

OHSU OB/GYN

Diabetes and Pregnancy Program

DAPP Guideline



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This management guideline is to serve as a reference and guide for health care professionals to use while caring for pregnant women with diabetes mellitus. This is primarily focused on women with gestational diabetes mellitus but significantly overlaps with pregestational diabetes care.

Women with pregestational diabetes are recommended to receive care at a comprehensive diabetes/MFM program. This document is to help provide guidance for women who present to your office with these high-risk conditions.



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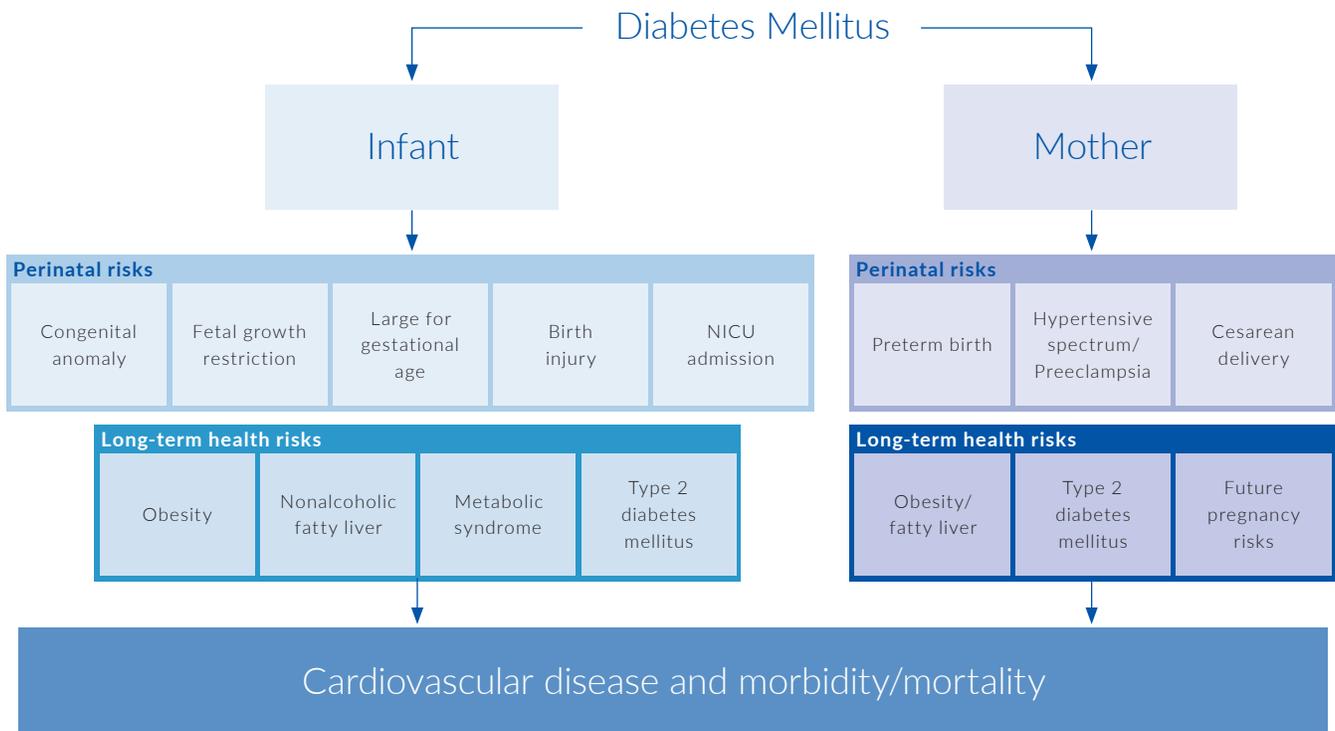
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I. Background¹⁻⁴

WHY SHOULD PROVIDERS AND PATIENTS CARE ABOUT DIABETES IN PREGNANCY?

- Like many chronic diseases, we cannot “see” the damage.
 - Developmental programming is occurring, usually without clinical or recognizable manifestations until 30–50 years later.
- Unlike many chronic diseases, GDM is **treatable** with lifestyle modifications.
- Early diagnosis and successful treatment of GDM reduce the risk of preeclampsia.
- Healthier lifestyles and conscious, high quality food choices that benefit the long-term health of the mother, the offspring and the future children of the offspring equals true **disease prevention**.

Gestational diabetes mellitus (GDM) complicates approximately 6–9 percent of all pregnancies in the United States. The Hyperglycemia and Pregnancy Outcomes (HAPO) study was a landmark study that demonstrated increasing adverse obstetric and neonatal outcomes with increasing hyperglycemia. Diabetes mellitus (DM) is associated with significant perinatal complications, including but not limited to hypertensive spectrum and preeclampsia, cesarean delivery, NICU admission, macrosomia, neonatal hypoglycemia, hyperbilirubinemia, operative delivery, shoulder dystocia and birth trauma. Women with GDM are also at risk for the development of overt Type 2 DM (T2DM): 10 percent immediately postpartum, an 11.4 percent per year increase in DM, and a cumulative incidence rate of 64.7 percent (up to 70 percent) within the next 5–10 years. Fetal exposure to maternal diabetes leads to a greater risk of abnormal glucose homeostasis, obesity and diabetes later in life beyond that attributable to genetic factors. Treatment of DM has been shown to improve perinatal outcomes, lowering rates of cesarean delivery, hypertensive disorders, shoulder dystocia, macrosomia, and large-for-gestational-age infants.



II. Definitions^{5,6}

GDM	A degree of glucose intolerance associated with adverse perinatal and maternal outcomes with onset or first recognition during pregnancy.
Prediabetes	High risk for development of DM and cardiovascular disease <ul style="list-style-type: none"> • Impaired fasting glucose (IFG): fasting blood glucose 100–125 mg/dl (5.6–6.9 mmol/l) • Impaired glucose tolerance (IGT): 75 gram 2h post-glucose load 140–199 mg/dl (7.8–11.1 mmol/l) • HbA1c 5.7–6.4%
T2DM	Insulin resistance and relative insulin deficiency with ANY of the following: <ul style="list-style-type: none"> • HbA1c \geq 6.5 percent • Fasting plasma glucose \geq 126 mg/dL (7.0 mmol/L) • 2h post-glucose load \geq 200 mg/dL (11.1 mmol/L) • Classic symptoms with random plasma glucose \geq 200 mg/dL. Without unequivocal hyperglycemia, results should be confirmed by repeat testing. The diagnosis is made on the basis of a confirmed test.
Type 1 DM (T1DM)	β -cell destruction, immune-mediated, inadequate insulin production. Defined by one or more of the following autoimmune autoantibodies: <ul style="list-style-type: none"> • Islet cell • Glutamic acid decarboxylase (GAD65) • Insulin • Tyrosine phosphatases IA-2 and IA-2b • Zinc Transporter 8

III. Preconception care for women with pregestational DM or at high risk for GDM⁷⁻¹⁷

Risks of hyperglycemia/hyperinsulinemia

- Fetal programming (future CV, DM, obesity)
- Congenital anomalies
- Miscarriage
- Macrosomia
- Fetal growth restriction
- Intrauterine fetal demise
- Preeclampsia
- Birth trauma
- Cesarean delivery
- Neonatal hypoglycemia, polycythemia, hyperbilirubinemia and NICU admission
- Maternal CVD and mortality

All reproductive-age women with pregestational diabetes should be counseled regarding the importance of optimizing glycemic control **prior** to conception, as maternal hyperglycemia during the first few weeks of pregnancy is strongly associated with an increased risk of miscarriage and major fetal anomalies.

Women with high-risk factors for diabetes in pregnancy (see section IV for list of high-risk factors) should be evaluated for diabetes and cardiovascular screening in addition to education/counseling to improve overall health and lifestyle prior to conception to optimize fertility and future *in utero* environment.

Maternal-fetal medicine (MFM) consultation for preconception counseling and pregnancy planning should be considered. As an intervention to improve fetal/neonatal outcomes, prepregnancy counseling significantly improves perinatal mortality by almost fourfold.

- Four critical counseling points for improving glycemic control (see specific sections for details):
 1. **Lifestyle interventions:** Advise a *minimum* of ≥ 150 min/week of moderate exercise spread over \geq three days/week. Two to three days per week of resistance or flexibility activity is beneficial.
 2. **Nutrition and conscious food choices:** Recommend referral to a registered dietician for medical nutrition therapy and pregnancy-targeted education. Advocate generous water hydration throughout the day.
 3. **Weight loss:** Recommend a weight loss goal of 5–10 percent current body weight within three to six months for overweight and obese women using healthy, sustainable lifestyle modifications and behaviors.
 4. **Sleep:** Inquire about quality of sleep and assess for sleep-breathing disorders, which have a significant impact on mood, glycemia and health.
- The relationship between maternal glycemia and congenital anomalies, perinatal mortality and miscarriage exists on a *continuum* (see Periconception A1c table):
 - Prepregnancy care has been shown to effectively reduce rates of congenital malformations by 75 percent.
 - **Target prepregnancy HbA1c level < 6.5 percent.**
 - Women with HbA1c > 10 percent should be strongly advised to avoid pregnancy and offered long-acting reversible contraceptives (LARC) to allow for sufficient optimization prior to pregnancy.

Baseline evaluation for all women with pregestational DM and with high-risk factors for GDM:

- Review vaccinations history, particularly live vaccines (CDC recommendations: VACCINES).
- Review patient’s current medications and herbal ingestion, discuss safety, switch to alternative medications as necessary and advise vitamin supplementation (see sections VII and X).
- Review patient’s medical history.
- Workup for cardiovascular disease as appropriate:
 - For women with chronic hypertension, systolic blood pressure of 110–129 mmHg and diastolic 65–79 mmHg are reasonable targets as they contribute to improved long-term maternal health.
- Encourage smoking cessation and develop quit dates or goal-oriented targets.
- Assess for sleep-disordered breathing and refer for a sleep study as appropriate.
- **Labs:**
 - Lipid profile: triglycerides, HDL, LDL and total cholesterol.
 - If OHSU Epic-based order = *LIPLAB0001 KCVI Lipid Profile-Plasma Lipids, HDL and LDL*.
 - Baseline TSH, serum creatinine, urine spot protein-to-creatinine ratio or 24-hour urine protein collection.
- Address dental hygiene and encourage routine dental cleaning and examination.

Periconception A1c and risk of adverse pregnancy outcomes			
A1c range (%)	Major fetal malformation	Miscarriage	Perinatal mortality
< 6.9	3.9%		2.1%
6.9–7.8	4.9%	8%	2.8%
7.9–8.8	5.0%	18%	3.3%
10–12	23.5%	20%	6.3%
12.1–15	38.9%	45%	
> 15	40%		

Symptoms concerning for hypoventilation during sleep

- Difficulty in sleep onset or maintaining sleep
- Snoring
- Apnea
- Pauses in breathing or restlessness observed by partner
- Morning headaches
- Nonrestorative or unrefreshing sleep
- Daytime hypersomnolence
- Lethargy
- Fatigue or easily getting tired
- Forgetfulness
- Attention deficits, irritability or concentration problems
- Nocturia or night sweats
- Decreased libido

KEY POINTS:

- Educate the patient on the risks of diabetes in pregnancy.
 - Discuss medication safety and provide alternative medications if indicated.
- Set realistic goals with the patient and, importantly, a follow-up plan to check in on her progress.
- Encourage healthy, sustainable lifestyle modifications to improve her health and a nourishing environment for her future child.

Additional evaluation and testing for women with pregestational DM:

Women with DM considering pregnancy should be evaluated and treated for **diabetic retinopathy, nephropathy, neuropathy, cardiovascular disease, hypertension, dyslipidemia, depression and thyroid disease**. Physical exam should include at a minimum blood pressure measurements, weight assessment, thyroid palpation, assessment of peripheral pulses and visual inspection of both feet.

- Appropriately adjust DM treatment regimens to reach pregnancy glycemic target ranges (see section IX) to easily transition into pregnancy.
- Referral to a registered dietician for reeducation regarding dietary expectations and recommendations in pregnancy.
- Hemoglobin A1c testing approximately every three months and target levels < 6.5 percent prior to conception.
- Ophthalmologic dilated retinal exam is recommended if not performed within the last three months.
 - No retinopathy ☐ annual exams.
 - Diabetic retinopathy ☐ treatment prior to conception is *imperative*.
- Electrocardiogram (ECG) for women ≥ 35 years old or with DM for > five years.
 - Abnormal ECG findings, cardiac symptoms, or ☐ risks of CVD ☐ referral to cardiology and/or additional testing is recommended.
- Women with T1DM should be assessed and optimized to minimize:
 - Hypoglycemic event frequency.
 - Hypoglycemic unawareness.
- Ensure patients have an emergency glucagon kit.
- Determine if T1DM and T2DM patients (if appropriate) are candidates to transition to an insulin pump with continuous glucose sensor for more optimal glycemic control and patient autonomy.
- Consider referral to Maternal-Fetal Medicine for preconception counseling

IV. Screening and diagnostic criteria for GDM¹⁸⁻³⁴

RECOMMENDATION:

- **2h oral glucose tolerance test (OGTT) for all pregnant women between 24–28 weeks' gestation**, supported by the increasing evidence of adverse perinatal outcome with progressive hyperglycemia, benefits of treatment, and the cost effectiveness of testing strategy.
- All patients with a high-risk factor(s) should be tested with a 2h OGTT when prenatal care is initiated and repeated again at 24-28 weeks gestation if early testing is within the normal range
- All women diagnosed with diabetes during pregnancy, regardless of gestational age, has the diagnosis of **gestational diabetes**. Women should be retested in the non-pregnant state to diagnose diabetes outside of pregnancy.

The American Diabetes Association, U.S. Preventive Services Task Force (USPSTF), ACOG, and the Endocrine Society recommend ***universal screening for all asymptomatic pregnant women after 24 weeks of gestation***, because “treatment of GDM can significantly reduce the risk for preeclampsia, fetal macrosomia, and shoulder dystocia. When assessing these outcomes collectively, the USPSTF concluded that there is a moderate net benefit for the mother and infant.”

The two-step NDDG/Carpenter-Coustan criteria for the diagnosis of GDM was developed to identify mothers at risk for progression to diabetes outside of pregnancy and **not** to ascertain the risk of adverse perinatal outcome and fetal programming potential.

The International Association of Diabetes and Pregnancy Study Group (IADPSG) diagnostic criteria is derived from the most robust dataset of glucose levels and associated obstetric/neonatal outcomes, though no large randomized trials comparing IADPSG and Carpenter-Coustan approaches exist to date.

LOW RISK (meets all factors)

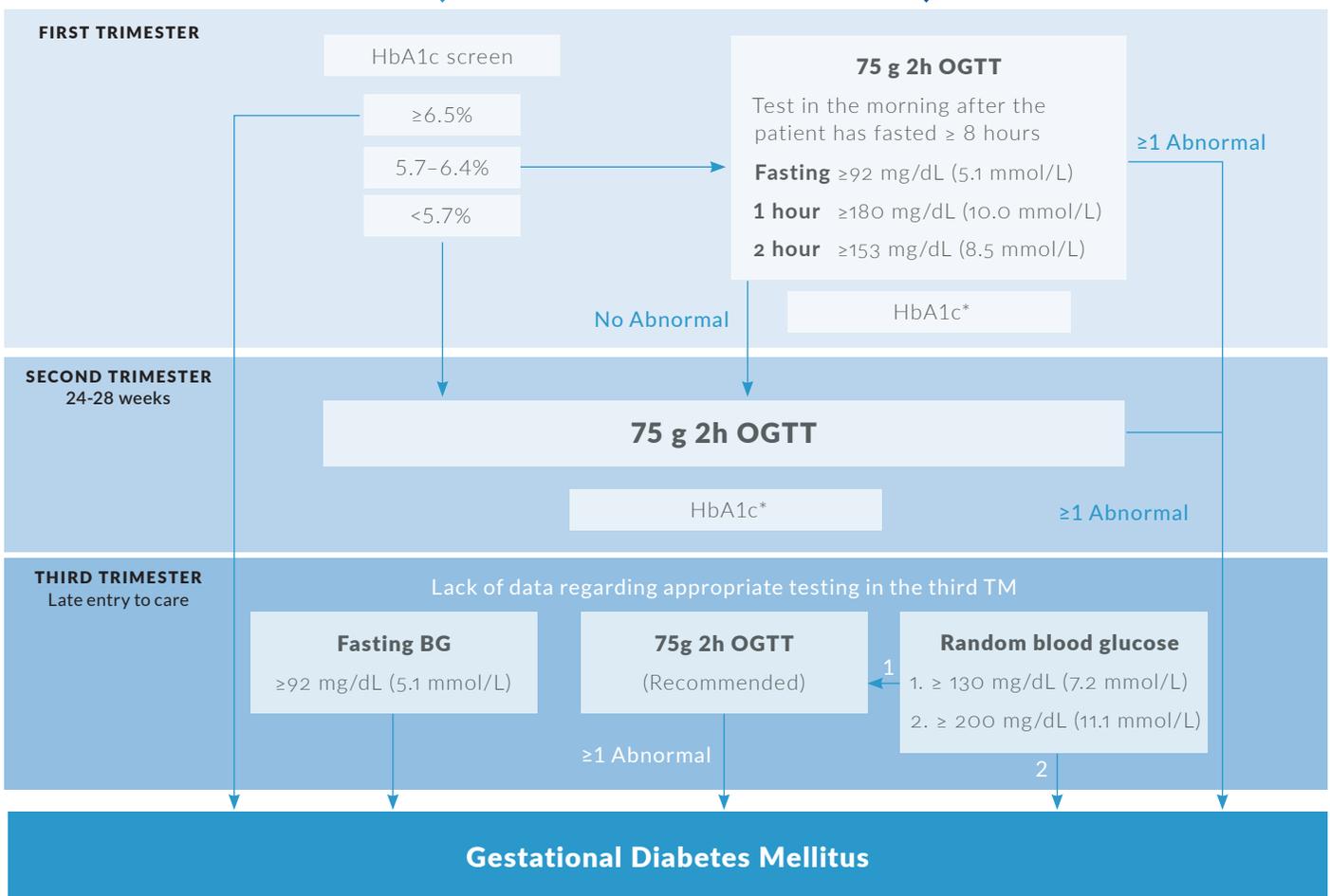
- < 25 years old
- Normal body weight (prepregnancy BMI < 25 kg/m²)
- No first-degree relative with history of DM
- No history of poor obstetric outcomes
- Not a member of an ethnic/racial group with a high prevalence of DM (Hispanic/Latino, Native/Alaskan American, Asian American, Non-Hispanic Black, Pacific Islander)

