at least 1 mg folic acid supplements daily prior to conception to help prevent birth defects.

**Prenatal**

Due to the significant risk for adverse pregnancy outcomes without appropriate therapy and surveillance, including intrauterine fetal death and severe maternal preeclampsia, women with pre-existing diabetes should see a high-risk obstetric specialist and endocrinologist for high-risk management throughout the pregnancy, whenever possible. The following recommendations are not extensive, and should not be considered the only source when managing pre-existing diabetes in pregnancy.

• Obtain an HbA1c test at first prenatal visit and every 12 weeks throughout pregnancy. Decreasing the HbA1c to < 7.0% is the goal (< 6.5% is optimal) and often requires intensive, flexible insulin regimens based on both pre-meal and post-meal glucose testing, and initiation of carbohydrate/insulin ratios and correction factors.

• Discontinue oral agents at first prenatal visit and initiate insulin, with the understanding that insulin requirements often decrease in the first trimester placing the mother at risk for nocturnal hypoglycemia and frequently increase by 2–3 fold in the late 2nd and 3rd trimester.

• Continue SMBG 4–10 times/day especially in women on intensive, flexible insulin regimens and in women with type 1 diabetes and hypoglycemic unawareness.

• Continue MNT and counsel on healthy maternal weight gain. Weight gain often does not need any restriction in women with type 1 diabetes who are at or below ideal body weight.

• Refer to an ophthalmologist in the first trimester, and then as needed.

• Obtain baseline preeclampsia labs and monitor for evidence of increasing proteinuria with 12 to 24-hour urines in women with proteinuric renal disease.

• Monitor mother for complications such as worsening renal disease, gastroparesis, progressive retinopathy, and for the development of preeclampsia. Understand that DKA can occur in women with type 2 diabetes as well as women with type 1 diabetes with glucose values < 200 mg/dl.

• Monitor the fetus for evidence of growth restriction from placental insufficiency, large for gestational age due to inadequately treated diabetes and/or obesity, major malformations, fetal distress and consider earlier delivery, especially for fetuses at risk for intrauterine fetal demise. Initiate fetal activity records at 28 weeks and fetal surveillance at 30–32 weeks in all women with pre-existing diabetes.

• Manage labor and delivery using an IV insulin drip to keep mother’s glucose 100–150 mg/dl to avoid neonatal hypoglycemia. Decrease mother’s insulin dose to pre-pregnancy levels (or lower) immediately after delivery.
GUIDELINES FOR GESTATIONAL DIABETES (GDM)

SCREENING AND DIAGNOSIS

(OGCT = Oral Glucose Challenge Test, 1-hour OGTT = Oral Glucose Tolerance Test, 3-hour)

First Prenatal Encounter: Universal Risk Assessment

High-risk if any of the following:
- Advanced maternal age (> 35 y.o.)
- Obese (BMI > 29 kg/m² based on ppw).
- High-risk ethnic population.
- h/o GDM.
- Previous macrosomic infant.
- h/o GDM related OB complications.
- First degree relative w/ diabetes.
- PCOS.
- Glycosuria.

High-risk: Screen immediately with 50-g, 1-hour OGCT ≥ 135 mg/dl, follow with 100-g, 3-hour OGTT. If suspect pre-existing diabetes, order HbA1c. < 135 mg/dl, rescreen between 24–28 weeks.

Not high-risk: Follow-up with universal screening between 24–28 weeks.

24–28 Weeks: Universal Screening

Test using 50-g, 1-hour OGCT
- ≥ 135 mg/dl, follow with 100-g, 3-hour OGTT.
- < 135 mg/dl, no further testing required.

OGTT Diagnostic Criteria for Gestational Diabetes*

If 2 or more values meet or exceed thresholds, diagnose GDM.

Note: If only 1 value meets or exceeds thresholds, re-test in 3-4 wks. using OGTT.

MEDICAL NUTRITION THERAPY (MNT) AND PHYSICAL ACTIVITY**

Meal Planning
- Educate on healthy food choices and smaller, frequent meals throughout the day.
- Teach portion control (plate method or carbohydrate counting) and reading food labels.
- Refer to an RD or CDE if available, or an RN or trained community health worker.

Food Record
- Record food and beverage intake including what, amount (cups, etc.), and meal and snack times.

Physical Activity
- Recommend regular physical activity 30 min/day, 5 days/week.
- Consult with MD re: any contraindications.

BLOOD GLUCOSE MONITORING

Self-Monitoring Blood Glucose Goals

<table>
<thead>
<tr>
<th>Time</th>
<th>mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>&lt; 95</td>
</tr>
<tr>
<td>1-hour pp</td>
<td>&lt; 130–140</td>
</tr>
<tr>
<td>2-hour pp</td>
<td>&lt; 120</td>
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<td>≥ 155</td>
</tr>
<tr>
<td>3-hour</td>
<td>≥ 140</td>
</tr>
</tbody>
</table>

Check and record BG 4x/day; fasting and 1 or 2-hours postprandial (pp) for a minimum of 2 weeks.