HIGH RISK (meets one or more factors)

- Obesity (prepregnancy BMI ≥ 30 kg/m²)
- High-risk race/ethnicity (Hispanic/Latino, Native/Alaskan American, Asian American, Non-Hispanic Black, Pacific Islander)
- Chronic hypertension
- Insulin resistant (PCOS, metabolic syndrome)
- First-degree family member with DM
- History of GDM in the prior pregnancy
- History of macrosomia
- Hyperlipidemia/triglyceridemia
- History of cardiovascular disease
- Prediabetes, impaired fasting glucose, impaired glucose tolerance
- HIV on protease inhibitors
- Chronic steroid use
- History of bariatric surgery

Low Risk

High Risk



Alternative testing methods if patients refuse 2h OGTT or are intolerant to glucose load				
Testing method	CHO	Timing	Values	Diagnosis
2-step Carpenter-Coustan criteria	Step 1: 1-hour 50 gm	Any time	≥ 200 mg/dL	GDM
			130–199 mg/dL	IGT (order 3h OGTT)
	Step 2: 3-hour 100 gm (should be performed ≤ 1 week of 1st step)	Fasting: ≥ 95 mg/dL 1 hr: ≥ 180 mg/dL 2 hr: ≥ 155 mg/dL 3 hr: ≥ 140 mg/dL	Any time point ≥ 200 mg/dL 2 abnormal values Fasting ≥ 126 mg/dL	GDM
			1 abnormal (< 200 mg/dL) (repeat 3h OGTT in 4 wks)	IFG or IGT
		No abnormal values (repeat 3h OGTT in 4 wks)	IGT	
Fasting blood glucose	None	8-hour fast	≥ 92 mg/dL	GDM
1 week continuous glucose monitoring	None	Sensor + 4x/day SCBG† for 1 wk	≥ 20% values out of range	GDM

†SCBG: self-capillary blood glucose monitoring.

ALL IGT, IFG OR GDM ARE RECOMMENDED TO BE REFERRED TO RD/CDE FOR MNT.

***HbA1c** measures the amount of glucose attached to hemoglobin in red blood cells and serves as an indirect measure of average blood glucose levels. Factors that increase red blood cell turnover impact hemoglobin glycation independently of glycemia include age, race/ethnicity, anemia, hemoglobinopathies, and pregnancy.

- A1c can be used as a diagnostic test for DM in non-pregnant women, but it is recommended to be used primarily as a **tool** to counsel patients on their respective glycemic control. Actual measured glucose values (SCBG) is more important for advising therapeutic changes.
- **During pregnancy, A1c is lower at all gestations compared to non-pregnant women.**
 - A1c **physiologically drops approximately 0.5 percent** in early pregnancy.
 - Pregnancy physiology attributable to A1c reductions:
 - Shortened erythrocyte life span.
 - > 50 percent increase in plasma volume, which begins as early as four to six weeks' gestation.
 - Altered degree of glycosylation due to the lower time-averaged glucose concentration compared to non-pregnant women.
- *Studies performed in **LOW-risk normoglycemic women demonstrate A1c ranges between 4.0–5.5 percent.***
 - These studies did not address women with **HIGH-risk** factors. Therefore, the same ranges for a high-risk population cannot be assumed.
- See table in section III for counseling points when A1c is drawn in the first trimester.
- Escalating A1c can be used as a surrogate of overall maternal glycemic control and can be used to counsel women of their risk of perinatal outcomes in the late second and third trimester (see table below).
- A1c is not useful to predict fetal overgrowth when measured at 24–28 weeks.

Increased risk of adverse pregnancy outcomes by A1c % at 26 weeks' gestation					
A1c range (%)	Preeclampsia	LGA (> 90th %)	Preterm birth (< 37wk)	Neonatal hypoglycemia	Neonatal hyperbilirubinemia
6.0–6.4	16%	61%	34%	30%	18%
6.5–6.9	34%	90%	53%	58%	27%
7.0–7.4	37%	115%	107%	70%	48%
> 7.5	41%	133%	80%	76%	49%

Table modified from T1DM population in *Diabetes Care* 2015;38:34–42. Adjusted for age, BMI, years of education, social class, ethnicity, parity, current smoking, duration of diabetes, microalbuminuria before pregnancy, vitamin treatment group, and center.

Continuous glucose monitoring (CGM) is useful to augment diabetes care when women are having difficulty with glycemic control, confusing/erratic BG patterns, frequent hypoglycemia or unclear compliance.

- Interstitial glucose levels are measured and averaged every five minutes for up to 288 readings, providing blood glucose trends and demonstrating prandial response patterns.
- Pregnancy outcomes are improved by increasing both hypoglycemia and postprandial hyperglycemia awareness, guiding insulin dose adjustments and normalizing overall glycemic control.

Bariatric surgery: Roux-en-Y Gastric Bypass (RYGB), Sleeve Gastrectomy, Adjustable Gastric Band, Biliopancreatic Diversion with Duodenal Switch (BPD/DS)

- Even after significant weight loss, women who have undergone bariatric surgery should be screened for GDM early at initiation of prenatal care, and if normal, should be tested again between 24 and 28 weeks' gestation.
- It has been reported after RYGB that individuals may continue to have abnormal glycemia characterized by early, high postprandial peaks as well as symptomatic hypoglycemia.

Limitations for glucose tolerance testing:

1. Because of accelerated and increased absorption of carbohydrates, postprandial excursions peak **quickly and within a shorter time** than non-diabetic and GDM pregnancies, which can result with a lower 1- and 2-hour glucose value.
2. Women, particularly with malabsorptive interventions, may not tolerate a glucose load (50 or 75 grams) given for the recommended diabetic diagnostic/screen test, causing a “dumping syndrome.”

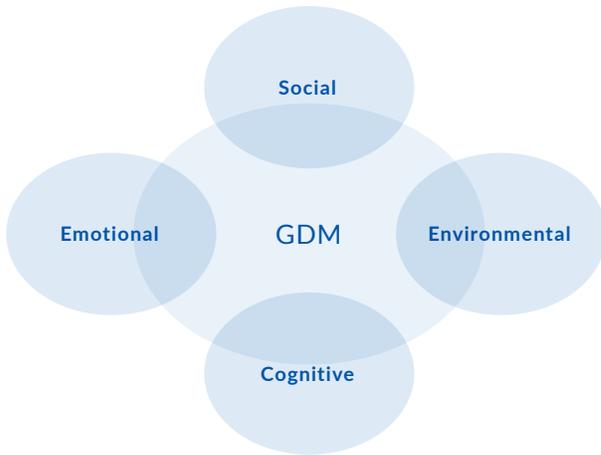
Dumping syndrome symptoms

- Abdominal pain, cramping, bloating
- Nausea, diarrhea
- Headache
- Flushing, diaphoresis
- Lightheadedness
- Tachycardia, palpitations

RECOMMENDATIONS FOR TESTING FOR BARIATRIC PATIENTS:

- a) For women who have tried and tolerated simple sugars, 2h OGTT is recommended.
If unable to tolerate simple sugars and/or have had a recent operation:
- b) Four times per day SCBG testing for one week – fasting and 45–60 min postprandial values (after first bite of food).
or
- c) One week of CGM plus SCBG four times a day.

V. Psychosocial assessment and evaluation³⁵⁻⁴⁴

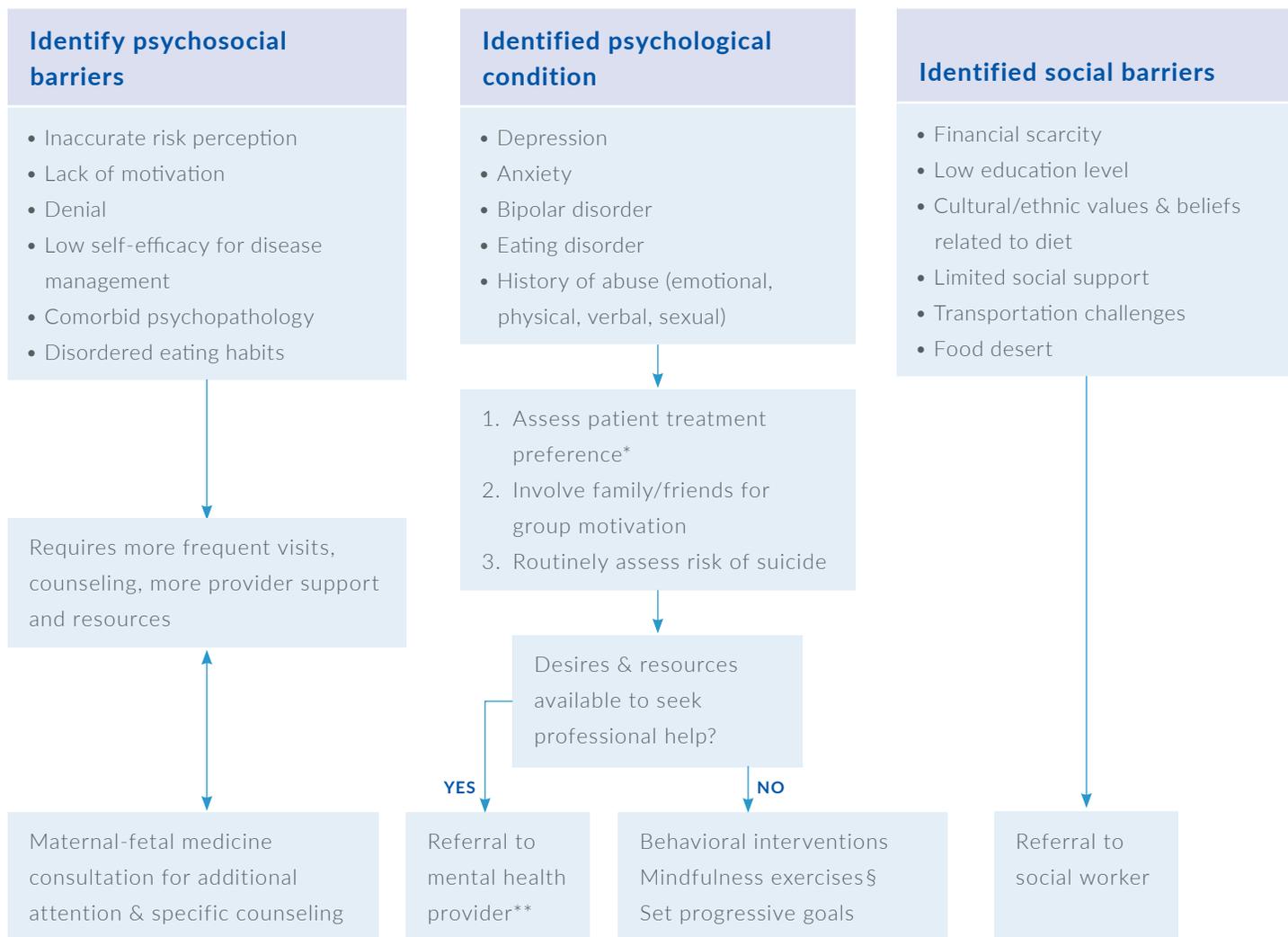


Approximately 20 percent of women with GDM experience significant symptoms of depression during the antepartum period. Psychosocial, emotional, cognitive and environmental factors impact adherence to treatment recommendations and implementation of lifestyle modifications. Women with GDM are challenged to alter their longstanding behaviors in a restricted pregnancy time frame.

- It is recommended to screen all women for depression.
- The stressors of GDM in addition to pregnancy may predispose women to symptoms of anxiety and should be assessed.
- Given the jeopardies associated with poor glycemic control during pregnancy, providers should screen for eating disorders by inquiring about bingeing, purging and restricting intake.

Psychological condition	Screening tool	Link
Depression	The Edinburg Postnatal Depression Scale	Edinburgh Postnatal Depression Scale
	Patient Health Questionnaire 9	Patient Health Questionnaire Screeners
Anxiety	Generalized Anxiety Disorder -7	Patient Health Questionnaire Screeners

Psychosocial care algorithm



*Treatment options: psychotherapy (cognitive-behavioral therapy), psychotropic medication management (pharmacological), or both.

**Mental health providers include psychiatrists, psychiatric nurse practitioners and/or psychologists. Providers specializing in reproductive medicine should be considered if those services are readily available.

§Resources:

A) **Mindfulness exercises:** Mind the Bump

B) **Cognitive-behavioral therapy workbooks:** *The Pregnancy and Postpartum Anxiety Workbook*. Authors: Pamela S. Wiegartz, Kevin L. Gyoerkoe, Laura Miller

C) **Goal setting:** 7 Habits of Highly Effective People with Diabetes

VI. Maternal evaluation for women with GDM/DM who present pregnant⁴⁵⁻⁵⁰

Women with GDM may have had metabolic dysfunctions prior to pregnancy but regardless they are at significant risk for future metabolic derangements in addition to peripartum preeclampsia and postpartum weight retention.

Baseline testing and evaluation:

- Review gestational weight gain and goals for pregnancy.
- Review blood pressure and preeclampsia precautions.
 - Women with T1DM, T2DM, GDM diagnosed early in gestation or GDM in conjunction with other comorbidities should be recommended low-dose aspirin (81–100 mg daily) for preeclampsia prevention starting after 12 weeks' gestation (USPSTF Recommendations).
- Assess the patient for sleep-disordered breathing and refer for a sleep study as appropriate.
 - Women with sleep-disordered breathing have more than a three-fold risk for developing GDM, which worsens with increasing severity.
- Comprehensive fetal anatomy ultrasound (if not already performed).
- *Labs:*
 - HbA1c to use as a counseling tool.
 - Lipid profile, including triglycerides, HDL, LDL and total cholesterol.
 - Maternal fasting free fatty acids and triglycerides have been shown to be predictors for large-for-gestational-age infants.
 - Diet modifications, exercise, and addition of omega-3 supplementation are the first-line intervention strategies for dyslipidemia and hypertriglyceridemia; referral to a registered dietician is advised.
 - If OHSU Epic-based order = *LIPLAB0001 KCVI Lipid Profile-Plasma Lipids, HDL and LDL*.
 - TSH.
 - Baseline preeclampsia/HELLP labs:
 - Serum creatinine.
 - Serum liver function.
 - Platelet.
 - Hematocrit.
 - Urine spot protein-to-creatinine ratio or 24-hour urine protein collection.
 - Lactate dehydrogenase.
 - Uric acid.

VII. Medical nutrition therapy (MNT) and education⁵¹⁻⁵⁸

Recommendations are the same for preexisting DM and GDM except where noted.

Counseling and education

- ✓ MNT is an evidenced-based lifestyle intervention that has been shown to improve outcomes for women with GDM.
- ✓ **Women with GDM should receive MNT education within one week after diagnosis of GDM.**
 - Research demonstrates improved maternal and neonatal outcomes for GDM, particularly with early intervention.
 - If OHSU Epic-based ordering = “Consult to CWH,” Department Specialty: *Obstetrics & Gynecology, Department: CWH Nutrition.*
- ✓ Registered dietitian (RD) and/or certified diabetes educator (CDE) should provide MNT.
 - If an RD/CDE is not available, an RN or community health worker may educate on the basic nutrition principles of GDM.
- ✓ Carbohydrate (CHO) counting is an important skill that benefits all women with diabetes.
- ✓ An RD, RN or CDE should provide patient training for SCBG.
- ✓ Daily SCBG logs ± daily food logs ± CGM are used to assess the effectiveness of MNT.

Goals of MNT

- Achieve euglycemia for pregnancy
- Prevent ketosis
- Prevent excessive weight gain
- Improve overall maternal health
- Optimize developmental, fetal programming
- Empower to make conscious, high quality food choices
- Implement sustainable food behavior modifications

Weight gain

- Gestational weight gain should be assessed and discussed at each prenatal visit.
- High quality food choices and physical activity should be encouraged to preclude excessive weight gain in pregnancy.
 - Pregnancy complications such as birth trauma, preeclampsia, cesarean delivery and macrosomia are associated with excessive weight gain in pregnancy.
- It is not uncommon for the patient to lose weight the first few weeks after the patient incorporates MNT modifications, secondary redistribution of CHO and being more conscious of her lifestyle choices.

National Academy of Medicine Weight gain recommendations for pregnancy			
Prepregnancy weight category	Body mass index (kg/m ²)	Total pregnancy weight (kg)	2nd and 3rd trimester mean range (kg/wk)*
Underweight	< 18.5	13–18	0.45 (0.45–0.59)
Normal weight	18.5–24.9	11–16	0.45 (0.36–0.45)
Overweight	25–29.9	7–11	0.27 (0.23–0.32)
Obese (all classes)	≥ 30	5–9	0.23 (0.18–0.27)

*Calculations assume a 1.1–4.4 lb. weight gain in the first trimester.

Modified from National Academy of Medicine (U.S.). Weight gain during pregnancy: reexamining the guidelines. Washington, D.C. National Academies Press; 2009. © 2009 National Academy of Sciences. There are no specific guidelines for women with diabetes in pregnancy.

GDM meal plan

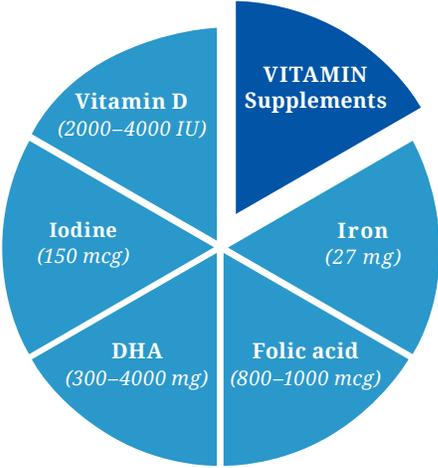
The GDM meal plan should be based on dietary recommendations adjusted to the **individualized** needs of the patient based on usual intake, preferences and any medication regimen. *My Pregnancy Plate* is an evidenced-based educational tool used to illustrate key elements of a healthy eating pattern not just during pregnancy but to sustain throughout life.

MEAL-TIMING IS **CRITICAL** FOR OPTIMAL CONTROL THROUGHOUT THE DAY, AND THE GOAL SHOULD BE EATING A MEAL OR SNACK EVERY TWO TO THREE HOURS DURING WAKING HOURS.

Carbohydrate (CHO) intake

GDM	DM
Breakfast 20–30 g	◊ Breakfast
Mid-morning snack 5–15 g	Mid-morning snack 5–30 g
Lunch 40–45 g	◊ Lunch
Mid-afternoon snack 5–15 g	Mid-afternoon snack 5–30 g
Dinner 40–45 g	◊ Dinner
Bedtime snack 5–15 g	Bedtime snack 5–30 g

Prenatal vitamins + the following supplements are recommended for all pregnant women:



◊ Individualized CHO per usual intake if appropriate control prior to pregnancy, activity/exercise timing, blood glucose levels and rate of weight gain.

My Pregnancy Plate

Choose large portions of a variety of non-starchy vegetables, such as leafy greens, broccoli, carrots, peppers or cabbage.

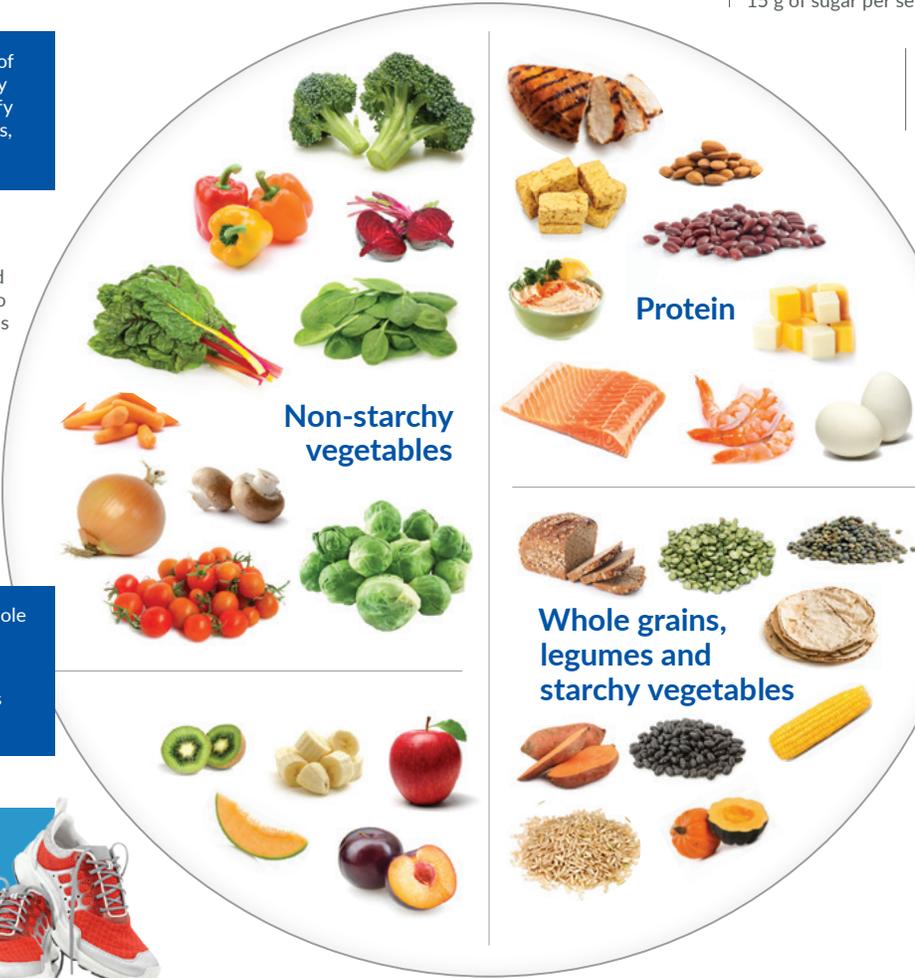
Choose small amounts of healthy oils (olive and canola) for cooking or to flavor foods. Nuts, seeds and avocados contain healthy fats.



Choose a variety of whole fruits. Limit juice and dried fruits.

Fruit is great for snacks and dessert, too.

Aim for at least 30 minutes of walking or another physical activity each day.



Choose 2 to 3 servings of nonfat or 1% milk or yogurt (cow, soy or almond). A serving is 8 oz. Choose yogurt with less than 15 g of sugar per serving.



Drink mainly water, decaf tea or decaf coffee and avoid sugary beverages.



Choose protein sources such as poultry, beans, nuts, low-mercury seafood, eggs, tofu or low-fat cheese. Limit red meat and avoid cold cuts and other processed meats.

Choose whole grains, such as whole wheat bread or pasta, brown rice, quinoa or oats and other healthy starches like beans, lentils, sweet potatoes or acorn squash. Limit white bread, white rice and fried potatoes.



Recommended daily allowances and nutrition in pregnancy

	RDA pregnancy grams/day	% of total daily calories	Facts
Carbohydrates (CHO)	175	40–45 (GDM) 40–50 (DM)	<ul style="list-style-type: none"> • Minimum number CHO grams needed for the health and safety of pregnant women and their offspring are unknown. • GDM CHO dietary content should be individualized and modified as necessary to achieve optimal goals for blood sugars and weight gain. • Smaller meals with two to three snacks per day are recommended as this helps to decrease postprandial hyperglycemia. • QUALITY of CHO is more important than quantity
Protein	71		<ul style="list-style-type: none"> • Protein foods do NOT increase blood glucose levels. • Include protein with EACH meal and snack to help stabilize glucose and promote satiety.
Fiber	28		<ul style="list-style-type: none"> • Fiber does NOT raise blood glucose levels; may help to blunt the glucose-raising effect of CHO foods. • High-fiber and low-glycemic foods should be substituted for other CHO choices. • <i>Good sources:</i> whole grains, whole fruits, vegetables, beans/legumes, peas and lentils.
Fats	No specified RDA for pregnancy	30	Trans <ul style="list-style-type: none"> • AVOID if possible. • <i>Sources:</i> fast food, fried foods, margarine, donuts and some packaged baked goods/snack foods.
			Saturated <ul style="list-style-type: none"> • Keep to < 7 percent total calories. • Contributes to higher levels of maternal triglycerides, which has been associated with macrosomia. • <i>Sources to discourage intake of:</i> butter, bacon, half & half, cream cheese, sour cream, whole fat dairy and fatty/processed meats.
			Polyunsaturated and monounsaturated <ul style="list-style-type: none"> • Should make up the majority of fats in the diet. • <i>Good sources:</i> olive oil, canola oil, nuts, nut butters, seeds, avocados, olives and fatty fish (e.g., wild salmon).

KEY POINTS:

1. Maternal nutrition during pregnancy plays a major role in both the short- and long-term health of a baby and the entire family unit, including the development of chronic diseases later in life.
2. ALL pregnant women, with or without diabetes, should be encouraged to eat a **high quality, nutrient-dense diet**.
3. Encourage making “the healthy choice, the easy choice.”

~ Christie Naze, RD/CDE

Special considerations

- Concentrated sugars can cause dramatic rises in blood glucose, are high in calories and low in nutrients, and contribute to unwanted weight gain.
- Insulin resistance and glucose intolerance is highest in the morning. Therefore, patients benefit from ↓ Breakfast CHO.
- Milk, fruit and/or unsweetened cereal *increase* blood glucose during breakfast meals and should be considered at other meal/snack times if desired.
- Fruits are best eaten during snack times.
- Non-starchy vegetables are “free” calories.
- Caffeine: limit < 200 mg/day. Excess caffeine consumption may increase the risk of miscarriage and fetal growth restriction.

Consider to AVOID or limit

Concentrated sugars:

- Fruit juice
- Soda
- Cookies
- Candy
- Highly processed foods

Foods high in trans fat

Foods high in saturated fat

Non-nutritive sweeteners (NNS)

- The FDA has approved aspartame, acesulfame potassium, sucralose, saccharin, neotame and stevia for general use.
- While there are recognizable benefits to the use of NNS with the maintenance of blood glucose control, to date there is limited evidence to support the use or nonuse of NNS in pregnancy.
- NNS are generally safe when consumed during pregnancy, within acceptable daily intake levels established by the FDA, with the exceptions of saccharin, due to delayed fetal clearance, and aspartame in women with phenylketonuria.
- NNS are usually in foods and beverages that are also low in nutrients.
- Recommended links:
 - [FDA Food Additives](#)
 - [American Heart and Diabetes Association Statement](#)

Recommended free phone apps

Diabetes tracker

[Glooko](#)

[GoMeals](#)

[Glucose Buddy](#)

[Tidepool](#)

Nutrition

[MyFitnessPal](#)

[Fooducate](#)

[MyPlate Calorie Tracker](#)

[Fat Secret](#)

[Calorie King](#)

Wellness & health

[Moves](#)

[Charity Miles](#)

[Pacer](#)

[Way of Life](#)

[Take a Break!](#) Guided Meditation for Stress Relief

[Headspace](#)

[MINDBODY Connect](#)

[Breathe2Relax](#)

[T2 Mood Tracker](#)

[The Gratitude Habit:](#) A Happiness Workshop

VIII. Exercise, activity and lifestyle⁵⁹⁻⁶⁶

“Pregnancy should not be looked at as a state of confinement. In fact, it is an ideal time for lifestyle modification, as a pregnant woman has the most available access to medical care and supervision.”

– **Raul Artal, M.D.**,

member of the Medical Commission of the International Olympic Committee

Exercise has minimal risk and provides significant benefit during pregnancy and lifelong if sustained.

- Physical activity may have to be modified due to normal physiologic and anatomic changes during pregnancy but should be encouraged at **every** visit.
- The U.S. Department of Health and Human Services recommends at a minimum for healthy pregnant and postpartum women **150 minutes per week** of moderate-intensity aerobic activity (e.g., 60–70 percent max heart rate; e.g. brisk walking, swimming, and cycling) and 2–3 days of resistance, flexibility, and neuromotor exercises per week.

Motivational counseling tools such as the Five A’s (Ask, Advise, Assess, Assist and Arrange), should be utilized at **each** visit to ensure the patient is meeting goals.

Benefits of exercise/activity in pregnancy:

1. Improves overall fitness and cardiovascular risks.
2. Reduces stress, incidence of muscle cramps and lower limb edema during pregnancy.
3. Reduces gestational weight gain, operative vaginal delivery, cesarean delivery and postpartum recovery time.
4. Twenty-five to 40 minutes of exercise reduces capillary blood glucose and insulin requirements per kilogram of body weight.
5. Resistance exercise decreases insulin requirements.
6. There are conflicting results regarding the role of physical activity in reducing GDM risk.
 - a. This is likely due to the heterogeneity of activity compliance and populations studied as well as a later gestational age of exercise intervention.
 - b. However, reviewing studies with high adherence to activity and structure, *aerobic and muscle strength training reduced the incidence of GDM, improved glucose clearance and decreased hyperinsulinemia compared with routine activity.*

Pearls for activity	Safe and encouraged activity	Activity to avoid during pregnancy (resume after delivery)	Conditions to evaluate & individualize activity recommendations
<ul style="list-style-type: none"> Stay well hydrated Wear loose-fitting clothing Avoid high heat and humidity “Talk-test” to measure exertion Ensure adequate caloric intake before exercise (especially if high intensity > 45 min) Progress gradually (if sedentary) Check capillary blood glucose (CBG) before and after exercise If CBG is < 70 mg/dL (< 4.0 mmol/L) prior to activity, 15g CHO + protein encouraged 	<ul style="list-style-type: none"> Brisk walking Swimming Stationary cycling Low-impact aerobics Yoga Pilates Running/jogging Racquet sports Strength/resistance training Muscle toning 	<ul style="list-style-type: none"> Contact sports (e.g., boxing, basketball) High-fall-risk sports (e.g., skiing, surfing) Scuba diving Sky diving “HOT” yoga/pilates 	<ul style="list-style-type: none"> Maternal heart disease with hemodynamic instability Unevaluated maternal arrhythmia Restrictive lung disease Cervical insufficiency Multifetal gestation w/high risk for PTB Persistent 2nd/3rd TM bleeding Placenta previa > 26 weeks Episode of PTL during pregnancy Ruptured membranes Preeclampsia Severe anemia Extreme sedentary lifestyle Poorly controlled seizure disorder

Modified from ACOG CO 650 (12/2015).

RECOMMENDATION:

Women with GDM should perform both aerobic (walking) at a mild to moderate intensity and resistance exercise (muscle strengthening) three to four times per week for 30 to 60 minutes per session, or higher intensity (70 percent of maximum heart rate) for 25 minutes per session, optimally one to three hours after a meal.

- Recommended to set exercise goals with your patients and review progress at each prenatal visit

IX. Self-monitoring of capillary blood glucose and optimal pregnancy targets⁶⁷⁻⁷³

- Risks for pregnancy complications such as large for gestational age, preeclampsia and preterm birth increase with elevating glycemia.
- Both elevated pre- and postprandial glucose values have been associated with large-for-gestational-age infants.
 - Reducing postprandial values has been associated with decreased macrosomia and neonatal hypoglycemia.
- Diet-controlled women should be monitoring four times per day (fasting and one-hour postprandial values).
- Women requiring medications for optimal control should monitor four to six times per day (fasting/preprandial and one-hour postprandial values) to have the appropriate objective data required to make medication adjustments.

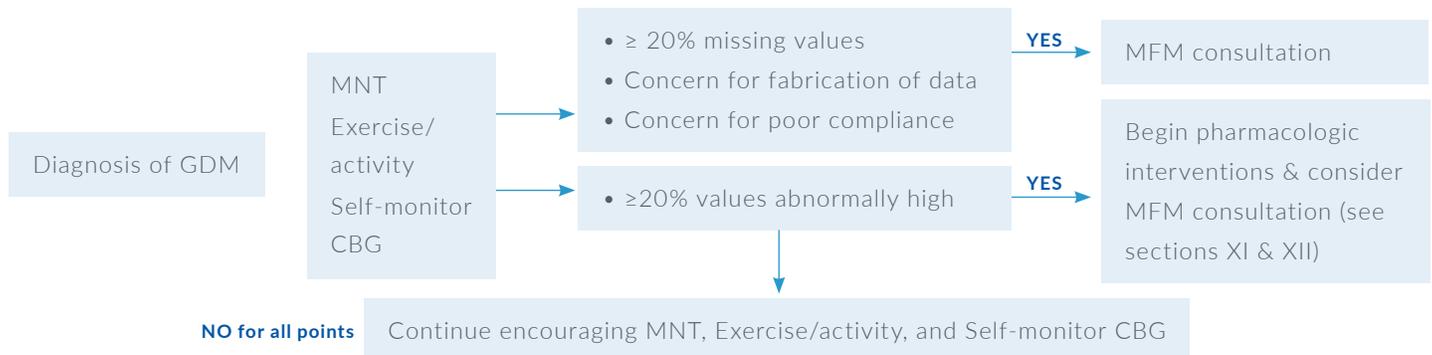
The goal of care is to aim for Euglycemia as observed in non-diabetic pregnancies (Patterns of glycemia in nondiabetic pregnancies)

- Fasting blood glucose has been shown to predict fetal overgrowth (macrosomia, large for gestational age) at measures > 85 mg/dL with more than double the risk.

Self-monitoring of capillary blood glucose ranges in pregnancy		
Timing	Non-DM range (mg/dL)	Diabetes target range (mg/dL)
Fasting	58–80	60–90
Pre-meal	65–90	60–100
Post-meal (1h after start of meal)	95–122	< 130
Bedtime (~2200)		60–90
24-hour mean range	87–104	100

If women cannot achieve these targets without significant hypoglycemia, begin with less stringent targets and individualize care

When to begin pharmacotherapy and/or refer to MFM consultation



X. Medication safety and contraindications for pregnancy⁷⁴⁻⁸⁵

It is important to consider medication safety in pregnancy for all women of reproductive age.