Never discontinue SMBG during GDM. Remain vigilant as glucose intolerance increases as pregnancy progresses. If frequency is decreased, rotate SMBG at different meals each day.

If 20% of BG values exceed the target while following prescribed nutrition and physical activity plan, consider medication therapy.

MEDICATION MANAGEMENT

Oral
- Glyburide is the only oral hypoglycemic agent that may be considered as an alternative to insulin.
- Metformin should not be initiated in pregnancy. If used to manage PCOS risks, discontinue after 1st trimester.

Insulin
- Use SMBG to guide the doses and timing of the insulin regimen.
- Aspart and Lispro are the most effective at reducing postprandial glycemic excursions.
- Regular and NPH have also been used safely in pregnancy.

PRENATAL SURVEILLANCE and DELIVERY MANAGEMENT

Surveillance
- A fetal based strategy (AC > 75th%ile at 28–33 weeks) may help identify women that may benefit from more intensive medical management.
- Prenatal surveillance may include NST, AFI, Biophysical Profile or Contraction Stress Test. Selection of the prenatal test is at the discretion of the practitioner.

Diet Controlled**
- Euglycemic: initiate surveillance at 40 weeks.
- Not euglycemic: initiate surveillance at 36 weeks.

Medication Controlled
- If pregnancy is not otherwise complicated, initiate surveillance at 32–34 weeks.

Delivery
- There is no data to support delivery at < 38 wks or cesarean delivery purely on the basis of GDM.

POSTPARTUM FOLLOW-UP

Due to the increased risk of developing type 2 diabetes, it is **crucial** that women return to their provider to receive the appropriate postpartum counseling, testing, and follow-up after a GDM pregnancy. See reverse for GDM Postpartum Algorithm.

These clinical guidelines (approved 9/12/2006) are adapted from the American Diabetes Association (ADA) Standards of Medical Care in Diabetes—2006. They are designed to assist clinicians in managing women with gestational diabetes and are not intended to replace a clinician’s judgment or establish a protocol for all women with gestational diabetes. For references, important updates, additional copies of guidelines, go to [http://www.coloradoguidelines.org](http://www.coloradoguidelines.org) or call 720-297-1681 or 1-866-401-2092.

** For more specific GDM nutrition information, visit the Gestational Diabetes Nutrition Guidelines at [http://www.cdphe.state.co.us/pp/diabetes/tools.html](http://www.cdphe.state.co.us/pp/diabetes/tools.html).

* American Diabetes Association, Carpenter and Coustan criteria.
**Gestational Diabetes Screening and Diagnosis**

**Universal Risk Assessment**
- First Prenatal Encounter
  - High-Risk
    - 50-g, 1-hour OGCT
  - Not High-Risk
    - 24–28 wks, gestation 50-g, 1-hour OGCT

**Universal Screening**
- OGCT ≥ 135 mg/dl
  - NO
  - 100-g, 3-hour OGTT
    - Diagnostic Criteria:
      - FBG ≥ 95 mg/dl
      - 1-hour ≥ 180 mg/dl
      - 2-hour ≥ 150 mg/dl
      - 3-hour ≥ 140 mg/dl
  - If OGTT ≥ 200 mg/dl, test serum fasting blood glucose (FBG) before 100-g, 3-hour OGTT.
  - If serum FBG < 95 mg/dl, proceed with OGTT.
  - If serum FBG ≥ 95 mg/dl, woman has GDM. No OGTT necessary.

**Reclassification Criteria for Postpartum Maternal Glycemic Status**

<table>
<thead>
<tr>
<th>Time</th>
<th>Normoglycemia</th>
<th>Pre-diabetes</th>
<th>Type 2 Diabetes Mellitus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>&lt; 100 mg/dl</td>
<td>≥ 100 mg/dl and &lt; 126 mg/dl</td>
<td>≥ 126 mg/dl</td>
</tr>
<tr>
<td>2-hour</td>
<td>&lt; 140 mg/dl</td>
<td>≥ 140 mg/dl and &lt; 200 mg/dl</td>
<td>≥ 200 mg/dl</td>
</tr>
</tbody>
</table>

**6-12 Weeks Postpartum**
- 75-g, 2-hour OGTT with fasting and 2-hour results

**Postpartum education for all women with prior GDM:**
- Encourage lifestyle modifications to improve insulin resistance, maintain normal body weight, make healthy food choices, increase physical activity.
- Recommend breastfeeding as it may decrease maternal progression to type 2 diabetes following a GDM pregnancy.
- Educate on effective contraception and the need for preconception counseling and evaluation before future pregnancies.
- Emphasize importance of a healthy lifestyle in children born to women with GDM.
  - Monitor for development of obesity and/or glucose intolerance.
  - Encourage daily physical activity.
  - Teach and model healthy eating habits.