Medication	Safety in pregnancy/ lactation	Cautions/side effects	Recommendation
Insulin	<ul style="list-style-type: none"> • Only FDA-approved diabetic medication in pregnancy. • Does not readily cross the placenta. • No association with congenital anomalies or other adverse fetal effects. • Endogenous and exogenous insulins are transported into breast milk, serving an important role in physiologic intestinal maturation in the infant. 	<ul style="list-style-type: none"> • Hypoglycemia. <ul style="list-style-type: none"> - More frequent in T1DM and in early part of pregnancy (weeks 8-16). • Hypokalemia. • Injection site reaction. 	<p>Recommended first line for all women with GDM/DM. (Only treatment for women with T1DM.)</p>
Metformin	<ul style="list-style-type: none"> • No association with congenital anomalies or other short-term adverse fetal effects. • Long-term safety has not been studied, and unknown metabolic effects in offspring. • Low breast milk concentrations; no adverse effects reported up to 6 months of age. 	<ul style="list-style-type: none"> • Crosses the placenta with cord blood concentrations \geq maternal blood. • Lactic acidosis (rare, 0.03/1000 patient years); more common with renal dysfunction. • Diarrhea/GI upset; titrate dose gradually and take with food. 	<p>Recommended as a second tier alternative to insulin.</p>

Medication	Safety in pregnancy/ lactation	Cautions/side effects	Recommendation
Glyburide	<ul style="list-style-type: none"> • Small concentration crosses the placenta (cord blood concentrations 1–2% of maternal blood) and excreted in breast milk, with no adverse infant outcomes reported. • No association with congenital anomalies or other short-term adverse fetal effects. • Long-term safety unknown. 	<ul style="list-style-type: none"> • Maternal and neonatal hypoglycemia. • GI upset. • Weight gain. • Macrosomia. 	<ul style="list-style-type: none"> • Not recommended. • May resume during lactation.

Other available pharmacotherapy

Glipizide	<ul style="list-style-type: none"> • Small concentration crosses the placenta but greater than glyburide. • Limited human studies; no evidence of an association with congenital anomalies. • Limited safety data in pregnancy. • Small concentrations in breast milk; no adverse effects reported in infants. 	<ul style="list-style-type: none"> • Hypoglycemia. • GI upset. • Weight gain. 	<ul style="list-style-type: none"> • Not recommended. • May resume during lactation.
α-Glucosidase inhibitors (e.g., acarbose)	<ul style="list-style-type: none"> • Commonly used in combination with other hypoglycemic agents. • Animal studies show placental transport and low concentrations in breast milk. • No association with congenital anomalies or short-term adverse fetal effects. • No human studies regarding lactation. 	<ul style="list-style-type: none"> • GI side effects; titrate dose gradually. 	Not recommended for routine use.

Medication	Safety in pregnancy/ lactation	Cautions/side effects	Recommendation
Thiazolidinedione (e.g., pioglitazone)	<ul style="list-style-type: none"> No human studies have reported data on use of this medication class in pregnancy. Crosses the placenta in animal studies with delayed fetal growth and insulin resistance. 	<ul style="list-style-type: none"> Caution with heart and liver disease. Weight gain. 	Not recommended.
Glucagon-like peptide-1 (GLP-1) agonists	<ul style="list-style-type: none"> No human studies have reported data on use of this medication class in pregnancy Animal studies demonstrated skeletal abnormalities at high dose concentrations 	<ul style="list-style-type: none"> Cases of acute pancreatitis have been reported 	Not recommended.
Dipeptidyl peptidase IV (DPP-4) inhibitors	<ul style="list-style-type: none"> No human studies have reported data on use of this medication class in pregnancy No teratogenicity reported in animal studies 	<ul style="list-style-type: none"> Hypoglycemia 	Not recommended.
Sodium-glucose cotransporter-2 (SGLT2) inhibitors	<ul style="list-style-type: none"> No human studies have reported data on use of this medication class in pregnancy 	<ul style="list-style-type: none"> UTI Vulvovaginal mycosis 	Not recommended.

See Appendix A for medication safety of other medications commonly consumed by women with metabolic disorders, lipid dysfunction, obesity or cardiovascular disease.

XI. Therapeutic pharmacologic interventions⁸⁶⁻⁹⁰

Pharmacologic interventions are recommended if lifestyle modifications alone do not reach optimal glycemic target ranges.

- Insulin is given to mimic normal pancreatic function.
- During pregnancy, over 50 percent of insulin is secreted as mealtime boluses.
- Weight-based calculation of insulin dosing will start the patient at a good baseline, initiating dose.

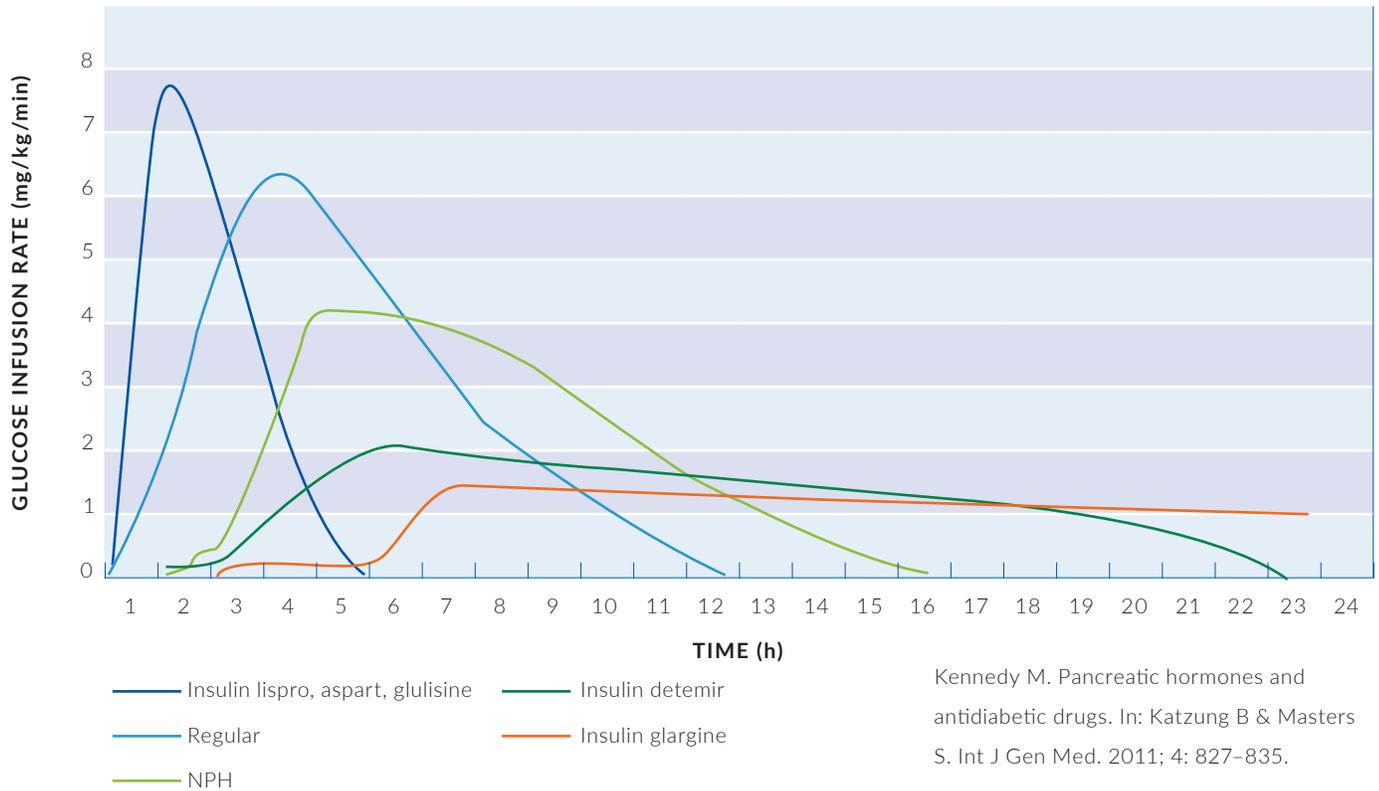
IMPORTANT insulin considerations:

All patients requiring insulin for optimal diabetes management should understand the following:

1. Demonstrate drawing-up and injecting the correct dose of insulin prescribed or have the literacy to dial the correct dose using an insulin pen.
2. Recognize signs/symptoms of hypoglycemia and have been instructed on the appropriate treatment for hypoglycemia (i.e., avoid inadequate or overtreatment of hypoglycemia).
3. Safeguard caretakers or family members should know how and when to use a glucagon emergency kit.
 - a. Patients, especially T1DM, should be prescribed a glucagon emergency kit to have at home and in their purses/personal carry-ons.
4. Cognizance of conditions that will require higher doses of insulin: medications (e.g., corticosteroids, protease inhibitors), illness/stress and obesity.

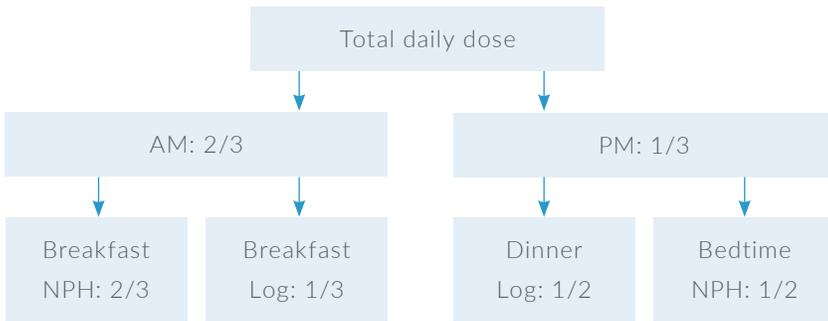
RECOMMENDATION:

Insulin is the only FDA-approved medication for diabetes management in pregnancy and is considered first-line therapy.



	Insulin type	Example	Onset (min)	Peak (hour)	Duration (hour)
Bolus	Rapid-acting analog (Log)	Lispro/Aspart	5-15	0.75-1.5	3-5
	Short-acting regular U-100	Humulin® R Novolin® R	10-75	1-7	4-8
	Regular U-500	Humulin® R Novolin® R	15-30	0.5-8	6-10
Basal	Intermediate-acting (NPH)	Humulin® N Novolin® N	120-240	4-10	10-20
	Long-acting analog	Detemir	60-120	6-8 (not defined)	10-18
	Long-acting analog	U100 Glargine	30-90	None	20-24
	Ultra-long acting analog	U300 Glargine	Develops over 6 hours	None	>30
	Ultra-long-acting analog	Degludec	30-90	None	>42

Insulin dosing regimen



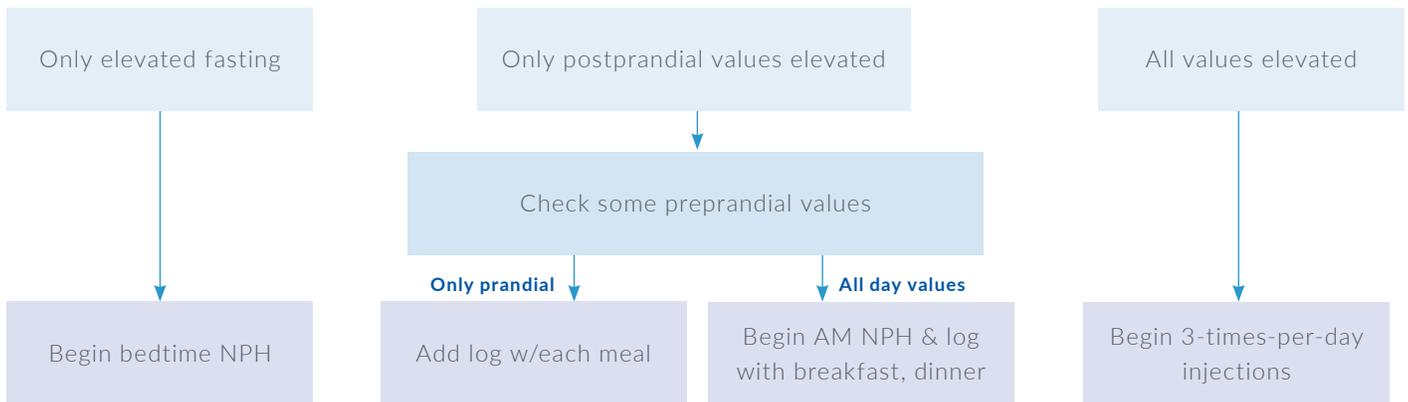
See Appendix B for alternative dosing for underlying metabolic dysfunction (chronic insulin resistance) or insulin pump initiation. These insulin dosing regimens are weight-based and insulin dose adjustments should be made according to patient glucose testing patterns.

Insulin initiation (weight-based calculations)

Traditional dosing calculation

Gestational age (wks)	Total daily dose (units/kg)
1-18	0.7-0.8
18-24	0.8-1.0
25-32	0.9-1.2
33-38	1.2-2.0

Example insulin initiation and troubleshooting:



Insulin dose adjustment:

- **Dose adjustments can be made every three to seven days** to expeditiously reach optimal glycemic targets.
 - Unlike non-pregnancy states, pregnancy is *limited* in time and prompt control is essential to decrease risk for offspring *in utero* and future adverse outcomes.
- No current evidence of optimal insulin dose adjustment algorithms.
 - **Must be individualized!**
- Expert opinions suggest ~20 percent increase of insulin from the current dose but patients may require more or less pending several factors (see below).

Factors that must be considered when discussing dose adjustments with patients (examples)

- How has she responded to your previous dose adjustments?
- How far off target range is the patient?
- How far in gestation is the patient (e.g., first, early second, late second, third trimester, late third trimester)?
- Is the patient eating meals on a routine schedule?
- Do glucose values vary by specific days of the week due to scheduled activities or changes (e.g., shift work)?
- What is her current weight and is she obese?
- How much weight has the patient gained through the pregnancy? Is it excessive?
- When are her meals and snacks in relation to her insulin injections?
- Can the patient *realistically* make better conscious food choices?
- What are the components of her snacks/meals?
- Is the patient intentionally carb-restricting to reach target goals?
- Is the patient eating a bedtime snack?
- Is the patient eating in the middle of the night? What/when is she eating in the middle of the night?
- Is she waking up in the middle of the night with signs of hypoglycemia?
- Does she have patterns during the day of hyper- or hypoglycemia?
- Is the patient having difficulty sleeping?
- Does the patient have an undiagnosed sleep breathing disorder?
- Does the patient currently exercise during the day?
- Is the patient willing to add or adjust an exercise regimen to help her glycemia?

Metformin therapy:

Starting dose 500 mg twice a day

- Increase by 500 mg every three to five days to reduce challenges with GI side effects.
- Reach 1000 mg twice a day for therapeutic dose (total 2000 mg daily).
 - Maximum dose is 2500 mg daily (2550 mg for extended release).
- *If the patient is sensitive to side effects, she may need to initially start with 500 mg daily and continue to titrate up as described above.*
- Metformin does not cause hypoglycemia.

Limitations of oral medications:

1. Risk of placental transfer on long-term outcomes with oral medications is unknown.
2. Require slow dose adjustments and cannot rapidly achieve euglycemia.
3. Usually insufficient to control glucose to optimal goals and especially should not be used when GDM is *diagnosed* < 20 weeks' gestation.

XII. MFM consultation

An MFM specialist's participation in a woman's diabetes care may vary, contingent on the primary provider and the patient's desires, comfort, needs and severity of disease.

- Diabetes care involves a **team** approach.
- The patient is the **leader** of the team and each member serves a supportive role to help the patient achieve a safe and healthy pregnancy in addition to improving the lifelong health of the patient and her future child.

MFM spectrum of care

- Preconception counseling
- One-time consultation of DM risks and recommendations for perinatal management
- Repeat consultations during pregnancy to readdress goals and change in perinatal management
- Co-management for management of DM and high-risk factors
- Primary prenatal management

When is the best time to consult MFM?

- **ANYTIME** after diagnosis but the earlier in gestation, the more useful for the patient and her pregnancy.
- Preconception is the ideal time for patient education and health optimization.
- When considering pharmacotherapy to help the patient reach optimal glycemic control.

Which patients should be referred to a specialized DAPP program or MFM (if a DAPP program is not accessible for your patient)?

- Pregestational DM, prediabetes or GDM
- Patient noncompliance
- Transitioning on to pharmacotherapy
- You believe the patient can benefit from a different perspective and possibly approach

Who will the patient see during her visit?

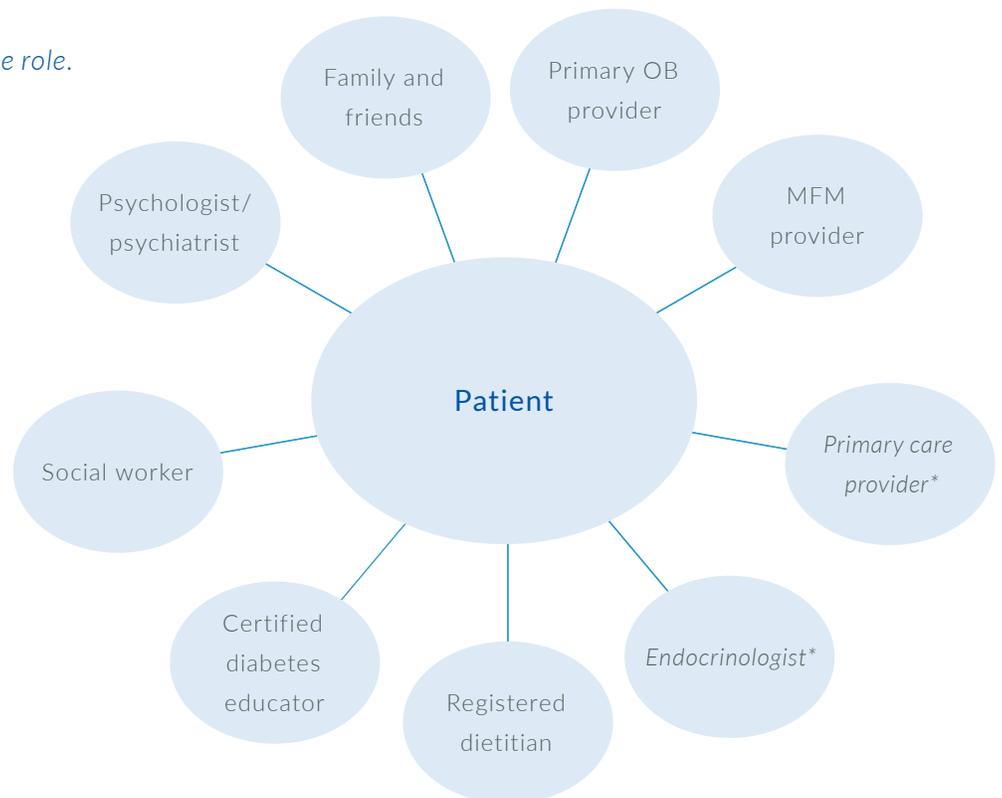
- MFM specialist
- Registered dietitian
- Certified diabetic educator
- Sonographer (if needed)
- Residents, fellows, and/or medical students
- Social worker (if applicable)

What are important aspects of care that are covered during an MFM consultation?

- Review patient goals for the pregnancy
- Review how each “team member” participates in her care and helps her achieve her goals
- Relevant pregnancy physiology
- Risks of hyper- and hypoglycemia
- Known maternal and lifelong risks of DM
- Fetal and lifelong programming risks
- Comprehensive anatomy and/or fetal biometry and review of ultrasound findings
- Impact of DM/GDM on future pregnancies
- Review how each intervention strategy (MNT, pharmacotherapy) helps to achieve the patient’s goals
- Risks and benefits of interventional options
- Insulin teaching (if applicable)
- Role of antenatal fetal surveillance (ANFS) and frequency
- Delivery timing
- Importance of taking emotional, mental and physical action for comorbid prevention and improving overall health and well-being

Patient Care Team:

Individuals may serve more than one role.



*May or may not be involved during the pregnancy but serve important roles in the long-term health and care of the patient.

XIII. Management of hypoglycemia

KEY POINTS:

- Hypoglycemia prevention is an important component of diabetes management.
- Educate women to check their blood sugars if they experience signs or symptoms of hypoglycemia.

Hypoglycemia is defined by abnormally low blood glucose levels and is unpleasant to patients with DM. It most commonly occurs in T1DM but may occur in T2DM and in GDM women taking insulin or some oral agents.

Hypoglycemia may result from inadequate or erratic carbohydrate consumption following insulin administration, missed meals and/or snacks, incorrectly timed or erroneous insulin type/dose injected, and conditions such as gastroparesis or hyperemesis gravidarum.

Pearls in treating hypoglycemia

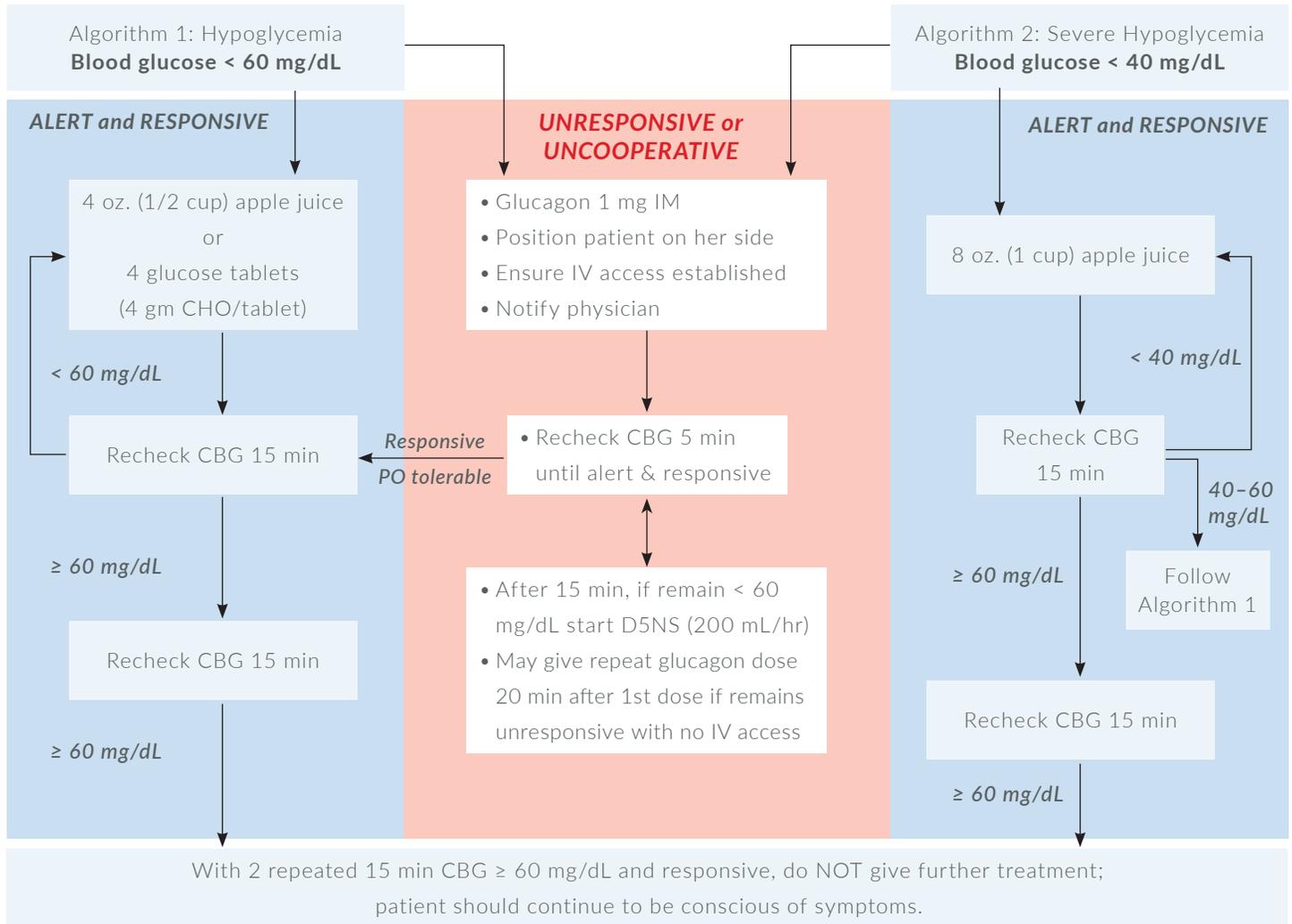
- *Oral* pure glucose is the preferred treatment as the acute glycemic response correlates better with the glucose content than with the carbohydrate content of food.
- Avoid ingesting **protein** to treat hypoglycemia as it may enhance the insulin response to dietary carbohydrates.
- Avoid ingesting foods with added **fat** (e.g., complex carbohydrates such as milk, cookies or candy) to treat hypoglycemia as it may *delay* and *prolong* the acute glycemic response of treatment.
- Patients should be instructed to carry glucose tabs or 4 oz. apple juices with them at all times.
- Patient should not be left alone during treatment.
- Hypoglycemia unawareness can develop after recurrent episodes of hypoglycemia.
 - The signals and symptoms of hypoglycemia are not detected or occur at alarmingly lower blood glucose levels.

Signs and symptoms of hypoglycemia

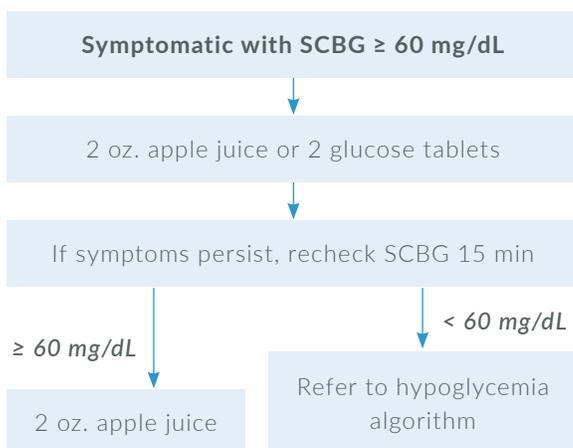
Irritability/impatience
Speaking difficulty
Sweating, chills and clamminess
Shakiness, nervousness or anxiety
Confusion, mental status changes or unconsciousness
Lightheadedness or dizziness
Hunger and nausea
Blurred/impaired vision
Tingling or numbness in the lips or tongue
Headaches
Weakness, fatigue or sleepiness
Lack of coordination
Seizures

Hypoglycemia treatment algorithm

Women with *symptoms* should check their blood sugar. Treatment of hypoglycemia depends on the clinical status of the patient and her ability to treat herself.



Treatment of hypoglycemia symptoms with normal glucose



XIV. Fetal assessment^{91, 92}

TRIMESTER	GDM		T1DM	T2DM ¹
	Diet-controlled (A1)	Medication (A2)		
1st	Dating US/viability			
			Nuchal translucency	
2nd	Level 2 US (20 wks)	Level 2 US (20 wks)	Level 2 US (20 wks) Fetal echo (22–24 wks) ²	Level 2 US (20 wks) Fetal echo (22–24 wks) ²
3rd	ANFS ^{3a} : Consider 1/wk US: Consider final growth (36–38 wks)	ANFS ^{3b} : 1-2/wk US ⁴ : Serial growth 4-6 wks (if poorly controlled) US ⁵ : Consider final growth (36–38 wks)	ANFS: 2/wk US: Serial growth 4–6 wks	ANFS: 2/wk US: Serial growth 4–6 wks

1. Women with prediabetes or suspected pregestational DM should also be included in this category.
2. *Recommend* fetal echocardiogram for women with pregestational DM, particularly with preconception or first trimester HbA1c \geq 6.5 percent.
3. Antenatal fetal surveillance (ANFS):
 - a. ANFS for women with well-controlled, diet only GDM is not recommended.
 - i. ANFS can be considered in women with GDMA1 if additional risk factors for adverse fetal outcomes are present (e.g., obesity, macrosomia and polyhydramnios).
 - b. *Recommend* fetal surveillance in women with poorly controlled GDM and those requiring medication as abnormal fetal growth and fetal demise have been associated with poor glycemic control in pregnancies complicated by pregestational diabetes.
 - c. **Type of ANFS:** The NST, BPP and modified BPP (NST with AFI) have similarly low false-negative rates.
 - i. We recommend a modified or complete BPP at least once a week +/- NST alone or modified BPP if twice-weekly testing is indicated.
4. Ultrasound (US): Serial biometry to assess interval fetal growth is recommended to begin at 28 weeks gestation every four to six weeks for pregestational DM and GDM women with poor glycemic control.
5. Final growth ultrasound prior to planned delivery may be considered to aid in delivery management.

XV. Peripartum management⁹³⁻⁹⁷

Antepartum management

Admission for glycemic optimization

- Goal to maintain glycemic control approximately **100 mg/dL**.
- Discontinue subcutaneous (SC) or pump insulin.
- Insulin drip dose initial calculation:
 - Calculate total daily weight-based dose (see section XI).
 - IV insulin total basal daily dose: $IV\ TDD = (TDD * 0.25) \div 2$.
 - Per hour = $IV\ TDD \div 24$.
 - SC rapid-acting insulin administered with food while using an insulin infusion for basal insulin coverage is also effective; dose can be calculated using insulin to carb ratio
 - IV insulin meal bolus dose = $IV\ TDD \div 3$.
 - Infuse the total bolus dose over two to three hours.
 - IV insulin drip using regular insulin 100 units/100 mL NS.
 - Check CBG every hour.
 - *Glycemic responses and requirements vary.*
 - For institutions that do not have software programs (i.e. EndoTools) or insulin drip protocols, the basic IV insulin algorithm below may be used and individualized to your patient

Conversion to SC insulin

- When converting back to SC insulin, the long-/intermediate-acting insulin should be administered one to two hours before discontinuing the IV insulin drip.
- Transitioning to SC insulin is appropriate when the patient is clinically improved, hemodynamically stable, and infusion rate is stable
- 80 percent of total daily infusion dose is used to estimate the 24 hour total SC insulin requirement. If the patient is eating, add the meal-bolus requirements to this total SC calculated total
 - Depending on patient characteristics and gestational age, basal and bolus insulin dose divisions will vary
 - Most T2DM and GDM can use the algorithm as described in section XI

Inpatient IV insulin drip dose adjustment algorithm

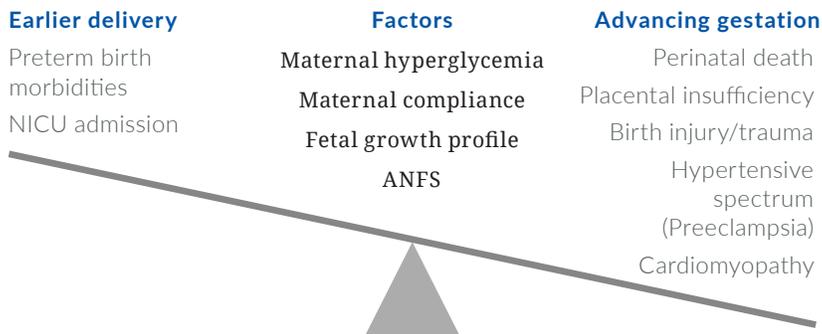
Glucose (mg/dL)	Insulin (units/hr)	IV solution
< 100	Discontinue	LR/NS or D5NS (if NPO)
100-120	0.5	LR/NS or D5NS
121-140	1.0	LR/NS or D5NS
141-160	1.5	LR/NS or D5NS
161-180	2.0	LR/NS or D5NS
181-200	2.5	LR/NS or D5NS
> 200	3 (Call MD)	LR/NS or D5NS
> 300	4 (Call MD)	LR/NS or D5NS

Preprandial hyperglycemia correction **Do NOT treat postprandial elevations**	
CBG (mg/dL)	Lispro/Aspart (units)
< 100	0
100-140	2
141-160	3
161-180	4
181-200	5
201-250	6
251-300	8
> 300	10

- Patients in the hospital should be monitored pre- and post-meals for optimal glycemic management.
- *Postprandial* elevations should never be treated with sliding scale insulin as it can cause insulin “stacking” or overlap and increase the risk for hypoglycemia.
- Preprandial elevations can be corrected with short-acting insulin analogues, given **together** with the scheduled meal bolus dose.
 - Inquire with the patient about any variations in meal-timing, meal-choices, medication changes, etc., before deciding to adjust basal insulin doses.
- For T1DM patients, the ‘rule of 1700’ may be used to calculate the insulin sensitivity factor, which estimates the point drop in glucose when 1 unit of rapid-acting insulin is given
 - Divide 1700 by the TDD. Example: if a woman takes 50 Units of total insulin in one day, $1700 \div 50 =$ every 1 Unit of rapid-acting insulin will decrease their glucose by 34 mg/dL
 - Calculate the appropriate insulin dose to decrease the **preprandial** glucose to 100 and add that to her meal-time dose. **Example:** preprandial glucose is 175 mg/dL, you would add 2 Units of rapid-acting insulin to her meal-time insulin dose
- The ‘rule of 1700’ can also be applied to T2DM and GDM patients
 - If it’s unclear what the TDD of insulin is or the patient had not previously been taking insulin, may start with the preprandial hyperglycemia correction table as a crude estimate until further data is obtained to make individualized correction scales

Delivery timing

Delivery timing should be individualized, as many factors need to be considered to determine the appropriate timing of delivery. The maternal and fetal risks of advancing gestation versus the neonatal risks for earlier delivery must be evaluated as diabetes poses ongoing risks to the pregnancy.



Condition	Gestational age at delivery (Individualize)
Well-controlled GDMA1	39–41 ^{0/7} weeks
Well-controlled GDMA2 or preexisting DM*	39 weeks
Poorly-controlled GDM/DM	36–38 weeks

**Individualize* delivery timing and consider additional conditions that otherwise increase risk for stillbirth or perinatal adverse outcomes.

Intrapartum management

Women's pre-labor glycemic control influences the insulin requirement during active labor (i.e., women with poor control commonly require higher insulin doses during labor).

- Maternal hyperglycemia during labor contributes to neonatal hypoglycemia.

Women with an insulin pump:

- For scheduled cesarean deliveries, women should continue their normal basal pump settings until taken back to the operating room.
- Because regional anesthesia time and other unit floor events are not always predictable, continue the insulin pump and remove just prior to prepping the abdomen for surgery.
 - Anesthesia colleagues should confirm insulin drip is started at the time the pump is discontinued.
- Women who desire to be managed during labor with an insulin pump should present with a preadmission plan to decrease their pump settings during *active* labor.
 - Providers who are comfortable with pump management should be present during the labor course.
 - Typically, during active labor insulin pump settings decrease down one-quarter to one-third of pregnancy settings.

Scheduled cesarean section:

- Cesarean sections, particularly for T1DM and women with diabetes using pharmacotherapy, should be scheduled early in the morning.
- Patients who have a morning planned admission are advised to administer the **full** NPH or detemir insulin dose the evening prior with their regularly planned bedtime snack.
 - If patients are receiving glargine at bedtime for basal insulin coverage, instruct patients to inject one-third of their scheduled dose the evening prior.

- Upon admission, blood glucose should be checked and treated as appropriate.
- T1DM women who are managed with injectable insulin should inject one-third of their morning basal dose of insulin, and be monitored carefully and treated as appropriate.

Induction of labor:

- During latent labor, a woman’s metabolic demands are usually stable.
- Patients who have a morning planned admission are advised to administer the full insulin dose the evening prior with their regularly planned bedtime snack.
- Patients with a planned evening admission are advised to administer their prescribed insulin regimen throughout the day and be given their full insulin dose at bedtime with their planned bedtime snack in the hospital.

Active labor:

- During active labor, a woman’s metabolic demands ↑ and insulin requirements typically ↓.
 - However, all procedures and states of physiologic stress such as labor induce counter-regulatory hormone release (glucagon, cortisol, epinephrine), leading to a more insulin-resistant state and increased risk for ketosis.
- GDM or T2DM women usually have appropriate endogenous stores/production of insulin but T1DM women do not have any endogenous stores and require insulin at all times.
- Stop the insulin drip after delivery of the placenta for GDM/T2DM women.

LATENT

- Monitor blood glucose every four hours.
- Blood glucose targets: 60–110 mg/dL.
- If ≥ 2 abnormal values, begin insulin drip protocol for GDM/T2DM.
- T1DM should be on an insulin drip the **entire** labor and delivery, unless managed on an insulin pump.
- All patients managed on an insulin drip should have glucose checks every hour.

ACTIVE

- Monitor blood glucose every one hour.
- Blood glucose targets: 60–110 mg/dL.
- If ≥ 2 abnormal values, begin insulin drip protocol for GDM/T2DM.
- Glucose infusion concomitantly with insulin drip is not necessary unless blood glucose falls < 60 mg/dL (protocols using both glucose infusion or as-needed glucose infusions have similar safety profiles).

XVI. Special considerations⁹⁸⁻¹⁰⁴

KEY POINTS:

- All patients regardless of glycemic status should have glucose monitoring until at least 72–96 hours after the first corticosteroid injection.
- Have a low threshold to initiate an insulin drip to keep optimal control.
- Increase insulin dose regimen by 30–40 percent for the first 72–96 hours after first corticosteroid injection.

Betamethasone

Antenatal corticosteroids are administered to women who are at risk of preterm delivery within seven days between 24 and 34 weeks' gestation (and up to 36 6/7 weeks in *non-diabetic* patients) to enhance fetal lung maturity and reduce neonatal mortality, necrotizing enterocolitis and intraventricular hemorrhage. While a recent randomized control trial demonstrated reduced neonatal respiratory morbidity when corticosteroids were given in the late preterm period, glucocorticoids are not without risk, particularly in the diabetic population who were excluded from the trial's study population.

- Glucocorticoids cause hyperglycemia by decreasing glucose uptake and oxidation and inhibiting glucose-stimulated insulin secretion from pancreatic β -cells \rightarrow increasing insulin resistance.
- All patients experience a transient elevation of plasma glucose after corticosteroid administration.
- Antenatal corticosteroids are associated with higher rates of neonatal hypoglycemia and hyperbilirubinemia.

► **The hyperglycemic effects of corticosteroids peak at four to 10 hours and continue for 24–48 hours after injection, but can last as long as three to five days post-injection.**

- Prior studies have demonstrated that increasing insulin doses soon after corticosteroid administration has more success controlling overall glycemia compared to waiting and responding to elevated serum glucose levels.
- As many as 50 percent of GDMA1s (diet-controlled patients) require pharmacotherapy for optimal glycemic control and over one-third of these women will require continuation of pharmacotherapy until delivery.
- There is a significant variability in the physiologic glucose response to corticosteroids but the majority of women require more than half to double their current insulin requirements for adequate control.

Tocolytics

- Terbutaline is a selective β_2 -agonist used for its effects on uterine smooth muscle. It is associated with significant side effects such as palpitations, tremors, increased lactic acid and plasma glucose levels, and decreased insulin sensitivity.
 - Betamimetics should generally be **avoided** for tocolysis in women with DM.

KEY POINTS:

- Prompt recognition, evaluation and, if **suspicious**, prompt hospitalization and targeted therapy with intensive monitoring are essential to improve perinatal outcomes.
- Education and prevention are important to address during office visits.

Signs and symptoms concerning for DKA

- Polydipsia/polyuria
- Generalized malaise
- Headache
- Nausea and vomiting
- Poor PO intake
- Tachypnea or hyperventilation
- Fruity or ketotic breath
- Weakness
- Dehydration
- Tachycardia
- Hypotension
- Oliguria
- Weight loss
- Disorientation/mental status changes
- Abdominal pain

Diabetic Ketoacidosis (DKA)

What is DKA?

- An acute metabolic crisis from a relative insulin deficiency, driving more hepatic glucose production and further decreasing end-organ uptake/utilization.

Can women with T2DM and GDM develop DKA?

- ***YES***. Several factors contribute to the development of DKA, which can occur at lower glucose levels compared to non-pregnant states.

Why are pregnant women at higher risk for DKA?

1. Accelerated “starvation”
 - a. Pregnancy is a relative diabetogenic state = insulin resistance with increased lipolysis and ketogenesis.
2. Decreased buffering capacity (↑ minute ventilation → respiratory alkalosis → bicarbonate renal excretion)
3. Unrecognized dehydration
4. Decreased caloric intake (nausea, vomiting, hyperemesis)
5. Placental insulin antagonists (human placental lactogen, increased cortisol, prolactin and growth hormone)

What are common precipitating factors for DKA?

1. Infection
2. Prolonged fasting
3. Skipping insulin doses, insulin pump failure or poor compliance
4. Labor
5. Corticosteroids
6. β-sympathomimetic agents

What laboratory findings are consistent with DKA?

1. Arterial pH acidosis
2. Low serum HCO₃
3. Positive serum/urine acetone
4. Widened anion gap
5. High osmolality
6. Hyper- or euglycemia
7. Falsely normal or low potassium

XVII. Breastfeeding¹⁰⁵⁻¹¹²

Women with GDM should be encouraged to breastfeed when possible.

- Breastfeeding decreases the likelihood of mothers with GDM developing type 2 DM within the next **two years** by **53 percent** and in the next **19 years** by up to **40 percent**.
 - Women who exclusively breastfed and breastfed for *longer duration* showed the greatest benefit, but any amount and length of breastfeeding was beneficial.
 - Beneficial impact even after adjusting for weight loss and underlying risk factors for DM.
- Maternal glucose metabolism is improved with breastfeeding, and breastfeeding may help to reset pancreatic beta cell function in patients with GDM.
- **Talk to your patients with GDM about their infant feeding plans** and provide additional lactation support to this vulnerable population, which has been shown to improve breastfeeding rates.

Factors associated with delayed lactogenesis, low milk supply and early weaning

GDM/DM Obesity
Cesarean delivery
PCOS
Prematurity
Uncontrolled glycemia
Primiparity
Advanced maternal age
Separation from newborn (secondary to infant health issues)

XVIII. Postpartum Management¹¹³⁻¹²²

The care of women with GDM does not end with delivery of the placenta.

- Up to 30 percent of women with GDM continue to have glucose abnormalities including prediabetes or T2DM immediately postpartum (PP).
- Fifty to 70 percent risk developing T2DM in the next five to 10 years.

Immediately postpartum	Postpartum inpatient care	Postpartum outpatient visit
Consider fasting CBG daily (may discontinue after PP day 3 if within normal range). <i>Minimum:</i> Fasting CBG PP day 1 and if ≥ 100 mg/dL, continue daily monitoring while inpatient.	Emphasize importance of follow-up diabetes testing.	Discuss long-term health risks of GDM.
If fasting CBG is > 125 over 2 times, start treatment (see below).	Emphasize benefits of breastfeeding.	2h OGTT (6–12 weeks PP)
Encourage the establishment of breastfeeding.	Emphasize continuing lifestyle modifications and exercise with weight loss goals by six months post-delivery.	Confirm patient has a PCP (or refer) and send note for follow-up in three to six months.
For T1DM or T2DM requiring insulin prior to pregnancy, decrease insulin regimen to 25–40% of pregnancy dose.	Order 2h GTT (fasting, 2h) and instruct patient to perform the morning of her scheduled six-week postpartum visit.	Encourage continuing high quality diet and exercise and set healthy weight goals.

Abnormal glycemia in the postpartum period for women with GDM:

≥ 2 abnormal fasting blood glucose

Instruct patient to check fasting + pre-/post-meal (e.g., pre-/post-lunch one day, pre-/post-dinner next day)

Follow up one to two weeks. If continues to be abnormal, educate on importance of (1) lifestyle modifications and (2) first-line agent is metformin if lifestyle modifications are unsuccessful

Refer to primary care provider for long-term follow-up

“For every kilogram of weight loss, there was a 16 percent reduction in risk, adjusted for changes in diet and activity.”

~Diabetes Prevention Program

TAKE-HOME POINTS:

- Women with a history of GDM, elevated BMI, elevated fasting glucose or impaired glucose tolerance are at increased short- and long-term risk of developing diabetes mellitus.
- This risk can be reduced substantially with either lifestyle intervention (number needed to treat = 7) or metformin (NNT = 11) to prevent one case of diabetes over 10 years.
- The goal is to **maintain** long-term weight loss and continue nutritious food choices to decrease women’s risk for T2DM and cardiovascular disease.
 - Additional benefit for overall improved health status for future pregnancies.
- Women need to be followed up by a primary care or women’s health provider **YEARLY** (or at least every one to three years), with diabetes and cardiovascular screening in addition to healthy lifestyle encouragement.

Postpartum outpatient visit and follow-up testing:

On average *only 10 percent of practitioners at tertiary care centers* regularly counsel patients on lifestyle changes at this visit.

- **Critical counseling visit for woman’s future health and optimization before future pregnancies.**
- **POSTPARTUM = PRECONCEPTION**
 - PP testing is increased when patients are counseled on their risk and the importance of follow-up for diabetes testing (2h OGTT for non-pregnant patient targets preferred).
- **Counseling points to address:**
 1. Set realistic weight loss goals with the patient.
 - Diabetes Prevention Program lifestyle goals = **recommended pace of weight loss is 1 to 2 pounds per week, for at least 7 percent loss within approximately 24 weeks (Diabetes Prevention Program Lifestyle).**
 2. Patient handouts: Patient Lifestyle Handouts.
 3. Diet and exercise have been shown to decrease the incidence and prolong the interval to developing T2DM.
 - Continuing a healthy, high quality diet that was encouraged throughout pregnancy should be encouraged for LIFE.
 4. Review 2h OGTT results.
 - If not already performed, order and educate patient on the importance of testing.
 - If testing is normal, 2h OGTT is repeated one-year postpartum and then every one to three years thereafter (ADA 2016).

Barriers to healthy lifestyle to address

- Lack of time and/or energy
- Lack of child care/support
- Emotional distress
- Postpartum depression
- Lack of motivation
- Financial stressors
- Lack of knowledge/understanding of future risks
- Poor body image
- Feeling of solitude/isolation
- Work obstacles
- Domestic expectations
- Weather
- Neighborhood safety

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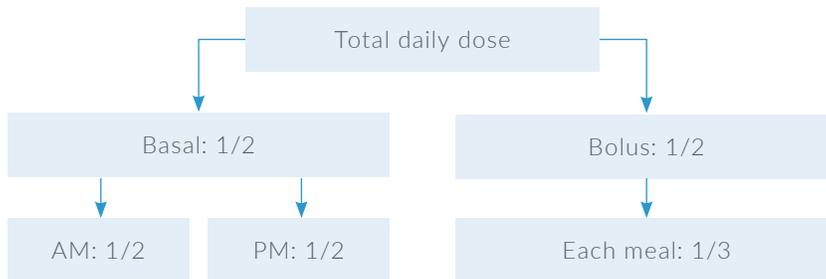
Appendix A: Medication safety¹²⁻¹³⁶

Medication	Safety in pregnancy/lactation	Cautions/side effects	Recommendation
Beta antagonists (e.g., metoprolol, propranolol, labetalol)	<ul style="list-style-type: none"> • Crosses the human placenta. • Animal/human studies have not shown an increased risk of congenital anomalies or other short-term adverse fetal effects. • Atenolol has been associated with transient fetal/neonatal bradycardia and low birth weight. • Concentration of labetalol and metoprolol in human milk is low and considered safe during lactation. 	<ul style="list-style-type: none"> • Hypotension. • Bradycardia. • Bronchospasm. • Do not discontinue abruptly with a history of ventricular arrhythmia or angina. • Monitor fetal growth if atenolol is used. • Atenolol breast milk concentration is 3–4x maternal serum; consider alternative β-blockers (risk neonatal bradycardia). 	<ul style="list-style-type: none"> • Labetalol recommended in pregnancy and lactation. • Atenolol is not recommended in pregnancy and lactation.
Calcium channel blockers (e.g., nifedipine, amlodipine)	<ul style="list-style-type: none"> • Animal and limited human studies do not demonstrate an increased risk of congenital malformations. • No demonstrated adverse fetal outcomes. • Concentrations in human breast milk \approx maternal plasma; no short-term adverse effects. 	<ul style="list-style-type: none"> • Hypotension. • Flushing. • Headache. • Theoretic risk of pulmonary edema and hypotension given concurrently with MgSO₄ in high-risk women (multiple gestation, chorioamnionitis, CHD). 	<ul style="list-style-type: none"> • Recommended in pregnancy and lactation.
Thiazide diuretics (e.g., HCTZ, chlorthalidone)	<ul style="list-style-type: none"> • Crosses the placenta. • Animal/human studies show no increased risk of congenital malformations. • Theoretic risk of fetal biochemical abnormalities and \downarrow utero-placental perfusion but unlikely for women using prepregnancy. • Minimal concentrations excreted in human milk; may inhibit initiation of milk production. 	<ul style="list-style-type: none"> • Electrolyte abnormalities (hypokalemia). • Hypotension/dehydration. • Consider monitoring amniotic fluid volume and fetal growth in third trimester given theoretical risk of diminished utero-placental perfusion. 	<ul style="list-style-type: none"> • Not recommended to initiate during pregnancy. • Acceptable to continue with use prior to pregnancy and continue during lactation. • Consider alternative first month if initiating postpartum.

Medication	Safety in pregnancy/lactation	Cautions/side effects	Recommendation
ACEi/ARB (e.g., lisinopril, captopril, losartan)	<ul style="list-style-type: none"> • First TM exposure risk for congenital anomalies is unknown; cardiac and limb abnormalities have been reported. • Second and third TM use → ↓ fetal BP and renal function leading to renal failure, oligohydramnios and growth restriction. • Minimal risk with lactation. • Minimal excretion of enalapril in human breast milk and should be considered for maternal benefits while breastfeeding. 	<ul style="list-style-type: none"> • LARC is strongly encouraged for reproductive-aged women taking ACEi/ARB. • Change to alternative antihypertensive medication if pregnant and taking ACEi/ARB. 	<ul style="list-style-type: none"> • Contraindicated in pregnancy; discontinue immediately. • First TM exposure, detailed fetal ultrasound and fetal echo recommended. • May resume during lactation.
Statins (e.g., atorvastatin, pravastatin)	<ul style="list-style-type: none"> • No known benefits of treating hyperlipidemia in pregnancy. • Early exposure unlikely to increase risk of adverse pregnancy outcome. • Theoretic risk of congenital anomalies related to decreased cholesterol signaling required for normal embryo development. • Lactation studies do not exist but animal studies show no adverse effects. 	<ul style="list-style-type: none"> • Myopathy. • Rhabdomyolysis. • Hepatotoxicity. • Pancreatitis. • GI disturbances. 	<ul style="list-style-type: none"> • Contraindicated in pregnancy; discontinue immediately. • Risks likely outweigh benefits during lactation.
Weight loss agents	<ul style="list-style-type: none"> • Intended weight loss should NOT be attempted in pregnancy. <p><u>Phentermine</u> (norepinephrine-releasing drug)</p> <ul style="list-style-type: none"> - Small series show no increased risk of congenital malformations. - Associated with hypertension in pregnancy. Lactation data is not available. <p><u>Phen/TPM</u> (phentermine/topiramate)</p> <ul style="list-style-type: none"> - Topiramate associated with orofacial cleft defects. - Lactation data is not available. <p><u>Orlistat</u> (lipase inhibitor)</p> <ul style="list-style-type: none"> - Small series shows no increased risk of congenital malformations. - Decreases absorption of fat-soluble vitamins. - Lactation data is not available. <p><u>Lorcaserin</u> (a selective serotonin 2C receptor agonist that acts centrally to increase satiety)</p> <ul style="list-style-type: none"> - Contraindicated with combined use of SSRIs. - Lactation data is not available. <p><u>Liraglutide</u> (glucagon-like peptide-1 receptor agonist)</p>	<p><u>Phentermine</u>: Hypertension, dry mouth, insomnia, tremors, anxiety; after prolonged use, risk of depression and extreme fatigue.</p> <p><u>Phen/TPM</u>: Increased heart rate, insomnia, paresthesia, altered taste, glaucoma and metabolic acidosis.</p> <p><u>Orlistat</u>: GI disturbances.</p> <p><u>Lorcaserin</u>: Headache, nausea, dizziness, fatigue, dry mouth, serotonin syndrome and constipation.</p> <p><u>Liraglutide</u>: Nausea, constipation and pancreatitis.</p>	<ul style="list-style-type: none"> • Not recommended in pregnancy or lactation.

Appendix B:

Alternative dosing for underlying metabolic dysfunction (chronic insulin resistance):



Insulin Pump Calculation for Pregnancy:

Total daily dose (TDD) calculation (24-hour)	<ol style="list-style-type: none"> Switching from insulin injectables to continuous subcutaneous insulin infusion (CSII): <ol style="list-style-type: none"> Total multiple daily injections (MDI) over 24 hours Reduce TDD by 25% when switching to pump (i.e., MDI TDD x 0.75 = CSII TDD) Weight based CSII TDD = kg x units for gestation (see below) 	
Weight-based CSII TDD		
Gestation	T1DM (units)	GDM or T2DM (units)
Prepregnancy	0.3	0.6
Weeks 1–18	0.4	0.7
Weeks 18–26	0.45	0.8
Weeks 26–36	0.5	0.9
Weeks 36–40	0.55	1.0
Postpartum < 6 weeks	0.3	0.4
Total daily basal dose (TDBD = 50% of CSII TDD)	TDBD = CSII TDD x 0.5	
Basal infusion rate (divided into 3 basal rates)	0000–0300	(TDBD ÷ 24) x 0.8
	0300–0900	(TDBD ÷ 24) x 1.5
	0900–0000	TDBD ÷ 24
	May need to add 1900–0000 infusion rate	Individualize
Correction/sensitivity factor (CF)	<ul style="list-style-type: none"> T1DM: CF = 1800 ÷ CSII TDD T2DM or GDM: CF = 1500 ÷ CSII TDD 	
Insulin to carbohydrate ratio (ICR) = grams of carbohydrates that 1 unit of insulin will cover	ICR = 500 ÷ CSII TDD	

Modified from AACE/ACE Consensus Statement, *Endocr Pract* 2014;20(No5).

Appendix C:

List of programs that have received or are applying for the U.S. Centers for Disease Control and Prevention (CDC) Diabetes Prevention Recognition Program. Program standards under CDC recognition assure lifestyle intervention education for the prevention of T2DM based on evidenced-based information. Because program information may change, please go to [Diabetes Prevention Recognition Program - Registry of Recognized Organizations](#)

Program	Location	Contact
African American Health Coalition	Legacy Emanuel Hospital Portland	Marsha Jordan & Maria Jones mariaj@aahc-portland.org 503-413-1850
Asante Physician Partners	Medford	Julie Kokinakes Julie.kokinakes@asante.org 541-301-8272
Asian Health & Service Center		Christine Lau clau@ahscpx.org 503-872-8822
Blue Mountain Hospital	John Day	Kim Jacobs kjacobs@bluemountainhospital.org 541-575-1311
Borland Free Clinic	Tigard	Chelsea Ban chelseaban@borlandclinic.org 503-974-8887
CAPECO Area Agency on Aging (Good Shepherd Medical Center)	Hermiston	Helena Wolfe, hwolfe@capeco-works.org 541-561-5443 Juli Gregory, jgregory@gshealth.org 541-667-3506
CAPECO Area Agency on Aging (St. Anthony's)	Pendleton Hermiston (in Umatilla County)	Helena Wolfe, hwolfe@capeco-works.org 541-561-5443
Central Oregon Council on Aging	Redmond	Jane Roger, jroger@councilonaging.org 541-548-1086
Clackamas Volunteers in Medicine	Oregon City	Grace Judd 503-722-4400
Columbia Action Team	St. Helens	Juliann Davis, jdavis@cat-team.org Heather Johnson, hjohnson@cat-team.org 503-366-6584
Community Connection of Northeast Oregon, Inc	La Grande	Rochelle Hamilton, rochelle@ccno.org 541-963-3186

Coquille Tribe	Southern Oregon Tribal Diabetes Prevention Consortium	Kelle Little kellelittle@coquilletribe.org
Cow Creek Health & Wellness Center, Cow Creek Band of Umpqua Tribe Indians	Southern Oregon Tribal Diabetes Prevention Consortium	Erin Audiss, EAudiss@cowcreek.com Jill Boyce, jboyce@cowcreek.com 541-672-8533
Crook County Health Services	Prineville	Kylie Loving Kloving@h.co.crook.or.us 541-447-3260
Deschutes County Health Services	Bend	Sarah Worthington sarahw@deschutes.org 541-322-7446
Eugene Family YMCS	Eugene	Kate Kevern prevention@eugeneymca.org 541-686-9622
Grants Pass Family YMCA	Grants Pass	Rita Kurz rkurz@grantspassymca.net 541-474-0001
Harney District Hospital	Burns	Amy Dobson adobson@harneydh.com 541-573-8318
Klamath Tribe	Southern Oregon Tribal Diabetes Prevention Consortium	Erin Tecumseh erin.tecumseh@klm.portland.ihs.gov (541)882-1487 ext. 222 (C) 541-591-3958
Lifestyle Medical Group	Clackamas	503-652-5070
LifeWeighs Wellness Coaching	Portland	Ashley-Nicole Browning info@lifeweighs.com 503-894-6004
Molalla Adult Community Center	Molalla	Kim Brooks tkbrooks@mollala.net 503-7087673
Mosaic Medical	Madras	Marlen Gutierrez Marlen.gutierrez@mosaic.org 541-475-7800

National University of Natural Medicine	Portland	Kyle Ashby 503-552-1551
Native American Rehabilitation Association of the Northwest, Inc.	Portland	Alison Goerl agoerl@naranorthwest.org 503-230-9875
Newport 60+ Senior Activity Center	Newport	Christine Lacedra, christine@resetmyweight.com 541-272-0124
NorthWest Senior and Disability Services	Warrenton	Zoe Manhire/Lavinia Gotozmanhire@sunsetempire.com lavinia.goto@nwsds.org 503-304-3408
	Salem Woodburn	503-884-2735 Berta2jo@gmail.com 503-304-3408 lavinia.goto@nwsds.org
Oregon Health & Science University	Portland	Don Kain, RD kaind@ohsu.edu 503-494-5249
Samaritan Health Services	Depoe Bay Lincoln City	Ruth Morelan rmorelan@samhealth.org 541-765-3265
Trillium Community Health	Eugene	Nina Watkins/Kim McGrew nwatkins@trilliumchp.com kmcgrew@trilliumchp.com
Warm Springs Health and Wellness Center	Southern Oregon Tribal Diabetes Prevention Consortium	Montel Elliot 541-553-5513
WVP Health Authority	Salem	Debbie Ficek dficek@mvipa.org
Yamhill Community Care Organization	McMinnville	Jennifer Jackson 503-376-7426
YMCA of Willamette-Columbia	Oregon City	Maria Pfeifer, prevention@ymcacw.org 503.862.4031

References

1. Rowan JA, Budden A, Ivanova V, Hughes RC, Sadler LC. Women with an HbA1c of 41-49 mmol/mol (5.9-6.6%): a higher risk subgroup that may benefit from early pregnancy intervention. *Diabet Med* 2016;33:25-31.
2. Crowther CA, Hiller JE, Moss JR, et al. Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. *N Engl J Med* 2005;352:2477-86.
3. Landon MB, Spong CY, Thom E, et al. A multicenter, randomized trial of treatment for mild gestational diabetes. *N Engl J Med* 2009;361:1339-48.
4. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. *Diabetes Care* 2002;25:1862-8.
5. American Diabetes A. 2. Classification and Diagnosis of Diabetes. *Diabetes Care* 2016;39 Suppl 1:S13-22.
6. American Diabetes A. Erratum. Classification and diagnosis of diabetes. Sec. 2. In Standards of Medical Care in Diabetes-2016. *Diabetes Care* 2016;39(Suppl. 1):S13-S22. *Diabetes Care* 2016;39:1653.
7. DeSisto CL, Kim SY, Sharma AJ. Prevalence estimates of gestational diabetes mellitus in the United States, Pregnancy Risk Assessment Monitoring System (PRAMS), 2007-2010. *Prev Chronic Dis* 2014;11:E104.
8. Wahabi HA, Alzeidan RA, Esmaeil SA. Pre-pregnancy care for women with pre-gestational diabetes mellitus: a systematic review and meta-analysis. *BMC Public Health* 2012;12:792.
9. Ylinen K, Aula P, Stenman UH, Kesaniemi-Kuokkanen T, Teramo K. Risk of minor and major fetal malformations in diabetics with high haemoglobin A1c values in early pregnancy. *Br Med J (Clin Res Ed)* 1984;289:345-6.
10. Rosenn B, Miodovnik M, Combs CA, Khoury J, Siddiqi TA. Glycemic thresholds for spontaneous abortion and congenital malformations in insulin-dependent diabetes mellitus. *Obstet Gynecol* 1994;84:515-20.
11. Wender-Ozegowska E, Wroblewska K, Zawiejaska A, Pietryga M, Szczapa J, Biczysko R. Threshold values of maternal blood glucose in early diabetic pregnancy—prediction of fetal malformations. *Acta Obstet Gynecol Scand* 2005;84:17-25.
12. American Diabetes A. (12) Management of diabetes in pregnancy. *Diabetes Care* 2015;38 Suppl:S77-9.
13. Dabelea D, Hanson RL, Lindsay RS, et al. Intrauterine exposure to diabetes conveys risks for type 2 diabetes and obesity: a study of discordant sibships. *Diabetes* 2000;49:2208-11.

14. Kitzmiller JL, Block JM, Brown FM, et al. Managing preexisting diabetes for pregnancy: summary of evidence and consensus recommendations for care. *Diabetes Care* 2008;31:1060-79.
15. Silverman BL, Rizzo T, Green OC, et al. Long-term prospective evaluation of offspring of diabetic mothers. *Diabetes* 1991;40 Suppl 2:121-5.
16. Jensen DM, Korsholm L, Ovesen P, et al. Peri-conceptional A1C and risk of serious adverse pregnancy outcome in 933 women with type 1 diabetes. *Diabetes Care* 2009;32:1046-8.
17. Practice ACoO. ACOG Committee Opinion No. 495: Vitamin D: Screening and supplementation during pregnancy. *Obstet Gynecol* 2011;118:197-8.
18. Final Update Summary: Gestational Diabetes Mellitus, Screening. 2016. (Accessed 11/09/2016, at <https://www.uspreventiveservicestaskforce.org/Page/Document/UpdateSummaryFinal/gestational-diabetes-mellitus-screening>.)
19. O'Sullivan JB, Mahan CM, Charles D, Dandrow RV. Screening criteria for high-risk gestational diabetic patients. *Am J Obstet Gynecol* 1973;116:895-900.
20. Statements NCDC. Diagnosing Gestational Diabetes Mellitus 2013 March 4–6, 2013.
21. Group HSCR, Metzger BE, Lowe LP, et al. Hyperglycemia and adverse pregnancy outcomes. *N Engl J Med* 2008;358:1991-2002.
22. Ostlund I, Hanson U. Repeated random blood glucose measurements as universal screening test for gestational diabetes mellitus. *Acta Obstet Gynecol Scand* 2004;83:46-51.
23. Ryser Ruetschi J, Jornayvaz FR, Rivest R, Huhn EA, Irion O, Boulvain M. Fasting glycaemia to simplify screening for gestational diabetes. *BJOG* 2016.
24. Nielsen LR, Ekblom P, Damm P, et al. HbA1c levels are significantly lower in early and late pregnancy. *Diabetes Care* 2004;27:1200-1.
25. Hughes RC, Moore MP, Gullam JE, Mohamed K, Rowan J. An early pregnancy HbA1c $\geq 5.9\%$ (41 mmol/mol) is optimal for detecting diabetes and identifies women at increased risk of adverse pregnancy outcomes. *Diabetes Care* 2014;37:2953-9.
26. Soumya S, Rohilla M, Chopra S, et al. HbA1c: A Useful Screening Test for Gestational Diabetes Mellitus. *Diabetes Technol Ther* 2015;17:899-904.
27. Lowe LP, Metzger BE, Dyer AR, et al. Hyperglycemia and Adverse Pregnancy Outcome (HAPO) Study: associations of maternal A1C and glucose with pregnancy outcomes. *Diabetes Care* 2012;35:574-80.
28. Landon MB, Cembrowski GS, Gabbe SG. Capillary blood glucose screening for gestational diabetes: a preliminary investigation. *Am J Obstet Gynecol* 1986;155:717-21.
29. Mosca A, Paleari R, Dalfrà MG, et al. Reference intervals for hemoglobin A1c in pregnant women: data from an Italian multicenter study. *Clin Chem* 2006;52:1138-43.
30. Maresh MJ, Holmes VA, Patterson CC, et al. Glycemic targets in the second and third trimester of pregnancy for women with type 1 diabetes. *Diabetes Care* 2015;38:34-42.
31. Bonis C, Lorenzini F, Bertrand M, et al. Glucose Profiles in Pregnant Women After a Gastric Bypass : Findings from Continuous Glucose Monitoring. *Obes Surg* 2016;26:2150-5.
32. Wittgrove AC, Jester L, Wittgrove P, Clark GW. Pregnancy following gastric bypass for morbid obesity. *Obes Surg* 1998;8:461-4; discussion 5-6.
33. Wax JR, Pinette MG, Cartin A, Blackstone J. Female reproductive issues following bariatric surgery. *Obstet Gynecol Surv* 2007;62:595-604.
34. American College of O, Gynecologists. ACOG practice bulletin no. 105: bariatric surgery and pregnancy. *Obstet Gynecol* 2009;113:1405-13.
35. Hui AL, Sevenhuysen G, Harvey D, Salamon E. Barriers and coping strategies of women with gestational diabetes to follow dietary advice. *Women Birth* 2014;27:292-7.

36. Kim C, McEwen LN, Kieffer EC, Herman WH, Piette JD. Self-efficacy, social support, and associations with physical activity and body mass index among women with histories of gestational diabetes mellitus. *Diabetes Educ* 2008;34:719-28.
37. Nielsen KK, Kapur A, Damm P, de Courten M, Bygbjerg IC. From screening to postpartum follow-up — the determinants and barriers for gestational diabetes mellitus (GDM) services, a systematic review. *BMC Pregnancy Childbirth* 2014;14:41.
38. Kim C, McEwen LN, Piette JD, Goewey J, Ferrara A, Walker EA. Risk perception for diabetes among women with histories of gestational diabetes mellitus. *Diabetes Care* 2007;30:2281-6.
39. Byrn M, Penckofer S. The relationship between gestational diabetes and antenatal depression. *J Obstet Gynecol Neonatal Nurs* 2015;44:246-55.
40. Flynn HA, Sexton M, Ratliff S, Porter K, Zivin K. Comparative performance of the Edinburgh Postnatal Depression Scale and the Patient Health Questionnaire-9 in pregnant and postpartum women seeking psychiatric services. *Psychiatry Res* 2011;187:130-4.
41. Da Costa D, Larouche J, Dritsa M, Brender W. Variations in stress levels over the course of pregnancy: factors associated with elevated hassles, state anxiety and pregnancy-specific stress. *J Psychosom Res* 1999;47:609-21.
42. Collier SA, Mulholland C, Williams J, Mersereau P, Turay K, Prue C. A qualitative study of perceived barriers to management of diabetes among women with a history of diabetes during pregnancy. *J Women's Health (Larchmt)* 2011;20:1333-9.
43. Carolan M, Steele C, Margetts H. Attitudes towards gestational diabetes among a multiethnic cohort in Australia. *J Clin Nurs* 2010;19:2446-53.
44. Gallant MP. The influence of social support on chronic illness self-management: a review and directions for research. *Health Educ Behav* 2003;30:170-95.
45. Zahn CMW, J. R.; Porter, T. F. Practice Advisory on Low-Dose Aspirin and Prevention of Preeclampsia: Updated Recommendations: American College of Obstetricians and Gynecologists. July 11, 2016.
46. Son GH, Kwon JY, Kim YH, Park YW. Maternal serum triglycerides as predictive factors for large-for-gestational age newborns in women with gestational diabetes mellitus. *Acta Obstet Gynecol Scand* 2010;89:700-4.
47. Schaefer-Graf UM, Graf K, Kulbacka I, et al. Maternal lipids as strong determinants of fetal environment and growth in pregnancies with gestational diabetes mellitus. *Diabetes Care* 2008;31:1858-63.
48. Luque-Fernandez MA, Bain PA, Gelaye B, Redline S, Williams MA. Sleep-disordered breathing and gestational diabetes mellitus: a meta-analysis of 9,795 participants enrolled in epidemiological observational studies. *Diabetes Care* 2013;36:3353-60.
49. Facco FL, Ouyang DW, Zee PC, et al. Implications of sleep-disordered breathing in pregnancy. *Am J Obstet Gynecol* 2014;210:559 e1-6.
50. Reutrakul S, Zaidi N, Wroblewski K, et al. Interactions between pregnancy, obstructive sleep apnea, and gestational diabetes mellitus. *J Clin Endocrinol Metab* 2013;98:4195-202.
51. Dietetics AoNa. Gestational Diabetes Evidence-Based Nutrition Practice Guideline 2008 11/09/2016.
52. Hernandez TL, Anderson MA, Chartier-Logan C, Friedman JE, Barbour LA. Strategies in the nutritional management of gestational diabetes. *Clin Obstet Gynecol* 2013;56:803-15.
53. Hernandez TL, Van Pelt RE, Anderson MA, et al. A higher-complex carbohydrate diet in gestational diabetes mellitus achieves glucose targets and lowers postprandial lipids: a randomized crossover study. *Diabetes Care* 2014;37:1254-62.
54. Moses RG, Cefalu WT. Considerations in the Management of Gestational Diabetes Mellitus: "You Are What Your Mother Ate!" *Diabetes Care* 2016;39:13-5.
55. Blumer I, Hadar E, Hadden DR, et al. Diabetes and pregnancy: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab* 2013;98:4227-49.

56. Zhang C, Liu S, Solomon CG, Hu FB. Dietary fiber intake, dietary glycemic load, and the risk for gestational diabetes mellitus. *Diabetes Care* 2006;29:2223-30.
57. Hone J, Jovanovic L. Approach to the patient with diabetes during pregnancy. *J Clin Endocrinol Metab* 2010;95:3578-85.
58. American College of O, Gynecologists. ACOG Committee Opinion No. 462: Moderate caffeine consumption during pregnancy. *Obstet Gynecol* 2010;116:467-8.
59. ACOG Committee Opinion No. 650: Physical Activity and Exercise During Pregnancy and the Postpartum Period. *Obstet Gynecol* 2015;126:e135-42.
60. Mottola MF, Artal R. Role of Exercise in Reducing Gestational Diabetes Mellitus. *Clin Obstet Gynecol* 2016;59:620-8.
61. Davenport MH, Mottola MF, McManus R, Gratton R. A walking intervention improves capillary glucose control in women with gestational diabetes mellitus: a pilot study. *Appl Physiol Nutr Metab* 2008;33:511-7.
62. Davenport MH, Skow RJ, Steinback CD. Maternal Responses to Aerobic Exercise in Pregnancy. *Clin Obstet Gynecol* 2016;59:541-51.
63. Melzer K, Schutz Y, Boulvain M, Kayser B. Physical activity and pregnancy: cardiovascular adaptations, recommendations and pregnancy outcomes. *Sports Med* 2010;40:493-507.
64. Melzer K, Schutz Y, Soehnchen N, et al. Effects of recommended levels of physical activity on pregnancy outcomes. *Am J Obstet Gynecol* 2010;202:266 e1-6.
65. Kusaka M, Matsuzaki M, Shiraishi M, Haruna M. Immediate stress reduction effects of yoga during pregnancy: One group pre-post test. *Women Birth* 2016;29:e82-e8.
66. Cordero Y, Mottola MF, Vargas J, Blanco M, Barakat R. Exercise Is Associated with a Reduction in Gestational Diabetes Mellitus. *Med Sci Sports Exerc* 2015;47:1328-33.
67. de Veciana M, Major CA, Morgan MA, et al. Postprandial versus preprandial blood glucose monitoring in women with gestational diabetes mellitus requiring insulin therapy. *N Engl J Med* 1995;333:1237-41.
68. Jovanovic L. Role of diet and insulin treatment of diabetes in pregnancy. *Clin Obstet Gynecol* 2000;43:46-55.
69. Hernandez TL, Friedman JE, Van Pelt RE, Barbour LA. Patterns of glycemia in normal pregnancy: should the current therapeutic targets be challenged? *Diabetes Care* 2011;34:1660-8.
70. Rowan JA, Gao W, Hague WM, McIntyre HD. Glycemia and its relationship to outcomes in the metformin in gestational diabetes trial. *Diabetes Care* 2010;33:9-16.
71. Seshiah V, Balaji V, Panneerselvam A, Balaji MS. "Abnormal" fasting plasma glucose during pregnancy. *Diabetes Care* 2008;31:e92.
72. Lapolla A, Dalfrà MG, Bonomo M, et al. Can plasma glucose and HbA1c predict fetal growth in mothers with different glucose tolerance levels? *Diabetes Res Clin Pract* 2007;77:465-70.
73. Parretti E, Mecacci F, Papini M, et al. Third-trimester maternal glucose levels from diurnal profiles in nondiabetic pregnancies: correlation with sonographic parameters of fetal growth. *Diabetes Care* 2001;24:1319-23.
74. Committee on Practice B-O. Practice Bulletin No. 137: Gestational diabetes mellitus. *Obstet Gynecol* 2013;122:406-16.
75. Nielsen LR, Pedersen-Bjergaard U, Thorsteinsson B, Johansen M, Damm P, Mathiesen ER. Hypoglycemia in pregnant women with type 1 diabetes: predictors and role of metabolic control. *Diabetes Care* 2008;31:9-14.
76. Rosenn BM, Miodovnik M, Holcberg G, Khoury JC, Siddiqi TA. Hypoglycemia: the price of intensive insulin therapy for pregnant women with insulin-dependent diabetes mellitus. *Obstet Gynecol* 1995;85:417-22.
77. Holt RI. Glyburide for gestational diabetes: time for a pause for thought. *JAMA Pediatr* 2015;169:427-8.
78. Balsells M, Garcia-Patterson A, Sola I, Roque M, Gich I, Corcoy R. Glibenclamide, metformin, and insulin for the treatment of gestational diabetes: a systematic review and meta-analysis. *BMJ* 2015;350:h102.

79. Camelo Castillo W, Boggess K, Sturmer T, Brookhart MA, Benjamin DK, Jr., Jonsson Funk M. Association of Adverse Pregnancy Outcomes With Glyburide vs Insulin in Women With Gestational Diabetes. *JAMA Pediatr* 2015;169:452-8.
80. Simmons D. Safety considerations with pharmacological treatment of gestational diabetes mellitus. *Drug Saf* 2015;38:65-78.
81. Briggs GG, Ambrose PJ, Nageotte MP, Padilla G, Wan S. Excretion of metformin into breast milk and the effect on nursing infants. *Obstet Gynecol* 2005;105:1437-41.
82. Eyal S, Easterling TR, Carr D, et al. Pharmacokinetics of metformin during pregnancy. *Drug Metab Dispos* 2010;38:833-40.
83. Langer O. Oral anti-hyperglycemic agents for the management of gestational diabetes mellitus. *Obstet Gynecol Clin North Am* 2007;34:255-74, ix.
84. Nicholson W, Bolen S, Witkop CT, Neale D, Wilson L, Bass E. Benefits and risks of oral diabetes agents compared with insulin in women with gestational diabetes: a systematic review. *Obstet Gynecol* 2009;113:193-205.
85. Feig DS, Briggs GG, Kraemer JM, et al. Transfer of glyburide and glipizide into breast milk. *Diabetes Care* 2005;28:1851-5.
86. Rowan JA, Hague WM, Gao W, Battin MR, Moore MP, Mi GTI. Metformin versus insulin for the treatment of gestational diabetes. *N Engl J Med* 2008;358:2003-15.
87. Gui J, Liu Q, Feng L. Metformin vs insulin in the management of gestational diabetes: a meta-analysis. *PLoS One* 2013;8:e64585.
88. de la Pena A, Riddle M, Morrow LA, et al. Pharmacokinetics and pharmacodynamics of high-dose human regular U-500 insulin versus human regular U-100 insulin in healthy obese subjects. *Diabetes Care* 2011;34:2496-501.
89. Blum AK. Insulin Use in Pregnancy: An Update. *Diabetes Spectr* 2016;29:92-7.
90. Cochran E, Musso C, Gorden P. The use of U-500 in patients with extreme insulin resistance. *Diabetes Care* 2005;28:1240-4.
91. Donofrio MT, Moon-Grady AJ, Hornberger LK, et al. Diagnosis and treatment of fetal cardiac disease: a scientific statement from the American Heart Association. *Circulation* 2014;129:2183-242.
92. Bulletins ACoP. ACOG Practice Bulletin. *Clinical Management Guidelines for Obstetrician-Gynecologists*. Number 60, March 2005. Pregestational diabetes mellitus. *Obstet Gynecol* 2005;105:675-85.
93. Kalra P, Anakal M. Peripartum management of diabetes. *Indian J Endocrinol Metab* 2013;17:S72-6.
94. Spong CY, Mercer BM, D'Alton M, Kilpatrick S, Blackwell S, Saade G. Timing of indicated late-preterm and early-term birth. *Obstet Gynecol* 2011;118:323-33.
95. Viteri OA, Dinis J, Roman T, Sibai BM. Timing of Medically Indicated Delivery in Diabetic Pregnancies: A Perspective on Current Evidence-Based Recommendations. *Am J Perinatol* 2016;33:821-5.
96. Catalano PM, Sacks DA. Timing of indicated late preterm and early-term birth in chronic medical complications: diabetes. *Semin Perinatol* 2011;35:297-301.
97. Hawkins JS, Casey BM. Labor and delivery management for women with diabetes. *Obstet Gynecol Clin North Am* 2007;34:323-34, x.
98. Gabbe SG, Carpenter LB, Garrison EA. New strategies for glucose control in patients with type 1 and type 2 diabetes mellitus in pregnancy. *Clin Obstet Gynecol* 2007;50:1014-24.
99. Gyamfi-Bannerman C, Thom EA, Blackwell SC, et al. Antenatal Betamethasone for Women at Risk for Late Preterm Delivery. *N Engl J Med* 2016;374:1311-20.
100. Kalra S, Kalra B, Gupta Y. Glycemic management after antenatal corticosteroid therapy. *N Am J Med Sci* 2014;6:71-6.
101. Sibai BM, Viteri OA. Diabetic ketoacidosis in pregnancy. *Obstet Gynecol* 2014;123:167-78.
102. Mathiesen ER, Christensen AB, Hellmuth E, Hornnes P, Stage E, Damm P. Insulin dose during glucocorticoid treatment for fetal lung maturation in diabetic pregnancy: test of an algorithm [correction of analoritm]. *Acta Obstet Gynecol Scand* 2002;81:835-9.

103. Pettit KE, Tran SH, Lee E, Caughey AB. The association of antenatal corticosteroids with neonatal hypoglycemia and hyperbilirubinemia. *J Matern Fetal Neonatal Med* 2014;27:683-6.
104. Smigaj D, Roman-Drago NM, Amini SB, Caritis SN, Kalhan SC, Catalano PM. The effect of oral terbutaline on maternal glucose metabolism and energy expenditure in pregnancy. *Am J Obstet Gynecol* 1998;178:1041-7.
105. Gunderson EP, Hurston SR, Ning X, et al. Lactation and Progression to Type 2 Diabetes Mellitus After Gestational Diabetes Mellitus: A Prospective Cohort Study. *Ann Intern Med* 2015;163:889-98.
106. Gunderson EP, Crites Y, Chiang V, et al. Influence of breastfeeding during the postpartum oral glucose tolerance test on plasma glucose and insulin. *Obstet Gynecol* 2012;120:136-43.
107. Ziegler AG, Wallner M, Kaiser I, et al. Long-term protective effect of lactation on the development of type 2 diabetes in women with recent gestational diabetes mellitus. *Diabetes* 2012;61:3167-71.
108. Lenz S, Kuhl C, Hornnes PJ, Hagen C. Influence of lactation on oral glucose tolerance in the puerperium. *Acta Endocrinol (Copenh)* 1981;98:428-31.
109. Ramos-Roman MA. Prolactin and lactation as modifiers of diabetes risk in gestational diabetes. *Horm Metab Res* 2011;43:593-600.
110. Matias SL, Dewey KG, Quesenberry CP, Jr., Gunderson EP. Maternal prepregnancy obesity and insulin treatment during pregnancy are independently associated with delayed lactogenesis in women with recent gestational diabetes mellitus. *Am J Clin Nutr* 2014;99:115-21.
111. Haile ZT, Oza-Frank R, Azulay Chertok IR, Passen N. Association between History of Gestational Diabetes and Exclusive Breastfeeding at Hospital Discharge. *J Hum Lact* 2016;32:NP36-43.
112. Stuebe AM. Does breastfeeding prevent the metabolic syndrome, or does the metabolic syndrome prevent breastfeeding? *Semin Perinatol* 2015;39:290-5.
113. Ko JY, Dietz PM, Conrey EJ, et al. Gestational diabetes mellitus and postpartum care practices of nurse-midwives. *J Midwifery Women's Health* 2013;58:33-40.
114. Bellamy L, Casas JP, Hingorani AD, Williams D. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. *Lancet* 2009;373:1773-9.
115. Middleton P, Crowther CA. Reminder systems for women with previous gestational diabetes mellitus to increase uptake of testing for type 2 diabetes or impaired glucose tolerance. *Cochrane Database Syst Rev* 2014:CD009578.
116. Ortiz FM, Jimenez EY, Boursaw B, Huttlinger K. Postpartum Care for Women with Gestational Diabetes. *MCN Am J Matern Child Nurs* 2016;41:116-22.
117. Kim C, McEwen LN, Kerr EA, et al. Preventive counseling among women with histories of gestational diabetes mellitus. *Diabetes Care* 2007;30:2489-95.
118. Aroda VR, Christophi CA, Edelstein SL, et al. The effect of lifestyle intervention and metformin on preventing or delaying diabetes among women with and without gestational diabetes: the Diabetes Prevention Program outcomes study 10-year follow-up. *J Clin Endocrinol Metab* 2015;100:1646-53.
119. Ratner RE, Christophi CA, Metzger BE, et al. Prevention of diabetes in women with a history of gestational diabetes: effects of metformin and lifestyle interventions. *J Clin Endocrinol Metab* 2008;93:4774-9.
120. Stuebe AM, Rich-Edwards JW, Willett WC, Manson JE, Michels KB. Duration of lactation and incidence of type 2 diabetes. *JAMA* 2005;294:2601-10.
121. Bao W, Tobias DK, Bowers K, et al. Physical activity and sedentary behaviors associated with risk of progression from gestational diabetes mellitus to type 2 diabetes mellitus: a prospective cohort study. *JAMA Intern Med* 2014;174:1047-55.
122. Guo J, Chen JL, Whittemore R, Whitaker E. Postpartum Lifestyle Interventions to Prevent Type 2 Diabetes Among Women with History of Gestational Diabetes: A Systematic Review of Randomized Clinical Trials. *J Women's Health (Larchmt)* 2016;25:38-49.

123. Friedman JM. ACE inhibitors and congenital anomalies. *N Engl J Med* 2006;354:2498-500.
124. Bullo M, Tschumi S, Bucher BS, Bianchetti MG, Simonetti GD. Pregnancy outcome following exposure to angiotensin-converting enzyme inhibitors or angiotensin receptor antagonists: a systematic review. *Hypertension* 2012;60:444-50.
125. American Academy of Pediatrics Committee on D. Transfer of drugs and other chemicals into human milk. *Pediatrics* 2001;108:776-89.
126. Werthmann MW, Jr., Krees SV. Excretion of chlorothiazide in human breast milk. *J Pediatr* 1972;81:781-3.
127. Collins R, Yusuf S, Peto R. Overview of randomised trials of diuretics in pregnancy. *Br Med J (Clin Res Ed)* 1985;290:17-23.
128. Magee LA, Schick B, Donnenfeld AE, et al. The safety of calcium channel blockers in human pregnancy: a prospective, multicenter cohort study. *Am J Obstet Gynecol* 1996;174:823-8.
129. Weber-Schoendorfer C, Hannemann D, Meister R, et al. The safety of calcium channel blockers during pregnancy: a prospective, multicenter, observational study. *Reprod Toxicol* 2008;26:24-30.
130. van Geijn HP, Lenglet JE, Bolte AC. Nifedipine trials: effectiveness and safety aspects. *BJOG* 2005;112 Suppl 1:79-83.
131. Naito T, Kubono N, Deguchi S, et al. Amlodipine passage into breast milk in lactating women with pregnancy-induced hypertension and its estimation of infant risk for breastfeeding. *J Hum Lact* 2015;31:301-6.
132. Chan WS, Koren G, Barrera M, Rezvani M, Knittel-Keren D, Nulman I. Neurocognitive development of children following in-utero exposure to labetalol for maternal hypertension: a cohort study using a prospectively collected database. *Hypertens Pregnancy* 2010;29:271-83.
133. Kalyoncu NI, Yaris F, Kadioglu M, et al. Pregnancy outcome following exposure to orlistat, ramipril, glimepiride in a woman with metabolic syndrome. *Saudi Med J* 2005;26:497-9.
134. Jones KL, Johnson KA, Dick LM, Felix RJ, Kao KK, Chambers CD. Pregnancy outcomes after first trimester exposure to phentermine/fenfluramine. *Teratology* 2002;65:125-30.
135. Pollack PS, Shields KE, Burnett DM, Osborne MJ, Cunningham ML, Stepanavage ME. Pregnancy outcomes after maternal exposure to simvastatin and lovastatin. *Birth Defects Res A Clin Mol Teratol* 2005;73:888-96.
136. Edison RJ, Muenke M. Mechanistic and epidemiologic considerations in the evaluation of adverse birth outcomes following gestational exposure to statins. *Am J Med Genet A* 2004;131:287-98.

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